PLASTIC FANTASTIC – POLYMERS IN THE WORKSHOP

MODEL ENGINEER & WORKSHOP

EST. 1898

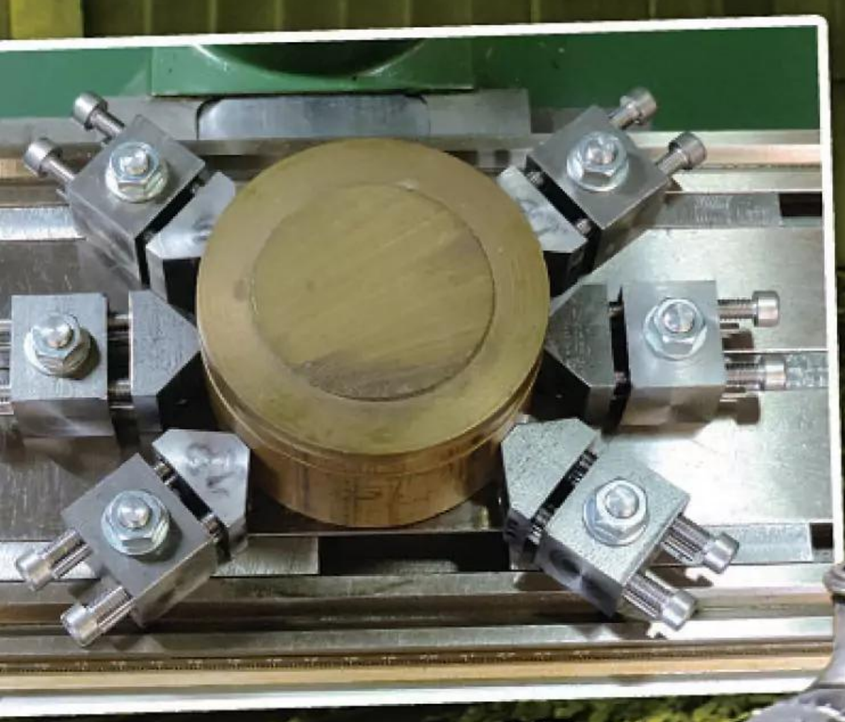
THE LEADING MAGAZINE FOR HOBBY ENGINEERS AND MODEL MAKERS

www.model-engineer.co.uk

Volume: 234, Issue: 4766, July 2025

Live Steam in the Midlands

WE VISIT STAFFORD MODEL ENGINEERING SOCIETY'S MULTI-GAUGE CLUB RAILWAY



Versatile Milling Clamps

ESSENTIAL ACCESSORIES HELP YOU MILL AWKWARD SHAPES

Get Tailstock Support

MAKE THESE ROTARY CHUCK ADAPTORS

INSIDE this packed issue:

Competition News: The Stevenson Trophy and The Bradford Cup • How You Can Make Internal Knurls • A Fully Working Multi-Door Ashpan • Making Trip Dies for Corliss Valve Gear • A Load of Hot Air? LBSC and a Toy Locomotive • Your Feedback – Reader Survey Results • Using Pin and C-Spanners • GWR Pannier Tank Smokebox • The History of Boring Machines Victorian Gallopers • A Steam Locomotive Lubricator.

PLUS ALL YOUR REGULAR FAVOURITES!

GET MORE OUT OF YOUR WORKSHOP WITH ME&W

KELSEY media

JULY 2025

PCBWay

Precision machining with no minimum order



CNC Machining (starts from $24.89)

Milling (3-, 4- & full 5-axis),
turning & post processing



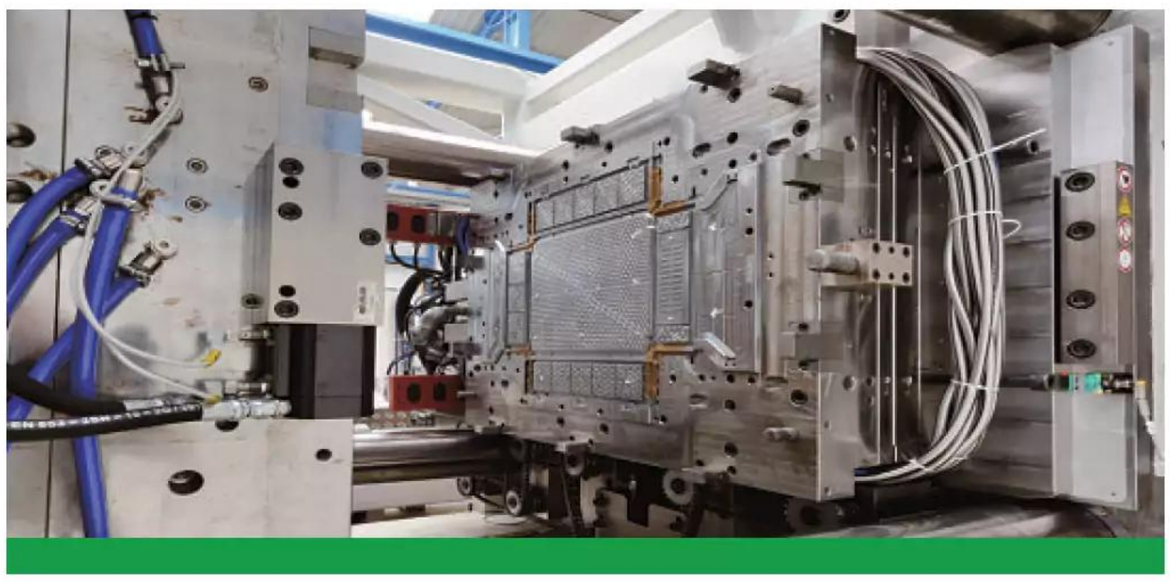
Sheet Metal Fabrication (starts from $24.89

Laser cutting, bending,
post processing



3D Printing (starts from $4.98)

SLA, MJF, SLS, SLM, FDM, DLP, SAF
High Precision & Superb Service



Injection Molding / Vacuum Casting

Rapid tooling, family molds,
multi-cavity molds and overmolding

“

PCBWay, renowned for its excellence in PCB manufacturing, has expanded into CNC machining services, providing high-precision custom parts for industries like aerospace, automotive, and electronics. Equipped with advanced 3-axis to 5-axis machines, we specialize in milling, turning, and finishing across materials such as aluminum, steel, and high-performance plastics.

With a focus on precision and efficiency, PCBWay combines cutting-edge technology with rigorous quality control to deliver components that meet the highest industry standards. Our expert team supports clients from design to production, ensuring seamless collaboration and timely delivery. At PCBWay, we turn ideas into reality with craftsmanship you can trust.

”



www.pcbway.com

3dcnc@pcbway.com

EDITORIAL
Editor: Neil Wyatt
Deputy Editor: Diane Carney
Designer: Darren Hendley
Illustrator: Grahame Chambers
Publisher: Tim Hartley

By post: Model Engineer & Workshop, Kelsey Media Ltd, Media Centre, Morton Way, Horncastle, Lincs LN9 6JR.
Telephone: 01507 529589
Email: meweditor@mortons.co.uk
©2025 Kelsey Media Ltd.
ISSN: 0033-8923

CUSTOMER SERVICES
General Queries & Back Issues
Telephone: 01507 529529
Mon-Fri: 8.30am-5.00pm 24 hour answerphone.

ADVERTISING
Group Head of Investment
Model & Tractor Publications
Mason Ponti
Email: mason@talk-media.uk
Telephone: 01732 920499

INVESTMENT MANAGER
Karen Davies
Email: karen@talk-media.uk
Telephone: 01732 442144
Talk Media, The Granary, Downs Court, Yalding Hill, Yalding, Kent ME18 6AL

PUBLISHING
Sales & Distribution Manager: Carl Smith
Head of Marketing: Charlotte Park
Commercial Director: Nigel Hole
Publishing Director: Dan Savage
Published by: Kelsey Media Ltd, Media Centre, Morton Way, Horncastle, Lincs LN9 6JR

SUBSCRIPTIONS
Full subscription rates (see inside for offers): 12 months, 12 issues, inc. post & packing - UK £71.40. Export rates are also available, see www.classicmagazines.co.uk for more details. UK subscriptions are zero-rated for the purpose of Value Added Tax.
Enquiries: subscriptions@mortons.co.uk

PRINT AND DISTRIBUTION
Printed by: Acorn Web Offset Ltd, W Yorkshire.
Distribution by: Seymour Distribution Limited, 2 East Poultry Avenue, London, EC1A 9PT
Telephone: 020 7429 4000

EDITORIAL CONTRIBUTIONS
Accepted photographs and articles will be paid for upon publication. Items we cannot use will be returned if accompanied by a stamped addressed envelope, and recorded delivery must clearly state so and enclose sufficient postage. In common with practice in other periodicals, all material is sent or returned at the contributor's own risk, and neither Model Engineer & Workshop Magazine, the editor, the staff, nor Kelsey Media Ltd can be held responsible for loss or damage, howsoever caused.
The opinions expressed in ME&W are not necessarily those of the editor or staff.
This periodical must not, without the written consent of the publishers, be given, lent, resold, hired out, or otherwise disposed of in a mutilated condition or in any unauthorized cover, by way of trade, or annexed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

This issue was published on:
18 June 2025
The next issue will be on sale:
18 July 2025

KELSEY media

recycle
When you have finished with this magazine please recycle it.

SMOKE RINGS

Thinking About the Unthinkable

It's a sad fact that, at some point, we will all have to leave behind our hobbies. In many cases our loved ones will face a confusing collection of items with little knowledge of their function or value. This was brought home to me recently, in the case of an engineer who passed away suddenly. What might have been a few thousand pounds' worth of lathe and mill were disposed of at a knock down price; perhaps more distressing is that a house clearance company were paid to remove the rest of the workshop contents. In this case, the relatives really had no option as the home needed to be cleared for sale and they had no information on the contents or their value.

It makes sense to have at least a rough inventory of the main items in your workshop and their values, perhaps with photos. You may well enjoy the exercise, sat in your workshop for an hour or so, going through your favourite tools and machinery with a cuppa or two. Such a list would also prove invaluable in the event of a theft, fire or flood. For more thoughts on this subject, including advice for relatives, there's an excellent article by Roger Backhouse on the www.model-engineer.co.uk Forum at tinyurl.com/229dhy3s, or follow the QR code.

A Club Record?

Some great news came to my attention this week, from the Worthing & District SME. Possibly a record for any club, three powerful new 5" gauge locomotives took to the track in four weeks! Firstly, Vice-chairman Geoff Bashall ran his superb Southern Region Pacific, Merchant Navy *Elder-Dempster Lines*, followed by Clive Patten with an Eastern Region Pacific, Peppercorn A1 *Silurian* (who's build Clive has been serialising in the Worthing newsletter) and most recently Chairman, Kevan Ayling unveiled his second scratch-built BR 'proposed 2-8-2, *Vortigern* (see photo). The Club is justifiably very proud of these members and their achievements and wonders whether any other club might be able to match this remarkable spectacle.



Club News

One of the stories in last month's Club News regarded a cautionary tale about past events at another club, mentioned in the Worthing & District Society of Model Engineers newsletter. I'd like to assure readers that Dave Cox's conversations all happened with the train stationary. In Dave's words *"Omissions and mistakes have put a completely different 'spin' on the incident and made us all involved in the hobby look rather careless. Particularly those who go out of their way to talk to interested members of the public and attempt to attract new members to local societies, the grass roots of the hobby!"* Our apologies to the Worthing Club and Dave for the distress caused.

There were also several inaccuracies in the report on the Pickering Experimental Engineering and Model Society newsletter, not least mis-spelling PEEMS and the fact that Jonathan is Chairman, not President (Mike Sayer).Our apologies to Mike Sayers and PEEMS.

It is the nature of *Club News* that any material included has to be summarised to fit the space and generally presented in a light-hearted context. Notwithstanding this, it is important that we do our best to present the facts behind the stories accurately.

Neil



Neil Wyatt
Editor



Diane Carney
Deputy Editor

Amadeal Ltd.
Machine Tools

Call: 0208 558 4615



CJ18A Mini Lathe - 7x14 Machine with DRO & 4" Chuck

SPECIFICATION:
Distance between centers: 350mm
Taper of spindle bore: MT3
Spindle bore: 20mm
Spindle speed: 50-2500mm
Weight: 43Kg

Price: £595



AMABL210D BRUSHLESS MOTOR 8x16- LARGE 38mm spindle bore

SPECIFICATION:
Distance between centers: 400mm
Taper of spindle bore: MT5
Spindle bore: 38mm
Number of spindle speeds: Variable
Range of spindle speeds: 50~2500rpm
Weight: 65Kg

Price: £1,185



AMABP250FX550
Combination Lathe/Milling Machine

SPECIFICATION:
Distance between centers 550mm
Swing over bed 250mm Swing over cross slide 150mm width of bed
135mm taper of spindle bore
MT4 Spindle bore 26mm

Price: £2,555



VM25L Milling & Drilling Machine Belt drive & Brushless Motor

SPECIFICATION:
Model No: AMAVM25LV (MT3) / (R8)
Max. face milling capacity: 63mm
Table size: 700×180mm
T-slot size: 12mm
Weight: 120Kg

Price: £1,431
W DRO – Price: £1,921
W DRO + PF - Price: £2,210



XJ12-300 with BELT DRIVE and BRUSH-LESS MOTOR

SPECIFICATION:

Gas Strut
Forward Reverse Function
750W BRUSHLESS Motor
Working table size: 460mm x 112mm
Gross Weight is 80Kg

Price: £725
W 3 AXIS DRO- Price: £955



VM18 Milling Machine Belt drive & Brushless Motor

SPECIFICATION:
Model No: VM18 (MT2) / (R8)
Max. face milling capacity: 50mm
Table size: 500×140mm
T-slot size: 10mm
Weight: 80Kg

Price: £1,190
W 3 AXIS DRO - Price: £1,627

See Website for more details of these machines and many other products at incredible prices!

PayPal

www.amadeal.co.uk
| Call: 0208 558 4615 | Email: info@amadeal.co.uk |

www.AMADEAL.CO.UK

NEW MACHINES NOW AVAILABLE
PLEASE CONTACT US ON 0208 558 4615 FOR MORE DETAILS ON THESE MACHINES



MPV290F - Movable Mill Head Lathe, Mill & Drill Combination Machine

VM28L
Ball Screw Type
Milling Machines





AMABL250E-550
VARIABLE SPEED LATHE
38mm Spindle Bore & Electronic Leadscrew System

VM32H
High Speed
Milling Machine





AMABL210E
With Electronic Change Gear System

WEISS MACHINE & TOOLS

Hi Spec Low Prices Why pay more?

Prices inc VAT & Free delivery to most mainland UK postcodes

We Accept VISA MasterCard

Contents

9 Rotating Tailstock Chuck Adaptors
A rotating tailstock chuck offers useful workholding options. Gavin Blakeman's adaptor design means you can make your own.

15 LBSC's Toy Locomotive Identified
Roger Backhouse has been seeking the toy LBSC saw as a child; he thinks he's finally tracked it down.

66 The Bradford Cup and Stevenson Trophy 2025
We are seeking nominations for the two prestigious competitions that are decided by you, our readers.

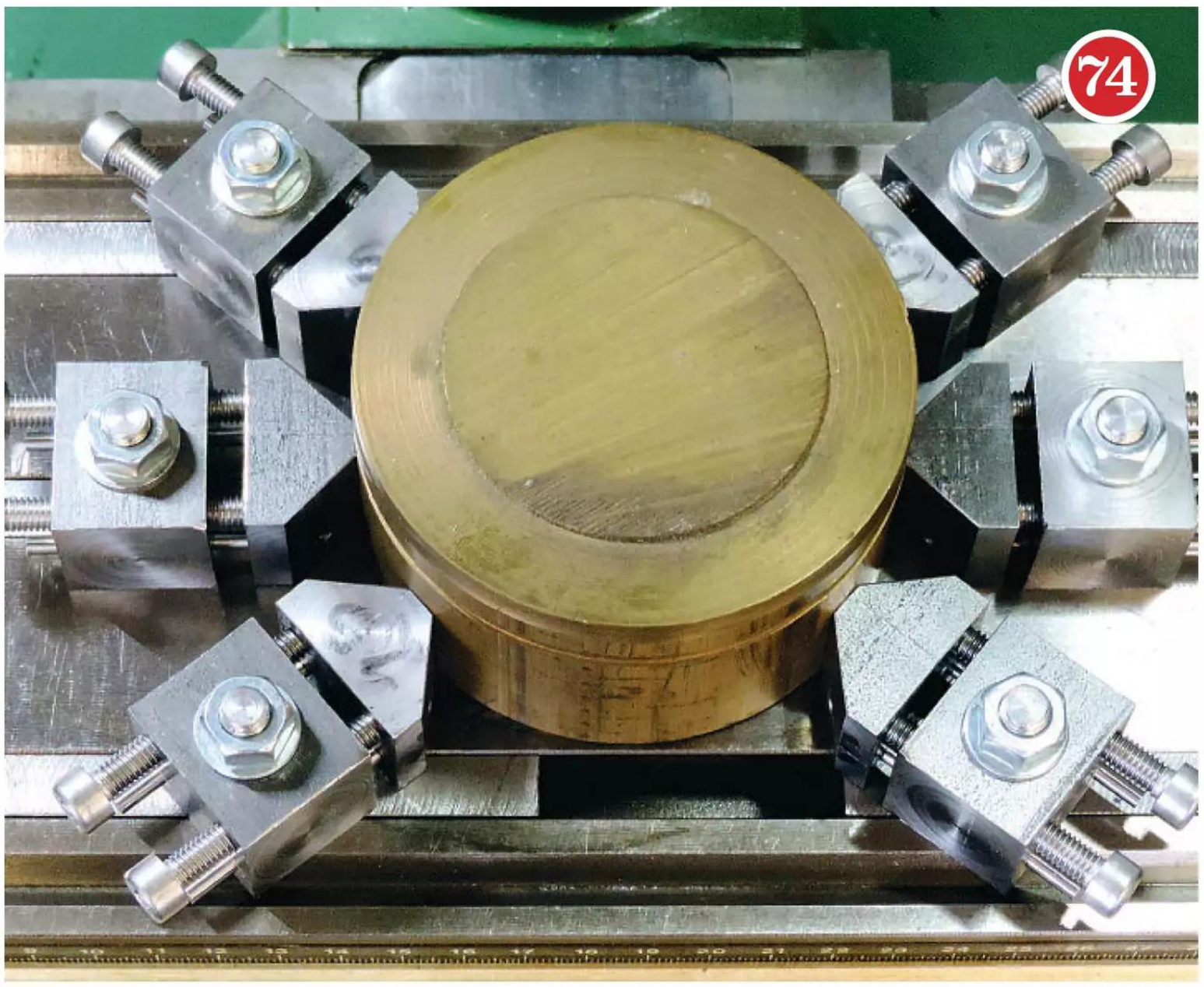
18 A Working Ashpan for a Princess Royal
Clive Fenn had a whole series of workshop challenges to overcome to make this complex mechanism.

27 A GWR Pannier Tank in 3 ½ Inch Gauge
Gerald Martyn explains how to make up a locomotive smokebox from laser cut mild steel parts.

37 A Tandem Compound Mill Engine
David Thomas completes the Corliss valves by making around forty parts, including the tripping mechanisms.

44 A Multipurpose Knurling Tool
In the second and final instalment, Jacques Maurel explains additional accessories for internal knurling to close up an oversize bore.

54 Beginner's Workshop
Geometer explains the applications of some less commonly encountered types of spanner.



56 COVER FEATURE – Model Engineer & Workshop visits the Stafford & District Model Engineering Society
John Arrowsmith calls in on a club with many different gauges of outdoor track.

60 Cheap Nasty Plastics
Or are they? Patrick Hendra contends that plastics and other polymers have an important place in our workshops.

66 Working on the Lathe: Drilling and Boring
Neil Raine concludes his series with a look at the development of boring technology.

67 The Brighton Gallopers
Neil Wyatt took a look at a ride that's been delighting tourists for nearly 140 years.

68 The BR Standard Class 4 2-6-0 Locomotive
Doug Hewson explains how to make an atomising lubrication system.

74 Versatile Milling Table Clamps
Keith Keen's design for moveable clamp jaws offers a great solution for holding awkward shapes.





Subscribe today!

Get your favourite magazine for less – delivered to your door!

See pages 34-35 for details!

Regulars

3 Smoke Rings
Thoughts from the Editor's Bench.

16 On the Wire
This month, we share the results of the ME&W reader survey, and what it means for the future of your magazine.

26 Readers' Tips
Our tips winner has a solution for getting a bandsaw to cut straighter. Send your tips to meweditor@mortons.co.uk, and you could win a prize.

36 Club Diary
Your guide to events at model engineering clubs around the UK.

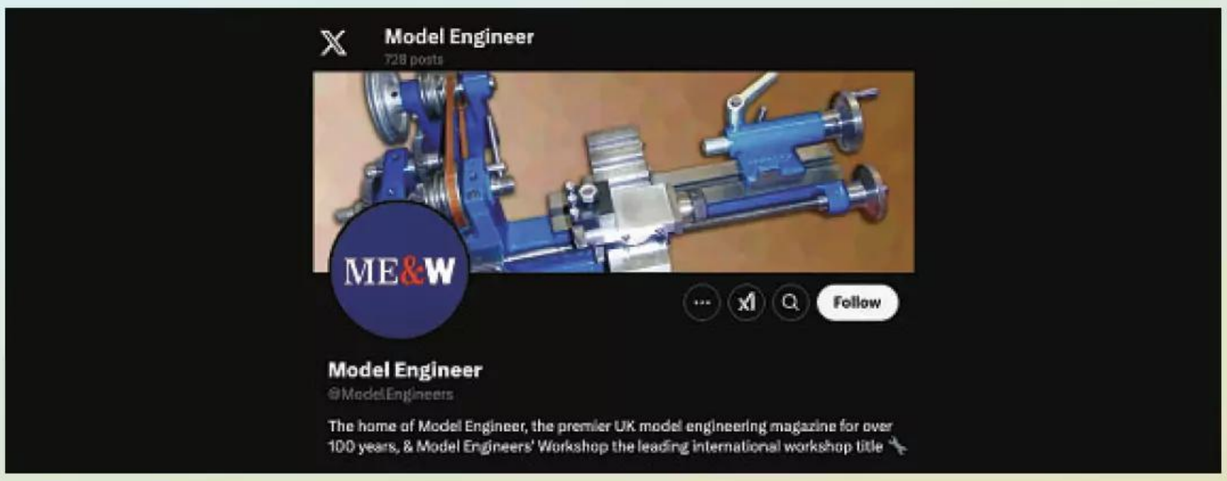
52 Postbag
Another varied selection of readers' news, queries and observations. Send the editors your letters at meweditor@mortons.co.uk.

77 Club News
Geoff Theasby's monthly report with news of engineering clubs across the country.

80 Readers' Classifieds
It's time to bag a workshop bargain, or if you have something to sell, email us the details or use the form in this issue.

Visit our Website

Why not follow us on X? www.x.com/ModelEngineers hashtag #MEW



Extra Content!
Your magazine is growing and changing into Model Engineer & Workshop. Find out more and let us know what you would like to see in the new, larger magazine at:
www.model-engineer.co.uk/forums

Download drawings for Gavin Blakeman's Rotating Tailstock Chuck Adaptors in larger and smaller sizes using this quick link or QR code:
https://tinyurl.com/ybfuk5ah



Hot topics on the forum include:

A parallel action hand vice started by Fulmen
One interesting solution raises other examples of parallel clamps.

1950 Myford/Drummond type M advice started by jimmyjaffa
It's surprising how many of these lathes are still working! Some useful advice for new owners of old lathes here.

Keratin Glue started by Michael Gilligan
Memories of various unusual and often smelly adhesives.

Farm Boy started by Dalboy
Making a well known hit and miss engine model.

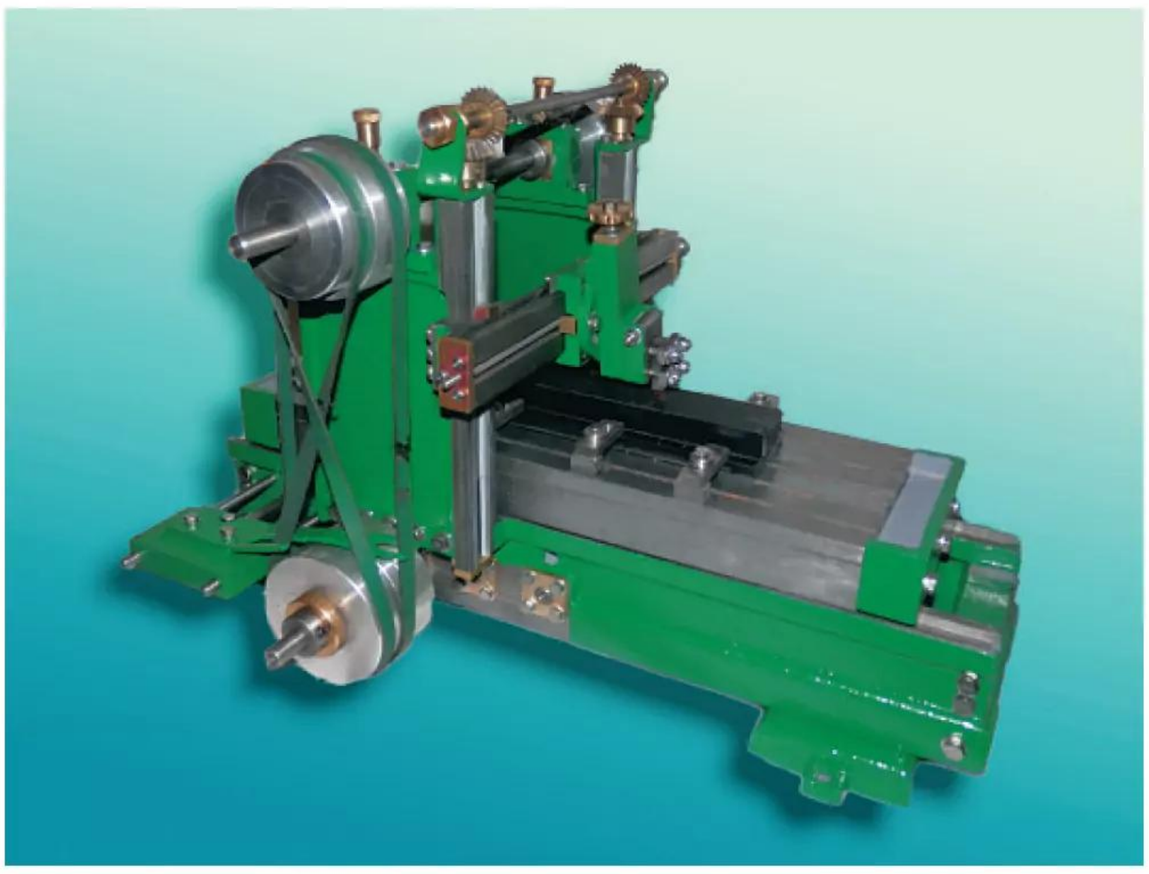
Come and have a chat!
As well as plenty of engineering and hobby related discussion, we are happy for forum members to use it to share advice and support.
Come and join us – it's free to all readers!

On the Cover



Our cover features one of the Stafford Model Engineering Society's younger members driving a 7¼" gauge BR Class 2 under the supervision of Dave Burrage. See page 56 for more news from Stafford.

Next Issue



In our next issue, Stuart Gunn makes a start on one of Stuart Models' more unusual designs.

EASY TO USE WEBSITE

NOW OVER **21,000** PRODUCTS ONLINE!

www.machinemart.co.uk

Machine Mart®

BRITAIN'S TOOLS & MACHINERY SPECIALIST

FRIENDLY STORES NATIONWIDE

SAVE £££S ON THIS WEEK'S £ PRICE CRASH

SEE ONLINE FOR LATEST DETAILS

GARAGES/WORKSHOPS

- Extra tough triple layer cover
- Heavy duty steel tubing
- Ratchet tight tensioning

BRIGHT WHITE INTERIOR

LENGTH UP TO 40'



ZIP CLOSE DOOR



CIG81220

KEEPS THE WEATHER OUT!

PRICE CUT NOW FROM £239.98 exc.VAT £287.98 inc.VAT WAS £298.80 inc.VAT

Model	Dims	Order Code	exc.VAT	WAS inc.VAT	inc.VAT
CIG81212	3.6 x 3.6 x 2.5m	140613584	£239.98	£298.80	£287.98
CIG81015	4.5 x 3 x 2.4m	140613570	£276.00	£334.80	£331.20
CIG81216	4.9 x 3.7 x 2.5m	140613574	£315.00	£382.80	£378.00
CIG81020	6.1 x 3 x 2.4m	140613572	£345.00	£418.80	£414.00
CIG81220	6.1 x 3.7 x 2.5m	140613576	£385.00	£466.80	£462.00
CIG81224	7.3 x 3.7 x 2.5m	140613578	£479.00	£586.80	£574.80
CIG1432	9.7x4.3x3.65m	140613594	£1079.00	£1318.80	£1294.80
CIG1640	12x4.9x4.3m	140613596	£2398.00	£3118.80	£2877.60

BOLTLESS SHELVING/ BENCHES



FROM £39.98 exc.VAT £47.98 inc.VAT

- Simple fast assembly in minutes using only a hammer



CHOICE OF 5 COLOURS

RED, BLUE, SILVER, GREY & GALVANISED STEEL

Model	Dims WxDxH(mm)	Order Code	exc.VAT	inc.VAT
150kg	800x300x1500	070710802	£39.98	£47.98
350kg	900x400x1800	070710808	£57.99	£69.59

3-IN-1 SHEET METAL MACHINES

- Bend, Roll & Shear metal up to 1mm thick
- Min. Rolling Diameter 39mm
- Bending angle 0-90°



ROLLING, SHEARING & FOLDING

SBR610

PRICE CUT NOW FROM £289.00 exc.VAT £346.80 inc.VAT WAS £358.80 inc.VAT

Model	Bed Width	Order Code	exc.VAT	WAS inc.VAT	inc.VAT
SBR305	305mm (12")	051210305	£289.00	£358.80	£346.80
SBR610	610mm (24")	051210610	£579.00	£717.60	£694.80
SBR760	760mm (30")	051210031	£689.00	£838.80	£826.80

METAL LATHE

- 300mm between centres
- LH/RH thread screw cutting
- Electronic variable speed • Gear change set • Self centering 3 jaw chuck & guard
- Power feed

PRICE CUT £679.00 exc.VAT £814.80 inc.VAT WAS £826.80 inc.VAT



CL300M 060712525

BELT AND DISC SANDER

- Belt sanding can be performed with the belt in the horizontal or vertical position
- Includes dust collection bag

£189.00 exc.VAT £226.80 inc.VAT



CS48 060611430

BENCH BUFFERS/ POLISHERS

FROM £74.99 exc.VAT £89.99 inc.VAT



CBB200

- For a brilliant shine

‡ WAS £563.98 inc.VAT

Model	Dia. (mm)	Order Code	exc.VAT	inc.VAT
CBB150	150	060710485	£74.99	£89.99
CBB200	200	060710490	£94.99	£113.99
CHDB500	150	060710492	£119.98	£143.98
CBB250‡	250	060710491	£169.98	£203.98

18V BRUSHLESS COMBI DRILLS

PRICE CUT £82.99 exc.VAT £99.59 inc.VAT WAS £107.98 inc.VAT

- 2 forward and reverse gears

2X2AH



CON18LIC 060219531

ARC ACTIVATED HEADSHIELDS GWH7 010120709

- Activates instantly when Arc is struck
- Protects to EN379
- Suitable for arc, MIG, TIG & gas welding

PRICE CUT NOW FROM £34.99 exc.VAT £41.99 inc.VAT WAS £44.39 inc.VAT



SEE FULL RANGE IN-STORE/ONLINE

MILLING DRILLING MACHINE

PRICE CUT £699.00 exc.VAT £838.80 inc.VAT WAS £862.80 inc.VAT

CMD300



£549.00 exc.VAT £658.80 inc.VAT

CMD10

‡ WAS £862.80 inc.VAT

Model	Motor	Spindle Speeds	Order Code	exc.VAT	inc.VAT
CMD10	150W/230V	100-2000rpm	060710850	£549.00	£658.80
CMD300‡	470W/230V	0-2500rpm	060710300	£699.00	£838.80

DRILL PRESSES

CDP102B

- Range of precision bench & floor presses for enthusiast, engineering & industrial applications

PRICE CUT NOW FROM £84.99 exc.VAT £101.99 inc.VAT WAS £113.99 inc.VAT



B = Bench mounted F = Floor standing

Model	Motor (W) Speeds	Order Code	exc.VAT	WAS inc.VAT	inc.VAT
CDP5EB	350 / 5	060712030	£84.99	£113.99	£101.99
CDP5RB	350 / 5	060710035	£89.98	£113.99	£107.98
CDP102B	350 / 5	060715512	£109.98	-	£131.98
CDP152B	450 / 12	060715522	£179.00	-	£214.80
CDP452B	550 / 16	060715575	£289.00	£358.80	£346.80
CDP502F	1100 / 12	060715592	£675.00	£826.80	£810.00

ENGINEERS HEAVY DUTY STEEL WORKBENCHES

PRICE CUT NOW FROM £259.98 exc.VAT £311.98 inc.VAT WAS £347.98 inc.VAT



Shown fitted with optional 3 drawer unit Only £155.98 Inc VAT

INCLUDES SINGLE LOCKABLE DRAWER

- Sturdy lower shelf
- Durable powder coated finish

‡ WAS £347.98 inc.VAT
◆ WAS £382.80 inc.VAT

Model	Dims. LxWxH (mm)	Order Code	exc.VAT	inc.VAT
CWB1500D‡	1500x650x985	040317718	£259.98	£311.98
CWB2001P	2000x650x865	040317809	£279.98	£335.98
CWB2000D◆	2000x650x880	040317807	£309.00	£370.80

ROTARY TOOL KIT

Kit includes:
- Height adjustable stand • 1m flexible drive • 40 accessories

£34.99 exc.VAT £41.99 inc.VAT



CRT130 060212135

BENCH GRINDERS

13 MODELS IN THE RANGE

FROM £64.99 exc.VAT £77.99 inc.VAT



CBG6250LW

STANDS AVAILABLE FROM ONLY £62.39 INC.VAT

‡ WAS £116.39 inc.VAT

Model	Duty	Wheel Dia.	Order Code	exc.VAT	inc.VAT
CBG6RZ	PRO	150mm	060510211	£64.99	£77.99
CBG6250LW	HD	150mm	060716252	£69.98	£83.98
CBG8370LW‡	HD	200mm	060718371	£94.99	£113.99

INDUSTRIAL ELECTRIC MOTORS

- Range of single phase motors suited to many applications
- All totally enclosed & fan ventilated for reliable long-term service



3HP 2-POLE MOTOR

FROM £79.98 exc.VAT £95.98 inc.VAT

Hp	Shaft Speed	Order Code	exc.VAT	inc.VAT
1/3	4 pole	010210426	£79.98	£95.98
1	2 pole	010210431	£99.98	£119.98
3/4	4 pole	010210430	£104.99	£125.99
2	2 pole	010210435	£124.99	£149.99
3	2 pole	010210465	£154.99	£185.99
4	2 pole	010210471	£189.98	£227.98

MMA & ARC/TIG INVERTER WELDERS

PRICE CUT NOW FROM £99.98 exc.VAT £119.98 inc.VAT WAS £125.99 inc.VAT

MMA200A



‡ WAS £125.99 inc.VAT
◆ WAS £125.99 inc.VAT

AT165



Model	Min/Max Output Current	Electrode Dia. (mm)	Order Code	exc.VAT	inc.VAT
MMA140A‡	20A-140A	1.6-3.2	010112161	£99.98	£119.98
MMA200A◆	20A-200A	1.6-3.2	010112163	£129.98	£155.98
AT165	10A-160A	2.5/3.2/4.0	010112149	£219.98	£263.98

PRO TOOL CHESTS & CABINETS

SEE ONLINE FOR OUR HUGE RANGE OF TOOL STORAGE

PRICE CUT NOW FROM £149.98 exc.VAT £179.98 inc.VAT WAS £185.99 inc.VAT



BALL BEARING ROLLER DRAWERS

Model		Description	Order Code	exc.VAT	inc.VAT
1	CBB209C ‡	9 Dr Chest	070118032	£149.98	£179.98
2	CBB217C	7 Dr Cabinet	070118057	£279.00	£334.80
3	CTC1300C	13 Dr Combi	070113042	£189.98	£227.98

EASY WAYS TO BUY...

CALL & COLLECT AT STORES TODAY

CLICK & COLLECT OVER 10,500 LOCATIONS

VISIT STORES NATIONWIDE

CALL 0115 956 5555

BROWSE machinemart.co.uk

BARNSLEY, S71 1HA	01226 732297	DEAL KENT, CT14 6BQ	01304 373434	LIVERPOOL, L3 5NF	0151 709 4484	PORTSMOUTH, P03 5EF	02392 654777
B'HAM GT. BARR, B43 6NR	0121 358 7977	DERBY, DE1 2ED	01332 290931	LONDON CATFORD, SE6 3ND	0208 695 5684	PRESTON, PR2 6BU	01772 703263
B'HAM HAY MILLS, B25 8DA	0121 771 3433	DONCASTER, DN2 4NY	01302 245999	LONDON EDM'TON, N18 020	0208 803 0861	SHEFFIELD, S2 4HJ	0114 258 0831
BOLTON, BL3 6BD	01204 365799	DUNDEE, DD1 3ET	01382 225140	LONDON LEYTON, E10 7EB	0208 558 8284	SIDCUP, DA15 9LU	0208 3042069
BRADFORD, BD1 3BN	01274 390962	EDINBURGH, EH8 7BR	0131 659 5919	LUTON, LU4 8JS	01582 728063	SOUTHAMPTON, SO17 3SP	02380 557788
BRISTOL, BS5 9JJ	0117 935 1060	EXETER, EX2 8QG	01392 256744	MAIDSTONE, ME15 6HE	01622 769572	SOUTHEND, SS9 3JJ	01702 483742
BURTON, DE14 3QZ	01283 564708	GATESHEAD, NE8 4XA	0191 493 2520	MC CENTRAL, M8 8DU	0161 241 1851	STOKE-ON-TRENT, ST1 5EH	01782 287321
CAMBRIDGE, CB4 3HL	01223 322675	GLASGOW, G4 9EJ	0141 332 9231	MC OPENSHAW, M11 1AA	0161 223 8376	SUNDERLAND, SR2 9QF	0191 510 8773
CARDIFF, CF24 3DN	02920 465424	GLOUCESTER, GL1 4HY	01452 417948	MANSFIELD, NG19 7AR	01623 622160	SWANSEA, SA7 9AG	01792 792969
CARLISLE, CA1 2LG	01228 591666	GRIMSBY, DN32 9BD	01472 354435	MIDDLESBROUGH, TS17 6BZ	01642 677881	SWINDON, SN1 3AW	01793 491717
CHELTENHAM, GL52 2EH	01242 514402	HULL, HU9 1EG	01482 223161	NORWICH, NR2 4LZ	01603 766402	TWICKENHAM, TW1 4AW	0208 892 9117
CHESTER, CH1 3EY	01244 311258	ILFORD, IG2 7HU	0208 518 4286	NORTHAMPTON, NN5 5JW	01604 267840	WARRINGTON, WA2 8JP	01925 630937
COLCHESTER, CO1 1RE	01206 762831	IPSWICH, IP1 1UZ	01473 221253	NOTTINGHAM, NG1 1GN	0115 956 1811	WIGAN, WN5 9AU	01942 323785
COVENTRY, CV1 1HT	02476 224227	LEEDS, LS4 2AS	0113 231 0400	PETERBOROUGH, PE1 2PE	01733 311770	WOLVERHAMPTON, WV4 6EL	01902 494186
CROYDON, CR2 6EU	0208 763 0640	LEICESTER, LE4 6PN	0116 261 0688	PLYMOUTH, PL4 9HY	01752 254050	WORCESTER, WR1 1JZ	01905 723451
DARLINGTON, DL1 1RB	01325 380841	LINCOLN, LN5 8HG	01522 543036	POOLE, BH14 9HT	01202 717913		

Calls to the catalogue request number cost 7p per minute plus your telephone company's network access charge. Calls may be monitored. All prices correct at time of going to press. We reserve the right to change products and prices. All products subject to availability, E&OE.

Rotating Tailstock Chuck Adaptors

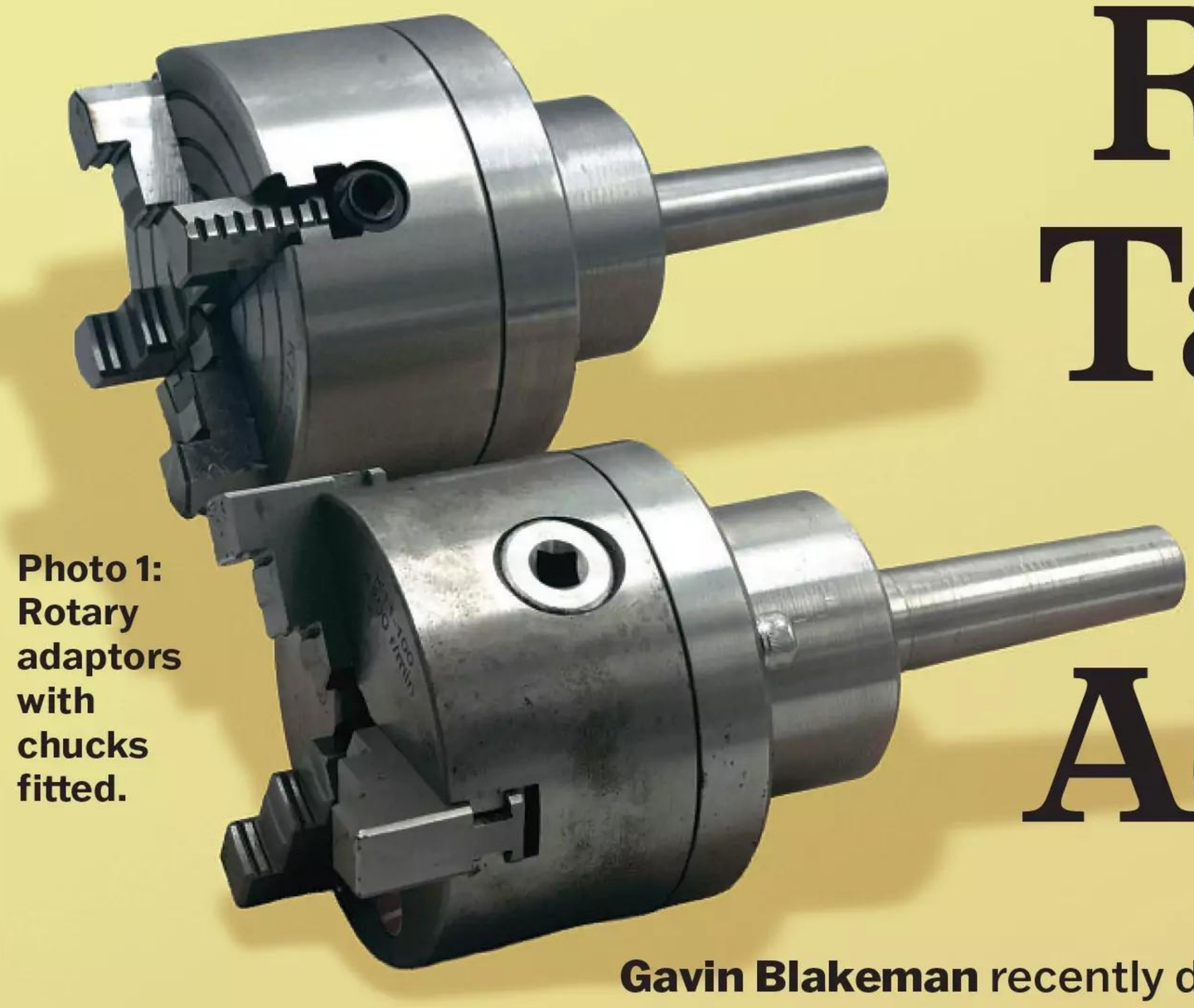


Photo 1: Rotary adaptors with chucks fitted.

Gavin Blakeman recently decided to build an adaptor to allow a rotating chuck to be mounted on the tailstock of his lathe; he looked at a variety of sizes and drawings of larger and smaller versions can be downloaded from www.model-engineer.co.uk.

A tailstock chuck adaptor, **photo 1**, allows mounting a rotating lathe chuck in the tailstock of the lathe. This can be useful for holding work that cannot be supported on a centre, **photo 2**, or by using the fixed steady. Examples of usage would be pipe that needs to be machined on the outside diameter (OD). This can be held by the chuck inner jaws and then the OD machined. If a 4-jaw chuck is mounted on the tailstock, irregular work pieces can also be held for machining. If you are a follower of the 'Cutting Edge Engineering' channel on YouTube, you may already be familiar with the use of a tailstock mounted chuck.

As a starting point, I looked at the various smaller 3-jaw and 4-jaw chuck sizes. This indicated that there are three practical sizes to consider, 80mm, 100mm and 125mm. These sizes are available in both 3-jaw and 4-jaw back-plate mount chucks. Further, the same size 3-jaw and 4-jaw chuck also share register size and have the same mounting hole pitch-circle-diameter (PCD). This implies that both a 3-jaw and 4-jaw can be mounted on the same back-plate to provide additional flexibility. There are differences in the bore sizes between the 3- and 4-jaw chucks; this can be overcome, however, by providing different sized preload flanges for the 3- and 4-jaw chucks. As the preload flange is easy to machine, this should not be a problem in practice. Additionally, 3-jaw chucks have three mounting bolts, and 4-jaw chucks have four mounting bolts, but it is possible to drill the adaptor for both 3- and 4-hole bolt patterns. This write-up will provide details for a MT3 arbor with a 100mm diameter chuck. Design packs for the remaining combinations may be downloaded from www.model-engineer.co.uk using the link: https://tinyurl.com/ybfuk5ah.

Table 1 summarises the various chuck diameters, bores and registers I found. The chuck diameter is the OD of the chuck. You may need to vary these for other brands of chuck.

The adaptor consists of three main components and several smaller components. There are three components to machine and four components to purchase. The machined components are the arbor, **fig 1**, that inserts into the tailstock and carries the bearings and the backplate, **fig 2**, that carries the chuck and the preload-flange. The adaptor is sealed front and back to protect the bearings. The seal at the back is a standard lip-type oil seal, while the seal at the front is provided by a plug with an O-ring that fits in the bore of the chuck. The last components are the bearings. These are standard metric taper roller bearings.

The lathe I use has an MT3 tailstock taper and a swing over the saddle of 230mm. The main chuck is a 160mm diameter camlock mount. The largest diameter that I considered would be required for the tailstock chuck would

Chuck Ø	3J-Bore	4J-Bore	Register	3J-Recess	4J-Recess
80mm	16mm	22mm	55mm	3.5mm	
100mm	22mm	25mm	72mm	3.5mm	4.0mm
125mm	30mm	30mm	95mm	4mm	4.5mm

Table 1

be covered by the 125mm chuck sizes. Considering that I also use this sized chuck on rotary tables and dividing heads, it made sense to plan for this sized chuck.

A number of designs, covering practical chuck sizes and common Morse taper tailstocks were considered. These are summarised in **Table 2**.

Tailstock Taper	80mm	100mm	125mm
MT2	Yes	Yes	No
MT3	No	Yes	Yes

Table 2

BEARING SELECTION

Taper roller bearings are used. In this application they have a number of advantages. Opposing pairs of taper-roller bearings are able to support axial (along the axis) and radial (90° to the axis) loads as well as moment loads (bending). In this they are similar to angular contact ball bearings. Taper roller bearings can also carry significant loads, larger than ball bearings of the same bore size. Taper roller bearings are separable, allowing the inner race to be mounted separately from the outer race, simplifying assembly. Another advantage of using taper-roller bearings is that they do not have to be widely separated to provide adequate support. More information in taper roller bearings can be found on the SKF website (www.skf.com).

The design uses back to back metric taper roller bearings of the same size. The bearings are mounted with the inner race stationary and the outer race rotating. The preload of the bearings is done by pushing the inner races towards each other using a cap-screw. The cap-screw is non-rotating. It should be possible to use angular contact ball bearings instead of taper-roller bearings as they are available in the same ID/OD configurations but have slightly smaller thicknesses (the B dimension in the SKF catalogue). Angular contact bearings would also have a smaller load carrying capacity.

Due to the design of taper roller bearings, they cannot have seals like deep-groove ball bearings. The sealing of the bearings therefore needs to be designed into the application. Grease lubrication is fine for the slower speeds typically encountered on lathes. This also makes the sealing of the bearings easier, as no arrangements are needed to retain the lubricant.

For the choice of bearing, the morse-taper major diameter was used as a guide to the limiting bore diameter of the bearing. An MT3 taper has a major diameter of 24.1mm, thus appropriate bearing bore sizes would be in the range of 20mm-25mm. Using a larger shaft diameter does not provide any additional strength as the maximum bending moment is at the major diameter of the arbor where it leaves the tailstock. This is also the point of least stiffness as it tends to be unsupported at this point in practice.

As a result, for an MT3, a bearing bore of 20mm was selected.

The OD of the bearing is less constrained. 20mm taper-roller bearings have an OD range of 47mm or 52mm. This is significantly less than the diameter of the back plate. For the 100mm chuck, a 47mm OD bearing was chosen.

Standard size oil seals are used to seal the back of the unit, while O-rings are used to form a seal in the bore of the chuck. This should be sufficient to keep dirt and cutting fluid from the bearings.

These bearings are standardised and available from a number of sources. I used cheaper bearings from a local supplier. I also purchased the oil seal and O-ring from the same supplier.

Features are included to allow easier dismantling of the bearings should it ever be necessary. However, if the bearings are adequately greased, they should easily last many years and are unlikely to require replacement.

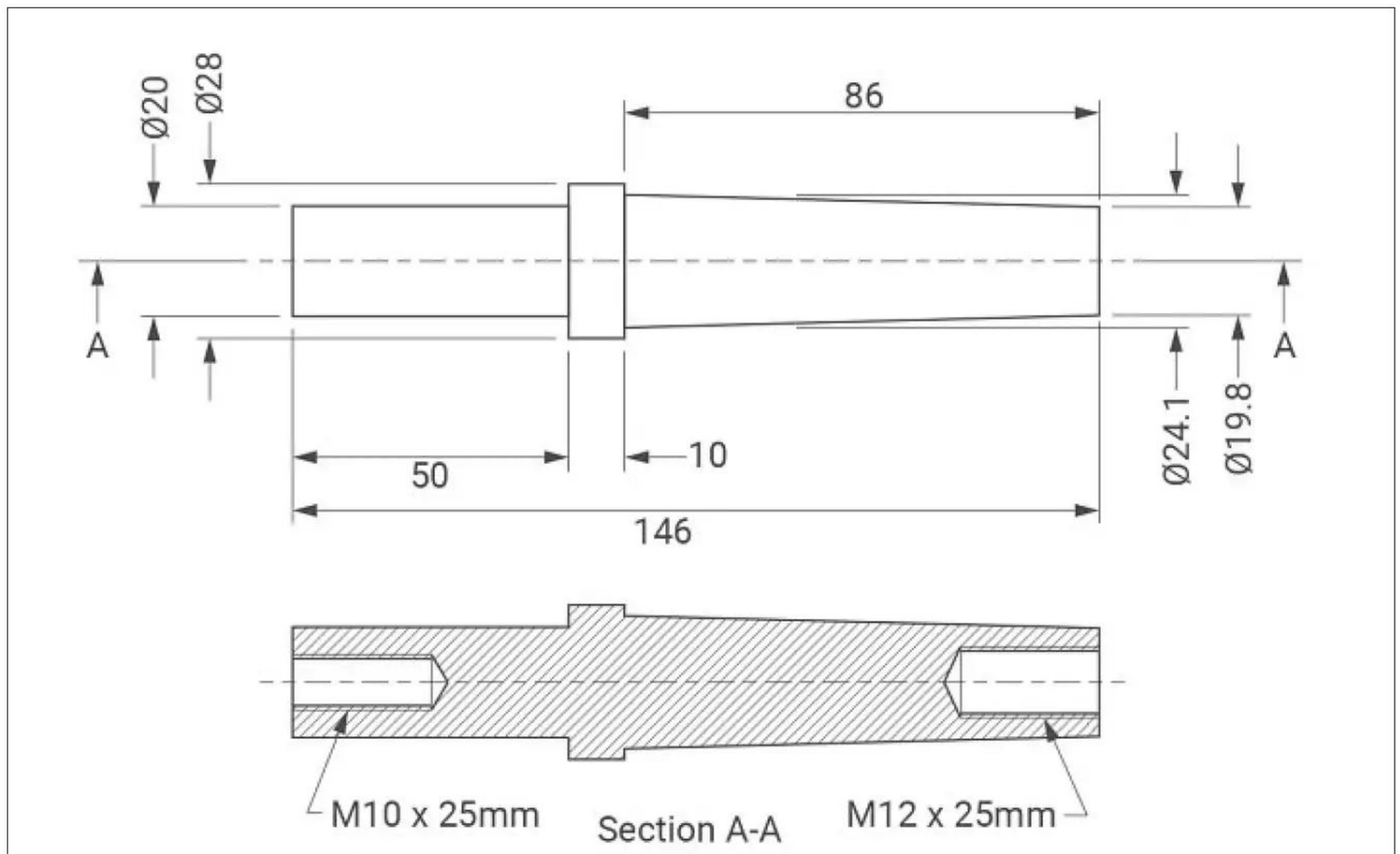


Fig 1 **Arbor**

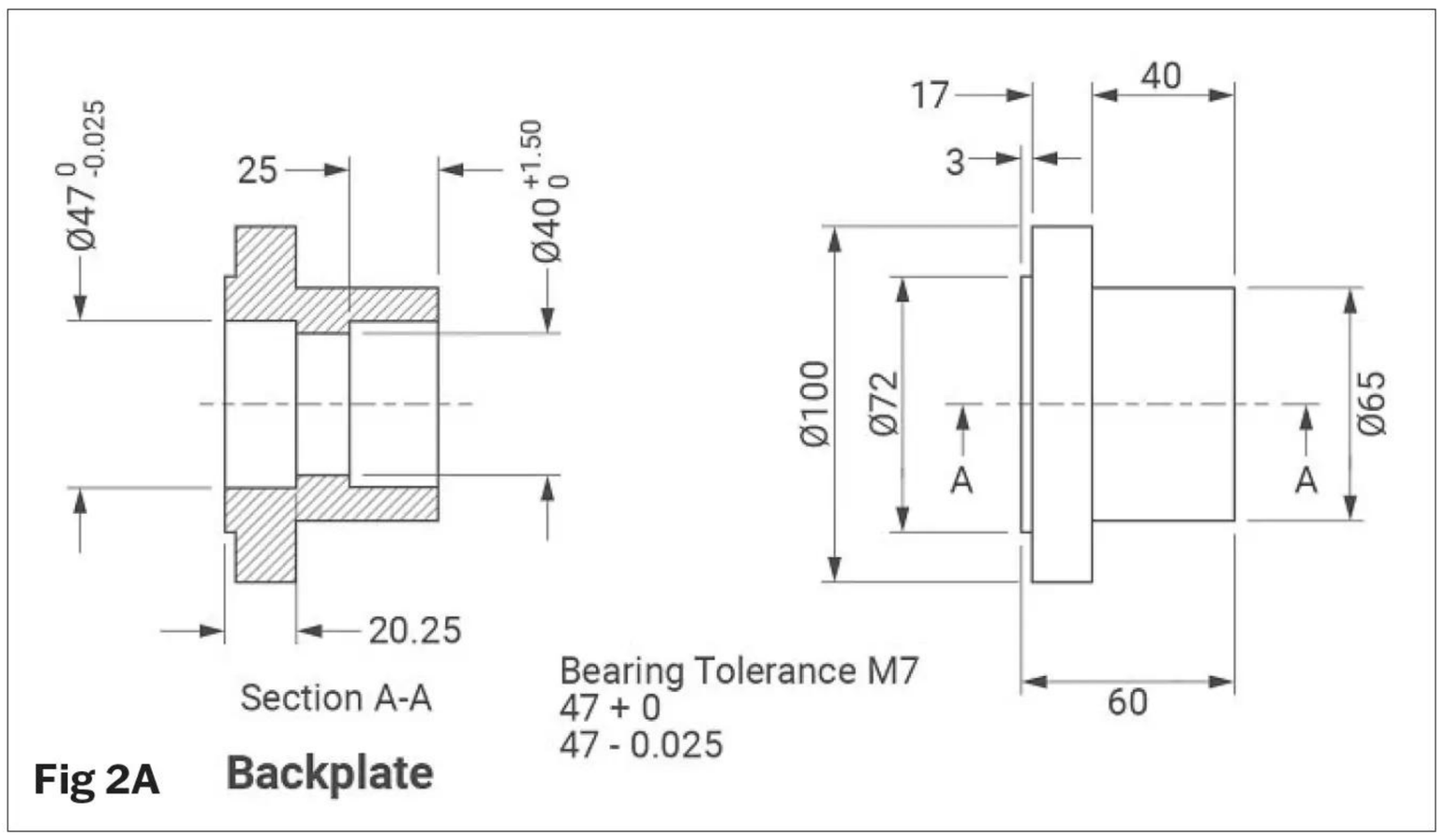


Fig 2A **Backplate**

Fig 2B

Drilling Pattern For 100mm Chuck

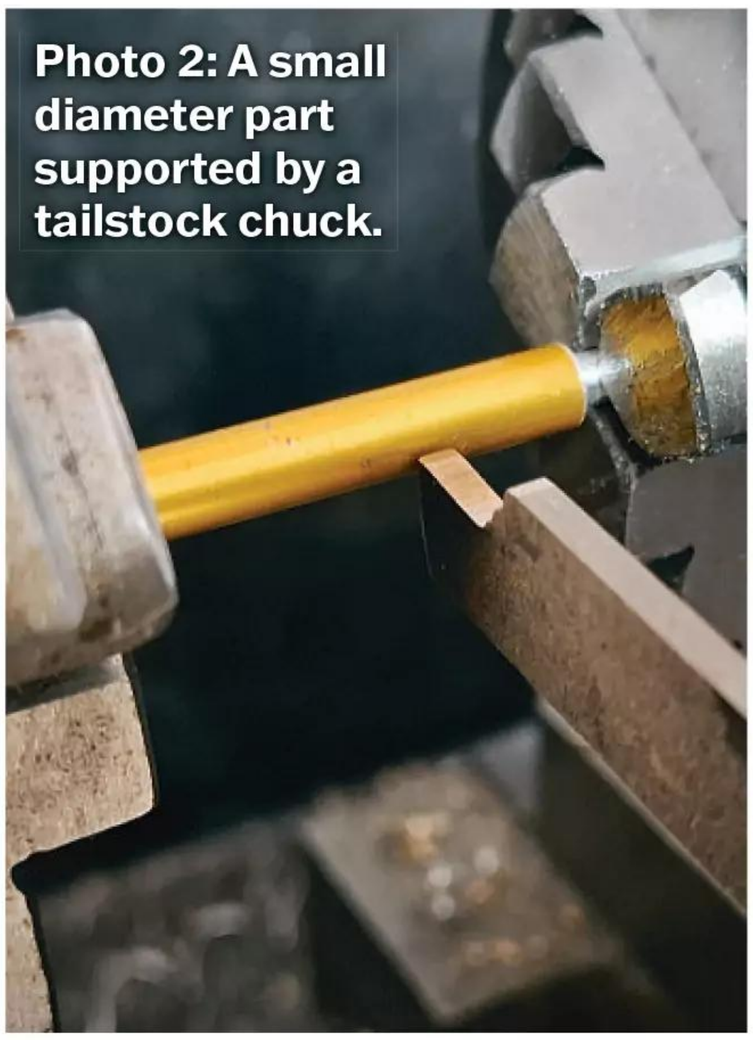


Photo 2: A small diameter part supported by a tailstock chuck.

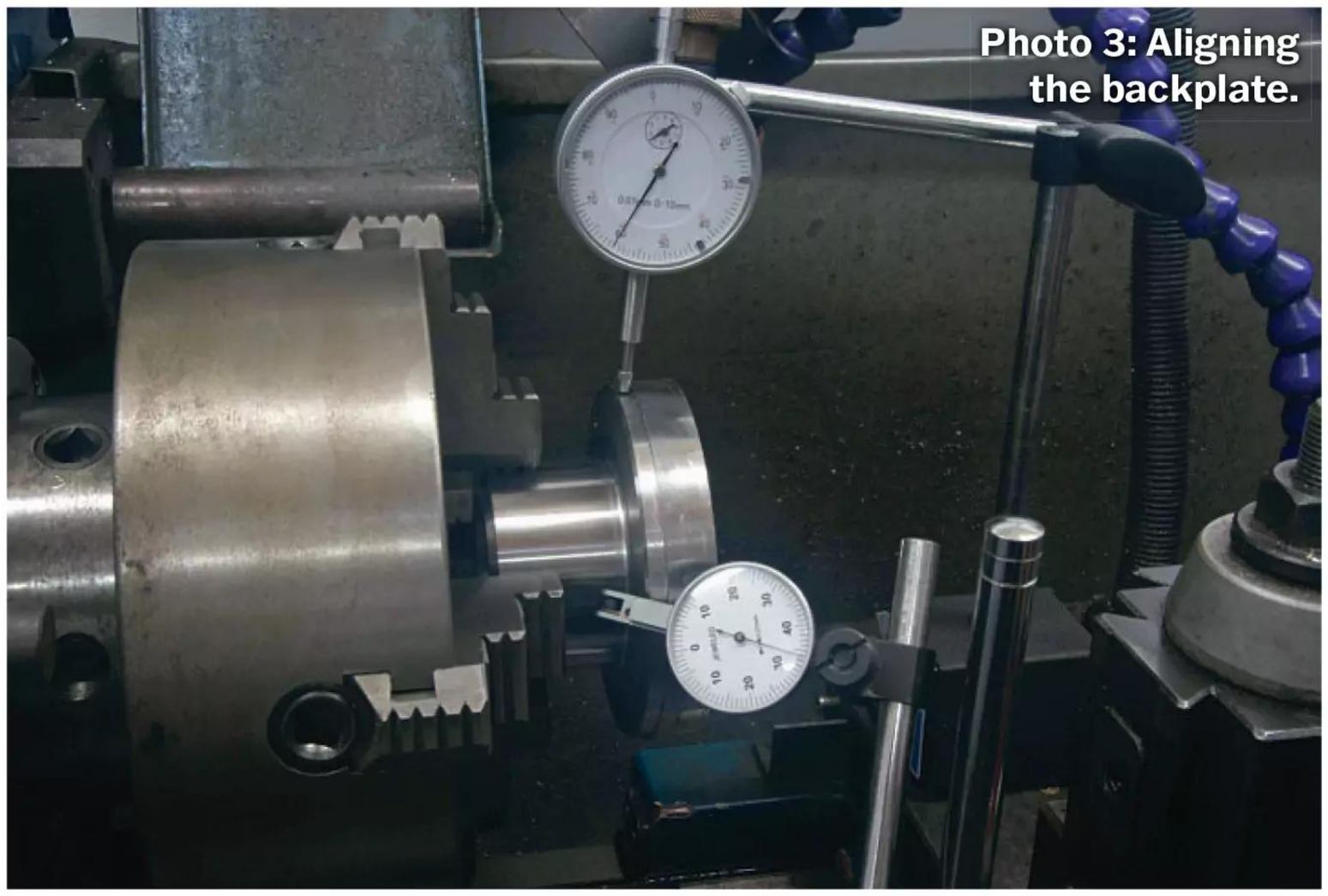


Photo 3: Aligning the backplate.

Component list	Tailstock Chuck	MT2		MT3	
		80mm	100mm	100mm	125mm
1. Back-plate	1020 (see notes)	Ø80mm x 60mm	Ø100mm x 60mm		Ø125mm x 65mm
2. Arbor	4140	Ø22mm x 129mm	Ø22mm x ?? mm	Ø28mm x 146mm	Ø28mm x 156mm
3. Pre-load flange	1214	Ø42mm x 25mm	Ø47mm x 17mm	Ø47mm x 17mm	Ø52mm x 25mm
4. Bearings	2 off	30302 (15/42)	30303 (17/47)	30204 (20/47)	30304 (20/52)
5. Oil Seal	NBR	22mm x 42mm x7mm	28mm x 47mm x 7mm		28mm x 52mm x 8mm
6. O-ring	NBR	O-ring size is dependent on chuck being used.			
7. Bolt		M8 Capscrew	M10 capscrew		M10 capscrew

NOTES ON 4140 STEEL

4140 is a high tensile alloy steel. This makes it tougher (mechanically) to machine. I use carbide tools and therefore cannot comment on how it would machine using HSS tooling. What I do find is that it takes a lot more lathe power to machine than the free cutting steels. Also, when machining there is a lot of heat generated and the heat does not leave with the chip. This means the work piece gets exceptionally hot if coolant is not used, and it is easily possible to burn oneself on the work piece if care is not taken.

That said, it does give a good, machined surface. You may wish to machine using coolant to remove the heat. When you are machining the areas that require a tight tolerance, keep the work piece cool, or cool the work piece before measuring. I have found deviations from hot to cold of 10-20µm (0.01 to 0.02mm) at times. These size changes from hot to cold are close to the tolerances allowed and care needs to be taken.

The application is not so arduous that high-tensile steel is required and a free-cutting steel should perform adequately.

CONSTRUCTION

I ended up building both a 100mm MT3 and a 125mm MT3 adaptor. The discussion that follows will feature the construction of the 100mm MT3 tailstock chuck. The photos show both the 100mm and 125mm version. The same principles apply to both the smaller and larger versions.

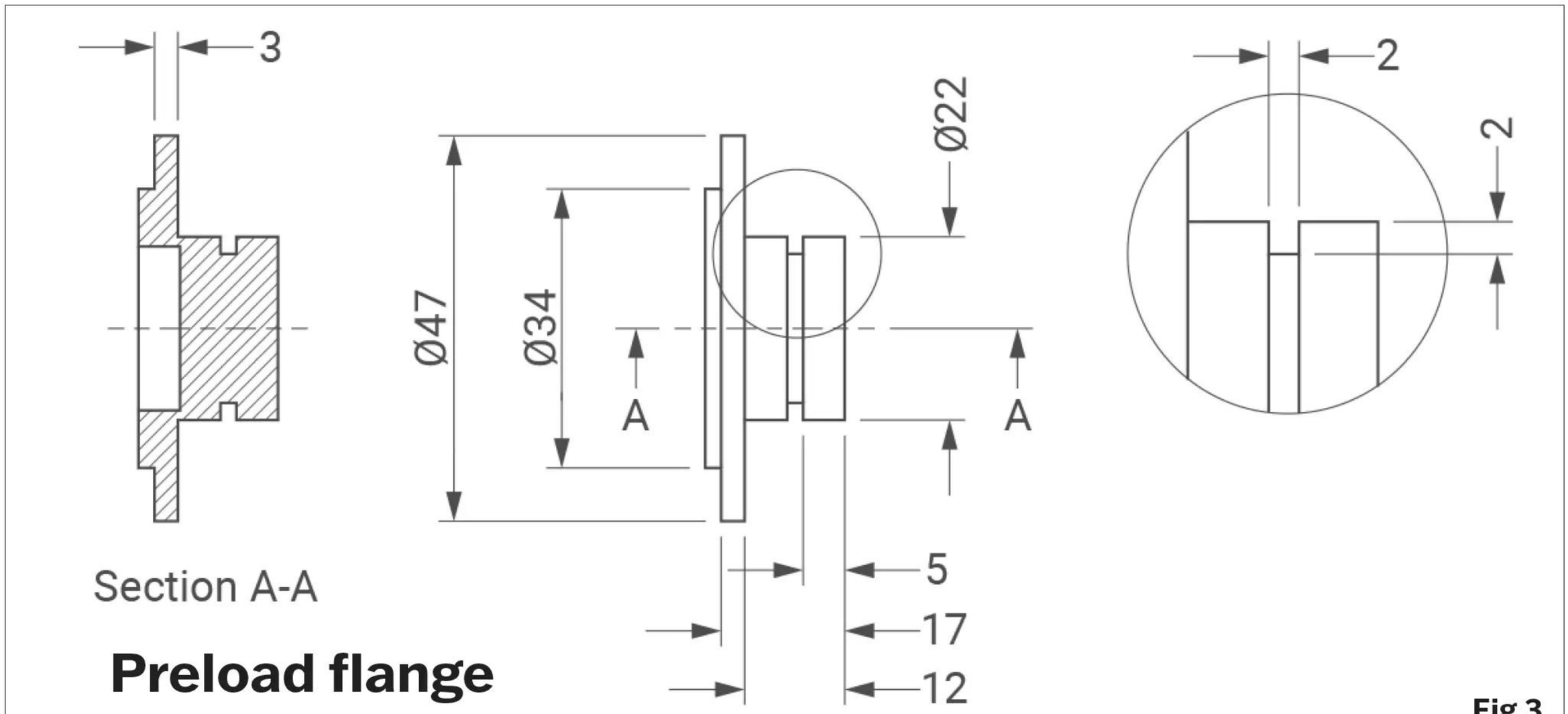


Fig 3

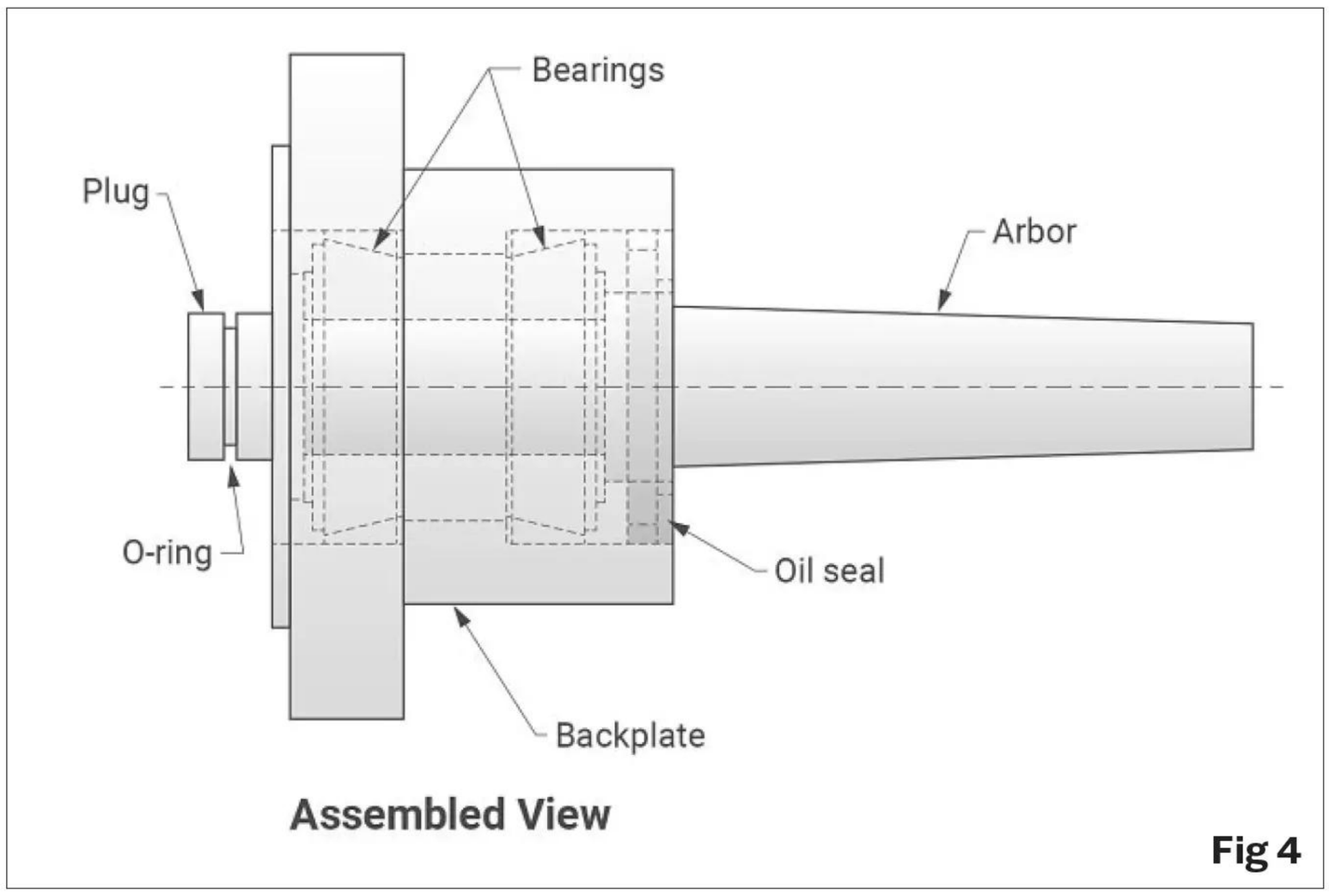


Fig 4

BACKPLATE

The back-plate, figs. 2A and **2B** does not perform an onerous duty and is machined from 1020 or 1214 steel. I could not obtain a suitably sized piece of 1214 and used 1020. This does require a lot of material to be removed, so an alternative is to make up a back-plate assembly by welding two suitable pieces of material together and then machining as a unit.

Regardless of the source of the back-plate, start by gripping the front in the 3-jaw. Face the back surface and then machine the back surface features, starting with the spigot. I left the spigot parallel as it provides the gripping surface for machining the opposite side of the back-plate. You will also need to machine a reference surface on the OD of the back plate. The reference surface only needs to be around 5mm long and should be slightly over the final diameter. This, together with the back surface of the back-plate, will be used to clock the back-plate once it is placed in the 4-jaw chuck to machine the front surface features.

Drill through and bore to 40mm (+1.5mm/-0.0mm). The 40mm is not a critical dimension but cannot be too oversize as it does provide the seat for the bearing. Using a large (stiff) boring bar, bore the housing for the oil seal and the bearing outer race. This bearing outer race must be an interference fit to the housing. The bearing housing should be:

$$47\frac{+0\mu m}{-25\mu m}mm\text{[46.975mm-47.000mm]}$$

Due to the interference fit, the bearing seat cannot be tested by offering the bearing up to the housing. If you make a mistake and oversize the bearing housing, do not despair, refer to the notes at the end that will provide a means to recover (or make Jacques Maurel's internal knurling tool as described in this issue! – Ed.).

You can machine the first 8-10mm of the bearing housing to 47mm to make it easier to fit the seal. Do not fit the bearing at this time.

Before removing the back place from the chuck, chamfer all the edges. I put a large (2mm) chamfer on the outside edges and a smaller one in the oil seal area.

Once all the backside features are complete, remove the back plate, swap to the 4-jaw chuck and chuck the back plate by the spigot/bearing housing. Then carefully centre and align the back plate.

Use two clock gauges and clock the back plate to as close to zero as possible in both the rotary direction and the axial direction. Any misalignment at this stage will show up as a taper when turning pieces held in the tailstock chuck. Try to get the run-out at both the periphery of the back-face and the 100mm OD to less than 10µm of TIR. This process took me the better part of half an hour to complete, alternately tapping with a hammer and adjusting chuck jaws, **photo 3**.

Once the back plate is clocked, clean up and true the front surface by taking a facing cut and bring it to final thickness. Machine the OD to final diameter and then machine the register for the chuck. This should be 2-3mm deep (depending on your chuck) and slightly

oversize, say 0.05mm.

Once this is done, machine the front bearing housing. The diameter and tolerances are the same as the back side bearing housing. The depth of the bearing housings need to be close, but are not critical, as some deviation can be taken up using the pre-load plug. That said, the closer to specification the better.

Once complete chamfer the front edges. This time, both chamfers should be fairly small.

It is now time to drill the holes for the mounting bolts.

I used the mill to drill the chuck mounting holes. The 125mm adaptor was counter-bored, while the 100mm was not. In hindsight, I would not counter-bore and leave the mounting bolts flush with the surface, see 100mm adaptor in photo 1. A 3-jaw uses 3 M8 holes and a 4-jaw uses 4 M8 holes. You can either drill for a single chuck, i.e. three or four holes, or drill for both three and four holes. I drilled for both. My approach is to use the zero-degree hole for both 3 and 4-jaw chucks, and then drill the rest of the holes, three at 120° for the three-jaw and 4 at 90° for the 4 -jaw.

Additionally, to provide jacking bolts to jack the chuck off the register, I threaded the 3-jaw chuck holes (spaced at 120°) for M10. An M8 clearance hole is 8.8mm while the tapping size for an M10 bolt is 8.6mm. This does give an M10 thread that is not fully engaging, but for the purpose of jacking the chuck off, this will be more than adequate. If you do use the jacking bolts, protect the threads on the chuck by either using a specially machined bolt, or drop a length of suitable sized bar in the bolt hole for the jacking bolt to press against, rather than pressing against the threads.

There are also three grooves to be milled or drilled into the bore of the housing. These are designed to facilitate the removal of the bearings should it ever become necessary.

ARBOR

The arbor is a morse-taper with an extended shaft. This will be machined from a solid piece of round bar. I used high-tensile 4140, but this is not necessary, and any bar of known provenance will do.

Face the bar to length and centre drill both ends. Drill and tap for the drawbar (M10 x 25mm) and the preload bolt (M8 x 15mm). We will be machining the arbor between centres.

Once the holes have been drilled and tapped, mount the arbor blank back in the 3-jaw. Set the cross slide over to 30° and using a small boring bar, machine a 60° included angle on both ends. This is required to allow the holes to properly mate with the centres.



Photo 4: Setting up for Morse taper turning.

Leave the cross slide at 30° and place a fixed centre in the chuck and machine a fresh surface on the centre. Mount the arbor between centres with a suitable drive mechanism and machine the bearing mounting surface. This is a straightforward turning job, but the aim should be to get the bearing to be a close sliding fit:

$$(20\frac{-9\mu m}{-16\mu m}mm)$$ [19.984mm-19.991mm]

Machine the surface for the oil seal to run on and then chamfer the available edges.

There are two approaches to machining the Morse taper; one is to offset the tailstock. This has the advantage that the taper can then be cut using the automatic feed. Also, if your compound slide has insufficient travel to cut the taper in one pass, this may be the better approach.

The other alternative is to use the compound and set it to the correct angle for the taper, and then machine using the compound travel.

I used the compound method. To get the angle correct, I mounted a MT3 arbor between centres and, using a dial gauge, set the compound to the correct angle. A similar method can be used if you decide to offset the tailstock, **photo 4**.

Before starting machining the taper, I used a sharpie to cover the surface to allow gauging of how far along the progress was. As my lathe does not have sufficient travel on the compound feed screw, I machined the taper in two sections, blending the joint as best I could. This turned out well, and the blend line cannot be seen.

Machine the taper and test fit to a Morse taper socket. There should be no play. However, a word of caution, I almost got the new arbor stuck several times as it would not withdraw from the socket and did not yet have sufficient depth to engage the ejection mechanism on the tailstock.

Once the taper has been machined and fits correctly, machine chamfers on any remaining edges.

I did not need to add a tang. However, your needs may vary. If you do need a tang for the arbor, machine it from a separate piece of stock and thread M12. It can then be screwed in or removed as required.

PRELOAD FLANGE

The preload flange, **fig. 3** performs two functions. First to provide the preload to the two bearings and second to provide sealing for the bearings. To simplify the design, the sealing is provided in the bore of the chuck using an O-ring. Depending on the bore sizes of the chucks that you wish to use, this may require a flange for the 3-jaw and a different flange for the 4-jaw.

The preload flange is a simple turning exercise. Any suitable piece of steel can be used. The sequence I followed was to grip the back end in the 3-jaw and then to machine all the front features, including the O-ring groove. After an 11mm hole was drilled through, the part was then parted off, flipped and the reverse side was machined.

The preload flange must be a sliding fit within the front bearing housing of the back plate.

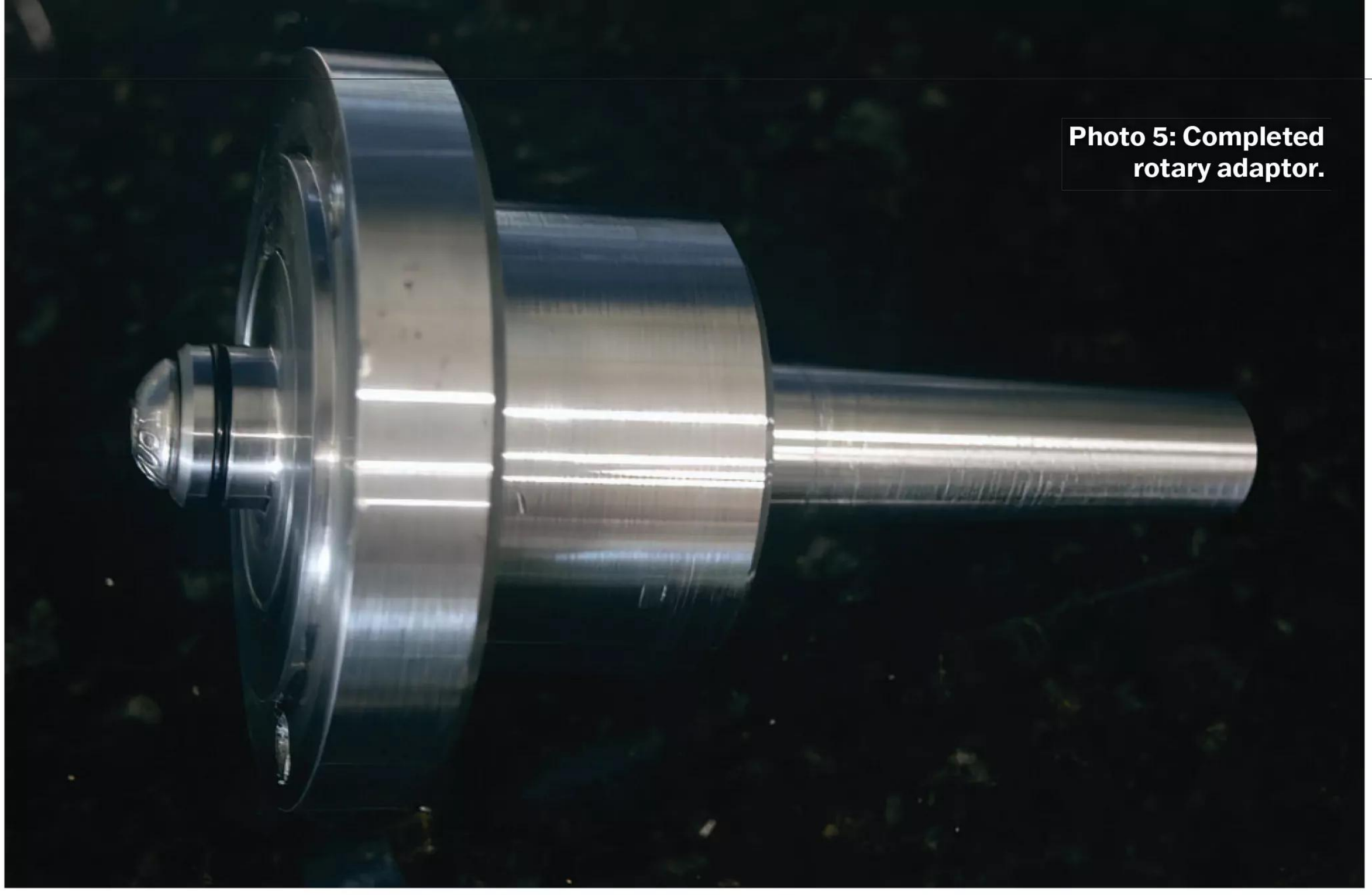


Photo 5: Completed rotary adaptor.

ASSEMBLY

Clean all the parts of swarf and other dirt. If you want to paint, or otherwise prepare the surfaces, it should be done before assembling the adaptor, **fig. 4**.

Start by mounting the bearings in the back plate. This requires some force, as the outer race is an interference fit in the housing.

Initially I tried to use differential expansion, heating the housing in the oven, while cooling the bearing in the freezer but this was unsuccessful and I ended up pressing the bearings into position.

I used an hydraulic press with suitable press tooling to press the outer races into position. If you have a suitably sized hydraulic press, this will be the best option, ensuring that the bearing is properly seated and goes in parallel to the housing.

If you don't have access to an hydraulic press, it will be best to make up a plug with a through hole and pull the outer race into position by jacking with a screw through the centre of the plug.

Once the outer races are mounted, install the oil seal. This can also be pressed in as it can take some force. Before pressing the oil seal in, remember to grease and install the inner race of the bearing.

The grease used is not critical, I just used a normal general purpose lithium grease. Be sure to get the grease on the inner race and work it into the space between the rollers, cage and inner race.

Slide the arbour through and then grease and install the front bearing inner race over the arbour. Follow up with the preload flange and preload cap-screw. Then install the O-ring on the preload flange.

The preload cap-screw can be accessed with the chuck installed, so just do it up lightly at this time.

Install the chuck and then place the completed unit in the tailstock. Test rotation, while tightening the cap-screw. The unit should turn with some resistance.

Tightening the cap-screw is removing any tolerance in the bearings. This provides the running accuracy and ensures no play in the bearings. Once the cap-screw is tightened, there should be no axial or radial play on the chuck. As the arbor, preload-flange and cap-screw are all non-rotating, the cap-screw should not work loose and should not need to have retainer applied.

MAINTENANCE

The adaptor should not require much maintenance but if you wish to change the grease or bearings, disassembly is simply done in reverse order.

FINAL REFLECTIONS

Both the units I made up came out well, **photo 5**. The 125mm having 25µm TIR on the front flange and 5µm TIR on the rotation axis. It may be possible to improve the front flange runout by locking the adaptor with the pre-load screw and then mounting in the head stock using a suitable adaptor sleeve and machining the front face. I have not tried this so cannot comment on the outcome.

The 125mm unit is quite heavy and, in hindsight, I would have limited myself to the 100mm unit, which is why the 100mm drawings are featured here.

BEARING HOUSING TOO LARGE?

If you make a mistake and oversize the bearing housing, there are several ways to recover. One way (that I would not recommend) would be to weld up the housing and re-machine it. The reason that I would not recommend this approach is that it will probably distort the entire back plate and it would be difficult to true up again.

The better approach would be to continue machining and aim to end up around 5mm larger than the bearing OD. (For a 42mm OD bearing, go to 47mm). Now machine up a plug that is the same OD, or slightly under if you plan to Loctite the plug.

With a size-for-size plug, the installation method would be to heat up the housing, and then press the plug in place, using the thermal expansion to create the diameter difference. Once the housing has cooled, the plug will not come out.

Whether you use an interference fit for the plug, or Loctite it in place, once the plug is in place, it can be drilled and machined for the bearing.

LBSC's Toy Locomotive Identified?

Roger Backhouse has unearthed more details about a toy hot air locomotive.

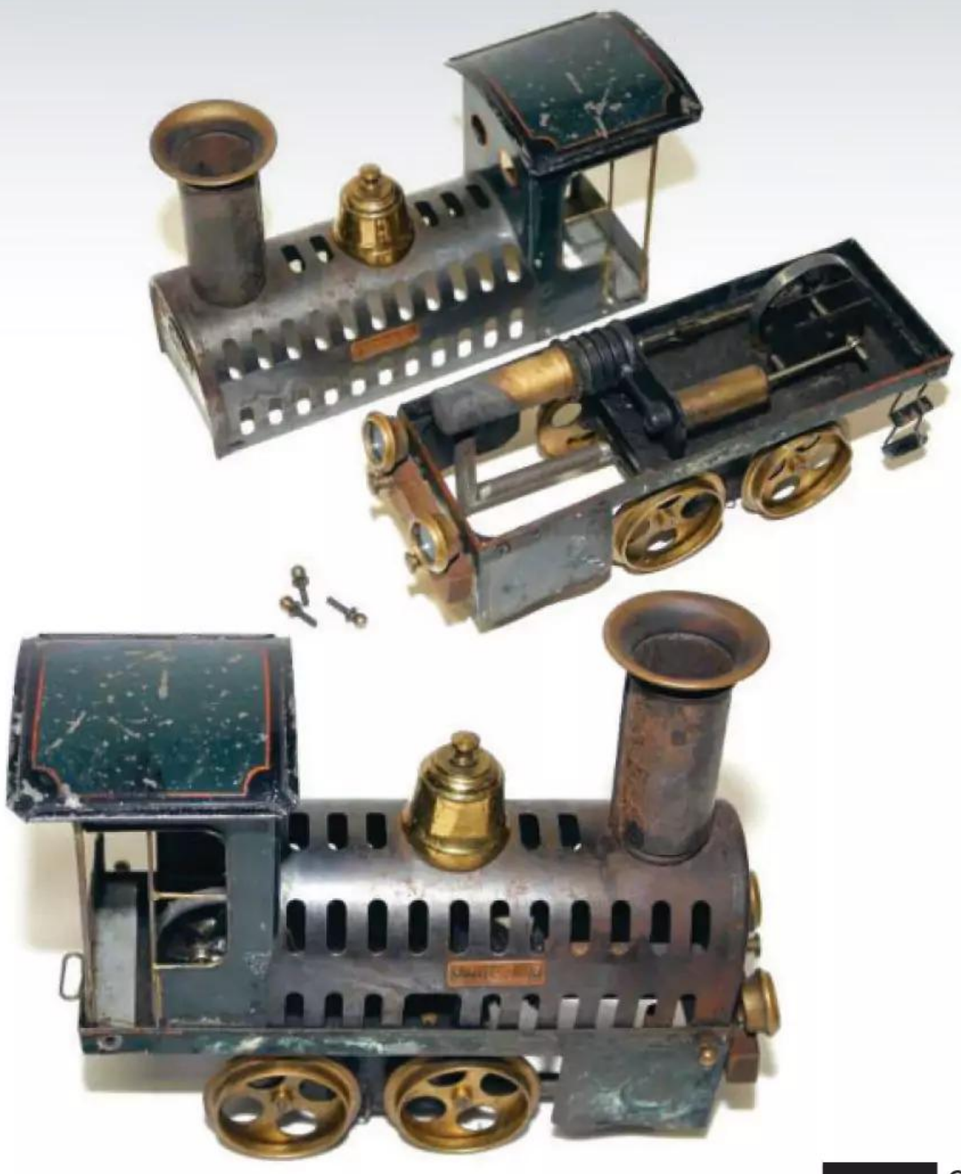
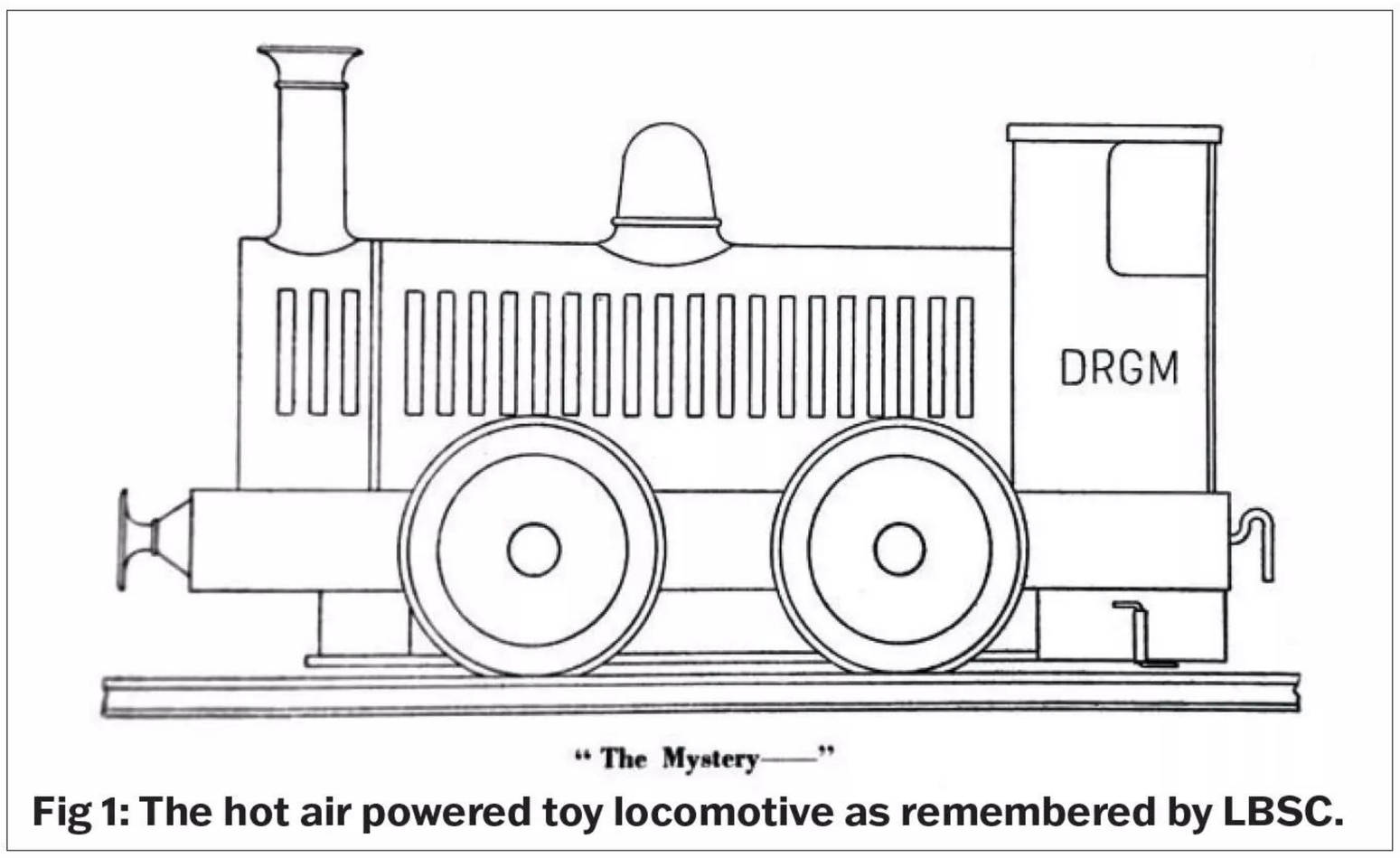


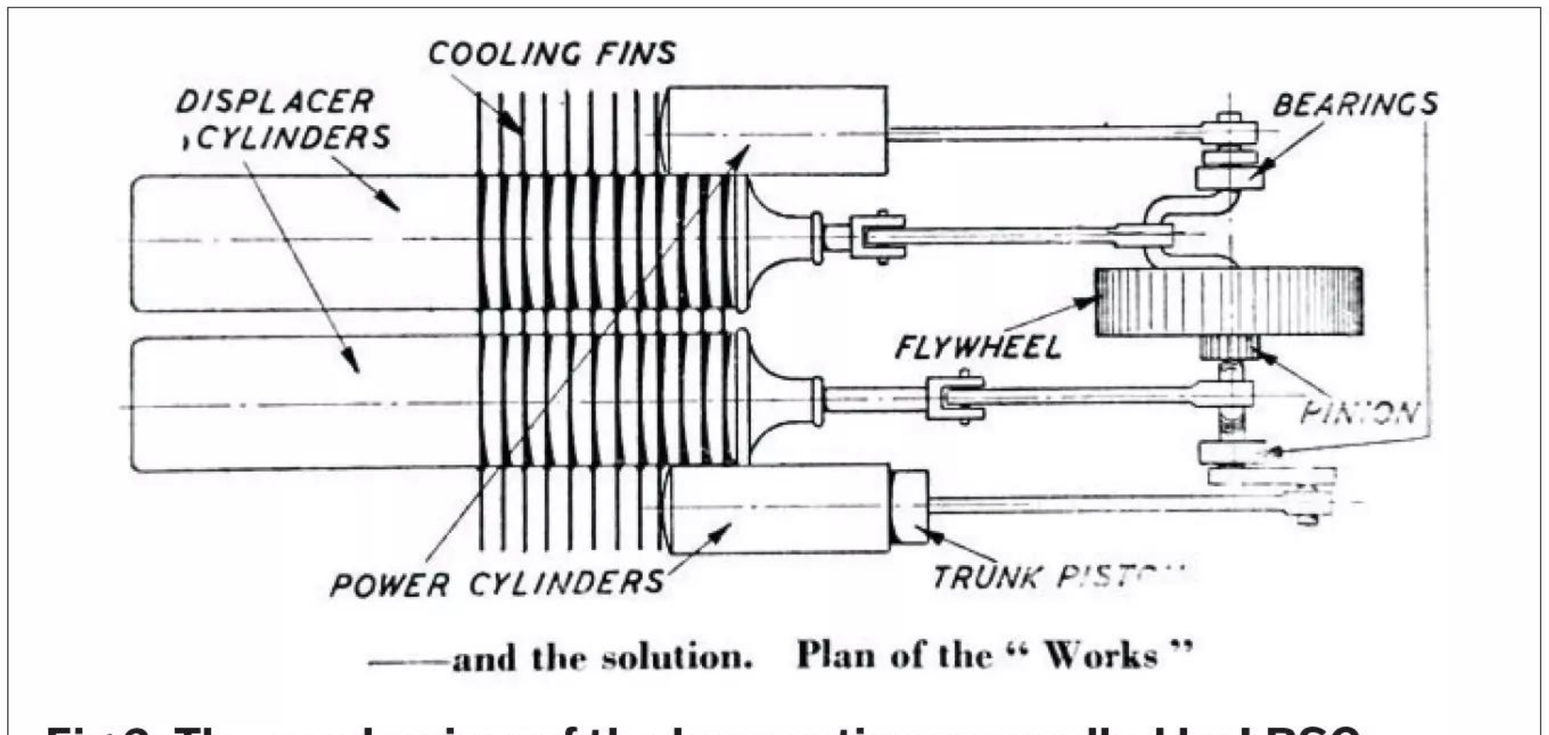
Photo 1: Air-cooled hot air locomotive by Ernst Plank of Nuremburg.
Credit: Gerd Maier 2020.

Following my article, *Hot Air Toy Locomotives* in *Model Engineer* Vol. 226, No. 4654, more information has come to light about another type of hot air locomotive made by Ernst Plank of Nuremburg.



"The Mystery——"

Fig 1: The hot air powered toy locomotive as remembered by LBSC.



——and the solution. Plan of the "Works"

Fig 2: The mechanism of the locomotive as recalled by LBSC.

From his boyhood memories the longstanding ME contributor, LBSC, drew pictures of the exterior and of the interior workings of such a toy, **figs. 1** and **2** in Vol. 83, 2068. His depiction of a hot air engine with finned cylinders for cooling differed from the water-cooled model owned by Alex Procyk shown in my article. Thanks to the help of Gerd Maier in Germany, who has collected many examples of hot air engines, an air cooled Ernst Plank locomotive has been found. It seems that this is one of several known, with the water cooled example being even rarer.

However, this too differs from that drawn by LBSC from memory in 1940, at least forty years later. It has just one displacer and one power cylinder rather than two of each depicted by LBSC, **photo 1**. Unfortunately the cylinder fins are very small and would have probably been ineffective for cooling.

As no other example has come to light it seems likely that while LBSC's memory was correct about air cooling, he was at fault with regard to the number of cylinders. What he drew looks like a more elegant engineering solution. It would probably have worked better though would have cost more to build, perhaps making it unsuitable for the competitive toy market. It should be possible to make a hot air locomotive approximating to LBSC's design or even to recreate the original Vulkan design of Ernst Plank.

REFERENCE

Gerd Maier, *Alt Heissluftmotore*, (9 booklets - 1997-2006), also Compendium Heissluftmotore (digitale Heftreihe).

THE BRADFORD CUP AND STEVENSON TROPHY 2025

We invite entries for the two model engineering competitions that are decided by a poll of readers of Model Engineer & Workshop and members of our forum, www.model-engineer.co.uk

THE BRADFORD CUP

The Bradford Cup is awarded to the author of the best article or series in Model Engineer during the previous year. Because of the change of title and range of content, articles appearing in Model Engineer in issues 4734 12 January 2024 to 4761, 24 January 2025 are eligible for this year's competition. Next year the competition will cover a full year of Model Engineer & Workshop. Graham Astbury recounts the story of the cup:

At Bradford MES, we were always short of copy for the Bradford MES Monthly Bulletin as members always seem to hide their lights under their bushels. In an attempt to encourage people to write articles for the Monthly Bulletin, the Committee thought that some award for the best contribution to the Bulletin might be a good idea. I suggested to the Committee that it might bring some publicity to Bradford MES (one of the oldest clubs in the country) if we were to widen the scope and there were to be an award each year for the best article appearing in 'Model Engineer'. Martin Evans agreed to do this as he hoped it might encourage people to write articles for ME. Hence the name of the trophy and why it is in Model Engineer. The cup was donated by Bradford MES to the Society for Model and Experimental Engineers, SMEE, and latterly has been presented at the Midlands Model Engineering Exhibition.

The competition first ran in 2022 and was won by Mike Tilby for his series on steam turbines, **photo 1**. Subsequent winners have been Steve Goodbody and Ron Fitzgerald.

Entry to the Bradford Cup is by nomination by a third party only only, you cannot nominate yourself. To make a nomination, please send the name of the author and the article in question to meweditor@mortons.co.uk by 25 July 2025.



Photo 1: Mike Tilby receives the Bradford Cup from Grham Astbury

THE STEVENSON TROPHY

As well as being a contributor to MEW, John Stevenson, **photo 2**, was known for his larger-than life presence on the Model Engineer forum and his willingness to advise on practical issues and often offer practical help. Funded by many donations in his memory, the Stevenson Cup was first awarded in 2018. The cup is engraved "John Stevenson, 1948 – 2017. Remembered by his many friends" with "Awarded for Excellence in Practical and Useful Workshop Equipment" on the plinth.

The John Stevenson Trophy is presented for just that, a well-made and usable piece of tooling, a modification to a machine or an accessory for a tool where the fact it works well is more important than making it look good.

The last two competitions were won by Bernard Towers, **photo 3.** Latterly the trophy is also awarded at the Midlands Model Engineering Exhibition.

The competition is open to all Model Engineers Workshop readers and Model Engineer forum members, who may enter their own work. We encourage entries of items published in MEW, but unpublished items can be entered. To enter, send four good photographs of your entry with up to 500 words of description by email to meweditor@mortons.co.uk no later than 25 July 2025.



Photo 2: John Stevenson

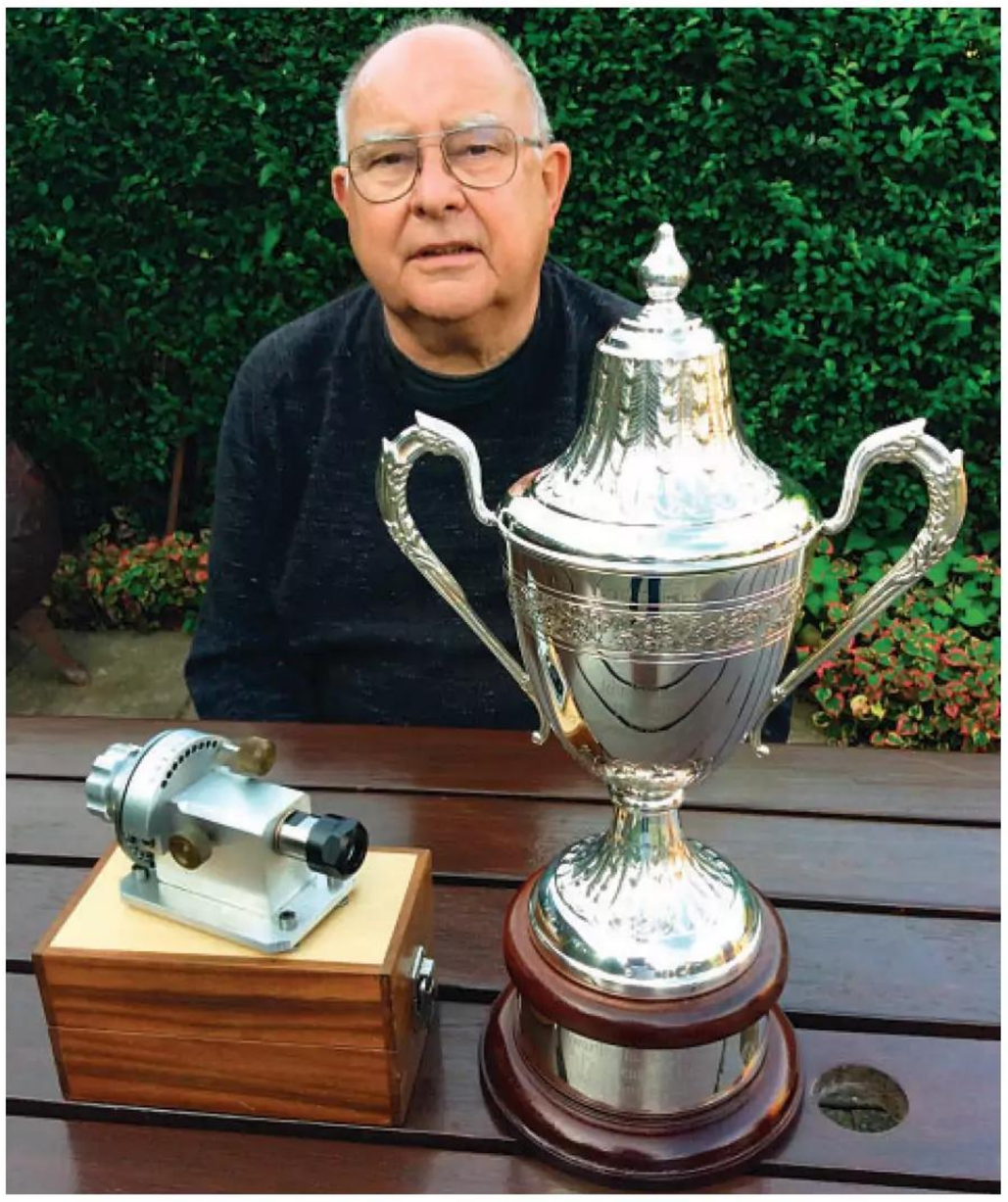


Photo 3: Bernard Towers with the Stevenson Trophy.

Bradford Cup Entry Rules and Conditions

1. Nominations from readers shall be invited in Model Engineer & Workshop magazine in the July issue.

2. Nominations shall close on the 28 July.

3. Nominations should be sent to the editor of ME&W stating: That it is a nomination for the 'Bradford Cup'; The author's name; The title of the article; The issue number in which it starts; The name, postal address and email address (if applicable) of the person nominating the article.

4. All nominations must not have been entered into the competition before.

5. Any reader of ME&W may submit only one nomination which must not be their own work.

6. The article must have appeared in issues 4734 to 4761 and may be a single article in a single issue; a single article published over more than one issue; or a series running in several parts which may run into or from another year.

7. All entries must have been nominated by at least three people to be eligible. When nominations close, the editor of ME&W will list all the articles in order of numbers of nominations.

The six articles with the greatest number of nominations will be deemed to be the entries to be selected for the judging. If there are fewer than six entries for the Trophy, then the editor may select, at his or her sole discretion, additional articles to make the nominations up to six.

8. If the editor of ME&W suspects that any unfair or undue influence has been brought in to attempt to influence the selection of entries, then that entry may be disqualified. The editor's decision will be final on this matter.

9. The editor may reject any entry if it fails to meet adequately any of the criteria for inclusion on the shortlist. These will be that: the article is well written; it demonstrates some original thinking or design; it reports experimental work undertaken by the author; it is well-researched; or describes something of interest to model engineers not published in the model engineering press before.

10. Articles which are a simple narrative of building someone else's design will not be eligible, unless the building involves a novel technique or process

11. Prior to publication of the list of entries available for voting, each author will be contacted to confirm that they are willing for their article to be entered into the competition. They may withdraw their consent at this time should they wish to do so. If this occurs, the editor of the Model Engineer shall select the next article in the list or may substitute another article of his or her own choice.

12. The entries for the competition will be listed in no particular order in ME&W in sufficient time for readers to vote. and the date for the latest submission of votes will be published also. Votes cast after this date will not be counted.

13. Voting shall be by an on-line vote by forum members on the Model Engineer website (www. model-engineer.co.uk). Readers who join the forum specifically in order to vote will be allowed to do so. Voting will be strictly one vote per person. Any reader of Model Engineer who does not have on-line access will be allowed to vote by writing to the editor of the Model Engineer clearly stating that it is a vote for the Bradford Cup and shall name the selected entry and the author.

14. In the event that the editor considers that invalid votes have been cast, or that an attempt has been made to unduly influence the result of the vote, any questionable votes will be disregarded and those entries may be disqualified

15. The winner from the six shortlisted authors will be announced ate the Midlands Model Engineering Exhibition, or other time or venue as decided. The trophy will be presented by a member of the Society of Model and Experimental Engineers.

16. The trophy will remain the property of the Society of Model and Experimental Engineers. The winner will take responsibility for ensuring safekeeping of the trophy until the next exhibition. The trophy must be returned in good condition, in the supplied packaging, in good time for awarding to the winner of the subsequent competition. However, an A4 certificate of the award will be presented to the winning author for their retention.

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

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

Stevenson Trophy Entry Rules and Conditions

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

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

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

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

By entering you confirm your permission to feature the entry in the magazines or on the forum.

If practical, you may be invited to display your entry at a model engineering exhibition in the future.

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

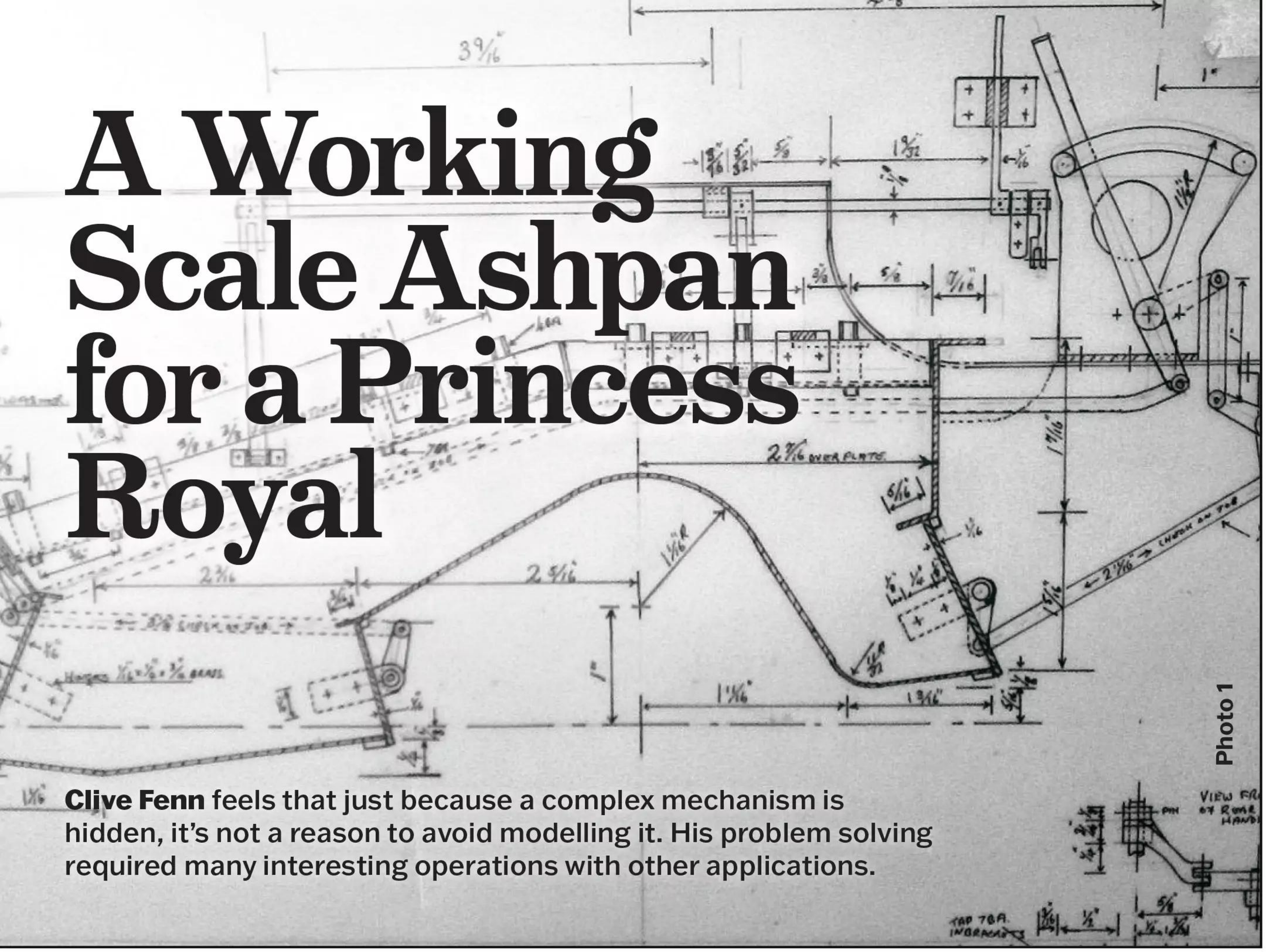
In the event that the judges consider invalid votes have been cast or that an attempt has been made to unduly influence the result of the vote any questionable votes will be disregarded, or entries may be disqualified.

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

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

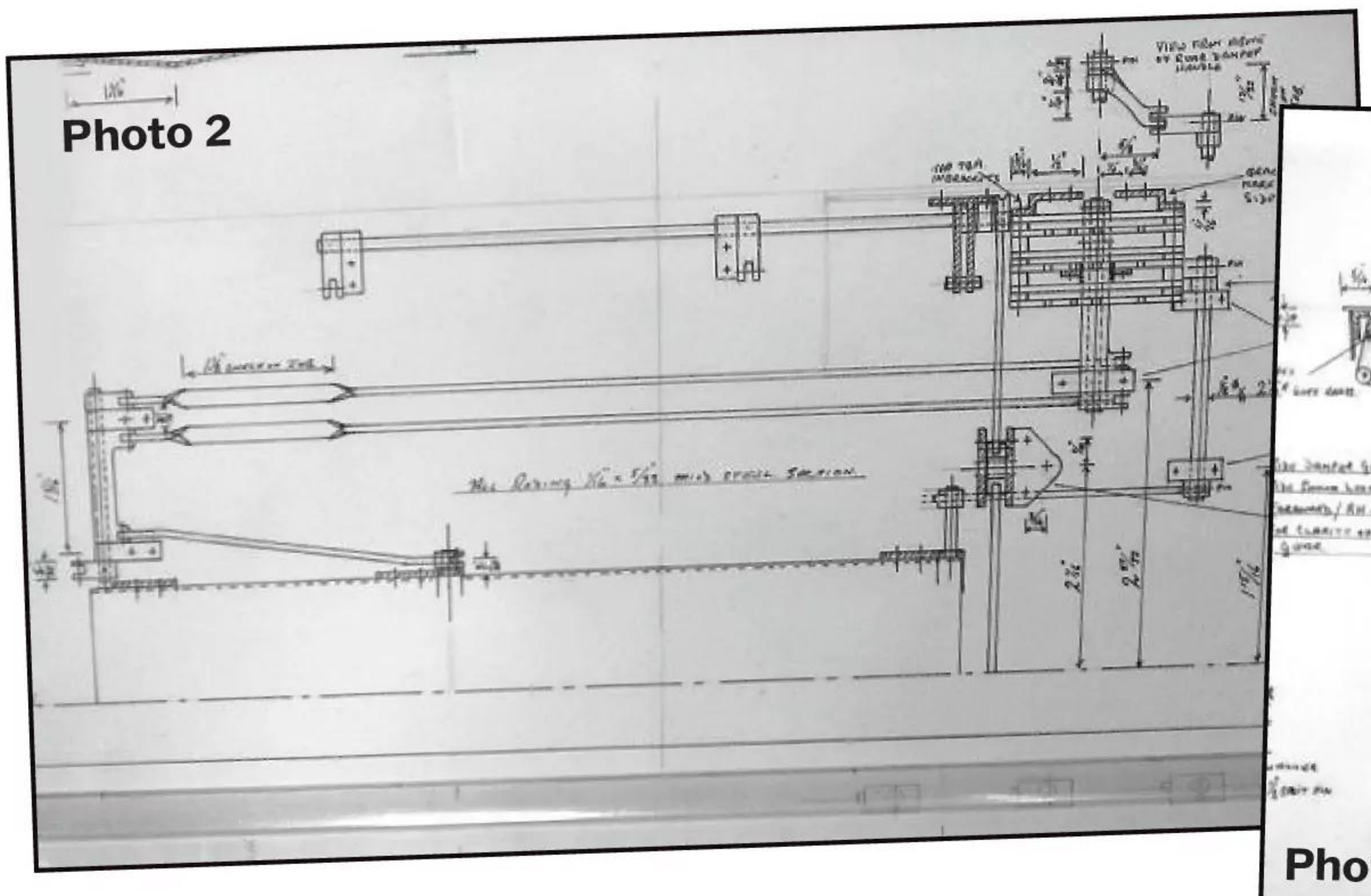
No alternative prizes, cash payments or awards will be made. In all matters relating to the competition, decisions made by the organisers are final.

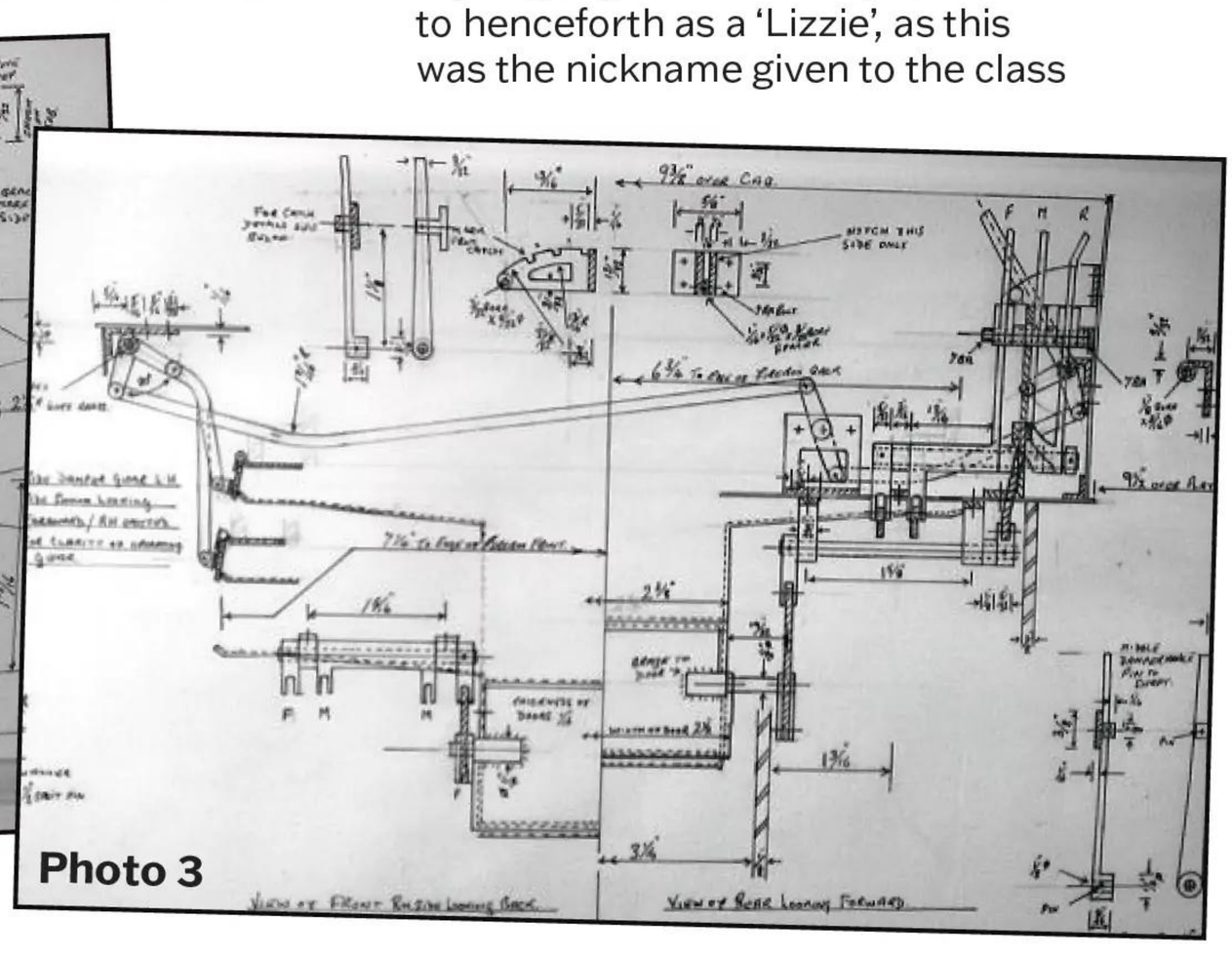
A Working Scale Ashpan for a Princess Royal



Clive Fenn feels that just because a complex mechanism is hidden, it's not a reason to avoid modelling it. His problem solving required many interesting operations with other applications.

You may be wondering, why write an article about making an ashpan? Well not all ashpans are simple boxes stuck under the firebox of a locomotive. For some of the larger engines the ashpans could be rather complicated affairs with very elaborate operating mechanisms. The 'Princess Royal' Pacifics of the London Midland and Scottish Railway were one such class of locomotive. The ashpan was of the hopper type and because they had wide fireboxes it meant that the sides had very little depth and the slope was very shallow. Also the door operating mechanisms involved many rods and cranks and was very complicated. Due to the lack of depth on the side slopes they were fitted with two doors on each side. These were operated by a lever on the fireman's side, that is the right-hand side of the cab for LMS Stanier engines when looking forward. The reason for these side doors was so that a rake could be used to push any compacted ash down into the hopper and make disposal easier. The mechanism to these side doors proved very troublesome, particularly during the war years when maintenance was poor. So it was decided to remove it and replace it with a simple locking mechanism on the outside of the engine. What follows is a description of the building of the ashpan for my 5" gauge Princess Royal, referred to henceforth as a 'Lizzie', as this was the nickname given to the class





Clive's hand-draughted drawings for the ashpan.

by railwaymen.

I am not a big fan of working with stainless steel and therefore only use it when absolutely necessary. I say this because there will be those of you that may be critical of my use of mild steel throughout its construction. My first task was to produce a drawing and for this I consulted LMS Locomotive Profiles No 4, The Princess Royals.

I still work on an old Rolls Royce drawing board; I know I am a bit of a dinosaur so therefore a bit long in the tooth to learn new techniques. When one sets out to build a 'Lizzie' one needs all the spare time one can muster and I therefore did not fancy wasting time learning new ideas. **Photographs 1, 2** and **3** show the drawings (these are included to show Clive's drawing skills and are not presented as working drawings - Ed.).

After this it was time to start construction and my first task was to make the support studs that secure the ashpan to the firebox foundation ring. On the full-size engine there were seven extra-long studs down each side which supported the ashpan and gave the necessary gap of 4" between foundation ring and slope of the ashpan. I opted to use four of these studs down each side as I thought these would be strong enough to do the job on the model, together with two more normal studs front and rear where the ashpan comes flush with the foundation ring. These four normal

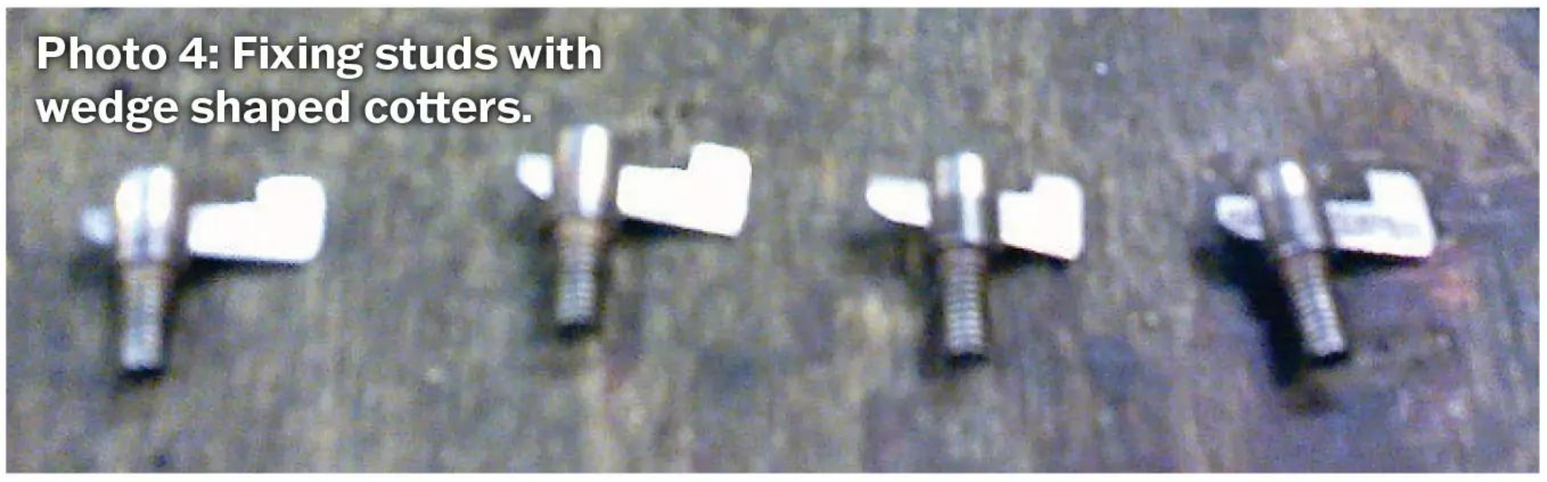


Photo 4: Fixing studs with wedge shaped cotters.



Photo 5: The ashpan fixing studs attached to the firebox foundation ring.

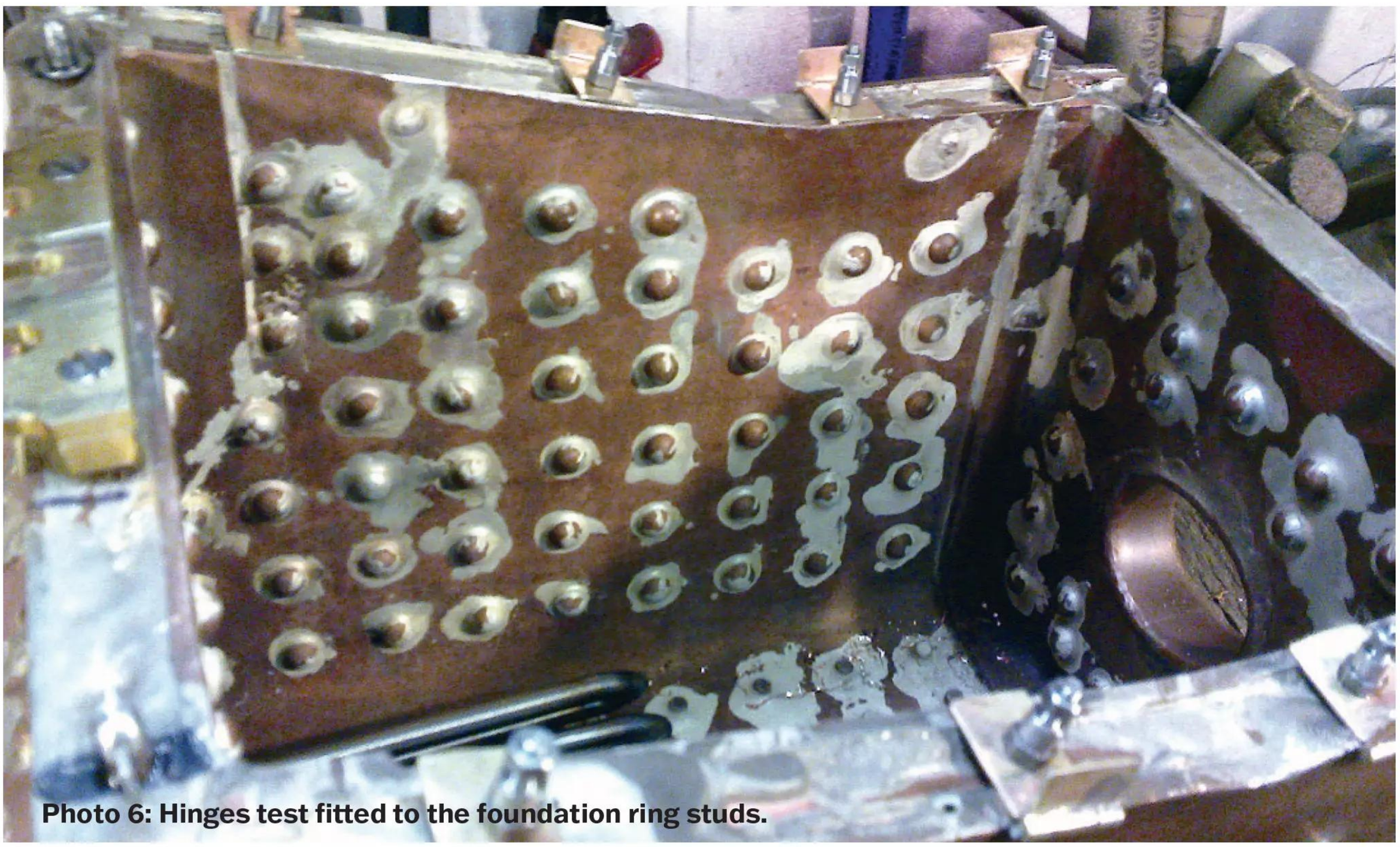


Photo 6: Hinges test fitted to the foundation ring studs.

Photo 7: Hopper side sheets in mild steel sheet.

studs have flat cotters in them as per full size, **photo 4**. Dummy visual effects will be provided for those long studs that have been omitted. **Photograph 5** shows the studs screwed into the foundation ring.

The eight hinges came next, four down each side and these were made from brass. The construction for these was very simple. I had no 3/32" brass tube to hand so I chucked a length of 3/32" brass rod, faced off the end, then lightly centred with a 1/16" centre drill. This was then followed by drilling out to 5/8" depth with a No. 56 drill at the highest speed on my Myford Super 7 (2150). Not all the holes came out dead on centre and the bad ones, only two, were discarded - but I did not know this until I had silver soldered the flats on and had cut them off the bar to shape them to size; **photo 6** shows the hinges in place on the foundation ring.

I now began to construct the ashpan itself using 1/32" mild steel sheet and **photo 7** shows the two hopper side sheets squared up using two spacers. My next task was to make and silver solder in place the curved base, the forward and rear bases and also the front and rear ends. **Photograph 8** shows the formed plates. Note the mild steel 1/16" x 3/16" strips riveted to the base. These had two purposes on the full size, first to strengthen the base at the doors and second to give a greater door sealing area. I have extended these strips slightly so as to prevent the plates slipping during the silver soldering operation. They were filed off flush before final fitting. **Photograph 9** shows the hopper now silver soldered and ready for the side slopes.

Photo 8: Formed plates for the ends.

Photo 9: Hopper after silver soldering.

Before I began to make the slopes, I had a trial fit of lowering the boiler in place onto the chassis with the hopper in position. All seemed to be fine, so I proceeded to make the side slopes, again made from 1/32" plate. With the boiler back on the bench and in the upside down position I began to make cardboard templates of the two rear horizontal plates. When happy I then made them from the mild steel plate using the templates as a former. These were then secured to the foundation studs and silver soldered to the hopper sides. **Photograph 10** shows the two rear slopes in place.

I now made templates of the forward slopes, **photo 11** and when satisfied converted these to steel plate. These

were then placed in position on the foundation ring studs and again silver soldered to the hopper sides and the rear horizontal plates, **photo 12**. At this stage, when cool I removed the ash pan from the firebox and placed it in the pickle for a good clean. When clean it was again fitted to the boiler and another trial fit took place on the chassis. All was good so I now made templates for the forward and rear end plates. Then again when happy with these, metal plates were made and silver soldered to the ashpan. It was then left to cool, **photo 13** before being removed from the boiler and again placed in the pickle for a good clean.

Now, with the ashpan nice and clean, another trial fit on the chassis took place before the next stage, which was to make and fit the side doors. They were 4 3/4" depth on the full size and this works out at approximately 13/32" for 5" gauge. Four pieces were cut to length and with the aid of a needle file, adjusted to fit the hinges. Then 3/64" holes were drilled through the hinges and doors. The appropriate piece of hinge was then removed from its sister piece and riveted to the appropriate door using 3/64" brass snap-head rivets. The doors were replaced one at a time for a trial fit. After a bit of filing to adjust, all was well. **Photograph 14** shows the doors in place on the left-hand side of the firebox, note the bracket for the lifting arms. At this stage I thought another trial fit would be a good idea. It was a good job I did, for there was not enough clearance to be able to open the rear doors. Also the forward doors required a bit more metal to be removed as they were catching on the top edge of the outside trailing frames. With the necessary alterations complete another trial fit took place and all was well.

It was now on to the next stage, to make and fit the hopper doors and for these 1/16" plate was used. Three doors were required, front, middle and rear; these all operated independently from the cab on the fireman's side but more about this later. The doors are of the flip-up type and so required stubs at both ends and are fitted into brass plates, held in place by 10 BA screws and nuts attached to the ashpan sides. **Photograph 15** shows the completed ashpan with doors fitted. To make the stubs 1/4" mild steel bar was used, turned down to 1/8" diameter x 1/4" at both ends. There was one exception and that was for the rear door. This needed to be turned down to 1/8" x 3/4" long on the right-hand side, enough to extend clear of the underside of the inside right hind frame.

To make two stubs and silver solder

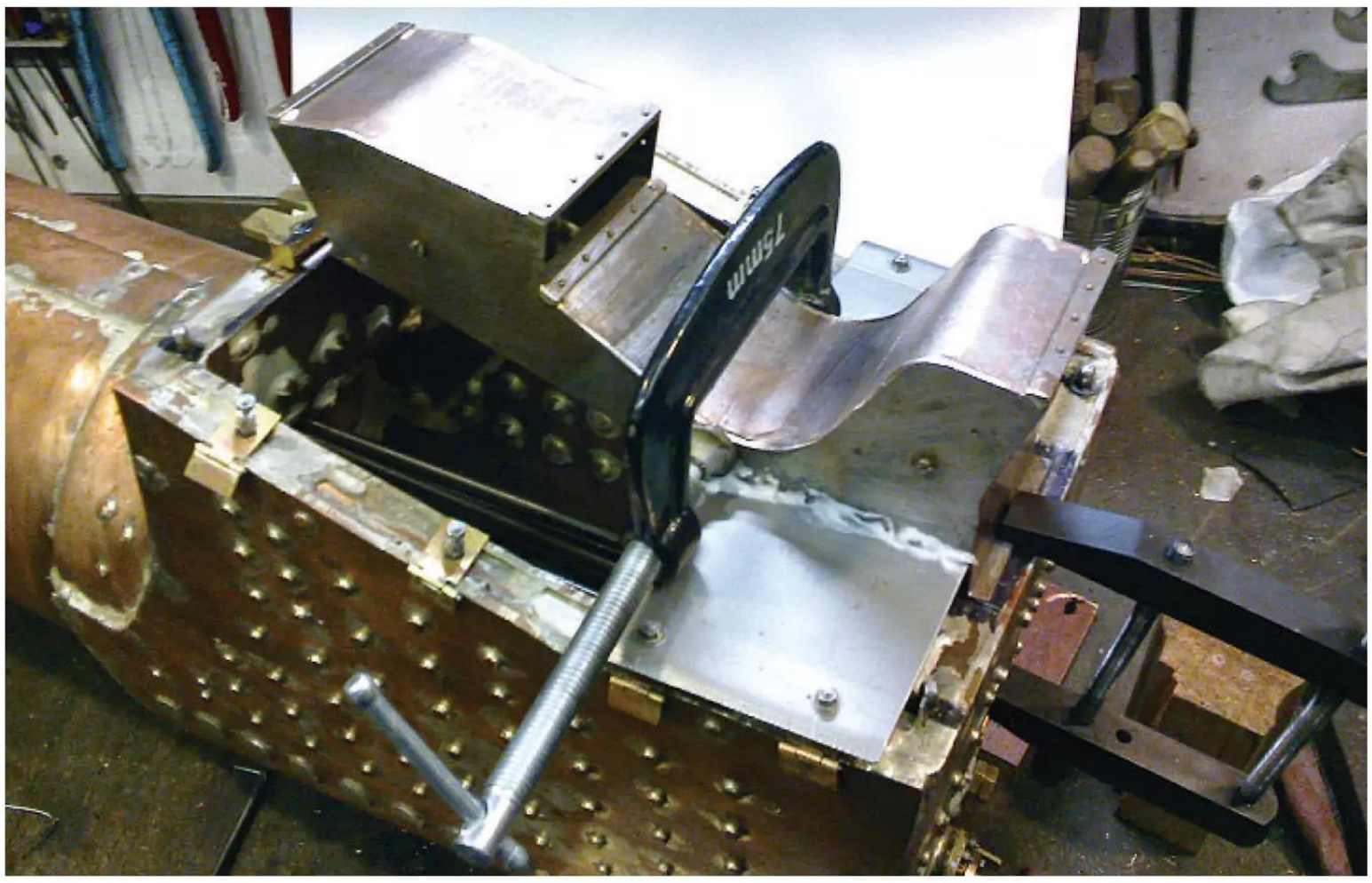


Photo 10: Rear slopes fitted to the hopper.

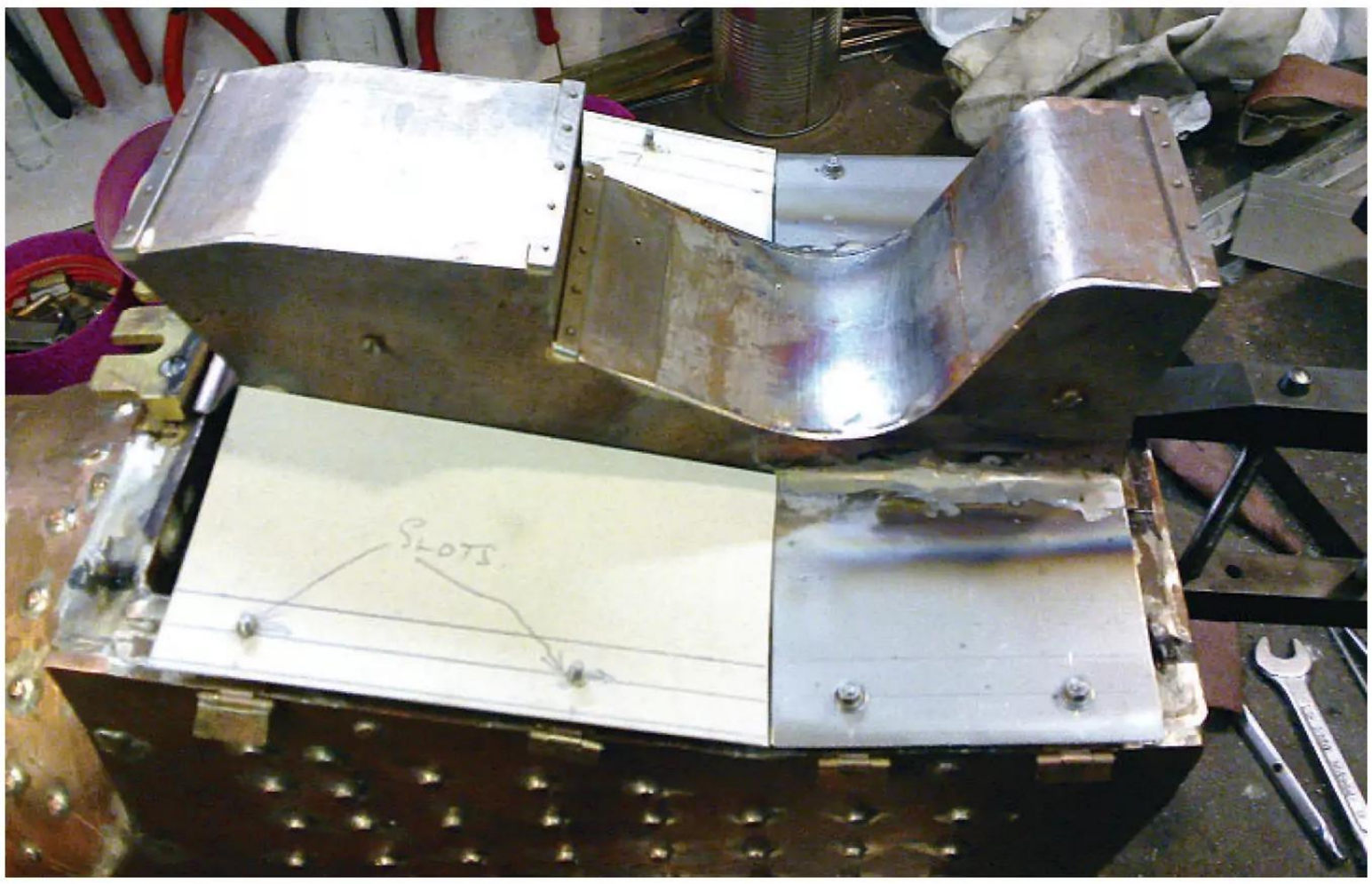


Photo 11: Template for the front right slope.

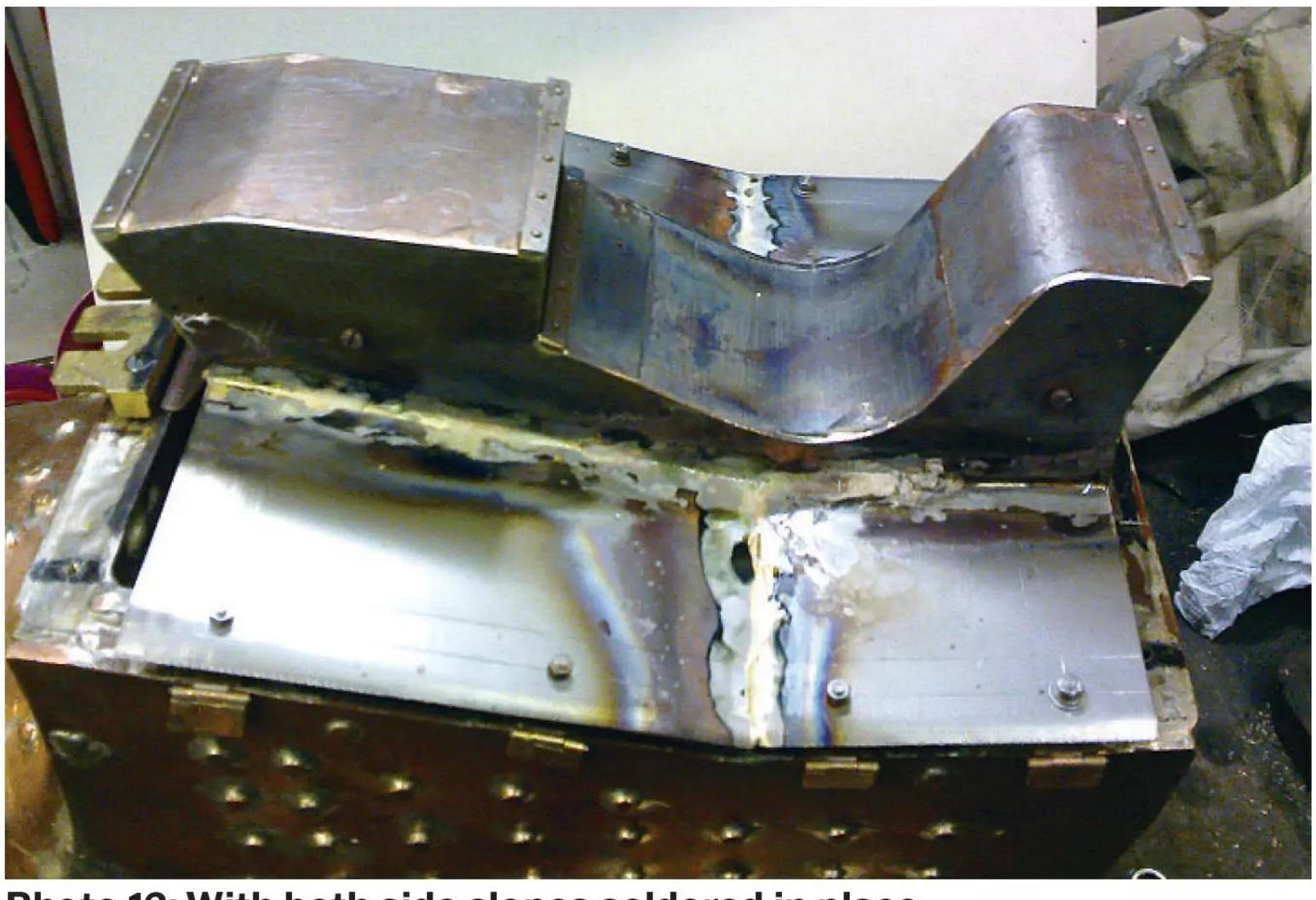


Photo 12: With both side slopes soldered in place.

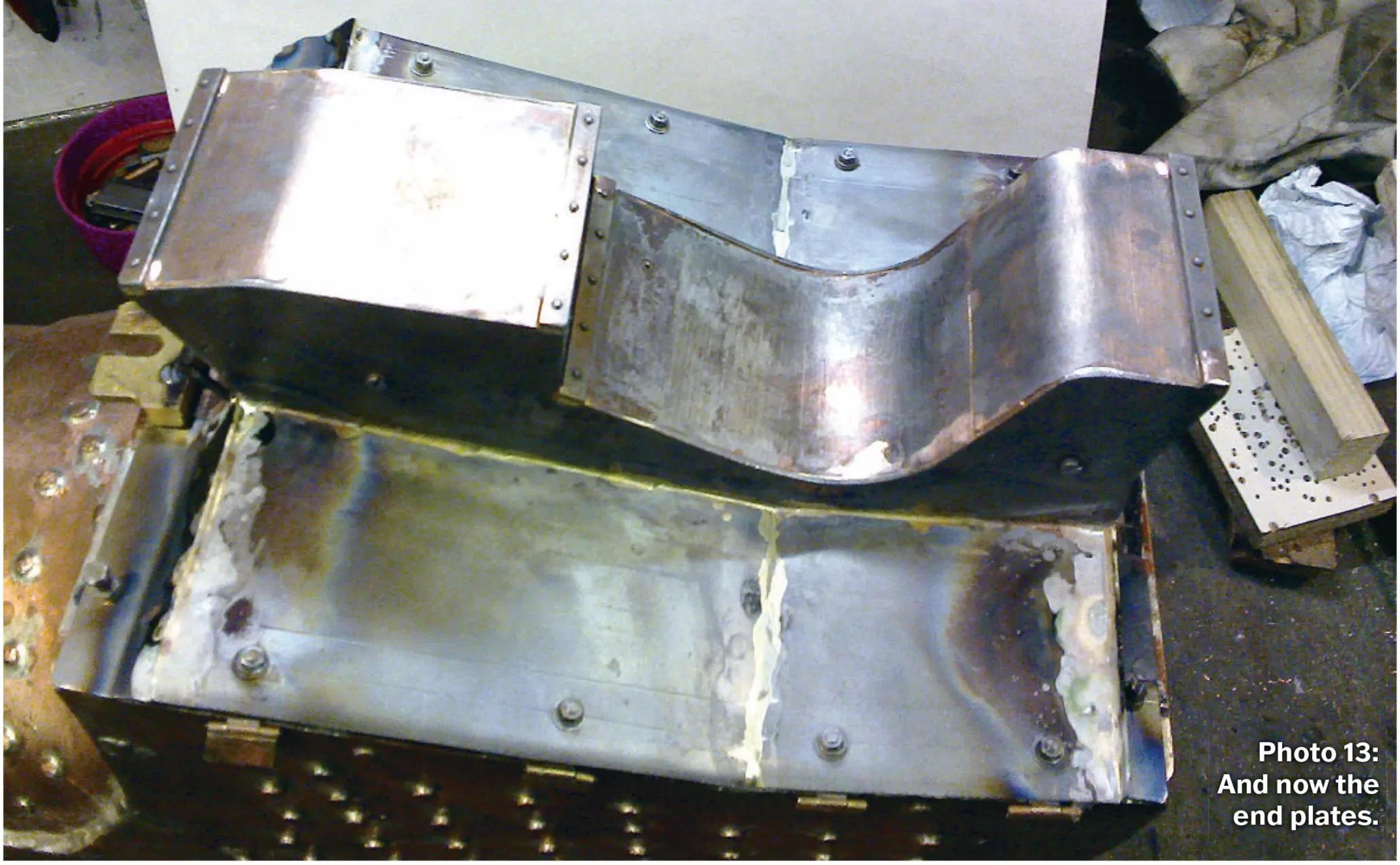


Photo 13: And now the end plates.

them into the correct position on the doors seemed to be a bit of a daunting task so I used one piece of bar. With the middle door in place on the ashpan I placed the 1/4" bar in position. The bar now had 10 thou shaved off the length to produce a flat, to give a greater area for the silver solder to attach. The door would have to come off the ashpan for the soldering process, so this posed another problem; how to remove the door with the bar attached? Answer - contact adhesive. With everything in place, a drop of adhesive was allowed to dribble under the centre of the bar. The door was then removed from the ashpan. A clamp was now placed in the centre above the adhesive so that the two ends could be fluxed and silver soldered without any fear of movement. The silver soldering of the bar was about 1/2" in from both ends. After a good clean, the door was placed in the milling machine and the centre of the bar removed to leave 1/2" long



Photo 15: Completed ashpan, without operating mechanism.



Photo 16: Hinge pins silver soldered in place.

Photo 17: Slotting a pair of levers.

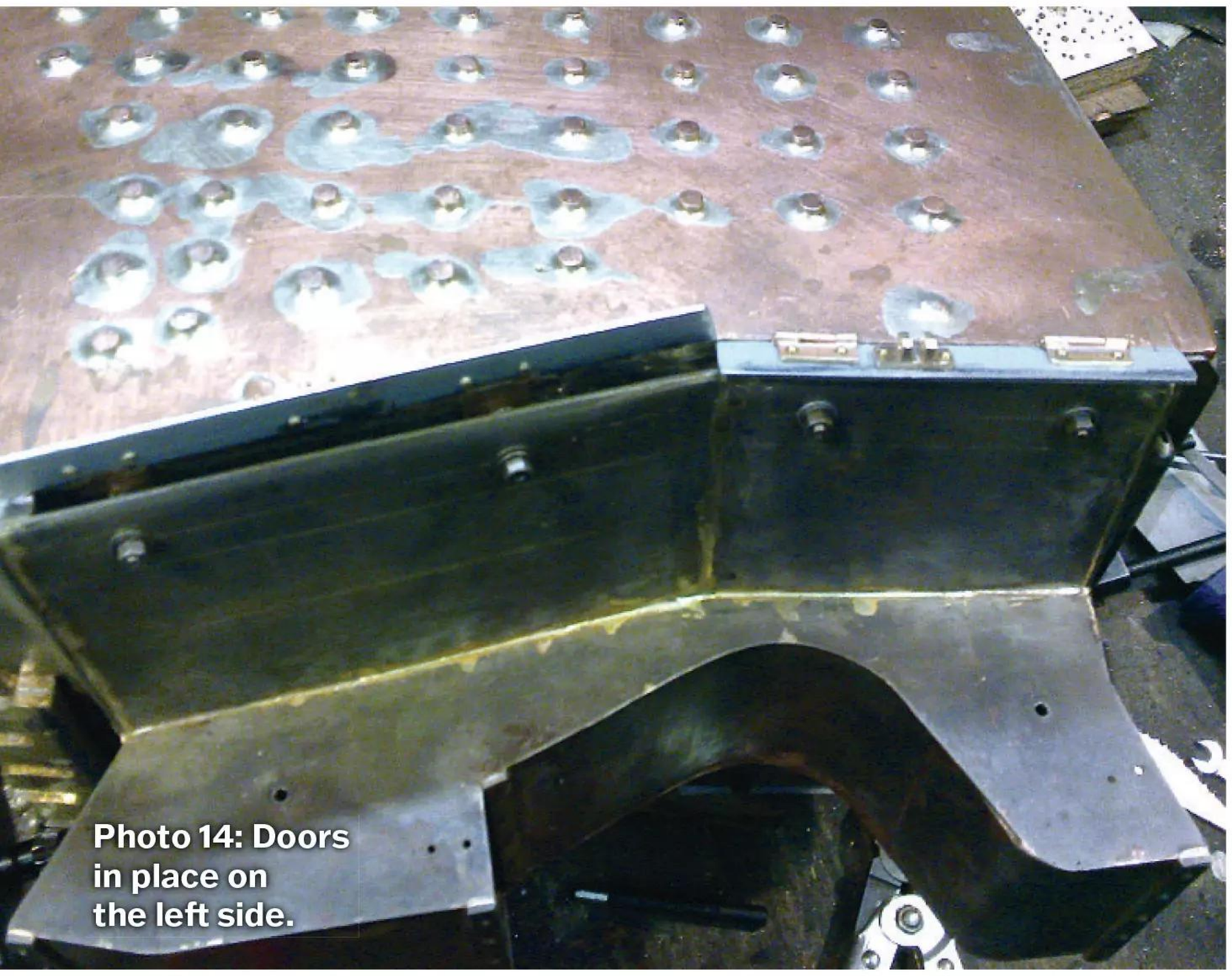


Photo 14: Doors in place on the left side.



Photo 18: Co-ordinate drilling the bars.



Photo 19: Shaping with filing buttons.

stubs at each side of the door, **photo 16**. This procedure was repeated for the front and rear doors.

With the doors in place it was now time to make and fit the operating mechanism. First off, I required thirteen levers with centres at 7/16". I decided to make fourteen and to do them in pairs so as to have plenty of metal to be able to hold them clamped to the tool post, so as to machine the 1/16" slot, **photo 17**, but first I needed to drill the two holes. I cut seven 1 3/4" lengths from 1/4" square mild steel bar. I used the milling machine to drill two 3/32" holes at the end of the bar and then two 1/8" holes at 7/16" in from the outer holes, **photo 18**. Each bar was then placed, one at a time, in the tool post and the slot machined. The bar was then turned around and the procedure repeated at the other end.

With the aid of filing buttons the levers were finally shaped, **photo 19**. Two of these levers needed to be silver soldered on to a piece of brass bar 1/4" diameter x 1 1/8" in length and drilled through 1/8". This item was to work the middle ashpan door and can be seen in **photo 20**; the levers on the outside work the forward door.

The operating mechanism for the side doors was the next job. The boiler was again placed in position on the chassis. The operating rods hang down vertically from levers which are placed under the platforms and are attached to a 1/8" diameter rod. This then comes through a hole in the forward curved part of the

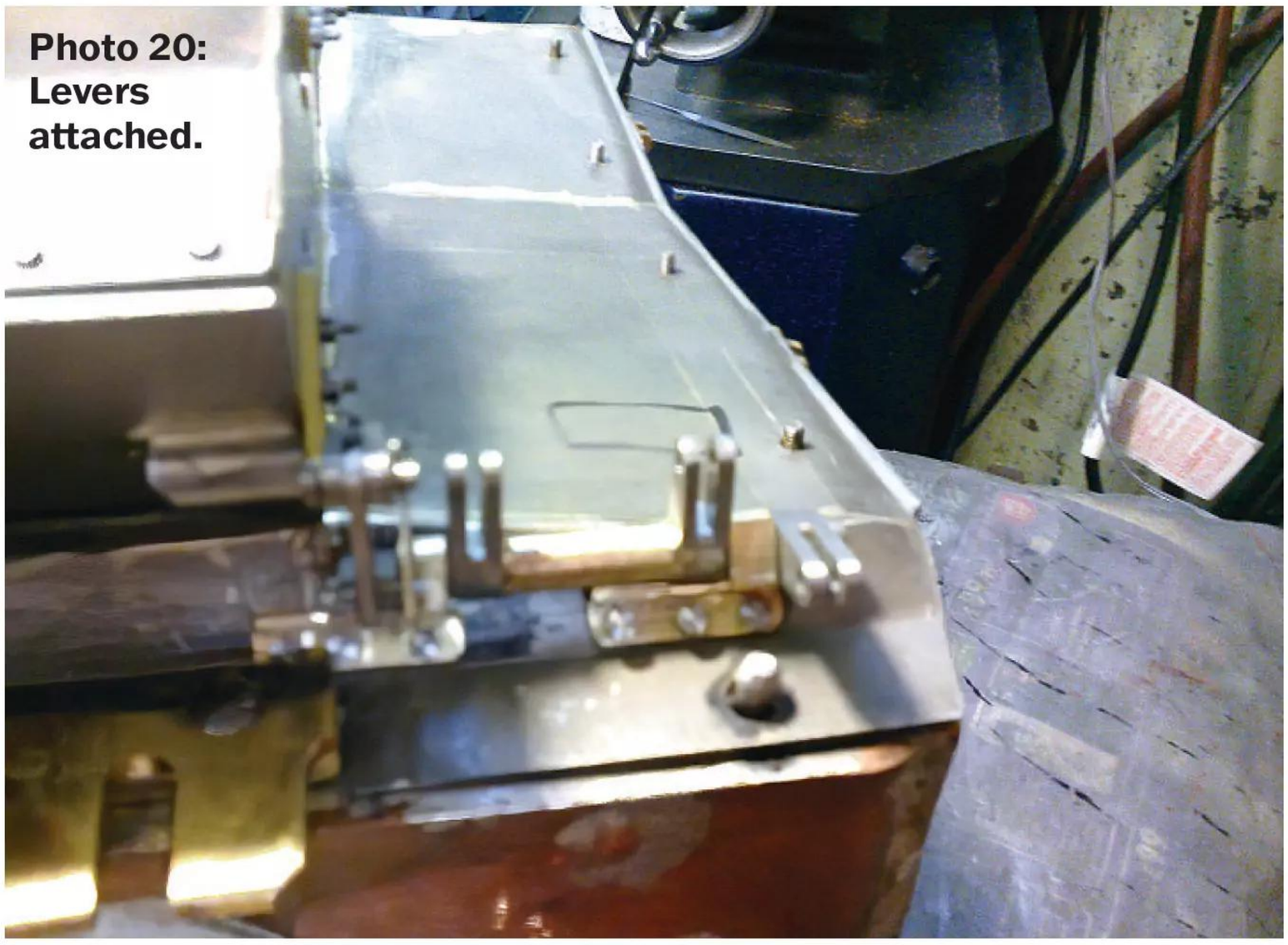


Photo 20: Levers attached.

Photo 22: Intermediate lever.

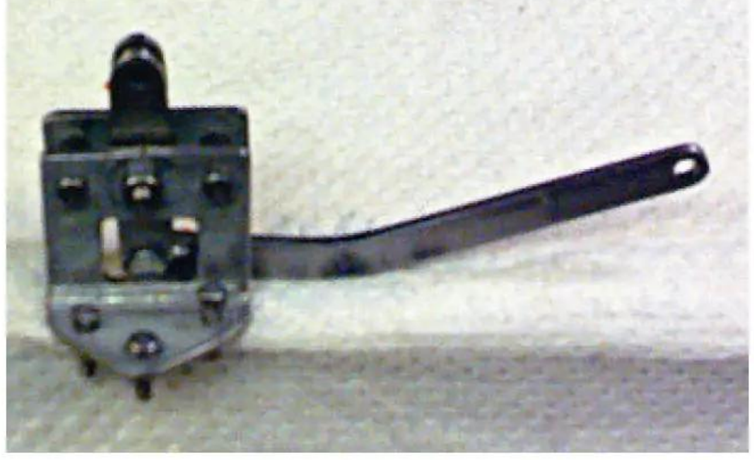




Photo 21: Side door mechanism hinges.

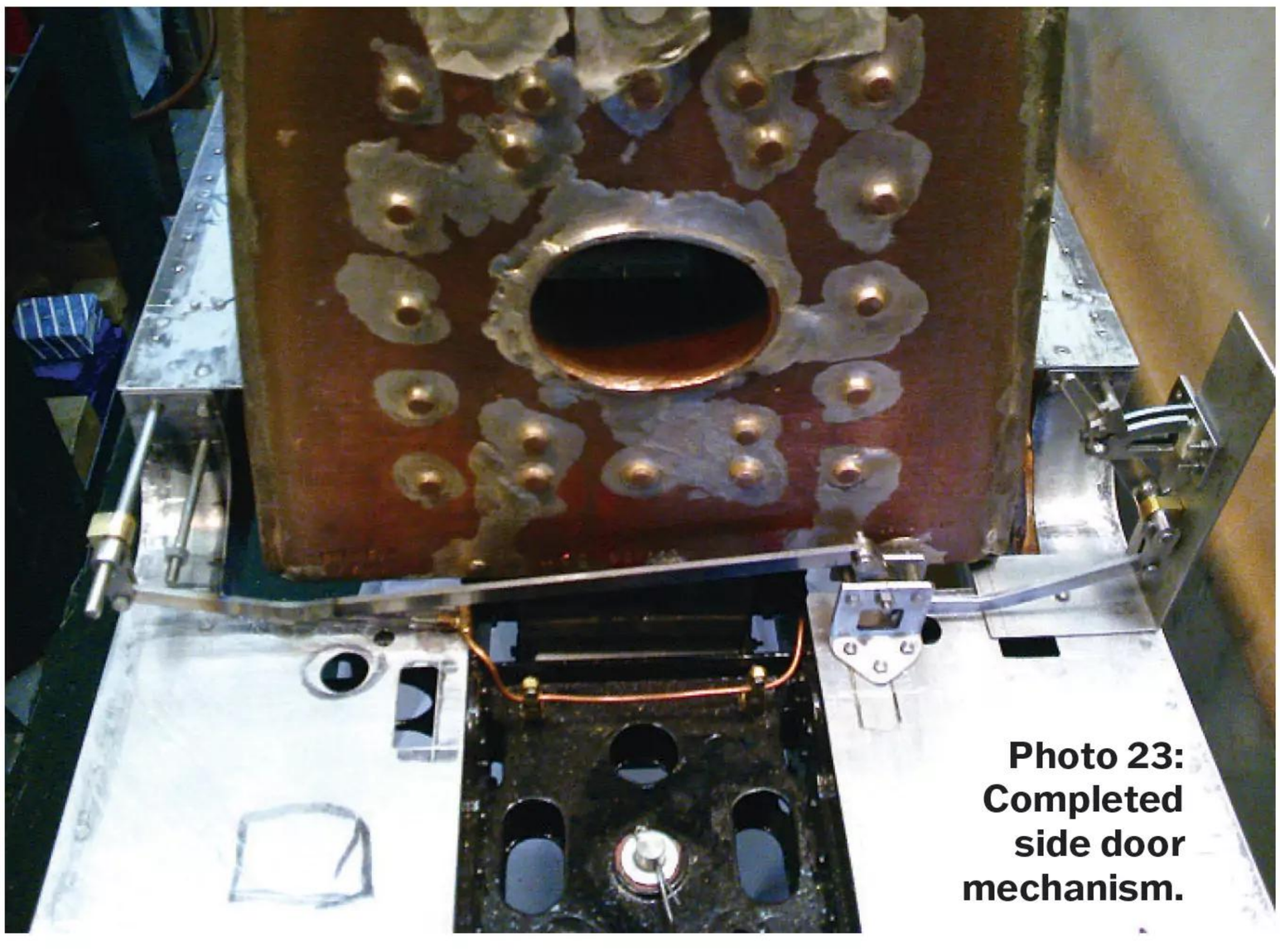


Photo 23: Completed side door mechanism.



Photo 24: Lever frame.

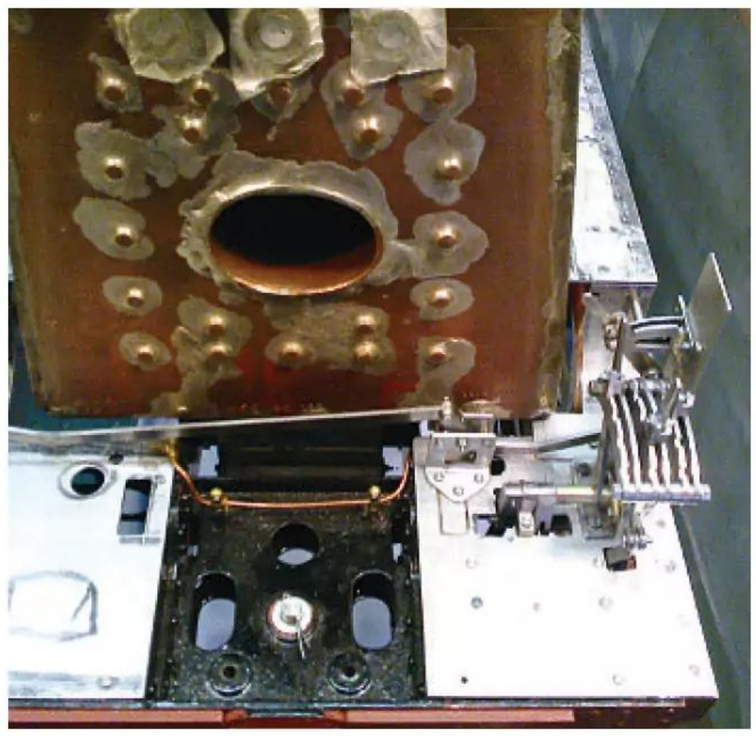


Photo 25: Levers in place on the loco.

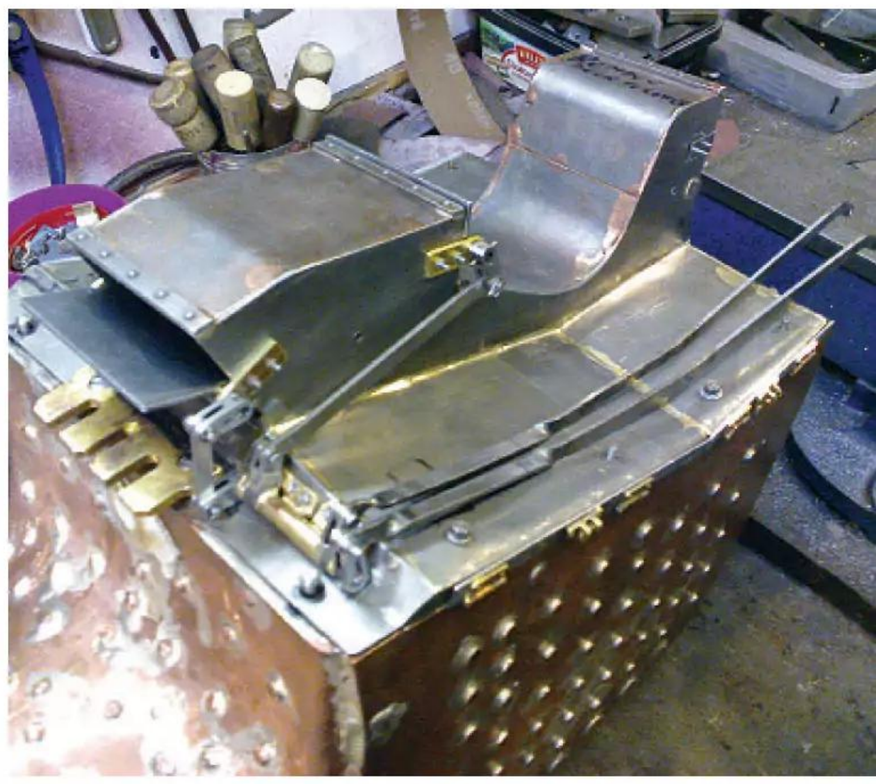


Photo 26: Ashpan with completed mechanism attached.

platform and into the cab space, where it is attached to the operating handle which in turn is attached to the inside of the cab side sheet, **photo 21**. (Note the large copper pipe; this is the exhaust steam pipe to the exhaust injector.)

Making the handle and attachment plate was the next task and was achieved by using a combination of files and a very fine bowsaw. The little catch on the handle was produced using the milling machine and a slitting saw much as described above for the levers. The intermediate vertical lever, **photo 22** was made using the same technique. With this lever fixed in position on the locomotive the remaining two pull/push rods could be measured up and made. **Photograph 23** shows the completed side door operating mechanism. All of this will be under the footplate floor and will be out of sight - but I know it is there and so do you now. This, for me, is the challenge of working to full size drawings, to get the model to being as close a copy of the full size as possible.

It only remained now to make and fit the operating mechanism to the three hopper doors. For this, a simple frame made from 1/16" thick mild steel sheet was required. The base was bent 90 degrees so as to be attached to the platform under the cab floor of the locomotive and above this at 3/8" is a brass bearing to take the three operating levers. Above the bearing is a 1 1/2" radius. Each lever works in between its own guide plates of which one has four slots in it, to give fully open, closed and two intermediate positions of the damper doors. To produce the guide plates to the same radius and shape I made one from gauge plate and hardened it and used this as a template to make the five that were required. **Photograph 24** shows the lever frame and levers together with the cranks.

With the operating mechanism made it was now time to fit it to the cab platform. With this job done I could now measure up for the remaining operating rods. The two long rods which run under the ashpan to the two levers at the front of the firebox and ashpan that work the forward and middle damper doors are so close to fouling the top of the outside frame plate that they were bent 90 degrees on the full size to clear and I had to follow suit. **Photograph 25** shows the operating levers in position on the locomotive. When the cab floor is fitted 1 1/8" above the platform only the radius frame and levers with the operating lever for the side doors will be visible. **Photograph 26** shows a view of the ashpan with the forward and middle door mechanism attached. Note the 90 degree twist in the operating rods.

To conclude, this has been a wonderful exercise in fabrication, drilling and filing with a little bit of machining thrown in. The entire mechanism is quite complex when one considers what is required. As I have already mentioned above, the side door operating mechanism was removed in the late 1940s but the damper door mechanism remained unaltered. It is still *in situ* on engine 46203, Princess Margaret Rose, on display in the West Shed at the Midland Railway Centre, Butterley, Derbyshire. When it came to designing the mechanism for the Princess Coronations ('Duchesses') it was much simplified and consisted of little more than three 'walking stick' type levers which came up through the cab floor! You Duchess builders don't know how lucky you are!

SILVER CREST
models

MARKET LEADER IN LARGE SCALE, READY-TO-RUN, LIVE STEAM

5” GAUGE CORONATION CLASS

LAST 2 MODELS AVAILABLE.

ORDER NOW TO AVOID DISAPPOINTMENT!



£14,995.00 + p&p

The Coronation Class

Designed by Sir William A. Stanier the first locomotives out of Crewe works were originally built as streamliners. Later some were built without streamlining.

All of the streamliners were finally re-built in un-streamlined form, and all eventually featured double chimneys. The model offered here is representative of the class as re-built. The locomotives were produced in a variety of liveries in BR days including maroon, blue and lined green.

- 5 YEAR WARRANTY
- BUY BACK GUARANTEE
- 1/2 PRICE SHOWCASE OFFER
- FLEXIBLE PAYMENT TERMS

See website for details

“My GWR King arrived as expected. What a lovely model, I am delighted with it. You did well with the bell, even the inscription, amazing.

Thank you and your team for the model it was well worth the wait”.

P.N. Wiltshire

Request your free brochure today

Request your free brochure today by e-mail, telephone, or by returning the coupon opposite.

Telephone: **01327 705 259**

E-mail: **info@silvercrestmodels.co.uk**

Find more information at **www.silvercrestmodels.co.uk**

Summary Specification



Approx length 80”

- Stainless steel motion
- Boiler feed by axle pump, injector, hand pump
- Etched brass body with rivet detail
- 4 Safety valves
- Choice of liveries
- Painted and ready-to-run
- Coal-fired live steam
- 5” gauge
- 4 Cylinder
- Piston Valves
- Walschaerts valve gear
- Drain cocks
- Mechanical Lubricator
- Silver soldered copper boiler
- Superheater
- Reverser

Approx Dimensions:

- (L) 80”x (W) 10”x (H) 14”
- Weight: 116 kg

The 5” Gauge Model

This magnificent model is built to a near exact scale of 1:11.3.

Although a 4 cylinder model of this size and quality can never be cheap it certainly offers tremendous value-for-money. You would be hard pushed to purchase a commercial boiler and raw castings for much less than the £12,495.00 + VAT we are asking for this model. Certainly a one-off build by a professional model maker would cost you many fold this with some medal winning examples changing hands at auction in excess of £100,000.

This model is sure to be a real head turner on the track pulling a substantial load, or when on display in your home, or office.

The model comes complete with a silver soldered copper boiler, hydraulically tested to twice working pressure. All our boilers are currently CE and UKCA marked, supplied with a manufacturer’s shell test certificate and Declaration of Conformity. **As testament to our confidence in the models we now provide a full 5 year warranty on every product**. The new batch is limited to just 15 models.

Order reservations will be accepted on a first come, first served basis. We are pleased to offer a choice of names and liveries.

Delivery and Payment

Save £195.00. Free p&p for any order received within 28 days.

We are happy to accept your order reservation for a deposit of just £1,995.00. For orders taken now model completion is presently scheduled for October 2025.

We will request an interim payment of £5,000 in July 2025 as the build of your model progresses, a further stage payment of £5,000 in August and a final payment of £3,000 in October 2025 in advance of shipping from our supplier.

FREE BROCHURE REQUEST FORM

Please send, without obligation, my free full colour brochure for the 5” gauge Coronation Class.

Name: _____

Address: _____

_____

_____ Post Code: _____

Please send to: Silver Crest Models Limited, 2 Gresley Close, Drayton Fields Industrial Estate, Daventry, Northamptonshire NN11 8RZ **ME&W**

Company registered number 7425348

Readers' Tips

CHESTER MACHINE TOOLS

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

Bandsaw Blade Guides

This tip to improve the accuracy of bandsaw cutting comes from Geoff Andrews.

I thought I would share this tip, as it takes some of the frustration out of setting up a band saw to cut accurate vertical slots. As can be seen on the photos, a small bracket is bolted to both the blade guides. Each bracket has an adjustable cap head bolt to allow for fine adjustment to the twist of the blade. To use it, you would make a test cut to decide which way to adjust the blade. Then, loosen the blade bracket bolt, tweak the adjustable bolt a small amount and then retighten the blade bracket bolt. Do another test cut and then re-tweak until satisfied with the cut.









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





Photo 97: Rivets each side hold the base.

PART 14

A GWR Pannier Tank in 3½ Inch Gauge

Gerald Martyn builds a locomotive he can lift.

Continued from Model Engineer & Workshop issue 4765

SMOKEBOX AND SUCHLIKE

You may be pleased to hear that no Loctite need be used in the manufacture of this part!

The smokebox G/A is shown at **fig 42**. The chimney and door are to be made from Rob Roy castings. The door is normally supplied together with a ring which is not needed in this design so try and buy it without if possible. The shell is made from laser cut mild steel, on grounds of cost. As mentioned before, the steel supplied at the thicknesses needed is specified as CR4, which is very malleable and does not work harden. You may find steel a bit more tricky to silver solder than brass, but not much - once you get used to it.

The laser cut parts have already been tabulated. I should show a picture of at least one 'kit' just for illustration, **photo 96**. All the parts for the shell are there. Something to note is that I've not called for the holes for the petticoat pipe to be put in the wrapper. To do so would mean the rolling and forming would need to be carried out very accurately to get the position atop the smokebox bang on centre and there would be a danger of getting out-of-roundness where the hole weakened the part. Instead, the wrapper is generously over-length and without any tabs so the only thing to worry about is getting a close wrap to the required shape, which is defined by the front plate. Other holes, too, are not put in for similar reasons. After soldering then trimming the ends, marking out and then cutting the holes is easily done. There are two pairs of tiny bits, the footsteps and the crossbar brackets, that need careful bending. It's a moot point whether these are worthwhile laser cutting, as the bending can easily go wrong. If it does then just make them the old way; bend a piece of steel then mark-out and cut to shape.

The parts and assembly drawing for the smokebox shell are shown at **fig 43**. Start the work by bending-up the crossbar brackets. These support the crossbar on their narrow edges which will not accumulate ash to the same extent as the more traditional flat-wise bent brackets shown for Rob Roy do. Put countersinks in the front plate rivet holes and rivet the brackets in place. Fit crossbar and admire. The brackets do not need any soldering but leave filing the rivet tails flush until after all the soldering is complete as there will be others to do then also. The footsteps can be bent around a piece of 3/8" bar. Getting the step positioned is easy but keeping it there while clamping up for bending is not; a drop of superglue will help. They have tabs to fit into the front plate and can be held in place with centre pops prior to soldering. Note they should be slightly toe-up. The base can be marked and folded next and note that the fold-down bits are over-length for trimming back later. The finished width needs to be the same as the front and rear plate width at this point, so adjust if necessary, but keep the two holes central. The baseplate front and rear tabs are different so, by the way, the



Photo 96: The smokebox kit as it arrives.

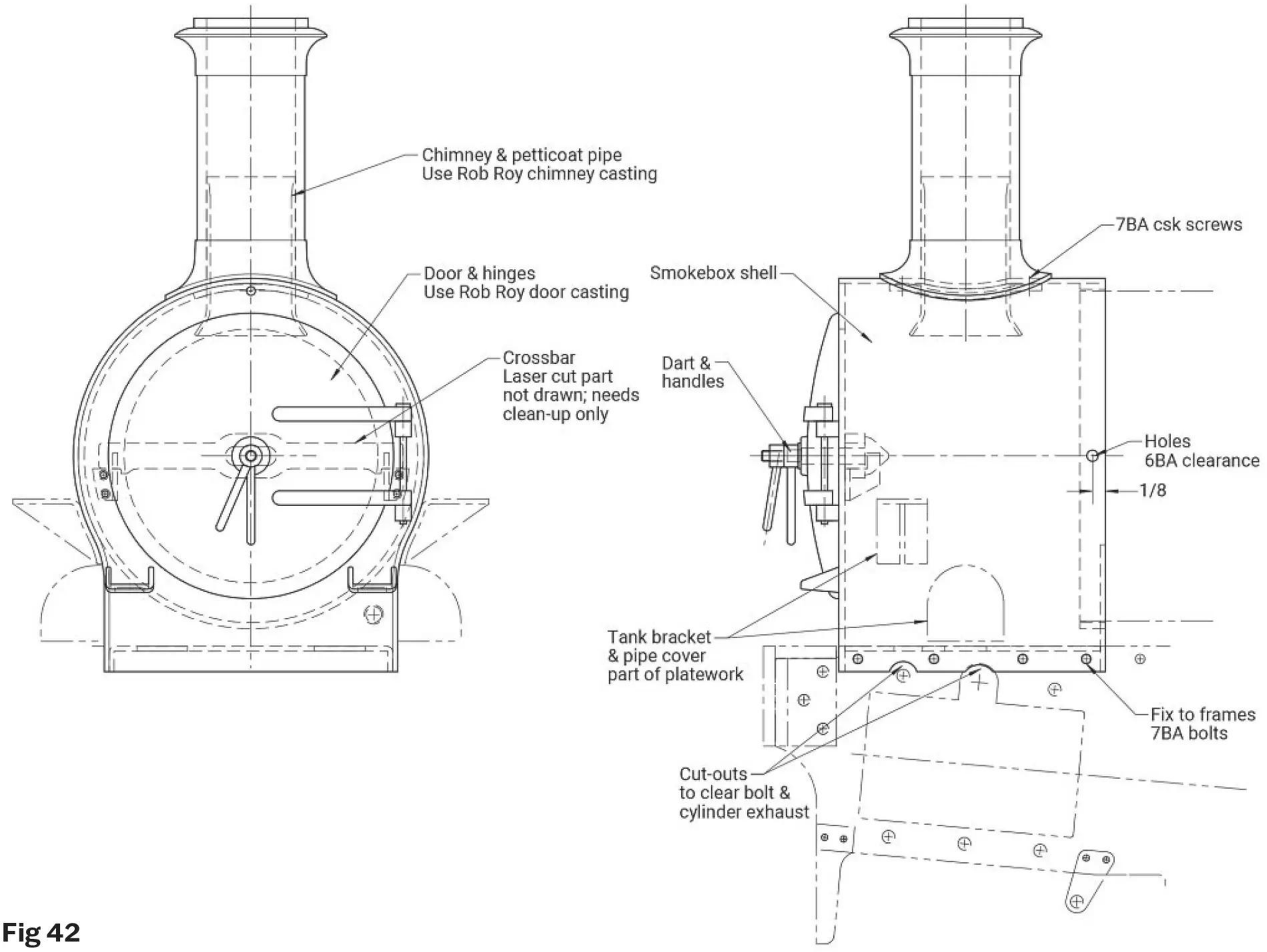

Chimney & petticoat pipe
Use Rob Roy chimney casting
Door & hinges
Use Rob Roy door casting
Crossbar
Laser cut part
not drawn; needs
clean-up only
7BA csk screws
Smokebox shell
Dart &
handles
Holes
6BA clearance
1/8
Tank bracket
& pipe cover
part of platework
Fix to frames
7BA bolts
Cut-outs
to clear bolt &
cylinder exhaust

Fig 42

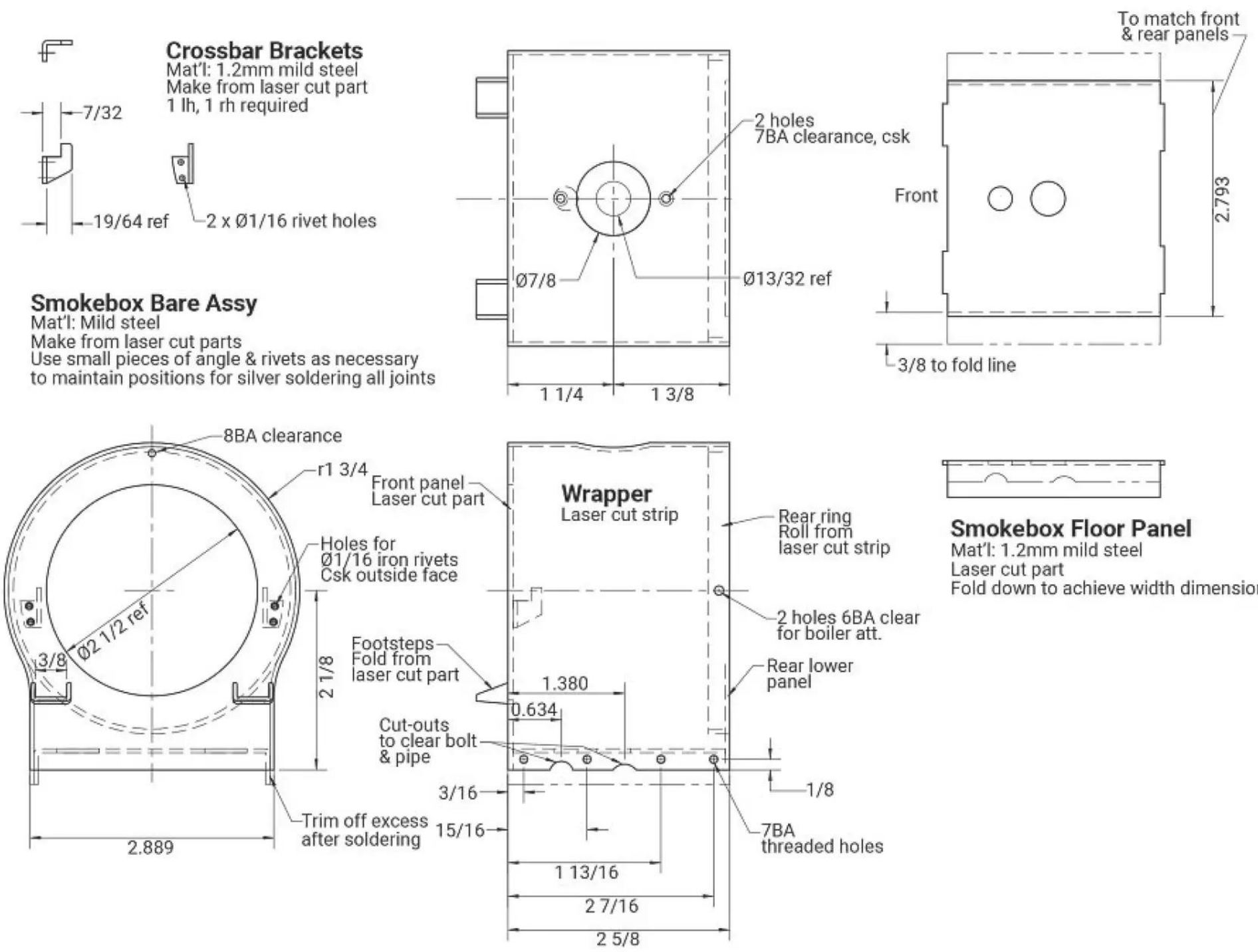

Crossbar Brackets
Mat'l: 1.2mm mild steel
Make from laser cut part
1 lh, 1 rh required
7/32
19/64 ref
2 x Ø1/16 rivet holes
Smokebox Bare Assy
Mat'l: Mild steel
Make from laser cut parts
Use small pieces of angle & rivets as necessary
to maintain positions for silver soldering all joints
2 holes
7BA clearance, csk
Ø7/8
Ø13/32 ref
1 1/4
1 3/8
To match front
& rear panels
Front
2.793
3/8 to fold line
8BA clearance
r1 3/4
Holes for
Ø1/16 iron rivets
Csk outside face
3/8
Ø2 1/2 ref
2 1/8
2.889
Trim off excess
after soldering
Front panel
Laser cut part
Wrapper
Laser cut strip
Rear ring
Roll from
laser cut strip
2 holes 6BA clear
for boiler att.
Footsteps
Fold from
laser cut part
Rear lower
panel
1.380
0.634
Cut-outs
to clear bolt
& pipe
3/16
15/16
1/8
7BA
threaded holes
1 13/16
2 7/16
2 5/8
Smokebox Floor Panel
Mat'l: 1.2mm mild steel
Laser cut part
Fold down to achieve width dimension

Fig 43



Photo 98: Copper bar riveting 'dolly'.

plates will only fit the correct end relative to the steam and exhaust holes.

Mark the centre of the wrapper and roll it, or bend around a pipe, to get the correct radius using the front plate as a guide. The reverse bends can be done incrementally using the vice and angles and just pulling the part by hand. Keep adjusting until the front plate is a good fit at both ends. Any thin gaps will fill with solder. Now roll the rear ring and trim the ends to get a snug join so that it can just be slid inside the wrapper behind the front plate (to get it the same diameter).

All the bits needed are now ready - but how do we hold them together? Tabs can be centre popped, of course and the rear ring can simply be riveted into the wrapper using 3/64 inch brass rivets here and there but not too many. Why brass? Well iron ones, if available, may well be covered in oxide which is hard to remove and will inhibit solder penetration. The base can be held in with a couple of rivets each side, **photo 97**. Note the clamps to hold everything just right before drilling. For the rest I used little spacers or bent steel brackets positioned wherever to best keep the gaps closed and held by 3/64" brass rivets. Two brackets are at the front and two flat spacers to support the rear.

As a 'dolly' for all riveting, particularly helpful in those hard to get places, I use a copper bar originally bought to make superheater headers, **photo 98**, but any soft (or, indeed, hard if the heads do not need to maintain shape) bar will do the job. My prototype smokebox ready for soldering is shown in **photo 99**.

In use the smokebox will get rather hot, so silver solder needs to be used. The aim is to get an essentially airtight box so that when finished and with the door shut, the only way in is through the tubes and out is through the chimney. So, solder is needed along all the joints but full penetration is not essential as the pressure is very low. Cover all the joints inside and out with flux, even if intending to only solder them one seam at a time. Oxidation at joints prior to soldering should be prevented if possible. Use a stiff mix so it doesn't all run away downhill when heated.

With the footsteps uppermost and the 'box on two bits of firebrick with space between, I started by soldering the footsteps in, then down to the rear ring and backplate and ran solder round these. I then turned the box upright for the two side seams at the base then, with front face down, ran solder all around inside the front join. Checking before cooling off revealed a gap at the rear ring to backplate joint, a difficult to access area when it was underneath, so with this still uppermost I put more flux on, applied the heat and ran some more solder in.

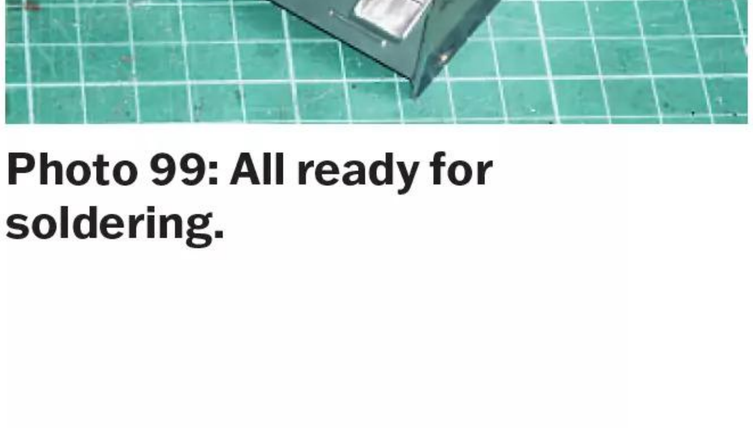


Photo 99: All ready for soldering.

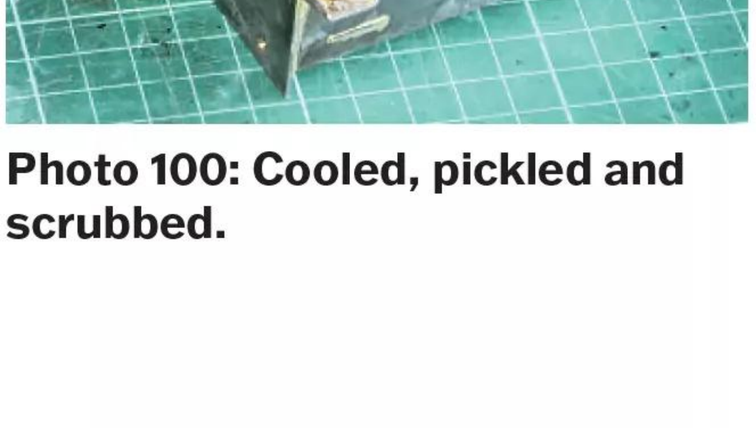


Photo 100: Cooled, pickled and scrubbed.

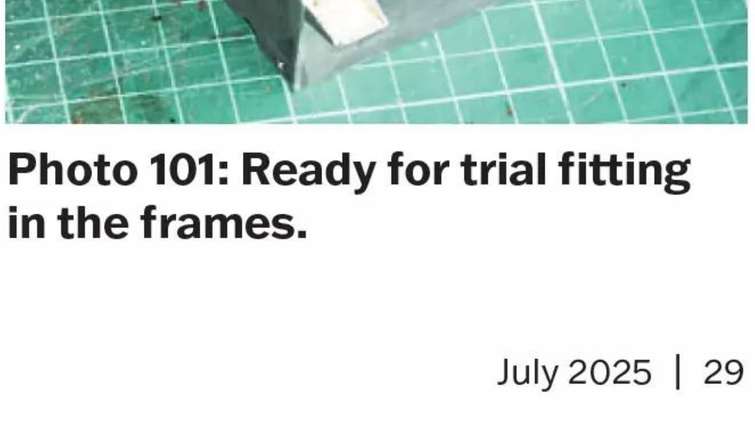
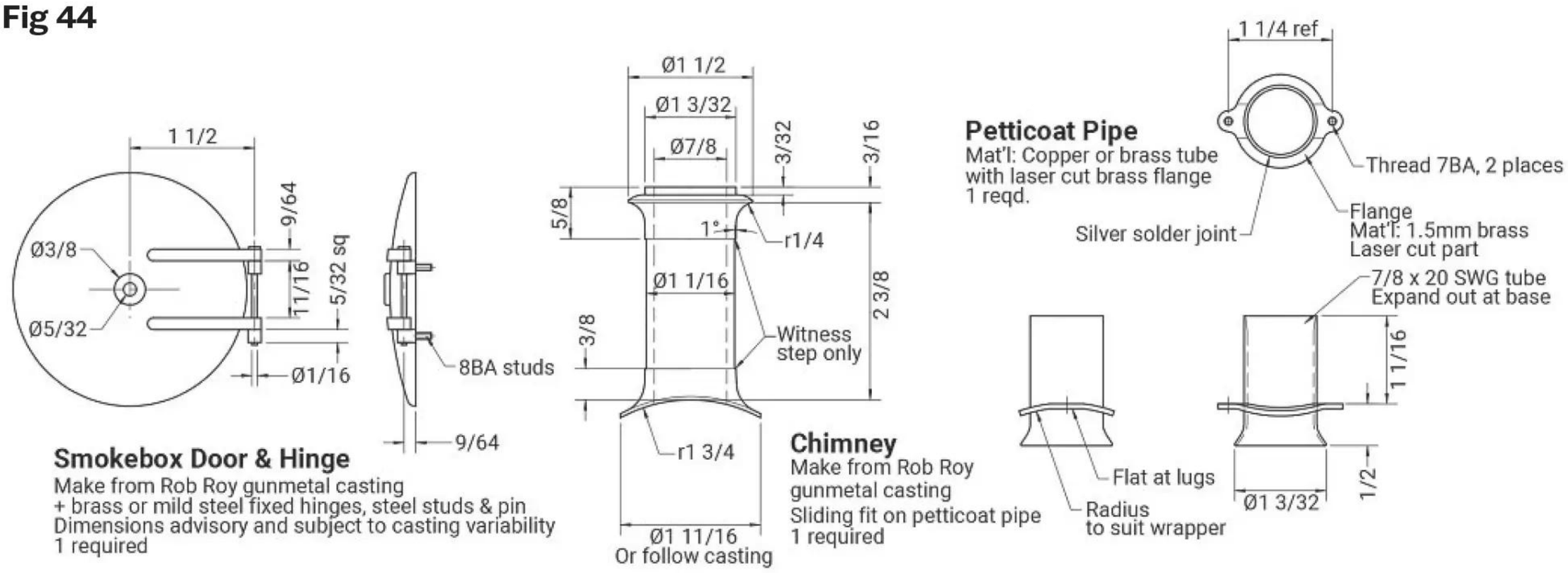


Photo 101: Ready for trial fitting in the frames.

Fig 44



Allow to cool gently; hot solder is still weak even when 'set' and hot quenching can cause uneven cooling and splits. After a day in citric acid and a scrub the result is shown in **photo 100**. A few blobs and lumps to clean off but, essentially, it all looks sound. *Phew!* I've always used brass for smokeboxes before so this was new territory and it was a relief to get it right.

Trim the lower edges to match the front and rear plates, file the tack rivets flush as necessary and give it all a good clean-up. Finally, mark out and put in all the holes in accordance with the drawing. The three decimal place dimension to the little cut-out to clear the cylinder bolt heads is what CAD gives us when an angled cylinder is compared to an horizontal frame top. It can be made 5/8" and the cut-out a bit larger and still do the job. It's not an important feature as long as the bolt is cleared. The smokebox should now be something like that shown in **photo 101** and can be tried between the frames. When bolted in it becomes, also, a very strong frame stretcher.

How many photographs of simple processes and bits of metal in the lathe chuck do I need to show? There are no photographs to support the next few basic parts, just the drawings and the words. The final drawings to complete the smokebox assembly are shown in **fig. 44** for the chimney and door and **fig. 45** for the smokebox dart parts. The petticoat pipe is much like Rob Roy. I made a short, tapered mandrel from a piece of bar to form the flare and tapped it into the pipe, annealing a couple of times to help things along. The laser cut flange can be curved then set on a couple of 3/64" rivets poked through accurately positioned holes in the pipe to set it at the right height and square fore-and-aft. Laterally, use a height gauge to set the two sides the same, then silver solder.

The chimney stretches the use of the Rob Roy casting. The one I purchased had no worthwhile machining allowance, which did not help and was presumably intended to be finished with hand tools. It also had a deep shrinkage depression around the sprue and the skirt was not properly curved to fit the smokebox, with wide gaps under the lower edges. The depression was fixed with a blob of silver solder when I soldered some 18 swg strips on to fill the gaps under the skirt. It would not have done for Rob Roy, either, without this work so perhaps should have been sent back. A decision must be taken based on how much work has been done and would now be wasted and how easy a repair would be. I'll not name the supplier. I started the proper job with the bore and there was so little to take out that my boring tool simply bounced over the surface. A file would do the job but my plan B was an expanding reamer. I've had a second-hand set of these for many years and only recently found how good they can be when I took a trip to the dark side and tried an I/C engine. The cylinder liner had hard spots and my bendy tool ensured that it would not bore true and parallel. A reamer saved the day. These are hand tools and it's possible to shave off tiny amounts using proportionately small torque and I did the job by gripping the reamer shank in the vice and turning the liner (and now the chimney) by hand. This eliminated any possibility of distortion due to clamping forces on what was a rather thin wall part (or for the chimney it's just plain awkward to clamp). The chimney bore should be made a sliding fit onto the petticoat pipe.

The next step is to turn up a mandrel and soft solder the chimney onto it with base towards the chuck. Centre the outside diameter of the chimney using a 4-jaw chuck to make best use of the metal that's there. I used a 3-jaw and ended up slightly under-size as the bore and outer were not concentric and

Fig 45

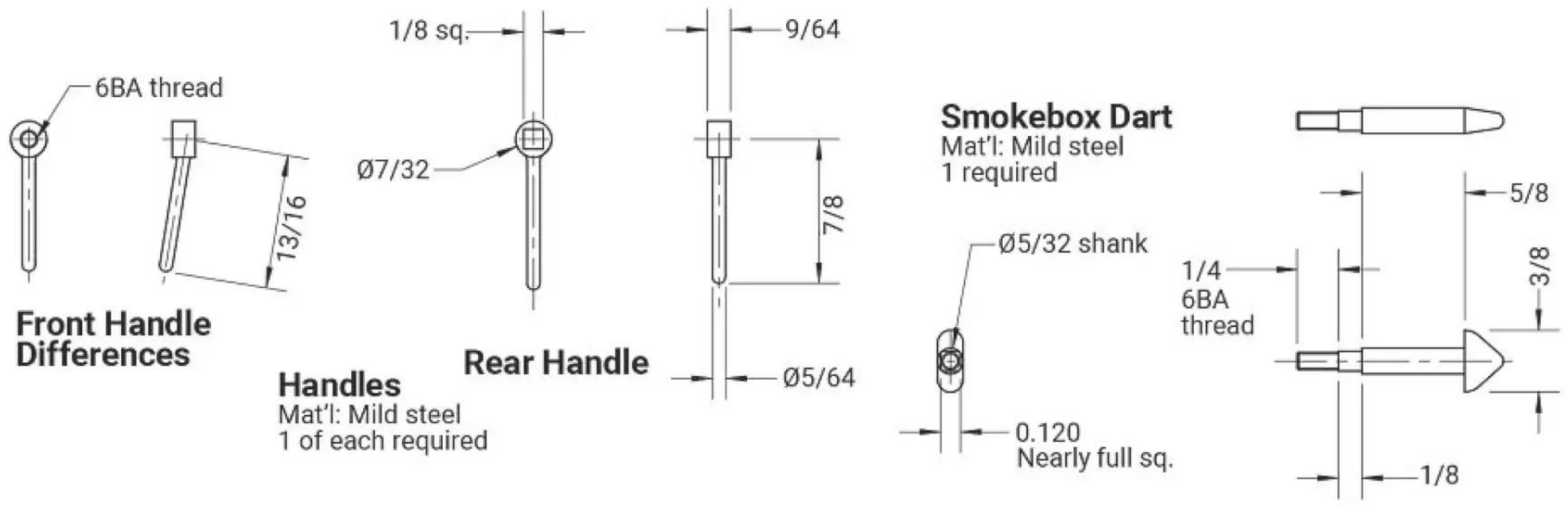




Photo 102: My 'extended' drills, ideal for line drilling.

there's no compensating machining allowance. Turn the top lip to 1½" diameter. Next turn under the rim to achieve the 2 3/8" dimension or less, if possible, as this determines the overall finished height. The dimension given should 'make' from the casting but the chimney will be 1/8" too tall for scale. It hardly shows but, if you're given the chance to do so, shorten it. The radius is not too important and can be formed by multiple cuts using any sensible round nose tool. The rest of the turning is standard stuff. Finally, a shallow taper inside the top of the bore will mask any eccentricity to the outer.

I've never fly-cut a skirt to fit a smokebox. In this scale it's just as quick to do the job with a file (including the lumps caused by the soldered-on bits). Similarly, the outside of the skirt is done with hand tools after doing the underside. Try it on the petticoat pipe until it looks good and note that it will be shielded by the tank top covers so doesn't need to be super good. To get a bit of friction, give the petticoat a very light squeeze in the vice to make it just slightly oval.

The crossbar is laser cut to a fancy shape that I possibly wouldn't bother with if making by hand, but looks much better for it. It just needs the usual cleaning-up to make it look even nicer.

The important features for the door are that the rear face to go against the smokebox should be flat and the hole for the dart should be in the centre. The rear face can be carefully turned in the lathe and the dart hole put in. The door has cast-in hinge straps so finishing the front is mostly by use of hand tools. Get the hinge lugs to width now but leave the profiles until after fitting. It's best to do the dart and handles next as they can be used to hold the door in place while the hinge positions are laid out. I turned and filed these from solid. Carefully position the door on the smokebox front and tighten the dart. Mark out the fixed hinge positions noting that the hinge pin should be as close to the door as possible, but that the holes for it need to be line drilled past the footstep. I have a few extended drills for jobs like this, just a piece of round bar with the required drill bonded into a hole in the end, **photo 102**. Make up, pilot drill 3/64" and fit the fixed hinges. Then with the door clamped in place, carefully checking location on the 'box, pilot drill right through from below. Then drill to finished size from the top with the 'box base flat on the drill table. The cast door hinge lugs were, I must say, gross. A piece of drilled 5/64" bar between the lugs can be used as a filing button to get them down to size. Finally, part a small piece off the end of the bar and solder it on to the top of the hinge pin to make the head. As little as possible wasted. The final result should look a bit like this in **photo 103**. Use engineer's blue to check for a good seal between the door and the smokebox face and scrape-in if necessary.

So what's missing? The smokebox front and rear edge seams were held together by rivets, a fine loop of them just inside the edge at the front being most noticeable, if slightly incongruous compared to the welded joints elsewhere. These will be dealt with under 'improvements'. A bit of confusion surrounds the chimney and, later in the build, the dome. The G/A shows these very clearly sitting on the curved tops of the smokebox and the boiler in the normal manner. Images of 1369 in preservation show them sitting on the flat top of the tank cover plates. So which is right and when? In early photographs, 1366 looks consistent with the G/A but views on the top of engines are very rare and I've not found one to provide certainty. For better or worse I opted to do things as shown on the G/A because it enables use of readily available castings. It is always possible to modify them, of course, to come into line with 1369 as it is now, if anyone wants to.

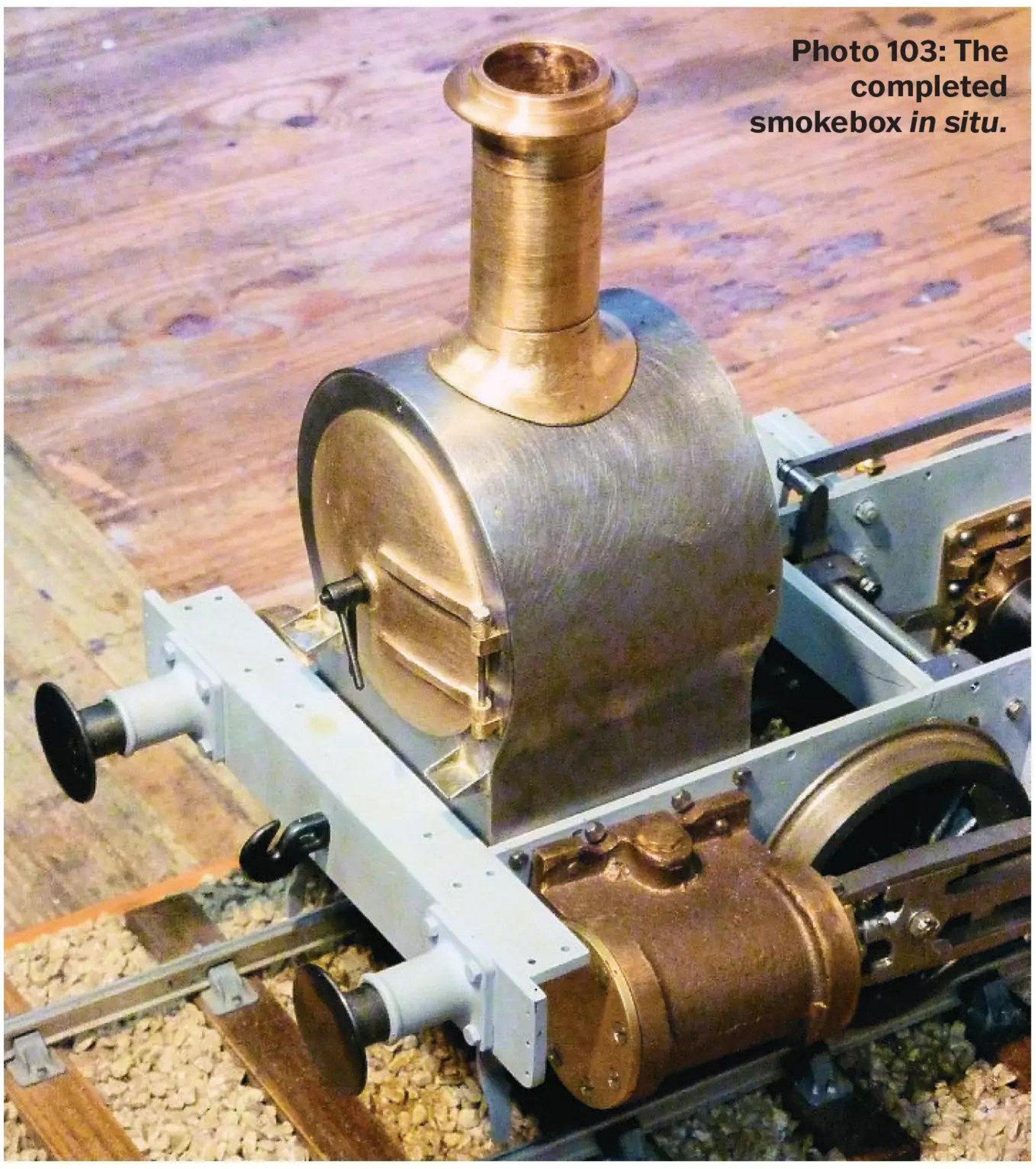


Photo 103: The completed smokebox *in situ*.

On the Wire

News from the world of engineering

The Model Engineer & Workshop Reader Survey

We would like to start by thanking everyone who took part in the reader survey. It's been a time of great change for everyone involved with the production of *Model Engineer & Workshop* (ME&W), and the coming together of the readers of *Model Engineer* (ME) and *Model Engineers' Workshop* (MEW) has created a new audience with a wide range of interests and expectations. There were nearly 340 surveys completed, more than enough for the results to be statistically valid, so we now have a good idea of what our readers think. Note that the survey focused on the old magazines, their content and how articles are presented. This was not looking at the design aspects of the magazine.

We found 69% of respondents were former ME subscribers and 79% former MEW subscribers, reflecting the overlap between the two magazines. About a quarter subscribe to at least one of RCM&E, Model Boats or The Railway Magazine, with a full three-quarters reading The Railway Magazine at least occasionally. Nearly half of respondents use the forum at www.model-engineer.co.uk which was by far the most popular choice.

The results for club membership gave an interesting insight, **graph 1**. Over half, 55%, of respondents are members of clubs related to the hobby, with about 30% being members of actual model engineering clubs or societies. 45% of are members of other types of club, mostly full-size steam, classic cars or motorcycles, all just under 10%. Figures for Men's Sheds, REMAP and Repair Cafes were more modest. Maker Spaces were under 1%, yet this movement is burgeoning and has so much in common with our hobby.

We then asked respondents to rate the various articles in the final issues of ME and MEW. There was a very broad range of responses every article was rated very good by some readers and uninteresting by others! The five most popular ME articles were:

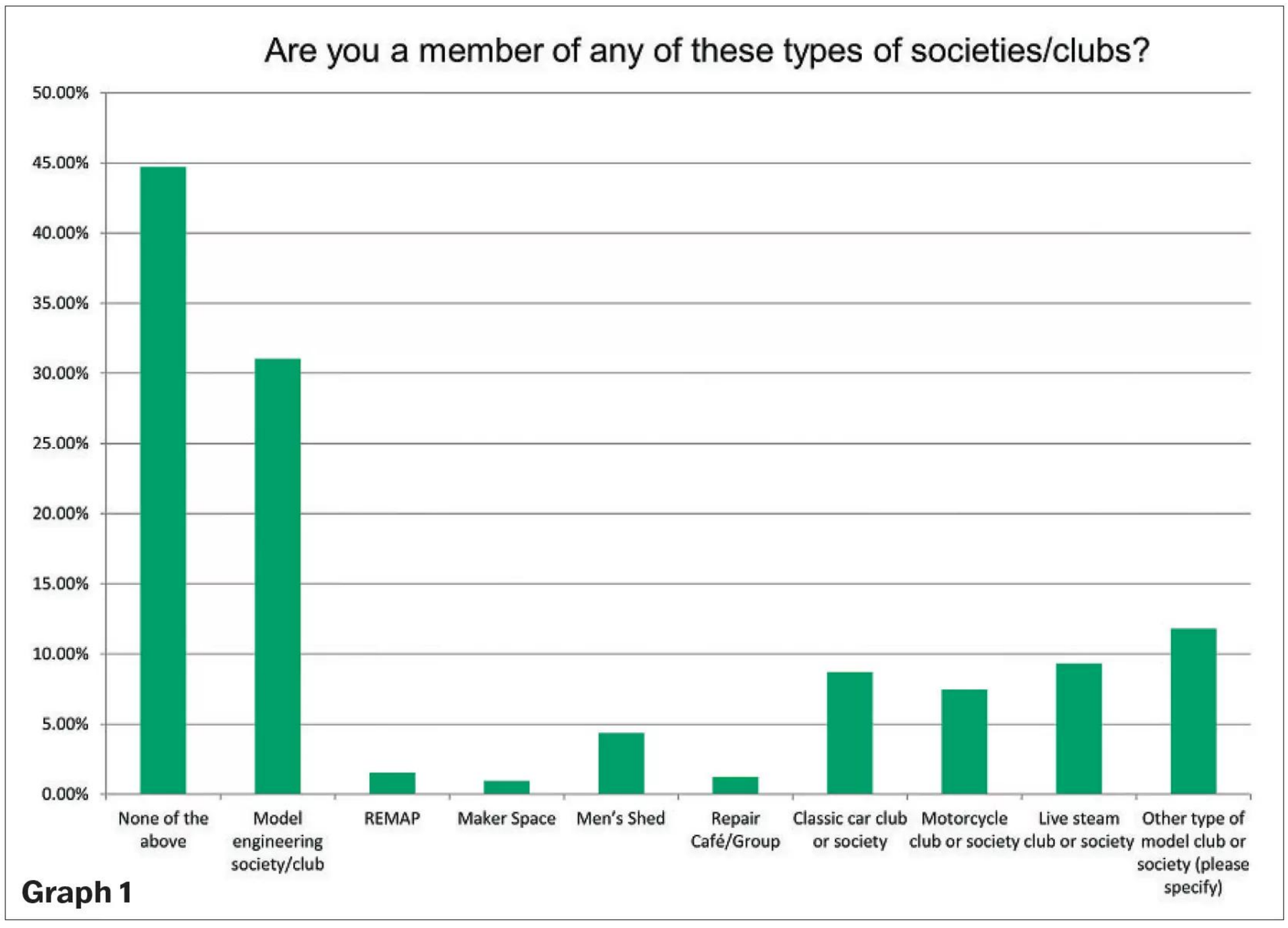
- **Working on the Lathe**
- **Postbag**
- **The Stationary Steam Engine**
- **An Engineer's Day Out**
- **A Tandem Compound Mill Engine**

For MEW, the five most popular were:

- **Readers' Tips**
- **Scribe a Line**
- **Beginner's Workshop**
- **Lathe Speed Measurement**
- **Using Spring Washers to Ease Gib Adjustment**

It's particularly interesting that the reader's letters pages are so popular in both magazines. A criticism sometimes made is of archive content, yet Beginner's Workshop is very popular. There is also plenty of practical content near the top of the lists for both magazines.

An important question asked readers to rate how interesting they found different topics from one to five. We worked out the average rating of each topic and ranked them, **table 1**. The most striking result is that is that articles on tools and techniques are by far and away the most popular, this perhaps explains why many ME readers have been happy to see MEW content return to the magazine. There is a high level of interest in historic and full-size engineering. Live steam railways seem rather less popular than stationary steam and are neck and neck with CAD, theoretical articles and 3D printing. The place of horology and ornamental turning perhaps reflects that these are minority interests. Electric railway models came last of all, I suspect many respondents thought of tabletop railways rather than large gauge models? Another important area to readers is the length of articles and series, especially as while ME would often run series



Graph 1

over several years and MEW rarely went beyond a few instalments, and the new magazine has to find a new balance.

Graph 2 is helpful here. Again this feedback is really about helping achieve the right balance, and it seems to be saying that the ideal is focusing on articles ranging from a few pages up to several parts. The least popular articles are the very brief ones, unfortunately these are unavoidable to be able to lay out the magazine, but naturally they do not occupy much space. At the other end of the scale, relatively few readers are most interested in longer series that might take up to several years to appear. Too many long series can deter new readers joining part-way through and also limit the amount of variety we can have in the magazine.

There was a clear preference for long articles to appear as several medium-length instalments, rather than a few very long ones or many brief ones.

What will matter most to readers, is what impact this survey has on the magazine. We've also read hundreds of the written comments, as well as many emails sent in and comments made on the forum. It's important our content reflects the interests of all readers, and a big challenge is that the least popular topics were the favourites of some readers, and vice versa. There were some apparent paradoxes some of the most popular articles were on less popular topics. This shows how good writing can make a dull subject interesting, and vice versa,

One message is we that we need to make sure there's plenty of coverage of the subjects towards the top of the list in the table, whilst those nearer the bottom are dealt with less often – but not ignored.

Another strong message is that we should not have too many long series running at the same time, and when we do have series, an ideal format is several medium-length parts.

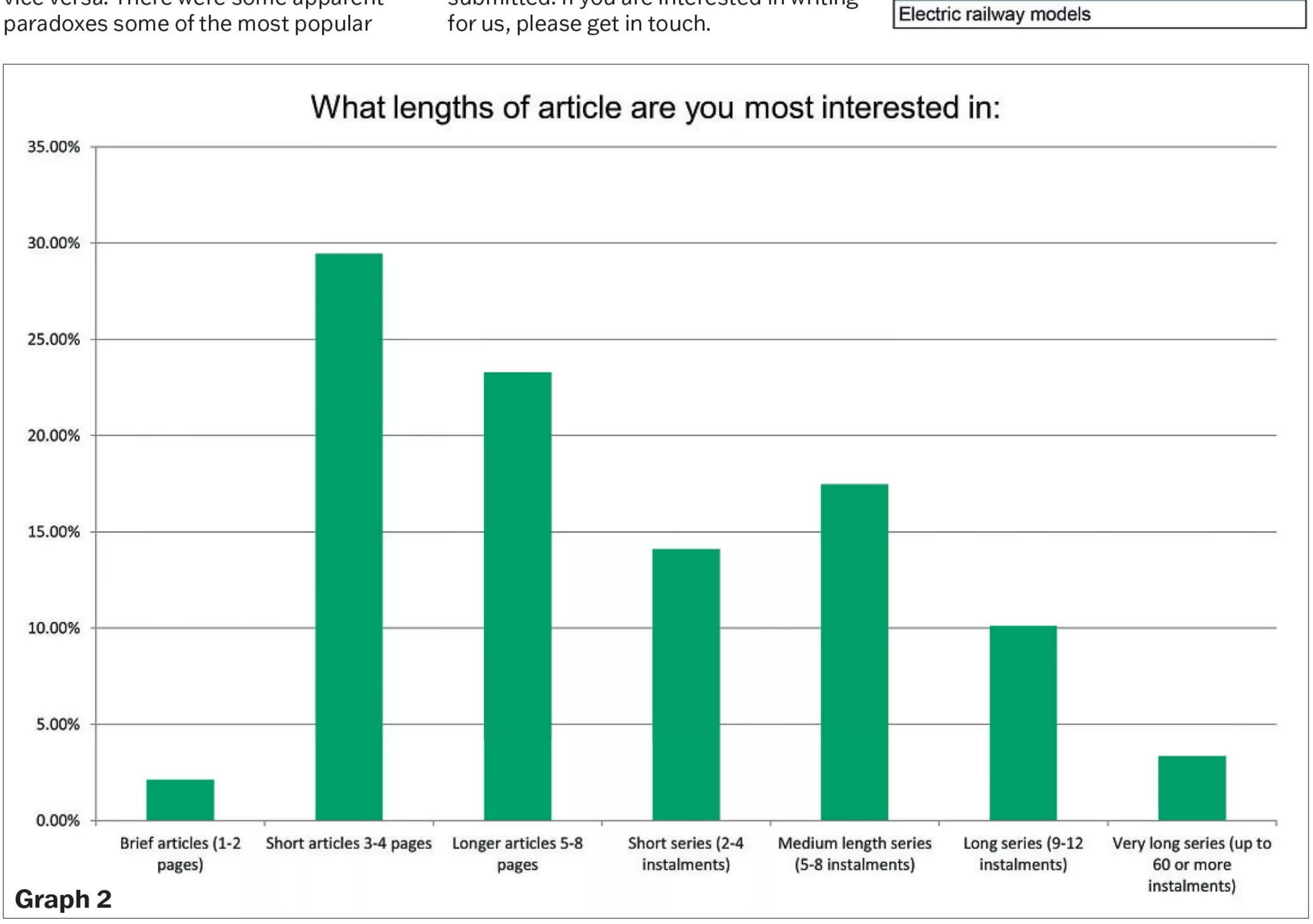
The new magazine, Model Engineer & Workshop, benefits from a significantly increased page count, allowing more feature content, so it's easier to cover a variety of topics and article lengths to ensure that all readers find plenty of interest in each issue.

Readers' feedback on the first few issues of ME&W has resulted in many improvements to its appearance and presentation. The survey results will guide the development of the magazine's content is more ways than detailed above. For example, it's been really useful to reflect on what has made some things popular and others less so. Thank you again to everyone who took part.

Of course the greatest challenge for editing a magazine like ME&W is that we can only publish articles from what is submitted. If you are interested in writing for us, please get in touch.

Table 1

Other workshop skills (e.g. brazing, finishing, welding, anodising)
Building items from scratch
Using machine tools and techniques
Modifying or upgrading tools
Making machine tools
Making hand tools and gadgets
Problem solving and repairs
Using hand tools and techniques
Historic engineering
Historic machinery
Full size engineering
Other working model engines
Machinery reviews
Stationary steam engines
Running a workshop
Stories about experiences in the hobby
Theoretical/mathematical articles
CAD design
Live steam railway models
3D printing
Wider anecdotes and stories with an engineering flavour
Laser cutting
CNC machining
Building items from kits
Places to visit
Horology (clocks and watches)
Activities and events
Ornamental turning
Electric railway models



Graph 2

MODEL ENGINEER & WORKSHOP
EST. 1898
THE LEADING MAGAZINE FOR HOBBY ENGINEERS AND MODEL MAKERS

SUBSCRIBE AND SAVE





Enjoy 12 months for just £51

PRINT ONLY

Quarterly direct debit for **£15**

1 year direct debit for **£51**

1 year credit/debit for **£56**

PRINT + DIGITAL

Quarterly direct debit for **£18***

1 year direct debit for **£63***

1 year credit/debit for **£66***

DIGITAL ONLY

1 year direct debit for **£37***

1 year credit/debit for **£41***

**Any digital subscription package includes access to the online archive.*

Great reasons to subscribe

» Free UK delivery to your door or instant download to your digital device

» Save money on shop prices » Never miss an issue

» Receive your issue before it goes on sale in the shop

Photo: *Neil Wyatt*

classicmagazines.co.uk/mewdps

01507 529529 and quote MEWDPS

Lines are open from 8.30am-5pm weekdays GMT

Offer ends July 21, 2025. Subscriptions will start with the next available issue. Direct Debit payments will continue on the agreed plan unless you tell us otherwise.
To view the privacy policy for MMG Ltd (publisher of Model Engineer & Workshop), please visit www.mortons.co.uk/privacy

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

Club Diary

Please send your events for Club Diary to meweditor@mortons.co.uk

2025

EVERY SUNDAY

Warrington MES
Running day. Contact : contact@wdmes.org.uk
Wakefield SMEE
Public running day. Contact Denis Halstead 01924 457690

JUNE

20 Rochdale SMEE
Bob Hayter – 'Evil Spirit'. Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers
21 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact

JULY

4 Rochdale SMEE
Models running night. Springfield Park, 17:00 onwards. See www.facebook.com/RochdaleModelEngineers
5 Bromsgrove SME
Modern Traction Open Day. All gauges welcomed 5", 3.5", 2.5", G1 and 16mm. Contact Doug Collins 07585 524836
5 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact
5/6 Guildford MES
Railway Gala, 10:00-17:00, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk
5/6 Cambridge and District MES
Two Day Rally, Fulbrooke Road, Cambridge. Contact: Andrew or Graham Clarke Andrew.clarke.clarke@btinternet.com
6 Bradford MES
Rae Day Gala, Northcliff. Contact: Russ Coppin, 07815 048999
18 Rochdale SMEE
General meeting. Springfield Park, 17:00 onwards. See www.facebook.com/RochdaleModelEngineers
19 Gauge 1 North
Gauge 1 live steam at Bakewell Agriculture and Business Centre. Gauge1north.org.uk
19/20 July Urmston & District MES
N.A.M.E. Rally (Northern Association of Model Engineers), 3.5 & 5 inch rail, model Road Steam and static displays.
20 Cardiff MES
Public Running Day, Heath Park, 13:00-17:00.
20 Guildford MES
Public open day, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk
20 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact

AUGUST

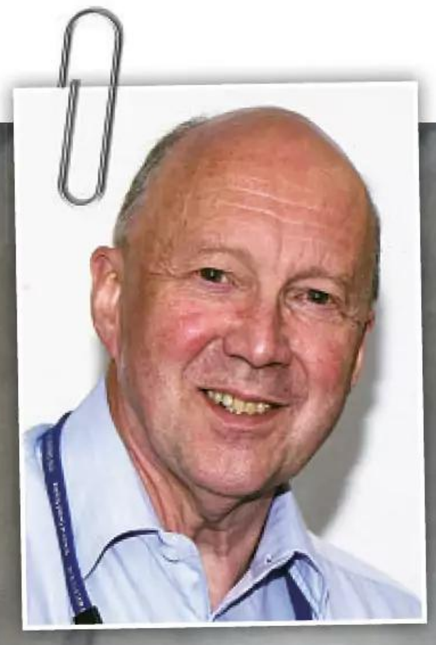
1 Rochdale SMEE
Models running night. Springfield Park, 17:00 onwards. See www.facebook.com/RochdaleModelEngineers
2 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact
3 Guildford MES
Small Model Steam Engine Group meeting, 14:00-17:00, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk
3 Cardiff MES
Public Running Day, Heath Park, 13:00-17:00.
7 Guildford MES
Public open day, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk
9 Wakefield SMEE
Visiting locos 7 ½"G only day. Thornes Park Track, Wakefield. Contact: Jacqui Owen jacquieowen@yahoo.co.uk
15 Rochdale SMEE
Auction Night. Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers
17 Guildford MES
Public open day, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk
17 Bradford MES
Running Day, public from 1:30 pm to 16:00, Northcliff. Contact: Russ Coppin, 07815 048999.
17 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact
19 Nottingham SMEE
Evening Run and BBQ. nsmee.org.uk/events/
24/25 Cardiff MES
Public Running Day, Heath Park, 13:00-17:00.
28 Guildford MES
Public open day, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk

SEPTEMBER

6 Bromsgrove SME
Open Day. All gauges welcomed 5", 3.5", 2.5", G1 and 16mm. www.bromsgrovesme.co.uk. Contact Doug Collins 07585 524836
6 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact
13 L&NWR Society & Stafford & District MES
Annual Steam Up. The County Showground, Weston Road, Stafford, 10:00.
13/14 Tiverton & District MES
LittleLEC at Worthy Moor Track. www.littlelec.co.uk
14 Cardiff MES
Public Running Day, Heath Park, 13:00-17:00.
19 Rochdale SMEE
Bits and pieces/personal project ideas. Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers
20 Bromsgrove SME
Hosting the Rob Roy Rally And 3.5"gauge friends. www.bromsgrovesme.co.uk. Contact Doug Collins 07585 524836
21 Guildford MES
Charity and Heritage Day, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk
21 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact
27 Bradford MES
Visitors Day – BMES welcomes members and their locomotives from other societies to Northcliff for breakfast & lunchtime butties. Let Russ Coppin, 07815 048999 know in advance, please.
27 Urmston & District MES
Polly Owners Group Rally.

OCTOBER

4 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact
5 Guildford MES
Small Model Steam Engine Group meeting, 14:00-17:00, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk
5 Bradford MES
Running Day, public from 1:30 pm to 16:00, Northcliff. Contact: Russ Coppin, 07815 048999.
12 Cardiff MES
Public Running Day, Heath Park, 13:00-17:00.
17 Rochdale SMEE
Annual General Meeting. Castleton Community Centre, 19:00. See www.facebook.com/RochdaleModelEngineers
19 Guildford MES
Public open day, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk
19 Tiverton & District MES
Running day at Worthy Moor Track. www.tivertonmodelengineering.org.uk/contact
21 Nottingham SMEE
Bits and Pieces Evening. nsmee.org.uk/events/
30 Guildford MES
Public open day, Stoke Park. Contact: Mike Sleigh, pr@gmes.org.uk or see www.gmes.org.uk



A Tandem Compound Mill Engine

PART 17

David Thomas builds Arnold Throp's model of a Corliss mill engine. Continued from Model Engineer & Workshop issue 4765.

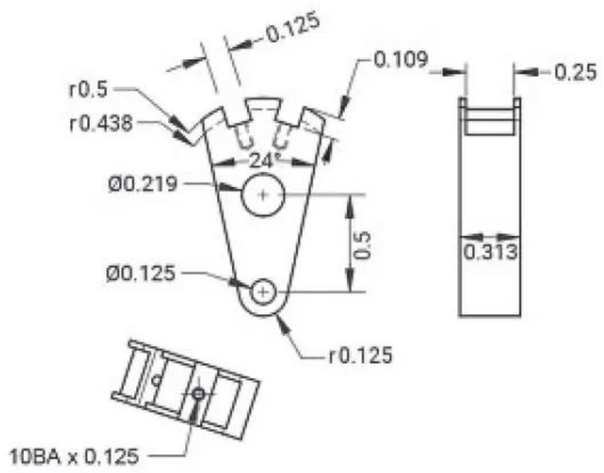
Photo 266: The steam lever marked out on the end of a piece of bar. The first cut has been taken.

There are something like 40 small parts needed to finish off the HP cylinder valve gear, **fig. 43**. Many of these require similar machining sequences so for those I'll describe the processes needed rather than detailing each part, thus avoiding repetition and boredom.

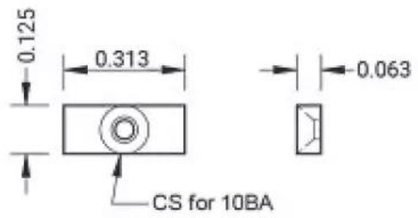
One part that does need a detailed description is the steam lever, the part that is rocked to-and-fro by the rods from the steam eccentric and therefore provides the motion that opens the valves. This is a part that is easy enough to draw but not so straightforward to make. The problem is that the lump at the bottom where the pin is secured is at a larger radius than the curved groove at the top and so gets in the way of simply turning the part from bar. It would be possible to make the part from plate and produce the curved top and groove in the mill but that would need a mandrel for mounting. The path that I chose was to turn the part on the end of a bar of FCMS and add the hole for the pin by gluing in a separate piece later, **photo 266**. The photo shows the largest diameter being defined. In **photo 267** the hole for the trunnion is being set on the lathe axis so that the top and groove could be



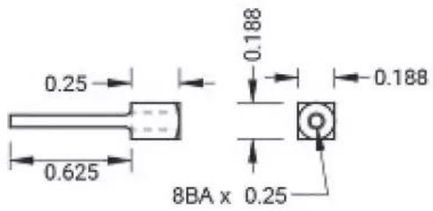
Photo 267: Recentering the steam lever to turn the groove in which the trip levers run.



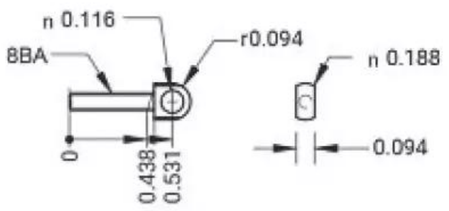
Steam Lever
Mat'l: M.S, 1 off



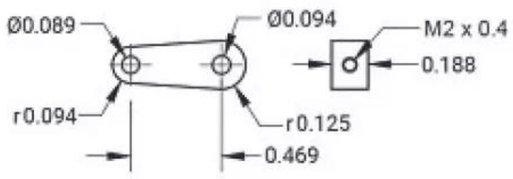
Trip Die
Mat'l: High carbon steel hardened, 2 off



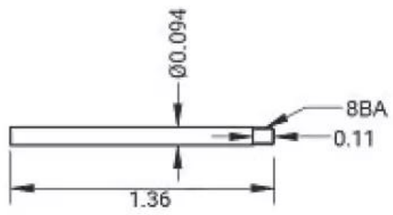
Trip Blade
Mat'l: M.S. case hardened, 2 off



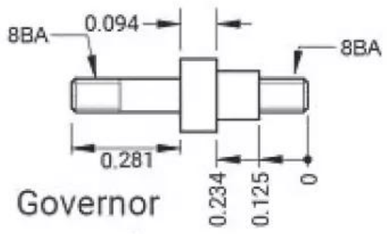
Trip Blade Pin
Mat'l: S.S, 2 off



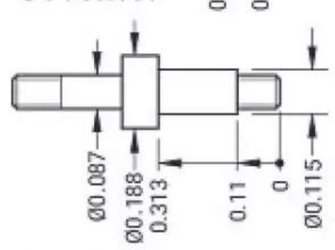
Control Lever
Mat'l: M.S, 2 off



Control Lever Shaft
Mat'l: M.S. or S.S, 1 off

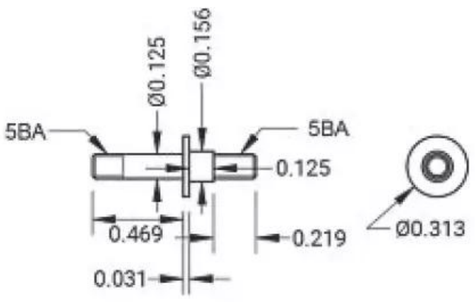


Governor

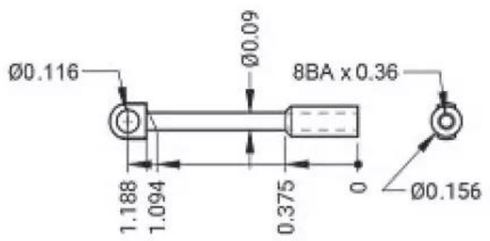


Trip Link

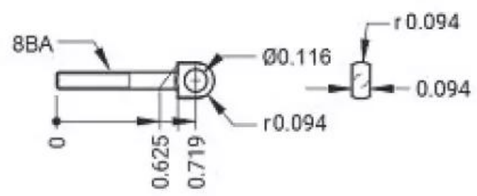
Control Lever Pins
Mat'l: M.S. or S.S, 1 off each length



Steam Lever Pin
Mat'l: M.S, 1 off

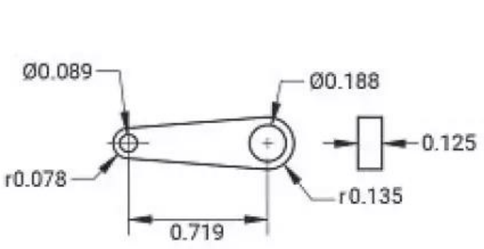


Upper

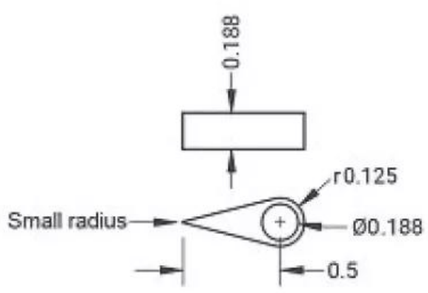


Lower

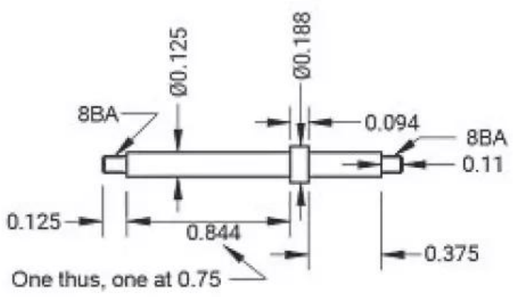
Trip Links
Mat'l: M.S. or S.S, 2 off each



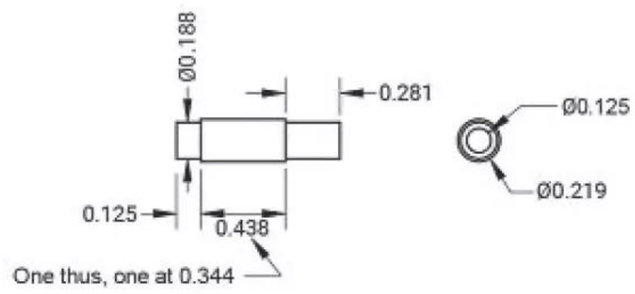
Trip Cam Lever
Mat'l: M.S, 2 off



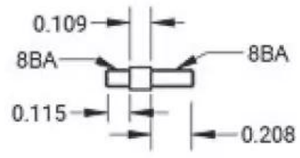
Trip Cam
Mat'l: M.S. case hardened or HC steel hardened, 2 off



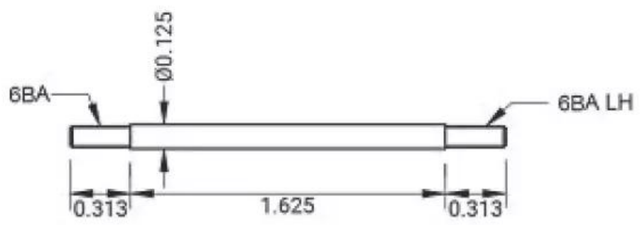
Trip Cam Pins
Mat'l: M.S. or S.S, 2 off



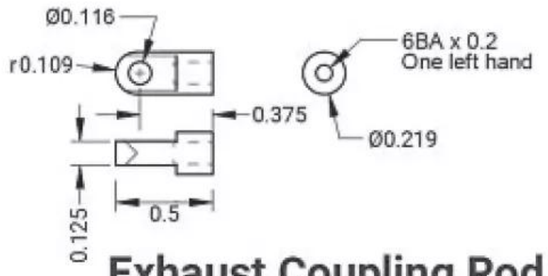
Trip Cam Pin Spacers
Mat'l: M.S. or S.S, 2 off



Trip Cam Lever Pin
Mat'l: M.S, 2 off



Exhaust Coupling Rod
Mat'l: S.S, 1 off



Exhaust Coupling Rod End
Mat'l: S.S, 2 off

Fig 43: Valve gear details.

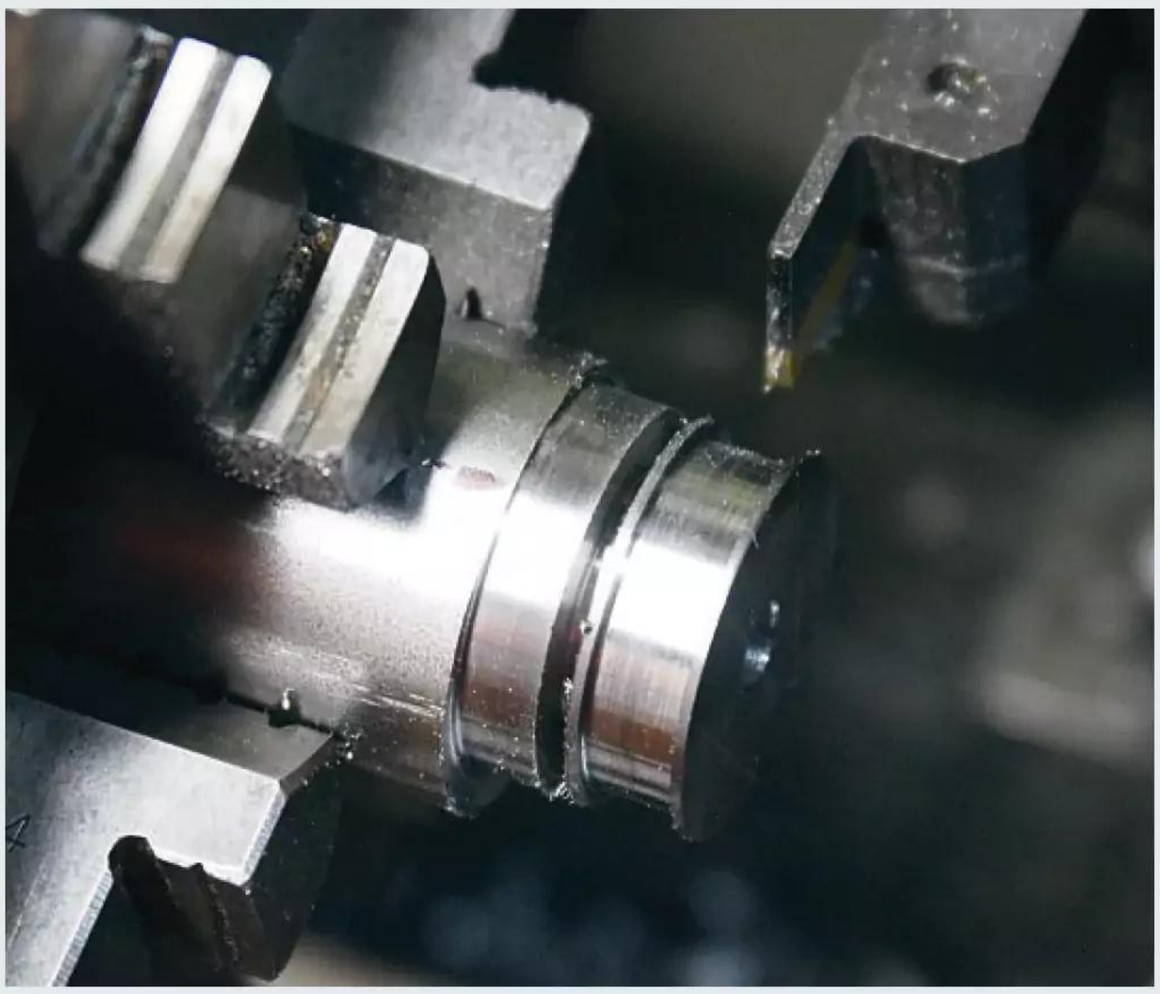


Photo 268: Groove turned and the thickness of the part marked with a parting tool.

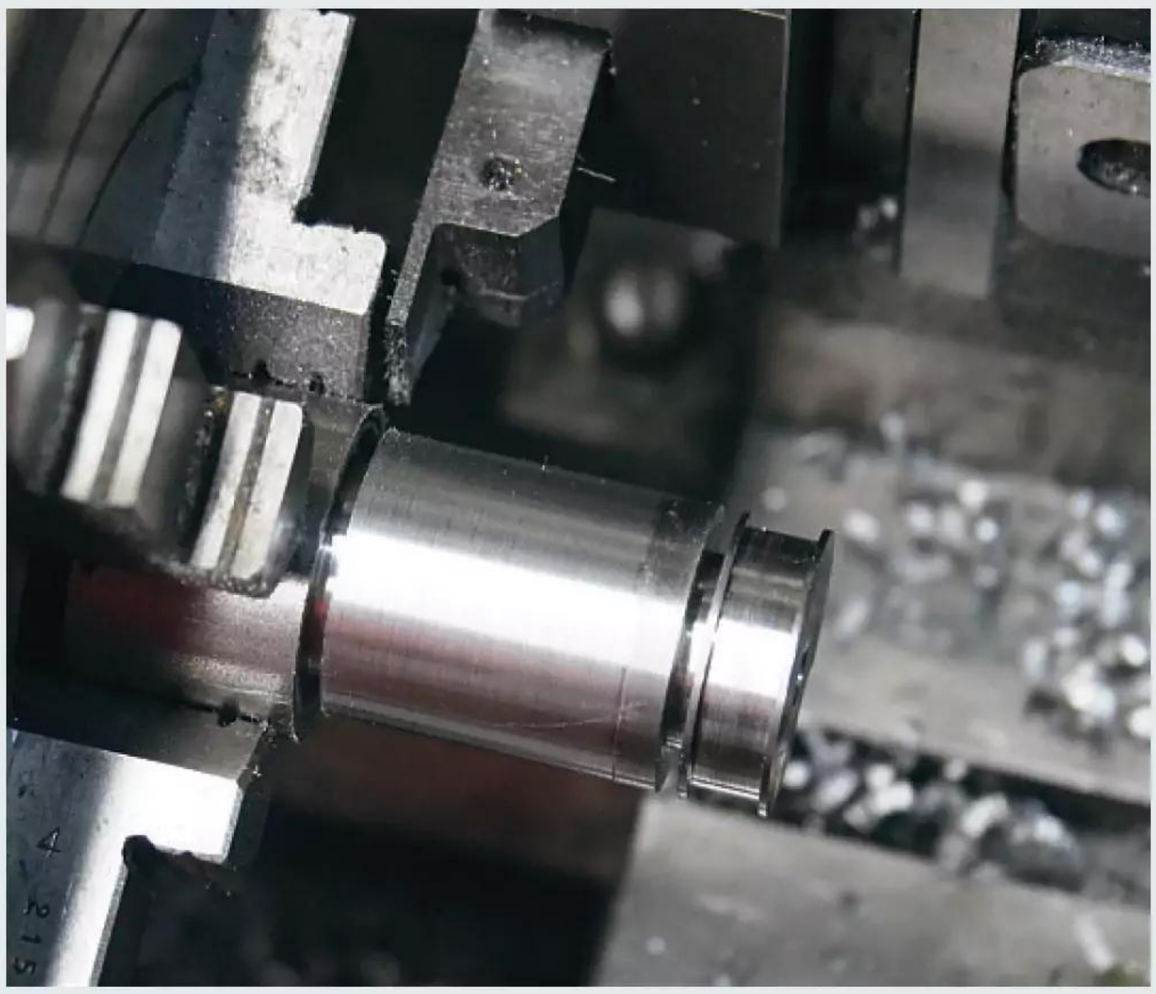


Photo 269: More of the stock has been turned concentric to form a support for the rest of the machining.



Photo 270: The part is now in the dividing head and the first trip die slot is complete.

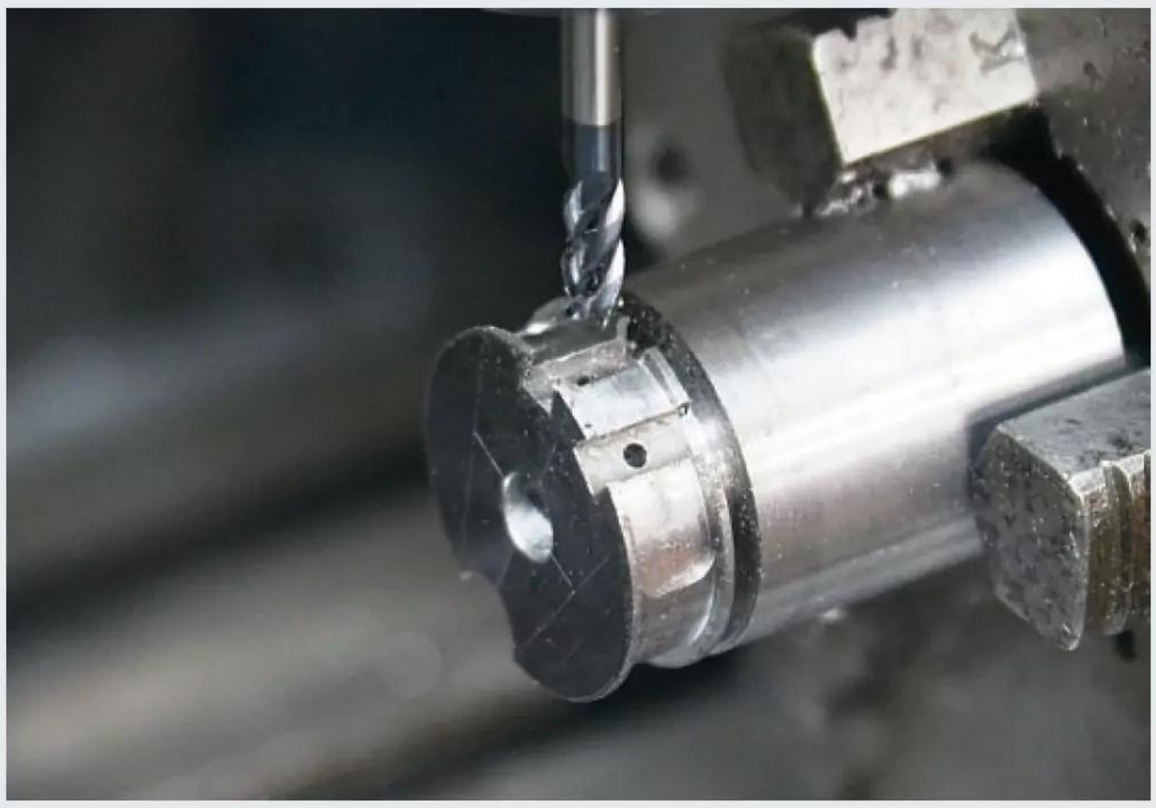


Photo 271: Second trip die slot finished.

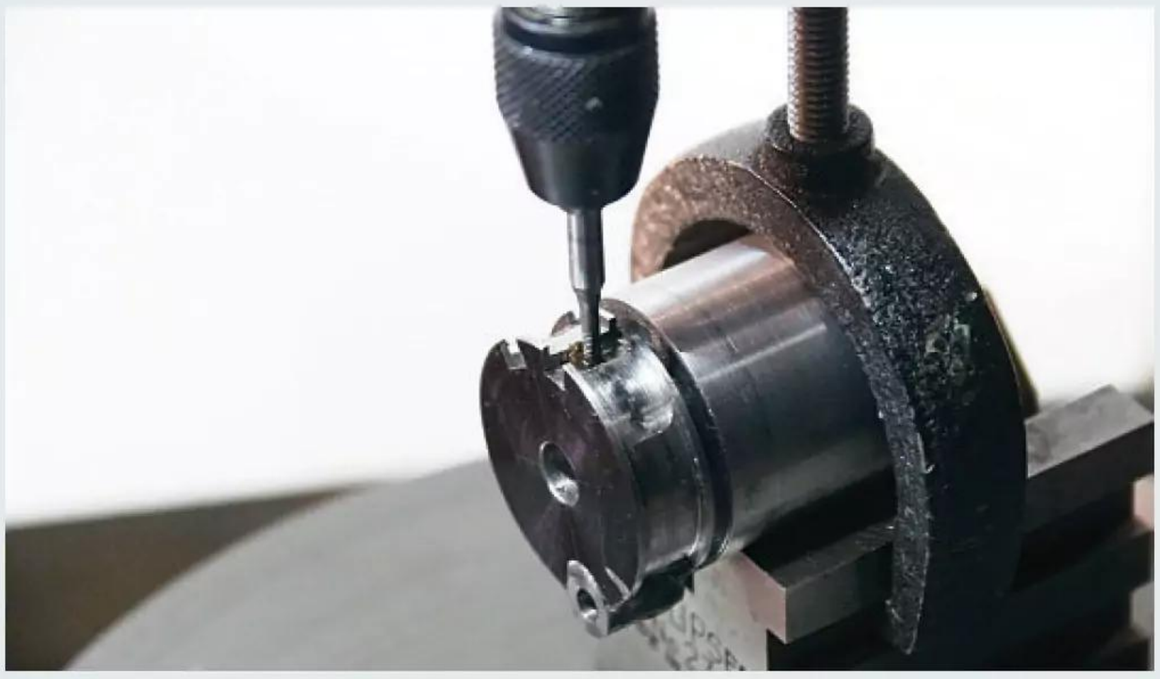


Photo 272: Holding the piece for tapping 10BA is much easier with it on the end of the bar. The bump for the pin hole has been epoxied in place.

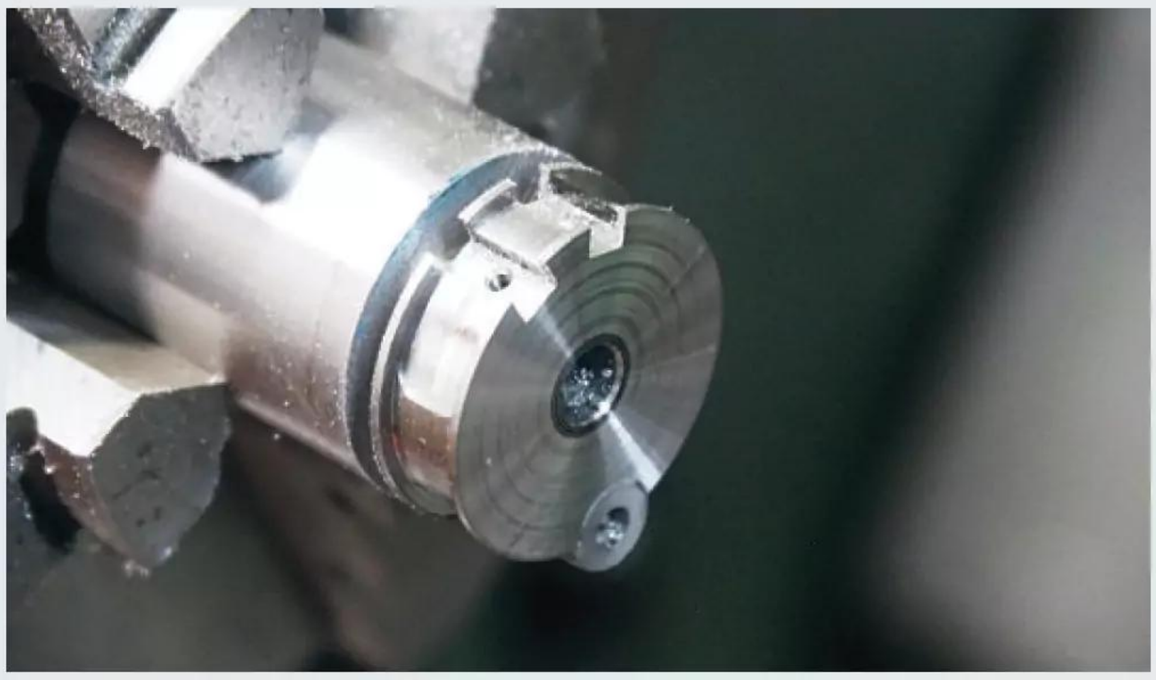


Photo 273: Cleaned up to thickness and ready to be parted off.

turned concentric, **photo 268**, and the bar turned down to form a mandrel to hold the part for milling and drilling the slots for the trip dies, **photos 269, 270** and **271**. The mandrel is useful again for tapping the screw holes, **photo 272** and the hole for the pin has now been attached. This can now be turned back to thickness, **photo 273** and parted off. The sides are easily milled flat, **photo 274** and the finish improved by hand, **photo 275**.

The trip dies need to be hardened and I made these from a scrap of oil hardening steel (gauge plate) that was 1/8 inch thick and so gave me one dimension directly, **photo 276**. To hold these for milling to thickness and length and for drilling, the stock was superglued to a larger piece of steel, **photo 277**. **Photograph 278** shows the steam lever with the dies.

The trip blades need to be from a steel that can be case hardened, so FCMS isn't suitable. Key steel is a useful source of square material that case hardens and is working well on my model. **Photograph 279** shows a blade formed but still attached to the stock; all that is needed

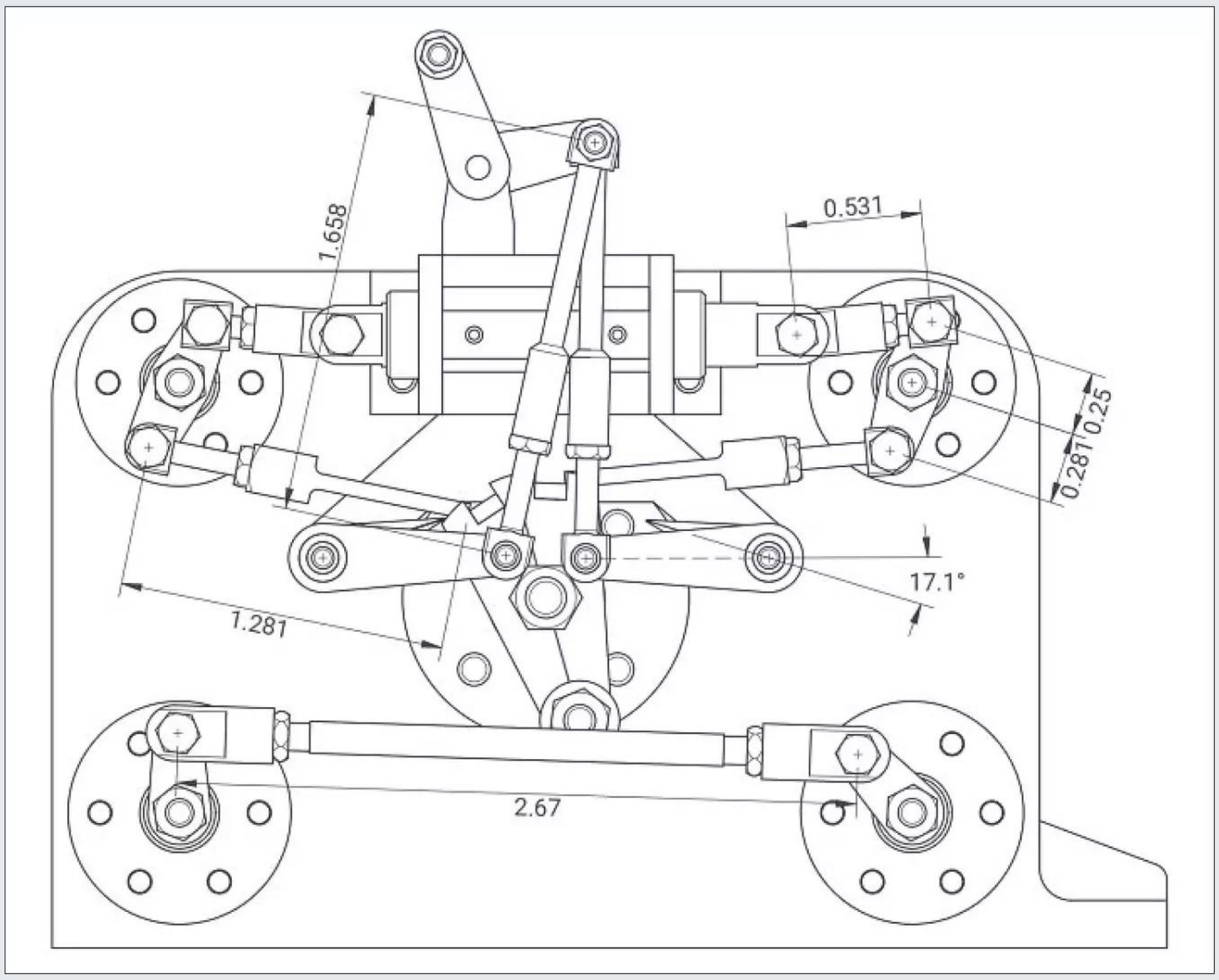
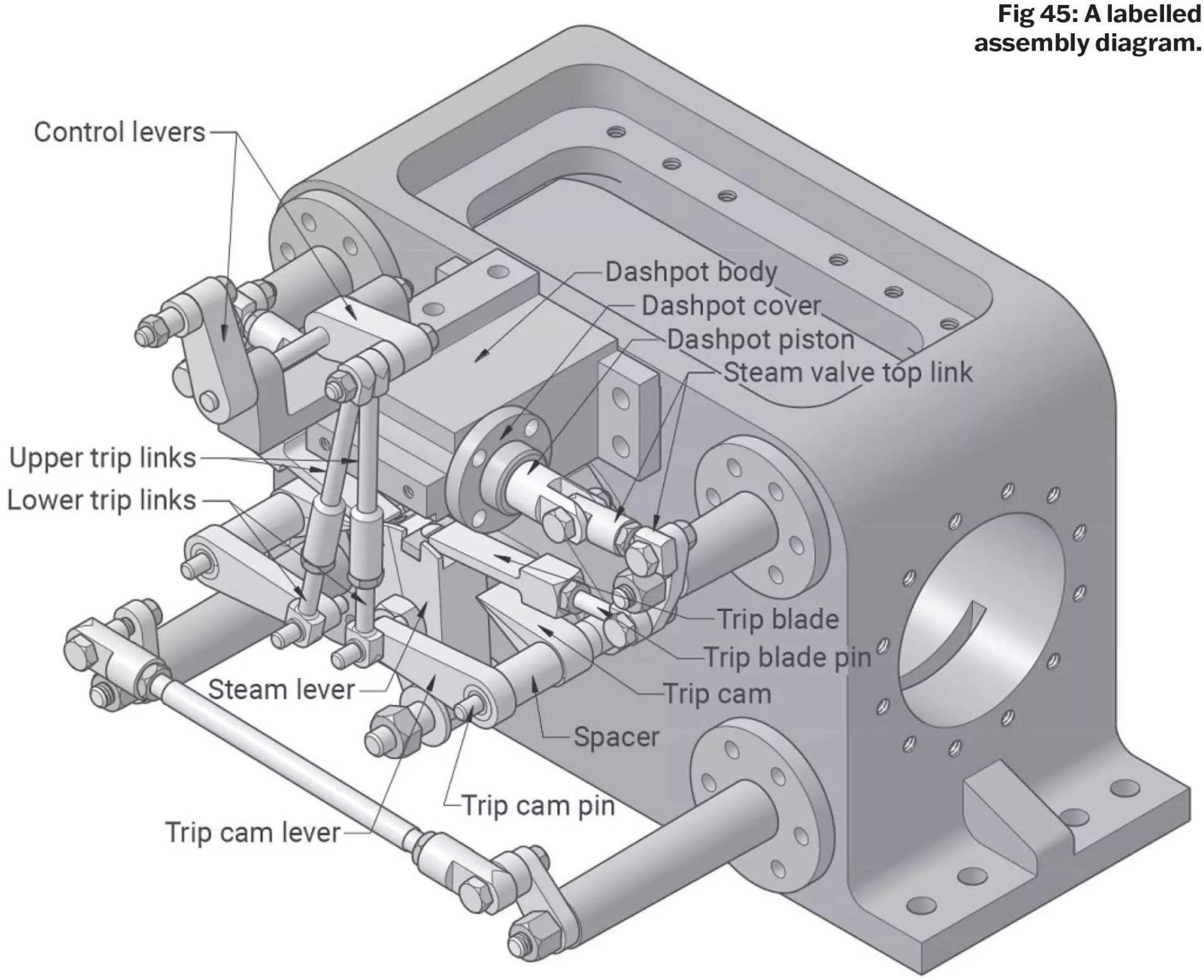


Fig 44: Dimensions for the valve gear links, measurements on the working model are very close to these.

Fig 45: A labelled assembly diagram.



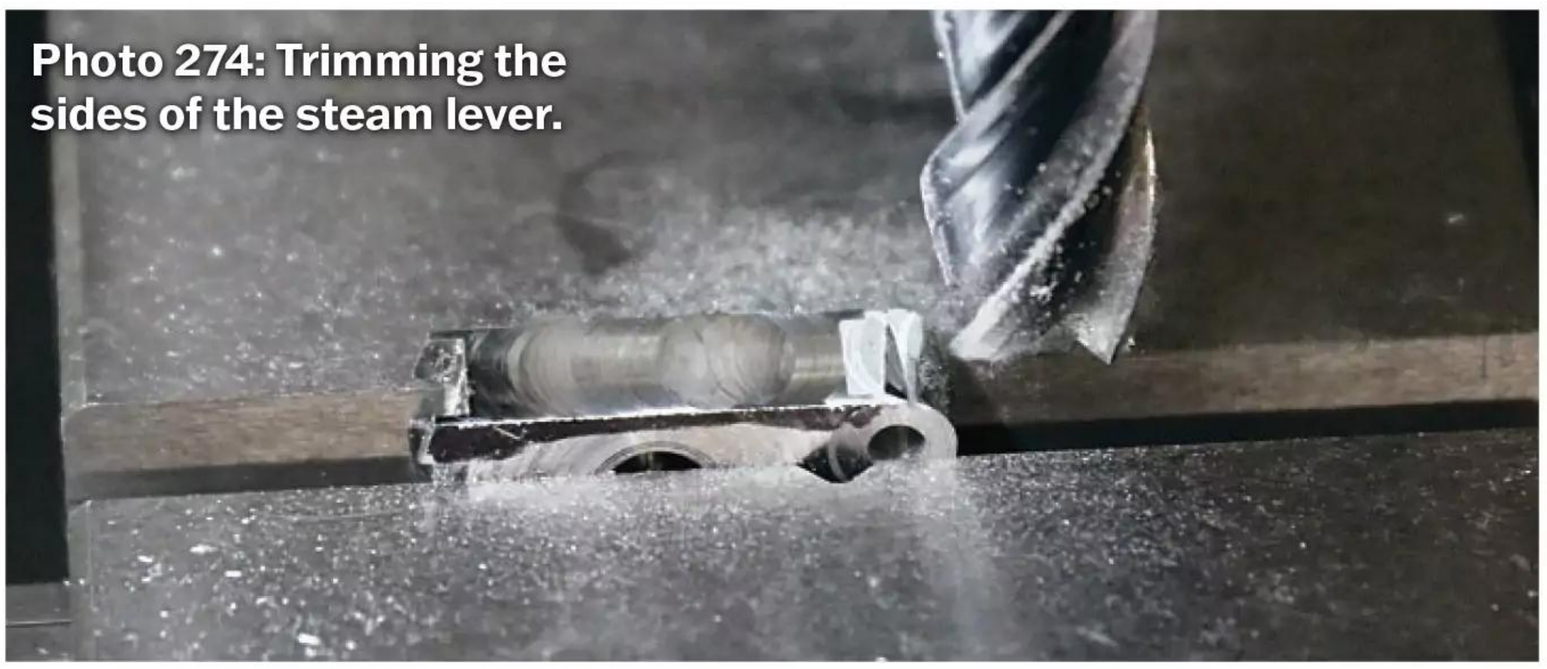

Photo 274: Trimming the sides of the steam lever.


Photo 275: Hand finished, and the steam lever pin is in place.


Photo 276: Slicing off a bit of 1/8" gauge plate as stock for the trip dies.


Photo 277: Gauge plate super-glued to a bit of plate to finish to thickness.


Photo 278: The completed steam lever with trip dies.



Photo 279: The first operation in forming a trip blade from square stock ...

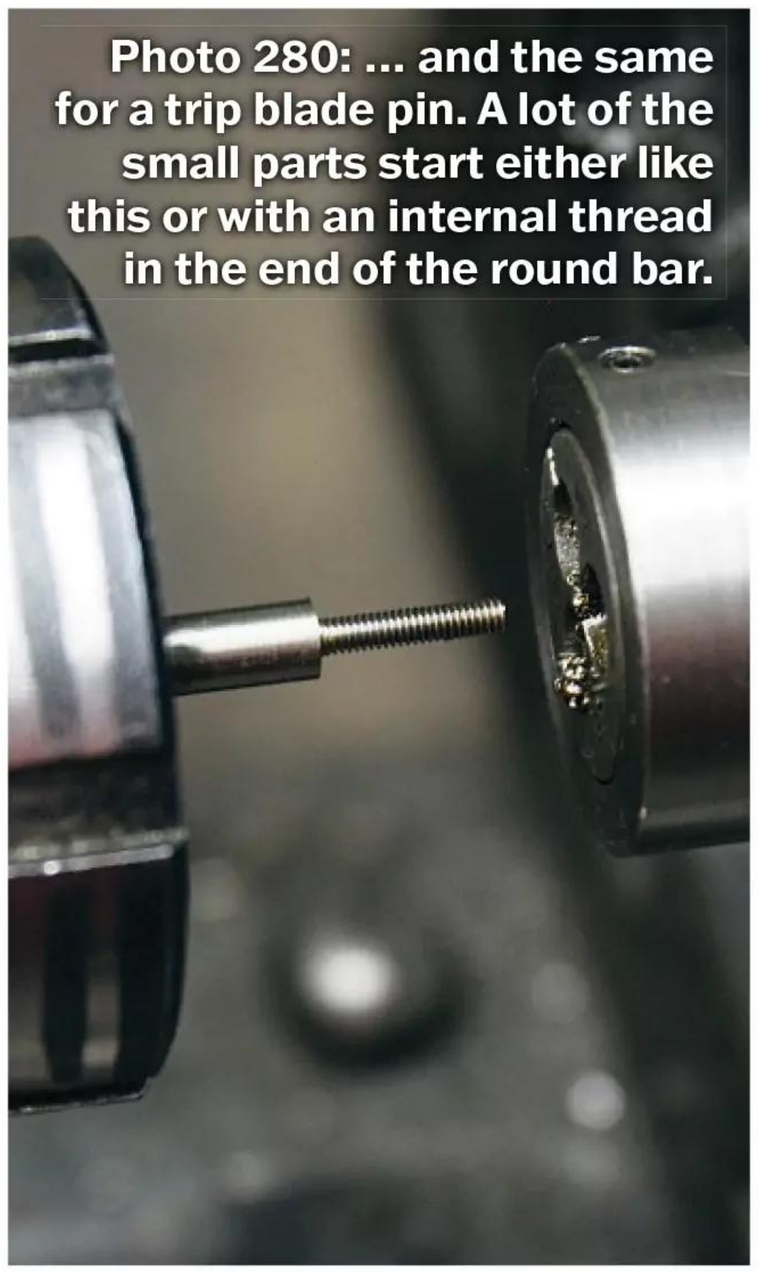


Photo 280: ... and the same for a trip blade pin. A lot of the small parts start either like this or with an internal thread in the end of the round bar.



Photo 281: Parts with an external thread can then go into a threaded mandrel so that flats can be milled on the end.

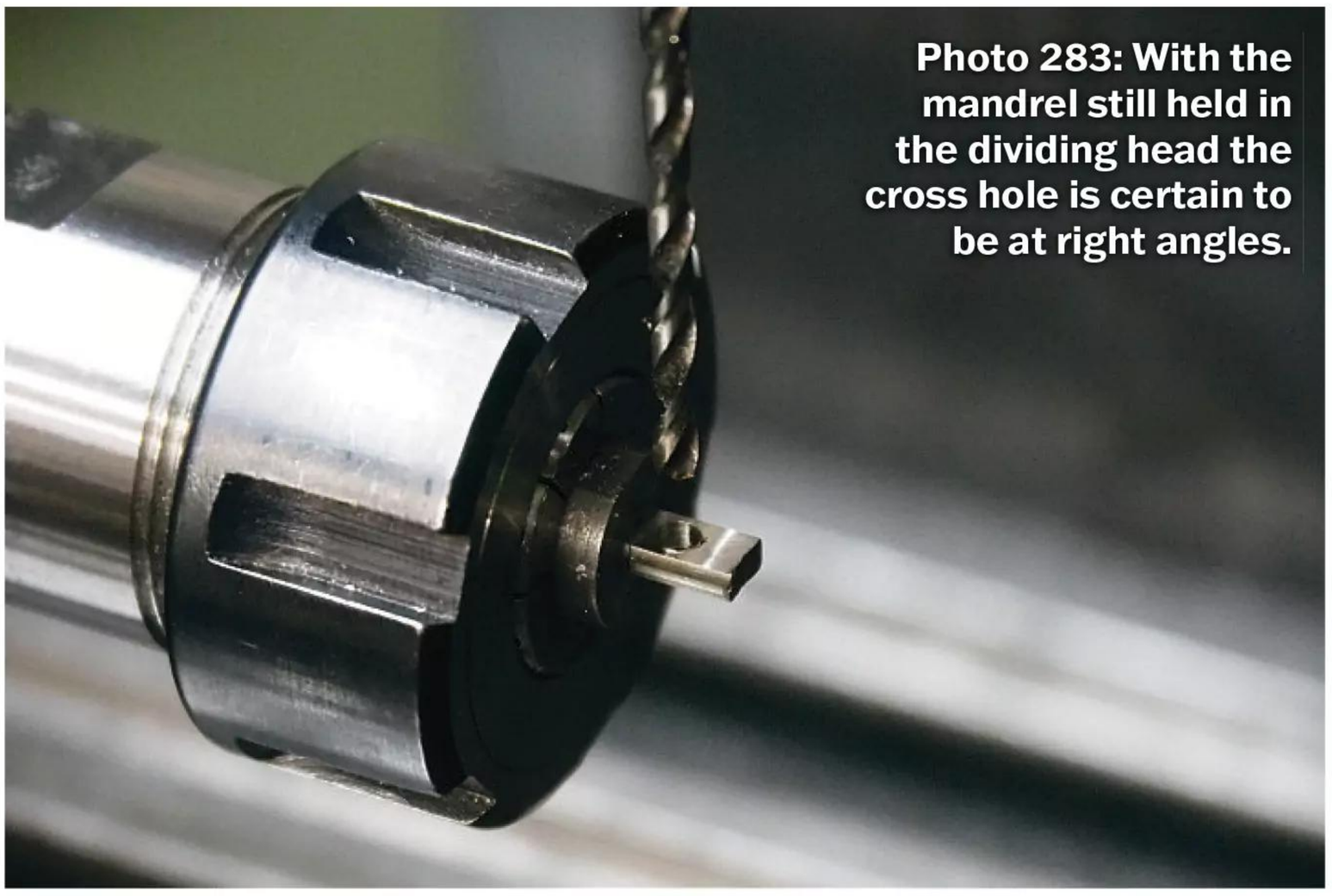


Photo 283: With the mandrel still held in the dividing head the cross hole is certain to be at right angles.



Photo 282: Two flats are needed for the trip blade pins and others but it might be six for a screw head.

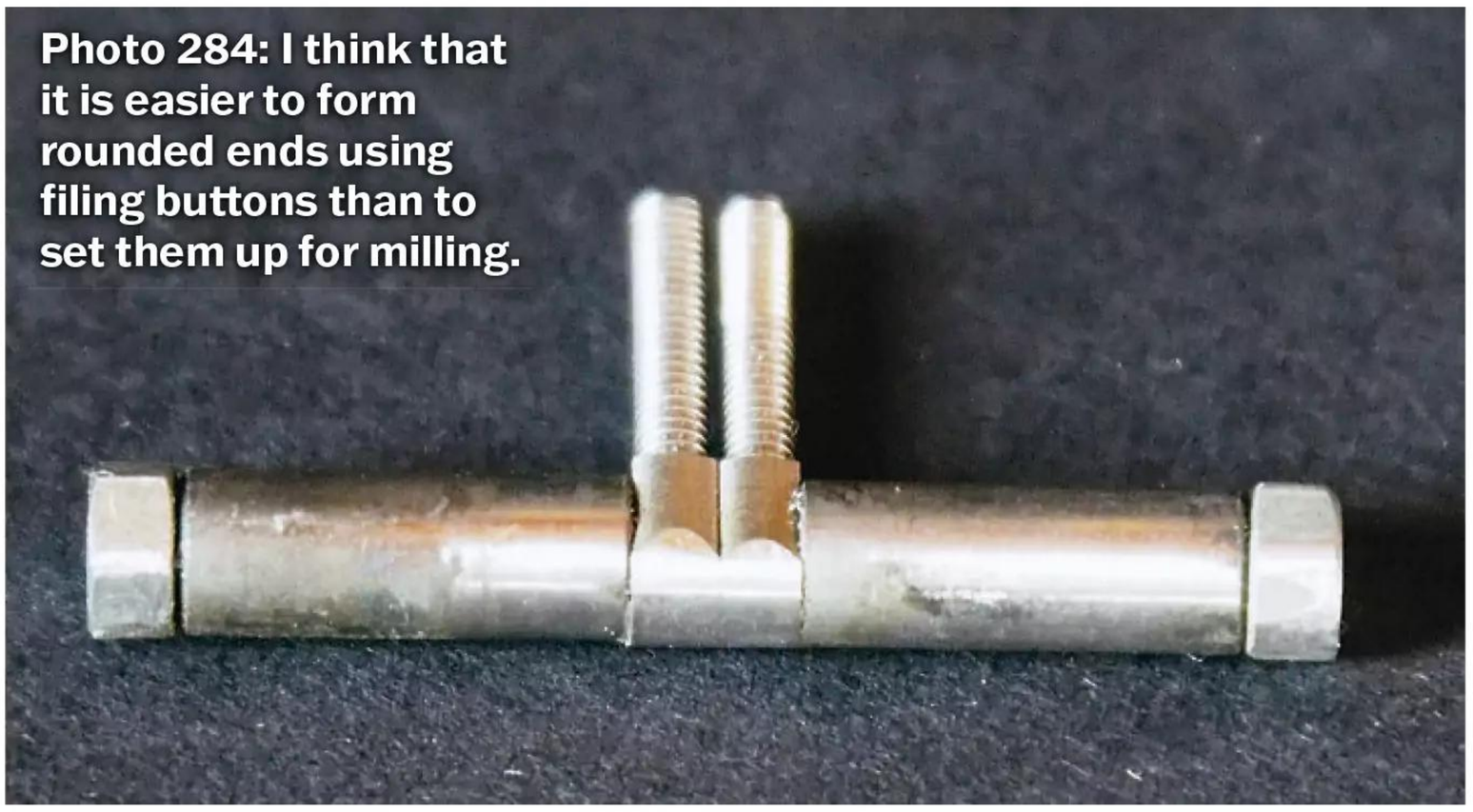


Photo 284: I think that it is easier to form rounded ends using filing buttons than to set them up for milling.

from this stage is to part it off and drill and tap for the pins. These pins are one of the generic parts that need a thread, a hole and a rounded-over end. A tail-stock die holder is essential for the threads, **photo 280**. Parts with an internal thread can be held directly in a collet in the dividing head; those with external threads need a tapped mandrel, **photo 281**, which allows the flats to be formed on the end, **photo 282** and the hole to be drilled, **photo 283**. Using filing buttons is a simple way to round over the ends, **photo 284** and, if left fully hard, these last a long time. The second group of parts that need to be threaded with the die holder and use the mandrel are the stepped screws that go through the links, **photo 285**.

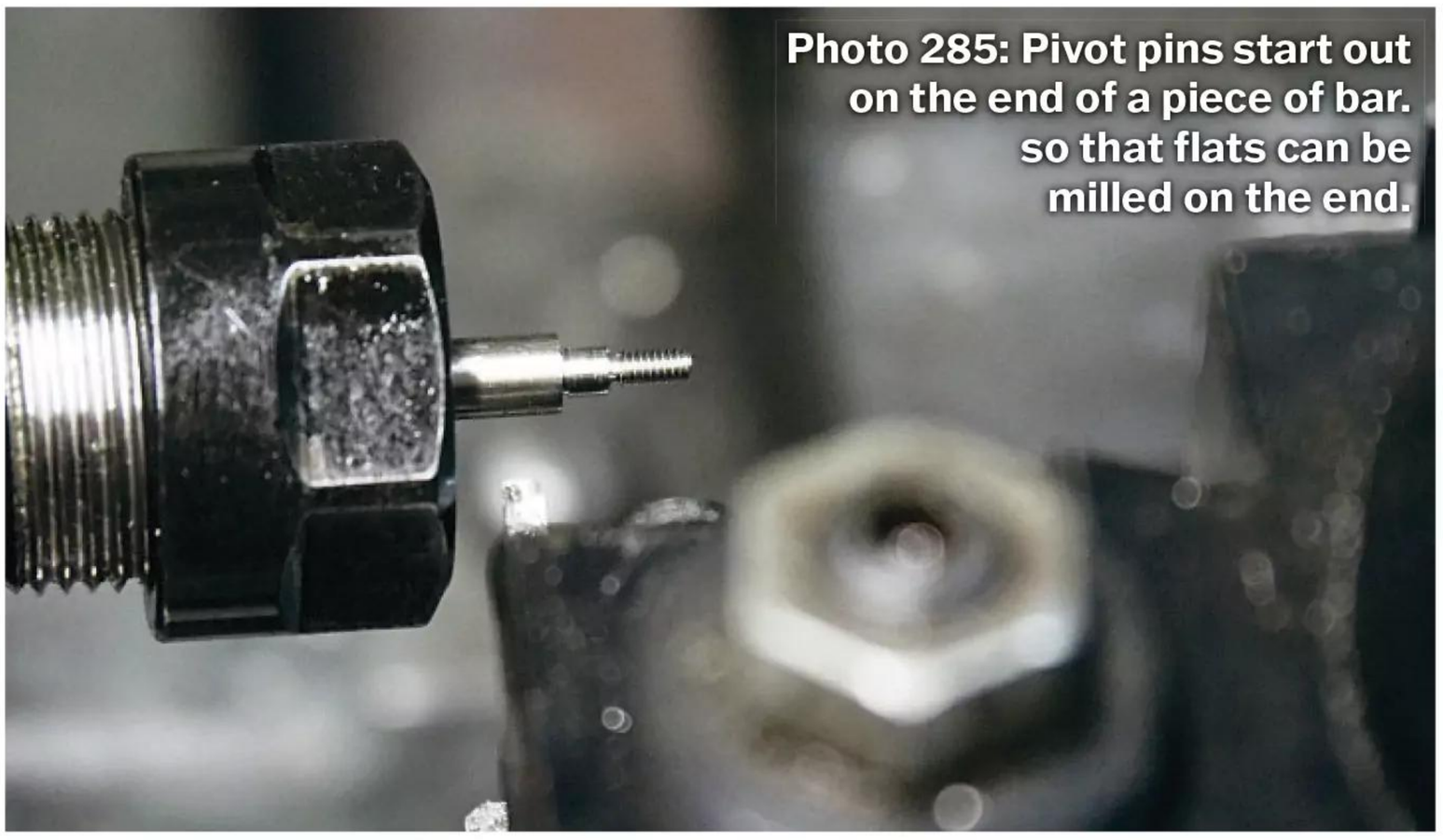


Photo 285: Pivot pins start out on the end of a piece of bar. so that flats can be milled on the end.



Photo 286: The exhaust valve linkage and some of the pins. Nuts are commercial 'one size down AF' BA.

Photograph 286 shows the exhaust valve coupling rod and examples of rod ends and stepped screws. Fine adjustment of the lengths of rods like this is much easier (and continuous) if the thread on one end is left-hand. Obviously this needs taps and dies, and the lock nuts will have to be made in the workshop but it very much simplifies valve setting.

Figure 44 has dimensions for the lengths of the various links in the trip gear taken from the working model. The 17° angle between the trip cam and trip cam lever is significantly less than that shown on the original drawings. This change is to provide room for the eccentric rod that operates the slide valve on the LP cylinder - the clearance is very tight for that - and I've seen pictures on the Internet of models with kinks in the rod to give this clearance. With the set-up shown the kinks aren't necessary but there is very little room for error. **Figure 45** shows the assembled parts with some labels and may help with assembly and adjustment of the valve gear. The original drawings show the design parameters for the valve gear and you should refer to those for more information if required.

References

1: Throp, Arnold; *The Last Years of Mill Engine Building; Stationary Power No: 7,* The Journal of the International Stationary Steam Engine Society. I.S.S.E.S 1993. ISBN 1 972986 07 2

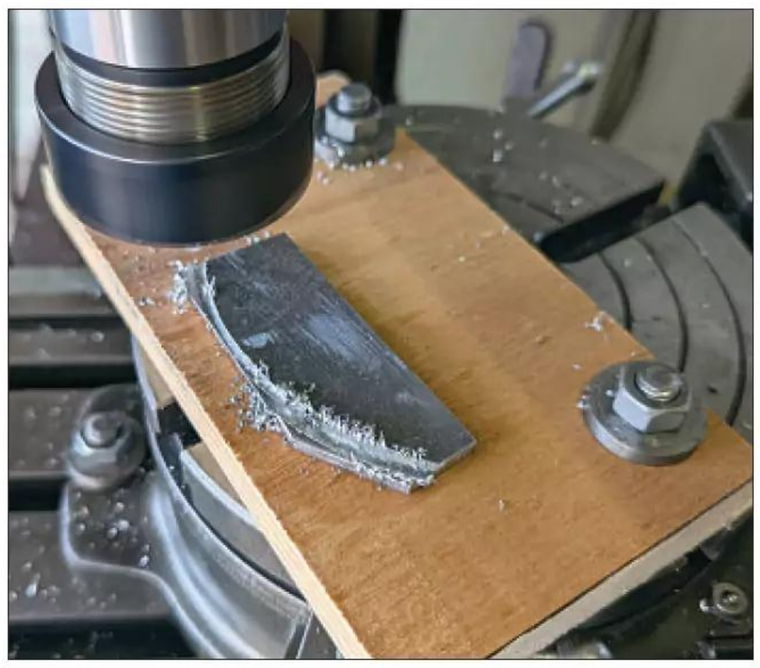
Look out for your next issue of Model Engineer & Workshop

Number 4767 August 2025

On sale July 18 2025



Stuart Gunn makes Stuart Models' Planing Machine.



Alex du Pre demonstrates some innovative approaches for workholding in the mill.



Luker looks at an essential back-yard foundry skill – riser design.

To pre-order your next copy of ME&W visit www.classicmagazines.co.uk or call 01507 529 529

J A Alcock & Son
Courses



Craft Your Own Mechanical Clock Movement

Introduction to Practical Clock Servicing

3 East Workshops, Harley Foundation Studios,
Welbeck, Worksop, S80 3LW
(Workshop visits by appointment only)

For more information including additional courses run by J A Alcock & Son please see our website
Tel: 01909 488 866 Web: www.sortyourclock.co.uk

All courses taught by a Fellow of the British Horological Institute

Find us on
@sortyourclock

THE HARLEY FOUNDATION

STEAMWAYS ENGINEERING LIMITED

LIVE STEAM LOCOMOTIVES
FROM O GAUGE TO 10¼" GAUGE



Steamways Engineering Limited builds working live steam locomotives from Gauge '0' to 10 ¼", Traction Engines up to 4" scale and stationary steam and launch engines – all to a high standard,

We also complete unfinished projects, finish paint and hand-line them.

The renovation and repair of steam models is sympathetically undertaken.

To assist you complete your own projects, we manufacture individual parts to order including supplying a range of fully certificated and EC PV Regulations compliant silver-soldered copper boilers up to and including 5 inch gauge.

Visit our Website
www.steamwaysengineering.co.uk
email us on info@steamwaysengineering.co.uk
or telephone us on 01507 206040 with your requirements for a no-obligation quote or discussion.

Steamways Engineering Limited
Dovecote House, Main Road, Maltby le Marsh, Alford, Lincs. LN13 0JP
Call: 01507 206040

MAXITRAK.COM / ACCUCRAFT UK

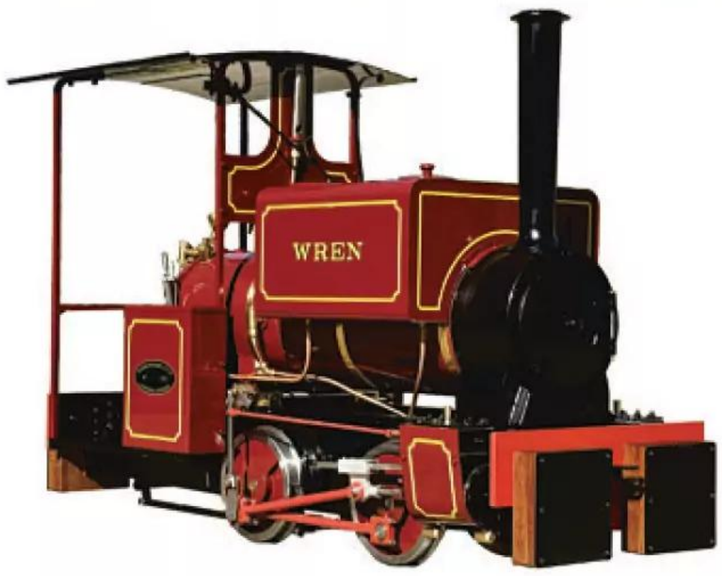
ACCUCRAFT UK

The best of model rail and road.



Live Steam

Accucraft UK 16mm & Gauge 1 Locomotives in stock!



New Maxitrak Wren 5" Gauge, Coal Fired Live Steam! Kit or Ready to Run



5" & 7 1/4" Battery Electric Locomotives





3/4" DG6 Sentinel Lorry

Tel: 01580 893030 Email: info@maxitrak.com



MAIDSTONE-ENGINEERING.COM
One stop model engineering shop
For Maxitrak & Accucraft Models.
Leading suppliers of fittings, fixings, brass, copper, bronze & steel
Tel: 01580 893030 Email: info@maidstone-engineering.com
Visit us: 10-11 Larkstore Park, Lodge Road, Staplehurst, Kent, TN12 0QY

MAIDSTONE ENGINEERING SUPPLIES





In this instalment **Jacques Maurel** offers notes on machining the cut knurling parts, then moves on to internal knurling.

PART 2

A Multipurpose Knurling Tool

Photo 11: Using a digital angle gauge to set holder angle.

Cutting knurl holder 24: Start with the 'cube' and 'tongue' that fit **14**, then drill and counterbore for the fixing screw **15**. Set the part in the machine vice at 30 degrees, see **photo 11**, and machine the slant surface and the tapped hole, made using a 'with plate pin', see **photo 12** (described in *Model Engineer* 4588). Mark, **photo 13**, and machine the 'polygon' to clear the 80mm diameter; finish with the chamfers.

When machining the angled surface, shown in **photo 12**, 1mm vertical feed leads to 2mm length reduction for the length, L = 45.

Cutting knurl bearing 26 and washer 28: Made of silver steel, must be hardened and tempered in the usual way.

Cutting knurls 27: I used ones from the Zeus range; bore 8mm, external diameter 15mm, width 4mm, helix angle 15 degrees, one right hand and one left hand.

Third function: The machinist's Grail - the much desired 'thicknessing file'!

Of course I'm half joking; the idea (known and used by many machinists) is to crush knurl an undersized cylinder to slightly increase its diameter - usually by about half the knurl pitch - and then machine the knurled part to the right size.

A near relative, but improved, process is marketed by Cogsdill; the KB Knurling-Burnishing 'scrap saver' process. The surface is first crush knurled, but then the knurls are flattened (burnished) by plain cylinders in place of machining to get the largest contact surface as no material is lost.

The Cogsdill attachment for reducing internal diameters.

From the catalogue information, this is made to work in a bore, **fig. 3** (see previous installment in issue 4745) which shows the principle of the knurling tool using two knurls set on an expanding spring collet. The diameter adjustment is made with a grub screw,

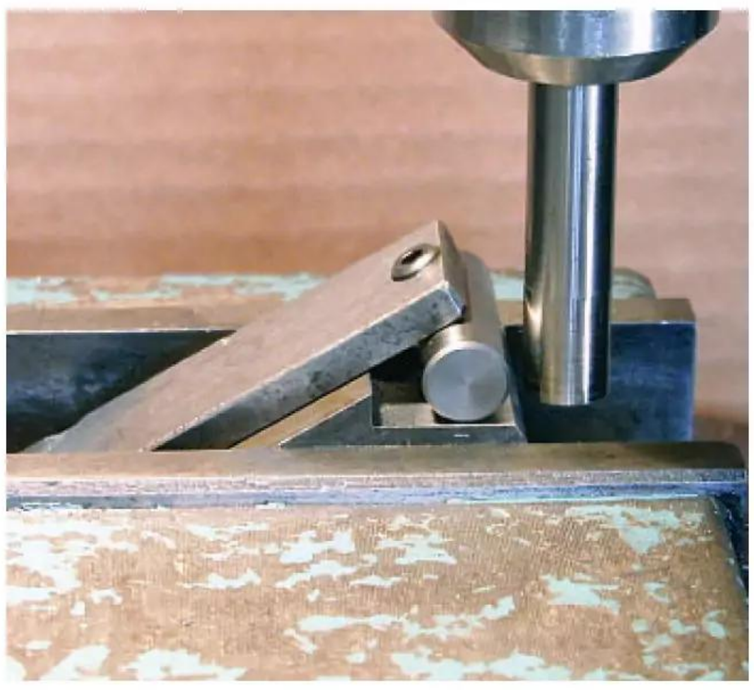
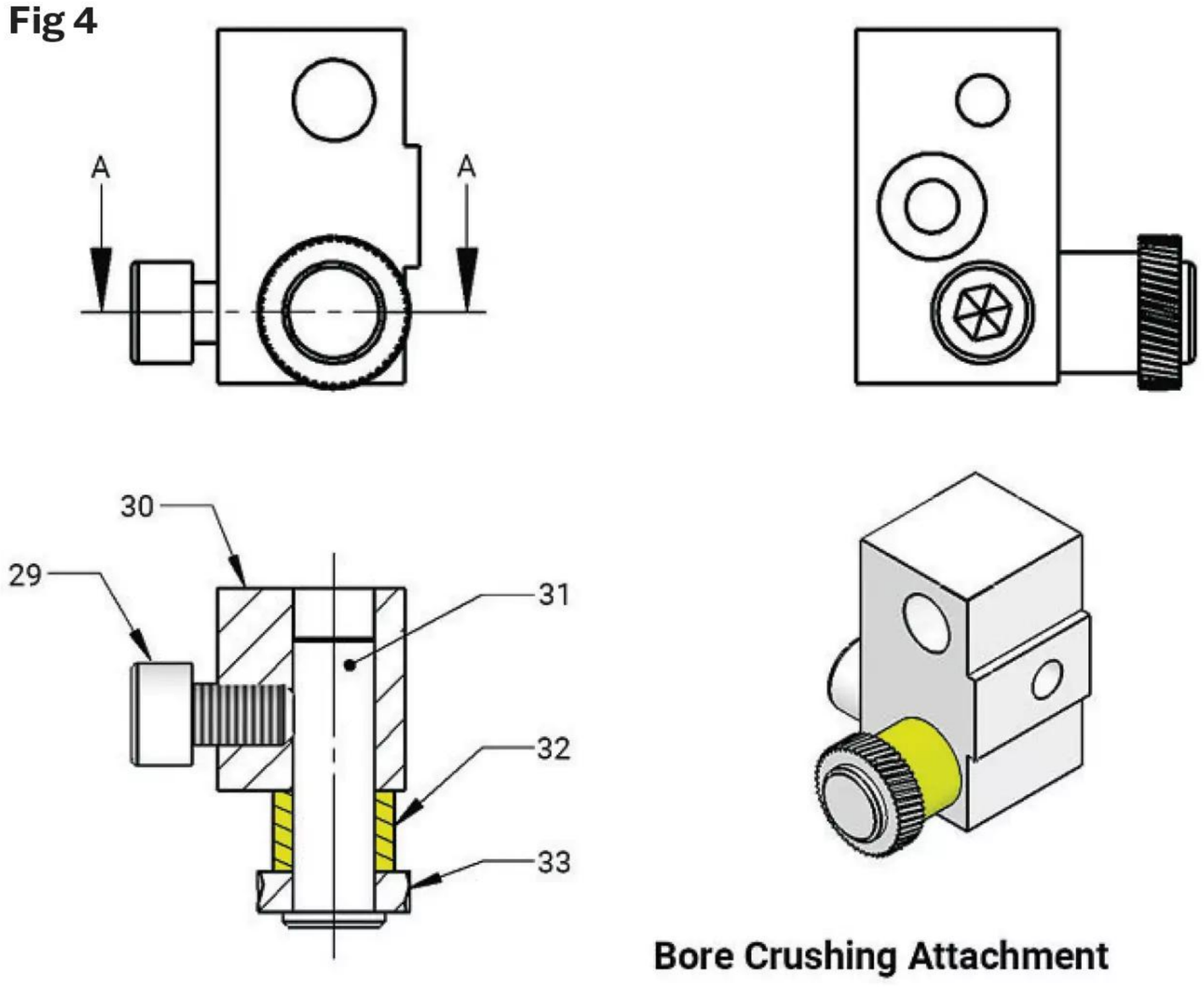
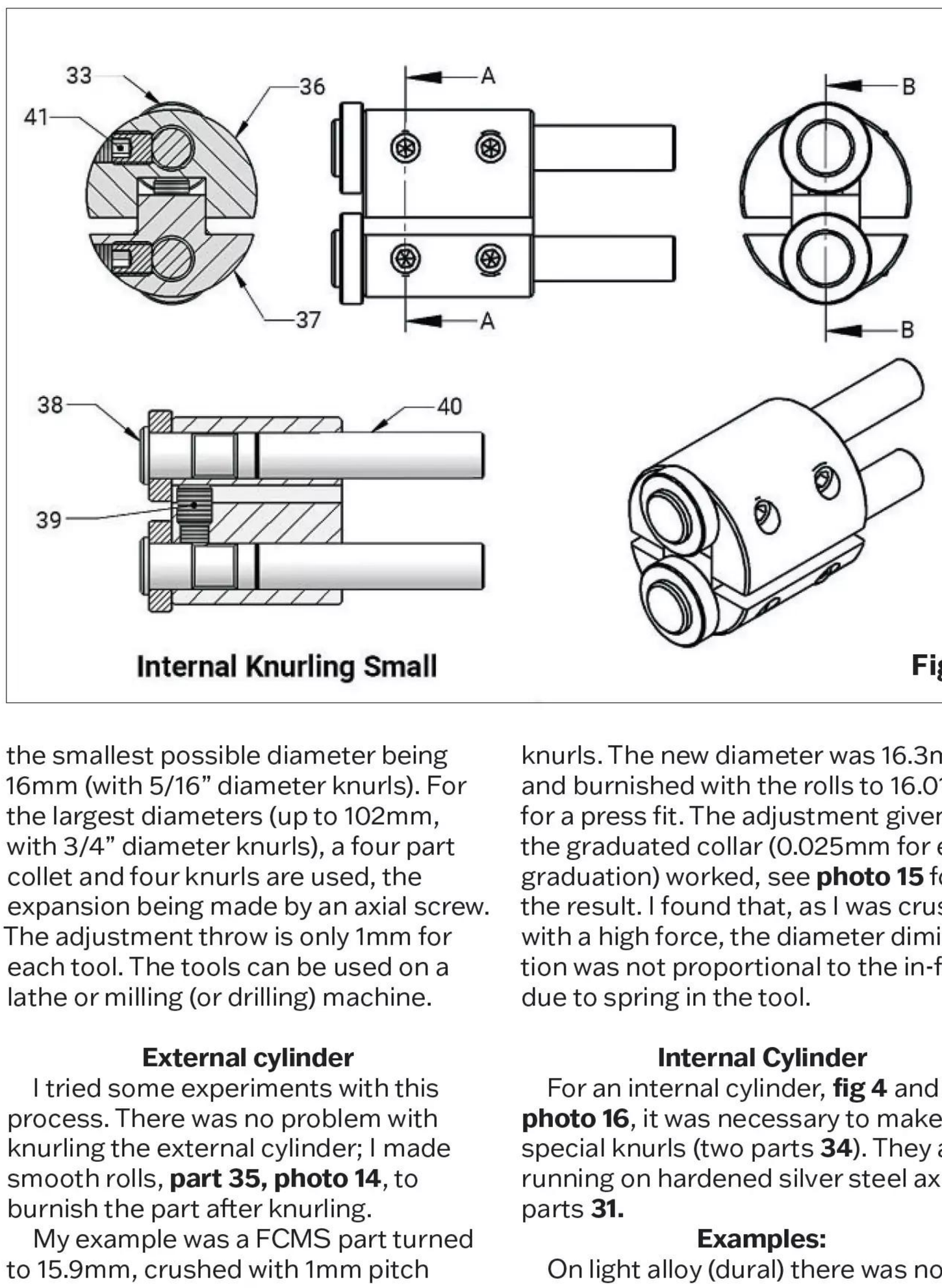


Photo 12: Using the plate pin described in ME 4588 for work setting.

Fig 4

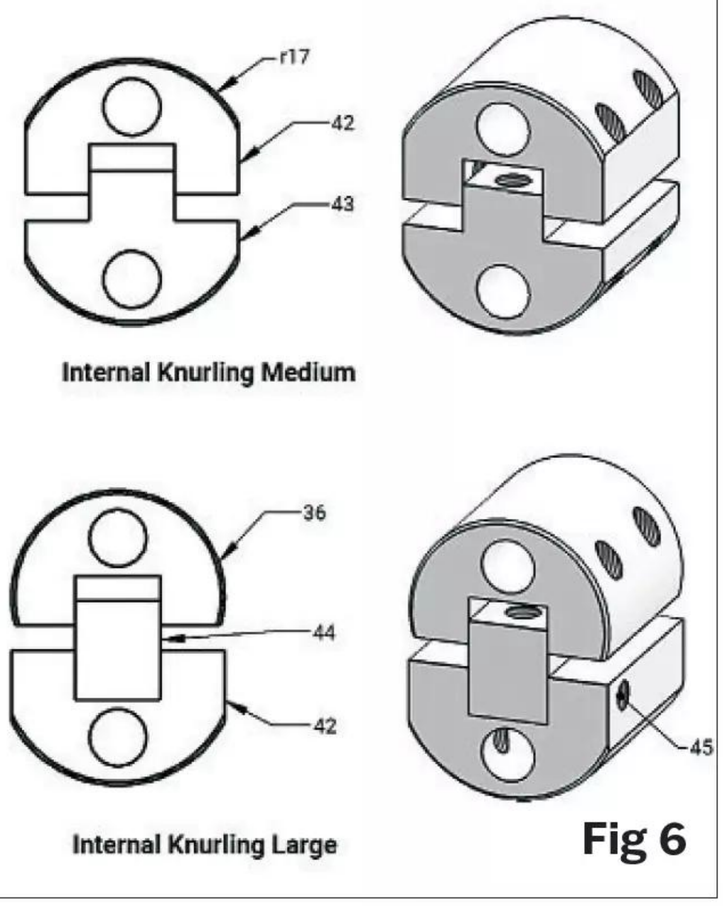


Bore Crushing Attachment



Internal Knurling Small

Fig 5



Internal Knurling Medium

Internal Knurling Large

Fig 6

the smallest possible diameter being 16mm (with 5/16" diameter knurls). For the largest diameters (up to 102mm, with 3/4" diameter knurls), a four part collet and four knurls are used, the expansion being made by an axial screw. The adjustment throw is only 1mm for each tool. The tools can be used on a lathe or milling (or drilling) machine.

External cylinder

I tried some experiments with this process. There was no problem with knurling the external cylinder; I made smooth rolls, **part 35, photo 14**, to burnish the part after knurling.

My example was a FCMS part turned to 15.9mm, crushed with 1mm pitch knurls. The new diameter was 16.3mm, and burnished with the rolls to 16.01mm for a press fit. The adjustment given by the graduated collar (0.025mm for each graduation) worked, see **photo 15** for the result. I found that, as I was crushing with a high force, the diameter diminution was not proportional to the in-feed, due to spring in the tool.

Internal Cylinder

For an internal cylinder, **fig 4** and **photo 16**, it was necessary to make special knurls (two parts **34**). They are running on hardened silver steel axles, parts **31.**

Examples:

On light alloy (dural) there was no problem for crush knurling but the tool was springy due to the poor position of the knurls relative to the guiding system, **photo 17**, and for roll burnishing, see **photo 18**. The burnishing is difficult to control for diameter due to a soft material and springiness, so the finishing was made by turning the last tenth of mm, with the result in **photo 19**.

Steel, thick tubing - 0.2% carbon, 1% manganese - was very hard to knurl, as the tool was too flexible, and it was also hard to burnish. The knurls should really be held with no overhang as for the Cogsdill attachment.

Improved internal knurling attachment

See **fig. 5** and **photo 20**. The idea is to use the already existing attachment to knurl inside a bore with no spring, even over a long distance, with a 5mm adjustment given by the screw **39**.

The knurling diameter is adjusted to 0.5mm more than the existing diameter (i.e. by half the knurl's pitch). A chamfer is made to start by centring the knurls in the bore. The knurl is made by axial feed (0.2mm/turn) with good lubrication, the result can be seen in **photo 21** on steel. It is also very good with light alloy, the decrease in diameter is about 0.4mm. Roll burnishing is possible but not to an accurate dimension, so finish sizing must be made by cutting. The minimum diameter of the outside knurls is 32.5mm (so you can knurl inside a 32mm diameter hole) and the maximum diameter is 37.5mm.

Three other parts are necessary to go beyond the 5mm adjustment for any larger diameter, see **fig. 6** and **photo 22**.

Using parts **42** and **43**, it's possible to adjust the outside diameter from 36.5 to 41.5mm, and using parts **36**, **42** and **44** to go from 40.5 to any larger diameter, by machining the spacer **44** to the desired length.

Parts List for Crush Knurling:

Ref.	No.	Name	Material	Remarks
29	2	Screw CHc M6-10	8-8	
30	2	Bore crushing arm	FCMS	
31	2	Bore knurl axle	Silver Steel	Hardened & tempered
32	2	Spacer	Bronze	
33	2	Bore crushing knurl	Silver Steel	See text
34	2	Bore burnishing roll	Silver Steel	Hardened & tempered
35	2	External burnishing roll	Silver Steel	Hardened & tempered
36	1	Internal knurl holder small high	FCMS	
37	1	Internal knurl holder small low	FCMS	
38	2	Internal knurl axle	Silver steel	Hardened & tempered
39	1	Screw Hc M6-7	8-8 min	
40	2	Holding rod	CRS	8mm diameter
41	4	Screw Hc M6-7	8-8 min	
42	1	Internal knurl holder medium high	FCMS	
43	1	Internal knurl holder medium low	FCMS	
44	1	Diameter adjusting spacer	CRS	12mm square
45	1	Screw Hc M5-8	8-8 min	
46	1	Bore crushing arm small	FCMS	

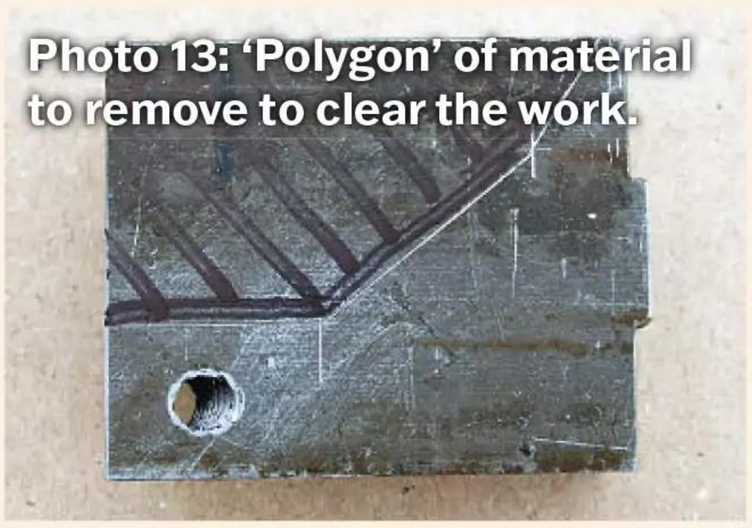


Photo 13: 'Polygon' of material to remove to clear the work.



Photo 14: Plain burnishing rolls.



Photo 15: External cylinder test piece.

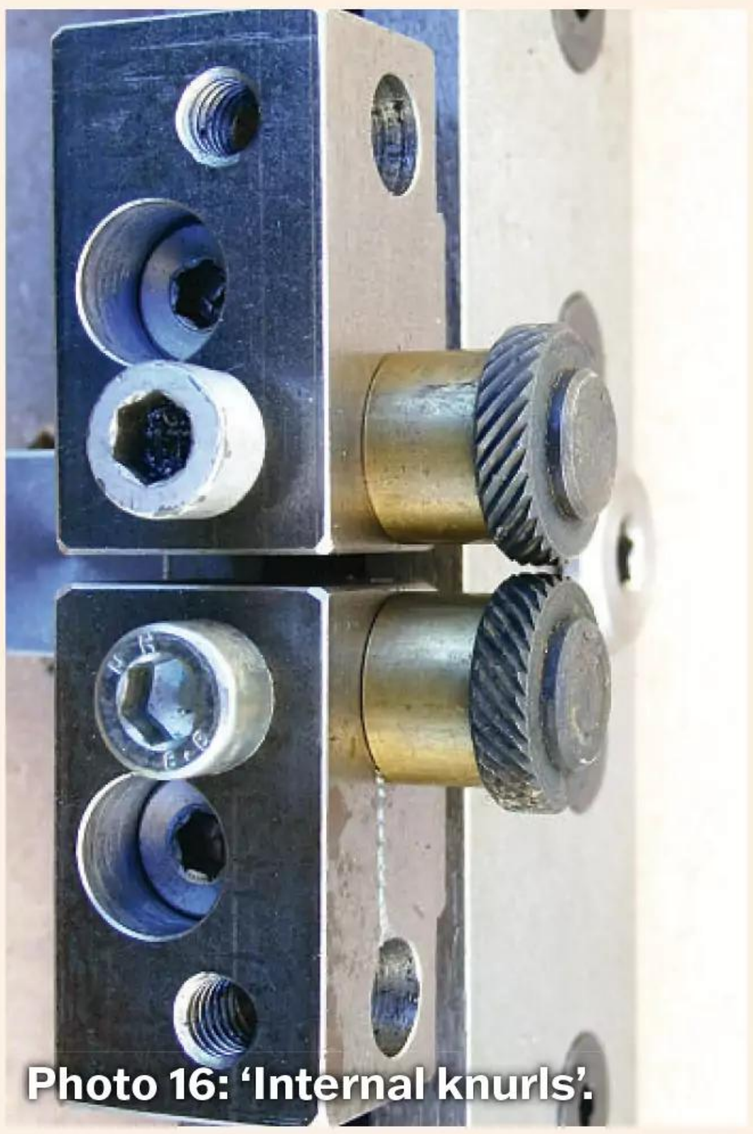


Photo 16: 'Internal knurls'.



Photo 17: Internal knurl.



Photo 19: Following a final finishing cut.

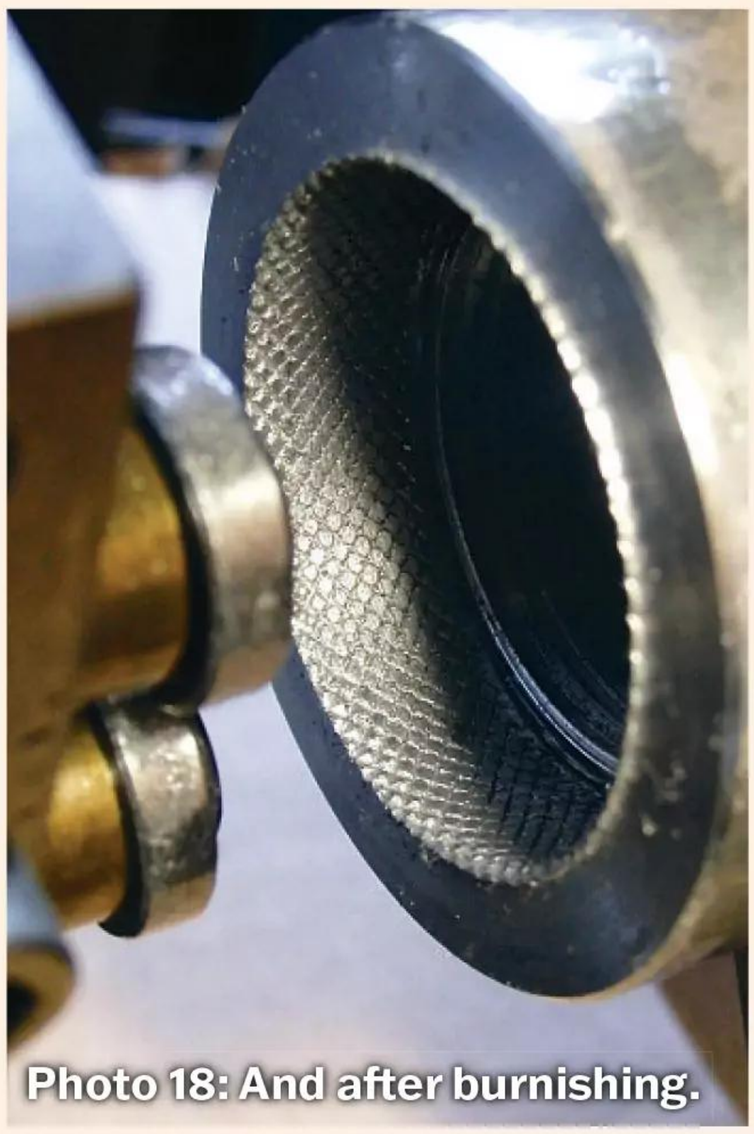
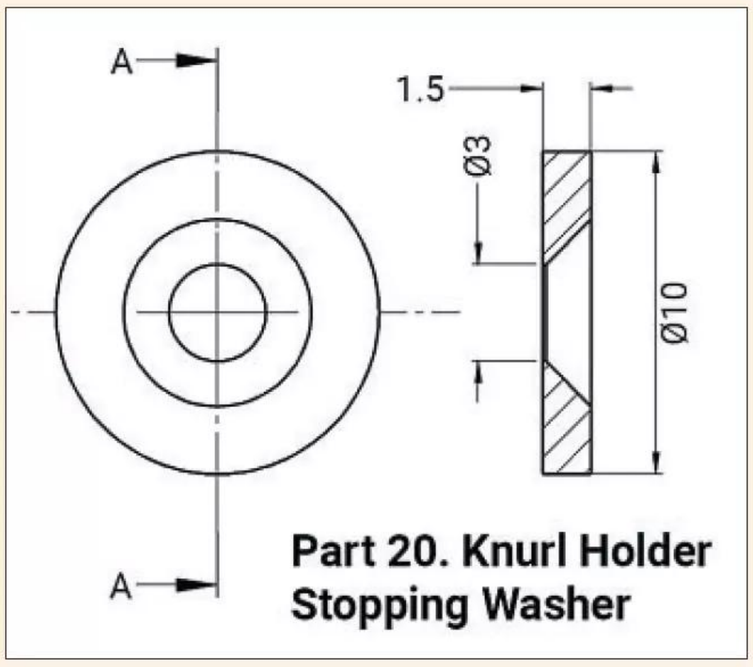
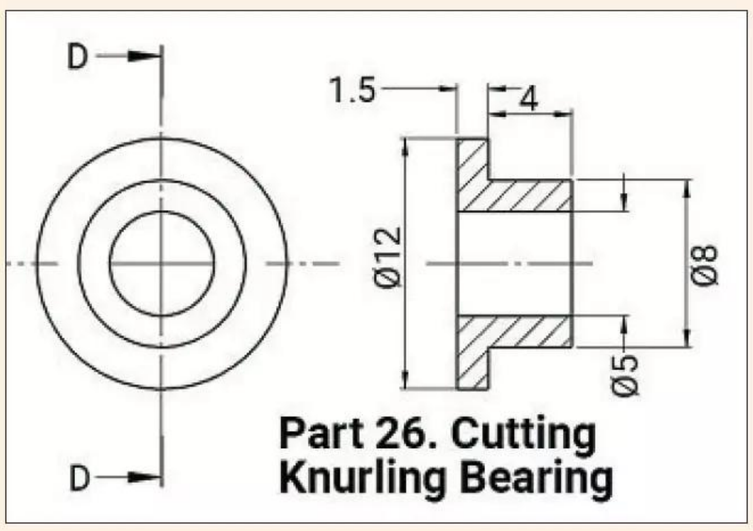


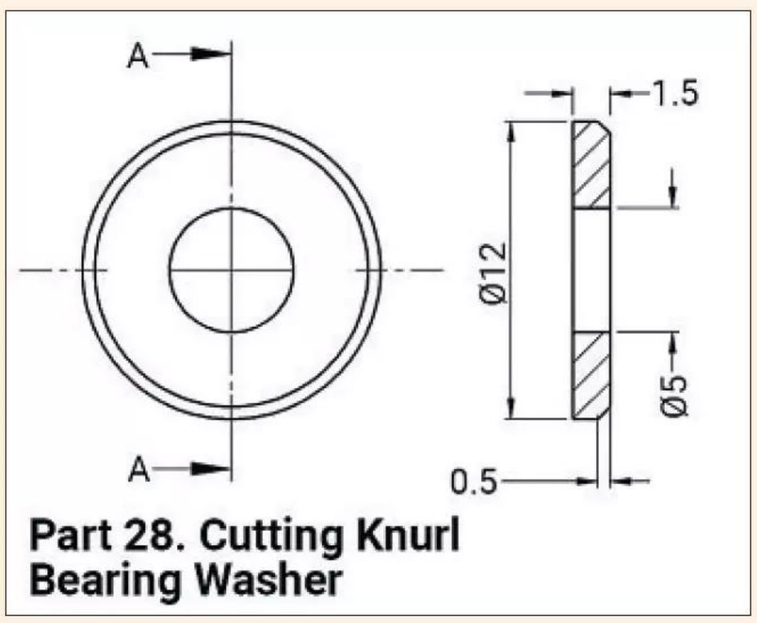
Photo 18: And after burnishing.



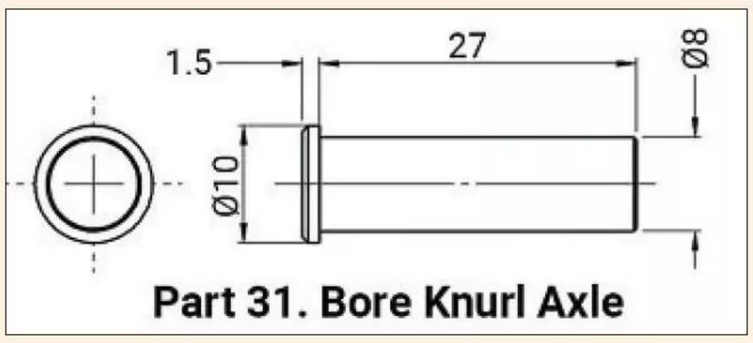
Part 20. Knurl Holder Stopping Washer



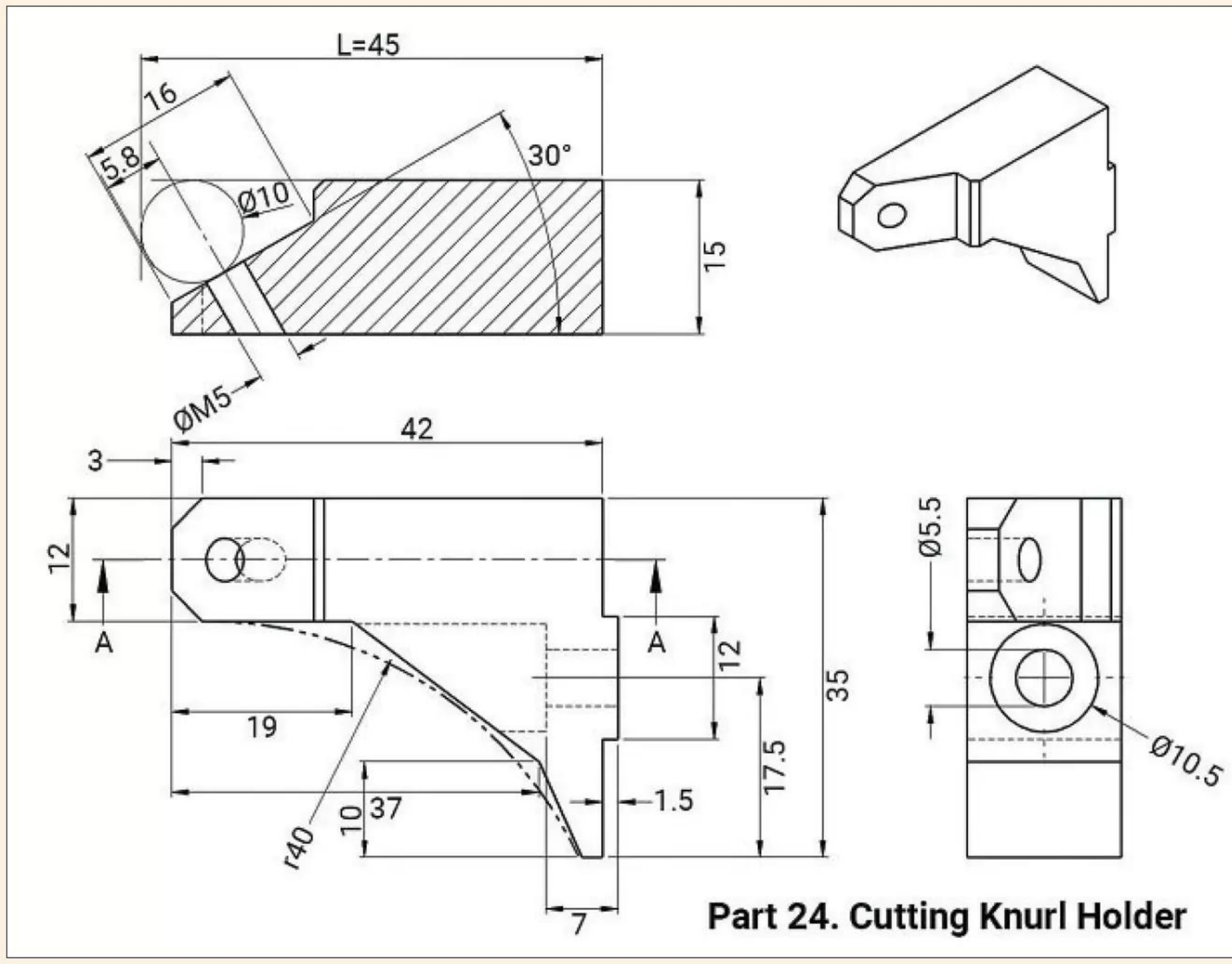
Part 26. Cutting Knurling Bearing



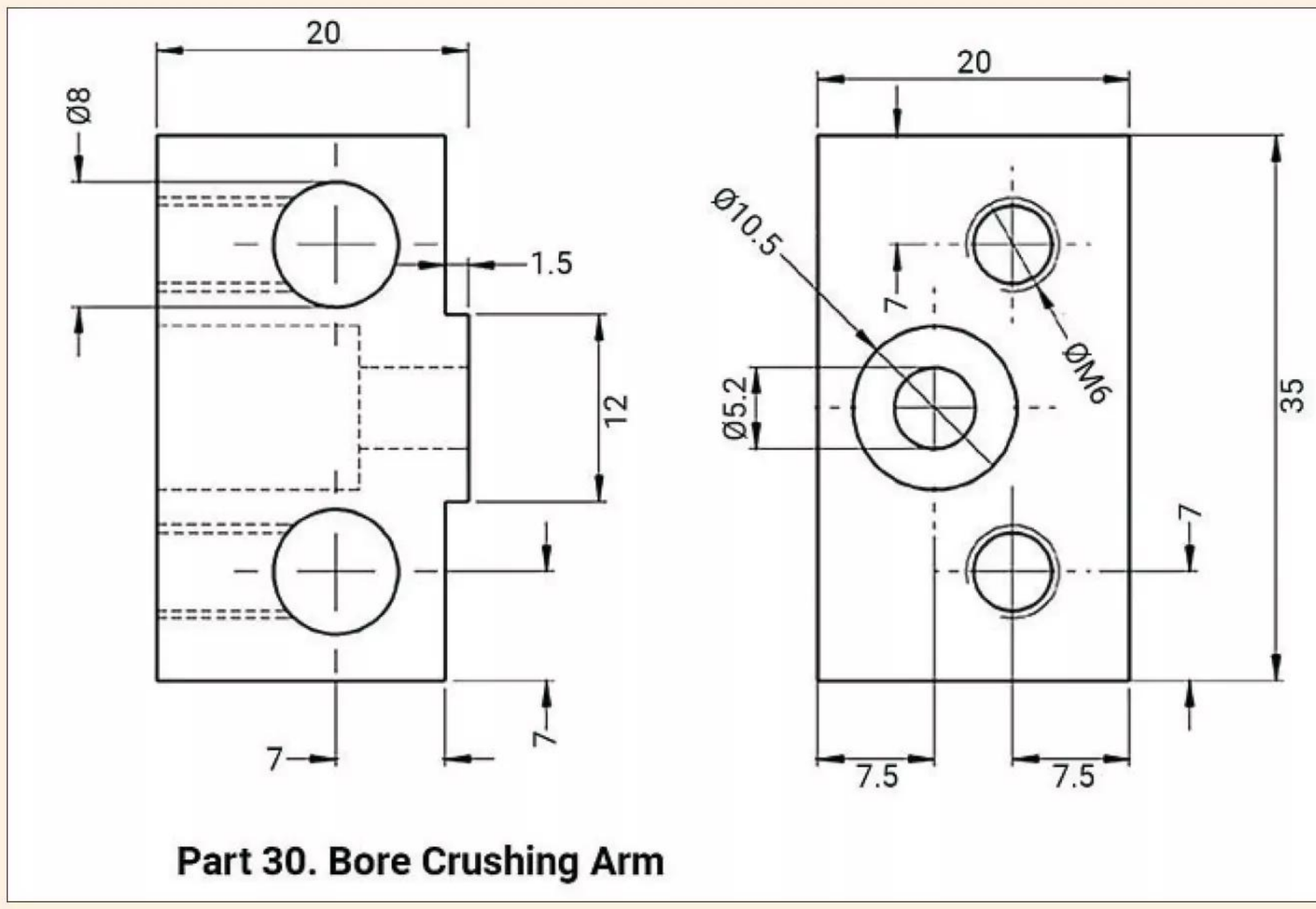
Part 28. Cutting Knurl Bearing Washer



Part 31. Bore Knurl Axle



Part 24. Cutting Knurl Holder



Part 30. Bore Crushing Arm



Photo 20: Improved internal knurling attachment.

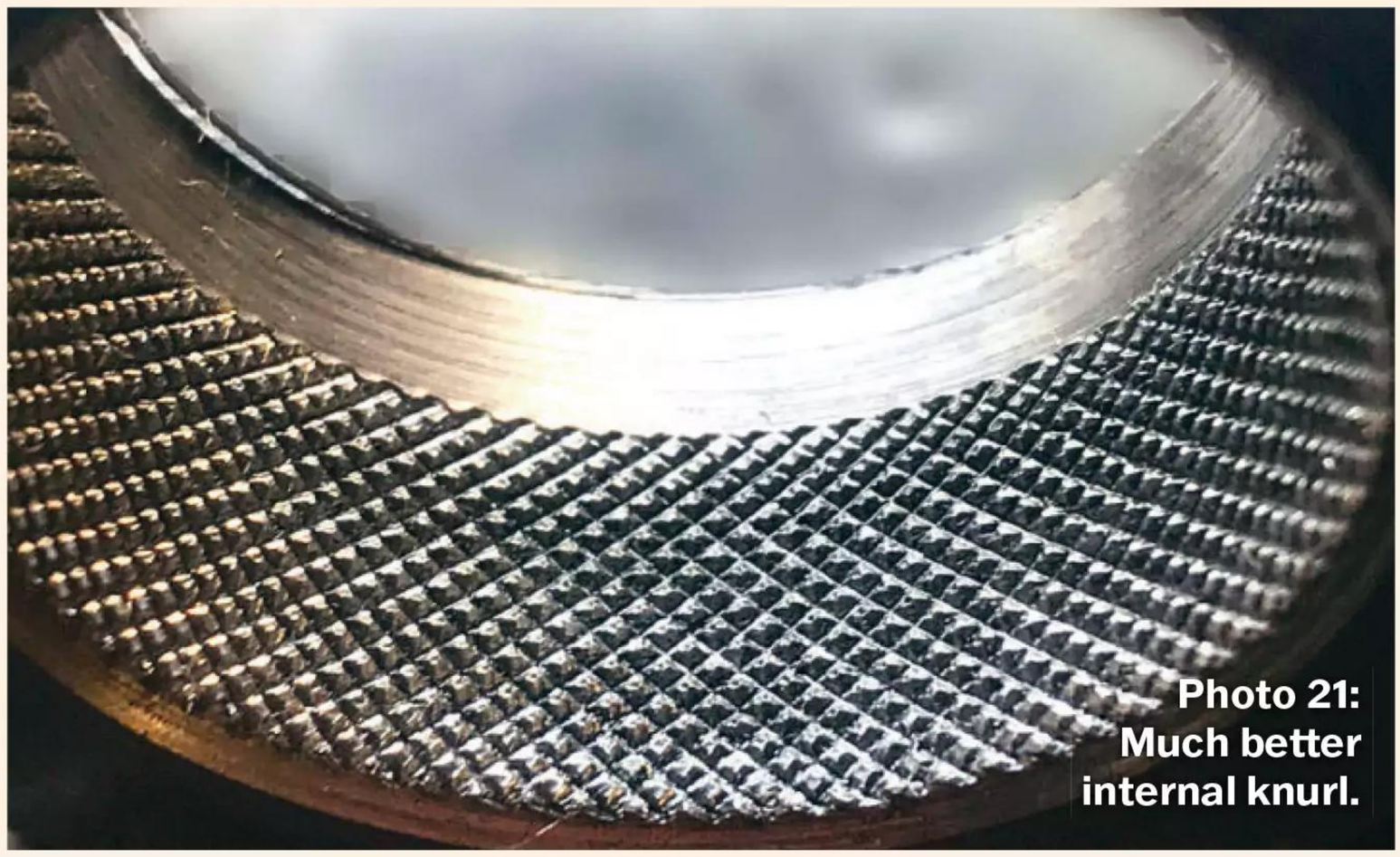


Photo 21: Much better internal knurl.



Photo 22: Variations allowing greater diameters to be internally knurled.

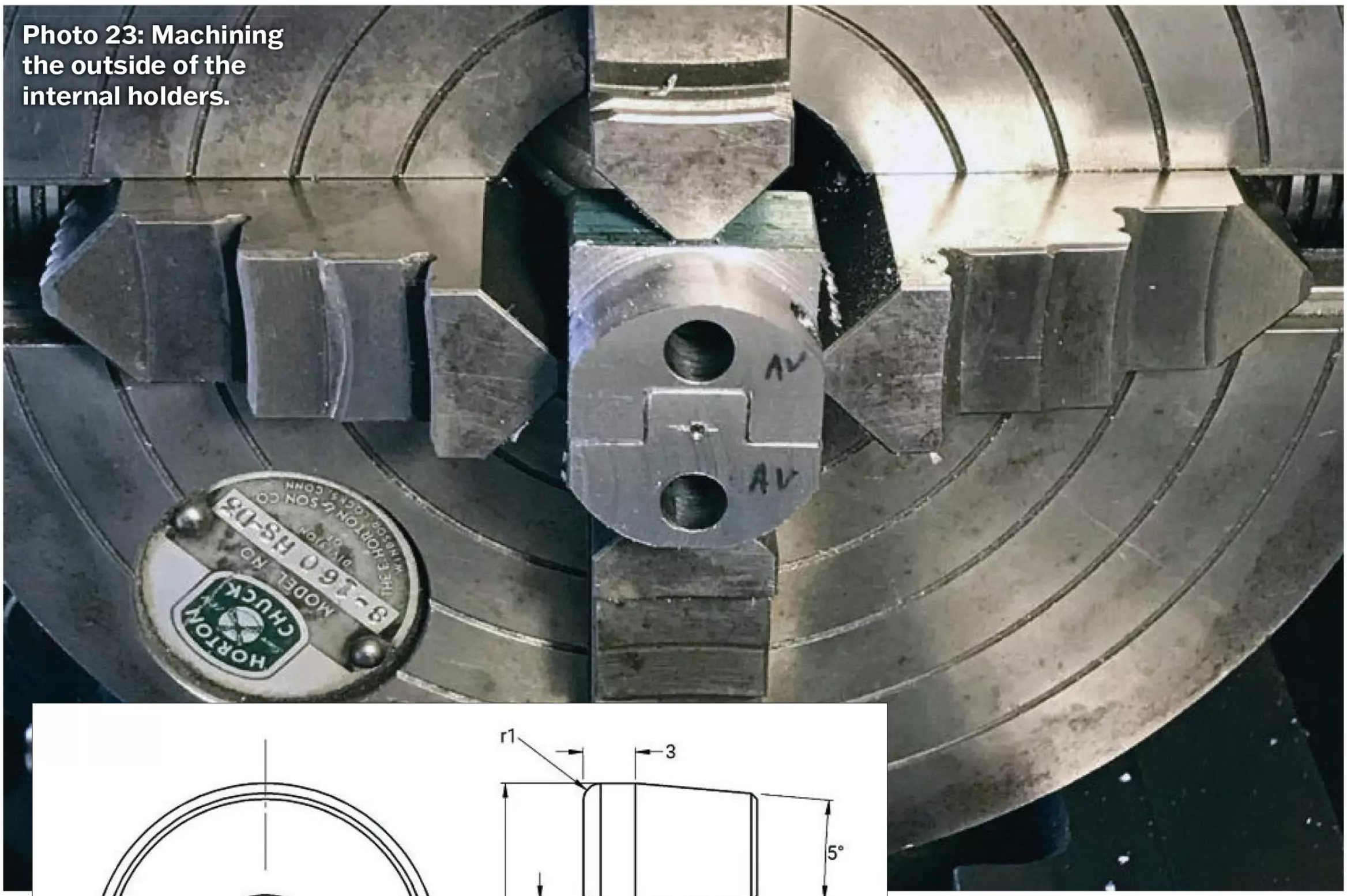
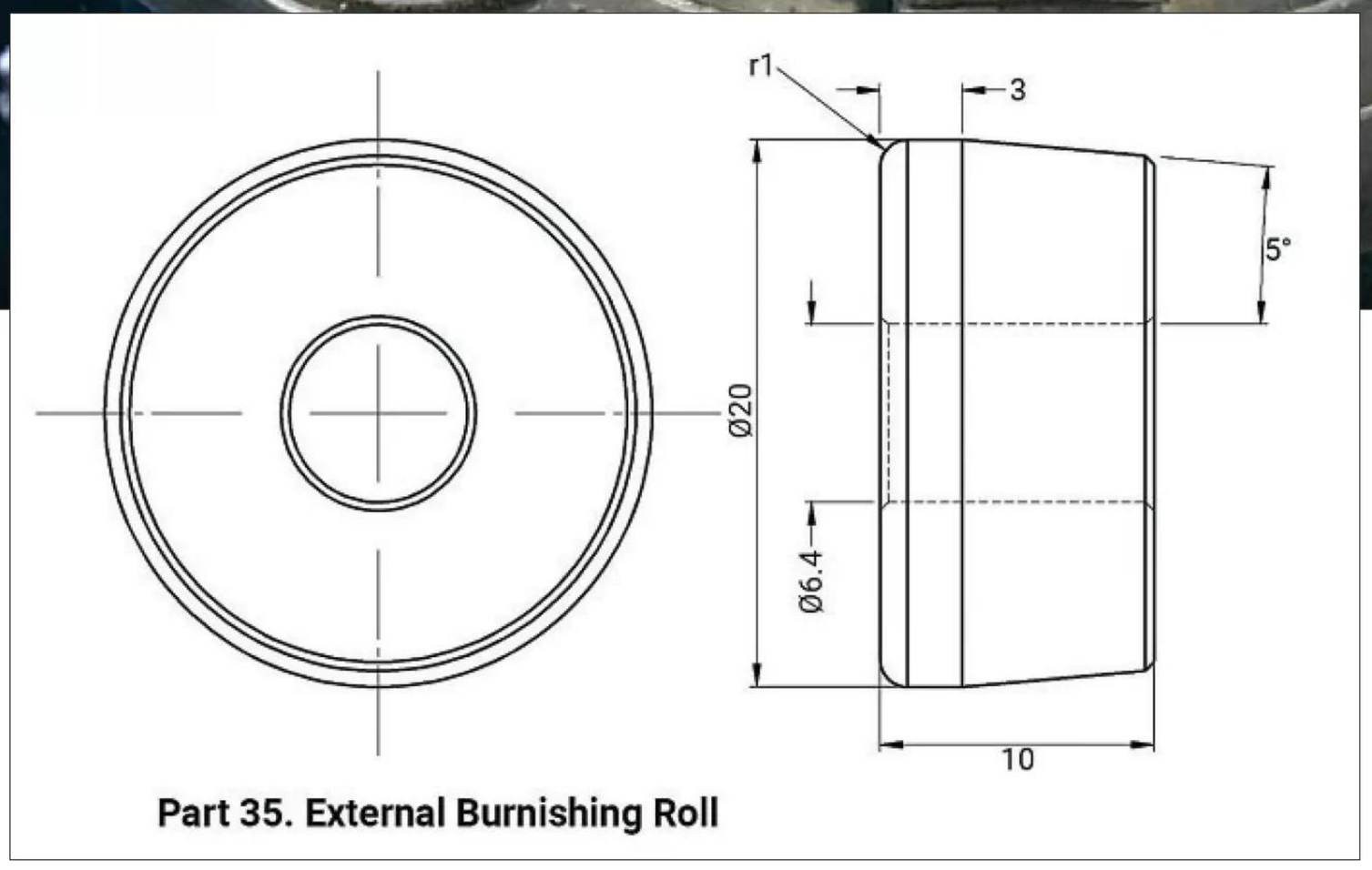


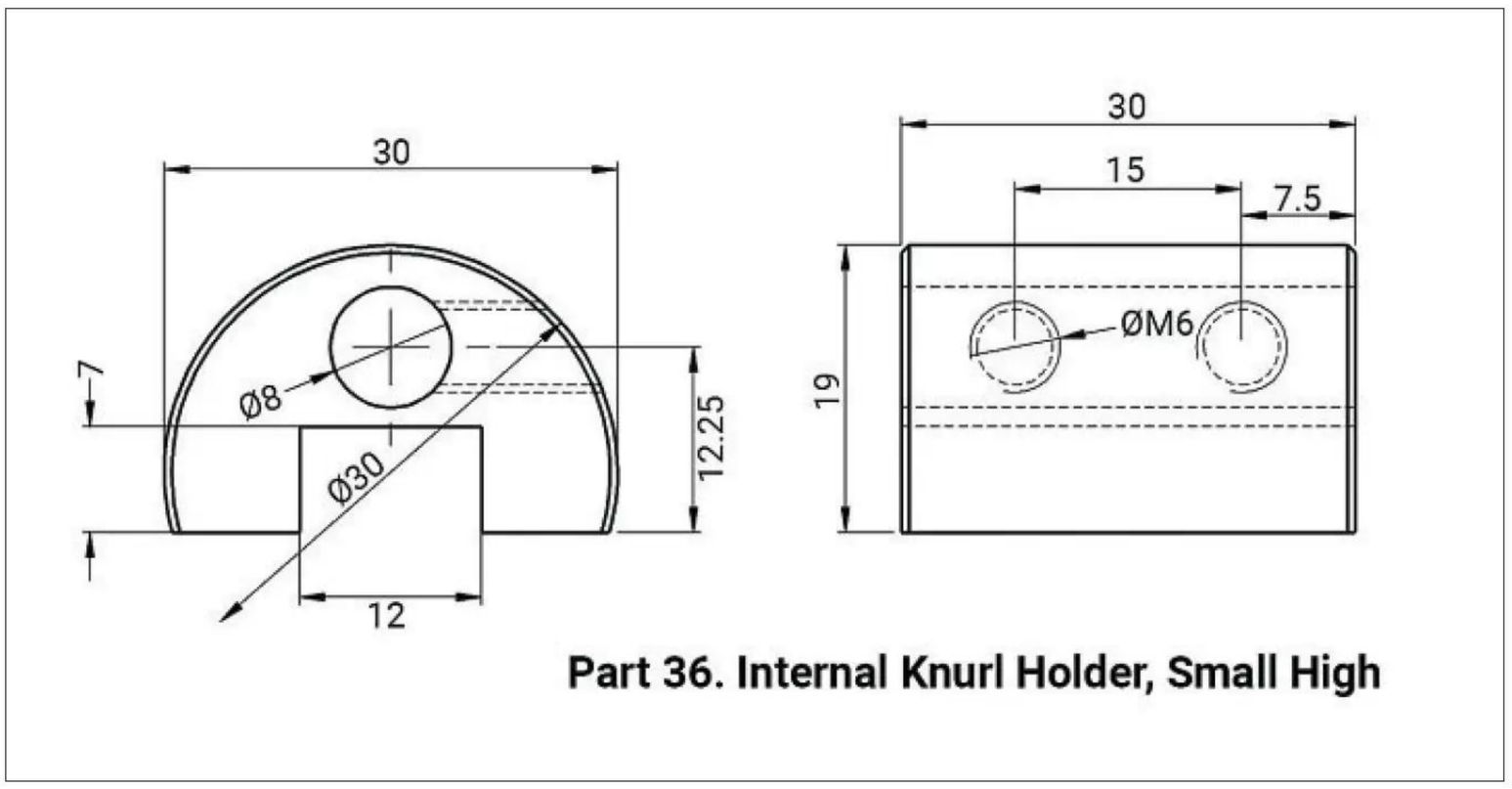
Photo 23: Machining the outside of the internal holders.



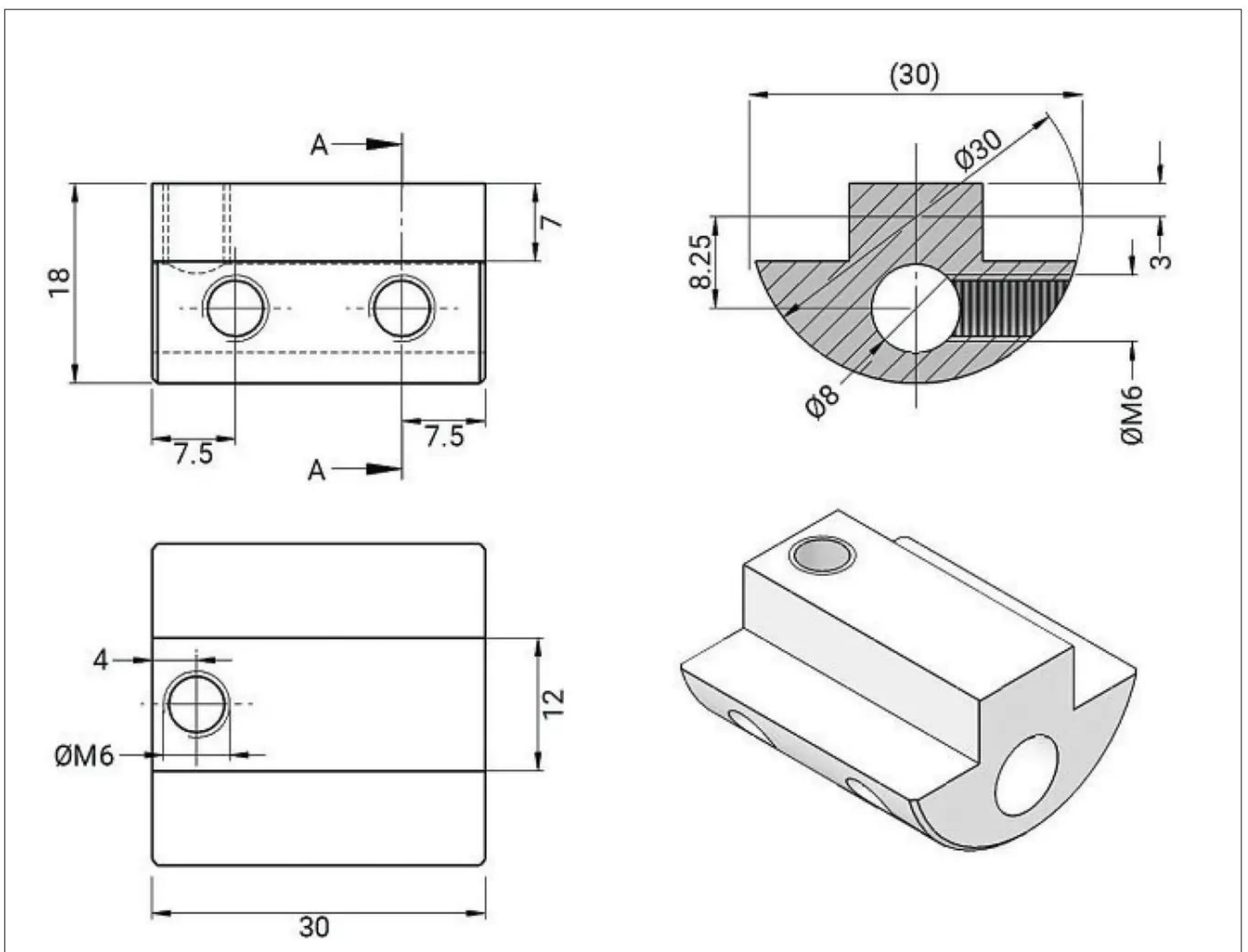
Part 35. External Burnishing Roll

Here are my notes on machining the parts for the thicknessing attachment.

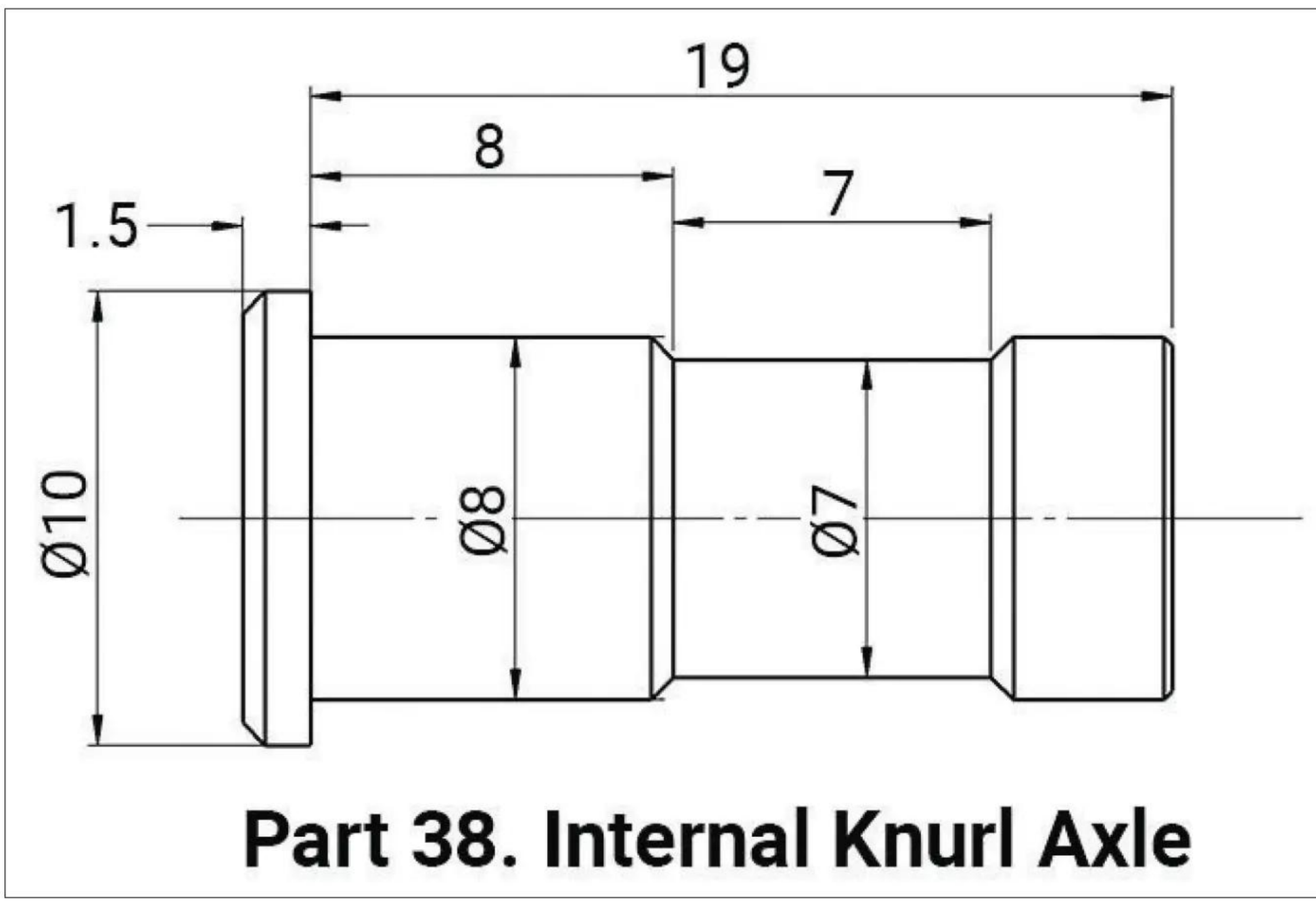
Bore crushing knurls 33: I cut knurled these (see *Model Engineer* 4543) from 16mm diameter silver steel, one left hand, the other right hand, 45 degree helix angle, then hardened. The bore diameter is 8mm and the length 4mm with a slight chamfer as can be seen in photo 16. Be careful to get sharp edges,



Part 36. Internal Knurl Holder, Small High



Part 37. Knurl Holder Bore, Small Low



Part 38. Internal Knurl Axle

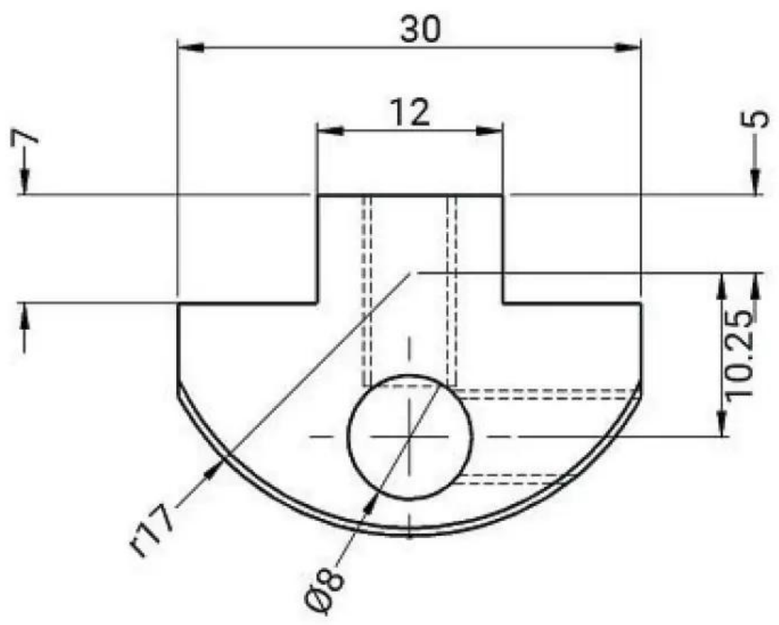


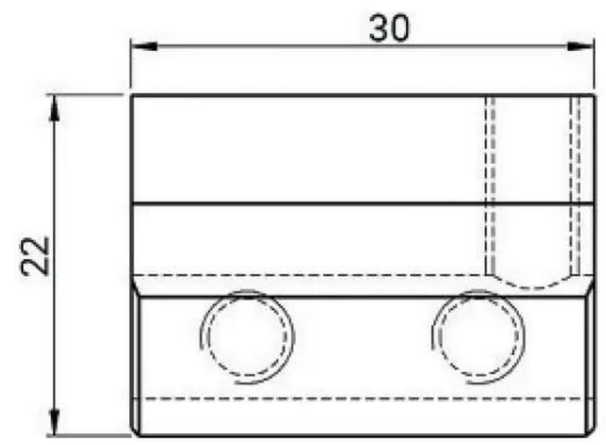
Photo 24: Using a split tube collet to hold the square-section spacer.



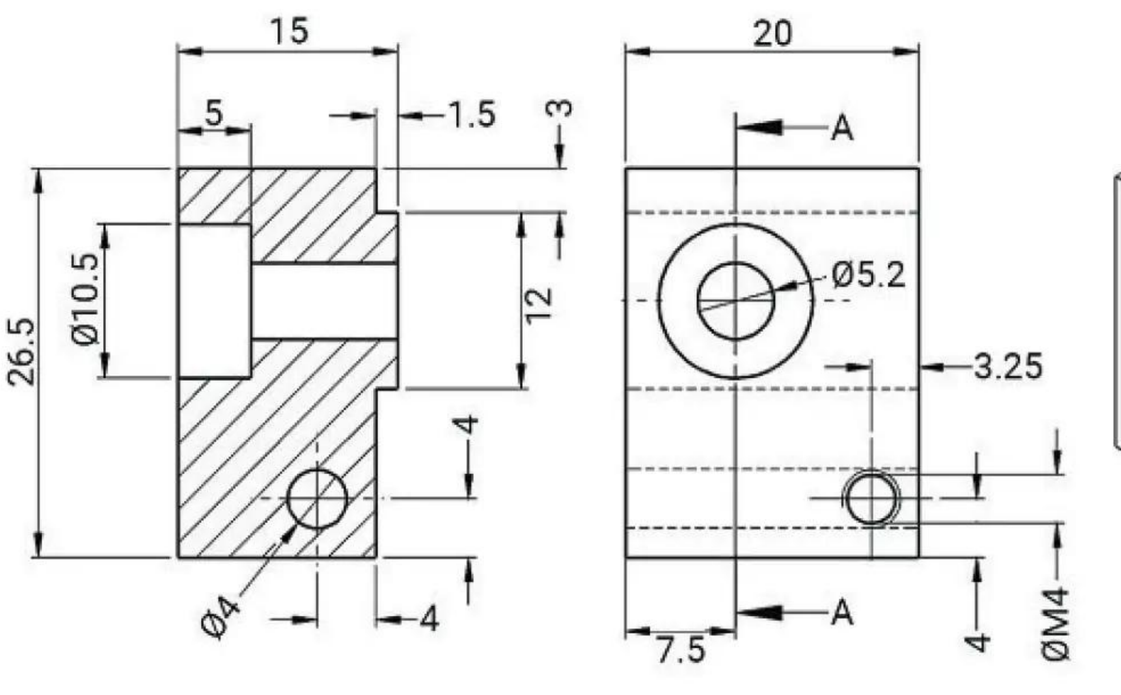
Photo 25: Scaled down miniature attachment.

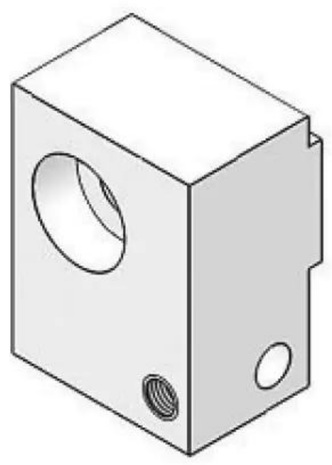




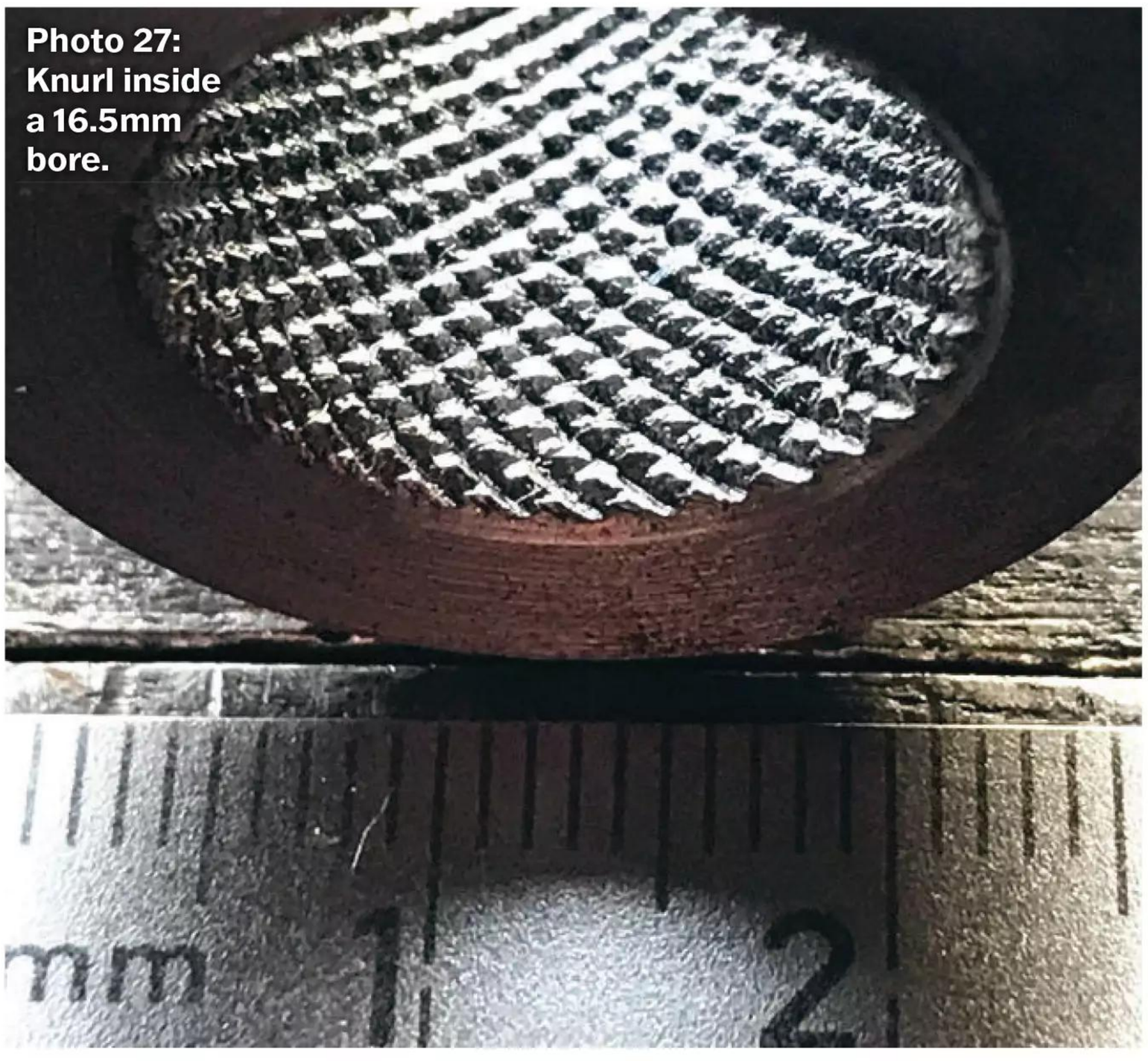


Part 43. Internal Knurl Holder, Medium Low





Part 46. Bore Crushing Arm, Small



protect with soft soap before heating and quench in brine (5% salt) with no temper for the hardest result. The 45 degree helix angle is the one used by Cogsdill as certainly the best angle for maximum knurl raising.

Internal knurl holders 36, 37, 42, 43: These parts must be made by first machining the mating surfaces, the outer curve being made on assembled parts 36/37 and 42/43, set in a four-jaw chuck, **photo 23**, the centre being the punch dot. Parts **36** and **42** are identical aside from the rounding radius.

Diameter adjusting spacer 44: This is easy to machine to the desired length from standard 12mm square CRS, **photo 24**; the screw allows for 5mm of adjustment.

Holding rods 40: Machine from 8mm CRS to the desired length.

There are no problems for the other parts.

Small Diameter Attachment

I've scaled down the attachment, **photo 25**, by half to start at 16.5mm outside diameter. Of course the smaller the parts the more difficult they are to make. The centring adjustment must be accurate, **photo 26**, the grub screws must not protrude out (I experienced this problem, one grub-screw caught on and cut away the knurled bore so I got no decrease in diameter). We must use 3mm diameter grub screws 3mm long. The knurls are 8mm in diameter but still 4mm width and 1mm pitch, so it is the same crushing force but on 4mm diameter knurl axle. These axles must be straight with no groove (I've broken axles at the groove, due to bending stress concentration). **Photograph 27** shows the result in a 16.5mm diameter mild steel bore, the knurl's outside diameter was 17mm and the resulting bore diameter 16mm after knurling.

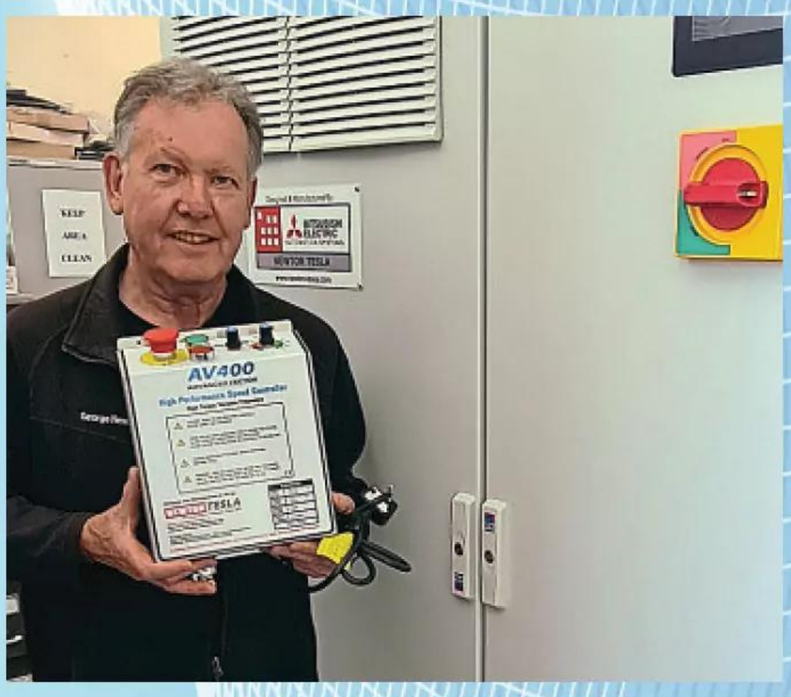
NEWTON TESLA

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

Newton Tesla (Electric Drives) Ltd have been trading since 1987 supplying high power variable speed drives and electric motors to industry up to 500KW so you can be confident in buying from a well established and competent variable speed drive specialist.













Now manufactured in stainless steel enclosures, 10 year Warranty

Managing director George Newton, originally from the British Steel industry where he worked with 20,000 HP rolling mill drives is also a skilled machinist and uses his own lathes to design and refine speed controllers especially for the Myford ML7 & Super 7

For the Myford ML7, George and his team produce the AV400, a complete 'Plug & go' solution including a new variable speed motor that meets the original Myford motor specification, has the correct 5/8ths shaft diameter and is a direct fit

The 'AV' range is extended with the AV550 & AV750 for the Super 7 lathe giving a choice of 3/4HP & 1HP motor power

Full Torque is available from motor speed 90 - 1,750 RPM

Advanced Vector control for maximum machining performance

Prewired and programmed ready to go

The AV400/550/750 speed controllers have an impressive 10 year warranty for the inverter and 3 years for the motor (Terms and conditions apply)

Over 5,000 units supplied to Myford owners

Speed control solutions also available for other lathes including Boxford, Southbend, Colchester, Raglan etc call or email for details

Technical support available by telephone and email 7 days a week



Newton Tesla (Electric Drives) Ltd.
Warrington Business Park, Long Lane, Warrington
Cheshire WA2 8TX, Tel: 01925 444773
Email: info@newton-tesla.com
Visit https://www.newton-tesla.com for more information.
Follow us on Facebook: www.facebook.com/NewtonTeslaLtd

VISA MasterCard

DRIVE SOLUTIONS CENTRE

MITSUBISHI ELECTRIC AUTOMATION SYSTEMS
NEWTON TESLA
Automation Dealer

Si (Systèm international d'unités) Newton, unit of mechanical force, Tesla, unit of magnetic field strength

Please mention Model Engineer when replying.

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

PostBag is one of the most popular sections of the magazine - readers want to hear from you! Drop us a line sharing your advice, questions or opinions. Why not send us a picture of your latest workshop creation, or that strange tool you found in a boot sale? Email your contributions to meweditor@mortons.co.uk.

THE NEWCASTLE ENGINE

Dear Neil, Not having been a subscriber to Model Engineer, I picked up on the article on the Newcastle Engine by Ron Fitzgerald in the recent combined volumes. My interest comes from the fact that my ancestors were miners at Wylam, after my three times Great-Grandfather moved there about 1800, from the lead mines to the west. Thus the family would have probably been familiar with at least the rumours about this 'new' engine.

Although it seems that it did not make it to Wylam, ultimately William Hedley, the mine's engineer (with support from Mr. Blackett), eventually produced his own engine, which worked down to the Tyne. In its travels it passed the cottage home of George Stephenson, although of course, by this time, he would probably have moved away. I understand however, that Stephenson started work at Wylam Colliery. An interesting article.

Ian Varty, by email

TWO QUERIES

Dear Neil, I am writing to you with two requests and I am hoping that you will be able to help me through the magazine.

Does anyone recognise this tiny IC engine? I was given it many years ago and would like to restore and remake it.

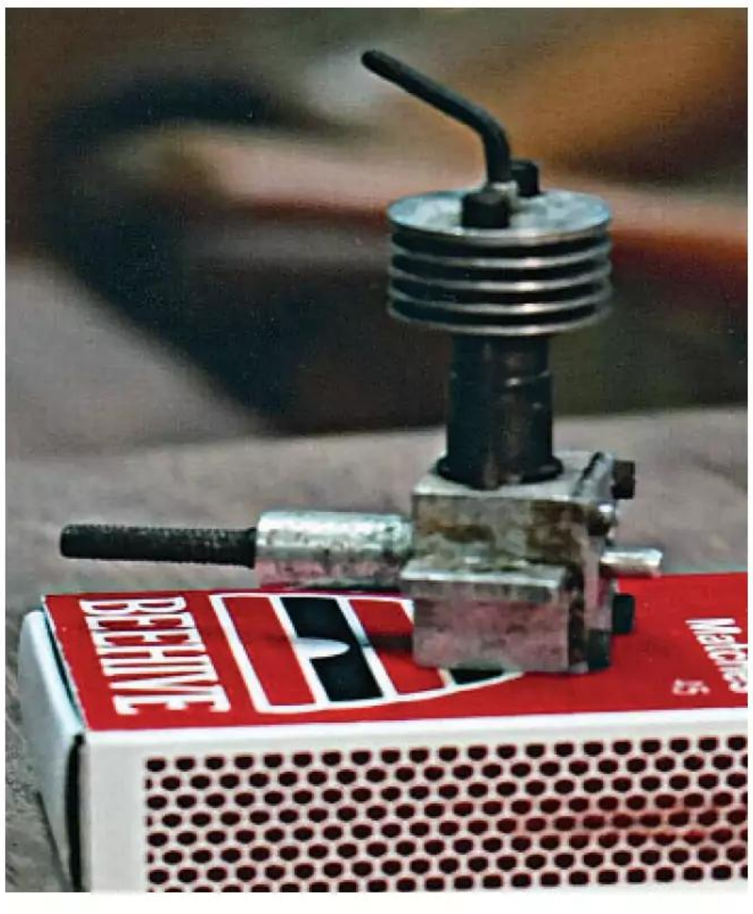
I would very much like to see the original drawings and details of the carburation/needle valve arrangement. The dimensions of the engine are: bore 5mm; stroke 6mm; height 35mm; length of crankcase 24mm, although it was probably made to imperial measurements. The screws are 10BA.

My second request concerns a tool and cutter grinder I am attempting to make. In MEW No. 321, November 2022, Marcus Bowman described his grinding table. In his book, *Tool and Cutter Grinding* he shows this table with some very nice work heads. Could Mr. Bowman be persuaded to describe these work heads in detail in your magazine? I assume they are his own design and not commercially available.

I like the new look of the magazine for the inclusion of another group of skillful draughtsmen, engineers and clever machinists. However, I will leave my thoughts on computer assisted machining for another time.

Geoffrey Pullum, Auckland, New Zealand

If any reader is able to offer Geoffrey assistance, please contact me via the email address above – Neil.





CAD PROGRAMS

Dear Neil, I used to subscribe to ME and while liked the idea of subscribing to MEW it totalled up to quite a lot of money so didn't, so I welcome this new combined mag. It all makes much more sense.

I'm the chairman of the St Albans & District Model Engineering Society and one of my aims is to ensure the club's survival for another 75 years by ensuring it doesn't become a dying museum for ancient practices. My approach is to have some of the new while retaining the old and everything in between. It drives our Newsletter content and topics for club evenings. My thinking is that if all our members are engineers, they will naturally be curious about new stuff relating to their hobby. Anyway, I think you are on the right track with the balance of old and new in ME&W. You will never please everyone!

In that vein I see nice engineering drawings in ME&W that have clearly come from some sort of CAD drawing package and there are mentions of Fusion 360 and Alibre and maybe others in the articles? I've wasted a lot of my time trying to find the best blend of functionality (e.g. exporting to the format of file for Model Engineer's Laser) and ease of use / shallow learning curve as well as affordability. The latest one I tried was FreeCAD, which promises endless functionality and zero cost but, my goodness, it is hard to get started. Any chance of an article surveying the options for model engineers when it comes to CAD software?

Mike Collins

If a reader with broad experience of different CAD programs would like to offer such an overview of different CAD programs, do get in touch. In the meantime, I am discussing a CAD tutorial series, alongside a free extended trial of a CAD program for readers - Neil

BRIAN WOOD



Dear Neil, with much regret we announce the passing of Brian (Woody) Wood. Woody started his career with Rolls Royce in the area of aero engine inspections. During this time he spent many weeks overseas both training crews on inspection techniques, and performing non-destructive testing inspections, traveling to Japan, South Korea, Singapore and the USA. He was later promoted to NDT Group Leader for remote inspections in a different part of the company - a position he held until early retirement.

Over several decades thereafter he contributed many articles to Model Engineer, Model Engineer's Workshop and Engineering In Miniature. In practically every case the articles dealt with a problem, typically a repair or modification that needed a considered approach. In all cases this was achieved satisfactorily and demonstrated that Woody was happiest when solving an engineering problem. Virtually all such activities involved the use of his trusty Myford S7 lathe, Dore-Westbury or Tom Senior mill.

Woody was particularly knowledgeable in the areas of lathe gearing trains and screw cutting. He derived much pleasure from unravelling the intricacies of lathe screw cutting gearboxes. His Crowood publication, *Gearing of Lathes for Screwcutting is a tour de force* on the subject and clearly illustrates his encyclopaedic knowledge of the topic.

Woody was always happy to help others; making a replacement key for a local church door, involving dental putty as part of the process; a winding key for the Harrison Long Case clock at Nostell Priory, and extending to numerous projects he completed for the REMAP organisation. Here, his gas-welding skills with thinner materials were much appreciated.

He will be much missed by those who were fortunate to know him - and by the wider home workshop engineering community.

He is survived by his wife, two children, seven grandchildren and four great grandchildren.

Bruce Wood, by email

As recently as issue 4764, I was corresponding with Brian, trying to help a reader with a screwcutting query. His knowledge and willingness to help fellow model engineers will be much missed, and I'm sure readers will join me in extending our condolences to his family. We will be publishing Brian's final article soon, as a tribute – Neil.

THE SUGAR CANE LOCOMOTIVE

Dear Neil, Many thanks to Jonathon Palterman for his response to my inquiry about missing issues from my collection in ME&W, 4764.

I probably should have been more specific in identifying the locomotive project of prime interest which is the second one that J.P. mentions; the Bundaberg Fowler loco, several of which served on the Northern New South Wales and Queensland cane fields. The model build was described as Bunyip in the AME magazines and I possess about half of the issues in that series. My intention had been, and remains, to rescale the drawings to produce a model of more manageable size than will result if built to 7 1/4" gauge. First, though I've to find the missing issues.

As regards the 0-4-0 Wombat loco which Jonathon also mentions in his response, I have all 21 parts published by AME.

Trawling through my AME collection has revealed some other information that may be of interest to J.P. and other readers.

In issues 69 and 70, AME published a two-part article on a 2 1/2" gauge Fowler 0-6-2 entitled *Toneya*. No drawings were provided but reference is made to Fowler locomotive print No.13134 supplied by the Rural History Centre, University of Reading, in the UK. Presumably therefore, the *Toneya* model had been built from scaled down original drawings. Nowadays the University of Reading has a website but in the interests of quickly completing this response I've not yet searched it for drawings.

Ron, Australia

THE YIELD POINT METHOD

Dear Neil, Brilliant. But I personally use the Australian Boiler Code standard when designing. It always gives a safe design. Many years ago when Mike Chrisp was the editor, I entered into correspondence with a designer of submarines, when I used Mhor's Circle Method to design an external pressure vessel. As a model engineer, should we follow the keep it simple principle? We generally use the next stock size larger material, rather than exact size materials.

On a personal note, I had a minor stroke and am making a slow recovery. I have many models of different types and styles. I continue to build, it keeps me busy and sane!

Apart from losing even more of my eyesight, everything is getting better. As I cannot drive, I am missing out on visits to tracks and exhibitions. To know a driver who is an enthusiast would be very useful, as any visits take considerable planning using public transport.

Paul Collyer, Tunbridge Wells, Kent

THE HISTORY OF MACHINE TOOLS

Dear Neil, would it be time again to bring LTC Rolt's *Tools for the Job* to the attention of the model engineering community? When I was about to write my article on accuracy and precision for ME, I scoured the Internet for books on the history of machine tools. Only Rolt's work and Professor Robert S. Woodbury's very detailed *Studies in the History of Machine Tools* came to light. Both are now about 50 years old, but nothing better seems to have appeared.

John Bauer, Ontario, Canada

These articles by Geometer (Ian Bradley) were written about half a century ago. While they contain much good advice, they also contain references to things that may be out of date or describe practices or materials that we would not use today either because much better ways are available of for safety reasons. These articles are offered for their historic interest and because they may inspire more modern approaches as well as reminding us how our hobby was practised in the past.

PIN AND-C-SPANNERS

APART from the screwdriver slot, the external hexagon, as on bolts, nuts and other components, is the most common means of effecting tightening and loosening.. Yet, of course, it cannot meet all requirements and alternative means to the same end are pin holes, multiple slots and sockets, which add nothing to the length or bulkiness of components and, in some cases, are more easily produced than hexagons.

For grinding in a cone or poppet valve, two holes may be 'provided 'in the head for a pin tool-as an alternative to a slot requiring milling with a circular cutter. On a large screwed,, flush-fitting plug two holes again drilled in the face provide means for tightening or loosening with a pin spanner. Round' the outside of a gland nut six or eight shallow radial holes admit a shaped-pin spanner; and the same number of longitudinal slots take the usual C-spanner. Two or four slots are usual on locking rings or thin nuts for such parts as cycle freewheels and camera lenses.

Thin ring nuts for C-spanner use have a number of advantages over those with normal hexagons. Reduced space may be the main consideration, since the outside diameter of such nuts need be little (if any) more than the distance across the flats of hexagon nuts. Then, again, ring nuts can be machined from round bar (or circular castings), followed by simple drilling or slotting operations, which, in large sizes, are quicker and easier than milling required for flats.

Causes distortion

In circumstances, too, where it is impossible to use an enclosing box spanner, slotted or drilled ring nuts can generally be pulled much tighter and far more easily loosened than thin hexagon nuts. This is because application of an open spanner to a thin hexagon causes distortion and the nut to grip the thread; whereas, with the other types, a circular pull is obtained. Should, however, this sort of grip be experienced with a thin hexagon nut, applying the spanner to other flats may be helpful in getting the nut to work round.

A pin tool for use as a light spanner or grinding in a valve, *A,* can be made by bending a piece of stiff wire or rod U-shape to fit into the holes, then slot-sawing the end of a larger rod for the stem, followed by soldering or brazing the U-piece into the slot, and finally cross-drilling the stem for the handle.

A powerful pin spanner, where it can be used on a large flush-fitting plug, *B,* can be made by drilling a flat bar at the required centres, driving in pins (from silver-steel rod) or tapping holes to screw them in.

For a radially-drilled gland nut, C, plate for the spanner, *D,* must be thick enough for a hole to be drilled for the pin; and where the internal curve for the spanner may be produced by drilling the spanner plate and a piece of same-thickness scrap can be clamped or held in the vice for drilling. The pin should be smaller than the holes in the nut or chamfered at the end for the spanner to be fitted. On a radially-drilled nut which is thick (and has not to be pulled too tight), a rod like a tommy bar may be used.

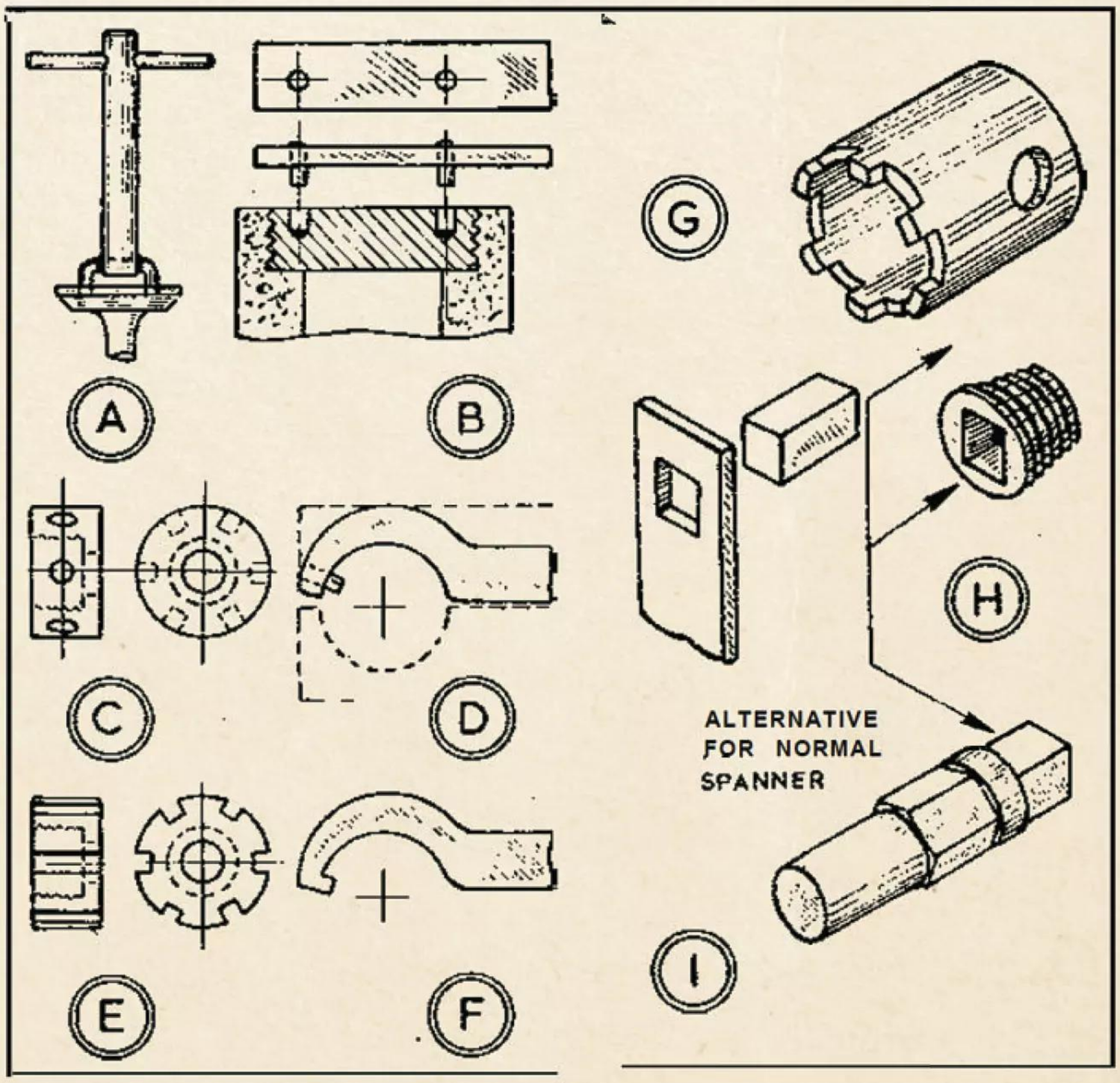
For a slotted gland nut, *E,* the spanner, *F,* can be thin, having its internal curve formed by filing with a half-round file and leaving the tongue at the end.

For slotted nuts to which end-on application must be made, the type of spanner at G is used, having the requisite number of lugs to engage with the slots. On occasion such a spanner can be made from steel tubing by careful filing-then drilling a cross-hole for a tommy bar and case hardening if required.

Square-socket spanners

Square-socket plugs on car gear-boxes and axles can be manipulated with a short length of square rod and a spanner, H, or the tool, I.

For B.M.C. cars, rod turned 21/32in. dia. is filed hexagon one end for a standard 9/16 in. across-flat ring spanner and 7/16in. square the other end for the plugs. If desired, a plain 9/16 in. diameter is convenient for holding in use. ❑



WE ARE THE EXCLUSIVE UK DISTRIBUTOR FOR

WABECO

MACHINE MANUFACTURER since 1885



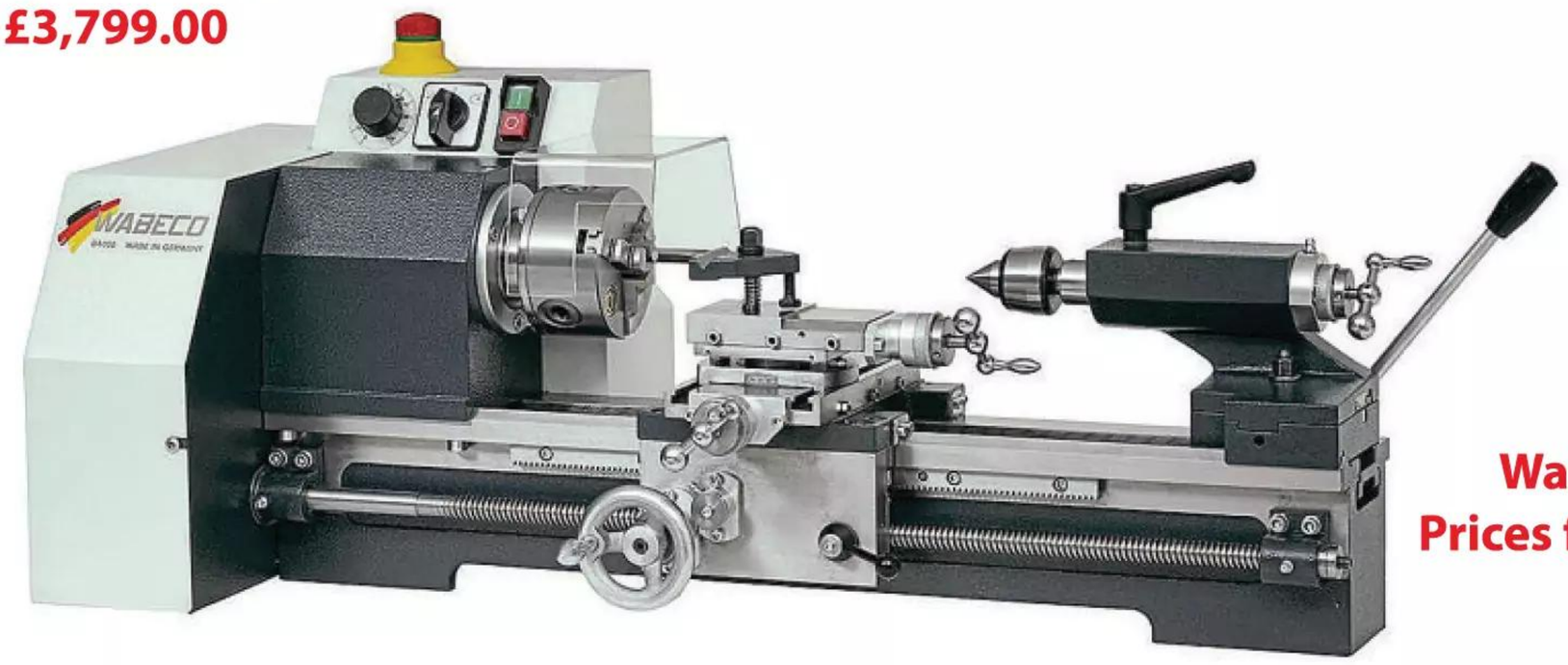
Wabeco milling machines
Prices from £3,799.00

5 YEARS WARRANTY

On selected machines



Wabeco drilling stands
Prices from £157.00



Wabeco lathes
Prices from £3,795.00

Prices include VAT & Delivery Mainland UK

We offer a complete range of quality, precision machines for the discerning engineer.

Developed and manufactured in Germany, Wabeco products guarantee the highest quality standards. Whether your milling or drilling with Wabeco, you're sure to get the best results possible.

Emco distributes a wide range of machine tools, CNC machines, lathes, drills, printers, routers, 3D scanners and waterjet cutters for industrial and educational use.

Visit emco.co.uk to see the full range of new and secondhand machines or call us on 02392 637 100 for more details.

isel WABECO MACHINE MANUFACTURE SINCE 1885

Emco Education Ltd, Unit 4, Hayling Billy Business Centre, Furniss Way, Hayling Island, Hampshire, United Kingdom PO11 0ED sales@emco.co.uk

emco UK DISTRIBUTOR

Model Engineer & Workshop visits the Stafford & District Model Engineering Society

John Arrowsmith pays a visit to this club in Staffordshire, a county whose engineering heritage is particularly noted for its ceramics industry and canals.

I dropped in to see the members at the Stafford and District Model Engineering Society at their fine site located in the Staffordshire Showground.



Photo 1: The slate club sign at the entrance.

Founded in 1971 the club is now a company limited by guarantee, and they have established an excellent facility in the showground. They have established an excellent working relationship with the Showground authorities and have access to their site without any restrictions. A fine stone tablet at the site entrance shows the club logo and who they are, **photo 1**. I asked about vandalism and they said that they have had some smaller problems in the past but now their side of the showground is used by the local constabulary to train their police dogs and, as if by magic, the vandalism has stopped. I wonder why that is.

The initial track was just 3½" and 5" gauge using aluminium rail and stayed like this until about 2003/4 when the main structure remained but the track was rebuilt using steel bar. They now have a very useful multi-gauge track covering 2½", 3½" and 5" gauges which will also accommodate O gauge as well; as I said, a very useful combination. It totals 132m (432 feet) in length and is an interesting layout. The ground level 7¼" gauge track was constructed during the 1999/2000 period and then it was extended and a new 5" gauge rail added. The area is nicely wooded and has some interesting gradients to test the best of drivers; the length of this inner loop is about 200m (656 feet). An extension out into the showground resulted in an increased length to about 545m (1788 feet). The extension track is a straight length out and back line terminating at Queensville station, where a turntable enables locomotives to be turned to face the right way to go back to Bagnall End



Photo 2: Dave Burrage runs round the train back to Bagnall End.



Photo 3: Bill Sellwood was running his Roundhouse Lady Ann which is fully radio controlled.

station, **photo 2**. As the name suggests, this is a nod to Stafford's locomotive building heritage. In addition to all this there is an extensive 32mm gauge track layout and a separate Gauge 1 track system, **photo 3**. They have their own dedicated club storage building which is useful as they can operate completely separately from the main section, **photo 4**. Access to the main central area is via a substantial steel footbridge which crosses all the tracks, **photo 5**.

Of course the club have, like so many others, a well-founded membership of about ninety with a modest membership fee of £40.00 who have access to the track at almost any time. They have a good-sized practical clubhouse, **photo 6** and **7**, with a very smart and tidy main workshop known as 'The Chapel', **photo 8**. No doubt a few prayers are uttered in there from time to time! They also have a small maintenance workshop to carry out day to day repairs, **photo 9**, and just outside this building was a very nice display of stationary and hot air engines all built by Patrick Malpass, **photo 10**. My visit coincided with one of the club's normal club work days so a number of different tasks were being looked at and various topics considered, **photo 11**. They had, however, provided a very nice 7¼" gauge 2-6-0 BR Class 2 locomotive owned and built by Dave Burrage, **photo 12**, who gave me a journey round the inner loop of the circuit. He then allowed me to have a turn on the regulator which showed that the engine runs as well as it looks, **photo 13**. The track runs very well and has been well maintained. It is a fully signalled system using mainly coloured lights which can be either manually or automatically controlled from a substantial signal box at the main station, **photo 14**. The signalling layout has been designed by Derek Tweed



Photo 4: The 16mm Modellers storage shed.



Photo 5: The splendid all steel footbridge over the main running tracks.



Photo 6: The main clubhouse.

using an MRCC system which has a British source code and has enabled him to modify his logic programme to suit the club track layout. All the point work on the layout is pneumatically powered and can also be controlled from the box. There is a nice touch at Bagnall End station in the shape of an original gas lamp from the North Staffordshire Railway station at Stone, now powered by electricity, of course, it added some atmosphere to the station, **photo 15**. A couple of other members were also enjoying some good track time with their steam locos. Mike Barlow was driving a tender version of a Sweet Pea which he acquired as a set of parts and has subsequently assembled with the help of another member. It runs very well and seemed to be running well on the elevated track without any problems.

To assist members and visitors with unloading heavy locomotives at the club they have installed an electro hydraulic lifting table in the main entrance. This is quite a unique piece of kit as the electricity for the device is supplied by a solar panel which I was told works very well indeed and this device has a track leading directly onto the main track turn-table so that it doesn't matter which way a loco is loaded when it arrives it can easily be accommodated on the track. A good set of well positioned steaming bays are fitted with a heavy-duty traverser and lift to assist members during steaming up, **photo 16**. These are adjacent to two large storage containers which also have a double traverser as part of the track layout. A portable hydraulic trolley is also available here as well, so no heavy lifting is required either.



Photo 8: Part of the well-equipped workshop.



Photo 7: The Kitchen end of the club house.

I had a nice conversation with one of the club's younger members, eleven-year-old Ben who has been with the club for some time. He told me that he joined because they make things and he likes to make things, particularly railway models. He was operating his clockwork model of a Hornby O gauge 4-4-0 tender loco, **photo 17**, which went very well on the 32 mm track system. He is allowed to drive one of the club's electric locomotives and also under supervision he drove the BR Std Class 2 loco built by Dave Burrage while I was there, **photo 18**. He is well supported by the members there and he feels very welcome. His immediate ambition is to own his own battery powered engine which he hopes will appear next year. This is sort of

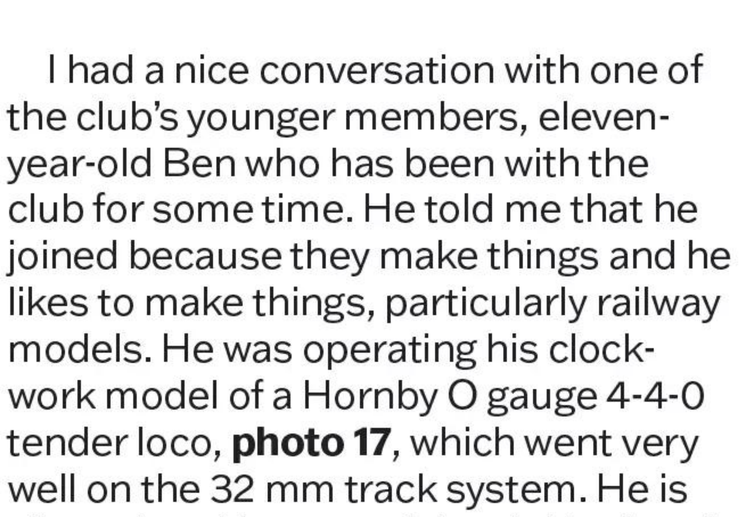


Photo 9: Inside the running repair workshop.

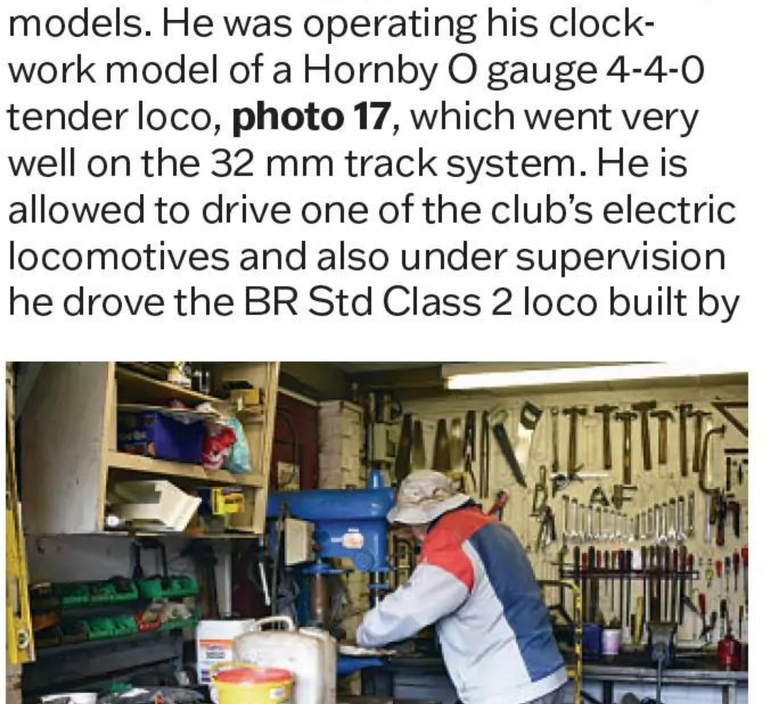


Photo 10: A lovely selection of very well made stationary and hot air engines built by Patrick Malpass.



Photo 11: Ken Wood talking with members about the building of his latest chassis.



Photo 12: Another view of the BR Std Class 2 locomotive built by Dave Burrage.



Photo 13: Approaching the track crossing in the station I get the pleasure of driving Dave's BR Class 2

approach to youngsters is very welcome to see, and the club are to be congratulated for encouraging this young man to take part in their activities. I hope he gets his wish and goes on to be an important member of the club.

On the bench in the club workshop was a 5" gauge locomotive which was under restoration, **photo 19**. The engine has an interesting history because it was built towards the end of the last war by a Mr. J.H.E. Rodgers who also designed it in 5" gauge. It was based on a Bagnall 0-4-0 number 2515 *Kenfig* where it worked in the South Wales steelworks. Mr. Rodgers named the engine *Anne of Holland*. A number of the models were



Photo 14: Inside the new signal box with Derek Tweed who built the system.

made and in 1948 The Bagnall company bought one for £200 as an example of their locomotives. A length of portable track was made by the company and together with some riding trucks was used at local fetes etc. to give rides to the public. Long after Bagnalls was taken over, the engine, which was displayed in the new company offices, was still being used, with the portable track operated by a couple of employees, Dennis Edwards and Alan Jones. The archive, **photo 20**, shows the engine in steam surrounded by Bagnall apprentices. The Stafford & District Society were given custody of the engine which is owned now by Alstom, the successors to Bagnalls, and



Photo 15: A refurbished North Staff's railway lamp.

they maintain and operate the engine on suitable occasions, hence the reason it was on the bench during my visit.

That just about sums up my visit to the Stafford & District MES; I would like to thank Chris Dobbs, Dave Burrage and Derek Tweed for their help, hospitality and information together with all the other members I spoke to. It was a most enjoyable time visiting a very impressive club with excellent facilities who are a very friendly group of people and who would be pleased to welcome potential new members to the club, they have a lot to offer. I hope the club continues to thrive and provide lots of pleasure to the local area.



Photo 16: A good sized hydraulic lifting table and traverser.



Photo 18: Ben brings the 7¼" gauge BR Class 2 back towards the station.



Photo 17: Eleven year old Ben is one of the young engineers at the club, with his clockwork O gauge Hornby 0-4-0.



Photo 19: The 0-4-0 locomotive originally acquired for the apprentices at the Bagnall locomotive works.



Photo 20: A paper cutting showing the Bagnall apprentices with the locomotive in steam.



Cheap Nasty Plastics

Patrick Hendra, Tutor for Eastleigh Young Engineers explains addresses the myth that plastics have no role to play in the home workshop.

For far too many years I gave a course of undergraduate lectures at the University of Southampton on the properties of polymers. It was always popular, possibly because I included demonstrations, many of which went spectacularly wrong. Everyone remembers those. Only one student ever worked out that the same demos went wrong each year!

I started the first lecture with the words: "Everything you can see in this room, including yourself, is a polymer. It is odd that the polymeric state is not emphasised elsewhere in your courses."

The same sentences could be offered to readers of *Model Engineer* – metals predominate and polymers rarely get a mention. I have had an involvement for many years in engineering, both as a model maker and as a manufacturer of small scientific instruments through a small company called Ventacon Ltd. Over the last 12 years I have been the Tutor of the Eastleigh Young Engineers Club.

The polymers that are available today, of potential interest to we modellers, are of relatively recent invention - almost all since WW2. Enough time has passed for us to be using them.

WHAT ARE POLYMERS?

Many chemicals, some very small ones and referred to as monomers, can be persuaded to link together to form very long chains, two-dimensional networks or even three-dimensional entanglements. As recently as the 1930s, polymer scientists disagreed over the size of these molecules. 'There must be a limit otherwise they would simply fall apart' versus 'why should they?' We now know that polymers can be of all lengths and hence some long chains containing a million or more linked monomers are routine. Many polymeric materials we come across are made of several monomers producing copolymers; the tyres of your car incorporate several while our flesh, skin and hair are made of massive, flexible copolymers and water.

Most people are aware of the properties of products made of polymers. They are soft, often flexible, easily bent, often get broken, feel a bit tacky, warm to the touch and are light in weight: cheap and nasty. Unlike metals which are 'good', heavy and long-lasting. Hence the title of this article!

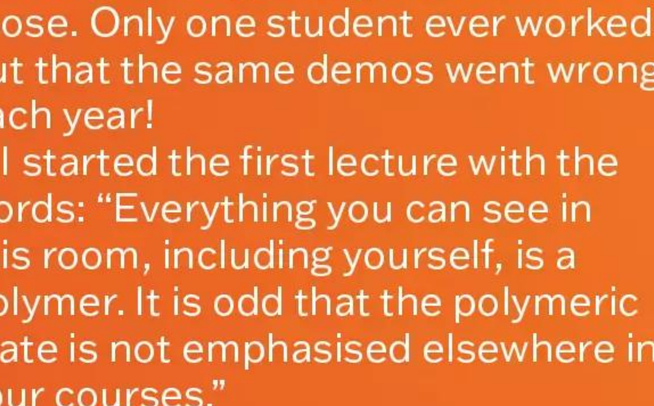


Fig 1: Polyethylene Structure (PE).

THE VAST RANGE AND COMPLEXITY OF POLYMERS

Let's look at the simplest of the polymer family: polyethylene, **fig. 1**. Polyethylene is made from ethylene. There are two different methods of polymerising ethylene. You can squeeze the ethylene molecules together at ultra-high pressures and heat the pressure vessel at the same time. This produces polyethylene which appeared

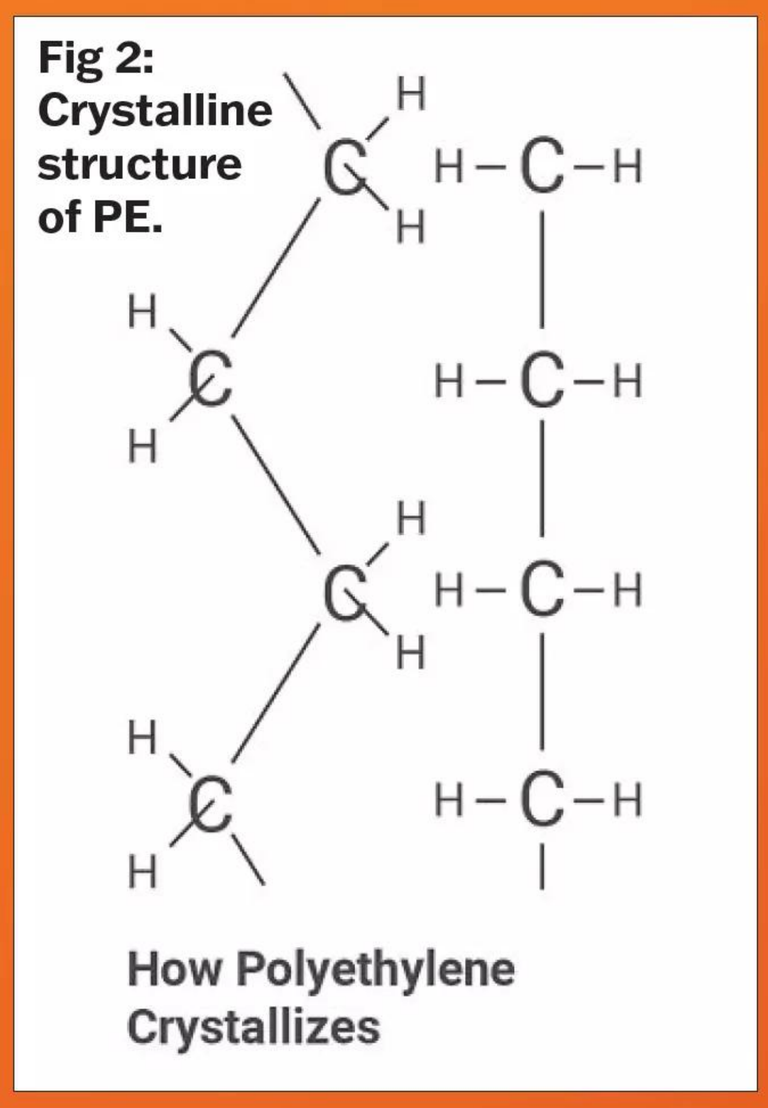


Fig 2: Crystalline structure of PE.

How Polyethylene Crystallizes

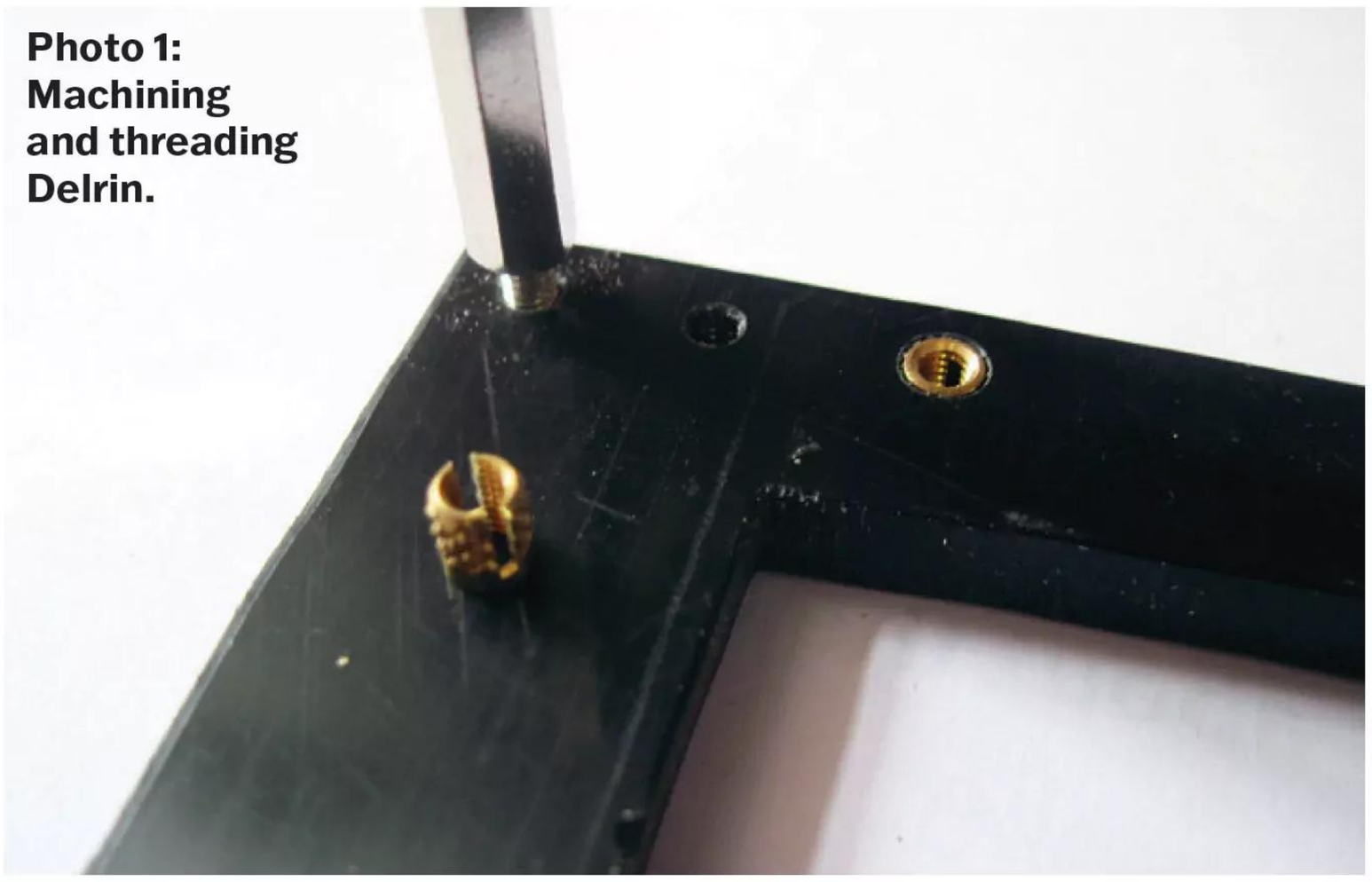


Photo 1: Machining and threading Delrin.

just before WWII, made by ICI here in the UK just in time to be made into high-voltage insulators in radar sets for planes. It is called low-density polyethylene, LDPE, and you will find it almost anywhere as plastic bags, wrapping film, barriers to water under concrete flooring and as insulation in cables.

The more recent method of polymerising ethylene (and several other monomers) is to make the reaction take place on the surface of a catalyst powder, in this case based on titanium chlorides. The product is very different from LDPE; it melts at a higher temperature, is more rigid and can easily be moulded into a vast range of plastic goodies! The material is always described as high-density polyethylene - HDPE. Why the difference? The answer lies in the crystallinity, **fig. 2**.

Like metals and many other materials, polymers have a tendency to crystallise, that is the chains try to pack together tightly to form three-dimensional clusters. As the chains are so long, they fold, so the packing can never be perfect and the folds are most definitely not regularly ordered and hence truly crystalline, they are soft and pliable. So a polymer acts like mortar; hard crystalline grains within a matrix of softer material. The consequence is that crystalline polymers are moderately hard and rigid. Those with lower proportions of the whole in crystalline zones, are softer. The crystalline density in polyethylene is almost exactly 1g per cc (the same as water) whilst the disordered bits have a density of around 0.7g. per cc. We have HDPE with a crystallinity of around 85% and LDPE with much lower proportions of the polymer chains in crystalline zones.

High density, crystalline polyethylene is hard and has a very low coefficient of friction. Although it is used almost everywhere, you will find it in food outlets – it is the very thin film the butcher slaps onto meat to prevent it from bleeding and sticking to wrapping materials. Said butcher then puts your purchase into a plastic bag inscribed with his name and often made from low-density polyethylene. Plastic bags are slightly waxy in feel, the material is soft, very flexible, stretches around hard contents and easily takes printer's ink.

In some respects metals and polymers behave in the same way. Heat treatment is often designed to increase or reduce the crystallinity of a metal, this can also be achieved in polymers (or cause a long-term problem).

So why does low-density polyethylene not crystallise? LDPE is made at high pressures and temperatures, so the polymerisation suffers defects. As the chains grow, every now and again they branch like trees. Just as it is hard to pack tree branches, branched sequences of PE won't crystallise.

Now a little more variety. As you will see in **fig. 3**, one can polymerise several monomers together, adding more complexity. These so-called copolymers can be made in blocks or made randomly. We animals contain DNA, a 'random' copolymer of several different amides, but the randomness is incredibly complex making us unique to each other.

There is another inherent complexity in polymers – the average length of the chains. Polymer chemists can make their polymers with an average length of only a few monomers or even millions of monomer units. The length of the chains, or rather the average of the lengths is defined on the label because the properties change with the average length. A good example again is polyethylene.

Candle wax is, in effect, a mix of various molecules with an average length of about twenty carbon atoms, that is five monomer repeats. Ultra-high molecular weight polyethylene (uHMWPE) is totally different from wax. It has immense tensile strength. It has been claimed that because it is so low in density, its tensile strength per gram is almost unequalled and greater than that of steel. Here the average chains are nearly a million carbon atoms long.

As you will now understand there are a panoply of various grades of polyethylene on the market, all different in property and all suitable for particular uses. And remember, we haven't yet added in copolymers; the availability is mind-bogglingly wide. To put it bluntly, there is no such thing as polyethylene

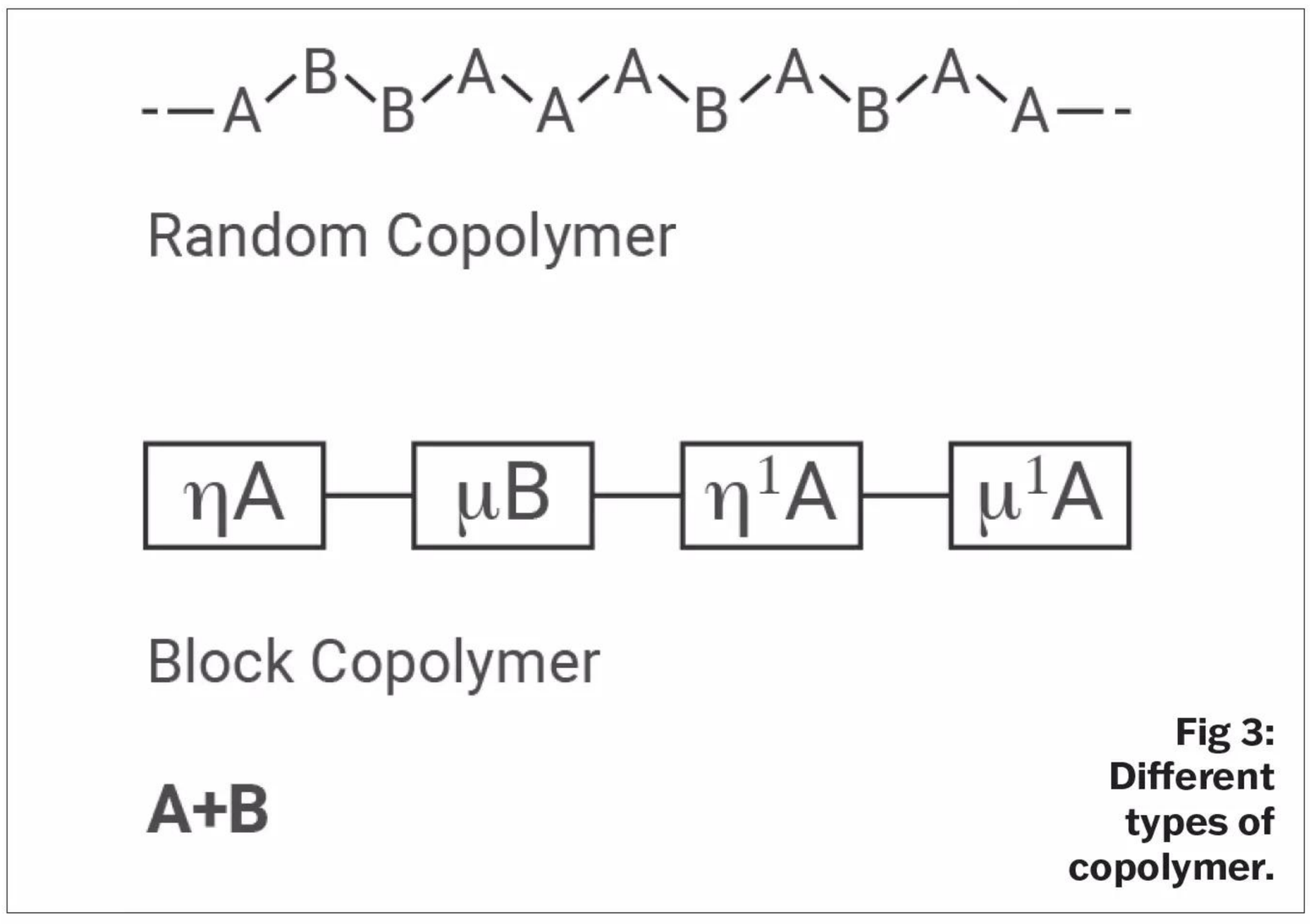


Fig 3: Different types of copolymer.



Photo 2: Turning virgin poly ether ether ketone (PEEK).

but there are grades of polyethylene.

Metals are much more professionally defined. I can order a bar of my favourite grade of aluminium alloy, 2011T3 or 6061 T6, confident that it will turn exactly as expected and I don't have to worry who made it, where or when. Similarly for brass - grade CZ121 is an excellent turning grade, always.

Some of us have bought lumps of metal at the shows, even though the stall holder didn't know the grade, and have found out that our purchase was rubbish. I have done this and finished up with aluminium tube of absurd softness, almost valueless! My own fault. As we all know, always buy from a stockholder who will specify the grade of the metal you plan to buy.

Buying polymers is even more fraught than chancing your luck at a show. You must buy from a respected supplier and buy the precise grade you know well from experience or take recommendations from colleagues who know what they are talking about. If you don't, do not be surprised if the material you have sourced won't behave the way you expected.

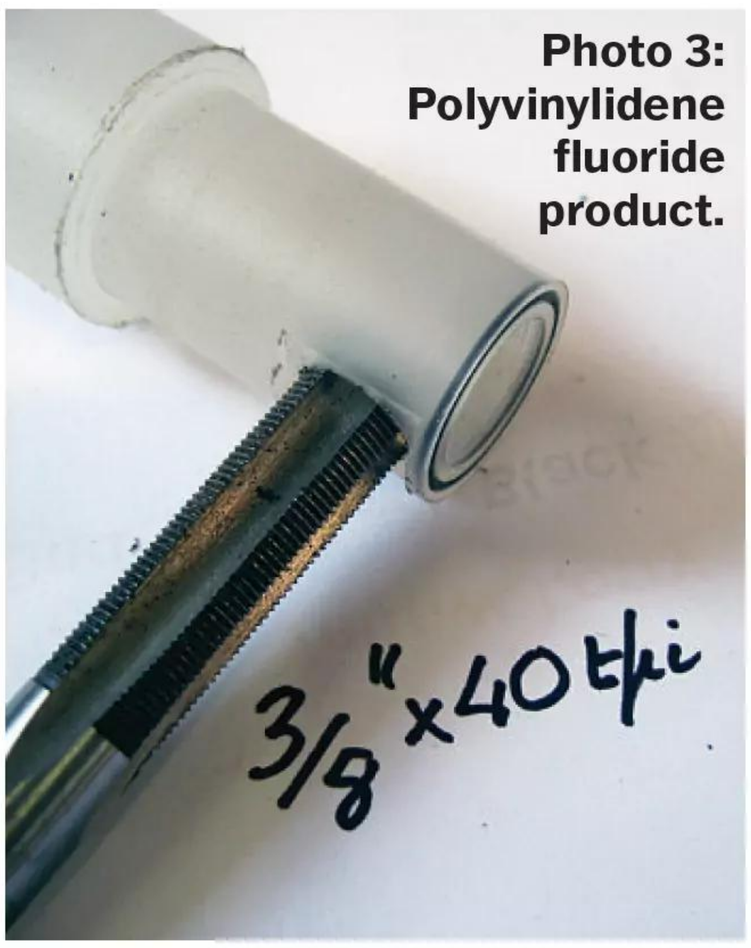


Photo 3: Polyvinylidene fluoride product.

It would be nice, from my point of view, to survey all the polymers that are commercially available, telling you about their clever and not-so-clever properties, but I will desist; it would bore you all! I will confine myself to a personal and hence ridiculously confined selection of machinable polymers and composites (composite sheets and rods). I will then finish with a very brief survey of available flexible polymers that have relevance to model engineers; tubing, O-rings and the like.

I will deliberately leave out paints, adhesives coatings and sealants and also foams but will include some information on ceramics.

MACHINING POLYMERS AND COMPOSITES

Machining virgin polymers, that is polymers containing no fillers (see below) is straightforward if you select the right material but some are horrible to handle.

Let us here define what I mean by 'virgin polymers' and composites. Virgin polymers are pure polymers, pure but will contain additives to give them colour or resistance to degradation due to oxygen or sunlight. Composites are filled with aggregates. These can be simple powdered talc, clay or even chalk or various types of fibres. These can be bundles, individual fibres and of various lengths. Since these aggregates are invariably more rigid that the surrounding matrix of polymer, the composite is always stiffer than the virgin material.

Returning to the main script, acetal (also called Delrin or polymethylene oxide) is a gem to machine. The surface finish is excellent and it is very easy to drill. It is not particularly strong but, in the right place, it can be very useful. You can use fast turning and milling speeds but go easy with the depth of cut. Light and fast is safest.

Tapping threads straight into Delrin is realistic but the thread length should be at least twice the nominal screw diameter. Brass inserts are available for Delrin. They are designed to pull into a hole less in diameter than the knurled outer surface of the insert. I have used them but found them a bit over the top for most purposes, **photo 1**.

Let us consider in a little more detail the use of metal screws threaded directly into polymers. Most engineers frown on the practice unless coarse Phillips-type self-tapping screws are used. My experience is rather different from the professionals.

Course threaded tapped holes work well in rigid polymers, but the threaded length must be at least twice the nominal diameter. Hence, 6mm of M3 is a minimum. This is not because of the modest tensile strength of polymers but rather, it is the low tensile modulus. A threaded metal will be much more rigid than the surrounding polymer, so it is essential to spread the stress over a long run of threads to prevent stripping.

An example of a hard-to-handle virgin polymer is ABS (acrylonitrile butadiene styrene). A material formed of short blocks of three polymers. It is very widely used as a mouldable material, but machining is a pain. The polymer tends to melt and stick to the cutting edge of tools. Why? In all machining operations heat is invariably generated but polymers are excellent thermal insulators. As a result, temperatures rapidly rise around the cutting edge and these materials are thermoplastics, that is they melt. Similarly, polycarbonate and most grades of polyethylene and polypropylene need very careful handling. On the other hand, some fluoro-polymers machine well and so does polyether ether ketone (PEEK), **photo 2**.

The fluorine containing polymer you are likely to encounter is polytetrafluoroethylene (PTFE). This material is unique in that its coefficient of friction against almost anything is very low. It can be used in sliding components unlubricated or wet with water. It resists almost all chemical environments and it machines moderately well but I have encountered a problem with dimensional stability. PTFE undergoes a slow molecular structural change close to room temperature. The change alters its density, so its dimensions can drift. Heating in an oven at 100 degrees C before machining usually removes this problem. This can also arise in other polymeric systems for other reasons given see below.

Before we move on to composites, let me repeat a very serious point; the stiffness of polymers is always less than that of metals. These very different materials may have acceptable

strengths for your purpose but always remember that the polymer will flex much more than will a metal under stress - the stress over strain ratio. Young's modulus is lower. On the other hand, almost all polymers are very low in density. As an inevitable result, the strength (and rigidity) per unit weight is not as low as one would assume.

If you are going to make a component in a polymer rather than a metal, be more generous with the material and allow a bit more thickness around stress points. The density of virgin polymers lie around 1.0 to 1.2g per cc. Fluoropolymers are much denser because they contain heavy fluorine atoms, at 2.3g per cc. To complete my comments on fluoropolymers, my favourite is polyvinylidene fluoride. This material machines superbly, **photo 3** - the picture says it all!

COMPOSITES

As we have seen above, composites are matrices of polymer containing a range of powdered 'fillers' such as ground chalk, talc or glass. The glass can be introduced as bulk or even fibre yielding 'short strand glass fillers'. Most fillers are not chemically bonded to the polymer matrix so when the material fails the fracture takes place at the polymer filler interface. Remember the filler particles, however fine they may be, are huge compared with the polymer molecules surrounding them. The result is that the tensile strength of such a composite is often less than that of the polymer itself, but the composite is stiffer and harder, often exactly what is wanted in a machinable grade.

It is possible to chemically bond the polymer matrix to the filler producing outstanding strength. The best example is vulcanised rubber. The rubber polymer (cis polyisoprene) is mixed with carbon black (ultra-fine, specially produced soot) and sulphur. The mix is moulded into a shape, such as a car tyre, and heated. The sulphur bonds to the polymer frequently along its chains and to the surface of the carbon black particles. You can't separate the carbon from the rubber once it is vulcanised. The composite has outstanding and controllable elasticity and strength allied with great tear resistance (even at 200mph plus in a tyre). A triumph of chemical polymer engineering. One can also align the filler producing unidirectional strength and rigidity. Familiar examples of a matrix of glass fibre surrounded by rubber are the V-belt and the toothed belt.

My favourite polymer is polyphenylene sulphide loaded with 40% glass fibre hence it is a composite. It's a bit expensive but worth every penny. As my father would have said, "cuts like cheese". Superb finish and hard. The modulus is high so 2mm thick discs ring if dropped onto a hard surface. The material withstands high temperatures and is recommended for valves and seatings and will safely operate to above 250 degrees C, **photo 4**.

PROBLEMS WITH CRYSTALLINITY

May I please ask readers to return to density – crystallinity and dimensional stability.

Polymers supplied to us, ready for machining have always been produced in a chemical plant, pelletised, melted and, in appropriate cases, mixed with a filler and then either rolled or extruded to form rods. The product is made as quickly as possible because time is money. All of this manipulation means that internal stresses lurk waiting to catch out the unsuspecting. Polyamides loaded with glass fibre - glass filled nylons (GFN) - are popular, machinable materials available in rods up to large diameters and sheets up to 30mm plus in thickness. Rod is notorious, particularly when large in diameter, because the core is under negative pressure. Why negative? As the polymer is extruded and then cooled the outer surface freezes first. The inner material freezes more slowly but the density of the solid material is higher than the melt. This is the opposite of the milk bottle containing frozen milk which tries to escape from the bottle because ice has a lower density than water. Thus, if the GFN rod is machined without annealing, the centre will crack, usually making the component useless. In the polyamides the glass fibre filler increases the rigidity exacerbating the problem. The maker's recommendation is to heat the rod before machining and to keep it hot until you are finished. Thank God for the hot air gun, **photo 5**!

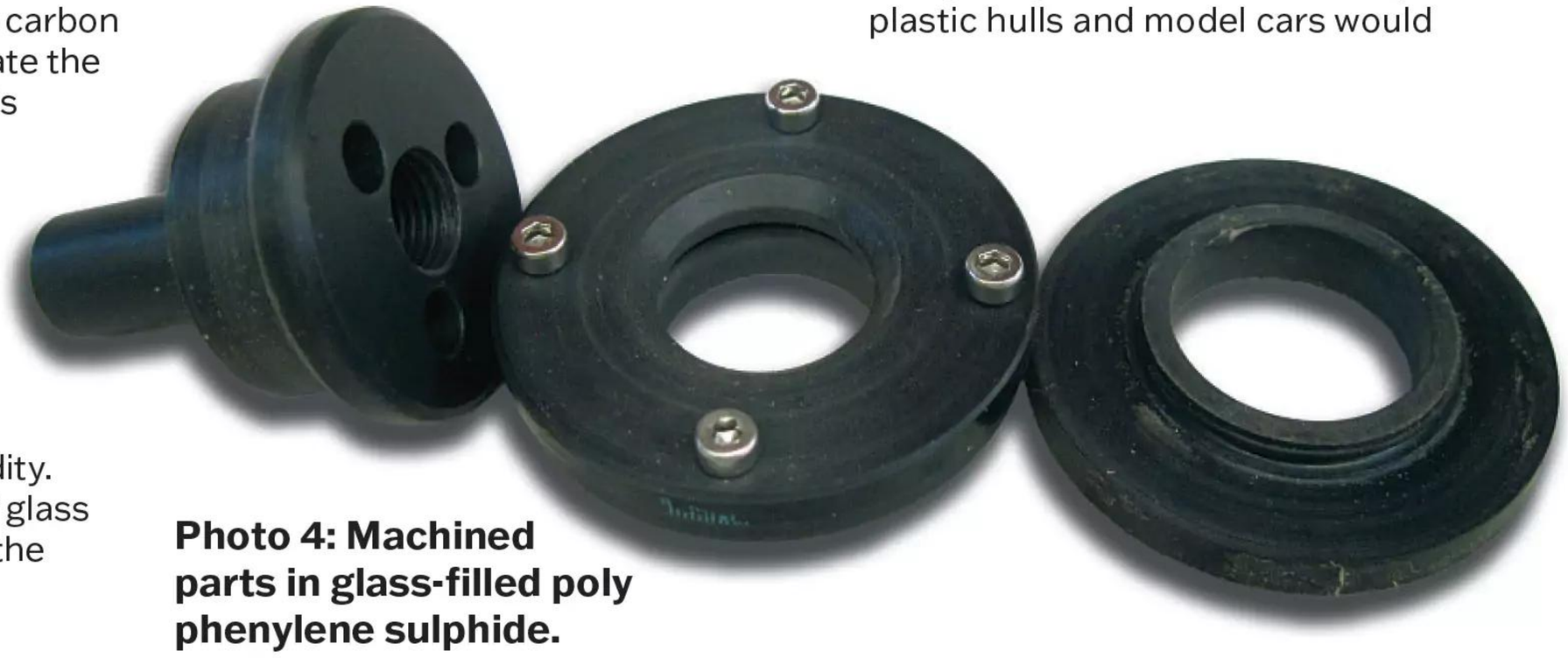


Photo 4: Machined parts in glass-filled poly phenylene sulphide.

ORIENTATION AND DIMENSIONAL STABILITY

Most readers will be aware that car tyres contain fibres, usually laid around and across the circumference of the tyre underneath the tread. The steel and glass fibres provide stability. This technique is also utilised in laid-up fibre mouldings to produce such products as boats, big and very large, or wings on Formula One cars. By using fibres made of crystalline carbon surrounded by epoxy resins (see below), incredibly light, rigid, strong elements can be devised. Our aircraft modelling colleagues use carbon fibre rod and sheet very widely and particularly as sheet. Readers should be considering using it as a replacement for metals far more widely than it is. Carbon fibre sheet is incredibly strong and stiff and it doesn't dent! Also, carbon fibre composites are very low in density.

All good things have a catch associated with them. Polymer sections are, in effect cast, but the casting process is not the same as casting metals. Molten metals have low viscosities. Molten polymers are as viscous as golden syrup up to that of hard, tooth-ruining toffee when they are melted and hence extruded. In order to get them into moulds the molten polymers are injected at pressures in the thousands of psi (up to a couple of Kilo-bars). Further, time is money, so the maker cools the melt as rapidly as possible before ejecting the product. An alternative manipulation is to extrude the polymer continuously, again at very high pressure, cooling the rod, film or section as fast as possible.

Sheets of polymer can be formed into hollow shapes by vacuum forming. Plastic baths and model boat hulls are made this way, **photo 6**. Modern 'ready to fly' model aircraft, cheap plastic hulls and model cars would

never be the same without them. The molecules are always aligned during the stretching involved in the shape-forming process. This problem also crops up when polymers are injection moulded as well and can appear when a bit of stray heat is around! As the material softens, the molecular orientation distorts the product irreversibly. During injection moulding, the polymer is forced as a viscous melt through the mould and then violently cooled before removal. The flow inevitably results in frozen-in orientation of the molecules.

RIGIDITY AND STRENGTH

All good engineers know that strength and rigidity are not closely related, but somehow, they sometimes seem to get muddled up. The polymers we are concerned with tend to be ductile and not brittle. Perspex doesn't particularly like being abused by flying bricks, but masonry simply bounces off polycarbonate. Thus the Police favour polycarbonate for their riot shields - another property of polymers worth mentioning, but only as an aside because it is unlikely that readers will exploit it.

Nearer the end of this piece, I offer a short account of plastic deformation and the production of high-tensile fibres.



Photo 5: Problems when machining glass-filled nylon.

THERMAL RESISTANCE AND OTHER LIMITATIONS

Polymers have a well-earned reputation for being useless when real high temperatures are about. Components distort and even collapse and melt into a sticky goo at even modest temperatures.

There are, however, some materials that can be used at quite elevated temperatures. They are so-called 'engineering polymers' and are available as rods and sheets but tend to be expensive. Glass-filled PEEK, PTFE and polyphenylene sulphide are worth considering. Almost all have really useful properties and are easy to machine. Yes, they are expensive but so is brass.

A relatively cheap polymer, widely available and trustworthy to at least 160 degrees C is glass-filled nylon (GFN). There are many different polyamides, 'nylon' for short, they have a range of properties but most of the readily available ones are useful. They do have a pair of limitations. Polyamides absorb water (up to about 2%) and hence are not precisely dimensionally stable. Also, they don't like acidic environments. I have not found either limitation to be a problem, but in my scientific instrument work, I have seen machined GFN components crack because they have been exposed to strong acids as vapours.

Polymers as a group tend to have higher thermal coefficients of expansion than metals. Coefficients for metals normally lie in the range of 10-25 x 10-6, virgin polymers several times greater. Glass-filled composites have much lower coefficients, for example my favourite, polyphenylene sulphide, has a coefficient of thermal expansion of 3 x 10-5 but its 40% glass-filled composite has a value around 1 x 10-5, close to that for steel.

To be continued

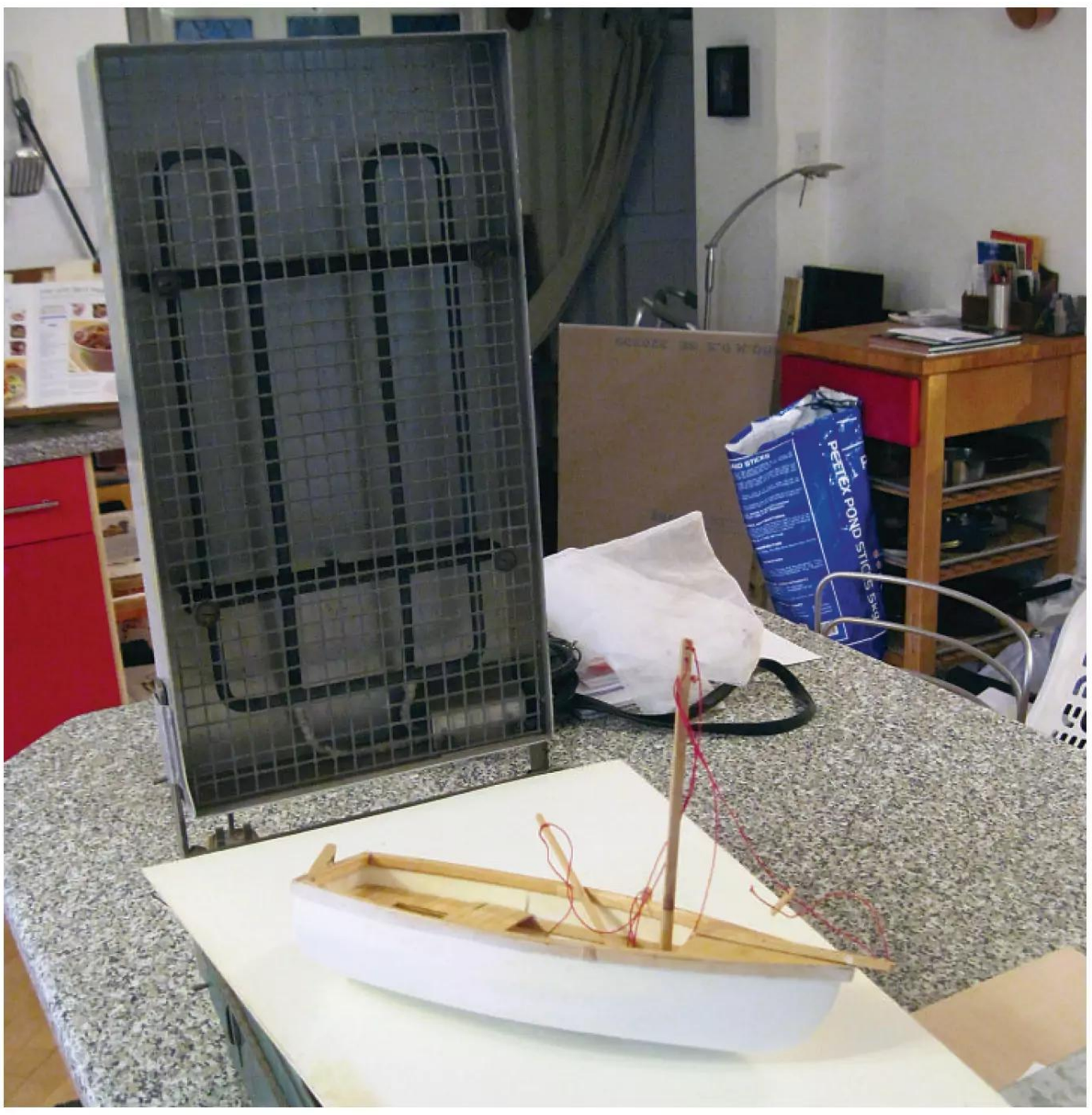


Photo 6: Vacuum forming a boat hull. The hull of the boat was made on this machine. The heater is vertical. The manual pump sucks air from under the softened film placed over a wooden mould.

Garden Railway Specialists

5 Inch Gauge, Coal-Fired, Kingscale Locos

'Gresley A4' 'Golden Eagle'/Apple Green **£14,995.00**
'Streamlined Coronation', LMS Blue **£14,995.00**
3F 'Jinty', 2 available, BR and LMS **£5,495.00**
'Gresley A3', 2 available, 'Flying Scotsman' BR Green and Apple Green **£13,995.00**









GRS Open Day 2025

20th & 21st Of June, 10am-4pm

Featuring both our digital and live steam layouts, a big sale across the shop & talks from LGB representatives.
We look forward to seeing everyone





Station Studio, 6 Summerleys Road, Princes Risborough, Bucks, HP27 9DT
E-mail: sales@grsuk.com Website: www.grsuk.com Tel: 01844 - 345158
Monday - Friday 09:00 - 16:00hrs Saturday 10:00 - 16:00hrs

HOME AND WORKSHOP MACHINERY

144 Maidstone Road, Foots Cray, Sidcup, Kent, DA14 5HS
Tel: 020 8300 9070 - evenings 01959 532199
website: www.homeandworkshop.co.uk
email: sales@homeandworkshop.co.uk
visit our eBay store! almost 8000 items available; link on website;
homeandworkshopmachinery


Check out our eBay store!



Micrometers, bore mics, clock dial indicators + stands etc.


Tool and Cutter Grinder 240V R8 collets £575


Colchester Bantam 2000 lathe (long bed) metric leadscrew, Dickson post £4950



Stanier precision vice 55mm jaw New / New Zealand £195


Boxford AUD Mk111 5" x 22", rare Griptru 3 jaw, DRO + inverter £4250


Harrison L5, M250, M300 Colchester Student 1200 / 1800 + A&S 1ES gears


JET GH1440 lathe from art college in very good order complete £5750



Myford Super 7B Connoisseur centre lathe + Tesla inverter, DRO, stand, tooling £9750


Myford 254 PLUS IMP 240V 'very nice' with rare D-13 head £7250


Super 7 lathe 'very nice example!' £3450

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


Colchester steadies!

Worldwide Shipping

POWERED BY barclaycard

Working on the Lathe: Drilling and Boring

Neil Raine concludes his series with an overview of the development of drilling and boring technology.

PART 8

The first important contributor to the development of tools and machinery for drilling and boring metal was the industry of munitions and armaments. Most weapons are effectively a strong, straight metal tube that is designed to withstand detonation of the explosive within. It is highly unlikely the first examples made were precisely bored to enable the accurate firing of the projectile.

It seems likely the shaving or boring of iron cannon barrels was undertaken at least as early as the 16th Century. Displayed at the Anne of Cleves House Museum in Lewes, Sussex, there is exhibited a cannon, possibly from that period, complete with a genuine boring tool 11' long (not recovered from the same site) that sits upon on a modern reproduction wooden frame designed to align and move the cannon relative to the tool. The energy to rotate the cutting tool was either manual, or perhaps horse powered. There is, however, no guarantee of the accuracy of this assembly.

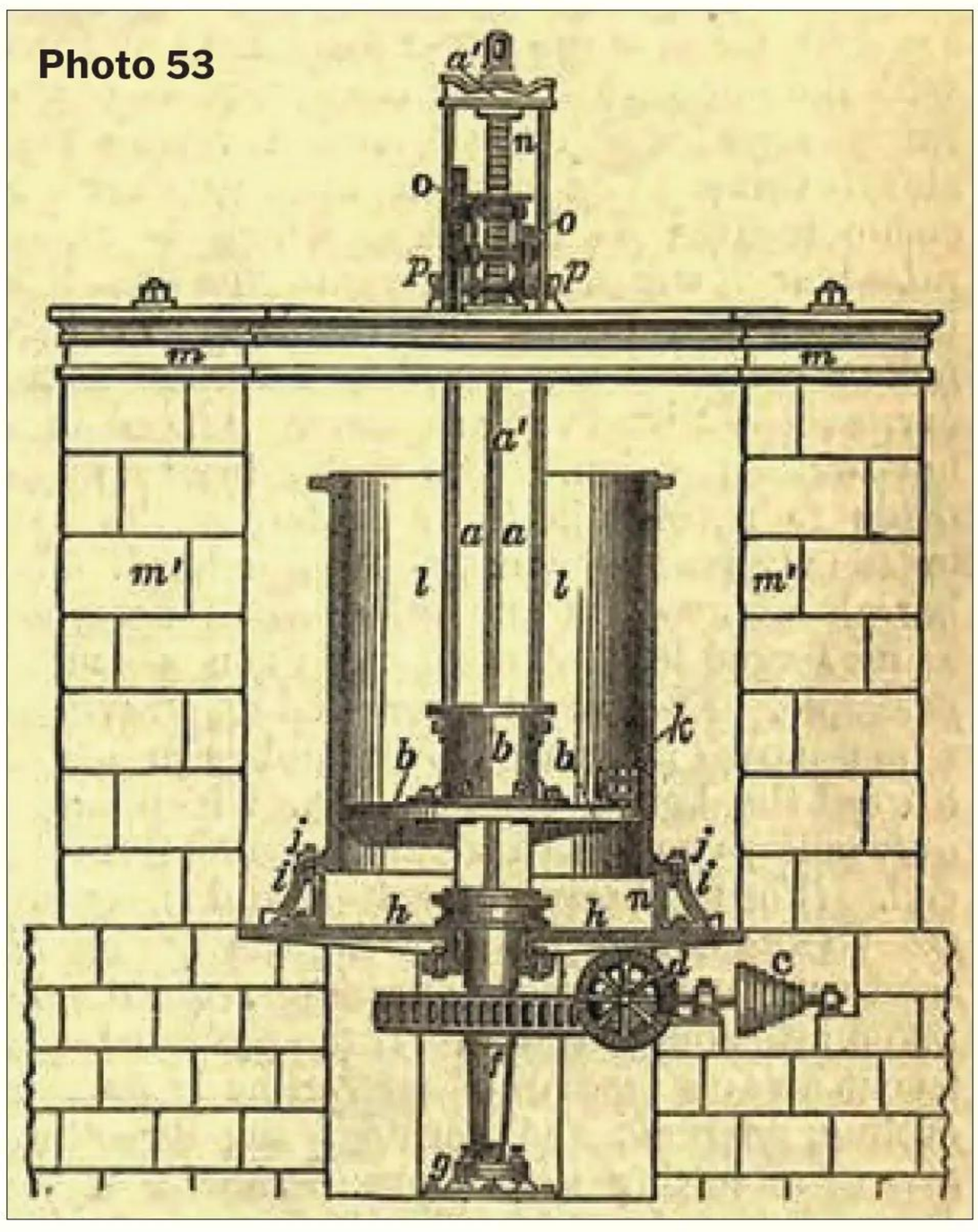
More definitive evidence comes from patent records. In the year 1716 a British patent was awarded to James Puckle for a portable gun or machine called a 'defence'. This is regarded by some to be the first, albeit primitive, machine gun, **ref. 11**. From the drawing contained within the patent, the gun resembles a large revolver supported by a tripod. There is no information about the method of how this device was manufactured, but it is unlikely to have been made without any engineering machinery. Around one-hundred years later in the year 1818, in the United States of America, Sylvester Nash listed a patent for a gun-barrel-lathe. Although there is limited information, there is a drawing of the lathe that is described as a 'machine for turning musket barrels', **ref. 10**.

Between the years 1716 to 1946, one source lists a total of 125 patents awarded in the category of armaments, in the USA and UK combined, **ref. 21**. From these, only seven specifically relate to the invention of tools or machinery used to manufacture armaments. As an example, one patent is entitled *Making Cannon Balls. Improvement in Lathes for Turning Spherical Shot and Shell*, ref. 5. The likelihood is high that the munitions and armaments industry, together with warfare generally was a significant force for the development of engineering machinery used for boring and drilling, as it is for many other technologies too. There is also the probability that the boring of cannon barrels began much earlier than is documented.

In addition to the patent record, other valuable resources provide a fascinating insight to the processes of manufacture of armaments and military transport undertaken within the past 150 years. Many of these films can be found by searching the archives of British Pathé Films on various media platforms, **ref. 22**. A particularly interesting example is *The Making of an Armstrong Gun*, by Sir W.G. Armstrong Whitworth and Co. Newcastle-London, between the years 1920-1929. The manufacturing process is shown from start to finish including both turning and boring stages. The scale of engineering is remarkable and the accomplishments of these skilled engineers and workers deserve to be remembered and appreciated.

Although technology tends to progress steadily there are often significant identifiable forces that drive it forward more quickly. Other contributors to the development of tools for drilling and boring metal include the production of the steam engine and steam locomotive, the motor car, ocean liners and other ships made from iron. The first recorded patent awarded for a drilling and boring machine was awarded in 1802 to Michael Billingsley, John Sturges and Co., Bowling Ironworks, York, UK, ref. 1. Although there is limited written information to accompany the patent, there is a drawing of what appears to be a considerable large vertical boring-mill. The patentee, Billingsley, wrote:

Photo 53



'The cylinder intended to be bored shall preserve a vertical position... by which means I permit the sand and borings from the face of the metal to fall down, instead of occupying one side of the cylinder, and wearing away the edges of the cutters, ibid.'

This description implies superiority to the alternative arrangement of using a horizontal boring-mill when the debris from cutting would be predicted to collect at the base of the bore.

Billingsley's mill offered significant advantages:

"Boring machines were made to avoid the bulging of the sides of cylinders when placed horizontally, as this was the main impediment to good boring; they also avoid the deflection of the boring bar. They require much less power than lathes to do the same work, and have several other minor advantages", ref. 13.

At one time, many industrial engineering firms will have owned a vertical boring mill similar to Billingsley's. These enormous machines were built into the fabric of the building and often spanned two floors. Perhaps the largest of these were used to bore steam-engine cylinders for ships.

Nasmyth, Gaskell and Company, (formerly The Bridgewater Foundry), was founded in 1836 by James Nasmyth and Holbrook Gaskell. The company was located in Salford, UK.

'Messrs. Nasmyth, Gaskell and company constructed the boring mill represented in fig. 1 for the purpose of boring the large cylinders, 10 ft. in diameter, for the Great Western steam-ship navigation company's vessel the Mammoth, at their works at Bristol', ref. 13.

The company constructed the boring mill represented in **photo 53** in their Bristol works to bore the 10' diameter cylinders of the steamship *Mammoth* for the Great Western Steamship Navigation Company, **ref. 23**.

Throughout the period of the Industrial Revolution, UK shipbuilders and locomotive works used enormous industrial machine-tools. There is one description of a lathe manufactured by Messrs. Galloway of Manchester that was capable of a 72-inch swing over the bed of a lathe that was 50' long by 9' wide. The headstock could be fitted with a faceplate that was 10' 3" in diameter. The total weight of the machine was 130 tons. Drive shafts for steam ships were turned in lathes such as this, ref. 6. Another equally massive machine was described by Haldane (1893): *A gigantic engine (lathe) capable of taking between its centres a 120 ton gun, and costing £6000 to £7000. In this case, eight tools may be employed at one time, each of which will take a cut 1½" deep in tough steel, thus removing about two tons of metal per hour*. ibid.

Machine tools like the ones described above have all but vanished now, certainly from the UK. These must have been a spectacle to see. It is fascinating to know that the processes and methods used on any small engineering lathe are very similar to those used on the enormous machines of the Industrial Revolution, 150 years ago.

SUMMARY

The related actions of drilling and boring metal can be challenging to complete precisely. When used together, the individual limitations of drilling and boring are cancelled making these perfect allies. With the option of many different machine-tools, related tooling and a variety of approaches, the most suitable solution is not always obvious. To successfully drill or bore into components of varying size, shape and complexity, each machine-tool has strengths and limitations. Among these, the lathe stands out because of its versatility and multi-axis alignment possibilities.

References (Where an online version of the publication is available the link is shown beneath).
21. Rucker, K. vintagemachinery.org
22. British Pathé www.britishpathe.com/
23. The American Cyclopædia, 1879.

The Brighton Gallopers

I recently visited Brighton for a short break, it was great to see the 1888 'Golden Gallopers' built by Frederick Savage of Kings Lynn, now nearly 140 years old. As well as introducing the innovation of powering roundabouts by steam, Savage also invented the mechanism for making the 'horses' move up and down. By 1875, the company was also producing agricultural traction engines and showmen's engines.

Neil Wyatt



Photo 141: Lubricator on a GWR pannier tank.

Doug Hewson looks at the lubrication of his BR Standard Class 2. 155 of these locomotives, known as Moguls, were built for British Railways.

The BR Standard 2-6-0 Class 4 Tender Engine

Continued from Model Engineer & Workshop issue 4765

PART 17

LUBRICATING YOUR ENGINE

I was speaking to a gentleman by the name of David Hudson at the Midlands Exhibition and admiring his 5 inch gauge BR Class 2. He had obviously not followed the drawings available as it was all built correctly. One thing I noticed on his engine were three little pipes that disappeared beneath the side platform, so I asked him what they were for. His reply came as a complete surprise; he said with twinkle in his eye, "These are for my atomiser". I said that I need an atomiser on my BR 4MT which I am designing so I asked what is inside it, to which David replied; "Nothing - you just need to direct the steam oil into the atomiser rather than the cylinders and fit pipes with live steam into the atomiser and then pipe the steam over to the valve bobbins and the live steam will do the rest." He obviously thought they were magic. I thought, right I am going to do the same on my 4MT. I then imagined a problem. If I am going use scale lubricator tanks, they will only last an hour or so. I had very recently read an excellent book on locomotive lubrication and one of the quotes from that book was that on an LMS 8F the lubricator pumps are set to deliver 1oz per 100 miles. That was a wake up call for me as I thought that most model engineers must use that amount in half an hour on the club track! I was also once, with a friend, on the footplate of 9681, a GWR pannier tank on the Dean Forest Railway and one thing which fascinated me was looking at the lubricator and watching the drops of oil going up the spout to the cylinders. There was only one drop of oil every second or third telegraph pole. That confirmed to me that we over oil our 5" gauge locomotives by at least twenty to one! This is probably why there is oil all over the track at several railways I have visited, including Gilling! **Photograph 141** shows the lubricator on 9681 which fascinated me.

Figures 61, 62 and **63** refer. I also decided that I needed to have a look

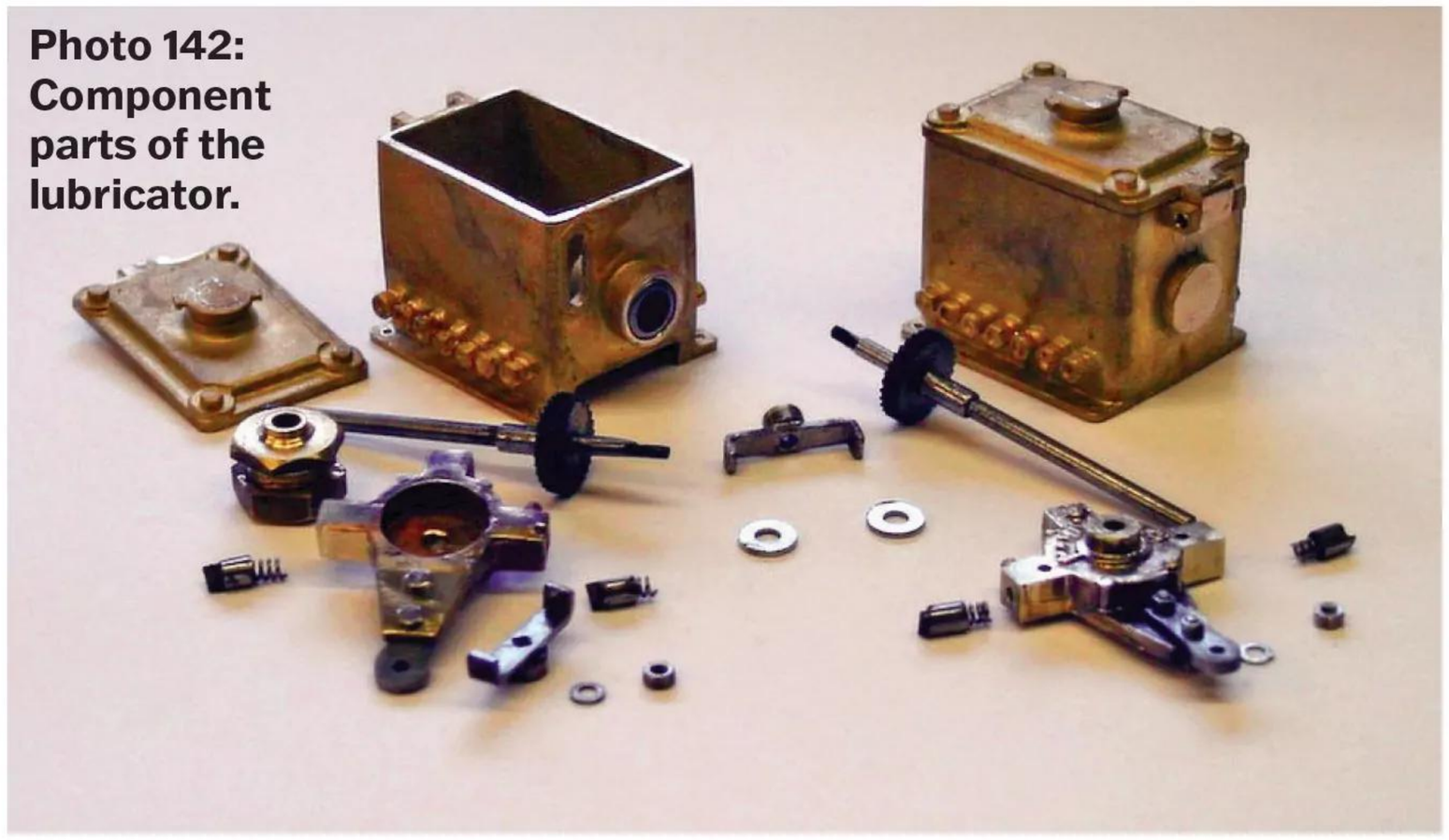


Photo 142: Component parts of the lubricator.

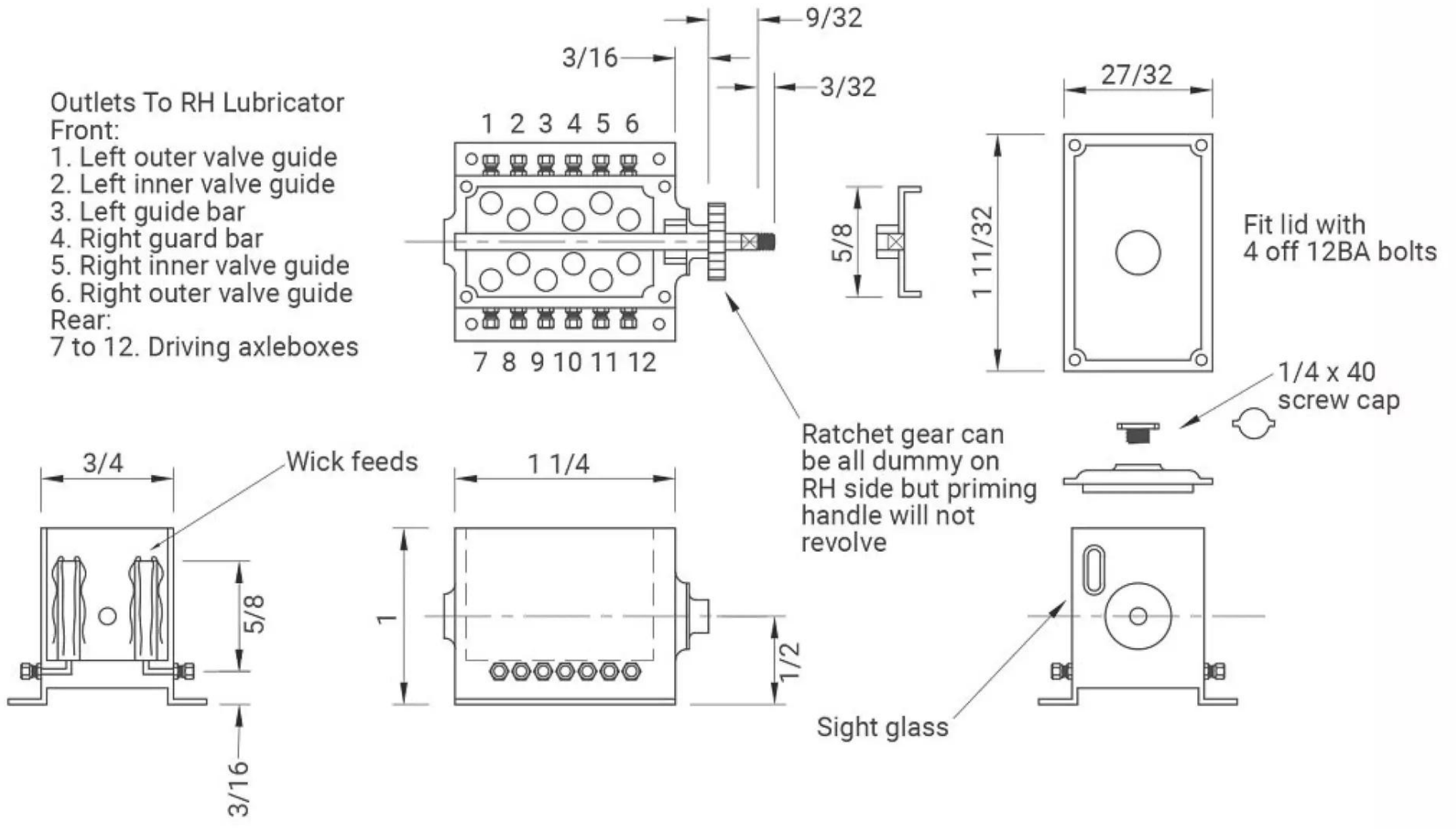


Fig: 61

at my lubricators to see if needed to reduce the output. The two lubricators on the Standard Class 4 just happen to be the same as on my 4MT so I took advantage of the fact that they have pawls dead opposite each other. The two pawls for each lubricator were made from 3/32" silver steel and I filed them to a chisel point as shown on my drawing. They need drilling out about No. 44 and furnished with springs from a cigarette lighter (if you can find one these days!). The shaft is also made from 3/32" silver steel. The fact that I used two pawls opposite one another meant that when the wheels revolve one turn, the ratchet only moves by half a tooth; the second turn of the wheel completes the movement to one ratchet tooth, thus using half the amount of oil … and if you have understood that then bully for you! I had also thought that I could reduce the size of the piston in the oil pump, but that might be a bit much for an engine 'running in'. **Photograph 142** shows all the parts of the lubricator with the pump body shown mid left, just below one of the lids. You also need to fit a 3mm sleeve immediately inboard of the ratchet wheel, but I would soft solder that on otherwise you will end up with a very brittle end and that would never do, now would it?! The two ratchets are also shown and they have one side filed flat and a 10BA screw on the outside to just touch the flat so that it can't turn. I found it a little awkward assembling the ratchets as the springs for those need to be in compression, so it was a three handed job.

Photograph 143 shows the valve I found was surplus to requirements. I wasn't sure whether or not the atomisers would over oil the engine, hence my introduction of the shut-off valve, almost hidden from view inside the left hand bracket. It just needs a 3/32" pipe to the atomiser tee'd off the tube to the drain cocks.

Another thing which I did was to modify the tank by fitting the lid with a stout hinge. The problem is that the lubricator is tucked that tightly under the boiler that it would be difficult to replenish the oil, especially the steam oil, so with the hinged lid it would be much easier just to pour it in, **photo 144**. I thought it would show the engine up rather badly if I were to build it with only one lubricator ratchet working so I made both of them work, just so no one would notice, even though it only has wick feeds in it. It is lovely when setting back on to a set of coaches all one can hear is the two ratchets clicking away and the hiss of steam.

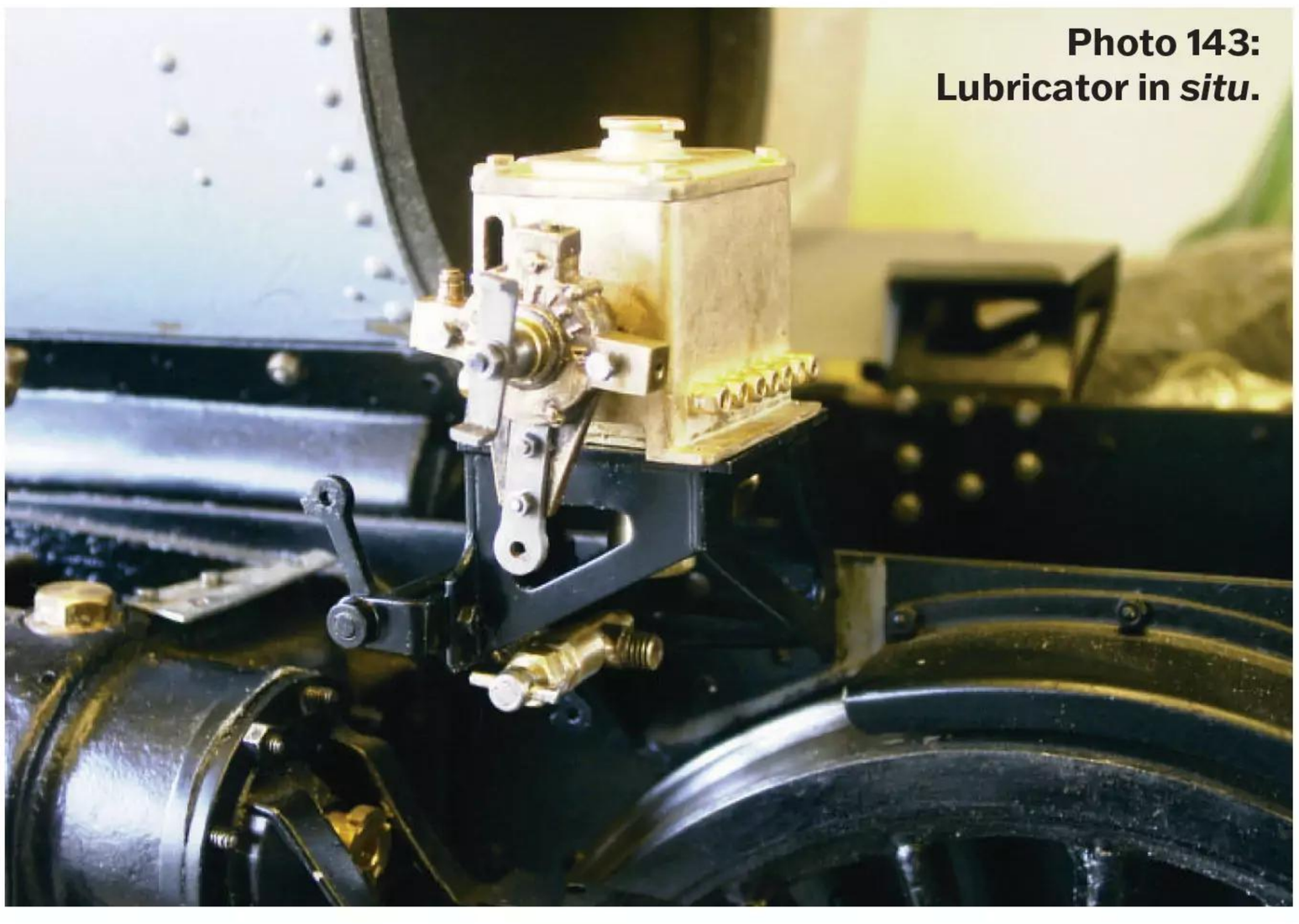
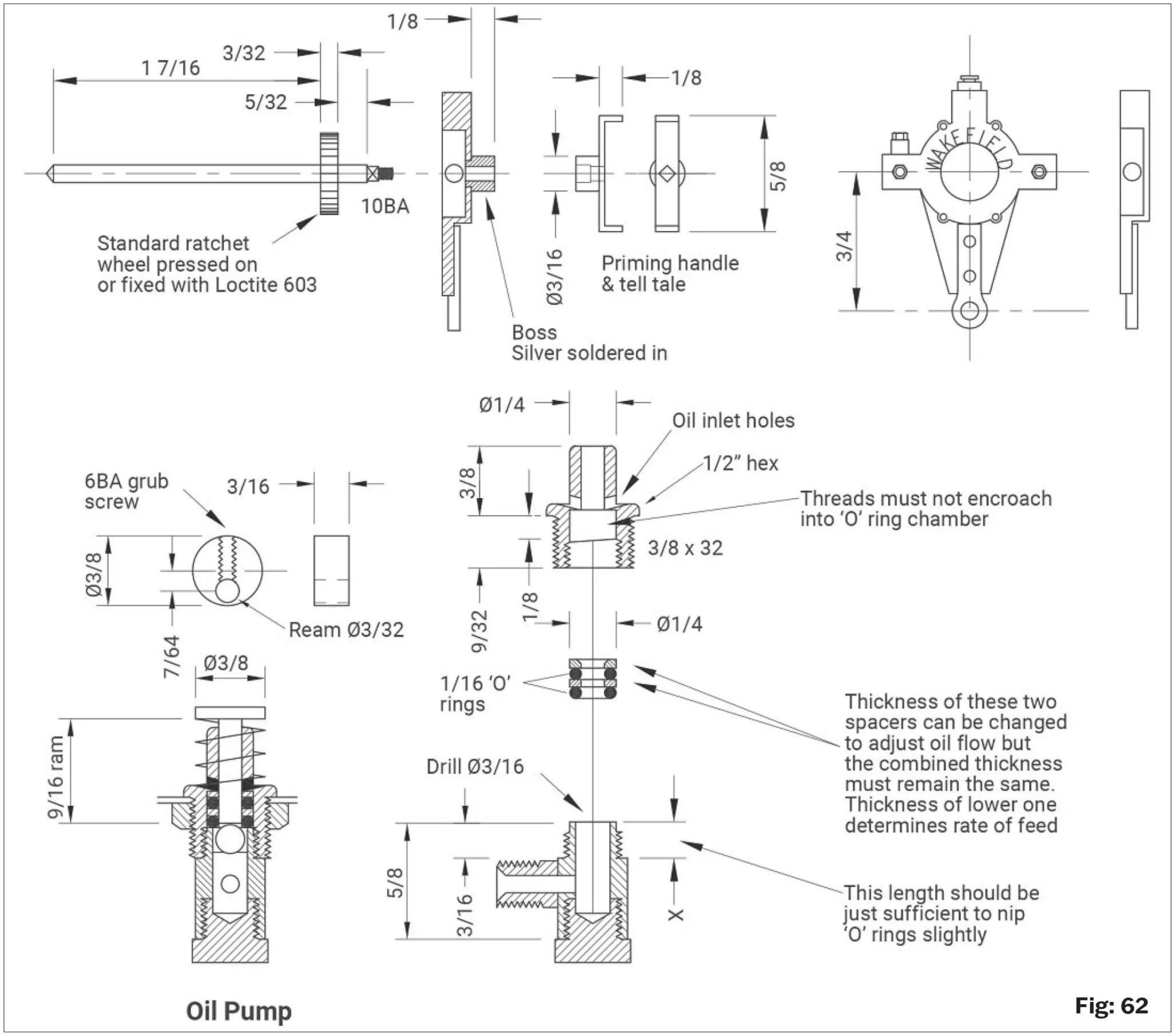


Photo 143: Lubricator in *situ*.



Oil Pump

Fig: 62

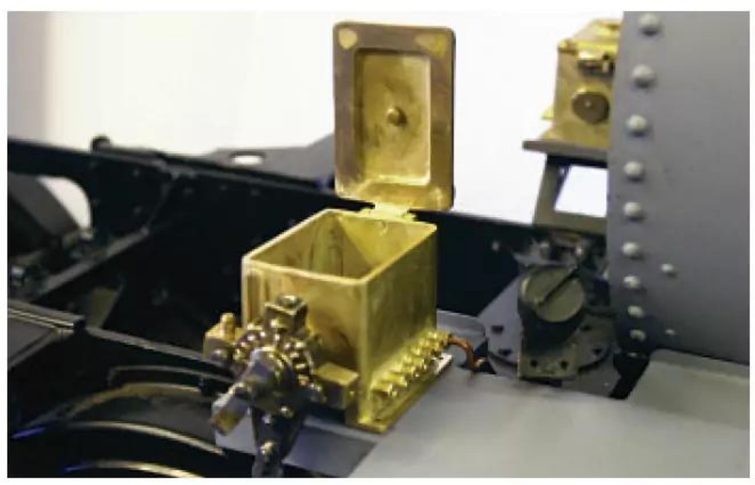


Photo 144: The hinged lid makes refilling easier.

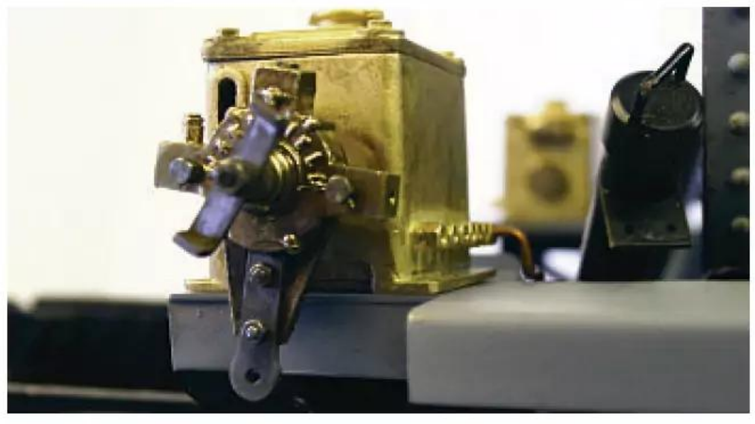


Photo 145: The right hand lubricator - at least it sounds nice!

Photograph 145 shows the right hand lubricator which is full of wick feeds but it does have the working ratchet! The pipes at the rear go to lubricate all of the axleboxes but, as you ought to see if you look closely, there is no connection between the pipes coming out of the lubricator and the pipes which go to the axleboxes. This was so that the lubricator could just be lifted off its platform without having to undo anything else. Unfortunately, I couldn't do the same with the front pipes as these go to the left hand side of the engine to lubricate the valve guides and slide bars.

One thing I didn't appreciate when I built my engine was the fact that the oil pipes to each of the valve bobbins need to be of equal length so somewhere under the side platforms you will need to make a double bend in the pipes to the left hand cylinder to make them the same length, otherwise you will have no oil getting to the right hand cylinder!

Another thing I used was a 1/16" tube to lubricate my valve rods and piston rods. With tongue in cheek I decided that I would drill through the unions where the piston rods etc. go into the cylinder block to see if they might work - and (big surprise) they did so that was another plus for my engine. I would encourage you to do that. One thing I did do when I had my shop in our local town, was to find a mill in Birmingham who would draw copper tube down to 54 thou diameter so I always kept a stock of thin walled copper tube from that size up to 1/4" diameter, in 1/32" increments and our customers loved that! I also used the 54 thou tube for lubricating my slide bars and valve guides and they all work. Eddy Gibbons, who has custodianship of my engine in at the moment, assured me that that after a day's running there is always a trace of oil on the valve rod and piston



Photo 146: My atomiser.

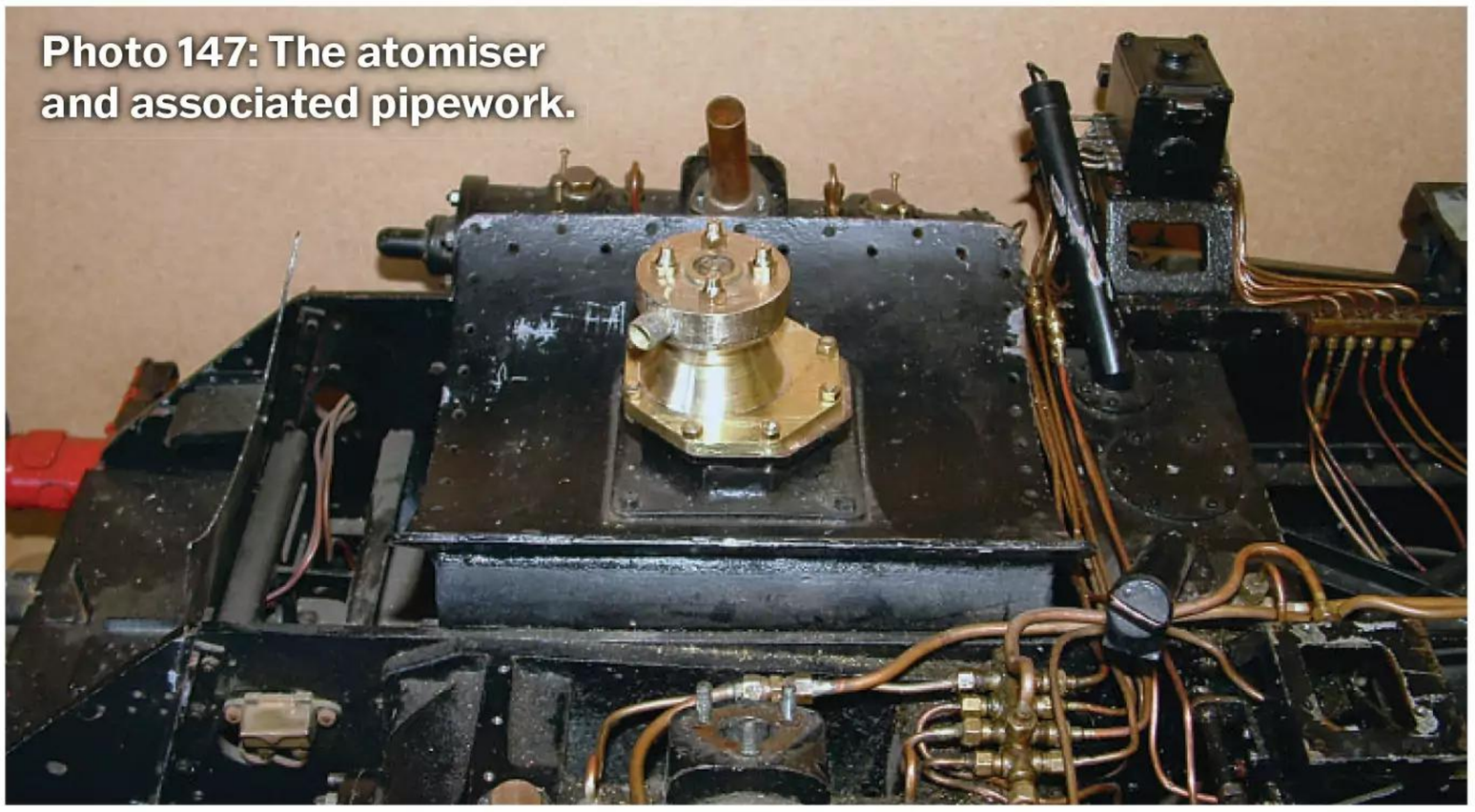


Photo 147: The atomiser and associated pipework.

rod and he also said that there is always a trace of oil around the blast pipe.

Photograph 146 shows my atomiser and yes, that is all there is to it. The body is just a piece of 3/16" rod with a 1/8" hole through it. Mine has four 6BA and four 5BA connections to it but you will need to fit all 5BA unions as you will not now be able to find 54 thou diameter pipe. They will also need a little more space between them as you will have to use 1/16" tube for all the connections. I will explain the pipework on this, the left hand side as the right hand side is more or less a mirror image. By the way, the pipes emerging from the outer ends of the lubricator are for the steam heating pipes which have a coil inside the lubricator so I just represented those as dummies.

Photograph 147 shows the atomiser on my 4MT which should be identical to the one on your engine.

1. The 3/32" pipe around the back of the cylinder steam inlet goes to the steam chest pressure gauge in the cab.
2. There are two 1/16" pipes over the valve bobbins which are second and fourth from the front from the atomiser and feed the oil and steam to the valves.
3. There is a 3/32" pipe which drops

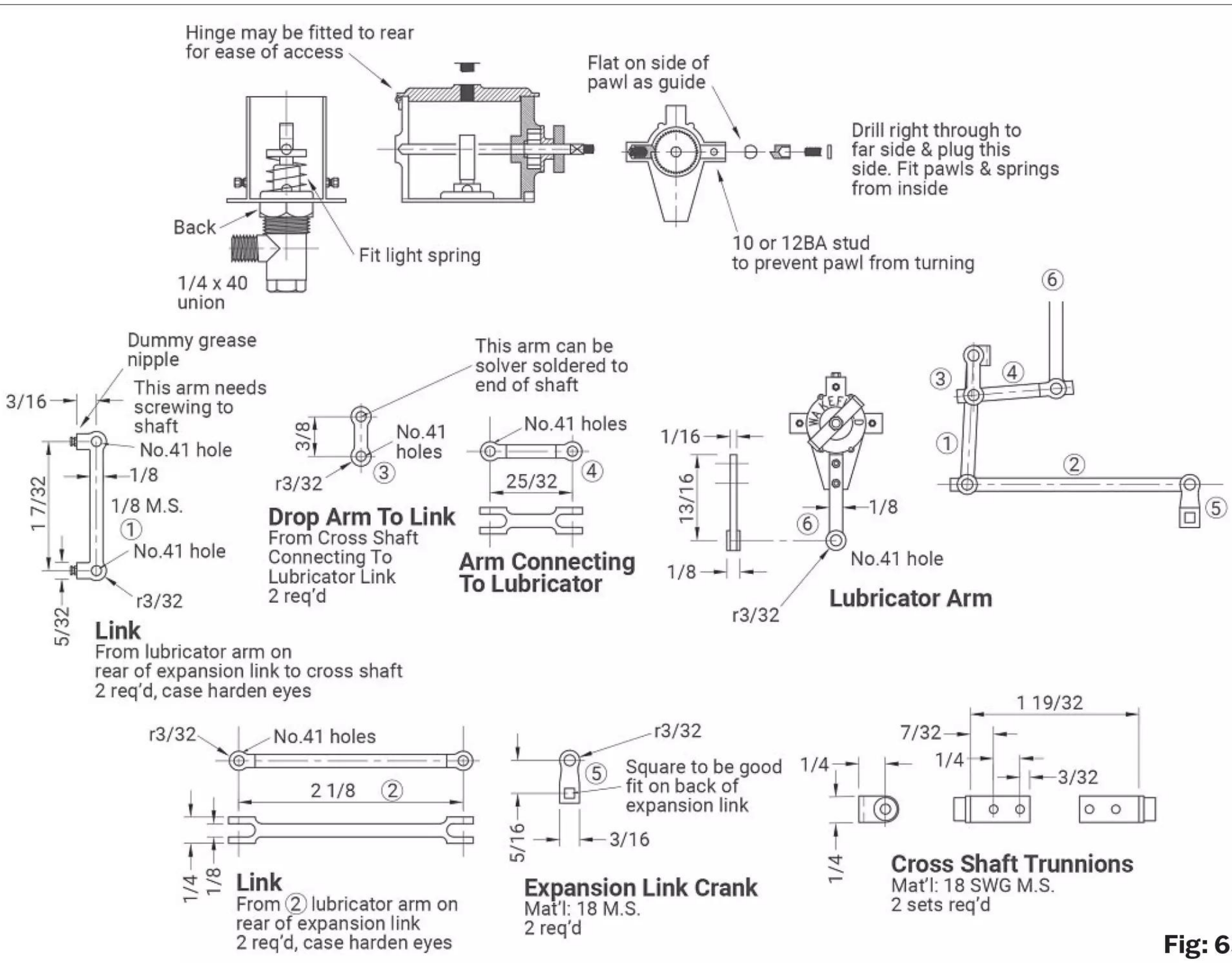


Fig: 63

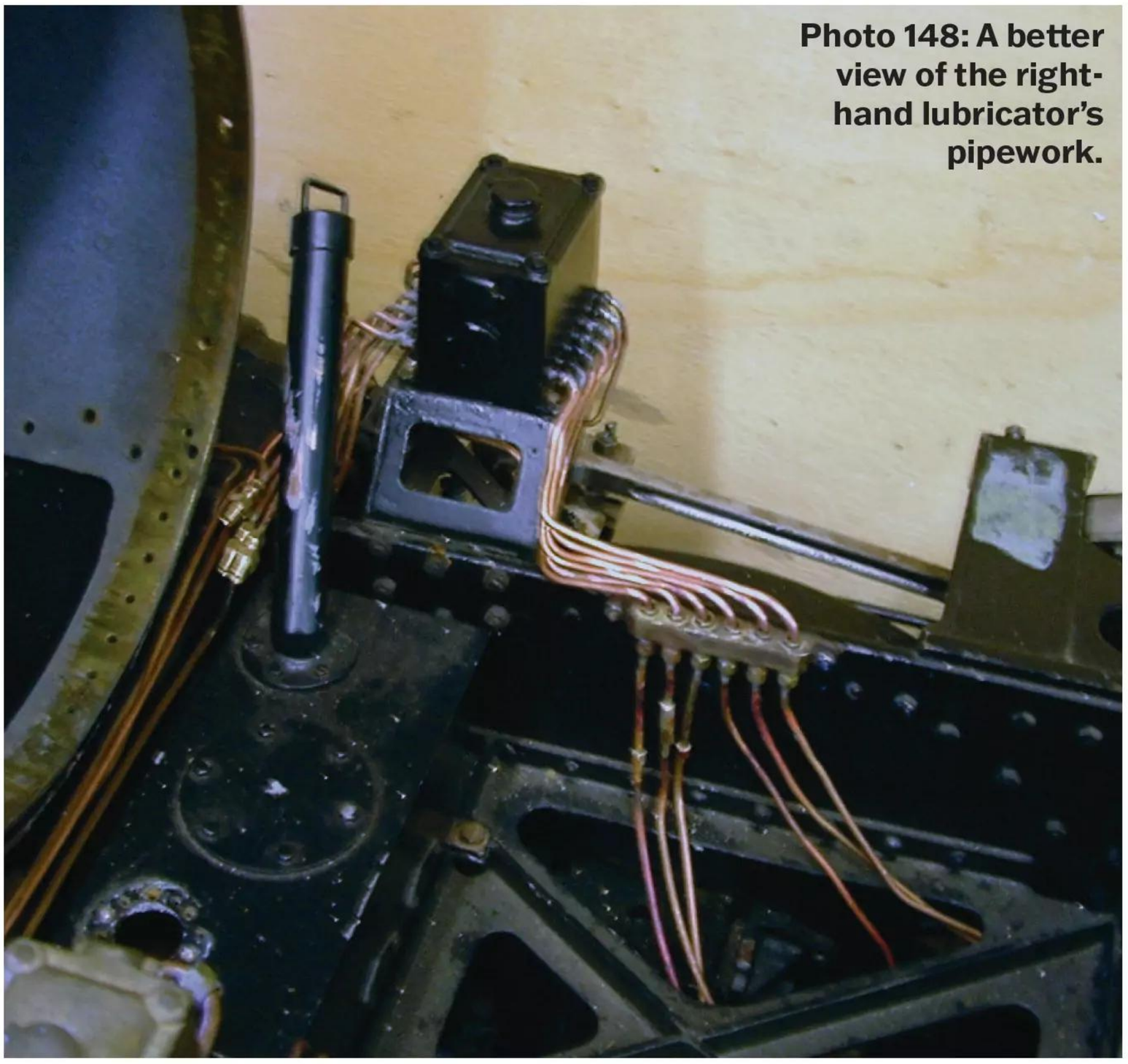


Photo 148: A better view of the right-hand lubricator's pipework.

down into the atomiser which is the steam which feeds oil into the atomiser.

4. There is a 54 thou diameter pipe which runs from terminal 1 to feed the valve spindle gland.

5. There is also a 54 thou diameter pipe from terminal 3 which feeds the piston rod spindle gland.

6. There is a 1/16" pipe to the front of the atomiser which is the steam feed into the atomiser. This comes from a tee off the cylinder drain cock feed. The four feeds off the right hand side all do a similar job on the right hand side of the engine. All are fed with live steam into the atomiser so the drain cocks must be left open when the engine is standing. You will also notice the double swab boxes on the outside of the frame plates that lubricate the pony truck and there is a triple one on the right had side which has pipes to the sliding blocks for the pony truck.

Photograph 148 shows a better view of the pipes from the right hand lubricator and photo 149 shows the general pipework between the frames. Once again the photo is of my 4MT but it should be virtually identical to your Mogul.

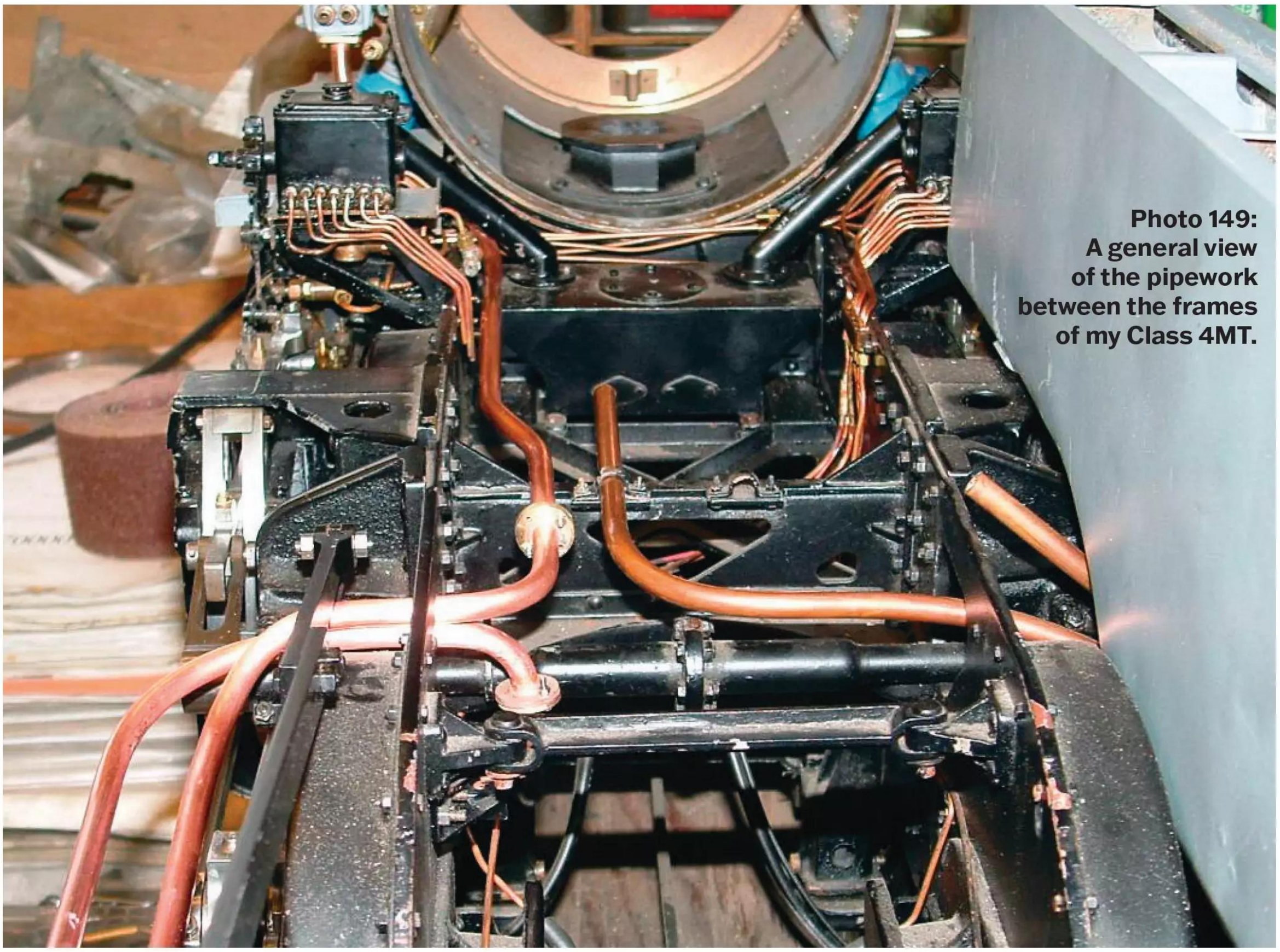


Photo 149: A general view of the pipework between the frames of my Class 4MT.

MODEL ENGINEERS LASER

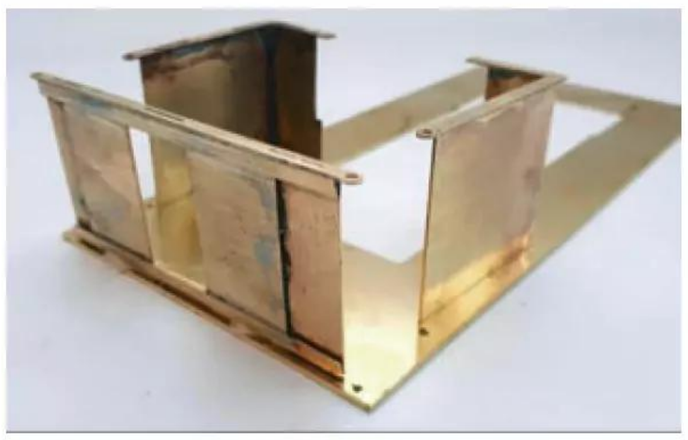
07927 087 172
modelengineerslaser.co.uk
sales@modelengineerslaser.co.uk

No minimum order for custom cutting with laser, water and plasma in steel, stainless, brass, plywood, plastics, copper, gauge plate, and aluminium.



Over 40300 parts for many common designs such as:

- Britannia
- Speedy
- Princess Marina
- Tich
- Virginia
- Conway
- William
- Galatea
- Romulus
- Super Simplex
- Maid of Kent





A.M.E
Abbots Model Engineering
Makers of fine 5" & 7¼" Gauge Locomotives & Rolling Stock

Scan QR code for website for up to date info.
01952 879607

5" & 7.1/4"g Locos & Driving trucks



Most Loco`s ready within 4 weeks
Most trucks ready within 2 weeks
Clubs, Private & Commercial

Shop open Mon to Fri 9.00am to 4.00pm
Locomotives, Coaches & Trucks all on display

Unit D7, Haybrook Ind Est, Halesfield 9, Telford, Tf7 4QW
www.ametrains.co.uk

webuyanyworkshop.com

Re-homing model engineers' workshops across the UK

It's never easy selling a workshop that has been carefully established over a lifetime.

I will buy your workshop so you don't have to worry about finding a new home for much loved workshop equipment and tools.

Please email photos to
andrew@webuyanyworkshop.com
Or to discuss selling your workshop, please call me on **07918 145419**

All equipment considered.
Myford, Warco, Chester, classic British brands etc.
Polly steam locomotives also purchased, especially those needing a bit of 'TLC'



PRODUCTS

- Taps and Dies
- Special Sizes
- Diestocks
- Boxed Sets
- Tap Wrenches
- Endmills
- Clearance Bargains
- Slot Drills
- Tailstock Die Holder
- Drills HSS
- Centre Drills
- Reamers
- Thread Repair Kits
- Drills
- Thread Chasers
- All British Cycle Threads Available

Drill Sets



Taper Shank Drills HSS



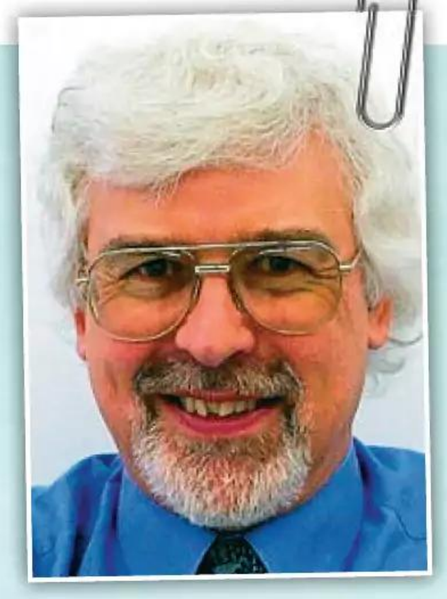


Reamer



Taps & Dies

Tracy Tools Ltd
Tap & Die Specialist, Engineer Tool Supplies
Tel: 01803 328 603 Fax: 01803 328 157
Unit 1, Parkfield Ind Est, Barton Hill Way, Torquay, Devon TQ2 8JG
Email: info@tracytools.com
www.tracytools.com

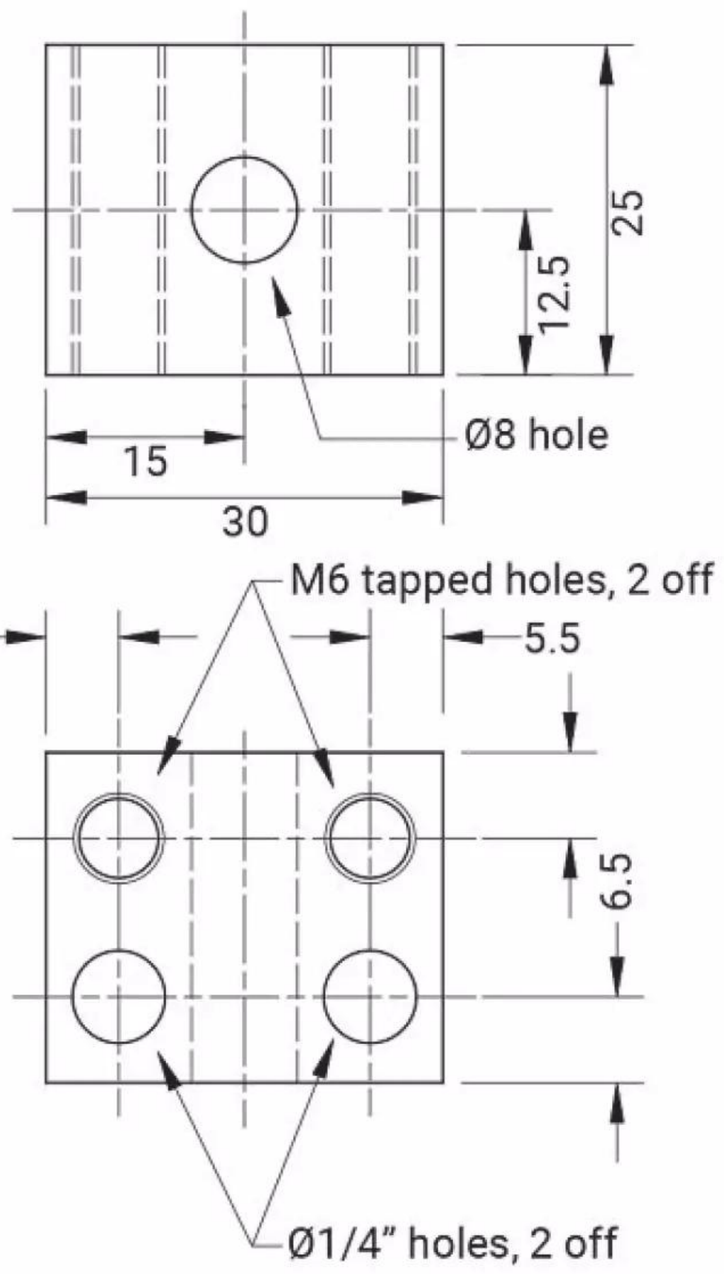


Keith Keen designed this set of clamping jaws for holding relatively large work piece items on a milling machine table.



Versatile Milling Table Clamps

Photo 1: The swivel block and sliding jaw clamp arrangement.



Swivel Block
Mat'l: Mild steel

Fig 1: Swivel block dimensions.

Some work pieces that are required to be milled or drilled on the XY table of a vertical milling machine are either too large or of an awkward shape to be held in a milling vice. For this type of situation, a clamping arrangement has been devised with moveable jaws that are somewhat similar to those of a four-jaw independent lathe chuck. These would allow almost the entire milling table extent to be used for holding essentially any shape of work piece. **Photograph 1** shows the clamping jaw arrangement which consists of a swivel block which is clamped to a tee nut in the milling table tee slot, and a sliding jaw with guide rods which is pressed against the work piece by two M6 capscrews in the swivel block. Either the front face or a 45 degree angled side face can be used for contact to the work piece.

Photograph 2 shows a set of six clamping jaws that have been made for the three tee slots of a Rishton VM601 vertical mill/drill which has a table size of 615 x 150mm. The swivel blocks clamp to tee nuts in the table tee slots with M8

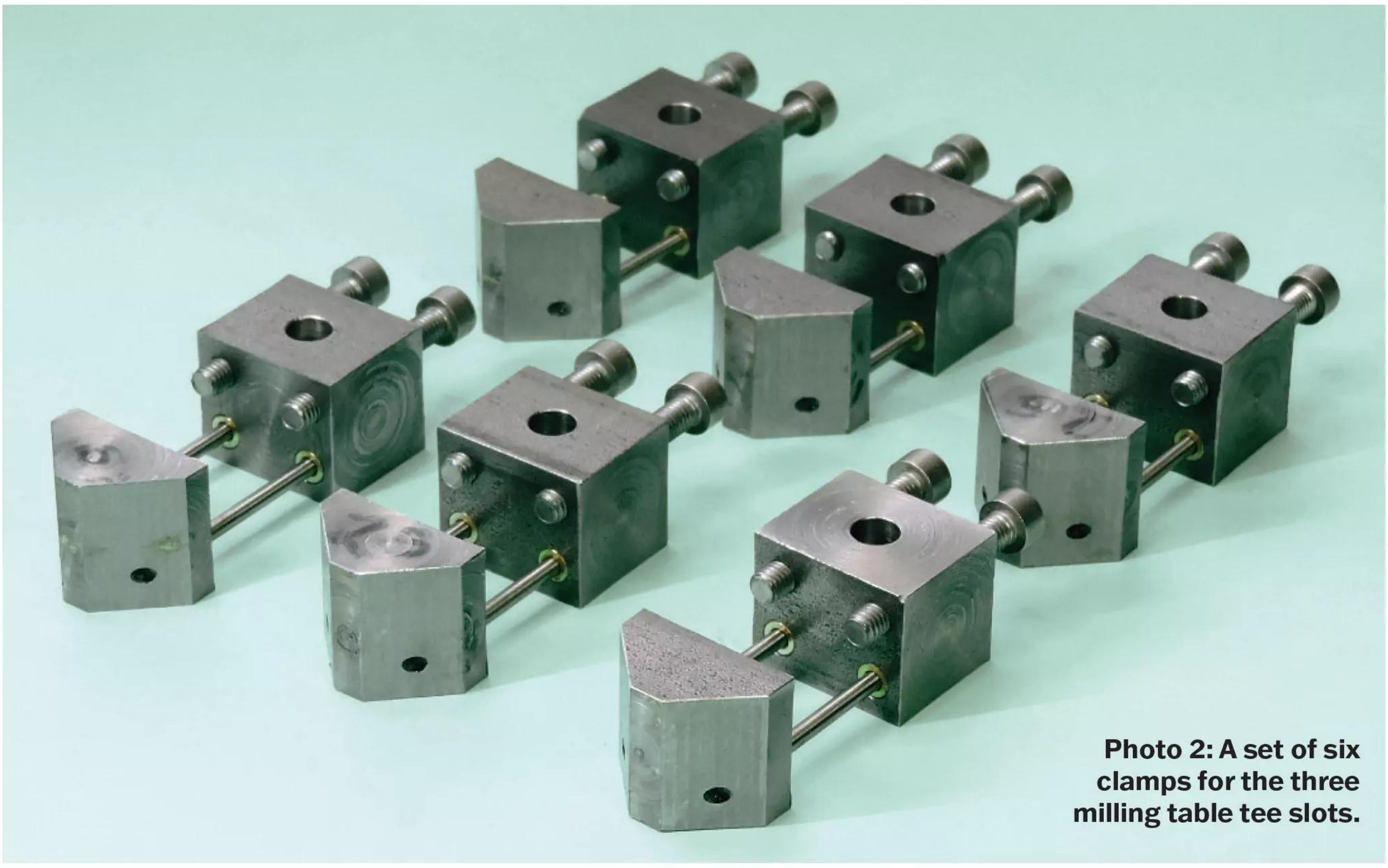


Photo 2: A set of six clamps for the three milling table tee slots.

threaded studs and can be set at any required angle. It is not always necessary to use all six clamping jaws, four might be sufficient, but using all six can often be beneficial. A milling machine table with four tee slots could usefully have a set of eight of this type of clamping jaw.

The rest of the photographs show some examples of the clamping jaws in use. **Photograph 3** shows a round brass bar of about 88mm diameter and 50mm thickness being held by the six clamps for top surface milling. **Photograph 4** shows a length of 1" square brass bar being held ready for width reduction milling

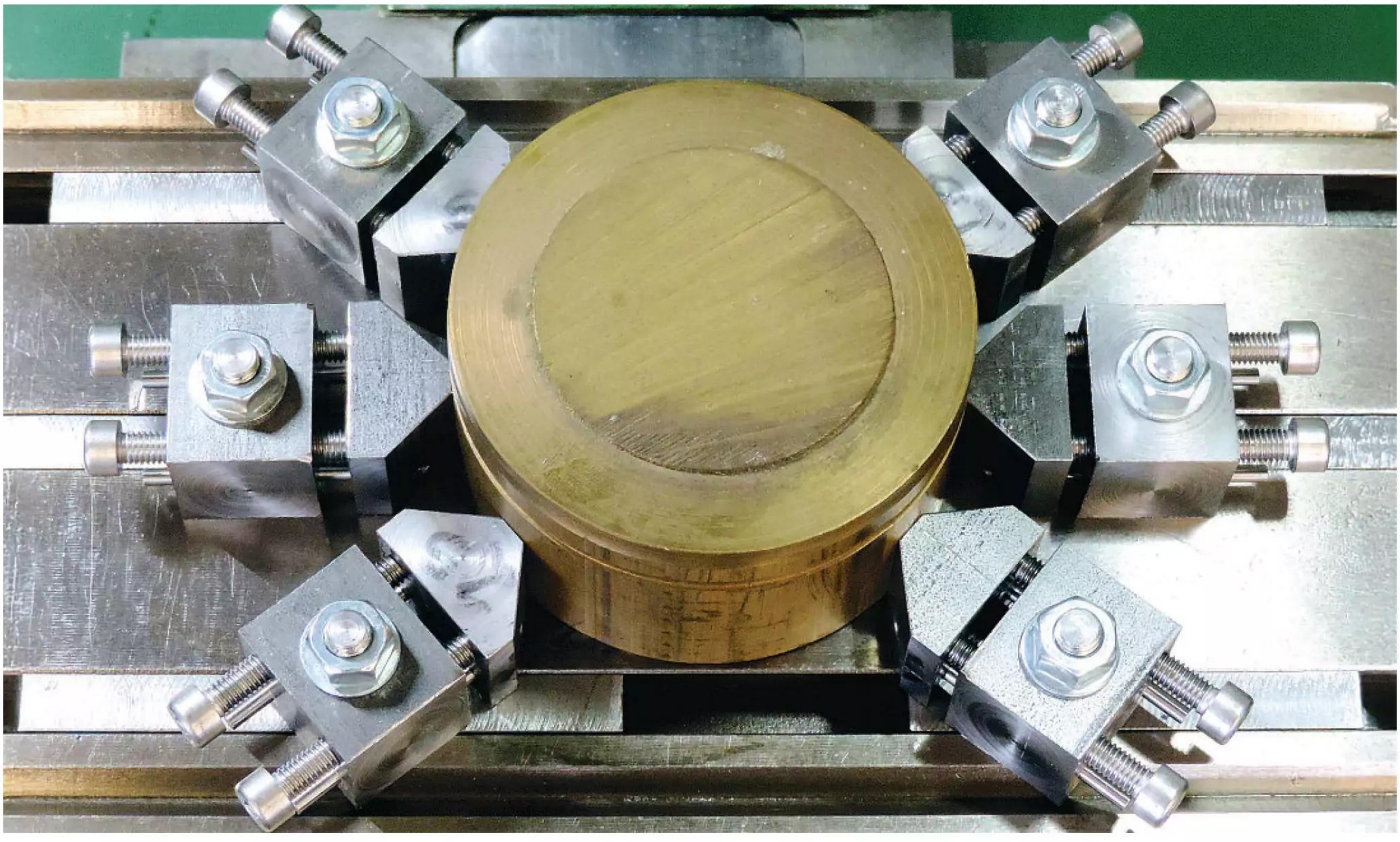


Photo 3: The six clamps holding a section of 3.5 inch diameter round brass bar on the milling machine table.

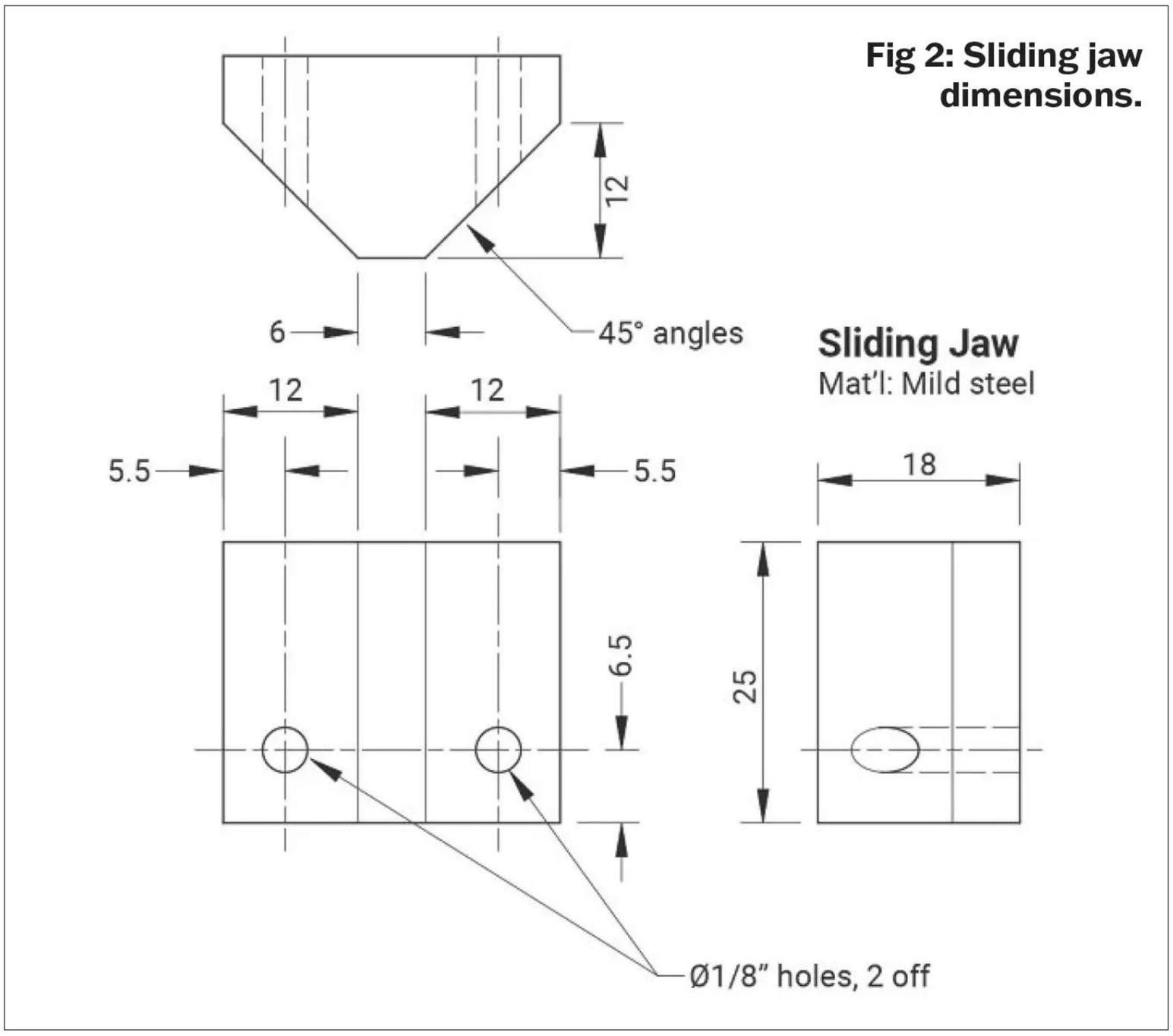


Fig 2: Sliding jaw dimensions.



Photo 4: Holding a twelve-inch length of 1" square brass bar on the machine table.

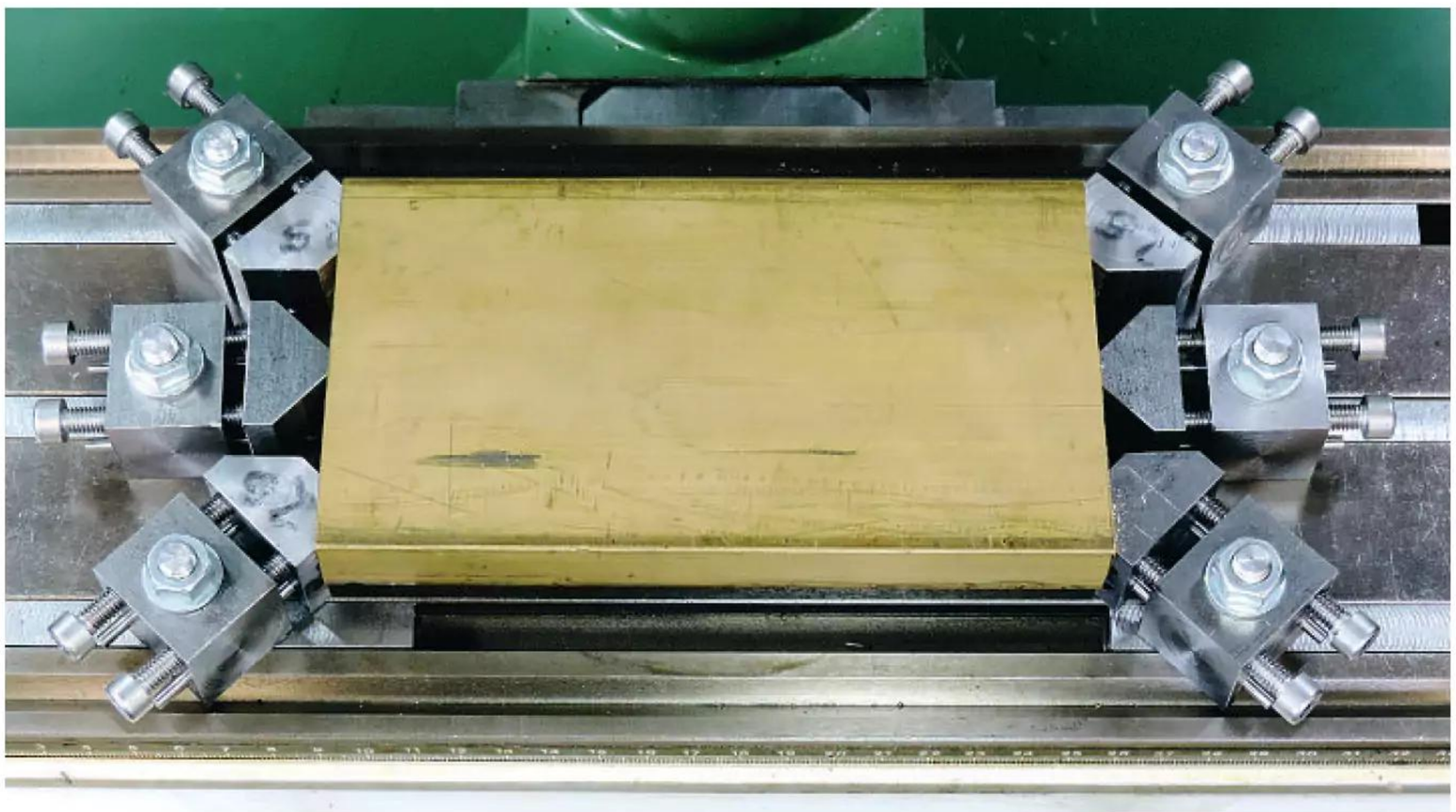


Photo 5: Holding a brass slab of approximately 165 x 90 x 20mm on the machine table.

and drilling and **photo 5** shows a 20mm thick brass slab being held for milling and drilling.

The design and construction of the clamping jaws is quite simple. The two main parts, i.e. the swivel block and the sliding jaw, are basically made of EN3B mild steel. The sliding jaw is shaped somewhat like the jaw of a 4-jaw lathe chuck with 45 degree angled sides, and has a pair of 1/8 inch diameter silver steel guide rods fixed in it which allow the jaw to slide in the swivel block. The swivel block has two round brass rod inserts with 3.3mm axial holes which act as simple linear bearings for the sliding jaw guide rods.

Figures 1 and **2** show the dimensions of the main steel parts. Other parts used in the construction were 1/8" diameter silver steel rods of length 48mm, 1/4" diameter brass rods length 25mm, which were subsequently drilled axially 3.3mm, and M6 x 40mm full thread socket cap screws. The reason for the imperial sizes was simply that it was due to the use of old stock materials.

Making the clamp parts was quite straightforward. The swivel block shown in **fig. 1** was made from 1" square EN3B steel bar. A cut off 'blank' of about 34mm was reduced to the required outer 30 x 25 x 25mm dimensions in the lathe, holding the 'blank' in the 4-jaw independent chuck. Then, transferring the work piece to a milling vice on the milling table with a wood spacer underneath it, the 8mm top hole was drilled. In a similar way, the 1/4" diameter and 5.3mm side holes were drilled. The side holes were then tapped M6. After cleaning up, the 25mm long 1/4" diameter brass rod insert pieces were fixed into the block using Truloc 231 high strength retaining fluid. The inserts were subsequently drilled 3.3mm with the required spacing of 19mm.

The sliding jaw body shown in **fig. 2** was made in much the same way as for the swivel block body, except with regard to the 45 degree angled faces. Milling these faces was carried out using a V-block under the work piece, in the milling vice and, after cleaning up, the silver steel sliding rods were fixed into the sliding jaw using the Truloc 231 retaining fluid, making sure that the rods did not protrude into the angled side faces.

When completed, the clamp parts were all painted with MetalGuard anti-rust coating, which (it says on the tin) gives a 2 micron thick corrosion protection film.

As a final comment, it was found that when these clamps were used to hold a workpiece with a backing support below it (for example a sheet of plywood to ensure that hole drilling didn't damage the milling table) it was sometimes necessary to tap down the work piece with a rubber hammer during final tightening of the jaws.



Club News

Geoff Theasby reports on the latest news from the clubs.

I start this month with a bit of video for you to find and view. A truly ugly (IMO) logging locomotive resurrected in Canada (?) I have to declare a bias here; I think the UK traction engines look more sophisticated than the US ones. Compare this picture, in which the machine looks crude and unfinished, with any run-of-the-mill traction engine, to say nothing of Showmans engines. https://www.youtube.com/watch?v=qhVrADoZNo8

My domestic engineering has not fared so well. I attempted to mend a broken wire in an Anglepoise lamp, despite Debs claiming we needed a new one. What should have been a five minute job took hours because I could not get the relevant holes lined up for reassembly to restore its angularity. If you have ever seen the Bugs Bunny cartoon where he wrestles with a set of bagpipes, you will understand. A picture frame fell off the wall and broke. Goodness knows why, but I decided to repair the frame which had become deranged at one corner. Rebuilding the corner with Plastikard, glue and and several screws, it seemed to be quite robust, so I hung it back on the hook. It then fell off the wall and broke. I hope I have more success with what follows.

In this issue: a casting, Mr Slater's laptop, closure of a Post Office and more ugly locomotives.



Photo 2: The fantail.

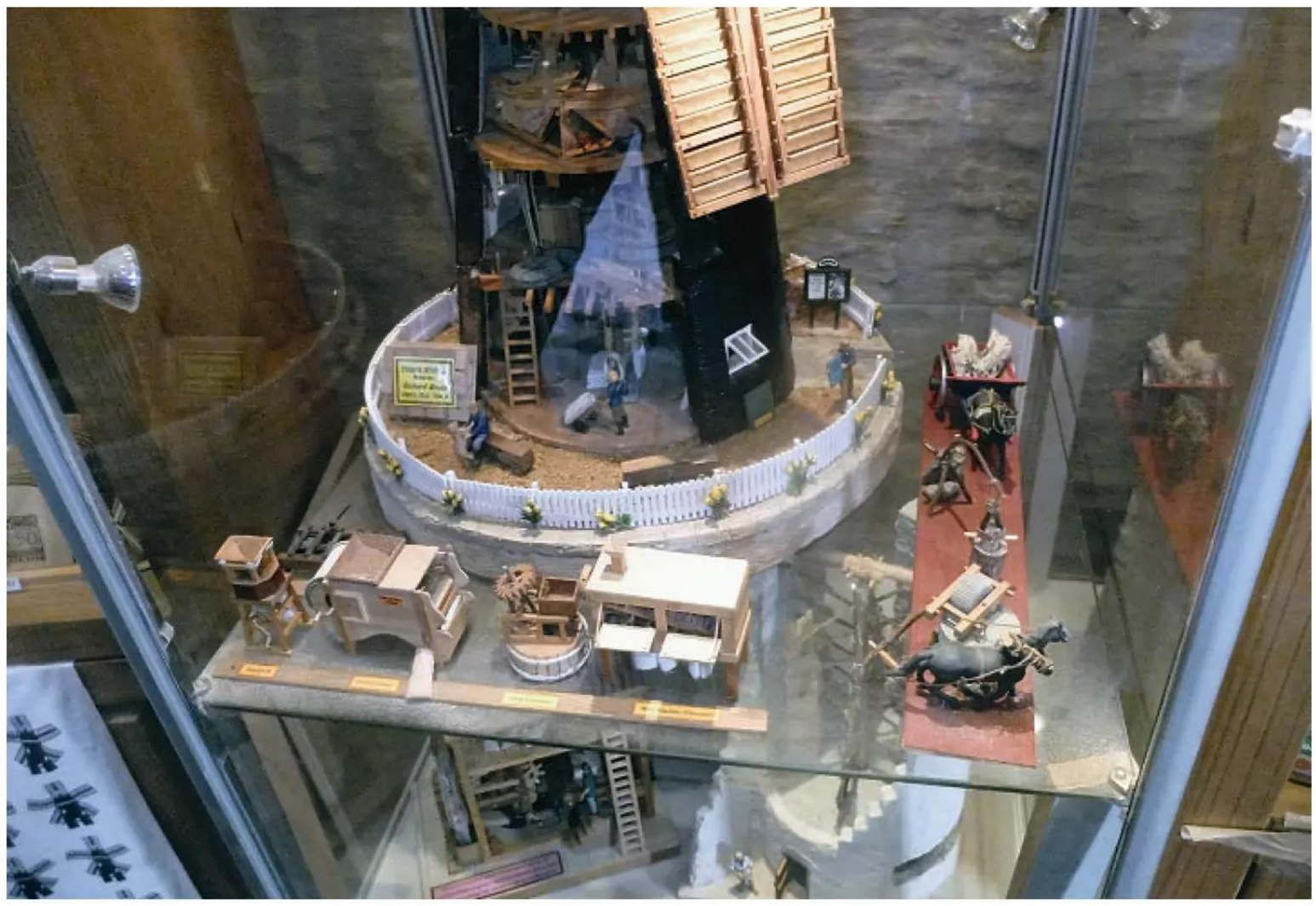


Photo 1: Holgate Mill, model by Richard Green, HWPS Vice President.

Streamliner, February, from the **P2 Locomotive Trust** notes that Dr. Adam Wilby has completed his thesis on Eng D in Materials Science at Sheffield University. A drawing of the casting of the P2's cylinders and valve bores cross section is on page 3 of the build process, together with a photo of the original, in 1933, cast at Gorton. Inspection of the drawings showed the width to be excessive so it was reduced and consequently the cylinder size had to be reduced, with a proportionate increase in the boiler pressure being required to maintain the stated tractive effort. W. www.cockothenorth.co.uk

Bristol Model Engineers newsletter, the *Bristol Model Engineer*, begins with a tale from Kevin Slater who was cruising the High Seas in the South Atlantic. All participants in the cruise were invited to make a model ship (Mr. Slater is a qualified Marine Engineer, M'Lud) and Mr. Slater's laptop 'just happened' to have an appropriate CAD program installed. He won, of course, but he also had to drink the contents of the outrigger bottles. I assume they contained something other than seawater. Junior Member, Thomas, used an alternative source of materials for his GWR model steam tram. With these ingredients, Thomas made a cake for his own 13th Birthday celebration but it is not on show at the clubhouse because he has eaten it! President Bernard North cabbed a locomotive on a sugar cane railway in Brazil (where the nuts come from). This visit unfortunately coincided with the Bristol AGM, but it was deemed a no-brainer. (Well, you would, wouldn't you?) W. www.bristolmodelengineers.co.uk

More on Holgate Mill. Here is a fine model of the mill by HWPS Vice President, Richard Green, **photo 1**. The fantail, keeping the mill facing into the wind, is shown in **photo 2**.

Bradford Model Engineering Society's *Monthly Bulletin* for April, deals with the stand taken at Keighley Model Railway Club's Exhibition 'show of work and items' at Bingley for their 50th Anniversary. Thanks go to Martin Birch for organising this. The Bradford Engineers in turn have exhibited at Leeds, Bradford and Halifax Industrial Museums. David Jackson, of Road Vehicle News was approached by a young lad who said he was going to build a Garratt. David suggested he try a simpler model - but no, he was



Photo 3: York Nuclear Bunker Ops Room.



Photo 4: Harry Pettit with his Y4 and, behind him, the forerunner of the Pacer.

checking all the items he needed to get right. David was so impressed he forgot to take a picture of the model so far. At last year's exhibition, young Sophie showed a Lego F1 car built from a kit. Very good for an 11-year old! Adrian Jennings relates a tale of vacuum brakes which nearly resulted in a runaway. A sequence of events which, individually, might not be so serious, but taken together could have spelt disaster. No Names... W. www.bradfordmes.uk

Debs and I visited the Cold War bunker in Acomb, York, and found it most interesting. It was built in 1961 and closed 30 years later. In great danger of being vandalised (ironically it suffered more from the predations of vandals, despite being designed to withstand an atom bomb landing on the nearby City of York!) it was handed over to English Heritage who have restored it and run guided tours. It is just as it was when it was left, complete with diesel generator, electromagnetic-pulse-protected telephone exchange, tiny kitchen, sewage ejector, bunk beds for up to 60 staff working three shifts and operations room (an updated version of the two-storey plotting table as seen in countless WW2 films). Senior officers on balcony, plotters down below, looking after a transparent wall map, **photo 3**. Imagine, if you will, 60 people locked in a closed space for a month with only basic washing and eating facilities, no TV or radio, knowing that the 'outside' is devastated; millions killed, no infrastructure and probably no future. https://www.english-heritage.org.uk/visit/places/york-cold-war-bunker/

On Track, April, from **Richmond Hill Live Steamers** recommends a video on the history of the US Railway Post Office. Sorting letters on the move and collecting/depositing parcels of mail without stopping. It acknowledges the UK Travelling Post Office, used by the GPO from 1830. https://www.youtube.com/watch?v=4gCkRoqBiUQ W. www.richmond-hill-live-steamers.tripod.com

Lionsheart April, from **The Old Locomotive Committee** has sad news. Following remarks in the previous *Lionheart*, no-one has come forward to take the position of Treasurer. In a poll of the 50 members, 16 replied, ten voted for

closing the society and six to carry on. The bank account will therefore be closed and the funds, amounting to just short of £8,000, transferred to the Museum of Liverpool. Similarly, the contents and information from the now inactive website will also be so transferred to the Museum. Treasurer, Jon Swindlehurst thanks all at the Museum for their help over the years.

Chesterfield & District Model Engineering Society's *The Stephenson Link*, Spring, proudly showed its new club locomotive presented by the family of Dennis Booth. It is a 5 inch gauge GWR 0-4-2 and will be made available to the junior members to operate and maintain. The Small Engine Meeting in January, saw a fine GNR 4-4-2, recently bought by Simon Wass but not steam tested. Pete Nash has a 7/8" scale quarry Hunslet. These small but robust locomotives were intended for use in the rough track in quarries and worked in several slate mines in North Wales. The majority of these engines have been preserved, some in the US and Canada. Remarkably, they are still being produced brand new from the Hunslet Engine Co. at Statfold Barn. Dave Penney writes on Meccano; he acquired his first collection at the age of ten. Prices were steady in the 1950s but it was regarded as an expensive hobby. A top of the range Meccano No. 10 set would cost a week's wages. Pre-war, the factory at Binns Road, was producing 1 million nuts and bolts per week. I visited that factory in about 1960 with my family. They asked us if we had come by car. My mother thought we might have got a better tour if we had! One point Dave mentions is that each model he built seemed to need lots of components which he did not have. For instance, an excavator required 365 collars with grub screws. After 40 years he finally gave up modelling in Meccano and sold his collection to a supplier, who paid his price, enabling him to buy a Myford Super 7. A new locomotive for the new year; No. 1628, five years in the making. Malcolm High was driving the Hady Belle, when it locked up and refused to locomote. An inspection showed that the crank had moved. To make another would be difficult as the original was 8mm plate. He finally had one laser cut, completed by reverse engineering. Malcolm then goes on to write about making lamps for the Hady Belle, John Cottam describes the



Photo 5: *Adele Marie*'s driver may have misplaced his hat...

Historical Museum of the Mongolian Railway at Ulaan Baatar with several photographs of locomotives plinthed or under cover. Adrian Lloyd continued with his Land Rover Series 2A. The drum brakes were adequate for the vehicle ex-factory but frighteningly inadequate for the speed of the uprated vehicle. 11 inch drums were the answer. Then, his local model flying club wanted rid of an old caravan that was to be replaced with a better building. On the fateful day he arrived to find it had not been moved. Seemingly, Japanese 4x4s are not brilliant at towing anything on wet grass. Did it succeed in pulling off the trailer? See next issue's exciting episode... A reprint of an article in the magazine from 50 years ago regarding heat treatment of steel, has a humorous comment about bright drawn mild steel; it is 'full of stress'. 'So would you be if you had been pulled, cold, through a die...' The back cover shows Harry Pettit, with his Y4 at an event at Shildon. He is pictured in **photo 4** in front of Leyland Experimental Vehicle, LEV 1, the forerunner of the Pacers. Looks good, dunnit? If only.... Finally **photo 5** shows a nice Sweet Pea, *Adele Marie* that was on the steaming bay on a recent visit. www.cdmes.co.uk

Model and Experimental Engineers, Auckland's April report begins with a clock, shown by Michael Cryns, and dating from 1785. The dial is of heavy brass therefore would have been expensive. Murray reminisces on his career which took him to Ella in Sri Lanka. The railway bridge there was built in 1921 during a shortage of steel and therefore used stone. It is still supporting trains. It measures 300 feet long, 100 feet high and was built in less than a year. Murray's first locomotive was a *Speedy*. He had intended a Tich but was talked out of it. He named the resulting locomotive Gonzales (a Speedy, Yes?). Cameron Webb has a Boley capstan lathe. He has not seen any others save in a 1920 catalogue. Jonathan Feist found a boiler on Facebook, possibly from a model boat. He intended it to run a Stuart No. 4, built by his grandfather. The boiler is not as well built as it should be and may have been fuelled by paraffin but the burner is missing.

A video I have seen on YouTube for the first time since its initial release in 1972 has been Clochemerle, the story of the erection of a pissoir in a French village, and its aftermath. It is notable for the awful playing of the theme tune by an ensemble who must remain nameless, to save their embarrassment. Nom du chien! Starring Cyril Cusack, the incomparable Wendy Hiller and a bevy of attractive young mademoiselles. Oh, and a steam train. https://www.france-voyage.com/tourisme/chemin-fer-vivarais-2093.htm

The Prospectus, March (See MEW 4765) from **Reading Model Engineering Society** notes a couple of contenders for the ugliest locomotives, suggesting the the Austrian Federal Railways 80 series. I can't look!

And I end as I began with more videos, this time on the making of crankshafts. The Sheffield company which made crankshafts for Merlin engines in WWII (Ambrose Shardlow) is still making these items https://www.youtube.com/watch?v=Mulq6jYzbBs

www.model-engineer.co.uk/classifieds

FREE Private adverts

Save a stamp! You can now place your classified ads by email. Don't waste time scanning the form, just send the text of your ad, maximum 35 words, **meweditor@mortons.co.uk**, together with your full name and address, a telephone number, whether it's a for sale or wanted and stating that you accept the terms and conditions for placing classified ads – see below. Please note, we do not publish full addresses or website links to protect your and other readers' security.

TOOLS AND MACHINERY

Dore Westbury Mark 1 Miller on a stand, £295. **Tel. 01246 277357. Chesterfield.**

Chester Conquest Lathe Super, electric fault, motor seems ok, spare gear, £200 buyer collects. **Tel. 01691 770826. Oswestry.**

Bridgeport Cherrying Head. Wolverhampton & District MES selling. It is in good order and is available for viewing by arrangement. £800 but sensible offers considered. **Contact David Godley. Tel. 07969 143473. Wolverhampton.**

Large vertical bandsaw 6'7 high, 20" table, can cut 16" log or metal at any angle, it is now in bits for transport, comes with 10 blades, it has 3hp single phase motor, 2 speed gearbox, £250 buyer collects. **Tel. 01142 334758. Sheffield.**

Perfecto Lathe 3 jaw chuck motorised, very good condition, buyer collects, £250. **Tel. 01725 510860. Salisbury.**

'Rodney' milling attachment suitable for Myford ML7 / S7 lathes. Complete with drive shaft and toothed coupling. The unit is in good clean condition. Has been used but NOT abused. This is collection ONLY. Sorry, it is too heavy to post. £720. **Email: alan_donovan@yahoo.co.uk. Nottingham / Derby Area.**

Selling my Halifax 10" (An 'improved' Atlas 10F) Complete but not fully assembled yet after repaint. Need space, so price is low! Can take photos of the machine "as is" for anyone interested. £325. **Tel. 01366-728030. Email: r.bartholomew@freeuk.com. Methwold, West Norfolk.**

Bison 3204-100 3 jaw chuck, as new. Bought new a few years ago but never used, unfortunately I lost the chuck key, hence the slightly worn one. Comes with standard & reverse jaws, it's heavy so I'll find out the postage cost, or you can collect. Price for a new one is over £700 so grab a bargain. £150. **Email: philip.farr@aol.com. Barkingside, Essex.**

PARTS AND MATERIALS

25 unused assorted V belts. Job lot for £15. Willing to separate at £1 per belt. Collection only. Please enquire for sizes and types. £15. **Email: mewalker1764@gmail.com. Downham Market, Norfolk PE38 9R.**

MAGAZINES, BOOKS AND PLANS

Loads of old The Model Engineer Magazines from Vol 90 1944 to Vol 104 1950 that I will otherwise dispose of. **Email wagners4@btinternet.com. Lower Moor, Worcestershire.**

'Locomotives Large and Small' by Don Young, complete set, offers, buyer collects. **Tel. 07340 130645. Cheshire.**

MEW Magazines from Parts 15 To 339 Some missing about 300 parts, free to whoever collects. T**el. 01313 323401. Email Neil.Macnaughtan@Talktalk.Net. Edinburgh.**

Kempes Engineers Year Book 1949. 2 volumes. Red Hardcover. Binding intact. Vol 2 hardcover in better condition. Vol 1 covering of spine split but still attached. Pages clean & in good condition for age. £10. Collection or postage (£7.89). **Email: mewalker1764@gmail.com. Downham Market, Norfolk PE38 9R.**

YOUR FREE ADVERTISEMENT

Max 36 words, plus phone and town - please write clearly ☐ WANTED ☐ FOR SALE

Phone:		Date:		Town:	
				Please use nearest well-known town	

Adverts will be published in Model Engineer & Workshop.
The information below will not be published in the magazine.

Name .....
Address .....
.....
.....
..... **Postcode** .....
Mobile ..... **D.O.B.** .....
Email address .....

Do you subscribe to Model Engineer & Workshop? ☐

Please post to: ME&W FREE ADS, c/o Neil Wyatt, Kelsey Media, Media Centre, Morton Way, Horncastle, Lincolnshire LN9 6JR
Or email to: meweditor@mortons.co.uk
Photocopies of this form are acceptable
Adverts will be placed as soon as space is available

Terms and conditions

PLEASE NOTE: This page is for private advertisers only. Do not submit this form if you are a trade advertiser. If you wish to place a trade advert, please email Karen Davies karen@talk-media.uk
By supplying your address, email and telephone number, you agree to receive communications by post, email and telephone from Kelsey Media and other relevant 3rd parties. Please tick here if you DO NOT wish to receive communications from: Kelsey Media ☐ Email ☐ Phone ☐ Post
or other relevant 3rd parties ☐ Email ☐ Phone ☐ Post

For more classified ads visit **www.model-engineer.co.uk/classifieds**. You will need to be a member of the forum and logged on, but this is a **FREE** service for readers.

MODEL ENGINEER & WORKSHOP
EST. 1898
THE LEADING MAGAZINE FOR HOBBY ENGINEERS AND MODEL MAKERS

BACK ISSUES

£5.75 EACH
(inc p&p)
For EU and ROW, please see www.classicmagazines.co.uk

Whether it's recent releases or vintage copies, step back in time and browse through the ages with the *Model Engineers Workshop* back issue collection.

AVAILABLE TO ORDER TODAY AT CLASSIC MAGAZINES.CO.UK



NOVEMBER 2024
- Steam start for editor
- Tool tip setting
- Stevenson trophy results



DECEMBER 2024
- Make a combination bolt
- Midlands exhibition
- Measure lathe speed



JANUARY 2025
- Retracting topslide
- Sharpen a boring tool
- Simplifying shapes



FEBRUARY 2025
- Cherry Hill tribute
- Riveting attachment
- Storage solutions



MARCH 2025
- Twin tank engines united
- Building spring parting tool
- Cast polyurethane



APRIL 2025
- Working mini oilcan
- Making traction engine Archie
- Making small threads



MAY 2025
- Garden rail show report
- Model everyday objects
- 3D printed metal parts



JUNE 2025
- Advanced knurling tool
- Industrial giants remembered
- Space-saving big end bearing

OTHER ISSUES ALSO AVAILABLE – ORDER YOUR BACK ISSUES NOW!

2 EASY WAYS TO ORDER

CALL: 01507 529529 **ONLINE:** www.classicmagazines.co.uk/issue/mew

MODEL ENGINEER & WORKSHOP
EST. 1898
THE LEADING MAGAZINE FOR HOBBY ENGINEERS AND MODEL MAKERS

To advertise please contact Karen Davies
Email: karen@talk-media.uk
Tel: 01732 442144

PUT TOO MUCH PRESSURE ON THAT OLD BOLT?
SNAPPED? STRIPPED THE THREADS?
DON'T WORRY THAT'S WHERE WE ARE SPECIALISTS!

UNI-THREAD

SUPPLIES QUALITY THREAD REPAIR KITS, INSERTS AND INSERT TAPS IN BSC, BSF, BSW, BA, UNF, UNC & METRIC.
BY SPEEDY MAIL ORDER SERVICE.
WE ALSO STOCK QUALITY TAPS, DIES, REAMERS, DRILLS, ETC.



WWW.UNI-THREAD.COM
CALL 01803 867832 Or Fax 01803 867982
for your free catalogue



CARBON STEEL TAPS & DIES NOW AVAILABLE
20% OFF ALL CARBON TAPS. 30% OFF ALL CARBON DIES

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

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

Western Steam Ltd

Western Steam Ltd specialise in the production of copper boilers for live steam locomotives and traction engines.
Boilers can be built to either standard published designs or supplied drawings.

Our boilers are of all copper construction, fitted with bronze bushes and silver soldered throughout. They are manufactured in accordance with the Code of Practice and standards laid down by the Association of Professional Copper Boiler Makers (ME). Upon completion, boilers are hydraulically tested to twice the maximum allowable pressure and are supplied with CCIT (Certificate of Conformity and Initial Test) - purchasers are welcome to witness this test at our factory.

Visit our website: www.westernsteam.com
or Email: westernsteamltd@gmail.com or Tel: 01278 788007
Helen Verrall, Unit 4A, Love Lane, Burnham-on-Sea TA8 1EY

CRACKING OFFERS ACROSS OUR SCALE MODEL MAGAZINES

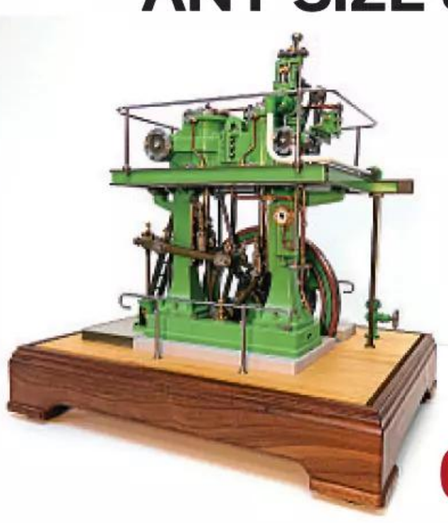
Whether you're passionate about building radio-controlled model aircraft, model boats, miniature powered machinery, or mastering model engineering tools and techniques – we have the perfect read for every model enthusiast!



SUBSCRIBE TODAY & SAVE UP TO 49%
VISIT: WWW.CLASSICMAGAZINES.CO.UK/MODELLING25
classic magazines CALL: 01507 529529 QUOTE: MODELLING25
OFFER EXPIRES 31/12/25

sarik hobbies
The World's Biggest Selection*
Huge range of engineering, railway & locomotive plans
MODEL ENGINEER BUILDER
O, OO & HO Gauge Scenery, Boats & Buildings
www.sarikhobbies.com
* World's biggest selection of printed RC Model Plans & Short Kits.

ALL LIVE STEAM ENGINES WANTED
ANY SIZE & CONDITION INCLUDING PART BUILTS



Stationary Engines inc. Stuart Turner, Bing etc
Traction Engines and Locos in all sizes.
Especially wanted 4" and 4½" gauge Traction Engines.
Any Locos from gauge 1 to 7¼".
Also any Electric models locos, buses etc
Will collect personally. Distance no object.





Call Kevin on 01507 606772 or 07717 753200

5"GAUGE WAGON KITS

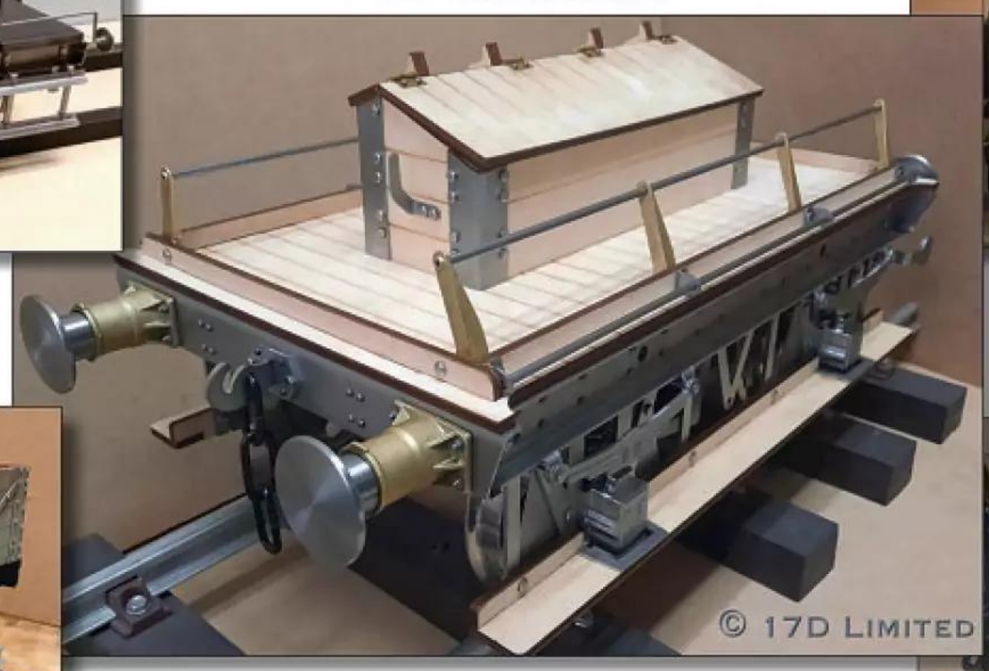
Email: sales@17d.uk
Phone: 01629 825070

Kits start from around £470

See our website or call
for full details



BR/LNER Brake Van



GWR Shunters Truck



Banana Box Van

5 Plank Wagon



7 Plank Wagon



WHEELS

Visit www.17d-ltd.co.uk
for latest prices & stock

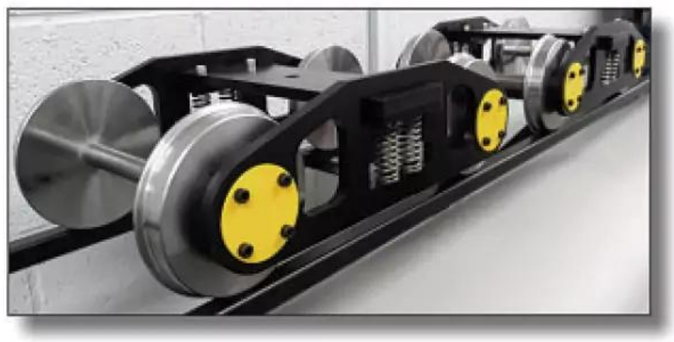


Machined Axle Boxes & Bearings
in 5" & 7¼" gauge



8 Spoke Wagon Wheels

4 wheels / 2 axles
in 5" & 7¼" gauge



Bogie Kits in 5" & 7¼" gauge



Plain Disc Wheels in 5" & 7¼" gauge

5" gauge 3 Hole Disc Wheels with profiled face



Narrow Gauge Wheels in 5" & 7¼" gauge

17D

www.17d-ltd.co.uk

MINIATURE RAILWAY SPECIALISTS

LOCOMOTIVES, ROLLING STOCK, COMPONENTS

CNC MACHINING SERVICES

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

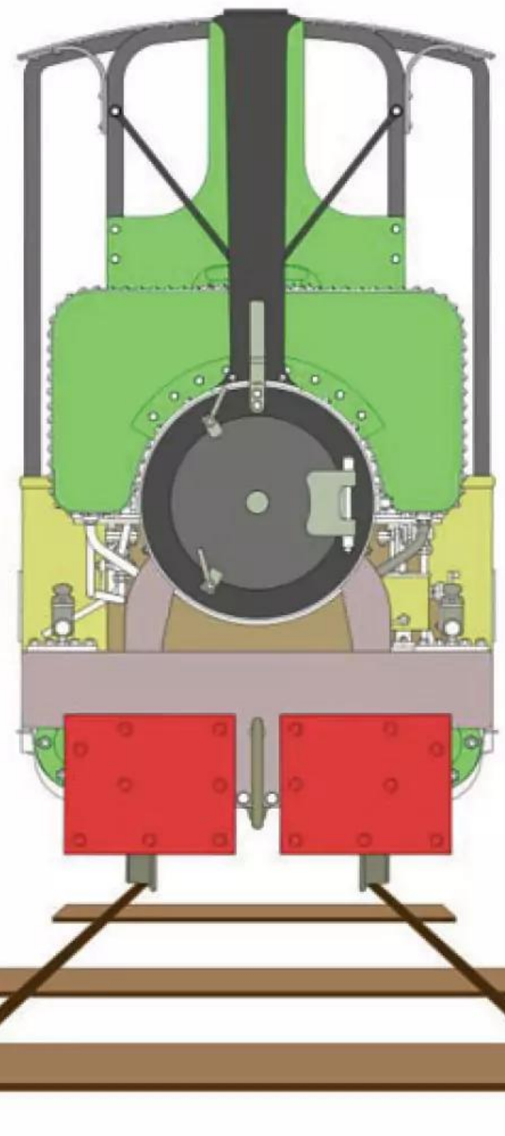
POLLY MODEL ENGINEERING

For all your Model Engineering Requirements



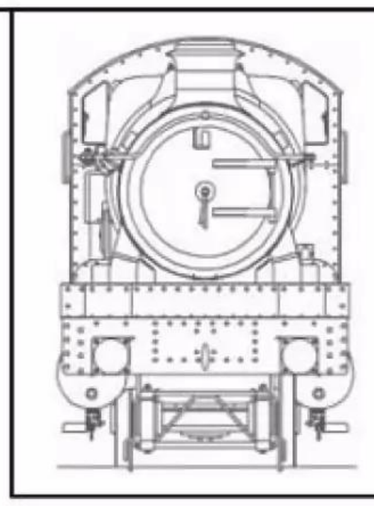












Polly Summer/Autumn Tour 2025

Polly Model Engineering will be attending these events – Hope to see you at one of them
Pre-Orders welcome. Customers are also welcome to visit our
trade counter based in the wonderful Derbyshire Dales.

EVENT	DATE
Cardiff Steam Rally	7-8th June 2025
Guildford MES Steam Gala	5-6th July 2025
Northern Association Rally, Urmston	19-20th July 2025
Newport MES Rally	15-17th August 2025
Polly Rally, Urmston	27th September 2025
Midlands Model Engineering Exhibition, Leamington	16-19th October 2025

Buy with confidence from an established British
Manufacturer & Supplier to the model engineering hobby

Polly Model Engineering
Unit 203 Via Gellia Mills,
Bonsall, Derbyshire,
DE4 2AJ, United Kingdom

www.polly-me.co.uk
Tel: +44 115 9736700
Find us on
sales@polly-me.co.uk