

MODEL ENGINEER

Vol. 202 No. 4345

13 – 26 February 2009

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

**READER SURVEY
GREAT PRIZES
TO BE WON!**

- **STOWE WITH
NEVILLE EVANS**
- **THE RE-CYCLE
ENGINE**
- **BEGINNER'S
PROJECT
CHESS SET**
- **INDEX TO
VOLUME 201**
- **MAKING
SPARK PLUGS**



FREE!

9 770026 732148 45 £2.75

**1,700 PAGE MSC/J&L INDUSTRIAL
SUPPLY CATALOGUE FOR EVERY UK READER**

WARCO

WARCO
Our next exhibition
**THE NATIONAL MODEL
ENGINEERING EXHIBITION**
HARROGATE SHOWGROUND
8TH TO 10TH MAY 2009
See you there!

SAVE POUNDS THIS NEW YEAR...

WITH VALUE YOU CAN MEASURE!

**WARCO ARE
COMMITTED TO
PASSING ON THE
NEW VAT SAVINGS
TO OUR CUSTOMERS**

WM18 VARIABLE SPEED MILL

FOR A LIMITED PERIOD, supplied with
2 axis digital readout at £225.00 including
supply, fitting and VAT



£1,223.39

- Infinitely variable from 50 to 3,000 rpm
- Dovetail column slide for positive head location during elevation and descent
- Tapered gibs to all slideways
- Digital depth gauge to quill. Metric/imperial/zero
- Back gear ensures maximum torque in low speed range
- Individual accuracy test report
- Supplied with 13mm drill chuck and arbor
- 3/8" Whitworth drawbar

MINI BENDER



- Vice mounting
- Segmented blade
- Up to 90° folding angle
- Capacity in mild steel
12"300mm x 20 swg/1mm

VMC TURRET MILL



- Compact, accurate, low cost vertical milling machine
- Nine speeds
- Vee belt drive
- Halogen low volt lighting
- Head tilts left - right calibrated to 45°
- 360° rotation on horizontal axis
- One shot lubrication system to slideways and leadscrews, ensures prolonged machine life
- Optional spindle taper: R8 or 3MT
- Choice of metric or imperial leadscrews and dials

Optional digital readout
Optional power feed

GH MAJOR MILLING MACHINE



- Totally enclosed oil immersed gear box.
- Quiet operation
- Speed selection by lever control
- Calibrated scale for tilting
- Supplied with 13mm drill chuck as standard
- Available in R8 or 3MT spindles
- Optional stand and wide coolant tray available

Table size 28 3/4 x 8 1/2"
X and Y travel 20 x 10 1/4"
Throat 10 1/2"

VARIABLE SPEED LATHE



- Fitted with inverter drive to allow infinite speed selection simply by rotating the control knob
- Exceptionally quiet, ideally suited to a noise sensitive environment
- Safely operates from a domestic 13 amp supply
- Both metric and imperial versions will cut metric and imperial threads
- Induction hardened and ground bedways
- High tensile cast iron bed
- Taper roller bearing headstock spindle
- Jogging switch
- Gap bed
- Supplied with accuracy test report
- Supplied with 3 jaw chuck, camlock with inside/out side jaws, 4 jaw chuck independent, telescopic lead screw covers, micro adjustable bed stop and equipment as illustrated

Optional digital readout
VS1224 £677.28 fitted
VS1232 £704.68 fitted

ENGINEER'S TOOL CHEST

- Part of a superb new range of higher than average quality tool storage cabinets
- Heavy gauge steel plate construction
- Drawers slide on robust ball bearing guides which give exceptional support
- Soft drawer closure
- Rubber liners to drawers
- Lockable



FRACTIONAL DIGITAL VERNIER



- 6"/150mm
- In addition to metric and decimal imperial reading this unique vernier shows fractional figures
- Easy to convert across the three measuring disciplines
- Thumb wheel for precise, accurate positioning
- Large easy to read screen

A RANGE OF MAGNETIC STANDS

WITH FINE ADJUSTMENT



- Very rigid hydraulic locking mechanism
- Switched magnetic vee base
- Suitable for circular or dove tail mounting

Available in 3 different heights:
220mm
360mm
440mm

FREE Delivery UK mainland • All prices include VAT • Please ring for our latest info packed brochure!

WWW.WARCO.CO.UK

WARCO, FISHER LANE, CHIDDINGFOLD, SURREY GU8 4TD
Tel: 01428 682929 warco@warco.co.uk

MODEL ENGINEER

Published by MyHobbyStore Ltd.
Berwick House, 8-10 Knoll Rise,
Orpington, Kent BR6 0EL
Email: customer.services@myhobbystore.com
Tel: +44 (0)844 412 2262
www.myhobbystore.com

SUBSCRIPTIONS

UK - New, Renewals and Enquiries
Tel: 08456 777 807
Email: modelengineer@subscription.co.uk

USA & Canada subscriptions -
New, Renewals and Enquiries
Tel: (001) 732 424 7811
Email: subs@ewamags.com

Rest of World subscriptions -
New, Renewals and Enquiries
Tel: +44 (0)1858 468811

BACK ISSUES & BINDERS

Tel: +44 (0)844 848 8822
Email: customer.services@myhobbystore.com

EDITORIAL

Editor: David Clark
Tel: +44 (0)1847 821136
Email: david.clark@myhobbystore.com
Production Editor: Kelvin Barber
Assistant Editor: Michael Jones
Technical Editor: Roger Bunce

PRODUCTION

Designer: Yvette Masson
Illustrator: Graeme Chambers
Pre-Press: Brian Vickers
Production Manager: Richard Baldwin
Ad Production: Robin Gray

ADVERTISING

Senior Sales Executive: Duncan Armstrong
Email: duncan.armstrong@myhobbystore.com
Tel: 0844 848 5238

MARKETING & SUBSCRIPTIONS

Marketing Executive: Heather Morrison

MANAGEMENT

Head of Design and Production: Nikki Coffey
Special Projects Publisher: Nikki Parker
Subscriptions Director: Rebecca Blight
Chief Executive: Owen Davies
Chairman: Peter Harkness



myhobbystore
media

© MyHobbyStore Ltd. 2009
All rights reserved ISSN 0026-7325

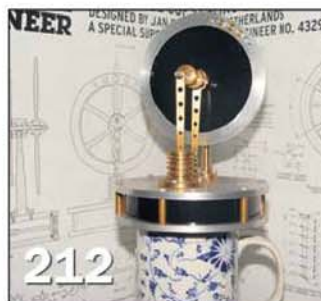
The Publisher's written consent must be obtained before any part of this publication may be reproduced in any form whatsoever, including photocopies, and information retrieval systems. All reasonable care is taken in the preparation of the magazine contents, but the publishers cannot be held legally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

Model Engineer is published for \$136 per year by MyHobbyStore Ltd c/o EWA Magazines, 205 US Highway 22, Green Brook, NJ 08812. www.ewamags.com. Periodicals paid at Dunellen, NJ. Postmaster please send address correction changes to Model Engineer Magazine c/o EWA at the address above.



When you have finished with this magazine please recycle it.

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



ISSUE IN THIS ISSUE IN THIS ISSUE

Vol. 202 No. 4345 13 - 26 February 2009

191 SMOKE RINGS

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

192 POST BAG

Letters to the editor.

195 WIN PRIZES!

Details of some great prizes on offer to those who fill out this issue's Readers' Survey.

196 A MODIFIED VERSION OF THE SUGDEN SPECIAL

Dave Fenner continues building this engine.

200 McONIE'S OSCILLATING ENGINE

Anthony Mount finishes the throttle and begins work on the governor.

204 MAKING GLOW PLUGS

Charlie Stone builds a miniature spot welder.

208 STOWE

Neville Evans makes a welcome return and continues with the tender's axlebox assemblies.

CENTRE PAGES

Index to Volume 201, your complete guide to the contents of M.E. in the second half of 2008.

212 YING'S COFFEE CUP ENGINE

Harold Pearson tells a junior model engineer's story.

215 A BEGINNER'S APPROACH TO MAKING A BRASS AND ALUMINIUM CHESS SET

Mike Freeman gives us step-by-step instructions.

219 THE RE-CYCLE ENGINE

A horizontal 4-stroke engine from the scrap box.

222 KEITH'S COLUMN

Keith Wilson discusses commercial plumbing fittings and talks about tolerances and scale effects.

224 I/C TOPICS

A collection of miniature spark plugs plus some ignition systems.

228 NEWS

News from the clubs.

229 DIARY

Forthcoming events.



ON THE COVER...

This saddle tank locomotive was on display at the Bournemouth Model Engineer Exhibition held at the Ringwood Town and Country Experience at Ringwood in Dorset. (Photograph by David Clark)

PLEASE SEE PAGE 190 TO TAKE ADVANTAGE OF OUR LATEST SUBSCRIPTION OFFER

Maidstone Engineering Supplies

A complete range of materials
B.M.S. Brass, Phos Bronze, Copper
St/Steel, Nuts & Bolts, Nylon
St/Tube, Screws, Studding, Rivets,
Drills, Reamers, etc

PROMPT MAIL ORDER
NEW Copper Welded Boilers
TEL 01580 890066

Catalogue £1.00

check out our
ON LINE SHOP AT
maidstone-engineer.co.uk

Maxitrak
kit & ready to run passenger
hauling locomotives



www.maxitrak.co.uk

MAXITRAK/M.E.S 10 Larkstore Park Lodge Road Staplehurst Kent
TN12 0QY Tel: 01580 893030 Email: info@maxitrak.co.uk

Convert scanned drawings to CAD!

SCAN
CLEAN
VECTOR
CONVERT
EDIT

NEW FREE TRIAL
Full-working
evaluation!

Scan2CAD

Use it with your own scans!
Download it from:
www.softcover.com

364 Milton Road, Cambridge, CB4 1LW England.
Tel: +44 (0) 1223 424342

12 & 24V MOTORS AND SPEED CONTROLLERS
SPROCKETS AND CHAIN . GEARS
SPEEDO'S . AMMETERS . BATTERY CHARGERS
PNEUMATICS INCLUDING VACUUM/PRESSURE PUMP
BATTERY CARE PRODUCTS . SPRINGS . BEARINGS
WHEEL BLANKS . SIGNALS . FUSES . LED'S . SWITCHES

TEL: 0870 9089373 (national rate) FAX: 01282 613647
EMAIL: pselectronics@btinternet.com FOR YOUR FREE LIST

PARKSIDE RAILWAYS
UNIT 2e & 3J, VALLEY MILLS, SOUTHFIELD ST.
NELSON. LANCs. BB9 0LD

STEAM & DIESEL CASTINGS

Drawings, castings, fibreglass mouldings, motors and electronic control systems available for the following 5" Gauge locos:

- Class 10*
- Class 20 (Chopper)
- Class 35 (Hymek)
- Class 37
- Class 40* (Whistler)
- Class 42/43 (Warship)
- Class 45 (Peak)
- Class 47
- Class 51 (Prairie Tank)
- Class 52 (Western)
- Class 55 (Deltic)
- De-Winton (Puffin)
- Planet Diesel*
- Metropolitan*
- Dock Shunter
- Mk 1 Coach
- Mk 11 Coach
- 10 Ton Wagon*
- Driving Trolley
- Riding Wagon
- ★ Available in 5" & 7 1/4" Gauge

Dan Jeavons at the controls of one his
CLASS 55 DELTIC locos

TEL **01562 754530**
email: steamanddieselcastings@yahoo.co.uk
For details send 9 x 4, 1st Class 50p S.A.E. to: Completely built locos, pre-machined kits, castings or drawings supplied

Steam & Diesel Castings, 59 The Foxholes, Kidderminster, Worcestershire DY10 2QR

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 VI 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 (J.C. 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 platework, 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

VISA MasterCard

The Hallmark of Distinction

Order with confidence from the leading supplier of Workshop Accessory Kits. Trusted by the world's most demanding constructors and tool makers

- 1 The Name to Trust since 1976
- 2 More designs than ever
- 3 Industry quality instruction sets
- 4 Hugely satisfying to build and use

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

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



STUART MODELS

FOUNDED 1906

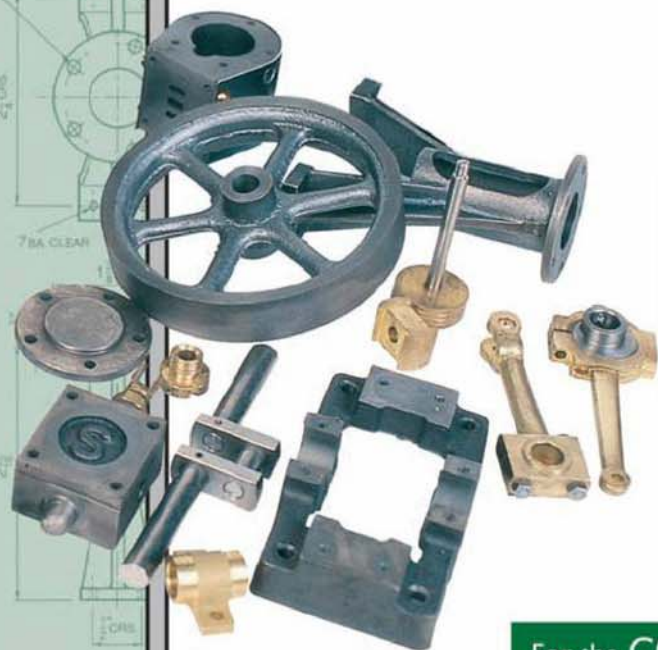
For the MODEL ENGINEER SETS OF CASTINGS

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 •

NEW - GLANZE INDEXABLE PARTING TOOLS!

Complete with special grade alumina coated insert — for a superior finish!

CODE	SHANK	PRICE
GX67	10 X 10MM	£25.95
GX68	12 X 12MM	£26.95
GX69	16 X 16MM	£28.95
GX70	20 X 20MM	£32.95
GX71	SPARE INSERT FOR 10, 12 & 16MM	£ 4.25
GX72	SPARE INSERT FOR 20MM	£ 4.25



Chronos

Engineering Supplies

QUICK CHANGE TOOLPOST - INCLUDES 2 X STD HOLDER, BORING HOLDER & PARTING • HOLDER AND BLADE!!



CODE	ITEM	PRICE
MX90	SET FOR MYFORD ML7	£65.00
MX91	SPARE STD HOLDER	£13.95
MX92	SPARE EXT'D HOLDER	£19.95
MX93	SET FOR BOXFORD 41/2	£99.00
MX94	SPARE STD HOLDER BF	£17.95
MX95	SPARE EXT'D HOLDER BF	£24.95

GOOSENECK HALOGEN MACHINE LAMP

NOW AVAILABLE WITH BOLT DOWN
OR MAGNETIC BASE

CODE	BASE
XC12	BOLT
XC13	MAG
XC138	MAG ATTACHMENT FOR YOUR EXISTING VERTEX LAMP



PRICE
£37.00
£44.00
£ 9.95

RIGID HALOGEN MACHINE LAMP

WITH BOLT DOWN OR MAGNETIC BASE

CODE	BASE
XC14	BOLT
XC14B	MAG
XC13B	MAG ATTACHMENT FOR YOUR EXISTING VERTEX LAMP



PRICE
£52.00
£57.95
£ 9.95

3 DIOPTR ILLUMINATED MAGNIFYING LAMP!

PROFESSIONAL LOW
HEAT LAMP WITH EXTRA
LARGE 19 X 16MM GLASS
LENSES.

40" REACH EXTENSION ARM

SUPPLIED WITH 2 X 9W
(TOTAL 18W) DAYLIGHT
SIMULATION BULBS

FULLY ADJUSTABLE
TABLE CLAMP INCL.



IDEAL FOR MODEL
ENGINEERS,
PROFESSIONALS AND
HOBBYISTS

CODE	PRICE
8609	£37.95
8609A	SPARE BULBS £ 4.95 (EACH)

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

Thinking of
building your first
Locomotive or starting
another one

G.L.R. DISTRIBUTORS Ltd

LOCOMOTIVE DRAWINGS & CASTINGS

See below
what we have
to offer!



7.1/4"	Tich	Dock Shunting Tank Loco	0-4-0	3.1/2"	Doris	LMS Class 5 Tender Loco	4-6-0
7.1/4"	1366	GWR Tank Loco	0-6-0	3.1/2"	Rainhill	Rocket Type Loco	0-2-2
5" g	Dholpur	NG Tank Loco	2-8-4	3.1/2"	Heilan Lassie	LNOR GNR Rebuild Loco	4-6-2
5" g	Butch	LMS Tank Loco	0-6-0	3.1/2"	Rob Roy	Caledonian Tank Loco	0-6-0
5" g	Chub	Freelance Tank Loco	0-4-0	3.1/2"	Miss 10 - 8	NER Tender Loco	4-4-0
5" g	Simplex	Freelance Tank Loco	0-6-0	3.1/2"	Juliet	Freelance Tank Loco	0-4-0
5" g	Springbok	LNOR B1 Class Loco	4-6-0	3.1/2"	Virginia	Old Type American Loco	4-4-0
5" g	King John	GWR Tender Loco	4-6-0	3.1/2"	Maisie	GNR Atlantic Loco	4-4-2
5" g	Dean Goods	GWR Tender Loco	0-6-0	3.1/2"	City of Truro	GWR Tender Loco	4-4-0
5" g	2251	GWR Tender Loco	0-6-0	3.1/2"	PV Baker	Freelance Tank Loco	0-6-0
5" g	Firefly	GWR 4500 Class Tank Loco	2-6-2	2.1/2"	Southern Maid	LNOR K4 Class Tender Loco	0-6-0
5" g	Mogul	GWR 4300 Class Tender Loco	2-6-2	2.1/2"	Austere Ada	Freelance Tender Loco LBSC	2-8-0
5" g	Peckett	Saddle Tank Loco	0-4-0	2.1/2"	Olympiade	LMS Tender Loco	4-6-0
5" g	Twin Sisters	LMS 2F Class Tank Loco	0-6-0	2.1/2"	Dyak	LNOR K4 Class Tender Loco	2-6-0
5" g	Pansy	GWR 5700 Class Tank Loco	0-6-0	2.1/2"	Purley Grange	GWR Tender Loco	4-6-0
5" g	Tich	Dock Shunting Tank Loco	0-4-0	2.1/2"	Fayette	Pacific Anglo-American design	4-6-2
5" g	Combpyne	LSWR 415 Class Radial Tank	4-4-2 T				
5" g	Nine Elms	LSWR A12 Beyer Tender Loco	0-4-2				
5" g	Salisbury	LSWR 460 Class Loco	4-4-0				
3.1/2"	Britannia	LNOR BR Pacific Loco	4-6-2				
3.1/2"	Molly & Mona	LMS Tank Loco	0-6-0				
3.1/2"	Cant. Lamb	Copy of original Invieta Loco	0-4-0				
3.1/2"	Petrolea	GER Tender Loco	2-4-0				
3.1/2"	Iris	GWR Tender Loco	0-6-0				

• If you are thinking of starting a new Loco or finishing one you started years ago, give us a ring for an itemised list of any of these Locomotives.

• All castings can be bought as complete sets or part-sets to suit your circumstances. • Look out for our other adverts for all your Model Engineering requirements



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

• Tel: 01327 878988 • Fax: 01327 876396 • E-Mail: petegl@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



A.m.€

Abbotsmodeleng.co.uk
"GOING LOCO IN 5 INCH"

Abbotts Model Engineering 7 1/4" Gauge Class 66 Now Available



- Bogie Kits
- Class 66
- Flat Wagons
- Driving Trucks
- Passenger Trucks
- Coal Hoppers
- Well Wagons
- Containers
- Cases
- 5" Accessories
- Railbus
- Rail Head Cleaner
- Sound Systems

www.abbotsmodeleng.co.uk

Tel: 01952 616628 • Mobile: 07050 221105
peter@abbotsmodeleng.co.uk



NEW Instructional DVDs from Rudy Kouhoup:



6 Projects for the Shaper

165 mins • DVD £ 29.31

Make a tapered soft jaw for your vise or a pair of V-blocks. Cut dovetail slides, external or internal keyseats and learn how to index and cut spur gears. Drawings, charts & etc. are all included

Building a Small Steam Engine

220 mins • Double disc DVD £34.27

Full plans (2 x A3 sheets), and building instructions on your screen, for building a simple, small horizontal 'mill' type engine. An ideal beginner's project, Rudy does it all on a little Sherline lathe and mill, so this engine can be made on a Unimat, Taig or similar lathe, as well as larger machines.

Building a Stirling Hot Air Engine

220 mins • Double disc DVD £34.27

Again, full plans (4 x A3 sheets) and building instructions on your screen for building a horizontal Stirling engine. For the beginner this is an excellent 'follow-up' to Rudy's small steam engine as, by its design, a hot air engine offers more in the way of challenges, not to mention hours of fun both building the engine, and running it!

PIONEER a Non-compression Internal Combustion Engine

230 mins • Double disc DVD £34.27

Rudy's last engine, Pioneer is a dynamic 2-stroke cycle, open frame engine with poppet valves. The cams, valves, con rod and all moving parts are visible - no gears! And, as with the steam and hot air engines, no castings are required. Spark plug ignition. 12 x A3 sheets of plans, and building instructions up there on your screen.

6 Projects
for the
Shaper



Building a
Small Steam
Engine



Building a
Stirling Hot
Air Engine



PIONEER
A Non-Compression
Internal Combustion
Engine



and NEW from Lindsay Publications:

Forming Methods Vol. 1 • Circa 1942 • £ 9.70

We really shouldn't be offering you this volume on shaping, bending and working metal for aircraft, as the Navy Department, Bureau of Aeronautics marked the originals "Unauthorized circulation of this pamphlet by anyone is prohibited", but before we get thrown into jail, here is an excellent book on the subject, from the early 1940s. In fact you get two booklets here, the first being *Forming by Section and Tube Bending*, which is probably the one which will be most useful to readers, as the second booklet, *Forming by Press Brake*, is far more concerned with power forming using dies in presses - which doesn't mean it isn't useful, but probably reduced in scale. It really doesn't matter if you need to make some parts for that Flying Fortress the wife is insisting you fly out of the back garden this instant, or you just want a really good, clear and concise book on bending and shaping metal sheet, section and tube - you will find this excellent. 80 pages, heaving with 'prohibited information'. Softcover.



Steam Engines - Principles and Practice - Library of Power Plant Practice 1922

• ed. Croft • £30.30

This is an absolute 'must' for anyone interested in stationary steam engines. Its 513 pages contain chapters on (amongst other subjects): *Function and Principle of the Steam Engine, Steam-Engine Mechanisms and Nomenclature, Slide Valves and Their Setting, Corliss And Poppet Valves and Their Setting, Fly-ball Steam-Engine Governors, Principles and Adjustment, Shaft Steam-Engine Governors, Principles and Adjustment, Compound and Multi-Expansion Engines, Condensing and Non-Condensing Operation, Steam-Engine Efficiencies and How To Increase Them, Use of Superheated Steam In Engines and Solutions to Problems*. Nearly every one of its 513 pages has a drawing to help the reader - probably the man in charge of a powerhouse miles from anywhere, who would have been constantly referring to it for guidance. Books like this don't come along that often, so grab a copy now! Hardbound.



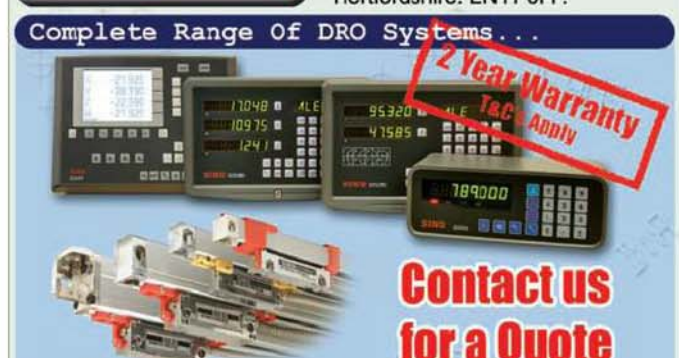
Prices shown INCLUDE U.K. Post & Packing (overseas customers please allow 10% extra for delivery)

Mail Order (no stamp required in the U.K.) to:-
CAMDEN MINIATURE STEAM SERVICES
FREEPOST (BA 1502) Rode Frome Somerset BA11 6UB
Tel: 01373-830151 Fax: 01373-830516
Secure on-line ordering: www.camdenmin.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
T&C 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...

0-75mm (3") Pocket Digital Calipers
£14.95 inc VAT
FREE DELIVERY
Quote issue number
on ordering.



www.machine-dro.co.uk
+44 (0)1992 450780

BUY 2, GET 1 FREE!

The Workshop Practice Series (WPS) is a comprehensive list of new and recently revised titles which have become standard reference works for amateur and professional engineers. Priced £6.95 each, plus p+p



- 1 Hardening, Tempering and Heat Treatment – Tubal Cain
- 2 Vertical Milling in the Home Workshop – Arnold Throp
- 3 Screwcutting in the Lathe – Martin Cleeve
- 4 Foundrywork for the Amateur – Terry Aspin
- 5 Milling operations in the Lathe – Tubal Cain
- 6 Measuring & Marking Metals – Ivan Law
- 7 The Art of Welding – W.A. Vause
- 8 Sheet Metal Work – R.E. Wakeford
- 9 Soldering & Brazing – Tubal Cain
- 10 Saws & Sawing – Ian Bradley
- 11 Electroplating – J. Poyner
- 12 Drills, Taps and Dies – Tubal Cain
- 13 Workshop Drawing 2nd Revised Edition – Tubal Cain
- 14 Making Small Workshop Tools – Stan Bray
- 15 Workholding in the Lathe – Tubal Cain
- 16 Electric Motors 2nd Edition – Jim Cox
- 17 Gears & Gear Cutting – Ivan Law
- 18 Basic Benchwork – Les Oldridge
- 19 Spring Design and Manufacture – Tubal Cain
- 20 Metalwork & Machining Hints & Tips – Ian Bradley

- 21 Adhesives and Sealants – David Lammas
- 22 Workshop Electrics – Alex Weiss
- 23 Workshop Construction – Jim Forrest & Peter Jennings
- 24 Electric Motors in the Home Workshop – Jim Cox
- 25 The Backyard Foundry – Terry Aspin
- 26 Home Workshop Hints & Tips – Edited by Vic Smeed
- 27 Spindles – Harprit Sandhu
- 28 Simple Workshop Devices – Tubal Cain
- 29 CAD for Model Engineers – D.A.G. Brown
- 30 Workshop Materials – Alex Weiss
- 31 Useful Workshop Tools – Stan Bray
- 32 Unimat III Lathe Accessories – Bob Loader
- 33 Making Clocks – Stan Bray
- 34 Lathework: A complete Course – Harold Hall
- 35 Milling: A complete Course – Harold Hall
- 36 Photo Etching – Brian King and Azien Watkin
- 37 Dividing – Harold Hall
- 38 Tool and Cutter Sharpening – Harold Hall
- 39 Model Engineers' Workshop Projects – Harold Hall
- 40 Bearings – Alex Weiss

Order today at
www.myhobbystore.com
 or call 0844 848 8822

myhobbystore
 .com

We also sell plans, back issues and binders
 - please go to www.myhobbystore.com to
 see our full range of products

First delivery sold out, now taking orders for Summer 2009!

ARMORTEK

IN ASSOCIATION WITH



Armortek in association with The Tank Museum are proud to present their latest release, the King Tiger.

Kit Price £3,910.00 + P&P (incl. VAT)
(Motors/Electronics and special effects are optional extras)

King Tiger 'Tiger II' (Sd.kfz 182)



1/6th Scale All Metal Engineering Kit



Undoubtedly the finest Armortek model to date this impressive 1/6th scale all metal model kit is set to surpass all previous releases.

With an exceptional level of detail and an entirely prototypical construction from the plate thickness

to the method of fabrication we are confident that no other scale model on the market comes close to the Armortek King Tiger.

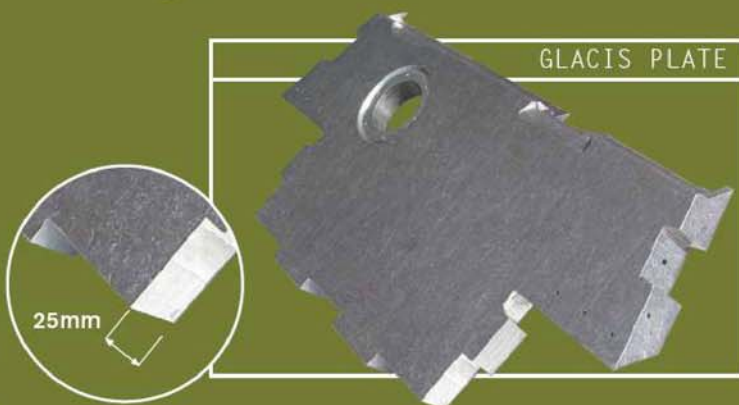
Considered to be the most powerful, not to mention largest and heaviest tank to see combat during World War II the King Tiger has been extensively researched with special reference to The King Tiger 104 owned by the world famous Tank Museum, Bovington (www.tankmuseum.org)

Visit our web site for more details

www.armortek.co.uk | e-mail: sales@armortek.co.uk

Telephone: +44 (0) 1404 892956

22 Flightway Business Park, Dunkeswell, Devon. EX14 4RD



With scale plate thickness up to 1 1/4" (30mm), an overall length of 65" (1655mm) and a weight of approximately 440 lbs (200 kg) you can be confident that the model you build from your Armortek kit will be outstanding in all respects.

By purchasing this Armortek kit you will not only become the proud owner of this superb model but you will also be contributing towards the future of tank preservation as a donation of £150.00 will be made by Armortek to The Tank Museum for every model sold.



MODEL ENGINEER

Vol. 202 No. 4344

30 Jan - 12 Feb 2009

- DARJEELING HIMALAYAN LOCOMOTIVE
- J15 LOCOMOTIVE IN 7½in. GAUGE
- CAM TURNING IN THE LATHE
- A STEADY FOR THE DRUMMOND LATHE
- COLOGNE VISIT



SUGDEN SPECIAL - A MODEL AIRCRAFT

HURRY
OFFER CLOSES
27th Feb '09

- **SAVE UP TO 23%**
- **DELIVERED TO YOUR DOOR**
- **JUST £13.75 EVERY 3 MONTHS**

SAVE UP TO 23%

when you subscribe to

MODEL ENGINEER

BY PHONE: 08456 777 807 quote ref. S085 **ONLINE:** www.subscription.co.uk/mde/S085

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 1 year (26 issues) with a one-off payment of £64.35, **SAVING 10%**.

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.ewamags.com

PAYMENT DETAILS:

☐ **Postal Order/Cheque** ☐ **Visa/Mastercard** ☐ **Maestro**

Please make cheques payable to MyHobbyStore Ltd and write code S085 on the back

Cardholder's name.....

Card no:.....

(Maestro)

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

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

YOUR DETAILS:

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

Address.....

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

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

E-mail.....

DIRECT DEBIT SUBSCRIPTIONS (UK ONLY):

CODE S085

☐ I would like to subscribe to *Model Engineer* paying £13.75 every 3 months by Direct Debit (UK ONLY). **SAVING 23%**. Please complete form below

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

☐ Pay £13.75 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 My Hobby Store 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 My Hobby Store 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 27th February 2009. 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 My Hobby Store 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 My Hobby Store 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 HARBOROUGH, LEICS LE16 9EF



DAVID CLARK
Editor



MIKE JONES
Assistant Editor



ROGER BUNCE
Technical Editor

Letters to the editor

I have had quite a few letters to the Editor and am working my way through them. If the letter is a query that I can answer over the phone, please supply a phone number so I can call you. Nowadays, the phone is cheaper than a stamp and is also quicker.

If the letter is not for publication, please say so in the letter. Any letter to the Editor will be assumed that it is intended for publication unless stated otherwise.

Free plans

Issue 4346 sees the start of a series of six double-sided plans. On one side will be Martin Evans 5in. gauge Metro tank locomotive and the reverse will have Edgar Westbury's Zephyr petrol engine followed by various other plans.

Hopefully there will be something included of interest to most readers.

The *Model Engineer* website will be online, hopefully within a couple of months. We can actually put it on the web within a few hours but we will need a few weeks to load up quality content for you to read. There will be forums where you can discuss model engineering topics; you will be able to put items for sale and items wanted onto the site. (This is not intended to replace the free ads page.) You will also be able to upload photos of your favourite project or model. I hope you will participate with this venture.

Land Speed record - target 1,000mph - The Bloodhound Project

Arguably the greatest ever land-based engineering challenge is headed by former World Land

Speed Record holder, Richard Noble OBE, and the car will be driven by the current World Land Speed Record holder, Andy Green OBE.

An RAF fighter pilot, Green was propelled to world acclaim 11 years ago, when he became the first to break the sound barrier on land, in Thrust SSC, at 763.035mph.

SGS Tool, the US solid carbide tool specialist from Ohio, has become an Official Supplier of products and technical resources, for the duration of the project - scheduled for three years.

They will supply both listed and bespoke solid carbide tooling for the production and finishing of assemblies and components - predominantly exotic metals and carbon composites - used in the Bloodhound Supersonic Car, which is under development in Bristol.

A complex combination of jet, rocket and piston-engined power is employed in the 12.8m, 6,400kg Bloodhound SSC (Supersonic Car) in the quest for the ultimate goal, which will unfold over three stages, starting with 800mph and 900mph bids in 2010, with the final 1,000mph target being challenged in 2011.

The heart of the hybrid vehicle combines a composite monocoque driver cell, mated to a rear space frame, into which is installed the petrol, jet and rocket motors, with fully-automated self-levelling suspension and solid, 900mm diameter wheels, front and rear.

If Bloodhound SSC achieves its target of 1,000mph (Mach 1.4) it will mark the greatest incremental increase in the history of the land speed record; it will also exceed the low altitude speed record for aircraft (c.994mph).

The 12.8m long, 6,422kg (fuelled), piston-engined, jet and rocket-powered vehicle will be more advanced than most spacecraft and faster than a bullet fired from a handgun.

Its 900mm diameter wheels will spin at over 10,000rpm, generating 50,000 radial G at the rim.

The car will accelerate from 0 - 1,050mph in 40 seconds and at V-max (maximum velocity), the pressure of air bearing down on its carbon fibre bodywork will exceed 12 tonnes per square metre.

At this speed, Andy Green will be covering a distance equivalent to over four football pitches, or 50m, in the blink of an eye and at 1,000mph, Green will cover the measured mile in just 3.6 seconds

The prime objective of The Bloodhound Project is to create an unprecedented education and engagement programme, led by a dedicated team of teachers and education specialists. From innovative, curriculum-based lesson plans covering subjects ranging from geography to citizenship, as well as science, technology, engineering and mathematics, to a schools visitor centre featuring the 'classroom of the future' at the team's HQ in Bristol the aim is to make Bloodhound SSC accessible to all ages from 5 - 19 and beyond.

The Bloodhound Project is a private venture. The government is part funding the three year education programme but not the build and running costs of the car. These costs are covered by sponsorships, with five founder sponsors already in place.

Andy Green OBE, commented: *"I've met graduate engineers who are adamant that our previous record was what inspired their career choice as youngsters: that sort of thing makes all the effort worthwhile. Bloodhound SSC will be so much faster and, we hope, will also fire up every school kid about the science and technology. We're going to invite everyone to follow our adventure in this, the most exciting and extreme form of motor sport - the World Land Speed Record. Both as a Mathematician, and as a Royal Air Force fighter pilot, I can't think of anything better."*

For more information on the Bloodhound Project, see www.bloodhoundssc.com

1. The Bloodhound SSC 1,000mph World Land Speed Record challenger.





FIRST CLASS POST

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 MyHobbyStore Ltd. Correspondence for *Post Bag* should be sent to:
David Clark,
The Editor,
Model Engineer,
MyHobbyStore Ltd.
Berwick House,
8-10 Knoll Rise,
Orpington, Kent BR6 0EL.
F. 01689-899266.

E. david.clark@myhobbystore.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.

"It's the steam stupid!"

SIRS, - I am pleased by the undoubted optimism of our new editor but comments about the death of model engineering are not to be ignored as it is a real risk for M.E.

There is little doubt that the average age of model engineers from the 'make a steam train with a lathe' mould is now considerably higher than it once was.

When as a teenager I went to model engineer shows in the 1960s I was surrounded by people of my own age and, sadly, I still am!

I attended the London Model Engineering Exhibition at Alexandra Palace last week and could not help but note the lack of young people. Indeed one of the workers at the venue said to me that he did not know how much longer such shows, or the traders that supported them, could continue. The reduction in the number of evening classes echoes the same pattern as does the reduction in the number of schools offering any sort of constructional education as our society moves, stupidly, into an era of (now failed!) financial services.

As mentioned in *Smoke Rings* (M.E. 4344, 30 January 2009), magazines and other media outpourings about full-size heritage engineering are all the rage but these tend to encourage non-constructional enjoyment of the heritage scene rather than the active making of models. The Dibnah effect is most welcome of course, but it has confirmed most people's view that manufacturing is part of our lost past rather than a current activity.

Toyshop sales of constructional toys have plummeted whilst the more expensive, and therefore more profitable, area of toys 'ready to go', usually electronic games based, has increased. One of my friends owns Pollock's Toy Museum and Toy Theatre shop in London and has great problems in selling anything that needs more than a clockwork wind-up to get it going. He refuses to sell electronic toys but is prevented

from selling many traditional mechanical or steam toys as they tend to breach Health & Safety rules for modern retail products. Mass produced working tin toys from China for example can only be sold as 'collectables' to adults.

It is clear though that modelling is still popular by the number of those who can be seen at weekends playing with model airplanes and boats etc. but the number of people making such models has surely declined to a very low figure as it is now far cheaper to buy even a radio controlled helicopter of considerable complexity than it can ever be to make one.

In short, kids are simply not being exposed to model engineering and despite the current slump they can afford to bypass the making stage by buying a fully working example in the way that I, and certainly my father's generation, could not which forced us to make what we wanted.

There is hope however! It is argued that children use models as an entry to the full-size world and tend to want models that reflect the world they see about them. Dolls, for example, still sell in ever growing numbers so it is not a problem with modelling the world per se, but perhaps that the kids no longer see steam trains and stationary engines, or in fact anything driven by steam, as part of their world. Kids, however, still do see motor cars, racing cars, skateboards,

bikes, quad motorcycles and TV programmes full of robots and spacecraft. Three year-olds terrorize me on weekend walks by racing tiny and very noisy motorcycles around my feet in public places and I was 'strafed' the other day by a small powered flying object with a tiny NiCad battery as currently even I/C engines are being phased out in favour of windmills and electric motors. So I guess there may be hope yet for mechanical engineering, albeit not the steam kind so traditional for M.E.

The most popular stand for kids at Alexandra Palace was that of the model rocket makers who displayed working model rockets from a few inches tall to over 10ft. long. One of the most popular stands for kids at last year's Brighton Modelworld was that showing some tiny *Robot Wars* style working robots each less than 2in. square and built from scratch by kids with an enthusiastic school teacher. At the same show it was not easy to avoid being trampled by homemade working Daleks of all sizes. Model engineering is not exterminated but has merely mutated away from steam as its prime mover.

A suggestion: Odd though it is to relate, kids in general are no longer excited by even a fully colour glossy picture of a wonderful steam engine as they simply have no idea what it is. Show them instead a magazine cover with the tempting promise of a working model racing car, skateboard, bike, quad motorcycle, robot or even rocket

Riveting article

SIRS, - Any chance of an article on 'How to Rivet Neatly' in our sizes? I can make dummy rivets, I can bolt, I can weld, but I can't seem to make an ordinary 1/8 iron rivet attach metal sheets, and look decent.

I have a pile of recent M.E.'s, and another pile from 15 years back, and another suitcase full from even further back, and nowhere have I found any information on 'How to'. There are lots of pictures of models with beautifully riveted joints, but no information on how to achieve them.

Any help greatly appreciated as I am trying to build a 3in. *Little Samson* traction engine, and while I can get away with welded or soldered dummies, both sides of some countersunk ones holding the steering bushes are inescapably visible.

Meyrick Griffith-Jones, by email.

inside and you may yet turn the tide. Even the radio controlled cars that we might poo-poo need a precision engineered chassis full of ball bearings and tight tolerance axles and that surely is the essence of what model engineering is about, i.e. how to design and make whatever is needed for one's model.

Perhaps then if *M.E.* gently started to include engineering projects that are relevant to modern kids it would achieve higher sales and a healthy future both for itself and the kids (of whatever age we are!) it might encourage in engineering.

As a basic rule I might offer the no doubt excommunication warranting idea that models where the prime mover is an electric motor rather than a steam or I/C engine are the realistic experience of the young that one needs to reflect. Ross Brawn of Ferrari F1 designer fame started by rewinding model electric car motors so let us not be too scathing about non-steam projects!

Paul J. Weighell, by email.

Wireless track occupancy

SIRS, - The recent letter from John Townsend (*M.E.* 4343, 16 January 2009) regarding using wireless communication rather than wire to communicate track occupancy seems to be unnecessarily complicated, in that the amount of data, and rate of transfer (1 bit per 5 minutes?), hardly justifies using flags, let alone sophisticated electronics. Moreover, I doubt that he will get the equivalent fail-safe reliability of a token-like system, or even a wired system, without inordinate effort - both in designing the data equipment using the radio system and making the radio link fool-proof. There is also the question of powering the radio, which itself calls for wires, or something expensive (solar and batteries) or troublesome (just batteries) at each equipment location.

I would suggest he may be overlooking the obvious possibility of using the rails themselves. I recently developed and installed the signaling system for the elevated track (3½in. and 4¾in.

gauges) at the Waushakum Live Steamers' site in Holliston, MA, USA. It is based closely on full-size practice (at least in the US) for automatic block signaling. Without going into details, we isolated the rails from each other, electrically bonded them end-for-end, and divided them into blocks with insulated fishplates, and used the isolated sections of rail to detect track occupancy in the normal way. The standard method is to feed a low voltage across the rails at the head of the block (meaning the last point in the block that a train passes before entering the next block, where the signal governing entry into the next block is located). This voltage is sensed at the other end by circuitry at the signal governing entry into the block. If the voltage is present, the block is clear, if not, the block is occupied, or a rail is broken. As a bonus, current flow due to rails being shunted by a train can be used at the next-block signal to provide approach lighting (which is universal in this country). Other systems using proximity sensors rather than current flow to detect trains do not even come close to operating as well, and are certainly 'unprototypical'.

This basic system is capable of expansion. At Waushakum, we use a three aspect system (red, yellow, green) for advanced warning, so we use a polarized voltage across the rails to pass on 'distant block' state information. Thus, the signal at the entrance to the block sees zero volts (shunt) if it is occupied, +12V if it is clear, but the next block is occupied, or -12V if it and the next block are both clear. This is also something that was done in full-size practice. The signal circuitry uses polarized relays (or diodes and regular relays) to detect the voltage and display the appropriate aspect (red, yellow or green respectively). The same relays use additional contacts to pass on the state to the next signal by switching the correct polarity to the rails, thus propagating occupancy information through the blocks.

Gilling rolling stock

SIRS, - I was greatly attracted by the rolling stock at the Gilling Rallies featured in *M.E.* 4343, 16 January 2009. I've always wanted to build some wagons/trucks and this article really fired my enthusiasm. Can you do some arm twisting and persuade some of the builders of these delightful examples to write a 'how to do it article' with plans.

Shaun Trewinnard, by email.

How about it then? Are there any takers to write articles on building rolling stock? Ed.

As an aside, the 'electronics' at each signal is nothing more than a small circuit board (about 3 by 3in.) with three \$2 relays and a few other devices, mounted in a waterproof electrical box on the signal pole. The same board is used for signals with multiple signal heads at diverging or converging tracks by using one board per head. Turnout position can be accounted for easily with no extra hardware beyond the position detector itself (magnetic burglar alarm sensors), on the basic principle that an adverse turnout is the 'same thing' as an occupied block. The whole thing is very robust and has survived several years of lightning storms without failure: most of the components are actually for protecting against spikes. The use of relays was made specifically because an older system using logic chips did not last the proverbial five minutes. The poor environmental conditions are another reason why radio might be difficult.

Whatever you do, wire or wireless, you will need to supply power to the lights and controlling circuitry, and that takes wires of some kind and length, and they will have to be properly installed for the conditions. It isn't a lot of power, less than 5W per signal in our case, even less with LEDs. As for powering the track occupancy detection system, the polarized voltage requires either two batteries, or AC power and local rectifiers at each signal. We originally wanted mains power at each system, but the Power Department has not kept pace with the Signal Department. Another

alternative considered was solar power. In the end, we simply mounted bell transformers (110V to 12V 4A from eBay) in two indoor locations, and fed 12V AC through a single wire threaded through the elevated track's structure. No support or protection was needed (or required by law), as the structure itself provide both, adequately for the low voltages in use. The power return, as well as the common for the track circuits uses one of the rails (actually two, as it is dual gauge, and the isolated rail must be the rail common to both gauges). There are a few places where the elevated structure 'disappears' (such as at turnouts), so the power wire, plus some other short wires to detect turnout state and so on are routed down to short sections of buried conduit. Thus we have only one wire (not even one pair) that passes along the track. In terms of overall effort, this power arrangement is only a small part of the work involved. Although originally a temporary arrangement, it works well. Cost is also very low.

We plan to use the same system on the 7¼in. ground level track, and have installed one signal head and a train-activated level crossing flasher (per American practice) as a pilot. In this case, we ran the low voltage AC power through PVC conduit buried at the side of the track. It turns out to be not that hard to lay and bury the conduit, even in our heavily wooded site. You do have to watch for the guys laying the water pipes, though!

Mr. Townsend did not give a lot of detail of his system, but implied a single block



between two sets of sidings. It seems simple to monitor the occupancy of this block from either end, if that is all he needs. Bidirectional systems are certainly harder than unidirectional ones, but that doesn't affect the wire versus wireless argument. If he can get the same information at both ends of the block what is left to be sent via wireless, or any other separate communications system? For let us not lose sight of the objective. It is NOT to use wireless, but to communicate information by some convenient means. Should he be adamant about needing a communications system separate from the rails, and if he is going to run power lines anyway, I would suggest that he might want to investigate some of the modern home automation products. These devices use the AC wiring as the communications medium, so are even more wireless than WiFi (WiFi has an antenna and a power cord, these just have the power cord... okay, it's a stretch). There is also a PC LAN technology that is essentially the same technology. The modern devices can use a PC to control everything, but it's not necessary. I would think it would be much more reliable than radio, within its limits, and does not need

direct wires between points, just having mains power at the communication endpoints.

I hope this helps Mr. Townsend a little towards his goal. He may communicate with me through the editor should I be able to help him further.

Jed Weare, by email.

More on evening classes

SIRS, - Re. Doug Hewson's letter (M.E. 4344, 30 January 2009). I lecture on construction technology to students who, in many cases, are not unlike Doug's step grandson and I would like to set the record straight on some of the observations made.

There are a range of courses available to students who wish to enter the construction industry and they are based on the individuals' ability and prior education, or lack of same. I am referring here to my own college, Worcester Tech', but I know that similar courses are available throughout the country.

The first and most basic of these is 'The Foundation Course in Construction'; this is almost entirely based on the acquisition of hand skills, yes there is a little necessary Health & Safety and the bare minimum of theory, i.e. how to peg a site out, what the different types of brickwork commonly used are, etc, but it is all practically related. The

exception being 'Key Skills', which is simply, a very basic look at the three 'Rs'.

Then there are the City and Guilds, level 1 courses in Brickwork and Carpentry, again, similar to the above, a little more advanced, but virtually no theory.

You will note that Plumbing is not mentioned, as it is now, and rightly so, recognised as engineering and subject to a three-year qualification. Brickwork & Carpentry are defined as Construction, the training period being two years.

The course that I lecture in, is the theory side of the BTEC First Diploma In Construction, which, when achieved, is the equivalent of four GCSEs at A-C level, all the students who are on this course will have been enrolled as foundation students and subjected to a three month selection process wherein they are divided into those who, in my opinion would be able to absorb theory and those who would be better off doing exactly what Doug advocates.

The course acknowledges that many of the students will have had bad school experiences and may well have been alienated from education as a result.

Some of my students have not been to school from the age of 13, or have been either temporarily or permanently excluded, that does not necessarily make them bad kids.

A good number of my students, who, when they came to college were neither literate or numerate, go on to study for HNCs in Construction and then into the workplace where they are sought after for positions in construction management.

I should point out that until I retired the first time in 2001, at the age of 60, I ran my own successful plumbing business, so I am not some armchair warrior, but thought that I might possibly have something to offer to others by way of my experience. It was quickly discovered by my employer, that because I went to school, (Sec Mod) when we were taught our Times Table and how to write a letter, that I could offer something to these youngsters

that formal education had passed by.

As a result of my experience, I think that coming from industry, anyone who can communicate with youngsters, you may have had apprentices, will have much to offer and I would commend to anyone the opportunity, not to moan about the kids of today, or the acknowledged, appalling standards of teaching in some of our secondary schools, but to get out there, contact your local Tech' and make, as I believe I do, a difference. Don't let age stop you, you will have, no doubt, worked out that I am now in my 68th year, but am still valued in the workplace.

Ted Holloway, Worcester.

Regrinding chucks

SIRS - I have found a very simple and effective way of regrinding a chuck, but it involves a rather costly bit of equipment. I refer to a Quick Step Mill as sold by Hemingway. (No connection, but appreciative customer). The QSM fits on the tool post, has a 9-speed reversible motor, is height adjustable in thous, and takes E20 collets. It is rather expensive, but very well made and accurate, which is what you tend to get if you buy British. (I have learnt about some other sources of tools the hard way!) If you can't afford one yourself, you want to find a kind friend who has one! The procedure is quite simple: Put the QSM in the tool post and set up so that the centre line coincides with that of the lathe mandrel. Fit a grindstone in the collet. I found that for my 50 year-old 6in. chuck a 3/4in. stone matched the existing curve on the chuck jaws. A smaller chuck is likely to need a smaller stone. Open the chuck jaws to just over the grindstone size and set one jaw at the bottom. My lathe has a 60-hole plate and a plunger built in, and the holes lined up with the jaw at BDC. Move the stone over the jaw and lower it until it cleans up the jaw. Keep that stone height, and move the chuck round 120deg. and repeat. Ditto the third jaw. Job done! (Return QSM to kind friend!).

Martin Leigh, Northumberland.

Minor changes

SIRS, - As a model engineer I must admit I am rather a small c conservative as are most of my counterparts. Making any changes to a magazine as respected as *Model Engineer* risks much criticism.

However, I approve of the changes you've made so far. Nothing too radical but something to add interest. As long as you maintain the right balance of articles it will remain the best read around.

I have enjoyed the articles by Roger Backhouse. It was good to see his account of the Dutch Railway Museum recently (M.E. 4342, 2 January 2009). Whilst I value Britain's engineering heritage other countries have their achievements too which can broaden our outlook.

You have also published articles from the same author about famous, and not so famous, engineers of the past. Will we see more of these in future? I hope so.

I am looking forward to further interesting issues.

Roy A. Lewis, by email.

There's more of Roger's Engineering Local Heroes articles in the pipeline. Ed.

DON'T MISS YOUR CHANCE TO WIN ONE OF THESE GREAT PRIZES!

MODEL ENGINEER

Readers' Survey 2009

It is a few years since a readers' survey was done so I have included one in this issue of *Model Engineer*. I have deliberately left the index until this issue so that I can add an extra eight pages to the magazine so you do not lose out on content.

It is a comprehensive survey and the results should enable me to plan for the future. I would like every reader to fill in the survey and send it back. Help me to help you. If I know the sort of articles you like, I can try to include more of them in the magazine.

For UK readers I have purchased several good prizes to be given to readers who respond. There is a 0 to 4 in. micrometer set complete with setting standards. A 10 pair parallel set, a pair of toolmaker's 3, 2, 1, blocks and a set of drills from 1mm to 5.9 millimetres.

I also have some copies of the MSC/J&L Little Black Book, which is an advanced version of the well known Zeus book. One copy will be for the UK respondents and four copies will go to overseas respondents. If you want to win one of these great prizes, remember to fill in your name and address. The prizes will be awarded by picking surveys at random. The editor's decision on winners is final.



J&L Industrial Supply UK has become MSC/J&L Industrial Supply

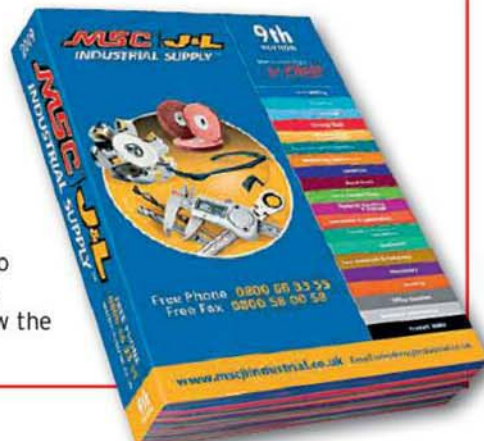
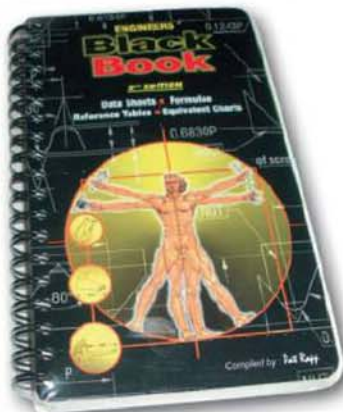
MSC/J&L have offered a **FREE** 1,700 page tool catalogue for every reader!

MSC acquired J&L in 2006 and has over 65 years experience in industrial distribution with a turnover exceeding £1 billion. J&L's operational systems were seamlessly integrated with MSC's more than 18 months ago and they now look forward to a future where they can offer customers all the benefits of dealing with a true global supply company.

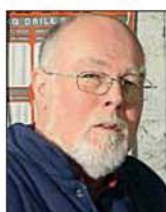
With the launch of MSC/J&L Industrial Supply their product range now exceeds 85,000 products, spanning 18 product sections in their recently launched 9th edition catalogue. Products are stocked in the UK and are available for next day delivery nationwide. With MSC and J&L's combined purchasing power, the ability to offer tools at competitive prices will be enhanced.

To order your free MSC/J&L catalogue, phone 0800 66 33 55 and ask for customer services. This is a free phone number. Please mention *Model Engineer* magazine when asking for the catalogue.

The new brand brings a new website that gives more features, log on to www.mscliindustrial.co.uk to turn the pages of the virtual catalogue, see live stock availability, request quotes quickly and easily and view the latest special offers.



A modified version of the Sugden Special



DAVE FENNER

Dave Fenner continues the machining.

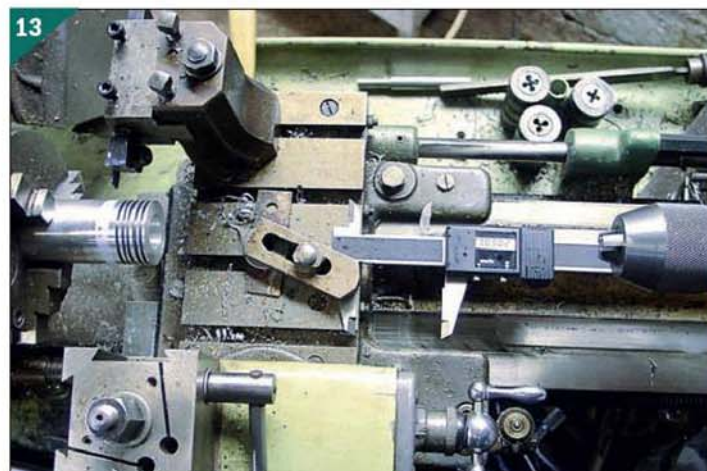
*Continued from page 153
(M.E. 4344, 30 January 2009)*

13. Digital calliper clamped in place to space fins.

14. Counterboring for the hold down bolts.



Machining the finned cylinder jacket **fig 5** was generally straightforward, requiring a piece of aluminium to be turned to O/D then bored to accept the cylinder before cutting the fins. During this latter operation, after finding a tendency for the swarf to jam in the slot, I modified the part off tool by cutting a small groove in the horizontal face by means of a mini tool and thin grinding disc. The result tries to mimic the shape seen on modern tipped part off tooling, and I believe the effect is to cause the ribbon of swarf to deform to a narrower width, and hence reduce the propensity to jam. Another dodge used here helped to set the fin spacing which I had set at 3 millimetres. Working out increments of 0.118in. using the Myford leadscrew handwheel would have entailed a fair degree of head scratching, but by clamping a digital calliper to the saddle (**photo 13**), and

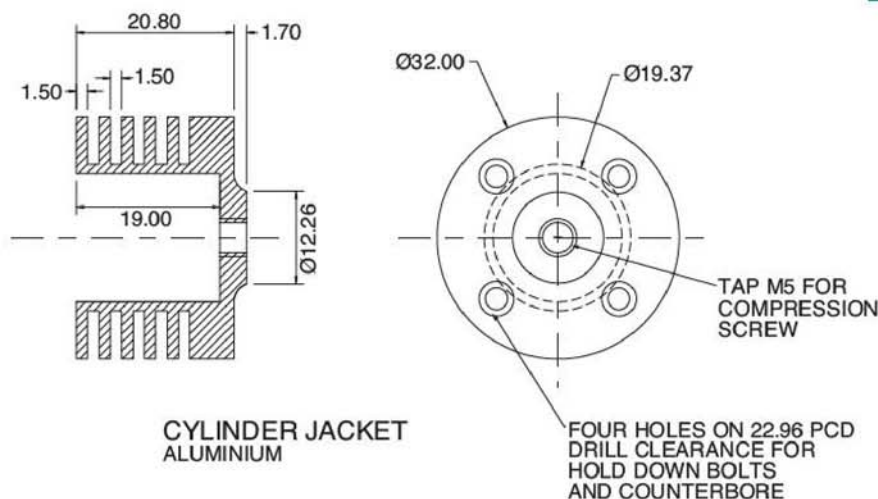


locating its depth rod against the tailstock, it became very easy to make the necessary moves. The original Sugden design called for a 2BA thread for the compression screw. Mine is made this way, but accepting the inevitable march of modernisation, I have shown M5 on the drawing.

Once turning was completed, the part was transferred to the mill to drill and counterbore the four positions for the four 6BA hold down bolts (**photo 14**).

Crankcase

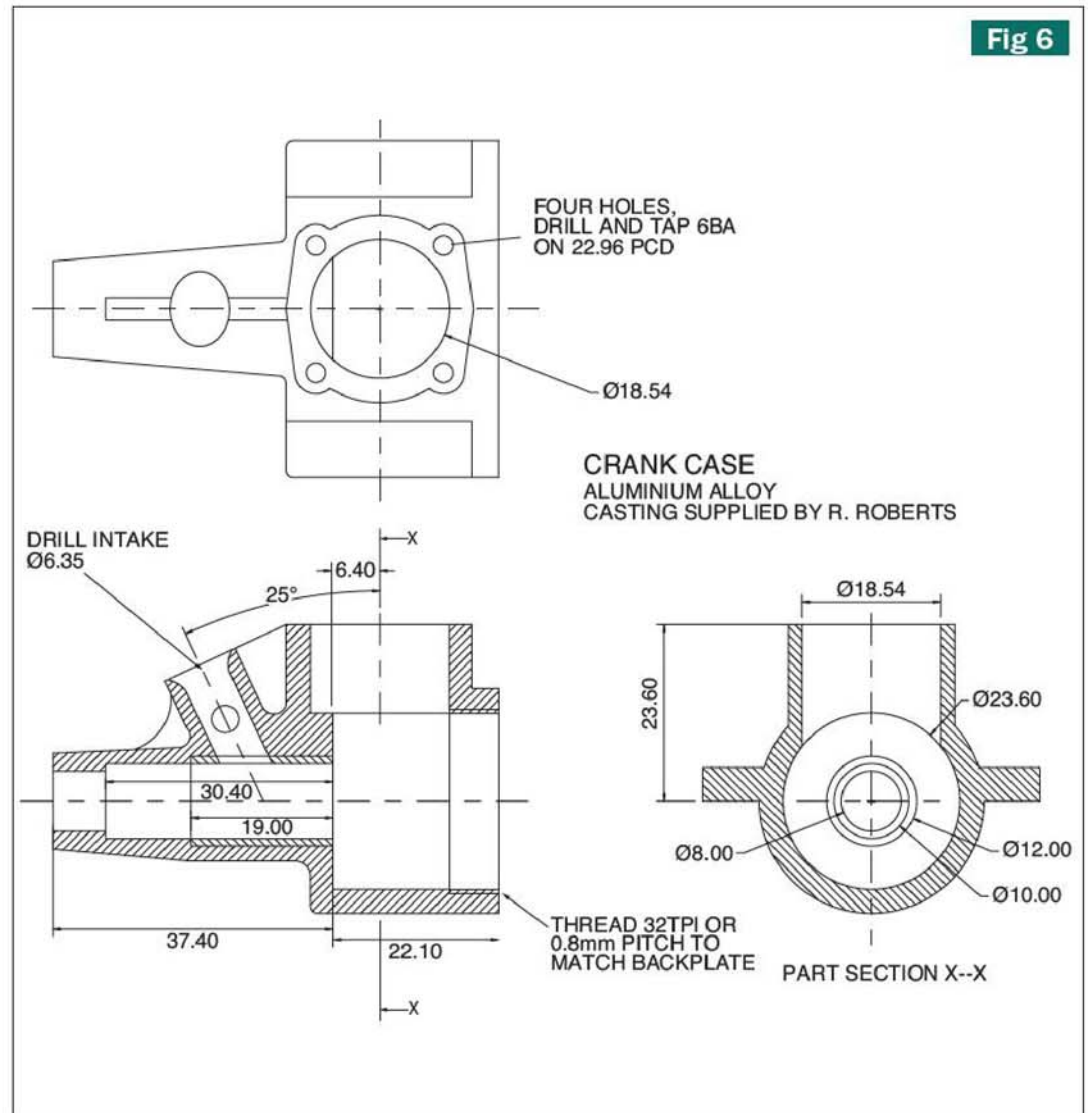
The first step in making the crankcase (**fig 6**), was to mark out the centres at the front and rear, then to drill centres at these positions. This enabled the casting to be mounted between centres allowing the chucking spigot to be turned to a clean diameter (**photo 15**). The spigot as cast was about 25mm diameter, but I chose to reduce this to just below 20mm. In the interests of accuracy and repeatability, this would give the option of using both the collet chuck in the Colchester Chipmaster, and the ER32 chuck on the Myford. With these two chucks, the work could be removed, swapped and rechecked, with no detectable loss of concentricity. Step one was to cut the rear face to the correct distance from the cylinder location, followed by progressive boring. Much of the material was carved out using two large drills of the same diameter. The first of these featured a normal 118deg. point, but the second had been ground flat (**photo 16**). After boring out the main clearance for the crank web, work then continued by drilling and reaming the two



diameters which would form the front bearing and the location for the shaft bush. The final operation at this stage was to cut the internal screw thread for locating the back plate (**photo 17**). I had chosen to produce the bush before machining the crankcase, retention being by Loctite. With the benefit of hindsight, it may be preferable to press fit a solid lump of bronze, then drill and ream for the bearing.

The crankcase could then be transferred to the mill, again held by the spigot, this time located on a rotary table. This enabled the underside of the mounting lugs to be trimmed, before attention turned to milling to height. When measuring between inside and outside diameters, or as here, between a bore and an external flat surface to determine cylinder height, one useful accessory is the 0.250in. ball attachment for the micrometer (**photo 18**). Work then moved on to drilling and boring out the cylinder location followed by the positions for the four hold down bolts (**photo 19**).

While set up on the mill, the opportunity was taken to drill the location for the needle valve assembly, then to incline the head 25 degrees to drill the intake passage. The original Sugden design has a trumpet shaped intake, which certainly adds to the appearance so I opted to produce something similar. To produce a nicely rounded form would be fairly easy if the work were mounted on the lathe, however, creating the form in the mill, would be made considerably easier if a suitable cutter was to hand. Contemplating this over a cup of coffee, the most likely home brewed tool would be a sort



15. Crankcase set between centres to turn chucking spigot.

16. Flat drill for rough boring, normal equivalent visible below.

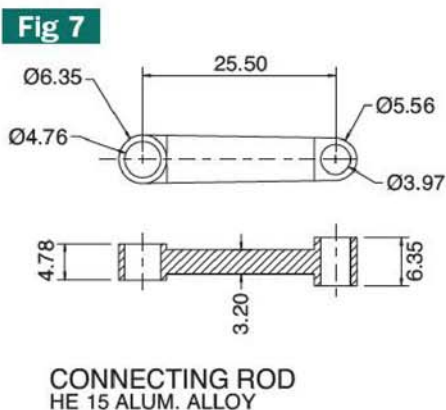
17. Cutting screw thread in rear of crankcase.

18. Ball attachment on micrometer for inside/outside measurement.



of profiled "D" bit. This would entail turning the form, then cutting away half, followed by hardening and light grinding to sharpen. To turn the form, (without a form tool) I could certainly turn roughly to shape then file more exactly. Now I must admit that in general I feel that CNC is more relevant when a batch of parts is planned, but after thinking it through, and studying the 'wizards' given with Mach 3, I decided to run the profile turning job on the little CNC Orac. Creating the program was a simple matter of typing in the start and finish coordinates, and the desired radius (I chose 4.5mm). A short length of 16mm silver steel was placed in the chuck, and the machine set to work (photo 20). A hacksaw was then used to saw down, then across leaving half of the material. It was then filed to improve the finish (photo 21), heated red hot and dunked in water. Finally the flat surface was lightly dressed with a fine stone.

The cutter was then fitted to the mill, and the venturi bell mouth cut to shape. After removal of the work from the mill, the various threads were tapped, after which the casting was again loaded in the lathe to part off the chucking spigot.



19. Final operation - tapping for hold down bolts.
20. Turning cutter profile on the CNC Orac lathe.
21. Trumpet cutter prior to heat treatment.
22. Milling rod material to size.
23. Rods positioned against stop bar to prevent cutter grab.

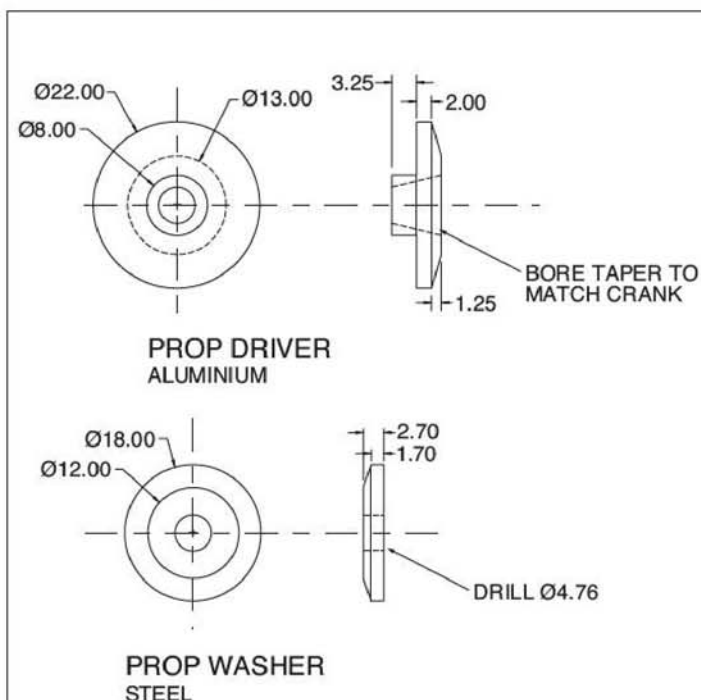


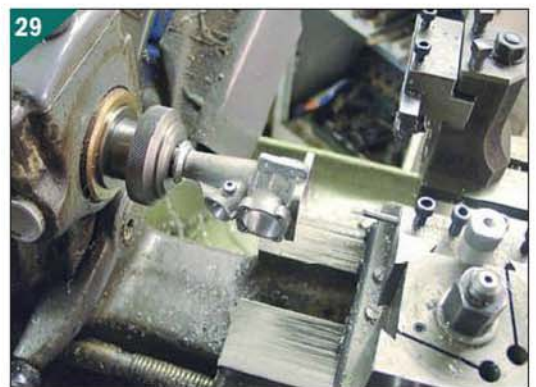
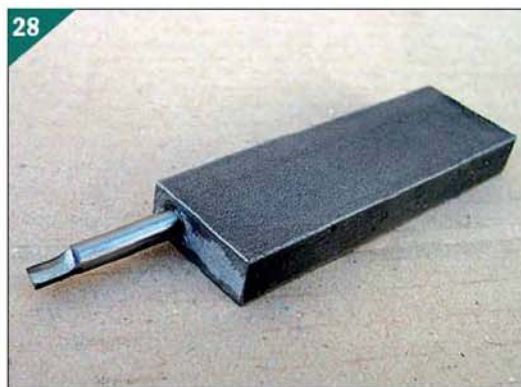
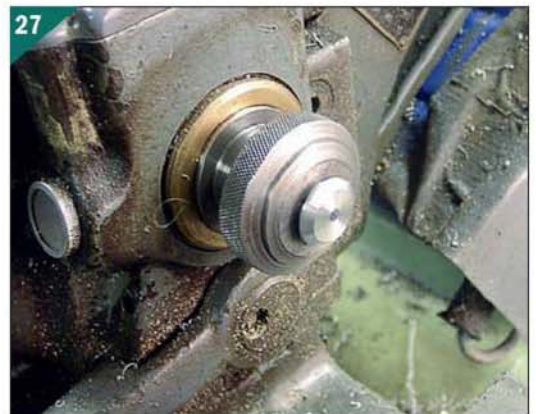
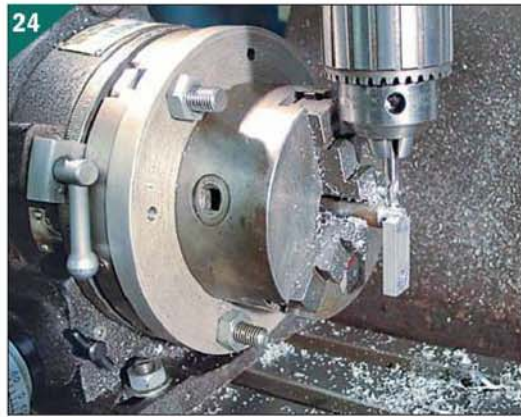
Fig 8

Con rod

As luck would have it, I had a sizeable length of $\frac{1}{2}$ in. square HE15 aluminium alloy bar for making the con rod (**fig 7**). A short length was sawn off then reduced in section to 0.250 in. (6.35mm) square in the mill (**photo 22**). Two holes were then drilled and reamed for the big and little ends, care being taken to ensure correct positioning and parallelism. After this, the work was mounted to allow the centre region to be reduced in section. The question then arose as to how to deal with the rounding and general profiling. After scrapping a first rod I resorted to good old fashioned filing on the second. However, for machine rounding, two approaches may be considered. **Photo 23** shows the set up adopted for the multiple rods required for the Bentley BR2 engine. The rod is mounted on a close fitting vertical pin around which it may rotate. What must be understood here is the inherent danger due to the tendency for the cutter to grab the work and 'climb'. To avoid this, a stop is set up and the work held against it. The job is then rotated against the cutter and taken a little beyond the halfway mark. It is then turned over and the process repeated for the other half. Due to the helix angle of the cutter, there may also be a tendency for the work to lift. To counter this, either apply downward pressure, or use a headed pin. Work then resumes on the other end, if necessary with a second pin of correct diameter.

Photograph 24 illustrates a setup where the axis is at right angles to the rod rotation pin, and this reduces the tendency to grab. My mistake here was to rely on a drill chuck for milling. The FC3 cutter being used wandered out of the chuck, cutting too deeply and scrapping the work.

As an aside, the design of rod offered here is generally a milling job in part following the lines of the original although, rather than turning the end bosses, my centre section is cut as a simple milling operation. It is, of course, perfectly feasible to turn rods from round bar, employing



a profiling tool. This approach, as used on the Bentley parts, is shown in **photo 25**, where the sequence of events adopted, starts with the cross drilling, then profiling, then rounding.

Prop driver

Before forging ahead with the prop driver (**fig 8**), it should be noted that to undertake the final taper boring you really need the assembled crankshaft and crankcase to establish the relative positions.

The outer features are first turned, then the radial face knurling applied by a home made tool (**photo 26**). (Making this tool, including the special knurling wheel, was described in *MEW* issue 147.) The reason

for the presence of the tailstock chuck in the picture is that it was used to apply the firm pressure needed to indent the knurl. The work could then be turned round and, to avoid damage to the 8mm dia., was held in a Myford collet (**photo 27**). Rear face work could then proceed.

In order to bore the tapered shaft location, a small boring tool was needed. The one shown in **photo 28** was made by taking part of a broken tap, Loctiting it into a flat steel holder, and grinding the square end.

Progress can be checked by offering up the shaft and case (**photo 29**), and I would suggest that a clearance of about 0.010in. (0.25mm) should be about right, as the

24. Alternative method of rounding rod end. (Editor's note: It is not a good idea to use a chuck for holding milling cutters.)

25. Con rods may also be made by profile turning from round bar.

26. Pressure is applied via the tailstock for the radial knurl.

27. Prop driver gripped in Myford collet for machining rear.

28. Home made boring tool.

29. Checking axial clearance when boring the taper.

gap will reduce a little when a prop is tightened up. If you run out of clearance, simply take a few thou' off the rear face of the driver.

●To be continued.

McONIE'S OSCILLATING ENGINE



ANTHONY MOUNT

Anthony Mount describes more throttle parts and begins work on the governor.

*Continued from page 141
(M.E. 4344, 30 January 2009)*

The next part to be described is the throttle push rod (**part 51**). However, I would advise making this item last, so that the centre distance can be measured from the assembled engine. This is because there can be a tolerance build-up in the parts and assembly of the elbow and stop valve; the 115mm centre distance, shown on the drawing, could be different on the assembled engine. Part 51 is described here merely to keep related parts together.

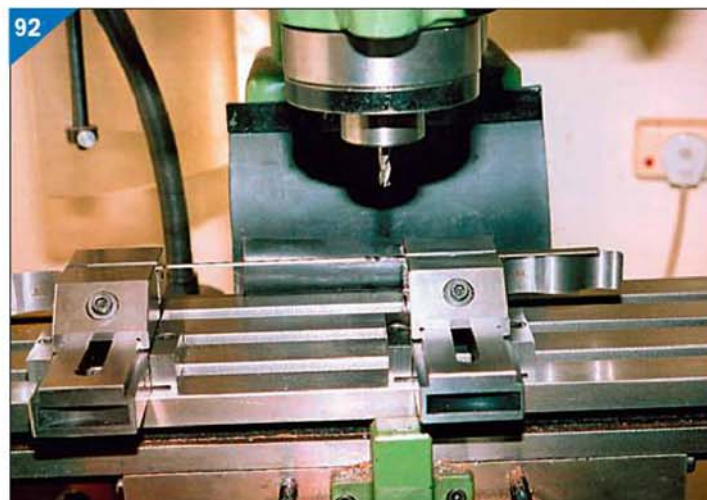
Although I have shown a slot at the handle end to allow the rod to be lifted to disengage the governor, I would advise using only a hole. On the full size engine the weight of the rod would have been enough to hold it in place; on the model, the rod is so light it can easily jump out of engagement.

The throttle push rod is made from a length of 6 x 1.5mm mild steel strip and needs to be cut about 50mm longer than required. Drill the holes at each end leaving equal overhangs so that the ends can be gripped in matching toolmakers vices (**photo 92**). It is very useful to have a pair of small vices to allow long material to be gripped at the ends, leaving the centre section clear for machining.

With the side of a 6mm end mill machine the strip to form the long thin centre section. The ends can be finished off by filing.

Rocker shaft bearings (Part 52)

A nice turning job comes next with a couple of little standards to support the rocker shaft. For the threaded bearing, start by cross drilling the hole in the end and then, with a form tool, turn the eye around the cross



92. Matching toolmakers vices used to hold slender parts.

93. Machining the governor fork arm.

94. Turning a ball using a form tool.

95. Machining flats on the governor support arms.

96. Finished governor support arms.



drilled hole. Turn the taper and form the flange, then reduce the diameter behind the flange and part off. The end is then threaded 8BA.

The other bearing has a square bottom that is screwed against the inside of the base. The bearing can be turned from 6mm square section mild steel. Proceed as for the previous bearing and then parting off leaving the square base. This fits into the 1mm deep seating machined in the base. Clamp in position and spot through from the tapped holes in the base, drilling through 2.3mm for the bolts. The inside edges of the square bottom need to be rounded to fit into the curved corners of the seating, unless you care to square out the corners in the seating with a file.

Governor shaft rocker (Part 53)

Tiny parts like the governor shaft rocker take far longer to make than some of the more substantial parts. Ideally, start with a length of 4mm square section EN1A mild steel rod. This is not easy to get but Mallard Metal Packs Ltd (M.E. Classified Adv.) stock it.

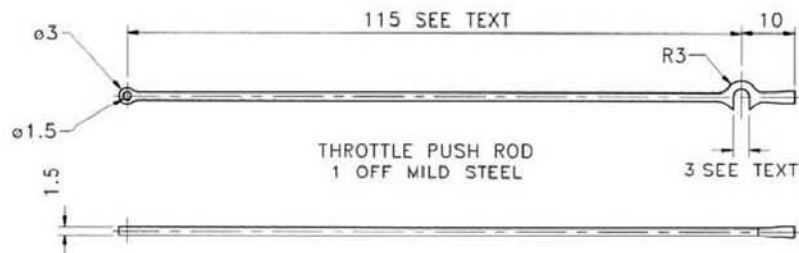
Square off the end and drill the two holes. With a small end mill, machine the reduced section between the two bosses and reduce the height of the bosses. File the tapers each side between the bosses or mill them with the side of an end mill. Round the large boss by filing, separate the arm from the parent material and finish by filing the small boss to size.

Governor fork arm (Part 54)

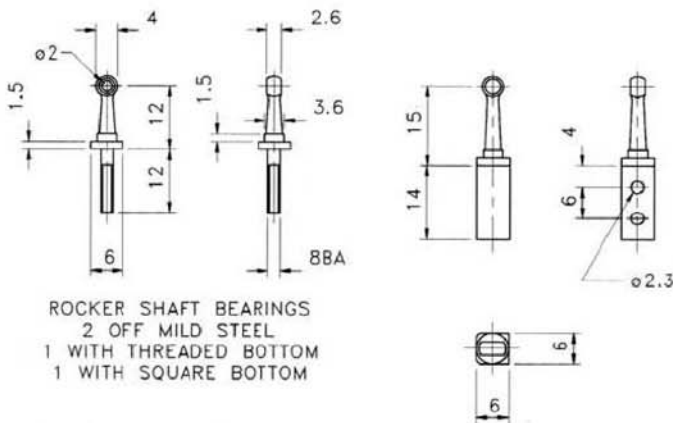
Machine a 12 x 4mm section on the end of a mild steel bar. I made a blank for two parts while I was at it, in case of accidents! Drill the 2mm holes and two 9mm holes. Mill a slot between the two 9mm holes to form the 'centre' of the two forks. With the bar overhanging the side of the machine vice, mill away as much metal as you can (**photo 93**).

I am afraid the rest of the job is down to your skill with a file to form the rounded end and profile of the arm. Separate the two parts from the parent bar and round the ends of the fork. The pins are short lengths of 2mm diameter rod Loctited into the fork.

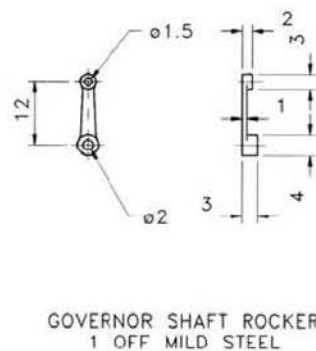
Part 51



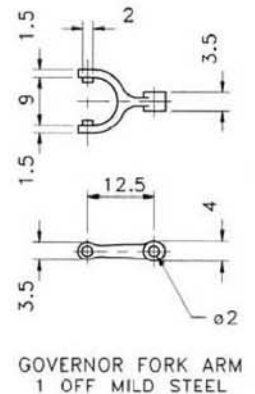
Part 52



Part 53



Part 54



1st ANGLE PROJECTION

Governor gear support arms (Part 55)

On the prototype engine, the support arms fitted into bored-out bosses on the mainframe casting and were held in place with wedges. For the model, I felt this reduced the flexibility of fitting the arms and would be quite difficult for many builders to machine, so I made the bosses part of the arms and fitted them to the mainframes with bolts.

To machine the arms, begin with a length off 8mm dia. EN1A mild steel, square off the end in the lathe and cross drill the hole that goes through the ball end. Rechuck in the lathe and, with a form tool, turn the ball (photo 94).

The form tool can be made from gauge plate and, after hardening and tempering, polish the cutting edge with a fine oilstone. The better the finish on the tool, the better the finish on the work.

Turn a shallow groove in the bar to show the end of the arm. To position the groove I put the shank of a drill in the hole and brought the parting tool up to touch it. The dial was zeroed and then the end of the arm found using co-ordinates.



The 2.5mm land can then be machined with the parting tool. Then set over the top slide to about 1½ degrees and turn the taper. I found that a short parting tool was very useful for this job. I have one with a 3mm wide cutting face and cutting edges at the sides.

The end can now be turned down to 7mm diameter. Transfer to the vice on the mill and machine the flat down to half the thickness (photo 95). A drill placed in the hole can be used to orientate the arm by sighting along the top of the machine vice.

Change to a centre drill, spot the bolt hole in the flat and drill through. Turn through 180 degrees and spotface the round surface to form a seating for the bolt. Part off and face to length. The completed arms are shown in photo 96.

Governor gear horizontal shaft (Part 56)

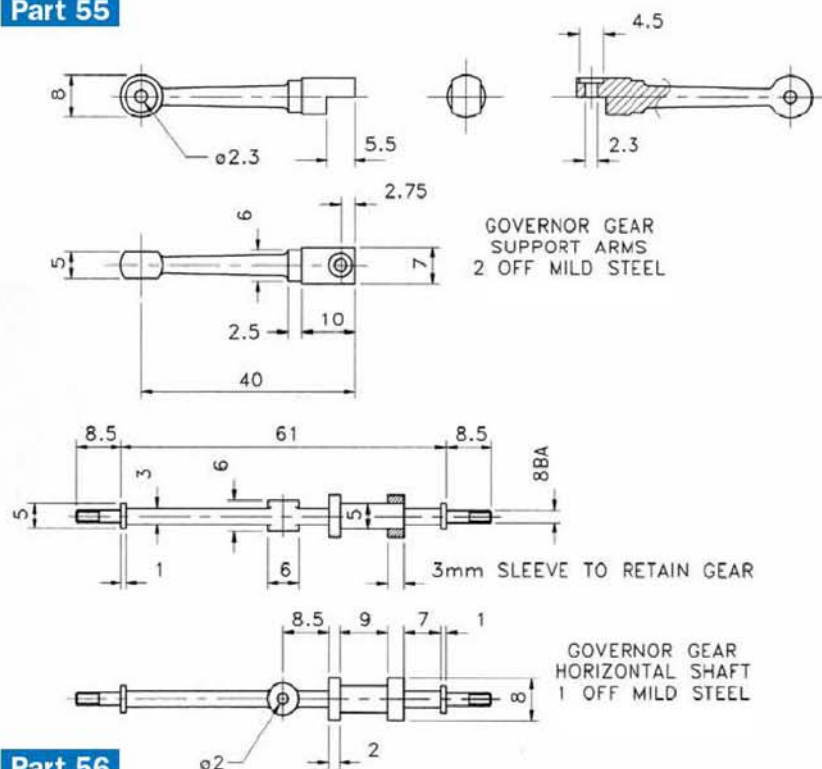
The shaft that carries the governor bevel gear between the support arms is quite flimsy and making it requires a little forethought to avoid wrapping it around the chuck!

Using a piece of 9.5mm (¾in.) EN1A mild steel rod, face



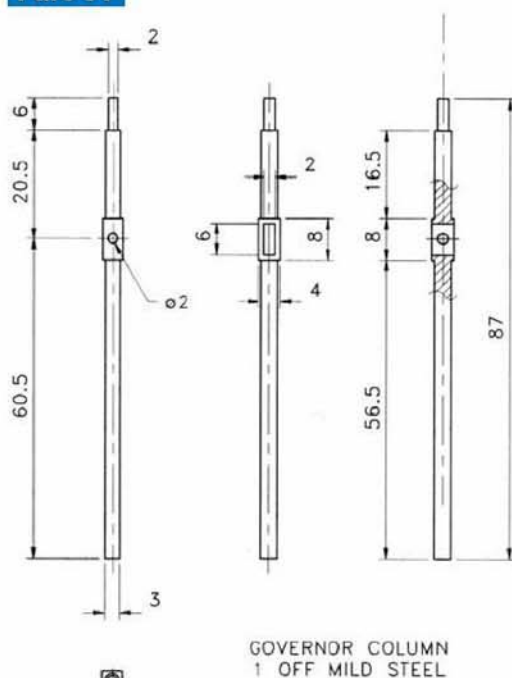
off the end, then cross drill for the pivot hole using the milling machine. Mount the shaft in the dividing head and machine a 6mm square around the drilled hole; take care that the faces are 'square' to the hole. Return to the lathe, turn down

Part 55



Part 56

Part 57



1st ANGLE PROJECTION

the end and thread 8BA using a tailstock die holder.

Make up a dummy centre from 6mm dia. rod about 12mm long. Drill right through and tap 8BA; counterbore one end to clear the plain portion of the spigot and lightly centre the other end.

With the minimum of material protruding from the chuck, and using the dummy centre to give tailstock support (**photo 97**),

turn down the 5mm dia. region and polish to give a close running fit with the gear.

With more material protruding from the chuck and still using tailstock support, turn down to 8mm dia. up to the square block. Next, machine the recess between the block and the flange, using a short parting tool. I have a special 3mm wide parting tool ground for this sort of work, with cutting edges on the sides as well as the front so that the tool can be traversed sideways, to get a good finish. The 3mm width of the tool tip is helpful in sizing the width of recesses.

With even more material protruding from the chuck and still with tailstock support, machine a shallow groove to mark the edge of the flange. Then, beginning at the central block and using the special parting tool, take a series of cuts working to the left to turn down the long recess of the shaft. Machine the diameter almost to size. Finally, use 'just a scrape of a cut' to clean up the whole surface. Only increase the depth of cut at the chuck end where it is stiffest.

Machine the 5mm flange and turn down the 2.3mm diameter for the other spigot (**photo 98**).

Part off and reverse in the chuck to cut the other 8BA thread with the tailstock die holder.

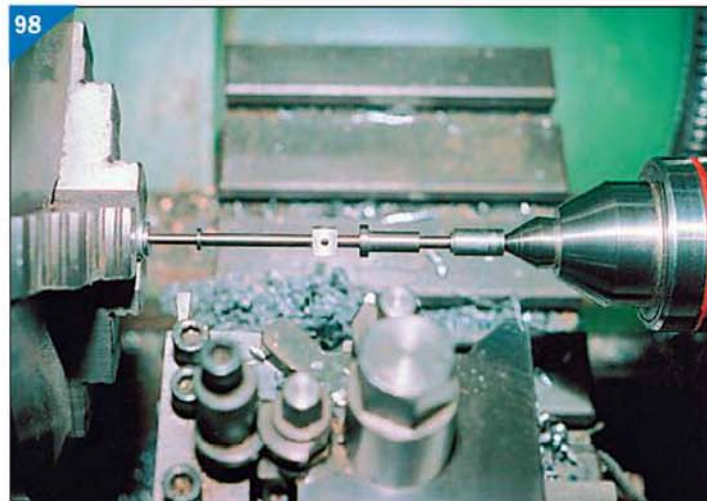
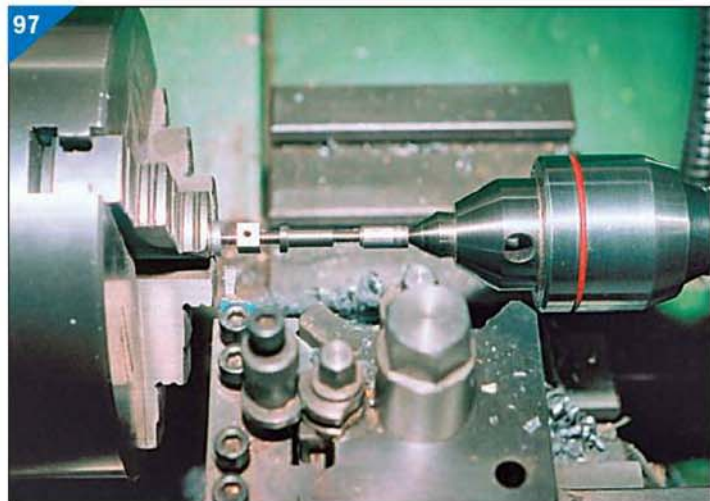
I have shown the centre boss as a round region on the drawing, as it was on the prototype, but it is much easier just to leave it square. To make it round, it can be mounted on a threaded arbor and each side turned down to size. The centre section, however, will have to be filed to shape and merged in with the other surfaces.

Governor column (Part 57)

The governor column is another slim item so, again, care is needed. Begin with

97. Machining the governor gear horizontal shaft using a dummy centre.

98. Machining the LH end of the governor gear horizontal shaft.



4mm square section mild steel stock and, after facing off the end, lightly centre. Using the point of the centre drill spot for the cross hole, but do not drill it yet as it will seriously weaken the shaft.

Turn the shaft through 90 degrees and spot the centres for three holes to begin forming the slot. The two outer ones can be drilled 2mm but the centre one should be drilled about 1.5mm to avoid the drill running off and down one of the other holes. Once it has been drilled 1.5mm it can be opened out to 2mm - the larger drill will follow the smaller hole.

Using a 2mm slot drill, open out the drilled holes into a slot. As I have mentioned before, only plunge the cutter in a few thou' at a time, then traverse sideways to clean up the slot. Too much side force on these tiny cutters can easily break them.

The corners can be squared out with a ground down Swiss square file.

Many years ago I came across a type of saw blade, the same length as a piecing saw blade, but available in sizes such as 1.6mm 2mm, 2.5mm and 3mm widths. These would be ideal for squaring out corners, but I have not seen them on sale for a long time.

Set up in the lathe using the SC 4-jaw chuck with about 12mm proud of the chuck and turn down to slightly over 3mm. Pull out another 12mm and do the same, continuing until you approach the square centre section. Then, using tailstock support, take a shallow cut to

clean up the surface and bring to finished size.

With more material protruding from the chuck and still using tailstock support, turn down the top end of the other side of the square block. Leave this section slightly over size. Turn down the 2mm dia. pivot (**photo 99**), and part off.

Chuck near the square section and, with a very fine file, dress the top region until the end just enters the bevel gear. Very close fits of small diameter similar material, often pick up and lock together. To avoid this oil the surface beforehand. If you forget the oil you can sometimes free the parts with a squirt of WD-40.

The aim of the fit is for the bevel gear to push on most of the way and then to tighten towards the bottom. There needs to be a little adjustment to ensure the two gears mesh freely.

Complete the column by cross drilling the square block for the pivot pin.

Foot bearing (Part 58)

The foot bearing that supports the bottom of the governor column, which can be made in brass or better still bronze, is a simple little top hat-shaped turning. The bearing surface is ideally reamed.

Governor slider (Part 59)

The governor arms are connected to the slider, which transfers the movement to the fork arm. To make the slider: start with a length of 13mm dia. mild steel; turn down to



9mm, then the 5mm dia. and form the groove with a parting tool. Centre and drill down 2.8mm dia. for say 15mm deep in the milling machine and, with a slitting saw, machine a 2mm wide groove in the end.

Form the ears from a length of 3mm square section mild steel. Drill the two pivot holes and reduce to 2mm thick; the ears need to be a fairly tight fit in the groove. Round the ends and, after fluxing, lay on a firebrick ready for silver soldering.

You do not want to swamp the joint with solder so use a fine wire. Heat up with a smallish flame (they are only small parts), and just touch the joint with the end of the solder, which will quickly run around the joint. Turn over with tongs and check that the solder has penetrated right through, if not, continue heating and touch the other side with the end of the solder.

99. Machining the upper pivot of the governor column.

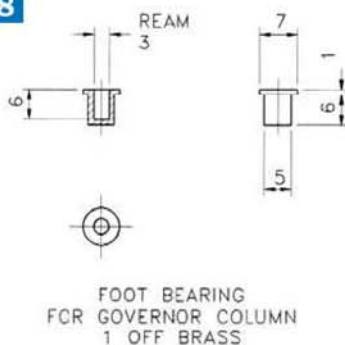
It is a pity that silver soldering discolours metal so much. To remove the discolouration, first try using a wire brush, which should remove most of the discolouration; check with an eyeglass and file off any unwanted solder.

Return the part to the lathe, re-center the end, drill 2.8mm to clear the hole and part off. Reverse in the chuck - this is where a 4-jaw self centring chuck will score as the ears will be clear of the chuck jaws. After facing the end, centre and drill 2.8mm dia. to meet the part drilled hole from the other end, then ream 3mm dia. to finish the hole.

Finally, check the governor column in the hole - it needs to be an easy sliding fit.

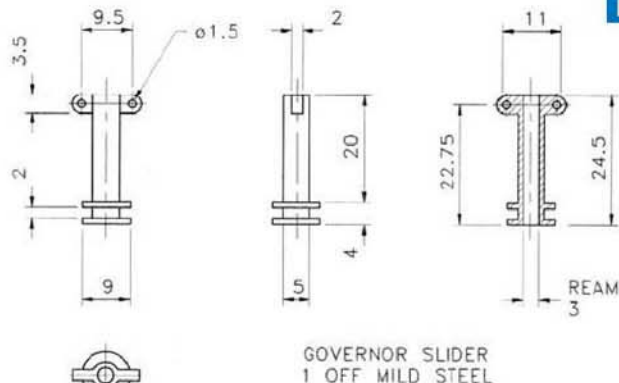
●To be continued.

Part 58



1st ANGLE PROJECTION

Part 59



Making Glow Plugs



CHARLIE
STONE

Charlie Stone conducts some experiments and makes his own glow plugs.

I expect that most model engineers will be familiar with model aircraft engines that use glow plug ignition. The glow plugs themselves are readily available commercially and come in several styles, diameters, element designs and heat ranges. The most commonly used types have a platinum alloy coiled element contained in a standard $\frac{3}{16}$ in. hex. steel body with a $\frac{1}{4}$ in. x 32tpi UNEF threaded section. Those are the types I mostly made, although I have also made $\frac{3}{16}$ in. plugs for an older engine (**photo 1**).

I began the project partly from curiosity about how design features affect the performance of glow plugs and partly because I already had some wire that I thought was platinum. In the process of making a few enquiries about what welding system would be needed, I contacted a person who had some experience with the commercial manufacture of glow plugs. He told me that it couldn't be done in the home workshop. I thought that he was wrong. I can now say for certain that it can be done, using my primitive methods, but it is very labour intensive. I realise that I was re-inventing the wheel, and it is a lot easier to just buy plugs, but I enjoy experimenting and have learned a lot along the way.

1. Left to right: Glow plug made to replace a $\frac{3}{16}$ in. spark plug in a vintage engine and two $\frac{1}{4}$ in. standard plugs.

2. Transformer and timer bolted to the foot of the machine.

3. Copper block holding the electrode.



Wire drawing

Some time ago, I was given about a foot of 18 thou' dia. wire made from a soft white metal that I thought was platinum. I gathered it up and carried it off to my lair with the thought of glow plug going on and off in my head like a neon sign. However, my attempts to prove what the material was came to nothing. I concluded that it could be platinum, but I still wasn't sure. The simple test was to try it and see if it worked. Another problem was that most glow plugs use wire between 6 and 10 thou' dia. whereas this was rather too heavy at 18 thou' diameter. Fortunately I have a good mate, Graham Ockleshaw, who knew how to deal with this. Graham is a skilled engineer and modeller. He helped me out by making a drawplate with the right sized holes for reducing the wire diameter and, as a bonus of course, increasing its length.

For those unfamiliar with a drawplate: this is a steel plate (about 16 gauge in this case), with a series of holes progressively reducing in area by a few percent with the smallest hole having the diameter needed for the finished wire. The holes each have a small entry taper or radius that blends into the hole. In use, the end of the wire is reduced in diameter until it can be poked through the plate from the entry side so that enough projects allowing it to be gripped firmly. I used a surgical tool called a haemostat (forceps) to grip the end of the wire. Then, with a liberal application of oil to lubricate it, I applied a firm and steady pull on the wire to drag it through the plate and reduce the diameter. This process was repeated until the wire was the required size. Some metals would require occasional annealing between stages, but this was not a problem with the soft wire that we were using. Drawplates are also used by jewellers to draw

down precious metal wires in a variety of sections including oval and square.

Initially we drew the wire down to 8 thou' dia. as that seemed to be the size used in several brands of commercial plugs. That resulted in a much greater length of wire than we started with. Later we reduced some of the wire to about 6 thou' dia. to make a hotter plug. The heat range of the plug is one of the things that can be varied to adjust the ignition timing of an engine. Thinner wire, or a larger diameter hole that the coil sits in, makes the plug hotter. Thicker wire, or a smaller diameter hole, makes the plug cooler. I used 0.0065in. dia. wire for most of my experiments; about 1in. of wire is needed per plug.

First experiments

My first experiment with a 'home-grown' glow plug was to fit a new element into an old brass knob KLG plug. The KLG is an early design that is fairly easy to dismantle - unlike the vast majority of modern designs, which have the top swaged or crimped over to hold all the bits in place. I thought it was necessary to take the plug apart to install the platinum element. I took one to pieces and fixed the replacement element in position mechanically. I swaged the wire to the centre post and, after the plug was reassembled, crimped the free end of the wire into a slot in the body. I managed to reassemble the plug and it did finally work as required. However, in the process, the element coil had taken on the appearance of having passed through Grandma's mangle! From the effort it took to keep the fragile element intact, while putting the plug back together, it was obvious that there had to be a better way.

Plan B

After some thought, it occurred to me that it would be much better to assemble the plug and add the element as the final operation. In fact, this is the method used by some commercial manufacturers. I pictured the coil being wound on a mandrel of the required diameter and then placed on an electrode of the same or slightly smaller diameter fitted to the welder. After centring the coil in the plug cavity, it could be welded to the centre post. The electrode could then be withdrawn and used to weld the free end of the coil on to the body of the plug. This would also mean that old blown plugs could have a new element fitted as long as the body was in good condition and leak free.

Welding - the electrics

With this in mind, I dug into my stock of 'things that might be useful one day' in search of things that could be converted into a spot welder. The first item I unearthed was a substantial transformer. It was a heavy-duty unit, but the secondary windings, which, as usual were the outer layers of wire, were not suitable for my purpose. I carefully removed them taking care not to disturb or damage the primary which was wound closest to the core. This left me with enough room in the frame to insert a secondary winding made of 4 turns of insulated automotive starter cable (photo 2). The conductor size was a bundle of copper strands of about 6 mm in diameter. I left plenty of



spare cable at the ends of the coil for termination on to the mechanical parts of the welder. The four-turn secondary winding gave an output of 3 volts and more than enough current.

Figure 1 is a simple electrical diagram of the element welder.

£350 or two bob

At this point I was visited by a fellow aeromodeler who is in the business of servicing electronic control systems for machinery. He saw the transformer sitting on my bench and, after finding out its intended purpose, he told me that it was old technology (I knew that already). He said it would be better to get, and adapt, a modern electronically controlled welder that could be switched to provide a very high energy pulse of a few nanoseconds at the peak of the cycle for improved welds. Nowadays they were quite

cheap and would only cost about £300 to £350!

I considered this for about the same number of nanoseconds that one of these wonder welders would take to work its magic. I decided that since I was doing this for my own amusement and might only produce a dozen plugs, it would hardly be cost effective. Besides, I believed the chap who once told me that an engineer is a bloke who can do for two bob what any fool can do for a quid. Not only was my way closer to the two bob option, I was sure that Ray Arden, who introduced the glow plug to the modelling world in 1946, didn't have any electronics in his welder.

The way in which I controlled the amount of energy into the workpiece was twofold: Firstly, I fed the mains voltage to the modified transformer via a Variac (variable

autotransformer), so that I could change the input voltage and hence the output. After experimenting the output was reduced to exactly two volts. Secondly, the input voltage duration was controlled by a small industrial timer that was finally set to 0.8 seconds.

My welding machine

Having decided on the electrical system, the next step was to decide how to hold the plug and electrode in order to direct the energy in a controlled way to where it was needed. I had a small, unwanted, drill press in my junk collection and that was modified to do the job. I discarded the motor, belt, and spindle assembly leaving just the hollow quill, which could still be lowered and raised by the feed handle, but without the return spring. I used a Perspex (acrylic) insulating block fitted with a copper centre in place of the lower bearing (photo 3). The copper centre was drilled axially to hold a 1/4 in. dia. copper electrode that can be raised or lowered in the holder and retained with a thumbscrew. The copper centre was also faced flat on one side and drilled and tapped for a bolt to clamp the lug soldered to one end of the transformer's secondary winding cable.

The other end of the transformer's secondary winding cable was fixed to a copper clamp used to hold the plug in position while being welded

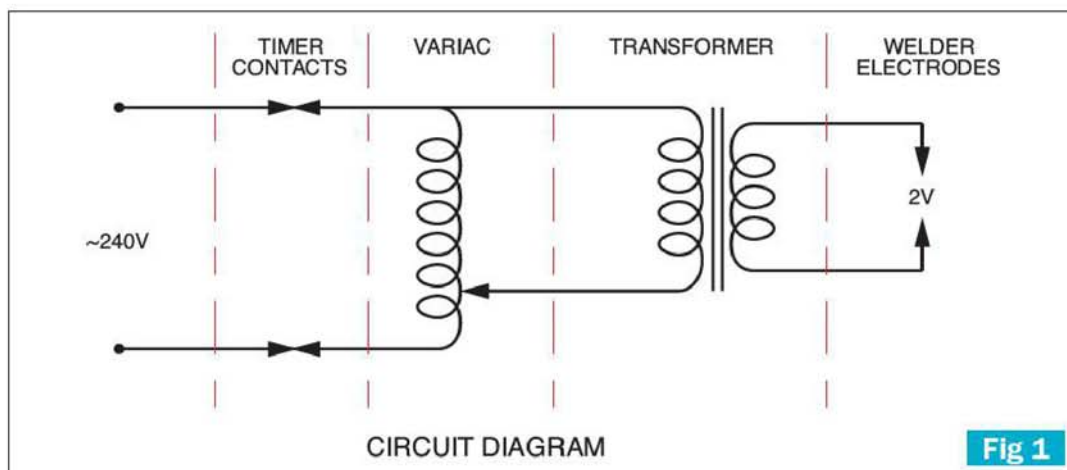


Fig 1



(photo 4). This clamp is held in a small drill vice on the original drill press table. To tidy up all the loose ends, the transformer, timer and its switching relay were bolted to the foot of the drill press frame immediately below the worktable. This made a solid and fairly neat unit (photo 5).

4. Lower electrode held in a small drill vice.

5. Complete welding machine.



Testing the welder

With the welder assembled, it was time to see if it worked: after a bit of experimenting to find the best voltage and welding time, my first attempts at fixing the wire to the outside of an old sacrificial plug body were crowned with success. The electrode that I used had a conical end with a contact region of about $\frac{1}{32}$ in. diameter. The contact pressure on the electrode was provided by a light tension spring attached to the press handle and temporarily hooked to the table. After a short session of self-congratulation, I set about welding a preformed element coil into the plug cavity. That was a failure!

Identifying the problem

The element coil that I was trying to weld to the centre post, down inside the plug, was wound on a $\frac{1}{32}$ in. mandrel. I had turned the electrode down to fit inside this coil and press on the wire end formed across the diameter of the coil. I thought that when the power was turned on, this end would be welded to the centre post. However, what actually happened was that the wire end became embedded into the electrode and the coil just came back out as the electrode was withdrawn. I decided that there was just too much energy for the size of electrode so using preformed coils of that diameter was not possible with this welder. Since the external welds had been successful with a sturdier electrode of lower

resistance, it seemed that I would need a similar electrode for welding inside the plug.

Next I tried welding a single uncoiled wire to the centre post with the sturdier electrode. That worked well. Clearly, I had to work out how to wind a coil down in the cavity of the plug!

Element winding in situ

I devised little winding tools having mandrels the diameter of the inside of the coil (photo 6). Sliding on the mandrel is a winding tool that fits neatly into the 0.113in. dia. plug cavity (fig 2). The drawing shows the slot that the element wire feeds through as it is being wound on to the mandrel. Note that the slot is deliberately cut at an angle and stops before reaching the central hole. Attached to the winding tool

Fig 2

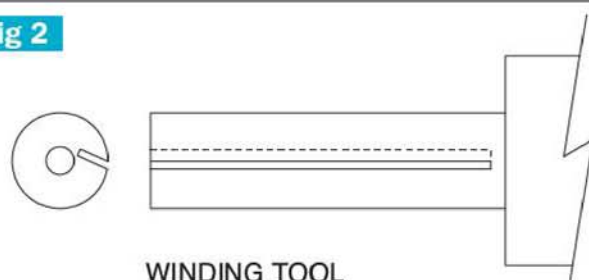
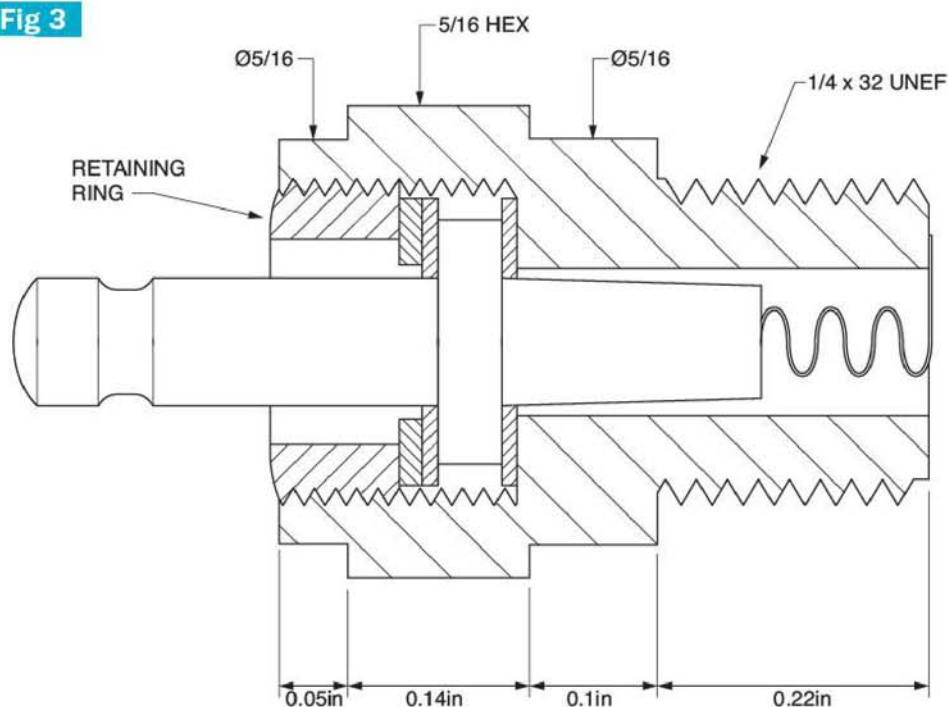


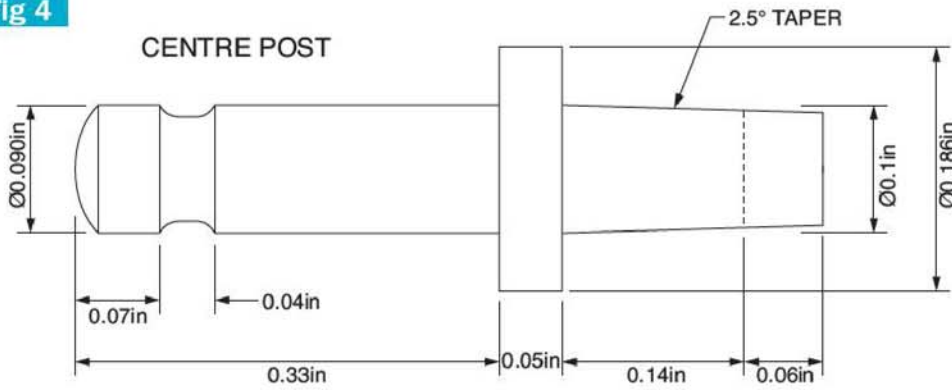
Fig 3



SECTION THROUGH GLOW PLUG

Fig 4

CENTRE POST



6. Two tools for winding element coils in situ.

6



is a wire finger that rests in a 50tpi thread on the mandrel. As the winder is turned, this finger acts as a guide to control the pitch of the element coil.

In use, the element wire is first welded to the centre post and the plug body held in the lathe chuck. The mandrel, with winder in position, is held in the tailstock and brought up until it touches the centre post. The element wire lies in the slot of the winder and the winder finger engages the thread of the mandrel. The winder is then rotated carefully by hand so that the wire element is wound round the mandrel and when the winder is clear of the plug body, winding stops. The end of the wire will then be lying across the end of the plug body. It is necessary to rotate the chuck slightly to relieve the tension of the element on the mandrel. The mandrel can then be withdrawn carefully and the plug returned to the welder for the end of the element to be fixed permanently to the body of the plug.

Platinum wire

After some experiments fitting new elements into some commercial plug bodies, I found that they seemed to run cooler

than optimum for the rich-running stunt engine that I was using to test them. I was still in doubt that the wire that I had used was the correct material. I needed to use commercial glow plug element wire as a reference. I contacted the manufacturer of a brand of glow plugs made here in Western Australia. They very kindly agreed to sell me a short length of the element wire that they used in their glow plugs. His wire is sourced from an American firm called Sigmund Cohn Corporation. The alloy used is 87% platinum and 13% rhodium. Since then I have managed to get another short length of the same alloy wire from a chap who manufactures thermocouples, but since this is 0.5 mm dia., I will have to see Graham again about using the drawplate.

Making glow plugs from scratch

While I was waiting for the element wire to arrive, I made an initial batch of six plugs of my own construction so that I could say that I had done the lot and not just repaired commercial plugs.

Figure 3 is a cross section through the glow plug body. These are turned from 1/16in.

hex. mild steel that I heat to blue for appearance - most commercial plugs are either plated or chemically blackened.

Figure 4 shows the mild steel centre post with dimensions suitable for use with an 0.046in. I/D element coil. The tapered part below the flange should be 0.2in. long. For use with an 0.031in. I/D element coil, reduce this length to 0.14in., as shown by the dotted line. **Figure 5** shows the brass retaining ring that locks the centre post against the seals. The outside is threaded 1/4in. x 40tpi and it has a 5/32in. hex. broached hole to provide a means of screwing it in. It is installed and tightened down on to the seals with a tool that is in effect just an Allen key with a hole drilled axially to fit over the centre post.

The centre post must be sealed to prevent gas leaks and be thermally and electrically insulated from the body. The insulating washers immediately above and below

the centre post are made from 0.015in. thick heat resisting gasket material called Klinger Oilit. These washers are 7/32in. O/D and 0.100in. I/D. The sealing washers also align the centre post, keeping it central during assembly of the body. A separate thin steel washer is fitted between the top sealing washer and the retaining ring to protect the soft washer from being damaged when the ring is tightened down. The steel washer is 0.020in. thick, 7/32in. O/D and 1/16in. I/D.

I made plugs with two types of element, the dimensions of which are as follows:

Elements with 0.046in. I/D coils have five turns and fit in a 0.113in. dia. hole (No. 33 drill) 1/16in. deep in the plug.

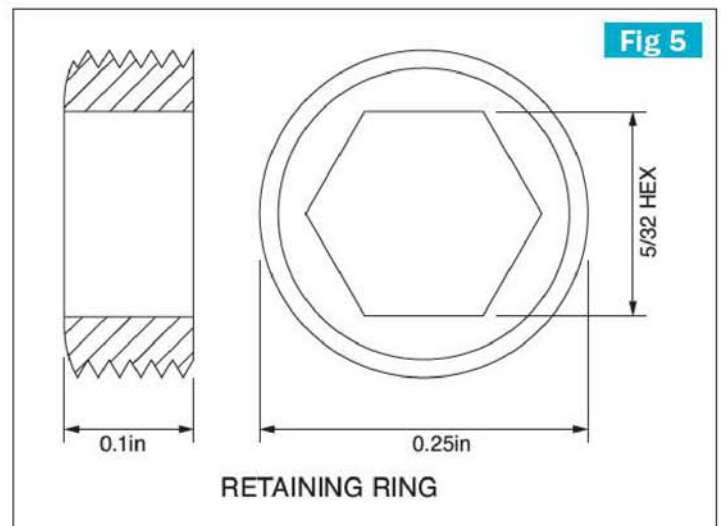
Elements with 0.031in. I/D coils have seven turns and also fit in a 0.113in. dia. hole but which is 3/16in. deep in the plug.

The current path that heats the coil is from the centre post, through the coiled element to earth via the body of the plug. Once the body was assembled, I use an ohmmeter to check that there is no electrical contact between the centre post and the body before the coil was welded in place.

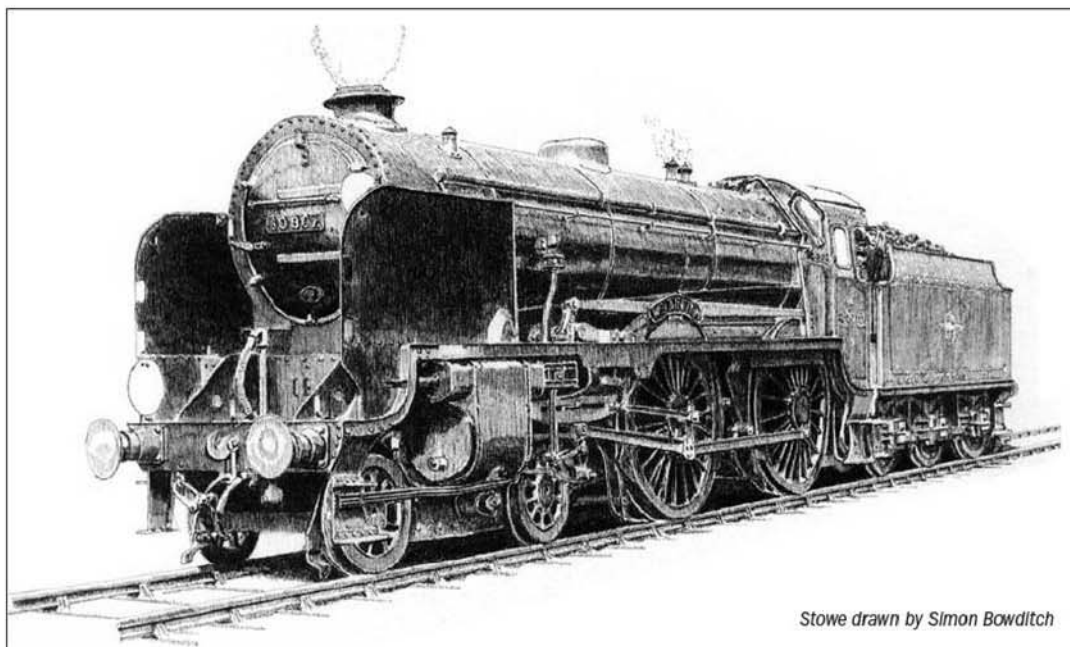
I am please to say that both versions of the glow plug work very well.

ME

Fig 5



STOWE - Southern Railway Schools class locomotive



Stowe drawn by Simon Bowditch

rather obtrusive ribs form part of a subassembly, which is screwed to the base of the box. The axlebox front is held on by means of two 12BA studs and nuts, and locates the lubricating tray, which in full size contained various pads that were soaked in oil and pressed against the axle journal. All quite straightforward and should present no difficulty to anyone who has, for instance, laboured through the Schools valve gear assemblies.

I have included drawings of both the spoked and disc tender wheels. The first five locomotives were supplied with spoked wheels. Later engines were fitted with discs. These disc wheels were perforated with holes, but I cannot find any information as to their number, exact size and position. I think that there were three holes and the size and location which I've specified certainly seem to fit. Most of these disc wheels seem to have been replaced by those of the spoked variety as and when they were available. Photographic evidence is not as plentiful as one would imagine, as most people wanted to obtain a three quarter front view of the smokebox, which



NEVILLE EVANS

Neville Evans describes the axlebox assemblies and springs.

PART 27

Continued from page 573
(M.E. 4338, 7 November 2008)

Hello again fellow conspirators, as the great Curly Lawrence, better known as LBSC, would have said. I'm sorry about the short break, but I needed a bit of a rest. I'm not getting old, I've got old, what I'm getting now is older and at a frightening rate. Note too that the article numbers have reappeared at the beginning of each gripping episode so that I can at least keep track of where I am.

The tender axlebox assemblies

As can be seen from the artwork, the axlebox is a great big lump of metal. It looks to me like an example of over design in the best Teutonic tradition; I suppose that things like axlebox fronts, chimney and dome shapes and the rest, were part of the trade marks of the various companies and that we should be thankful for a bit of variety. I don't know whether or not the box will be available as a lost wax casting by the time you read this, if not, don't worry as it is quite a simple

piece of fabrication, which will I'm sure represent a very worthwhile saving, as the cost of any sort of casting seems to be going through the roof. The assembly can consist of four easy to make parts which assemble into a rather complex looking whole. The main axlebox is merely a machined lump of brass, which houses the all-important roller bearing. There are two stiffening ribs on the underneath. These



1. Original horn stay but a different pattern of axlebox front.



didn't give a lot of tender detail. All the preserved locomotives have spoked wheels, so no help there then.

The axles are plain lengths of half-inch diameter silver steel. I have never seen the sense in buying a piece of ground, round bar and then turning lumps off, destroying the integrity of the whole thing. I have specified my usual roller bearing.

Unfortunately in this small size I have yet to find a sealed bearing, which means that annual inspection, cleaning and oiling is probably necessary. Whatever you do, don't over-oil as this may damage the rollers. Note that the bearing should be squeezed slightly on assembly; I find that a nice tight fit is all that is needed to ensure that the rollers engage all the way round the axle. I never harden the axle ends as silver steel is pretty tough stuff in its

own right. I intend to detail an axle pump, which will work on the rear axle. I tried one of these on a Gauge One 4-6-0 many years ago without success as the little tender simply was not heavy enough. Since seeing one on that lovely little Southern Railway Q1 at the Midlands exhibition I decided to have another go using



a sealed ball race eccentric. It seems to be very satisfactory. Watch this space....

The springs

All quite straightforward, but note that the top four springs are 0.044in. thick and the other 12 are $\frac{1}{32}$ in. Everyone seems to have his own idea. David Aitken uses a bank of phosphor bronze springs on his $1\frac{1}{2}$ in. scale Collett Goods. These springs have rectangles milled out of the insides to increase flexibility, and seem to have just the right amount of movement. I was given a long strip of nickel silver the other day, which seems to be beautifully springy. There is also the time honoured dodge of using strips of Paxolin

or such as a filler, with spring steel leaves top and sometimes bottom. I must say that I have never particularly liked this method, as I don't feel that too much flexibility in the springs is a particularly good idea.

The springs are suspended in the prototypical manner using tight fitting cotters on the ends of the spring rods. Also note that I have specified a locating rod that passes through the centre of the leaves. This buckle pin could even be turned from a long 8BA hex headed screw leaving $\frac{3}{32}$ in. or so of thread at the head end as per drawing.

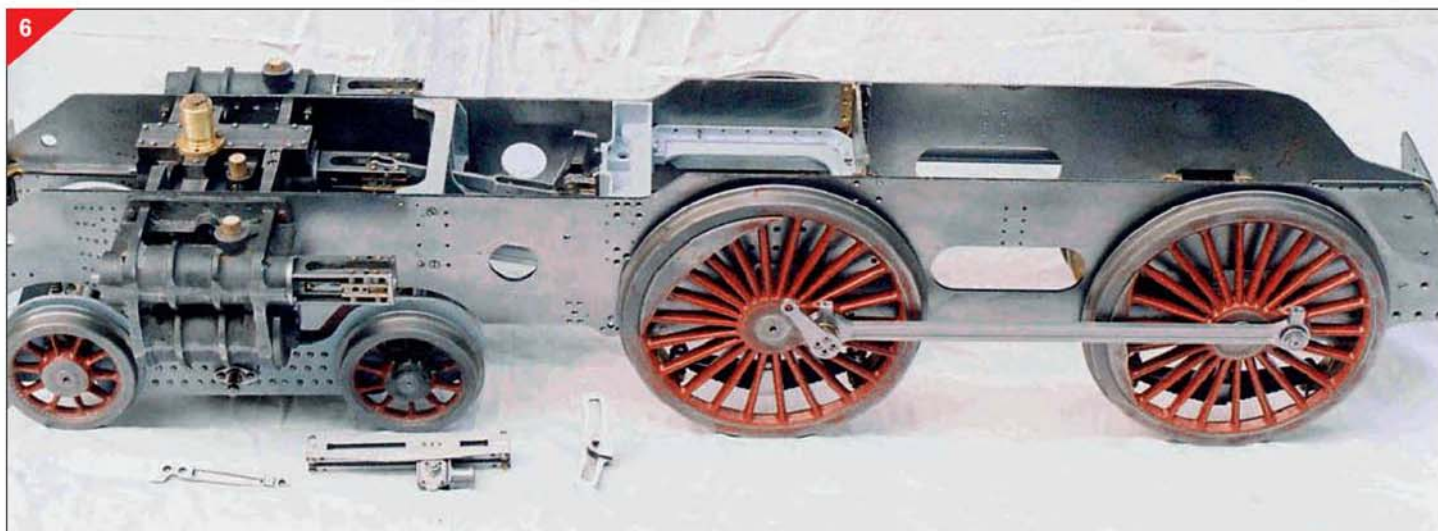
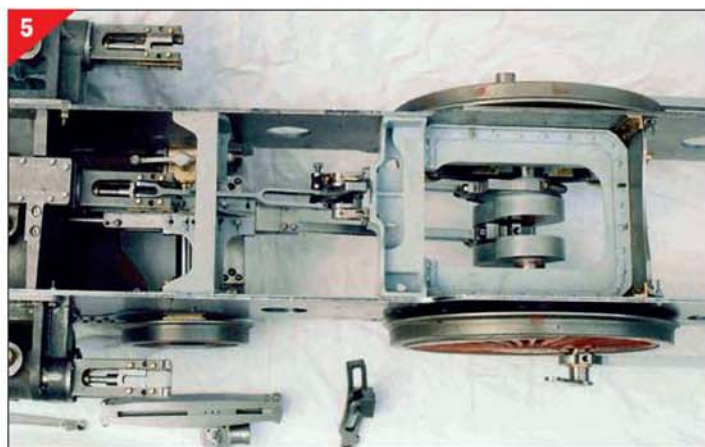
● To be continued.

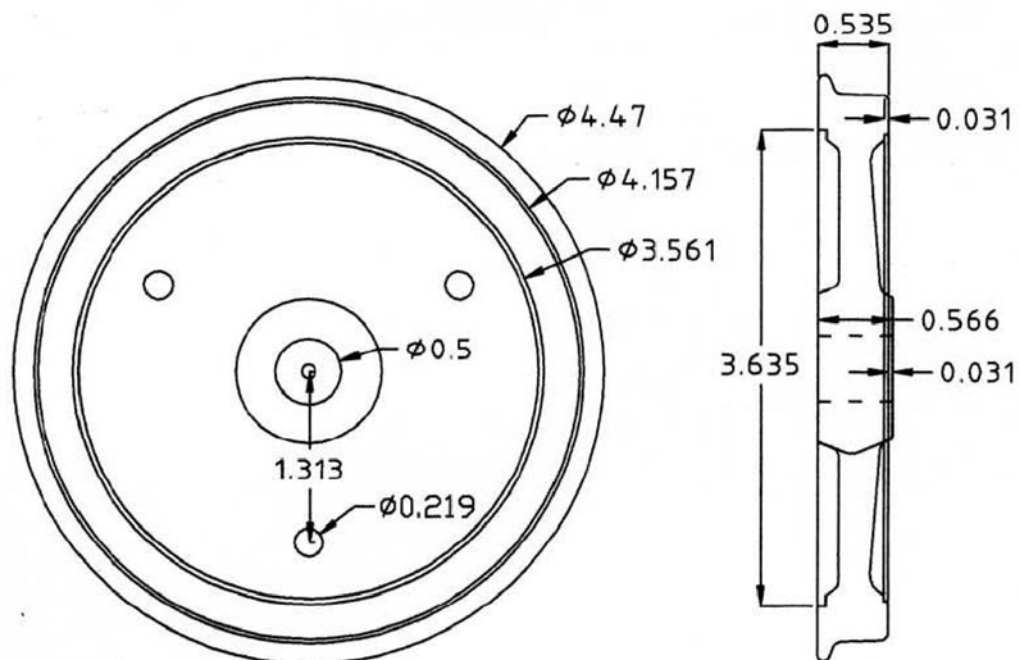
2. Shows the spring brackets well.

3. I like this little photo of a lamp bracket from Repton.

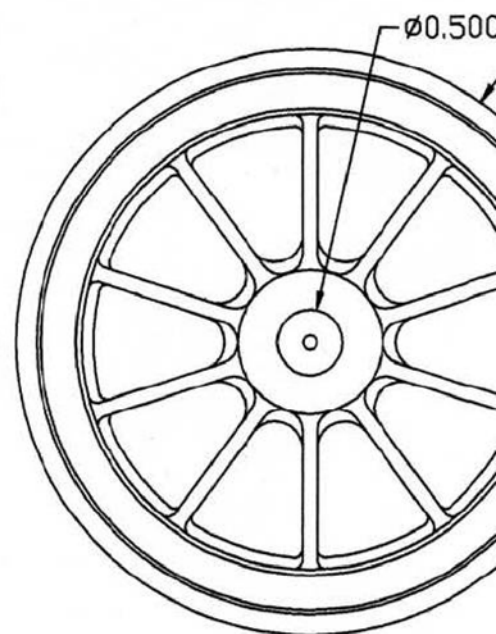
4. Note that the axlebox front is original but the horncheek stay is flame cut.

5 & 6. Progress so far on Paul Norrington's chassis - it runs very well on the inside cylinder.



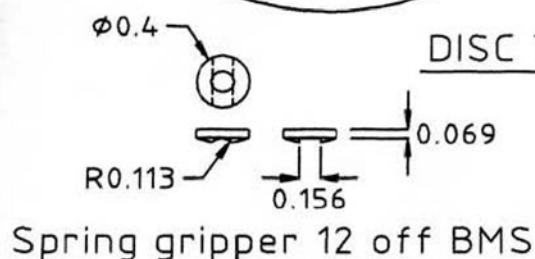


DISC TENDER WHEEL

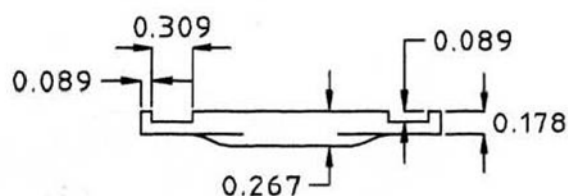


SPOKED TENDER WHEEL

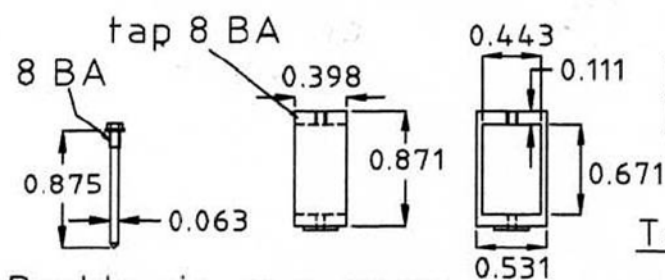
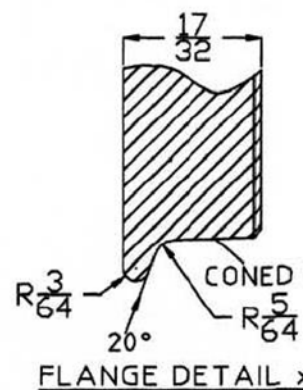
Set wheels 4.688



Spring gripper 12 off BMS

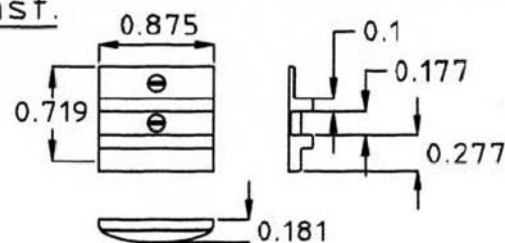


Tender horncheek stay
6 off LW cast.

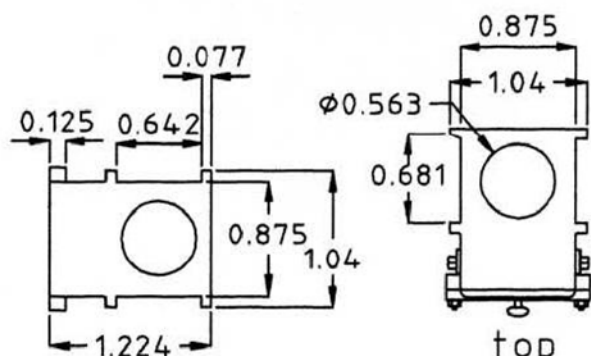


Buckle pin

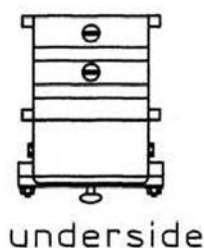
Spring buckle 6 off BMS



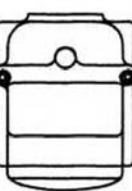
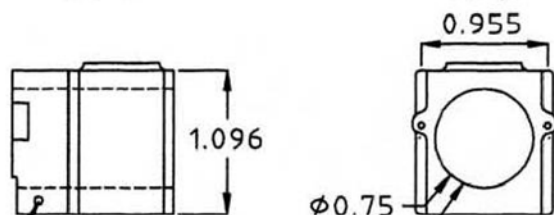
Bottom ribs 6 off Br.



top



underside

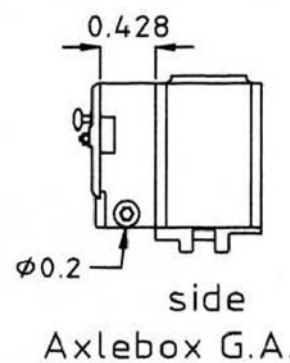


front

Tap 10 BA

Use 3/4" x 1/2" x 1/2" needle roller

Axlebox main body 6 off br.



side

Axlebox G.A.







Ying's Coffee Cup Engine



CHENG KA YING



HAROLD PEARSON

Cheng Ka Ying and Harold Pearson -
Tales of a junior model engineer.

1. The completed engine sat on a coffee cup.

Having retired two years ago, I have been able to spend more time on my lifelong hobby of model engineering. My workshop is setup in the downstairs kitchen of our house in Phnom Penh, Cambodia, where I now live with my Chinese wife and our two children from my wife's previous marriage. Our son is in his twenties and pretty well independent. Our daughter, Ying, has just turned 17 and is still in high school preparing for university. I have known Ying since 1998 when she was six years old. With her mother in full time work, Ying lived with her elderly grandparents and other close relatives - seven of them in two small rooms! Recently Ying has taken to coming downstairs to my workshop. Perched on the high

stool she watches me working, asking questions and showing a genuine interest. Recently, I was involved in a bit of difficult riveting - one of those times when you wish for an extra pair of hands. Ying, looking over my shoulder, asked if she could help, an offer gratefully accepted. I was impressed with her seriousness and the way she took care. She then asked if she could use the hammer and bash over a rivet! Reluctant at first, I thought why not let her have a go? To give her a bit of practice I drilled a couple of bits of scrap, off she went doing a great job with no half moon hammer marks. We completed the rest of the riveting in short order. Since then Ying has helped me on several occasions.

One evening, we had just finished reviewing her homework when she asked me,

"Dad can I make something in the workshop?" At that moment, not having the faintest idea of what the project would be, I said, "Yes, of course."

Ying is a persistent young lady and asked me constantly over the next few days if I had come up with a workshop project for her. After giving the matter some thought, I decided it would have to be something of a known design with drawings, in order that I could work through the preparation with her. Looking through some recent Model Engineer magazines I came upon the perfect project: Jan Ridders design for *A Coffee-Cup Stirling Engine* (M.E. 4329, 4 July 2008). Ying was immediately taken with the idea, her eyes lit up as she drooled over the pictures. **Photograph 1** shows Ying's completed engine.

This was in November with Ying heavily involved in schoolwork and exams coming up. We decided a start would be made in the first week of December during half term break.

Prior to cutting any metal we had to do some preparation. This took the form of Ying making a work list of all the components to be made and the materials required. I had realised from the start that some changes would be needed since not all the materials specified would be available in Cambodia. The first problem came with identifying suitable material for the displacer cylinder and top and bottom plates. A walk down the street to one of the many plumbing suppliers and we soon identified a heavy plastic pipefitting that would machine up nicely as the displacer cylinder. For the top and bottom plates, 5mm aluminium plate was available but, with very good local foundry facilities, I felt we would be better off having some castings made, therefore Ying's first job was to make a couple of patterns, one for the two plates and the other for the flywheel (**photo 2**). This was a good opportunity for me to give Ying a few lessons on materials including ferrous and

non-ferrous metals, and their properties. The completed patterns were sent off to the foundry with a promise of completion in a couple of days.

Ying already had some experience with bench work, cutting and filing as well as some time on my little Chinese drilling machine. Fitted with a ¼HP motor it can be brought to a standstill with a gloved hand! I think it's rated in mouse power rather than HP? Nevertheless, with care holes up to 10mm can be drilled. Personally, for safety reasons I do not like too much power in the home workshop and have down rated the motor on my Colchester lathe.

With the majority of the parts on the little engine involving lathe work, it was now time to introduce Ying to the lathe. She was a little apprehensive at first but soon gained confidence, encouraged by the ease of operating my elderly Colchester Chipmaster. The machine is very user friendly having a lovely feel that transmits through the users hands. After a little training and supervision I was told to stand back as she carried on making the six cylinder spacers.

We had an amusing little incident in the workshop one day when I dropped a small component on the floor, which instantly disappeared. After a couple of minutes on my knees unable to find it, I muttered something derogatory in reference to the workshop gremlin's parental heritage and stood up. Ying, looking at me curiously, enquired "What's a

gremlin?" As are most Asians, she is well into myths, mysteries dragons and the like. I thought this is going to be fun! I started by explaining that all workshops and mechanical devices such as cars, aeroplanes and even toasters had a resident gremlin, that they were little creatures who, in the case of a workshop, lived under the workbench. Anything dropped on the floor would immediately be snatched and hidden, perhaps never to be seen again. If the part was ever found it would be in a place a long way from where it was first lost. Another gremlin activity is to move objects such as spectacles, pens, spanners and other items from where they had been put down only moments before. Ying looked at me for a moment and asked, "Do we really have one in our workshop," then, "does mom know?" I had to turn away to hide my chuckles. The next day she came to me after school reporting that none of her friends or teachers had ever heard of gremlins. It was not long, however, before the little creature was up to its tricks in the form of a disappearing propelling pencil, in use one minute and gone the next! Ying wanted to drop something on the floor in an attempt to catch the little devil pinching it.

The sequel to the above is that, to some extent, I was hoisted on my own petard when my wife collared me wanting to know about magical beings living in the workshop. Some fast-talking was required and a bit of luck when her

attention was diverted by her ringing cell phone.

With the castings back from the foundry a start was made on the base and top plates. As the castings had chucking pieces, the first operation was to grip the outer rim in the four jaw chuck. After centering the chucking piece, we took a small cut to clean it up. Changing back to the three-jaw chuck, a facing cut was taken and the O/D turned to size (**photo 3**). We then took a small facing cut across the back without touching the jaws, to be used for clocking the face when the plate was reversed. Ying completed the second plate to the same stage as the first with very little supervision from me.

The next step required changing the chuck jaws. I attempted to explain the workings of a three jaw chuck but could see Ying was having a hard time understanding what I was talking about. However, I only had to show her once. Being a 'nasty old devil', I took all six jaws and mixed them up, handing them back to her to sort out. She gave me a look that I can't really describe, but I am sure can be imagined saying that if she succeeded, I would have to buy her a \$5 mobile phone card! Thinking I was on safe ground, I agreed. I should have known better; two minutes later I was \$5 worse off with the chuck sporting perfectly set reverse jaws.

Using a DTI we set the reversed plate to run true. I worked through the machining operations with Ying, doing the facing and the small recess that would hold the displacer cylinder. The top plate was left till last as it is a little more complex with an 8mm bored hole in the centre for the displacer piston rod bushing. Using a sharp pointed tool, a 105mm pcd circle was scribed for the cylinder spacers. The circle was indexed in three places using the jaws of the chuck, the other three holes were stepped off later with dividers and the top plate was used as a jig to drill the bottom plate. At this point I took time out to give Ying a



2. Cutting out the patterns.

3. Facing one of the castings.

few geometry lessons about the spacing of holes on circles, the maths and the realities of actual placement. Finally, a line was scribed across the centre to be used as a reference for positioning the bearing stand and power piston cylinder.

Saturday morning found my wife, Ying and me mounted upon my wife's little 70cc Honda motorcycle heading for the Japanese market (in Cambodia they get as many as five people on one small motorcycle). The market is so called due to its proximity to a bridge built by the Japanese. The market sports a number of well stocked bearing shops. Ying had become pretty proficient with my vernier calliper and, armed with the specifications, begun looking for suitable ball races. With the size called for on the drawings as 3mm I/D x 10mm O/D x 4mm thick not available, we purchased the closest at 4mm I/D x 12mm O/D x 4mm thick. We took them home, removed the seals and de-greased them with some paint thinner.

Being a bit tricky, I decided I would machine the bearing housing, Ying observed, learning about machining operations and their order. I made a small modification to the housing increasing the length by 5mm. I felt this was required given we were using larger bearings with a corresponding shaft size increase from a 3mm to 4mm diameter.



COFFEE CUP ENGINE



With all the lathe work completed we turned our attention to the displacer piston that calls for 4mm thickness polystyrene (PS) or balsa wood. I didn't think there was any chance of finding balsa wood locally so it would have to be PS. I had a good search amongst old packing boxes that had housed computers etc but found nothing of a suitable thickness. After some thought, I hit on the idea of slicing some PS rather like a loaf of bread. What was needed was a method to control the material thickness as it was cut. This was achieved using two bits of 4mm thickness Perspex laid flat, spaced on the bench and held in place with thin double-sided adhesive tape. With a 25mm thick slab of PS located between the Perspex strips, I took a new hacksaw blade and proceeded to make a horizontal cut using the Perspex strips as thickness guides for the blade to follow. After a couple of attempts I learned that by not trying to guide the blade, simply allowing it to 'float' through with only slight pressure to keep the blade in contact with the Perspex strips good results were achieved. A few rubs on some fine sand paper on a flat surface quickly took out any slight irregularities, leaving it nice and smooth with an even thickness. Using plastic covers from some old CD boxes, Ying made a template for the PS piston, which was trimmed to size with a craft knife, the centre hole being made with a small cutter specially made for the purpose. More old CD covers

were used to make the two piston support washers. Tip: the sharp point of the dividers used as a trepanning tool easily cut the thin plastic covers.

Construction had now reached a point where some assembly could take place. The crankshaft was assembled using Loctite. With the bearing housing set on the bearing stand, the flywheel could be spun. The assembly ran very freely but, even after some running in, I could not get it to spin for the 4 minutes suggested in the article, one minute being the best result achieved. However, one problem that had to be addressed was flywheel wobble. The flywheel is only 8mm wide at the hub with, in our case, an axle of only 4mm diameter. Cast aluminium is not the best material in which to make an accurate hole, in particular, one so small and short. Also, the one-sided pressure applied by the single screw used for clamping the flywheel did not help matters. We solved the problem by boring out the hub and fitting a bronze bush increasing the width by 3 millimetres. If I had to do the job again, I would make the hub with a collet arrangement, which would clamp evenly onto the axle.

Ying got on with making the power and displacement piston rods from 1mm brass while I made some small gaskets for the displacement cylinder, rod bushing, power piston cylinder and stand base.

We now had all the parts for a complete assembly at which time we balanced the flywheel. Ying was getting very excited so I sent her off to boil some water and find a suitable tin cup. I was somewhat worried after the earlier disappointing unloaded spin results, however, when we tested the completed engine it would spin for 20 odd seconds - well within the range recommended in the article. We set the cup up in my brazing hearth and, in order to give us a better chance whilst testing, a candle was put under the cup to keep the water hot. Movement was spectacularly absent, much to Ying's disappointment. I explained this was to be

expected on the first try and that we would soon sort things out. Two small problems were identified: the displacer piston was slightly touching the inner wall of the cylinder and there was an air leak between the top plate and the cylinder. Having fixed these we tried again. The engine just sat and, even with encouragement, would not sustain rotation. One thing that came to my attention was the workshop fan that puts out a fair old breeze. I turned the fan off and was greeted with a little yelp of pleasure from Ying as the little engine started to run (**photo 4**). It was soon rotating at a fair clip - I timed it at 150rpm or so. It would not do the 300rpm suggested in the text, but we were both very pleased with the results of our work.

The next day when Ying was at school, I stripped the engine down, cleaned all the parts, polished the flywheel, painted the displacer cylinder and the inner flywheel. Re-assembled, the little engine looks great. When Ying came home she was very pleased saying that she wanted to take the engine to school to show her teacher and friends. I said that would be fine but she should first clear it with her teacher and it would be better, for safety reasons if she did not try to run it. She was a little disappointed but brightened up when I suggested we made a short digital movie of the engine in action to show the class.

I would like to congratulate Jan Ridders on a super design that has given Ying and I a lot of pleasure and satisfaction in its making and running.

Ying says:

"I like to watch my father in his workshop as he works on his steam engines; sometimes I have helped my dad and enjoy working with tools and metals. Recently I have been thinking it would be good if I could make something. When I saw the *Stirling Coffee Cup Engine* in the *Model Engineer* magazine I liked the look of it very much.

With the help of my father we built a Coffee Cup Engine and I learned many things on the way: how to read a vernier calliper, marking out, drilling, how to use a bandsaw and safety in the workshop. The most challenging for me was using the lathe. For me it looked a big and powerful machine but I wanted to learn and providing I paid attention and gave the machine respect, it became fun to use, I liked it very much.

As we made more parts I became very excited to see my finished engine. When it did not work the first time I was very disappointed but my dad explained there are always a few problems with a new machine, it did not take long to fix the problems and get the engine going.

I am very pleased with my little engine that is very pretty and interesting to watch (**photo 5**). I will take it to school next week to show my friends."

ME

4. The engine running at speed.

5. Ying with her completed engine.





A beginner's approach to making a brass and aluminum chess set



MIKE FREEMAN

Mike Freeman makes a retirement present.

PART 1

Trying to combine hobbies is always a productive thing to do in my mind. As a novice model engineer I wanted a project that would teach me new skills in using the lathe, and the milling machine.

I have always believed that repetition enhances quality, and if I made a chess set (**photo 1**) not only would I learn how to turn tapers, ball shapes, and do some profiling but I would also have to produce like items, to the same standard. After all there are 32 pieces to make.

After deciding to make the chess set, my first task was to design the pieces and decide what size each piece should be. I used a small wooden chess set I had to set the ratios between the pieces. Then I looked at various chess boards for the square size, finally arriving at the height and diameter of each chessman

(and queen). When the set was complete, I intended to present it to my younger brother on his retirement from the Police Force. So I wanted to make it to the best standard that I could.

I decided to use brass and aluminum for the chess men because I wanted a set that not only would be very tactile, but also the finish would be distinct in regards to both sides or 'black and white'. I also liked the idea of heavy and light pieces when playing, as you would get used to moving your own men, but when taking an opponent's piece, there would be an additional experience of either a heavy, or light chess piece. Because of these weight differences there may be a benefit for blind, or partially sighted players.

The next stage was to get some drawings done and once the basic shapes were sketched out I then worked out

how to machine them. However, before too much time was invested, I thought I would try and make a pawn as a practice piece since it required both taper turning and a ball shape for its head. **Photograph 2** shows a finished pawn.

As neither turning balls, nor tapers are something I had done before or even knew how to do, it was into the books, magazines, and a search on the internet, to find out how you did both tasks.

Ball turning tool

I found two or three different methods to turn balls on the internet (no doubt there are many more), and these varied between using a form tool, and making a tool specifically for the task.

Since some pieces required a large ball I discounted a form tool and decided to make a special ball turning tool. This

1. The finished chess set.

2. A finished pawn.



would allow me to have a tool for future use, and have the flexibility of turning different diameters in the future. Additionally, since there were 16 pawns and four bishops to make, both with different radii, it made sense to invest the time to make the tool.

Once I decided to make a special tool the next decision was which one? In the end the final design choice came down to what materials I had at hand, so I went for the design shown in **photo 3**.

Bearing in mind my experience level at that time, making this tool was a major undertaking in its own right but I must say I was quite pleased with the results. Whilst not to exhibition standard, I made a

3. The ball turning tool.

4. A pawn blank with two marks.

5. Pawn with taper cut.

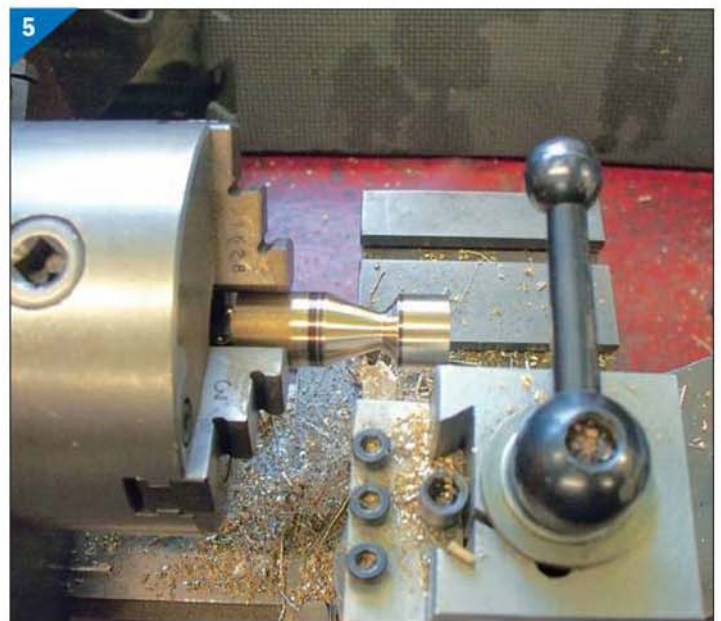
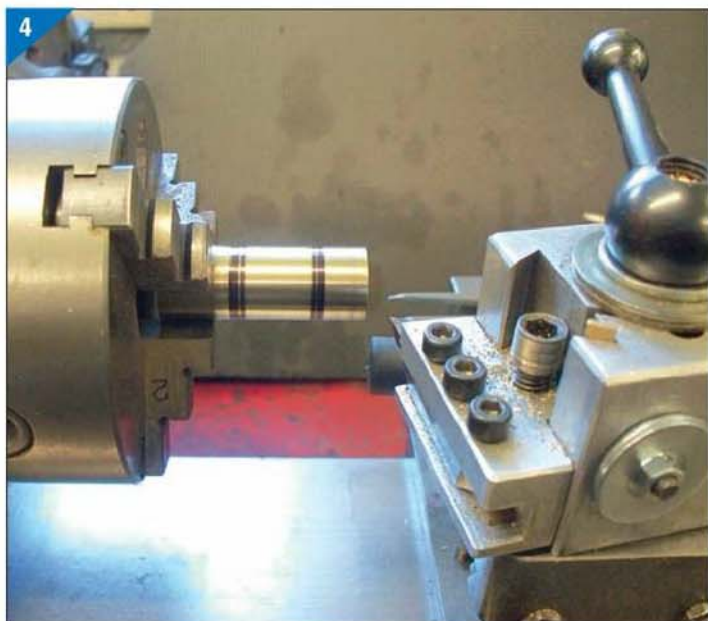


Table 1

Pawn 1.25in. (31.75mm) tall

1. Chuck $\frac{3}{4}$ in. (19.05mm) bar and measure $\frac{1}{2}$ in. (12.7mm) from the faced end.
2. Set top slide over to 20deg.
3. Make sure the top slide has enough travel for taper.
4. Start the taper at the $\frac{1}{2}$ in. (12.7mm) mark and work towards the chuck.
5. Cut taper to a length of $\frac{3}{4}$ in. (19.05) from $\frac{1}{2}$ in. (12.7mm) mark.
6. Use ball turning tool to turn the ball end of the pawn.
7. Always compare with the master pawn.
8. Always sharpen tools before starting another pawn.

tool that turned balls of variable sizes, and to a fine finish.

So, armed with the tool to turn the ball shaped heads, I then focused on how to turn tapers?

Taper turning

It was then that I discovered that the top slide actually moves around! My only lathe at this time was a small Myford ML10 and having located the two bolts on the cross slide I loosened them and swung the slide to a variety of settings. I made several cuts at different degrees of topslide setting until I found the angle I liked the best.

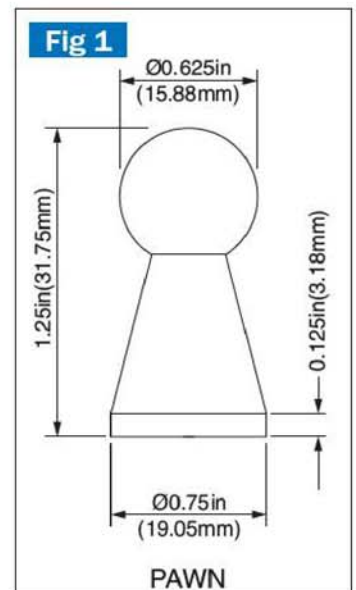
This simple task of taper turning to the experienced model engineer may seem so simple, but to me the results were most satisfying.

I now had the basic information and tools required for my pawn design so the next task was to decide how to machine the pawn itself. Since there were 16 pawns to make I

thought that some form of aide memoir (see **Table 1**) would be useful - and so it proved to be.

The first Pawn

The pawns are $1\frac{1}{4}$ in. (31.75mm) tall. I used aluminum for the first pawn, since I found it easier to turn at that time, and I had several $\frac{3}{4}$ in. (19.05mm) dia. bars in stock. Pawn dimensions are shown in **fig 1**. To make a pawn, first put a length of bar into the three-jaw chuck, leaving about 3in. (76.2mm) showing. After facing the end of the bar, measure back 0.500in. (12.7mm) from the faced end. I used a pair of dividers set to $\frac{1}{2}$ in. for marking the bar. The front $\frac{1}{2}$ in. will be left for the moment and will be for the pawn's head. From the $\frac{1}{2}$ in. mark, measure back towards the chuck another $\frac{3}{4}$ in. (or mark from the faced end back a total of $1\frac{1}{4}$ in. (31.75mm)). There should now be two guide lines as shown in photo 3.



Set the top slide over to cut a 20deg. taper between the two marks. The method I used when cutting the taper was to take very light cuts, moving from the chuck towards the faced end and finishing the cut at the $\frac{1}{2}$ in. mark. Then I moved the cross slide back towards the chuck and started again, continuing to cut the taper until it met the back mark (**photo 4**). Next I changed the cutting tool for the ball turning tool. The radius for the tool to cut is $\frac{1}{16}$ in. (7.9mm) and light cuts only are required to turn the ball. Continue forming the ball until it meets the taper neck. It may be required to take a further light cut or two off the taper until the neck and the head blend together.

The pawn now only requires a base of the original diameter left for $\frac{1}{16}$ in. (3.18mm) where it should be parted off. However, I took the opportunity of the pawn being held securely to polish it with metal polish impregnated cloth (*Using a polishing cloth in the lathe is considered unsafe, Ed*). This can be found in many large supermarkets. I protect the lathe bed, whenever polishing, using kitchen paper held in place with small magnets. It always surprises me how well aluminum polishes up, and how quickly it dulls again!

When satisfied with the finish, part off 0.125in. (3.18mm) from the end of the taper. This completes the machining and hopefully there is now the first pawn, looking something like the pawn in photograph 1. I marked my first pawn underneath as the master. This would allow comparison against a set standard. Only another 15 to go!

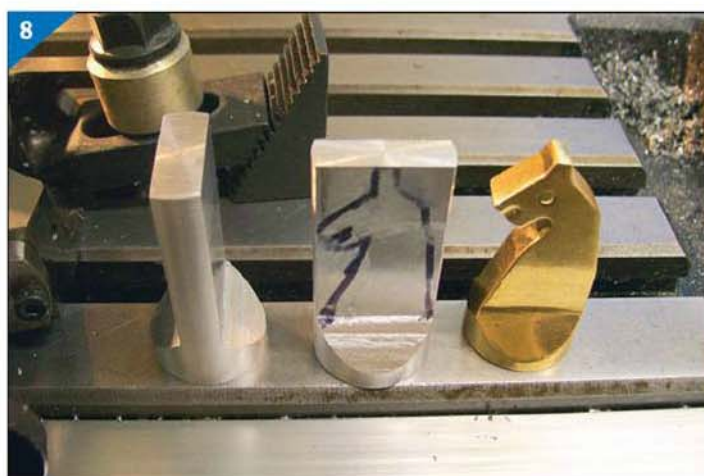
I was pleased with the first attempt at the pawn, but thought that if the chess set had any chance of completion, I would need to be able to make, what I considered to be the most complicated piece, the knight. I didn't want to proceed with the next 15 pawns only to find I couldn't produce a good enough knight, and it did prove to be the most demanding machining I had yet done.

Since I was breaking new ground with the chess set, I had to produce each piece one after another, to check the feasibility of the design, and machining methodology. However, if you consider making this set, I would suggest that the pawns be tackled in one go. I believe you achieve a better common standard when making a large batch. The size of the chessmen and the machining procedures are now known, which should make it easier to work in batches.

Pawn dimensions are shown in fig 1.

Knight

The knight is 2in. (50.8mm) tall. The first task is to produce a knight blank on the lathe, before moving onto the



6. Cutting the knight body parallel.

7. Cutting the taper on the knight base.

8. Knight blank with profile.

9. Knight holding fixture for the rotary table.

'interesting' work on the milling machine. If you do not have a milling machine I am sure it would be possible to achieve a nice knight with filing.

You start by placing 1in. diameter (25.4mm) aluminum or brass bar in the chuck, with $2\frac{1}{2}$ in. (63.5mm) showing. Face the end of the bar and then take a light cleaning cut for 2in. (50.8) towards the chuck. With the lathe stopped and using the cross slide, mark a line on the faced end across its diameter. This mark will be used later on the milling machine. It's not possible to use a large length of bar with my method as the chuck needs to transfer to the Vertex dividing head with the blank, for part of its operation.

Still holding the knight blank, transfer to the milling machine and when setting up the Vertex it is important that it is secured square to the milling table.

With the blank held parallel to the table and the end of the end mill, or slot drill, just

touching the blank, set the z axis digital readout (DRO) to zero. The next task is to mill down for $\frac{1}{16}$ in. (7.9375mm) for $1\frac{1}{2}$ in. (38.1mm) from the faced end towards the chuck. The Vertex is then revolved 180deg. and the second side is milled the same as the first (**photo 6**).

The next stage is to cut the 45deg. base shoulder tapers. To do this the Vertex is adjusted to a 45deg. angle and careful cuts are made until the top of the taper meets the main body. The Vertex is then revolved a further 180deg. and the second cut is made. The blank should now look something like **photo 7**.

The blank is now removed from the chuck and the challenging part started, which was the work on profiling the knight's body. I found it useful to draw the approximate shape of the body on each side of the blank, in permanent marker pen (**photo 8**). This helped with orientation and which cut was required. It makes it a lot easier

to follow what needs milling, and confirms you have got the angles right. The Vertex is now removed to be replaced by a rotary table, which is again set square to the milling table.

A fixture to hold the knight blank onto a rotary table is required (**photo 9**) and a little on how I made the fixture may be helpful: my fixture had two main parts, the base and the holding bar, which is secured by two screws. These apply pressure on the knight's base and therefore secure it in place.

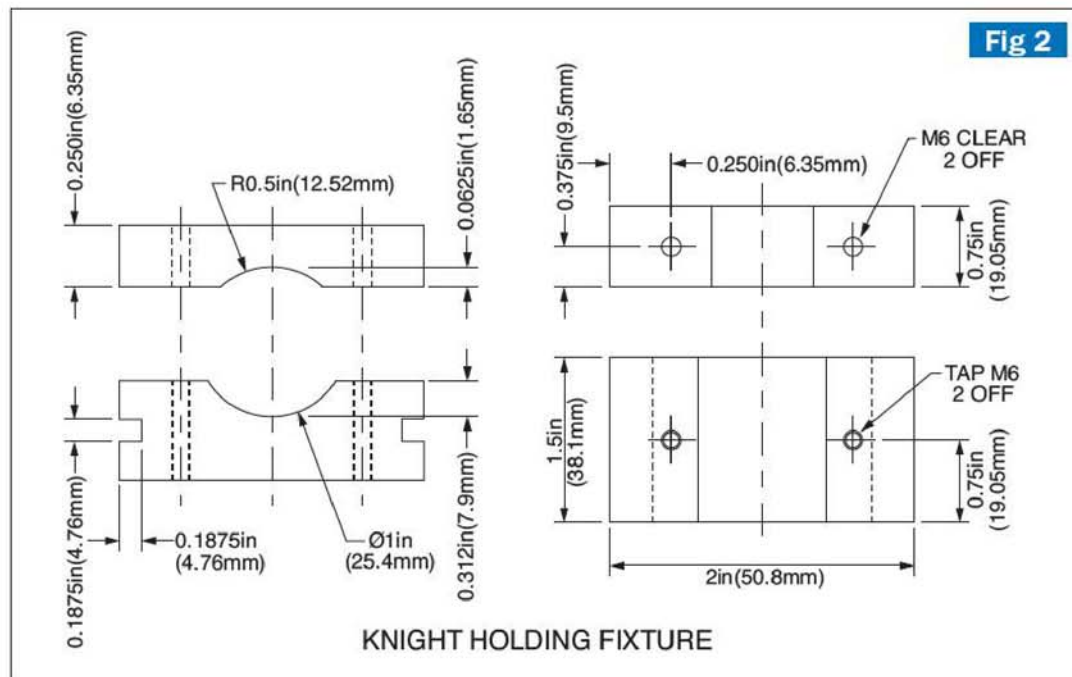
The dimensions for the aluminum base are 2in. (50.8mm) x 1.5in. (38.1mm) x $\frac{3}{4}$ in. (19.05mm). The steel holding bar is made from 2in. (50.8mm) x $\frac{3}{4}$ in. (19.05mm) by $\frac{1}{4}$ in. (6.35mm) bar. The base was made by holding the squared off aluminum blank against a large angle plate on the milling machine and the cutout was bored to 1in. (25.4mm) dia. and a depth of $\frac{1}{2}$ in. (7.9mm). The holding

CHESS SET

bar also has a 1in. dia. recess bored into it to a depth of $\frac{1}{2}$ in. (1.651mm). The base was then placed in a vice and a $\frac{3}{4}$ in. (4.8mm) wide x $\frac{3}{4}$ in. (4.8mm) deep slot milled around the four sides to allow clamps to be used to hold it onto the rotary table. Two 6mm holes were tapped in the centre of the aluminum base for the securing bolts. **Figure 2** shows the drawing for the knight fixture.

Once the rotary table was set square to the milling table and centered under the quill (**photo 10**), all DRO's were zeroed. The knight blank should be positioned on the holding fixture so that the blank is at 90deg. to the Y axis. To ensure the body of the knight was parallel to the milling table, I used a digital angle meter. First, the angle meter was zeroed on the milling table and then put onto the knight blank, adjusting the blank until the meter read zero (**photo 11**).

The fitting of DROs to my milling machine has proved

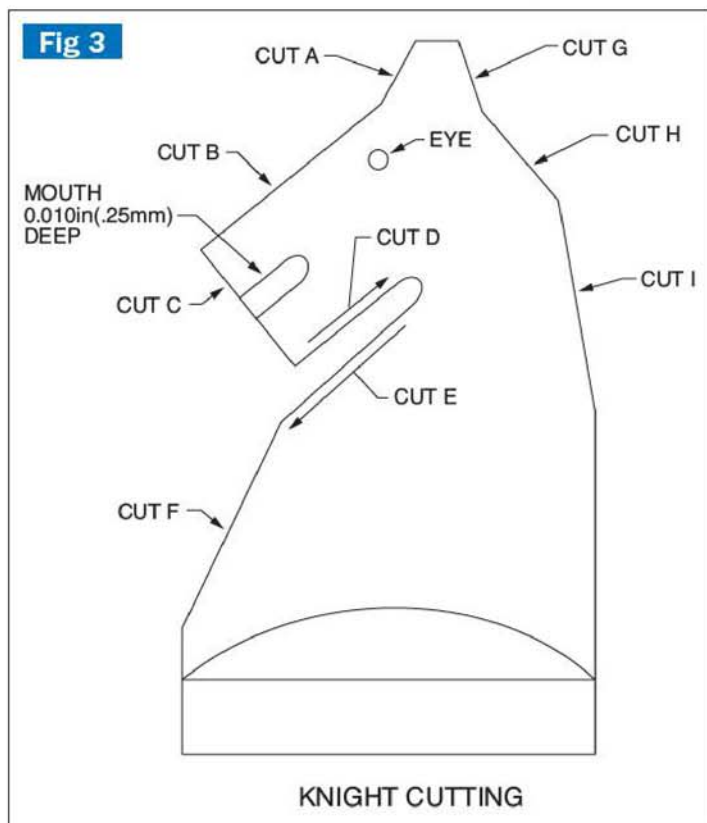
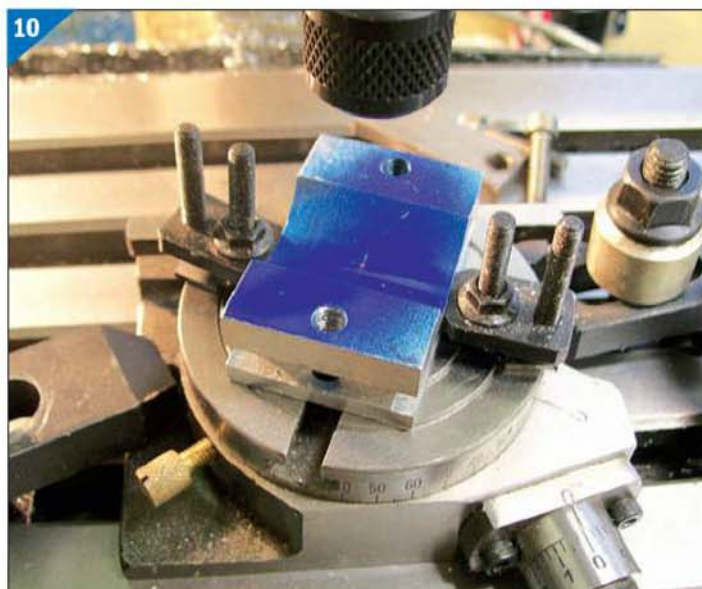


invaluable and I would recommend the expense to any novice engineer with a milling machine. To aid in machining the profile I used a diagram, **fig 3** showing the direction of the profile cuts for the knight. A $\frac{1}{8}$ in. (3.18mm) slot drill was used to make all the cuts which were kept light. This helped to ensure mistakes were minimised.

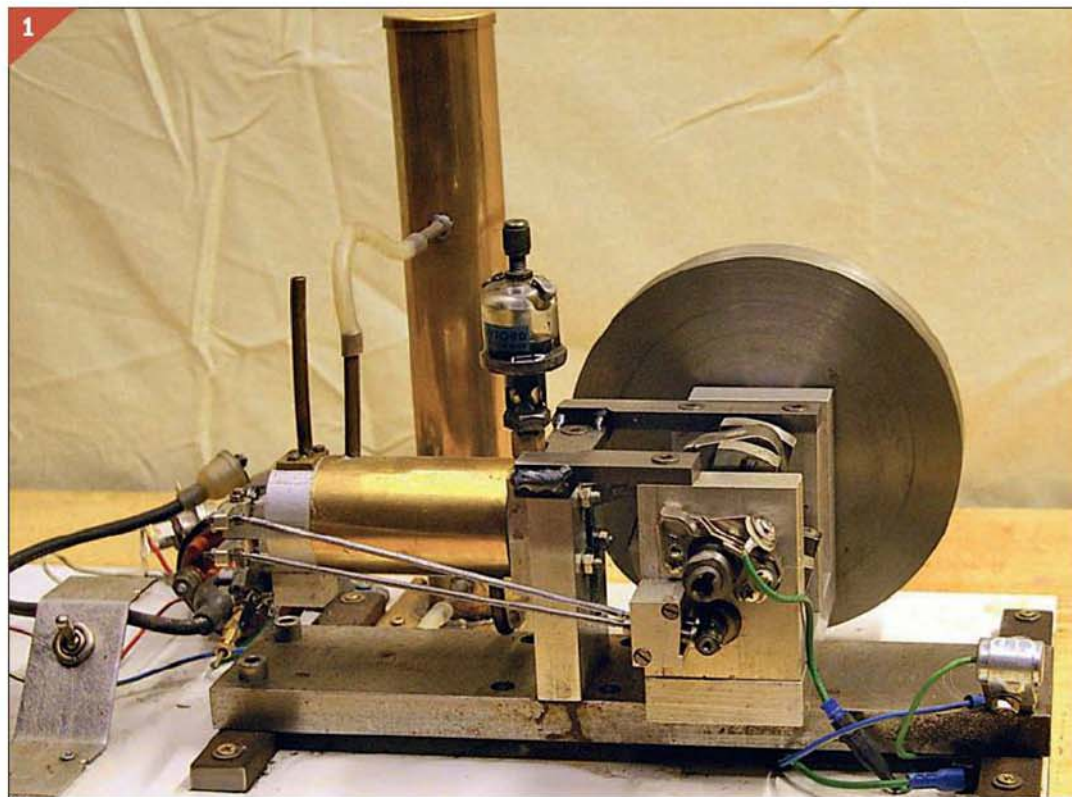
● To be continued.

10. Centering the fixture on the rotary table.

11. Digital angle meter used to set the knight blank.



The Re-Cycle Engine



practice and expose the moving parts. Thus the concoction, which was eventually built, features an open crank, rockers, camshaft, followers, pushrods, and contact breaker points.

Photograph 1 shows the engine on its initial test stand; a later version would endeavour to introduce an element of tidiness to the overall arrangement.

Design process and description

To use the word 'design' is to glorify matters just a touch. Let's just say it substitutes for what was an iterative process working between scribbled envelopes, CAD layouts and the material store (aka scrap box). A convenient pair of bearings suggested the sizes for the crankshaft and main bearing housings, the latter then being cut from lengths of aluminium flat bar. Cylinder size was determined by available seamless steel tube 1.25in. bore and 0.0625in. wall thickness. In keeping with the slow revving philosophy, to give the thing relatively long stroke geometry, the crank throw was set at one inch, giving a two in. stroke and a capacity of around 40cc.

Many of the early engines featured a horizontal layout and that, rather than vertical was adopted here. Accordingly, a sizeable slab of mild steel



DAVE FENNER

Dave Fenner dives into the scrap box and emerges with a horizontal 4-stroke.

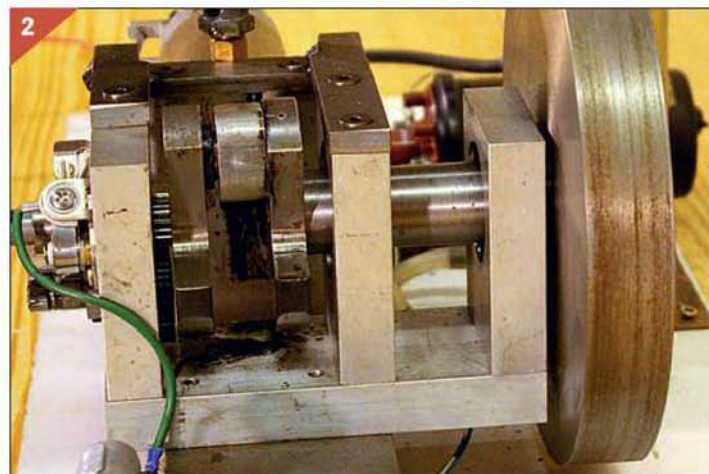
Rationale: Several factors combined to provide the motivation for this little project.

I had observed that one of our club members, who after constructing a number of superb steam models and restoring equally superlative motorcycles, now builds models of historic stationary I/C engines. For demonstrations, unlike the more usual high revving examples, his could be set up running on a tabletop and allowed to chug away, for all of an afternoon if needed.

One of the inescapable aspects of model engineering is the escalating costs, particularly concerning on one hand castings, and on the other, copper and other non ferrous materials for boiler making etc. So in the best traditions of the 'experimental' and 'penny pinching' sides to the ME hobby, I set out to produce a slow revving petrol or gas engine, which could easily be operated over an extended period but which would

employ stock materials, ideally from the scrap box. Hence it became christened the Re-Cycle engine, nevertheless operating according to the theory, laid down a century or so ago, by Otto.

Modern engines tend to be totally enclosed - which keeps dirt out and oil in; unfortunately this also means that all the interesting bits (especially to younger spectators) are hidden from view. The aim therefore was to follow early engine



1. General view of the engine.
2. View on crank, timing gears and nylon bush are visible.



3. Simple puller for flywheel removal.

4. Cylinder head and rockers are visible here.

(previously used as part of a jig for racing car wishbones) found a reincarnation as the base plate. As can be seen in the photo, legacy holes remain from the earlier use.

From a casual glance at **photo 2**, it appears that the crankshaft might be a pressed up composite single assembly, however, to keep things simple, it is in reality two sub assemblies. The larger runs in two large ball races. It carries the flywheel at the outer end and the main web and crank pin at the inner. This part carries the main loads. The secondary section of the shaft is basically a slave separately supported by two smaller races. It is driven by an extension to the crank pin locating in a nylon bush (to allow for any slight misalignment), and carries the primary timing gear and ignition cam. The primary crank web is fitted to the shaft with a belt and braces approach, involving Loctite 638, together with a grub screw 'key' driven in axially along the cylindrical joint interface. Retention of the crank pin was accomplished by means of Loctite augmented by a roll pin driven through a cross drilled hole. Dividing the crankshaft into two sections would also avoid the need for a split big end, allowing rolling element bearing options to be considered.

My original intention was to fit a cast iron flywheel of some

nine inches diameter. Indeed, I had collected a suitable 30mm thick disc from College Engineering at the previous Harrogate show. However, when it came to actually making the bits, this size looked a bit OTT, and I subsequently settled on a smaller steel disc from the scrap box, whose size seemed more appropriate to the scale of things. This was fitted to the crank, with a conventional key and a retaining bolt. A small extractor (**photo 3**), which would engage in a couple of tapped holes, was made up to facilitate flywheel removal.

To keep the camshaft assembly simple, the ignition cam was divorced from it and mounted on the slave crank, which running at engine speed, results in a wasted spark configuration. Contact breaker assemblies have become something of a rarity in car scrap yards these days, but a trip to the local Auto Electrical specialist, unearthed a small gold mine of vintage stock, both CB assemblies and condensers. Of course the first question was, "What car is it for?" Fortunately the chap behind the counter was more than sympathetic about the project and produced a box of parts from which I selected one which I felt would be easily accommodated.

It may be noted that a welded reinforcing yoke has been added, linking the upper face of the cylinder base to the main bearing housings. This was a 'development improvement' as it was found that even with the 25mm thick base plate, a

certain amount of flexing took place when running, causing bolts to slacken.

As the intention was to build something which might run for more than just a few minutes at a time, a plain big end bearing was unlikely to cut the mustard. Consequently, thoughts turned to using a needle roller set up. As it happened I had a number of 16mm ID bearings, also some 16mm silver steel, which would serve as crankpin material. The connecting rod is a fabricated steel affair, a slim long section welded to a short stubby plate, which houses the bearing. A phosphor bronze bush is fitted at the small end.

As noted above, the cylinder would be cut from my stock of seamless steel tube (purchased for the Bentley BR2) and the piston would be a carbon copy of those made previously for that engine. Mine however, has a single cast iron ring, whereas the original Blackmore version sports two.

The cylinder head, which can be seen in **photo 4**, would be an aluminium affair, carved from the solid, housing two conventional poppet valves machined from stainless steel, and a single 1/4in. spark plug. The plug had been nestling quietly in a tool box since 1958, when my Frog 500 was converted to glow plug. The rockers were carved from aluminium then given hardened

silver steel faces to minimise wear against the valve stems. Screwed elements allow tappet adjustment. The pushrods are recycled spokes salvaged during the wheel rebuild on my Bonneville 750. Arranging for the cylinder head to be pulled down by studs threaded into the underside, and projecting down past the water jacket, meant that space would not be required to accommodate fasteners on the upper surface, giving more freedom to place the rocker post.

The engine could probably have been built using air cooling, but as I had some two inch diameter by 16gauge brass tube, I felt that a couple of pieces cut from this could be used to give a passable water jacket and form the cooling water reservoir.

The camshaft is supported in a pair of ball races, and the gears are steel (on the slave crank) and moly loaded nylon (on the camshaft). This combination of materials was chosen to allow extended running with minimal lubrication. Both gears were cut on the mill using dividing head and an involute cutter.

Whilst on the subject of lubrication, all the rotating parts could be mounted on ball or roller bearings, but this left the question of how to get oil to the piston and cylinder.





It might well have been acceptable to use a petrol mix as for two strokes, but I felt it would be more in keeping with the spirit of the thing to add a drip feed lubricator. It so happened that I had a Myford example salvaged from a small capstan lathe of their manufacture from when it was finally consigned to the great workshop in the sky. This is positioned to deliver at the lower end of the stroke, and is easily set to deliver the occasional drip. Blackened oil deposited around the base plate suggests the system works.

Years ago, when I built a Jones 605, (published in *Model Engineer*), I did make the carburettor to the drawings given. This time, I thought that I would save a bit of manufacturing time. Some months ago, I considered designing a twin cylinder engine, and purchased a couple of Super Tigre carbs, one of which is shown in **photo 5**. This project (along with numerous others) has not moved off the back of the proverbial envelope, so an intake adapter was made up to take one of these.

General set up

For simplicity, the water cooling system is a simple thermosyphon with no pump. Two diametrically opposed pipes are connected to the upper and lower parts of the

jacket (**photo 6**), and these are linked to two similar pipes at the upper and lower levels of the reservoir. Once the engine is running, the outlet pipe warms up very quickly, confirming the flow.

Apart from the model style spark plug, the ignition system has been plagiarised directly from automotive practice. The purchase of the contact breaker assembly, visible in **photo 7**, was mentioned above, also its associated condenser. To source a suitable coil required a trip to the local car breaker's yard, followed by an extensive trawl under the bonnets of most of his stock. These days, a fair proportion of cars are diesel powered and those using petrol have all singing, all dancing engine management systems often without a discrete coil. I did eventually find a BMW from the 80's and relieved it of this vital part. What I could not see,

was the associated ballast resistor, so something suitable would have to be introduced. (For any readers not familiar with ballast resistors in ignition circuits, my recollection is that they date back to the mid sixties. Hitherto, cold starting had been compromised by the drop in available battery voltage whilst powering the starter motor. To get around this, manufacturers fitted a coil rated for a lower voltage, and fed it during normal running via a ballast resistor thus reducing the voltage at the coil to its rated value. Under starting conditions, the resistor was bypassed and thus a healthy spark produced.

For initial testing, the good filament of an unserviceable headlamp bulb was wired into the circuit, and this performed the dual functions of introducing resistance, and also giving visual evidence of current flow.

Initial running

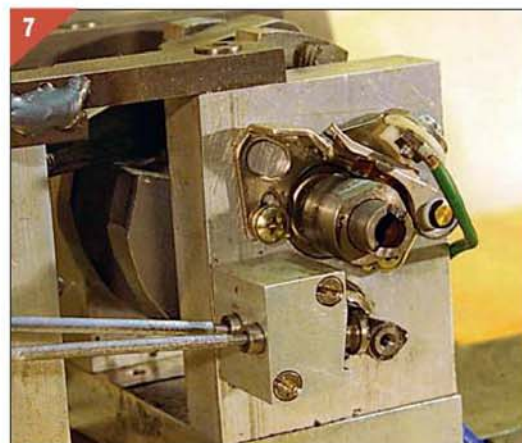
I had seen other engines where their owners had simply turned the flywheel back against compression, then given it a smart flick forwards, when the machine would burst into life. Alas mine did not initially want to play that particular game. At that time I had not invested in a model aero engine starter, so looked around for alternative means of spinning the engine. A battery powered cordless drill seemed to have promise, so to provide a self ejecting drive, thoughts again rolled back some sixty years to the typical car starting handle arrangement. A miniature version allowed the engine to be spun over and it quickly fired up.

One feature that was very noticeable, after just a short spell of running was the extent to which the compression had improved. Some of this may have been due to the piston ring bedding in, but I believe that most of the gain came from improved valve sealing. My guess is that the repeated hammering back on the seats by combustion pressure caused this.

Careful examination of some of **photo 1** will reveal a little rusting on the base plate. For simplicity, rather than try and design in O rings, to seal the water jacket and cylinder, I chose to rely on a good quality sealing compound. This did, in fact, work very well but unfortunately I forgot about the potential for leakage along the cylinder studs. This would be easy to cure at strip down, using the same sealant.

Next steps

Now that the engine has been built and tested, if our editor approves, I plan to dismantle it, draw the parts, (I did say that it had not really been designed) and offer a series of articles describing the construction. A revised mounting will probably carry the 12 volt battery and coil in a compartment beneath, and have a fitted fuel tank with petrol tap, rather than the model aero tank used thus far. **ME**



5. Commercial Super Tigre carburettor.

6. Brass water jacket showing feed and return pipes.

7. Detail view of contact breaker and cam follower arrangement.



KEITH WILSON

Keith Wilson

considers a range of topics including commercial plumbing fittings, tolerances and scale effects.

1. A commercial fitting.



In building a locomotive that isn't a 'scale' miniature of what is best referred to as a 'mainline' locomotive i.e. something like, say, a Gresley A4, a Duchess, King, Castle, Merchant Navy or any similar engine that is remarkably realistic to a 'main line' locomotive, it is not too important to follow what might best be described as 'scale' fittings.

This of course applies to 'narrow gauge' engines - such as Romulus, Hunslet, Lillian, Anna etc. where it can be much easier and more convenient to use commercial plumbing fittings almost everywhere (photo 1). They can also make the locomotive easier to handle. This can prove very useful, for an emergency can arise and require instant action. It cannot be denied that some engines are easier to control than others.

About 15 years ago I had occasion to make four 'Romulus' locomotives, and built up the turret/fountain system with commercial plumber's fittings. In an engine of this size this looked reasonable and what is more worked well.

I have not the slightest wish to apparently denigrate any locomotive type, but some years ago I had a lap with the late Bob Shaw's 7¼ in. Britannia. This particular locomotive can best be described as superb; I have seen few if any to match it. But I found it tricky to drive, for the fittings were all accurately placed and some were on the front of the tender, out of sight for the driver - I mean the person sitting on the tender, not the full-size one standing on the footplate! It follows that until one was thoroughly used to driving it and didn't have to locate some controls by feel alone, things could be tricky at times.

Incidentally, Bob himself told me that his Britannia had no blast pipe nozzle; just a plain pipe pointing straight upwards. It worked well, for a Brit boiler is a big one, and with only two cylinders to fill, the inescapable tiny leakage is less. For no matter how carefully pistons and valves are fitted and honed

etc. a very small amount of leakage must occur.

Avoiding accidents

I express my gratitude to Mick Nicholson (M.E. 4341, 19 December 2008, Postbag), for correcting my remarks on signaling and the Hull Paragon accident. However, I submit that under certain circumstances it is perfectly possible to have distant 'off' and home at danger. Of course I know that distant cannot be cleared until all else is cleared, but surely nothing must be allowed to prevent a signalman from throwing home signals 'on' instantly in times of danger. If he had to release distant before setting home to danger, very valuable seconds might well be lost. I read about this in a book dealing with signaling, it made sense to me so I didn't cross-check. I remember giving a short talk on interlocking to the rest of my class at the Regent Street Polytechnic School, it went down quite well. I was 12 at the time.

Incidentally, I have had a little full-size signalbox experience in the old days of steam, and I recall a day at the Stoneleigh Echills Wood railway where I was 'controller' with 13 locomotives in steam. With the operations on the two-way single line, engines turning round, coaling, watering, to and from the yard, once or twice the interlocking system paid for itself. After about 4 hours of this, I was just about knackered; son Alan took over, this time with 14 in steam. For better or worse only some 3½ hours of daylight were left. Even so, it was quite a strain.

As I mentioned in the article concerned, occasionally less than a second can be the difference 'twixt safe and sorry, with no one completely to blame. Mentioning 'blame' reminds me that to allocate blame instead of finding the causing factors is counter-productive of safety; which is why road accidents are more frequent than they need to be.

As an example of ascertaining factors, readers may remember a case a year or two ago when a road driver dozed off approaching a railway underbridge and the

vehicle ended upon the railway line below and was the main factor in the resultant accident. I remember mentioning to a friend that this accident would not have happened with some guard fencing of hefty barriers installed.

I have noticed that in many, if not all such places, heavy barriers have been so installed. Clearly if the matter had been blamed entirely on the road driver, under similar circumstances a substantially identical accident could easily reoccur. But it is much easier and immediately cheaper to holler "bad driving" and ignore the real factors causing the accident. Even with the case of drivers dodging the barriers on a level crossing (I wish that they would get 'done' for it good and strong), only happened after the old-fashion standard heavy gates were replaced by lifting bars.

CAD tips

Nemett's (doesn't he look like Malcolm Stride?) articles on CAD work reminds me of a little dodge for easier startups. Set up a new 'blank' drawing, to any convenient size (my 'blank' is set to A4). If all desired parameters (such as letter size, dimension style - arrows and such - are set to choice, plus scale factor, fractions or decimals, overall 'fit' size and so on, much time is saved, and if a larger blank is desired it can be easily done with a couple of clicks. If this is saved in an easy-to-find location, it can prove invaluable. No doubt I am teaching both my fans how to suck eggs, but everything must be new to some folk however well-known it is to us old-timers.

Pistons and cylinders

A matter of importance to every loco builder, it is to get a very good fit with cylinders and pistons; an essential but not over-easy task. The cylinder must be dead cylindrical and parallel.

Although it is possible to bore a cylinder on a small lathe by using a boring bar in the chuck (preferably supported by a revolving centre in the tailstock), it is not too easy to get the criteria mentioned above. The lathe is not designed for this operation; the trouble being the

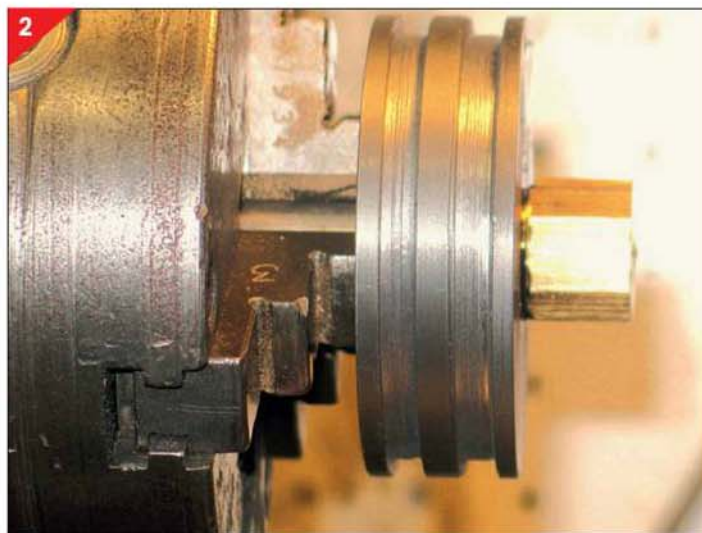
moving direction of thrust from cutting. It follows that there must be no slack in the cross-slide and in the saddle traverse - but here is a snag: A lathe saddle is very good for downward thrust and not too bad for sideways forces but upward forces are another thing. If the gib-strips are too tight then it must put a bit of extra loading on the leadscrew. In any case, vertical clearance is controlled by shims under the top of the lathe bed. One way round is to make sure that the last cuts are minimal, preferably the last three without altering the depth of cut.

It is not very easy to get to an exact size this way unless you can somehow 'procure' a reamer. Anyway, hone the bores to get accuracy down from 'thous to tenths', and a much better finish.

The rear cylinder cover must be as accurate as possible, but there is much to be gained by using a floating gland for the piston rod. Once satisfied with the said rear cover, it may be permanently fixed, as it should not be necessary to remove this again. In fact, in some full-size engines, there was no separate rear cover, it was cast as part of the whole cylinder block. All very well, if you happen to have a suitable boring machine designed for such a task.

This presented me with a tricky problem designing *Ariel*, the Merchant Navy in 5in. gauge. However, this design, although tricky to make, has done very well. I don't know how many have been or are being built, but it certainly is a popular design. Some have been done to a very high degree of faithfulness to the prototype. Indeed, some photographs sent to me have required close inspection to confirm actual size; in one case the only clue was just visible in front of the locomotive, the third rail (covering a 3½in. track). As I wrote recently, to see that someone has built to one of my designs and done a considerably better job than I could, gives me great pleasure.

An important matter with pistons fitting on rods is that the load on the joint is not



constant; it reverses twice at every wheel revolution. In 5in. gauge or smaller it is annoying rather than dangerous. But for bigger locomotives it is very damaging, for if it is going to brake then it is most likely to happen at the rear end of the cylinder; and the result of the very hard blow on the front cylinder cover can bust that cover quite easily. So a very secure fixing is most important.

If the front end of the rod is turned to a good fit in the piston, and the piston is counter-bored at the front side, then a brass nut is turned to a good fit in the piston and threaded to match the rod (**photo 2**). After de-greasing (acetone, cheap and strongly recommended) the thread, rod, and nut are all anointed with Loctite 601 then the nut can be done up as tight as possible. Turning off the nut end to flush with the piston is easy, and the piston can be turned to its exact size to fit cylinder bore.

One small word of warning, grip the rod in the chuck very tightly, for this is far less damaging to the rod than the rod slipping round in the chuck.

Tolerances and scale effects

Do not shrink from using shims to get guidebars and crossheads accurately lined up - this was common practice in full-size. I am not aware of the exact process, but with a guidebar set up dead accurately the exact thickness of shim required was measured and

a single block ground to this thickness. It follows that virtually all running clearances were accurate to 0.001in. or better. In connection with this, examination of the link from the outer end of a King, Castle or Star rocking lever to the outside valve rod was fitted with a micrometer-type adjuster, probably graduated in 'thous' I wouldn't wonder.

Much as we would like, there are things that cannot be 'scaled', tolerances for example, and still work. The tolerance for coupling rods at Swindon as far as I know was about ± 0.003 in. This says a lot for the optical method of lining things up on assembly; those who would like to work to 0.000375in. are welcome to try. Water gauges on boilers, whistles, flue tubes in boilers, boiler plate thicknesses come to mind, no doubt there are others. I seem to remember that full size water gauges were $\frac{3}{16}$ in. O/D and $\frac{1}{16}$ in. I/D. For us to use a gauge glass of about $\frac{3}{16}$ in. O/D would be useless; the capillary effect would make readings virtually useless.

In cylinders, room must be found for a film of oil, likewise in bearings. I read somewhere that full-size axleboxes put into place on frames and horncheeks would stay put without support. Unswept volume in cylinders is as low as possible; Swindon got it down to $\frac{1}{16}$ in. each end. A scale whistle would be a high-pitched screech (as distinct from about A flat above middle C for musical readers or about

2. Piston fitted on rod.

415 Hz), which is why working whistles of correct pitch are best left under running plates.

Hence my remarks above on shims used to get things as near as we can to ideal, tighter tolerances than this will render operation very poorly.

"Steam, Pull, and Go"

I remember that about 50 years ago there was a builder at the Harlington Locomotive Society who would turn up once per year (usually at an open day when passenger-hauling was paramount). He would steam up his engine with distilled water, do a few laps by himself then take his engine off and clean it down etc. Now I am not denying that he had a perfect right to do this, but on a busy open day he was not quite as welcomed as he might have been.

Another case was in an exhibition at the famous Hoover factory at Perivale, Middlesex. A *Butch* locomotive was displayed near to a *Hielan Lassie*, the former was made to very high precision and the latter had seen better days, although still in good working order. The *Butch* builders looked somewhat askance at the *Lassie*, and some muttered undertones were heard. Philip Tweedy, the *Lassie* owner suggested coupling up to the compressed air line to compare results. *Butch* could only work slowly and not too smoothly, whereas *Lassie*'s works became a blur, as might well be expected. I have nothing against those who build super-scale engines, but prefer those engines that will "Steam, Pull, and Go" - one of Curly's sayings. **ME**

WILSON'S WORDS OF WISDOM

Human nature is so constituted that it always tends to accept the solutions that demand least effort.

Lumiere



MALCOLM
STRIDE

Nemett looks at a collection of miniature spark plugs sent in by a reader and provides details of two sources of ignition systems.

1. Bill Linfield's gearless hit and miss engine running on one of his own spark plugs.

2. The plug body construction showing the integral earth electrodes.

3. The body, Delrin insulator, and central electrode of a typical plug.



A correction

Having just received my copy of *M.E.* 4343, I noticed that I have fallen into the trap created when writing material in one year for publication in the next. The drawings for the NE7.5-S *Jaguar* are planned to be available in the first quarter of this year, 2009.

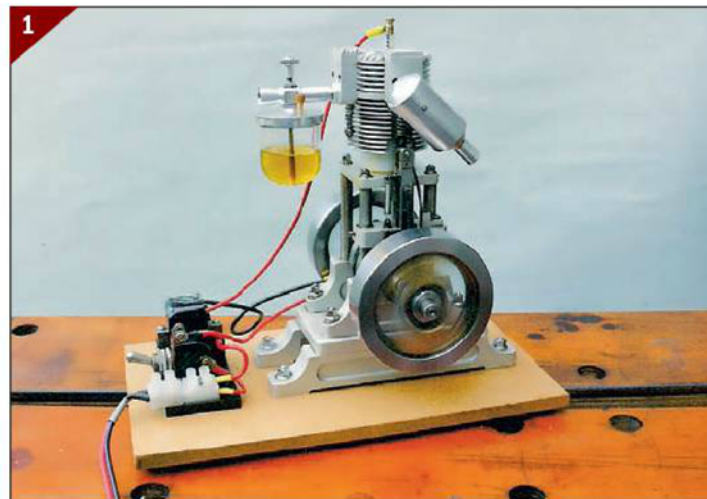
Spark Plugs

Some 18 months ago I received a parcel from Bill Linfield in Oxfordshire who sent in information and several samples of spark plugs manufactured to his own design and using various types of material for the insulator.

Since I have also had others ask about such things at regular intervals I thought it was time to share this information.

Over the years, the supply of miniature spark plugs suitable for small model engines has been somewhat hit and miss with those that have been available becoming ever more expensive. I am talking in particular about the small $\frac{1}{4}$ in. x 32tpi threaded variety which I and others use in four stroke engines with an individual cylinder capacity of anything from 5cc upwards. Smaller capacities than this get very difficult when it comes to fitting the valves and spark plug in the head. With commercial examples in this size now costing around £16.50 each in the UK (Hemingway Kits), life gets expensive when building a V8, with two sets of plugs (one spare) costing over £250!

The same supplier also lists a kit (including ready cut



ceramic insulation material) for making two circular discharge spark plugs at £13.60 which is somewhat cheaper. I have tried these (*M.E.* 4291, 19 January 2007) and the finished plugs give very good results.

The larger 10mm commercial plugs are much cheaper at £6.25 each but are only suitable for larger engines. Note that this size of plug has a 1mm. pitch thread not the standard 1.5mm. metric thread pitch, so you will need the special spark plug tap to cut the thread.

Returning to Bill's letter, he says that a few years ago he did quite a lot of work on small spark plugs and that reading this column 'got him going again' so he has produced several plugs using various insulation materials including Delrin, PTFE and machinable ceramic rod. It was my intention (and still is) to try these plugs out in my engines but events last year overtook me so I will report on such things later on. In the meantime, Bill has

done some running on his own engines and also enclosed a selection of photographs of plugs being fired in a test rig. Bill's single cylinder gearless hit and miss engine is shown running with one of his plugs (**photo 1**).

As with many model engineering projects, miniature spark plugs suffer from the effects of scale. The first problem is that the electrodes are much smaller than full size plugs and have a reduced gap meaning that the plug can become oiled up more readily. The second is that, although the spark voltages with modern miniature electronic ignition systems may be almost as high as on full size engines, the plug insulation thickness and length is less. This can lead to the plug breaking down and sparking outside the cylinder rather than inside.

Bill has constructed his plugs in several different forms with various electrode configurations. These include the common centre/side electrodes and also three different circular electrode configurations.

Standard electrode configuration

In this, the conventional configuration, there is a central insulated electrode which carries the high tension voltage, with a side earth electrode attached to (or part of) the body. In Bill's method of construction, the side electrode is formed as part of the body (**photo 2**). and bent over on assembly to form the spark gap. One of the



two electrodes in the picture will normally be removed. This method of manufacture is a very good approach because it avoids any possible problems with the electrode coming adrift which can happen with a separate electrode. This is obviously not very good for the health of an engine!

As I have already said, Bill has used several different materials for the insulators and a set of parts for a typical example with a PTFE insulator is shown in **photo 3**. This photo also shows the finished form of the body. Note that with the softer materials such as PTFE and Delrin the insulator is threaded into the body and the centre electrode is threaded into the insulator. Bill does not say if any form of sealant is used. The advantages of these insulation materials is that they are easy to machine and are also cheap.

Bill uses a built up centre electrode which has a main brass body with an inserted steel tip. Bill uses the connectors from low voltage

halogen lamps to make the tip of the electrode. Others use a one piece steel electrode right through. In common with many miniature plugs, the insulation is carried almost to the end of the body with no gap between the two, as is common with full size plugs. With small engines, this gap (**photo 4**) can be a cause of problems because it can get filled with oily carbon deposits causing the plug to fail. Being very small it is almost impossible to clean out effectively. I have some commercial plugs where the insulation is flush with the end of the body forming a flat surface with the centre electrode protruding from it (**photo 5**). These provide a shorter insulation path, but are easier to keep clean.

An example of a completed plug is shown in **photo 6**, and this one has done quite a lot of running.

Bill has a test set-up (**photo 7**), for trying out the plugs and a standard plug is shown under test (**photo 8**). Bill is also using a magneto in this example.



Looking at the plugs Bill has sent in, I can see no sign of any deterioration of the PTFE or Delrin insulation after some running. It will probably need an extended period of high speed running (still to be done) to show any problems. Miniature engines tend to run cooler than their full size counterparts, so the use of such materials should not present any problems.

In addition to the electrode configuration shown, Bill has also used a side electrode arrangement which reduces

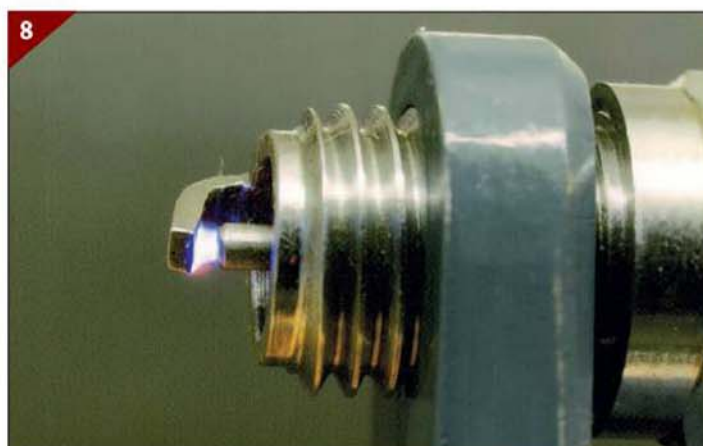
4. A commercial plug showing the narrow air gap around the insulator making cleaning difficult.

5. A commercial plug with a flush insulator, which is easier to clean.

6. This completed plug has a PTFE insulator.

7. Bill Linfield uses the magneto test set-up shown when checking his plugs.

8. This conventional electrode plug shows a good fat spark on the test rig.





9. A side electrode configuration firing on the test rig.

10. The circular discharge plug showing the cylindrical spark gap and PTFE insulator.

11. A different type of circular discharge plug with a radial spark gap and a ceramic core/Delrin outer insulator construction.

12. The 'star' configuration gives several defined spark gaps.

the length protruding into the engine (photo 9). This can be important on small high compression engines where clearances at top dead centre are small. Bill's side electrode arrangement differs from the conventional setup (photo 6 above) because it still allows easy gap adjustment by slightly bending the side electrode. This is more difficult with the conventional layout where the earth electrode is radial to the centre.

Machinable glass ceramic

The other insulation material that Bill has used is Macor, a machinable glass ceramic which is still listed by RS Components, but is very expensive. Technical data on this product can be found on the Aremco web site at www.aremco.com/macor.html and

on the RS Components site at <http://uk.rs-online.com>. The following advice on machining was found on the Aremco web site:

The recommendation is to use carbide tools and a water based coolant.

Suggested cutting speeds are:

TURNING

Cutting speed 30-50ft surface feet per min.

Feed rate 0.002 - 0.005in/rev.

Depth of cut 0.15 - 0.25in.

MILLING

Cutting speed 20 - 35ft surface feet per min.

Chip load 0.002in. per tooth

Depth of cut 0.15 - 0.2in.

DRILLING

Diameter (in.)	Speed (rpm)	Feed (in./rev.)
0.25	300	0.005
0.5	250	0.007
0.75	200	0.010

It is recommended that 0.05in. is allowed on the length to allow for drill breakout causing chips in the brittle material. This can be machined off after drilling.

Tapping

Clearance holes should be about 4 thou larger than normal.

Chamfer both ends of the hole to reduce chipping. Run the tap in one direction only. Turning the tap back and forth can cause chipping. Continuously flush with water or

coolant to clear chips and dust from the tap.

Sawing

A carbide grit blade is recommended or a diamond or silicon carbide cut-off wheel.

Macor is a mixture of fluorophlogopite mica and borosilicate glass, so care should be taken to avoid inhaling dust and also to keep it off machine surfaces because it is abrasive.

When used in spark plugs, I would suggest that an adhesive be used to assemble the parts rather than threads. A suitable one is JB Weld - High Temperature Epoxy, which can be obtained from Hemingway Kits. I think that the strength of a short external thread cut into the ceramic material would be minimal and make the plug prone to damage because the ceramic material is easily broken.

One plug design supplied by Bill has a ceramic core with an outer Delrin sleeve which should provide some protection to the ceramic core.

Circular electrode configuration.

Among the set of plugs provided, are three with circular electrode configurations. These are supposed to perform better with slow running engines where the conventional electrode arrangement can become oiled up due to the cool running nature of such engines.





The circular discharge plug avoids this problem because the spark gap forms a continuous ring around the centre electrode with the spark able to cross at any point. This means that even if part of the gap becomes oiled up, because oil is an insulator, the spark will still fire across another part of the gap.

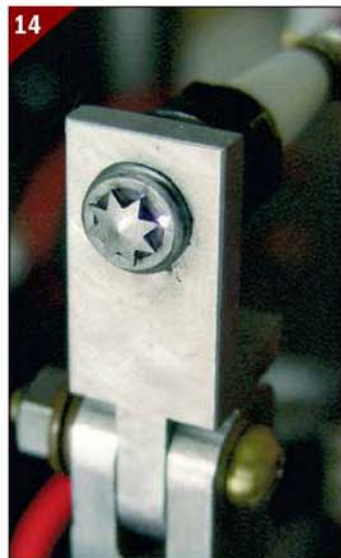
Bill has provided two plugs with differing plain circular spark gaps and another with a 'star-shaped' central electrode.

The two plain plugs differ in the size and orientation of the spark gap. The first plug has a larger diameter gap which is basically a cylinder between the electrode and the body (**photo 10**). This plug has a PTFE insulator. The spark gap in this case is 0.015inch. One thing to watch with this layout is to make sure that all the plug tip protrudes into the cylinder. If the plug tip is set back into the head thread, the spark can be shielded by the thread which can affect the performance of the plug. In fact the spark may jump to the cylinder head rather than the plug body which is not what we want.

The second plug has a smaller gap forming a ring round the electrode and has a ceramic core with a Delrin sleeve (**photo 11**). This layout obviously avoids the problem mentioned above.

Both these plugs have been used on engines with good results.

The third of the circular designs is the 'star'



configuration which also has a ceramic core and Delrin sleeve (**photo 12**). This example has 'done a good bit of running' on Bill's flat four engine but did not show any advantage over the other types.

Two of the plugs are shown in the test rig and the way the spark jumps the gap can be seen (**photos 13 and 14**). I think the multiple sparks are because Bill's test rig is set to fire the plugs continuously (to enable photography) and the photographs are in fact showing several sparks rather than the one which would occur in normal use.

It seems that with modern materials, model I/C engine builders are now free from the vagaries of commercial plug availability and expense, and can make plugs to suit any engine being produced.

I thank Bill for all the information and samples he has sent and congratulate him on his work, particularly the photographs of plugs under test. Bill has used a variety of digital cameras for his shots and has obviously experimented a lot to get the results he has.

Electronic ignition systems

Having talked about spark plugs at length, this seems like a good time to share two new (to me at least) sources of complete electronic ignition systems with readers.

The first company is an American one, S/S Machine

& Engineering LLC. Details of several self contained electronic systems, kits and accessories can be found on the company web site www.cncengines.com Other contact details are: S/S Machine & Engineering LLC, 16940 County Road T, Fayette, OH 43521, T. (419) 452-6042. The company lists a range of systems including one designed for twin cylinder engines, which might come in useful soon!

The second company, Apache Aviation, is based in the UK and also supplies a range of self contained systems and accessories by the same manufacturer (RCXL). The company can be found at The Pump House, Longton Road, Stone, England, ST15 8TB, T. 01785 812583 or via the web site www.apacheaviation.co.uk This company does not list versions for the small 1/4in.x32tpi plugs on the web site, so an enquiry will be needed first to see if these can be supplied.

The systems are capacitor discharge systems of a similar type to the one shown in **photo 15**, which is one I obtained many years ago. Be warned that this type of system produces a very healthy spark which bites! The links for both sites will be on the Nemett web site <http://sites.google.com/site/nemettengines>

nemettengines by the time you read this.

These systems are all fully shielded and so are good for use with radio control models. This does mean that the engine must have adequate clearance round the spark plug for the HT lead. Those wishing to use one on the Lynx will need to machine a greater clearance round the outside of the spark plug. I will sort out a modification to cater for this at some point.

A milestone

As I was preparing this column, I have received the 80th order for drawings for the Lynx. I would like to express my thanks to all those who have bought drawings and make a plea for examples of the engine to be entered in the Model Engineer Exhibition this year so that I can award the Nemett Cup again. The cup could not be awarded last year because there were no examples at the show other than the last winner. **ME**

13. This circular discharge plug firing on the test rig shows that sparks can jump anywhere round the gap.

14. The 'star' electrode plug on the test rig.

15. These capacitor discharge Ignition systems give a very healthy spark.



What's going on at the Lindsey Model Society (LMS) in North Lincolnshire?



DOUG HEWSON

Doug Hewson
talks tankers.

What we are doing is building a train of 15 tank wagons as a club project to carry water to three yards on the railway where we do not have water supplies. There are already water storage facilities installed at the various yards so we are intending building a scale fuel terminal at each yard where the tanks can be discharged into the underground storage facilities. For further reading the railway is currently being described in the GL5 magazine *Turnout*.

We had a very pleasant running day on Saturday with two steam locomotives running and two Diesels. Ballan ran his K1 and Elizabeth ran her green L1. However, later in the day Malc was driving the L1 and found that he could turn the regulator about 200deg. and nothing happened at the other end. The locomotive was taken back on shed, fire dropped, dome removed, regulator rod out and it was found that the rod through the boiler was mild steel and the square on the end which went into the regulator had worn to a round stub. Neither Malc nor I had a piece of $\frac{3}{16}$ in. stainless long enough to make a replacement so it looks like the loco might be a failure for Sinsheim. Hopefully Graham will be able to make a temporary one to keep it in traffic.

Ballan's K1 ran like a sewing machine as usual. We got another one of the tank wagons completed so with Colin's two we now have six which is beginning to make a good train. I was in Peak Forest Signal box and put a point back early so crashed Ballan's new tank wagon on its first outing, sorry Ballan!

1. Dave Myers' Class 20 in Peak Forest Yard having just delivered a train of coal.

2. Another recently completed tank wagon.



Dave Myers brought his Class 20 so that meant we had three main line locomotives and therefore the main lines were kept busy. I took a few photos but the light level was so low almost everything which moved came out blurred. I have tried to rescue a few just for those who couldn't make it.

Our friend and stalwart driver training instructor Dave Kinsella came to visit us for the first time and just loved it so he has asked if he can join. He is going to come to the AGM and Geoff is going to rig him up with the necessary info.

Bob Willis worked Belle Isle Box and after a slight hiccup with the block bells we worked together all day. Good fun now that the signal boxes are running with telephones, block bells and instruments.

Since Saturday I have managed to get a few hours in the workshop and have got the next tank wagon finished apart from transfers. I will try to get

them on before next weekend and then it can be varnished. It is a 'Shell Electrical Oils' red tank and will officially be Geoff's. I also made the bottom discharge pipes for the next one which will be a black ESSO for Graham and Elizabeth. Last week I collected another Chassis from Malc which he had already painted and fitted the buffers and Ballan delivered all the buffers, springs, collars and draw gear for the remaining ones. I have just got started fitting the bottom discharge valve in the ESSO one so hopefully it will be completed in a few days. (When we have got over the New Year!) Malc and Steve have been painting the next underframes and apart from one all the other tanks are ready for the fittings to be added.

The lost wax castings arrived last week for the Fuel Terminal hose ends so once they are machined a start can be made on building the Terminals at Stowmarket, Peak Forest and Coton Hill.

In Memoriam

It is with the deepest regret that we record the passing of the following model engineer. The sympathy of staff at *Model Engineer* is extended to the family and friends they leave behind.

Kenneth Moule

St Albans and District and
Welwyn Garden City societies.

FEBRUARY

- 13 Colchester SMEE.** Members DVDs. Contact Jon Mottershaw: 01206 383456.
- 13 Hereford SME. AGM.** Contact Nigel Linwood: 01432 880649.
- 14 Glasgow & S.W. Rly Ass'n.** Iain Lothian: That was then, and this is now. Contact Bruce Steven: 0141 810 3871.
- 14 SM&EE.** Polly course training day 3. Contact Maurice Fagg: 020 8669 1480.
- 15 Birmingham SME.** Cup Competition Day. Contact Mike Page: 01564 784006.
- 15 Westland & Yeovil DMES.** Steam Memories. Contact Gerald Martyn: 01935 434126.
- 15 York City & DSME.** Running Day. Contact Pat Martindale: 01262 676291.
- 16 Lancaster & Morecambe MES.** Project Night. Contact Mike Glegg: 01995 606767.
- 16 Model Steam Road Vehicle Soc.** Mick Morris: Steam Locos & Traction Engines. Contact John Bagwell: 01452 304876.
- 16 Peterborough SME.** Stan Bray: Tales of an Old London Bobby. Contact Lee Nicholls: 01406 540263.

- 17 Chesterfield & District MES.** Meeting. Contact Mike Rhodes: 01623 648676.
- 18 Bristol SMEE.** Auction Sale. Contact Trevor Chambers: 0145 441 5085.
- 18 Hull DSME.** Malcolm High: Laser Cutting for model engineers. Contact Tony Finn: 01482 898434.
- 18 Leeds SMEE.** Bits & Pieces. Contact Geoff Shackleton: 01977 798138.
- 19 Sutton MEC.** Gauge 1 Round-Up. Contact Bob Wood: 020 8641 6258.
- 20 Colchester SMEE.** Auction. Contact Jon Mottershaw: 01206 383456.
- 20 North London SME.** Tony Dunbar: A trip to Train Mountain USA. Contact Rachael Chapman: 01442 275968.
- 21 SM&EE.** Workshop Topics. Contact Maurice Fagg: 020 8669 1480.
- 21 Westland & Yeovil DMES.** Track Running Day. Contact Gerald Martyn: 01935 434126.
- 21 York City & DSME.** Richard Green: Holgate Windmill. Contact Pat Martindale: 01262 676291.

- 23 Canterbury & District MES (UK).** Meeting. Contact Gina Pearson: 01227 830081.
- 26 Sutton MEC.** Michael Barker-Hemmings: Photographing your models. Contact Bob Wood: 020 8641 6258.
- 27 Colchester SMEE.** Auction. Contact Jon Mottershaw: 01206 383456.
- 27 Hereford SME.** Brian Perkins: Aquila Engine. Contact Nigel Linwood: 01432 880649.
- 27 Newton Abbot & District MES.** Meeting. Contact Graham Day: 01626 772739.
- 28 SM&EE.** AGM. Contact Maurice Fagg: 020 8669 1480.

MARCH

- 1 Frimley & Ascot LC.** Public Running. Contact Bob Downman: 01252 835042.
- 1 Reading SME.** Public Running. Contact Ian Fothergill: 0118 9421679.
- 2 Lancaster & Morecambe MES.** Informal. Contact Mike Glegg: 01995 606767.
- 2 Peterborough SME.** Bits & Pieces. Contact Lee Nicholls: 01406 540263.
- 3 Oxford (City of) SME.** Malcolm High: Laser cutting for model engineers. Contact Chris Kelland: 01235 770836.

- 3 Stamford MES.** Peter Scott: The BRM story. Contact Derek Brown: 01780 753162.
- 4 Birmingham SME.** Library & Chit Chat Evening. Contact Mike Page: 01564 784006.
- 4 Hull DSME.** Keith Ward: Tooling & Welding. Contact Tony Finn: 01482 898434.
- 4 Leeds SMEE.** Trophy Night. Contact Geoff Shackleton: 01977 798138.
- 5 Sutton MEC.** Bits & Pieces. Contact Bob Wood: 020 8641 6258.
- 5 Westland & Yeovil DMES.** Loctite Adhesives for model engineers. Contact Gerald Martyn: 01935 434126.
- 6 Colchester SMEE.** Hugh Mothersole: Steam Cars. Contact Jon Mottershaw: 01206 383456.
- 7 Birmingham SME.** Annual Dinner Dance. Contact Mike Page: 01564 784006.
- 7 SM&EE.** Track Day. Frank Banfield: Industrial Archive Films. Contact Maurice Fagg: 020 8669 1480.
- 7 York City & DSME.** Bits & Pieces. Contact Pat Martindale: 01262 676291.
- 8 Leeds SMEE.** Running Day. Contact Geoff Shackleton: 01977 798138.

ISSUE NEXT

- Martin Wallis introduces his new 6in. Scale Gold Medal Tractor
- Producing shallow tapers
- Re-Cycle Engine part 2
- Sugden Special part 3
- McOnie's Engine
- Mike Sayers' Bentley Engine part 2
- Neville Evans continues with Stowe
- Making Chessmen part 2
- Better Benders
- Making testing times easier

PLUS all your regular favourites

Norman Barber describes his hydraulic testing rig for testing boilers and boiler fittings. This purpose made fixture saves having to bodge a setup each time you need to test a boiler or a fitting.

The next issue will also include a free double-sided plan. One side will have the first of six sheets for Martin Evans Metro tank engine in 5in. gauge and the other side will have Edgar Westbury's Zephyr petrol engine.



ON SALE 27 FEBRUARY 2009

Contents subject to alteration

FREE

Private Adverts

MODEL ENGINEER

MODEL ENGINEERS' WORKSHOP

Subscribers, see these adverts five days early!

**SUBSCRIBE
TODAY
AND SAVE
£££'S**

Machines offered

■ 32 Imperial drills, 1/2in. - 1in., No.1, 2 & 3 MT shanks all in good condition, also No.2 No.3 jump up sleeve. All in home made wooden stand, very heavy therefore prefer buyer to collect, £120. 550 Watt 240 volt single phase electric motor, 1425 rpm with resilient mountings, ex Myford Super 7 lathe. Comes with toggle type reversing switch (Up/Down). Very heavy, prefer buyer to test and collect, £60 the pair. Several ex golf trolley 12 volt dc motors, some with controllers all in good working order, £15 each. **Tel: 01723 362537 Scarborough.**

■ Myford Super Seven with gearbox, chucks etc. £550. Hobbyrat mill including selection of cutters, £385. **Tel: 01245 250297 Chelmsford.**

■ Myford ML7 on makers stand, 4 jaw and tailstock chucks, faceplate, catchplate, changewheels, centres and vertical slide, all in good working order, £600 ono. **Tel: 01559 370354 Carmarthen.**

■ Myford Super Seven, approx 1957, three-jaw chuck all in useable condition, £495 ono. **Tel: 01246 277357 Chesterfield.**

■ Senior horizontal mill (not M1) floor standing, single phase, table 23in. x 6in., very old but well made British machine, buyer collects, £275. **Tel: 01903 786821 West Sussex.**

■ Myford ML10 with three and four-jaw chucks, 4in. and 6in. faceplates, change wheels, leadscrew clutch, centres, roller bearing version, wooden bench included if required, £600. **Tel: 0131 6609443 Edinburgh.**

■ Excel 'Pinnacle' universal mill/drill, 3/4hp, 5 speed belt drive, 3MT spindle, 3 1/2in. stroke, calibrated fine feed, 3/8in. BSW drawbar, 18in. x 6in. table, dovetail gibs, imperial graduated handwheels, large 30 x 33 steel drip tray. **Tel: 01792 298564 Swansea.**

■ Bullfinch torch (self igniting) with two burners, hose and regulator, £30. **Tel: 01256 862932 Basingstoke.**

Models offered

■ 5in. Gauge Simplex running chassis with boiler, 90% built, excellent engineering, £3,500ono. **Tel: 01782 711353 Stoke on Trent.**

■ 7 1/2in. gauge 0-4-0 narrow gauge locomotive, diesel hydraulic, air cooled diesel engine driving Eaton Hydraulics. Vacuum braking on loco and truck. Alternator charging system, lighting and speedo with driving truck. £4000 ono. **Tel: 01245 401326 Chelmsford.**

■ Speedy, 5in. gauge gunmetal cylinder castings, £90. **Tel: 0151 6372492 New Brighton.**

■ Sweet Violet 3 1/2in. gauge part built chassis, drawings and cylinder set, £200 ono + P&P. **Tel: 01484 665368 Huddersfield.**

Models wanted

■ 5in. gauge locomotive, British prototype, quality engineered, painted and lined and fully detailed, current S/Name boiler certificate. **Tel: 01948 666149 Shropshire.**

■ Castings etc. for 5in. Dinorwic Hunslet 'Alice' to the Don Young design, would prefer unmachined but will consider any castings for this loco. **Tel: 01472 389229 Grimsby.**

■ Battery locomotive and driving trolley for 5in. gauge garden railway, part built or in need of

TLC OK, need for son's hobby. **Tel: 01303 875136 Folkestone.**

■ Edgar Westbury, Seagull, Seal, Sea Lion or similar engines to complete two period model boats, part completed engines considered. **Tel: 01430 431997 East Yorkshire.**

■ Model Aircraft engines wanted, mainly diesel and also spare parts. **Tel: (evenings) 02088 048869 Enfield.**

Miscellaneous offered

■ Glass optical flat 1in. x 6in. x 16in., perfect condition, sensible offer accepted, buyer collects, brass bar at half price, 2in.dia. x 14 1/2in., 2in.dia. x 20 1/2in., 2 1/2in.dia. x 17 1/2in., 2 1/2in.dia. x 9 1/2in., 3 1/2in.dia. x 15 1/2in., 3 1/2in.dia. x 15 1/2in., 1 1/2in. hex x 19 1/2in. Other sizes available, buyer collects. **Tel: 01252 842626 Camberley.**

■ Pressure gauge, 25mm dia 0-30 Kg/cm², £5 + P&P. **Tel: 01276 508434 Camberley.**

■ Blacksmiths swage block on cast iron base, 18 x 18 x 6, buyer collects, £125. **Tel: 01706 822473 Lincs.**

FOR SALE Wanted **MACHINES** Tools **MODELS** Miscellaneous **BOOKS** Magazines **MATERIALS** Information

YOUR FREE ADVERTISEMENT: (Max 30 words plus phone & town - please write clearly)

Phone:			Town:		
No Mobile phone numbers except by prior arrangement			Please use nearest well known town		

Please insert advert into: (Tick one box only)

☐ Model Engineer ☐ Model Engineers' Workshop

Name

Address

.....

.....

..... Postcode

Please post to:

David Clark, **ME/MEW FREE ADS**, MyHobbyStoreLtd, Berwick House, 8-10 Knoll Rise, Orpington, Kent BR6 0EL

Photocopies of this form are acceptable.

Adverts will be placed as soon as space is available.

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

SPECIAL EDITION MAGAZINE

RESERVE YOUR COPY NOW!

16mm Narrow gauge in your garden

From the publishers of

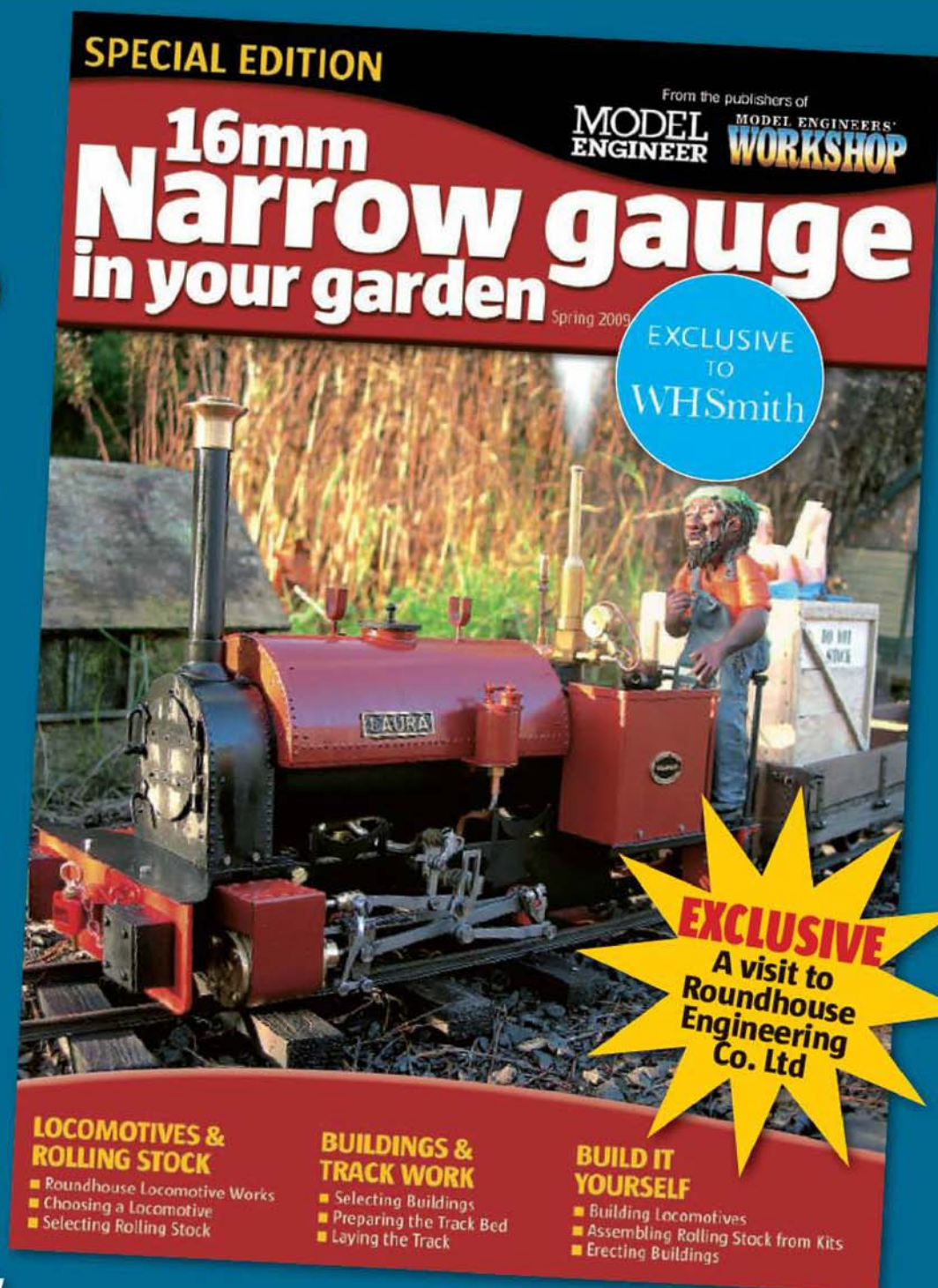
MODEL ENGINEER

MODEL ENGINEERS' WORKSHOP

- The complete guide to building a 16mm Narrow Gauge Railway in your Garden
- Learn to design the track layout, do the earthworks and lay the track
- Find out how to build your own rolling stock and buildings from kits
- This special edition features a visit to the Roundhouse Locomotive Works in Doncaster

**DON'T MISS OUT,
RESERVE YOUR
COPY TODAY -**

CLOSING DATE 26TH FEBRUARY



Reserve your copy by calling +44 (0) 1858 438 797 and quote REF: S087
or online at www.subscription.co.uk/myhobbystore/gauge/S087

ON SALE exclusive to WHSmith - 5TH MARCH 2009

GB BOILER SERVICES

COPPER BOILERS FOR LOCOMOTIVES AND TRACTION ENGINES etc.

MADE TO ORDER

Constructed to latest European Standards 7 1/4" gauge and P.E.D. category 2 Specialist

Enquiries, Prices and Delivery:

Telephone:

Coventry 02476 733461

Mobile: 07817 269164

NO VAT



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



COMPASS HOUSE MODEL ENGINEERING



BATTERY ELECTRIC LOCOMOTIVES

In 7 1/4" & 5" Gauge

Ready to run or Machined kits

Showroom Preseason Open Weekend

Thursday 19th—Saturday 21st March

Come and view a selection of model's from our range and discuss your requirements.

We also have some clearance line's from our old tool stock plus castings, wheels and many other items all at bargain prices.

Thursday/Friday 10.00 – 16.00 Saturday 10.00 – 14.00



Colour Catalogue

£3.00

Post paid

www.compass-house.co.uk

High Street, Rotherfield, East Sussex, TN6 3LH

PHONE: 01892 852968 - 07711 717067 - 07811 048364

sales@compass-house.co.uk



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 • 1/2 HP (0.37kW) £94.95
• 1 HP (0.75kW) £134.95 • 2 HP (1.5kW) £189.95
• 3 HP (2.2kW) £239.95



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.



THE NEW DRIVES DIRECT ROTARY PHASE CONVERTER

THE BEST QUALITY AT THE BEST PRICE ANYWHERE

- Simple Plug and Play 3 Phase Conversion.
 - 240V Single phase Input with a 415V 3 Phase+N output via a 5 pin socket.
 - Input and Output overload protection via MCB.
 - Input Amp meter.
 - Pushbutton START/STOP controls.
 - Mains ON Pilot Light.
 - No MINIMUM LOAD required.
- 2HP - £475 • 3HP - £550 • 4HP - £650 • 5 1/2 HP - £750
• 7 1/2 HP - £950 • 10HP - £1095 • 15HP - £1375



3 PHASE ELECTRIC MOTORS

We offer a range of high quality aluminium 3 phase motors in sizes ranging from 90 Watts (1/8 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 £99.95



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 £649.95



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**

New Online Shop at
www.ajreeves.com



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

Class 2, 14-0 Tender Loco

This fine design of standard gauge 'locomotive' has been well proven in service with many excellent having been built.

Block Code	Description	Image	Price
15001	BR CLASS 2 DRAWINGS "T"	No Image Available	£39.95
15001B	BR CLASS 2 CONSTRUCTION MANUAL	No Image Available	£16.45
15001C	BR CLASS 2 INDIVIDUAL DRAWING	No Image Available	£5.91
15002	BR CLASS 2 LOCO FRAME STEEL	No Image Available	£19.00
15003	BR CLASS 2 LOCO BUFFER BEAM STEEL	No Image Available	£5.00
15004	BR CLASS 2 LOCO CYLINDER STEEL	No Image Available	£12.00

Back to Main Site

How to Use this Site

1. 0-10" Locomotive 14-0 tender available.

2. 0-10" Locomotive 14-0 tender available.

3. 0-10" Locomotive 14-0 tender available.

4. 0-10" Locomotive 14-0 tender available.

5. 0-10" Locomotive 14-0 tender available.

6. 0-10" Locomotive 14-0 tender available.

7. 0-10" Locomotive 14-0 tender available.

8. 0-10" Locomotive 14-0 tender available.

9. 0-10" Locomotive 14-0 tender available.

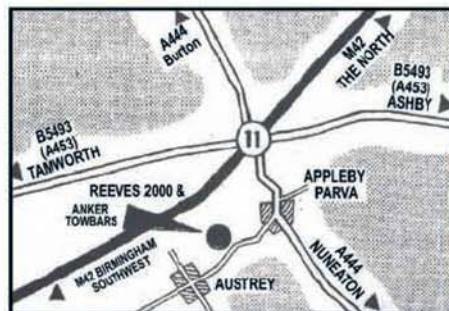
10. 0-10" Locomotive 14-0 tender available.

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,
Brazing & Silver
Solders
and much more.....



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

9:00am-4.30pm Monday - Friday
9:00am-12.00pm Saturday



The World's Largest Stockists
of Model Engineering Supplies



The 'Starter Kit'



SIEVERT®
Heating tools for professionals

+
5 x J&M Easy-flo 2, 1.5mm
+
50g Easy-flo Flux
= **£79.95** inc VAT
(while stocks last, please mention advert when ordering)
Save over £25 on separate selling price

'starter kit' includes 1x50g Easy-flo flux, 5x1.5mmx600mm Easy-flo 2 rods,
1xregulator, 1x3m hose, 1xS3486 handle, 1xS3511 neck tube, 1x2941 burner



Always ask for genuine Johnson & Matthey, don't accept anything less!!!

Trade Counter Now Fully Stocked and Open to Callers - ALL WELCOME
Reeves 2000
Appleby Hill
Austrey
Warks
CV9 3ER
Tel: 01827 830894
Fax: 01827 830631
sales@ajreeves.com
<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
• LH/RH thread screw cutting
• Electronic variable speed • Gear change set
• Self centering 3 jaw chuck & guard • Power feed

Machine Mart

53 SUPERSTORES NATIONWIDE

FREE CATALOGUE
GET YOUR COPY NOW
0844 880 1265
www.machinemart.co.uk
NEW LOWER 15% VAT



Where *Quality* Costs Less

ONLY £399.99
£459.99
Full range of accessories available

CLARKE MICRO MILLING & DRILLING MACHINE

CLARKE

- 150w/230v motor
- Variable speed 100-2000rpm
- M12 Spindle Taper
- Face mill capacity 20mm, end mill 10mm • Table cross travel 90mm, longitudinal travel 180mm

CMD10

ONLY £249.99
£287.99

CLARKE MEASURING EQUIPMENT

CLARKE

FROM ONLY **£8.99**
£10.99

MODEL	DESCRIPTION	EX VAT	INC VAT
CM100	150mm/6" Vernier Caliper	£9.99	£10.34
CM180	0-25mm Micrometer	£9.99	£11.48
CM145	150mm/6" Digital Vernier	£18.99	£21.84

CLARKE CUT-OFF SAW

CLARKE

- For fast, accurate cutting of ferrous metals, brick, stone etc.
- 2200w, 230v, 1 phase motor
- Cuts material up to 115mm diameter

CC014

FROM ONLY **£89.99**
£103.99

CLARKE BENCH GRINDER STAND

CLARKE

- Complete with belt mountings and feet anchor holes

BGS1

ONLY £34.99
£40.99

CLARKE BENCH GRINDERS

CLARKE

FROM ONLY **£19.99**
£22.99

6" & 8" available with light

MODEL	DUTY	WHEEL DIA.	EX VAT	INC VAT
CB66RP	PRO	150mm	£19.99	£22.98
CB66RZ	PRO	150mm	£27.99	£32.19
CB66SB	PRO	150mm	£37.99	£43.69
CB66RW	HD	150mm	£37.99	£43.69
CB66RSC	HD	200mm	£47.99	£55.19
CB66SW	(wet) HD	150/200mm	£39.99	£45.98

CLARKE TURBO FAN GAS HEATERS

CLARKE

- Efficient gas heater for medium sized spaces • 35,000 btu/hr

LITTLE DEVIL

FROM ONLY **£69.99**
£80.99

Full range of infra-red heaters also available

CLARKE VARIABLE SPEED LATHE

CLARKE

CL250M

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

ONLY £289.99
£333.99

CLARKE AIRBRUSH KITS

CLARKE

FROM ONLY **£6.99**
£8.99

DIY KIT - CAB1H
Spray pattern adjustable
ONLY £6.99 EX VAT
£8.04 INC VAT

PRO KIT - CAB2P (pictured)
Double action trigger for accurate air/paint control
Precision machined nozzle • Special lightweight hose
ONLY £19.99 EX VAT £22.98 INC VAT

CLARKE ROTARY TOOL KIT

CLARKE

CRT40

ONLY £24.99
£28.99

Kit includes:

- Height adjustable stand with clamp
- Rotary tool
- 1m flexible drive
- 40x accessories/consumables

CLARKE TAP & DIE SETS

CLARKE

FROM ONLY **£12.99**
£14.99

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

TYPE	EX VAT	INC VAT
16pc Metric	£12.99	£14.94
24pc UNC/UNF/NPT	£19.99	£22.98
28pc Metric	£19.99	£22.98
33pc Metric/UNC/NPT	£29.99	£34.48
32pc Metric	£34.99	£40.24

24pc Best Budget Buy, 34pc Recommended Practical Classics

CLARKE MAGNIFYING LAMPS

CLARKE

ONLY £14.99
£17.99

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

CLARKE BELT AND DISC SANDER

CLARKE

CS4-9C

ONLY £64.99
£74.99

Also Available
6" belt & disc sander
also available
£151.99 EX VAT
£183.98 INC VAT

- 230v motor
- 4"x36" belt - tilts & locks at any angle 0 to 90°
- 6" diameter disc • 6" dust extraction port
- Supplied with removable sanding table

CLARKE DRILL PRESSES

CLARKE

- Tables tilt 0-45° left & right
- Depth gauge
- Chuck guards

B-Bench mounted
F-Floor standing

MODEL	WATTS	EX VAT	INC VAT
CDP50D	250/5	£47.99	£55.19
CDP101B	245/5	£59.98	£68.98
CDP151B	300/5	£79.98	£91.98
CDP10B	370/12	£99.98	£113.48
CDP301B	510/12	£149.98	£172.48
CDP451F	510/16	£199.98	£229.98
CDP501F	900/12	£379.98	£436.98

* Includes wet 'T' slot table & worklight

CLARKE ENGINEERING SWIVEL VICES

CLARKE

ONLY **£14.99**
£17.99

• A range of swivel base vices with top quality cast iron construction

CMV125

• Red in colour • Swivel & Rotate

MODEL	JAW WIDTH	OPENING	DEPTH	EX VAT	INC VAT
CMV100B	100x100x55	mm	mm	£14.99	£17.24
CMV48B	100x100x55	mm	mm	£14.99	£17.24
CMV150B	150x180x80	mm	mm	£33.99	£39.09
CMV125	125x120x75	mm	mm	£44.99	£51.74

CLARKE SOLDERING KIT

CLARKE

ONLY **£13.99**
£16.99

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

CLARKE ARC/TIG INVERTERS

CLARKE

FROM ONLY **£139.99**
£160.99

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

MODEL	AMPS	ELECTRODE	EX VAT	INC VAT
85	25/80	2mm	£139.99	£160.98
110	30/105	2.5mm	£169.99	£195.48
155	22/140	3.25mm	£289.98	£333.48

CLARKE CERAMIC HEATERS

CLARKE

- For fast, efficient heating in workshops, garages etc.
- Lightweight & portable
- Variable output, 1.4kw 1 panel, 2.8kw 2 panels

FROM ONLY **£89.99**
£103.99

DEVIL 340

MODEL	EX VAT	INC VAT
Devil 340 - 230v	£89.99	£103.48
Devil 340 - 110v	£99.98	£114.98

CLARKE 12 SPD MILL/DRILL

CLARKE

CMD125C

Precision engineered with cast iron head, base & column

- Spindle speeds 100-2150rpm
- ¾ Hp, 230v, 1 Ph motor
- Accessories available
- 63mm milling cutter
- 16mm chuck
- Table size 585x190mm

ONLY **£679.99**
£780.99

CLARKE BOLTLESS SHELVING/BENCHES

CLARKE

FROM ONLY **£29.99**
£34.99

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

CS5150

Available in red, dark grey, blue & galvanised steel

MODEL	SHELF DIM(WxDH)	CAPACITY	EX VAT	INC VAT
CS5150	800x300x1500mm	150kg	£29.99	£34.48
CS5350	1800x400x900mm	350kg	£44.99	£51.74
CS5550	1800x400x900mm	350kg	£49.99	£57.48

* All colours • Red, dark grey & blue.

CLARKE TURBO AIR COMPRESSORS

CLARKE

FROM ONLY **£99.99**
£114.99

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

air master

BIG 2Hp 7.8cfm

- Higher Outputs
- Higher Specifications

MODEL	MOTOR	CFM	TANK	EX VAT	INC VAT
Tiger 8/44	2 Hp	7.8	24ltr	£99.99	£114.98
Tiger 8/64	2 Hp	7.8	50ltr	£149.99	£172.48
Tiger 9/24	2.5 Hp	8.7	24ltr	£139.99	£160.98
Tiger 9/60	2.5 Hp	8.7	50ltr	£179.99	£206.98
Boxer 55f	3 Hp	12.2	50ltr	£329.99	£379.48

† Belt Driven

CLARKE WORKSHOP CRANES

CLARKE

FROM ONLY **£129.99**
£149.99

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

Fully tested to proof load

CLARKE CHESTS & CABINETS

CLARKE

FROM ONLY **£59.99**
£68.99

BALL BEARING

HEAVY DUTY

MODEL	DESC.	DR. LOAD	EX VAT	INC VAT
2 CB2203	3 Dr step up	38kg	£59.99	£68.98
1 CB2804	4 Dr chest	38kg	£74.99	£86.24
4 CB2206	6 Dr chest	38kg	£99.99	£114.98
CB2209	9 Dr chest	38kg	£109.99	£126.48
CB2210	10 Dr chest	30kg	£139.99	£160.98
CB2212	3 Dr cab	43kg	£159.99	£183.98
3 CB2215	5 Dr cab	43kg	£189.99	£218.48
5 CB2217	7 Dr cab	43kg	£219.99	£252.98

CLARKE ENGINEERS STEEL WORKBENCHES

CLARKE

FROM ONLY **£139.99**
£160.99

ONLY £79.99 EX VAT £91.98 INC VAT

- Sturdy lower shelf
- Durable powder coated finish
- INCLUDES SINGLE LOCKABLE DRAWER
- shown fitted with optional 3 draw unit

MODEL	SIZE (LxWxH)	EX VAT	INC VAT
CWB1000B	1000x500x880	£139.99	£160.98
CWB1500B	1500x500x880	£189.99	£196.48
CWB2000B	2000x500x880	£209.99	£241.48

CLARKE MIG WELDERS

CLARKE

Includes:

- Gas regulator
- Earth clamp
- Face mask
- Welding torch

FROM ONLY **£124.99**
£143.99

Pro90-151TE includes CO2 gas bottle

MODEL	MIN-MAX AMPS	EX VAT	INC VAT
950NB (No gas)	27-85	£124.99	£143.74
90NB (No gas/gas)	24-90	£139.99	£160.98
Pro 90	24-90	£149.99	£172.48
110E	30-100	£179.99	£206.98
135TE	30-130	£199.99	£229.98
135TE	30-150	£229.99	£264.48
135TE Turbo	30-155	£299.99	£344.98

CLARKE 6 SPEED METAL LATHE WITH 12 SPEED MILL DRILL

CLARKE

ONLY **£649.99**
£747.99

- 430mm between centres
- Compound slide with 4 way tool post
- Power fed screw cutting facility
- Forward/reverse lathe operation
- Clutch for independent mill/drill operation
- Shown with optional floor stand & tray
- ONLY £129.99 EX VAT £149.98 INC VAT
- ALSO AVAILABLE: CL430 • As above but without the Mill/Drill head £539.98 EX VAT £620.98 INC VAT

BUY IN-STORE

MAIL ORDER
0844 880 1250 Mon-Sat 8:30-6pm

ORDER ONLINE
www.machinemart.co.uk
Over 6500 products, see the full range

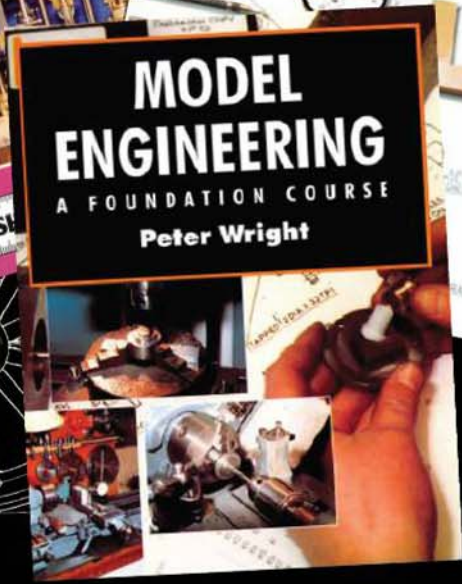
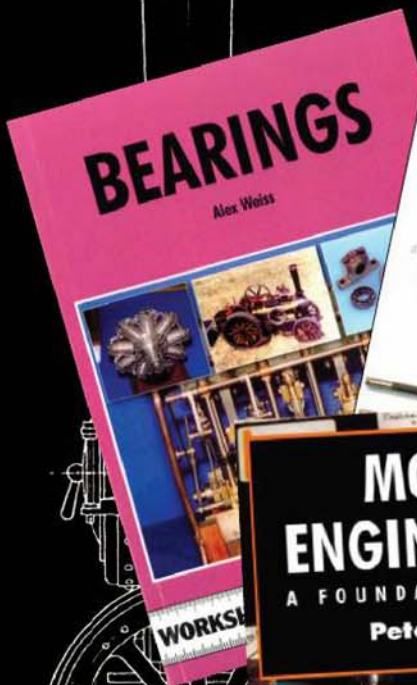
NEW STORES
Sunday Opening at
Burton Upon Trent
Lincoln & Warrington

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

BARNESLEY Pontefract Road, Barnsley	01226 732 297	GATESHEAD 50 Lobley Hill Road	0191 493 2520	NOTTINGHAM 211 Lower Parliament Street	0115 956 1811
B'HAM GREAT BARR 4 Birmingham Road	0121 358 7077	GLASGOW 290 Gt Western Rd	0141 332 9231	PETERBOROUGH 417 Lincoln Road, Millfield	01733 311770
B'HAM HAY MILLS 1152 Country Road, Hay Mills	0121 771 3433	GLoucester 221A Barton Street	01452 417 949	PLYMOUTH 58-64 Embankment Road	01752 254050
BOLTON 1 Thynne Street	01204 365796	GRimsby Ellis Way	01472 354435	POOLE 127-129 Bournemouth Road, Parkstone	01202 717913
BRADFORD 105-107 Manningham Lane	01274 390052	HULL 8-10 Holderness Road	01482 223161	PORTSMOUTH 277-283 Copnor Road, Copnor	023 9265 477
BRISTOL 1-3 Church Road, Lawrence Hill	0117 936 1060	ILFORD 746-748 Eastern Ave	0208 518 4286	PRESTON 53 Blackpool Road	01772 703263
BURTON UPON TRENT 12a Lichfield Street	01283 564 708	LEEDS 227-229 Kirkstall Road	0113 231 0400	SHEFFIELD 453 London Road, Healey	0114 258 0831
CARDIFF 44-46 City Road	020 2046 5424	LEICESTER 60 Malton Road	0116 261 0689	SOUTHAMPTON 516-518 Portswood Road	023 8056 7788
CARLISLE 85 London Road	01228 591696	LINCOLN Unit 5, Palmam Centre, Canwick Rd	01522 543 036	SOUTHEND 1130-1141 London Rd, Leigh on Sea	01702 483 742
CHESTER 43-45 St. James Street	01244 311258	LIVERPOOL 80-98 London Road	0151 709 4484	STOKE-ON-TRENT 382-396 Waterloo Road, Hanley	0181 519 8773
COLCHESTER 4 North Station Road	01206 762631	LONDON 6 Kenda Park, Edmonton N18	020 8803 0861	SUNDERLAND 13-15 Ryhope Road, Graythwaite	0191 519 8773
COVENTRY Bishop St	024 7622 4227	LONDON 503-507 Lea Bridge Road, Leyton, E10 020	0858 8294	SWANSEA 7 Sarriat Road, Llanerhaenydd	01792 702990
CROYDON 42-423 Brighton Road, South Croydon	020 8763 0640	LONDON 100 The Highway, Docklands	020 7488 2129	THWICKENHAM 83-85 Heath Road	01793 491717
DARLINGTON 214 Northgate	01325 380841	MAIDSTONE 57 Upper Stone Street	01622 769 572	WARRINGTON Unit 3, Handley's Trade Pk, Handley's Ln	01925 630 937
DEAL (KENT) 182-186 High Street	01304 373 434	MANCHESTER 71 Manchester Road, Altrincham	0161 941 2666	WOLVERHAMPTON Parkfield Road, Bliton	01902 494186
DERBY Derwent Street	01332 290031	MANCHESTER 169 Chatterfield Road South	01623 622160	WORCESTER 48a Upper Tything	01905 723451
DUNDEE 24-26 Trades Lane	01382 225 140	MIDDLESBROUGH Mandale Triangle, Thornaby	01642 677891		
EDINBURGH 163-171 Pleasfield Terrace	0131 659 5919	NORWICH 282a Higham Street	01603 766402		

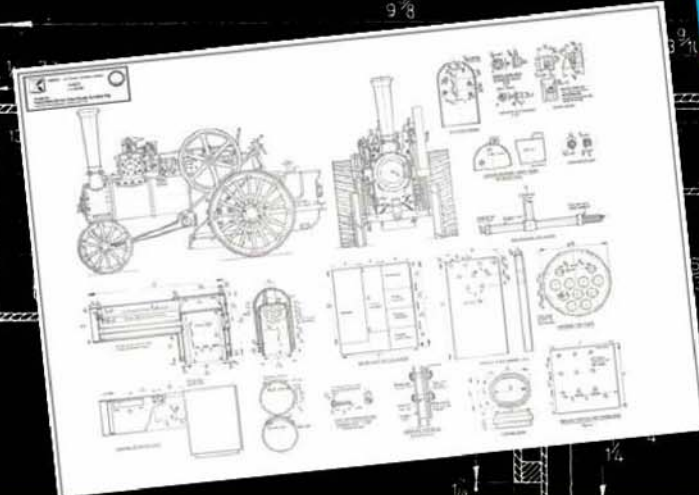
Maximum call charges from a BT landline are 5p/min to 0844. Calls from mobile & other networks may vary. For security reasons, calls may be monitored. All prices correct at time of going to press. We reserve the right to change products & prices at any time. All offers subject to availability, E&OE.

Books



Subscriptions

Plans



BUY TWO PLANS ONLINE
AND RECEIVE ONE
FREE

Everything a Model Engineer needs from
back issues, binders and plans through to
subscriptions and exhibition tickets.

**MODEL
ENGINEER**

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.

BOOST PHASE CONVERTERS



The UK's most advanced
phase converters with a
unique 3 year guarantee.
Never beaten on price.

Tel: 01344 303 311
Fax: 01344 303 312
Mob. 07952 717960
www.boost-energy.com
info@boost-energy.com

BOOST HAS BEEN MANUFACTURING HIGH QUALITY
PHASE CONVERTERS IN THE UK SINCE 1957

Breaking MYFORD ML7 & SUPER 7 lathes

Most parts available • Home workshops cleared
• World wide shipping •
• We accept cards on mail order •
(Myford ML10, ML7 & Super 7 lathes always wanted)
Sorry we do not stock parts for other makes of lathes
We are open: Monday-Friday 9-5pm.

www.new-or-used.co.uk

LATHE PARTS • lathe-parts@new-or-used.co.uk
Tel: 01205 480 666 • Near Boston, Lincs. UK. NE40

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: phillsales@aol.com www.phillsales.com

PART BUILT 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 complete.

Will travel any distance.

Please telephone Graham. **0121 358 4320**

COMPLETE HOME WORKSHOPS

AND MODELS PURCHASED.

DISTANCE NO OBJECT

Tel: Mike Bidwell on

01245 222743

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**

ALL STEAM ENGINES WANTED

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



ALL 5" GAUGE LOCO's WANTED

Hunslet, 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

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

ALL TRACTION ENGINES WANTED

Minnie, Burrell, Royal Chester, etc

ALL PART BUILT MODELS WANTED

WORKSHOPS BOUGHT AND CLEARED

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 at 2. All copper construction, silver soldered throughout using quality materials to the standards required by the APCBM(ME), PER, & relevant Model Engineering Associations. CE marked and certificates of proof test and conformity supplied.

Write or phone to Helen Verrall:
Unit 4A, Love Lane, Burnham-on-Sea
Somerset. TA8 1EY
Tel. 01278 786 007
Visit our website: www.westernsteam.co.uk

myford
Enjoy a day with us at the
MYFORD SPRING SHOW
Thursday 16th April
to
Saturday 18th April 2009
To find out more contact Malcolm
0115 925 4222
Website: www.myford.com
Email: sales@myford.com

www.modelsteamenginesuk.com

Cotswold HERITAGE

BCA MkIII Jig Borer/Miller
1 Phase Supply
2 Machines available, both equipped.
For details contact:
TENGA Eng Co Ltd.
Telephone: **01425 622567**

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.

www.powercapacitors.co.uk
Transwave
CONVERTERS
THE ONE-STOP CONVERTER SHOP
The ONLY Phase Converter Manufactured to BS EN ISO 9001/2000
PLUS WARRANTY
OPERATE THREE PHASE MACHINERY FROM YOUR SINGLE PHASE SUPPLY
• ROTARY CONVERTERS
• STATIC CONVERTERS
• IMO 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, Harrogate, Bristol, Ascot and Leamington Spa Model Engineering Exhibitions
Local Call: 0844 7700 272
transwave@powercapacitors.co.uk

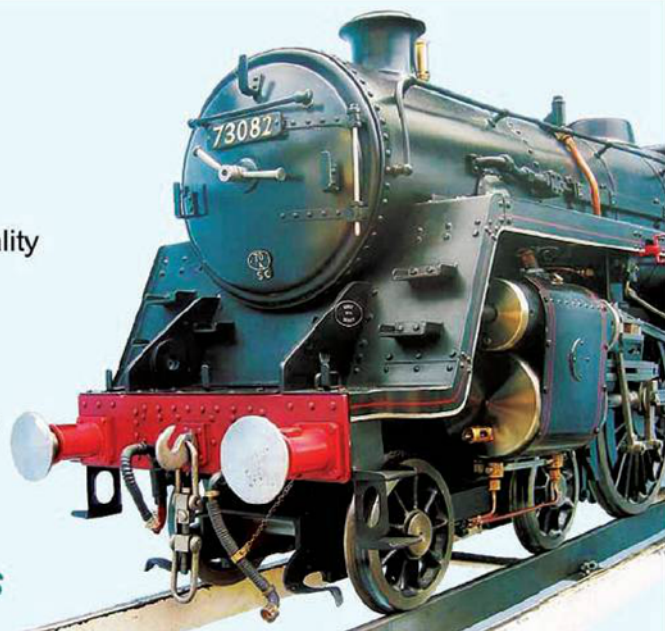
THINKING OF SELLING YOUR LATHE MILL OR COMPLETE WORKSHOP?
and want it handled in a quick, professional no fuss manner? Contact
David Anchell, Quillstar (Nottingham).
Tel: 0115 9206123 Mob: 07779432060

BA FASTENERS IN BRASS STEEL & STAINLESS
SPLIT PINS, TAPER PINS, ROLL PINS, TAPS, DIES, DRILLS, NUTS WASHERS, RIVETS, MATERIALS
Send Stamped addressed envelope plus four first class stamps for 28 Page List (Overseas £2.50) 'Quote Me'
"ITEMS" MAIL ORDER LTD,
Mayfield, Marsh Lane, Saundby,
Nr Retford, Nottinghamshire, DN22 9ES
Telephone 01427 848880 Fax 01427 848880

Don't know what it's worth?

- Good prices paid for all live steam models
Locomotives from gauge 1 to 10 1/4 inch
Traction engines to 6 inch scale
Part-built or broken through to exhibition quality
- A no-obligation offer and firm decision over the telephone
- Fully-insured collection arranged nationwide
- Free seller's guide on request

Speak to the experts



STATIONROADSTEAM.COM

Build, buy & sell all types and sizes of locomotives, traction & stationary engines

Call Mike or Jayne Palmer on 01526 320012 (office) or 01526 328772 (workshop)

Station Road Steam Ltd, Unit 16 Moorlands Industrial Estate, Metherringham, Lincs LN4 3HX
Open daily Monday to Saturday from 8am to 6pm, visitors welcome by appointment

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



£275-£425

JUST IN!
Fobco, Startrite, Ajax & Meddings 240 volt bench drills



£2450

JUST IN!
Boxford 1130 lathe (not finished)



£3450

Elliot '00' Omnimill. One of the BEST ones yet!! Vertical and horizontal



£65-£80

Eclipse De-magnetisers



£164.50

Crompton/Tyco NEW motor for ML7/Super 7



£595/£345



£875



£2950

JUST IN!

Harrison M250 5" x 30 lathe



£3250

Boxford 5" x CLUTCH / IMP gearbox almost immaculate RARE!



£345

Zeatz 10" rotary table



£3550

Myford Super 7, 3 1/2" x 19" lathe genuine as NEW



£245

RJH Trimtool grinder + stand



£185 2 available

Harrison M300 fixed steady HARD TO GET!



'Home and Workshop Machinery' "Special NEW YEAR deals"

Myford vertical slides £100 - £245
Herke tapping machine £375
Micrometers (various) £5 - £40 each
Vertical milling cutters £2 - £7 each
J&S arbor press (large) £225
Bridgeport slotting head (last one) £750
Taylor spinning lathes £1250 - £1650
RJH Ferret (240V) grinder £345
Gear cutters small each £12
Swage block 12" square £125
Crompton NEW 2HP motor each £120
Myford MA99E collets each £20

20 Assorted 1" bore horizontal milling cutters for £59*
*inclusive of post and VAT. UK mainland only.

Stock changing daily!



JUST £950

Colchester Student 1500rpm



£725

Startrite 1475 steel cutting vertical bandsaw in excellent condition



£575

Q and S 6" Sawmaster hacksaw



£1250

Waltons 50" 16g guillotine + stops



£2950

Boxford 250STS (rare 240 volts model)



£1125

Astra L4 vertical & horizontal mill + chuck & stand



£1125

Clarkson Mk11 tool and cutter grinder



£625

Clarkson drill point and tap grinder



£1750

Harrison 140 lathe + gearbox & power cross feed



£345

Fobco 1/2" drilling machine



£2450

Bridgeport turret mill awaiting cleaning (power two ways)



£425

RJH bench grinder / buffer - 240 volts



NEW £125

Milling/Drilling ground X-Y table



JUST IN!

Harrison M300 6" x 24"

£2750

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

DISTANCE NO PROBLEM! DEFINITELY WORTH A VISIT ALL PRICES EXCLUSIVE OF VAT

Just a small selection of our current stock photographed!

We have wood lathes, saw benches, bandsaws, morticers and Record vices etc - large selection!





£245

CEJ (Sweden) gauge blocks / slips



£1650

Taylor spinning lathe + tooling



JUST IN!

Myford vertical slides and accessories



£1200

Harrison LS lathe



£40 & £50 each

Keyway broaches 7/16" 18mm



£1250

Colchester Chipmaster



£375

Herke tapping machine (awaiting cleaning)



£950

Cowell's miniature milling machine



£345

RJH Trimtool grinder (240 volts)



£425

Huntton 6" hand corner knocker



£40

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



£550

Boxford dividing head + two plates



£40/£45

Pap No.0 & No.1



£40 each

Dickson toolposts to suit Colchester Mascot (others available)



£125

Harrison M300 travelling steady (one available)



£245

Boxford 5" vertical fixed steady



£155

Colchester Triumph fixed steady



£20 each

M & W / Eclipse surface gauges



Just in £345

Q and S 6" power hacksaw + coolant



£525

Viceroy metal/woodworking lathe (240 volts)



£120

Clarkson 40INT collet chuck + collets (we have 2MT-5MT and 30INT to 50INT in stock!!)



£525

Viceroy 5" x 24" lathe



£345

Abwood 6" swivel / tilt machine vice



£225

Burnerd 'LO', D13 & D14 collet chucks



£245

Vertical / horizontal bar holding vice



£1175

Clarkson Mk11 tool and cutter grinder



£575

Raglan 5" x 24" lathe



Tom Senior M1



£2750

Startrite TA1250 12" full sliding table saw bench (240 volts)



£625

RJH vertical liner + built in extractor



Winter Reduction to £250

Clarke Vacuum former 917 (up-graded) + stand



£625

Harrison horizontal milling machine



£20 each

Myford MA99E collet chuck collets



£1950

Boxford STS 1020 lathe



£245

Denford Viceroy buffer's



£70

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



From £20

Eclipse angle plates



£345

EME (Elliot Small Tools) precision universal vice



£625

Merit RPS20A spot welder 415V / single phase

We are still **OPEN SATURDAY MORNINGS** dedicated to the model engineer

THESE ARE ALL
NEW MACHINES AT
PRICES COMPARABLE WITH
RE-CONDITIONED OR
SECOND-HAND EQUIPMENT

MACHINE & TOOLING SPECIALISTS

Mills



Drills



Bandsaws



Lathes



CHESTER U.K.

LIMITED
MACHINE AND TOOLING
SPECIALISTS
www.chesteruk.net

All machines come with relevant safety features, standard accessories, manual and parts list

MODEL B MULTIFUNCTION MACHINE

The 'Original' Chester Multipurpose machine is capable of turning, milling, drilling and thread cutting. Built from cast iron and with a large swing of 16" capacity the Multipurpose is the answer to a Model engineers needs!



£799.00

Swing	420mm/16"
Centres	520mm
Spindle Bore	20mm
Spindle Tapers	MT3
Speeds	7 - Lathe 14 - milling 0.2-3mm 8-120TPI
Metric Threading	Taper Roller
Imperial Threading	300x 150mm
Headstock Bearing	3/4hp-240volt
Milling Table Size	930 x 690 x 1090mm
Motor	155kgs
Size	
Weight	

FEATURES
• Large 16" Swing
• All Tapers MT3
• Cast Iron Construction
• Compact Space saving Design
Supplied with
• 3-Jaw Chuck
• Steel Centres
• Lathe Tools
• Dula Purpose Vice
• Change gears



H80 BANDSAW

Max Cutting Capacity @ 90°	Round 90mm Square 90x 120mm
Max Cutting capacity @ 45°	Round 65mm Square 70 x 120mm
Blade Speed	20, 29, 50m/min
Motor	420w
Power	240volt
Blade Size	1300 x 0.53 x 12.5mm
Packing Size	760 x 295 465mm

FEATURES

- Cast Iron Base and Arm • Can be used with stand supplied or bench mounted
- Roller Bearing Blade Guides • Angled Cutting • Auto Switch off when cutting finished
- Ideal machine for the Home Workshop providing large capacity cutting in a small space.

£145.00



DB11VS

Centre Distance	700mm
Swing over Bed	280mm
Spindle Bore	26mm
Motor	1200w
Spindle Speeds	125-2500rpm
Net Weight	180kgs

FEATURES

- Digital Speed Readout • T Slotted Crossslide • Variable Spindle Speed • Metric & Imperial Thread Cutting • Longitudinal Power Feed

STANDARD ACCESSORIES

- 3-Jaw Chuck • 4-Jaw Chuck • Face Plate • Coolant Tray • Rear Splash Guard • Lathe Tool Set • Chip Guard

£1188

CENTURY MILL



FEATURES

- Variable Speed Spindle
- Digital Depth Readout
- Fine Feed Quill
- Heavy Duty Cast Iron Construction
- Strong 1.5hp Motor
- Angled Milling Head
- Wide Speed Range

Max Drilling Capacity	20mm
Max End Mill Capacity	22mm
Max Face Mill Capacity	70mm
Table Size	600x100mm
Cross Travel	200mm
Long Travel	350mm
Taper	MT3
Speeds	50-3000rpm
Size	720x565x1020mm
Weight	135kgs

£875.00

D13 AND D13R BENCH DRILLING MACHINE



FEATURES

- Supplied with Keyless Drill Chuck and Arbor
- Rigid Cast Iron Construction
- Drilling Table can tilt for angled drilling
- These are a quality drilling machine with high standard of finish that would complement the home users works

DR13R
£95

DR13
£65

	D13	D13R
Drilling Capacity	13mm	13mm
Chuck Size	1-13mm	1-13mm
Spindle Travel	50mm	60mm
Spindle Distance to base	350mm	535mm
Spindle Distance to table	210mm	415mm
Spindle Taper	B16	MT2
Speeds	5 x 600-2500rpm	5 x 450-2890rpm
Height	585mm	800mm
Motor	250w	370w
Weight	17kgs	29kgs

WHY CHOOSE CHESTER?

• ONE YEAR WARRANTY -

All machines come supplied with a 12 month manufacturers parts warranty from date of receipt of delivery

• MADE TO LAST - Chester

Machines are built to high standards. All machines are made from cast iron and quality checked throughout production.

• WE KNOW MACHINE TOOLS - A

good understand of machine tools and there environment is essential to provide you the customer with the right machine.

• LATEST TECHNOLOGY - Chester

continue to expand their range of machine tools and accessories, enabling us to offer the widest range of machines and tooling in the UK.

• SERVICE AND SUPPORT - Chester

offer parts and after sales service from both our Chester HQ and Midlands Showroom along with local agents here in the UK and Overseas.

• EXPERIENCE - Chester have been

distributing and installing machine tools all over the UK and Overseas, for many years, including private individuals, training establishments, schools and industrial customers.

For full details on these and other machine tools please contact

Chester UK Ltd

Clwyd Close, Hawarden Industrial Park CHESTER CH5 3PZ

T: + 44 (0)1244 531631 F: + 44 (0) 1244 531331

email: sales@chestermachinetools.com

www.chestermachinetools.com

SOUTHERN SHOWROOM

TPH Machine Tools,

Fairview Industrial Park,

Rainham ESSEX B18 5PN

T + 44 (0) 1708 523 916

email: machines@tpmachines.co.uk

Opening Times: 9am-5pm, Mon-Fri.

Sat 9am-12pm

MIDLANDS SHOWROOM

Unit 4 Plant Lane Business Park

Plant Lane,

Burntwood

Staffs, WS7 3GN

Tel 01543 448940