

MODEL ENGINEER

Vol. 200 No. 4325

9-22 May 2008

**Beginner builds
brilliant boiler**

**Axial
engine**



**Getting that
Gold Medal finish**

£2.75
RETAILER DISPLAY UNTIL 22 MAY 2008

**MODEL
ENGINEER
EXHIBITION**

**ASCOT, 19-21
SEPTEMBER, 2008**

CAN \$8.95 | AUS \$8.95 | NZ \$10.90



ALL PRICES INCLUDE VAT & CARRIAGE (UK MAINLAND)
(Prices are correct at time of going to press and are only available while stocks last)

Tel: (01582) 471900 5 Lines Fax: (01582) 471920

Web: www.chronos.ltd.uk Email: sales@chronos.ltd.uk

**CHRONOS LTD, UNIT 14 DUKEMINSTER ESTATE,
CHURCH STREET, DUNSTABLE, LU5 4HU**

Chronos

Engineering Supplies

GLANZE INDEXABLE BORING TOOLS

CODE	SHANK	PRICE	
KC34	8MM	£18.00	£16.00
KC35	8MM	£18.00	£16.00
KC36	10MM	£18.00	£16.00
KC37	12MM	£22.00	£19.00
KC38	16MM	£24.00	£21.00



VERTEX ROTARY TABLES

CODE	SIZE	PRICE	
KC155	6" / 150MM	£155.00	£125.00
KC156	8" / 200MM	£205.00	£190.00
KC157	10" / 250MM	£255.00	£210.00



ACCESSORIES FOR SOBA & VERTEX 6" TABLES

CODE	SET	PRICE
KC160	SET 3 T NUTS	£ 8.00
KC161	SET 3 T NUTS, STUDS & CLAMPS	£15.00
KC162	TAILSTOCK	£47.95
KC163	SET 3 PLATES ETC	£35.00

GLANZE INDEXABLE LH TURNING TOOLS



CODE	SHANK	PRICE	
KC43	8MM	£14.00	£13.00
KC44	8MM	£14.00	£14.00
KC45	10MM	£14.00	£14.00
KC46	12MM	£16.00	£16.00
KC47	16MM	£22.00	£22.00

SOBA 4" HZ/VT ROTARY TABLE

CODE	PRICE
MX88	£72.00
SET OF T NUTS, STUDS ETC	PRICE
MX83	£14.00 £12.00
NEW TAILSTOCK	PRICE
MX112	£39.95



MORSE TAPER CHUCK ADAPTOR SUITABLE FOR ROTARY TABLES KC164, KC155 & KC156

CODE	MTC THREAD	PRICE
KC165	3MT MYFORD THREAD	£19.95
KC166	3MT MYFORD THREAD	£32.95
KC167	3MT BOXFORD THREAD	£35.95
KC168	3MT BOXFORD THREAD	£39.95



GLANZE INDEXABLE PROFILING TOOLS



CODE	SHANK	PRICE	
KC39	8MM	£14.00	£14.00
KC40	8MM	£14.00	£15.00
KC41	10MM	£14.00	£16.00
KC42	12MM	£16.00	£19.00

SOBA 4" HZ/VT TILTING ROTARY TABLE

CODE	PRICE
MX82	£79.95
SET OF T NUTS, STUDS ETC	PRICE
MX83	£14.00 £12.00



80mm CHUCKS ON MOUNTING PLATE TO SUIT KC164, MX60 & MX62 ROTARY TABLES

CODE	TYPE	PRICE
GX46	3 JAW	£55.00
GX47	4 JAW	£48.00



NEW GLANZE MINIATURE INDEXABLE BORING BAR 5.5M SHANK 100MM LONG - 8MM HEAD



CODE	ITEM	PRICE
MX136K	BORING BAR & INSERT	£22.00
MX136A	SPARE INSERT	£3.25

PIVOT TYPE BORING HEADS GRADUATED DIAL - CAPACITY 4 1/2" ACCEPTS 3/8 BARS

CODE	TYPE	PRICE
GX36	2 MORSE TAPER	£39.95 £39.95
GX37	3 MORSE TAPER	£39.95 £39.95



SOBA 4" HZ/VT ROTARY TABLE WITH 2MT BORE

CODE	ITEM	PRICE
MX75	4" ROTARY TABLE	£99.00
MX88	TAILSTOCK	£47.95
MX89	SET 3 DIVIDING PLATES ETC	£35.00



GLANZE INDEXABLE RH TURNING TOOLS



CODE	SHANK	PRICE	
KC43	8MM	£14.00	£13.00
KC44	8MM	£14.00	£14.00
KC45	10MM	£14.00	£14.00
KC46	12MM	£16.00	£16.00
KC47	16MM	£22.00	£22.00

SOBA PRECISION MILLING VICES

CODE	TYPE	PRICE
KC285	2" SWIVEL ONLY	£49.00 £49.00
KC286	3" SWIVEL ONLY	£59.00 £59.00
KC287	4" SWIVEL ONLY	£69.00 £69.00
KC288	2" SWIVEL/TILT	£55.00 £55.00
KC289	3" SWIVEL/TILT	£65.00 £65.00
KC290	4" SWIVEL/TILT	£75.00 £75.00
KC291	2" 3 WAY	£90.00 £90.00
KC292	3" 3 WAY	£120.00 £120.00



NEW - DRILL VICES WITH TILTING JAWS! IDEAL FOR HOLDING NON PARALLEL ITEMS!

CODE	TYPE	PRICE
GX48	2" JAW WIDTH	£24.95
GX49	4" JAW WIDTH	£26.95



SET OF 8 GLANZE HSS LATHE TOOLS



CODE	SHANK	PRICE	
KC64	8MM	£22.50	£22.50
KC65	8MM	£28.00	£28.00
KC66	10MM	£24.95	£24.95
KC67	12MM	£44.95	£40.00

0-12BA TAP & DIE SET IN A WOODEN BOX



CODE	PRICE
MX33	£24.95 £26.95!!

52PC MILLING MACHINE CLAMPS KITS

CODE	SLOT	STUD	PRICE
KC304	3/8	5/16	£32.95
KC305	1/2	5/8	£36.95
KC306	5/8	1/2	£39.95
KC307	12MM	16MM	£36.95
KC308	14MM	12MM	£39.95
KC309	16MM	14MM	£39.95



NEW PROFESSIONAL PARTING SYSTEM

FOR UP TO 4 1/2" CENTRE LATHES - THE SHANK IS ON THE SIDE AND IS 1/2" THICK, SUPPLIED WITH A HSS BLADE 4MM THICK, 34MM WIDE & 150MM LONG.

CODE	ITEM	PRICE
GX50	HOLDER & BLADE	£22.00
GX51	SPARE BLADE	£1.00



MINI METRIC TAP & DIE SET 1MM - 2.5MM - 18 TAPS & 9 DIES



CODE	PRICE
KC172	£24.95 £21.00

COMBINATION SQUARE

The measuring range is 0-180" with readings of 1". This tool incorporates an angle meter, angle stop, depth meter, scriber and height meter!!



CODE	PRICE
GX52	£34.95 £39.00

SET OF 4 INDEXABLE BORING TOOLS

SHANK SIZES 8, 10, 12 & 16MM



CODE	PRICE
KC89	£24.95

MECHANICAL DIGITAL MICROMETER 0-25MM - CARBIDE ANVILS ETC

CODE	PRICE
GX91	£24.95 £14.95



SET OF 4 METRIC HSS COBALT BALL NOSE MILLING CUTTERS

3-6 10 & 12MM

CODE	PRICE
GX90	£16.95



MODEL ENGINEER

Published by
MAGICALIA PUBLISHING LTD.
 Berwick House, 8-10 Knoll Rise,
 Orpington, Kent BR6 0EL
 UK Calls: 0844 412 2262
 International Calls: +44 (0)1689 899 200
 Fax: +44 (0) 1689 899266
 Email: customer.services@magicalia.com

SUBSCRIPTIONS

UK SUBSCRIPTIONS
 NEW, RENEWALS AND ENQUIRIES
 Tel: 08456 777807
 Email: modelengineer@subscription.co.uk

USA & CANADA SUBSCRIPTIONS
 NEW, RENEWALS AND ENQUIRIES
 Tel: 001 732-424-7811 Fax: 001 732-424-7814
 Email: subs@ewamags.com

REST OF WORLD SUBSCRIPTIONS
 NEW, RENEWALS AND ENQUIRIES
 Tel: +44 (0) 8456 777807

TO SUBSCRIBE ONLINE,
 PLEASE TURN TO THIS ISSUE'S
 SUBSCRIPTION OFFER

PLANS, BACK ISSUES, BINDERS

Tel: +44 (0) 844 412 2262
 Email: customer.services@magicalia.com

EDITORIAL

Editor: David Carpenter Tel: 01689 899255
Production Editor: Kelvin Barber
Technical Editor: Roger Bunce
Assistant Editor: Michael Jones
Associate Editor: Malcolm Stride

PRODUCTION

Designer: Simon Gould
Commercial Designer: Ben Wright
Retouching Manager: Michelle Briers
Production Manager: Richard Baldwin
Ad Production: Robin Gray Tel: 01689 899286

SALES AND MARKETING

Sales Director: James Burton
 Tel: 01689 899237
Senior Sales Executive: Duncan Armstrong
 Tel: 01689 899212
 Email: duncan.armstrong@magicalia.com
Marketing & Subscriptions Executive:
 Chris Webb Email: chris.webb@magicalia.com

MANAGEMENT

Events Director: Jaz Walters
Creative Director: Nikki Parker
Managing Director: Owen Davies
Executive Board: Peter Harkness,
 Owen Davies, Adam Laird, Jeremy Tapp



© MAGICALIA PUBLISHING LTD. 2008
 All rights reserved ISSN 0026-7325

The Publisher's written consent must be obtained
 before any part of this publication may be reproduced
 in any form whatsoever, including photocopying, and
 information retrieval systems.

All reasonable care is taken in the preparation of the
 magazine contents, but the publishers cannot be held
 legally responsible for errors in the contents of this
 magazine or for any loss however arising from such
 errors, including loss resulting from negligence of
 our staff. Reliance placed upon the contents
 of this magazine is at reader's own risk.

Model Engineer is published for \$136.00 per year by
 Magicalia Publishing Ltd c/o EWA Magazines, 205 US
 Highway 22, Green Brook, NJ 08812. www.ewamags.
 com. Periodicals paid at Green Brook, NJ. Postmaster
 please send address correction changes to Model
 Engineer c/o EWA at the address above.



ISSUE IN THIS ISSUE IN THIS ISSUE IN THIS ISSUE IN THIS ISSUE IN THIS

Vol. 200 No. 4325 9 - 22 May 2008

549 SMOKE RINGS

News, views and comment on the
 world of model engineering.

550 POST BAG

Letters to the editor.

553 NEW SERIES: MY FIRST BOILER

Julia Old used modern methods to
 successfully construct her first boiler.

556 I/C TOPICS

Concluding the new basic carburettor
 design plus a readers' query.

559 SELF-STARTING SINGLE- CYLINDER DOUBLE-ACTING STEAM ENGINE

Les Kerr continues the construction of
 parts for this ground-breaking steam
 engine design.

562 ENGINEERING'S LOCAL HEROES - ROBERT FORESTER MUSHET OF COLEFORD

Roger Backhouse profiles the man who
 perfected the tungsten steel process.

564 FINISHING AN EXHIBITION CLOCK

Roger Castle-Smith relates how he
 achieved a Gold Medal-winning finish.

569 ANNA

D. A. G. Brown and Mark Smithers
 detail the boiler's steam fittings.

573 SUPERHEATERS: PRACTICAL EXPERIENCES

Dennis Postlethwaite concludes his
 advice on the merits of superheating.

575 ANOTHER CENTRE HEIGHT-SETTER

Dr. W. M. Foreman constructs an easy
 to use workshop tool.

576 WORKSHOP WRINKLES

Budget laser alignment of milling
 machines and keeping yourself and
 your workshop tidy.

578 LETTERS TO A GRANDSON

M. J. H. Ellis describes the historical
 development of tool steels.

579 KEITH'S COLUMN

Keith Wilson reminisces on an
 eclectic variety of topics.

582 NEWS

News from the trade and clubs in the
 UK and around the world.

584 DIARY

Forthcoming events.



ON THE COVER...

Quarter-scale model of the historic motor racing engine, the
 Offenhauser ('Offy') 270 engine, built by Ron Colonna. As reported
 recently this fine engine is part of Ron's output which led to him
 winning the Joe Martin Foundation, Metalworking Craftsman of the
 Year award for 2008.

(Photograph Ron Colonna)

PHONE 08456 777807 TO TAKE ADVANTAGE
 OF OUR LATEST SUBSCRIPTION OFFER

FUSION FURNACES

Lift-out crucible furnace

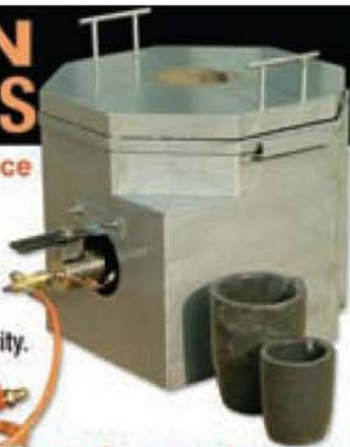
Ideal for small scale sand-castings or art mouldings. Standard model fired by Natural Draught Propane Gas burner, up to 1000°C. Brass 18kgs. Aluminium 6kg. capacity.

Roy Hall Combustion Ltd.

Tel/Fax: 01273 517119

e-mail:

sales@furnaceexchange.com www.furnaceexchange.com



PHOENIX PRECISION

Can Your Current Paint Supplier Honestly Claim to be The Only Professional Model Paint Manufacturer in the UK.

WE CAN

Send a stamped, self addressed envelope[letter] (110mm x 220mm minimum) plus 2 first class stamps to receive either catalogue or 3 first class stamps plus sase [100gm large letter] for both.

Phoenix Precision Paints Ltd

P.O.Box 8238, CHELMSFORD, Essex, CM1 7WY. Tel: (01268) 730549
Monday - Friday 10.00 - 16.00 (except exhibition dates)

TPH MACHINE TOOLS

NEW CHESTER SHOWROOMS NEAR LONDON!

Tel: 01708 523916

Open: Monday - Friday

8.30am - 5.00pm &

Saturday till Noon

(Also stocks of Used Lathes, Mills, etc)

Just 10 minutes from Dartford Tunnel (and Lakeside)

Please check our website:

www.tphmachinetools.com



Ever thought about a job in design?

Design experience is not essential, but you must have experience of building steam locomotives, understand steam valve gear and machine tool capabilities. You must also be computer literate (basic Windows, Excel, etc.) and, although reporting to the Design Manager, be able to work on your own initiative.

We use a 'state of the art' CAD system called Solidworks to create designs ensuring a balance between practicality, safety and cost-effectiveness. Full training will be given. We can also be highly flexible on hours of work.

Interested? Then e-mail us, before Friday, 23rd May 2008 quoting

Job Ref: 3/8 and giving details of your experience to:

Kerry@modelworks-int.com

For more information about us, visit our website:

www.modelworks-int.com

Machine - DRO.CO.UK

www.machine-dro.co.uk

Allendale Electronics Limited
43 Hoddesdon Industrial Centre,
Pindar Road, Hoddesdon,
Hertfordshire, EN11 0FF.

Complete Range Of DRO Systems...



2 Year Warranty
Tact. Apply



Contact us for a Quote

We stock an extensive variety of digital readout display consoles, ranging from cost effective entry level systems to the latest generation of LCD display systems. We also offer a wide range of precision linear scales and rotary encoders, to fit to your machine tool.

Please contact us for a quote & latest special offers on our DRO Systems.

This Month's Readers Offer...

15-35mm Internal Dial Bore Calipers

£34.95 inc VAT

FREE DELIVERY

Quote issue number on ordering.



www.machine-dro.co.uk

+44 (0)1992 450780

NEW!

GET GOING!

7 1/4" Loco from £1195

5 1/2" Loco from £750

Complete £3.50

www.maxitrak.co.uk

MAXITRAK/ME S 10-11, Larkstone Park, Lodge Farm, Stansted, Kent
TN12 0QY. Tel: 01580 890030 Email: info@maxitrak.co.uk

GET WOODWORKING .COM

GETWOODWORKING The Ultimate woodworking resource



STUART MODELS

FOUNDED 1906

For the **MODEL ENGINEER** **SETS OF CASTINGS**

We offer Sets of Castings suitable for both those starting out in model engineering as well as those looking for a new and challenging project.



For the **ENTHUSIAST** **PRE-MACHINED KITS**

Many of our engines are available as Pre-Machined Kits allowing you to finish the model with a set of spanners and simple hand tools.



For the **COLLECTOR** **READY TO RUN MODELS**

The perfect choice for anyone who has an interest in steam. These models are assembled, painted and thoroughly tested in our workshop.



STUART MODELS
2003-2005

CATALOGUE - £5.00
80 PAGE FULL COLOUR

Please send £5.00 for our eighty page comprehensive full colour catalogue which covers our entire range of models and accessories.



STUART MODELS

• DEPT. ME, BRAYE ROAD, VALE, GUERNSEY, UK, GY3 5XA •
• TEL 01481 242041 • FAX 01481 247912 • www.stuartmodels.com •

G.L.R. DISTRIBUTORS Ltd

TINA

1" Bore x 1.1/2" Stroke -Slide Valve
Length of Baseplate 12"
Diameter of Flywheel
Height 6" - Width 6"
Weight 4.1/2 Kilos
Complete, Drawings and Materials
(Hardwood base £15 extra)
Unbeatable value at
this price £175.00
plus £8.00
Carriage
to mainland
All prices
include vat



SPECIAL OFFER

Materials and Castings for Boiler and Engine

**Buy both together at ONLY
£245.00**

Carriage **FREE** to UK mainland

*Catalogue of all our products
included*

*Pictures are
illustrations of
models when built by
our customers*

MULTI-TUBULAR BOILER KIT

Runs on Coal - Gas - Spirit
4" dia. x 16swg Copper tube -
8.1/2" high
25 5/16" x 20g Copper tubes
Firebox 3.1/2" dia.
3.1/2" long
Working pressure 80 psi
£85.00 plus Carriage
£8.00 to mainland UK
Set of 6 fittings
optional at £95.00
All prices
include vat



Catalogue included offering our extensive range of Materials • Tooling • Steam fittings • Fasteners • Adhesives etc.
Plus our complete range of Charles Kennions Locomotive drawings and Castings

NEW PREMISES - G.L.R. DISTRIBUTORS, UNIT 3, GRESLEY CLOSE, DRAYTON FIELDS, DAVENTRY, NORTHANTS. NN11 8RZ

• Tel: 01327 878988 • Fax: 01327 876396 • E-Mail: peteglr@btopenworld.com

Web site: www.modelmakingsupplies.co.uk

Send 6 first class stamps for catalogue & Price List

OPEN TO CALLERS - Monday-Friday 9.00am - 5.00pm SATURDAY 9.00am - 12.00 noon

TurboCAD®



Avanquest solutions

- Draw in 2D or 3D
- Free advice and support during office hours
- Free tutorials to get you started
- 50% discount for Model Engineer readers -
Professional 12 at £120, Professional 14 at £267,
Deluxe 12 at £30, Deluxe 14 at £40

For all sales and enquiries call Paul Tracey
at Avanquest on 01962 835081 ptracey@avanquest.co.uk

For further information on TurboCAD
and details on how to draw the illustrations
shown please visit www.turbocad.co.uk



New Online Shop at
www.ajreeves.com



Over 8000 different items available to order 24 hours a day, 7 days a week!

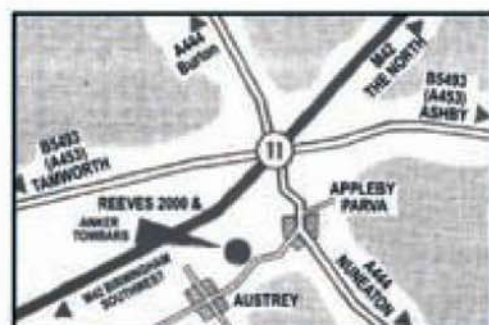


New, secure online ordering
from Reeves 2000

Visit the Shop That's
Got the Lot!



Castings,
Drawings,
Boiler Fittings,
Paint,
Transfers,
Drills,
Taps & Dies,
Bar Stock,
Rivets,
Bolts, Screws,
& Washers,
Spring Steel,
Braze & Silver
Solders
and much more....



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

9:00am-4.30pm Monday - Friday
9:00am-12.30pm Saturday
Closed Sun & Bank Holiday Sat & Mon

The 'International Range' of Boiler Fittings



The World's Largest Stockists
of Model Engineering Supplies



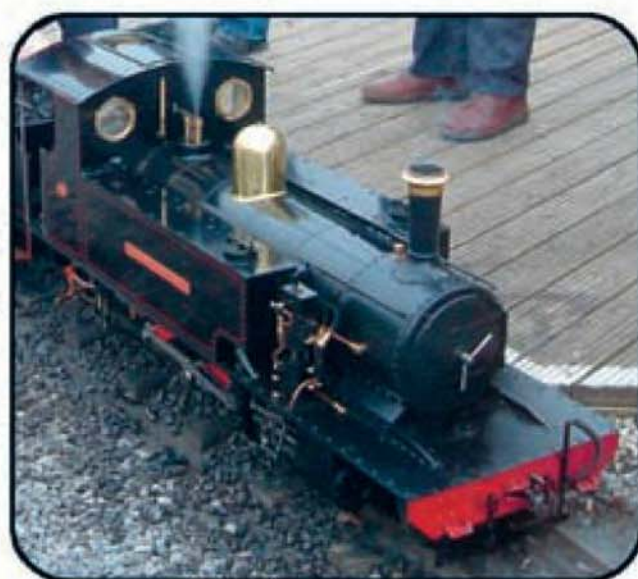
****New Addition****

**5" NG 2-6-0T Loco
and Tender**

Aquila

castings and drawings available

as featured in Model Engineer...



Trade Counter Now Fully Stocked and Open to Callers - ALL WELCOME

Reeves 2000
Appleby Hill
Austrey
Warks
CV9 3ER

9:00am-4.30pm Monday - Friday
9:00am-12.30pm Saturday
Closed Sun & Bank Holiday Sat & Mon
Tel: 01827 830894 sales@ajreeves.com
Fax: 01827 830631 <http://www.ajreeves.com>

26th Edition Catalogue

UK: £7.00 inc p&p
Europe: £8.00 inc p&p
Rest of World: £12.00 inc p&p
New Price List 4 x 1st Class Stamps

NOW OPEN IN LINCOLN & BURTON UPON TRENT

METAL LATHE
CL300M
• 300mm between centres
• LHRH thread screw cutting
• Electronic variable speed
• Self centering 3 jaw chuck & guard
• Gear change feed

SLASHED
ONLY
£329.99
£387.99
WAS £422.99 INC VAT

Full range of accessories available

Machine Mart

53 SUPERSTORES NATIONWIDE

Where Quality Costs Less

NEW CATALOGUE

GET YOUR FREE COPY NOW

IN-STORE ONLINE
machine-mart.co.uk

PHONE 0845 450 1855

ORDER ONLINE

Machine Mart

CLARKE MICRO MILLING & DRILLING MACHINE

• 150w/230v motor
• Variable speed 100-2000rpm
• MT2 Spindle Taper
• Face mill capacity 20mm, end mill 10mm, longitudinal travel 90mm, longitudinal travel 180mm

SLASHED
ONLY
£219.99
£257.99
WAS £270.23 INC VAT

CMD10

CLARKE VARIABLE SPEED LATHE

• 150w motor
• Ultra compact precision lathe
• Variable speed control 100-2000rpm

ONLY
£249.99
£293.73
WAS £310.23 INC VAT

CL250M

CLARKE 12 SPD MILL/DRILL

ONLY
£599.99
£703.99
WAS £750.23 INC VAT

CMD1225C

Precision engineered with cast iron head, base & column
• Spindle speeds 100-2150rpm
• 4Hp, 230v, 1 Ph motor
• Accessories available
• 63mm milling cutter
• 16mm chuck
• Table size 565x190mm

CLARKE ARC/TIG INVERTERS

• Used for ARC & TIG welding
• Low amp operation - ideal for auto bodywork & thin mild/stainless steel
• Inc. Arc welding kit
• Lightweight only 3.5kg

FROM ONLY
£129.99
£152.99
WAS £165.23 INC VAT

MODEL	AMPS	ELECTRODE	EX VAT	INC VAT
85	25/80	2mm	£129.98	£152.73
110	30/105	2.5mm	£169.98	£187.98
155	22/140	3.25mm	£269.98	£317.23

CLARKE HYDRAULIC PRESSES

PROFESSIONAL QUALITY
Built for tough daily use in automotive/industrial workshops

FROM ONLY
£159.99
£187.99
WAS £200.23 INC VAT

MODEL	EX VAT	INC VAT
10 ton bench	£199.98	£197.98
10 ton floor	£179.98	£211.48
15 ton floor	£389.00	£468.83
25 ton floor	£649.00	£762.58
50 ton floor	£1198.00	£1407.65

BUY IN-STORE

MAIL ORDER
0845 450 1800 Mon-Sat 9.30-5pm

ORDER ONLINE
www.machine-mart.co.uk
Over 8500 products, see the full range

NEW STORES
Sunday Opening at
Burton Upon Trent
Lincoln & Warrington

CLARKE ANGLE GRINDERS

FROM ONLY
£15.99
£18.99
WAS £20.23 INC VAT

Inc. disc & handle

MODEL	DISC (MM)	MOTOR	EX VAT	INC VAT
AG122	115	900w	£15.99	£18.79
B&D CD115	115	700w	£21.99	£25.84
CON115	115	1010w	£24.99	£29.36
AG232 (9")	230	2000w	£26.99	£31.71
Ryobi EAG-8011	115	800w	£26.99	£30.54

CLARKE MAGNIFYING LAMPS

• Powerful 3 dioptr 89mm precision lens
• Adjustable spring balanced arm for exact positioning
• Quick fixing universal clamp base

FROM ONLY
£14.99
£17.99
WAS £19.23 INC VAT

CS4-0C

CLARKE BELT AND DISC SANDER

ONLY
£59.99
£69.99
WAS £75.23 INC VAT

CS4-0C

Also Available
6" belt 8" sander also available
£164.48 Ex VAT
£176.23 Inc VAT

CLARKE ELECTRIC WINCHES

FROM ONLY
£109.99
£129.99
WAS £140.23 INC VAT

• Powerful and compact general purpose winches
• Quick and easy to install for all types of pulling & lifting work
• Cable doubles to increase load capacity

MODEL	POWER	CABLE	EX VAT	INC VAT
CHP250	530w	125kg	£109.98	£129.23
CHP400	880w	200kg	£139.98	£164.48

CLARKE WORKSHOP CRANES

FROM ONLY
£129.99
£152.99
WAS £165.23 INC VAT

MODEL	DESC.	EX VAT	INC VAT
CF500F	1/2 ton folding	£129.98	£152.73
CF100	1 ton folding	£129.98	£152.73
CF1000LR	1 ton long reach	£149.98	£178.23
CF1000	1 ton large folding	£159.98	£187.98
HDC100	1 ton pro	£319.98	£375.98
HDC200	2 ton pro	£669.00	£796.08

• Folding and fixed frames available
• Robust, rugged construction
• Overload safety valve

CLARKE CHESTS & CABINETS

FROM ONLY
£56.99
£66.99
WAS £72.23 INC VAT

HEAVY DUTY

MODEL	DESC.	DR. LOAD	EX VAT	INC VAT
CB8203	3 Dr step up	38kg	£56.99	£66.98
1 CB8209	9 Dr chest	38kg	£99.98	£117.48
CB8210	10 Dr chest	38kg	£129.98	£152.73
2 CB8213	3 Dr chest	43kg	£159.98	£187.98
CB8215	5 Dr cob	43kg	£169.98	£199.73
CB8217	7 Dr cob	43kg	£199.98	£234.98

CLARKE HEAVY DUTY RANGE

MODEL	DESC.	DR. LOAD	EX VAT	INC VAT
3 CB8900	9 Dr chest	30kg	£88.99	£102.21
1 CB8200	2 Dr step up	30kg	£39.98	£46.98
4 CLBT005	5 Dr cob	30kg	£149.98	£176.23
4 CLBT007	7 Dr cob	30kg	£169.98	£199.73

CLARKE SOLDERING KIT

ONLY
£12.99
£15.99
WAS £17.23 INC VAT

• 100w, 230v trigger operated instant heat soldering gun
• Hands free magnifier
• De-solder suction tool to remove excess from joints
• Scraper/probe tool
• Spare gun tip

CLARKE MEASURING EQUIPMENT

FROM ONLY
£8.99
£10.99
WAS £12.23 INC VAT

MODEL	DESCRIPTION	EX VAT	INC VAT
CM100	150mm/6" Vernier Caliper	£9.99	£10.56
CM180	0-25mm Micrometer	£9.98	£11.73
CM145	150mm/6" Digital Vernier	£11.99	£12.14
CM265	300mm/12" Digital Vernier	£29.98	£36.23

CLARKE ROTARY TOOL KIT

ONLY
£24.99
£29.99
WAS £32.23 INC VAT

Kit includes:
• Height adjustable stand with clamp
• Rotary tool
• 1m flexible drive
• 40x accessories/consumables

CLARKE ENGINEERS STEEL WORKBENCHES

FROM ONLY
£119.99
£140.99
WAS £150.23 INC VAT

ONLY £79.98 EX VAT £93.98 INC VAT

MODEL	SIZE (LMM)	EX VAT	INC VAT
CWB1000	1000x650x880	£119.98	£140.98
CWB1500	1500x650x880	£169.98	£187.98
CWB2000	2000x650x880	£189.98	£223.23

• Sturdy lower shelf
• Durable powder coated finish
• INCLUDES SINGLE LOCKABLE DRAWER

CLARKE QUALITY TOOL KITS

• Assorted AF and metric sets
• Huge selection of the most popular tools

FROM ONLY
£59.99
£70.99
WAS £75.23 INC VAT

CHT548

MODEL	PIECES	WEIGHT	EX VAT	INC VAT
CH1497	242	19kg	£59.98	£70.48
CHT548	300	24kg	£84.99	£99.86

CLARKE BOLTLESS SHELVING/BENCHES

• Weight loading per shelf up to 150Kgs
• Strong 9mm fibreboard shelves
• Quick assembly unit

FROM ONLY
£25.99
£30.99
WAS £32.23 INC VAT

CS5150

CLARKE TAP & DIE SETS

FROM ONLY
£12.99
£15.99
WAS £17.23 INC VAT

• High quality tungsten steel
• Supplied in metal storage case, except 16pc

TYPE	EX VAT	INC VAT
16pc Metric	£12.99	£15.26
19pc UNF	£14.99	£17.61
24pc UNC/UNF/NPT	£19.98	£23.48
28pc# Metric	£19.98	£23.48
33pc# Metric/UNF/BSP	£29.98	£36.23
32pc Metric	£34.99	£41.11

CLARKE BENCH GRINDER STAND

ONLY
£24.99
£29.99
WAS £32.23 INC VAT

• Complete with bolt mountings and feet anchor holes

Stand Only

CLARKE BENCH GRINDERS

FROM ONLY
£14.99
£17.99
WAS £19.23 INC VAT

6" & 8" available with light

CB68W features 8" whitestone & 6" drystone

MODEL	DUTY	WHEEL DIA	EX VAT	INC VAT
CB68P	DIY	150mm	£14.99	£17.61
CB68Z	PRO	150mm	£19.99	£23.49
CB68SC	HD	150mm	£26.99	£31.71
CB68SB	PRO	150mm	£26.99	£30.54
CB68RW	HD	150mm	£29.98	£35.23
CB68SC	HD	200mm	£36.99	£43.46
CB68W (wet)	HD	150/200mm	£34.99	£41.11

CLARKE DRILL PRESSES

• Tables tilt 0-45° left and right
• Depth gauge
• Chuck guards
• B=Bench mounted
• F=Floor standing

MODEL	WATTS/CFM	EX VAT	INC VAT
CDP500	250/5	£33.99	£39.94
CDP1018	245/5	£49.98	£58.73
CDP1518	300/5	£79.98	£93.98
CDP108	370/12	£89.98	£106.73
CDP2018	370/12	£99.98	£117.48
CDP15F	370/12	£109.98	£129.23
CDP3018	510/12	£139.98	£164.48
CDP351F	510/12	£149.98	£176.23
CDP4018	510/12	£169.98	£187.98
CDP451F	510/12	£189.98	£223.23
CDP501F	980/12	£379.98	£446.48

* Includes wet 'T' slot table & worklight

CLARKE MIG WELDERS

Includes:
• Gas regulator
• Earth clamp
• Face mask
• Welding torch

FROM ONLY
£99.99
£117.99
WAS £125.23 INC VAT

Pro90-1511E includes CO2 gas bottle

MODEL	MIN-MAX AMPS	EX VAT	INC VAT
BS5NB (No gas)	27-45	£109.98	£129.23
PRO90 (No gas/gas)	24-90	£119.98	£140.98
Pro 90	24-90	£129.98	£152.73
110E	30-100	£159.98	£187.98
135E	30-130	£179.98	£211.48
151E	30-150	£199.98	£234.98
165E Turbo	30-155	£269.98	£317.23
175E Turbo	30-170	£329.98	£387.73
205E Turbo	30-185	£369.98	£422.98

CLARKE TURBO AIR COMPRESSORS

• Superb new range ideal for DIY, hobby & semi-professional use

FROM ONLY
£73.99
£86.99
WAS £92.23 INC VAT

BIG 2Hp 7.8cfm

• Bigger Outputs
• Higher Specifications

CLARKE 8mm air hose

FROM ONLY
£9.98 EX VAT
£11.73 INC VAT

• Best buy mini mag

MODEL	MOTOR	CFM	TANK	EX VAT	INC VAT
Tiger 8/44	2 Hp	7.8	24lt	£73.99	£86.94
Tiger 8/64	2 Hp	7.8	50lt	£119.98	£140.98
Tiger 9/24	2.5 Hp	8.7	24lt	£99.98	£117.48
Tiger 9/60	2.5 Hp	8.7	50lt	£129.98	£152.73
Hunter 60"	2.5 Hp	12.5	50lt	£179.98	£211.48
Boxer 55"	3 Hp	12.2	50lt	£239.98	£281.98
Boxer 100"	3 Hp	12.2	100lt	£299.98	£352.48

CLARKE BENCH GRINDERS

FROM ONLY
£14.99
£17.99
WAS £19.23 INC VAT

6" & 8" available with light

CB68W features 8" whitestone & 6" drystone

CLARKE DRILL PRESSES

• Tables tilt 0-45° left and right
• Depth gauge
• Chuck guards
• B=Bench mounted
• F=Floor standing

CLARKE 6 SPEED METAL LATHE WITH 12 SPEED MILL DRILL - CL300M

ONLY
£649.99
£763.73
WAS £810.23 INC VAT

Full range of accessories available

• 430mm between centres
• Compound slide with 4 way tool post
• Power feed reverse cutting facility
• Forward/reverse lathe operation
• Clutch for independent mill/drill operation
Shown with optional floor stand & tray
ONLY £129.98 EX VAT £152.73 INC VAT
ALSO AVAILABLE:
CL430 - As above but without the Mill/Drill head
£539.98 EX VAT £634.48 INC VAT

Need a kit? Get the book...

Get the very best from your workshop. Hemingway Kits provide over 70 unique tooling projects:

- Add capabilities to your workshop
- Work to finer limits
- Finish jobs more quickly
- Your production engineering team!



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

Hemingway

Hemingway Kits
126 Durnall Road, Bridgnorth
Shropshire WV16 4LZ United Kingdom
Tel/Fax: +44 (0) 1746 767730
Email: info@hemingwaykits.com

www.hemingwaykits.com

COMPASS HOUSE MODEL ENGINEERING



**5" Gauge Class 23
"Baby Deltic"**
Features
4 Axle hung motors
Sprung bogies
Electronic controller
Ready to Run*
From £1495.00

BATTERY ELECTRIC LOCOMOTIVES

7 1/4" Gauge Class 35 "Hymek"



With its four axle hung 280 watt motors and 150 amp electronic controller our "Ready to run" Hymek will pull a three car train all afternoon!

From only £2995.00 on the track!

*Requires two batteries "Not included"

Colour Catalogue £2.50 Post paid

HIGH STREET, ROTHERFIELD, EAST SUSSEX, TN6 3LH, UK

PHONE: 01892 852968 - 07711 717067

www.compass-house.co.uk

E-Mail: sales@compass-house.co.uk



My
Hobby
store.com

First stop for:

**Plans • Parts • Books
Binders • Show Tickets
DVD's • Back issues
Subscriptions**

**Over 3,000 items under one roof
Magicalia at its finest**

**For our stock at
a glance visit**

www.myhobbystore.com

or phone 01689 899200

Model Engine Builder

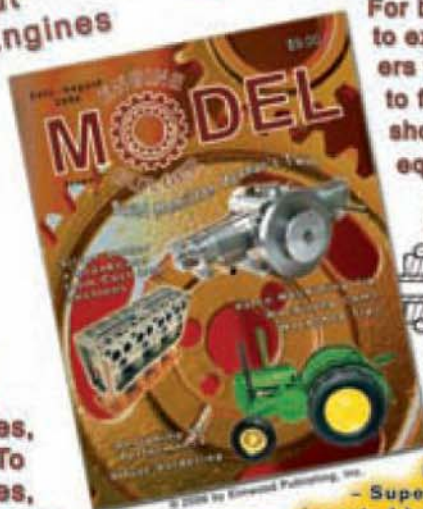
About
IC Engines



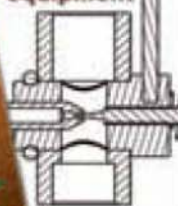
**Build
Articles,
How-To
Articles,
Centerfold
Articles,
Large Drawings
279mm X 432mm
(11" X 17")**



Morton M5
Issue 2
Build Article



For beginning
to expert builders with small
to full-sized
shops and
equipment



Section B-B

- Brilliant

Illustrations

- Superb Drawings

inserted but not bound

in so you can take them into your shop

Subscribe now for 2006/2007

All Back Issues are available.

Subscribe directly on our Web site

or print the Subscription Form

found there and send it today to:

Elmwood Publishing, Inc.

737 Elmwood Ave.

Vallejo, CA 94591-8841 U.S.A.

www.modelenginebuilder.com

Toll-free, U.S. & Canada 1-888-998-8999

Elsewhere 001-707-643-1970

Fax 001-707-642-5783

Polly Model Engineering Limited
Incorporating Bruce Engineering
For all your model engineering requirements.

POLLY MODEL ENGINEERING LIMITED
Manufacturers of the renowned Polly 5" gauge passenger hauling, coal fired steam loco kits, which are easily assembled with hand tools and minimal skill. Polly loco kits provide an ideal introduction to the model engineering hobby. Latest Polly V1 illustrated kit price only £5995 inc VAT.

Manufacture is complemented by our Bruce Engineering Model Supplies business, giving a comprehensive range of steam fittings, accessories, materials, books, etc. We specialise in supply of quality injectors (JC, Chiverton), pressure gauges, etc.

Stationary engine kits we produce a wide range of over 45 different models, including designs by Anthony Mount, our own large R&B gas engine, etc., and supply the full range of Stuart Models.

Practical Scale: Drawings, Castings, lost wax parts, laser cut frames, CNC rods, CNC platwork, etc for the range of locos designed by Neville Evans and serialised in Model Engineer.

See us at exhibitions or find these & other items in our Supplies Catalogue £1.75 posted UK \$5 worldwide Polly Loco Kit Catalogue £3 Stuart Models Catalogue £5

Polly Model Engineering Ltd (Inc. Bruce Engineering)
Bridge Court, Bridge St., Long Eaton, Nottingham, NG10 4QQ
tel. 0115 9736700 fax 0115 9727251
www.pollymodelengineering.co.uk

CLOCK CONSTRUCTION & REPAIR

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

**SPRINGS
BEARINGS
FRAMES
DIALS etc.**

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

THE MOST VERSATILE TOOL FOR TURNING & FACING

It's easy to see why our biggest selling turning tool is the SCLCR. It can turn and face a bar without altering the toolpost, and the 80° nose angle gives much more strength than a 60° (triangular) insert. The NJ17 insert cuts steel, stainless, cast iron, phosphor bronze, brass, copper, aluminium etc. Please state shank size required - 8, 10 or 12mm square section. Spare inserts £5.36 each for 8-10mm tools, £6.20 for 12mm.

SPECIAL OFFER PRICE £33.90 (MRRP = £64.04)

USE THE OTHER 2 CORNERS FOR ECONOMY!

Our SCRGR rough turning tool uses the same inserts as the 6, 8 & 10mm sq SCLCR tool above, and the boring bar below. The good news is that it uses the other two corners! These very strong 100° corners are rigid enough for rough or intermittent turning. The insert is mounted at 75 deg to the lathe axis. 10mm sq section only.

SPECIAL OFFER PRICE £35.90 (MRRP = £64.04)

PROFILING WHEELS or SHAPING AXLES & PILLARS?

If you need to create complex shapes, our SRDCN button tool is invaluable. The 10mm square shank holds a 5mm dia cutting insert, and gives great versatility, superb strength and excellent tool life.

Mr D Hudson of Bromsgrove SME has used these tools since 1995 to profile the special form of tyre treads for his self-steering wheel sets with great consistency. Spare inserts just £4.55 each.

SPECIAL OFFER PRICE £33.90 (MRRP = £62.77)

TURN SMALL DIAMETERS with LIVE CENTRE IN PLACE!

The SDJCR tool uses a 55° insert, allowing access to small diameter components when using a tailstock centre. It can also profile back-angles. The NJ17 insert cuts steel, stainless, cast iron, phosphor bronze, brass, copper, aluminium etc. Shank size 10mm square section. Spare inserts just £5.36 each.

SPECIAL OFFER PRICE £33.90 (MRRP = £64.04)

A TOP QUALITY BORING BAR FOR YOUR LATHE

Here's your opportunity to own a top quality boring bar which uses our standard CCMT06 insert. Steel shank boring bars can generally bore to a length of approx 5 times their diameter. Please state bar dia required - 8, 10, 12 or 16mm. Spare inserts just £5.36 each.

SPECIAL OFFER PRICE £36.90 (MRRP = £81.84)

WAKE UP FROM YOUR NIGHTMARE WITH KIT-Q-CUT!

The original and famous Kit-Q-Cut parting tool fits the vast majority of ME lathes, including ML7 & ML10 machines, regardless of toolpost type. The tool can effortlessly part through 1.58" dia. bar. It comes complete with key to insert and eject the tough, wear resistant insert. Cuts virtually all materials. Spare inserts just £8.37 each.

SPECIAL OFFER PRICE £49.50 (MRRP = £79.90)

55° NEUTRAL THREADING and PROFILING TOOL

Our SDNCN tool with neutrally mounted 55° insert allows Whitworth, BSF & BSP threads to be generated, as well as profile turning - both towards and away from the chuck. The 10mm square shank comes as standard with 0.2mm point radius insert. Inserts also available with 0.4mm or 0.8mm radius at the same price of £5.36 each.

SPECIAL OFFER PRICE £35.90 (MRRP = £64.04)

EXTERNAL THREADCUTTING TOOL

Our range of external threading tools use the industry standard 'laydown' 16 mm triangular (3-edged) inserts. By using tough, fully ground HSS inserts, coated with titanium nitride for wear resistance and smooth cutting, threads can be cut at slow speeds - even by hand-revolving the chuck! Tools are right handed as shown in picture. Insert not included - order separately at £12.74.

SEE OUR WEBSITE FOR MORE INFORMATION

SPECIAL OFFER PRICE £38.60 (MRRP = £61.10)

TURNING/BORING/PARTING TOOLS COME COMPLETE WITH 1 INSERT

Please add £2.00 for p&p, irrespective of order size or value



See us at Harrogate
9-11 May!



GREENWOOD TOOLS

Greenwood Tools Limited

2a Middlefield Road, Bromsgrove, Worcs. B60 2PW

Phone: 01527 877576 - Fax: 01527 579365

Email: GreenwTool@aol.com

Buy securely online: www.greenwood-tools.co.uk

MINIATURE RAILWAY



Miniature Railway, 40 Manor Road, Dorchester DT1 2AX
**THE UK'S ACTION-PACKED
 MINIATURE RAILWAY
 MAGAZINE**
£7.50 ANNUALLY
SUBSCRIBE NOW
www.miniature-railway.com
T: 01305 259998

ALL STEAM ENGINES WANTED

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

ALL 5" GAUGE LOCO's WANTED

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

ALL 3½" GAUGE LOCO's WANTED

Tich, Juliet, Rob Roy, Firefly, Jubilee, Maisie, Doris, GWR Hall, Britannia, Hielan Lassie, etc.

ALL 7¼" GAUGE LOCO's WANTED

Hunslett, Hercules, Jessie, Romulus, Dart, Bridget, Holmeside, Black Five, A3, B1, etc.



ALL TRACTION ENGINES WANTED

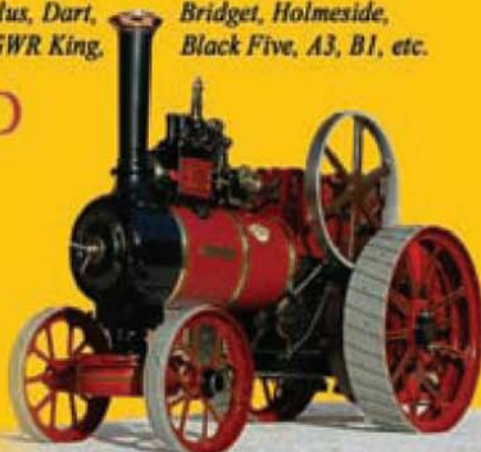
Minnie, Burrell, Royal Chester, etc

ALL PARTBUILT MODELS WANTED

For a professional friendly service, please telephone:

Graham Jones M.Sc. 0121 358 4320

www.antiqusteam.com



MODEL ENGINEER

Vol. 2003 No. 4325

9-22 May 2008

Beginner builds brilliant boiler

Axial engine



SAVE AN EXTRA 10%
when you subscribe online

MODEL ENGINEER EXHIBITION
ASCOT, 19-21 SEPTEMBER, 2008

*When you take out a 2-year subscription.

SAVE UP TO £43*

when you subscribe to

MODEL ENGINEER



BY PHONE: 08456 777 807 quote ref. E825



ONLINE: www.subscription.co.uk/mde/E825

Alternatively, you can complete the form below and return, with payment, to the address provided.

UK ONLY SUBSCRIPTIONS:

☐ I would like to subscribe to *Model Engineer* for 2 years (52 issues) with a one-off payment of £100.00, **SAVING 30%**.

☐ I would like to subscribe to *Model Engineer* for 1 year (26 issues) with a one-off payment of £53.50, **SAVING 25%**.

OVERSEAS SUBSCRIPTIONS:

☐ I would like to subscribe to *Model Engineer* for 1 year (26 issues) with a one-off payment: ☐ Europe (incl Eire) £78.00 ☐ ROW Airmail £85.00

For all Canadian, North and South American subscriptions please call 001 732 424 7811 or go to www.ewmag.com

PAYMENT DETAILS:

☐ Postal Order/Cheque ☐ Visa/Mastercard ☐ Maestro

Please make cheques payable to Magicalia Publishing Ltd and write code E825 on the back

Cardholder's name.....

Card no: (Maestro)

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

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

YOUR DETAILS:

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

Address.....

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

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

E-mail.....

DIRECT DEBIT SUBSCRIPTIONS (UK ONLY):

CODE E825

☐ I would like to subscribe to *Model Engineer* and **SAVE 27%**, paying £12.99 every 3 months by Direct Debit (UK ONLY).

Please complete form below

Instructions to your bank or building society to pay by Direct Debit.
Originator's reference 422562

☐ Pay £12.99 every 3 months by Direct Debit (please tick).



Name of bank.....

Address of bank.....

Postcode.....

Account holder.....

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

Sort code..... Account number.....

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

Reference Number (Official use only).....

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

TERMS & CONDITIONS: Offer ends 22nd May 2008. Subscriptions will begin with the first available issue. Please continue to buy your magazine until you receive your acknowledgement letter. Refund requests must be in writing to the Publisher and will not be given on accounts with less than £20 credit. A £5 admin charge will apply and will be deducted from any refund. Refunds will only be given at the Publisher's sole discretion. We will use the contact details supplied to communicate with you regarding your Model Engineer subscription. If you are also happy for us to contact you about other products or services available from Model Engineer and Magicalia Publishing Ltd, please indicate here: Contact by: ☐ email ☐ telephone ☐ mobile. If you are happy for us to pass your details on to other carefully selected companies to contact you about their products and services please indicate here: Contact by: ☐ email ☐ telephone ☐ mobile. If you do NOT wish us to contact you by POST about products or services available from Model Engineer and Magicalia Publishing Ltd, please indicate here ☐ If you do NOT wish us to pass your details on to other carefully selected companies to contact you by POST about their products or services please indicate here ☐

SEND TO: MODEL ENGINEER SUBSCRIPTIONS, TOWER HOUSE, SOVEREIGN PARK, MARKET HARBOUROUGH, LEICS LE16 9EF



Caught red-handed

"What's that you're reading?"

"Oh, nothing. Just a magazine."

"No its not, it's my copy of *The Engineer*."

"Well, yes. Actually, I often pick it up and look through it. There's always something really interesting in it, usually more interesting than in other magazines I read, or stuff I see on TV."

"Really?"

"Yes."

Just goes to show, you can be married to someone for 40 years, and not know they are closet engineers.

It also set off a train of thought. Would readers of *Model Engineer* be interested in advances in full-scale engineering?

We have always been happy to look back at engineering in by-gone days as the inspiration for models, and much of the new engineering is not at all suitable for home workshops.

We cannot imagine someone building a model fuel cell (wait for the letters!) and much modern engineering is based on new materials, rather than metal. But would readers like to be kept up to speed with new developments in engineering? It would certainly be interesting, but is it relevant to the model world?

Now, where's it gone?

"Have you got *The Engineer* again?"

New supplier

A warm welcome to new model engineering supplier A.M.E., started by enthusiast Peter Grigg. Peter has produced some outstanding designs, and has now responded to requests to make them available commercially by forming A.M.E.

One of them is pictured on this page, a class 66 powered by two 24V batteries. These powerful locomotives can be finished in a range of liveries. They can be supplied ready to run or as an easy-to-finish kit.

A variety of wagons are also available plus a working railhead treatment train, to clean up track. Finished bogies



and some smart looking cases are also available.

W. abbotsmodeleng.co.uk

T. 01953 6616628/07050 221105

E. peter@abbotsmodeleng.co.uk

IMLEC...

It is not long to go now to IMLEC 2008, the locomotive efficiency competition for the Martin Evans trophy. This year's event is at sunny Southport on July 5 and 6. Be sure to put it in your diary.

Why not make a weekend of it? This seaside resort town has plenty to offer and a visit to www.visitsouthport.com will provide all the information you need. We also have details of the event on page 581.

...Little LEC

The new Little LEC competition is taking place over the weekend of May 24 and 25 at the Guildford Society track. If you have a suitable model, why not have a go? Potential entrants should contact Peter Langridge on 01252 654675, or by email at peter.langridge@ntlworld.com, for more information and an entry form.

There will be a trophy for the winner, donated by Station Road Steam, and will be known as the 'Small Locomotive Challenge Trophy'. Warco has also put up a prize in the form of a voucher. Along with a *Model Engineer* prize, there is plenty to try for in this fun competition.

We are delighted to hear that this is not going to be a one-

off. Peter is in the process of locating a club to run the event in 2009.

Gremlins

The gremlins have been quiet for some time, but they struck in issue 4323 (April 11). Fortunately, it is quite rare, but now and again there is a hiccup in the printing process. By and large these escape unnoticed.

The machines that print 'ours' are fitted with some neat devices, which scan the output as it goes through the machine. As soon as something goes amiss it is spotted and things are put right. All affected copies are withdrawn and pulped.

However, just now and again, a faulty one creeps through. issue 4323 had some pages printed twice and others not at all. Unfortunately, this time a few did escape and were distributed.

It was probably no more than a dozen. However, if there are any more out there who have one like this we will be happy to replace it. Just contact Customer Services on 01689 899200 and they will send you a new one.

The gremlins, computer variety, also attacked Nemett's column in the same issue. In his carburettor drawing, the diameter symbol was replaced by a letter 'n'. It was to do with CAD drawings produced on a PC going through our production on Macs and converting to pdf files. Fortunately the problem is now solved.

1. Fine looking Class 66 engine, one in the range from new producer, A.M.E.



Code breaking

SIRS, - In *Machine Tools* (M.E. 4314, 7 December 2007) Mr. Griffiths referred to "the ...

Bombe mechanisms... as part of the Colossus computer system". Bombs were used to break Enigma, Colossus was used to break Tuny, a totally different cypher.

Enigma substituted one letter for another, and the Bombs mechanised testing possible solutions. Each Bombe was effectively a large number of Enigma machines running in parallel. Tuny was a far harder cypher, enciphering at the bit level, using early teletype technology. Enigma carried lots of different levels of traffic of highly varying usefulness to the Allies; Tuny carried traffic between Hitler and his generals in the field, all very high-grade material.

J. M. Rushton, Kent.

Allchin answers

SIRS, - I am writing to you in response to the *Allchin query* of Steve Whitehouse (M.E. 4320, 29 February 2008).

From the book *Steam Traction Engines, Wagons and Rollers* by Brian Johnson I quote the following information, No. 3251 was the last traction engine built by Allchins in 1925. It was to have been displayed on Allchin's stand at the Chester Show when new although it never actually appeared there. The engine was named *Royal Chester* after the show.

Samuel Brown, by e-mail.

A clockmaker's approach to model engineering

SIRS, - I read with great interest Ken Jones' article *Fixing Auntie's Clock* (M.E. 4320, 29 February 2008) and his model engineer's approach to clock mending. I particularly enjoyed his ingenious if somewhat convoluted solution to the problem of getting a new and lively spring safely into a rather small French barrel, and his subsequent encounter with the dreaded "Twang of Doom" - a newly reassembled clock with a non-engaging winding arbor.

This led me to give some consideration to the differing

philosophies behind the two disciplines, and I would like to offer the following thoughts on a clockmaker's approach to model engineering:

Metric? Imperial? Who cares? Just file it to fit.

It's bound to go better with a bit of end-shake.

Who said a file is not a lathe tool?

Milling machines are for wimps. I keep good stocks of piercing saw blades.

There's not much that can't be fixed with a good staking set.

Sue Cookson, East Sussex.

Small Whitworth threads

SIRS, - Re. the letter from John Wilson (M.E. 4320, 29 February 2008) regarding small Whitworth threads. The smallest Whitworth thread in our own stocks is $\frac{1}{16}$ in. BSW x 60tpi.

Your readers may be interested to know that the smallest BA thread is 25BA, made for watchmakers in Switzerland. The smallest drill in our stock is 0.004in. (0.1mm).

Our ranges of standard and special thread tools are very comprehensive, and should your readers require a current (free) catalogue, please send a stamped addresses envelope to Tracy Tools Ltd.

Unit 1, Parkfield Industrial Estate, Barton Hill Way, Torquay, Devon TQ2 8JG, (T. 01803 328603).

Peter Cotes, Tracy Tools Ltd.

Compact fluorescent lamps

SIRS, - I have followed the recent correspondence on this topic with interest and would like to add two further snippets of information.

1) In the machine shops of the engineering company, with which I served my apprenticeship, the lighting was by a mixture of sodium and mercury lamps. There were two light fittings at each position, one sodium and one mercury. The fittings were connected to different phases of the electricity supply. This resulted in an improved colour temperature and as the light intensity varied with a 120deg. difference there would be much less stroboscopic effect than a single lamp.

2) In my own workshop (garage) I fitted twin fluorescent fittings. These are usually wired lead/lag, not to reduce the stroboscopic effect but to increase the power factor to near unity. However, I replaced the standard chokes and capacitors with a high frequency unit which operates between 25kHz and 30kHz. Following Graham Astbury's tests with his laundry basket lid (*Postbag*, M.E. 4321, 14 March 2008) I also carried out a test, but using a small D.C. computer type-cooling fan. With a mains lamp there was significant evidence of strobing as the fan slowed down, however under the high frequency fluorescent lamps there is no sign at all.

I also followed up on Graham's reference to the NXP website; the application note for the 10 watt lamps is a mine of information. This lamp operates at 28kHz, but I have seen some examples which operate at 43kHz. I presume that in these low cost CFLs there is some leak through from the rectifier circuit superimposing 100Hz.

Perhaps a request to Philips Lighting could produce a short article covering these issues.

Peter Howson, Alloa.

Sensational Sinsheim

SIRS, - Having been a visitor to Sinsheim for several years, and afterwards often asked the same questions, I was very pleased to read your editorial (M.E. 4320, 29 February 2008). I have also visited other rallies in Europe such as Le Bouveret and not only noted but enjoyed the very relaxed atmosphere which benefits both locomotive operators and the public alike as they are all there to have a pleasurable experience. There just is no point in attending if one cannot enjoy events due to overzealous policing. If my very basic knowledge of the language is somewhere near correct, a recent German television programme claimed that 22,000 visitors attended the 2008 Sinsheim event.

The March 2008 *Engineering in Miniature* magazine quoted over 11,500 visitors also for a three-day show at Alexandra

Write to us

Views and opinions expressed in letters published in *Post Bag* should not be assumed to be in accordance with those of the Editors, other contributors, or Magcalla Publishing Ltd. Correspondence for *Post Bag* should be sent to: -

**The Editor,
Model Engineer,
Berwick House,
8-10 Knoll Rise,
Orpington, Kent, BR6 0EL;
fax: 01689-899266 or to david.carpenter@magcalla.com**

Publication is at the discretion of the Editor.

The content of letters may be edited to suit the magazine style and space available.

Correspondents should note that production schedules normally involve a minimum lead time of six weeks for material submitted for publication. In the interests of security, correspondents' details are not published unless specific instructions to do so are given.

Responses to published letters are forwarded as appropriate.

Palace. Does this not speak volumes? It is my belief that we are being led by the nose by the 'What if syndrome' lobby who are perhaps justifiably concerned about the litigious nature of society today and the Health and Safety Czars who may or may not jump all over us as the result of a perceived wrong doing.

As an example, while at Sinsheim I photographed trains running round, and yes with children driving or riding as passengers with no problems whatsoever. Yet a couple of weeks later while in a large shopping mall in Scotland, which in my opinion was a public place by virtue of unencumbered public access, I was very quickly apprehended and instructed by a plain clothed security guard that I was not allowed to use a camera in that place. I am also aware that some miniature railways, run by model engineering societies, despite being in public parks, do not allow photography of their activities.

I am a model engineer who has been constructing and operating steam locomotives in 3½in. and 5in. gauges for around 60 years and have therefore enjoyed yesterday's freewheeling times of running at tracks such as Maidstone, Beech Hurst, and Southampton etc before the days of boiler certificates, CRB checking and all the other criteria that now affects society. Maybe we cannot put the genie back in the bottle, but I do believe that we can, if we are strong enough, enjoy the same freedom that is the norm in Europe. No doubt an exhibition such as Sinsheim could be held in the UK, but not only are there those in authority to convince that we are sane and sensible, but the commercial risks, and the high cost of travel, hotels and limited incomes of the participants, many of whom are pensioners, will need to be part of the overall consideration.

Clive R. Young, Kent.

Great Orme telephone systems

SIRS, - Back in 2006 Ron Isted wrote about the Great Orme Tramway and asked if anyone

Offset turning in 3-jaw chuck

SIRS, - Stan Bray's simple method of packing out one jaw of a 3-jaw chuck by the required offset of an eccentric (*M.E.* 4318, 1 February 2008) is not quite as simple as he implied but by the time I had put finger to keyboard the correct formula was set out for all to see in the *Rail Rolls* feature in the following issue of the magazine. The trick of packing one jaw is quite useful but the formula for calculating the packing thickness is too complicated for general workshop use. A simplification can

be achieved by expressing 'offset' and 'packing' as fractions of the eccentric radius (the one it is held by in the chuck) and the formula can be reduced to the degree that only a small table is required to cover all likely jobs. By expressing both the offset and packing as fractions of the radius of the eccentric ($x = \text{offset}/\text{radius}$, $p = \text{packing}/\text{radius}$) the formula reduces to:

$$p = 1.5x - 1 + \sqrt{1 - 0.75 x^2}$$

This can be made more workshop friendly by means of a simple table: for any eccentric calculate 'x' by dividing offset by eccentric radius, look up the factor in the table and multiply the actual offset by the factor to arrive at the packing thickness.

Stan Bray needed an offset of 1.75mm on an eccentric of o/d 28mm, fractional offset = $1.75 / 14 = 0.125$

Multiply 1.75 by factor 1.453, required packing is 2.54mm

Finding packing of the correct thickness may be difficult but in many cases exact eccentricity is not required. Repeatability, as needed for pairs of Stephenson eccentrics, is however assured.

Michael Wheelwright, West Sussex.

Fractional Offset	Packing Factor
0.025	1.491
0.050	1.481
0.075	1.472
0.100	1.462
0.125	1.453
0.150	1.444
0.175	1.434
0.200	1.424
0.225	1.415

Fractional Offset	Packing Factor
0.250	1.405
0.275	1.395
0.300	1.386
0.325	1.376
0.350	1.366
0.375	1.355
0.400	1.345
0.425	1.335
0.450	1.324

had any information about the telephone system, referred to in a 1902 publication as a *Hunningscote transmitter and receiver*. On re-reading this article recently it occurred to me that my copy of *Electrical Installations* by Rankine Kennedy, 1903, might have something to say on the matter. Sure enough there is a reference to a Hunnings microphone.

This is in fact the familiar carbon granule microphone, which was invented by Henry Hunnings, a clergyman from Yorkshire in 1878. What is it with these Victorian English clergymen? Anyway, it seems that the 'Hunningscote' is a typo, it should be 'Hunnings cone' which refers to the cone that was part of the design. The telephone part of the system would thus be a standard carbon microphone based telephone system, as was in common use until at least the sixties and is quite probably in use somewhere in the world even now. I have a pair in my basement that would probably work if I put a battery in the system.

This brings me to another point from the article; it refers

to hand-cranking the phone in order to talk, and using a bell push for the rings. As far as I know, such telephone systems generally used a battery for the microphone supply, the reason being that any sort of generator tends to be too noisy for supplying the microphone. I would expect the generator part to be used to supply the ringing current. The duration of the rings is then controlled by turning the crank a small amount or a large amount.

If the rings were controlled at Great Orme by a bell push, it implies the presence somewhere in the system of a battery powerful enough to ring the bells, which would therefore be more than sufficient to power the microphones as well. So on balance of probabilities, I would suggest that the telephone part would have been powered by a dry cell, while the bells would have been operated by the crank.

Incidentally such systems, at least the more modern ones, have contacts on the generator so that while it is turning the local microphone and receiver are switched out of the circuit. Motor generator sets were used to generate ringing current at

exchanges, but not at subscriber premises, and most likely not at an isolated system like this with only a few phones to ring. During the era we speak of, induction coils were being introduced to step up the speech voltage on the lines, allowing working over longer distances. This may not have been needed for the Great Orme system. Of course at that time there was no available form of amplifier, other than the carbon microphone itself. Some information about the Hunnings cone system can be found at www.richardsradios.co.uk/hunnings.html
John Olsen, Auckland, New Zealand.

Screw head friction - a good idea?

SIRS, - As usual, Grandpa's letter on screw tightening (*M.E.* 4319, 15 February 2008) was amusing and informative but I am not convinced that, in this case, he has driven his analysis through to the correct conclusion. I can see that his 'patent' screw with a concave underside to the head would, when tightened to the limit, require more torque to undo than a conventional flat headed



screw, so far so good.

But consider how the screw becomes undone, without a screwdriver, when it works loose during service. Grandpa outlines an elaborate analysis of this problem but seems to miss the crucial point that the torque supplied to the screw thread during this undoing process comes from the friction of the head. Let's take the simple case of two metal plates, one with a threaded hole and one with a clearance hole, joined by a single screw. We all know from experience that the simplest way to try to undo the screw without a screwdriver is to rotate the top plate anti-clockwise with respect to the other. This works because the head friction is usually greater than the thread friction - as Grandpa says. But I suggest that this is also what usually happens when a screw becomes loose during service. Slight rotational jiggling tends to loosen the screw by the ratchet mechanism, as Grandpa explains, but he does not say that the torque forces for this are transmitted to the thread through the head friction. Imagine, in our simple experiment, that we had locked the thread so that its friction would exceed the head friction. We would then need a lot more force to rotate the plates relative to each other. If we succeeded in overcoming

the head friction (and the friction between the plates) then the plates would slip but the main point is that the screw would not become loose, it would still perform a potentially useful service in keeping the plates together.

My conclusion is that, instead of increasing the head friction, Grandpa should have invented a screw with reduced head friction and increased thread friction in order to avoid it working loose. I think that the successful inventors of various patent screws and locknuts have realised this but I would be interested to hear what more expert readers think. While it is certainly true that serrated washers placed beneath screw heads are used to increase head friction, my impression is that the serrations are generally twisted so that a greater frictional force opposes the head turning anti-clockwise with respect to the plate beneath. Thus, during rotational jiggling, the ratchet effect of the washer would oppose the ratchet effect of the screw thread and tend to keep the screw tight.

Perhaps it's just as well that Grandpa did not invent his screw 50 years ago when he might have been tempted to patent it and mortgage his house in order to finance its production!
Graham A Dunn, King's College, London.

Small Whitworth threads

SIRS, - John Wilson (M.E. 4320, 29 February 2008) suspects that $\frac{1}{2}$ in. Whitworth were special threads not commonly available. In fact they were made by the billion, and are still extensively in use, for this size is that used by Meccano!

Tony Finn, East Riding of Yorkshire.

Filing, metal cleaning, screws and superheating

SIRS, - Since an article in M.E. 4284, 13 October 2006) on draw filing I've been eagerly awaiting some clever fellow pointing out the very flawed technique shown. I still remember at school my mate getting beaten by the metalwork master for daring to demonstrate the method shown in one of the pictures. Draw filing by holding the ends of the file causes nothing short of a very wibbly-wobbly file action (that's a technical term) resulting in a flawed finish. The method subsequently beaten into us tyro metal workers was to pin the file, usually a 6in. smooth, normal to the edge to be draw-filed by the over-lapping Peter-Pointers of each hand with an equal amount of file sticking out each side. The aim being to locate the file on the surface before carefully grasping the file ends with the remaining digits and thumbs. From this point draw the file smoothly along the edge, forwards and backwards. The same technique applies to 'draw-filing' using emery on a hard block.

In M.E. 4306, 17 August 2007, John Day describes his disappointment with ultrasonic cleaning. I think it worth pointing out that he maybe expecting too much on rusty black steel. Being a little less ambitious I've had great success removing the final stubborn grot from various nooks and crannies using my 50-watt unit from Maplins. For the task outlined I would suggest looking to the Machine Mart Spot-blast kit, a snip at just over £17 to complement the ever-useful workshop compressor. Apart from the "don't try this at home" (in the workshop, that is) warning because the grit goes everywhere, I found it

an essential tool for removing surface grot, particularly around rivet heads prior to repainting. If anyone does try this it's worth investing the time converting a large cardboard box into a spray booth and doing it all at the end of the garden as far away from the compressor and other precision kit as possible. Just add a spare pane of glass and a couple of sleeves made from polythene sheet, gloves and goggles and a very effective breathing mask. Also expect to be banned from the house afterwards. Agreed a huge overhead on simple ultrasonic cleaning but it'll cut through the surface grot on steel or brass and can be both very effective and sympathetic on complex contours.

In the same issue Ron Wallman correctly points out the dangers of trichloroethylene. Since re-discovering motorcycling I've also discovered a whole range of wonder products to keep the things in pristine condition, nearly all applicable in some way to model engineering, motorcycle chain cleaner in a convenient spray tin in this case. Maybe followed up with a trip in the ultrasonic cleaner.

I can also recommend using one of the many 'dry' chain spray lubricants for clean soak-in, stay-put lubrication. Check out your local motorcycle shop; maybe even buy a new British motorcycle.

I also very much enjoyed the letter on screws used in the manufacture of firearms, M.E. 4318, 1 February 2008). It illustrates a point I tried to raise a year or so back on the tricky subject of modelling firearms. I wanted to understand the broader issues and techniques required but got closed down by a single correspondent from Somerset.

And finally, superheating the pros and cons: I have to say it's like watching the debate on the number of angels one can get on the head of a pin. Will superheating in model engines prevent global warming (another thread)? Unlikely, but just do it anyway.

Steve Walkley, Cheltenham.

Thread markings

SIRS, - We recently had the task of clearing a fellow model engineer's workshop who had sadly passed away, and found, as we would have expected, various taps and dies of the constant pitch model engineers threads.

However, on closer inspection some of the taps and dies have in addition to manufacturer's name and thread details, the inscription 'WF' (and in a minority of cases 'WWF').

Although I have been involved in model engineering for around 40 years, I have never come across these inscriptions before. Is it possible for one of your technical experts to advise on their purpose. Are these taps and dies interchangeable with what I would call the normal constant thread items?

Thanking you in anticipation.

Ivan Smith, Stockholes Farm Railway.



The thread markings on the die found by Ivan Smith.

My first boiler

Julia Old

Describes how she used modern methods, and expert guidance, to make her first boiler.

Ever since I became interested in steam I have wanted to make my own boiler. I tried several years ago but, despite several attempts, they all leaked. The final straw came when I set fire to my hair and I concluded that boiler making was beyond my abilities. I was given a second chance when I joined the Maidstone Model Engineering Society, which positively encourages boiler making. The club has excellent facilities for silver soldering and many knowledgeable members on hand to provide advice.

The Rail-Motor's boiler struck me as a good starter subject as it is small, but with a full set of features. The finished boiler is 11½in. long with a 4¾in. diameter barrel. Another advantage of my club is that it gives me access to past issues of *Model Engineer* and I was able to locate Don Young's original description of the Rail-Motor Boiler. On reading the description, written in 1968, it

was apparent that the method of boiler construction was not in line with current best practice. The most obvious issue being the extensive use of soft solder caulking. The boiler drawing from Reeves shows some revisions, but it was clear that I would have to update the design. While I have brought many boiler making books over the years, none fully describe best practice in line with current thinking. Had I not been a member of a club I would have found it very difficult to discover what should be changed and what should be retained. To an expert, I suspect the changes would be regarded as trivial, but it took me several weeks to understand what was required.

There are several approaches to building a boiler that will achieve the same overall effect. The professionals aim to minimize time and materials and perform many operations in one heat using silver solder sparingly. As a novice I took my time and used many more

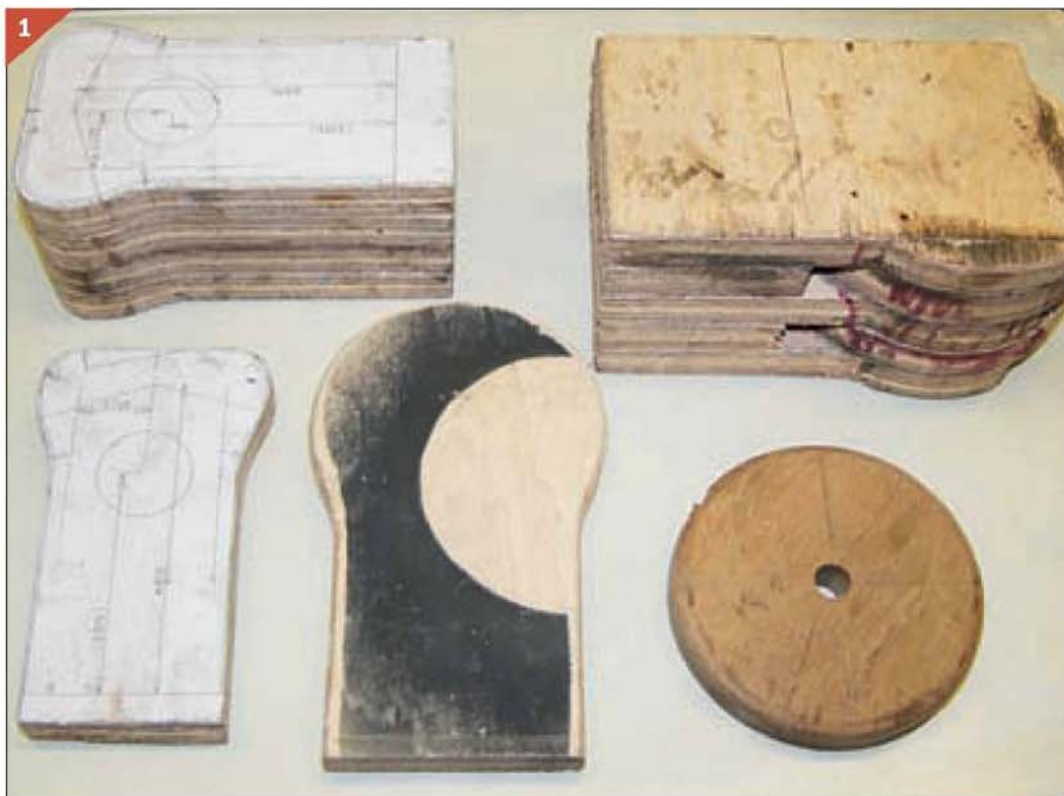
heats than strictly necessary. After each join was completed the boiler was cooled, pickled in acid, washed and inspected. Any joint that could not be seen to be perfect was reheated. All significant soldering operations were performed at my club assisted by a mentor who was an expert boilermaker. I did not always have the same mentor and this did cause some hiccups as the phrase "I would not have done it that way myself" was often used. On the plus side it did expose me to different methods and has enabled me to adopt those suited to my way of working.

Making a start

October 2007: To give me a head start I decided to order a kit of parts from Reeves. This came with a set of flanged plates and most of the copper for the boiler. As supplied the flanges were rather rough and not at right angles to the plate and on measuring the distance across flanges I found them up to 100 thou over size. I took them to my club for advice and they told me that I would need to improve the flanges before proceeding.

Even though I originally thought that they would not be needed, my first task was to make a set of flanging formers (**photo 1**). As I was only going to use them once, I made them from wood. I made the former for the front tubeplate from oak using my lathe to turn the disc to size. This used up my supply of oak and I turned to ¾in. ply for the remainder. As I had the boiler drawn on my CAD system I was able to print out full-size drawings of the backhead & the firebox tubeplate and stick these onto the wood to save the effort of marking out. The dimensional accuracy achieved is remarkable, but care is needed not to stretch the paper when it is wetted by the glue used to stick it down to

1. Formers used to re-flange plates.





2. Trimming front tube plate to size.
3. Trial assembly.
4. Throat plate attached to barrel.
5. The 'valley' is not filled but there is a fillet of silver solder.
6. The clamp invention that caused a lot of grief.

the wood. I sawed the formers roughly to shape using a coping saw for the curves and brought them down to size using a bastard cut file.

I annealed the copper and placed the partly shaped plate over my former. I held the sandwich in the vice with a flange uppermost and gave a succession of blows with a rubber mallet. The sandwich was turned until all of the flanges had been treated. Where there were tight curves, I used a stick of wood between the mallet and copper so that I could accurately direct the action. After annealing the copper is very soft and it almost felt like I could bend it with my fingers. Unfortunately it soon work hardens and, in cases where I was not happy that I had achieved the desired profile, I stopped and re-annealed the plate. I checked

the outside dimension between flanges and where necessary reduced the size of the former.

I tried to shape the outer wrapper using my bending rolls, but found I difficult to achieve the correct profile. The method of using the barrel and tubeplate to pull the wrapper to shape using screws, described in the M.E. article, did not appeal so I decided to make a wooden former. I made this by sticking several pieces of $\frac{3}{4}$ in. ply together as shown on the right-hand side of photo 1. This made life a lot easier and henceforth I shall make formers whenever I need to form a complex shape.

After trimming the front tube plate to size (photo 2), I had enough bits to enable me to trial assemble the outer shell of the boiler (photo 3).

Soldering

Where to start soldering? I received divergent advice at the club either a) Outer wrapper to barrel or b) Throat plate to barrel. The rationale for the latter choice was that by resting the upturned barrel on a flat surface it would be easy to ensure that the throat plate was square. As that provided the most gentle start I plumped

for that option, but I was later to regret this choice. Note: proficient boiler makers would tackle both and perhaps more at the first heating.

The next questions was how to hold the parts during the soldering operations. Here I discovered there was a variety of methods that could be used singly or in combination:

- Clamps
- Rivets
- Bronze screws
- Silver solder tacks
- Nothing, other gravity and the hearth

As the project proceeded I came to prefer rivets

augmented with either screws or clamps. In most cases the rivets were inserted as locating pegs and left straight. Where there was a possibility that they may fall out, they were slightly bent over. I never used a hammer to close a rivet! Where there was a tendency for the parts to spring apart, I used either a clamp or a bronze screw. For the throat plate to barrel I used a single rivet and trusted that, with the parts resting on the hearth, they would not move.

Yet another question was the selection of silver solder. The majority of club members use EasyFlow 2 but I have previously used the more expensive cadmium free solder. As I would be working very much in the open air, I decided to go with the majority and use EasyFlow. This has the lowest melting point and is very free flowing (not so good at gap filling!). The next question was 'thick or thin'. I had previously witnessed a novice making a boiler with 1.5mm rods and these were being used at an alarming rate. One of my mentors advised me to use 3mm (or $\frac{1}{8}$ in.) diameter rods and I selected these, as they seemed to offer better value. For the smaller joints I did, however, use 1.5mm rods. For the complete boiler I used six of the 3mm and seven of the 1.5mm rods.

I was advised that it was not worth step brazing. This is when early joints are done with higher melting point solder. However, I did cheat and used higher melting point 440 alloy for some of the bushes.





Photographs 4 and 5 show the completed joint - not much done for a first heating, but completed successfully. The silver solder was applied from the outside of the barrel, and the fact that it flowed through and formed a visible fillet on the inside, gave confidence that there had been good penetration of the joint. From reading, I have learnt that it is the solder in the 1-20thou. gap between the flanges that provides the integrity of the joint and not the fillets. However, at my level of competency, it is very reassuring to see fillets both sides and it will be some time before I will risk cutting down on the silver solder. When a plate is flanged and the flange butts up against its mating plate a 'valley' is formed. It is unreasonable to expect this 'valley' to be filled with solder, however, there should be a fillet of solder at its bottom.

Unfortunately my initial success made me over-confident and things began to go wrong on my next soldering session at the club.

Disaster

My first error was faith in a complex multi-point clamp fabricated from angle iron (**photo 6**). On each arm I had welded a line of nuts, to enable a row of bolts to be inserted, to push the wrapper against the throat plate. My mistake was compounded by a belief that three rivets would ensure proper orientation of the wrapper and barrel. In normal

circumstances, three points would fix the relative location of two parts but once heat was applied, and the copper relaxed, twists appeared which throw the alignment off.

Instead of one rivet at the top of the barrel, and one either side at the bottom of the throat plate, I should have used at least three rivets in the barrel alone and probably two rivets on each side of the throat plate. I had only inserted the rivets as locating pegs, it would have been better to have used a bronze screw, instead of the bottom rivet, in the wrapper.

As a result of these

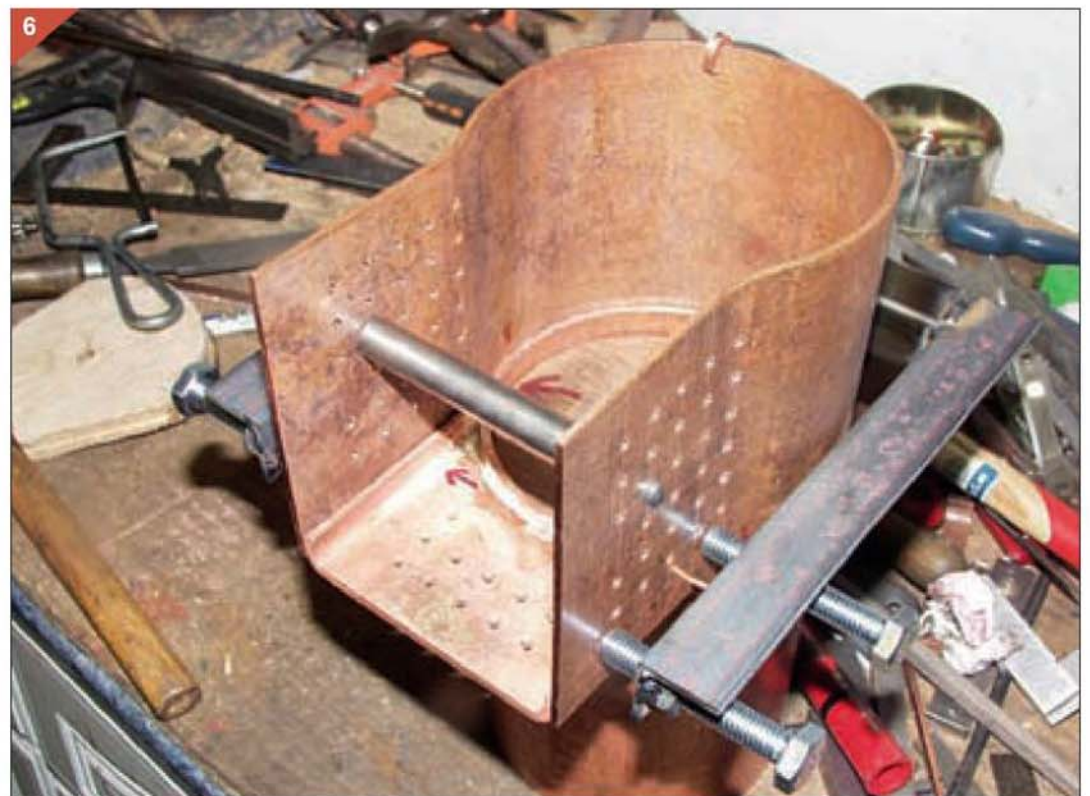
errors, there was a slight twist between the barrel and wrapper. It was not bad enough to make me scrap the work but I had to make sure I bent the cheeks of the wrapper to align with the barrel.

Worse was to come when I tackled the firebox and smokebox tubeplates. The first step was to solder the tubes into the firebox tubeplate. The club has a jig that enables the firebox tubeplate to be held parallel to a flat surface on which the ends of the tubes rest. The smokebox tubeplate is also fitted as an alignment aid (not soldered at this stage)

to correctly space the tubes. Unfortunately, I do not have a picture since I had not intended to publish - I was having enough trouble making my boiler! The soldering went well and I was pleased with the results.

Next, I used my special clamp and proceeded to silver solder the firebox wrapper to the tubeplate. I managed to complete the top seam and one of the sides. Then disaster! As I was working down the final side, with insufficient locating rivets to prevent twisting, the clamp fell off and a wide gap appeared!

● To be continued.



approximately two turns, and with the throttle set to about one third open. If the engine does not start and run at these settings, adjust the needle valve until it does. If the engine starts with an initial choke of fuel and then dies it is probably set too lean, so open the needle slightly and try again. Once the engine is running, adjust the needle to get maximum consistent speed before gradually opening the throttle. Adjust the needle to get maximum speed at full throttle and allow the engine to warm up.

Now gently close the throttle to get the slowest even running without changing anything else. At this point open the air bleed slowly giving the engine time to react. If the engine speeds up slightly, then adjust the air bleed to the highest speed before closing the throttle slightly to slow the engine.

If the engine slows when the air bleed is opened, some adjustment to the throttle barrel may be needed. The objective is to obtain a slightly rich mixture (too much fuel) at the slow speed setting with the air bleed closed. This can be achieved by

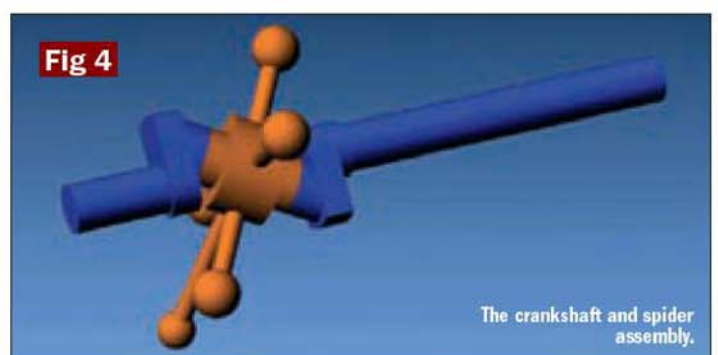
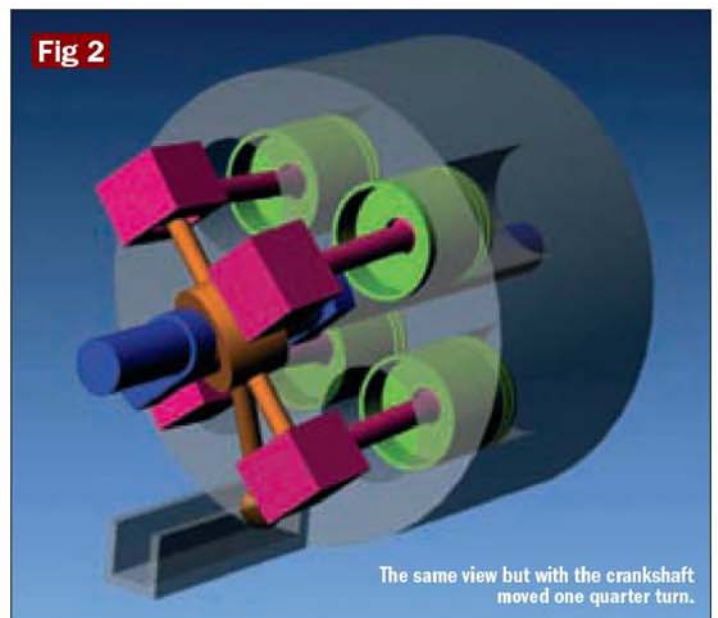
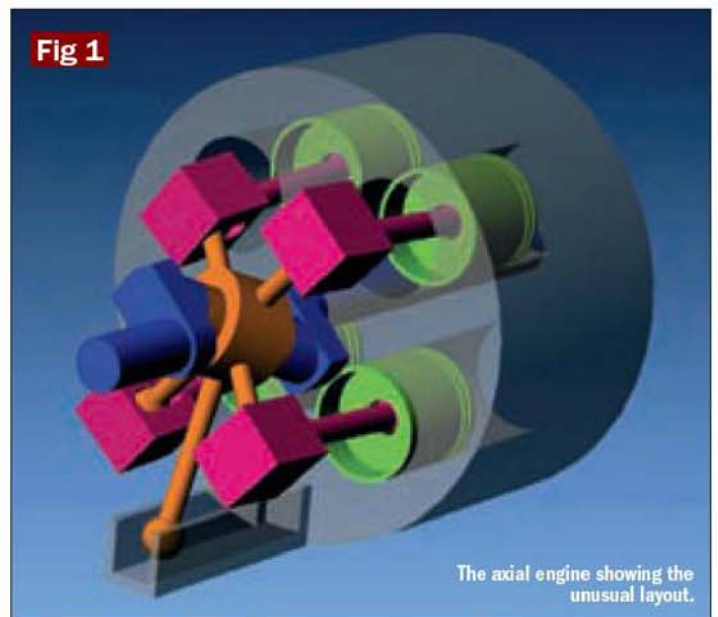
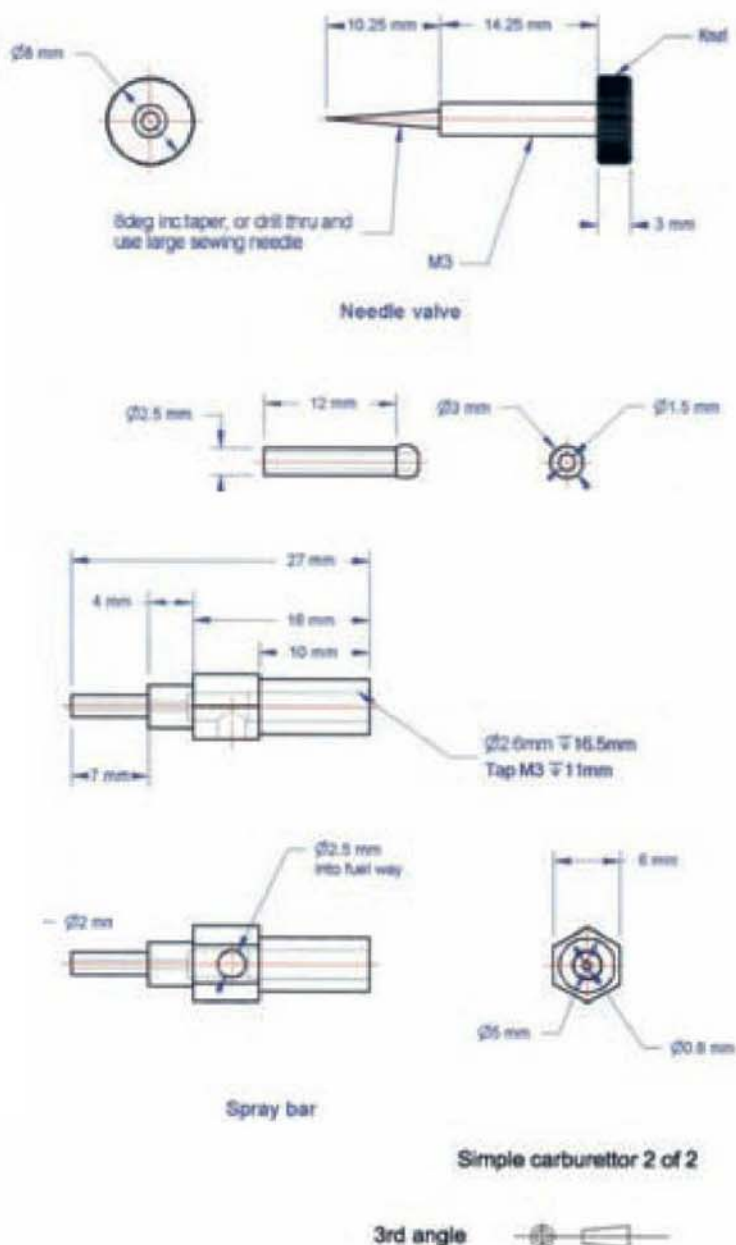
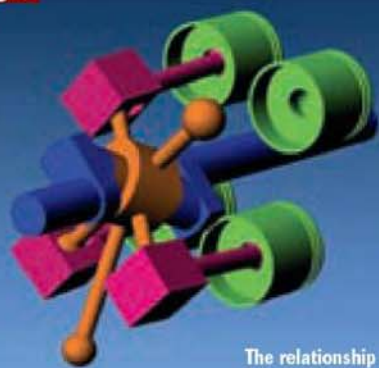
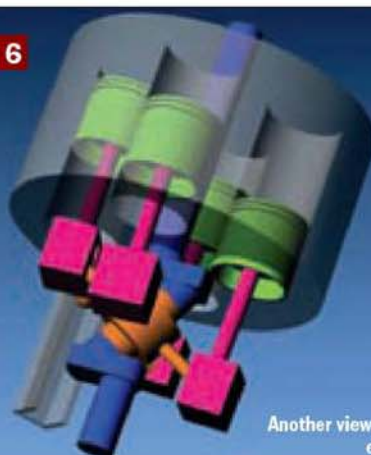


Fig 5

The relationship of the internal parts.

Fig 6

Another view of the engine.

removing a *very small* amount of metal from the engine side closing edge of the barrel. One or two strokes with a needle file will be all that is needed.

Once the engine reacts correctly to the air bleed adjustment, it will be found quite easy to obtain a good slow even tick-over speed by alternately adjusting both settings.

At each adjustment, test how the engine picks up speed when the throttle is opened slowly. The objective is a good even tick-over and a smooth pickup when the throttle is opened. Remember, don't snap the throttle open suddenly and expect the engine to keep up.

If you are expecting the engine to run on tick-over for long periods, you may need to set a higher tick-over speed to stop the engine being gradually swamped with fuel. I have been sent some more information on carburetion and will include that next time.

Axial engine query

I have received the following query from Ricky Smith from Sussex regarding the operation of axial engines.

"SIRS, - I have just finished reading *The Knife and Fork Man* by Bill Fairney, about the life and work of Charles Benjamin Redrup, engineer and inventor 1878-1961 and including how he furthered developed the Axial Wobble Plate engine.

"The author explains that in an axial engine the cylinders are arranged around the drive-shaft rather like the barrel of a revolver and that various

designs are used to translate this axial motion to rotary, either by using an angled 'swash-plate', cams, or a 'wobble plate'.

"From a lay perspective I can see that the cylinders, pistons and connecting rods lie parallel to the crankshaft (not at right angles as we are more used to) so somehow this is converted to rotary motion. How does this happen?

"Looking at the crankshaft I see that the bottom end is in a Z shape and a circular 'wobble plate' (also described as a 'spider') is to be found (mounted on the inside of the Z where the big end of a connecting rod would be normally be). I think the 'big-end' of the connecting rods is connected to the outer circumference of the 'wobble plate'.

"I can only guess that the 'push and pull' of the connecting rods creates a 'wobble' motion on the 'wobble plate' and because it is in the Z-angle of the crankshaft it creates rotary motion. It's not easy to grasp but maybe I have over complicated (or misunderstood) it!

"Is this right and what are the advantages?

"Are any such engines in use today? Have any models of such an engine been built?"

Ricky Smith, West Sussex.

To help answer Ricky's query, I have produced a basic 3D model of a 4-cylinder axial engine layout to show the mechanism and the relationships between the

parts. I have only included the basic cylinder block, crankshaft, spider (or wobble plate) and piston/connecting rod assemblies. I should stress that this is not a working design, but is purely to show the principle of operation.

The complete assembly (fig 1) shows the Z-shaped crankshaft (dark blue), the spider (orange), connecting rods (pink), pistons (green) and the cylinder block (grey).

The crankshaft (fig 3) shows the Z-shaped construction referred to by Ricky. The angled part carries the spider (fig 4), which is free to rotate on the shaft. Obviously the shaft or the spider will have to be of built up construction to be able to assemble the two. The centre of the spider is aligned with the centre line of the crankshaft and when the shaft rotates the spider 'wobbles' on its axis, thus generating an oscillating motion at the ends of the spider arms. Conversely, if the arms of the spider are subjected to a force parallel to the crankshaft axis, the crankshaft will be rotated. The longer 5th arm on the spider is to constrain the spider motion so that any force on the spider is transmitted to the crank. Several methods can be used to constrain the spider, but I have just shown a very simple option.

Figure 1 shows the engine with the top left cylinder at the top dead centre position. The spider is tilted towards that cylinder and away from the one opposite it. The spider constraining arm is at the outer end of the groove.

Figure 2 is the same view with the crankshaft rotated a quarter turn anti-clockwise. It can be seen that, because of the shape of the crankshaft, the spider is now tilted towards the lower left cylinder which is now at top dead centre, with the opposite cylinder at bottom dead centre and the two others halfway up (or down) the stroke. The constraining arm has moved to the inner end of the groove.

Because the arms of the spider do not move in a straight line, the big and small ends must allow for this, so I have shown ball joints (fig 5) for illustration purposes.

As the crankshaft rotates, the pistons are moved up and down the cylinders as in a normal engine. Another view of the full assembly is shown in fig 6.

I think the advantages of such engines are that they are very compact and also very smooth running. The wobble plate engines by Charles Redrup were used in the Simmonds *Spartan* aeroplane, a motor launch and a Crossley motor car in the 1920s. An early example from a Bristol bus is on display at the Bristol Industrial Museum. I do not know if any wobble plate axial engines are running today. The modern Fairdiesel designs (www.fairdiesel.co.uk) use a specially shaped cam running in slots in the pistons to produce the required motion.

I have reviewed Bill Fairney's book on Charles Redrup and hopefully that review will be published shortly in these pages.

For those with internet access, a visit to YouTube (<http://uk.youtube.com>) and a search for 'modelengineermedia' will give you a moving display of the 3D model used for this article. This illustrates the motion far better than I can describe it.

Hopefully this has clarified things for Ricky and others. Perhaps such an engine is a good subject for those adventurous souls out there? I suppose having done part of the design, I could finish it off.

ME

Self-starting single-cylinder double-acting steam engine

Les Kerr continues the construction of the parts for the steam engine.

*Continued from page 442
(M.E. 4323, 11 April 2008)*

Two rotary valve centres are required (fig 27). The inside is hollowed out to reduce the weight of the valve centre, making it easier to rotate. I used a piece of $\frac{1}{2}$ in. dia. by 52mm brass for this part. I drilled the 4mm holes first, then turned down the 6mm dia. section. The remaining 19mm length was reduced to 0.38 dia. (0.005in. oversize). Transfer the chuck with job to the dividing head which was previously mounted vertically on the mill.

The drill should still be aligned with the axis of the 4mm hole. Drill the first 1mm hole (from the surface to the 4mm hole) 6mm from the shoulder. Use a small centre drill to dimple the surface to give a good starting point for the drill. Rotate the dividing head 45 turns (180deg.) and drill the other side of the 1mm hole. Rotate the dividing head 11.25 turns (45deg.) and move the mill 7mm along its xy axis. Drill the first half of the second 1mm hole. Rotate the dividing head 45 turns (180deg.) and drill the other side of the 1mm hole. Return the chuck to the lathe and reduce its diameter so that it is a tight fit in the valve housing.

Using metal polish smooth the outside surface so that the centre slides smoothly into the housing. Clean out the 1mm hole and polish off any burrs. Finally, plug the ends using Loctite and pieces of brass 4mm dia. by 3mm long (two-off).

Stepper motor bracket

I made this item from stock 40mm wide by 3mm thick aluminium 'L' extrusion (fig 28). After drilling the holes polish the surfaces as the gears are in contact with these and we don't want any binding.

Rotary valve brackets

Again I made these parts (two required) from off the shelf 40mm wide by 3mm thick aluminium 'L' extrusion (fig 29). After drilling the holes, polish the surfaces as the gears are in contact with these and we don't want any binding.

Tube connectors

Twelve of these connectors (fig 30) are required and they can be made from $\frac{1}{8}$ in. dia. copper tube. Using Loctite fit six to each valve housing as shown on the assembly drawing.

Valve sub-assemblies

The valves are attached to rotary valve brackets using M2.5 by 6mm countersunk screws. Check that the screw heads are below the surface of the valve brackets. If not increase the depth of the countersink. This is important as we don't want the driving gears to bind on the screw heads. Fit the centres and attach the 20 tooth gears. If all is well, the centres should rotate freely in the housing.

Valve calibration

The next step is to calibrate the valves. 'Valve 1' is calibrated in the closed position and 'Valve 2' in the open position. To do this hold the valve assembly with the gear end facing away from you and the four tubing connection upwards.

Insert a 1mm dia. pin down the centre of the right-hand tubing connector closest to you so that it goes right through the centre locking it in place. Inscribe a line from the valve centre to the outside of the valve housing. We will use this line later to initially set the valves in position. Finally, mark

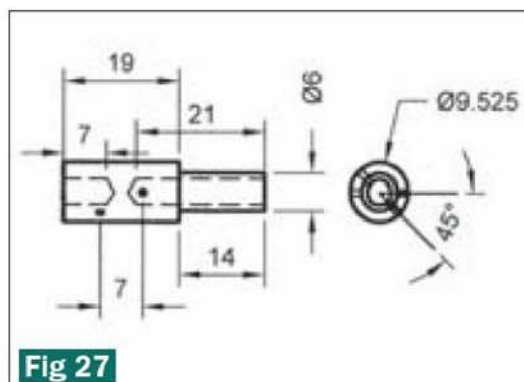


Fig 27

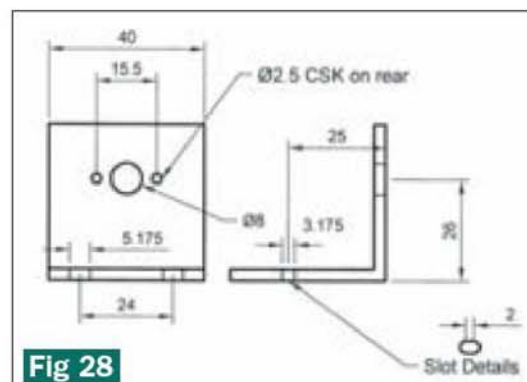


Fig 28

Fig 27. Rotary valve body.

Fig 28. Stepper motor bracket.

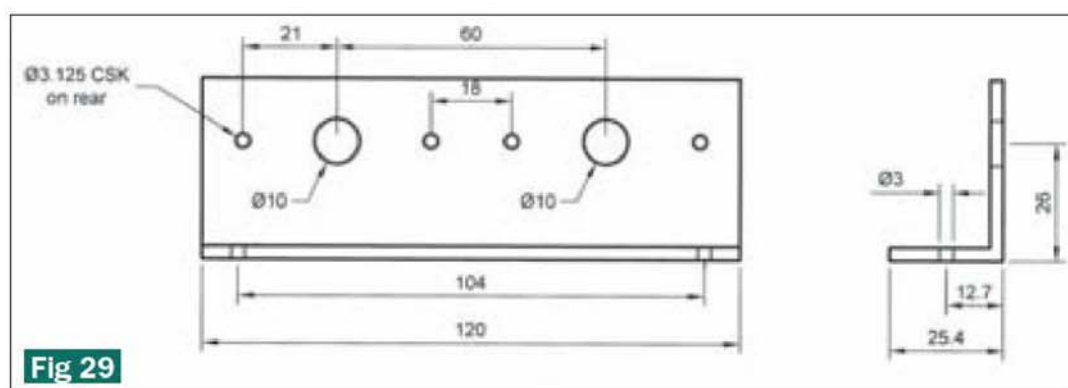


Fig 29

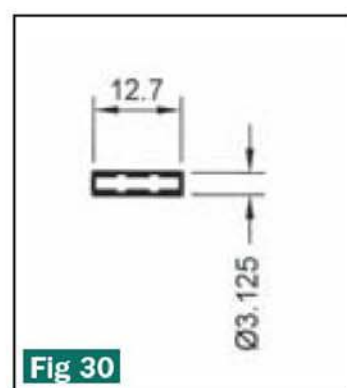


Fig 30

this 'Valve 1'.

Do the same for the second valve, only this time place the pin in the centre of the right-hand tubing connector furthest away from you. Inscribe a line as before but this time call this 'Valve 2'.

Motors

Next attach the two stepper motors fitted with the 6mm bush to the motor bracket with M3 by 8mm countersunk screws plus nuts and washers. Attach the 30 tooth gears to the motors.

Engine

Figure 31 shows the assembly drawing of the engine whose construction is discussed below.

Piston

To reduce its weight, the front and back face of the piston are recessed (**fig 32**).

I made mine from a length

of 1in. dia. brass. Recess the end then reduce the outside diameter to about 0.020in. over the finished size. Drill the hole for the piston rod then part off just slightly oversize. Cut a length of $\frac{3}{16}$ in. dia. stainless steel rod and Loctite it into the piston head so that the correct amount protrudes. Carry out the next operation after you have made the cylinder.

Using a $\frac{3}{16}$ in. collet chuck mount the piston assembly in the lathe. Reduce its width to size and recess the end. Taking small cuts reduce the outside diameter so that it is a push fit in the cylinder. Finally, polish the outside until it is a slide fit in the cylinder.

Crosshead

I have found with items like the crosshead (**fig 33**) it is better to use the milling machine to cut the rectangular section first. The

rectangular section using a dial gauge and a 4-jaw chuck can then be set within a couple of thous to run true along its axis. The cylindrical diameter can then be machined for a slide fit in the crosshead guide trunk and, at the same setting, the piston shaft hole can be drilled. Last of all the connecting rod hole can be drilled as well as the holes for the 3mm retaining grub screw which also has to be tapped. I made my crosshead from brass and fitted a 3mm by 3mm grub screw.

Washer

A simple turning job from $\frac{3}{16}$ in. dia. brass rod (**fig 34**).

Flywheel

I had in my junkbox an old piece of bronze bearing material that was two inches in diameter and had an I/D of 1.5 inches. I decided that if I filled this with

aluminium then I would have quite an attractive flywheel (**fig 35**). Loctite was used to attach the aluminium to the bronze. Next I turned the small spacer boss on the face and then reduced the outside diameter to size. The hole for the shaft was then drilled. It was then parted off and the other side was faced to size.

The job was transferred to the milling machine where the holes for the crank pin were drilled and the hole for the grub screw was drilled and tapped. The small $\frac{3}{32}$ in. dia. hole is to let the air out when you Loctite the crank pin in place. Fit an M4 by 6mm grub screw.

Connecting rod

The connecting rod is fabricated from two brass ends and a length of $\frac{3}{32}$ in. dia. stainless steel rod which are held together with Loctite (**fig 36**). In this operation the hole centres are set 2in. apart. If we start with the fork end, first mill out the slot and drill the hole for the gudgeon pin. Cut a piece of scrap to replace the material removed and insert

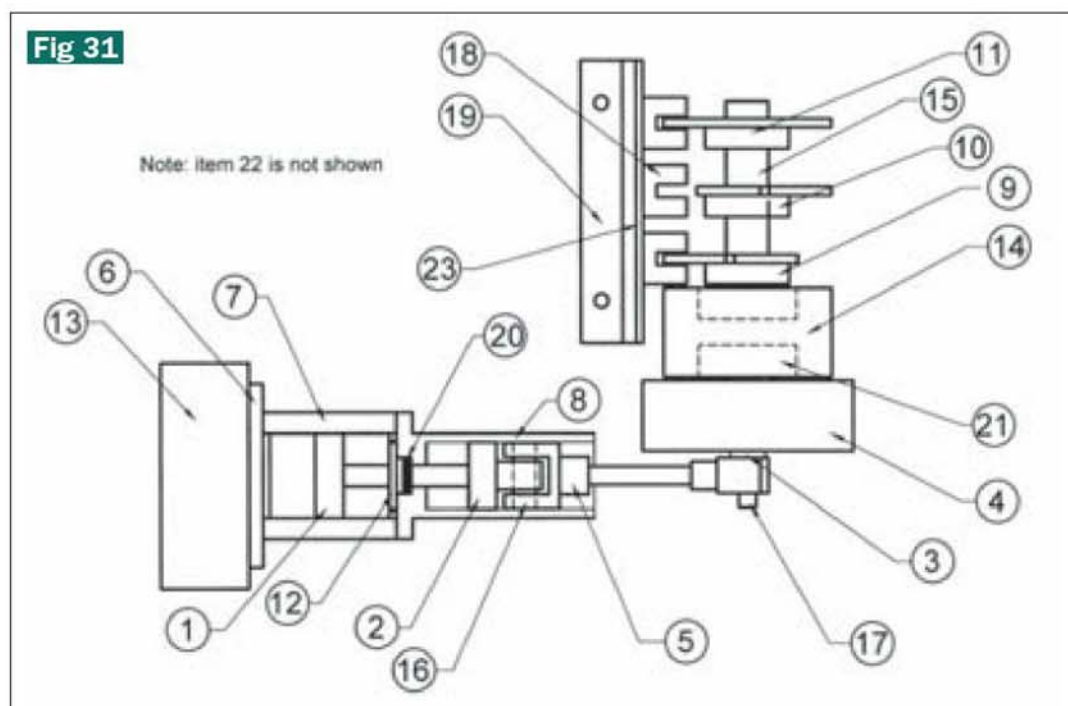
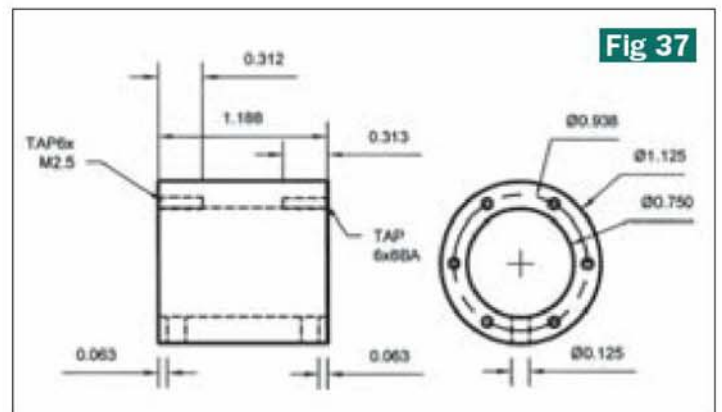
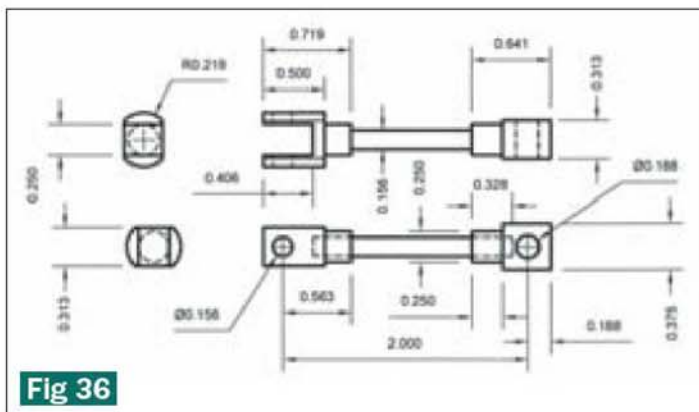
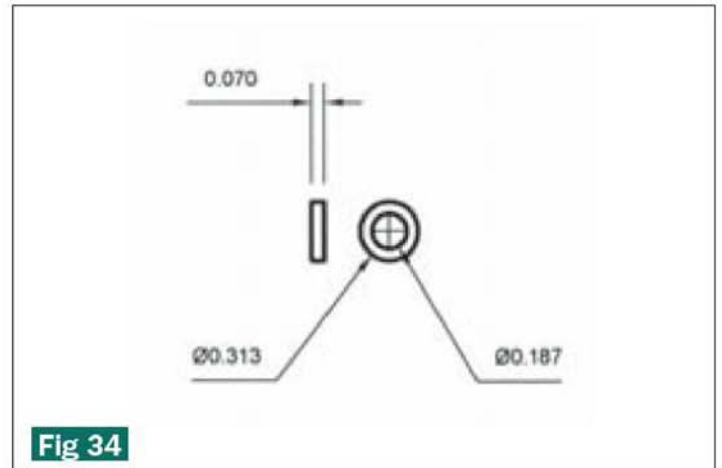
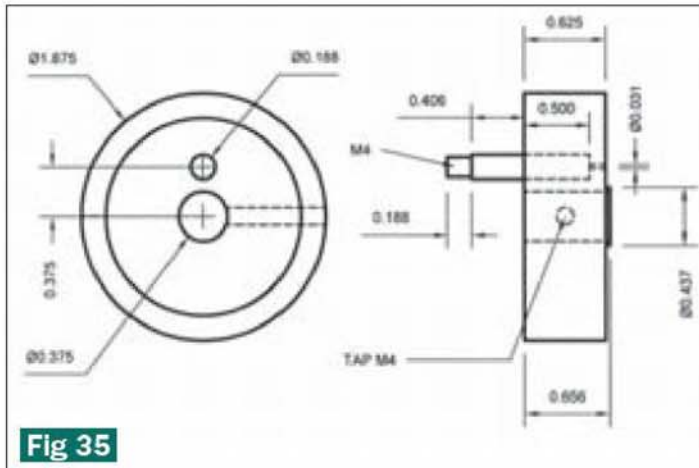
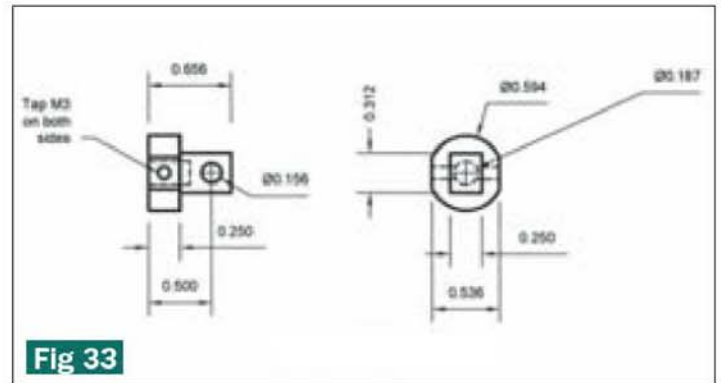
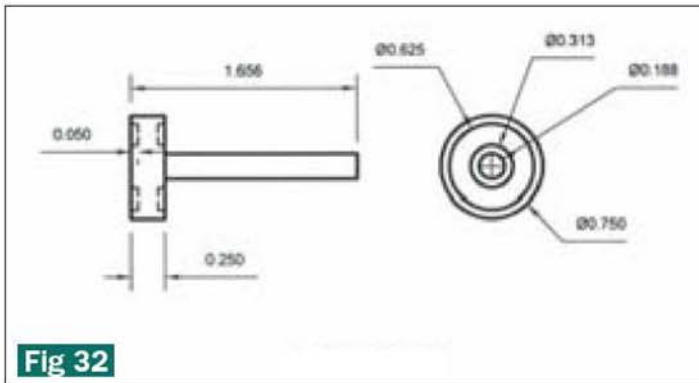


Fig 31

Key to parts in Fig 31

ITEM	DESCRIPTION	QUANTITY
1	PISTON	1
2	CROSS HEAD	1
3	WASHER	1
4	FLYWHEEL	1
5	CONNECTING ROD	1
6	CYLINDER COVER	1
7	CYLINDER	1
8	BARREL	1
9	CAM 1	1
10	CAM 2	1
11	NO POINT CAM	1
12	O RING COVER	1
13	CYLINDER SUPPORT	1
14	FLYWHEEL SUPPORT	1
15	SHAFT	1
16	GUDGEON PIN	1
17	CRANK PIN	1
18	PHOTO INTERRUPTER	3
19	INTERRUPTER BRACKET	1
20	O RING	1
21	BEARINGS	2
22	TUBING CONNECTORS	2
23	MATRIX BOARD	1



this in the slot. Mount this end in the 4-jaw chuck and using a dial gauge set it to run true along its axis. Face the end to length, turn the outside diameter bush to size and drill the hole for the connecting rod.

Finally, reverse the job in a 3-jaw chuck and turn the outside of the forks. For the other end mill the rectangular end first then drill the hole for the crank pin.

Mount this end in the 4-jaw chuck and again use the dial gauge to set it running true along its axis. Face the end to length and turn the outside diameter of the bush to size.

Cylinder

This part (**fig 37**) was made from a length of 1.25in. dia. brass. In the lathe, face the end, turn the outside to size, then bore out the centre hole to a few thous below the finished size. Transfer the chuck with job to the milling machine and drill the holes for the inlet and outlet ports. Return the job to the lathe and finish the bore to size. Take several passes of the boring tool to make sure the cylinder bore is uniform.

Again transfer the chuck with job to the milling machine fitted with a dividing head and drill and tap the six holes to mount the barrel. In this operation

make sure that the cylinder ports are aligned 30deg. from the mounting holes. Part off and finish the other end to size.

To polish the inside of the cylinder, take a piece of hard wood and turn its diameter for a tight fit in the cylinder for a length of 2 inches. Add metal polish with light oil to the timber and using a small piece of kitchen towelling to hold the stick slide it back and forth with the lathe running at mid speed. Reverse and repeat the operation until you see a smooth finish on the inside of the cylinder. If in this operation the cylinder binds on the timber let go of the paper towelling

and switch off the lathe. Also remove any tools from the tool post that may get in the way. Rinse the cylinder in hot soapy water to remove any excess metal polish.

● To be continued.

Fig 29. Rotary valve mounting bracket.

Fig 30. Tube connector (12 required).

Fig 31. Engine parts schematic.

Fig 32. Piston and piston rod.

Fig 33. Crosshead.

Fig 34. Washer.

Fig 35. Flywheel.

Fig 36. Connecting Rod.

Fig 37. Cylinder.

ENGINEERING'S LOCAL HEROES

ROBERT FORESTER MUSHET OF COLEFORD

Roger Backhouse profiles the man who transformed engineering with his tungsten steel process in the mid-19th century.

When model engineers use tungsten steel tools they rarely think of the man who made these fast cutting materials possible. Robert Mushet's development of the first tungsten steels transformed engineering. Robert Mushet was born in 1811 at Tump House, Coleford, in Gloucestershire's Forest of Dean. His father David was an experimental metallurgist who moved from Scotland in 1808 to manage the Whitecliff Ironworks nearby. He acquired share holdings in Forest coal mines and tramways becoming wealthy, but at the cost of a dysfunctional family. Robert and his brothers grew up distrusting each other and later lawyers grew rich through their disputes.

Robert was employed by his father in the ironworks but, after a brief spell at Cambridge University, decided to work in a coal pit for a year to become a Forest of

Dean Free Miner, despite poor health which persisted throughout his life. A Free Miner could mine for coal anywhere within the Forest boundaries and gave Robert status in this close-knit community.

After his spell in the mine, Robert worked with a Birmingham businessman to set up a small experimental steelworks at Darkhill, south of Coleford. Here Robert made good quality iron and steel sheets. He was helped by his wife, Mary Ann Thomas, who played a key part helping with his metallurgical experiments. It is believed he made over 10,000 steel making experiments and took out 48 patents, mostly for alloys. Helped by his wife he cast the first ingot of manganese steel.

At that time quality steel could only be made using the Huntsman process, melting the ingredients in a crucible. Robert patented the idea of creating steel by blowing cold air through

molten cast iron anticipating the Bessemer process. Using this method, Robert made steel successfully but, incredibly, let the patent lapse. He made the first steel rail laid at Derby Station in 1857. Robert always felt disappointed that this was not preserved.

Henry Bessemer's 1856 process also used cold air blown through molten steel in a converter. This enabled production of large quantities of steel cheaply for the first time but quality was often poor due to phosphorous in the iron ore. Robert realised that if all impurities were removed, by adding controlled quantities of carbon and manganese alloy (*spiegeleisen*) would produce steel of specified quality. However, he refused to co-operate with Bessemer who found his own solutions. Despite a later annuity from Bessemer, Robert nursed a grudge though he later admitted he had 'done no

1. 'Bear' or slag lump from Darkhill Ironworks.

2. Memorial to David and Robert Mushet near Darkhill.

3. Plaque commemorating the Mushets at Forest House.

4. Remains of crucible steel pots at Darkhill Ironworks.

5. Remains of Robert Mushet's Titanic Steelworks.

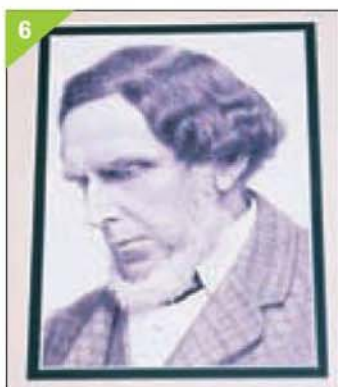
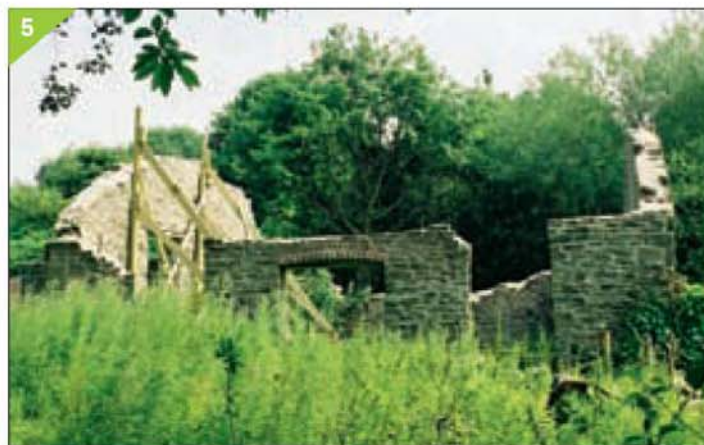
6. Robert Mushet 'Man of Steel'.

7. Ruins of Robert Mushet's Darkhill Ironworks.

8. Tump House, former home of the Mushets, now the Forest House Hotel and Bluebell Restaurant.

9. Whitecliff Ironworks blast furnace near Coleford.





more than provide the rudder for the Bessemer ship'.

Robert's most successful invention was adding tungsten ores to make air hardening tungsten steel. Previously tool steel was hardened by quenching which led to cracking in long use. Strangely, he did not patent the process instead relying on secret ingredients and the loyalty of trusted workmen at his Titanic steel works near Darkhill. However, the business did not succeed until he went into partnership with the able Sheffield businessman Samuel Osborn. Robert's sons Henry and Edward with Forest of Dean steelmen went north to run the process. Samuel built up a remarkable export business and transformed the Sheffield steel industry.

Robert retired at the age of 60 to Cheltenham where he died in 1891. His childhood home is now the Forest House Hotel and Bluebell Restaurant and the family are commemorated locally by a shopping walk. A memorial made of a railway crossing stands near the former Darkhill Ironworks.

References

Man of iron – man of steel: the lives of David and Robert Mushet by Ralph Anstis.

Published by Coleford: Albion House, ISBN 0-951137 4 X.

An excellent book about the family, their quarrels and achievements.

Robert Mushet and the Darkhill Ironworks by Keith Webb.

Published by Lydney: Black Dwarf, ISBN 1-903-59902-4.

A useful history of the ironworks and guide to the remains written by a local resident.

Visiting the area

There is much industrial history interest in the Forest of Dean with well signposted walks around Darkhill Ironworks.

Information from Coleford Tourist Information Office, High Street, Coleford, GL16 8HG. T. +44 (0) 1594 812390. E. tourism@fdean.gov.uk

Robert Mushet's former home is now the Forest House Hotel and Bluebell Restaurant, one of the best in the area. T. +44 (0) 1594 832424. www.forest-house-hotel.co.uk

ME



FINISHING A GOLD MEDAL

Roger Castle-Smith describes the methods he used for finishing his clock, which won a Gold Medal at the 2007 Model Engineer Exhibition, and was featured on the cover of ME 4314.

This article was written for three reasons: Firstly, because much interest was expressed at the exhibition on how the Gold Medal-winning finish was attained. Secondly, because queries were e-mailed to me after the exhibition. Thirdly, because the editor encouraged me to write it!

It is quite clear, talking to people, that a method of finishing and polishing which suits one person, does not necessarily work well in the hands of others. Therefore, my methods should not be regarded as definitive, but rather as a starting point for experimentation. Experience suggests that finishing parts to a high standard will take, on average, at least 20% of the time needed to make them.

CZ120 engraving (hard) brass

To cut down on finishing time, it is well worth buying brass sheet which is covered on at least one side with a protective peel-off plastic film. If a large part is to be made from a sheet with only one scratch, then material has to be removed from the entire area to get a near perfect finish. This can take a long time and increases the chance of getting rounded edges. If a scratch is abraded out without removing an equal amount of material all over, then the resulting dimple will show up badly when viewed against the light. A good ploy is to buy sheets of brass from which several parts can be cut. So if there are any scratches, parts can sometimes be laid out to avoid them without wasting too much material. Finally, in the context of scratches, when using marking-out blue, be careful to only use the lightest of scribe strokes unless marking an edge.

Choice of abrasives

The finest abrasive sheet grade to use before commencing polishing is very much a matter of personal preference. One

things is certain, if a long time has to be spent polishing after abrading, then the abraded finish is not good enough. My first choice for brass is 3M brand Wetordry in grits P800(01972), P1000(01971) and P1200(01970), the packet part numbers being shown in brackets. Two finer 3M grades are described as Perfect-it Micro Fine and are available in half sized sheets. These are P1500(09545) and P2000(09546). The finer grades only seem to be available from automotive finishing dealers. Be wary of using abrasive paper sold in local car accessory shops or ironmongers for two reasons: Firstly, such papers may come from a mixed bag of suppliers and often contain a smattering of over-sized grit particles. Secondly, stacks of paper in racks often get mixed up so that a fine grade paper can easily become contaminated with grit which has rubbed off a coarser one. The 3M papers supplied in packets, in the form of cardboard sleeves, avoid both these problems.

There is another abrasive sheet which some might like to consider using and that is MicroMesh. Although not my first choice for brass, it is excellent for ferrous materials. It is available in two types, Regular and MX. The Regular has a fairly soft latex like backing whilst MX has a harder one. Although an excellent product for which it was originally intended, namely finishing and polishing aircraft cockpit canopies, some have said that the latex backing of the Regular grade is apt to lead to rounded corners. So my recommendation is to only use the Regular grade in its sub 5 micron grades for polishing. MicroMesh grit classifications are somewhat bizarre. **Table 1** shows the approximate relationship between MicroMesh grit size classifications and the more



familiar Federation of European Producers of Abrasives (FEPA) grades. The latter are the same, for all practical purposes, as the familiar P grading seen on, for example, silicone carbide abrasive sheets. MicroMesh in the USA were asked why they use different numbers for about the same grit sizes in the Regular and MX grades. They said that this was partly for historical reasons, and partly so that Regular and MX grades do not get mixed up! It is well worth trying out. It can be used under water and this works well. MicroMesh is available from DEP in the UK, T. 01462 441 414.

Another product is crocus paper which has been mentioned by John Wilding. It is a lead oxide based paper and is coloured red. However, the sample I used added more fine haze scratches than it removed.

Finally, 3M colour-coded lapping film, with its abrasive on a thin plastic backing, is excellent for the ultra fine finishing of ferrous and hard materials. It is graded from 12 microns down to an astonishing 0.3 microns. One supplier is H. S. Walsh T. 020 724 237 11. But it is costly and using it on brass has no benefit over one of the far cheaper 3M silicone carbide papers. In use, a part must only be moved over the film once, otherwise the embedded metal causes more micro scratches than the film removes!

Choice of polishing liquids and pastes

Brasso, diluted with some 30% of white spirit, is my choice for final polishing of brass

1. Underside of clock base.
2. Holding flat parts and ensuring edges are not rounded.
3. Finishing edges.
4. Use of the filling button.
5. Finishing the end of a 12BA screw.

Table 1			
Regular	MX	Microns	FEPA Euro
	60	60	P240
		52	P320
	80	45	P360
	120	42	P400
	150		
		40	P600
1500	180	30	P800
		20	P1000
1800	240	15	P1200
		13	P1500
2400	320		
		10	P2000
		9	P2500
3200	360		
3600	400	8	
4000	600	5	
6000	800	4	
8000	1200	3	
12000			

CLOCK

parts. When used neat it dries too quickly. But one word of warning – if you aspire to the highest finish possible, then on no account use the domestic tin of Brasso, which will almost certainly be contaminated; keep your own tin well hidden away in the workshop! For steel components, other than screw heads, Autosol Metal polish in its paste form, cuts faster and is readily available from car accessory shops. But its use on brass, for the finest finishes, should be avoided as it contains aluminium oxide which can produce haze scratches.

My experience using the best available felt, calico and swansdown rotary mops, with graded polishing compounds, has been less than successful for obtaining a close to perfect finish. But this may well be one of those techniques that does not work well for me but does for others.

Finally on polishing liquids: A word of warning was given to me by a member of the British Horological Institute (BHI). Their gold plating process was going well. Then a problem occurred – although the polishing process had apparently not changed! Eventually, this was found to be due to Silvo which was being used to polish prior to gold plating. Enquiries to the manufacturer revealed that, recently, silicone had been added as a tarnish retardant. Removing all traces of silicone, with liquid solvents, can be extremely difficult. So, if it is proposed to electro plate after polishing, be wary of any polish which contains something like 'long term' in its name. If in doubt, a call to the manufacturer could save hours of wasted work.

Polishing cloths and tissue

Difficulty was experienced in achieving a near perfect finish on brass. Although a part looked well polished at first, viewing a large clock plate against the light revealed a

haze of micro scratches. This problem was traced to using yellow coloured cotton dusters available from supermarkets. These feel quite soft but, in fact, contain some harsh fibres which do a lot of damage. Eventually, it was discovered that a MicroMesh very fine and soft cotton polishing cloth, obtainable from DEP produced a mirror finish without a trace of haze.

A soft tissue is useful for two purposes: Firstly, for cleaning off polishing medium residue. Secondly, for protecting the surface of an already polished part, when it has to be placed face down to polish the other side. Again, some brands proved to be quite scratchy but Kleenex Ultra Soft tissues came up trumps.

Finishing large flat brass surfaces

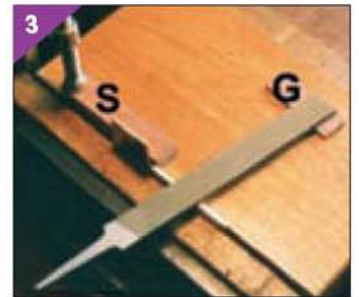
Unless there are some bad scratches, start with 3M P1000 and then work down through P1200, P1500 and finally P2000. For large surfaces, such as the 8in. dia. base for my clock, glue a piece of the abrasive to a block of wood, say around $2.25 \times 1.25 \times 1.00$ in., which is convenient to hold. Some 3M Photo Spray Mount adhesive works well for this purpose, as spent abrasive is easily peeled off. It is tempting to use a piece of abrasive wrapped around the block without adhesive, but the surface will ripple and cause rounded edges. Be especially careful when using the coarser grits to keep pressure on the block over the plate, again to avoid edge rounding. Use each grade wet at right angles to the previous one. Before moving to the next finer grit, ensure that all traces of the previous coarser scratches are removed, after which, wash off any grit

under running water assisted with wet tissue. Having got to grit 2000, the surface should have a fine matt appearance to the naked eye with little to no sign of micro scratches.

Polishing can then commence with a piece of the MicroMesh polishing cloth, soaked in the Brasso/spirit mix, and wrapped around the wooden block. At this stage it is best to use a circular motion and press very lightly. A high polish should be evident after about 10 minutes work at most, on a large plate. Remove all traces of Brasso with tissue. A final clean can be carried out with a proprietary cleaner. There are many solvents which can be obtained from horological suppliers but Spotless dry cleaner, available from supermarkets, works well. **Photograph 1** shows the underside of my clock base plate in its assembled form for a trial run, but before gold plating; note the reflections from the tool drawers.

Finishing long thin objects such as stretchers

The only difference between these and large flat parts is the need to devise a method of firstly, holding the part and, secondly, ensuring that edge rounding does not take place, especially when using the coarser abrasives (**photo 2**). A thin part can be held in place by locating it with brass dowels D on a piece of melamine covered board available from B&Q etc. Drill right through the board so that the dowel can be adjusted with its top just clear of the surface of the part. Drilling with a $\frac{1}{16}$ in. drill for a dowel of the



same size gives a nice push fit. The melamine surface is much better than MDF as it does not get embedded with abrasive grit and Brasso can easily be wiped off it. The abrasive is glued to a strip of wood and the tip is held over the guide G to prevent it rocking. If the underside of the guide is given a modest polish, then it will slide easily while being gripped by the abrasive. As with the large parts, use successive abrasive grades at right angles to each other. This is best achieved by stroking at 45deg. across a part. When polishing, a piece of tissue paper T is located under the part to protect the side which has already been polished.

If there are no convenient holes in the part for location by a couple of dowels, then four dowels may be placed around the edge. In this case, slip some plastic sleeving over each ➤





6. Polishing the circumference of a screw head.

7. 'Ring' holder for finishing the tops of screw heads.

8. Screwed bar for finishing the flats of nuts.

9. Blueing a small screw.

10. Storing the parts on tissue paper before assembly.

dowel to prevent the edge being damaged. This method of holding works well even for very thin parts such as hands.

For very small parts, it is better to stick the abrasive on to a piece of hard and flat board. Then rub the part on it while being careful not to rock it. For polishing, stretch a piece of polishing cloth, soaked in the Brasso/spirit mix, over a square of float glass (plate glass).

Finishing edges such as those on a plate

Photograph 3 shows a method of finishing straight plate edges. A small bespoke table is held between the jaws of a wood vice; with a block underneath to locate it on the vice slide bars. The plate, whose edge is to be filed and then finished, is held between the front vice jaw and the table. Tissue paper, not shown, is used to protect the plate surface. The plate edge is adjusted so that it projects above the table equal to the thickness of the guide G. The stop S prevents the file from going too far into the already finished rounded corner. It is easier to blend a straight edge into a rounded corner rather



than vice-versa.

Photograph 4 shows a filing button used to guide a file, then an abrasive stick, to produce a rounded corner on a plate. This is made from hardened silver steel. The outside edge is rounded slightly so that if the file is tipped accidentally, it will not damage the file teeth. To produce a guide for an inside curve, such as that to the left of the stop S in **photo 3**, bore a hole in a piece of silver steel with the required curve radius and then cut it into four quadrants. An alternative is to first drill a hole of the required radius, and then finish it without a guide.

Finishing round objects such as pillars

All that would seem to be necessary is to wrap a piece of abrasive strip partly around the part and rotate it in the lathe. However, even when keeping the abrasive moving longitudinally, tiny ridges started to appear. It seems that once a circular mark has established itself, it then becomes a depository for further grit which makes the problem worse. One way around this is to use the first grade of abrasive with the lathe revolving. Then stop the lathe and use the next grade to abrade longitudinally as shown by the arrows at A (**fig 1**). Then rotate for the next grade etc. This will inevitably lead to corner rounding at the point B. So, make the end collars a few thou too large to start with and then skim to the right size, when abrading and polishing of the 'neck' has been completed. Finally, finish the collars.

Finishing screws

Several methods have been described for holding screws using bespoke two-part fixtures, including those by John Wilding, for whom I hold great respect. However, for small sizes, say 8BA and below, and for watch screws, a different approach is required.

After much thought, this proved to be very simple. For small screws, take a length of hexagon or round bar, say $\frac{3}{4}$ in. long, and drill a blind hole, which doesn't quite reach the end, with a diameter which is slightly larger than that of the screw head. Drill another hole from the other end and tap to suit the screw. Now insert the screw down the hole and see how much of the thread protrudes. If insufficient, machine a little off the end of the holder; it is easier to do this in steps rather than trying to drill the blind hole to the required depth. Finally, relieve the threaded end of the holder so that its diameter is a little less than that of the screw head. The screw end can now be machined by inserting it into the holder from the bored end; only a gentle tighten is required to stop rotation in the holder if light cuts are taken.

Photograph 5 shows a 12BA screw being held for machining the end of the thread. Then, insert the screw in the holder from the other end to enable the head to be finished. Using this method it is possible to accurately finish a tiny screw which is only a few threads long. Making holders for all the common BA sizes from 2 to 16 pays dividends in the long term. For the larger sized screws, a holder comprising a long threaded collar is all that is required but its diameter must be larger than the screw head size. A 'D' bit can be used to give the holder bore a flat

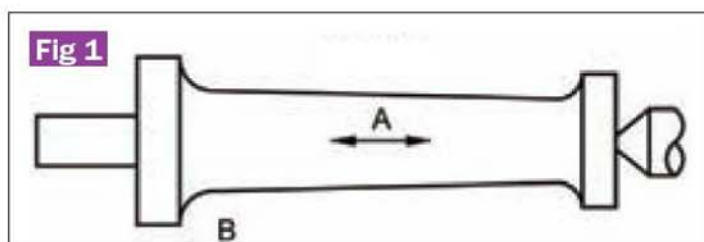


bottom to match the underside of a screw head. But after trial and error, it was found that the conical end made by a drill ensured that the head was accurately centred.

After machining the screw to the finest finish possible, the thread end and circumference can be finished. For polishing the circumference of the head, stick the abrasive paper on a flat piece of hardwood, or metal strip, and hold one end of it against the lathe bed to prevent any barrelling of the head (**photo 6**). My preference is to hold the abrasive under the head so that it is possible to see how the polish is progressing. The abrasive must be kept moving from side to side otherwise tiny scratch rings will result.

Although omitted from the photo for clarity, it is essential to cover vulnerable parts of the lathe, such as the bed and leadscrew, to prevent abrasive grit from reaching them. Even a small amount of grit will cause considerable wear over time.

This leaves the question of how to finish the top of the head to a mirror polish while still keeping it dead flat. To achieve this, make a ring with three tapped holes to take three screws (**photo 7**). If a multiple of three screws is not required, the extra ones are



simply placed in the 'might-come-in-hand-one-day' box! One ring can be made to suit several screw sizes by drilling intermediate holes. The holes have a slight countersink to ensure that the screws fit snugly against the ring. Insert three screws and rub on abrasive paper.

Three methods were tried to obtain the final polish, although P2000 paper alone produces a good finish on steel. The first was to use a type-metal lap embedded with rolled-in diamond paste. The second was to use 3M's lapping film and finally, the finest grades of MicroMesh MX. Lapping film produces a mirror finish on mild or silver steel screws and is not expensive for the small areas involved.

Finishing nuts

Holding a nut to finish the ends is easy; simply insert a piece of threaded rod into the lathe chuck so that it protrudes a little less than the nut thickness and screw on the nut. The 30deg. bevels on the end of a nut can be polished in the same way as described for the circumference of a screw head only with a bevel cut on the strip which bears the abrasive paper. For finishing the ends, use the same ring as used for polishing the screw heads. Screw short pieces of threaded rod or screws into the ring so that they protrude a little and screw the nuts onto them. Then rub on the abrasive, as for the screw head. Finally, finish the nut flats.

Photograph 8 almost speaks for itself. The nuts are loosely screwed onto the end of a rod and then rubbed on the abrasive sheet taking care to give the same number of strokes per flat. The neck in the rod is to assist with holding it. For a tiny nut, and hence rod, wrapping a piece of double sided Sellotape around the rod enables it to be moved easily with the pad of one finger.

Blueing screws

Never heat a screw directly as it is almost impossible to get an even blue in this way. Instead,

bore a hole, whose diameter is 25% larger than the screw thread, not less than about $\frac{3}{4}$ in. from the end of a narrow brass strip around $\frac{1}{16}$ in. thick. Before blueing, the screw must be absolutely clean otherwise even a small finger mark will result in an uneven result. This is another use for Spotless dry cleaner, after which, use tweezers to insert the screw in the hole.

Heating directly under the screw may result in a nicely blue head, but the end of the thread will overheat and will go past deep blue to a light colour. This is no good for screws whose ends will be scrutinised closely by an exhibition judge! Instead, gently and alternately heat the brass strip on either side of the screw so that the heat runs upwards from the strip to the head and downwards to the thread. By so doing, it is possible to get an even blue across all sizes of screw from 2BA to tiny watch screws. Use a very gentle flame. An old-fashioned type of meths. lamp is ideal. One of these purchased from a reputable horological supplier, imported from India, was useless. It had a fibreglass wick which burned before it soaked up enough meths. to produce a steady flame. So a copy was made from a Heinz baby drink bottle with a piece of cotton wick obtained from a local ironmonger.

Photograph 9 shows a small screw being blueed. Once a deep blue has been achieved, quickly dump the screw into oil to quench. Hot steel being quenched in water will produce minute rust pits which may not be evident to start with, but certainly will be later. Screws which only require a little nip-up to tighten sufficiently can be made from mild steel. But for the ones which needs firmer tightening, or which has a large thin head, silver steel is better. Either way, don't ruin your lovingly finished screws by using an ill fitting screwdriver!

Gold plating

Most of the brass parts in my clock are gold plated. The



smaller parts were done at home and the larger plates by a commercial firm. The actual process of gold plating is a big subject in itself and is well outside the scope of this article. Apart from anything else, the process can involve the use of chemicals which may attract the attention of the Health and Safety Executive. However, here are a few points which need to be considered by those who would like to have plating done commercially.

The first decision is whether to plate straight onto brass or plate with copper as a key, followed by nickel and then gold. Gold straight on to brass may at first seem to be the cheaper option. However, the gold needs to be thicker otherwise it tends to alloy with the brass, the net result being that it appears to vanish after a time. The advice which was given to me is to use a minimum thickness of 8 microns of gold if straight on to brass. If gold is applied on top of copper/nickel, then 4 to 5 microns will suffice. This turns out to be cheaper despite the two extra plating steps involved. So which method should one use?

My choice was to use copper/nickel/gold for all parts which are not subject to wear and to use gold alone on wearing parts such as wheels. In this case, gold will eventually wear through at the wheel teeth, and burnished brass underneath is far less obvious than nickel. The second

decision concerns the type of gold to be used. Pure gold is far too soft and it will wear and mark easily. So-called hard gold has traces of other elements. These can affect the colour which may range from bright gold, to gold with a nice red tinge. This should be discussed with the plating firm, as not all firms offer the same options.

The greatest trouble was taken to ensure sharp, right-angled, edges on all components but this caused a plating problem. The gold can be rubbed off sharp corners with a finger – not entirely satisfactory! This is because the electrical potential gradient at corners is much higher than elsewhere; rather like the high potential gradient at the tip of a sharp lightning conductor. This results in a higher plating rate which can lead to so-called spongy gold. The remedy is to slightly round all sharp corners – just a couple of strokes with grade P2000 paper is sufficient, so that it will not be seen by an exhibition judge. A second option is to plate slower, but this can then be costly if done commercially.

Finally, a very important point is not to expect plating to cover up any imperfections in the surface finish because this will not happen. Even if there are only very slight haze scratches on the brass, they will show up on the gold surface. Having had parts gold plated, or even after polishing parts which are not plated, handle them with great care. Scratched gold,

EXHIBITION CLOCK



11. The magnetic circuit, finished in black.
12 Extending the mandrel of the Myford to turn the wooden base.

or acid finger prints which stain brass after a time, can ruin an otherwise good job. The use of soft cotton gloves, available from say Boots, is recommended. Carefully store the parts on tissue paper before assembly (**photo 10**).

Blackening

Blackening can make an attractive finish when there might otherwise be too much polished steel. This was the finish applied to the magnetic circuit parts of my clock (**Photo 11**). Blackening can either be done at home, with kits such as those supplied under the brand name Black-it, or can be done commercially using a hot process. Although Black-it works well, there is no doubt that the hot commercial process is more durable.

Lacquering

There is much controversy over lacquering and when advice was sought through the *M.E. Post Bag*, there were as many different opinions as replies. My conclusion is to use lacquering for small parts if justified, but for large components, such as plates, it is questionable. Badly applied lacquer, which

usually means too thick, can look dreadful. A time honoured method is to apply it with a cotton wool ball which has been dipped in the lacquer and then squeezed out a little. But, in this case, speed is essential. Only wipe over each area once, otherwise you will get a sticky mess with cotton wool hairs clinging to it. If this happens, remove the lacquer with a solvent and try again!

An alternative to spraying or cotton wool, is to use a soft, wide, lacquer brush which is specially made for the purpose. Another alternative was given to me by a member of the BHI namely: to thin the lacquer to almost water like viscosity, submerge the part in it, then gradually draw the part out to avoid bubbles and dribbles. The result looks good with the lacquer being almost invisible. However, a large expensive bath is required for all but small parts. So, the bottom line for me is to either leave large brass parts just polished, or gold plate.

For those who wish to try some lacquering, clear Metal Lacquer from Meadows and Passmore (M&P), T. 01273 421 321, works well as does Ercalene A from H. S. Walsh, T. 020 8778 7061. If sprayed, the M&P product can be used neat with a Badger spray gun, while Ercalene A needs thinning by at least 50% with thinners available for it. Automotive lacquers, cellulose and acrylic based, although liked by some constructors, seem to produce a rather thick coat and are consequently a little obvious.

Balance rim

To start with, this was highly polished steel but it looked somewhat out of place against the gold. In the end, the rim was sandblasted to give a slightly matt finish and then sprayed with Meadows and Passmore clear lacquer, while slowly revolving in the lathe.

Coil finishing

One frequently asked question was, "How do you wind such a neat magnet coil?" (**photo 11**). There are two simple

precautions: The first is to use a layer of acid free brown paper between about every other layer. The second is to rotate the coil former, using the slowest lathe speed, and guide the wire by hand. However, before the wire reaches the hand, it should pass through two Z-shaped paths, one in each plane, guided by soft plastic rollers. This ensures that the wire is absolutely straight. If there is the slightest bend in the wire before it reaches the coil, it will be impossible to get turns which are tightly placed against their neighbours.

A personal hate is untidy wiring showing in an electric clock, sometimes with the coil ends being kept in place with Sellotape! The ends of my coils are taken through a coil cheek, in tiny milled slots, and then connected to a pair of pillars which protrude downwards through the base plate (**photo 11**). In the same vein, connections are taken from contacts down through the centre of their supporting pillars rather than by means of visible external wires.

Plinth

This was made from Amazaque (Guibourtia Ehie) which is an African hardwood with an appearance somewhat akin to Walnut. Six coats of shellac sanding sealer were needed to fill the grain completely. These were smoothed with flour paper between coats, and finally finished with clear Briwax. The resulting finish was a little too glossy for my liking but a gentle touch with super-fine wire wool, after the wax was hard, produced a pleasing sheen.

My Myford lathe was too small to accommodate the 10in. diameter of the plinth. A wood turning lathe for just one job would have been unnecessarily expensive and there was no room for one in my workshop. After much head scratching, I decided to extend the mandrel of the Myford (**photo 12**). The extension comprises a tubular shaft, supported by a self aligning ball race, which is held in a

cup bolted to the fixed steady. This is driven via a universal joint attached to a catch plate. An extended turning rest, not shown in the photo, was bolted to the lathe bed. A dedicated wood turner might sneer at this setup as not being stiff enough. But used with light cuts it produced an acceptable result.

Dial

This was a departure from the classical approach of engraving, followed by filling with black wax or, more recently, Araldite loaded with carbon black. Instead, the design was produced on my PC and the CAD file given to Bedford Dials, together with the finished and grained chapter ring. They had it silver plated and immediately afterwards the design was printed, using offset lithography, then lacquered before the silver had time to tarnish. Offset lithography gives a far better definition than screen printing. A photograph of the dial of my clock is on the front cover of *M.E. 4314*.

Incidentally, may I make a final point concerning dial numerals. At the London Model Engineer Exhibition there was a CNC machine engraving a chapter ring. But this looked dreadful, when inspected closely, as the top and bottom serifs of the numbers did not follow the curvature of the dial. This was particularly noticeable on wide numbers such as the VIII. To get round this difficulty, standard 'Times New Roman' numerals were drawn on the dial artwork. Circles were then drawn, using 'logical addition' on a drawing layer, to cover the top and bottom serifs, then erased to leave numerals without serifs. The circles were drawn again and the lines between the numerals deleted, to leave the numerals with rounded tops and bottoms.

Conclusion

I hope that this article will be useful, particularly to those clockmakers struggling to achieve the 'perfect' finish. But remember, a lot of patience is needed to go that extra step towards perfection.

ME

ANNA

A MANNING WARDLE LOCOMOTIVE FOR 7¼in. GAUGE

D.A.G. Brown and Mark Smithers detail the construction of the steam fittings.

*Continued from page 458
(M.E. 4323, 11 April 2008)*

When discussing the boiler I alluded to the testing of its fittings *in situ*. So it is opportune to illustrate some of the methods which I employed in making them. As I have said in the past, I believe in standardisation and interchangeability; thus wherever possible the threads are ¾ x 32tpi, which has already been of benefit in the boiler assembly. We shall have a look at the steam valves as illustrated in **photo 1**, with a scrap of the relevant drawing as an *aide-memoire* in **fig 1**. When this was first specified in M.E. 4253, 5 August 2005 (p. 146-7) of the original series, it was detailed as part of the water installation, the components being called up as common between water and steam services. If, however, you examine the whole locomotive it is apparent that it is worth

setting up some small batch production to enable all these common components to be tackled in groups. This requires a certain attitude of mind, but it is well worth the trouble insofar that you have only one set-up operation for each part. You will make good use of the slide graduations of the machine tools, but it is absolutely vital that all the tools are very sharp to start with.

Looking around the layout of the boiler, we require five steam valves including that for the blower. In addition, there is the pump water valve of basically similar design, and the water control valve for the Giffard injector, in which the top end fittings are all common. There are even some common features in the pump relief valve, the water gauges and blowdown valve. When it comes to the pipe connections, there are union nuts and nipples all over the place, so you need to take a view of the number required, but it is almost certain that you will have to make up some extras at a later date. Just take the axle pump and hand pump for a start and the numbers will start to climb; you will soon appreciate the benefit of standardisation on ¾ x 32tpi.

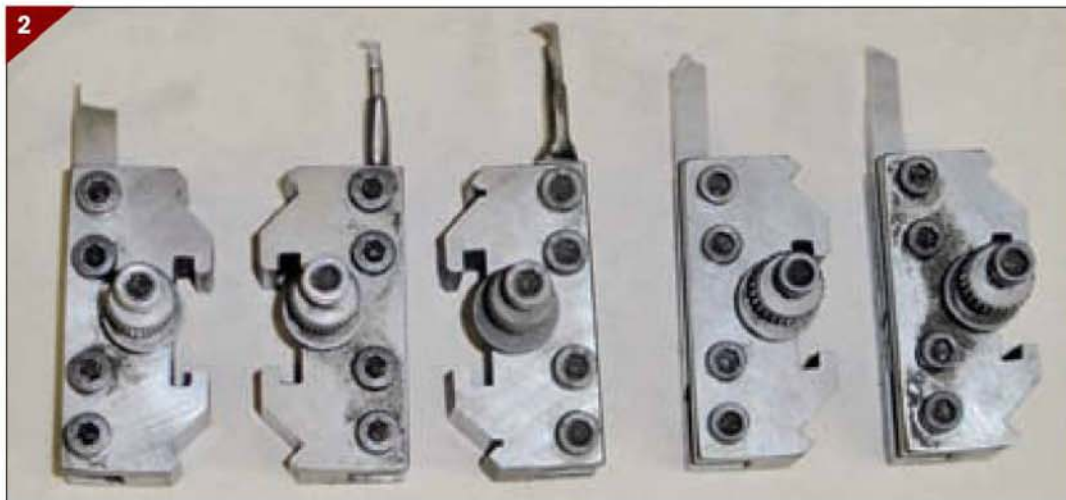
Machining nipples

Unusually, this drawing is in colour, since it helps to identify the various bits in the description; in the assembly view, the colours are the same as those in the details. First let us address the nipples and union nuts, since they represent the largest numbers of any common components. Here is my method of working, and how

the dimensions are worked out: a ¾in. x 32 female full thread has a core diameter of 0.335in. The outside dia. of the nipple is set at 0.333in., to give a small clearance. The hole through the nipple, at ⅞in., makes sure that it will never cause an obstruction in the pipe bore. Turn down say ¾in. of brass bar to 0.333in. dia, i.e. enough to make three nipples. Face the end of the bar, using a knife tool with a 30deg. angle ground on its front edge surface. Note the reading on the leadscrew handwheel. Next, centre drill the end of the bar, drill ⅞in. to a depth of ¾in. and follow up with a 6.4mm drill ⅞in. deep to give soldering clearance for the pipe. Next advance the knife tool along the bed by 0.188in. Plunge the tool into the job for a depth of 0.053in., which leaves a wall thickness of about 0.004in. before parting off. The parting operation should be done by a ⅞in. wide tool, similar to that used in injector making. The tool should cut say 95 percent of its width to the left of the plunge cut, so that before it parts off it removes a tiny amount of the tapered material. Note the reading of the leadscrew to achieve this relative position, so that the advance or retard of the carriage can be repeated for duplicate operations. I record all these readings on a small piece of paper, which is then stuck up in front of the lathe during repeat performances. From a parted-off face, you can repeat the above movements two more times, until you reach the end of the first drilled hole. It is then necessary to re-chuck the bar and repeat the above

1. A finished steam valve, with spare union nut and nipple.





2. The five tools: $\frac{1}{32}$ in. parting tool, $\frac{1}{4}$ in. wide boring tool, internal screwcutting tool, asymmetric two-faced chamfering tool and 30deg. knife tool.

3. Double-ended square hole broach for $\frac{1}{8}$ and $\frac{3}{16}$ in. sizes.

sequence as many times as necessary. As you proceed, the unit time becomes quite short, which is the essence of batch production. I must make a point about the rigmarole of parting off in the above fashion; if you should part off merely by continuing the plunge cut right through, you would be left not only with a sharp edge to the component, but the 30deg. face would be scarred with a parting line which would resist efforts to achieve steam tightness in the joint.

Union nuts

In my working days, I dared not mention this phrase, it would have been misconstrued as disparaging to the shop stewards; but I can utter it in the safety of my present office in the Rutland countryside. The detailed design of a seemingly simple nut is carefully arranged so that not only does it clear the nipple, but also goes round bends in the pipework of radius equal to three times its

diameter.

I am a strong advocate of boring and screwcutting. You will need the same small boring and screwcutting tools which we have already seen (**Photo 2**); besides these, the small parting tool, 30deg. knife tool and chamfering tool with a centre-drill and 6.4mm or letter F drill form the total armoury. Chuck some $\frac{3}{8}$ a/f brass hexagon, leaving it sticking out of the chuck by about $\frac{3}{16}$ in., so that the small parting tool just takes a cut at leadscrew reading 0. Advance the parting tool by three turns + 93 (for a 0.030in. part width) and part to a diameter of say 0.320 inch. Next, centre and drill $\frac{1}{4}$ in. clear to a depth of just under $\frac{1}{2}$ in. Then bore for exactly three turns of the leadscrew to a finished diameter of 0.339 inch. This can be gauged by using a letter R drill, indicating the removal of the inside 4 thou. or 10 percent of the thread. Next retract the boring tool by 0.040in. on the leadscrew and increase the cut depth by 0.018in. per side, finishing up to the end of the bore again at this setting, thereby providing an undercut 'chamber' at the end of the thread for say 0.100in., assuming a boring tool width of 0.060in. The screw-cutting operation at 32tpi can now be

carried out in say three passes, to a depth of 0.018 – 0.019in. Start by relieving the first thread to full depth; at each pass of the screwcut, you will hear when it is finished; use a gentle hand on the leadscrew to sense just how far the cut has proceeded before opening the clasp nut and retracting the tool. As confidence builds, so will the turning speed. I personally feel comfortable with making such passes at 95 to 135rpm, which just means dropping into backgear from say first or second fast range speed of the Myford. You should now have a correctly threaded hole in the end of the hexagon, with a 'chamber' beyond it, up to a cleanly machined end, which has been drilled to accommodate the pipe. The penultimate operation on the nut is to chamfer the corners of the hexagon with the chamfering tool. Just discernible in **photo 2** is the fact that the right cutting edge of this tool is slightly forward of the left edge; thus you can get into the parting tool gap to chamfer the left edge of the piece without overdoing the right edge of the parent material. Finally, part off with the leadscrew returned to read 93 as originally measured. During these screwcutting operations I use a little

homemade thread gauge which has been tapped $\frac{3}{8}$ x 32tpi, and a plug tap which serves to correct any slight discrepancy in the thread form.

Suffice it to say, if all the dial readings are recorded on paper, you can repeat the operations *ad nauseam*, or until it is bedtime. Machining the other parts at the top left-hand corner of **fig 1** is done using similar set-ups and the same tools. One small variation in the gland nut is the boring of the O-ring recess to 0.313in. dia., which must be done to a precise depth of 0.063 inches. Again, this is where the readings on the leadscrew handwheel come into their own. That 0.063 dimension is arranged to give the right degree of squeeze to the O-ring, as it grips the valve spindle lightly.

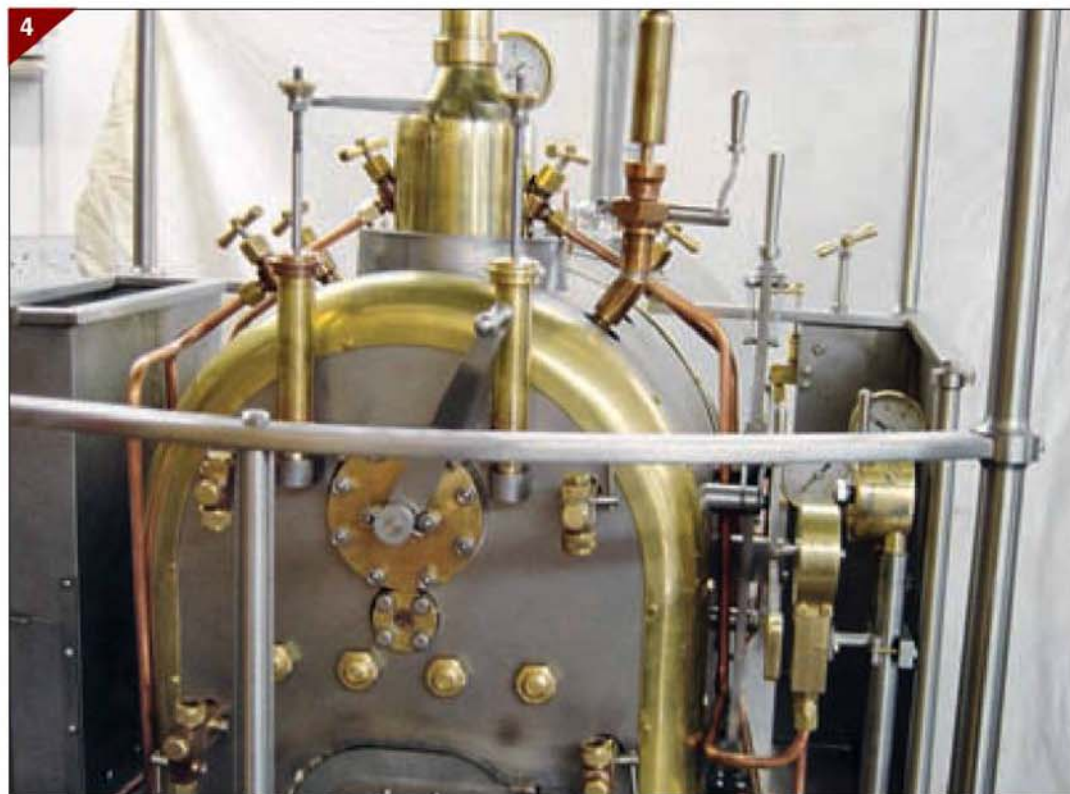
Brass Handles

The brass handle is made with 5½deg. tapers at each end (11deg. included), and as such sets an interesting challenge for the effective machining of a small batch. The problem is how to machine matching tapers at both ends without parting off. Having set over the top slide by 5½deg., it is simple to fashion just under $\frac{1}{4}$ in. of length from a major diameter of $\frac{1}{4}$ in., using a round nosed tool. Leaving the middle $\frac{1}{4}$ in. of the piece at its full diameter, the complementary rising taper can be formed by another round nosed tool in the guise of a boring tool, mounted upside down in the toolpost. This operation determines that the tool should cut at the back of the job, which it is quite safe to do. In no circumstances should you be tempted to run a screwed-on chuck in reverse, which would be necessary were the tool placed the right way up in the toolpost. This procedure avoids the need to reset the topslide angle between each pair of cuts, which I deem to



be economical since we are talking about a total of eight similar handles, one of which is cut short on one side for the pump relief duty. As before, the end chamfers are put on by the dedicated tool, used in conjunction with the small parting tool.

It is now necessary to change the shape of the central boss, to give it two flat surfaces separated by about $\frac{3}{16}$ in. Mount the raw handle in the 4-jaw chuck to run symmetrically; this can easily be achieved by touching the outsides of opposite jaws with a tool or clock gauge. Face off $\frac{1}{16}$ in. from the centre boss. The flat so formed should blend quite well with the bottom of the taper. Drill $\frac{1}{8}$ in. right through and use the hole as an alignment aid for the reverse side; re-mount in the chuck the other way round, with a $\frac{1}{8}$ in. dia. mandrel (e.g. the drill itself) in the tailstock chuck while the spindle chuck is tightened and trued. Remove $\frac{1}{16}$ in. of metal from this side and, lo you have a smart handle which just requires a $\frac{1}{8}$ in. square hole (or $\frac{3}{32}$ in. in two instances). For the squaring operation I use a double ended broach, whose cutting edges are razor sharp. This requires the bulk of the hole to be roughly filed out using a needle file, since the single edged broach would not go the whole hog on its own. Shown in **photo 3**, the broach has one end of $\frac{1}{8}$ in. and the other of $\frac{3}{32}$ in. square precisely. It is made out of high speed steel, notably a length of $\frac{3}{16}$ in. round material ground flat on both ends. With the tool blank gripped in a chuck or collet, the assembly can be indexed in 90deg. increments, no matter what sort of cutter grinder you are using. I set my Quorn table over at 3deg. and removed equal amounts of metal from each of the four sides, until the dimension across the flats was precisely right. You don't need a great length of material past the cutting edge, $\frac{1}{4}$ in. at most will do and the shorter it is, the more rigid. My cutter has survived cutting a good many holes and is normally held in



the drilling machine chuck, with its down-feed facility quite adequate for the purpose, like a crude shaping operation.

I think I can hear storms of protest, that you cannot grip such a small piece in a 4-jaw chuck in such a way that its axis is at right angles to the mandrel; it is true that I have a little light 4in. chuck, in which two of the tiny jaws reversed do the job admirably, but if you are running the standard 6in. chuck you are well advised to place a length of strip steel, say $\frac{3}{4}$ x $\frac{1}{8}$ in. diagonally between the jaws to act as a parallel.

Valve body and spindle

It is in the machining of these two sets of components that the benefits of screwcutting can really be felt; it enables you to hold concentricity between components just where it matters and, in the end, ensures that the valves shut gastight with the minimum of torque on the handles. In the drawing of the body, the main piece has male threads at both ends and a female thread 'up the spout' for the spindle. Obviously this indicates that two set-ups should be used for the complete machining and it is important that the correct sequence

is followed to preserve concentricity in the operating area. Chuck a length of $\frac{1}{8}$ in. dia. bronze rod, centre and drill No. 3 or 5.4mm to a depth of $2\frac{1}{2}$ in. Do not be tempted to ream to size until after the side branch has been silver-soldered into place. Now with the small boring tool, open to a diameter of 0.276in. for a depth of 0.849in. (six turns of the leadscrew plus 99). Increase the cut depth by 0.018in. for the final $1\frac{1}{2}$ turns of the bore in order to form a full diameter chamber about $\frac{1}{4}$ in. long in the area where the steam is going to turn through a right angle. For this operation you should check that there is no swarf remaining in the void and for this I use a pair of tweezers.

To carry out the internal screwcutting operation, set the tool just to touch the bore, withdraw by 0.018in. and remove the first thread ($\frac{1}{32}$ in.). The screw can be formed in say three cuts, counting five turns during each pass. When cut to depth, a plug tap should enter all the way. The external $\frac{1}{16}$ in. thread of the same pitch can now be cut, running out into a groove after three turns of the leadscrew. Do not forget to relieve the outside 0.004in.

4. Driver's view of the finished engine, with six of the valve handles visible, plus the truncated handle for the pump bypass.

in the area of the thread, or in other words start threading from an outside dimension of 0.434in. Final gauging of that thread is by means of the thread gauge mentioned earlier.

While the valve body is still in place, the relief behind the operating face should be turned; a full-width parting tool is useful for this operation, feeding in 0.125in. from the original stock diameter. A nice touch here is to make a radius on each end of the remaining parallel surface of the body, turning it into a part of a ball; it is easy if you have made yourself a ball turning tool. I am also sorely tempted to cut the $\frac{1}{8}$ x 32tpi on the boiler end of the valve body; you know the setting for a $\frac{1}{16}$ x 32tpi, which you have already gauged, so it is simple to add 0.031in. onto the radius value for the smaller thread. You can turn a run-out for the thread at its extreme end and this procedure avoids a second operation in the chuck after parting off.

You now have a set of truly turned valve bodies, which need side branches in accordance with the drawing. Over to the milling machine table with its vice aligned parallel to the X-axis; clamp over the remaining part of the original $\frac{3}{16}$ in. metal stock, registering the left end of the part so that it is dead level with the end of the vice jaw. This becomes the datum for setting all of that family of components. It is now simple to pick up the X-axis zero as the end of the vice jaw, and the Y-axis zero as the (fixed edge of the vice jaw + 0.313in.) Move X = 0.717in. and lock the slides. You can now drill $\frac{7}{32}$ in. through to the inside of the valve and counterbore $\frac{3}{16}$ in. dia. for a depth of 0.050in. This leaves a perfect location for the side branch. Now is the time to machine down the short length of original material to $\frac{1}{4}$ in. hexagonal in a dividing head. This hexagon will be

slightly truncated and that is not a bad thing.

Repetitive operations should produce identical components quickly. Machining the side branches needs no special remarks, other than pointing out that a short length of material left at full $\frac{3}{16}$ in. diameter after the threading makes for a good fit for silver-soldering. Make sure that the solder runs right around the joint; good flux treatment followed by adequate temperature will ensure success. Pickle thoroughly and then ream $\frac{7}{32}$ in. through the original hole in the valve. After reaming the hole, check with a magnifying glass that there is no burr on the seat; should there be, it can be removed by rotating a small piece of dowel which has been loaded with Brasso.

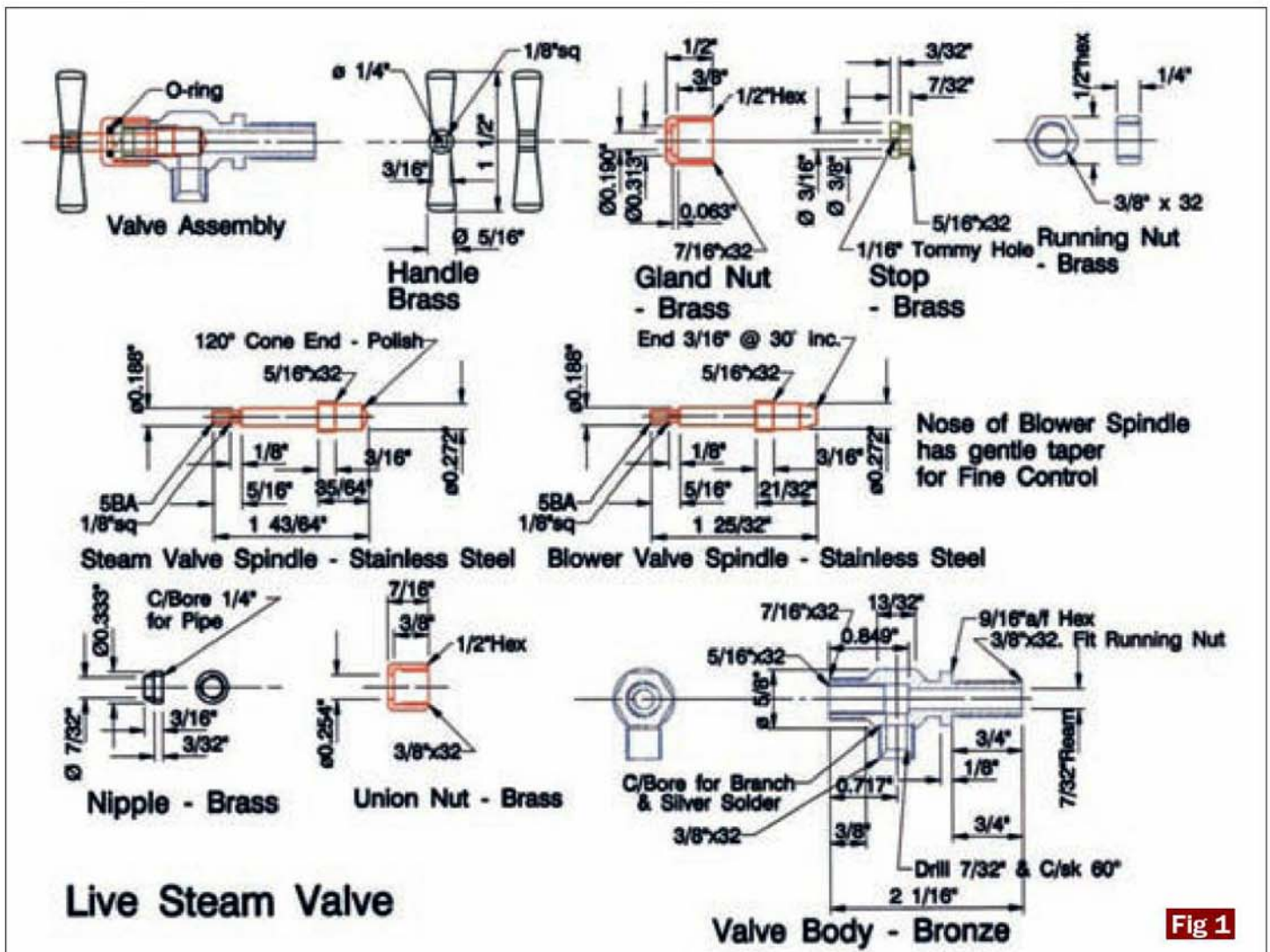
There remains the valve spindle to machine out of stainless steel; grade 303 is free machining and responds

well to a sharp tool. With just over 1in. of $\frac{3}{16}$ in. round bar sticking out of the chuck, turn down $1\frac{1}{2}$ in. to precisely $\frac{3}{16}$ in. diameter. This must be to a good finish and within 0.0005in. from end to end. The end $\frac{3}{16}$ in. should be turned to $\frac{1}{2}$ in. dia. and chamfered before screwing 5BA – I actually used a die for this operation! Then part off to length, mount in the dividing head and form the four flats for a length of $\frac{1}{2}$ in. to fit the valve handle. A little note on detail design is perhaps interesting: the flats are $\frac{1}{2}$ in. long, whereas the square in the handle is $\frac{3}{8}$ in. This means that you are not relying on the nut (and washer) to reach the end of the thread – good practice! In repeating these operations you will note four 'standard' components, one for the blower and odd ones yet again for the two water valves;

they are sufficiently common to make the batch machining philosophy worthwhile.

For the business end of the spindles, they should ideally be held in a collet. Turn down the end as indicated to 0.272in. dia., leaving just $\frac{3}{16}$ in. to be reduced to 0.309in. for the thread. This may be cut, as before, and should fit comfortably into the valve body. Finishing the ends to drawing will enable the valve to close properly without much torque being applied. When it is fully open (in about seven turns), it comes up against the brass stop. The O-ring seals the spindle against leaks. My **photo 4** shows the finished installation with all the valve handles visible, save that on the top of the Giffard injector. That should appear in the next instalment, along with some tips on pipe strangling.

● To be continued.



Superheaters: PRACTICAL EXPERIENCES

Dennis Postlethwaite concludes by considering how tube diameter, materials, the Second Law of Thermodynamics, and lubrication affects superheating.

*Continued from page 444
(M.E. 4323, 11 April 2008)*

The return bend in the superheater tubes is not the only important design factor. One of the most critical, which I was again to learn by practical experience, is the diameter of the superheater element. My good friend, who had provided me with samples of return bends, only had $\frac{3}{8}$ in. and $\frac{1}{2}$ in. stainless tube at his disposal. Obviously, two $\frac{1}{2}$ in. tubes would not fit into the existing superheater flues, so I used $\frac{3}{8}$ in. O/D superheater tubes.

This application was based on experience gained with Frank Wallbank's 5in. gauge *Lion*, which again I regularly drove. The superheaters on that failed and, as an expedient experiment, I replaced them with $\frac{3}{8}$ in. O/D superheaters as described above. Yes, $\frac{3}{8}$ in. O/D! Despite gloomy mutterings from the 'resident experts', the prophets of doom, and my own misgivings regarding restricted steam flow

and wire-drawing, the *Lion* went like a proverbial rocket. Certainly, $\frac{3}{8}$ in. I/D pipes didn't seem to make a hoot of difference. There were no ash and no blocked flues; another salutary lesson on superheaters learnt the hard way.

Eventually the superheaters of the 5420 failed again. This was after several years running; considerably longer than with the traditional copper 'block' elements. More fiddling in a small smokebox and more Railroad Esperanto! On removing the superheaters, it was obvious they had failed on the return bend, probably due to stress cracking (**photo 11** and close-up **photo 12**).

I renewed the superheaters with bends I had made myself, again from $\frac{3}{8}$ in. O/D stainless tube. Anticipating a good run, my next forage onto the track proved disappointing. Although the little engine ran, it lacked power. It was not as lively as it

should have been and, because of this, the fire did not pull up as bright and it was 'hard work' to get round the track. I ran my 5in. gauge rebuilt *Royal Scot* (with $\frac{3}{4}$ in. superheater elements as described above). The 5420 lingered in the workshop as I considered the problem. I eventually came to the conclusion that either one or more of the tubes had become blocked when I silver-soldered them to the copper manifold pipes. This is not as stupid as it may seem: it happened to fellow WMES club member, Mr. V. Harrison, with his magnificent 1969 Silver Medal-winning model of the GWR 3440 *City of Truro* now in the NRM York. Alternatively, the stainless tube I had used, although $\frac{3}{8}$ in. O/D, had a smaller I/D than that of my originals. To resolve the first possibility was difficult, to resolve the second, impossible. After much thought, I decided that the best solution would ➤



be to use larger diameter tube. In our enlightened days of metrication, I chose 4 millimetres. After quite a search, I eventually bought 20ft. of 4mm stainless tubing (from a hydraulics fittings supplier) and made new superheaters. They were recently refitted to 5420 but have not yet been tested. In the meantime, the boiler certificate had expired – but that is another story.

Superheater material

Another critical design factor, not only of superheaters but of boilers and associated fittings generally, is the choice of materials used. Indeed, consideration and knowledge of the materials used in boiler construction is now a mandatory part of the required boiler accreditation process. Before the latter came into being, many of us, certainly in the early days, followed the prescriptions of LBSC, Henry Greenly and, latterly, Martin Evans *et al.* The basic superheater design in those days comprised headers, both wet and dry, fabricated from copper, as were indeed the elements attached to them. And therein lies the first problem.

Copper is a wonderful metal to work and braze. What is not generally realised is that its oxide, which is formed every time copper is heated and cooled (*viz* annealing) is non-cohesive; a black powder, in fact. This oxide is formed every time a locomotive with copper superheaters is steamed and run. At the end of the run, the oxide on the surface of the superheater elements (and to a lesser extent on the headers) cools, becomes brittle and eventually flakes off. The failed elements referred to above, all failed because of such oxidative wasting. I have seen elements so thin at the firebox end (especially the 'block-end' type) that a scribe could easily be pushed through them. Sometimes they were even lace-like, porous and perforated.

That real problems are caused by oxidative copper wastage is evidenced by full-

size experience (*ref.*). The LMS found that copper stay wastage was the main reason for having to undertake boiler repairs. Research conducted at Derby concluded that, because of oxidative wastage, copper was an unsuitable material for stays and this led, after a series of trials with different alloys, to the adoption of monel as the preferred material.

Hence, in my opinion, copper is not a suitable material for making superheaters (at least in the higher temperature regions). This may be one factor why some model engineers challenge so vehemently the value of superheaters in miniature locomotives. At the end of the day, practical experience can teach lessons not obvious from theory.

The best material for superheaters currently would appear to be stainless steel. Although this is more difficult to form and braze than copper, the surface oxide is strong and cohesive, with the result that wastage, and eventual perforation, does not occur. For radiant superheaters, which protrude into the firebox, there would appear to be no satisfactory alternative material to stainless steel. There are some drawbacks with stainless steel, notably a tendency for stress-corrosion and cracking, its higher cost than copper and, importantly for model engineers, grade identification. Regarding the latter, the usual sources of model engineering materials can be a problem unless the grade of stainless steel is identified with certainty.

I have often thought that brass could be a suitable material for the headers and, indeed, general pipework in the smokebox, since this also forms a cohesive oxide. Early editions of *M.E.* give examples where brass has been used successfully. Of course, brass is not suitable for superheater elements because of the very much higher temperatures involved. Another material that I have considered is cupronickel (Cuni) which is used for condenser tubing in ships and nuclear reactors. The difficulty

12



with Cuni is in obtaining it in the small bore sizes. I do have some $\frac{3}{16}$ in. and $\frac{1}{2}$ in. dia. Cuni tube and one day I intend to see if it is suitable for header and other applications.

Second Law of Thermodynamics

Despite my derisory remarks about experts and pontification, the advantage of superheating has a sound theoretical basis in the Second Law of Thermodynamics. This Law applies to heat engines. These invariably undergo some form of Carnot Cycle in which heat energy is transformed into useful work.

One consequence of the Second Law (certainly easier to comprehend than some of the others which I had to learn and understand as a young student) is that the efficiency of a heat engine is dependent upon the temperature difference of the working fluid, in our case steam, before and after it leaves the engine. In the case of a steam engine, the exit temperature is fixed by atmospheric conditions. An increase in efficiency can only be realised by increasing the temperature of the steam. Thus, the higher the steam temperature, the more efficient the engine.

This was confirmed in full-size locomotives, where steam temperatures were continually raised and superheaters eventually become the norm. Indeed, it was acknowledged (dare I say it) to be one of the failings of 'God's Wonderful Railway' where all things 'Godly'

were sacrosanct. Then Stanier went to the LMS where he soon found that much higher degrees of superheat were necessary. In the end, the GWR realised the error of its ways, too. The performance of the Kings and Castles was transformed out of all recognition through the use of multi-tube, high temperature superheaters and improved draughting, mainly through the efforts of Sam Eil. This is practical testimony to the Second Law of Thermodynamics and the efficiency of heat engines. The effect is further exemplified by the greater operating temperatures, and hence increased efficiency, of the gas turbine.

Lubrication, metallurgy, and snifting valves

It should also be recognised that it was not just the generation and use of superheated steam that led to more efficient steam locomotives. Although the value of superheating was recognised in pre-grouping days, its application in practice was hindered by other factors, especially the availability of lubricants which could sustain the higher temperatures of superheated steam. The lubricants conventionally used carbonised at these higher temperatures, leading to valve and piston failures. Thus, superheater application and efficiency went hand-in-hand with the development of better lubricants and with metallurgy. Notably, more resilient metals were used for construction of cylinders, pistons, piston rings

and sealing glands, as well as for the construction of the superheaters themselves.

A pertinent point arising from the latter is the benefit, or otherwise, of snifting valves (or anti-vacuum valves as they are sometimes called). Originally snifting valves were designed to prevent the vacuum created, when drifting with the regulator closed, sucking ash and abrasive particles from the smokebox into the cylinders. Once superheaters were applied, it was advocated that the snifting valve should feed directly into the wet header so that the cold air sucked in is drawn through the superheaters when drifting,

thereby cooling the latter and preventing excessive heating of the elements. This may be reasonable in theory but I have some reservations in practice, stemming from the oxidative degradation of metals (especially at very high/radiant temperatures) referred to above. It seems to me that sucking air through radiantly hot metal tubes could be undesirable since it is liable to cause internal oxidative wastage - another possible cause of early failure of copper superheater elements.

Conclusion

Superheaters in our miniature locomotives are like diamonds

in life - not essential but desirable. In my opinion, they are undoubtedly beneficial if a locomotive is a working model that is run regularly. But they must be designed and made properly. This takes time and effort. Whether it is worth it is entirely at the whim of the builder: it is his decision alone. In my opinion, the optimum form of superheater for use in a working, miniature, steam locomotive would comprise stainless steel radiant elements extending well into the firebox, attached to a copper or stainless steel header. Proper construction is essential and care must be taken when

brazing or silver-soldering stainless steel. The latter is very important. I remember winding the reverser of the old *Hall* into full gear and opening the regulator. She moved off - there was a loud 'pop' followed by the hiss of escaping steam. The end of the wet header had blown off its cap due to faulty brazing.

More sighs, more 'railroad esperanto', and another practical lesson learned the hard way!

Reference

Bond, R. C., *A Lifetime with Locomotives*, published by Goose & Son, 1975, pp92 - 93.

ME

ANOTHER CENTRE HEIGHT-SETTER

Dr. W. M. Foreman constructs a height-setter that's particularly easy to use.

My tool consists of a 1 3/4 in. dia. horizontal flat disc at centre-height, on a post attached to a magnetic base standing on the bed. The disc shape enables the device to be used any way round. A lathe tool can be extremely quickly and easily set to the exact height by feeling with the fingertip. It is surprisingly accurate and avoids all that stooping and squinting which at my age I find so inconvenient. The magnetic base gives it stability when in use and allows for rapid storage on any nearby flat ferrous surface, even an inverted one.

Disc

Secure a 2in. length of, say, 2in. dia. mild steel rod in the 3-jaw chuck and turn down a boss to 0.8in. dia. and 0.5in. long. Chamfer the edge of the rod to an angle of about 30deg. (see photo). Drill a central hole and tap 3/8in. UNF; note that the depth of this hole must be such that it does not perforate the surface of the finished disc. Part off at the edge of the chamfer and set it aside.

Base

First obtain your magnet, which should be long enough to

span the lathe's bedway and about 1in. wide. My magnet came from a 'Keep-a-Key' box which was designed to store a spare key on the underside of your car. Alternatively, you can explore sites such as www.buntingmagnetics.com. Next, select a piece of steel bar about 3/8in. or 1/2in. thick and machine it so that it is equal in length and width to the magnet. Secure it in the 4-jaw and drill right through at its centre point and tap 3/8in. UNF. A quick way of trimming the ends is to mount it lengthways in the 4-jaw and machine them flat. Do not drill the magnet.

Post

Use a non-ferrous (I used brass) 3/8in. rod of suitable length and cut appropriate

lengths of 3/8in. UNF thread at each end.

Finishing

Assemble and adjust to a few thou. above centre height. Remove the base, mount the post in the 3-jaw chuck and take a final cut off the top of the disc. Now remove the disc. Refit the base by applying a little Araldite to the thread. When it has set, skim the bottom of the bar, in a similar fashion to the disc, to ensure accuracy. Glue the bar to the magnet with Araldite or similar. Finally, paint the parts the same colour as your lathe, but not the bottom of the magnet, the top of the disc or the nut. Reassemble and set to centre height.

ME

1. The addition of a magnet at the bottom increases stability and provides instant storage on any flat ferrous surface, even upside down.



WORKSHOP WRINKLES

Budget laser alignment of milling machines

R. L. Wright

suggests tramming a milling machine head to the table using a inexpensive laser level.

The accompanying photos show a very simple method of checking the square alignment between a milling machine table and the spindle, by making use of a cheap laser level.

The device is provided with a $\frac{1}{4}$ in. Whitworth female thread into which fits a small tripod supplied with the unit. This also enables it to be mounted upside down as shown, on a support rod shouldered and threaded to match and held in a chuck or collet in the mill spindle.

A simple target completes the apparatus (**photo 1**). In my case, it is an aluminium plate bearing a punch mark and fitted to a small magnetic base, but of course any angle plate or square block, even wood, would suffice.

Operation is obvious. Set the table mid point under the spindle centre line, position the target at one end of the table and aim the beam at the spot (**photo 2**). Then, rotate

the spindle 180deg. and place the target at the other end of the table (**photo 3**). The spot and beam should coincide. If not, adjust the angular position of the head until this is achieved.

On my machine I was pleasantly surprised to discover that not only was the alignment correct, but the simple angular scale on the head also lined up at zero! Bearing in mind that this is a cheap, far-eastern product, I thought this was pretty good.

Note that geometrically, the laser body does not need to be square to the spindle. As long as the laser does not move with respect to the spindle during the test, the laser spot end will scribe a circle whose horizontal radius will automatically be square to the vertical centre line as the spindle rotates.

However, the beam will not necessarily be exactly horizontal nor parallel to the table, consequently the target distances either side of the centre must be equal. **ME**

1. Inexpensive laser level with mounting post and target on small magnetic base. Note the aiming spot marked on the top of the target.

2. Target is placed on table and laser beam is aligned with the target spot.

3. The spindle is rotated to aim at the spot on the target which been placed at the other end of the table.



Keeping yourself (and your workshop) tidy

Peter Spenlove-Spenlove

provides an inexpensive way to stay clean in the workshop and shares some tips for gripping slippery plastics for machining.

Buy some cheap bargain-offer, soft tissue, toilet rolls and kitchen rolls. Bend up some wire hooks (ex-coat-hangers). Hang the rolls in a convenient place in the workshop, but not near your blowtorch area! Mine hang from the ceiling. A piece ripped off is clean and ideal to wipe paint or oil splashes from the face. A cloth could be dangerous as metal swarf pieces can get caught in the weave. The use of tissues on a 'use once and throw

away' basis also avoids the possibility of transferring wiped spills onto something later.

Fire risk

All wipers should be discarded into a safe metal bin with a lid, such as kitchen pedal bin. This will prevent grinder sparks, etc., from causing wipers to smoulder and burst into flames (after you have left the work area!).

Maybe the kitchen needs a new pedal bin!

Gripping slippery plastics

Supposing you have bought an assortment of plastic bar off-cuts, from traders at a rally or model engineering show. Some types, such as polypropylene and nylon, machine very easily in the lathe and miller using keen-edged tools; but there is a snag:

The plastics that feel slightly 'waxy' and which slip easily along a piece of shiny hardened steel do not like

being gripped in the lathe chuck or milling machine vice. The jaws of both are usually very smooth.

A piece of this type of plastic in the 3-jaw chuck often slips outwards. A flat-sided piece in the machine vice may slip during a cut. It's no good tightening the grip. This distorts the plastic and it still tries to escape, often suddenly, while taking a cut.

The cure

Glue two pieces of the finest grit sandpaper together back to back. I use Pritt stick which is made for sticking paper to card. Smear it on very thinly and press the sheets firmly. When dry, cut pieces off and place between the chuck jaws and the plastic. Do the same with the machine vice. This will help stop slippage.

If you have no fine grade sandpaper handy, try fine 'wet or dry' paper. It does not stick so well back to back. If no abrasive material is

available, use ordinary matt writing paper. The paper will help to stop slipping, if you work gently. Avoid glossy paper which feels slippery. This type of paper may have 'plastic' material within the surfaces, making it useless for this purpose.

I found that if latex adhesive was used to stick 'wet or dry' papers back to back, this 'sandwich' does not always stop nylon bar slipping in the chuck. The glue joint seems to creep slightly, probably because the adhesive takes a while to fully harden.

A further tip: If you need to machine a number of plastic pieces in the lathe, use a set of soft jaws. Bore the jaws to accept the bar stock. However, use a sharp V-pointed tool for the final cut. Traverse the tool quickly to make a fine, grooved surface. The 'rough' surface of the jaws will hold the plastic accurately and securely without using the aforementioned methods. **ME**

NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE N
ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT I

- Choosing a micrometer
- Neat filing rest
- How to make number plates
- McOnie's steam engine
- Beginner's clock
- CNC lathe for your mill
- Hydra
- Backhouse on Cogden
- Historic locomotive

■ Exhibition entry form



PLUS

**ALL YOUR USUAL FAVOURITES
ON SALE 23 MAY 2008**

Contents may be subject to change

LETTERS TO A GRANDSON

M. J. H. Ellis
describes
the historical
development of
tool steels

Dear Adrian, I have now finished considering electro-chemical machining. Since I am still collecting the material for my discourse on the next way of machining without the use of edged tools, this will be a convenient point to consider machining using tradition methods. This is an historic account of the development of specialised tool steels, culminating in high-speed steel, which is such a boon to the model engineer.

Benjamin Huntsman

Specialist steel goes back to the middle of the 18th century, when Benjamin Huntsman was making clocks and watches in Doncaster, Yorkshire. He was dissatisfied with the inferior quality of the springs available to him, and decided to try to make something better. After three years of experiment, and many failures, in 1746 he discovered how to make crucible steel. At first, he made it for his own use, but in 1751 he began to produce steel commercially in Sheffield.

Let me remind you how crucible steel was made: Selected bars of wrought iron, which is comparatively pure metal, were melted in a crucible with the proper amount of carbon, for about four hours, during which time the iron slowly assimilated the carbon. The success of the operation was largely dependent on the skill and experience of the operative.

It is to Huntsman's credit that he achieved success by patient trial and error, without really understanding what he was doing. It was not until about 1820 that the basic difference between cast iron, steel, and wrought iron, (ie, the different carbon content) became clear. When hardened and tempered, crucible steel was able to provide the reliable cutting tools called for by the refined machine tools of a new generation of precision engineers, typified by Henry Maudslay.

Now let me tell you about the development of high-speed steel both here and in America:

Robert Mushet

In the Titanic Company Works, near Coleford, in the Forest of Dean. Robert Mushet performed experiments on alloys of iron with chromium, manganese, and tungsten. Years ago, I visited the site of these works with a party of industrial archaeologists, and found a scene of utter dereliction, with scarcely one stone standing on another. Yet it was the scene of very important developments. Mushet's 'special steel', containing 2% carbon, 2.5% manganese, and 7% tungsten was first produced in 1868. It possessed a property which Mushet had never dreamt; after being forged, it hardened on its own, simply by being left in the air to cool.

Notwithstanding the success of the new steel, Mushet's company failed financially, but the product continued to be manufactured by Samuel Osborne & Co at Sheffield. Mushet never patented his discovery, but the process of manufacture remained a jealously guarded secret, even to the present day.

The Manchester experiments

As long ago as 1903, experiments were conducted jointly by the Manchester Association of Engineers and the Manchester School of Technology on the rate at which metal could be removed in a lathe using a high-speed steel tool. The tools were driven as hard as possible but none of them were able to stand up to two hours' continuous use.

They found that the deeper the cut, the slower the lathe had to run. A general principle became clear: The deepest cut took metal off at the fastest rate, and was also the most economical regarding the horsepower needed. The metals used in the trials were, soft, medium, and hard types of mild steel, and cast iron.

American developments

Similar developments were taking place in America. At the Paris Exhibition in 1900 visitors were astonished by the spectacle of sizzling blue swarf

being peeled off by an American lathe, the tip of the tool of which glowed red hot.

The new alloy steel was such an improvement on the old carbon steel, and tools were able to remove metal at such a rate that new, more robust, designs of lathes and other machine tools had to be developed.

All this time, the American engineering industry had been expanding rapidly, and important experiments were carried out which were so extensive that one wonders why the Manchester experiments were done at all. Beginning in 1880, the American experiments went on for no less than 26 years, during which time 50,000 experiments were performed, and 357 tons of metal were removed.

Supported by William Sellars, president of the Midvale Steel Co., Pennsylvania, (who gave his name to the Sellars threads), they were performed under the guidance of Frederick Taylor, and later with the cooperation of Maunsel White, a metallurgist at the Bethlehem Steel Works. In 1906, (i.e., after the result of the Manchester experiments had been published), Taylor reported his now classic work to the American Society of Mechanical Engineers. Amongst other things, Taylor and White proved that the self-hardening property of Mushet steel was attributable to the 2.5% manganese.

In 1894 Henri Brustlein sent samples of chrome-tungsten steel from Unieux to Taylor and White. They discovered that if manganese was replaced by chromium, its properties would be improved. Further experiments showed that the addition of silicone improved shock resistance and 0.7% vanadium also improved its performance.

This is by no means the full story, but indicates the vast amount of work that went into the development of HSS steel, which nowadays we take for granted.

Your affectionate Grandpa.

[Ed., see also p562-3, this issue.]

KEITH'S COLUMN

Keith Wilson muses on an eclectic variety of topics. The news is that the *Lillian* write-up will resume.

1. Layering of exhaust steam shows well in 'our' size under the right conditions. Photo taken at Leyland SME 1 January 2008.

A brief note on dimensions. Readers with CADD programs will know that a computer will usually do exactly as it's told – which is why 'to err is human, but a computer can really muck things up – it doesn't know any better – or for that matter – care'.

The point here is that you tell the computer to dimension to three decimal places, which for many dimensions – especially those needing working clearances – is perfect. Unfortunately, it cannot distinguish between important and unimportant dimensions; hence the total width of a hornblock casting for example comes out to three places, where of course it doesn't matter the proverbial damn. Individual dimensions can be modified, but then they don't obey re-sizing commands (such as converting from 7¼ to 5in. gauge, in which case they are difficult to spot). So superfluous accuracy rears its head, and peculiar figures can appear. A nice example rears its head in the fitting dimension on 5Knotty axlebox and hornblock. The exact size does not matter, but they must fit well.

An amusing musical reminiscence from about 1957. Although my knowledge of music is quite good, my ability as a player was not. I came to performing a bit too late in life.

We were rehearsing one of Eric Coates' works, the *Miniature Suite*, which I believe might have been his first success, although a few songs preceded it. The last movement (out of three) called *Scene du Bal* has a tricky little bit for flute solo in its third part. I knew the work well although the conductor didn't know that.

When we got to this solo, I played it perfectly – although I sez it myself. Conductor listened with great surprise, stopped the rehearsal and said, "What a virtuoso performance, Keith. How did you do it?"

"Well, I blow across that little hole there, and move my fingers up and down on these keys."

He was so taken aback that he could only say

"You insufferable beast!"

The band loved it!

He later became the Head of RAF Music Services.

Once I knew a piece well there was no trouble.

Another time we were playing the third movement of the

second *L'Arlésienne Suite* - by Bizet. The English title would have been *The Maid of Arles*, i.e., Joan of Arc. Said third movement is almost solo flute all the way, but it is not at all difficult. On completion, the entire band gave me a good round of applause. I have a feeling that I might have stood up and bowed.

A thought that has puzzled me for many years now is that for some people, once they have been told something by a person of authority they will blindly accept it in spite of the evidence of their own eyes and direct experience. I have in mind a Scout of about 60 years ago whose father (a chef) had told him that there was no need to grease a pan before frying bacon because it would never stick. The fact that it invariably did stick to the pan never fazed him, it just 'did not stick'. To be sure, it usually did stick even if the pan was first greased; it was a matter of temperature. Frying over a camp fire produces quite high temperatures. But he had been told, and 'that was that'.

We are told officially that there are only four forces in nature, the strong atomic force, the weak ditto, electromagnetic





2. Profile of steam exhaust on a winter's day which replicates the full-size effect. GWR King is working the train.

and weakest of all, gravity. But there is a very weak force that is ignored; I can only call it 'nerve force' and I don't know where it fits in with the others. I read about it nearly 50 years ago and I have demonstrated its existence to several people.

Get a piece of paper about 9 x 3in., roll it into a cylinder about 3in. diameter. Make two small holes in it about ½in. from one end, diametrically opposite each other. Thread a straw through both holes so that it forms a diameter. Press a small darning needle through the center of the straw, point towards the end of the cylinder further from the straw. Mount this assembly on something like a bottle top so that you have a freely rotating device, with next to zero friction.

Now cup your right hand around the cylinder, fingers and thumb pointing in the same direction. Make sure that there is no wind blowing on the cylinder including your breath and the cylinder will revolve slowly in the direction your fingers are pointing. Don't forget to try both hands.

The best explanation so far is that large nerves (the Median nerves) runs down each arm and ends at the tips of thumb and first two fingers, and the nerve energy or force runs down this nerve and some energy or force is passed out through these digits.

My thanks to Les Hulme of Whitby, North Yorkshire for a useful tip dealing with formulae

on Excel, such as the program given for spring calculations recently. As I mentioned at the time, the program will show calculations as distinct from the formulae in the program, which can be difficult when trying to print out a formula for others to load.

By holding down the 'control' button (bottom left) and pressing the key at top left (just under 'Esc') the position is reversed in one sense and the screen shows all the formulae instead of results. Pressing the said key again together with Ctrl toggles back to results. Very useful. It seems that this key has no official name, so Les Hulme's tutor calls it the 'twiglet' key, it is just to the left of '1'.

Les also gives a 'more orthodox' method, but the above is quicker.

It has been drawn to my attention that the *Lillian* design has yet to be completed. Reason is that the matter of house-moving took temporary precedence. We had a big house; too big in fact. With four floors (counting the cellar) it was just too much for both of us – both in our 70s. So a bungalow was called for. Seven times our house was sold, six of them it fell through. The strain got worse – not surprisingly perhaps – and I have already related the story of our owl down the chimney. Work was stopped in the workshop, and vast quantities of decisions had to be made,

for squeezing my big workshop from 39 x 22ft., plus storage space of about 16 x 16ft. down to about 18 x 8ft., is not one of the lighter matters.

The big milling machine had to go (two tons), the bandsaw with it and the Colchester Student has gone to a good home.

Quite a lot went into storage – in fact just about everything in the workshop, fortunately my locomotives found just enough room in the garage of our temporary rented bungalow. Space was at such a premium that things could only be taken out on the basis of last in—first out.

A safety matter has recently been mentioned to me. I don't know where and if I did I certainly wouldn't say. There was a minor shunt on a 7¼in. track; this is not an uncommon event. The rearmost driver had miscalculated by a foot or two, and – mark this clearly – the struck train was empty. However, in no time at all three had sat on the rear carriage and were noisily complaining of whiplash effect!

Fortunately this was witnessed by enough people to give them the lie for, in this sickening age of suing everyone in sight, insurance companies often find that it is cheaper to fork-out than to fight the case, but what sort of message does this send to evil minds?

With all the delays in our sale going through, we 'took' several nice bungalows but out of fairness to sellers we had to withdraw. The penultimate choice we had to reject because of the seller's thoroughly incompetent solicitors who had ignored the fact that the deeds only showed about half the site! It took a few months to be put right, but then they refused to draw up a new contract, suggesting that we merely altered the original contract. Now I admit to being 'full of tricks', but that ain't one of them, so we withdrew – any questions?

Then luck changed, for we were offered a fine bungalow not too far from motorway access, town centre, and eldest

son; yet in a little close (cul-de-sac) so passing traffic is rare. It was vacant and for about £500 extra came completely furnished.

The bathroom was changed to a shower room, a conservatory added to the rear and garage 'sorted out' to be a workshop. So although I have yet to fully recover from my spinal re-bore operation two years ago, I am re-starting on making *GWRILLIAN*, so can show some more pix. Knot that I am knot carrying on with Knotty, but can deal with both. Oddly enough, this helps.

I am now getting on with boiler, cleaning up flue tube ends (35 flues, six superheater tubes.)

There has been much recent debate on superheaters – yea or nay. Now I have not yet gone into the matter thoroughly, so am not competent to give a firm commitment either way. Way back, when Henry Greenly designed the big locomotives for the RH&DR way down in Kent, he provided very large tenders to cover the New Romney-Hythe-Dungeness-Hythe-New Romney round trip. Hythe water was very hard, so it was not used from choice. When superheating was added to one loco, it was found that water consumption was less by enough to suit smaller tenders, though I am unaware of same being made. I do not know the present position on that line.

One of the main reasons for the thermal inefficiency of steam engines generally is the heat needed to cook the water from cold to 100deg. C; in virtually all steam locomotives this heat is unrecoverable. So it seems to me that if we can make the steam go a bit further by superheating it, then superheating is worth while. It is of course a matter of opinion as to whether the extra work involved is worth the trouble.

There is no doubt that it pays in full-size, however the old 'square-cube' has to be considered. The smaller locomotive has, say, ⅓ the surface area (considering cylinders) but ⅛ the volume. It is therefore more wasteful

of heat in proportion to its size. The smaller the scale, the worse it gets, so somewhere along the line the loss is such that with or without superheating makes no difference. By the same reasoning, to take expansion of steam into account whilst running notched-up there must come a point where heat loss in cylinders is so great relative to size that heat losses render notching-up useless. By experience this point comes well below 2 ½in. gauge.

Now I have used copper superheat elements with block return items; alas the erosive action of grit helps to cause failure just in front of the block. For as flue gases plus grit pass the block they must accelerate in order to keep the same energy content; and once past the block then they move a bit slower as the steam expands and the grit tends to erode away the soft copper. It probably grinds a bit of the flue tube as well as the element,

but I have never measured this. Unless I am sadly wrong, this is the main cause of copper element failure.

I tried a 'concentric tube' type (using stainless) reaching back into the firebox, but could not discover a way of getting boiler steam down the inside tube and back up the outside tube without complications in the smokebox – certainly the most unwelcome place for such! This system worked, but not as well as I would like. So I came to the spearhead type, made in stainless iron (mostly called stainless steel) reaching to the back of the firebox where the temperature is highest and therefore heat transfer is greatest. Copper conducts heat much better than stainless, but the latter is clearly stronger than the former, also with higher melting point.

On operating my own locomotives, after a few puffs at starting, the draincocks can be closed and remain closed for the rest of the day as cylinders

stay hotter than condensation temperature unless a prolonged stop is made. So superheating does pay, for the locomotive uses less water. Since, as I wrote above, this means less water has to be boiled, it follows that superheating does work. Whether or not this saving of water (and therefore coal) is worth the trouble of fitting good radiant superheater elements is therefore much of a personal choice.

The pictures shew a rather rare occurrence, that of layers of exhaust steam mirroring full size. Normally, 'our' sizes do not produce this effect; it is a matter of quantity. In our cases there is not enough condensed steam to shew, it is far too dispersed. If it were possible to separate a small quantity of 'full-size' condensed steam it would be just as difficult to see as 'ours'.

However, at the time these pictures were taken, weather and temperature conditions were just right. They were

taken earlier this year as the Leyland track; on January first. It doesn't really matter, but the locomotive is a King.

Husband: - "We have to cut down on expenditure."

Wife: - "You'll have to stop drinking."

"No, you'll have to give up make-up."

"But I use make-up to look beautiful for you."

"That's why I drink."

Deadly silence.

WILSON'S WORDS OF WISDOM

Most decisions that matter are taken by people who don't know anything about them.

STEAMING UP SOON: IMLEC 2008

Mark your calendar to visit the 40th running of the International Model Locomotive Efficiency Competition (IMLEC) hosted by the Southport Model Engineering Club.

5-6 July 2008

Victoria Park
access off Rotten Row
Southport
Sefton

Or for your GPS:
53° 38' 24.49"N
3° 1' 27.99"W

Ample off-street parking is available

Southport, a delightful Victorian seaside town known as 'The Classic Resort', is renowned for its gardens, sandy beaches and many golf courses - including Royal Birkdale where the 2008 Open Golf Championship will be held the week before IMLEC. Its elegant town centre provides a vast array of shops and a wide selection of restaurants. Lord Street, the main street has many pavement cafes situated under a glass and cast iron Victorian canopy. For family members who are interested, the fine market town of Ormskirk, nearby, hosts a Saturday open market. Programme purchase will provide entry to the club grounds and the event itself on both days.

W. www.southportmec.co.uk

E. john.a.c.rothwell@btinternet.com





Malcolm Stride reports

will start this issue with a special mention of the **Ashcombe Miniature Railway** which is based at Ashcombe School and has been reported many times in these pages. Unfortunately the teacher who masterminded the railway is retiring and no one else has come forward to take over, so the railway is closing. The gentleman in question is Roger Wakeford who has been involved in three school railway clubs in his career. The first was at De Burgh School, Tadworth, in 1969 where he assisted another teacher with the school railway club. The second was at Therfield School where he started a model railway club which evolved into a passenger carrying miniature railway. This railway was the one eventually brought to Ashcombe. I think there must be many model engineers who started their activities under Roger's guidance and I am sure many readers will agree that he deserves a big thank you for his efforts in encouraging youngsters over the years. We wish Roger a long and happy retirement, hopefully spending time on some of his own model engineering projects.

If any of you reading this were encouraged to take up model engineering by Roger, we would be delighted to hear your stories.

A reminder

May I remind readers that when sending items in for *News* or *Diary*, all such items must be sent to the Editor, David Carpenter. We have had a couple of items delayed

recently because they were sent to someone else. Also when sending time critical items in for the *Diary*, or a special mention in *News* please allow an absolute minimum of six weeks for publication and preferably more.

Notices

Model engineering evening classes

For those in the St. Albans area, there is an evening class being run at the Marlborough School, Watling Street, St. Albans, AL1 2QA. A full range of equipment including lathes, milling machines and welding and brazing facilities is available every Thursday evening during term time from 6.30pm until 9.00pm. The charge is £10 per evening and there is no requirement to book other than on an evening by evening basis. Contact Ian Fergusson (T. 01727 868302) for more information.

MJ Engineering open day

MJ Engineering is holding an open day at the **Reading SME** site (Prospect Park, Reading) on Sunday 18 May from 10am until 4pm.

The event will start on Saturday afternoon from 2pm onwards and visitors are welcome to camp in the club grounds overnight (please book in advance).

The company hopes to have exhibits of all its models on show, inside and outside. Some of them will be in steam, driving around the hard-standing. Also, there will be locomotives running on the track giving rides to those who wish them.

The shop will be at the open day with the usual range of stock for visitor's perusal. Those with specific requirements are asked to let the company know in advance so that the items can be brought to the show thereby saving buyers postage.

There will be light snacks and refreshments available all day; all proceeds going to the club.

The day will be a good opportunity to talk to other builders, to pick their brains and to see work in progress

and finished models,

If you have a model, complete or part complete, you wish to bring along please phone and let the organisers know. Any models to be steamed will, of course, need a valid boiler certificate.

The Reading SME site is situated in Prospect Park on the north side of the A4 – Bath Road about one mile to the west of Reading town centre. It is recommended that visitors approach the site from the West, avoiding the town centre traffic. From the M4 – Junction 12 – Theale take the A4 towards Reading. After about 2¼ miles you will reach a set of traffic lights. Keep to the A4, on your left you see a large area of parkland and the road soon starts to curve to the left. The RSME site is on the left about 150 yards before the next set of traffic lights. There are keep clear markings on the carriageway immediately outside the entrance. Visitors towing caravans are advised to carry on to the next roundabout then retrace their steps so as to make a right turn into our site.

For further information contact MJ Engineering at The Forge, Cricket Hill Lane, Yateley, Hampshire GU46 6BB, T. 01252 890777. W. www.mjeng.co.uk E. sales@mjeng.co.uk

Two events at the City of Oxford SME

The annual Sweet Pea Rally will be held at the **City of Oxford SME** track at Cutteslowe Park over the weekend of 7/8 June this year.

The Dreaming Spires Rally will be at the same location over the weekend of 26/27 July.

Isle of Wight Exhibition

We have advance notice that the biennial exhibition held by the **Isle of Wight MES** will be held on 20/21 September this year at the River Side Centre, Newport, Isle of Wight. Further details will follow later in the year.

UK club news

Des Adeley reports in the **National 2½" Gauge**

1. The snowy conditions did not deter passengers at the Audley End Railway.



MAY

- 7** **Bradford MES.** *Stuart Lindsey: Darjeeling Railway.* Contact John Mills: 01943 467844.
- 7** **Leeds SMEE.** *Meeting.* Contact Geoff Shackleton: 01977 798138.
- 8** **Cardiff MES.** *Forum.* Contact Don Norman: 01656 784530.
- 8** **Leyland SME.** *Fantastic Plastic Night.* Contact A. P. Bibby: 01254 812049.
- 8** **Sutton MEC.** *Busy Night.* Contact Bob Wood: 020 8641 6258.
- 9** **Hereford SME.** *Train Driving for All.* Contact Nigel Linwood: 01432 880649.
- 9** **Nottingham SMEE.** *Graham Davenport: Harrogate ME Exhibition.* Contact Graham Davenport: 0115 8496703.
- 9** **Polegate & District MEC.** *Tony Deller: Stratford Diesel Repair Shop.* Contact D. F. Pratt: 01323 645872.
- 10** **SM&EE.** *Training Seminar.* Contact Maurice Fagg: 020 8669 1480.
- 11** **Canterbury DMES (UK).** *Public Running.* Contact Mrs P. Barker: 01227 273357.
- 11** **Cardiff MES.** *Open Day.* Contact Don Norman: 01656 784530.
- 11** **Edinburgh SME.** *Public Running.* Contact Robert McLucke: 01506 655270.
- 11** **Harlington LS.** *Public Running.* Contact Peter Tarrant: 01895 851168.
- 11** **Leicester SME.** *Public Running.* Contact John Lowe: 01455 272047.
- 11** **Maidstone MES (UK).** *Public Running.* Contact Martin Parham: 01622 630298.
- 11** **Norwich DSME.** *Running Day.* Contact Shirley Berry: 01379 740578.
- 11** **Nottingham SMEE.** *Public Running.* Contact Pete Towle: 0115 987 9865.
- 11** **Saffron Walden DSME.** *Public Running.* Contact Jack Setterfield: 01843 596822.
- 11** **Sutton MEC.** *Track Day.* Contact Bob Wood: 020 8641 6258.
- 11** **Taunton ME.** *Public Running.* Contact Nick Nicholls: 01404 891238.
- 11** **Worthing DSME.** *Public Running.* Contact Bob Phillips: 01903 243018.
- 12** **Bedford MES.** *Nigel Morrell: Thames Sailing Barges.* Contact Ted Jolliffe: 01234 327791.
- 12** **Melton Mowbray DMES.** *Norman Smedley: Building the Foden Speed 6.* Contact Phil Tansley: 0116 2673646.
- 12** **Saffron Walden DSME.** *Club Night.* Contact Jack Setterfield: 01843 596822.
- 13** **King's Lynn DSME.** *Bits & Pieces.* Contact Mike Cootie: 01533 673728.
- 14** **High Wycombe MEC.** *AGM.* Contact Eric Stevens: 01494 438761.
- 14** **Hull DSME.** *Alan Dixon: Marine Diesel Engines.* Contact Tony Finn: 01482 898434.
- 14** **Norwich DSME.** *Brian Tipple & David Davey: DIY CNC.* Contact Shirley Berry: 01379 740578.
- 14** **St. Albans DMES.** *Phil Locke & Kim Belcher: Insight into Model Lifeboats.* Contact Roy Verden: 01923 220590.
- 16** **Rochdale SMEE.** *Meeting.* Contact Bob Denyer: 0161 959 1818.
- 16** **Romford MEC.** *Dave Simms: Royal Gunpowder Mills.* Contact Colin Hunt: 01708 709302.
- 17** **Aylesbury (Vale of) MES.** *Southern Federation Spring Rally.* Contact Andy Rapley: 01296 420750.
- 17-19** **British Columbia SME.** *Spring Meet.* Contact Sean Laurence: (604) 931 1547.
- 17** **Cardiff MES.** *Steam-Up & Family Day.* Contact Don Norman: 01656 784530.
- 17/18** **Chesterfield MES.** *Open Weekend.* Contact Mike Rhodes: 01623 648676.
- 17/18** **Hutt Valley MES.** *Thames Open Weekend.* Contact Gavin McCabe: 567 4487.
- 17** **South Lakeland MES.** *Open Day.* Contact Adrian Dixon: 01229 869915.
- 17/18** **Tyneside SMEE.** *Spring Open Weekend.* Contact Malcolm Halliday: 0191 2624141.
- 17** **York City & DSME.** *Running Day.* Contact Pat Martindale: 01262 676291.
- 18** **Edinburgh SME.** *Public Running.* Contact Robert McLucke: 01506 655270.
- 18** **Frimley & Ascot LC.** *Club Run.* Contact Bob Dowman: 01252 835042.
- 18** **Leeds SMEE.** *Running Day.* Contact Geoff Shackleton: 01977 798138.
- 18** **Leicester SME.** *Public Running.* Contact John Lowe: 01455 272047.
- 18** **Maidstone MES (UK).** *Public Running.* Contact Martin Parham: 01622 630298.
- 18** **Norwich DSME.** *Running Day.* Contact Shirley Berry: 01379 740578.
- 18** **Nottingham SMEE.** *Public Running.* Contact Pete Towle: 0115 987 9865.
- 18** **Oxford (City of) SME.** *Running Day.* Contact Chris Kelland: 01235 770836.
- 18** **Plymouth MSLS.** *Public Running.* Contact Malcom Preen: 01752 778083.
- 18** **Saffron Walden DSME.** *Public Running.* Contact Jack Setterfield: 01843 596822.
- 18** **SM&EE.** *Model Steam Show.* Contact Maurice Fagg: 020 8669 1480.
- 18** **Sutton MEC.** *73rd Annual Exhibition.* Contact Bob Wood: 020 8641 6258.
- 19** **Model Steam Road Vehicle Soc.** *Model Night.* Contact John Bagwell: 01452 304876.
- 20** **Chesterfield MES.** *Chris Jones: Old Road, Changing Scenes.* Contact Mike Rhodes: 01623 648676.
- 20** **North Cornwall MES.** *Meeting.* Contact Geoff Wright: 01566 86032.
- 20** **Nottingham SMEE.** *John Barratt: An Introduction to Gauge 1.* Contact Graham Davenport: 0115 8496703.
- 21** **Leeds SMEE.** *Gordon Neal: An Engineer's Travels.* Contact Geoff Shackleton: 01977 798138.
- 21** **Maidstone MES (UK).** *Members' Playtime Run.* Contact Martin Parham: 01622 630298.
- 21** **MELSA.** *Meeting.* Contact Graham Chadbone: 07 4121 4341.
- 22** **Isle of Wight MES.** *Meeting.* Contact Malcolm Hollyman: 01983 564568.
- 22** **Leyland SME.** *Ted Avery: Canadian Flying Boats.* Contact A. P. Bibby: 01254 812049.
- 23** **North London SME.** *AGM.* Contact Rachael Chapman: 01442 275968.
- 24-26** **Brighton & Hove SMLE.** *Public Running.* Contact Mick Funnell: 01323 892042.
- 24** **Chesterfield MES.** *Public Running.* Contact Mike Rhodes: 01623 648676.
- 24-26** **Ryedale SME.** *Spring Mainline Rally.* Contact David Myers: 01388 661255.
- 24** **York City & DSME.** *Best Work of Year.* Contact Pat Martindale: 01262 676291.
- 25/26** **Bedford MES.** *Public Running.* Contact Ted Jolliffe: 01234 327791.
- 25/26** **Bristol SMEE.** *Public Running.* Contact Trevor Chambers: 0145 441 5085.
- 25/26** **Cardiff MES.** *Open Days.* Contact Don Norman: 01656 784530.
- 25** **Edinburgh SME.** *Public Running.* Contact Robert McLucke: 01506 655270.
- 25** **Harlington LS.** *Charity Open Day.* Contact Peter Tarrant: 01895 851168.
- 25** **High Wycombe MEC.** *Public Running.* Contact Eric Stevens: 01494 438761.
- 25/26** **Leicester SME.** *Public Running.* Contact John Lowe: 01455 272047.
- 25/26** **Maidstone MES (UK).** *Public Running.* Contact Martin Parham: 01622 630298.
- 25** **MELSA.** *Sunday in the Park.* Contact Graham Chadbone: 07 4121 4341.
- 25** **North Cornwall MES.** *Sunday Steam-Up.* Contact Geoff Wright: 01566 86032.
- 25/26** **Northern Mill Engine Society.** *Steam Days.* Contact John Phillip: 01257 265003.
- 25** **Norwich DSME.** *Running Day.* Contact Shirley Berry: 01379 740578.
- 25/26** **Nottingham SMEE.** *Public Running.* Contact Pete Towle: 0115 987 9865.
- 25/26** **Oxford (City of) SME.** *Running Days.* Contact Chris Kelland: 01235 770836.
- 25/26** **Saffron Walden DSME.** *Public Running.* Contact Jack Setterfield: 01843 596822.
- 25** **Taunton ME.** *Public Running.* Contact Nick Nicholls: 01404 891238.
- 25** **Worthing DSME.** *Public Running.* Contact Bob Phillips: 01903 243018.
- 26** **Leighton Buzzard NG Rly.** *Teddy Bears' Bank Holiday.* Enquiries: 01525 373888.
- 26** **New Jersey Live Steamers, Inc.** *Memorial Day Run.* Contact Karl Pickles: 718 494 7263.
- 26** **Northampton SME.** *Bank Holiday Steam-Up.* Contact Pete Jarman: 01234 708501 (eve).
- 26** **Reading SME.** *Children's Festival.* Contact Brian Joslyn: 01491 873393.
- 26** **Stockholes Farm MR.** *Bank Holiday Running.* Contact Ivan Smith: 01427 872723.
- 26** **Westland & Yeovil DMES.** *Running Day.* Contact Gerald Martyn: 01935 434126.
- 28** **Bedford MES.** *School Holiday Public Running.* Contact Ted Jolliffe: 01234 327791.
- 28** **Hull DSME.** *Discussion Night.* Contact Tony Finn: 01482 898434.
- 29** **Sutton MEC.** *Chat Night.* Contact Bob Wood: 020 8641 6258.

WORLD CLASS

MODEL ENGINEERING

www.model-engineer.co.uk



**MODEL
ENGINEER
EXHIBITION**

19 - 21 SEPTEMBER 2008, ASCOT



DRIVES DIRECT

Digital Phase Converters

• www.drivesdirect.co.uk
• sales@drivesdirect.co.uk

DIGITAL INVERTERS

Basic 220 Volts input - 220 Volts output

These small and compact basic 220 Volt output inverters allow you to run a DUAL VOLTAGE motor from a single phase supply. They come in sizes from 1/4 HP up to 3 HP (0.18kW up to 2.2kW) and offer SOFT START, SPEED, ELECTRONIC BRAKING and JOG functions via the low voltage remote control terminals. They are perfect for fitting into workshop machines. It is often possible to connect the remote START/STOP and FORWARD/REVERSE to the machines existing controls as long as they are of the maintained type (IE not push button).

- 1/4 HP (0.18kW) £77.50
- 1 HP (0.75kW) £134.95
- 3 HP (2.2kW) £239.95
- 1/2 HP (0.37kW) £94.95
- 2 HP (1.5kW) £189.95



We also offer ADVANCED INVERTERS in the same size range as above, these offer all the functions of the basic inverters BUT they drive the motor using a method known as torque vector modulation, this can only be used on single motor applications such as a lathe spindle and offer super smooth speed control over the full range and also full power even at very low RPM. In addition to this advanced inverters also offer extra functions like 3 wire START/STOP control so they can interface to a machines existing pushbutton control, removable display panels, built in PLC logic and advanced communication are just some of the extra functions these units offer, please contact us for more information and prices on this range. Prices start at £149.95



Basic 220 Volts input - 415 Volts output

These basic 415 Volts output inverters come in 3 sizes from 1HP up to 3HP and they offer all the functions of the 220 Volt output version BUT the fact they offer 415 Volts output means they can be used with motors that are NOT DUAL VOLTAGE, this would often be the case on older motors or on DUAL SPEED motors.

- 1 HP (0.75kW) £274.95
- 2 HP (1.5kW) £329.95
- 3 HP (2.2kW) £419.95



All of the inverters above are available as IP-65 units for applications where dirt/dust or fluid ingress may be a problem, these units have a built in mains power ON/OFF switch, FORWARD/STOP/REVERSE selector and a SPEED CONTROL as well as a digital display and programming pad, please ring our sales office for pricing on any of these units.



3 PHASE ELECTRIC MOTORS

We offer a range of high quality aluminium 3 phase motors in sizes ranging from 90 Watts (1/4 HP) up to 2200 Watts (3 HP), the 90 W motor being one that's small enough to hold in the palm of your hand with a 9mm shaft that's perfect for fitting to bench top lathes etc. Prices start at £39.95



MOTOR & INVERTER PACKAGES

We also offer matched motor and inverter packages for retrofitting to your machine with remote control boxes if required, we can supply everything you need for these conversions including motor pulleys, cable and connectors. Please contact us with your requirements. Prices start at just £149.99



DIGITAL PLUG & PLAY CONVERTERS, POWER YOUR WHOLE WORKSHOP WITH ONE CONVERTER

These units come in sizes ranging from 5 1/2 HP up to 30 HP and they will convert a single phase 240 Volt supply into a 415 Volts 3 phase regulated output, various versions are available from units to power basic machines up to advanced systems that can be used to run CNC machines and welders via a workshop ring main and are able to run more than one machine at once, please call us with your requirements.

Prices start at £499.95



At Drives Direct we pride ourselves on customer service and we offer you full telephone technical support to guide you through the wiring and programming on any products purchased from us, you can buy with 100% confidence that you have the correct item for the job and that you will receive all the help you need to get up and running, this service is available from 10.00am until 10.00pm.

You are not just purchasing a box from Drives Direct!

All prices include VAT

Drives Direct is a trading name of Drives Direct (Inverters) LTD.

Tel: 01773 811038

Fax: 08717 334875

Mob: 07976 766538

Bonhams

1793



The Henley Sale 2008

Bonhams first sale of Live steam models at Henley in 2007 was a great success with exceptional models achieving exceptional prices. We are now accepting entries for this year's sale to be sold alongside Hercules.

Enquiries:
Leigh Gotch
+44 (0) 8700 273 628
leigh.gotch@bonhams.com

Catalogues
+44 (0) 1666 502 200

Illustrated:
'Hercules' a rare and important 6in gauge model of a Norris 4-2-0 locomotive of circa 1840, to be sold at Henley-on-Thames 19 July 2008. Estimate £15,000 - 20,000

Bonhams
Montpelier Street
Knightsbridge SW7 1HH



London · New York · Paris · San Francisco · Los Angeles · Hong Kong · Melbourne · Dubai

A selection of conventional machines for the medium size workshop

280B Belt Drive Lathe



- Wide, double vee bedways – hardened and ground
- Precision spindle support on taper roller bearings
- Offset facility to tailstock
- Large cross slide with two full length tee slots
- Metric and imperial thread cutting
- Reversible leadscrew for left hand threading

Drill chuck, arbor and live centre free of charge

£1100.00

918 Lathe



- Hardened and ground bedways
- Precision ground spindle supported by taper roller bearings
- Quick change gearbox with change wheels for imperial/metric threading
- Tee slotted cross slide
- Zero/friction dials

Drill chuck, arbor and live centre free of charge

£650.00

BV20 Lathe



- Fully enclosed geared headstock, speed selection by lever
- Precision ground vee bedways
- Large bore spindle
- Set over tailstock facility
- Tee slotted cross slide
- Zero/friction dials

Drill chuck, arbor, and live centre free of charge

£535.00

ZX-15 Milling Machine

- 3MT Spindle bore
- Wide cross slide for maximum support
- Tilting head – worm gear mechanism
- Rack and pinion quill feed for drilling operation
- Fine feed to quill for precise milling and boring

Set of 3 direct collets free of charge

£550.00



Tool Cabinet

- Part of a wide range. Please send for full details.
- Professional, industrial quality
- Ball bearing drawer runners
- Fully lockable
- Rubber lining to drawers
- Heavy duty castors, two locking

Tool cabinet £199.00

Tool chest £110.00



BDS 690 Belt and Disc Sander

- Floor standing machine, with stand supplied
- Cast iron bed
- Tilting table, with mitre gauge
- Table can be used with the sanding belt in a vertical position
- 3/4 hp motor
- Belt size: 6" x 48"
- Disc size: 9"
- Table size 12 1/4" x 6 1/8"

£175.00



6" Bench Grinder

- 500w motor
- Powerful machine fitted with strong tool rests
- Lock on safety switch
- Eye shields
- Smooth running, with large, high quality bearings and balanced components

£75.00 (Optional stand £49.00)



Economy Mill Drill

- Straight forward belt drive mechanism
- Rack and pinion feed for drilling operation
- Precise fine feed for milling and boring
- 3MT Spindle

Collet chuck set free of charge

£680.00



2F Drill

- Floor standing
- 2MT Spindle
- Chuck capacity 16mm
- Throat depth 215mm
- Size of table 355 x 355mm
- 1 hp motor 16 speeds

19 piece drill set, metric, free of charge

£235.00



2B 12 Bench Drill

- 2MT Spindle
- 16mm chuck capacity
- Throat depth 195mm
- Size of table 290 x 290mm
- Tilt of table 45-0-45°

19 piece drill set, metric, free of charge

£190.00



Please mention ref.AD0307 when contacting our Sales Department

Prices include VAT • Delivered UK mainland • Please ring for comprehensive sales literature

WARCO Fisher Lane, Chiddingfold, Surrey GU8 4TD fax. 01428 685870 warco@warco.co.uk

tel.01428 682 929 www.warco.co.uk

WARCO
Our next exhibition...
**THE BRISTOL
MODEL ENGINEERING
EXHIBITION**
Thornbury Leisure Centre, Bristol
15th - 17th August 2008
We are unable to take all small tooling items to exhibitions due to space restrictions. If you wish to purchase any spares, bulbs, collets or backplates, please contact us before the exhibition, so that we can bring the item for you.

Covering the whole UK engine scene plus fascinating insights into the hobby worldwide.

Subscribe AND SAVE £2.85

AND receive your magazine first-class post each month!*

- Engine restorations
- Identity and Assistance
- Finds and Discoveries
- Classified engines and parts for sale and wanted
- Auction reports
- Company histories
- Engine torque
- Marine Engines section
- 'Just Pumps'
- Show reports
- Readers letters
- Helpline
- Museum visits



UK subs only £31.32*, Europe/Eire £36.84, Rest of World £42.36

FOR THE BEST DEAL - Phone 01959 541444 to pay by Direct Debit and get a FREE BINDER. Quote source ME

Post to: 'Stationary Engine' Subscriptions, Kelsey Publishing Group, Cudham Tithe Barn, Berry's Hill, Cudham, Kent TN16 3AG.
Tel: 01959 541444. Fax: 01959 541400. E-mail: se.mag@kelsey.co.uk (website: www.stationaryengine.com)



SUBSCRIPTION APPLICATION

I wish to subscribe for one year (12 issues)

commencing with the _____ issue 200_____

I enclose my cheque for (see rates above) £/\$ _____
(payable to Kelsey Publishing Ltd)

(Or) I wish to pay by credit card



Card No _____

Expiry date _____ Issue No (Switch) _____

Signature _____

Name _____

PLEASE PRINT CAREFULLY

Address _____

_____ Post code _____

Daytime Tel: _____

ME

On occasion Kelsey Publishing Group, publishers of Stationary Engine, may contact you or permit other reputable companies to make offers of Stationary Engine related products or services that we believe may be of interest. If you DO NOT wish to receive such information, tick this box ☐

FREE

CLASSIFIED ADVERTISING

Machines and equipment offered

■ Centec 2A milling machine complete with horizontal arm and vertical quill head. Single phase, machine on original (I think) steel cabinet type base, has electric motor inside it, small gouge on table does not effect use, comes with a few cutters, £900, buyer collects or arranges transport. **Tel: 01904 654149. York.**

■ Boxford ME10.CAP 5in. x 22in. lathe with screwcutting gearbox, as new 3 and 4 jaw chucks, 4 way tool post, 240volt single phase in excellent condition on makers stand with user and parts manual. £1245 ono. **Tel:01438 715819. Welwyn, Herts.**

■ Boxford lathe CUD, single phase, complete with 4 jaw chuck, quick change tool post, vertical slide, and change wheels. £400. **Tel 01903 742593 evenings. Worthing.**

■ Warco Minor imperial drill/mill. £290 Myford Trilever ML&. £550. Clarkson Mark 1 tool and cutter grinder. Single phase. £475. **Tel: 01472 389229. Louth.**

■ Myford ML7 lathe with drip tray, raising blocks, 3 jaw chuck, change gears, bed reground and leadscrews and nuts replaced. £500. **Tel: 01536 482916. Kettering.**

■ Perfecto motorised shaper, 15in. bed in excellent condition. £100. **Tel: 01283 790620. Burton on Trent. jeffgreatwood@btinternet.com**

■ Adept No 2 hand shaper with added auto crossfeed. Micro mill with X & Y dro's. Both good order. Offers? **Tel:01434 320430. Carlisle.**

■ Set of four mounts to fit Myford or similar cabinet. Used but in good condition. £35 + post and packing. **Tel:01253 858455. Cleveleys.**

■ Baty dial indicator, 2 1/4in. diameter, reads to 0001in. 2in. range in good condition. £30. M&W 0-25mm micrometer, Satin chrome finish, brand new in case but older model. £25. **Tel 0208 6414238. Sutton.**

■ Warco 3 1/2in. mitre arm bandsaw mounted on wheeled trolley to fit under bench, as new. Includes spare blades. **Tel:01202 694821. Poole.**

■ Myford series 7 long bed swarf Tray in good condition. Buyer collects. £20. BCA Mill on stand. A quality machine unused for some years but sound. Motor mounting requires attention. £450. Atlas 7in. shaper, adjustable stroke, auto feed, vice and stand. Single phase. £130. Swivel table, X-Y metric with resettable index dials. Travel, 220 x 100mm, rotation 360deg. Table size 335 x 220mm. 3

tee slots. Unused but shop soiled. £130. **Tel:01425 476837. Ringwood.**

■ Drill bit set, 115 piece. £20. Axminster ER32 collet holder and 8 collets as new. £60. **Tel:01275 374550. Bristol.**

■ Drills, Dormer, SKF etc. Excellent condition, mostly taper shank imperial. Long, stub, standard and step drills, 7/32in. to 1 1/32in. 50p to £2.50 + P&P **rev.roberts@virgin.net Tel:01280 850378. Brackley.**

■ Wolf 4in. Grinderette in nice case containing instructions, tools and grinding and cutting wheels. £34. P&P £10. 57 new grinding discs, various grades. £37. **Tel:01895 236203. Uxbridge.**

Machines wanted

■ Boxford lathe stand in any condition. **Tel:01565 654143. Knutsford.**

Models offered

■ Stuart casting sets, 10, double 10, 9, real, oil field pump and boiler feed pumps. Offers.) **Tel:1983 863021. Isle of Wight.**

■ 6in. scale Ruston Proctor steam tractor complete with matching ride on trailer and water cart and lfor Williams ramps. Steamed for last 5 seasons. £12,000 **Tel:01453 546830. Glos.**

Locomotives offered

■ Sweet Pea 5in. gauge with tender. Professionally built cooper boiler. Run on air only. £3,000 ono **Tel: 01330 824162 Aberdeen. John. french588@btinternet.com**

■ Manor 5in. gauge. £7000. Terrier 5in. gauge, nearly finished. £2500. Also 5in. Britannia part built. **Tel: 01900 824554. Cockermouth.**

Locomotives wanted

■ Simplex or Super Simplex, 5in. gauge. **Tel:01273 455774. West Sussex.**

Magazines offered

■ Model Engineers' Workshop magazines, No's 1 to 60 in 5 binders. Offers? **Tel:01395 446256. Budleigh.**

■ Model Engineer and Electrician, matching bound volumes 9 to 17, (1903 -1907). Good condition, buyer collects. **Tel:01920 461831. Herts.**

Miscellaneous wanted

■ Early 2 1/2in. gauge blueprints/ drawings especially Bonds circa 1930's, early 1940's, BS300 etc. series. **Tel 01676 541317 Evenings. Coventry.**

Model Engineer Classified



Railway cottages
now available for great
holidays. Have a look
on our website

www.railwaycottages.info

ALL LOCOS AND STEAM ENGINES, TRACTION ENGINES, BOATS, LORRIES AND STATIONARY PLANTS, STUART TURNER, ETC. REQUIRED.

ANY SIZE OR CONDITION EVEN PLAIN WORN OUT!
COMPLETE COLLECTIONS PURCHASED FOR CASH!
DISTANCE NO OBJECT, AVAILABLE 7 DAYS A WEEK.

PLEASE TELEPHONE **01507 606772** FOR A FRIENDLY AND INFORMAL CHAT.

www.arceurotrade.co.uk

Unbeatable Value Engineering Products by Mail Order

Shop on-line or call us on 0116 269 5693 for our *New Catalogue No.5*

COMPLETE HOME WORKSHOPS

AND MODELS PURCHASED.
DISTANCE NO OBJECT

Tel: Mike Bidwell on
01245 222743

SOUTHERN STEAM

Buy ALL live steam engines

Especially locomotives
and traction engines.

Partbuilt models also purchased.

For speedy prompt service
please telephone,

01634 719 183

FOR SALE!

THIS SPACE

Available from as
little as

£51.50 per month

Just call

01689 899212

PARTBUILT MODELS BOUGHT.

All locomotives, at any stage of
construction. Completed models also
bought regardless of condition. Traction
engines and all Stuart stationary
engines wanted - beam, vertical,
horizontal etc, part built or com-
plete. Will travel any distance. Please
telephone Graham, 0121 358 4320. (T)

5"g A4 Gresley Pacific and any Mike Breeze model

wanted by serious collector

Please Tel: Graham Jones on **0121 358 4320**

COPPER TUBE, SHEET, BAR and other non-ferrous metals.

Send 9" x 4" SAE for lists.

R. Fardell, 49 Manor Road, Farnley Tyas,
Huddersfield HD4 6UL.

Tel: **01484 661081**

ALL STEAM ENGINES WANTED

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



ALL 5" GAUGE LOCO's WANTED

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

ALL 3½" GAUGE LOCO's WANTED

Tich, Juliet, Rob Roy, Firefly, Jubilee, Maisie, Doris, GWR Hall,
Britannia, Hielan Lassie, etc.

ALL 7¼" GAUGE LOCO's WANTED

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

ALL TRACTION ENGINES WANTED

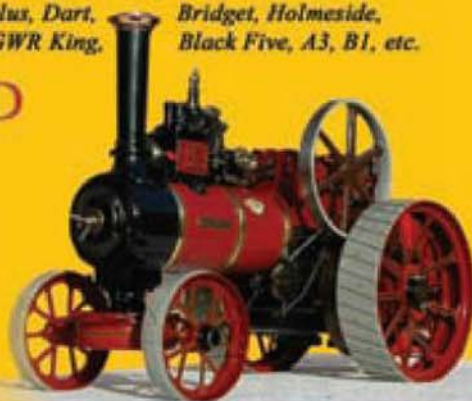
Minnie, Burrell, Royal Chester, etc

ALL PARTBUILT MODELS WANTED

For a professional friendly service, please telephone:

Graham Jones M.Sc. 0121 358 4320

www.antiqusteam.com



Model Engineer Classified

WESTERN STEAM

Model Engineers

Founder Member Assn of Copper Boiler Manufacturers (ME)

COPPER BOILERS

For Locomotive, Traction, Marine & Stationary engines, to PER cut 2. All copper construction, silver soldered throughout using quality materials to the standards required by the APCBM/MEI, PER, & relevant Model Engineering Associations. CE marked and certificates of proof test and conformity supplied.

Write or phone to Helen Vennell:
Unit 6A, Lower Lane, Burnham-on-Sea
Somerset, TA8 1EY
Tel: 01279 786 007
Visit our website: www.westernsteam.co.uk

www.powercapacitors.co.uk

Transwave

THE ONE-STOP CONVERTER SHOP

The ONLY Phase Converter Manufactured to BS EN 150 9001/2000

OPERATE THREE PHASE MACHINERY FROM YOUR SINGLE PHASE SUPPLY

- ROTARY CONVERTERS
- STATIC CONVERTERS
- VFD FREQUENCY CONVERTERS offering electronic motor control and a 2-year or 5-year warranty

PRICES from £89.00 + VAT

See the market leader at the London, Birmingham, Bristol, Leeds and Luton Shows

Local Call: 0844 7700 272
transwave@powercapacitors.co.uk

Model Engineering Products (Bexhill)

www.model-engineering.co.uk
Email: mep1@btconnect.com

Manufacturers of 5" and 7 1/4" diesel outline battery electric locomotives and rolling stock.

Visit our shop to see the stock.

Colour brochure inc. p&p £1.75

PHONE/FAX: 01424 223702

MOBILE 07743 337243

17, SEA ROAD, BEXHILL ON SEA,
EAST SUSSEX. TN40 1EE.

PENNYFARTHING TOOLS Ltd.

The Specialist Tool shop

Quality Secondhand
Machine Tools
at Sensible Prices

We purchase complete Workshops,
Machines, Models and Hand Tools.

Agreed settlement on inspection -
Distance no object

Tel: Salisbury 01722 410090
Web Site: www.pennyfarningtools.co.uk

Non-Ferrous material supplied in all forms,
tailored to your need by size & quantity.
Aluminium, Brass, Copper & Stainless steel,
Silver steel, Gauge plate, B.M.S. steels.

Catalogue free.

P.L.Hill (Sales) Ltd

Unit 3 Crownworks, Bradford, BD4 8TJ

Tel/Fax: 01274 733300

Email: p.hill@sales@aol.com www.p.hill@sales.com

THINKING OF SELLING YOUR LATHE MILL OR COMPLETE WORKSHOP?

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

Tel: 0115 9206123 Mob: 07779432060

CLOCK CONSTRUCTION & REPAIR

Books by John Wilding and others

Free Catalogue

01420 487 747

www.ritetimepublishing.com

Folkestone Engineering Supplies

An outstanding range of materials, fasteners
& quality small tools for the model engineer.

Fast friendly service

www.metal2models.bfinternet.co.uk

Tel: 01303 894611 Fax: 08707 625556

NEIL GRIFFIN

St. Albans, Hertfordshire
Engineering Services

Machining for Model Engineers
From drawing, sketch, pattern etc.

Friendly personal service.

Telephone / Fax: 01727 752865

Mobile: 07966 195910

EVENSON ENGINEERING

Quality Machines
and Tooling

Machine Sales

D.14 18" face plate as new	£125	Union graduate bowl only wood turning lathe 1 phase.....	£400
D.16 12" face plate (Triumph 2000)	£90	Bridgeport milling machine excellent condition.....	£2200
Harrison L5A boring table excellent condition.....	£125	8" cap ajax power hacksaw.....	£275
Boxford ME10 Lathe immaculate condition most of tooling	£1775	Denford Viceroy lathe with gear box.....	£850
as new, single phase		Kasto 8" power hacksaw modern machine.....	£375
Most student Harrison etc face plate in stock.....	P.O.A	Wadkin horizontal surface grinder.....	£500
Boxford V.S.L. Lathe, lots of tooling and full collet set	£1600	Harrison vertical mill ex university.....	£1600
In excellent condition, 1 1/4" spindle bore		Harrison vertical mill as new.....	£800
J+S dia form attachment model A.T as new in box.....	£300	2 off Tom Senior m1 milling machines 1 single phase.....	Each £1200
6" dividing head no tailstock.....	£120	1-3 phase good condition	
Colchester bantam 2000 Lathe ex college.....	£2500	Viceroy AEW milling machine 30int good condition.....	£1200
Harrison M300 gap bed lathe tools excellent condition.....	£3000	Harrison LS'A' lathe fully tooled outstanding condition.....	£1150
Harrison M300 gap bed lathe long bed tools good condition.....	£2000	Colchester student Mk II lathe tooled good condition.....	£1500
Harrison vertical milling machine as new.....	£2200	Compound x-y table, English made in excellent condition.....	£325
Colchester master, roundhead, in excellent condition.....	£1400	suit large drill	
4 Foot treadle guillotine, modern machine cut 1/5mm, good condition.....	£450		

WE ALSO PURCHASE QUALITY MACHINES & TOOLING

DELIVERY SERVICE AVAILABLE PLEASE TELEPHONE BEFORE TRAVELLING - WEEKEND & EVENING VIEWING AND DELIVERY SERVICE

More machines always in stock. Tel: 01274 402208 & 780040 Mobile 07887 535868 4 Duchy Crescent, Bradford, BD9 5NJ

Model Engineer Classified

TurboCAD® Professional 12 Avanquest
www.turbocad.co.uk
 Call Paul Tracey at Avanquest on 01962 835081 ptracey@avanquest.co.uk

Mechanically Minded?
 Find more interesting books than you can imagine at
www.camdenmin.co.uk

 **www.chesteruk.net**

www.modelsteamenginesuk.com 

D. Hewson (Models)
 Precision Lost Wax Castings for Locomotives & Rolling Stock
www.the-hewsons.co.uk

 **DRIVES DIRECT**
 Digital Phase Converters
 • **www.drivesdirect.co.uk**
 • sales@drivesdirect.co.uk • Tel: 01773 811038

www.antiqusteam.co.uk

LIVE STEAM MODELS LTD
 DRAWING, CASTINGS OR MACHINED
 CASTINGS FOR A POPULAR
 RANGE OF TRACTION ENGINES
www.livesteammodels.co.uk 

MAXITRAK
 Passenger Carrying Garden Railways
 • Steam • Diesel • A/C • Remote Control
 • Accessories • Track etc
 Tel: 01580 993120
WWW.MAXITRAK.CO.UK  

www.myhobbystore.com

Phoenix Locomotives Ltd
www.phoenixlocos.com • 01704 546 957 • keith@phoenixlocos.com 

 **REEVES**
 The World's Largest Stockists
 of Model Engineering Supplies
2000 **www.ajreeves.com**

 **My Hobby store.com** **Magicalia at its finest**

First stop for:
 Plans • Parts • Books • Binders • Show Tickets
 DVD's • Back issues • Subscriptions

Over 3,000 items under one roof
 For our stock at a glance visit
www.myhobbystore.com
 or phone **01689 899200**

To advertise on these pages contact Duncan Armstrong on 01689 899 212 or duncan.armstrong@magicalia.com

HOME AND WORKSHOP MACHINERY

Genuine Used Machines & Tooling

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

Telephone: 0208 300 9070 - Evenings: 01959 532199 - Facsimile: 0208 309 6311

www.homeandworkshop.co.uk stevehwm@btopenworld.com

Opening Times: Monday-Friday 9am-5.30pm - Saturday Morning 9am-1pm
10 minutes from M25 - Junction 3 and South Circular - A205



Meddings, Fobco & Startrite bench drills



Elliot '00' Omnimill, one of the best ones yet!! vertical and horizontal



Myford ML10, 3 1/4" x 13" lathe



Cowell's miniature lathe



Astra horizontal / vertical milling machine 240 volts!



Denbigh No.6 flypress + stand



Boxford drilling (pedestal) machines



Startrite 18-S-5 240 volts bandsaw; 18" throat / 5 speed / non ferrous



Myford Super 7 lathe (power cross feed)



Crompton/Tyco NEW motor for ML7/Super 7



GHA Alexandra engraving grinder + collets



SIP 39" high, 16 speed, 2MT 5/8", rack table NEW



Record No.23 quick release bench vice
Selection available

Myford/Boxford Accessories

Myford dividing head £395

Boxford dividing head £895

Myford vertical slide £100 - £245

Boxford vertical slide £345 - £425

Myford 6" 4 jaw chuck £90 - £140

Boxford 6" 4 jaw chuck £85 - £125

Myford collets boxed £275

Boxford collets + draw bar £175

Myford fixed steady £90

Myford travelling steady £40

Myford 9" faceplate £45

+++ loads more



Harrison pedestal grinder



Gabro 16 gauge 6" corner notcher



Brierley drill point grinder + wheels and followers



Raglan 5" lathe + gearbox and variable speed



Boxford 1130 5 1/2" x 30" + stand



Colchester Student, gearbox + gap



Eagle Model 3 + magnetic chuck



Bridgeport slotting head



Milling/Drilling ground X-Y table

Also:

Myford Super 7B lathes with power cross feed; selection of seven

- Myford Fixed steady £90
- Myford travelling steady £40
- Colchester Bantam travelling steady £45
- Baly 0-1" (calibration certificate) NEW £30
- Baly 0-25mm (calibration certificate) New £30
- Micrometer 11"-12" M & W £55
- Micrometer 12"-18" M & W £120
- CEJ metric slips (as new) £245
- Engineers flat's £125 each
- Harrison (lathe) jig boring table £175
- Boxford (lathe) jig boring table £145
- Burnerd 3 jaw chuck for Graduate wood lathe £70
- Meddings EMG tool grinder £475
- Marlow vertical mill (3MT) £950
- Viceroy vertical mill (30INT) from £495
- Super Brown cut-off-saw £345
- Pedrazzoli Aluminium cut-off-saw £345
- Viceroy sharpedge 10" wheel £150
- Clarke Strongarm 1 ton (fold up) crane £125
- Epco 1 ton quality engine crane £245
- Clarke profile router 145 £175
- RJH Gerbil 2020 vacuum plastic cutting mch. £275
- Clarke 812V vacuum forming machine £345
- Draper WTL 100 wood lathe £100
- Multico K3 mortiser £475
- Startrite 145 sawbench £395
- Startrite 275 sawbench + sliding table £1950
- Startrite TA1250 sawbench + bells & whistles £2250
- Startrite 14-S-5 bandsaw £595
- Black & Decker radial saw £345
- Minor tinisher 4" wide/ bench type £145
- Jones and Shipman No.2 arbor press £175
- Hearths (small pedestal model) £70
- Flamefast DS220 hearth £245
- Crompton 240 volt Myford motors NEW £155
- G & C 2hp 240 volts 1420 revs £120 each
- Brook 3hp 240 volts 2850 revs motor £120
- Denford CNC Microrouter £625
- Hulton Universal 12 Universal press £425
- Boxford PD4 2MT pedestal drills £245 - £295
- Burnerd 10" D14 Harrison M300 4 jaw £245
- Triumph fixed steady (round head)
- Colchester Triumph £175

PLEASE PHONE 0208 300 9070 TO CHECK AVAILABILITY OR TO OBTAIN OUR LIST

DISTANCE NO PROBLEM!

DEFINITELY WORTH A VISIT

ALL PRICES EXCLUSIVE OF VAT

Just a small selection of our current stock photographed!



£1950

Boxford STS 1020 lathe



£425

Hulton Universal 12 / 12" throat press



£50 each

'LO' Colchester drive/catch plates



£155

Brook Crompton/Tyco motor for Myford lathes



£70

'LOO' face plate + we have loads more from Myford to Colchester Mascot



£3150 & £3250

Myford Super 7B's with gearbox and power cross feed



£345

RJH buffing machine 3000 revs



£20 each

Myford MA99E collet chuck collets



£425

Gabro 24" folder



£345

EME (Elliot) swivel tilt vice



£12 each

Gear involute cutters 'More just in'



from £25

More broaches metric and imperial



Just in £345

Q and S 6" power hacksaw + coolant



£1250

Colchester Chipmaster lathe



£825

Boxford dividing head complete



£120

Clarkson 40INT collet chuck + collets (we have 2MT-SMT and 30INT to 50INT in stock!!)



£90

Burnerd Boxford 4jaw chuck (more variations available)



£1400

Bantam 5" x 20" geared head and gearbox 240 volt precision lathe



£475

EMG tool grinder



£40 each

Dickson toolposts to suit Colchester Mascot (others available)



£375

Almost silent running 8 bar compressor



£245

Crown Windley magnetic sine table MSPM44



£145

Flamefast double sized hearth + guns



£625

Clarkson Mk1 tool and cutter grinder



£10-£45

Micrometers in (most sizes and makes)



£345

Tom Senior slotting head



£40

Harrison LS travelling steady (LSA, L6, Student, Master also)



£345

Boxford 'Little Giant' toolpost grinder



£145

Mitutoyo 150mm - 300mm micrometer set as new



£75

Archer tapping head 2MT (more sizes available)



£245

Denford Viceroy buffer's



From £20

Eclipse angle plates



£225

Burnerd 'LO', D13 & D14 collet chucks



£425

Myford dividing head complete with two plates as new



£625

RJH vertical linisher + built in extractor

FREE UK DELIVERY on this motor

Please call 0208 300 9070 to check availability or request our list

SEE US AT
HARROGATE
MODEL ENGINEERING
SHOW 9TH, 10TH, 11TH MAY



SAWS



LATHES



MILLS



DRILLS

Chester Machine Tools

DB8VS



£595

Features
Digital Variable Speed Reducer • Hardened and
Ground Vee Shafts • Offset Shafts • Variable
Speed • Metric & Imperial Thread Cutting •
Longitudinal Power Feed • Cast Iron Construction

Distance between Centres 400mm
Turning 210mm
Motor 110W

Supplied with optional stand

H110 BANDSAW

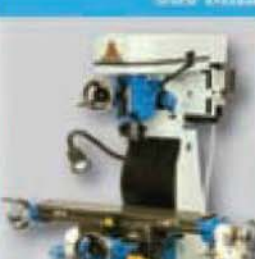


Special Offer

£149

Features
Max Cutting Capacity 40 mm
Max Cutting Capacity 90 mm
Band Speed 20.0m/min
Motor 90W
Feed Rate 10mm/min
Max Cut Length 1000mm
Max Cut Width 100mm
Max Cut Depth 100mm

628 MILL



£1450

Features
1.5HP Motor • Metric & Imperial Machines •
MT2 or MT3 Spindle Taper • Head Swivel 90 degrees •
Head Tilt 45 degrees • One Shot Lubrication System

Standard Accessories
Machine Work Light • Central Lubrication System •
Machine Stand • Table Guard • Drilling • Manual &
Parts List

Including Power Feed

Max Mill Capacity 10mm
Table Size 1000x500mm
Motor 1.5hp

COBRA MILL



£239

Features
Variable Speed
Angled Working Head
Adjustable GTS Slings
Soft Feet Pad
Standard Accessories
Soft Chucks
Spindle
Drillbit
Vee Bits

Specifications
Max Mill Capacity 10mm
Table 145 x 400mm
Spindle Variable 100-2500rpm
MT2
MT3
Depth 600 x 200 x 100mm

CHAMPION 16 V MILLING MACHINE



Special Offer

£495

Features
Variable Speed • Clutch Control • Digital GTS
Depth • Head • Column • Bedway • Taper
Head • Large Table Size • Wide Speed Range

Standard Accessories
Soft Chucks • Drill Chucks • Chuck Guard
• Drilling • Manual & Parts List

Max Mill Capacity 10mm
Table Size 500x1400mm
Motor 600W

Supplied with optional stand

CENTURION MACHINE CENTRE



Special Offer

£1095

Features
Powered Crossfeed • 3 Motors • 20mm Spindle
Bore • Large Working Table • Taper Roller Bearings
Standard Accessories
3-Jaw Chuck • Drill Chuck • Steel Centre
Change Gear • Lathes Tools • Vice

Specifications
Centre Height 210mm
Centre Distance 210mm
Spindle Bore 20mm
Turning Capacity 100mm
Cut Mill Capacity 10mm
Weight 210kg
Motor 3-hp

£1450

Features
1.5HP Motor • Metric & Imperial Machines •
MT2 or MT3 Spindle Taper • Head Swivel 90 degrees •
Head Tilt 45 degrees • One Shot Lubrication System

Standard Accessories
Machine Work Light • Central Lubrication System •
Machine Stand • Table Guard • Drilling • Manual &
Parts List

Including Power Feed

Max Mill Capacity 10mm
Table Size 1000x500mm
Motor 1.5hp

COBRA LATHE



Special Offer

£199

Supplied With
3-Jaw Chuck • Lathes Tools • Steel Centre • Change
Gear • Variable Speed • Spindle Guard

Centre Height 100mm
Centre 210mm
Motor 100W
Weight 30kg

£495

Features
Variable Speed • Clutch Control • Digital GTS
Depth • Head • Column • Bedway • Taper
Head • Large Table Size • Wide Speed Range

Standard Accessories
Soft Chucks • Drill Chucks • Chuck Guard
• Drilling • Manual & Parts List

Max Mill Capacity 10mm
Table Size 500x1400mm
Motor 600W

Supplied with optional stand

100mm 3-Jaw Chuck



£41.12

Mag. Base and Dial Gauge



£18.00

Scroll Chucks Plain Back Fitting



63mm £28.00
80mm £50.00

Digital Caliper



£25.00

Bore Gauges



£9.98

Boring Tool Set MT2



£69.00

Quick Action Vice Low Working Height



£39.00

T1 Quick Change Toolpost Used 3 Holders



£118.00

Chromalloy Set of 8 Imperial & 8 Metric Collets



£110.00

Hobby Coolant System



£59.95

Machine Angle Level



£65.00

1" Bench Hand Steers



£58.93

1" Bench Hand Steers

£60.00

V Blocks and Clamps 1" Capacity



£10.50

Collet Chuck 10mm Drill



£35.00

Collet Chuck 10mm Drill

£39.00

Angle Plate 4 1/2" x 3 1/2" x 3"

£15.00

Slip Rolls



12" £99.00 / 16" £109.00
20" £199.00

Pin Punch Set



£8.00

D13 Drill



£49.00

Dial Height Gauge



£30.00

Screws Knurled 3 sets knurled



£20.00

Centre Punch Set



£4.50

Box & Pin Vices



12" £199.00 / 24" £298.00

All prices include VAT. Delivery Free to UK mainland - excluding certain Scottish postcodes. Prices valid for duration of this issue only.



Chester UK Ltd, Clwyd Close, Hawarden Industrial Park CHESTER CH5 3PZ

T: +44 (0)1244 531631 F: +44 (0)1244 531331 www.chesteruk.net email: sales@chesteruk.net

