MODEL ENGINEER

Vol. 195 No. 4251 8-21 July 2005

FESTIVAL OF MODEL TRAMWAYS
•
23-24 July
•
KEW BRIDGE STEAM MUSEUM

EIGHT-STROKE AERMOTOR

MG TC SUPER MODEL

SPRING HAMMER

VOL 195 NO 4251 £2.50
51>
9 770026 732131

HARROGATE EXHIBITION 2005
Winning competition entries

WARCO

ANOTHER FIRST FOR WARCO

WARCO ARE PROUD TO INTRODUCE A NEW RANGE OF VARIABLE SPEED LATHES AND MILLING MACHINES.

- Exclusive to Warco • The right speed every time
- Low speeds for precise threading and boring operations
- Five different specifications available • Amazing value for money

WARCO – CONTINUING TO RESPOND TO CUSTOMER DEMAND

WM–180 *New*

3" CENTRE HEIGHT
12" BETWEEN CENTRES
SPEED RANGE 0 – 3,000 RPM
£499.00

ALL PRICES INCLUDE DELIVERY UK MAINLAND

WM–210 VARIABLE SPEED LATHE

4" CENTRE HEIGHT
13" BETWEEN CENTRES
SPEED RANGE 0 – 2,500 RPM
£699.00

New

FEATURES

HARDENED AND GROUND BEDWAYS
TAPER ROLLER SPINDLE BEARINGS
OFF SET TAIL STOCK FACILITY
A CHOICE OF METRIC OR IMPERIAL LEADSCREWS/DIALS
ALL CUT METRIC AND IMPERIAL THREADS

EACH LATHE IS EQUIPPED WITH:

3 JAW SELF CENTRE CHUCK WITH INSIDE AND OUTSIDE JAWS
4 JAW INDEPENDENT CHUCK
FIXED AND TRAVELLING STEADIES
FACE PLATE. FOUR WAY TOOL POST. DEAD CENTRES.

WM–250 VARIABLE SPEED LATHE

New

5" CENTRE HEIGHT
22" BETWEEN CENTRES
SPEED RANGE 0 –2,000 RPM
£999.00

WM–280 VARIABLE SPEED LATHE

5" CENTRE HEIGHT
27" BETWEEN CENTRES
SPEED RANGE 0 – 2,500 RPM
£1,399.00

New

WM–16 VARIABLE SPEED MILL

TABLE SIZE 20" X 7"
2 MT
TILTING HEAD
SPEEDS 0 –3,000
£998.00

New

See these machines under power at:

Model Engineer Exhibition.
Sandown Park,
Esher 29th - 31st Dec. '04

London Model Engineer Exhibition.
Alexandra Palace
21st - 23rd Jan '05

30 years in the making

WARCO

Warco, Fisher Lane, Chiddingfold, Surrey GU8 4TD Fax: 01428 685812
Tel: 01428 682929 warco@warco.co.uk **www.warco.co.uk**

Model Engineer is published by
HIGHBURY LEISURE Publishing Limited
Berwick House, 8-10 Knoll Rise, Orpington, Kent BR6 0PS
Tel: 01689-887200 Fax: 01689-886666
www.hhc.co.uk/modeng
HIGHBURY LEISURE Publishing Limited, a
HIGHBURY HOUSE COMMUNICATIONS PLC
COMPANY

EDITORIAL

Editor
David Carpenter (01689-887255)
Technical Editor
Neil Read (01604-833670)
Production Editor
Kelvin Barber
Associate Editor
Malcolm Stride
Technical Consultants
Mike Chrisp
Stan Bray,
J. Malcolm Wild FBHI,
D. A. G. Brown
Editorial Administrator
Laura Ellis (01689-886677)

PRODUCTION

Design
Carol Philpott
Production Manager
Alan Scott
Printed by
Polestar (Colchester)
Origination by
Atelier Data Services

SALES & MARKETING

Group Sales Manager
Colin Taylor (01689-886649)
Sales Manager
Tony Robertson (01689-886650)
Subscription Marketing Executive
Voula Browne (01689-887209)

CIRCULATION

Circulation Director
Brian Donnelly (020 7608 6723)
Non-newstrade Distribution
Mike Reynolds-Jones
(0121-788-3112)

MANAGEMENT

Publisher
Jez Walters
Divisional Director
Dawn Frosdick-Hopley
Group Financial Controller
Tom Stringer
Managing Director
David Nizol

SUBSCRIPTIONS & BACK ISSUES

Direct Subscriptions and Back Issues are available from Model Engineer, Tower House, Sovereign Park, Market Harborough, Leics. LE16 9EF
Order hotline: 0870 8378600; Customer Service: 0870 8378668
Email: modelengineer@subscription.co.uk
(Operating hours: 8am-9.30pm Mon-Fri; 8am-4pm Sat.)
Rates for 26 issues (annual):
UK: £65.00 Europe: £80.00 US Airmail: $130.00
RoW Airmail: £86.00
Cheques payable to Highbury Leisure Publishing Ltd.
Second class postage paid at Rahway NJ USA.
Postmaster, please send address corrections to
Model Engineer c/o Mercury Airfreight International Inc,
2323 Randolph Avenue, Avenue 1, NJ 07001. Usps 0011099.
US Subscription Agent: Wise Owl Worldwide Publications,
5150 Candlewood Street, Suite #1
Lakewood, CA 90712-1900, USA
Phone: 562-461-7574; Fax: 562-461-7212.
Email: info@wiseowlmagazines.com
Website: www.wiseowlmagazines.com
Visa/MC/Discover accepted.
Canadian Distribution by Gordon & Gotch Periodicals
(Toll free 1-800-438-5005).
Model Engineer is published fortnightly.

ISSN 0026-7325

IN THIS ISSUE

● Vol. 195 No. 4251 8 JULY 2005 ●

HARROGATE EXHIBITION 2005
Winning competition entries

On the cover ...

One of the stars of the National Model Engineering & Modelling Exhibition at Harrogate was this impressive Hornsby Crawler, based on a prototype built for the Yukon, made by Steve Baldock. Located just inside the entrance to the show it stopped many visitors in their tracks. In this issue we report on the models which won awards at the exhibition, including a fine GWR Prairie tank locomoive which was awarded Best in Show. More to come on the club exhibits in the next issue on 22 July 2005

(Photograph by Neil Read)

TURN TO PAGE 10 FOR GREAT OFFERS ON SUBSCRIPTIONS

INDEX to ADVERTISERS

Machine Mart

49 SUPERSTORES NATIONWIDE

Where Quality Costs Less

NEW STORE MAIDSTONE NOW OPEN

MASSIVE PRICE CUTS

Clarke HD PROFESSIONAL TOOL CHESTS & CABINETS

THE ULTIMATE IN TOOL CHEST STORAGE!

BALL BEARING

- Extra heavy gauge double wall steel construction

MODEL	DESC	DRAWER LOAD	EX VAT	INC VAT
CB8204	4 Dr chest	38kg	£69.95	£82.19
CB8205	5 Dr chest	38kg	£89.95	£105.69
CB8206	6 Dr chest	38kg	£84.95	£99.82
CB8209	9 Dr chest	38kg	£119.95	£140.94
CB8203	3 Dr step up	38kg	£54.95	£64.57
CB8215	5 Dr cab	43kg	£169.95	£199.69
CB8217	7 Dr cab	43kg	£199.95	£234.94
CB8212	3 Dr cab	43kg	£129.95	£152.69
CB8213	3 Dr cab	43kg	£159.95	£187.94

REDUCED! CB8204 was £88.07 inc.VAT, CB8206 was £111.57 inc VAT

FROM ONLY £69.95 EX VAT £82.57 INC VAT

Clarke MECHANICS TOOL CHESTS & CABINETS

- Robust steel construction
- 1 piece roll formed friction slide drawer runners

FROM ONLY £39.95 EX VAT £46.94 INC VAT

MODEL	DESC.	DR LOAD	EX VAT	INC VAT
CTC600	6 Drawer chest	19Kg	£39.95	£46.24
CTC900	9 Drawer chest	19Kg	£49.95	£58.69
CTC500	5 Dr. cabinet	35Kg	£84.95	£99.82
CTC800	5 Dr. Chest/cab	19Kg	£84.95	£99.82
CTC700	7 Dr. cabinet	35Kg	£99.96	£117.45
CTC1300	13 Dr. Chest/cab set	19Kg	£139.95	£164.44

Clarke TURBO AIR COMPRESSORS

TIGER 8/40

TIGER 8/40 ONLY £69.95 EX VAT £82.19 INC VAT

- 7 cfm displacement
- 1.5Hp
- 24Ltr

Clarke rubber air hose (10m)

FROM ONLY £9.95 EX VAT £9.95 EX VAT £11.69 INC VAT

OTHER MODELS IN THE RANGE

MODEL	MOTOR	CFM	TANK	EX VAT	INC VAT
8/45 o/l	1.5Hp	6.3	24ltr	£84.95	£99.82
Panther 25	2Hp	8.2	24ltr	£129.95	£152.69
Panther 50	2Hp	8.2	50ltr	£169.95	£199.69
10/70†	2.0Hp	9	50ltr	£254.95	£299.57
15/55	3.0Hp	14	50ltr	£259.95	£305.44
15/65†	3.0Hp	14	50ltr	£359.95	£422.94

Clarke AIR TOOLS & SPRAY GUNS

PRO12C

TYPE	MODEL	EX VAT	INC VAT
Pro Spray Gun	-	£16.95	£19.92
Super Pro Spray Gun	SP14C/SP18C	£27.95	£32.84
Air Hammer	CAT29B	£15.95	£18.74
Die Grinder Set	CAT36B	£19.95	£23.44
Grit Blasting Gun	SB3	£19.95	£23.44
Spot Blast Kit	SB5	£14.95	£17.57
6" Dual Action sander	CAT80	£24.95	£29.32
1/2" Sq. Drive Ratchet	CAT22B	£25.95	£30.49
5/8" Air drill	CAT27B	£26.95	£31.67
14pce 1/2" Ratchet set	CAT221B	£33.95	£39.89
13pce 1/2" Impact wrench set	CAT231B	£37.95	£44.59
High Speed Saw	CAT26B	£25.99	£30.54

Clarke ROTARY TOOL SYSTEM

CRT40

ONLY £25.50 EX VAT £29.96 INC VAT

Kit includes:

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

Clarke MIG WELDERS

FROM ONLY £119.95 EX VAT £140.94 INC VAT

Includes free:

- Face mask
- Earth clamp
- Gas regulator

Pro90-150TE also inc

- Welding wire
- CO_2 gas bottle

OTHER SIZES & ARC WELDERS AVAILABLE

MODEL	AMPS	EX VAT	INC VAT
Pro 90	24-90	£119.95	£140.94
100E	30-100	£139.95	£164.44
135TE Turbo*	30-130	£159.95	£187.94
150TE Turbo*‡	30-150	£179.95	£211.44
165TE Turbo*	30-155	£239.95	£281.94
175TE Turbo*	30-170	£299.95	£352.44
205TE Turbo*	30-185	£329.95	£387.69

*Turbo fan cooled for longer welding at full output

Clarke ANGLE GRINDERS

Inc. disc & handle

FROM ONLY £24.95 EX VAT £29.32 INC VAT

MODEL	DISC SIZE	MOTOR	EX VAT	INC VAT
CAG115C	115mm	720w	£24.95	£29.32
CAG115	115mm	500w	£25.95	£30.49
CAG232	230mm	2000w	£29.95	£35.19
CON115	115mm	1010w	£29.95	£35.19

Clarke SOLDERING GUN

CSK100

ONLY £12.49 EX VAT £14.68 INC VAT

Kit Box Included

- 100w soldering gun
- 30w soldering iron
- Hands free magnifier
- De-Solder tool
- Scraper / probe tool
- Soldering iron stand
- Spare soldering gun tip
- Solder coil
- Pot of flux

Clarke ENGINEERS WORKBENCHES

FROM ONLY £114.95 EX VAT £135.07 INC VAT

Shown with optional drawer ONLY £21.95 EX VAT £25.79 INC VAT

- 3mm high grade steel
- Runners for optional drawer units

MODEL	SIZE (LWH MM)	EX VAT	INC VAT
CWB1000	1000x650x880	£114.95	£135.07
CWB1500	1500x650x880	£149.95	£176.19
CWB2000	2000x650x880	£169.95	£199.69

Clarke TAP & DIE SETS

FROM ONLY £12.95 EX VAT £15.22 INC VAT

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

TYPE	EX VAT	INC VAT
16pce Metric	£12.95	£15.22
19pce UNF	£14.95	£17.57
24pce UNC/UNF/NPT	£19.95	£23.44
28pce#‡ Metric/UNF/BSP	£19.95	£23.44
33pce# Metric/UNF/BSP	£29.95	£35.19

#28pce Best Budget Buy, 33pce Recommended: Practical Classics

Clarke VICE

MULTI - PURPOSE CHV125

ONLY £37.95 EX VAT £44.59 INC VAT

- Jaw width 127mm
- Jaw opening 120mm
- Jaw depth 75mm
- 360° rotating vice head
- 360° double locking swivel base

Clarke MEASURING INSTRUMENTS

OTHER SIZES AVAILABLE

MODEL	DESCRIPTION	EX VAT	INC VAT
CM100	150mm/6" Vernier Caliper	£8.49	£9.98
CM145	150mm/6" Digital Vernier	£19.95	£23.44

Clarke WORKBENCH

HEAVY DUTY CWB1250

ONLY £49.95 EX VAT £58.69 INC VAT

- Large lockable cabinet
- Extra thick, reversible plywood faced worktop
- LWH: 1205x600x850mm
- Constructed from robust, heavy gauge steel

Clarke AIRBRUSH KITS

FROM ONLY £7.99 EX VAT £9.39 INC VAT

DIY KIT - CAB1H

- Spray pattern adjustable

ONLY £7.99 EX VAT £9.39 INC VAT

PRO KIT - CAB2P (pictured)

- Double action trigger for accurate air/paint control
- Precision machined nozzle
- Special lightweight hose

ONLY £23.95 EX VAT £28.14 INC VAT

Clarke AIR COMPRESSOR

WIZ OIL FREE MINI AIR COMPRESSOR

ONLY £54.95 EX VAT £64.57 INC VAT

- Ideal for airbrush work
- 1.58 cfm air displacement
- 2.8 Bar Max Working Pressure

Clarke BENCH GRINDER STAND

BGS1

Complete with bolt mountings & feet anchor holes

ONLY £24.99 EX VAT £29.36 INC VAT

Clarke BENCH GRINDERS

CBG8W features 8" wetstone & 6" drystone.

FROM ONLY £12.75 EX VAT £14.98 INC VAT

MODEL	DUTY	WHEEL DIA.	EX VAT	INC VAT
CBG6RP	DIY	150mm	£12.75	£14.98
CBG6RZ	PRO	150mm	£18.95	£22.27
CBG6RSC	HD	150mm	£25.49	£29.95
CBG6RWC*	HD	150mm	£29.95	£35.19
CBG8RSC	HD	200mm	£33.95	£39.89
CBG8W	HD	150mm	£33.95	£39.89

Clarke DRILL PRESSES

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

FROM ONLY £29.95 EX VAT £35.19 INC VAT

Full range of Drill Vices available

MASSIVE PRICE CUTS

* Includes wet 'T' slot table & worklight

MODEL	WATTS/SPEEDS	EX VAT	INC VAT
CDP5DD	245/5	£29.95	£35.19
CDP101B	245/5	£49.95	£58.69
CDP151B	300/5	£79.95	£93.94
CDP201B	370/12	£99.95	£117.44
CDP251F	370/12	£129.95	£152.69
CDP301B	510/12	£134.95	£158.57
CDP351F	510/12	£149.95	£176.19
CDP401B*	510/16	£159.95	£187.94
CDP451F*	510/16	£189.95	£223.19
CDP501F*	980/12	£379.95	£446.44

‡ REDUCED! CDP101B Was £64.57 inc.VAT

REDUCED

Clarke BLAST CABINETS

- Blast away paint, surface rust, scale, burrs, carbon & dirt & revitalise aluminium
- 1,020 ltr/h Max pump rate

FROM ONLY £94.95 EX VAT £111.57 INC VAT

MODEL	DESC.	TYPE	EX VAT	INC VAT
CSB20B	Compact Cabinet	Bench	£94.95	£111.57
SB30	Large Cabinet	Floor	£249.95	£293.69

ALUMINIUM OXIDE POWDER FROM ONLY £19.95 / £23.44

Clarke VARIABLE SPEED LATHE AND SEPARATE MILL DRILL HEAD - CL250M & CL251MH

MASSIVE PRICE CUTS

REDUCED £279.95 EX VAT £328.94 INC VAT

WAS £340.69 INC VAT

CL251MH (ATTACHMENT)

- 250mm between centres
- 153mm swing over bed
- Power feed
- Screw cutting facility
- Transforms the CL250M into a superb Lathe/Mill
- 10mm max drill capacity
- Variable 30mm travel for drilling spindle

SAVE £11.75

REDUCED! NOW ONLY £159.95 EX VAT £187.94 INC VAT

WAS £199.69 INC VAT

Clarke 6 SPEED METAL LATHE WITH 12 SPEED MILL/DRILL

Full range of accessories available

ONLY £649.95 EX VAT £763.69 INC VAT

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

Shown with optional floor stand ONLY £119.95 EX VAT £140.94 INC VAT

ALSO AVAILABLE: CL430 - As above but without the Mill/Drill head. ONLY £549.95 EX VAT £646.19 INC VAT

N.B: The Mill/Drill head is not available separately

Clarke MICRO MILLING & DRILLING MACHINE

CMD10

ONLY £239.95 EX VAT £281.94 INC VAT

- 150w/230v motor
- Variable speed 1000-2000rpm
- MT2 Spindle Taper
- Face mill capacity 20mm, end mill 10mm
- Table cross travel 90mm, longitudal travel 180mm

Clarke METAL LATHE

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

ONLY £359.95 EX VAT £422.94 INC VAT

CL300M

FULL RANGE OF ACCESSORIES AVAILABLE

Clarke 12 SPD MILL/DRILL

CMD1225C

ONLY £599.00 EX VAT £703.83 INC VAT

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 585x190

NEW SPRING/SUMMER CATALOGUE

Collect from your local branch
Order from www.machinemart.co.uk
e-mail: sales@machinemart.co.uk
TELEPHONE 0845 450 1855 (LOCAL RATE)

ORDER ONLINE

www.machinemart.co.uk

OVER 4000 PRODUCTS - SEE THE FULL RANGE

24hr TELESALES

0845 450 1800

0845 450 1801

(Calls charged at local rates)

4 WAYS TO BUY

- SUPERSTORES
- TELESALES
- WEBSITE
- FAX

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

BARNSLEY 01226 732 297
Pontefract Road, Barnsley

B'HAM GREAT BARR 0121 358 7977
4 Birmingham Road, Great Barr

B'HAM HAY MILLS 0121 771 3433
1152 Coventry Road, Hay Mills

BOLTON 01204 365799
1 Thynne Street

BRADFORD 01274 390962
105-107 Manningham Lane

BRISTOL 0117 935 1060
1-3 Church Road, Lawrence Hill

CARDIFF 029 2046 5424
44-46 City Road

CARLISLE 01228 591666
85 London Road

CHESTER 01244 311258
43-45 St. James Street

COVENTRY 024 7622 4227
Bishop St.

COLCHESTER 01206 762831
Unit 4 North St, Station Road (No VAT)

CROYDON 020 8763 0640
423-427 Brighton Road, South Croydon

DARLINGTON 01325 380841
214 Northgate

DEAL (KENT) 01304 373 434
182 - 186 High Street

DERBY 01332 290931
Derwent Street

DUNDEE 01382 225 140
24-26 Trades Lane

EDINBURGH 0131 659 5919
163-171 Piersfield Terrace

GATESHEAD 0191 493 2520
50 Lobley Hill Road

GLASGOW 0141 332 9231
280 Gt Western Rd

GLOUCESTER 01452 417 948
221A Barton Street

GRIMSBY 01472 354435
Ellis Way

HULL 01482 223161
8-10 Holderness Road

ILFORD 0208 518 4286
746-748 Eastern Ave

LEEDS 0113 231 0400
227-229 Kirkstall Road

LEICESTER 0116 261 0688
69 Melton Road

LIVERPOOL 0151 709 4484
88 London Road

LONDON 020 8803 0861
6 Kendal Parade, Edmonton N18

LONDON 020 8558 8284
503-507 Lea Bridge Road, Leyton, E10

LONDON 020 7488 2129
100 The Highway, Docklands

MAIDSTONE 01622 769 572
57 Upper Stone Street (NOW OPEN)

MANCHESTER 0161 941 2666
71 Manchester Road, Altrincham

MANSFIELD 01623 622160
169 Chesterfield Road, South

MIDDLESBROUGH 01642 677881
Mandale Triangle, Thornaby

NORWICH 01603 766402
Heigham Street

NOTTINGHAM 0115 956 1811
211 Lower Parliament Street

PETERBOROUGH 01733 311770
417 Lincoln Road, Millfield

PLYMOUTH 01752 254050
58-64 Embankment Road

POOLE 01202 717913
137-139 Bournemouth Road, Parkstone

PORTSMOUTH 023 9265 4777
277-283 Copnor Road, Copnor

PRESTON 01772 703263
53 Blackpool Road

SHEFFIELD 0114 258 0831
453 London Road, Heeley

SOUTHAMPTON 023 8055 7788
516-518 Portswood Road

STOKE-ON-TRENT 01782 287321
382-396 Waterloo Road, Hanley

SUNDERLAND 0191 510 8773
13-15 Ryhope Road, Grangetown

SWANSEA 01792 792969
7 Samlet Road, Llansamlet

SWINDON 01793 491717
21 Victoria Road

TWICKENHAM 020 8892 9117
83-85 Heath Road

WOLVERHPTN 01902 494186
Parkfield Road, Bilston

WORCESTER 01905 723451
48a Upper Tything

- Stationary Engines
- Materials
- Boilers

- Marine Engines
- Steam Fittings
- Fixings

Founded 1906 by Mr Stuart Turner

STUART MODELS

Workshop Machinery Models

Stuart Pillar Drill

The Stuart Pillar Drill is now available from stock. this is the second release from our range of workshop machinery models, and makes an elegant counter piece to our first release, the Stuart Engineering Lathe.

Stuart Pillar Drill
Set of castings materials, fixings and precut gears

£147.00 inc Postage & VAT

Stuart Engineering Lathe
Set of castings materials, fixings and precut gears

£149.00 inc Postage & VAT

STUART MODELS
Full Colour Catalogue

The all new Stuart Models catalogue is now available, featuring many new models including our range of workshop machinery, which are available as Sets of Castings, Machined Kits and Ready to Run Models.

Please send £5.00 for our New Catalogue

STUART MODELS
• Dept. ME, Braye Road, Vale, Guernsey, UK, GY3 5XA •
• Tel 01481 242041 • Fax 01481 247912 • www.stuartmodels.com •

GREAT DORSET STEAM FAIR

SOUTHDOWN, TARRANT HINTON, BLANDFORD, DORSET
(A354 BLANDFORD – SALISBURY MAIN RD)
WEDNESDAY 31ST AUGUST – SUNDAY 4TH SEPTEMBER 2005

Take a giant trip of nostalgia into the days of yesteryear at this renowned annual extravaganza, widely recognised as the leading event of it's type in the World. Held on one of the largest outdoor showgrounds in Europe at a mammoth 600 acres, see an old time steam driven funfair, the world famous line-up of showman's engines and the magnificent steam powered heavy haulage, threshing, woodsawing, ploughing and road rolling demonstrations.

Over 200 full size working steam engines including 60 showmans type with their twisted, gleaming brass.

Also featured are traditional 'can can' girl dancing shows, fairground organs, heavy horses, rural crafts, vintage tractors, stationary engines, old commercial and army vehicles, vintage cars and motorcycles, models, trade stands, auto jumble and five entertainment pavilions with live music and over 50 real ales/beers. In all we have 2000 exhibits plus 800 trade stands.

It's not all old time!

For our younger clientele take a white knuckle tide on one of the Country's biggest travelling modern funfairs. Rides include a '120ft Giant Wheel', a 'Log Flume', a 'Roller Coaster', a 'Drop Tower' and the 'Shock Wave Ejection Sear Reverse Bungee'.

A fantastic day out for all the family.

Regularly attended by over 200,000 visitors from both the UK and abroad.

For further details contact the Show Office, Dairy House Farm, Child Okeford, Blandford, Dorset, DT11 8HT. Tel/Fax 01258 860361 or visit our website at www.steam-fair.co.uk

In association with The Badger Brewery, Two Great Dorset Traditions.

SUBSCRIBE

BY DIRECT DEBIT

AND SAVE 28%!

HUGE REASONS TO SUBSCRIBE

- **PAY** by Direct Debit or make a one off Payment and save 28%
- **DELIVERY** direct to your door
- **NEVER** miss an issue
- **AVOID** price increases throughout the year
- **ENJOY** your favourite magazine, containing the very best model engineering features, detailed projects plus event news and reports from fellow model engineers around the world.

DON'T MISS OUT!

Subscribe now by calling 0870 8378600

or for alternative subscription offers log on to www.subscription.co.uk

DIRECT DEBIT CHOICE

☐ YES! I would like to subscribe to *Model Engineer* for £11.70 every three months by Direct Debit – please fill out the form opposite (UK only).

ONE OFF PAYMENT OPTION

☐ YES! I would like to subscribe to *Model Engineer* for myself/as a gift (please circle) and save 28% with a one-off payment by

☐ Cheque (made payable to Highbury House Communications) and write V026 on the back

☐ Postal order (please include ref. V026)

Issues	UK	Europe (inc. Eire)	US Airmail	RoW Airmail
26	☐ £46.80	☐ £57.60	☐ $61.00	☐ £61.90

☐ Mastercard ☐ Visa ☐ Switch

Cardholder's name: .....

Card no | | | | | | | | | | | | | | | | | | |

Expiry date: ..... Switch Issue no/valid date: .....

Signed: ..... Date: .....

Title: ..... Initials: ..... Surname: .....

Address: .....

.....

.....

Postcode: ..... Country: .....

Tel: ..... E-mail: .....

Terms & conditions: Offer valid until 30th July 2005. Subscriptions will begin with the first available issue. Please allow 28 days for delivery of your first issue.

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

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

HIGHBURY

Instruction to your bank or building society to pay by Direct Debit

DIRECT debit

1. Name and full postal address of your bank or building society

To: The bank/building society manager

Address

.....

.....

.....Postcode.....

2. Name(s) of account holder(s)

3. Branch sort code

4. Bank/building society account number

5. Instructions to your bank or building society.

Please pay Highbury House Communications plc. 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 Highbury House Communications plc and, if so, details will be passed electronically to my bank/building society.

Signature.....

Date .....

Originator's identification number

4	0	4	6	5	8

Reference number (official use only)

Banks and building societies may not accept direct debit instructions for some types of accounts.

Please allow 28 days for delivery of your first issue. We cannot accept responsibility for orders lost, delayed or damaged in the post. Details of the Direct Debit Guarantee are available on request

PLEASE RETURN YOUR COMPLETED COUPON TO: Model Engineer, Tower House, Sovereign Park, Market Harborough, Leic. LE16 9EF

US/CANADIAN SUBSCRIBERS - PLEASE RETURN YOUR COMPLETED COUPON TO:
Model Engineering Subscriptions, Wiseowl Worldwide Publications, 5150 Candlewood Street, Suite 1, Lakewood, CA 90712-1900 U.S.A. Tel: 562-461-7574 Fax: 562-461-7212 email: info@wiseowlmagazines.com

Offer Ends 30th July 2005

Photocopies of this page are acceptable

V026

gandmtools

Be the first to see our new stock and look at the new arrivals page on our website

email: sales@gandmtools.co.uk **web: www.gandmtools.co.uk**

LATHES

Emco Maximat Super 11 Centre Lathe,Tooling, 3ph,VGC £2100.00
Emco Maximat Super 11 Centre Lathe,Tooling, 3ph,VGC £2100.00
Emco Maximat Super 11 Centre Lathe,Tooling, 3ph,VGC £2100.00
Emco Maximat Super 11 Centre Lathe,Tooling, 3ph,VGC £2100.00
Conect Cadet Plus CNC Lathe, Used Once Only,240 volt, ... £1450.00
Pultra 1750 Bench Lathe, Drive Unit, Collets, Chucks,
Tooling, 1ph,VGC £1500.00
Pultra 1750 Bench Lathe, Motor,Well Tooled,Collets,1ph,VGC £1500.00
Pultra 1770 Bench Lathe c/w Handrest,Tailstock,10 Collets,
No Motor ..... £ 350.00
Denford Startum CNC Bench Lathe,1ph, Manual £1000.00
Denford Startum CNC Bench Lathe with Auto Tool Turret, 1ph £1450.00
Denford Orac CNC Bench Lathe,1ph, Manual £1450.00
Boxford AUD 5" x 22" Lathe, Well Tooled, New 240 Volt
Single Phase Motor,VGC £1850.00
Boxford BUD 5" x 22" Lathe, PCF,Tooled, VGC,Fitted New
240 Volt Motor £1650.00
Boxford AUD 4 ?" x 18" Lathe,Tooled,New Single Phase
Motor Fitted £1250.00
Boxford Model A 4 ?" x 18"" Lathe,Stand,Gearbox,PCF,
Tooling,Single Phase £1250.00
Myford ML7 3 ?" x 19" Lathe ..... £ 650.00
Myford Super 7 Long Bed Bench Lathe, 1ph, Old ..... £ 600.00
Myford Super 7 Bench Lathe with Gearbox,Stand,
3 Jaw and Toolpost,1ph ..... £ 800.00
Myford Super 7 Bench Lathe with Tray & Blocks, 1ph,
Tooling £1000.00
Colchester Triumph 2000 Gap Bed Lathe, 7 ?" x 50",
3ph,Tooled £2500.00
Colchester Chipmaster 5" x 20" Lathe,Metric,Tooled,
Quiet,VGC,3ph ..... £ 950.00
Colchester Bantam 1600 5" x 20", (Late Type) Chucks,
Lever Op Collet Att,Coolant, QCTP,Guards,Light, Manual,
3ph,VGC £2500.00
Colchester Bantam 1600 5" x 20" Tooled,Coolant,
QCTP,VGC,3ph £1450.00
Harrison 280 CNC Manual/CNC Training Lathe, Faults, ... £2000.00
Harrison 13" Swing Lathe, Old & Dirty But Runs Very Well,
Tooled, 3ph ..... £ 650.00
Harrison M300 6" x 25" Gap Bed, Well Tooled Inc
Lever Op Collet Chuck,3ph £2750.00
Harrison 11" Centre Lathe and Tooling, 3ph ..... £ 750.00
Harrison 4 ?" x 25" Centre Lathe with Tooling, 3ph ..... £ 750.00
Pultra 1770 Cabinet Mounted Micro Lathe,Drive Unit,
Well Tooled, 3ph £1250.00
Acorn Capstan Lathe, 1ph, Cut Off Slide,Old ..... £ 375.00
Acorn Capstan Lathe, 1ph, Cut Off Slide, Old ..... £ 325.00

DRILLING MACHINES

Boxford Union Pillar Drills, Rack Op Table, 3ph ..... £ 325.00
Boxford Union Pillar Drill, 3ph, Excellent Condition. ..... £ 450.00
Thoka Arbo No 2 6 Station Turret Drill Head,3MT ..... £ 175.00
Spares Available for Fobco Star,7/8 and 10/8
Pillar & Bench Drills ..... £ POA
H & G 22N Bench Tapping Machine,Fitted 1/64" -1/4"
Drill Chuck,3ph ..... £ 250.00
Startrite Mercury Bench Drill,3ph ..... £ 150.00
Clearance of Meddings,Startrite,Progress,Tauco,Fobco,
Union Pillar & Bench Drills Choice of 25
all Three Phase ..... From £35.00
Meddings Pacera Pillar Drill ..... £ 325.00
Sealey Pillar Drill, 1ph, ... £ 150.00

MILLING MACHINES

TEP CNC Bench Engraver, 1ph, Unused, As New ..... £ 750.00
Aciera F3 Vertical/Hori Tolroom Mill, 3 Axis DRO,
Well Tooled,3ph £4750.00
Tom Senior M1 Vertical/Horizontal Mill, 240 volt Single Phase,
Requires Work! ..... £ 775.00
Bridgeport Varispeed Turret Mill, 42" x 9" Table,
Power Feed, 3ph £1250.00
Bridgeport Turret Mill, 3ph ..... £ 850.00
Alexander 2A Die Sinker/Engraver, Single Phase,
240 Volt,VGC ..... £ 500.00
Adcock & Shipley Vertical Mill, 40 INT,3ph ..... £ 450.00
Boxford 165HMC CNC Horizontal Machining Centre £2500.00
Burke Machine Tool Co. Small Horizontal Mill, Old ..... £ 250.00
KRV Turret Mill, DRO, 3ph ..... £ 750.00
BCA Jig Borer/Mill, Stand, Collets,3ph, ... £ 975.00
BCA Jig Borer/Mill, Stand, 4 Collets,Keyless Chuck,
Vice,1ph ..... £ 975.00
Boxford VM30 Variable Speed Vertical Mill,
30 INT Spindle,Collet Chuck,3ph ..... £ 800.00
Tom Senior Vertical Milling Head,2MT ..... £ 500.00
SIP Mill/Drill,NEW,1ph,3MT ..... £ 799.00
Stand For Above ..... £ 145.00
Strausak Gear Hob Sharpener ..... £ 350.00
Alexander 2B 4 Spindle Engraver,3ph ..... £ 750.00
Hauser 3BA Jig Borer,3ph £2000.00
Hauser 2 BA Jig Borer,3ph £1500.00
Bechler Pinion Leaf Cutting Machine ..... £ 300.00
Clock Gear Cutting Machine, Constructed from Clarkson
T & C Grinder,1ph ..... £ 325.00
Thiel 158 Duplex Universal Milling Machine,
Well Equipped,3ph £2500.00
Avon CNC Vertical Mill,Anilam Crusader 2 Control,
3ph, Not Working, ... £ 500.00

POWER HACKSAWS/BANDSAWS ETC

Axminster Power Tools Metal Cutting Bandsaw,1ph ..... £ 150.00
Startrite Motora 10" Cut Off Saw,3ph ..... £ 375.00
Startrite 18-S-5 Vertical Bandsaw,3ph,VGC ..... £ 650.00
Startrite 18-S-5 Vertical Bandsaw,1ph, 240 Volt ..... £ 750.00
Midhage HS804 Precision Circular Saw,150mm Blades,3ph. £ 250.00
Qualters and Smith 260 A Horizontal bandsaw ..... £ 950.00

GRINDERS,LINISHERS,POLISHERS

Alexander Single Lip Grinder,3ph ..... £ 750.00
Christen 05-8 Drill Point Grinder,3ph,VGC £1850.00
Dronsfield Eagle Surface Grinder,Coolanrt Unit,
Mag Chuck,3ph ..... £ 550.00
Viceroy Double Ended Grinder, Pedestal Stand, 3ph,VGC ..... £ 250.00
Christen 05-8 Drill Point Grinder,3ph, Lots of tooling. £1650.00
Brierley ZB25 Drill Point Grinder on Cabinet Stand,
Some Tooling,3ph ..... £ 750.00
Clarkson Radius Grinding Attachment ..... £ 275.00
Viceroy Double Ended Buffer/Polisher,3ph ..... £ 225.00
Turner 6" x 16" Heavy Duty Belt Linisher,Spare Belts,3ph ..... £ 500.00
Hauser Jig Grinder,Well Tooled,3ph £3750.00
Jones & Shipman 540 Surface Grinder,Mag Chuck,3ph £1000.00
Erzell Rotary Filing Machine,3ph ..... £ 250.00
Canning 2HP Polishing Spindle,3ph ..... £ 350.00

SHAPERS

Elliot 14M Shaper, 3ph ..... £ 400.00
Elliott 14S Shaper, 3ph ..... £ 500.00
Main Gear For Alba Shaper & Box of Other Spare Parts ..... £ 100.00
Box Table & Other Parts for Elliott 10M Shaper ..... LOT £ 100.00

BOXFORD SPARES & TOOLING

Change Gears (Also Fit Southbends)
16T-£10,18T-£11,20T-£11,21T-£11,22T-£11,23T-£11,24T-£11,26T-£11,
27T-£11,28T-£11,30T-£12, 31T-£12,32T-£12,35T-£12,36T-£12,37T-£12,
38T-£14,40T-£14,41T-£14,42T-£14,44T-£14,45T-£14, 46T-£14,48T-£14,
50T-£15,52T-£15,53T-£15,54T-£15,56T-£15,59T-£15,60T-£15,64T-£15,
71T-£18, 75T-£18,79T-£18,80T-£20,88T-£22,100T-£25,127T-£30,
100/127T Compound Gear £55.00,
127/135T Compound Gear £95.00,
54/18T Compound Gear £30.00,
72/18T Compound Gear £35.00,
32T Tumbler Reverse Gear ..... £ 12.00
Boxford Manual "Know Your Lathe" New Copies &
Drawings & Parts List ..... £ 25.00
Boxford 4" Chuck Backplate,Drilled,Used ..... £ 10.00
Boxford 5" Chuck Backplates,New ..... £ 20.00
Boxford 5" Catchplate ..... £ 15.00
Pratt Burnard 4" 4 Jaw Chuck ..... £ 75.00
Toolmex 6" 4 Jaw Independent Chuck Fitted Boxford
Backplate,NEW ..... £ 155.00
Boxford Lathe Cabinets,Cupboards,Coolant Tank,Tray,
Ideal for Many Small Lathes ..... £ 100.00
Headstock,Saddle & Apron Parts Available ..... £ POA
4 ?" & 5" Tailstocks ..... £ 125.00
Boxford Change Gear Cover ..... £ 40.00
Boxford Change Gear Quadrant ..... £ 15.00
Boxford Topslide Assembly ..... £ 45.00
Boxford T-Slotted Boring Table,8 ?" x 7", Fits in Place
of Cross Slide,NEW ..... £ 135.00
Boxford Power Crossfeed Saddle Assembly ..... £ 250.00
Boxford T-Slotted Cross Slide,NEW,Fits
AUD,BUD,CUD,TUD,Models A,B & C ..... £ 125.00
Boxford Taper Turning Attachment,Complete ..... £ 300.00
Boxford Screw Cutting Gearbox & Leadscrew ..... £ 375.00
Boxford Cross Slide Stop ..... £ 25.00
Boxford Cut Off Slide ..... £ 250.00

MYFORD SPARES & TOOLING

Change Gears:
20TE7.00,21TE7.00,22TE7.00,24TE7.00,25TE7.50,26TE7.50,27TE7.50,
28TE8.00,29TE8.00,30TE8.00,31TE8.50,32TE8.50,33TE8.50,34TE8.75,
35TE9.00,36TE9.00,37TE9.50,38TE9.50,39TE9.50,40TE9.50,42TE9.75,
43TE10.00,44TE10.00,45TE10.50,46TE11.00,47TE11.00,48TE11.00,
50TE13.50,51TE13.50,53TE14.50,54TE14.50,55TE14.75,56TE15.00,
57TE15.00,58TE15.00,59TE15.50,60TE15.50,61TE16.50,62TE16.50,63TE17.
00,64TE17.00,65TE18.00,66TE18.50,70TE18.50,75TE19.50,80TE21.50,
81TE21.50,85TE24.00,90TE24.00,91TE25.00,95TE26.00,100T£27.00,
127T£35.00
Metric Conversion Set,Comprises Quadrant,Gears,
Spacers and Studs,NEW ..... £ 185.00
Myford Quick Change Gearbox, Leadscrew and Cover ..... £ 550.00
Myford 3 Point Steady,NEW ..... £ 105.00
Myford 2 Point Steady,NEW ..... £ 45.00
Myford Super Manual Inc Gearbox Info ..... £ 22.00
Toolmex 100mm 3 Jaw,Myford Mount,NEW ..... £ 125.00
Toolmex 160mm 4 Jaw Ind Chuck,Myford Direct
Mount,NEW ..... £ 145.00
Myford 7" Faceplate ..... £ 30.00
Myford 9" Faceplate ..... £ 40.00
Myford 4 ?" Catchplate ..... £ 15.00
Myford 4" Chuck Backplate ..... £ 18.00
Myford 5" Chuck Backplate ..... £ 20.00
Myford MA73 V Block ..... £ 12.00
Myford Cross & Top Slide Fitted Single Toolpost,Late Type,
Unused ..... £ 225.00
Myford Super 7 Tailstock ..... £ 175.00
Myford ML7 Saddle/Apron ..... £ 125.00
Myford ML7/Super 7 Lathe Bed (well used) ..... £ 40.00
Myford Super 7 Cabinet Stand with Cupboard,Rusty Bottom
Edge,Long Bed ..... £ 200.00
Myford Super 7 Saddle,Apron & Cross Slide ..... £ 250.00
Myford Part No 1430 Series 7 Leadscrew
Handwheel & Pointer ..... £ 25.00
Myford Rear Toolpost ..... £ 48.00
Myford Swivelling Vertical Slide ..... £ 200.00
Myford/Toolmex Quick Change Toolpost + 4 holders ..... £ 115.00
Myford Quick Change Gearbox & Leadscrew ..... £ 575.00
Myford Con Rod Boring Fixture, Rare! ..... £ 200.00
Myford Handwheel Operated Cut Off Slide,with
2 Toolposts, VGC ..... £ 200.00

New Myford Toolmex 4" Self Centering 3 Jaw Chuck, with Key & Reverse Jaws, Threaded Body, Fits Super7 & ML7
£125.00 plus vat.

Clarkson R8 Autolock Collet Chuck, with Operators Handbook, Spanner and 4 Imperial Collets, Excellent Condition,
£135.00 plus vat.

Kanon Height Gauge, as New, Boxed, 3 sizes available, 300, 450, 600mm,
all only £75.00 each plus vat

Conect Cadet Plus CNC Lathe, Only Used Oncel, 240volt, VGC,
£1450.00 plus vat.

Harrison T-Slotted Boring Table, Fits L5/6 and 140 Lathes,
£150.00 plus vat.

Myford Super 7 Tailstock, Complete,
£165.00 plus vat.

Emco Maximat Super 11 Centre Lathe, 3ph, Tooled, VGC,
£2100.00 plus vat.

Mitutoyo Bore Gauge Set, 10-16" Range, New, Boxed, was £200.00 plus vat
now only £150.00 plus vat.

Mitutoyo Inside Groove Vernier Caliper, 0-150mm, as New,
£75.00 plus vat

Mitutoyo Gauge Block Set, as New, Grade 2, sizes available,
46 Piece Metric Set (pictured) £150.00 plus vat,
87 Piece Set £200.00 plus vat,
103 Piece Set £225.00 plus vat.

All items are subject to availability. All items are subject to postage and packing and vat @ 17.5%.

Opening times Monday–Friday 9am–1pm & 2pm–5pm. Saturdays 9am–1pm only

G AND M TOOLS, THE MILL, MILL LANE, ASHINGTON, WEST SUSSEX, RH20 3BX

emails: sales@gandmtools.co.uk web: www.gandmtools.co.uk

Telephone 01903 892510 fax 01903 892221

SEE US AT PICKERING 23 -25 SEPTEMBER 2005!!

Chronos
ENGINEERING SUPPLIES

PHONE FOR YOUR FREE 120 PAGE CATALOGUE 01582 471900

ORDER ONLINE AT WWW.CHRONOS.LTD.UK

SET OF 7 INDEXABLE LATHE TOOLS 12MM SQ

CODE SCT126
£42.00

INCLUDES THREAD CUTTING TOOL

SET OF 6 HSS PLAIN SHANK T SLOT CUTTERS

PLAIN SHANK — HSS

1/4 - 5/16 - 3/8 - 1/2 - 5/8 - 3/4
CODE SCT071B - £65.00

GEAR CUTTERS + ARBORS

SET OF 6 CUTTERS
0.5 MODULE - **£48.00**
2MT ARBOR - **£48.00**
3MT ARBOR - **£48.00**

POLICRAFT POLISHING KITS INC. MOPS, COMPOUND + ARBOR

Code	FOR	PRICE
PC1001	BRASS	£18.80
PC1002	STEEL	£24.70
PC1003	WOOD	£20.70
PC1004	PLASTIC	£18.70
PC1005	CHROME	£16.70

SET OF 4 INDEXABLE COUNTERBORES

CAP SIZES
3/8 7/16
1/2 5/8
C/W INSERTS

CODE SCT 133 S - £49.95

SHOBHA 6" ROTARY TABLE TAILSTOCK & DIV PLATE SET

4 SLOT MODEL
2MT CENTRE HOLE
DETAILED MANUAL Code XP1

Complete for £139.00 inc VAT

SPECIAL OFFER!!

CODE	ITEM	PRICE
XP00	TABLE ONLY	£90.00
XP101	TABLE + DIV SET	£110.00
XP1	TABLE + DIV SET + TAILSTOCK	£139.00!!

WHILE STOCKS LAST!

VERTEX BSO DIVIDING HEAD!!

Code	PRICE	
XP17	~~£265.00~~	£194.00

VERTEX K TYPE MILLING VICES!!

Code	JAW WIDTH	PRICE	
CG6	4" (K4)	~~£79.80~~	£69.95!!
CG7	5" (K5)	~~£105.00~~	£79.95!!
CG8	6" (K6)	~~£121.00~~	£99.00!!

VERTEX 6" & 8" ROTARY TABLES

Code	ITEM	PRICE	
XP8	HV6 TABLE	~~£155.00~~	£125.00
XP9	TSI TAILSTOCK	~~£69.00~~	£47.95
XP10	DPI DIV SET	~~£58.00~~	£37.95
XP11	HV8 TABLE	~~£235.00~~	£192.00
XP12	TS2 TAILSTOCK	~~£79.00~~	£58.00
XP13	DP2 DIV SET	~~£69.00~~	£52.00

CHRONOS IMPORTED CHUCKS!!

3JAW SC

Code	TYPE	PRICE
XP72	80MM	£39.95
XP73	100MM	£49.95
XP74	125MM	£59.95

4JAW INDEPENDANT

Code	TYPE	PRICE
XP75	80MM	£49.95
XP76	100MM	£56.95
XP77	125MM	£64.95

NEW CLAMP SET FOR VERTEX + SHOBA 6" ROTARY TABLES

Code SCK1 - **£15.00**

NEW - 80MM FRONT MOUNT 3 JAW LATHE CHUCK

Includes 2 sets of jaws, chuck keys + fixing screw

Code BSCH - **£60.00**

NEW 80MM 4 JAW CHUCK + MOUNTING PLATE FOR SHOBA 4" ROTARY TABLES

Code VO
£49.95

NEW - MICRO MACHINING DVD S BY J F RODRIGUEZ EXCLUSIVE TO CHRONOS - SOLE UK DISTRIBUTOR

THE MILLING MACHINE & ITS USES
4 HOURS LONG. COVERS ALL ASPECTS OF MILLING
CODE DVD1 - **£34.95 INC**

GRINDING LATHE TOOL BITS AND OTHER THINGS
90 MINS. CODE DVD2 - **£26.95**

MICRO MACHINING ON THE TAIG/PEATOL LATHE
2 HOURS, INCLUDES FACING, TURNING, GROOVING, PARTING, CHAMFERING, DRILLING, TAPPING ETC ETC ON THIS POPULAR SMALL MACHINE, EXERCISES ARE APPLICABLE TO ALL SMALL LATHES
CODE DVD3 - **£26.95**

ADVANCED TAIG/PEATOL LATHE OPERATIONS
4 HOURS. SEE THE PEATOL LATHE PERFORM SOME OF THE MOST UNORTHODOX MACHINING TECHNIQUES THAT MOST THOUGHT WERE IMPOSSIBLE
CODE DVD4 - **£34.95**

THREADING ON THE LATHE
2 HOURS. FINALLY THE MYSTERY OF THREAD CUTTING HAS BEEN MADE SIMPLE ENOUGH FOR THE BEGINNER
CODE DVD5 - **£26.95**

MACHINING OPS ON THE 7X10 VARIABLE SPEED MINI LATHE
4 HOURS. THIS DVD IS ALL ABOUT THE 7X10 VARIABLE SPEED MINI LATHE CURRENTLY OFFERED UNDER VARIOUS BRAND NAMES INCLUDING THE CLARKE 300. IT IS VERY THOROUGH INCLUDING A FULL TOUR OF THE MACHINE AND SHOWS VIRTUALLY VERY BASIC MACHINING CUT A LATHE CAN DO. AN EXTREMELY INFORMATIVE PRESENTATION WHATEVER TYPE OF LATHE YOU HAVE.
CODE DVD6 - **£34.95**

MILLING WITHOUT A MILLING MACHINE
2 HOURS. LEARN HOW TO DO SUCCESSFUL MILLING WITHOUT A MILL - USING YOUR LATHE AND EVEN A DRILL PRESS.
CODE DVD7 - **£26.95**

MAKING GEARS THE EASY WAY
4 HOURS. THE SECRETS OF THE HOB REVEALED. HOW TO USE ONE AND EVEN HOW TO BUILD ONE FROM SCRATCH ON A SMALL - MEDIUM SIZED LATHE AND SMALL MILLING MACHINE
CODE DVD8 - **£34.95**

FURTHER DETAILS AT WWW.CHRONOS.LTD.UK OR ASK FOR OUR DVD LIST

SHOBA HZ/VT ROTARY TABLES

Code	PRICE
XP2	3" £69.95
VP4	4" £99.00

BA TAP + DIE SET IN WOODEN BOX

0, 2, 4, 6, 8, 10, + 12BA

CODE EBAS - £31.95

5 PC QUICK CHANGE TOOLPOST SET

SUPERB QUALITY INCLUDES 2 STD HOLDERS, 1 BORING & 1 PARTING

Code	TO SUIT	
XP59	MYFORD ML	
~~£125.00~~		£95.00
XP60	BOXFORD 4 1/2	
~~£160.00~~		£125.00

SPARE HOLDERS FOR MYFORD & BOXFORD SYSTEMS

Code	TYPE	PRICE
XP61	MYFORD STD	£13.95
XP62	MYFORD EXTENDED	£19.95
XP63	BOXFORD STD	£17.95
XP64	BOXFORD EXTENDED	£24.95

SECURE ONLINE ORDERING AT WWW.CHRONOS.LTD.UK

PRICES INCLUDE VAT & CARRIAGE (UK MAINLAND)

CHRONOS LTD, UNIT 14 DUKEMINSTER TRADING ESTATE, CHURCH ST, DUNSTABLE, BEDS, LU5 4HU

PRICES ARE CORRECT AT TIME OF GOING TO PRESS AND ARE ONLY AVAILABLE WHILE STOCKS LAST
TEL (01582) 471900 – 5 LINES FAX (01582) 471920 WEBSITE WWW.CHRONOS.LTD.UK
EMAIL SALES@CHRONOS.LTD.UK

SMOKE RINGS
With the Editors

Get into business

Ever fancied taking up model engineering as a living? We are told that Historic Steam Models is for sale. The business is a division of Vision Engineering, an instrumentation engineering company based in Surrey. The company says it has been generating substantial turnover, mainly from the two primary models that were refined from the designs by Maxwell Hemmens of Yorkshire.

Plans and designs including CNC programmes for the two main models and drawings for numerous other engines and locomotives are included in the sale. The York - Bolton Plant and Mill Engine is a 1:24 scale model of an1890s stationary steam engine. Merlin is a 1:10 scale model of an agricultural engine, used to power threshers, saws, grinding mills, and so on. The models are manufactured from brass, copper and stainless steel. Many of the components are electro-lacquered or stove enamelled.

Two demonstration models, one Merlin and one York Bolton, both are fully assembled and in perfect working order, as well as a suitable compressor for non-steam running are included. Tooling, stock, purchasing information are all available as well as an international database of customers, and prospects totalling 3,173 contacts generated from advertising, exhibitions and a website. The website comes with all images, source files and codes. Spare parts for three years, or more, are included. Contact Tom Ashby on 01483 248300 or e-mail: tom.ashby@visioneng.co.uk

75 and still going strong

This year's Model Engineer Exhibition will be the 75th. Everything is now booked. Once again we are returning to the popular Sandown Park racecourse venue. Once again we are looking forward to the best display of top models and equipment, great club stands, and trade stands with bargains that are worth waiting for. Put the dates in your diary. It's the usual period between Christmas pudding recovery and New Year festivities, December 29 to 31, to be precise.

If you have a nice model, why not show it. It is not a competition, although awards are made to recognise achievement. It is for everyone, not just potential Gold Medal winners. Not finished? Let everyone see how it is coming along by putting it in the loan class.

Promote your club. Take a club stand. Its good fun, interesting, and a chance to make new friends and compare notes.

Be part of this very special show.

Bristol weekend

The highly popular Bristol SMEE model engineering and hobbies exhibition has been set for the weekend of August 19 to 21. It will be staged at the Thornbury Leisure Centre, a short distance from the city. This is said to be the largest show in the West Country, and covers all aspects of model engineering, including locomotives, traction engines, clocks, and stationary engines.

It also includes model boating, model aircraft, and woodworking, with many local societies taking part. There will be a boating lake, train rides, steam displays, together with a display of other crafts.

The leisure centre is within easy reach of the M4/M5 interchange, and has plenty of car parking. Catering and a bar complete the facilities.

Thornbury is a small town within easy walking distance with many local amenities for visitors. Contact George Ganley on 01454 318748.

An experiment for readers

You will notice that our friends at Greenwood Tools have placed an additional experimental full-page advertisement in this edition. The reason is simple. Greenwood Tools are main distributors for many top brands which cover not only metal cutting, but power tools, hand tools, metrology and other aspects of engineering.

In model engineering circles, the company has concentrated on metalworking brands. Supported by one of their main business partners, Dormer Tools (UK) Ltd, a special price deal is available in the ad for readers on tool sets, giving at least of 60% off list prices until the end of July.

If that is successful, Greenwood Tools will approach some of its other principal manufacturers with the idea of creating similar full-page special offers in future editions.

We await the results with interest.

Quick thinking at Maxitrak

Maxitrak has a couple of new products on the way. A Class 66 battery-powered diesel, and a De Winton 'coffee pot' vertical boiler steam locomotive with an attractive introductory price. More of that in a later issue, plus details of an electronic water gauge – a brilliant idea at a sensible price.

Meanwhile, a true story.

Some weeks back the company received a call, dreaded by many.

"*Hello, I am from Trading Standards, is that Maxitrak?*"

"*Yes, how can we help?*"

"*Are you still in business? Our records show that you started in 1978 and to date we have not had a single complaint. So we thought we had better come along and see if you're still going.*"

"*OK*"

So round they came.

"*Do you have wheel chair access?*"

"*Yes, we have a wheel chair ramp,*" was the quick thinking response, pointing to what had hitherto been called the engine-loading ramp, and re-christened for the occasion.

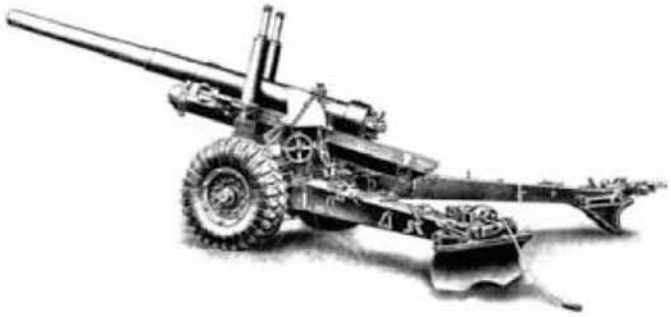
"*Do you include VAT in all quoted prices?*"

"*Yes*" and all the catalogues were handed over.

Maxitrak did have one failure, however. They failed to sell them a kit to make sure it went together properly.

CHUCK, the MUDDLE ENGINEER — by B. TERRY ASPIN

POST BAG



More big guns

SIRS, - I am writing to say how interesting I found the article by David Wilcox describing his model of the 5.5in. medium gun. This brought back memories for me as I remember this gun quite well.

Our regiment – the 58th Medium had this gun in Germany in the 1950s. I was with the regiment for nearly two years stationed near the Hohne firing ranges. Here are just a few instances I remember:

In the hot summer of 1957 during live firing exercises, occasionally the camouflage nets would catch fire on recoil!

One day the hydraulic pipeline burst showering us all with hydraulic oil!

We only ever had one hangfire, but of course one is enough.

Nevertheless, this gun was a formidable piece of artillery as you state.

I remember the guns in our regiment all had a machined metal plate on the breech block. This was used with an American made clinometer during a 'precision' shoot, a fact David Wilcox has not mentioned. I believe all these guns are now with the New Zealand and Indian armies.

Congratulations to David Wilcox on his fine model – I admire his patience.

R. Darby, Sheffield.

Framed!

SIRS, - I must take issue with Dennis Monk's observations concerning cast frames for the BR Britannias (*M.E.* 4245, 15 April 2005). I have long held the view that the often quoted fault with bar framing was that it was very much heavier than the 'traditional' plate frame.

I worked for BR in a CMEE's office and a little later in South Africa. The locomotive pool in South Africa was a revelation in its diversity and good engineering practice based on American ideas. Though I never worked for them I have a high regard for the locomotives built by and for SAR.

I have gone through some quick but nonetheless reasonably accurate sums for the Britannia and a local pair of locomotives with comparable dimensions to the BR locomotive, one has the same power output, the other is 40% more powerful. The BR engine had frames $1^1/4$in. thick and approximately 42in. deep, on the SAR engines the top bars of the frame are 5 x 4in. and 5.5 x 4in. deep and the lower one about 3in. deep , the respective areas are then BR - 52.5sq. inches , 19D - 32sq. inches and the 15F 34sq. inches. My contention is that the masses of the three engines would also be proportional to these areas which says the bar frames are much lighter.

Many bar frames were tapered at front and back over the carrying wheels which would narrow to half width so there would be a considerable saving here. All frames have to have cross bracing but the amount in the Britannia frame was considerable and I would guess was about the same mass as in the bar framed comparisons. SAR had several early classes of locomotive with both bar and plate frame variations and I think they give the lie to the thought that bar frames were too heavy. The classes 14 and 15 had these variants utilising exactly the same boiler and dimensionally the same throughout but in each case the bar framed engines were lighter , 14 - 90 tons, 14CRB - 83 tons, 15AR - 94 tons and the 15B 91 tons. These locomotives were also producing greater piston thrusts than the Britannia as they all had 22in. cylinders in place of the 20in. in the BR engine. All the SAR types have eight coupled wheels which would make the total frame heavier as there was one more set of pedestals than the Britannia.

I first came across the comment that the original Britannia was to be bar framed in a paper to the Inst Locomotive E around May 1951 by E. S. Cox and the diagram would indicate that the frames were to be like those of the SAR engines, made from cast slabs fully machined all over but the team that went to America and, I presume, General Steel would have seen cast beds as the slab frame was then some twenty years out of date. The frames on inspection might have included those for SAR class 25, a 120 ton 4-8-4; class 24, a 72 ton 2-8-4 and the big Garratt frames for Class GMA and GO which were 187 ton mass. A cast bed would on face value appear to be exceedingly heavy compared to plate as the complete cast bed contained the cylinders, all cross bracing, air tanks, and every conceivable bracket, blob and lug required, eliminating bolts entirely in equipment subject to cyclic loads, but General Steel took the opportunity to reduce thicknesses in less critical areas so the beds for the class 24, for instance, could not be more than around 30 tons mass and that would be hard to beat in a plate frame loco carrying a 5ft. 6in. boiler by 18ft. long and 36sq. ft. of firebox grate at the end.

I believe the reason for not proceeding with the bar framed Britannia was more to do with politics than sound engineering as the general instruction to the design team was that all locomotive building was to be done in house and immediately that would rule out cast beds as these could not be machined by the BR shops.

I cannot believe that the bolting of the motion bracket entered into any calculations as with bar frames the practice was well established in America and proven over the 50 years before the Britannias were thought of. One small advantage of the bar frame was its thickness and with some local thickening at bolts on cast parts that clamped to them, the bolt lengths could be long enough to permit straining of the bolts to ensure that they would never relax enough to let the mating parts breathe which, with only $1^1/4$in. plate and the normal $1^1/4$in. bolt, would not be quite so easy to achieve, if possible at all. On the cast bed there would be no bolts and in any case BR design had no reservations about placing the frames on the axle box centre lines, which was the intention for bar framing, they chose to follow Bulleid and the Merchant Navy design, which must have hurt.

Sadly, the bar frame was the right way, I would think three quarters of the world's locomotives possessed them and I can make comparisons on life and maintenance of bar versus plate frames to know which worked best. Nonetheless, the Britannias were good engines and in many ways a major step up on what was there already.

Alan Aldridge, by e-mail.

Let there be more light

SIRS, - I am aware that there are some stroboscopic effects from fluorescent tubes, however they do run cool and give an excellent spread of light.

I have a workshop which measures 18 x 12ft. and it has four 6ft. x 70W units equally spaced and the one over the lathe is doubled up with a second tube set 1ft. apart from the main unit, this minimises shadowing for fine work. Do remember though that these tubes emit most light sideways and very little endwise. If you want a more daylight colour, some tubes are better than others. The standard tube is green deficient and may not be to your liking.

The use of halogen bulbs should be restricted to machine lights (12v x 20W) because of their greater heat generation or certainly higher surface temperature. Although Andrew Howard may be short sighted, he is using a high brightness to shut down the iris which gives a greater depth of field in focus. I do not know what wall colouring he has, a white wall or white surface, even polystyrene or one of the smooth surfaced polystyrene boards used for display boards can bring a better even light to bear on a subject.

Ken Willson, Hants.

Technology

SIRS, - Thanks for the Technology Report in *M.E.* 4244, 1 April 2005. This reminded me of a remark someone made in *Post Bag*, about four or five years ago, that he had changed the copper tubes in his steel boiler to steel tubes and found no noticeable difference in steam generation. I can confirm this experience with my Durham and North Yorkshire traction engine. A subsequent reply in Post Bag stated

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 HIGHBURY LEISURE Publishing Limited.
Correspondence for *Post Bag should* be sent to: -
The Editor *(Model Engineer)*, Berwick House, 8-10 Knoll Rise, Orpington, Kent, BR6 0PS; fax: 01689-886666 or to dcarpenter@highburyleisure.co.uk
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.

that the conductivity of the metal of the tubes is not the controlling factor. The difficulty is in getting the heat out of the combustion gasses into the inner surface of the tube and getting the heat off the outer surface of the tube into the surrounding water. This is without considering any soot on the inside or scale on the outside of the tubes.

This reminded me of similar correspondence in a motoring magazine about 30 or 40 years ago when it was remarked that the shallow fins on the outside of the cast aluminium gearbox casing of the (original) Mini car would not dissipate much heat. Remember that the engine and gearbox used the same oil. The knowledgeable reply stated that the fins would do more good on the inside of the gearbox, because it is more difficult to get the heat out of the oil and into the aluminium casing than it is to get it off the outside surface of the casing into the passing air.

There is a whole technology out there that could benefit boiler design and steam raising. Could some knowledgeable person please enlighten us and help us generate steam more efficiently?

Finally, may I endorse John Ditchfield's plea for e-mail correspondents to identify their whereabouts.

Tony Webster, Northants, by e-mail.

Wellington bombers

SIRS, - It was most interesting for me to read Phil Hopkins' letter (*M.E.* 4246, 29 April 2005 re-Wellington Bombers fitted with a mine sweeping device.

In April 1940 whilst on my back in the Isolation Hospital at Ashford, Kent (now under Junction 9 of the M20) with polio, I have always remembered, despite being only 5½ years-old at the time a low flying bomber fitted with an enormous ring which spanned the fuselage and wings coming over the hospital one dark stormy evening. I have recounted this story at various times over the years and have encountered many different reactions from being viewed as being a figment of imagination from a sick child, to being completely nonplussed.

It was only in the last couple of years or so that I read an aeronautical magazine which revealed all to me. The bomber was indeed a Wellington, and the mine sweeping device was a product of the fertile mind of Barnes-Wallis. The bomber was fitted with this large coil, and a generator set in the fuselage. Due the weight of this assembly every extraneous piece of equipment had to be removed from the aircraft to enable it to fly. It would be interesting to know whether this equipment was in fact successful.

Clive R. Young, Kent.

Sticky fingers?

SIRS, - With advancing years my fingers are no longer as nimble as once they were, and a certain amount of scarring has reduced sensitivity at the tips of some. Recently, with a prototype (two steps forward, one two or three back), I had some small screws to do up (several times!), and not much space on the nut side, albeit plenty on the Phillips-head side. My wits are, alas, also getting less nimble, but the failing in the fingers stirred the wits to come up with this new, to me, solution.

The foundation is one of those smooth sticks used for making water-ice lollipops. They are approximately 100 x 12 x 1.5mm and have many uses in the workshop. One end had its width pared down to about 7mm for about 20mm, and the last 8mm on one side of the narrow bit had a very thin layer of Bostick Blu-Tack applied. A hot day and my Chinese Swiss Army knife were the only tools required.

The nut is stuck to the stick, and it is now easy to present it to the screw in a right and proper manner. A twirl with the screwdriver, a run of a finger along one side of the nut, an application of a mini spanner, and it is on to the next one.

The simpler the tool or method, the more it attracts my simple mind, so I got a kick from *M.E.* 4238, 7 January 2005. The late Len Snell's hardness comparator and Don Unwin's method of heat treating springs elicited a standing ovation from me. My sanity re small springs was finally saved by a cute method which when used with stainless steel wire gives an excellent result with no further treatment. See note. (Big springs I buy from the experts).

Note: *Home Workshop Hints and Tips*, edited by Vic Smeed, Workshop Practice series No. 26, Nexus Special Interests 1997 - pages 47/48.

Derek Cooke, Australia.

Puzzled?

SIRS, - I refer to the information in your pages from H. N. Richmond, who said that ideally, boiler feed water should be "at a low positive pH". My school Chemistry tells me that pH runs from zero (acid) to 14 (alkaline) approximately, so 'a low pH' must be very acid indeed.

pH is defined as "minus log to base 10 of the Hydrogen ion concentration", and a concentration of 10 to the power -7 is approximately 'neutral' (neither acid nor alkaline). Pure water thus has a pH of around 7. I surmise that by 'a low positive pH', HNR means 'just on the alkaline side of neutral' or say pH 8-9?

Chris Finn, East Yorkshire, by e-mail.

Seen it all?

SIRS, - Just when you start to think that you have seen it all, along comes someone like John Olsen. To adapt something published in 1887 and come up with a method of producing curves on a shaper really goes to show just what an inventive lot model engineers are, and what an excellent magazine *M.E.* is.

D. Charles, by e-mail

M.E. musical clock

SIRS,- Claude Reeve was a very fine amateur clockmaker. Everything he made was beautiful and well proportioned. I never saw anything from his workshop which was ugly. During his life he made some 50 clocks after retiring as a dental mechanic. Several of his designs were published in Model Engineer. By today's standards his instructions were very brief and his photographic contributions were confined to pictures of finished assemblies.

Recently I have revised two of his designs. The ornate Regulator clock (which was on show at the Model Engineer Exhibition at Sandown Park last January) and is being serialised in *M.E.* I have also done the same to his 4-legged gravity escapement clock. Claude's drawings have often been criticised for not showing enough detail. He did not like making the drawings; in fact he didn't do them, he simply took the clock movement up to Noel Street where the *M.E.* offices were at that period. The clock was dismantled and the wife of the late Martin Evans then made the drawings. In the two clocks which I have just made I have simply enlarged the drawings to full size and then any missing information can be taken from the full size drawings.

I now want to tackle the Musical Clock which Claude made during the war. A brief introduction with pictures was published in *M.E.* in the April 9th 1953 issue. Apparently there was sufficient interest and the serial started in 1956. Later in 1975 the serial was published in book form. Unfortunately no attempt was made at that time to update the original serial.

By today's standards the clock is difficult to make and very expensive. Two sets of tuned bells (octave) are specified and these would cost just under a thousand pounds from the Whitechapel Bell Foundry. Five different module sizes are used in the clock and with the price of cutters now, this would entail an outlay of some £300. Pinion wire which is unobtainable today is specified and if these are to be cut then there would be a substantial outlay for the cutters.

The purpose of this letter is to trace anyone who has made modifications to the clock in order to reduce the expenditure required for the tooling. I am pretty sure that the clock can be made to carry out the chiming and musical work on one set of bells, also that the number of module sizes could be reduced to two, but I would like to hear from anyone who has achieved this. I seem to remember that someone did and the clock was shown at the Model Engineer Exhibition at Wembley. I would be most grateful to receive any relevant information via the Editor.

John Wilding, Hampshire.

Mr. A. Crossfield's 5in. gauge large Prairie tank engine was awarded a First Certificate, the Barry Jordan Award for Best in Show and the Myford Shield.

Mr. I. Dahlberg's 2:5 scale Mercer Raceabout earned its builder a First Certificate and the Precision Paints Award for the Best Finished Model.

HARROGATE 2005

THE NATIONAL MODEL ENGINEERING & MODELLING EXHIBITION

Neil Read
reports on the competition entries in this first-class event.
● *Part I*

One concerned visitor was heard to ask *"Has this show really been running 12 years?"* upon receiving his souvenir guide. When the answer was in the affirmative he walked away shaking his head perhaps realising that he too had 'clocked-up' another twelve years. So yes, this year's 'Harrogate' really was the 12th in the series and Lou Rex and his family and team are once more to be congratulated on a fine event enjoying a superb array of models, strong club and trade support and, most importantly, a continuous stream of enthusiastic visitors throughout the three days of the event. Certainly everyone I spoke to during the course of the show was unstinting in praise for the standard of organisation and the excellence of the venue and I am sure they left with many happy memories.

Mr. T. Halliday fettles his Foster traction engine. (Photo: M. Chrisp)

Trophies and awards

The Barry Jordan Trophy for the Best in Show, the Myford Shield for the Best Locomotive and a First Certificate in Class 43 were awarded to Mr. A. Crossfield for his excellent 5in. gauge large Prairie tank engine (**photo 1**). The judges were particularly impressed with this model because of its excellent workmanship and superb painted finish. The beautiful standard of rivetting on the engine was particularly noteworthy. We know Mr. Crossfield likes to steam his engines so we look forward to seeing this locomotive on the track in the coming months.

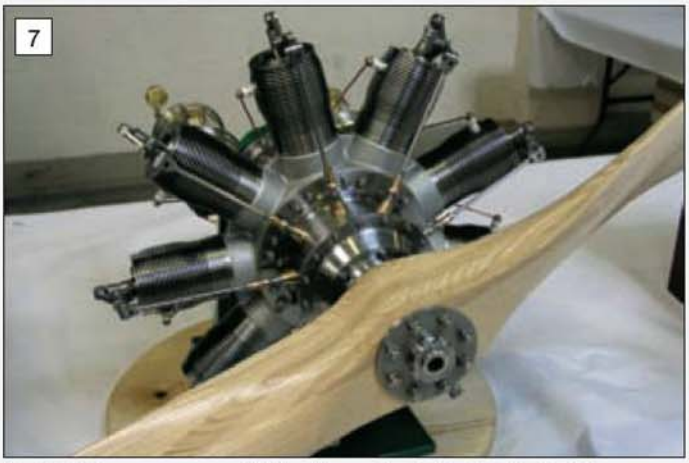
The Precision Paints Award for the Best Finished Model and a First Certificate were awarded to Mr. I. Dahlberg for his stunning 2:5 scale Mercer Raceabout of 1910 (**photo 2**). This remarkable model has been seen at several events around the UK during the last twelve months and always evokes gasps of astonishment both for its high standard of finish and attention to detail. It was certainly a pleasure to have the opportunity to examine it again in the well-lit surroundings of the model hall at Harrogate.

Winner of the Raymond McMahon Trophy for the Best Road Vehicle in Steam was Mr. T. Halliday (**photo 3**) for his 1:3 scale Foster 6nhp general purpose traction engine. The previous events I have attended at Harrogate have all been blessed with fine, dry and reasonably warm

Mr. Bowler was awarded the Chester Shield for Best Workshop Equipment and a Commended Certificate for his model engineer's dividing head.

Winner of the Eventex UK Shield for Best Boat and a First Certificate in the Model Boats - Scratch Built Class was Mr. H. Barrow for his landing craft.

Bradford Model Engineering Society was awarded the N.A.M.E. Shield for Best Club Stand.



Mr. J. G. Winrow was awarded the Warco Trophy for the Best Stationary Engine for this Gnome 9-cylinder monosoupape rotary engine.

This superb 5in. gauge 10½ ton hopper wagon earned its maker, Mr. C Garton, the Doug Hewson Trophy for Best Rolling Stock

Chris Vine's 7¼in. gauge LNER B1 Bongo *earned its builder a First Certificate plus many admirers over the weekend.*

weather. This year was rather more unsettled with a keen wind blowing most of the time and squally showers throughout the weekend with a hailstorm of epic proportions on Sunday afternoon. We therefore congratulate Mr. Halliday as much for his staying power as for his fine traction engine and send our thanks to all the outside exhibitors for braving the weather so stoically.

One of my personal interests is workshop equipment and it was with much pleasure that I examined the range of items exhibited by Mr. P. J. H. Bowler. The judges were obviously drawn to this exhibit too as they awarded Mr. Bowler the Chester Shield for Best Workshop Equipment and a Commended Certificate for his model engineer's dividing head (**photo 4**).

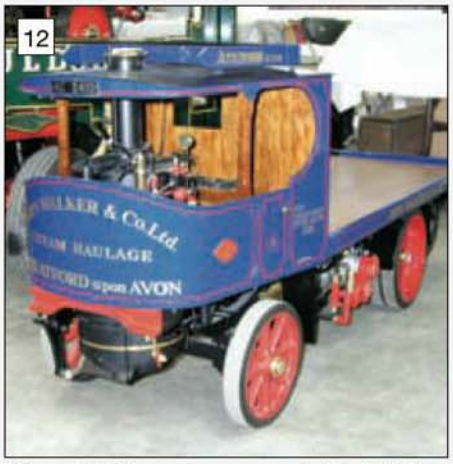
The boating fraternity are always well catered for at Harrogate with a strong club presence and enthusiastic support of the competition classes. The winner of the Eventex U.K. Shield for Best Boat and a First Certificate (Class 52) was Mr. H. Barrow for his superb landing craft (**photo 5**). Landing craft appear to be simple in outline but this model really did warrant closer inspection as considerable care had been taken to reproduce the various deck fittings and other details. One particular job I do not envy the judges having to make is choosing the best club stand. With so many well stocked stands to admire where would you start? Well, however they did it a decision was made and this year the N.A.M.E. Shield for the Best Club Stand was awarded to Bradford MES (**photo 6**).

There was a good selection of stationary engines of various types this year. The Gnome 9-cylinder monosoupape rotary aero engine by Mr. J. G. Winrow (**photo 7**) caught the judge's eye and this model was awarded the Warco Trophy for the Best Stationary Engine. These engines involve machining batches of parts of the same type to close tolerances and individual items can be extremely delicate so Mr. Winrow is to be congratulated on his achievement.

Last but not least, the final major award was the Doug Hewson Trophy for Best Rolling Stock. This year this was awarded to Mr. C. Garton for his 5in. gauge 10½ ton hopper wagon (**photo 8**). This incorporated all the mechanism of the prototype and was fully functioning as could be ▶

Raymond MacMahon's 5in. gauge GWR pannier tank engine was awarded a Second Certificate and his passenger coach a First Certificate.

Mr. D. Wainwright's superb 5in. gauge Manor was considered worthy of a Second Certificate by the judges.

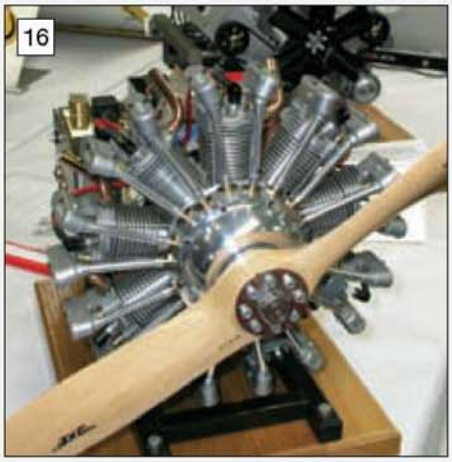


This neat Atkinson steam wagon by Mr. J. Walker was awarded a Second Certificate.

Mr. M. Angus was awarded a Third Certificate for the 1:3 Dodman traction engine.

This lovely 14-cylinder aero engine by Mr. D. Bramwell was awarded a First Certificate.

The 200cc supercharged V8 engine built by Mr. I. Dahlberg and awarded a First Certificate.



Also by Mr. Dahlberg was this 9-cylinder radial engine. It was also awarded a First Certificate.

Mr. J. Healey's 1:4 Bentley BR2 engine won its builder a Second Certificate.

seen from the various photos on display on the GL5 stand.

Other awards

As well as the major trophies the judges also awarded a number of additional certificates. In the Locomotive Class (Class 43) Mr. C. Vine was awarded a First Certificate for his 7¼in. gauge LNER B1 *Bongo* (**photo 9**). This locomotive won a Gold Medal and the Charles Kennion Memorial Trophy at the Model Engineer Exhibition in 2004 and it was indeed a privilege to see and admire it again. The 5in. gauge GWR pannier tank engine (**photo 10**) by Raymond McMahon and the 5in. gauge GWR Manor by Mr. D. Wainwright (**photo 11**) were both awarded Second Certificates. Mr. B. Rylance's 5in. gauge O&K locomotive (based on the Sweet Pea design) was awarded a Third Certificate.

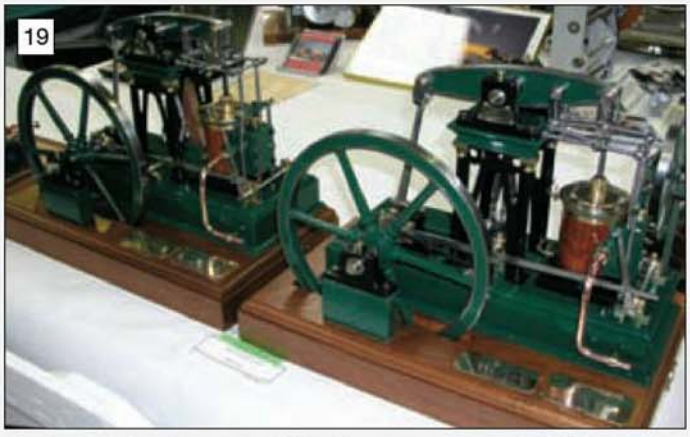
In the Road Vehicle Class (Class 46) Mr. J. Walker was awarded a Second Certificate for his 3in. to the foot Atkinson steam wagon (**photo 12**). Nearby in the steam road vehicle display was a 1:3 Dodman traction engine by Mr. M. Angus and this was awarded a Third Certificate (**photo 13**).

As has already been mentioned the Stationary Engine Class (Class 48) was well supported this year. In addition to that given to Mr. Winrow's award winning rotary engine First Certificates were awarded to the 106cc 14-cylinder aero engine by Mr. D. Bramwell (**photo 14**) and the 200cc supercharged V8 engine and 130cc 9-cylinder radial engine both by Mr. I. Dahlberg (**photos 15** and **16**).

A Second Certificate was awarded to Mr. J. Healey for his 1:4 Bentley BR2 aero engine (**photo 17**) and a Third Certificate each to Mr. C. Gibson for his tandem compound horizontal mill engine (**photo 18**) and Mr. M. Worthington for his Stothert & Pitt beam engines (**photo 19**). Mr. J. A. Cogden's James Booth rectalinear engine was Commended.

In the Miscellaneous Class (Class 49) a Second Certificate was awarded to Mr. D. Hodgson for his 1:6 scale German Tiger tank (**photo 20**). This was demonstrated throughout

A Third Certificate was awarded to Mr. C .Gibson for this neat tandem compound mill engine.



Two for the price of one. Mr. M. Worthington was awarded a Third Certificate for this pair of fine Stothert & Pitt beam engines.

Mr. D. Hodgson's 1:6 scale Tiger tank was demonstrated throughout the event and was awarded a Second Certificate.

A grasshopper skeleton clock and a scissors clock by Mr. D. Lawson. Each was awarded a Second Certificate (photo: M. Chrisp).

All the fun of the fair! Mr. E. Wilkinson's 1:12 carousel was awarded a Highly Commended Certificate.

Mr. P. Redman's 580 series E-boat was awarded a First Certificate in the Model Boats - Kit Built Class.

the show and earned praise for the wealth of detail incorporated into the basic model. Second Certificates were also awarded to Mr. D. Brook for his 1:16 vintage lorry and tractor, Mr. D. Lawson for his grasshopper clock and scissors clock (**photo 21**), Stephen Atkinson for his 1:8 scale MG TC car (currently being serialised in *M.E.*) and Mr. N. Wilkinson for his 50:1 Bucyrus Erie 1200T walking dragline.

Fairground models are always popular with the public, perhaps because they kindle happy memories. In Class 50 (Fairground Models) Mr. B. Rathmell was awarded a Second Certificate for his model fairground. A Third Certificate went to Mr. G. Ryall for his scratchbuilt model cars. Mr. M. Slater's 1:24 Scammell Showtrac and Mr. E. Wilkinson's 1:12 carousel (**photo 22**) were Commended and Highly Commended respectively.

In the Model Boats – Kit Built Class (Class 51) Mr. P. Redman's 580 series E-boat was awarded a First Certificate (**photo 23**). Two further certificates were awarded in Class 52 (Model Boats – Scratch Built). To both Mr. B. Young and Mr. B. Seaman went Second Certificates, to Mr. Young for his 1:12 thames launch (*Bluebird of Chelsea*) and to Mr. Seaman for his Flower Class corvette HMS *Bryony*.

In the Model Wheelwrights Class (Class 53) second certificates were awarded to Brian Young for his 1:12 Albion expanding horse hay rake (**photo 24**) and to Mr. B. Simpson for his splendid 1:8 Bavarian Waggon. Two Third Certificates went to Mr. J. Cartledge, the first for his 1:8 diorama of rescue equipment and the second for his 1:8 quarry wagon.

The Rolling Stock Class (Class 54) had two certificate winners. Raymond McMahon's 5in. gauge GWR passenger coach received a First Certificate and Mr. D. Ventress' 5in. gauge covered carriage truck was Highly Commended (**photo 25**).

Next time we will present a summary of the results together with a report on the club stands.

●*To be continued.*

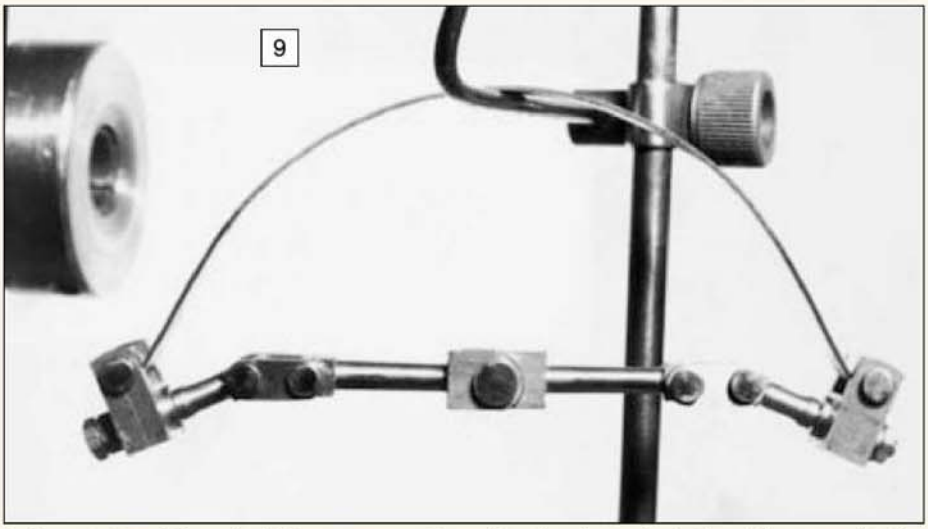
Brian Young was awarded a Second Certificate for this 1:12 Albion expanding horse hay rake.

This 5in. gauge BR covered carriage truck by Mr. D. Ventress was awarded a Highly Commended Certificate.

A MODEL POWER DRIVEN SPRING HAMMER

The late **Dave Lammas** describes the spring linkage components.

●*Part III continued from page 681 (M.E. 4249, 10 June 2005)*



A close-up view of the spring linkage components used to allow the spring to flex while suspending the hammer.

The spring linkage components are shown in **fig 7** and **photo 9**. Starting at the centre it will be seen that the link on one side is forked where it fits into the hammer body while the other is plain to fit into the fork, a single pin through both forms the pivot.

The forked one is made from 3/8in. square mild steel by first marking the hole at the fork end near the end of a length of material about 4in. long, this length forming a convenient handle by which to hold the part until it is almost complete. Drill the hole then mill, saw or file the slot. Set the bar up to run centrally in the 4-jaw chuck to turn the 5/32in. dia. portion using a round nose tool to form the correct radius at each end, sharp corners are not wanted as this is supposed to represent a forging. Drill the second hole if not done at the same time as the first, then mill to 3/16in. thick around the area of the hole. Now cut it off from the bar just beyond the eye. To radius the eye first prepare a pivot by turning a 1/4in. length of 3/8in. dia. silver steel down to 3/32in. diameter. Cut the rod to about 1 1/2in. long and turn 7/16in. length at the other end down to 5/32in. diameter. Harden and temper the whole piece to purple colour. Grip the pivot in the machine vice with the 3/32in. dia. end sticking out towards a small end mill, slip the eye of the work over the spigot and traverse the vice until the eye approaches closely to the rotating end mill. Hold the fork end firmly with pliers having smooth jaws and rotate the piece slowly against the direction of rotation of the cutter. Traverse the vice backwards a little to clear the cutter before swinging the work back around to start another cut. Wind the vice in again and continue likewise until the eye has the desired size. Take great care always to move the work against the rotation of the end mill and wind clear before returning to the start, take only light cuts. You may care to wear a pair of heavy gloves to protect your hands while undertaking this operation.

Reverse the silver steel in the vice to deal with the forked end in exactly the same way, each leg of the fork may be done separately instead of attempting to do both together. Just turn the work over on the pivot to do the second leg. Keep the pivot rod for future use on this and other jobs.

After all that the plain link will, I hope, be plain sailing. The only point to watch is that it may not be easy to centre the thinner job in the 4-jaw chuck because the jaws of a large chuck might interfere with each other. If so centre the 3/8in. dimension between two opposite jaws first then slip a short length of 1/8in. dia. rod between one of the other jaws and the work holding it with tweezers until the jaw just nips it. Do the same with the remaining jaw before gradually setting it to run true.

Threaded links

These two identical pieces can be made from 1/4in. square steel in similar fashion to the foregoing. Mark and drill the eye 15/16in. from the end of the length of metal, turn down and thread the end leaving a sharp corner on this side of the collar because it has to fit against the boss of the mating part. The other side of the collar should have a radius as with the portion adjacent to the eye. Mill the eye to 3/16in. thick before sawing off from the bar and rounding the eye.

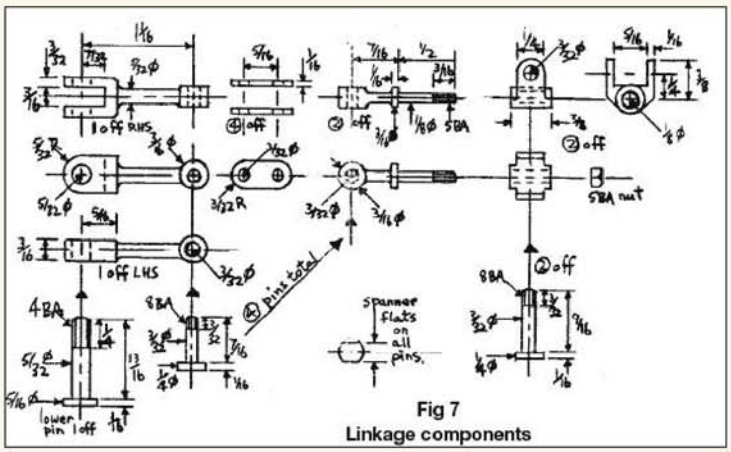


Fig 7
Linkage components

Connecting links

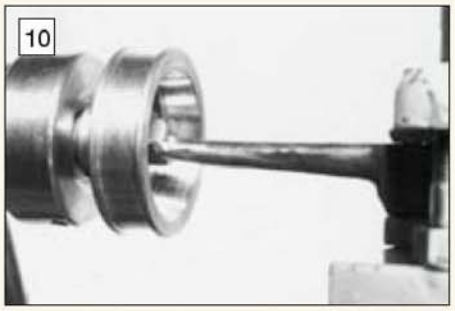
Cut four pieces of 1/16 x 1/4in. mild steel strip about 2in. long. Mark out and drill the holes near the end of one piece then use it as a jig, clamped to each of the other bits in turn to make sure all the holes have the same spacing. Round one end of each before sawing off, then round the other end holding it tightly in the pliers.

End fittings

Some 1/2in. square steel is the starting point for these items. Mark out and drill the cross-hole just over 3/16in. from the end of the bar, now mark on the end face the position of the longitudinal hole and centre-pop. Offset the metal in the independent chuck so that the pop mark runs true, align it with the tailstock centre or use a wobbler for this purpose. Centre-drill and drill 1/8in. dia. x 1/2in. deep. Next turn the end carefully to form the boss, at the same time making sure the end face finishes 1/8in. from the centre of the cross-hole. If you have not already scribed lines as a guide the simplest way to check is by putting a short length of 1/8in. dia. rod in the cross-hole and holding the end of the rule against it, the reading should of course be 1/16 inch.

Use a parting tool to turn a groove forming the other boss, again checking that the central part finishes to 1/4in. wide symmetrically about the cross hole. Part off bringing the piece to length.

As the region below the bosses is still square at this stage it is not difficult to hold in the machine vice for milling the slot. However, since the grip is rather small use a 3/16in. dia. slot mill and take small bites as previously mentioned. The tops of the lugs may be rounded with a file or milled if a handle is made by turning a 1/8in. dia. threaded spigot on the end of a 3in. or 4in. length of 1/4in. dia. steel. Slip it through the longitudinal hole, put a nut on the end and a nice safe holding arrangement will result. A very useful assortment of such devices together with the pivot rods is soon accumulated and will greatly simplify future jobs of this nature.



Boring the internal taper for the clutch in the pulley on the lathe.

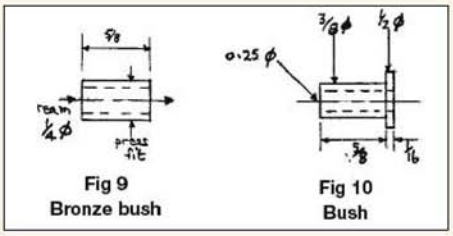
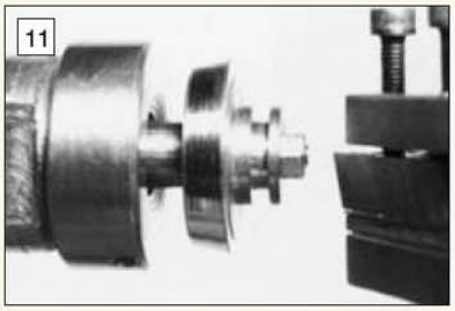


Fig 9
Bronze bush

Fig 10
Bush



Turning the taper on the outer diameter of the clutch sliding member.

Pins

It is a good idea to make all the pins or bolts for the whole machine at the same turning session. Little need be said about this job I am sure, but you are free to introduce some variation if you wish. For instance the link fastenings are shown as bolts, although plain pins with washers and split pins would also suffice, 1/32in. dia. split pins would be called for. The round heads of the bolts should have two flats filed to fit a convenient size of BA spanner. If using the threaded form do make certain that sufficient plain length is allowed as it is not good practice for parts to bear on the thread.

Rotating mechanism

This includes the crankshaft, flywheel/crank disc, pulley and clutch, as well as the necessary bushes.

Bushes (fig 9)

Turn a plain bronze bush to a light press fit in the front bearing boss. This one is a permanent fixture therefore it may be Loctited in place. Make it a few thousandths of an inch longer than the housing rather than shorter.

The flanged bush for the rear housing (**fig 10**) should be a push fit only as it will probably be inserted and removed a number of times during building. Do not leave it slack though or it could fall out when the hammer is working. The best solution would be to make it an easy push fit for about three-quarters of its length but a tighter fit for the remainder, it could then only be pushed right home on final assembly.

Leave the pulley bush (see **fig 12**) until the pulley itself has been made. This bush is a press fit.

Crank disc/flywheel (fig 11)

If a piece of 2in. steel bar is available the outer diameter can be left as received. This is just a plain turning, drilling and reaming job but get the thickness dimension right or the con-rod might bind. The throw of the crank is not critical. It can be marked out with rule and scriber for the crank pin hole to be drilled in the drilling machine. Just make sure that the hole is square to the face. Loctite the pin in place.

The radial threaded hole for the fixing grub screw is rather long for some taps that I have come across. Why do manufacturers not make them with shanks of tapping drill size? After all the weakest part is where it is fluted. To get over this little problem open out the hole to shank diameter as deep as needed for the tap to cut right through. This hole can be plugged lightly on completion to improve the appearance if you wish.

Pulley

The inside of the pulley also forms one component of the clutch so accurate workmanship here is advisable if free engagement is to occur.

Start with another slice of the 2in. steel, grip it in the chuck and turn the 3/4in. dia. x 3/8in. boss but do not drill. Reverse in the chuck holding by the turned boss to carry out all remaining operations. First drill and ream 3/8in. dia. then with a boring tool recess to the depth of the internal boss to a diameter of about 1 1/4 inch. Continue recessing around the boss using both left and right-handed boring tools or make up a special recessing tool to do the job. Set the top-slide around to 10deg. for boring the clutch cone seating, make sure the tool is very sharp and set at exact centre height to obtain a true cone having a fine surface finish. The mouth of the cone should be 1 1/2in. diameter (**photo 10**).

Finally turn the O/D belt groove 1/16in. deep leaving well rounded flanges to avoid belt wear. The bronze bush can now be turned to a press fit in the bore but do not alter the top-slide setting yet as it will be required later to turn the clutch cone to exactly the same angle.

Clutch disc (fig 13)

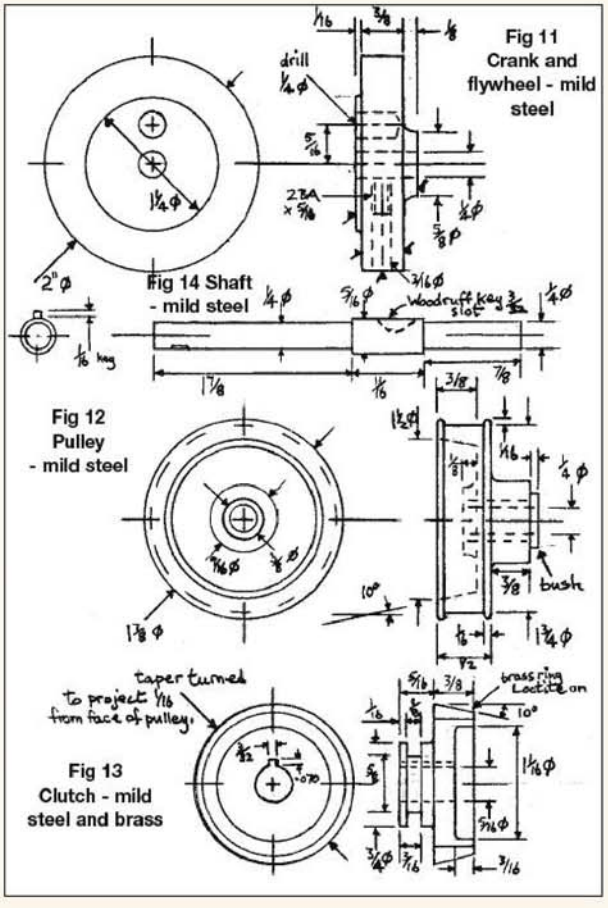
This time a slice of 1 1/2in. dia. steel or larger will suffice but first we must prepare a brass blank that will eventually become the contact face of the clutch cone. If the two parts of this mechanism were turned from steel the faces would soon become scored and damaged therefore it is wise to make one part of a different material. Brass has been shown but cast iron for the whole of clutch disc would be an equally good or perhaps a better choice. The prototype would most likely have been fitted with a leather faced clutch bearing on a cast iron pulley cone, if you fancy doing likewise then by, all means do so since it should not be too difficult to glue thin leather on using Araldite adhesive.

If deciding to adopt the brass ring method, turn the brass outer diameter parallel and about 1/16in. over size before boring out the centre to 1 3/16in. dia. then part off to around 1/2in. long. As with the pulley, first turn the boss of the disc then reverse in the chuck to hold by the boss. Drill and ream, 5/16in. dia. before boring the recess. Now turn the outer diameter parallel to a press fit in the brass ring or a push fit and Loctite.

From 3/4in. dia. steel make a turning arbor having a spigot 5/16in. dia. by about 7/8in. long to fit closely in the disc. Thread the end of the spigot to take a clamping nut. Without disturbing the freshly turned spigot in the chuck mount the disc, recess inwards for turning the cone on the brass portion. Do not take the large end down to a sharp edge at exactly 1 1/2in. dia. but leave it somewhat oversize in order that the disc will project not more than 1/16in. from the face of the pulley when assembled. Besides allowing clearance within the clutch it will enable the disc to be skimmed in future should constant use wear the cone (**photo 11**). A couple of shallow grooves can be cut in the cone surface with a pointed tool, also a number of axial grooves may be cut around the circumference at regular spacing by setting the tool on its side with the point at centre height and traversing the top-slide to 'plane' them. This breaks up the smooth surface of the cone into a number of rectangular sections enabling any oil on the clutch face to be wiped off leading to smoother take-up of power.

It is necessary to either file, slot or broach a key way in the bore of the disc, which enables it to slide axially while continuing to drive the shaft. A semi-circular Woodruff key is fitted to the shaft, it is 3/32in. thick and stands 1/16in. above the shaft surface. This means that a key way 3/32in. wide by just over 1/16in. deep is needed in the disc. If filing (as I did) first prepare a gauge consisting of a length of metal 3/32in. thick by 1/4in. wide by which progress can be checked as a narrow needle file is poked through the bore. Take care to hold the file radially in the hole or a lop-sided slot might result.

●*To be continued.*



I/C TOPICS

AN EIGHT-STROKE AERMOTOR

Nemett
describes a rather unusual eight-stroke engine but makes a start by outlining the purpose of this column and addressing a reader's query.

I will start this second *I/C Topics* by outlining the purpose and functions that I see this column performing. I intend that the column should provide a focus and act as a forum for news, views and technical topics related to I/C engines of all types much like Edgar Westbury's *Petrol Engine Topics* did many years ago. It will initially be targeted more at those who are new to the building of I/C engines because I have heard many, experienced model engineers, when confronted by a large complex multi-cylinder engine say, *"I could never build an I/C engine"*. I hope that I will encourage more of you into this fascinating branch of our hobby and demonstrate that if you can build a steam engine, you can build an I/C engine.

Having said that, I am not proposing that you set off on a double row, 18-cylinder radial engine as your first attempt. That would be like attempting a GWR King as your first steam locomotive! However, I have to admit to building a four-cylinder, four-stroke engine (Edgar Westbury's 'Seal') as my first I/C engine, so it is probably a case of 'do as I say not as I do'!

As an incentive, remember that with I/C engines, you will not have to suffer the regular attentions of the boiler inspectors as you do with steam engines!

One of the things I have planned is to cover some of those operations perceived as 'tricky' and I aim to show you that they are no trickier than many of the things you all happily tackle when making steam engines. These will include camshafts, valves and any other items that you as readers out there would like to see. Obviously your needs can only be included if I know what you want, so I would encourage you to write in and let me know your particular interests. I would also like to see any queries you may have on I/C engines so that they can be aired and ideas exchanged through this forum. If you have already built I/C engines or have unusual examples in you possession and would like to share them with our readership then please send in details and photos.

One of the things I am currently working on is a basic 15cc single-cylinder, four-stroke engine aimed at those new to the field. It is intended that this will run as a construction series once I have completed the drawings (I am busy wrestling with Turbocad at the moment) and have proved the design.

One point I will make is that I am by nature what I would call a 'pragmatic' model engineer by which I mean that I use methods and techniques which work for me and tend not to worry too much about the purists and theorists views. After all we each have our own approaches to life and my production management background tends to point me in the direction of the simplest method which works and produces the desired result.

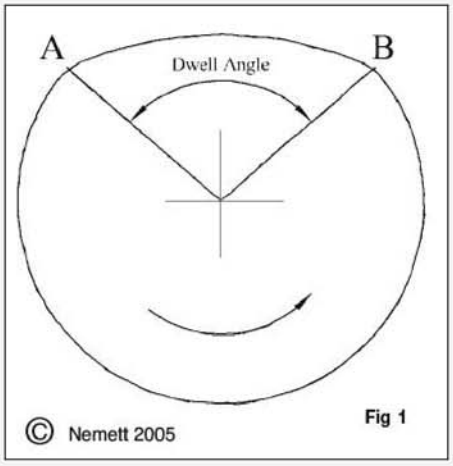


Fig 1

Ignition cams

As a starter for the real business this month, I will respond to the query by reader James Wells (*M.E.* 4246, 29 April 2005) on ignition cams. James wanted information on the method of arriving at the required dwell angles (see **fig 1**) of the ignition cam for a single cylinder two-stroke engine.

The basic answer to this is that it is a balance between ensuring that the contacts are closed for long enough to give the current in the coil time to rise to its maximum value and not so long that the battery is drained quickly (assuming it is not charged from the engine). A good guide figure is 90deg of cam rotation for the closed period although for a very high speed engine using mechanical points some sources suggest a longer period. With modern rechargeable battery packs and coils, 90deg should be more than adequate for any but the most extreme of engines. Don't forget that for the four-lobe cam on a four-cylinder four-stroke engine, 90deg is not possible in any case since the points have to go through the complete 'close, dwell and open' cycle within the 90 degrees.

I must admit that I have not found any 'theory' to calculate the period but it must be a function of engine speed, coil electrical characteristics and battery characteristics. Those with access to electronic test equipment could no doubt measure the time taken for the coil to achieve maximum current and then use this figure and the desired maximum engine speed to calculate the dwell angle.

I have an electronic ignition system using a Hall effect transistor in place of the points but with a normal coil. The paperwork with this quotes a dwell time of rpm x 0.0075 as being suitable. Since in this system the Hall effect transistor is directly replacing the points, one could draw the conclusion that this could be used as the basis for calculating the dwell angle for mechanical points. One point to be aware of is that when using Hall effect ignition, the dwell angle becomes dependant on the width of both the Hall effect sensor and the operating magnet together with the diameter at which the magnet rotates. A smaller diameter will increase the dwell angle.

Examples from two of my own two-stroke engines show dwell angles of 90 and 110deg, the latter for a 10cc car racing engine.

The ignition points gap will also affect the dwell angle. Increasing the gap will cause the points to close slightly later and to open slightly earlier thus reducing the dwell angle.

Figure 1 illustrates a typical ignition cam, the dwell angle is defined as the angle between points A (points close) and B (points open and ignition fires). Notice that the part of the cam between these points is not flat but curved to a radius equal to the cam diameter and that the 'corners' at A and B have been rounded to ensure smooth operation. The material used can be mild steel but it must be case hardened and highly polished. The cam follower is normally Tufnol.

Alan Thatcher's splendid eight-stroke Aermotor and its pump.

New book

I have recently received details of a book called *Model Engine Mechanics*, which is a reference manual on two-stroke engine design. The book has been written by Gordon Cornell and is a 156 page, spiral bound book with many colour illustrations and diagrams covering all aspects of

The unusual cam and roller follower used to give eight-stroke operation.

A top view showing the exhaust valve operating lever and cylinder lubricator.

The mechanically operated exhaust valve. The inlet valve is of the automatic type.

A view of the engine running showing the 4:1 timing gears and the pump drive arrangements.

A view of the engine running seen from the flywheel side. A heavy flywheel is necessary to accommodate the eight-stroke cycle.

two-stroke engines. The sample pages I have include sections on engine porting and cylinder and piston design and manufacture. Gordon has also produced 'ICE', a computer program for two-stroke engine analysis which is available for a reduced price when purchased with the book. Further details from Gordon at **19 The Earls Croft, Cheylesmore, Coventry CV3 5ES**. I will be reviewing the book and the ICE program in the near future.

Another unusual engine

The featured engine this month is very unusual in that it is an eight-stroke hit and miss type engine. It is a model of an 'Aermotor' built by Alan Thatcher from Reading SME using castings obtained from the United States.

These engines were originally designed to operate water pumps when the normal wind power was unavailable. To this end they had to be reliable and economical, after all the owners were using costly fuel to power something that was normally available for free! A full view of the engine and pump is shown in **photo 1**.

The basic operating cycle of this engine is as follows:

Stroke 1	Inlet
Stroke 2	Compression
Stroke 3	Power
Stroke 4	Exhaust
Stroke 5	Air intake via exhaust
Stroke 6	Air expelled via exhaust
Stroke 7	Air intake via exhaust
Stroke 8	Air expelled via exhaust

Strokes five to eight are extra strokes which cool and scavenge the cylinder. Also because no fuel is being used they serve to improve the economy of the engine. During these strokes the exhaust valve is held fully open. The inlet is of the spring loaded, automatic type and so does not open during the extra strokes.

The big-end and crankshaft bearings. Just inside of the flywheel is the 'hit and miss' drive.

The camshaft is driven at one quarter of the crankshaft speed and the unusual shape of the cam can be seen in **photo 2**. The cam rotates clockwise in this view and the long curved part of the cam is the part that provides for the four, extra strokes. The other parts of the cam cover the normal exhaust cycle. The rectangular metal bar to the left of the cam is part of the 'hit and miss' mechanism and, when operating, holds the exhaust operating lever in the 'open' position. **Photograph 3** shows the long operating lever whilst the valve end of this lever together with the cylinder head and silencer is depicted in **photo 4**.

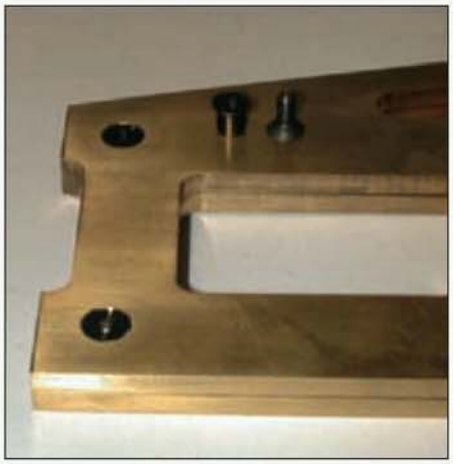
Photograph 5 shows the engine running and gives a good view of the cam and pump drive gears. The rear view (**photo 7**) shows the camshaft mounting arrangements and also the big end and main bearings, which are typical for this type of open crank engine.

In **photo 6** the cam position shows that the engine has just finished stroke eight and is commencing a 'normal' four-stroke cycle.

The engine starts easily and runs well pumping water from the tank underneath the base plate and back with the usual 'hit and miss' sound. The unusual thing is the apparently large amount of 'miss' due to the eight-stroke cycle.

The engine is certainly economical and, even though it is air-cooled, the cylinder only gets warm to the touch. Alan has used a proprietary electronic ignition system on his model which is hidden away under the engine mount.

All in all an unusual and fascinating engine to watch and listen to in operation.



Two clock plates fastened together with the alignment bushes.

The set of alignment bushes. They are hardened for durability.

This skeleton clock was the author's first attempt at clock making and prompted the bush idea.

CLOCK PLATE ALIGNMENT BUSHES

Peter Rawlinson

explains how his engineering knowledge helped him make his first clock.

Some years ago a design for a skeleton clock caught my eye in an American hobbies magazine. I do not think the design was anything special and, in fact, it was quite plain. However, I decided to build it as a first attempt at clock making. Being unused to clocks I looked at it from an engineering point of view.

Now I detest having to do the same thing or part twice. I realised that with the system of pinning the plates together I would be doing the same operations at least twice and even then the pins would not be flush on both sides. As I have a die filer and would have to turn the plates over for access to corners and the like this would be a major inconvenience. In the past I have made parts that needed to be pinned together and have found the necessity of having to support the work on parallels on the die filer to be difficult and dangerous. This is particularly true if you are approaching an acute angle where the file can get caught between the two surfaces.

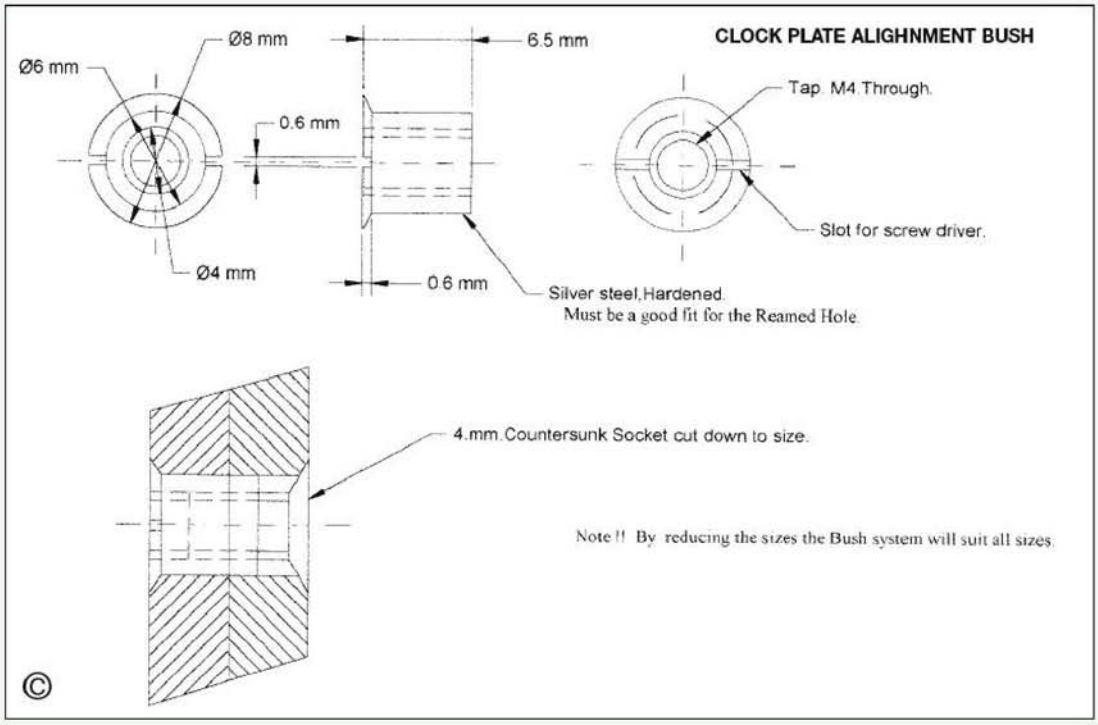
I decided therefore that another system of pinning the plates together was required and I came up with the following bush system, which solved all my problems and I hope it will help others. The bushes not only locate the plates accurately together over and over again, but also hold them tightly together wherever they are fitted. As a bonus, if fitted in the pillar positions then the countersinks are completely obscured by the cover washers.

The bushes I have used very successfully on the original skeleton clock and on the unfinished Congreve clock are 6mm dia. and are a tight fit in a 6mm dia. reamed hole. I started by drilling and reaming a single hole with the plates clamped together and then countersunk it to suit. The first bush was then fitted and tightened up. The second was then completed and then the last two done together. In this way a perfect fit can be obtained. The plates can be separated and re-assembled as many times as required and the accuracy is always maintained.

The bushes can be made to a size to suit the clock or job in hand (I have found them useful for other things as well as clocks. Mine will clamp two 5/32in. thick plates together but could be shortened to clamp say two 2mm plates. I believe the drawing is self-explanatory and together with the photographs should give any would be user enough information.

The cover washers on the pillars of this Congreve clock cover the bush countersinks.

These simple parts certainly save their manufacturing time over and over and I recommend them to those of you about to start on making a clock.



LETTERS TO A GRANDSON

M. J. H. Ellis

explains an unusual coupling found in the Science Museum

●*Part LXXVII continued from page 679 (M.E. 4249, 10 June 2005)*

Several letters back (*it was in No. 74, - Ed.*) I said that I would tell you about some of the interesting, but little-known, mechanisms that are in the care of the Science Museum in London. I shall try to finish the present letter with one of them, which provides a 2 to 1 ratio of angular motion between two shafts without gearing. It is not known who invented it. In my sketch (**fig 3**) A is a disc mounted on the end of a shaft, and has two slots B formed diametrically at right angles to one another across its end face. On another shaft, parallel to that on which A is mounted, is the member C. It is shown as another, smaller disc, but it could equally well be a. double arm. On either side, diametrically opposite and equidistant from the centre line of the shaft, are two crankpins, on which are mounted the blocks D. One of these slides to-and-fro in one of the slots in A and the other block in the other slot. The shaft that carries C is mounted at a distance from the shaft carrying A precisely equal to the radius at which the blocks D rotate. The size of A does not matter, provided that it is sufficiently big, that the blocks D never escape from the slots.

As the shafts rotate, the blocks slide in their slots, and C makes two revolutions for every revolution of A. That the motion is uniform is demonstrated in my sketch (**fig 4**) PQ and RS are the centre-lines of the slots, and rotate in my sketch around O. X and Z are the centres of the pins, which carry the sliding blocks. By hypothesis, XY = YZ = YO. Therefore, triangle OXY is isosceles, and angle XOY = angle OXY. Let this angle be denoted by 'a', and angle OYX by 'b'.

Then b = 180 - 2a deg.

Let the disc now rotate through any angle δa, so that the parts move to the position shown by the dotted lines. Angle a diminishes to (a - δa) and b becomes:

180 - 2(a - δa)
= (180 - 2a) + 2δa

i.e., b increases by 2(δa), that is, twice as much as a. But a can be assigned any value, so it follows that however far the disc turns, the blocks rotate twice as far. Q.E.D. Try that one out on your Dad!

Your smugly, self-satisfied Grandpa.

●*To be continued.*

This photograph was unfortunately omitted due to space reasons from the last* Letters to a Grandson. *It shows J. J. Constable driving* Juliet *on the St. Mellons track. John Constable won what the author believes was the Model Engineer Challenge Cup with his entry, a 'Sentinel' industrial engine, which so far as he knows was the first of its type.

FIGURE 3
2:1 ROTARY COUPLING

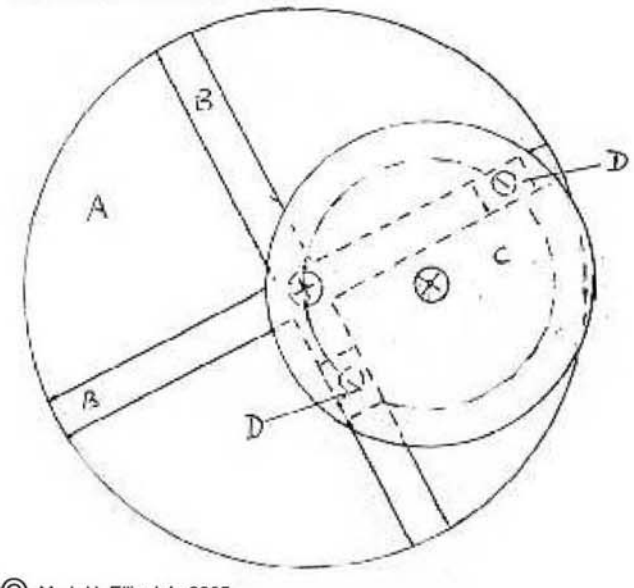
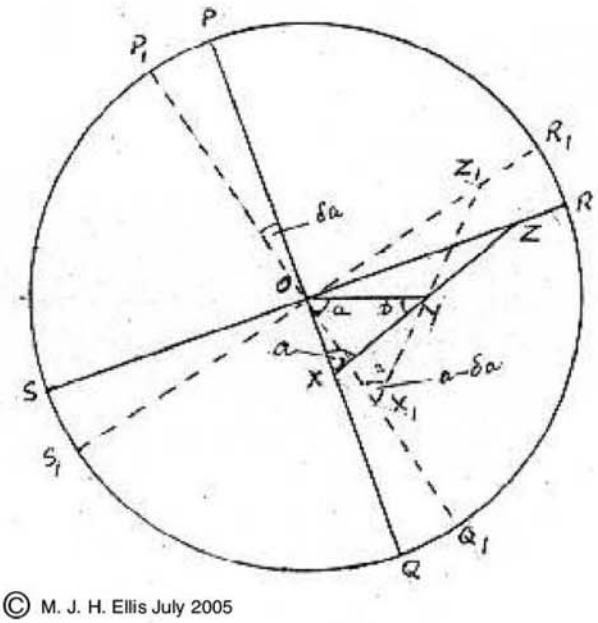
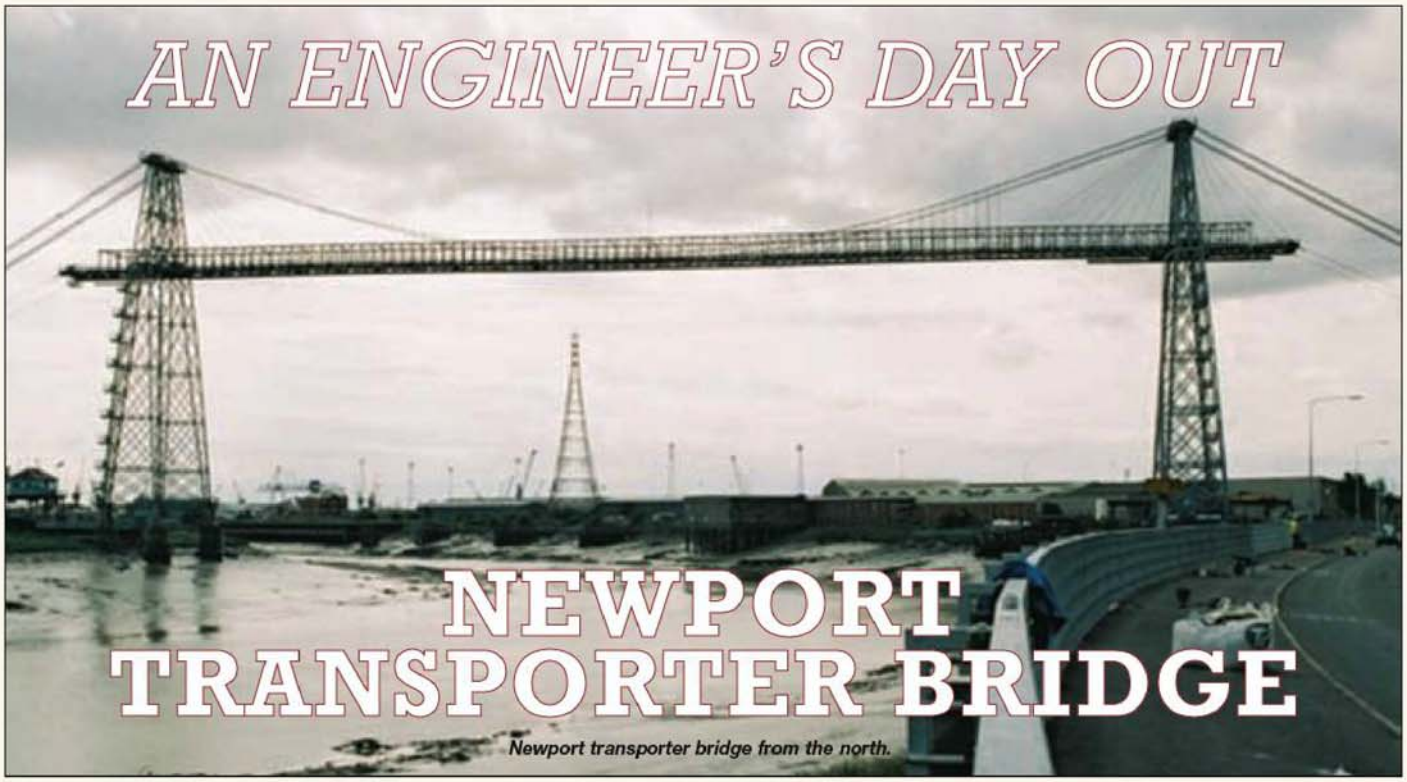


FIGURE 4



AN ENGINEER'S DAY OUT

NEWPORT TRANSPORTER BRIDGE



Newport transporter bridge from the north.

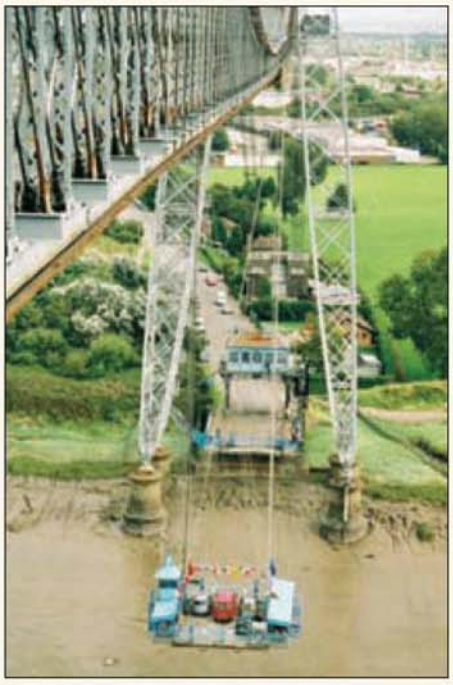
Roger Backhouse
visits the Edwardian glory of an 'aerial ferry' located in Wales.

Someone compiling a list of the engineering wonders of Wales would have to include the Newport Transporter Bridge. Though not as famous as its Middlesborough counterpart Newport has the largest remaining example in the world. Once in danger of demolition it has been renovated and looks like delighting passengers for some years to come. A transporter bridge is a unique hybrid of bridge and ferry, sometimes called an aerial ferry. A gondola for passengers and vehicles is suspended at approach road level from a high level boom or girder. It is then winched across as traffic requires.

All transporter bridges were built across navigable waterways between 1893 and 1916. When sailing ships were still in common use they provided sufficient clearance for the tallest masts. Unlike a conventional bridge approach roads could be built at river bank level with a large cost saving. Transporter bridges were safer to operate and staff costs were much lower than a ferry. Worldwide about 19 bridges were built but only a handful still survive in working order; one in France, two in Germany plus the earliest one, at Bilbao in Spain. In Britain one at Runcorn was replaced by the present steel arch bridge in 1961, though the Middlesborough bridge is still in use. A small bridge survives at a chemical works in Warrington but no longer operates.

The first proposal for a transporter bridge was made by a Hartlepool engineer, Charles French, in 1873 but was never realised. The idea was successfully developed by the French engineer, Ferdinand Arnodin, working with a Spaniard, Alberto de Palacio, who both deserve to be better-known in the English speaking world. Arnodin was a leading designer of suspension bridges and was responsible for improving the design and safety of these bridges.

Newport was a town of rapid growth in the 19th century. It is on the strongly tidal River Usk crossed by a masonry bridge near the castle. Just down stream was the Town Dock with a growing export trade. The planned development of a steel works near the Usk mouth meant that existing bridges would be inadequate for traffic whilst river traffic still needed to go upstream to the Town Dock. Although there was a ferry it was inadequate for traffic and dangerous to operate



Gondola from top of west tower.

A close-up view of the Gondola cabin.

The west tower - it stands 74 metres high.

With a full complement of cars aboard, the Gondola arrives on the east side.

A view of the Motor House on the east side. Cars await their turn to board.

due to the high tides. Other types of moving bridge were considered and rejected because of the risk of river obstruction. High level bridges and a tunnel were rejected because of cost.

Construction

Borough Engineer Robert Haynes saw the potential of a transporter bridge and, after a councillor's visit to inspect one over the Seine at Rouen, contracted Arnodin to design one for Newport. The construction contract was let to Alfred Thorne of Westminster. There were problems as the drawings, still preserved in the Newport archives, were in metric units and the steel used was in slightly larger imperial sizes. There was additional confusion between the use of imperial and metric tons when testing the bridge but, despite this, construction went well. The bridge was successfully opened to traffic in 1906. The span is 210 metres (645ft.) making it the longest surviving transporter bridge in the world. However, these bridges could be built even longer - the Runcorn example had a span of 1,000 feet.

The Newport bridge is a blend of suspension and stayed girder construction. There are two towers at each end with a rather elegant bowed profile mounted on masonry piers sunk 25 metres (86ft.) into the ground. The towers are 74 metres high (242ft.) From the towers wound steel cables go back to massive ground anchorages and in a classic parabolic catenary fall gently between the towers to support the boom. Oblique straight stay cables also fan out from the towers to add support. The boom itself is a type of Whipple truss. Each bay is crossed by diagonal stiffening cables.

The travelling carriage supports the gondola. It is about three times the length of the gondola in order to spread the weight across as many bays as possible. Even on top of the bridge there is remarkably little vibration when the traveller crosses, a tribute to the quality of the original design. The motor house at the east end is little changed inside. The original electric motors pull the traveller across though these have been rewound many times.

Original 1906 motor still in use.

Renovation

Unfortunately the bridge never achieved the income expected which limited the money available for maintenance. Arnodin designed the bridge so that parts could be easily replaced but by 1985 the structure had become seriously weakened and the bridge was closed. There were even proposals to demolish the bridge. With the closure of the Town Dock and Cashmore's scrapyard ceasing to break ships there was no need for a high level bridge over the Usk. Fortunately the Borough Council put together funding package and key repairs, including replacement of support cables, were completed for reopening in 1995. The council in recognising the tourist value of the bridge (it is easily the most distinctive landmark in Newport) recently opened a small visitor centre at the bridge's western end.

Visiting the bridge

The bridge is currently open for traffic between April and September from 8am to 9.50pm Mondays to Saturdays and 1pm to 9pm. on Sundays. During the winter months it opens 8am to 5.50pm weekdays and 1-5pm on Sundays. There is a charge of 50p for cars. Foot passengers and two wheelers go free. It is closed in very high winds.

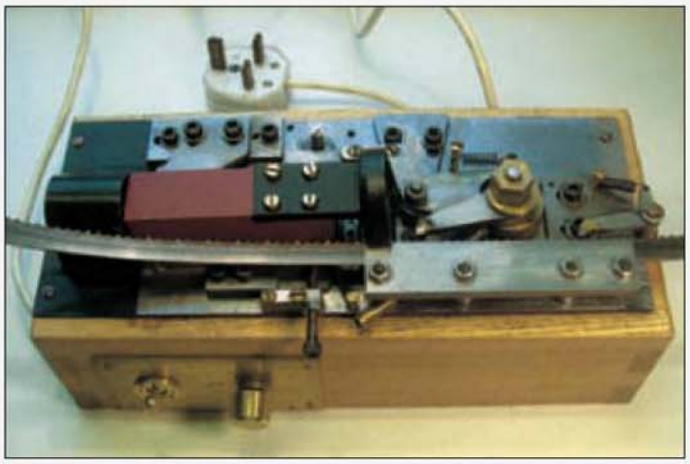
By car it is best reached via the A4042 from either Junction 26 or Junction 28 off the M4. The bridge is about 25 minutes walk from Newport railway station. The number 15a bus goes from the bus station in Corn Street to near the bridge.

There are occasional open days, usually on Spring and August Bank Holiday Mondays. Then it is possible to walk over the boom 54 metres (177) above the water for a modest £2 charge which goes towards maintenance of the bridge. The views are stupendous if you can cope with the sight of the river below through a rather thin steel mesh. The really brave may also try abseiling down the towers for charity on special days!

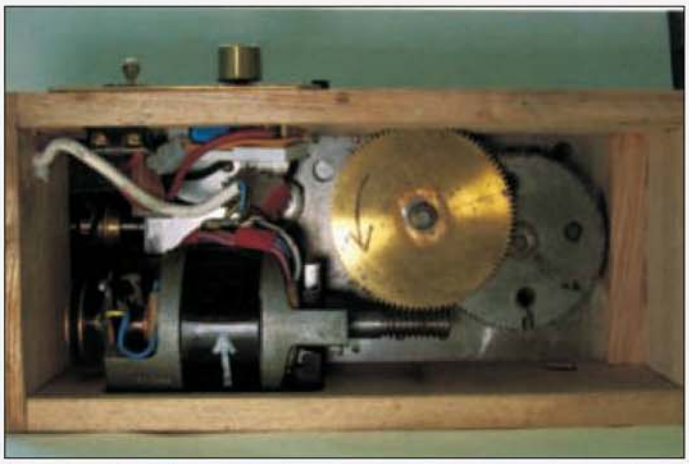
There is an active Friends Group who can be contacted at FONTB, 67 Hoskins Street, Newport NP20 5LA tel. 01633-781612. Website **www.fontb.org.uk** Other information is available on the Borough Council website **www.newport.gov.uk**

East side foundations - these go 26 metres (81ft.) into the ground.

East side cable anchorage holding boom anchor cables.



The bandsaw blade grinding machine shown with a blade in position ready for grinding.



The underside of the unit showing the wiring, drive motor and camshaft actuation gearing.

A BANDSAW BLADE REGRINDING MACHINE

D. Venables

describes how to put new life into worn bandsaw blades.

Sometime ago I made a machine to enable me to sharpen/regrind my bandsaw blades. At that time I was engaged in making various items of woodwork for pattern making, turned bowls and similar articles using hardwoods such as mahogany, rosewood, ebony and maple. The amount of work I was doing soon caused the blades to loose their sharpness, and of course, it is not possible to cut wood accurately with a blunt blade. Hence the need to replace the blades, or better still and less expensive, regrind the blades and use them again.

The bandsaw is a Dewalt 3501 fitted with a 1/2in. wide general-purpose blade 2095mm (82.5in.) long with 8-teeth per inch, (i.e. about 650 teeth). After a certain amount of experimentation and trial and error, the machine about to be described came to be made. As can be seen it is made up of odds and ends from my scrap box. The motor is from a food-mixing machine, the gear wheels are home made and/or from an old wind up gramophone and it is all fitted into a wooden case 11 x 5 x 3 inch. It was never intended to be an exhibition piece, just a tool to do the job.

The machine works quite well in so far as it will grind each tooth of the blade sufficient to restore the edge and so enable the blade to be used again. However, the machine does not cater for putting the 'set' of the teeth on again. The first regrind is therefore acceptable but the third, and possibly even the second, may well reduce the 'set' to a state where the blade is no longer serviceable.

Construction

The motor is double ended, which allows one end to drive the grinding wheel spindle at full speed, whilst the other end drives through the reduction gearing to a camshaft (see fig 4), to provide the following functions: -

1: To advance the saw blade (see fig 4), by means of a pusher arm, which has a piece of tool steel soldered to it to resist the wear that would otherwise take place.

2: To prevent the blade slipping backwards (see **fig 5**).

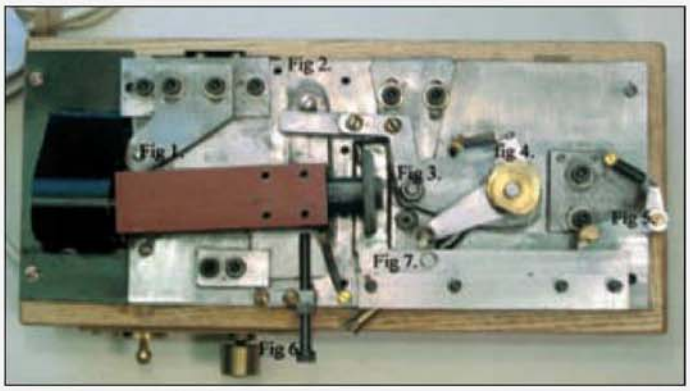
3: To hold the blade still against the guide plate, whilst grinding takes place (see **fig 7**).

4: To move the grind wheel assembly backwards against a spring and allow it to move forwards into the blade when the tension is released by the arm controlled by the cam.(see **figs 2** and **3**).

The exact position of the cam and spindle pivots can be adjusted (see **figs 1** and 2). The forward movement of the grind wheel is restricted by the limit stop screw (**fig 6**).

On the front of the box is an on/off switch and a normal 40/600 watt dimmer to control the speed of the motor and so the speed at which the blade is pushed through the guide plate. The guide plate is made of two pieces of 1/8in. thick steel plate, the underside of the upper one having the thickness of the saw blade milled off, so as to allow the blade to pass through the guide plate without the set of the teeth touching the plate. The top plate is removed to permit the blade to be located in the track of the guide plate, then secured by the four 2BA nuts. The guide plate is raised above the base plate to coincide with the centre line of the grind wheel. The grinding wheel assembly is made from 1in. square steel mounted on a plate to carry the pivot and peg. It is bored to carry two ball races for the spindle with a thread and nut to attach the grinding wheel. The drive for the spindle is via a belt and pulleys from the motor, the amount of fore and aft movement that takes place here when in motion is negligible and does not affect the drive. The grinding wheel is 30mm diameter by 6mm wide and a number were purchased from Graham Engineering of West Bromwich. The wheel needs to be reshaped with a diamond tool to suit the shape of the teeth. In use the amount of wear on the wheel is small and the original wheel is still on the machine.

The operation produces a certain amount of grinding dust, which accumulates in the dustpan under the wheel and in the wheel cover. This needs to be cleared away after the machine has been used. All moving parts need to be lubricated including the guide plate.

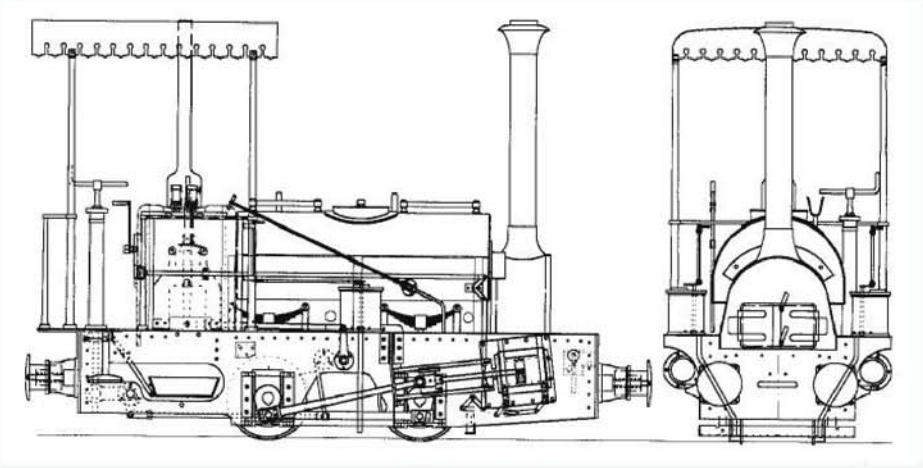


A bird's-eye view of the machine with the key features annotated with the figure numbers referred to in the text.

Operation

To operate the machine the blade is first placed in the guide plate. The pusher and the non-return will fall into place against the blade. Extend the limit stop screw (fig 6) so that the movement of the grind wheel clears the teeth. Switch on the power, adjust the speed and withdraw the limit stop screw until the grind wheel just touches the blade. Mark the place on the blade where the first cut was made. Observe the depth of cut, it should only be sufficient to create a new point or cutting surface on each individual tooth. Now stand back and let the machine do its work. Regrinding one blade usually takes about 50 minutes.

It is important not to let the blade go past the start point as there is no automatic stopping device, and it should not be necessary to go round again.



ANNA
A MANNING WARDLE LOCOMOTIVE FOR 7¼in. GAUGE

D. A. G. Brown and Mark Smithers give details of the cylinder and boiler cladding.

●*Part XVII continued from page 688 (M.E. 4249, 10 June 2005)*

Now that the main structure of the locomotive is in position, it is convenient to deal with the various sections of cladding, in general constructed from 1mm thick 3Cr12 and available in due course as laser cut sections.

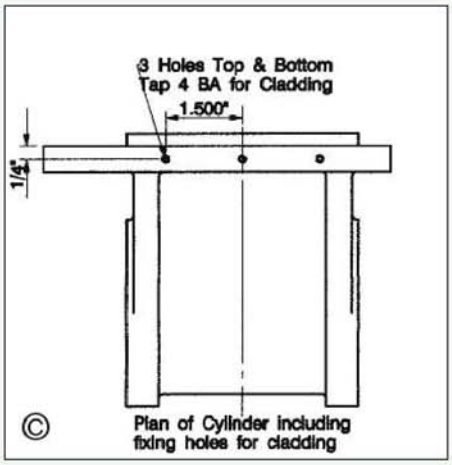
Cylinders

When I originally drew out the cylinders, I did not have details available of the cladding, so I append the detail of the holes, which must be drilled and tapped 4BA, three each in the top and bottom of the cylinder flanges. Go easy on the depth of the holes, since some of them will just about break through into the main bolting holes. Provide a decent countersink at the entrance to each hole: it does make finding it on a dark night with a 4BA screw so much easier. It certainly makes sense to cut these holes when the cylinder is up on the mandrel, as discussed in Part XVI of the series.

Because there are no connections for drain cocks underneath the cylinders, the task of cladding them is simple and the sheeting can easily be installed and removed. In the relevant part of the drawing you will see a scrap view of the end of the top or bottom straight sections nearest to the main frames. These contain three slotted holes fully big enough to take 4BA set screws, (not forgetting the washers which should be Loctited in place.) Having measured the perimeter of my own cylinders I find that it is about 1/32in. longer than the theoretical amount shown on the drawing. Therefore, in scheming out the parts for laser cutting, I am allowing 1/16in. extra metal on the entire length, which may be trimmed as necessary, depending upon how your cylinder castings turn out. The arc centres for the screw holes are set back a further 1/16in. from the edges of the metal, the idea being that the screws will probably not be snug up to the ends of the slots, but it makes for ease of fitting, in the best tradition of consumer durable products (save of course for those which are deliberately designed to thwart the would-be repairer!)

The top and bottom screws are invisible to all but contortionists (and of course Dennis Monk and the mirror which he brandishes when judging exhibition models!); so the fact that the screw holes are slotted for ease of fitting is not obvious, but well worth the detail. I have been most impressed by the performance of the glass wool lagging sold by Messrs. Reeves & Co. Do pack the voids around the cylinders with it, as well as the front covers and, as a consequence, once the engine has warmed up, there will be no need to open the drain cocks, even when starting again under load after a ten minute respite in a station.

Making the cylinder end cover sections is simple, the flange being rolled up and silver-soldered to the flat disc, using the tabs and slots provided. One word of caution, however, go easy on the heat. If you warm up too much of the surface of the metal unnecessarily it will buckle, so 'little at a time' is the best advice I can give. Start with rolling the flange and joining it, this allowing the tabs to be joggled into place in their slots. You will not be after a steam tight joint around the flange! Eventually the Covers will be painted black and secured in place by black screws. That treatment looks really smart.



Dressing up the boiler

Talk of dressing up reminds me of my time running the ICI workshops; one of the chaps working for me as a storekeeper was an old soldier called Willie, ex-Argyll and Sutherland Highlanders. Fiercely protective of all things Scottish, he regarded me at first with great suspicion but I eventually won his respect and we got him trained up in some useful ancillary work. The company policy was, in those days, to evaluate every job in order to set it within the universal pay structure, and this entailed the job-holder being present before the evaluation panel. Willie came into my office one morning in a pensive mood; *"Dag,"* he said, *"is it right that I shall have to wear my best suit for the panel?"* I made a polite approval, muttering something about feeling more confident if you appear smart. *"Very well, then, I'll wear the Kilt, that is my best suit"*. In the event he looked magnificent, with a MacDonald tartan surmounted by a neat jacket and sash and a fine ornate pair of black brogues setting off the woollen stockings which held a murderous-looking *sgian-dhu*. The assessment panel were most impressed, although I am not sure that it affected the level of assessment! I was reminded of it years later, when I met one of the panel at another Works; he said that it was the only occasion when someone appeared before a panel in full highland dress.

The suit of armour for the boiler is simple and I have drawn it out in detail so that it can go to the laser cutters for the usual treatment in 1mm 3Cr12. The holes will be cut small, so that in the event of holes not being in the correct positions, they can be suitably opened up. Three boiler bands are to be applied and these look quite monstrous in the large scale of this model, their 3/4in. width representing 2in. in the full size. There is plenty of space (5/16in.) between the copper of the boiler and the cladding to fill it with the glass wool insulation material, which was mentioned in connection with the cylinders and this should allow the water in the saddle tank to keep cool enough for it to work in the injector. A useful tip for the installation of the boiler cladding is to glue four small wooden pads to the boiler surface just in front of the firebox. This will keep everything in proper alignment while the boiler bands are tightened and avoid placing stress on the rather weak front section of the firebox cladding. There is a nominal 1/4in. between the boiler cladding and the underside of the Saddle Tank and this void may, if desired, be filled with the mineral wool insulation for even greater isolation of the tank water from the heat supply.

In fitting the cladding to the boiler barrel, it is essential that it be divided into two sections, otherwise it would be impossible to apply it with the boiler in position in the frames. By splitting the circle top and bottom, the joints will be invisible, obscured by the saddle tank and the frames themselves. A nominal clearance is designed between the barrel cladding and the hole in the throatplate cladding.

Firebox Cladding

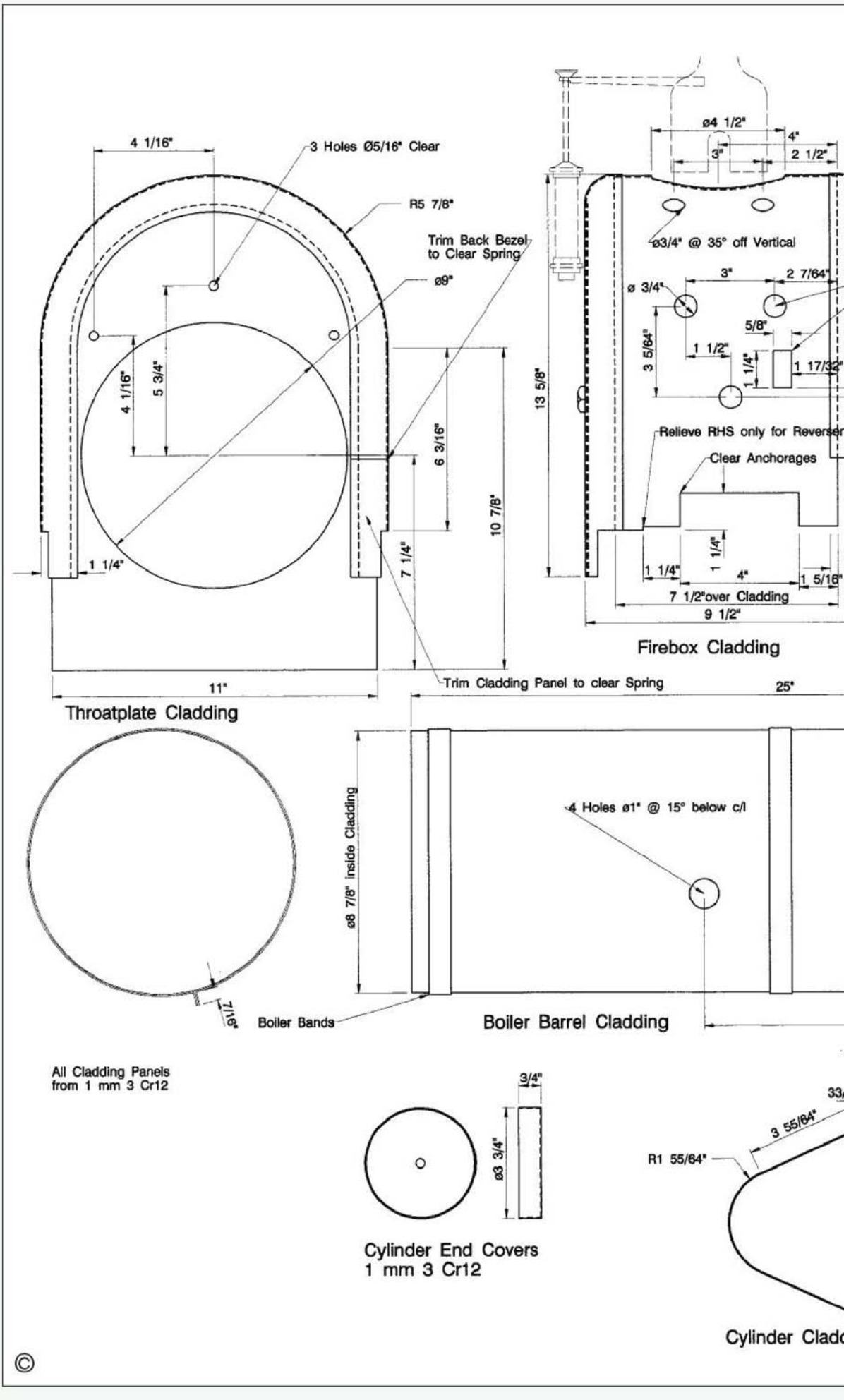
Dealing with the firebox protection, the front piece nominally straddles the boiler sheath as ▶

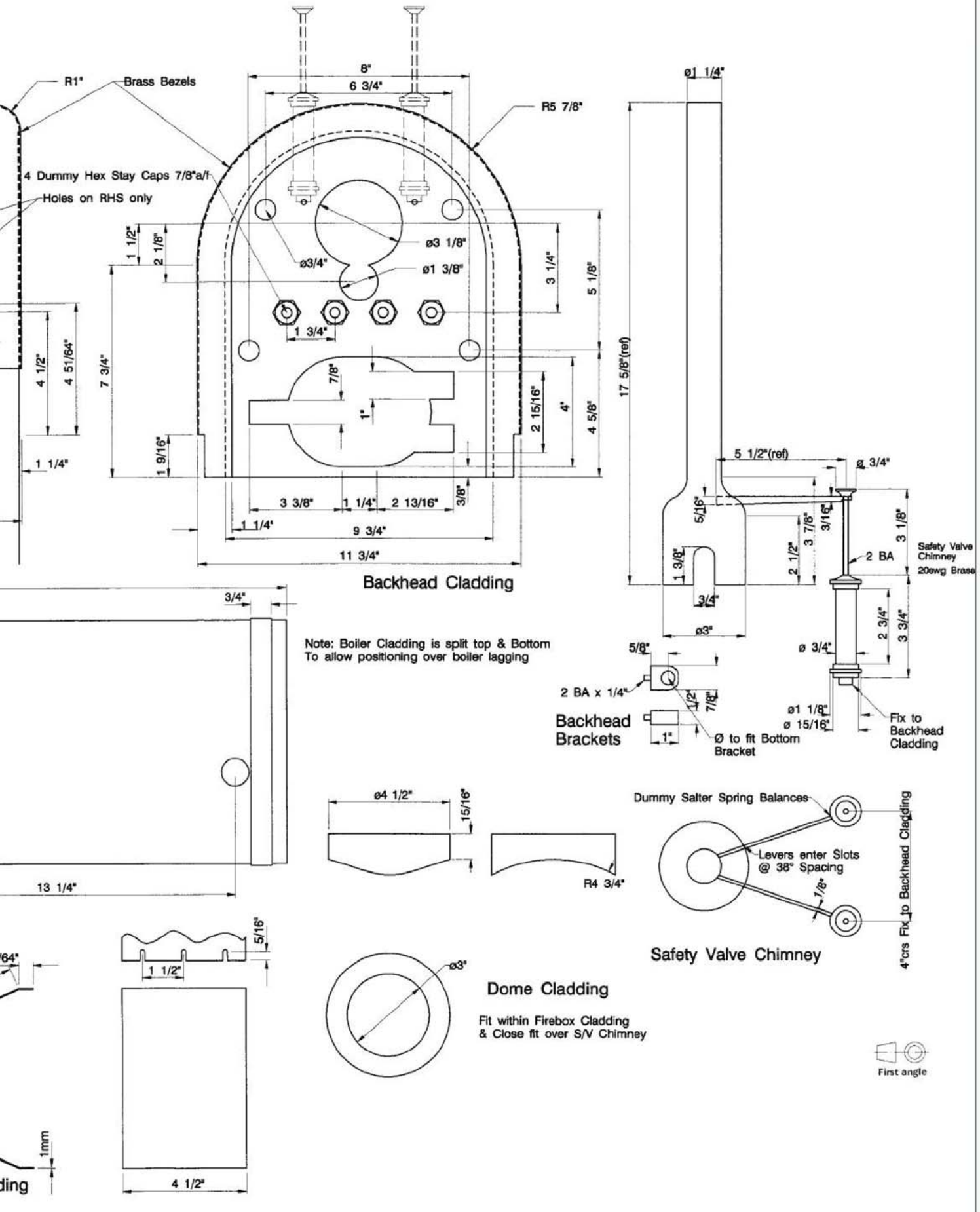
described, while the side sheet has to be rolled up to follow the contour of the firebox before taking out the large hole for the dome. Provision is made for four flanges to protrude through the cladding, for the steam valves whose functions will soon be made apparent. The cladding stops clear of the boiler anchorages and on the right side there are holes for the reversing gear and cylinder drain cock lever support. Since the rear suspension springs are anchored behind the line of the front of the firebox cladding, it will be necessary to cut away two clearance holes in the front piece, but this is left to the time when fitting takes place. The spring hangers are positioned very close to the copper of the boiler, but the modesty panels of the cab structure ensure that any cutting away is not visible from a distance.

The backhead sheet is designed to clear the paraphernalia of the firehole door and regulator, as well as the water gauges. In addition there are two holes by which to fix a pair of dummy spring balance safety valves, of which more in a minute. Above the cut out for the firehole are another sham, namely four dummy stay ends, which are conspicuous on the original boiler backhead. With Mark's guidance I have drawn them as hexagon half nuts with the first thread poking through. This is surely a neat little touch, which adds to the air of authenticity. With symmetry reigning on the backhead, you can turn the 1mm thick laser-cut sheet to suit either a left or right-hand hung door.

Brass bezels

One of the charms of many ancient locomotives, especially those of Leeds manufacture was the fitting of brass bezels around the edges of firebox wrappers, in this case both front and back. The cross section, indicated in the side elevation, is a quadrant of radius 1in., with 1/4in. flat extension around both edges. The obvious material is gilding brass, which forms nicely, and the whole thing could be beaten around a former, excess metal being trimmed off after that process. The shape also lends itself to fabrication, the straight




R1"
Brass Bezels
8"
6 3/4"
R5 7/8"
4 Dummy Hex Stay Caps 7/8"a/f
Holes on RHS only
ø3 1/8"
ø3/4"
ø1 3/8"
1 1/2"
2 1/8"
3 1/4"
5 1/8"
1 3/4"
4 1/2"
4 51/64"
7 3/4"
7/8"
1"
2 15/16"
4"
4 5/8"
1 9/16"
1 1/4"
3 3/8"
1 1/4"
2 13/16"
3/8"
1 1/4"
9 3/4"
11 3/4"
Backhead Cladding
ø1 1/4"
17 5/8"(ref)
5 1/2"(ref)
ø 3/4"
5/16"
3 7/8"
3/16"
3 1/8"
2 1/2"
2 BA
Safety Valve Chimney 20swg Brass
1 3/8"
3/4"
ø3"
2 3/4"
3 3/4"
ø 3/4"
5/8"
2 BA x 1/4"
1/2"
7/8"
ø1 1/8"
ø 15/16"
Backhead Brackets
1"
Ø to fit Bottom Bracket
Fix to Backhead Cladding
3/4"
Note: Boiler Cladding is split top & Bottom
To allow positioning over boiler lagging
13 1/4"
ø4 1/2"
15/16"
R4 3/4"
Dummy Salter Spring Balances
Levers enter Slots @ 38° Spacing
1/8"
4"crs Fix to Backhead Cladding
Safety Valve Chimney
5/16"
1 1/2"
ø3"
Dome Cladding
Fit within Firebox Cladding
& Close fit over S/V Chimney
1mm
4 1/2"
First angle

sections being easily formed in bending rolls and silver-soldered to the half-rounds, which in turn are produced by metal spinning.

This was the process that I used on my Hunslet and you cannot see the joint! It depends on what demand develops for a spinning. I could be persuaded to commission some sections within the trade, which could merely be cut in two and made ready for joining to the vertical parts as already mentioned.

Having fitted the firebox cladding, the one remaining part, the dome cladding, fulfils two purposes, namely sealing the edge of the 4 1/2in. diameter hole in the top section, and acting as a steady for the safety valve chimney. This piece can be made either from a piece of 20 gauge brass tube 1 1/4in. diameter, with the bottom section again spun and fixed by silver soldering, or alternatively the whole thing may be beaten up from the sheet material. Whichever way you decide to tackle the problem, a turned wooden former is required to define the finished profile; sheet brass responds well to annealing for such a job. Please be warned: the arched cut-outs at the bottom are necessary not only to lead out pipes, but also to allow entrained air to circulate with the plume of steam when it appears, so as to avoid 'raising the roof', so to speak.

Safety valve provision

We are going to fit a pair of high performance modern pop valves, which will make easy work of controlling the boiler pressure with the minimum of accumulation. Nevertheless, our original locomotive was fitted with the (then) commonplace spring balance valves and we are going to fit a pair of dummies to the holes already mentioned in the backhead. Besides drawing them out for copying to look like the real thing, I have ghosted them in the elevation drawings, which also enabled me to check my dimensions on CAD.

The original spring assemblies would have been inside brass tubes, with steel (2BA) adjusting screws and large nuts. You have to imagine the balance levers pointing in the general directions of the valves which were set into the top of the dome flange.

Things that get in the way

During this design process we have slavishly followed the Manning Wardle original information, such as was available. A fascinating revelation by Mark caused me to look again at the various clearances, as will shortly become apparent: in 1886 a L/Cpl. R. Cutler of the Royal Engineers sketched one of the class at Brompton Barracks, Chatham and this remarkable piece of work was acquired some time ago by Mark. It illustrates clearly that recesses were formed in the boiler cladding to accommodate the spring hangers as they went up and down. This has caused us to speculate whether M-W had got around a design error in which the hangers fouled the cladding.

The method finally used by our contributor to correctly postion the holes in the split rod brasses.

Checking on the current design we apparently have the same problem looming, which the CAD has picked up. I do not fancy the idea of forming such reliefs in the Cladding panels, so the alteration offered involves thinning down the dummy Springs by 1/4in. and moving the inner Hanger top arms asymmetrically inwards by the same amount. The anchor pins are also re-jigged to eliminate their protrusion towards the boiler. I also take advantage of the situation to make a minor shortening of the hangers themselves, so as to avoid any clash with the saddle tank bottom. By lowering the spring hangers there is a small interference with the frame extensions at the rear of the front spring, but this can be overcome by a little local relief.

These alterations are shown in the accompanying scrap of a drawing, the original having been modified, of course! Casting patterns for both springs and hangers are also being modified. Having made my hangers already, I have done a 'nip and tuck' job with bandsaw and silver solder.

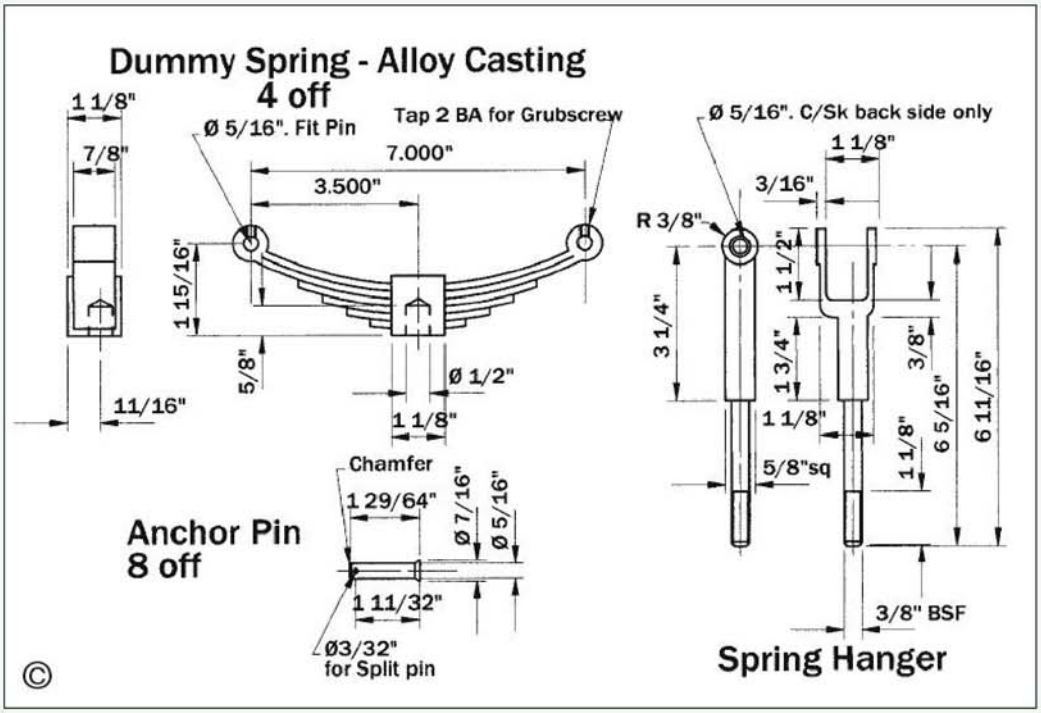
Machining the rod brasses

Following the description of some of the machining operations in the last instalment, I should like to mention another critical one, namely that of getting the holes in the split rod brasses in the right places. My previous writings on the subject proved less than sound, so here is the method that I actually used: starting with a square of surplus low grade brass (though steel plate would do equally well), chuck by the middle of the sides and turn the corners so that the 4-jaw chuck will hold them as shown. Bore 7/8in. dia., the same as the rectangular hole in the ends of the side rods.

Transfer to the milling machine and open out the hole to say 0.876 x 1.125in., in such a way that three adjacent edges are just touching the circumference of the bored hole. The roughed out rod brasses should fit snugly within the rectangle, the three flanges of the smaller components fitting around the three concentric sides as described.

Looking at the square in the picture, the odd web has a hole tapped 1/4in. BSF to enable a long setscrew to pinch the wedging surface of the rod brasses into place. After the milling and tapping operations, the fixture is held in the chuck and clocked so that the three similar straight edges of the rectangular bore give the same reading on the dial gauge. It now follows that all the rod brasses held by the clamp screw will have their bores finished in identical positions, thereby preserving the centre spacings within the coupling rods. When positioning the brasses, a gentle knock with a rubber mallet ensures that they lie truly in contact with the fixture.

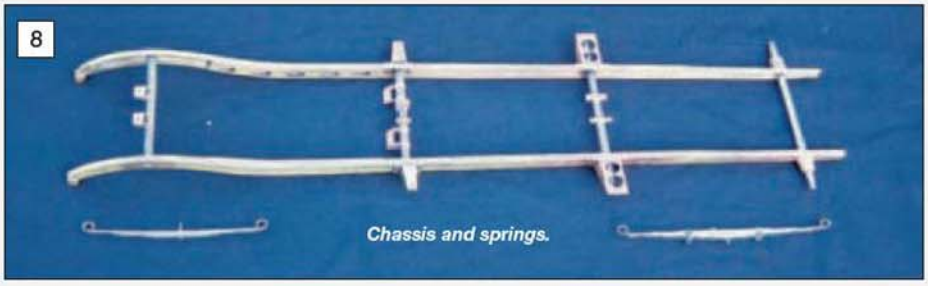
●*To be continued.*



BUILDING A 1946 MG TC

Stephen Atkinson continues his model with the chassis before moving on to the suspension.

●*Part II continued from page 674 (M.E. 4249, 10 June 2005)*



Chassis and springs.

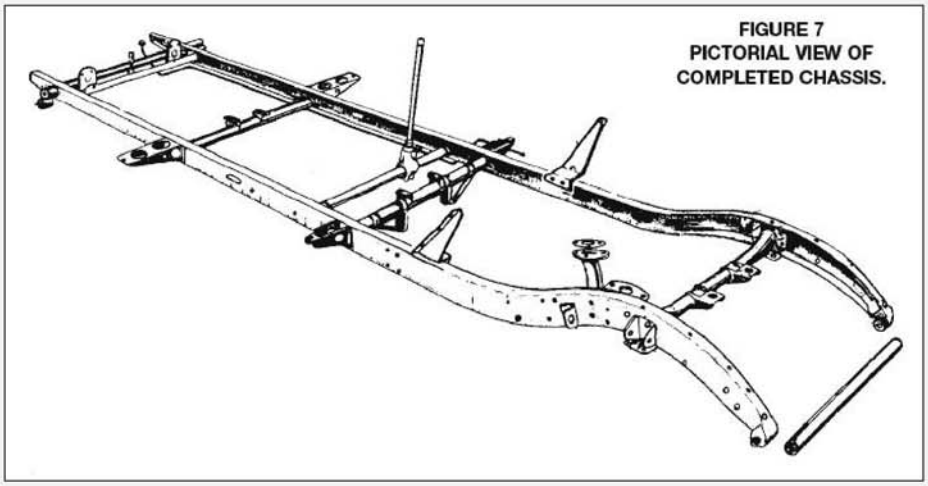


FIGURE 7
PICTORIAL VIEW OF COMPLETED CHASSIS.

The side members on the full-sized car are obviously pressed out of mild steel and joined together by tubes. It is difficult to see how these side pieces could be bent or pressed to shape without making very special and time-consuming equipment. It was, therefore, decided that the only practical way to form the open girder shaped side pieces was to fabricate them (**fig 6**). In this way, the bends could be reasonably sharp and the curves at the front in side elevation would be less difficult.

Choice of materials is always a problem and although pretty well the whole of this car was made in mild steel, an early decision was made to extensively use brass. Chassis, bodywork, fuel tank etc., were all going to require a lot of silver-soldering and brass seems more sympathetic to that method of joining (**figs 7** and **8**). Incidentally, at this point where I first introduce silver-soldering into the equation, and there will be very much more, let me stress the name, *not* silver brazing as some would like to call it. As a qualified silversmith among other things, brazing is carried out with brass unlike the solder we shall be using.

So now to work. Draw out full size the side elevation of the two vertical side pieces and make card templates of them. From there, using a sharp scriber mark out onto the 0.7mm brass sheet (the old 22 gauge). Carefully cut these out and file to shape. They will seem to be very flimsy at this stage until the top and bottom pieces are fitted. Now make the four top and bottom pieces parallel in width throughout their length. Clean everything up with fine wet and dry paper. This makes a better job in my opinion for cleaning prior to silver-soldering. The silversmith, prior to soldering would generally scrape the jointing surfaces clean with a small scorper but fluxes are so well improved that a rub with wet and dry around 500 grit will suffice. Try to avoid touching them with bare fingers as the natural grease from the skin can prevent good flowing of the solder. Holding the three pieces in proper contact over their total length is not easy. You can probably come up with all sorts of ideas of jigs for holding the strips prior to soldering but I agree it is not easy (**photo 8**). Lay the vertical ▶

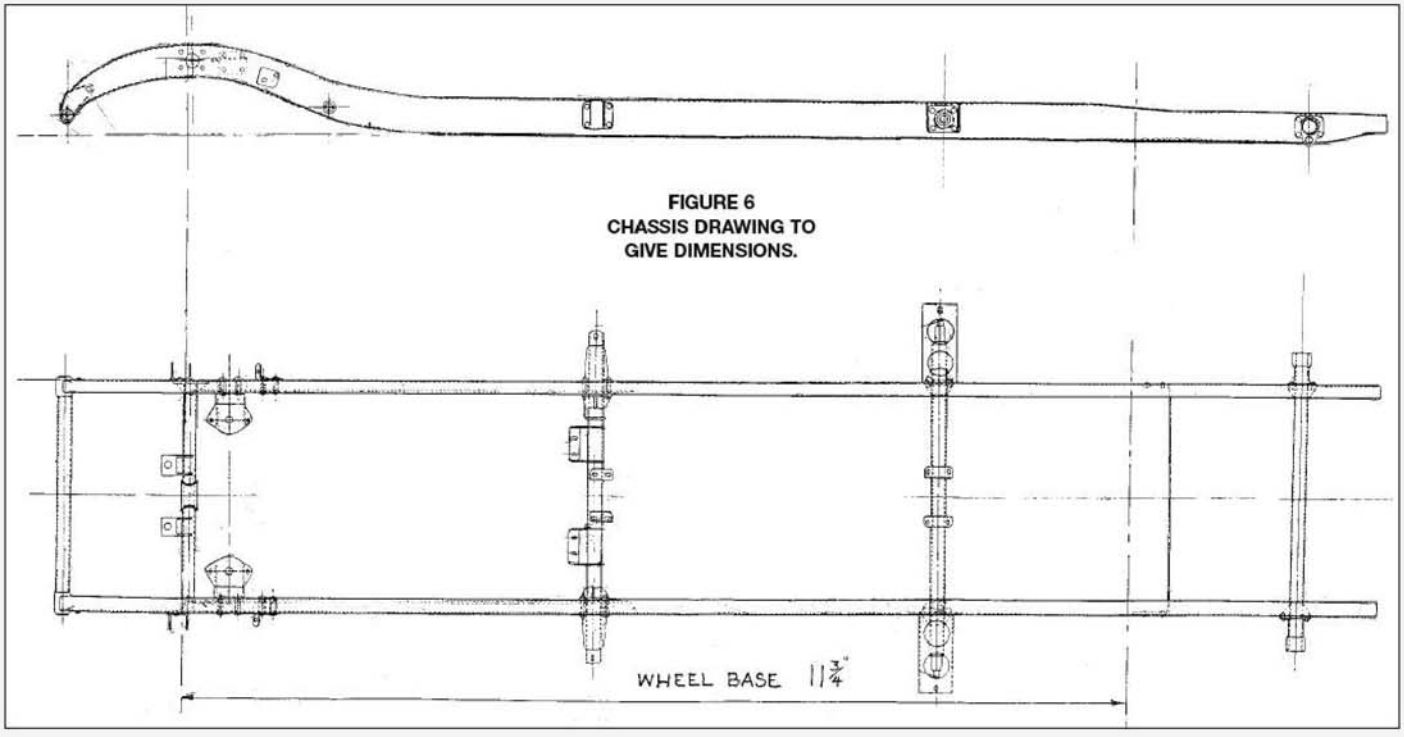


FIGURE 6
CHASSIS DRAWING TO GIVE DIMENSIONS.

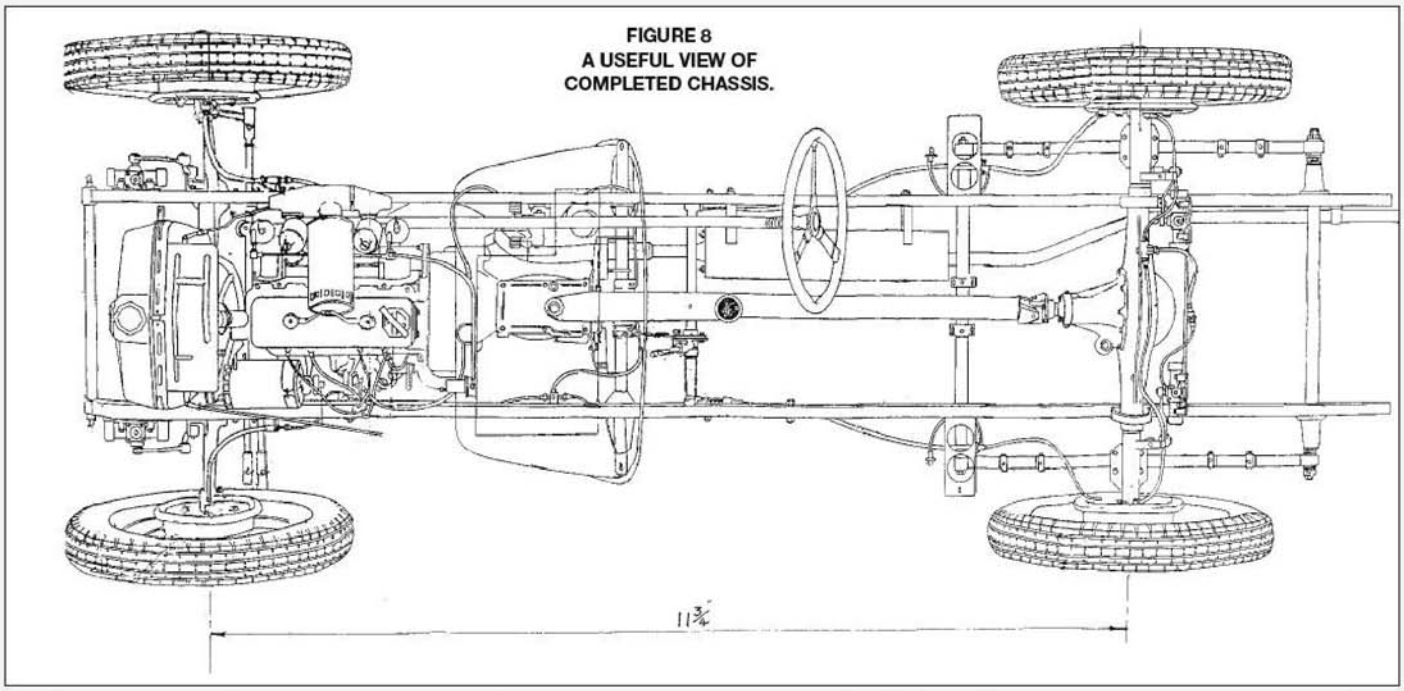


FIGURE 8
A USEFUL VIEW OF COMPLETED CHASSIS.

shaped side piece on a firebrick and then bend the top and bottom sections to the curves required to fit. I have some small cubes of fireclay each about 1in. size and I find these very useful for propping and holding things. You might try making some spacers out of thin sheet that will clip over the two now vertical pieces and hold them in position. Silver-soldering on this sort of work can be very satisfying and yet at times so frustrating. Brass sheet in 0.07mm takes very little heat to reach the temperature required for Johnson and Matthey's Easyflo No. 2. This is the grade of solder I recommend for all the work on this model. Not only does this thin sheet soon get up to soldering temperature, it will also melt at a little above that heat, so beware. Do get used to holding the rod of solder in the right hand and the small torch in the left, that is for right-handed folk! The method of putting small pallions of solder along the joint and then heating always gives problems for me. The moisture in the flux mix bubbles up and moves the solder from where it is needed and then probably melts where it is not wanted. Perhaps I should make more mention of the flux we use. Easyflo No. 2 flux comes as a white powder and is mixed with water to make a nice smooth creamy paste before spreading along the joints with a small artists paintbrush. When the joints are completed along the length of both chassis legs, drop them into your acid pickle and leave for an hour or so. The pickle I always use is 10 parts water to one part sulphuric acid which makes a good job of cleaning up your work.

Before the side legs can be counted as complete there are stiffening plates to be fitted. These are on the internal surfaces around where the engine will be mounted. They may as well be made and soldered in before moving onto the next steps.

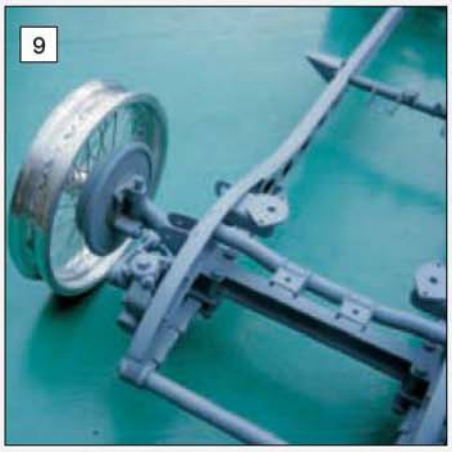
The drawing indicates their length and the number of holes which have to be pierced through them. By far the best way is to make the two pieces wider than required, invert the sides on the firebrick with the stiffener underneath and then solder along their lengths. The spare sheet can then easily be removed by small snips and careful filing.

Clamp the side pieces together by holding their outside flat surfaces in contact and carefully mark out the positions for the crossmembers. Although tube is employed on the full-size car, rod is more suitable for the model. Use 5/32in. dia. bright mild steel rod as this can be turned and threaded where necessary. The wheelbase of the car is 94in. making the model distance between axles of 11 3/4 inches. Mark these centres onto the top edges of your side legs while you have them clamped together. The rear axle is exactly 3in. from the very ends of the side legs. Drill for the crossmembers according to the positions shown on the drawing. At this stage drill each position 1/16in. dia. for location purposes. These can then be opened out to their respective sizes when the time comes.

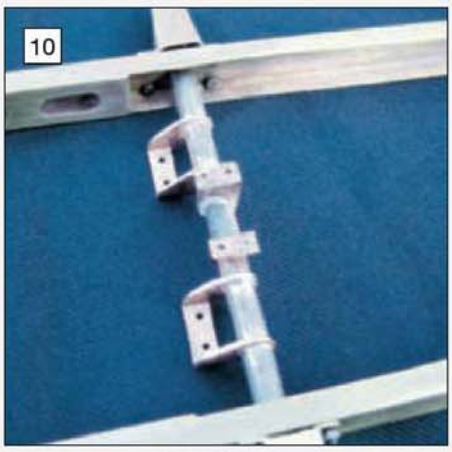
Before the two chassis legs are finally connected there are quite a number of pieces to make and fit. Starting at the front. The cross tube does not fit into the legs themselves but into small castings which in turn are riveted onto the legs. These pieces shown in my drawing can be fabricated without much trouble. A word of warning, do make a handed pair. Perhaps I should have given this warning earlier in relation to the chassis legs. However beautiful a job you may have made of the two, unless you have a left and a right one you have a big headache!

The two 'castings' at the front should be riveted to the inside of the chassis legs with 1/32in. brass round head rivets and to make safe, a touch of Easyflo around them. Moving rearwards, the next cross member has two lugs fixed towards the centre. These are to support the radiator which has two small threaded rods fixed to its underside. Make these from 0.7mm brass sheet and solder them into position (**photo 9**). Where this cross piece joins the sides there are two small pieces which are in turn riveted to the sides, each with four rivets. At this stage I think it is appropriate to decide on the amount of correct detail you intend to reproduce. Some parts, such as these fittings, can be simulated by simplifying them. I leave it to you to decide.

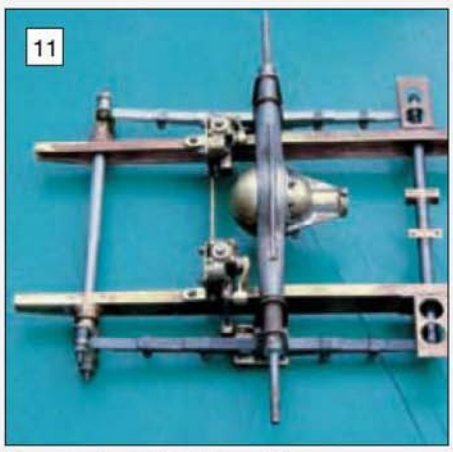
Before moving rearwards to the next crossmember there are two engine mounts to be fitted to the inside surfaces of the chassis legs.



Front of chassis detail.



Gearbox supports and those for tunnel.



Rear axle detail with differential.

Again, bend up from brass and rivet to the sides. Do make certain that the upper horizontal surfaces of these fittings are lined up as indicated.

Moving along towards the rear we come to the tube which has two gearbox supports fitted (**photo 10**). These have their horizontal surfaces lower than the centre of the crossmember. On the outer ends of this cross tube there are supports for the bodywork fitted. These have their flat surface level with the top of the chassis legs.

The No. 4 crossmember, moving to the rear again, has small supports in the centre which take the edges of the tunnel and also supports at the outside ends, again for bodywork. These supports have lightening holes drilled into them. The very ends of this rod take the front ends of the rear leaf springs, and must be turned and threaded accordingly. Finally, we come to the last tube which takes the spring shackles.

Once all these crossmembers are complete with their fittings the whole chassis can be cleaned up for jointing, laid flat on the fire brick and a touch of silver solder at each location. Do, of course, ensure that the chassis is free from any sign of twist and that it is square. These are very important checks as the whole car relies on this as building progresses.

There are four small fittings which may as well be made and fitted at this point in order to complete the chassis. They are towards the front on the vertical outer surfaces. The first pair are U-shaped and support the strengthening bar at its lower end. This bar supports the front wing, has a location for the headlamp bracket towards its centre and takes the sidelight at its upper end. Drill them for a cross bolt and rivet them with one 1/32in. rivet before a touch of silver solder. The other pair of fittings are simply to take the end of the flexible brake pipe and require similar treatment to the previous pair of fittings.

The chassis is now complete and you really have some model making to be reasonably proud of. I tend to be a paint as I go sort of person and like to see a component, such as the chassis, looking neat and tidy before progressing. Therefore, I would most certainly give the frame some sort of treatment if not the finished coat. Brass can be troublesome to paint with adhesion proving difficult, especially on edges and corners, so a coat of good etching primer will at least begin to treat the work. I well remember talking to a specialist paint representative at a model show some years ago. On their stand, this firm had spray cans and tins of etching primer for brass. I was informed that although the spray cans were handy to use, their contents were certainly not as effective for etching as were the contents of the 'still' cans of paint. So taking this advice from an expert, I suggest purchasing a can of self-etching primer for brass along with a suitable thinner. You really must spray all the paint on a model such as this car and so if you have not yet got one, now is the time to obtain a small spray outfit. The choice is quite wide when it comes to spraying equipment, but this model is relatively small and a good airbrush with a small compressor is probably the most suitable choice. I would leave it at this stage having covered it well with the etching primer. It will eventually be painted with a black eggshell like finish to represent the real chassis black.

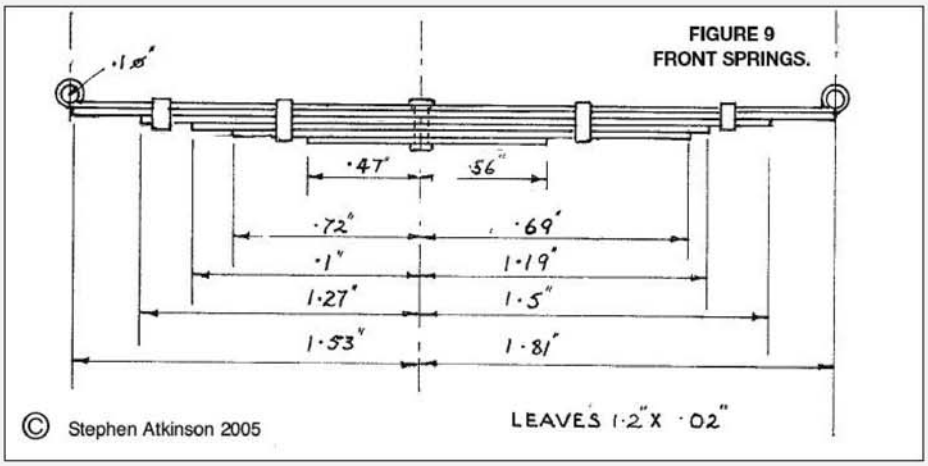


FIGURE 9
FRONT SPRINGS.

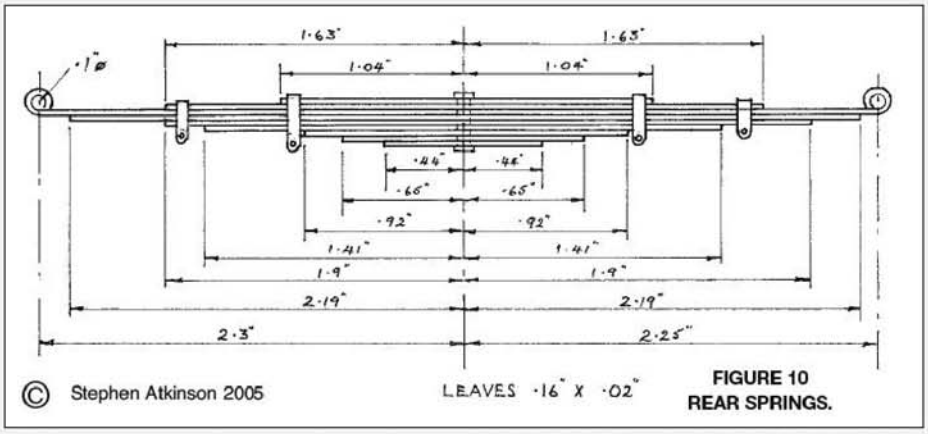


FIGURE 10
REAR SPRINGS.

Now we have a chassis along with wheels and tyres so the next step is to connect the two and this means suspension.

Suspension

Our MG is supported on leaf springs at both front and rear ends, connected of course to axles and the whole being damped by shock absorbers. We therefore have a lot of interesting work before we can look at a chassis supported on wheels.

Leaf springs

Should you wish to make your car actually spring on being pressed down, then the springs will need to be made of spring steel. This really does involve a lot of work in heat treatment to enable the loops at the end of the springs to be formed. I decided at the outset that mine was to be a static model which would hopefully look right but not 'perform'. My springs are therefore made out of the packing strip material which is often fastened around large packages. It is there for the taking in skips and like places and can often be obtained quite new and shiny looking.

My drawings (**figs 9** and **10**), were accurately produced by taking measurements from the actual springs gives the length of each leaf. Cut all these and set out in order. The upper leaf of each of the four springs has its ends turned into a circle to fit to the suspension point. The material I suggest is quite malleable and can be turned in its cold state. I used a pair of round nosed jewellery pliers. As mentioned before in relation to holding and twisting the spoke wire, these pliers do not have any serrations on the jaws so that no marks are made on your work piece.

It is a good idea to take a piece of hardwood and drill holes at the correct distance apart to the size of the spring loops. Into these holes fit two pegs of mild steel rod, just the same as the fixings on the car chassis. Obviously you need one pair for the front springs and another for the rear. Now the loops can be adjusted with your pliers until the top leaf will easily fit into place. Keeping it there, fit if the remaining leaves. The leaves are now clipped together with narrow strips of the same material and bent around in their appropriate positions.

The main fixing in the centre of each set of leaves is made as per the drawing (**fig 11**) so that it can be bolted to its axle. The front axle is a built ▶

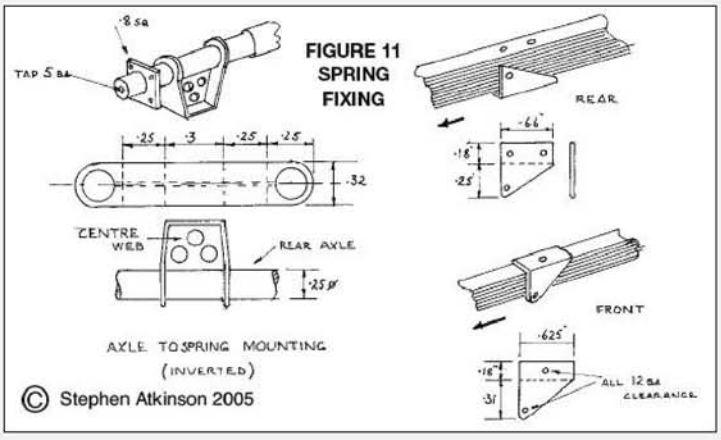
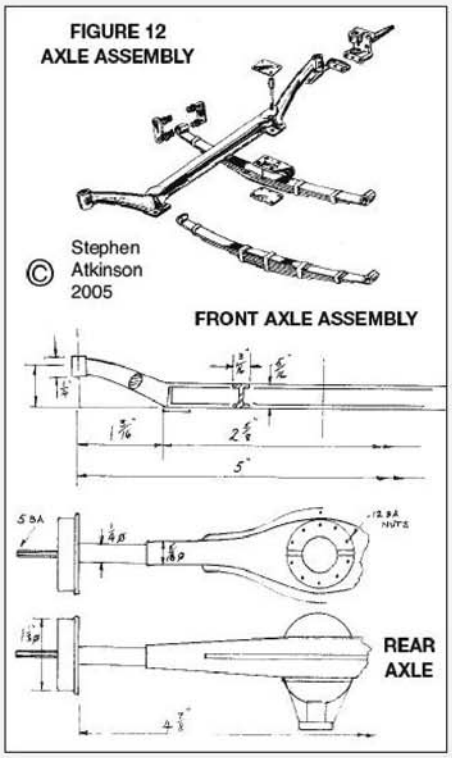


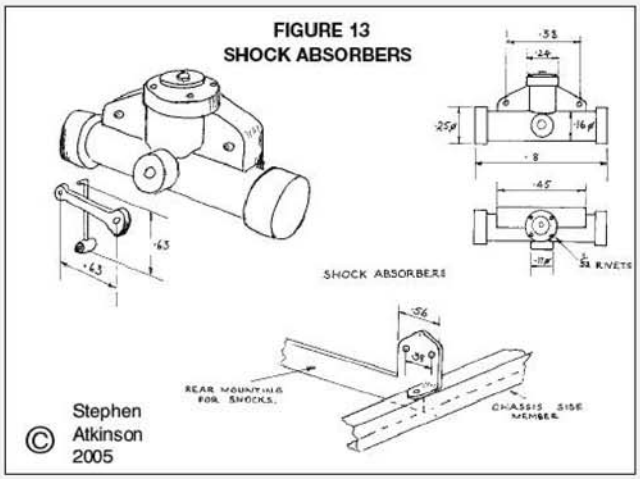
FIGURE 11
SPRING FIXING



up section as per the drawing. The centre is of an H-section on its side. Solder together three pieces of mild steel to produce this. Onto the ends of this girder section there are slightly curved pieces fixed. The section of these is elliptical where they join the central girder and change to circular where the king pin housing is soldered at each end. This just has to be a filing job I am afraid. As spring seatings we need to solder plates on where the joints are underneath and add two very small triangular webs to make them look realistic. Each end has a short tube piece soldered in place to accommodate the king pin. Remember to make these slope very slightly so that the front wheels do have a slightly narrower track on the ground than at the top, do not overdo this slope.

Rear axle

This has the differential built into its centre **(fig 12)**. This is an interesting piece to make, illustrating just how complicated looking pieces may be simplified by building one piece onto another. I started with a rectangular section of mild steel and turned its profile according to the requirement. Each end was then drilled and 1/4in. rod soldered in to give the correct length including sufficient for the 5BA threads at each end. These would finally have the wheels screwed on and enough protruding to take the wheel nuts or spinners as they are called. Now onto the rear centre of the axle a domed piece is silver-soldered, just turn a small pip onto it to fit into a suitable sized hole. Onto the front of the axle we have the remainder of the differential housing. This is again built up and the flange drilled to take the 10 bolts.



The bolts are all 12BA, a short threaded rod with a nut in place. Rather than solder small pieces like these into place I prefer to wait until all the silver-soldering is complete and then glue the screws into plain holes. There are any number of suitable adhesives for metal these days. Use one of the suitable Loctite products or a spot of super glue works wonders. To complete the differential housing there are two webs at the front, mounted horizontally, these need to be soldered in place. Also there are two web like pieces running along the length of the axle on the top and at the bottom. A hacksaw groove or one milled there will hold small pieces of sheet steel prior to silver soldering. Your rear axle should now begin to look quite as it should and there is just some work required at the ends to complete this section.

A U-piece with holes to take the axle is required at each end **(photos 11- 13)**. These provide a mounting surface for the springs. Finally, a pair of brake drums are turned to fit onto the 5BA threads. These each have a square flange piece on their internal surfaces. A small 12BA bolt can be placed in each corner of these squares, again glue these into position. It would, of course, be folly to aim at threading all these small screws into their locations when adhesives will do the job without any fear of breaking such small taps as those for 12BA. The time will come when this is necessary but not yet!

Brake drums

Those for the front axle need to have a housing to accommodate the king pins. There is no need to make these pivot as the steering is not intended to work. You do have to make track rod and steering rod ends and fit these to the inside surfaces of the front brake drums. The connecting rods for these are easy to make out of 1/16in. dia. rod with enlarged end pieces soldered or glued into place.

Shock absorbers

Once all the foregoing pieces have been made, the chassis can be assembled with its spring suspension and axles. In order to complete this part of the project you have to make the four shock absorbers. These are small and fiddly but I must say I really enjoyed the challenge, first how to design and then how to manufacture them.

I made all the pieces from bits of brass and my exploded drawing illustrates how I went about making the whole unit by again building up the various pieces **(fig 13)**. With work such as this it is my practice to produce a spare in case anything does go wrong. It did not, and a friend who used to sell MG TCs in years gone by begged the spare just as a fascinating reminder of his old sales.

Each piece was produced in the volume required and all pieces were soldered together during the build up. In this way you finish with a complete set rather than making one and then starting all over again with the next. Once you have your four shock absorbers finished they can be fitted to the chassis. The pair on the front simply bolt onto the chassis sides with the lower link being fastened to the spring centre piece **(photos 15** and **16)**. The rear ones require a piece of sheet brass to be fabricated with bolting surfaces for the shocks and then itself bolted to the chassis. The drawings, I trust, will make this clear.

With a complete assembly of all your bits and pieces made to date you should be able to look at a smart chassis. All you need now is an engine and bodywork!

●*To be continued.*

Front axle details.

Front axle mounting.

Rear spring mounting.

Front shock absorbers - front view.

Front shock absorbers - side view.

ELECTRO-PNEUMATIC CONTACTORS

Colin Beckwith

moves on to the auxiliary contact finger carrier, the moving contact sub-assembly and the arc chute.

●*Part IX continued from page 691 (M.E. 4249, 10 June 2005)*

The auxiliary contact finger carrier is probably the smallest brass fabrication on the contactor, but nonetheless very important. Its accuracy is critical to the satisfactory operation of the unit. It orients the auxiliary contact fingers at the correct height and distance to the contact segments. Reference to the operating cylinder drawing (drawing 9) shows the component as fitted to the contactor. Drawing 26 shows the detail of the part. Once again the part is machined after fabrication. Two sets of holes are required for mounting the carrier to the cylinder and to receive the auxiliary contact finger, mounting block. Yet another jig has been used to aid the drilling of these holes. The cylinder mounting includes a press fit dowel for positional accuracy. This dowel presses into the carrier and locates in a hole drilled in the cylinder. An 8BA screw secures the carrier to the cylinder. In this way the whole auxiliary contact finger assembly can be removed easily from the cylinder. This makes changing the contactor relatively easy should it become defective.

Moving contact sub-assembly

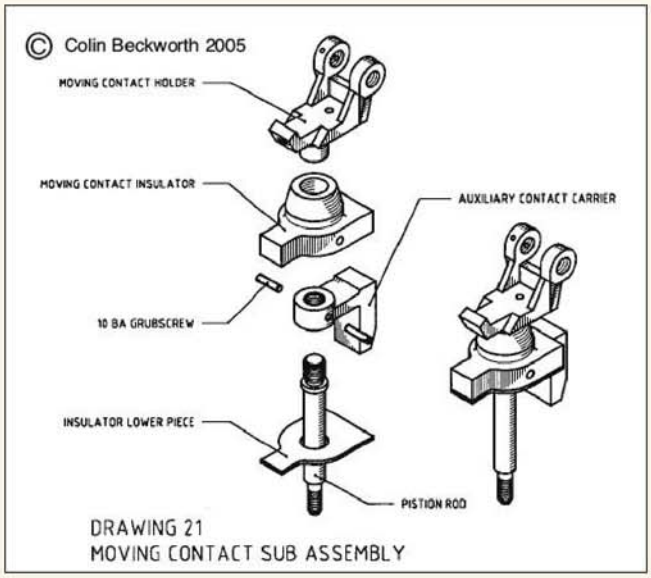
This is shown in **drawing 21** along with its component parts. It is assembled with the aid of a jig, which will be of little surprise to you by now. It is probably the most important assembly on the contactor. The reason for this is that it is the link between the main contacts and the auxiliary contacts. Most of the justification for the status of this assembly are discussed elsewhere, so I will not repeat myself. Suffice to say that if this assembly operation is done inaccurately the satisfactory operation of the control equipment is just a pipe dream.

The first operation in the assembly is to screw the piston rod into the auxiliary contact carrier. Care is needed when gripping the piston rod to avoid marking the sliding surface. If I were a bit more pedantic than I already am, a suggestion as to the tightening torque being applied would lend well. As I am not, I will not, so will only suggest that it should be pretty tight. This is mostly to ensure correct bedding of the piston rod abutment against the face of the auxiliary contact carrier, further ensuring squareness. Not to worry too much about locking because of the two 10BA grub screws that are next fastened into the auxiliary contact carrier against the piston rod thread. This is the purpose of the two 5/64in. dia. holes in the moving contact insulator. Of course if I were really intent on splitting hairs I would suggest putting a couple of spanner flats on the piston rod. This would save quite a lot of potential trouble resulting from putting parts into the vice, so it could be 'back to the drawing board' as they say.

It might be as well here, to check the parts for squareness as there will be little recourse subsequently. This can be done in the lathe with a DTI suitably poised for the operation. The next operation is the point of no return, as it were. The insulator and moving contact carrier are carefully coated with epoxy and then offered together. This done, the piston rod and auxiliary contact carrier have the same treatment. Once all is in place, the jig is fitted which stabilises the parts whilst curing. The jig is also the major dimensional setting aid for the assembly as inferred above. The whole job is then left to its own devices whilst the epoxy cures. I put the assembly into an oven at low temperature once the initial stage of curing was complete, which makes the joints far stronger.

The only thing that then remains is to clean the lower face of the insulator of any epoxy residue, before yet more of the stuff is applied to it. This will fix the lower part of the insulator to the upper part, sealing off the inner workings and lending final strength to the structure. In theory it should be possible to renew the piston rod without destroying the other parts of the assembly. I have not tried this, but it would make life a lot easier when it comes to refurbishment, should it be necessary. It may be evident that the assembly could be easier to service. I feel this to be true. I also believe the assembly is a lot more stable compared to an exclusively bolted or threaded one. The jury is still out on this, only to return when they have the benefit of hindsight.

An important design consideration can be mentioned here, to do with the relative positions of the contact tips and the piston rod. Reference to drawing 13c has a view of the contactor when closed. Notice that the cylinder centre is in line with the point where the moving contact holder touches the moving contact carrier. If these points were not in line, then there would be a for and aft component to the force on the tips. This would tend to tilt the assembly when the contacts close. Wear in the piston rod and the sleeve in the cylinder would result, causing bad contact and binding of the mechanism. It would also put undue strain on the glued assembly described above. This is one of the lessons that I learned through experience after testing one particular prototype. Of course it is obvious now and I look back on my own inexperience with kindly and parental regard.



DRAWING 21
MOVING CONTACT SUB ASSEMBLY

Arc Chute

Purpose

The arc chute is provided to contain the arc formed between the contacts on opening. This is necessary in order to limit the possibility of the arc finding an earth and causing a short circuit. It can also cool the arc by touching it or by the use of special cooling features such as fins. In addition to this the arc chute can include splitter plates which literally split the arc into several sections. However, in this design none of these extra complications have been deemed necessary. The arc chute also carries the magnetic poles of the blow out coil. Some designs have these poles separate from the arc chute being fixed to the contactor independently. This makes maintenance very much more difficult as poles are very wide and close together, relative to the size of my fingers. Their presence would make access to the main contact tips very much more difficult had this design been adopted.

Arc Chute Construction

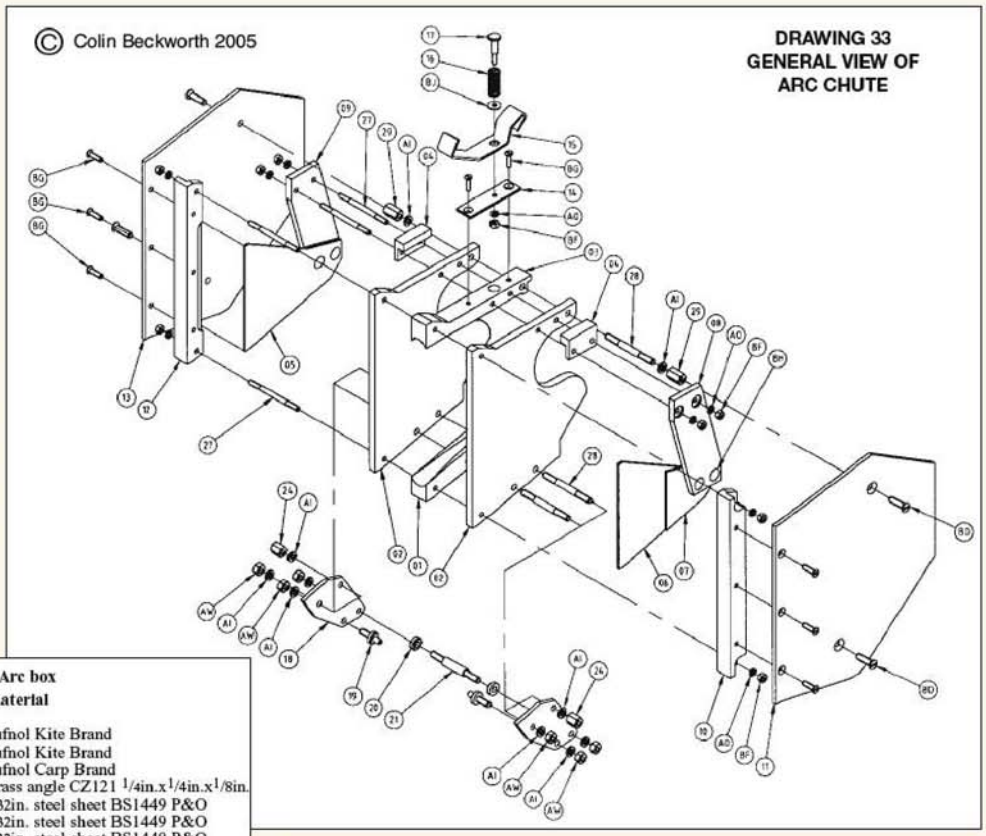
The construction of the arc chute is shown in the exploded view **drawing 33**. The arc chute forms an open-ended box in which the main contacts operate. With reference to drawing 4 you will see the arc as it is forced into the arc chute. This will illustrate the need for what is a very large protuberance on the contactor. The main structure of the box is made from Tufnol laminate sawn and filed to shape. In full size, these parts would be made out of a special fire proof material generally known by its trade name of Sindanyo. I could not find a source for this in the desired thickness, so I elected to use Tufnol. This may not be the most suitable choice for the long term and I may be forced to try harder to source a better material. The arc is very hot and it could burn the Tufnol resulting in a loss of performance from the arc chute. All this aside, the main containment consists of two side plates held apart by two horizontal spacers, one at the top and the other at the bottom of the structure. There are also two outer side guard plates, which are held to the rest of the structure by two vertical spacers. The plates serve to separate individual contactors when ▶

they are mounted in close proximity. The outer spacers are placed vertically and allow the outer side plates to clear the contactor sides. The inner side plates are shaped in order to fit snugly against the contactor structure once installed. The spacers are made just the right thickness to allow the chute to slide closely over the semi-circular upper arc horn. These tight constraints are necessary to prevent arc leakage into the earthed areas of the contactor.

Also contained in the arc chute are the blow out poles and cheeks as referred to in drawing 27. They are mounted inside the arc chute so that they are insulated from the live electrical parts. The material for these poles and cheeks is normal, bright mild steel. This is a very good approximation of 'soft iron', which tends to be over used in textbooks. The details of these parts are shown in **drawings 38** and **39**. When the arc chute is slid into position, the blow out poles will touch the end of the blow out coil core. This ensures the continuity of the magnetic circuit for the blow out system. In order to assure a good contact, an interference-fit is needed at this junction. The blow out coil core is shown in **drawing 40**. The particular fixing points for the blow out poles and cheeks allows some degree of movement. If all goes well, there will be some residual force left to ensure that there are no gaps. In short, the idea is for the cheeks to bend out slightly over the ends of the coil core ensuring a tightish fit.

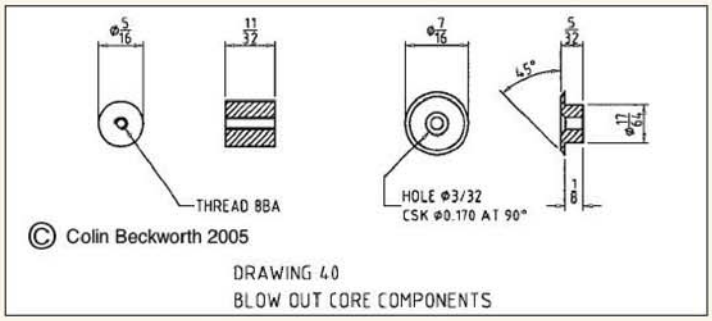
The main contact tips have a small clearance within the inside of the arc chute, inner side plates. Again this has to be minimised to limit the blow out coil duty. The reason being that this spacing affects the spacing of the blow out cheeks, the bigger the air-gap the greater the magnetic leakage. The narrower tips possible with EP contactors is a great advantage here. This being in direct opposition with the need to provide enough clearance for the main contacts to move up and down unhindered. Design compromise was needed here in order to come to a workable solution. It works out that there is about 1/64in. on each side of the contact tips. The profile of the inner side plates when viewed from the sides is designed to enclose the contact tips as much as possible. This is in direct conflict with the easy removal and replacement of the arc chute. This compromise has to be carefully examined at the design stage. CAD makes this a lot quicker and more efficient in that items can be moved around and clashes detected before you cut any material.

All the plates and spacers of the arc chute, together with the blow out poles and cheeks are

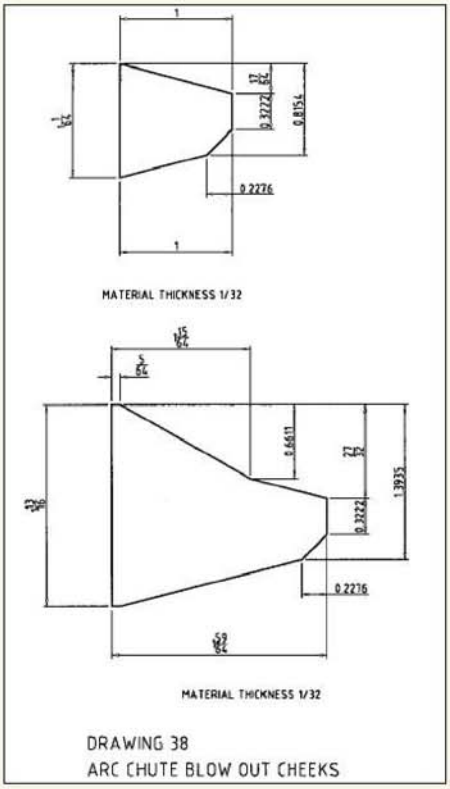


NA5 contactor parts list - Arc box

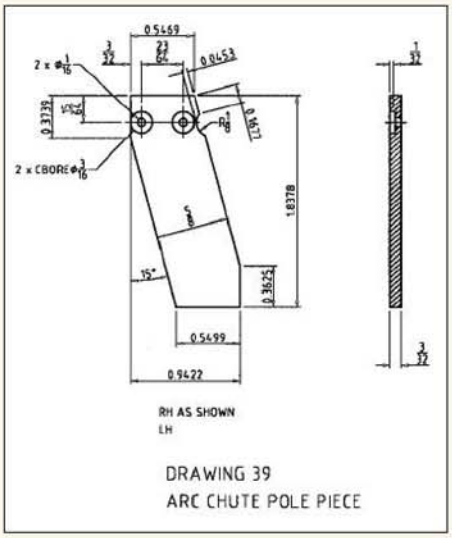
Item no.	Description	Material
01	Spacer tuf bottom	Tufnol Kite Brand
02	Plate tuf side	Tufnol Kite Brand
03	Spacer tuf top	Tufnol Carp Brand
04	Block BRS support	Brass angle CZ121 1/4in.x1/4in.x1/8in.
05	Cheek SHS blow out inner LH	1/32in. steel sheet BS1449 P&O
06	Cheek SHS blow out inner RH	1/32in. steel sheet BS1449 P&O
07	Cheek SHS blow out outer	1/32in. steel sheet BS1449 P&O
08	Pole BMS blow out RH	Bright mild steel 3/32in.x5/8in.
09	Pole BMS blow out RH	Bright mild steel 3/32in.x5/8in.
10	Spacer tuf outer guard RH	Tufnol Carp Brand
11	Guard tuf outer RH	Tufnol Kite Brand
12	Spacer tuf outer guard LH	Tufnol Carp Brand
13	Guard tuf outer LH	Tufnol Kite Brand
14	Plate SHS catch support	1/32in. steel sheet BS1449 P&O
15	Catch SHS arc box	1/32in. steel sheet BS1449 P&O
16	Spring SST catch	Stainless steel wire
17	Pin BMS catch	Bright mild steel 3/16in. dia.
18	Plate tuf support	Tufnol Carp Brand
19	Spacer BMS location	Bright mild steel 1/4in. dia.
20	Spacer BMS support	Bright mild steel 1/4in. dia.
21	Pin BMS arc box support	Bright mild steel 1/8in. dia.
24	Spacer BRS outer guard SM	Brass section CZ121 3/16in. AF hex.
27	Stud BRS blow out pole	Brass rod CZ121 3/32in. dia.
29	Spacer BRS outer guard LG	Brass section CZ121 3/16in. AF hex.



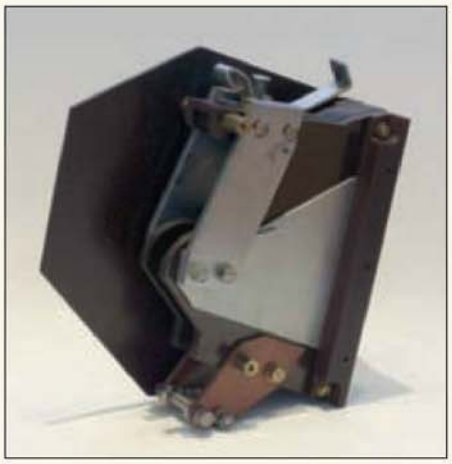
DRAWING 40
BLOW OUT CORE COMPONENTS



DRAWING 38
ARC CHUTE BLOW OUT CHEEKS

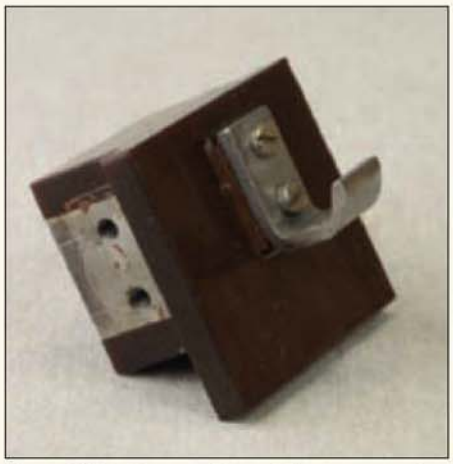


DRAWING 39
ARC CHUTE POLE PIECE



The arc chute with an outer guard removed to show the magnetic blow out pole pieces.

with epoxy resin. The only other parts are the threaded inserts that receive the arc chute retention bracket screws, which are both 10BA. These inserts are turned up from brass and mounted in pre-drilled holes. These holes are jig drilled with the jig being reused when it comes to fixing the inserts into the holes. The inserts are retained in the component with further charges of epoxy resin. The main reason for this item having an insulating coating is its proximity to the upper arc horn. It is just possible that the arc could get out of the top of the arc chute. A short circuit would result if this was exposed and earthed metalwork.



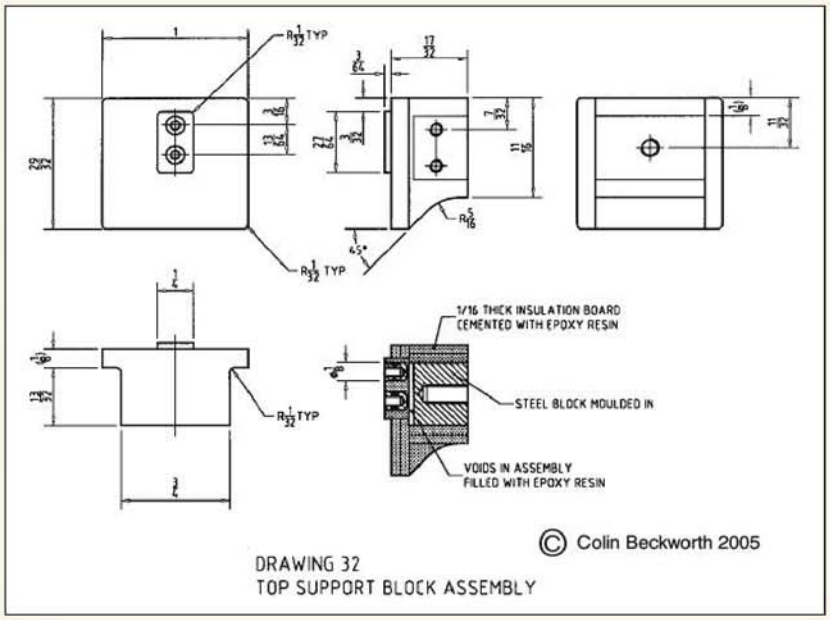
The catch for the arc chute quick release can be seen bolted to the support block assembly.

secured with brass fasteners. The non-magnetic nature of brass was the main selection criteria for these items. Steel fasteners, being stronger would have been desirable. However, they would have partially shorted out the blow out magnetic circuit. The flux would have gone through these, rather than across the air gap like it should do. The flux path provided by the steel screws being an easier route than the air gap itself.

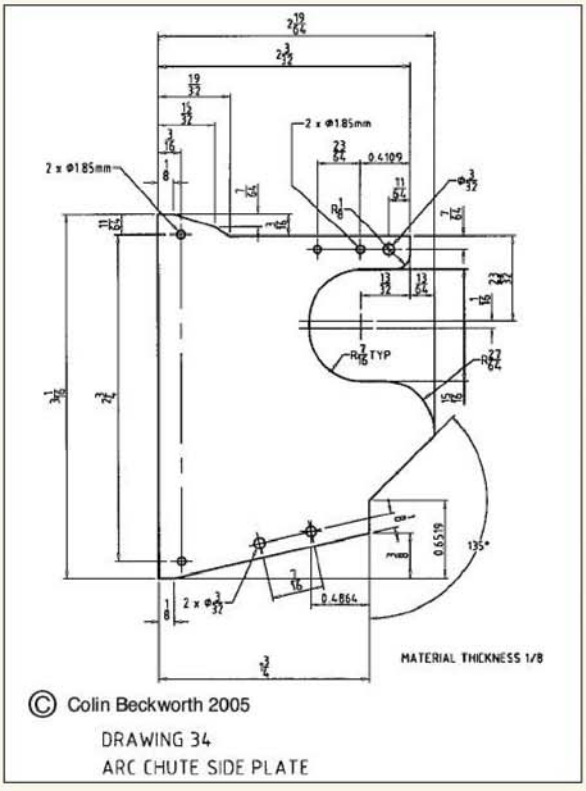
Arc chute mounting

The arc chute is mounted on a bracket fixed to the contactor's operating cylinder. Then it is finally secured with its own clip on the upper part of the assembly. The clip engages with a hook mounted at the top of the contactor on an insulator. The arc chute has to be and is readily removable for the purposes of inspection and maintenance. The clip has been designed to be simple to operate and has evolved from the full sized unit. The ideal way of installing the arc chute is to line up the pins with the lower bracket. Then, once this has been done, the chute can just rotate into position with a reassuring click, which I am glad to say does actually happen. As the chute rotates the blow out magnetic circuit is remade as described above, so as expected, there is a bit of 'stiffness' encountered.

The insulator that the arc chute retention hook mounts on is also an important part of the contactor structure. It is the spacer for the contactors main side support bars and contains the upper main mounting thread for the contactor. It is shown in **drawing 32** which shows the composite nature of its construction. The part is formed of a bright mild steel core, which is drilled and tapped for the purposes mentioned above. There are four 8BA blind holes to secure the side bars and a further 5BA blind hole for mounting. All the holes are pre-drilled, that is, before the part is assembled. The rest of the structure consists of Tufnol sections fixed into place



DRAWING 32
TOP SUPPORT BLOCK ASSEMBLY



DRAWING 34
ARC CHUTE SIDE PLATE

Arc chute components

Side plates

As mentioned before, the main structure of the arc chute comprises Tufnol of the 'Kite' Brand genesis for those who know such things. These people will also know that for all its magical electrical properties, the material is a bit of a challenge to the newcomer. The arc chute side plates have a rather convoluted profile, which would be murderous to mark out for the pair needed for one contactor let alone the remaining eleven units. So with the benefit of my experience with this material I elected to create templates for these parts. These templates were made from 20 gauge mild steel, thin enough to profile easily and tough enough to last the course. This recourse to templates has a couple of advantages. The first is that the profile is almost certainly guaranteed to be the same for each part. Accepting the small discrepancies introduced during the shaping process of course. The second is that the material can be scribed quite confidently. A fact that makes the filing a whole lot less of a tentative affair. The worst thing above all about Tufnol is its ability to chip. Not just tiny little chips but big ugly imperfections usually in the most unwanted and exposed places. The proverbial buttered toast landing face down scenario. This is by virtue of its structure and being manufactured from layers of paper bonded with resin giving it characteristics similar to wood. The scribed lines stop the minute cracks in the material propagating beyond them and although they form they do not encroach on the finished work. Anybody who has had recourse to file this material will know that the ideal way to file it is along its length. This is very difficult to do when you consider the shape shown in the side plate **drawing 34**. The semi-circular cut out is the most arduous feature to create with reference to the difficulties outlined above.

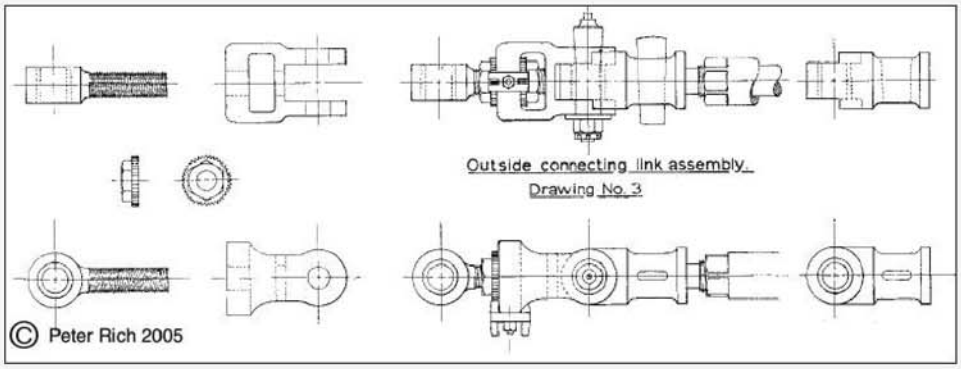
●*To be continued*

ROCKER LEVER DRIVES ON GWR AND LMS 4-CYLINDER LOCOMOTIVES

Peter Rich

concludes his short series on this fascinating topic.

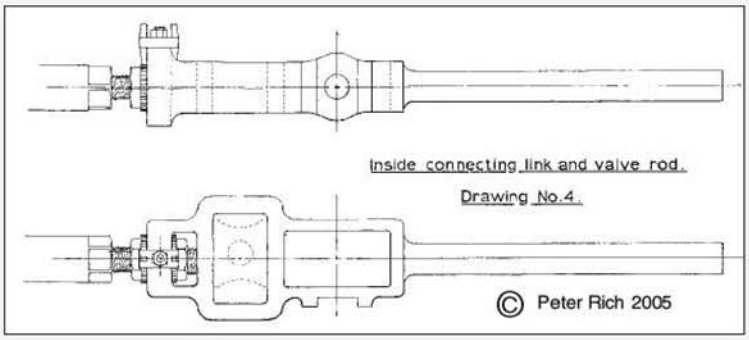
●*Part II continued from page 763 (M.E. 4250, 24 June 2005)*

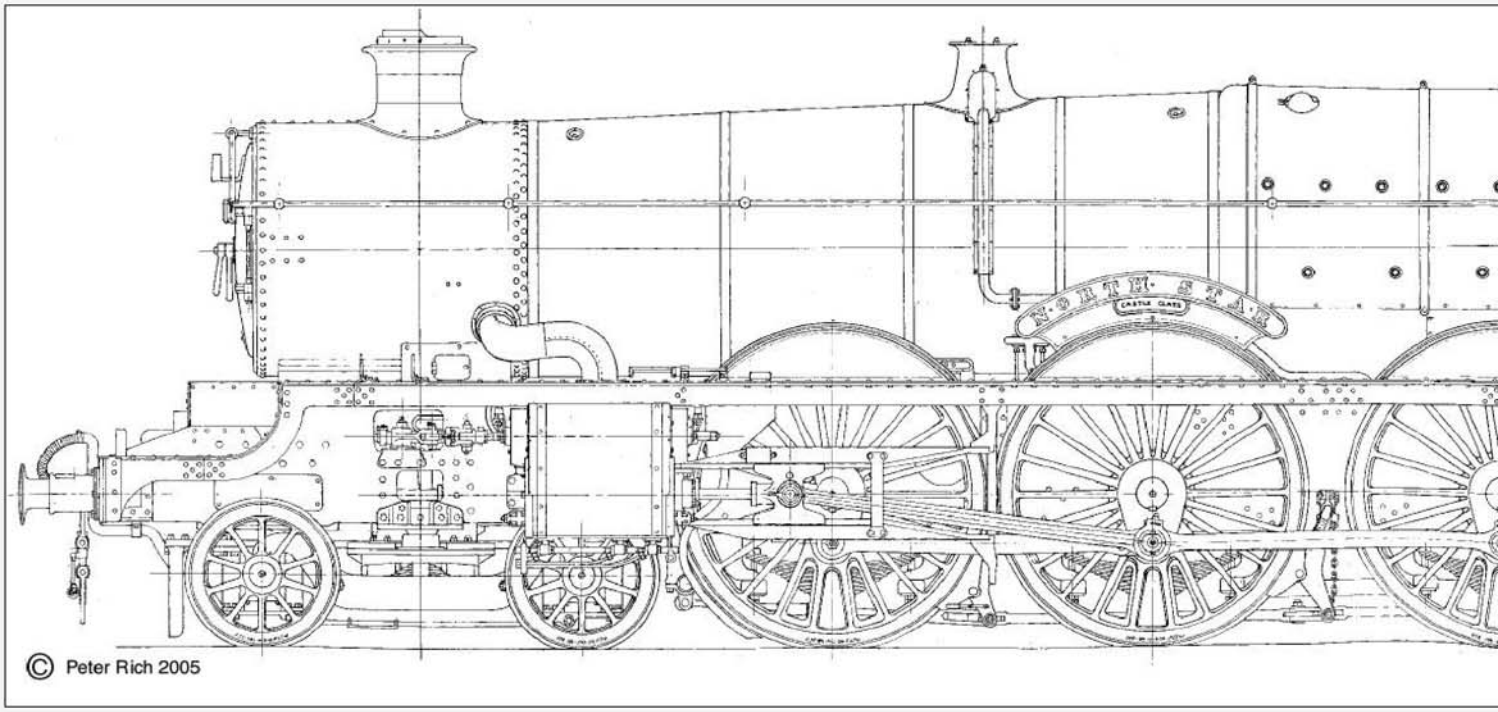


My first article effectively took care of the angularity between the inside and outside connecting rods, but Pearce was still left with the other two angularities I mentioned and about which very little could be done. He could not, for instance, re-set the crankshaft at 88deg. or 92deg. because, while such a setting may be alright on one stroke of the piston, it would create problems on the opposite stroke to say nothing about the errors which would be introduced from one side of the loco to the other. Neither could the drive rods to the quadrants be lengthened or shortened for the same reason.

Therefore, Pearce fell back on that very important and wonderful time-honoured method of curing valve gear faults, which the people who know about these things call 'compromise' and, in support of what I say, I point out that the official Swindon works drawing (No. 29098 of 1905) speaks volumes.

The compromise allowance in the design was that the driving connections to the inside valve spindle and also the connecting link between the outer end of the rocking lever and the outside valve spindle crosshead were made adjustable by screw thread. My **drawing No. 3** shows the assembled adjustable link, also the various parts of it, for the outside valve spindle. From this it will be seen that two hexagon nuts provided the adjustment, both nuts having a serrated flange which, after final adjustment, allowed the nuts to be secured in position via a small 'dog' bolted on to the buckle. My **drawing No. 4** also shows the inside valve rod from which the rocker arm was driven and has the same serrated nut connection to the inside valve spindle. I cannot recall counting the number of serrations but they were very numerous and allowed a very fine adjustment. The 'speaks volumes' reference I have made is that the official Swindon drawing shows the length of the outside connecting link as 8 9/16in. with that wonderful word 'about' added to the dimension which gave the valve setters a certain amount of latitude. I may be wrong but I cannot think of any other type of GW locomotive, other than the 4-cylinder





classes, where the valves could be adjusted by screw thread. All others had the various joints secured by taper fits with cotters, any adjustments then being made either by blacksmiths having to 'jump' the rods or by packing pieces being inserted or removed between the eccentric rod and its strap.

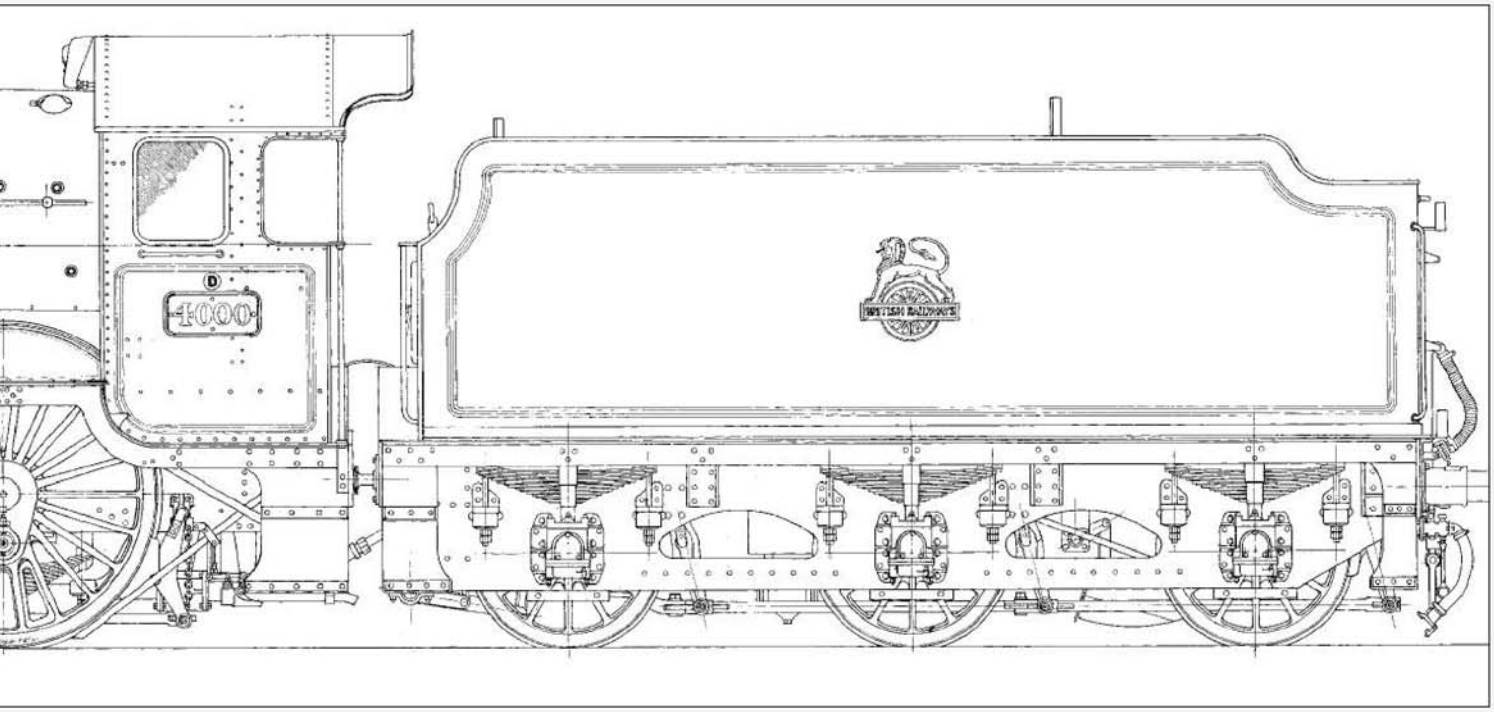
To sum up, the reason for the GW rocker being cranked backwards is as follows. On the introduction of loco No. 40, *North Star*, with its 'scissors' valve gear, there was no other way that a delay on the closing point of the outside valve could be achieved other than by cranking the rocker lever. This introduced 'angularity' to the motion of the connecting link. The designer also allowed the valve setters a screw adjustment which provided an easy means of compromise.

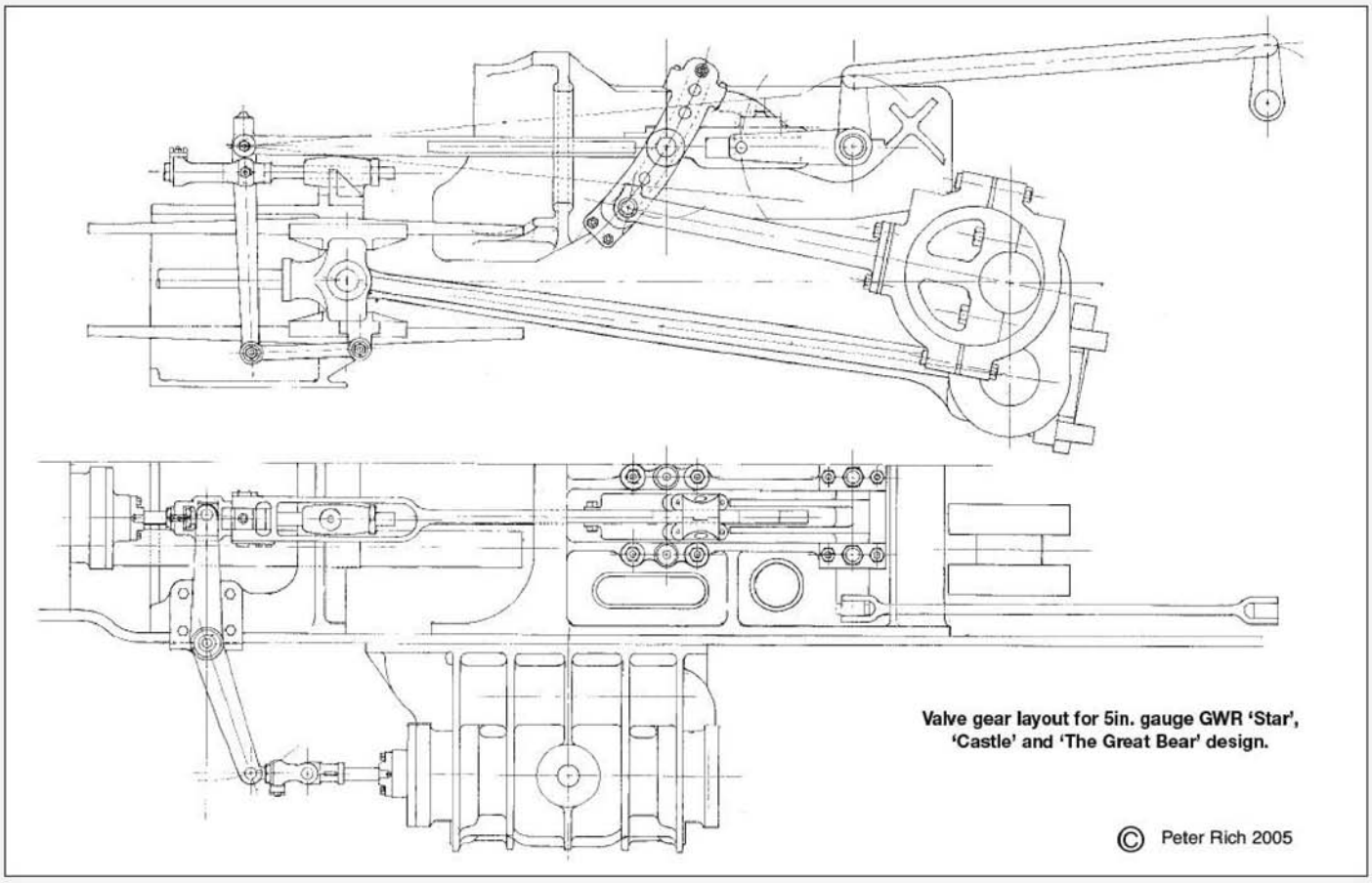
In view of the fact that the next batch of 4-cylinder locomotives appeared in February 1907 their design must have been fairly well developed when the decision to change to Walschaerts valve gear was made. In order not to hold up the work, Pearce probably fell back on his previous sketches of the Walschaerts gear and simply substituted an eccentric sheave and rod to drive the quadrants and left everything else as it was. The fact that they appeared so early in 1907, not yet a year since No. 40 appeared, must mean that their design was well under way in 1906 and the decision to change the valve gear must have been made very shortly after *North Star* appeared. That each side of the locomotive now no longer had any influence on the other side meant that there was no need to have retained the adjustable part of the design but, having provided the adjustment, it was probably retained as a very handy feature to have in valve setting. I know from experience that it was a very handy facility if both outside and inside valve links had to be dismantled at the running depots, where the use of a pair of dividers and a scribed line from a couple of centre popped marks gave the fitters a very easy means of re-setting the valves back to the original Swindon, Wolverhampton or Caerphilly valve positions. A locomotive could thus leave a running shed, after repair, with exactly the same valve setting as when it entered.

The cranked rocking lever was retained in order to cope with angularity between the inside and outside connecting rods and pistons and, that being the case, the eccentric sheaves could be positioned in the normal way for Walschaerts valve gear without having to do a great deal of redesign work. In other words I believe the easiest and quickest option was utilised and retained throughout the rest of the GWs 4-cylinder locomotives. Probably the reasons why the rocker lever was made cranked and the links made adjustable was forgotten in the meantime because they had no reason to question it. In any case, why alter a situation that the Works could cope with and which gave the valve setters at the main works, but more importantly shed maintenance staff, a handy very easy method of valve re-setting. Therefore, it was a very necessary feature of these locomotives.

On locomotives valve setting was often a compromise between forward and backward settings but on these 4-cylinder locomotives it was also a compromise between inside and outside cylinders. If the cut off points of the outside cylinder were made exactly equal then the points of release at the end of the stroke would not be so. The GWR attached great importance to synchronised exhaust beats contributing to good steaming by providing an even blast on the fire. The valve setting was therefore made to favour the points of release more than the points of cut off. In his book *The GWR Stars, Castles and Kings* 0. S. Nock published the actual figures for a 'Castle' class locomotive stating they were given in Phillips' *Locomotive Design: Data and Formula*. When the front and back cut-off for the right inside cylinder were 20.8% and 20.4% the figures for the right outside cylinder were 26.9% and 19.1%, however, the points of release were 70.9% and 68.5% for the inside cylinder and 72.3% and 67.6% for the outside cylinder. From this it will be seen that the differences in the points of release were less than the differences in the points of cut off. That the valve setting was a compromise was pointed out to me many years ago by my old friend Cyril Goulding who told me that this could be seen in the fire on these locomotives. It was demonstrated to me when I was a cleaner at Ebbw Junction Depot in 1956 and was put to accompany Driver 'Butty' Young on shed shunting duties. The locomotive used was 'Star' class No. 4056, which had come on to Ebbw for a repair in the workshops. 'Butty' showed me that when starting off very slowly with a heavy load two distinct impulses could be seen in the fire for each, apparently single, exhaust beat up the chimney thus showing that the valve setting between inside and outside cylinders was not exactly in synchronisation. I saw it many times on 'Castle' class locomotives after that.

Let us now turn our attention to the LMS 'Coronation' Pacific type locomotives which also had piston valves driven by rocking levers but, in their case, the lever was straight. Before going further, I have to say that I do not have a wide knowledge or experience of LMS locomotives and all that follows is my own observations having studied the LMS official general arrangements drawings of the 'Coronations'. The drive for the rocking lever was taken from the valve spindle at the rear of the outside cylinders valve chests and, like GW engines, was transferred to the inside by a rocking lever via an aperture in the frame. Unlike the GW locomotives the drive to the rocking lever was made via links rather than a die block while the drive to the inside valve from the lever was also via a link, in this case about 4ft. long. Because the rocking lever was straight, its end drive pins moved parallel to the valve spindles and while a small amount of 'angularity' was involved it would have had very little effect on the movement of the valves. ▶





Valve gear layout for 5in. gauge GWR 'Star', 'Castle' and 'The Great Bear' design.

Recently, on receipt of a copy of the official works drawing of a 'Coronation', I set out its valve gear on my drawing board in diagrammatic form. Usually with Walschaerts valve gear the eccentric rod's centre line takes a line through the quadrant drive pin and the centre of its driving axle. The return crank pin is usually set on this centre line to give an equal swing of the quadrant about its vertical centre which, of course, provides a centralised movement of the piston valve in relation to its piston. I spent many hours setting the gear out many times but could not get the return crank pin to coincide with the eccentric rod centre line, as outlined above, as it should have done. Whatever dimensions I took or scaled the return crank pin always came out at about 3/4in. above the eccentric rod centre line. I had spent many hours contemplating this when, while looking at an official outline sketch of a 'Coronation' class, I noticed that the connecting rod big end was shown at the quarter of a turn of the crank position rather than at the 50% piston stroke position. Armed with this knowledge I then set out the valve gear with the crank at the quarter turn position and, low and behold, the return crank now appears to come to the position I expected it to be. It occurred to me - was this the LMS method of curing the problem of connecting rod angularity? After all, a return crank pin coming late to its front and rear dead centre positions, would introduce a delaying action to the closing of both valves of the inside cylinders and would tend to equalise the valve events overall especially if our old friend 'compromise' played a part. Unfortunately, I do not have possession of the works drawings of the LMS 'Coronations' valve gear and have had to base all of my research on the works G/A drawings of the whole locomotive, which is not really satisfactory. Therefore, I am not going to make a definite statement that the LMS counteracted connecting rod angularity by delaying the return crank setting. However, I will say that I would not be very surprised to find this was the case. It may well be that there are other members of our fraternity out there who know exactly what the situation was as far as the 'Coronations' were concerned. If so lets hear from them and get some discussion going on the subject.

I am sure that Swindon believed that, to achieve the results it required, the cranked rocking lever and adjustable link so successfully helped to solve the problem of connecting rod angularity that it was retained for all of their later 4-cylinder locomotives. It was regarded as very necessary to the later designs and was an excellent legacy from loco No. 40 *North Star*. Because it was so successful it was not necessary to change it for the rest of the GW 4-cylinder classes. After all, why alter an existing design which worked?

My drawing shows the valve gear as re-designed to Walschaerts and applied to the 'Star' and 'Castle' classes from 1907 but I should point out that there were slight differences when it was applied to the 'Kings'. The last batch of the 'Star' class, Nos. 4061 to 4072, and all 'Castles' and 'Kings' had their inside crank webs extended to form balance weights.

To round off these articles I enclose a copy of my drawing of *North Star* as rebuilt as a 'Castle' class locomotive and in its final condition in BR days. The rebuild involved an extra 12in. added to the rear of its frame, new inside and outside cylinders of the 'Castle' class design, replacement of the 'scissors' valve gear, the fitting of the larger standard No. 8 boiler and a new, large, side window cab of Collett's design. It is quite apparent that Swindon kept this loco right up to date because my design is based on official Swindon works drawings and on contemporary photographs. We now see that it has all the later modifications which were applied to 'Castle' class locomotives, with the exception of a large superheater and a double chimney. It now has the modern 'Hawkesworth' flat-sided tender with the latest type axleboxes, later type cast crossheads, larger radius steam pipe to the outside cylinders, web spoked wheels under the cranks and parallel, large head buffers. When rebuilt to a 'Castle' in 1929 it was obviously fitted with the larger cylinders of the 'Castle' type. However, photographs taken near the end of its working life show later type inside cylinders with modified combined smokebox saddle as introduced with the 5098 class of 1946. Photographs also show that right to the end it retained the original outside guidebar brackets fitted in 1906 and the unique bogie side bearer brackets as fitted when converted to the De Glenn bogie in 1909. It was also unique amongst the early 'Castles' in that it retained the decorative brass beading down the front edge of the cab whereas all of the other early 'Castles' up to 5012 had this feature removed in later days. I only ever saw *North Star* on two occasions, both times at Paddington. It was very much a rarity in South Wales until its very last days when I understand it became allocated to a west Wales depot. By this time I was serving my apprenticeship and had other matters on my mind. Sadly it was withdrawn for scrap in May 1957.

The diagrams accompanying these articles have been made up especially for the purpose, however, I should point out that the drawings which accompany them are not drawings of the full size valve gear and locomotives. They are taken directly from my 5in. gauge Star/Great Bear/Castle design of the early 1970s, however I have enlarged them for clarity and I feel they are sufficiently accurate to illustrate the articles.

EASIER WORM GEAR SET CUTTING

Stephen Wallin

describes a free hobbing process for worm gears.

Recently it occurred to me, that what had seemed to me to be an everyday workshop process, was a mystery to a colleague who happens to build quite a lot of model railway locomotives. The process in question concerns the production of suitable worm gear sets for driving these models. He has a lathe but has never done any gear cutting although these worm sets were specific to his requirements. I soon came to realise that a lot of fellow model engineers are unaware of an easy way to make worm gear sets, namely free, or loose, hobbing of the blanks.

We all might require smaller sized worm wheel gear sets in our engineering models, although in fact there is really no size limit for this process. For larger sizes and coarser pitches, a gear hobbing machine which turns the blank in phase with the cutter is better, but for small sizes (for model railways and model engineering up to, say, 1 to 2 inch dia.) free hobbing works easily.

Firstly, you do not need a special machine, as almost any lathe will do. The main requirement, to make the process easy, is a low lathe speed, but if your lathe cannot manage this, then a hand drive to the mandrel will do. I use my lathe set at 40rpm for all cutting of these gears.

The method is based on the use of ordinary taps as the cutter, with the chosen pitch tap placed in the chuck of the lathe, and the gear blank mounted in a frame holder that is bolted into the tool holder of the lathe. The drawing shows the principles, but exact dimensions will depend on your own lathe. The overall size of the frame must be adjusted to allow for the maximum diameter of blank to be used.

The machining is done by advancing the gear blank towards the cutter with the cross slide as it is rotating. Contact with the prepared blank causes the work to rotate and as the cut is gently increased the teeth are formed on the blank. This may take several minutes. It is best to proceed as slowly as possible, especially if steel is used for the blank.

I have made gear sets from 1:20 to 1:150 or more, in many diameters, over the years. Usually the taps that I used for these small model railway sizes are metric, at a pitch of 1 to 1.5 mm, which makes any calculations easier, but any tap with a known pitch will serve. Do not forget that, to produce the matching worm, your lathe must be able to cut the same pitch thread as the tap

Both three and four flute taps will work, with the obvious proviso that it must be a straight-sided tap, not a taper type, and that it is really sharp! Some two-flute taps will not work with narrow blanks, as there will be no continuous contact to drive the rotation of the blank. This is the reason the blanks should have a generously wide face for the machining, which can be thinned down after the worm wheel has been cut.

Most of the gears that I have produced by these methods have been based on the use of a steel worm and a brass or bronze gear. These methods will work with mild steel gears, but machining must be done with lots of lubricant. This will not be needed with brass, but if phosphor bronze is used then a lubricant should be used, such as a tapping oil or compound (or lard mixed with a little olive oil).

Process notes

Now, some further practical points about the process. First, it is vital to calculate the diameter of the blank to end up with correctly formed teeth at the expected pitch, to match the worm. The cutter will always appear to cut teeth that engage with the tooth form of the tap, but if the pitch of the tap does not divide correctly into the circumference of the blank, then thin, small or distorted teeth will result.

The easiest approach is to plan for the required ratio, (this is equal to the number of teeth on the gear), and then multiply the number by the pitch of the tap being used as the cutter. The result is the pitch circle of the blank from which you can get the diameter. If the overall diameter of the required gear is more important, then divide the diameter by the pitch and then adjust the diameter, (or the pitch, if the tap is available), to get the pitch to divide exactly.

I found that the blank is best prepared with a radiused groove cut in it, to match the tap diameter. The gear blank diameter should be larger than the pitch circle diameter calculated, by over twice the height of the teeth form. It does not matter if it is larger it will just take longer to machine down to the final size.

The work is checked for overall diameter as the work progresses towards the expected final diameter with the form of the teeth examined closely with a magnifier. If you proceed too far then the teeth count will be wrong or, with a small amount too little, it will result in thin or distorted teeth.

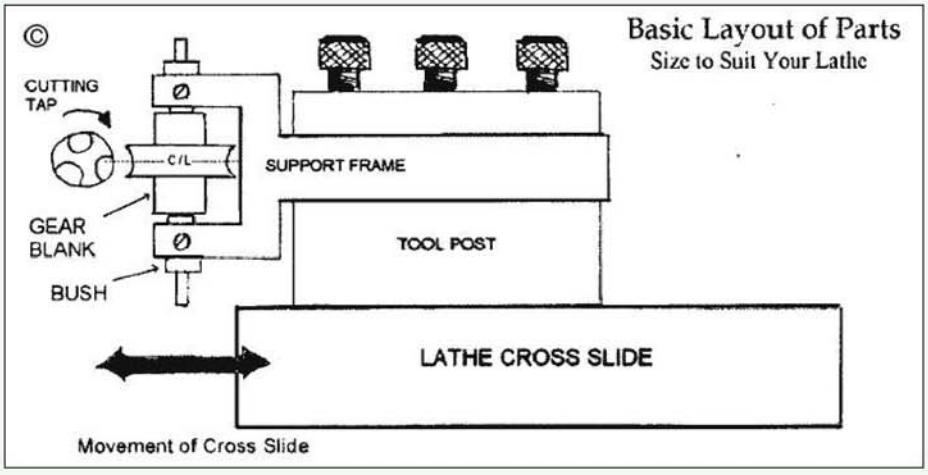
To complete the set you will need to turn a worm, to match the diameter and the pitch of the tap and this is why the use of 1mm or 1.5mm makes the process easier, as most gear cutting lathes can cut these pitches with ease. The point of the tool for cutting the worm must be ground to match the angle of the chosen tap. Do not be tempted to make very small gear sets with BA taps, as the pitches are near impossible to match when you machine the worm. Make life easier and stick to matching threads that your lathe can cut.

The blanks are best supported in the frame, mounted firmly in place on the shaft, (or equivalent), to be used in the model. The bearings in the frame are removable to allow fitting of alternate shafts or removable coned centres, which fit in place of the plain bearings in the frame. Both the plain and the coned bushes are retained by grub screws in the frame arms. The overall need here is to retain concentricity of the shaft with the gear teeth.

Some models will require worm wheels that are removable from the shaft, and greater care will be needed with the chosen method of support to retain the concentricity. I usually plan this type of gear to be made as an extra thick blank with heavily centre drilled faces. The blank is then drilled and reamed to the final fit for the shaft. The blank is then supported on the centre-drilled cones for the machining of the gear. The coned portions of the gear can then be simply machined away, leaving a reamed hole, which should still be concentric with the gear face.

With all the gears that I have produced by this method that have been for my own use, I have always carefully polished the worm gear to a fine finish. Then I run in the gear set with a small amount of cutting compound to get a good final finish. A final aside, which should be mentioned, is that if the gears are made for model railway use then no side play can be allowed with this type of gear. If side play is needed, then the set must be mounted in a suitable gearbox, with a flexible drive shaft from the motor.

This is why so many gear sets for model railway use are made with straight cut teeth so that the gear can move with the axle side play, it maybe bad engineering practice, but it works!



KEITH'S COLUMN

LILLIAN
A NARROW GAUGE LOCOMOTIVE
for 7 1/4in. gauge

Keith Wilson

describes some further parts for this fine locomotive.

● *Part X continued from page 703 (M.E. 4249, 10 June 2005)*

The piece last time on the hornstays reminds me of an interesting little bit of history. I do not recall seeing a locomotive design utilising 'notched' hornstays until my series 'Bulldog and Dukedog'. After this time however, other designs appeared using the same system. Perhaps needless to state, I claim no originality for this idea, for 'twas full-size practice long before I came along.

So my shown design of slots parallel to the frames is not necessarily a handicap. On an engine like this, extra weight is valuable; and with such a short wheelbase, frame distortion is less important.

I am reminded of a visit to an American track some six years ago. The track was quite extensive, with two complete loops (in the sense of continuous running) present. There were many potential passengers present, but what caught my eye was a beautifully made giant 4-8-2 on the inner track, pulling only the builder and his son. Meanwhile, the outer track had several trains on it creating valuable revenue for the club. Now of course there are several possible reasons for this state of affairs, such as a brand-new locomotive being steamed for the first time, or a shortage of rolling stock for passengers etc. However, it struck me as a waste.

But for me, the 'feel' of driving a heavy passenger-full train outweighs running lone (or 'light engine' any time. It is of course purely personal. About 50 years ago, one club member would turn up once per year with his glass-case locomotive, steam it up with distilled water, and run gently for a few laps, with only him as the load. This of course does not really matter, but he always seemed to choose a well-filled public open day for this operation. It occupied valuable track space, and relatively rough-looking locomotive did all the revenue earning. In all fairness, I am not aware of any claim of superiority of locomotive on his part, but had he taken part in actual work many would have been somewhat more pleased.

Making some parts with 'eyelet' holes at the ends, or bosses etc. (Coupling rods, connecting rods, valve gear parts etc. come to mind) present an interesting problem – to wit: how do we get the straight-milled parts to match up to the round bosses? Having tried careful marking-out of the job, directly we get going in the milling machine then most marking-out marks rapidly disappear under piles of swarf, and/or soluble 'cutting' oil (suds) and it is not too easy to know exactly where to stop a cut. If, with a bolted part (bolted to a flat jig, for example) has a correct-sized washer on top, it is very much easier to locate correct places to stop. I show a picture of a blank pair of 'hooks' for the front springs mounted on a flat plate. This method relies on some accurate drilling of the blank bar.

The method used to support the material for the front spring hooks to facilitate machining on the milling machine.

Use jig-boring methods (see recent article by Peter Spenlove-Spenlove, *M.E.* 4244, 1 April 2005) preferably also with digital read-out units. Alternatively, mark one out with extreme care and use this as a jig to drill the others.

The jig for actual machining is just an odd piece of steel, in the case shown a piece of 1 1/2 x 3/8in. mild steel that had no other immediate use. It was drilled and tapped from the part mentioned in the last paragraph. Long-enough bolts were put through from below and tightened against the bar; this allowed each 'hook-pair' to be put in the jig with a 1/2in. O/D thick washer on top and a couple of ordinary washers underneath so that the cutter could reach the full depth of the job without carving into the vice jaws or the jig. The two central or larger bolts – in this case 3/8in. – had 5/8in. O/D spacers on top.

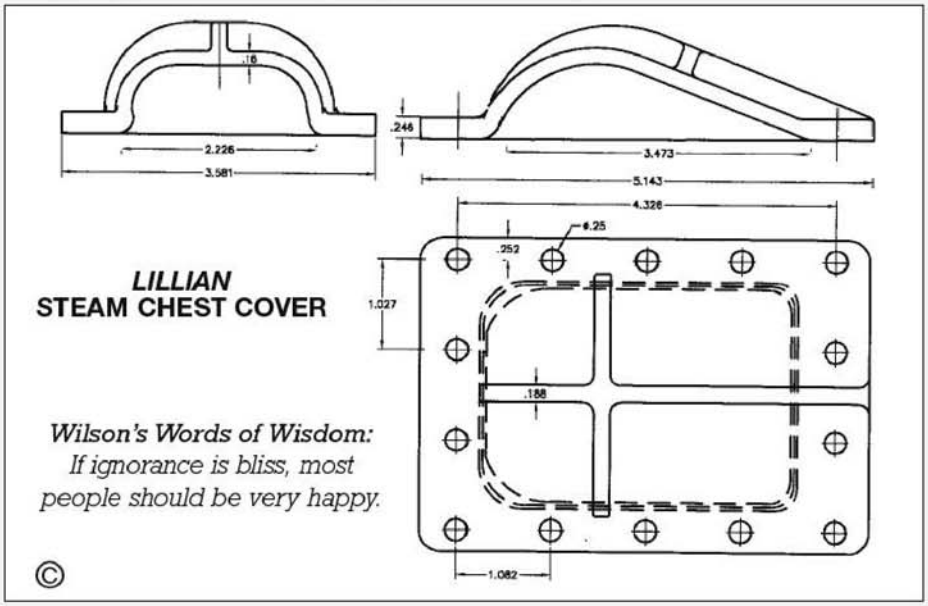
In the case of my milling machine, the soluble oil has gone off and although working perfectly as a cooling and cutting agent, has lost its nice white colour and become a clear dark brown. Annoying but harmless. Even the addition of some caustic soda (NaOH) has not cured this problem; even complete washing out of the whole system with much stronger NaOH solution has not provided a permanent cure. The cutter shown in the picture is a standard 5/8in. end mill.

The system worked well, and four nice pairs of matched hooks was the result. Whilst on the subject of tidying up earlier articles, included in this part is a drawing of the steam chest cover. Lack of space prevented this appearing with the cylinder drawing.

Saddle

The smokebox saddle is a useful part to have handy. In our case, the parts for this were laser-cut. However, getting the bends right is another matter. Unless you have a really hefty set of benders (or, of course, access thereto) this is not easy, for the thickness of the plates relative to their dimensions requires respect.

In a hefty vice, and armed with a fair-size oxy-acetylene torch plus a big hammer, bending is less difficult. Extreme accuracy is not too important at this stage, for if the bits are lined up and the top portions of the sides welded to the



Fly-cutting the concave surface of the saddle to give the correct radius after fabrication by welding.

A Clupet ring (left) compared to a standard ring. Clupet rings are available directly from the makers.

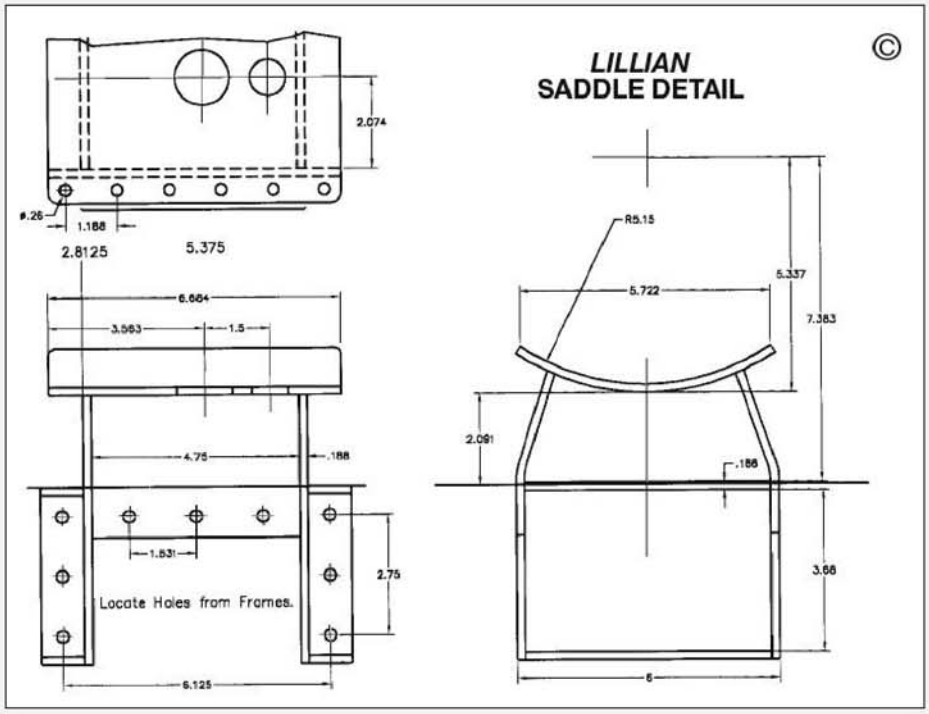
ends, a couple of big G-clamps will persuade it that you know best. Welded up complete, we come to the problem of curving the top plate. I very much doubt if any rolling machine would cope with this, and even if you have an 'umpteen-ton' press you've still got to knock up a pair of moulds or dies.

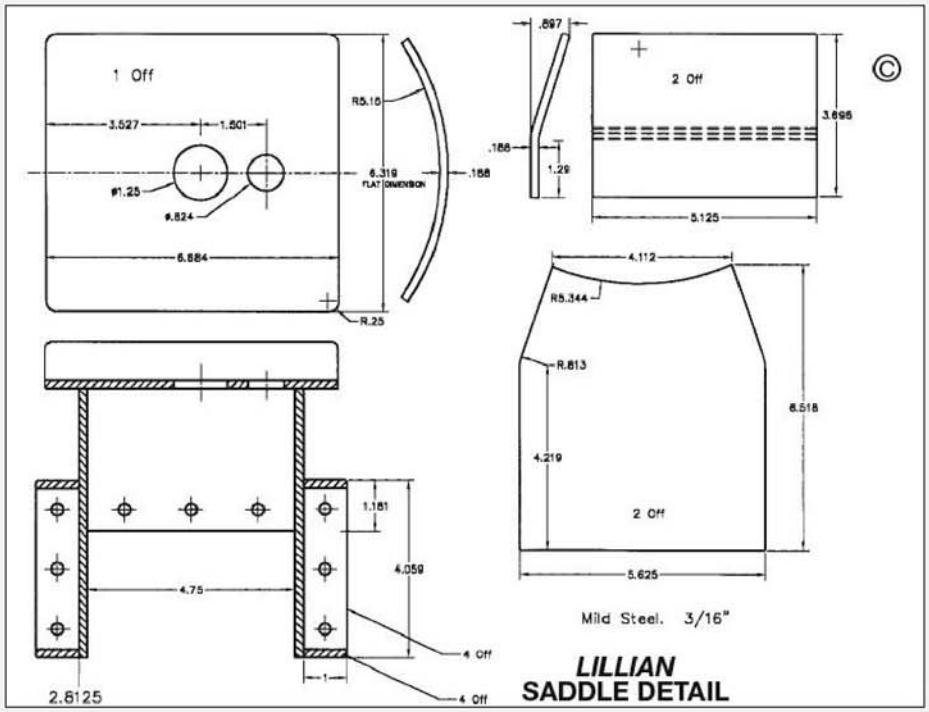
Bethink you; we already have one of these moulds in the shape of the end plates of the saddle. A bar across the top and a couple of hefty clamps will make a start in forming the top; heat applied via the torch will help greatly. In this case, a multi-jet jet will help; it gives a softer flame but great heat. The top will soon agree with you that curving is best, and a clout or two with a hammer is a good argument in your favour. Eventually, it can be welded firmly into place. If your milling machine is big enough (and it doesn't have to be colossal) then the inside of this curved top can be machined to match the required smokebox diameter. A carbide-tipped fly-cutter does the job, for I don't think any of you will actually own a side-and-face cutter just $10^{5}/16$in. dia., nor for that matter a sufficiently large machine to handle such a 'beastie'.

Narrow-gauge couplings are many and varied, only a few use buffers and couplings of the 'main-line' type. The Tal-y-llyn is such a one, others may come to mind (the Corris?). However, for many miniature railways, a system is used of one central coupling with a flat link between each pair of vehicles. Many use a casting, attached to its vehicle by a $^{1}/2$in. square bar through the buffer plates, with fairly hefty springs, one each side of said buffer plate so that springing flexibility operates in both directions.

Now Larry Barker, a brilliant local model engineer, built the locomotive that actually started me off on this particular design. I have shown one or two pictures of his locomotive, a very fine piece of work. He has a somewhat more sophisticated central buffer, and any credit for this design must go to him, not me. I have merely put it down on paper and the drawing shows this type of buffer.

Making a pair 'head-to-head' offers certain advantages when the stock material won't go through your lathe headstock. The shanks are easily machined this way, drilling and tapping too is a proverbial 'doddle'. I used a self-generating jig on the lathe to turn the front spherical; this works for any radius; it is just a matter of filing a flat piece of steel to make the guide. It works for smokebox doors too, very useful indeed when we get to doors 8in. or more in diameter and 10in. spherical radius.





The central slot looks quite tricky, but using a 5/16in. dia. long series end mill and taking cuts about 1/8in. at a time will do the trick. The cross-drilled hole for the pin needs no explanation, and the choice is yours whether to keep the buffer head plain, attached by the 1/2in. square bar or attached to a square back-plate so that it can be bolted onto the buffer plate by four bolts.

Pistons and valves

Having (I hope) got smooth honed bores (preferably to exact size) we come to a matter hardly less important – pistons. They present very little problem, and even if you do make a mess of the job first time, they are not too expensive to re-make.

Oddly enough, there is no desperate need to make them a 'perfect' fit in the bore. Dear old Curly recommended a 'cold' clearance of 0.001in. for his size ('0' gauge to 3 1/2in. gauge were all he made. This is not a criticism, but a statement of fact.) I don't think he ever used rings, but I may be wrong here.

With the advent of Clupet piston rings, things are rather different. These rings are rather like key rings, a double circlet of heat-treated cast iron. Finished dead to size, they spring open slightly to press gently against the cylinder bore. For purchasing these direct, contact: -

Clupet Piston Ring & Gauge Company,
Factory B
Solway Industrial Estate,
Maryport,
Cumbria, CA15 8NA
Tel: 01900 818361
Contact: Alan Smith

I found them very kind and helpful people. He/they willingly provide tolerance details.

To make the main part of the pistons, the easiest way is from a piece of continuous-cast iron; this is of good quality. A pair of cast piston blanks is equally good; they should be cast with a fairly hefty spigot to grip in the chuck for turning. However, there is an easy-to-miss trick here, for both casting and spigot will be slightly tapered. So grip the large part in the chuck, and turn the spigot parallel. Carbide-tipped tools are just about essential, as are light cuts. Take my word for it, if you don't do this there is a very high risk of the spigot slipping in the chuck, you tell me how long it takes to reset!

If you have an appropriate-sized micrometer, then make good use of it. If you get the blank piston down to 2.505in. dia., this is the time to cut the grooves for the rings. As clean a groove as you can manage please.

Now dear old Curly recommended (as I wrote) a cold clearance of about 0.001in., which of course is right for soft packing and gunmetal cylinders. But with the modern piston rings, this can mean less diameter (or more clearance – take your pick). Also, since we are using cast iron, things are a little bit different. Recollect that the piston will get hot before the cylinder block; therefore it expands first. This could produce weird 'graunching' noises, quite alarming until you know what is causing them. I suggest anything up to 0.002in. clearance.

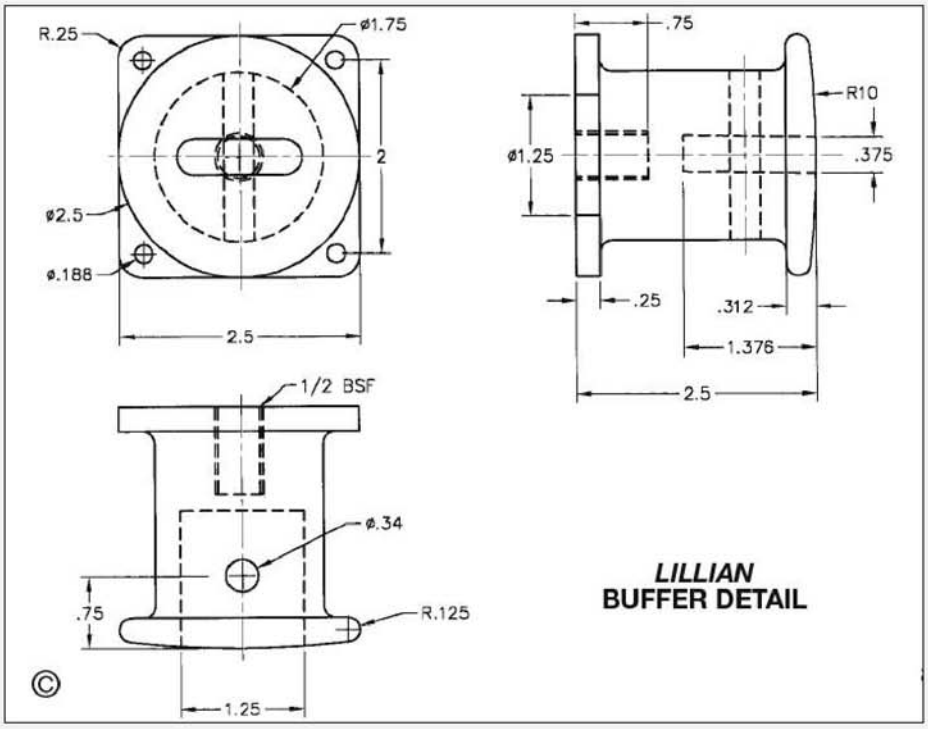
My second 10 1/4in. gauge 47xx was run in this way. The engine was jacked up so the wheels turned freely, the boiler was filled with water and an air compressor connected to the boiler; pressure being set so that the works turned over gently. The fire was lit with the engine's own blower going; as temperature rose a certain amount of steam mingled with the air and as cylinders heated up strange noises emerged there-from. Eventually as things inside settled down, they were quieter, and the eventual result was a sweet-running and very powerful locomotive.

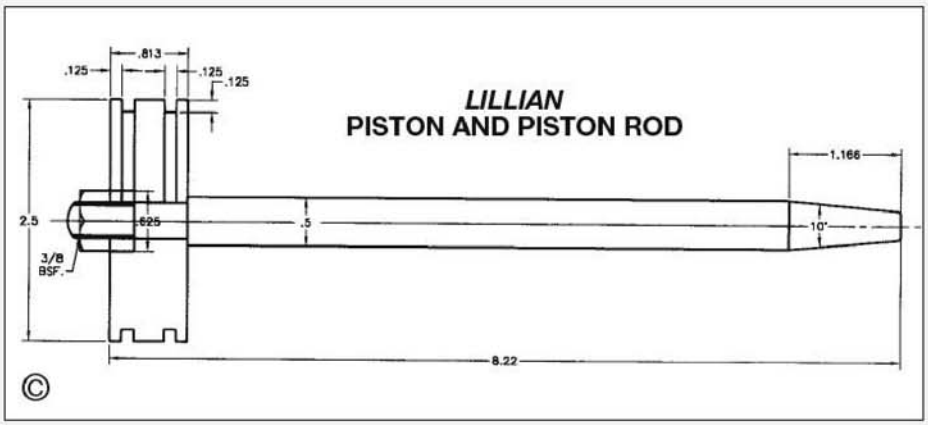
Note that the ring is definitely not a tight fit in the groove, for the sealing process depends on the side of the ring pressing against the side of the groove for sealing, as well as its light pressure on the cylinder bore. It follows that the rings will shift slightly relative to the piston – so what. There is one dicey problem with these rings, for it is difficult to remove them once assembled: but even this can be overcome, by working on both ends of the ring at once, for it is easy to break a ring on removal. It will twist as you try to remove it, jam, and snap. If both ends are prized up gently, most of the jamming is removed. A few domestic pins are a good investment, for on levering up one end gently a pin can be slid under it to keep it in place, followed by the same process at the other end. Once this is done, the ring can be twisted a little, enough to 'unscrew' it from its groove.

The only reason for removing a ring is that it is a fraction too large (or more likely your bore is about 0.001in. too small); this is rare but sometimes occurs. Recollect that a matter of only 0.001in. in diameter is enough, when things match up perfectly the piston will slide quite easily along the cylinder. If needful to adjust, then gentle use of a flat Swiss file on the ends of the ring will teach it manners.

The depth of the groove is not too critical, but as long as the ring does not 'bottom' when it is in its bore, all is well.

The mounting of the piston on its rod is worth a word or three. Full size, they were 'wrung' together in the sense of being fitted tightly on a taper, with plenty of 'beef' used to tighten the nut on the end. The assembly had to ring like one solid item when assembled. On the Southern at least, the nut's tightness was aided by a weld. For,





lookyou, if the piston does come loose it can be goodbye to the front cylinder cover as the piston slams into it. In our case, a piston weighing just a bit less than 1lb mass has an acceleration of - wait for it - 42g approx. at 85% full pressure. That is, 42 times that due to gravity. Assuming that the piston stops very suddenly at the front cover, in fact in about 0.01in., further calculations show that this produces a shock force of some 21 tons. Phew! (Wipes sweating brow). Any questions?

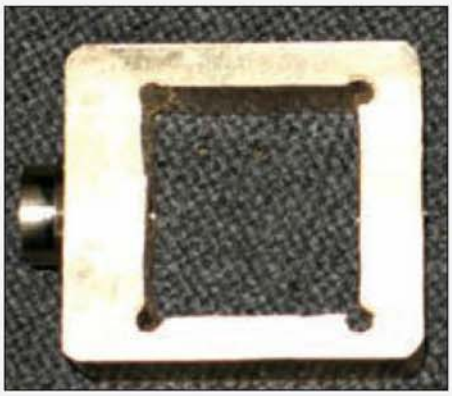
It is important that the piston and rod are concentric, although with the 'floating' gland this is less critical there should be no avoidable eccentricity. A collet chuck is probably the most accurate way, although if your 3-jaw is true then this will do. Alternatively, use the 4-jaw and adjust until the rod is dead true, preferably with a dial-test. Take light cuts, preferably with a carbide tool with a little radius at the cutting edge; use a fine feed and watch the swarf come off as fine dust.

A final treatment with fine emery/carborundum paper ('wet or dry') is suggested, roughly equivalent to lapping. It can gently remove the last 0.0001 inch.

The method of fixings that I find useful is to ream the piston bore, and turn down one end of the rod to this same diameter. Thread the end 3/8in. BSF, or any convenient fairly coarse thread (screw-cutting strongly recommended on account of its greater concentricity). A brass nut is made to the same thread and screwed as tightly as you can onto the rod and into the piston. Piston inside, rod, and thread being generously washed (acetone) and anointed with Loctite 601 first. After setting, the front of the assembly is turned flush with the piston. If you ever need to get it off, it's easier to drill out the rod and fit a new one.

Tip: grip the rod fairly tightly, for if it slips in the chuck it will damage the rod far more than a tight grip will do – I've had some! But first, get the rod to correct length.

It will be clear that the exact length of the rod is critical. To get this right, turn the taper on the rear end of the rod (where it fits into the crosshead). With 't'works' assembled, i.e. guidebars, cylinders mounted firmly onto frames, driving wheels assembled and in their horns, connecting rods assembled in crosshead and onto driving crankpin, mount a small collar on the rod, after threading the rod through the rear cover. The collar should a good fit, a small set-bolt being put through it to assist location. If put onto the rod (plus a washer about 0.03in. thick) where it sticks out through the front end (on front centre) and pushed in, then when the motion is rotated to back dead centre, it follows that the collar will mark the rear end of the parallel shoulder on the piston rod. As a check, put another washer onto the rod and re-try gently, it should come to a dead-end stop just before back dead centre. In view of the fact that the rod will certainly pull out of the crosshead, put the taper pin through the lot, if it is not bashed in too tightly it will come out easily enough. Note that is put in at 45deg. so that gravity can help it to stay put. Eventually, on final assembly, bash it in good and hard. That will teach it manners. Incidentally, if you want to fit more than one pin, fit one only for the present, do not on any account fit them in pairs at the same time, for great accuracy is required for a pair of pins. Fitting one pin firmly, then drilling and reaming for the second pin can easily achieve this accuracy. If you are really worried about these pins working loose (possible, although it is usually one hell of a job to get them out when you need to!) then you could always shove a split cotter through it below the crosshead, or thread it and bonding on a nut.



A valve buckle in the process of being machined from a solid piece of brass.

Valves and buckles

There are several ways of driving the valves. One would be to screw the rods directly into the valve itself. Not recommended. The valve must be free to move towards the port face, or it won't seal.

A deep groove on the back of the valve (in our case, the top) can hold a block that is screwed onto the valve rod and is easily adjusted, however with constant oscillating movements the thread can work loose, when it does so wear and tear is greatly and rapidly increased.

The valve design of Romulus avoids this by having two nuts that can be tightened onto the cross-member. These nuts are trapped by the valve block and, being hexagon, they cannot unscrew themselves. Excellent.

In our case, a buckle is used of brass or gunmetal. I chewed mine out of a slab of brass, but no doubt a casting will be available as it will be for the valve itself.

By filing or milling, the buckle must be a snug fit on the valve, not tightly but with no play. It is not too difficult, but a useful tip is to keep the corners of the valve (where it fits the buckle) rounded off, for it is easier to do this than to get the inside corners of the buckle dead square. The rod is screwed tightly into the buckle, preferably will some Loctite 532 (thread sealant) to maintain its location. The outer end of the rod is locked into its fitting with a nut, hence it is fairly easy to adjust and then lock. Tip: when machining the inside of an object (such as the inside of the buckle, valve cavity) it is decidedly best to feed a light cut with the cutter's rotation instead of the safer way of against the cutter. Reason: when coming to an inside corner in the "safe" way, the cutter will be forced sideways into the face that you have just milled. Not so bad with the buckle, but disastrous with the exhaust cavity in valve and in port face.

'Climb' milling – I think the term speaks for itself – is normally dangerous, for the cutter tends to pull the job into the cut. This can be deadly. 'Posh' machines can be fitted with devices that virtually eliminates backlash, which is of course the source of the trouble. In cases where climb milling is unavoidable, it is possible to nullify much of this by tightening up the slide locks. Naughty, but needs must etc. It is a surprising fact that climb milling uses much less power than the usual 'safe' way. Many years ago now, I inadvertently did a bad climb-milling job, for I switched on the motor before ensuring that the nut was fastened on the traverse screw. Result – a 3/8in. dia. end mill snapped clean off and the bit cut a sweet little groove (?) across my right eyeball. Smack across the vision centre – if you get my meaning. With the aid of a neighbour, I had to drive 25 miles to the eye-hospital. Easy enough on empty Devon roads, for seeing two roads ahead (split vision) I only needed to follow the left-hand one, no trouble ensued. The hospital asked me to produce the bit of steel that had done it; but when I took it in a couple of weeks later they were a bit nonplussed, for they had not expected the cutting portion of a 3/8in. dia. end-mill! Recovery was quick and perfect.

Reason for superiority of climb milling: as the cutter touches the job in normal milling it starts by distorting the blade, which tends to slide along the cut until the pressure builds up far enough to force the start of the actual cut. In the other case, the blade hits the cut at a much steeper angle and therefore starts the actual cut sooner. The result is less power absorbed, and normally a better finish.

So, if you have a smallish mill, do the brutal work by the usual method (careful to avoid the corner dig-ins mentioned above) and take off the last few thou. the climb way.

The face of the valve must be dead flat. Probably the easiest way is to grip it in the 4-jaw chuck and make the final facing cut with fine feed and a rounded tool. Finish by rubbing on a piece of fine emery or carborundum paper resting on a dead flat surface – your plane table is ideal. If a figure-of-eight motion is employed it will be advantageous, but try not to tilt the valve or you will end up with a somewhat convex surface – not too useful.

If you have set out the ports and the valve length and cavity correctly, not much further work should be needed when we come to setting the valves and gear generally.

Corrected drawings

In view of the fact that we are actually making a pair of these puffers, it follows that errors are likely to surface from time to time. Also, bearing in mind that once published, errors cannot be directly corrected, it is always possible that builders may not notice later corrections in subsequent issues.

Therefore, anyone who is actually building Lillian is invited to contact me. I will then send corrected drawings on receipt of S.A.E., or if you use e-mail, drawings can be sent freely. AutoCAD is preferred, but there are other systems, such as dxf etc. as long as I know which system is required. **keithgwrloco@blueyonder.co.uk** will meet the case nicely.

For those who are interested in the Echills Wood Railway, there is a light at the end of the proverbial tunnel. Reference to the website:- **www.ewr.org.uk** is recommended. The website has been modernised a lot now and no longer shews pictures of the old railway but gives information on the new. Marvellous picture at bottom of the site - modest blush. As soon as I can, further information will be to hand and I will pass it on.

● *To be continued.*

CLUB CHAT
With Malcolm Stride

UK News

Contractors are now busy at the **Ascot Locomotive Society** site building the replacement locomotive shed/rest room and workshop/carriage shed. At the time of writing Secretary Derek Alford reports that they are half way through the work the result of which will replace the facilities lost during the race course redevelopment. In addition to this the society members have laid on a water supply to various points and laid ducting ready for the electricity supply. Future development will be carried out by several teams working in parallel with each other to ensure the fastest possible completion of the various projects.

Bedford MES has welcomed some new members into the fold who will, no doubt, soon be getting involved in the society activities. The Chairman reports that over Easter visitors to the site were entertained by a full-size steam roller levelling the farm track beside the railway. He comments that this road now has a surface which is arguably better than many of the major roads in the area. I am sure that a similar sentiment will be echoed by many readers. Attendance at the formal meetings has increased since the change of location to a local village hall. Member Ray Sweeting is looking for a copy of the book *Garratt Locomotives of the World*. I have searched the internet and found that it was written by A. E. Durrant (Publishers - David & Charles, 1981, ISBN 0-7153-7641-1) and is available from several of the specialist railway book sellers. What a mine of information this column is! Good progress is being made on the improvements to the ground level 'Summerfield Railway' with the Wednesday Gang having built and laid over 60 track panels resulting in the double track reaching 'Badgers Holt'. Netting has been spread alongside the track in an attempt to discourage vandals of the cuddly furry variety (rabbits!) from covering the track with their excavations. Can I suggest that some pies might be in order! Those attending the LBSC Bowl competition will have an opportunity to see the new facilities later in the year. A revised set of operating rules is being drawn up for the raised track 'Winterfields Railway' because it is felt that those used for the ground level operations cannot be applied in total to the raised track. Following a successful trial the society have decided to sell items left over from club sales on the internet auction site e-bay.

Members of **Bournemouth DSME** exhibited at the Salisbury Model Engineering Exhibition in March, *"a small band of members set up on the Friday afternoon, with a good selection of models that more than covered the allocated space"*. So much space in fact that the organisers shuffled another society along to make more room! The star exhibit was Gordon Miles' automata, in which a carpenter planed a piece of wood when the handle was turned. Editor Richard Harvey's clock was *"tied to the wall"* and he reports that it amused *"the people who noticed that it only rarely showed the correct time"*. The club have been awarded a grant under the 'Awards for All Scheme' which will be used to finance a station building. A volunteer is being sought to make a body for the new club battery locomotive.

Members of **Chichester DSME** have also been busy at exhibitions, taking their roundhouse and a full compliment of $3^1/2$in. gauge locomotives together with several hot air engines. The Chairman reports that *"Bob Stenning and co. have started on a much needed extension to the carriage shed"*. Modifications are also being made to the riding trolleys to prevent rubbing on the anti-tip rail. The society website is at **www.cdsme.co.uk**

Frimley and Ascot Locomotive Club made the Easter Monday public running session a charity run on behalf of the Mayor's chosen charity and the Mayor, Councillor Paul Illnicki, was pleased to receive a substantial cheque at the April running session. A number of options for the long-term future of the signalling system have been detailed in a report by Richard Cant and are being considered by the committee. The *Hudson* overhaul is complete and the locomotive now has a much more substantial chassis and the bearings, gears and chains have been replaced. The class 08 shunter is in the process of having the electrics fitted and a trial run has taken place which proved successful with the locomotive responding well to the controls and running at just the right speed.

For those of you who have trouble keeping the fire going and steam up in the larger scales spare a thought for those members of the **Gauge '1' Model railway Association** who use coal firing. In the latest newsletter Markus Neeser describes his experiences with his Gauge '1' Ivatt 'Atlantic'. Markus has now got things sorted out because he has achieved a run of $2^3/4$ hours which achievement will embarrass some large scale drivers that I know. Markus mentions that he had lots of support from members of the Association which demonstrates one of the many advantages of joining a club.

At the time of writing this, members of **Guildford MES** are

CLUB DIARY

A minimum of 6 weeks notice is required for diary entries. Clubs and Societies are asked to include a telephone number for the assistance of would-be visitors.

JULY

9 **Amnerfield Miniature Railway.** *Visitors Day, all types of loco. 5in & $7^1/4$in.* Contact David Jerome: 0118-9700274.

9/10 **British Columbia SME.** *Annual Meet.* Contact Sean Laurence: (604) 931-1547.

9/10 **East Herts MR.** *Celebration of Garden Railways.* Contact: I. Dinnes: 0208-292-2997.

9 **Cardiff MES.** *Lord Mayor's Charity Day.* Contact Trevor Jenkins: 029-2075-5568.

9 **Erewash Valley MES.** *Barbecue & Raffle.* Contact Jim Matthews: 01332-705259.

9 **High Wycombe MEC.** *SARSPA, Steam-Up for South African Railways/African livesteam locos.* Contact Eric Stevens: 01494-438761.

9/10 **Hull DSME.** *Annual Steam Weekend.* Contact Tony Finn: 01482-898434.

10 **Bristol SMEE.** *Public Running.* Contact Trevor Chambers: 0145-441-5085.

10 **Canterbury DMES (UK).** *Public Running Day.* Contact Mrs P. Barker: 01227-273357.

10 **Cardiff MES.** *Chernobyl Children's Visit.* Contact Trevor Jenkins: 029-2075-5568.

10 **Harlington LS.** *Public Running.* Contact Peter Tarrant: 01895-851168.

10 **Leeds SMEE.** *Running Day.* Contact Colin Abrey: 01132-649630.

10 **Plymouth MSLS.** *Members' Day.* Contact John Brooker: 01752-671722.

10 **Sutton MEC.** *Track Day.* Contact Bob Wood: 0208-641-6258.

10 **York City & DSME.** *Running Day & Barbecue.* Contact Pat Martindale: 01262-676291.

11 **Bedford MES.** *Bangers & Mash Night.* Contact Ted Jolliffe: 01234-327791.

11 **Frimley & Ascot LC.** *Meeting.* Contact Bob Dowman: 01252-835042.

11/12 **Harrow & Wembley SME.** *Open Weekend.* Contact Dr. Roger Greenwood: 020-8427-2755.

11 **Saffron Walden DSME.** *Club Night.* Contact Jack Setterfield: 01843-596822.

12 **Dockland & E. London MES.** *Meeting.* Contact P. M. Jonas: 01708-228510.

12 **Northampton SME.** *Running Night.* Contact Pete Jarman: 01234-708501 (eve).

12 **Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797-362295.

13 **Brighton & Hove SMLE.** *Wrinklies Running Day.* Contact Mick Funnell: 01323-892042.

13 **High Wycombe MEC.** *Evening at Track.* Contact Eric Stevens: 01494-438761.

13 **Norwich DSME.** *AGM.* Contact Paul Reed: 01603-462925.

13 **St. Albans DMES.** *Cdr. LeQuelnec: HMS Belfast.* Contact Roy Verden: 01923-220590.

14 **N. W. Leicester SME.** *Ploughman's Supper.* Contact John Elliott: 01455-847040.

14 **Sutton MEC.** *New Drivers Run.* Contact Bob Wood: 0208-641-6258.

14 **Worthing DSME.** *Second Summer Steam-Up.* Contact Bob Phillips: 01903-243018.

15 **Canvey R&MEC.** *Shunting Competition.* Contact Brian Baker: 01702-512752.

15 **Romford MEC.** *Track Maintenance.* Contact Colin Hunt: 01708-709302.

16 **Brighton & Hove SMLE.** *Fun Run for Members.* Contact Mick Funnell: 01323-892042.

16 **Cardiff MES.** *Steam-Up and Family Day.* Contact Trevor Jenkins: 029-2075-5568.

16/17 **Furness MRC.** *Tram Sunday, Fleetwood & North Fylde MRC.* Contact Fred Firth: 01229-821192 or Colin Burns 01229 837079.

16/17 **Guildford MES.** *The 38th Model Steam Rally & Exhibition.* Contact Dave Longhurst: 01428-605424.

16/17 **Guild of Model Wheelwrights.** *Much Marcle Steam Rally, Herefordshire.* Contact Biddy Hepper: 01492-623274.

16 **Gravesend MMES.** *Open Day with evening barbecue.* Contact John Gibbs: 01622-880652.

16/17 **Model Expo 2005**, National Exhibition Centre, Birmingham. 9.30am-6.30pm (5.30pm Sunday 11th) Information 0121-767-2117.

16 **Romford MEC.** *Track Afternoon.* Contact Colin Hunt: 01708-709302.

16 **Romney Marsh MES.** *Saturday Track Meeting.* Contact John Wimble: 01797-362295.

busy preparing for their 38th Model Steam Rally and Exhibition which is will be held on 16/17 July this year at the society's Stoke Park site. The 'Thursday Gang' were galvanised into action in March by some spring weather and have made good progress with the outstanding jobs awaiting completion in the steaming bays. These include a retaining wall round the ground level turntable and a new coal store.

A lot of activity has taken place at the club house of **High Wycombe MEC** with the club house being repainted, cleared out and new kitchen units fitted. New guttering and relocation of the large water tank from the far shed has improved the water supply and stopped water getting into the building.

Leeds SMEE is holding its rally this year on 6/7 August at the Eggborough Power Station site. Further details can be obtained from Colin Abrey, tel: 0113-2649630, or e-mail colin.abrey@ntlworld.com You can also visit the club website at **http://homepage.ntlworld.com/colin.abrey/LEEDS.htm** The electrical system in the club house has had a major refurbishment with new consumer units fitted and the loads redistributed to give a more balanced load on each circuit.

At the time of writing members of **Northampton SME** are busy preparing for IMLEC which will have taken place by the time you read this. A sub-committee has been set up to consider the direction that future site developments should take. The idea is to develop a plan which defines where the club should aim for over the next ten years. A questionnaire seeking members views has been sent out with the newsletter. This sounds like a very good idea which will help to ensure that everyone pulls in the same direction.

The **Northern Association of Model Engineers** is celebrating its Diamond Jubilee this year. As they say: "*Sixty years of continuous service to the King of Hobbies is something worth celebrating*". Looking at the calendar, various celebrations are planned at several clubs during the year. Can we extend our congratulations to all involved and express our thanks on behalf of all model engineers to those who have contributed to the success of the association's efforts over the years. The association has a new website at **www.normodeng.org.uk** which was set up by member Paul Masters. The newsletter carries a report on the development of two microprocessor controlled dynamometer cars by Garth Porter and Carl Bailey from **Northampton SME**. The cars are in the form of well wagons and the use of microprocessors enables the provision of extra facilities not seen on mechanical cars. The cars will also cope with a wide range of tractive efforts from small 3½in. gauge locomotives up to a 5in. narrow gauge locomotives.

The *Flywheel*, journal of the **Northern Mill Engine Society**, carries a very informative article on Pollit & Wigzell slide valve engines built in the latter half of the 19th century. The remaining society steaming days for this year are 28/29 August and 10/11 September.

Ian Brown has retired as organiser of the winter talks at **Reading SME** and in recognition of his efforts over the past few years was presented with a parcel of '0' gauge track for use on his garden railway. As a recipient of Ian's efforts I can confirm that he provided a very varied and interesting programme for the members during his tenure of the post. Tony Giles is taking on the role in Ian's place.

Alex Gray of the **Scottish Model Engineering Trust** describes the construction of a 1895 Otto Deutz inverted vertical gas engine. This is to be a companion to his Red Wing and Gardner engines. The Otto engines were very popular in industrial applications in the 19th and early 20th centuries.

The journal of the **Society of Model & Experimental Engineers** carries a photograph of the 'Polly' oscillating engine and boiler which is to be the subject of the society's new model engineering course which is currently under development. Member Michiel Kapp describes his development of a computer controlled rotary table. The program on the computer allows for extra functions including the ability to automatically advance to the next position. This could be controlled by a detector on the machine which triggered the table indexing when the quill was retracted to its highest position.

A council contractor turned up at the track site of **Wigan DSME** to prepare the car park area but *"he was only equipped with a 'Bobcat' and did little more than scratch the surface"*. This was nowhere near the high standards set by the club ▶

In Memoriam

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

Count Antonio Giansanti-Coluzzi	*Gauge '1' Model Railway Association*
Roy Killinger	*Wigan DMES*
Stan Rains	*Hutt Valley MES*

16	**West Riding SLS.** *Freedom House Fun Day.* Contact David Batty: 01924-363908.
16	**York City & DSME.** *Informal club discussion.* Contact Pat Martindale: 01262-676291.
17	**Bedford MES.** *Public Running.* Contact Ted Jolliffe: 01234-327791.
17	**N. W. Leicester SME.** *Public Running.* Contact John Elliott: 01455-847040.
17	**Oxford (City of) SME.** *Public Running.* Contact Chris Kelland: 01235-770836.
17	**Plymouth MSLS.** *Public Running.* Contact John Brooker: 01752-671722.
17	**Rugby MES.** *Public Running.* Contact David Eadon: 01788-576956.
17	**Saffron Walden DSME.** *Running Day (public running after 2pm).* Contact Jack Setterfield: 01843-596822.
17	**St. Albans DMES.** *Club Running.* Contact Roy Verden: 01923-220590.
17	**Taunton ME.** *Public Running.* Contact Don Martin: 01460-63162.
17	**Wimborne DSME.** *Public Running.* Contact Eric Basire: 01202-897158.
18	**Peterborough SME.** *Bits & Pieces.* Contact Tony Meek: 01778-345142.
19	**Chesterfield MES.** *T. Wood: Talk.* Contact Mike Rhodes: 01623-648676.
19	**Erewash Valley MES.** *Steaming Evening.* Contact Jim Matthews: 01332-705259.
19	**Nottingham SMEE.** *Geoff Hennell: Visit to the JCB factory.* Contact Graham Davenport: 0115-8496703.
19	**Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797-362295.
19	**South Durham SME.** *Afternoon Steam-Up.* Contact B. Owens: 01325-721503.
20	**Bournemouth DSME.** *AGM.* Contact Dave Fynn: 01202-474599.
20	**Hull DSME.** *Shep, Watson & Wilson Comp. Trophy.* Contact Tony Finn: 01482-898434.
20	**Leeds SMEE.** *Invitation Running Day & Barbecue.* Contact Colin Abrey: 01132-649630.
20	**West Riding SLS.** *Visit to Leeds Club.* Contact David Batty: 01924-363908.
20	**West Wiltshire SME.** *Steam-Up.* Contact R. Nev. Boulton: 01380-828101.
21	**Isle of Wight MES.** *Bits & Pieces.* Contact Ken Stratton: 01983-531384.
21	**Leyland SME.** *Discussion Night on Valves.* Contact A. P. Bibby: 01254-812049.
21	**North London SME.** *Barbecue at Colney Heath.* Contact David Harris: 01707-326518.
21	**North Norfolk MEC.** *Track Evening.* Contact Gordon Ford: 01263-512350.
21	**Sutton MEC.** *Derek Tidbury: A Signal Evening.* Contact Bob Wood: 0208-641-6258.
23	**Chesterfield MES.** *Running Day.* Contact Mike Rhodes: 01623-648676.
23	**Leyland SME.** *Members' & Guests afternoon driving session.* Contact A. P. Bibby: 01254-812049.
23/24	**Claymills Pumping Engines.** *Non Steaming Open Days.* Contact B. Eastough: 01283-812501.
23/24	**Kew Bridge Steam Museum.** *Festival of Model Tramways.* Information: 020-8568-4757.
23/24	**Oxford (City of) SME.** *Dreaming Spires 2005.* Contact Chris Kelland: 01235-770836.
24	**Amnerfield Miniature Railway.** *Public Running.* Contact David Jerome: 0118-9700274.
24	**Bournemouth DSME.** *Charity Day Chrones & Colitis Association.* Contact Dave Fynn: 01202-474599.
24	**Bristol SMEE.** *Public Running.* Contact Trevor Chambers: 0145-441-5085.
24	**Cardiff MES.** *Open Day.* Contact Trevor Jenkins: 029-2075-5568.
24	**Frimley & Ascot LC.** *Club Running.* Contact Bob Dowman: 01252-835042.
24	**Guildford MES.** *Driver Training Day.* Contact Dave Longhurst: 01428-605424.
24	**Harlington LS.** *Public Running.* Contact Peter Tarrant: 01895-851168.
24	**Leicester SME.** *NAME Diamond Jubilee Celebration.* Contact Raymond Wallis: 0116-285-8824.
24	**Rugby MES.** *Visit to Kinver Society.* Contact David Eadon: 01788-576956.
24	**York City & DSME.** *Running Day.* Contact Pat Martindale: 01262-676291.
25	**Bedford MES.** *The Bubbly Bottle Challenge.* Contact Ted Jolliffe: 01234-327791.
26	**Romney Marsh MES.** *Public Running.* Contact John Wimble: 01797-362295.
28	**Sutton MEC.** *Evening Steam-Up.* Contact Bob Wood: 0208-641-6258.
28-31	**Canvey R&MEC.** *Open Days.* Contact Brian Baker: 01702-512752.
28	**Wimborne DSME.** *Club Barbecue.* Contact Eric Basire: 01202-897158.
28	**Worthing DSME.** *Neil Gough: Spare Time Restoration.* Contact Bob Phillips: 01903-243018.
29	**Chichester DSME.** *OGM.* Contact Brian Bird: 01243-536468.
30/31	**Furness MRC.** *Lytham Exhibition.* Contact Fred Firth: 01229-821192 or Colin Burns 01229 837079.
30	**Norwich DSME.** *Visit by Ipswich Society of Model Engineers.* Contact Paul Reed: 01603-462925.
30	**Romney Marsh MES.** *Public Running.* Contact John Wimble: 01797-362295.
31	**Bristol SMEE.** *Public Running.* Contact Trevor Chambers: 0145-441-5085.
31	**Chichester DSME.** *Steam on Sunday.* Contact Brian Bird: 01243-536468.
31	**Elmdon MES.** *Midland Reds.* Contact Chris Giles: 0121-458-1291.
31	**Guildford MES.** *Members' Running Day.* Contact Dave Longhurst: 01428-605424.
31	**High Wycombe MEC.** *Public Running.* Contact Eric Stevens: 01494-438761.
31	**Oxford (City of) SME.** *Public Running.* Contact Chris Kelland: 01235-770836.

and so the troops were organised and the area was dug out by the members to a suitable depth. As the Editor reports, "*Many hands make light work*" and the job was accomplished over four days. At the time of writing the members are waiting for the hardcore to arrive. Brian Douglas has been elected president following Vince McGeever's retirement after his allotted three years. George Howard gave a presentation on old tools at a recent meeting. George's talk was in the form of a quiz in which members tried to identify the tools and artefacts on display and George then explained the purpose of each. Items included an adze, a saddle maker's cramp, a strickle and a fleame (or phleam). Answers on a postcard please! At the March meeting Alan Maloney presented Chairman Geoff Buckley with a turned wooden gavel as a replacement for the Swiss knife that was the usual means of bringing the meetings to order (by rapping it on the table!).

The porticos and doors for the rolling stock tunnels have been installed ready for the running season at **Wimborne DSME** and members then turned their efforts towards repairing the bridge of which "*many parts were rotting away*". The repairs were completed in a *"burst of activity over a couple of days"*. The society celebrates its 30th anniversary this year although a date has yet to be set. There is an excellent club website at **www.wdsme.co.uk**

Worthing DSME has a new newsletter Editor in the person of Lorna Trickey who has taken over from Jim Alderman who has 'retired' after 12 years wielding the quill pen. We welcome Lorna to the fold and I look forward to reporting her efforts in this column. The annual club dinner was attended by 48 members and partners who had a pleasant evening with excellent food and service. At the AGM Andrew Breese was elected as engineering representative and has already been busy organising repairs to the riding cars and other items.

York City DMES is examining proposals for changes to the ground level track layout and signalling system. The signalling system will use electronic interlocking and *"a signal box with a suitably trained signalman/woman would replace the track marshal."* As a way of maintaining the woodland ecology of the area, member Brian Wardman has made and erected 32 bird boxes around the site. The front of the boxes has been made of oak following previous experience when the vandals (woodpeckers) enlarged the hole in the front of previous boxes. The newsletter reports that the boxes are all numbered and suggests that this may be so *"that birds visiting from afar can book their favourite box in advance."*

World News

New Zealand

The recent exhibition weekend held by **Auckland SME** was a great success with several locomotives in steam (and volts!) running for passengers on the Sunday and a good number of members attending the Saturday Club Day. The society is to stop passengers riding with bare feet as this is felt to be dangerous and will have a sign made advising of the need for suitable footwear to be worn. At the 'Bits and Pieces' evening, members had a selection of items including the front wheel rims for Bill Parker's 1:3 scale traction engine, The valve and liner for Hugh Martin's GWR 2-6-2, Mike Jack's chassis and bogies for a 5in. gauge passenger carriage and Trevor Taylor's *Ajax* which he is rebuilding.

At a recent meeting of the **Hutt Valley MES** member Peter Brown described his experiences with gas turbine powered model aircraft. Peter quoted a description of a model jet as "*a good way of turning kerosene into noise*".

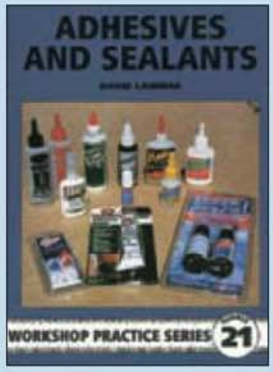
Maidstone MES (NZ) has had several successful working days and has made good progress with repairs to the track and other facilities. The society has decided to use and continue to maintain only four of its raised track riding trucks. The others will be stored or cannibalised to provide spares.

South Africa

The working parties at **Durban SME** have accomplished several tasks recently including completion of the steaming bay plumbing, fencing repairs, levelling and coach wheel maintenance. An assessment of the state of trees round the site is to be carried out following the damage caused when a Casuarina tree broke and fell onto the fence. As the newsletter comments *"the combination of high winds and the public attendance is a worrying combination"*. The newsletter carries an article exploring the use of 'quantum entanglement' as a means of teleportation. Is this a way round health and safety problems because if passengers can be teleported round the track they will arrive at the other end but won't remember anything of the trip and thus can't complain of sparks, derailments or any of the other things that cause potential problems.

information information information

BUY ANY TWO OF THESE WORKSHOP PRACTICE BOOKS AND CHOOSE A THIRD FREE



WPS 21

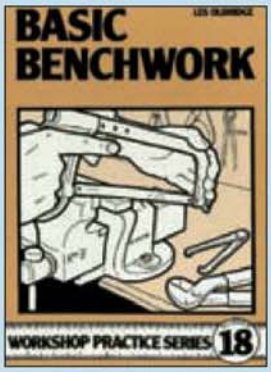
ADHESIVES & SEALANTS

David Lammas

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

144 PAGES
ILLUSTRATED PAPERBACK

ISBN 1-85486-048-8 *£6.95*



WPS 18

BASIC BENCHWORK

Les Oldridge

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

128 PAGES
ILLUSTRATED PAPERBACK

ISBN 0-85242-920-7 *£6.95*

WPS 10

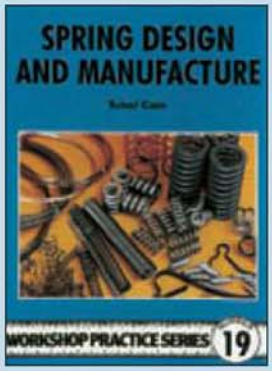
SAWS & SAWING

Ian Bradley

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

96 PAGES
ILLUSTRATED PAPERBACK

ISBN 0-85242-887-1 *£5.95*



WPS 19

SPRING DESIGN & MANUFACTURE

Tubal Cain

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

96 PAGES
ILLUSTRATED PAPERBACK

ISBN 0-85242-925-8 *£6.95*

WPS 20

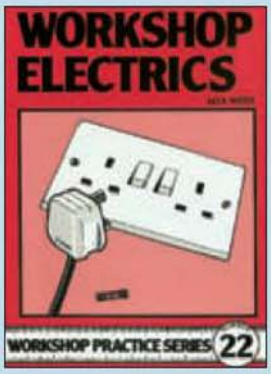
METALWORK & MACHINING HINTS & TIPS

Ian Bradley

A workshop information pot-pourri combining useful advice and instruction for beginners, with explanations of tools and techniques.

96 PAGES
ILLUSTRATED PAPERBACK

ISBN 0-85242-947-9 *£6.95*



WPS 22

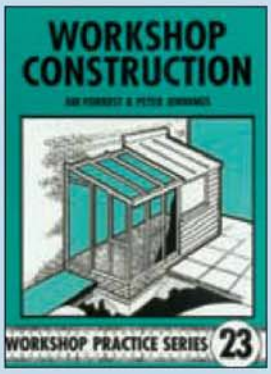
WORKSHOP ELECTRICS

Alex Weiss

This book deals with electricity in the garage or home workshop and includes everything from fitting a 13 Amp plug to wiring up a new workshop building. Starting with the planning necessary, the book then deals with fusing, equipment, lighting, fixtures, fittings and wiring for 240 volts mains electricity.

128 PAGES
ILLUSTRATED PAPERBACK

ISBN1-85486-107-7 *£6.95*



WPS 23

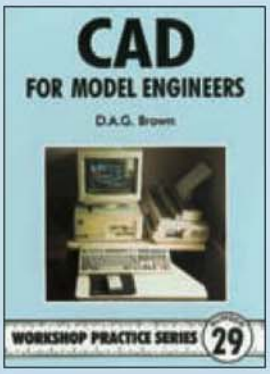
WORKSHOP CONSTRUCTION

Jim Forrest & Peter Jennings

A complete work on the construction methods used, this book contains the details for building the floor assembly, walls and roof and covers the peripheral areas including layout, planning regulations, tools, materials, cost savings, ideas, drainage, power supply lighting, heating, fitting out, security and insurance.

144 PAGES
ILLUSTRATED PAPERBACK

ISBN 1-85486-131-X *£6.95*



WPS 29

CAD FOR MODEL ENGINEERS

D.A.G.Brown

Derek Brown shows how by taking one step at a time the computer can soon be turned into a versatile drawing tool with many advantages over traditional drawing methods. In this book he seeks to strip away the mystique surrounding CAD by avoiding jargon and provides advice on how to choose and progress with the right system.

128 PAGES
ILLUSTRATED PAPERBACK

ISBN 1-85486-189-1 *£6.95*

WPS 32

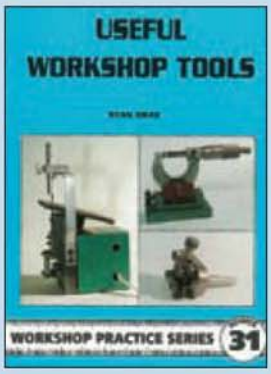
UNIMAT III LATHE ACCESSORIES

Bob Loader

An acknowledged authority on the popular Unimat mini-lathe, the author has developed numerous accessories for use with this machine. The projects in this book increase the scope of the machine and provide insights into the performance of a number of tricky operations.

160 PAGES
ILLUSTRATED PAPERBACK

ISBN 1-85486-213-8 *£6.95*



WPS 31

USEFUL WORKSHOP TOOLS

Stan Bray

A collection of fifteen invaluable additions to the model engineer's armoury of tools and equipment from the former editor of Model Engineer's Workshop. This practical collection covers benchwork, the lathe and milling operations.

104 PAGES
ILLUSTRATED PAPERBACK

ISBN 1-85486-194-8 *£6.95*

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

Send payment with your name, address and telephone number to:
Customer Services, HIGHBURY LEISURE Publishing Limited, Berwick House, 8-10 Knoll Rise, Orpington, Kent BR6 0PS.
Cheques made payable to Nexus Media Limited.

Telephone Customer Services on 01689 886660/886661.
Don't forget Valid From, Expiry Date and Issue Number details if you're paying by credit card.

MODEL ENGINEER

CLASSIFIED
Advertisements

Send to Model Engineer Classified Department, Highbury Leisure,
3rd Floor Berwick House, 8-10 Knoll Rise, Orpington, Kent BR6 0EL.
Fax: (01689) 886666, Email: trobertson@highburyleisure.co.uk
All advertisements will be inserted in the first available issue. There are no reimbursements for cancellations.
All advertisements must be pre-paid.
The Business Advertisements (Disclosure) Order 1977 – Requires all advertisements by people who sell goods in the course of business to make that fact clear. Consequently all trade ads in *Model Engineer* carry this 'T' symbol

MODELS AND MATERIALS

ALL MODEL STEAM ENGINES REQUIRED

Any gauge, any condition including static models, unfinished projects OR JUST PLAIN WORN OUT!
Also Stuart Turner, Bing Marklin, Traction Engines and Boats.
Even complete collections. Will call and pay cash. Distance no object!! Available 7 days a week

Tel: 01507 358808

PHOENIX PRECISION

The Railway Livery Specialists
for authentic colour paints and waterslide transfers
Monday - Friday 10 am - 4 pm
Except Exhibition Weekends
Send S.A.E. and 50p (stamps accepted) for a copy of our full catalogue to:-
PHOENIX PRECISION PAINTS LTD
P.O.Box 8238, CHELMSFORD Essex. CM1 7WY
e-mail: sales@phoenix-paints.co.uk Tel: (01245) 494050 website: www.phoenix-paints.co.uk

---

FYNE FORT FITTINGS
(Freshwater, IOW)
The Steam Fitting Specialists
Clarence Boatyard, East Cowes,
Isle of Wight, PO32 6EZ, UK
Tel: 01983 293633 Fax: 01983 297755
List still free send large SAE
and 3 1st class stamps
www.fynefort.co.uk

Myford

Enjoy a day with us at the
MYFORD OPEN HOUSE
Wednesday 26th October
to
Saturday 29th October 2005
0115 925 4222
or e-mail
sales@myford.com
for further details

PHOENIX LOCOMOTIVES LTD
Class 52 Western and
Class 50 Hoover in 5" gauge
Battery Electric
www.phoenixlocos.com
Phone 01704 546 957

SOCKET SCREWS
Cap. Csk. Button. Set (Grub). Shoulder
METRIC. BA. BSF. BSW. UNF. UNC
Hexagonal & Slotted Screws Nuts & Washers.
Dowel & Spring Pins. Dormer HSS Taps & Drills. Draper Tools.
NO MINIMUM ORDER **PROMPT SERVICE**
Send 4 x 1st class stamps for our latest catalogue
Special offer * * * * * **Workshop Discount Pack** * * * * *
30 different packets of socket, hex. and slotted screws
Pack 1. BA 8BA to 2BA.
Pack 2. Metric M2 to M6.
Catalogue value of pack is over £30.00
Either pack on offer to you
for only £24.95 + £2.95 p/p
Send for this offer and benefit from a very useful stock of screws in your workshop.
You will not be disappointed. Refund guaranteed.
Emkay Screw Supplies (ME)
74 Pepys Way Strood Rochester Kent ME2 3LL
Email: emkaysupplies@onetel.net
Tel: 01634 717256 www.emkaysupplies.co.uk *Mail Order Only*

BA FASTENERS IN BRASS STEEL & STAINLESS

SPLIT PINS, TAPER PINS,
ROLL PINS, TAPS, DIES,
DRILLS, NUTS WASHERS,
RIVETS, MATERIALS

Send Stamped addressed envelope plus two first class stamps for 28 Page List (Overseas £1.50) 'Quote Me'

"ITEMS" MAIL ORDER LTD,
46, ST. MARTINS ROAD, NORTH LEVERTON,
RETFORD NOTTINGHAMSHIRE DN22 0AU
Telephone 01427 884319 Fax 01427 884319

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

WANTED
HARRISON M300
MUST BE IN SUPER CONDITION
SHORT BED, DUAL DIALS
ALAN SKEGGS, **01582 792732**
(REDBOURN HERTFORDSHIRE)

Hobbymat HD65 lathe with integral BFE 65 milling machine for sale. Covers, tools, metal stand included. Extremely good condition. Little used. £300.

Tel: 0113 2673641 (Leeds)

The Miniature Railway Supply Co. Ltd

www.miniaturerailwaysupply.com

Phone / Fax
01442 214702

WANTED

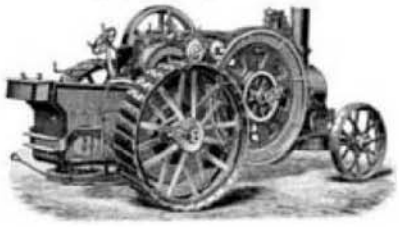
Wanted - all Loco Blueprints. Tel: 01983 293633 or Fax: 01983 297755. (T)

ATTENTION MODEL MAKERS

A wide selection of used workshop machinery Boxford, Viceroy, Colchester & Harrison Mills, drills and wood lathes.
BBC MACHINE TOOLS LTD
Carluke, Strathclyde, Scotland.
Tel: 01555 751121
Fax: 01555 751682

STATION ROAD STEAM

Good prices paid for live steam models in any condition, broken or part-built through to exhibition quality. Collections purchased. Locomotives, traction and stationary engines, bought, sold and part-exchanged



• Locomotives from gauge 1 to 10 1/4 inch •
• Miniature railway equipment, rolling stock etc •
• Traction engines from 3/4 inch to half full-size •
• Stationary engines from table-top models to full size, including designs by Stuart Turner, Westbury •
• Spirit, gas and coal-fired boilers in all sizes •
• All types of restoration projects & part-built models •

Fully serviced and tested locomotives and traction engines supplied with our renowned "no quibble" written warranty

Large range of items in stock, available for inspection and trial at our premises at any time, by appointment
Comprehensive workshop and test track facilities on site.
Advice, valuations and driving tuition freely given

World-wide mail-order service, goods supplied on 7 days approval, competitive shipping rates.

Fully illustrated and priced catalogue online at
www.stationroadsteam.com
Telephone Lincoln 01526 320012

COWELLS SMALL MACHINE TOOLS LTD
Tendring Road, Little Bentley, Colchester, Essex, CO7 8SH
Tel/Fax +44 (0) 1206 251792 E-mail sales@cowells.com
MANUFACTURERS OF PRECISION SCREW CUTTING LATHES, 8MM HOROLOGICAL COLLET LATHES AND MILLING MACHINES.
www.cowells.com

Winter Model Engineering tour to Koln/Sinsheim Exhibitions in Germany (rail coach air) for individuals or groups tel: 08700 113994 www.historyinharmony.com

4-6-0 Chassis and tender chassis, air running, 31/4" gauge, reasonable work - needs boiler, platework. £375 o.v.n.o. Tel: 01422 256969 (West Yorks).

Congreve rolling ball clock from J.Wilding plans. All parts professionally made, movement assembled, needs finishing, book included, offers. Tel: 01625 861728 (Cheshire)

Cowells lathe, well equipped, as new. £500 o.n.o. Also bench drill and double ended grinder. Tel: 01892 524681 (Kent)

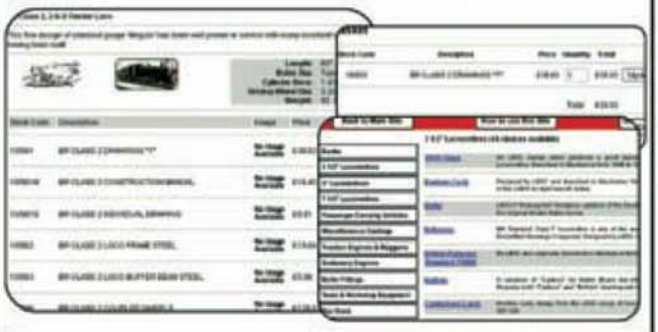
4" Foster Agricultural Steam Engine

Finished in 2002 with full boiler certification valid until April 2006. On rubber tyres, complete with driving seat and towing passenger trailer which is fitted with water tender and pump. Currently rallying around the country. £13,500.
Tel: 07740 880116
(Boston)

New Online Shop at www.ajreeves.com

REEVES MODEL ENGINEERS 2000

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



New, secure online ordering from Reeves 2000

Visit the Shop That's Got the Lot!

REEVES MODEL ENGINEERS 2000

**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-12.30pm Saturday

Full Boiler and Flanged Plate Service Available.

Competitive Prices and Prompt Delivery

Boiler Kits Despatched within 7 days!*

VISA MasterCard Switch

The World's Largest Stockists of Model Engineering Supplies

REEVES MODEL ENGINEERS 2000

Drawings and Castings Currently Available

31 Stationary Engines

including....
Centaur Gas Engine
Lady Stephanie Beam Engine
Mary Beam Engine
Nicholas Vertical Engine
Triple Expansion Marine Engine
Trojan Vertical Engine
Vulcan Beam Engine
Warrior 2 Vertical Engine....

52 'Up to 3½" Locomotives'

including....
0-4-0 Juliet Tank Loco
0-4-0 Tich Tank Loco
0-4-0 Hunslette Tank Loco
0-6-0 Rob Roy Caledonian Loco
2-6-2 Firefly G.W.R. Loco
0-8-0 Caribou Canadian International Loco
4-4-0 Virginia Early American Tender Loco
4-6-2 Britannia Class 7 BR Pacific Loco....

34 7¼" Locomotives

including....
0-4-0 Dolgoch Tank Loco
0-4-0 Elidir Tank Loco
0-4-0 Romulus Tank Loco
0-4-2 Tom Rolt Tank Loco
0-6-0 Holmside Tank Loco
0-6-0 Paddington Tank Loco
4-4-2 Lorna Doone Loco
4-6-0 King George V Loco....

13 Road Going Vehicles

including....
1" SC Minnie Convertible Engine
1.5" SC Allchin Traction Engine
1.5" SC Marshall Portable Engine
2" SC Clayton Waggon
2" SC Lincolnshire Lad Traction Engine
2" SC Thetford Town Traction Engine
3" SC Foden Waggon
4" SC Foden Timber Tractor....

62 5" Locomotives

including....
0-4-0 Ajax Tank Loco
0-4-0 Dolgoch Tank Loco
0-6-0 Jack Tank Loco
2-4-0 Asia "Europa" Class Loco
4-2-2 Stirling Single Tender Loco
4-4-0 Maid of Kent Tender Loco
4-4-0 Washington Tender Loco
4-6-0 King's Own Tender Loco....

Workshop Equipment

including....
Clock Depthing Tool
Geared Rotary & Indexing Table
George Thomas Tapping & Staking Tool
Lathe Backplates & Frontplates
Light Duty Compound Table
Reeves Sensitive Mini Drill
Sparey Tailstock Turret
Versatile Dividing Head....

For full product listings, please see our website

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

Reeves 2000
Appleby Hill
Austrey
Warks
CV9 3ER

9:00am-4.30pm Monday - Friday
9:00am-12.30pm Saturday

Tel: 01827 830894
Fax: 01827 830631

sales@ajreeves.com
http://www.ajreeves.com

25th 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

HOME AND WORKSHOP MACHINERY

QUALITY USED MACHINE TOOLS

144 Maidstone Road, Foots Cray, Sidcup, Kent, DA14 5HS.
Telephone 020-8300 9070 – Evenings 01959 532199 – Facsimile 020-8309 6311
www.homeandworkshop.co.uk stevehwm@btopenworld.com

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


£3950
Myford Super 7B precision (gearbox) screwcutting lathe + power crossfeed, cabinet stand, drip tray & blocks and rare Hardened Bed


£2250
Elliot powered suface grinder "as good as it looks"


A selection of tinmans stakes from £20 each


Special £145
Rapidor Manchester, just in off the truck


£1225
Taylor Hobson Model D engraver (single phase) lovely shape


£575
Brierley ZB25 drill grinder complete with cams and single phase motor


£40 each
Lockwood quad head 2MT and 3MT die sets, last few available


We have a good selection of bench vices from £12.50 including the Record No.23 at £75 each


£1225
BCA jig borer/milling/ drilling machine complete with collets & cabinet stand


£2250
Colchester Chipmaster 5" x 20", a very nice example with dual dials


£625
RJH 4" linisher complete on dust extractor cabinet


£375
Wellsaw 4" hacksaw (240 volts)


£499
Harrison M250 / late bantarn only capstan attachment as new


£345
Rishton buffer (The best buffer in its class)


£345
Rishton quality bench grinder


£3950 Now special £2950
Asquith 14-54 001 Mk.2 5MT radial drilling machine


A selection of lathe steadies we currently have from £30


£1650
Harrison milling machine complete with vertical 30 INT & powered table


£1225
Henry Mins 6 ½" x 48" geared head, gearbox and gap bed + tooling just in off the lorry


Choice £2950-£3450
Tom Senior 'E' Type vertical milling machine


£2450
Boxford 1130, 5 1/2" x 30"


£1250
Boxford CUD Mk III centre lathe 5" x 22" in very nice order


£2250
Ajax turret milling machine in very good order with powered table just in


£1725
Tom Senior M1 milling machine in very nice order


£2950
Colchester Student 1500rpm gap bed precision lathe complete with taper turning, 3 & 4 jaw chucks, full screwcutting gearbox



£3950
Harrison M250 lathe complete with 3 and 4 jaw chucks, extra gears, with the high 2000rpm top speed almost as new


£150 Each
Crompton Parkinson Motors NEW 3/4HP ideal for Myford & Boxfords etc.


£475
RJH Swordfish universal saw complete with dust extractor


£345
Flamefast DS130 ceramic chip force, 240 volts, natural gas


£645
Lorch precision lathe complete with collets


£345
Mikron 79 gear cutter


£425
Barber and Coleman (USA) gear cutter


£1400
Raglan 5"x24" lathe complete with gearbox, variable speed & power cross feed


£425
Houser multi spindle cutter


£345
Safag gear cutter

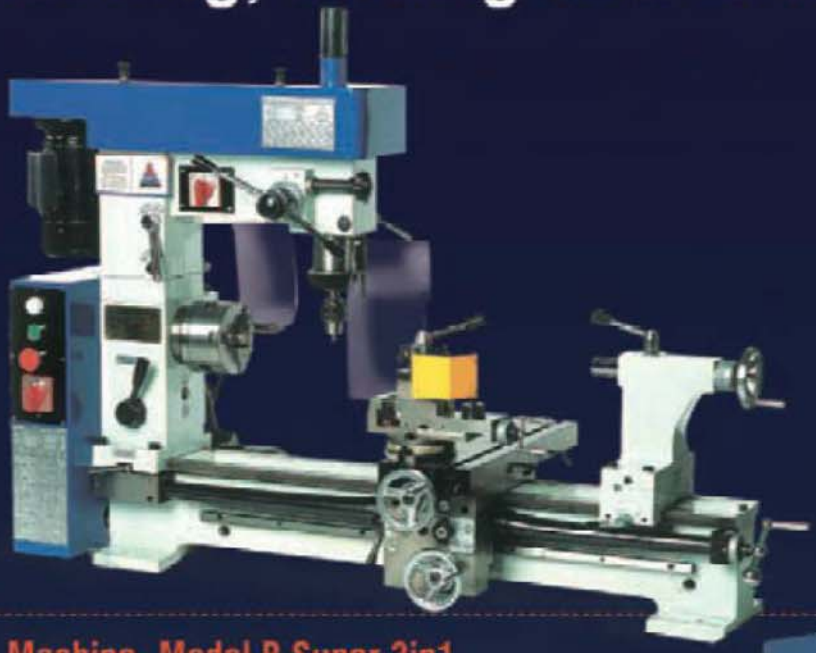
PLEASE PHONE 020 8300 9070 TO CHECK AVAILABILITY OR TO OBTAIN OUR LIST
DISTANCE NO PROBLEM!! DEFINITELY WORTH A VISIT ALL PRICES EXCLUSIVE OF V.A.T.

We also have a massive range of small tooling far too much to list!!

Just A Small Selection Of Our Current Stock Photographed!!

Chester UK Ltd

"Turning, Milling and Drilling in One!"



Centurion 3in1 Machining Centre Long Bed

Standard Accessories
125mm, 3-Jaw Chuck
1-13mm Drill Chuck & MT3 Arbor
Set of 5 Carbide Lathe Tools
Combined Vice/Compound Slide

Specifications

Centre Height	210mm
Distance Between Centres	800mm
Spindle Taper	MT4
Milling Table Size	475x160mm
Lathe Motor	¾ hp
Milling Power	¾ hp
Net Weight	300kgs
Dimensions	1570x480x955mm

Price: £1395.00 Inc VAT
Price includes delivery to UK mainland

Machine- Model B Super 3in1

Standard Accessories
3-Jaw Chuck
1 13mm Drill Chuck & Arbor
Dual Purpose Compound Slide/Machine Vice
Set of 5 Carbide Lathe Tools

Specifications

Centre Height	210mm
Distance Between Centres	520mm
Spindle Taper	MT3
Milling Table Size	300x150mm
Motor	¾ hp
Net Weight	155kg
Dimensions (HxWxL)	930x690x1090mm

Price: £645.00 Inc VAT
Price includes delivery to UK mainland

(shown with optional deluxe tray)

(shown with optional deluxe tray)

Centurion 3in1 Machining Centre Short Bed

Standard Accessories
125mm, 3-Jaw Chuck
1-13mm Drill Chuck & MT3 Arbor
10mm Lathe Tools
Combined Vice/Compound Slide

Specifications

Centre Height	210mm
Distance Between Centres	520mm
Spindle Taper	MT4
Milling Table Size	475x160mm
Lathe Motor	¾ hp
Milling Power	¾ hp
Net Weight	250kgs
Dimensions	1270x480x955mm

Price: £1100.00 Inc VAT
Price includes delivery to UK mainland

TEL NATIONAL: 01244 531631 | INTERNATIONAL: +44 (1244) 531631
FAX NATIONAL: 01244 531331 | INTERNATIONAL: +44 (1244) 531331
EMAIL sales@chesteruk.net **WEB** www.chesteruk.net
CHESTER UK LTD | CLWYD CLOSE | HAWARDEN INDUSTRIAL PARK | HAWARDEN | CHESTER | CH5 3PZ