MODEL ENGINEER

MODEL ENGINEERING IN COLOUR

GOOD BUILDING

GOOD READING

SOMETHING OF INTEREST FOR ALL

Vol. 189 No. 4180

18 - 31 October 2002 £2.20

CYGNET ROYAL

Building a 3-cylinder radial steam engine

AN ENGINEER'S DAY OUT

Lead, steam and water in the North Pennines

9 770026 732100 80>

HIGHBURY

THE MODEL ENGINEER EXHIBITION

29 - 31 DECEMBER 2002 AT SANDOWN PARK, ESHER, SURREY

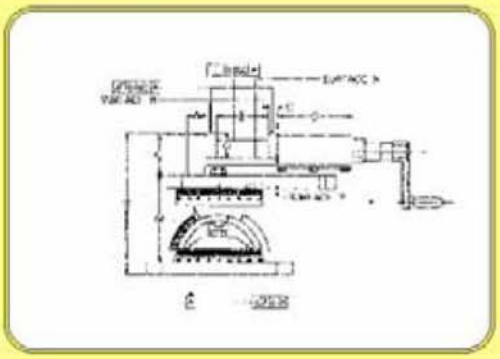
SEE US AT DONNINGTON & SANDOWN

CHRONOS LIMITED

ALL PRICES INCLUDE VAT + UK CARRIAGE

NEW!!

PRECISION 2" MODULAR MACHINE VICE



This new vice is made of close grained cast iron and is extremely versatile. The rotary base is adjustable through 360° and the tilting action moved 45° each side. The really unique feature about this unit is the fact that the vice assembly can be removed and replaced with a 4" x 5" slotted milling table (supplied as standard)!! Another great feature is that when removed the vice assembly can be used independently as a low profile (50mm high) milling vice as the base has useful mounting legs.

£115!!

H	L1	W1	H1	A	B	C	D	E	F	R
130	125	100	22	20	50	9	72	24	38	80

SET OF TUBE BENDING SPRINGS
1/16 - 3/32 - 1/8 - 5/32 - 3/16

CODE S0111 PRICE £3.95

105 PC POLISHING & GRINDING SET

TO SUIT MINICRAFT ETC
CODE PS200 PRICE £8.95

OPTICAL CENTREPUNCH

CODE OP270 PRICE £87.95

LITTLE HOGGER SET OF INDEXABLE ENDMILLS 3/4 DIA SHANK

Code	Price
LHS	£29.95

ALIGN POWER TABLE FEEDS (110V)

Code	To Suit	Price
CX68	Bridgport Type	£259.00
CX69	Major Minor Type	£259.00
CX70	Transformer	£44.00
CX71	Bridgport & Trans	£289.00
CX72	Major/Minor & Trans	£289.00

QUALITY DRILL CHUCKS WITH KEY

Code	Capacity	Price	
CX73	13mm JT6 Mount	~~£20.00~~	£19.00
CX69A	16mm JT6 Mount	~~£24.00~~	£22.00

VERTEX BSO DIVIDING HEAD

Complete with Headstock, Tailstock, Div. plates, Test Certificate

CODE S057 PRICE ~~£255~~ £199!!

GENUINE VERTEX

VERTEX ROTARY TABLES & ACCESSORIES

Code	Item	Price
S058	HV4 4" Rotary Table	£135.00
S059	Div Set for HV4	£ 49.95
S060	Tailstock for HV4	£ 55.00
S061	HV4 + Div Set + Tailstock	£220.00
S062	HV6 6" Rotary Table	£145.00
S063	Div Set for HV6	£ 49.95
S064	Tailstock for HV6	£ 55.00
S065	HV6 + Div Set + Tailstock	£230.00
S066	HV8 8" Rotary Table	£220.00
S067	Div Set for HV8	£ 65.00
S068	Tailstock for HV8	£ 74.00
S069	HV8 + Div Set + Tailstock	£320.00

New MT2 Chuck Adapter with Myford Thread to suit HV6

Code	Price
S070	£24.95

SECURE ONLINE ORDERING AT WWW.CHRONOS.LTD.UK

PRICES INCLUDE VAT & CARRIAGE (UK MAINLAND)

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

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

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

EMAIL SALES@CHRONOS.LTD.UK

MasterCard VISA SWITCH

Model Engineer is published by Highbury Nexus Special Interests Limited
Nexus House, Azalea Drive, Swanley, Kent BR8 8HU
Tel: 01322 660070 Fax: 01322 616319
www.hhc.co.uk/modeng
Highbury Nexus Special Interests Limited is a wholly owned subsidiary of Highbury House Communications plc.

EDITORIAL

Editor
Mike Chrisp
Technical Editor
Neil Read
Assistant Editor
Kelvin Barber
Club News Editor
Stan Bray
Technical Consultants
Martin Evans, John Haining, Stan Bray, J. Malcolm Wild FBHI, D. A. G. Brown, H. D. Bickley BSc CEng MIEE.
Editorial Administrator
Sarah White

PRODUCTION

Design
Elizabeth Marfell
Production Manager
Sifa Symons
Printed by
Polestar (Colchester)
Origination by
Atelier Data Services

SALES & MARKETING

Group Sales Manager
Colin Taylor
Sales Manager
Tony Robertson
Marketing Manager
Rebecca Bradberry

CIRCULATION

Circulation Sales Director
Sharon Douglas
Circulation Manager
Kevin Maloney
Specialist Outlet Development
Emma Stammers

MANAGEMENT

Divisional Publisher
Dawn Frosdick-Hopley
Associate Publisher
Jez Walters

SUBSCRIPTIONS & BACK ISSUES

Direct Subscriptions and Back Issues are available from Highbury Nexus Subscription Services, Link House, 8 Bartholomew's Walk, Ely, Cambs CB7 4ZD
Phone: 01353 654422; Fax: 01353 654400
Email: nexus@wyverncrest.co.uk
Rates for 26 issues (annual), 13 issues (six months):
UK: £57.20 (annual) £28.60 (six months);
Europe: £70.00 (annual), £35.00 (six months);
RoW Surface: £71.00 (annual), £35.50 (six months);
RoW Airmail: £75.50 (annual), £37.75 (six months);
US Surface: $100.00 (annual), $50.00 (six months);
US Airmail: $115.50 (annual), $57.75 (six months).
Cheques payable to Highbury Nexus Special Interests 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 Services, 1926 S. Pacific Coast Highway, Suite 204, Redondo Beach, CA90277-6145, USA.
Phone: (310) 944-5033; Fax: (310) 944-9963.
Email: wiseowl@sprintmail.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. 189 No. 4180 18 October 2002 ●

On the cover ...

Intending them respectively for mixed traffic and express passenger duties, Sir William Stanier introduced his celebrated 4-6-0 'Black Fives' and 'Jubilees' in 1933. Based on Sir Henry Fowler's 3-cylinder 'Baby Scot' and fitted with a tapered boiler, lower maintenance costs and reduced susceptibility to incidental troubles ensured that the 'Jubilees' were favoured by the LMS Railway on which they operated. At first un-named, the class became known as 'Jubilees' following the naming of No. 5552 Silver Jubilee *in 1935 to honour the Silver Jubilee of His Majesty King George V. Our cover shows preserved 'Jubilee' 4-6-0 5XP No. 5690* Leander *heading a special train at Wennington in Lancashire.*

(Photograph by James Guilliam)

APEX TOOLS LTD

SPECIALISTS FOR ALL OF YOUR THREADING & RE-THREADING REQUIREMENTS

We stock a complete range of Taps, Dies & Dienuts in Carbon Steel & High Speed Steel in the following thread forms:–

METRIC, UNC/UNF, BSW/BSF, BSPF, NPT, BSPT, UNS, BRASS, ME, WF, BA & BSCY.

Also available:
Tap & Die cased sets, Dienut cased sets, Tapwrenches, Diestocks, End Mills & Slot Drills

Special Taps, Dies & Dienuts made to order

IF YOU WOULD LIKE TO BECOME AN APEX TOOLS DISTRIBUTOR PLEASE WRITE TO:

PO Box AT02, Model Engineer, Nexus House, Azalea Drive, Swanley, Kent, BR8 8HU

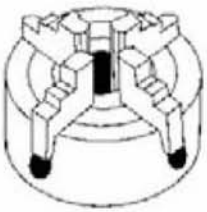
Castle Lathe Chucks

4-jaw Independent **Back Plate Mounting**

4-jaw chucks

80mm	£54.50
100mm	£59.50
125mm	£65.50
160mm	£75.50
200mm	£85.50

Back plates available for Myford or Boxford



Post

chucks

80/100	£4.00
125/160	£5.00
200	£7.50

Cheque or phone Visa/Mastercard
Prices inc. VAT

Please send 4 first class stamps for full catalogue

COMPASS HOUSE TOOLS
High Street, Rotherfield, East Sussex TN6 3LH
Phone: 01892 852968 Fax: 01892 853522 www.compass-house.co.uk

BRUCE ENGINEERING

SOME OF THE ITEMS TO BE FOUND IN THE BRUCE ENGINEERING CATALOGUE

STEAM RAISING BLOWERS 12 VOLT

BRITISH RAILWAYS

TRANSFERS SAE for list

PRESSURE GAUGES
1/2", 3/4", 1", 1 5/8", 2", 4"
400PSI TEST GAUGES

SCALE COUPLINGS
GWR, LMS, LNER
ALSO HOOK & CHAIN

Catalogue £1.75 posted UK $5 worldwide
HOLLOW TREE, PENNY LANE, SHEPPERTON
MIDDLESEX TW17 8NF
tel. 01932 245529 fax. 01932 226738
E mail. bruce.engineering@zetnet.co.uk

DORMER H.S.S. Drill Sets

Made in England

SPECIAL HALF PRICE OFFER

* **SET 202** 1 to 6mm x 0.1mm (51 Drills, Metal Case) Normally, £89.66 **HALF PRICE £44.85**
* **SET 203** 6 to 10mm x 0.1mm (41 Drills, Metal Case) Normally, £187.25 **HALF PRICE £93.65**
* **SET 204** 1 to 13mm x 0.5mm (25 Drills, Metal Case) Normally, £109.45 **HALF PRICE £54.75**
* **SET 18** 1/16 to 1/2in x 1/64in (29 Drills, Metal Case) Normally, £137.80 **HALF PRICE £68.90**
* **SET 14** Letter Drills A-Z (26 Drills, Metal Case) Normally, £245.15 **HALF PRICE £122.60**
* **SET 12** Number Drills 1 to 60 (60 Drills, Metal Case) Normally, £160.33 **HALF PRICE £80.20**

Please add £2.50 P&P on above Metal Cased sets

* **SET 61/80** Number Drills 61 to 80 (Plastic Case) Normally, £77.50 **HALF PRICE £38.75**
* **SET 31M** 0.3 to 1.0mm (20 Drills, Plastic Case) Normally, £58.70 **HALF PRICE £29.35**
* **SET 513** 1/16 to 1/4in x 1/64in. (13 Drills, Plastic Case) Normally, £24.64 **HALF PRICE £12.35**
* **SET 613** 1 to 6mm x 0.5mm. (13 Drills, Plastic Case) Normally, £22.50 **HALF PRICE £11.25**

TOS LATHE CHUCKS

(Czech)

NEW LOW PRICES

3 and 4 Jaw Self-Centring Lathe Chucks

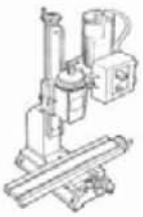
3 Jaw Self-Centring	***Old Price***	**Price Now**
80mm (3 in.)	£60.75	£57.75
100mm (4 in.)	£67.95	£63.95
125mm (5 in.)	£74.75	£71.00
160mm (6 in.)	£95.75	£91.00
4 Jaw Self-Centring		
80mm (3 in.)	£77.25	£71.00
100mm (4 in.)	£85.00	£75.50
125mm (5 in.)	£91.75	£84.00
160mm (6 in.)	£128.75	£120.00

Part-Machined Backplates (bored & threaded)
Myford (1⅛" x 12 tpi) 4 in.– £25.00 5 in.– £29.75
Boxford (1⅛" x 8 tpi) 5 in.– £29.75 6 in.– £39.75

Unmachined Backplate Castings
3 in. – £8.75 4 in. – £9.50 5 in. – £12.50
6 in. – £18.50 8 in. – £28.50

SHERLINE MINIATURE LATHES AND MILLING MACHINES

Manufactured to high standards in the U.S.A.

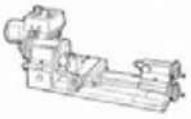


Sherline Milling Machine

Throat Depth	2½ in.
Table Size	2¾ x 13 ins.
X Travel	9 in.
Y Travel	3 in.
Z Travel	6½ in.

Electronic Variable Speed Control 70 to 3000 rpm
PRICE £495 + £10 Carr.

Sherline Lathe



Centre Height 1¾ in.
Dist. between centres 8 in., variable speed control as mill above.
PRICE £495 + £10 Carr.

Price includes 3 jaw lathe chuck and tailstock drill chuck. Huge range of accessories. Send for the free Sherline 46 page brochure and our price list.

BOOK: Tabletop Machining by *Joe Martin*
A basic approach to making small parts on miniature machine tools. 338 pages. **Price £32.00**

SKODA QUALITY LIVE CENTRES at Reduced Prices

MT1 – was £29.00 now **£25.00**
MT2 – was £35.00 now **£29.00**
MT3 – was £45.00 now **£39.00**

SIEVERT L.P.G. EQUIPMENT

Starter Set for Model Engineers
Comprises 3061 Regulator, 2 metre Hose, 3486 Handle, 3511 Necktube & 2941 Burner
Special Offer £97.50 - Normally £114.45
Other Sievert items also available

We have many more items for Model Engineers – Send for our free catalogue – Satisfaction or refund.
All prices include VAT and post (except where stated) – Major credit cards accepted.

MILLHILL SUPPLIES, 66 THE STREET, CROWMARSH GIFFORD, WALLINGFORD, OXON OX10 8ES
Tel. 01491 838653 • Fax. 01491 825510 • E-mail: sales@millhillsupplies.co.uk • Website: www.millhillsupplies.co.uk

WARCO

The widest choice... ...the best prices!

ONLY £625.00

Mini Mill Drill

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

ONLY £998.00

ZX-16 Mill Drill

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

Optional stand £149

Major GH Mill Drill

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

ONLY £1,250.00

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

ONLY £799.00

Economy

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

ONLY £985.00

Minor Mill Drill

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

ONLY £1,150.00

Major Mill Drill

- 2 hp motor
- Table size 29" x 8"

ONLY £1,600.00

VMC Mill

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

ONLY £899.00

1016 Lathe

- 5" centre height x 18" between centres
- Supplied with 3 and 4 jaw chucks, fixed and travelling steadies, face plate,.
- 4 way tool post.
- Also available 22" between centres with Norton thread cutting gear box £1,099

1224 Lathe

ONLY £1,850.00

- Gear Head lathe
- 6" centre height x 24" between centres
- Supplied with Camlock 3 and 4 jaw chucks, face plate, fixed and travelling steadies.
- Speeds 75/1400
- 2 hp motor
- Gap bed
- Hardened bedways
- Also available 32" between centres £1,950

Ask for our latest Colour brochures!

PRICES INCLUDE VAT AND DELIVERY TO UK MAINLAND

www.warco.co.uk

ONLY £2,250.00

WARCO

GH-1322 Lathe

- Superb, compact gear head lathe.
- 6 1/2" centre height x 22" between centres. Speeds 70/2000
- Supplied with Camlock 3 and 4 jaw chucks, fixed and travelling steadies, face plate, four way tool post, coolant system, halogen lighting, telescopic lead screw covers and foot operated spindle brake.
- Gap bed. Hardened bedways.
- Also available 30" between centres £2,990

ONLY £1,600

Warco BH-600

- 6" Centre height
- 20" between centres
- Power cross feed
- 1½ HP single phase
- Supplied with 3 and 4 jaw chucks
- Fixed and travelling steadies
- Face plate
- Tee slotted cross slide
- Rear splash guard
- Cabinet stand & coolant tray
- Hardened bedways
- Speed range 50/1200 rpm
- Also available 37" between centres £1,900

Warco, Fisher Lane, Chiddingfold, Surrey GU8 4TD

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

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

SMOKE RINGS
With the Editors

Countryman's Steam

We hasten to preface the following with the assurance that this is definitely *not* an obituary! Along with many readers who have made contact to enquire, we have been much concerned about the absence from these pages of our much respected contributor John Haining whose series describing the construction of a Sentinel S-type steam wagon commenced in *M.E.*4138, 26 January 2001 and ran for six instalments, the last of which was published in *M.E.*4159, 14 December 2001.

News came to us by way of Cherry Hill that our concerns regarding John's health and well being were unfounded, and shortly before the recent Usk show we learned from John's wife Ann that he had been finding the pressure of preparing material for publication on an unremitting monthly basis had become rather too much. After this year's event, we understand that John and Ann have also decided to relinquish the organisation of the display of model engineering in the Model Tent at the Usk Show.

Together with Colin Tyler, John's first constructional series for this magazine commenced with their 2in. scale Fowler BB ploughing engine which was introduced over 36 years ago in *M.E.*3300, 1 July 1966. Readers soon became aware of the quality of this material and the series was enjoyed as much by armchair modellers as by those who had decided to build the engine.

Steeped in the Sentinel tradition, John's knowledge of agricultural and road steam has both breadth and depth while his eminently readable style of writing conveys not only his authoritative understanding of such matters, but also his love of the countryside and its farming folk and communities.

The Fowler BB was followed by a succession of occasional articles on full-size traction engine practice, a style which has been a feature of John's writings over the years. Colin Tyler also continued to write for *Model Engineer* and in *M.E.*3377, 19 September 1969 he and John began their next constructional series, this one describing the construction of a Kitson and Hewitson ploughing engine c1862, this and the Fowler BB representing the first and last engines of John Fowler (Leeds) Ltd. Sadly, in due course the partnership came to an end with Colin's untimely death. John, however continued writing and many further designs from his drawing board were featured in these pages, including his Durham and North Yorkshire agricultural traction engine, a Suffolk dredging tractor and his innovative *Caradoc*, a 3in. scale RH2 steam tractor in the 'modern mode'.

After such a long and distinguished association with *Model Engineer* magazine we thank John for the extent of his contribution, respect his decision to step back from regular appearance and hope that despite the unwelcome effects advancing years he will enjoy his retirement, remain as one of our respected Consultants and perhaps even regale us now and then with the occasional reminiscence of the steam engines and the country folk with whose lives he was so closely associated.

Use it or lose it!

Model engineering classes start at **Southgate College** every Tuesday evening 7-9.30pm from 1 October 2002. This course was under-subscribed last term and is under threat of closure. There is a wide range of machinery and a tutor on hand to advise and instruct. A few minutes from Southgate tube station on the Picadilly line, the college would welcome extra students for this course. You decide what to build and the equipment is there to do the work. 'Phone 020-8982-5050 to enrol.

Oxford College of Further Education currently runs an evening class from 5.45-8.15pm. Officially open from 6.30pm, the workshop is usually open earlier. It is a good class but unfortunately numbers have dwindled and those attending feel the college may not allow it to continue unless numbers increase. Anybody interested in joining should contact Derek Sherwood 01865-761212 for further information.

It was with a 2in. scale Fowler BB ploughing engine that John Haining and Colin Tyler made their M.E. debut in 1966. Among many other artefacts of considerable interest, an example of the prototype is displayed at Armley Mills, Leeds Industrial Museum (call 0113-263-7861). Leeds was the home of John Fowler & Co. until the Steam Plough Works finally closed in 1974. John Fowler is reputed to have been inspired to invent steam ploughing after witnessing for himself the effects of the Irish potato famine.

Castings for *The Junior*

Fay Grimmett of L. A. Services tells us that they have had some difficulty with the supply of castings for *The Junior* i.c. engine currently being described by Stan Bray. She apologises for any delay caused and, confident that the problem has now been overcome, is sure that customers should have received their orders by now.

25 years on!

It hardly seems possible that the first Midlands Model Engineering exhibition was held 25 years ago in Leicester's Granby Halls! From here to Birmingham's Bingley Halls, Birmingham University, the Royal Agricultural Showground at Stoneleigh and now at Castle Donington, this event has become a firm favourite with a faithful following. Presented in a convenient and centrally situated venue with plenty of free car parking, visitors can be assured of a comprehensive display of competition and loan models together with club and trade support and workshops.

Between 19-24 October and in a wide range of sizes and scales, visitors will be able to see steam locomotives, steam road and agricultural vehicles, stationary steam, i.c. and hot air engines, ship models, horse drawn vehicles, aircraft, tooling and clocks.

See *Club Diary* (p398 in this issue) for admission times and prices or call Meridienne Exhibitions (01926-614101) for further details.

CHUCK the MUDDLE ENGINEER **by B. TERRY ASPIN**

POST BAG

my choice anyway! And incidentally it was called *Peregrine* because they catch ducks!
Tony Wall, Yorkshire.

Hairpin clips

SIRS, - In *Post Bag* (*M.E.* 4173, 12 July 2002) Mr. R.G. Marden seeks a source of small hairpin clips for a 3/16in. dia. shaft, with an enclosed diameter of 9/64 inch. These are available from McMaster Carr in the USA. Many other sizes are also offered at reasonable prices. I have no connection with them except as a satisfied customer.

McMaster Carr is a large mail order industrial supplier, probably the biggest in the USA, with an unbelievable range of goods. The part number Mr. Marden needs is 90153A214, cost US$7.58 per 100 pieces. The clips are in stainless steel. This company's website is **www.mcmaster.com** and they can be reached by telephone in the USA on 630-833-0300.
Jeff Dayman, Ontario, Canada.

Peregrine

SIRS, - As the builder of the A4 locomotive depicted in the *Fringe IMLEC* article published in *M.E.* 4175, 9 August 2002 I would like to attempt to correct the impression I must have given your reporter Neil Read. In the notes I prepared I tried to explain that the model was intended to depict the locomotive in its condition during the period stated at the end of 1947, and not that this class of locomotive was only painted in the blue livery for this short period.

The A4s were in fact painted 'Garter Blue' from the inception of the streamlined London to Edinburgh 'Coronation' express service in 1937. The earlier silver and green liveried locomotives were then gradually repainted in this livery.

During the war years they lost their side valances and their blue livery became plain black under a coating of grime. In 1945, the LNER slowly started to get back to the earlier standards and one of the first visible signs was the repainting of locomotives in their earlier pre-war liveries. I well remember my first sight of a brilliant blue 'streak' on a Doncaster to Leeds local service often used as a running-in turn for ex-works locomotives.

Hence *Peregrine* is in 'Garter Blue' with stainless steel letters and numbers but without the original side valances, and is numbered 34 instead of the original 4903, a condition it was only in from November 1947 until renumbered 60034, renamed *Lord Faringdon* and lettered British Railways in March 1948 — and since I built it, it was

M. Maurel's object

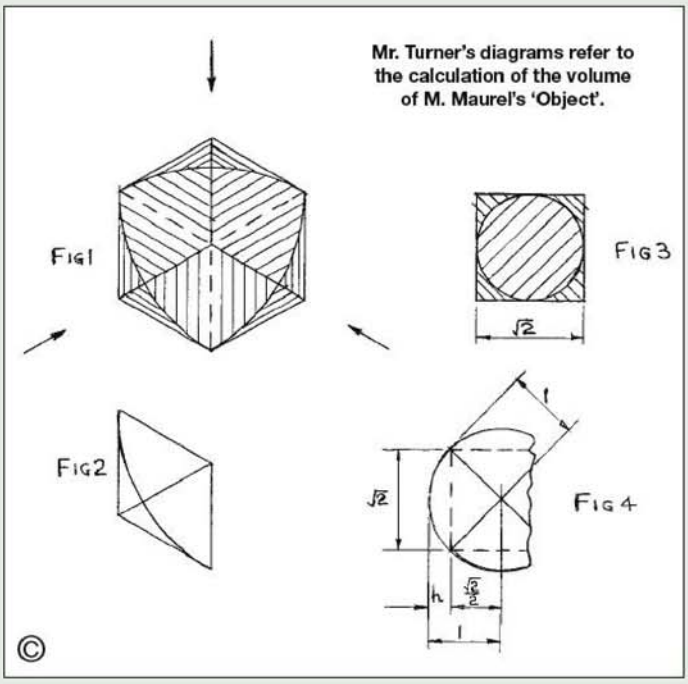
SIRS, - In a previous *Post Bag* letter (*M.E.* 4170, 31 May 2002) concerning the article by M. Maurel on his 'Object', (*M.E.* 4165, 22 March 2002) I happened to mention the volume of the object. Some enquiries have been made about the way this volume may be calculated, so what follows is an explanation of my method.

Figure 1 is an isometric perspective diagram of the common space at the intersection of three identical cylinders each with a radius of one unit and mutually perpendicular, i.e. M. Maurel's 'Object'. The diagram is similar to M. Maurel's diagram in *M.E.* 4165 with the addition of three dotted lines. The cylinders are not shown but the three arrows are on their centre lines. The viewpoint is midway between two horizontal arms of the cylinders and looking down at an angle from above. All the faces in view are portions of cylindrical curves of radius one unit.

If the full lines on the perimeter of the diagram, together with the three dotted lines, are viewed as a 3-D solid, it can be seen that they outline a cube. On each face of this cube we have a sort of pyramid but, instead of being flat, the four faces are curved portions of a cylinder. Opposite faces of each pyramid are parts of the same cylindrical surface that can be seen to continue to adjacent pyramids to form a complete circle around the object. It may be seen that the volume of the object can be considered to be the volume of a central cube added to the volume of six curved face pyramids.

To determine the volume of this cube we need to know the length of the edge. The diagonal on the face of the cube is equal to the diameter of the cylinders, i.e. two units long, so the edge of the cube is the hypotenuse of a right angled triangle whose apex is at the centre of the face, the other sides each being one unit long (**fig 4**). So the edge length is $\sqrt{(1^2 + 1^2)} = \sqrt{2}$, and from this we get the volume $(\sqrt{2})^3 = 2 \times \sqrt{2}$.

We already have an imaginary construction, the internal cube. We now need to imagine a central sphere with a radius of one unit. This will just touch the apex of each pyramid and the mid-point of each edge of the cube, as well as making a complete circular contact with the cylindrical surfaces.



There are three of these circles of contact, one in each plane. If we take a cross-section along one of the faces of the cube, the pyramid on that face is separated as shown in **fig 2** and a segment of the sphere is cut off, embedded in the pyramid.

Figure 3 is a view of this cross section looking directly onto the face of the cube. The square has a side of length $\sqrt{2}$ and the circle, which is the border of the cut off sphere, just touches the four sides. Although the sphere is imaginary, its border is shown as a full line. The area of the square in fig 3 is $\sqrt{2} \times \sqrt{2} = 2$ and the area of the circle is given by $\pi \times (\sqrt{2})/2 \times (\sqrt{2})/2 = \pi/2$ so the ratio of the areas is $2/(\pi/2) = 4/\pi$.

If any other section of the pyramid is taken parallel to the face of the cube we get a smaller square, the border of the pyramid at that section, with a circle inside, the border of the sphere, a smaller version of fig 3 and the areas of the square and circle have the same ratio $4/\pi$.

Cavalieri's theorem says that if two solid objects have the same height and their cross sections at any equal height above and parallel to the base have areas that always have the same ratio, then the volumes of the objects are in the same ratio. It follows that the volumes of the pyramid and sphere segment are in the same ratios as the areas of the square and inscribed circle.

To find the volume of the pyramid it is only necessary to find the volume of the segment of the sphere cut off at the face of the cube and multiply it by $4/\pi$.

The volume of a segment of a sphere is $\pi \times h^2 \times (r - h/3)$ where r is the radius of the sphere and h is the height of the segment measured from its base. As the radius is one unit, h is found by subtracting from one the distance between the centre and the face of the cube. The cube has an edge of $\sqrt{2}$ so $h = (1 - (\sqrt{2})/2)$ as shown in fig 4.

Substituting these values in the formula, the volume is given by $\pi \times (1 - (\sqrt{2})/2)^2 \times (1 - (1 - (\sqrt{2})/2)/3)$ which simplifies to $\pi \times (8 - 5\sqrt{2})/12$.

The volume of the pyramid is found by multiplying this volume by $4/\pi$, which comes to $(8 - 5\sqrt{2})/3$.

As there are six pyramids this value has to be multiplied by six, resulting in $16 - 10\sqrt{2}$. After adding on $2\sqrt{2}$, the volume of the cube, the final volume of the object is $16 - 8\sqrt{2}$.
H. D. Turner, Wakefield.

Matters arising

SIRS, - I would like to take up a small amount of column space in *Post Bag* with a few points arising from *M.E.* 4175, 9 August 2002.

1: Monty Ellis discussed simplifications to his lathe tool height gauge. I submit a minimalist setting gauge, for use with any tool-post with a screw adjustment for tool height. In use, the tool is swung around so that the tip is over the bed, not the cross-slide. The adjusting screw is backed off so that the tool is low. The gauge is held with the left hand, its end resting on the lathe bed with the step over the tool tip. The tool is then raised with the right hand.

It is almost impossible, and fortunately undesirable, to hold the gauge perfectly still. The left hand will sense the point at which the rising tool arrests the movement of the gauge clearly. After a few trials to get the feel, it is possible to set the tool height within 0.001-0.002in. *with your eyes closed.*

To set a parting tool in the rear tool-post, a bit of 1/4in. square is mounted at centre height in the front tool-post and the parting tool then set so that it just lands on that.

Mr. Paterson's 'minimalistic' tool height setting gauge in use.

An obvious enhancement would be to add some sort of foot so that the gauge will stand on its own. In fact, the freedom to rock slightly is fundamental to its operation. This particular example is set for a nominal 3½in. centre height and will need a little fine-tuning with a file for a particular lathe.

2: *Model Engineer* includes an index of advertisements. This is a good thing, but it would be even better if the advertising pages were numbered!

3: Dennis Fielder raised the perennial problem of errors in drawings. As part of a 'Teach myself CAD' exercise I played with DesignCAD 2000. A number of interesting possibilities arose. My Hewlett Packard inkjet printer will print on tracing paper, so a proof copy, at the same scale as the original that was being copied, can be laid over the original. Discrepancies are then obvious.

Use of tracing paper is subject to only one sheet being added to the white paper stack at a time (paper feed becomes erratic if more than one sheet of tracing paper is present). Extra drying time is required to avoid smudging, as tracing paper is less absorbent than ordinary copy paper.

DesignCAD 2000 *can* print a large drawing as a number of A4 tiles, but selecting a print window of a large drawing would be far less wasteful of time and paper.

DesignCAD 2000 supports 256 layers which are analogous to transparent sheets which can be superimposed one on the other. The user decides what goes on what layer and which layers are active (i.e. visible and/or editable) at any time. The text book use is for services like electrical supplies or pipework in a building floor plan. The electrical supply layer can be switched off, when not required, to avoid clutter.

Assuming a steam locomotive (what else do model engineers make?), set a reference point (0,0) at rail level below the buffer beam shown at the left hand side. Draw the frame outline on layer 1 using absolute co-ordinates, i.e. relative to (0,0). Put the frame dimensions on layer 2. If the valve gear is between the frames, show that on layer 3, with key dimensions for valve events on layer 4 and manufacturing dimensions for the valve gear on layer 5. And so on, until all the information required for a general arrangement/section is present, with the lettering and lining on the top layer — 256 layers will go a long way. Everything is shown in its correct position in space. Choosing appropriate layers (e.g. the frames and the stretchers) will highlight any discrepancies between them.

All this is based on a side elevation For items that also require another view, such as a front view of the chimney to show the smoke-box radius, that can be added to the dimension layer. DesignCAD 2000 also supports animation, controlled by an integral BASIC program, so the completed drawing could be stripped off, layer by layer, from the lettering down to the bare frames and back. This is now more of an educational toy than a design tool but it is still using the same basic data.

Speaking (writing?) of educational toys, the Locomotive Publishing Co. of yore produced cardboard models of Walschaerts and link valve gears. These must be suitable candidates for re-invention, probably as computer simulations.

Back to drawing errors. This idea, if developed, would allow a design to be 'assembled' without cutting metal, using a low cost CAD program. I believe that it might be the basis for a self-checking system for drawings that may help to reduce errors in *future* designs.

All we need now is an army of computer-literate volunteers to redraw all the existing designs.

R. G. Paterson, East Lothian.

Machine tool bible

SIRS, - I refer to the letter concerning the above from Jim Evans in *M.E.* 4174, 26 July 2002. The main problem with producing such a volume is the sheer range of different manufacturers' products that the neophyte is likely to be offered. Were I to be asked for advice, I would take a different approach and assess viability for purchase on two basic lines of appraisal.

The first concerns the type of modelling to be undertaken, namely small, medium or large.

1: Small being clocks, railways up to about 3½in. gauge, small aero, automotive to about 1½in.:1ft. scale, small traction engines, boats, and the like.
2: Medium being railway to 5in. gauge, traction engines to similar scales, etc.
3: Large being 7¼in. gauge and generally larger projects.

The second is a cruelly objective assessment of condition of the machinery.

1: Filthy, with beaten up slide faces around the work area, scars and chipped paint everywhere, rusty pulleys, 'all sloppy' and no trace of oil.
2: Dirty with beaten up slide faces around the work area, 'all sloppy', chipped paint and little or no trace of oil.
3: Dirty with clearly worn parts, some movement in slides, chipped paint, and some evidence of lubrication.
4: Clean but not recently made so, worn, just detectable movement in slides, chipped paint, and slight sheen of oil.
5: Clean, evidence of slight wear, paint chipped, smooth movements, and slight sheen of oil.
6: Clean, usage marks on slides, no paint chips, 'taught' feeling to controls, and a slight sheen of oil.
7: New.

The first assessment will require the advice of an experienced model engineer as to size. I would suggest that 'small' means a pillar drill to hold up to 0.25in./6mm dia., a lathe to about 3in./75mm centre height, smallest vertical mill holding up to 0.375in./9mm cutters. 'Medium' means a pillar drill to hold up to 0.5in./12mm dia., a lathe of the gap-bed type of about 3½in./80mm centre height to 5in./125mm, 'Large' means anything within reason bigger than this.

The second assessment means that '1' should be avoided like the plague, it will break your heart and pocket and is fit only for the scrap yard. '2' and '3' should be avoided unless you are desperate and have no intention of doing any accurate work, ever! Repairs and spares will probably cost more than a new machine. '4' will do for a time particularly if you are broke. When you cease to be broke, it can be reconditioned within reasonable cost; a reground bed is cheaper than a new machine! '5' and '6' are what most impecunious model engineers should aim for, as this will give you many years of good service. The lucky few go for '7' No further comment is necessary.

There are exceptions to the above; sometimes close examination of a filthy and apparent class '1' wreck reveals that under all the filth is a virtually unused machine. An idle machine at the back of a machine shop accumulates muck very fast. It also gets used as a 'dumping ground', which makes it look even worse. I make no other comment than that application of a little practical psychology may be required when purchasing this one.

Notwithstanding all of the above, what the neophyte will end up with is what all the ex-neophytes have, namely a workshop containing a disparate collection of machinery ranging from the antique to modern, most of the acquisition of which was unplanned, most being bargains that were 'come-by' unexpectedly.

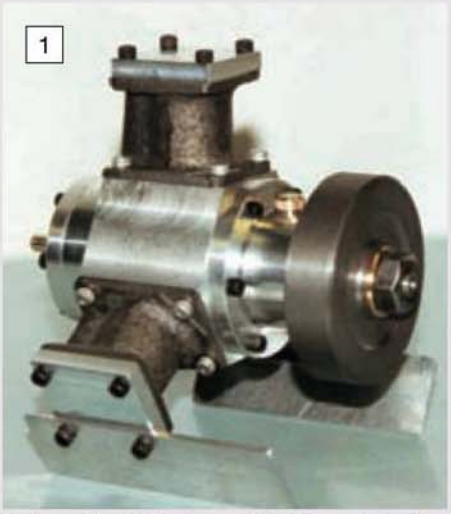
Peter King
Christchurch, New Zealand.

Colour on drawings

SIRS, - May I express my own opinion about the use of colour on drawings? Colour can be useful and helpful if used with taste, but I should like to see some order in its use. In assembly or arrangement drawings it can discriminate between the various components to make things clearer, whereas in an ordinary drawing of a single component it probably serves no useful purpose.

However, there are some rules which I believe should be followed. All dimensions, centre lines, construction lines and comments should always be black, otherwise a drawing starts to look like a child's colouring book! New technology is fine if it remains a servant rather than a master.

D. A. G. Brown, Rutland.



A view of the Author's completed Cygnet Royal *steam engine. The three 5/8in. bore x 1/2in. stroke cylinders of are spaced 120deg. apart around a central crankcase. This configuration makes the engine self-starting.*

BUILDING THE *CYGNET ROYAL*

S. J. Curtis

describes the construction of an unusual radial steam engine designed by E. T. Westbury.

●*Part I*

"And now for something completely different" as the well-known catch phrase has it! Having completed my last project, and pondering on what to make next, I chanced upon the *Cygnet Royal*, in the Woking Precision Models catalogue. It struck me as an interesting challenge and a marked contrast to conventional steam engines. I obtained the drawings and, after perusal, made my decision, collected the castings from Woking Precision and, from my conversation with the previous owner of this business Dennis Harris, it transpired that although he had sold quite a few kits, he had not heard of one being completed. For a moment my heart sank until I reminded myself that E. T. Westbury had designed this engine, whereupon there was an instant revival of enthusiasm and confidence was restored! So, here goes! Some small detail changes have been made and these will become apparent as we proceed.

Crankshaft

Turn down a piece of bright, mild steel bar to 1.250in. dia. for a length of a little over 3 inches. Rough out and finish-turn the journal to 3/8in. dia. using one of the ball races as a gauge to provide a push fit. Turn down and thread 5/16in. BSF the first 3/8in. as per the drawing. Part off to a total length of 2.8125 inch. Protect the journal in a reamed and split aluminium bush and reverse in the chuck.

To turn the crankpin, I used an eccentric jig (see **fig 1**) in the 3-jaw chuck in preference to offsetting in a 4-jaw chuck (**photo 2**). Starting with a low speed and a small cut, increasing both as the intermittent cut and diameter are reduced, to produce the crankpin. If time is at a premium, saw away some of the excess material beforehand. Before removal from the jig, drill the oilway 2.30mm and tap 6BA x 1/4in. for the end plug.

Re-chuck, using the aluminium bush, and drill the 1/8in. dia. oil passage in the crankshaft. Transfer to the dividing head on the milling machine and drill the radial oil-ways 2.30mm dia. in the crankpin and crank disc. Change to an end mill and mill the flats on the end of the crankpin. Mill the balance weight profile on the crank disc. Note: for simplicity I turned the crank disc 3/16in. thick; additional weight can be affixed later if found necessary.

Transfer to the rotary table and remove 0.100in. from the circumference adjacent to the crankpin. Tap the radial oil way 6BA x 1/8in. for the plug. Remove from the rotary table, place in

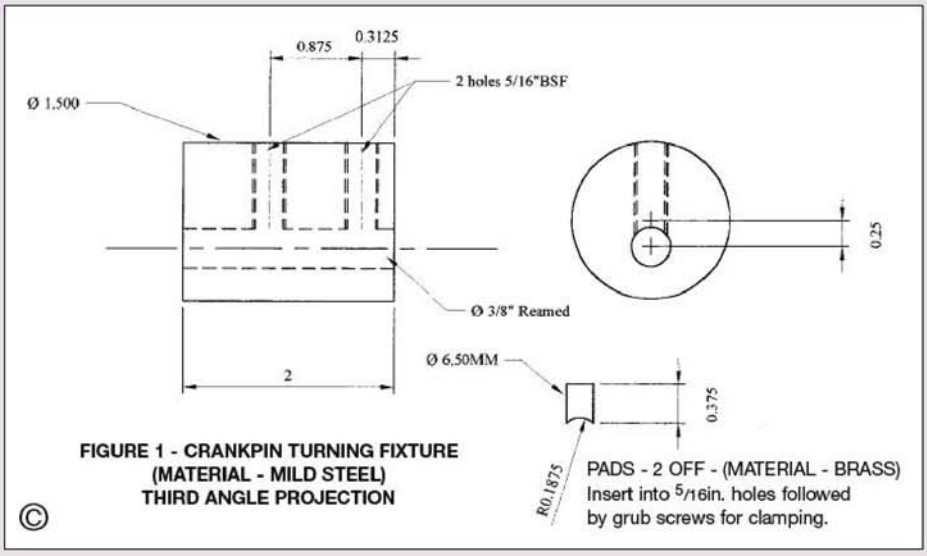
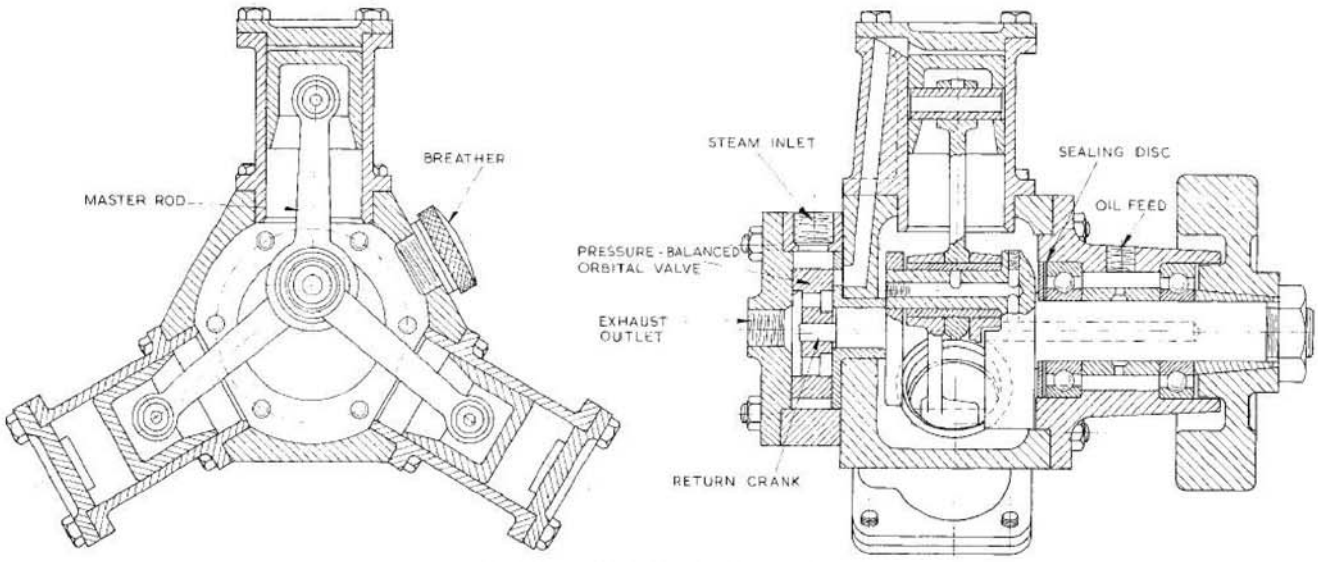
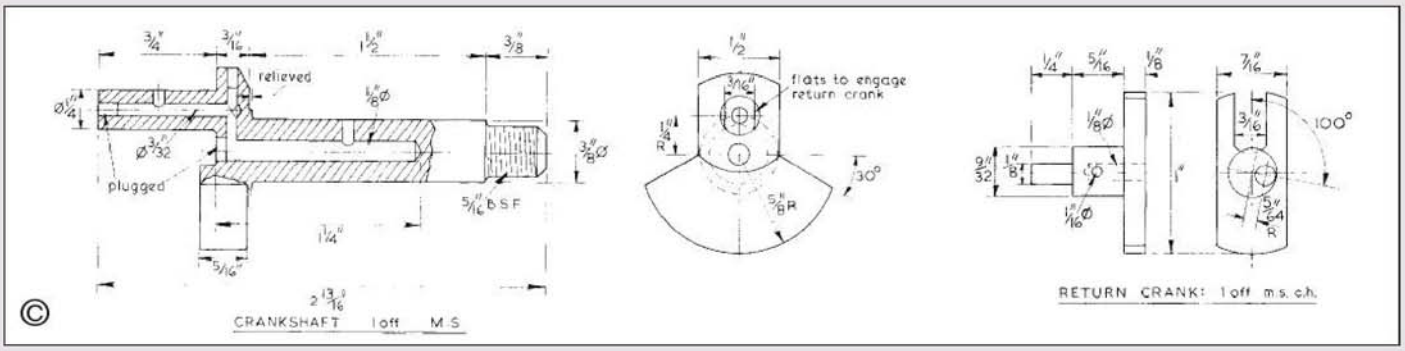


FIGURE 1 - CRANKPIN TURNING FIXTURE
(MATERIAL - MILD STEEL)
THIRD ANGLE PROJECTION

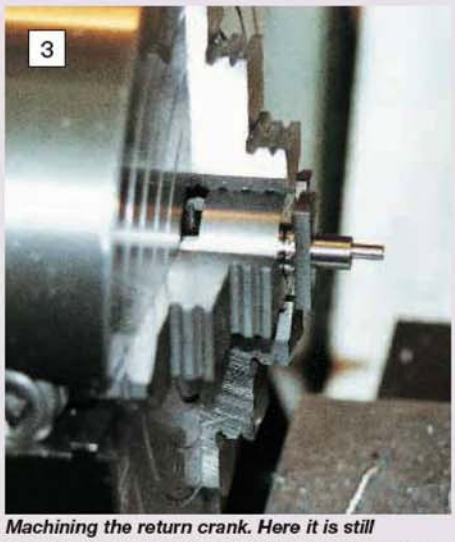
PADS - 2 OFF - (MATERIAL - BRASS)
Insert into 5/16in. holes followed by grub screws for clamping.



THE "CYGNET ROYAL" RADIAL STEAM ENGINE
5/8in. bore x 1/2in. stroke



Turning the crank pin. The crankshaft is held in an offset fixture which allows the operation to be carried out in a 3-jaw chuck.



Machining the return crank. Here it is still mounted on its chucking piece and is seen after finishing the offset pin for the orbital valve.

Milling the slot in the return crank. The workpiece has been transferred to the milling machine and is mounted on the rotary table.

the vice, protected with paper in the jaws, and drill the 1/8in. radial oil way in the journal. Finally, blank off the axial oil way with 1/16in. long oversize plug, pressed in.

Return crank

Turn down bright mild steel bar to 1in. dia. for 1 1/2 inches. Turn a diameter of 9/32in. for a length of 0.563 inch. With your parting tool, make a clearance groove to provide a 0.130in. thick disc. Part off the bar to a length of 1 1/2in. to provide a chucking piece for the next operation. Using the dividing head, mill the flats as per the drawing.

To position the centre of the offset peg, I used the rotary table. Centre the spindle and align one flat along the Y-axis, using a dial test indicator (DTI). Rotate the table 10deg. anti-clockwise and move the mill table X-axis 5/64in. (0.078in.) to the left. Using a BS1 centre drill, drill just deep enough to provide a cone to locate the point of a wobbler.

Re-chuck in the 4-jaw (**photo 3**), centre with the wobbler and carefully turn the 1/8in. dia peg. Replace in 3-jaw and part off from the chucking piece. Reverse in the chuck and, using a protective aluminium alloy bush, face off to 1/8in. thickness and drill the 1/8in. axial oil way. Set up in the chuck on the rotary table, align as before, centralise the spindle and mill out the crankpin engagement slot (**photo 4**).

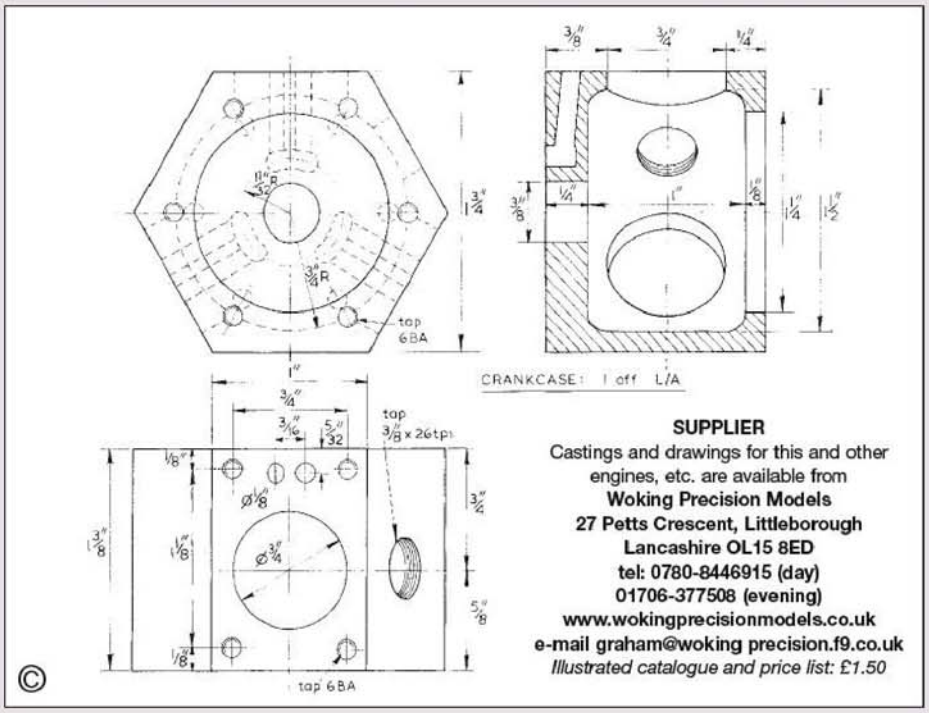
Drill the 1/16in. dia. radial oil way.

Crankcase

As with all castings, the first operation is to machine a datum face. Clean off any flashing with a file, particularly on the six sides, to improve jaw contact area. Place in the 3-jaw with the rear of the casting against the chuck face (**photo 5**). Adjust to obtain minimum run out of the front face of the casting. Gently tighten the jaws and, taking fine cuts, face off to give the 1/8in. thickness as per the drawing.

Reverse in the chuck and tighten the jaws while gently tapping the casting against the chuck face to ensure parallelism. Face off to give a front-to-rear dimension of 1 3/8 inch. Because this casting is somewhat irregular in shape, I decided to bore out the crankshaft housing register on the lathe cross-slide. In order to establish accurate clamping surfaces, place the casting in the vice and mill one of the six sides (one without the cylinder cored hole). Remove only the minimum amount necessary to produce a flat surface; there is very little excess material. Likewise mill the opposite facet. Aim for 0.010in. or so greater than the required final 1 3/4in. dimension across these facets.

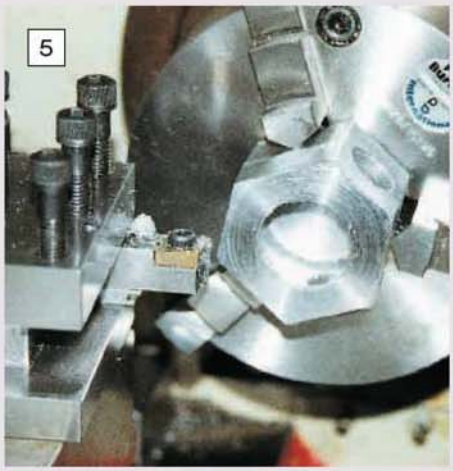
Next, make a mandrel as per my drawing (**fig 2**). Its purpose will become apparent later. ▶



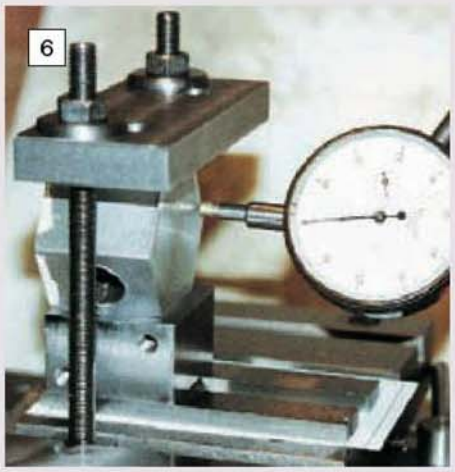
SUPPLIER

Castings and drawings for this and other engines, etc. are available from

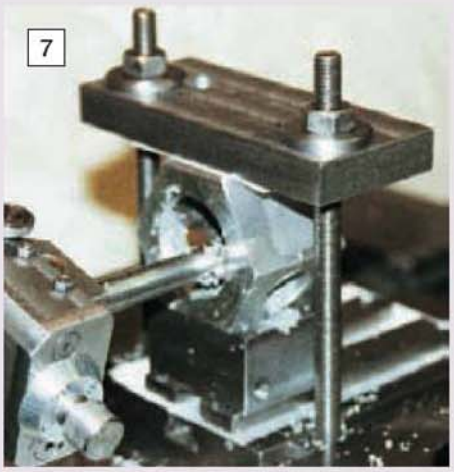
Woking Precision Models
27 Petts Crescent, Littleborough
Lancashire OL15 8ED
tel: 0780-8446915 (day)
01706-377508 (evening)
www.wokingprecisionmodels.co.uk
e-mail graham@woking precision.f9.co.uk
Illustrated catalogue and price list: £1.50



The first machining operation on the crankcase. The casting has been fettled and is mounted in the 3-jaw chuck for facing.



Aligning the casting prior to boring. The crankcase has been bolted to the boring table of the lathe for this operation. Note the packing.



Boring the register for the main bearing housing with an offset boring head. Note the paper under the packing piece to avoid bruising the table.

The next stage is to mount the casting on the cross-slide with the facet with the cored hole uppermost, to bore out the crankshaft housing register. On a Myford Super 7 lathe you need to prepare a 1.187in. thick packing piece with top and bottom faces parallel. The packing thickness is given by the calculation:

Packing thickness =

Centre height above cross slide - (1.750/2)

This establishes the position of the centre of the casting above the cross-slide. Now clamp the casting onto the cross-slide and, using a DTI on the rear face, line it up at 90deg. to the lathe axis (**photo 6**). Next, align the centre of the casting with the lathe axis. This is best done by lining up the near side of the casting with a pointer in the chuck and zeroing the cross-slide dial. Wind out, noting the number of turns of the feed screw, until the pointer is aligned with the far side of the casting. Divide the distance travelled by two and wind in the cross-slide by that amount being careful to allow for any backlash in the screw!

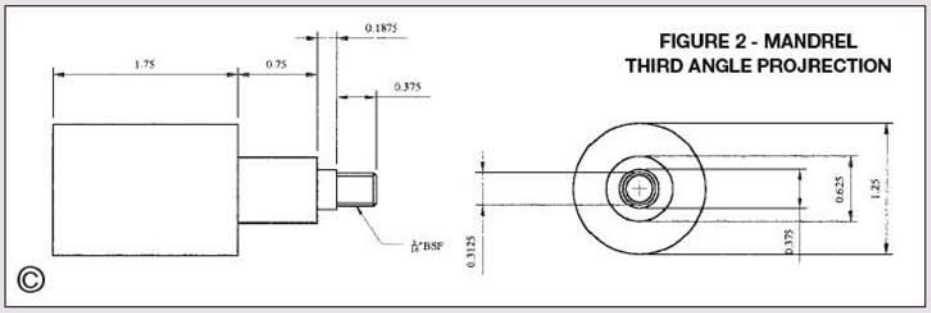
Lock the cross-slide. Drill and ream the 3/8in. hole in the rear of the casting. Spot face with a 5/8in. slot drill. Using a boring head, produce the 1 1/4in. dia. register for the crankshaft housing using the previously made mandrel as a hole gauge (**photo 7**). Remove from the cross-slide, thoroughly clean out any swarf, then fit the casting onto the mandrel and secure with a washer and nut.

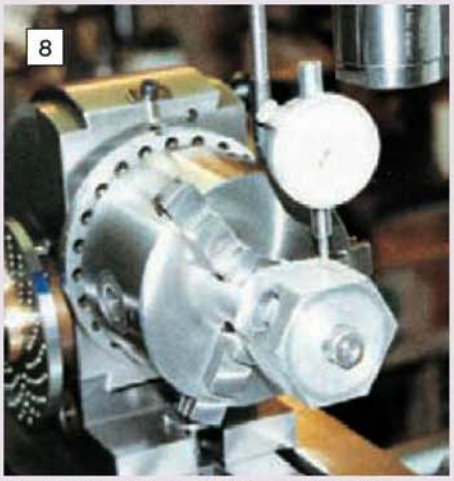
Place in the chuck on a dividing head on the milling machine table and clock one of the previously milled faces level (**photo 8**). Mill all six faces to finish at 1 3/4in. across flats. Set the maximum depth of cut 1/4in. above the mandrel, which is 1 1/4in. diameter (**photo 9**). Centre the spindle above the centre line of the mandrel and 3/4in. from the rear face of the casting, and bore out the cored cylinder registers to 3/4in. diameter (**photo 10**).

Before dismantling the set up, drill and tap for the crankcase breather. I also drilled and tapped for the provision of a drain for removal of any condensate that may accumulate in the crankcase. Next, set up on the rotary table to mill out the steam ports (**photo 11**). For a 60deg. arc at 11/32in. radius, using a 3/32in. slot drill, the table movement is 44 degrees.

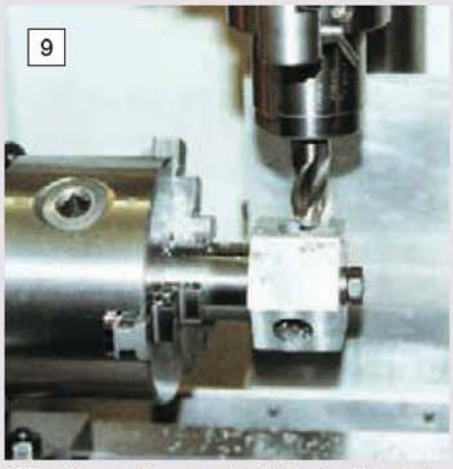
The remaining operations, steam passages and tapped holes, should be left until the various mating components are completed.

●*To be continued.*

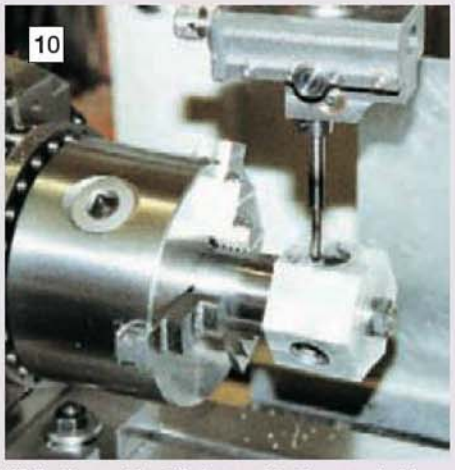




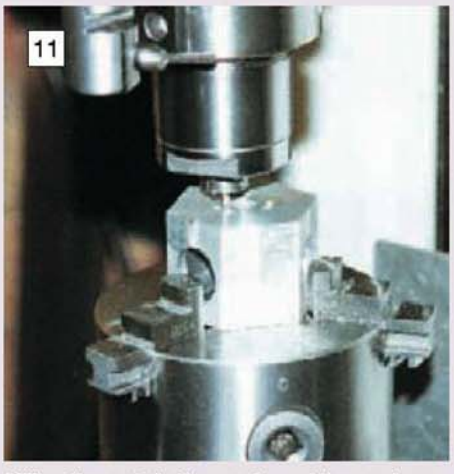
Setting the crankcase up in the dividing head with a DTI such that one of the faces on the casting is parallel to the milling machine table



Milling the crankcase on its six facets. This photo. shows how the casting is clamped to the mandrel and held in the dividing head chuck.



While the part is still clamped to the mandrel in the dividing head, the cylinder registers can be machined with an offset boring head.



Milling the ports in the rear face of the crankcase using the rotary table on the milling machine.

PETE'S PAGE

STARTING OUT

Peter Spenlove-Spenlove recalls the first time he was shown the use of a lathe and offers much useful advice for the tyro.

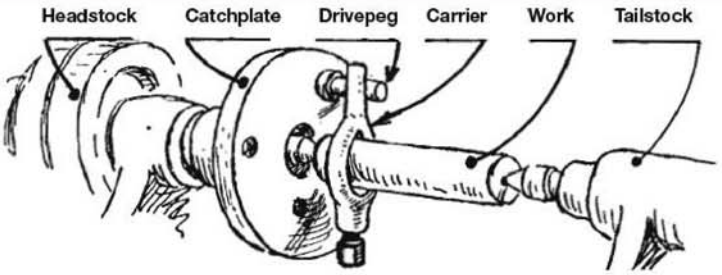


FIGURE 1 - TURNING BETWEEN CENTRES
Carriers, drivers or dogs as they are variously called, are placed on one end of the work to drive it between the lathe centres.

When I was a young boy I watched our local plumber refurbishing a batch of brass gas lighting fittings on his ancient lathe. Although most garages had one lurking somewhere, this was the first time I had seen a lathe in action. This lathe was treadle driven and the brass parts were gripped in a 3-jaw chuck. A tailstock drill was used to clear muck from the bore while emery cloth was used to brighten the outside prior to lacquering. On being called out, the plumber let me do the rest. It was fun and I was hooked.

He introduced me to H. J. (Bert) Dyer who taught me a lot in subsequent school holidays. As a contributor to *Model Engineer*, he suggested I should start reading it. The plumber's small lathe had no other accessories and I didn't know about catch plates, centre holes and turning between centres. It was some months later when I saw Bert turning a shaft between centres, having first removed the headstock chuck and drill chuck and fitted two pointed things in the exposed holes. This was indeed a far cry from sand papering parts for gas light fittings!

Some readers could currently be starting from scratch too, like me, with a very old lathe and a mysterious box of bits and pieces. Without a 'how to' book or an experienced engineer friend to help sort things out, an absolute beginner might assume, as I did, that the chuck is all you need. The cutting tools and drill chuck are pretty obvious and soon sorted, but what about the remaining bits in the box. No need to bother with them. The lathe works, so shove them under the bench until an 'expert' calls.

Maybe the illustrations from a 1920s 'how to' book could be your expert. The lathe is a typical small flat belt driven machine with **fig 1** showing normal turning between centres. **Figure 2** shows how to bore a cylinder or face the curved (part of a circle) saddle of, say a traction engine cylinder. In this case the lathe drives a stout bar with a cross-hole to hold a small cutting tool. A grub screw allows this tool to be moved out to cut the bore a bit bigger. This is repeated until the correct radius is achieved. It may be a slow process, but a true parallel hole should result.

Figure 3 may not have so much relevance today but when lathes were foot driven, this was how you would have worked on items that were too hard to turn. You simply treadled the lathe and turned the grinding wheel by hand. The grinding spindle assembly was clamped in the tool post which, in this instance, is the old English type. These are still found in many model engineers' workshops today. As you ground you treadled which was good exercise or hard work depending how you looked at it.

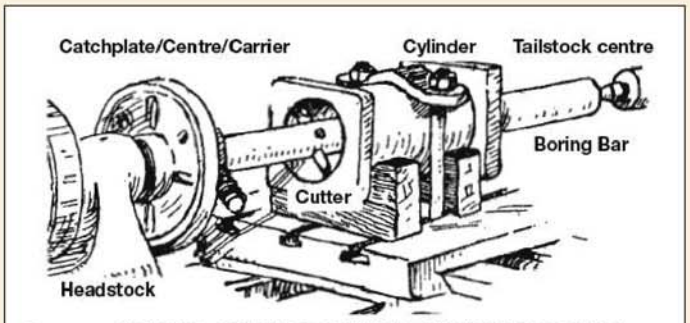


FIGURE 2 - BORING A CYLINDER ON THE CROSS-SLIDE

If, as a newcomer to workshop equipment, you read old engineering books you will come across alternative names for items. For instance many early books refer to fixed and loose headstocks. Today many of the regional variations have died out and we refer to the loose headstock as a tailstock. Some people still call the catch plate a drive plate. The carrier is often called a lathe carrier, driver or dog. In fact the term 'dog' was used for almost any clamping accessory used on machine tools until the mid-twentieth century. Dogs are even found beside the domestic fireplace to locate the poker and tongs. Sawyers and carpenters used spiked dogs to hold timber in place. Seafarers use the term too. Why the name of man's best friend should be given to clamps and spikes and other such gadgets is a mystery to me.

You may come across different spellings of the same word too. I have come across five or six different spellings for the word 'reamer' in old books. Much of this was caused by regional phonetics — the word was written as it was pronounced. Modern communications have largely resolved this issue.

Readers sometimes advertise in *Model Engineer* for an instruction manual for an early machine tool. In fact, very few makers issued one. A few prominent makers such as Myford and Southbend issued an installation and servicing manual. A few included a spare parts and accessories list. If obtainable, these are useful for identifying the parts that are missing off an old machine. If you have access to the internet it is well worth checking **www.lathes.co.uk** to see if any information is available for your machine.

Being mostly power driven today, machine tools are potentially dangerous. Most points are obvious but they can cause accidents, even if the machine is foot powered. Roll your shirt sleeves up, or better still, wear a short sleeved shirt. Don't wear a sloppy sweater, it's better to wear a buttoned up workshop jacket. Tuck your tie inside your shirt, it's better not to wear a tie at all. Don't wear a watch or a bracelet or rings when you're using machinery. Tie back long hair, or better still, tuck it inside a cap. Always remember to remove the chuck key before starting the spindle. If you don't it might fly out and hit you and/or damage your lathe. Keep small children away from your machinery, little fingers can so easily get trapped in gears or belting. When checking work in process, stop the machine completely and watch out for sharp cutting tools while you measure or test fits.

Make sure your eye protection suits you — and use it! Brass or cast iron swarf flies off the tool at high speed so watch your eyes. Other metals produce a ribbon swarf which is usually very sharp and hot. Stop the machine and remove it with pliers or a hook. Never use your fingers and never remove swarf when the machine is running. These points also apply to milling machines and even the small, humble drilling machine. They can all bite you when you least expect it!

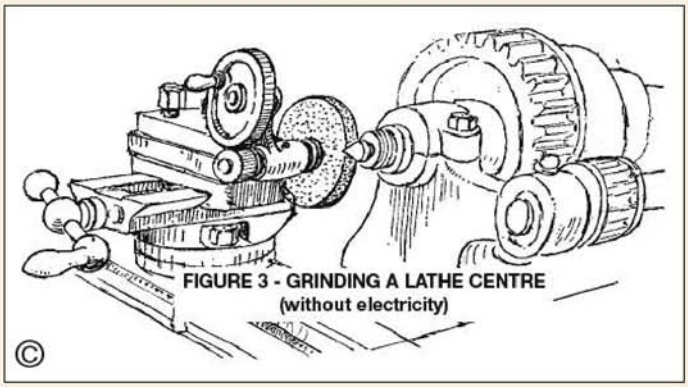
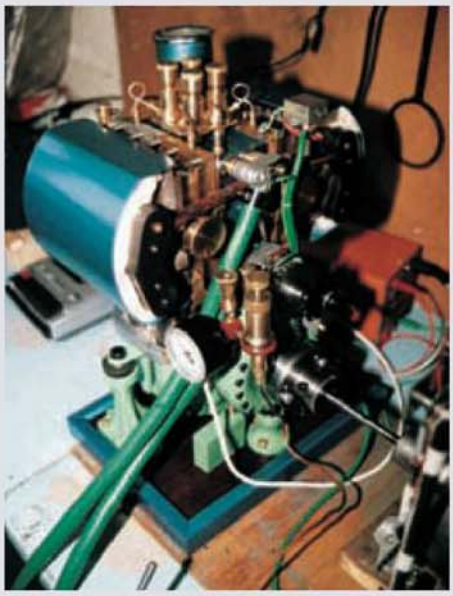


FIGURE 3 - GRINDING A LATHE CENTRE
(without electricity)



The Author's finished engine on its test bed surrounded by the associated insrumentation.

A BURNT AIR ENGINE

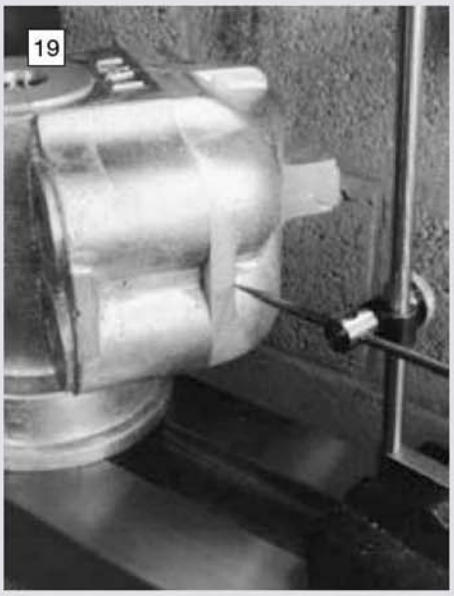
Frank Taylor
describes how he machined the sump casting for his interesting hot air engine.

●*Part III continued from page 275 (M.E. 4178, 20 September 2002)*

Work on the sump casting began by placing the square protrusion in the 4-jaw independent chuck and machining the gasket face. The sump was then offered up to fit nicely to the crankcase and the holes for the locating pegs drilled. As the yoke guides are in the sump, it was very important that the sump retains an exact position relative to the crankcase. Any error is likely to cause fouling or jamming when bolted up and identification of the exact problem would be very difficult to discover.

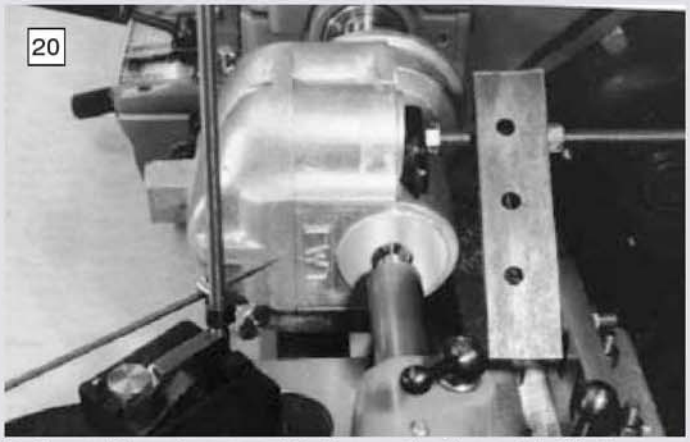
The method used to transfer the between-cylinder centre line, which was used to position the cylinders and to align the crankshaft, is shown in **photo 19**. **Photograph 20** shows how the crankshaft, mounted between the lathe centres, supported the crankcase. The threaded rod fixed to a piece of angle iron gave further support.

Before the sump was fitted, the crankcase gasket face was aligned vertical to the lathe bed by adjustment of the nuts on the threaded rod. The sump was then offered up on its locating pins. In this position the vital centre line was transferred to the sump.

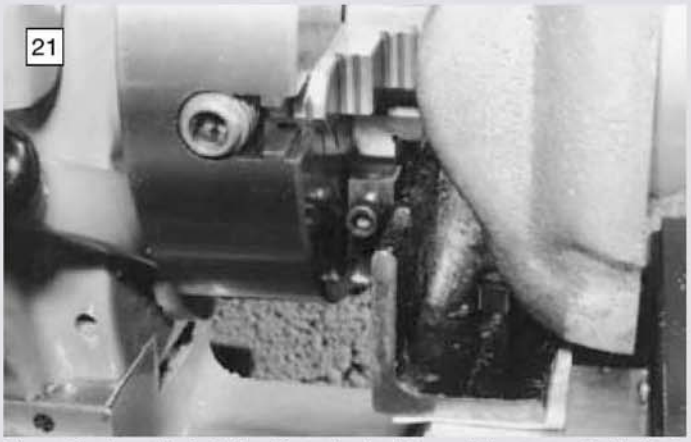


Transferring the between-cylinder centre line to the sump casting using a surface gauge.

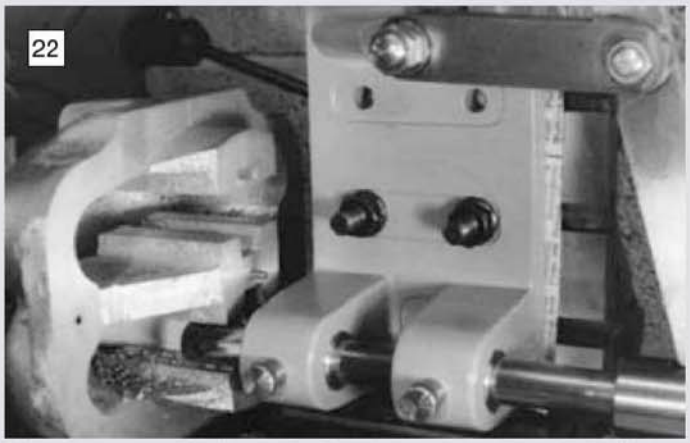
The next operation was to cut the slots in the sump to accommodate the hardened steel yoke guides. Before this could be done, the casting had to be returned to the 4-jaw chuck and set to run true. A pin had already been put in at lathe centre height when the face was turned, and this was used to set it up with a dial gauge. It was also necessary to set the datum lines truly horizontal. This was achieved with the special fitting shown in **photo 21** which I have found useful on many occasions since.



Further marking out was completed by mounting the crankshaft between centres and using this to support the crankcase casting.



The method used to lock the 4-jaw chuck while providing means for limited angular adjustment. The device is simply constructed from angle iron.



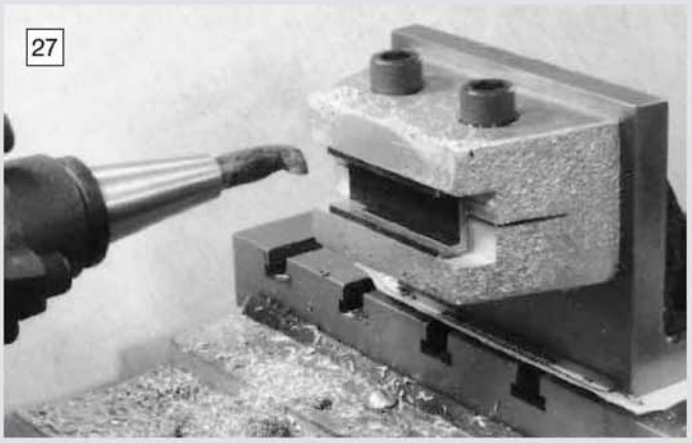
Using the home made slotting attachment mounted on the vertical slide to machine the yoke guide slots for the hardened steel inserts.

Finishing the sides of the slots with a specially ground tool racked to and fro using the saddle.

Finishing the bottom of the slots with a dental burr. Better attention to casting design would have avoided this by providing a through slot.

Milling the slot liners from gauge plate. This was a nice easy job as it utilised the lathe power cross feed. Table travel is towards the reader.

Machining the slot in the special aluminium alloy fixture used to hold the slot liners for finish machining.



Finishing a slot liner gripped in the specially prepared fixture. This device worked well and enabled the parts to be finished without distortion.

The fitting is a piece of angle with two blocks welded on. These blocks straddle the lower jaw of the chuck and are threaded and fitted with cap screws. Adjustment of these screws gives a small range of rotational movement and, when tightened, prevents the chuck from turning. Setting up on either of the vertical or horizontal centre lines was a 'doddle' and gave the four positions necessary for machining the slots which carry the hardened steel yoke guides that followed (**photos 22, 23** and **24**).

The bulk of the metal was removed using my home made slotting attachment (photo 22) mounted on the vertical slide. With the slotter handle high in the air and out of the picture, this was tough on the right arm muscle. The full depth was cut at this stage, leaving the sides of the slots a little undersize. The sides of the slots were finished to size with a specially ground tool clamped to the vertical slide (photo 23). Racking the saddle back and forth provided motion. This gave a good accurate result, but I regard it as ill treatment of a lovely machine. I was comforted by the fact that only a small amount of metal had to be removed. Note the centring pin mentioned earlier and one of the locating pin holes.

An error occurred somewhere when the pattern for the core of this casting was made. It was intended that all slots would be open ended to allow the cutter to clear. As can be seen (photo 24) the slot is not clear and the end of the slot was a bit messy. However the mess cleaned up quite nicely with a dental burr.

Machining the blocks that run in the slot liners using the faceplate. The pair on the opposite side of the faceplate are hidden by the tool post.

Slot liners

These were made from gauge plate in an attempt to minimise distortion when hardened. I felt that the thin U-shape would be prone to twisting. The liners posed a holding problem which was solved by the use of a special jig.

With power cross feed (**photo 25**) this is the sort of nice easy job where you can sit back, sip a 'cuppa' and watch the wheels go round. The liner was soft-soldered to a piece of plate which was packed up to the correct height and bolted to the cross-slide. The cross-slide was set to move outward, that is, towards the operator, to avoid the problems encountered in climb milling. After the cutting shown, the two uncut parts in the centre were removed to produce a shallow U-shape. When finishing to size, it was essential to ensure that all four slides were identical and that the slot was perfectly parallel to the edges. I chose the following method, involving another casting.

An aluminium alloy block was cast and slit as shown (**photo 26**) and the boring head used to cut a slot equi-spaced either side of the centre line. Cutting in this manner produced backward and forward forces on the cross-slide and small movement due to backlash. Out of sight of my camera is a weight hanging over a pulley to give this slide sufficient bias to prevent movement.

The engine slide was then gripped by tightening the cap screws (**photo 27**) without distorting the work, and the slide slot finished to the accuracy required. At the outset, I had my doubts about the method and was anticipating trouble, but it all worked out well. The job was finished by hardening and lapping.

Remaining items for the sump were four identical blocks to slide in the identical slides (**photo 28**). These were cut on the faceplate but this apology for an illustration was arranged with one pair of blocks neatly hidden behind the tool post.

I don't enjoy the photography because it takes takes up precious time and interrupts the job. This loss of continuity sometimes causes me to produce errors.

●*To be continued.*

BRAY'S BENCH

THE JUNIOR
A STATIONARY INTERNAL COMBUSTION ENGINE

Stan Bray

describes how he machined the crankcase covers for this attractive and deservedly popular little i.c. engine.

●*Part III continued from page 277 (M.E. 4178, 20 September 2002)*

There are two covers on the sides of the crankcase. One contains the timing gear and this also forms a housing for a main bearing as well that of the cam. The other, in addition to sealing the crankshaft housing, carries the other main bearings. Both are good clean castings which require the minimum of machining.

Main bearing housing cover

Although this is a good casting (**photo 12**), it is inevitably unlikely to run true of its own accord. So, gripping it by the large stepped section, it should first be set up in the 4-jaw independent chuck with the centre boss which will act as the bearing housing adjusted to run as nearly true as possible. Once set up to your satisfaction, the outer and smaller diameters are straightforward turning operations. The boss can also be trued and finally drilled for the bearing (**photo 13**).

The casting can now be reversed and gripped by the small diameter. A 'floating' centre interposed between the work and a tailstock centre used in conjunction with a dial gauge can be used to set the casting to run true (**photo 14**). This might be thought of as an unusual set up, but a normal centre finder won't work, because the hole is too large. Small pieces of shim brass or aluminium should be interposed between the chuck jaws and the work as a means of preventing damage to the machined surface as the jaws are tightened. Once correctly set, it is quite easy to finish the necessary machining.

Six holes are required around the edge through which studs are passed to secure the casting to the crankcase. Readers will have different ideas on how to make these. Experience suggests that three model engineers asked for advice regarding a machining operation will offer half a dozen methods! The easiest method is to do the dividing while the casting is still held in the lathe. For those with limited equipment, the divisions can be obtained by using one of the change wheels in conjunction with a detent, a method that has been described innumerable times in these pages.

Builders with a dividing head can of course use that. Whether or not the holes are drilled with the casting *in situ* will also depend on the equipment available in the workshop. If there are no facilities to drill the casting while it remains in the chuck, a centre punch holder is required. This need only be a piece of rectangular bar with a hole drilled along its length, and a tapped hole cross drilled for a screw to clamp the punch. This gadget is mounted in the tool post and the point of the punch set to centre height.


12

The aluminium alloy casting for the main bearing housing cover was clean and of good quality.


13

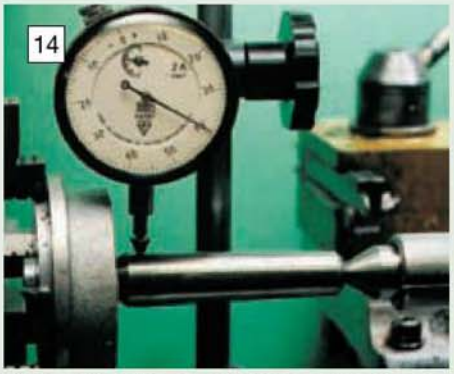
Set up for machining the outer face and bore of the main bearing housing cover.

The carriage is wound smartly towards the workpiece until the punch hits the casting on which it should leave a mark sufficient to allow a centre drill to start a hole. Repeat at all six positions before releasing the casting and taking it to the drilling machine to drill the holes tapping size. These holes should then be deburred.

Alternatively, the piece of rectangular bar could be drilled an easy but not sloppy clearance for the punch. Align the punch with the casting and hit it *once* and once only with a small hammer. Repeat this for all six holes.

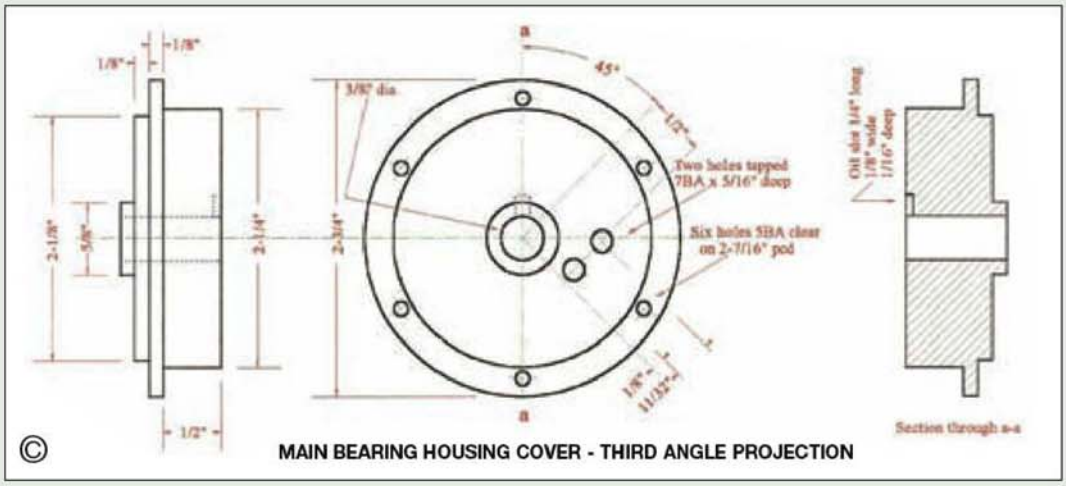
Having drilled the holes tapping size, using the cover as a jig, their positions can be transferred to the crankcase. Those in the cover can then be opened out to clearance size and the holes in the crankcase tapped.

There are two further holes in the cover, both tapped 7BA. At 11/32in. centres they are positioned on a line 1/2in. below a 45deg. angle through the centre of the cover, the first set 1/8in. off centre as shown on the accompanying drawing. These holes are used to secure the governor lever bracket to the cover and I suspect that attempts to mark them out to match holes previously made in the bracket would prove to be a real nightmare. I suggest that the centre line of the holes is clearly marked, together with the position of the left hand hole which can be drilled and tapped. When we come to the bracket it can be bolted to the single hole, aligned with the scribed line and used as a jig for the second hole.

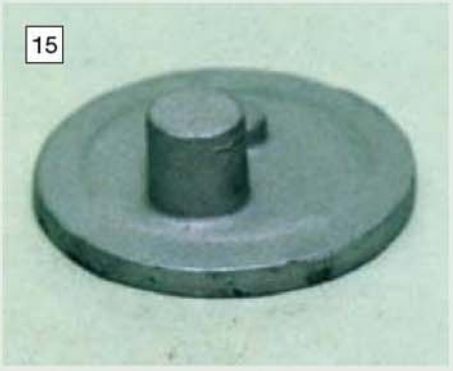

14

Finding the centre of the bore after reversing the cover in the chuck using a centre and dial gauge.

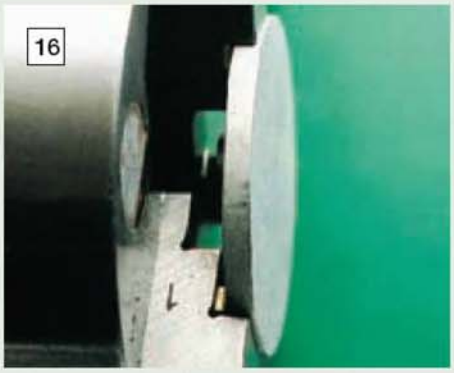
It only remains now to make to make the oil-retaining slot which is the same as the one in the crankcase. This one is easy enough to produce



MAIN BEARING HOUSING COVER - THIRD ANGLE PROJECTION



The timing case cover casting showing the extended boss referred to in the text.

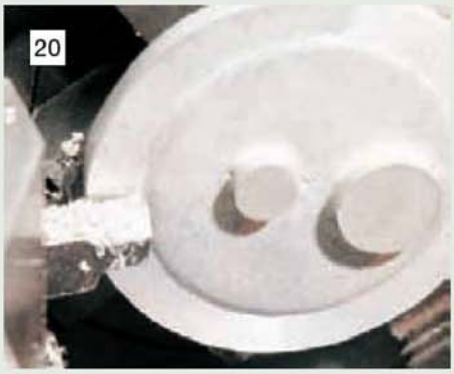


Make a start on the timing case cover by machining the back to size in the 3-jaw chuck.

The casting has now been reversed in the chuck and a small centre mark made.

After making the centre mark as a marking out aid, the bosses can be machined to length.

The cover was stuck to a block of steel using double sided tape and the centre picked up.



The outer face and edge can now be machined. Cut into the support block to complete the edge.

by milling, unlike that in the crankcase which was very difficult to get at.

Three bronze bearings will be needed in total. One of these is for this cover and there is no reason why they should not be made now in readiness for fitting.

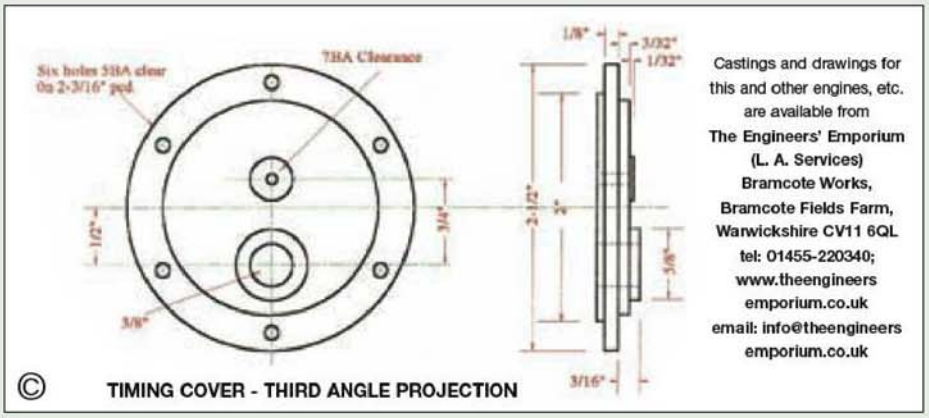
Timing cover

Unfortunately the timing cover is less straightforward than the main bearing housing and takes a little more time to set up. It is a considerably thinner casting with two small bosses cast on. The larger of these is obviously also used in the casting process and is much longer than required (**photo 15**). If left like this it gets in the way when setting up so I suggest that a start is made by shortening it but leave sufficient material so that it can be machined.

As with the others, this casting is sufficiently accurate to allow the back face to be machined with the minimum of fettling necessary beforehand. It can be gripped in the 3-jaw chuck for this operation as accurate concentriciety at this stage is not important. I found that 1/16in. thick brass packing was required between the jaws and the casting to bring the latter out far enough for machining (**photo 16**). These were stuck to the chuck jaws with double-sided adhesive tape to stop them falling about as adjustments were made. A slight discrepancy on the original general arrangement drawing shows a recess to allow for location of the cover in the hole, while the detailed view of the part shows it as plain. We understand that the drawings presented with these articles will be the ones supplied in future with the castings.

It is of course always handy to have a locating lip, but since one of the two holes is for a crankshaft bearing, the problem of accurate alignment will also require consideration. If the lip is machined on, very careful marking out will be necessary to get things properly lined up. Without the lip, adjustments can be made easily.

The two bosses both have holes in them; one, as detailed above, is for a main bearing. The other is for the camshaft and neither is concentric with the outer edge of the casting, which complicates matters a little. Assuming your 3-jaw chuck is reasonably accurate, start by gripping the casting in it and making a tiny centre with a small centre drill (**photo 17**). The faces of the two bosses can also be trued at this stage (**photo 18**).



© TIMING COVER - THIRD ANGLE PROJECTION

The outer rim now has to be machined true to the centre mark just drilled, so it is not practical to hold the casting in a chuck. I resorted to my time-honoured technique of sticking it to the trued face of a block of mild steel, using double-sided adhesive tape. If you choose to follow suit, make sure when doing this that all traces of the white spirit which you have been using as a cutting fluid have been removed from the back face of the casting; a drop of washing-up liquid helps here. The mild steel block can be gripped in the 4-jaw chuck or on the faceplate if you prefer and the cover centralised by using a centre finder in the indent made with the centre drill.

The centre finder which I normally use wouldn't fit between the bosses and so I had to make a special one with a 1/8in. dia. body and 1/16in. dia. probe. This was fitted into a pin chuck, which in turn was supported on the tailstock centre. It was then possible to adjust the cover accurately so that the outside rim and outside edge of the face could be machined true (**photo 19**). Double sided adhesive tape is fine if only light cuts are taken in order to avoid stripping the casting from its adhesive mounting. A modicum of common sense should ensure that the method is quite safe (**photo 20**). *Please understand that it is important that the surfaces to which the adhesive tape attaches on both the block and casting must be absolutely smooth and free from oil/grease.*

After machining has been completed, a sharp tap with a wooden mallet in a sideways direction should separate the casting from the block. If it doesn't, give it a generous spray with WD40 or similar and leave it overnight after which it should come away easily.

The holes in the two bosses can be marked off from the centre that was used to set the casting in the lathe and can either be drilled at this stage or left until later. The six holes for the bolt down studs can also be drilled.

●*To be continued.*

A FERRIS WHEEL CLOCK

Richard Stephen

describes how to make and fit the front section of the centre arbor before continuing with further work on the motion, dial and hands.

●*Part VIII continued from page 291 (M.E. 4178, 20 September 2002)*

The centre arbor cock in position in the clock together with the respective wheels and pinions.

The dial and hands of the clock. The Roman numerals are best engraved mechanically.

The front section of the centre arbor and the centre arbor cock are shown in **fig 28**. This section of the centre arbor should be made from blue pivot steel. I turned my arbor from a length of 4mm dia. steel. Blue steel turns quite easily with correctly ground tools, however most readers may prefer to fabricate the arbor. For this you will need a 30mm length of 2mm dia. blue steel or equivalent. Draw the temper from about 5mm from one end. This will make it easier to drill the 1mm hole for the pin.

Begin by drilling a 2mm dia. hole about 8mm deep in a scrap length of 6mm dia. brass rod. Insert the softened end of the blue steel rod and secure with Loctite screwlock. Cross drilling the 1mm hole will be much easier as the 6mm rod is easier to hold and there is much less likelihood of a small drill snatching as it breaks through the 2mm dia. rod. Gently heat the brass rod to remove the blue steel rod.

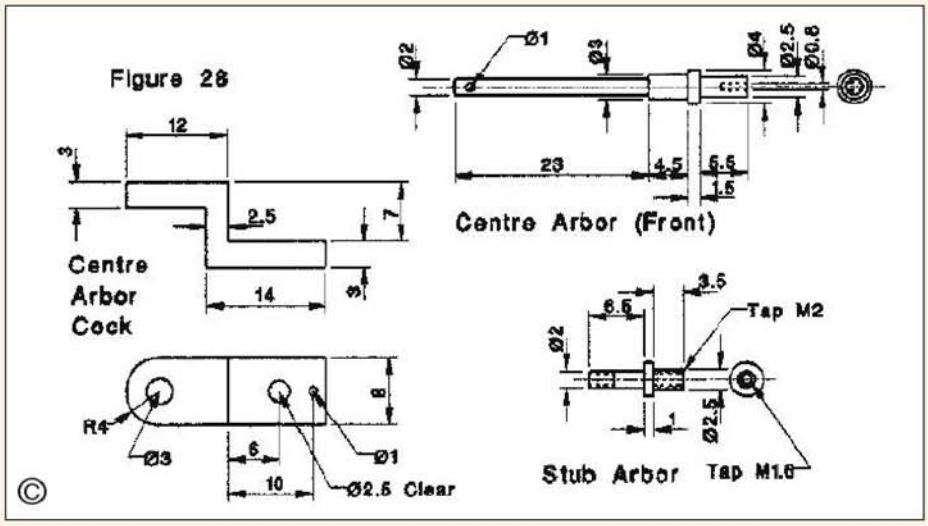
The remainder of the arbor can be made from EN1A mild steel as the arbor runs in a ball race in front and, as before, the pivot is 0.8mm dia. high-speed steel drill rod. Take a 15mm length of mild steel rod, face the end and drill and ream a 2mm dia. hole 8mm deep. Using Loctite high strength retainer, fix the blue steel rod into the hole. Allow the Loctite to cure. Very gentle warmth will accelerate the curing process. Hold the 2mm dia. rod in a collet or true chuck and machine the rest of the arbor. Drill a 0.8mm dia. hole for the pivot and secure the drill rod in place using Loctite. Cut off 3mm for the pivot and finally grind the pivot to its final length of 2.5mm.

The recess in the front bar for the 3mm ball race can now be counterbored as previously described, and the race fitted. Fit the arbor in the ball race and measure the distance between the surface of the front bar and the rear shoulder of the arbor. This measurement, plus 0.25mm, will be the height of the centre arbor cock. The remaining dimensions of the centre arbor cock are given in fig 28. The cock is best made from a solid piece of brass 8 x 12 x 35mm. Drill the holes for the 2.5mm dia. aluminium bronze bush, retaining screw and the 1mm dia. register pin.

Fitting the centre arbor cock

Begin by facing off a short length of 15mm dia. brass or steel rod. Drill and ream a 3mm dia. hole through the piece of rod. Using Loctite screwlock, fix the length of true 3mm silver-steel rod into the hole with about 25mm protruding from the faced end. Pass the 3mm dia. rod through the 3mm dia. hole for the centre arbor in the front bar and thread on the centre arbor cock. Clamp the cock in position on the front bar. The cock will be correctly positioned when, with the faced end of the 15mm rod pressed against the front face of the front bar, the 3mm rod can be easily turned with the fingers.

Drill the 1mm dia. hole for the register pin.



Insert the register pin in the cock and reposition the cock using the register pin to locate it. Check that the 3mm dia. rod still turns easily, clamp in position and drill and tap the 2.5mm dia. hole for the retaining screw. The aluminium bronze bush can now be made and fitted in the cock. Insert the ball race and the arbor and fit the cock in place. The arbor should spin freely with a small amount of end shake.

Motion work

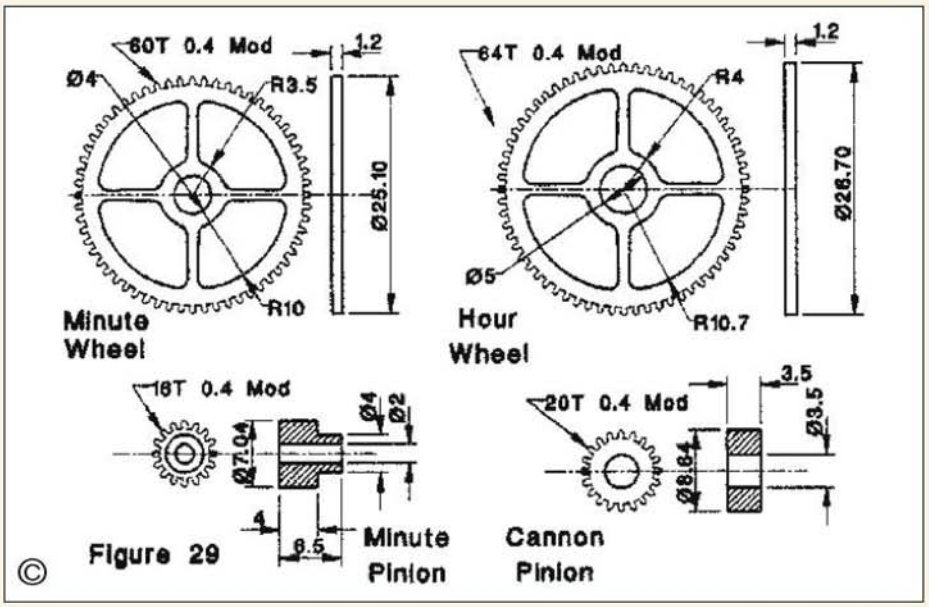
The motion work used in the clock is unusual in that it uses large count pinion wheels. Instead of the usual 6 tooth minute wheel pinion, the motion work for this clock uses a 16 tooth minute wheel pinion. The details of the motion work are given in **Table 2**. The cannon pinion and minute wheel pinions can be made either of steel, hardened and polished, or from hard brass. The dimensions of the wheels are shown in **fig 29**.

Cut the teeth in the wheels and the two pinions not forgetting to cut a couple of spares of each while everything is set up. Before crossing out the minute and hour wheels don't forget to polish the teeth as previously described. Holes will need to be drilled in the pinions when you have finished cutting the teeth. Drill a 3.5mm dia. hole in the cannon pinion to fit on the minute pipe. The cannon pinion is 3.5mm long. The minute pinion is turned down to 4mm dia. for 2.5mm, and a 2mm dia. hole drilled. The minute pipe, hour pipe,

Table 2

	No. of teeth	P.C.D (mm)	Full dia. (mm)
Minute wheel	60	24.0	25.1
Hour wheel	64	25.6	26.7
Cannon pinion	20	8.0	8.64
Minute pinion	16	6.4	7.04

All wheels and pinions 0.40 module



hour hand collet and the washer for the front of the minute hand are shown in **fig 30**.

The tension spring is unusual in that it is a 2mm I/D compression spring fitted inside the minute hand pipe. The spring presses against the shoulder on the center arbor which extends through the front bar. Peter Bradley introduced me to this method for tensioning the minute hand several years ago since when I have found it superior to the more usual leaf spring. The stub arbor illustrated in fig 28, on which the minute wheel and pinion runs, is made of silver-steel and hardened and tempered.

Planting the motion work

Set the motion work up on the depthing tool. A long 2mm dia. runner will be needed for this. The theoretical arbor spacing for the motion work is 16mm. Set the arbors at this spacing and position the wheels. Check that the motion work runs smoothly. Remove the runner from the drilling jig and insert the 3mm dia. end of the other runner into the 3mm dia. centre arbor hole. Position the jig centrally below the centre arbor and drill a 3mm dia. hole through the front bar.

This hole must now be expanded to 3.5mm dia. to take the end of the stub arbor. The safest way to expand the hole without accidentally shifting the centre is to drill it on the milling machine. I have a 50mm length of 6mm dia. silver-steel with one end ground to make a centre. Fix the centre in the drill chuck, locate the hole in the front bar and press the bar firmly against a drilling board. Clamp firmly in position. Remove the centre, fit a 3.4mm dia. drill and expand the hole, finishing with a 3.5mm dia. reamer.

Assemble the centre arbor and the motion work and check that it still runs smoothly. The 3mm dia. centre arbor hole in the front bar should now be expanded to 3.5mm diameter.

Dial

The dimensions of the dial for the clock are given in **fig 31**. Unfortunately, apart possibly from the hands, the dial is the one (and in my opinion the most important!) part of the clock, about the making of which I can offer little advice. There are four options:

1: Hand engraving,
2: Chemical etching,
3: Machine engraving,
4: Getting someone else to make it.

If you are an expert with a hand graver there is no doubt that a hand engraved dial is by far and away the most stylish and best choice.

Chemical etching involves the use of corrosive chemicals best kept well clear of the workshop. With care, etched dials are good, provided CZ108 brass is used.

For most amateur clock makers the last two options are possibly the only practical ones but for myself, I do not like asking someone else to make the one part of a clock which everyone looks at.

This leaves machine engraving as the final option. If you have access to a pantograph engraver and the appropriate copy, this a viable option. The dial for the prototype was engraved on my Wabeco CNC mill. If you are heavily into clock making it is almost worth retro-fitting a CNC set-up on your milling machine simply to make dials. The cost of the CNC would be soon recovered with the saving on dials.

Fitting a poor dial to a clock you have possibly spent months making is a complete waste of time.

Hands

The design of the hands which I made for my clock is shown in **fig 32**. I have tried many different designs for hands but always revert to the Brueget style which I consider to be both simple and elegant.

The best material I have found for hands is the steel from a cheap cross-cut wood saw blade which is a little less than 1mm thick. The steel is rather hard and a bit difficult to work but this disadvantage is more than offset by the stiffness of the steel which enables very delicate hands to be made without sacrificing strength. When finished, the hands must be brought to a high polish, carefully degreased and then remain untouched by bare fingers until they have been blued.

The spring collet for the hour hand is illustrated in fig 30. The only tip I can offer when making the collet is to leave the diameter well oversize when you cut the slits with a slitting saw. If the diameter of the collet is reduced to its final thickness before slitting there is a danger of the teeth of the saw snatching. Once the slits have been cut, the diameter can be reduced to its final size, the collet being supported by inserting a length of 5mm dia. rod and taking very light cuts with a very sharp tool.

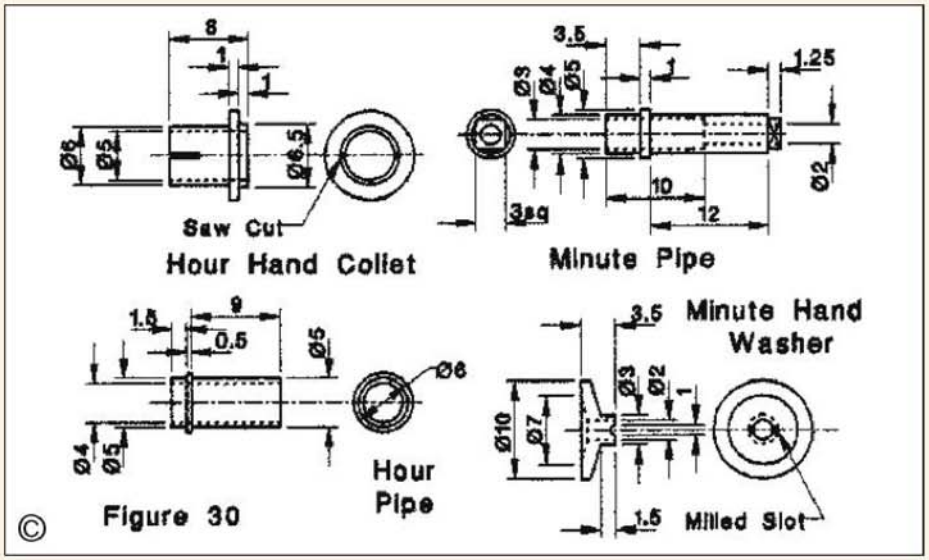
Use Loctite to retain the hour hand securely on its collet and then rivet the hand firmly in place, using an old lathe back centre.

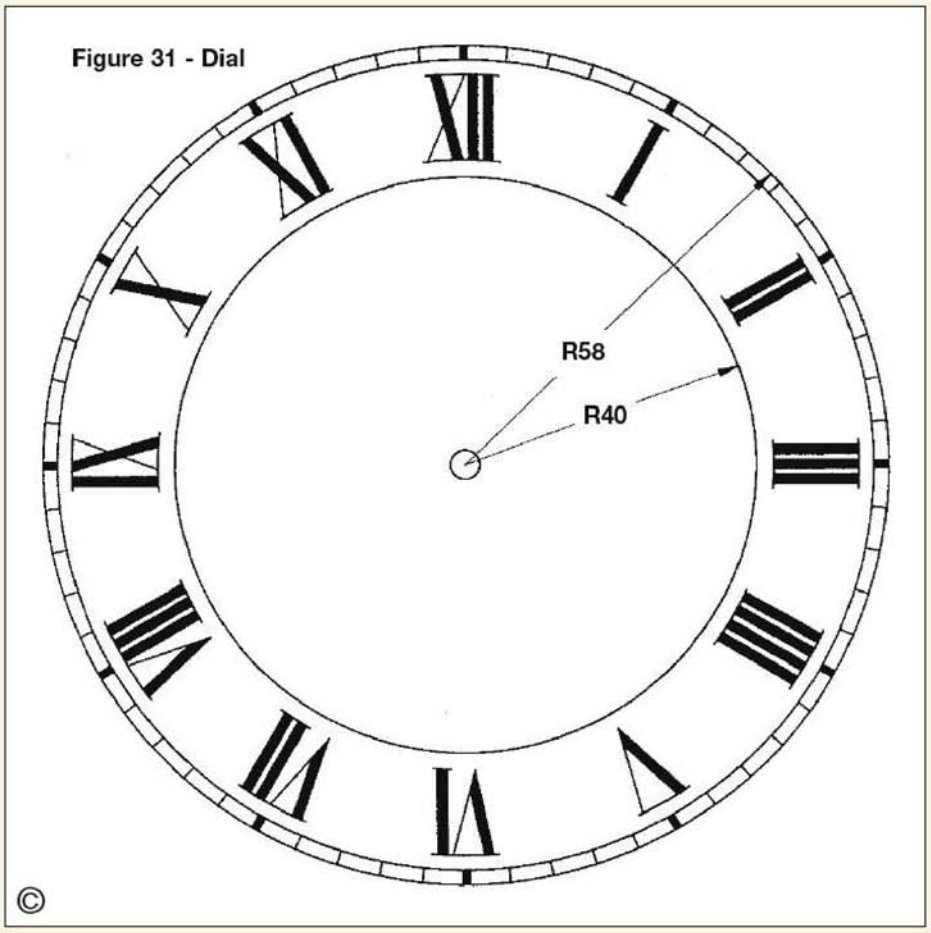
Fitting the dial

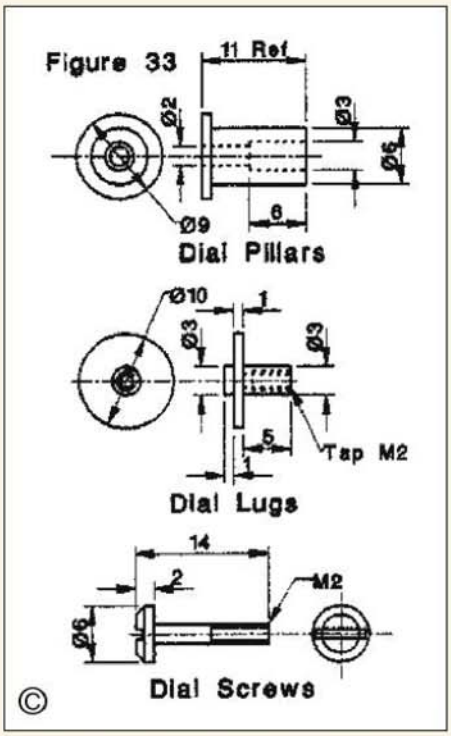
The dial is attached by two screws which pass through the front time bar, through two spacing pillars and screw into two lugs soft soldered onto the back of the dial. The dimensions of these parts are given in **fig 33**. The height of the pillars is best determined when you are fitting the dial in place as this depends on the final positioning of the hands.

To fit the dial correctly in position you will need a 125mm square piece of 1.5mm thick Dural or other aluminium alloy sheet, or any other sheet metal which happens to be to hand. Mark the centre, scribe two circles equal in diameter to the inside and outside diameters of the dial and mark a line to pass through the centre (**fig 34**). Now drill two 1mm dia. holes on the line midway between the two circles (fig 34) and a 3mm dia. hole in the centre.

Fit the front section of the centre arbor and the front arbor cock in position on the front bar. Pass the centre arbor through the centre hole in the Dural sheet and align the centre line (uppermost) on the Dural sheet with the centre line of the front bar. Clamp the Dural sheet to the front bar. Mark the positions of the two 1mm dia. holes in the Dural sheet on the front time bar using a 1mm dia. drill. ▶







Remove the Dural sheet from the front bar and place the dial on top of the Dural sheet, lining up the 12 and 6 with the scribed line and the outside and inside circumferences of the dial with the scribed circles. Clamp the dial and the Dural sheet firmly together. Mark the positions of the two 1mm holes on the back of the dial, again using a 1mm drill.

Clamp the dial on a drilling board onto the table of the milling machine and locate one of the 1mm holes marked on the back of the dial using the centring microscope. Drill a 2mm dia. hole *1mm* deep in the back of the dial. Replace the drill with a 3mm dia. slot drill and expand the hole to 3mm diameter. Pick up the second hole and drill it. *Take care not to drill through the dial.* Check that the dial lugs fit snugly into the holes drilled.

Tin the area around the holes and the lugs with soft-solder. Smear a little flux on both tinned areas; locate the lug and heat with a small flame until the solder melts. Repeat the process for the second lug. Carefully remove any solder that is visible and wash off any remaining flux using detergent and hot water.

Drill the 2mm dia. holes in the front bar using the milling machine, using the centring microscope once more to locate the positions of the holes. The dial can now be screwed in position. The final height of the dial spacers can be determined when the hands are fitted. A 1mm separation between the dial face and the hour hand and between the hour hand and the minute hand is about right.

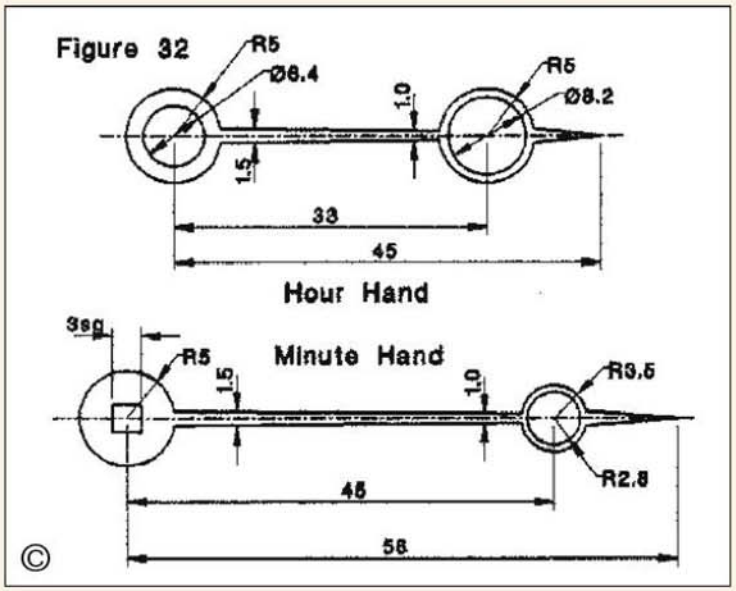
With the dial fitted, the engraving on the dial can be filled. The best filler for dials is slow setting epoxy, coloured black with candle black.

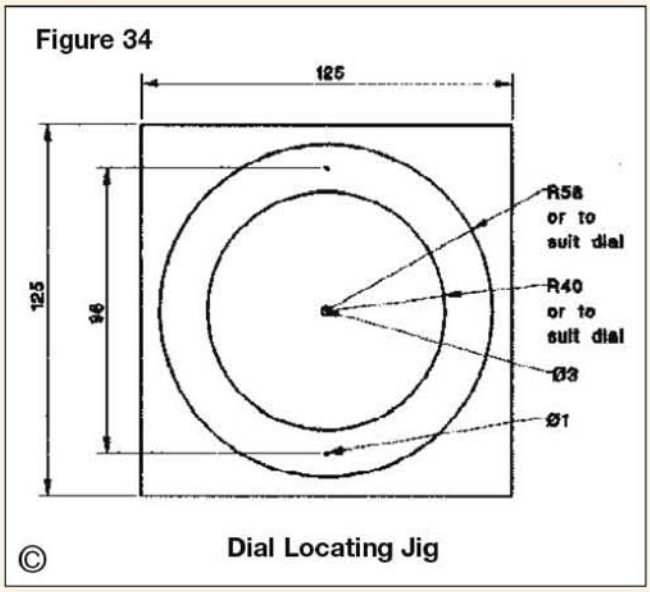
Hold a scrap of sheet metal in a candle flame until a good deposit of soot appears on the metal surface. Allow to cool. Mix some slow set epoxy in the middle of the soot and incorporate the soot into the mixture. Smear the mixture into the engraving and warm the dial very gently until the epoxy runs. This will ensure that the epoxy thoroughly penetrates the engraving. Leave overnight to allow the epoxy to fully cure.

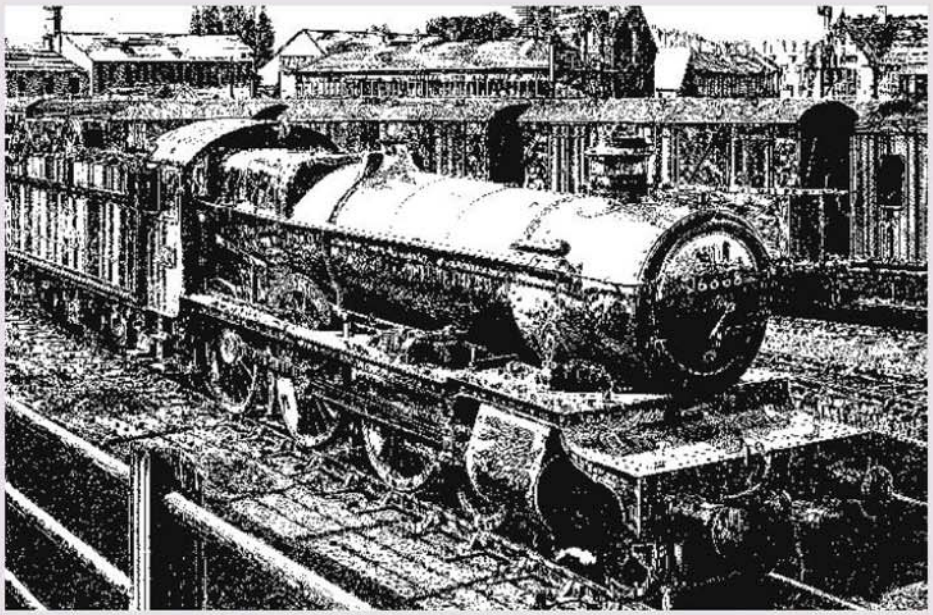
Excess epoxy can be removed with 500 grit wet and dry abrasive paper. This is best done in warm water to which a squirt of washing up liquid has been added. The surface of the dial can now be grained using 1200 grit wet and dry abrasive paper. Wash off the dial, dry with paper towel and silver immediately. Finally lacquer the silvering and the back of the dial.

Assemble the entire movement and run it for as long as you can be bothered to keep replacing the balls as they drop off the wheel. My movement will run with two balls in slots close to the '9 o'clock' position. With all eight balls in place there is plenty of power to spare!

●*To be continued.*







PENRHOS GRANGE

Neville Evans
discusses a few more facts about the prototype locomotive before commencing work on his new design with a description of the frames and buffer plates.

●*Part II continued from page 180 (M.E. 4176, 23 August 2002)*

The frames of the Great Western outside cylinder locomotives were unique in British practice. Churchward used bar frames which extended from behind the cylinders up to the buffer beams and plate frames from the rear of the cylinders to the rear drag beam. This rather strange arrangement evolved from American practice, in which the bar frames continued the length of the locomotive. The Americans, however, mostly used Wootten type fireboxes for their larger engines. Owing to the greater height of the generous American loading gauge, these wide fireboxes could sit on top of the bar frames. Chuchward wanted to use narrow fireboxes set between the frames and therefore was obliged to use plate frames at the rear of his locomotives in order to fit in the maximum width of box.

In America, it was not unusual for the two cylinders and the smokebox saddle to be made as a one-piece casting which, of course, contained all the live steam passages as well as the exhaust ports. Churchward was much taken with this arrangement but found that he was unable to make a one-piece casting. Because he wanted to cast his cylinders integral with the smokebox saddle, he had to be content to have them cast in two halves. To save the expense of unnecessary pattern making, the two halves were similar, which meant that when bolted back to back, the cylinder bores obviously had to be parallel to the centre line of the locomotive. This had nothing to do with any prejudice against inclined cylinders which he used on most, if not all of his inside cylinder locomotives, it was just simple economics and common sense.

The other locomotive that was built with the No. 1 boiler was No. 97, the prototype of the 2800 class, which was the standard heavy freight engine with 4ft. 7in. coupled wheels. This locomotive used the same cylinder castings as the 2900s, and to avoid fouling station platforms, the cylinder centres had to be lifted by 2 1/2in. above the centre line of the wheels. As the 2900s used the same cylinders, they were also given the 2 1/2in. offset. Normal practice with separate cylinders would be to incline them, but Churchward was unable to do this for the reasons given. At the time, I think Churchward was being criticised by some members of the Great Western board for making such elaborate, expensive locomotives, and therefore any slight economy would have been worthwhile.

The 'Courts', which were the last of the 2900s, were turned out with the cylinders dropped 2 1/2in. so that their centre line coincided with the centre line of the coupled wheel sets. Presumably the Great Man felt that his position was now strong enough to lash out on a new pattern, having proved that the 'Saints' were by far the best engines in Britain.

Frames

I have shown three drawings of the frames in side view. The complexity of the design means that it would be too difficult to get all the detail in even two views. The plan view will follow in the next, gripping episode. When I first looked at the General Arrangement drawing of the 'Grange', I was immediately struck by the differences between these frames and those of the 'Manors'. As I said in the previous article, the 'Grange' has much greater depth over the coupled wheels to give greater rigidity and strength in this area. The frames are also, of course, longer at the rear end to accommodate the larger firebox of the No. 1 boiler. I do not think that scale bar frames and prototypical cylinders and saddle are justified in a 5in. gauge model, although Trevor Shortland's 6100 2-6-2 tanker does incorporate all these features. The huge expense of pattern work and that of the intricate cylinder casting necessarily precludes this approach to the model and I'm sure that the average modeller would prefer a locomotive that doesn't cost the earth and which can be built over a reasonable time span.

Starting at the sharp end then, I have made the buffer plate, or should we call it the buffer beam, I'm never quite sure, closer to scale thickness and have incorporated a brass rectangle as a front stay and support for the beam. The outside portion is braced by two 1/16in. plate stays, and the whole set-up should be quite rigid as well as closer to prototype in outward appearance.

Most of the rivet detail on the buffer beam has to be dummy, the snap head rivets being recessed into the rear of the plate. The plate is fastened to the brass stay by means of 6BA countersunk screws. You can either Linish off the slots, or fill the slots with one of the many proprietary fillers after assembly. The buffer plate and the stay can then be left as a finished assembly. Incidentally, on the full size 'Manor', the largest rivet heads on the buffer beam are 1 1/2in. diameter which is 0.132in. to scale. As the head sizes of small rivets seem to vary quite a lot, I suggest you measure some up and choose the most appropriate shank diameter. The buffers and draw hooks are as detailed by Martin Evans for *Torquay Manor*. Note that although the later batch of 'Manors' was built with the parallel shanked buffers which had eight bolts, four large to hold them onto the beam and four small, to tension the buffing spring, the early 'Manors' and the 'Granges' used the older type with only four bolts. Later in their tragically shortish lives most of the 'Granges' sported the parallel buffers as can be seen in many of the later photographs.

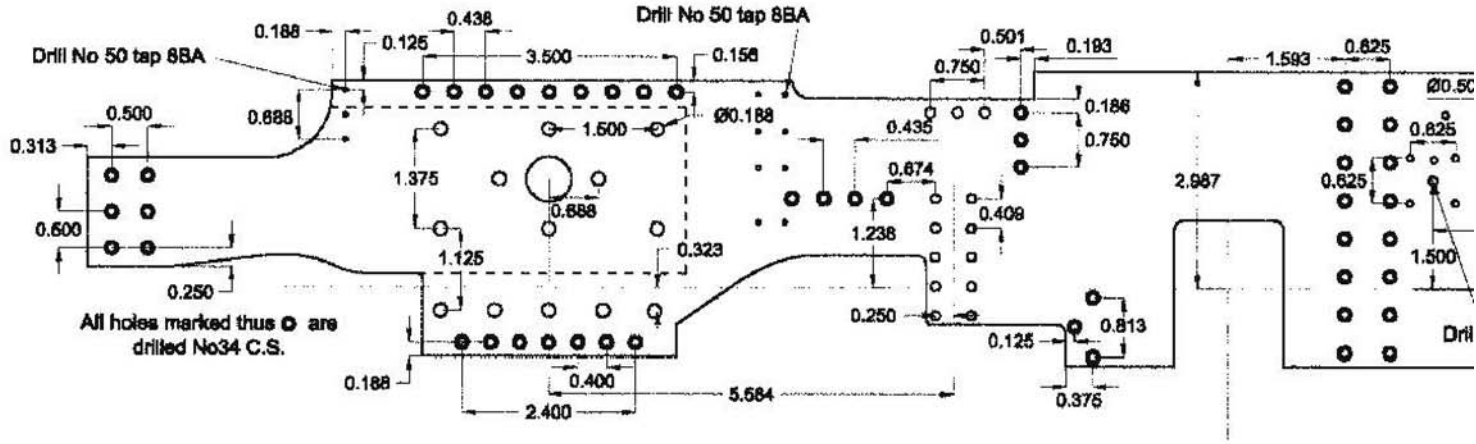
Frame doublers

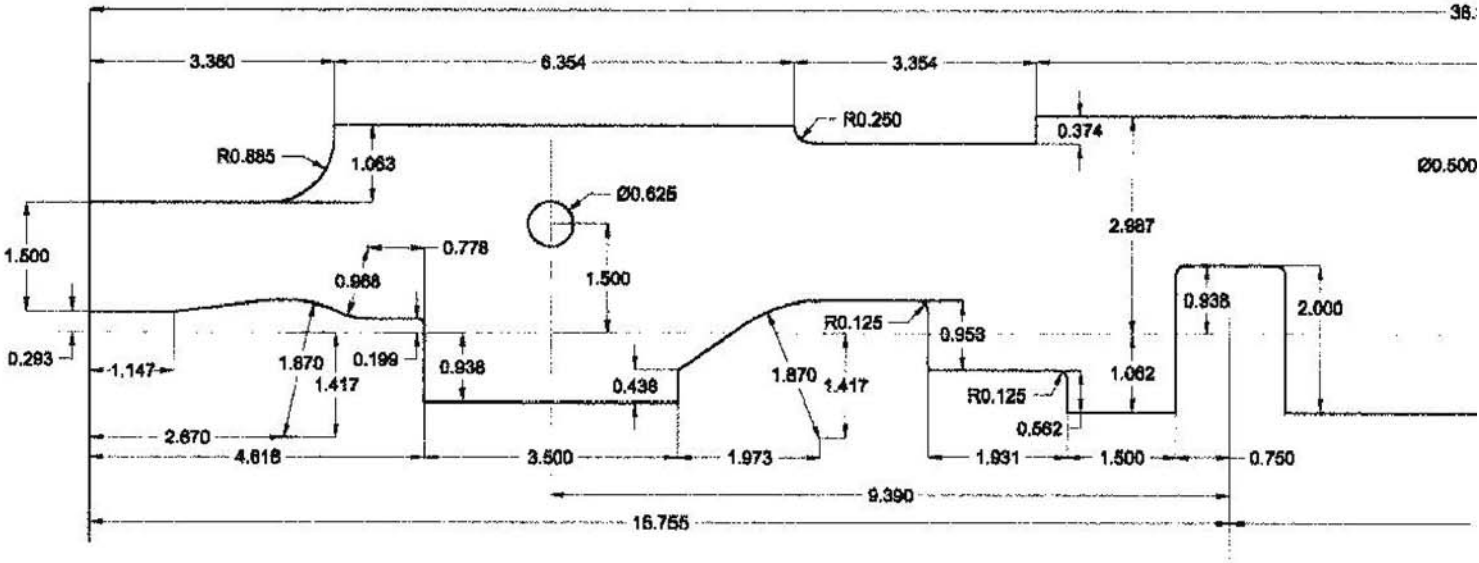
There are 1/8in. or 3mm doublers stretching from the buffer plate to the rear of the cylinders. They have the effect of stiffening the rather shallow front end, and giving a base for the distinctive GWR smokebox saddle. The doublers are fastened by a line of 1/16in. rivets about 1in. apart and 1/8in. from the outside edge of the plate. The bogie and bogie stay are as describd for *Torquay Manor*. I shall be detailing the rest of the stays because of the greater depth of the frame and the fact that the cross member to the rear of the driving axle is vertical in the 'Grange', as opposed to the angled stay on the 'Manor', which, of course, is necessary because of the sloping firebox tubeplate of the 'Manor'.

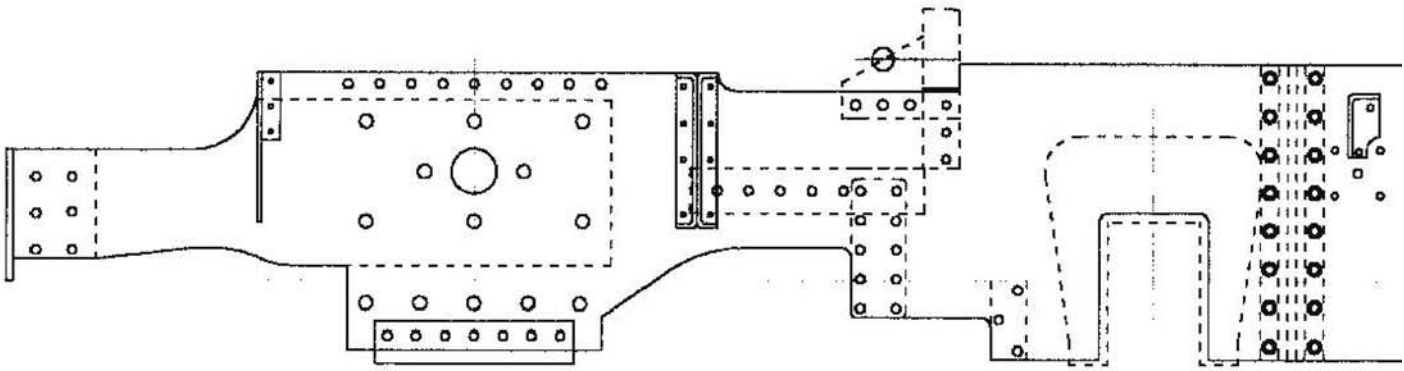
The horizontal stay has unequally placed bolt holes because the two rear holes are also used to locate the motion bracket. Once the position of the motion bracket has been fixed, then the holes can be spotted, drilled through and tapped. The frames are from 3mm CR4 steel. If you use 1/8in. plate (assuming you can get it) then remember to reduce the total width of all the various stays by 0.012 inch. The front block will of course have to be thinner by 0.024in. due to the doubler plates. Laser cut frames will be available from Practical Scale at reasonable cost. One of the great advantages of laser cut frames, which actually are not much more expensive than the cost of the steel plate, is that any worries about warping after cutting disappear.

The drag box is cut from solid brass. This adds a great deal of useful weight where it's most needed, as well as giving the back end a really secure fixing platform. The rear plate is as close to scale as I can get it, including the two rubbing plates for the tender buffers. The holes which appear behind the coupled wheels are for the brake hanger pins. ▶

GWR 68xx No. 6868 *PENRHOS GRANG*

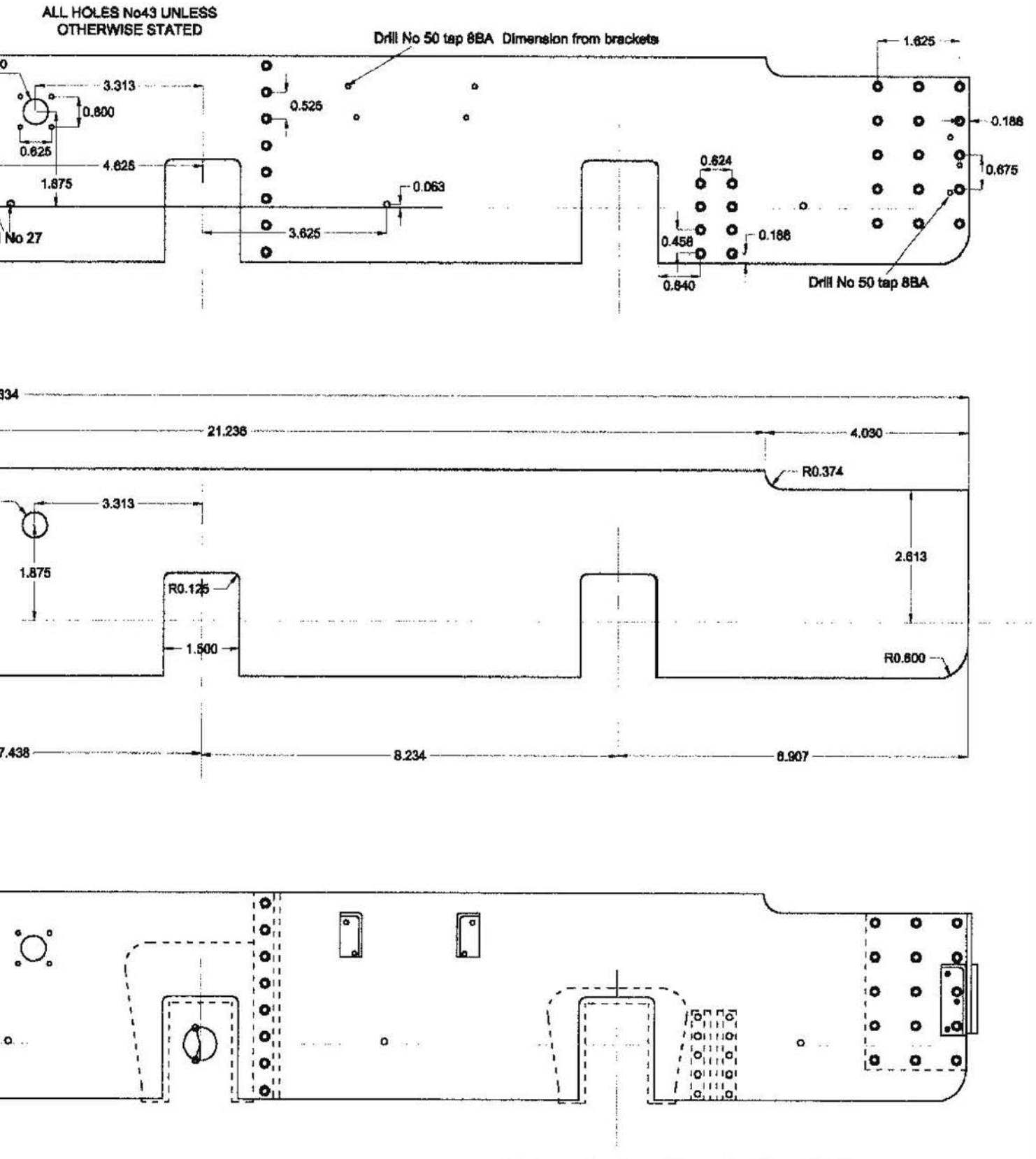






PENRHOS GRANGE MAIN FRAMES: 3mm or 1/8in. bright mild steel.

E by Neville Evans



Drawings, castings, laser cut frames, etc. will be available from **Practical Scale, 46 Pentyla, Port Talbot, West Glamorgan SA12 8AA tel/fax: 01639-883741.** Please send a stamped addressed envelope for list.

outing of the Hughes 5F 2-6-0 generally known as the 'Crab' for obvious reasons. This superb model was built by Robin Young of the West Wiltshire Model Engineering Society. As Chris Rayward said to me the other day *"There may not be so many locomotives being built these days, but the overall quality is rising all the time."*

Torquay Manor

Drawings (15 sheets, code LO940) for *Torquay Manor* by Martin Evans are available from Highbury Nexus Plans Service (call: 01322-660070). *Torquay Manor* was described in consecutive issues *M.E.* 3440, 5 May 1972 (Vol. 138) to *M.E.* 3475, 19 October 1973 (Vol. 139).

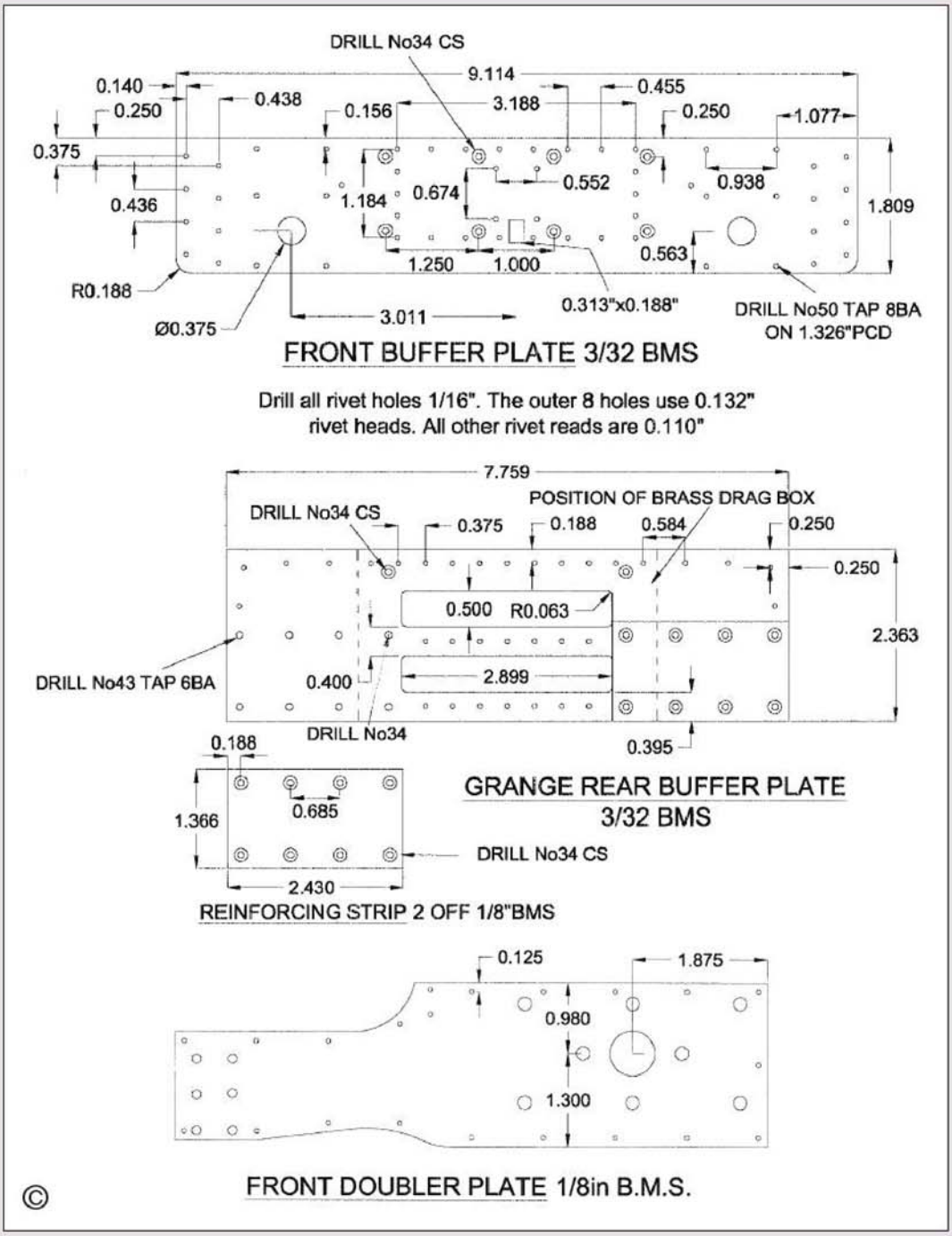
●*To be continued.*

I suggest that you consider Doug Hewson's lovely lost wax castings for these complex hangers, which can be stuck on and the bolting holes can be drilled through at a later date.

These frames have been designed to use the *Torquay Manor* piston valve cylinders as detailed in *M.E.* 3450 (6 October 1972). I must say that I like this design very much, the only snag that I can foresee is that the height of the valve chest above the piston rod centre line is set at 1.812in. whereas the scale dimension is 1.737in., as the distance between the cylinder bore and the valve bore on the 'Grange' and the 'Manor' is 1ft. 7⅝in. The 'Saints', 'Halls' and 'Counties' have 1ft. 5⅝in. between the bores, which of course scales out at 1.560in. at 1.063in.:1ft. for 5in. gauge. While I'm pretty sure that the offending 0.075in. can be lost in the cylinder casting to achieve scale dimensions in the 'Grange', I don't think that we can lose over 3/16in. so that these cylinders can be used for the 'Halls', etc., I am therefore offering a design for built-up cylinders which will fit the bill for both these locomotives and the 'Granges', as it will be easy to just alter the cylinder end plate dimensions to suit. The valve gear can be left as per *Torquay Manor* which has given excellent results in the past, or the eccentrics altered to my roller bearing design.

The other item that should be included with the frame drawing is the main hornblock arrangement. I can do no better than to ask you to follow the *Torquay Manor* drawings and to use either the standard hornblock which I shall detail in the next article, or to use Martin Evans' excellent design which shows separate horncheeks and leaf springs.

The photograph which accompanies this article was taken by Simon on the occasion of the first



ROAD STEAM

SAVAGE'S *LITTLE SAMSON*
in 3in, 4in. (and other) Scales

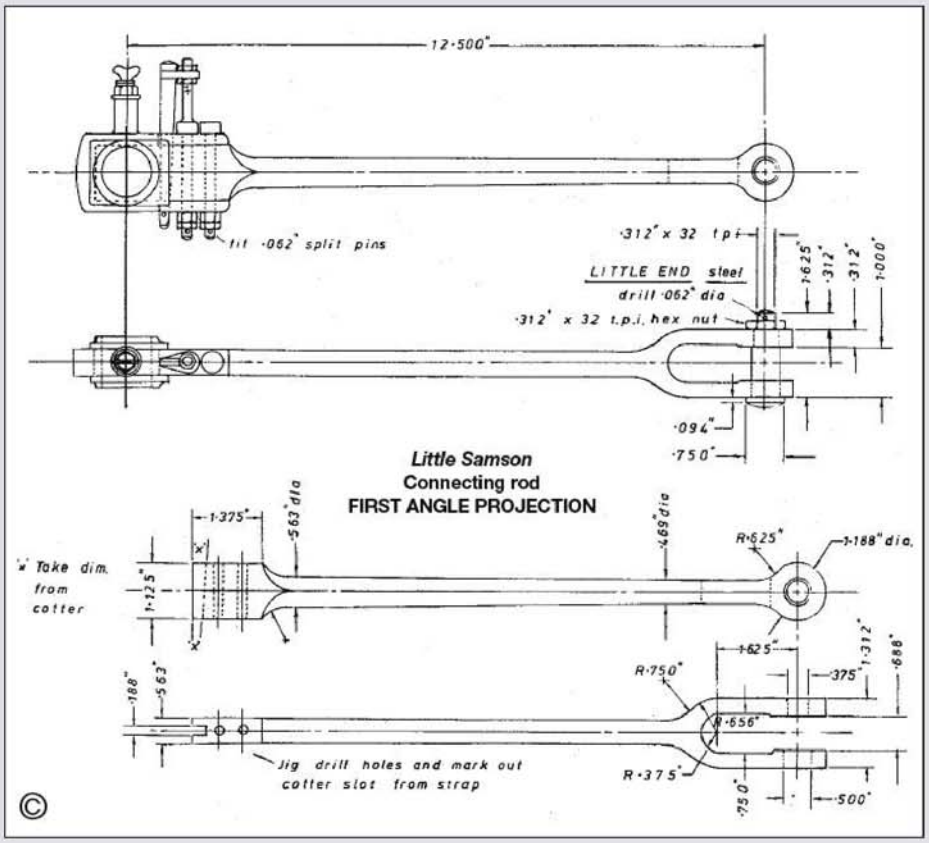
Martin Wallis

deals with the connecting rod.

●*Part XXX continued from page 288*
(M.E. 4178, 20 September 2002)

This time we start in earnest on the motion work, or top works as some folk prefer. When working hard, for example on a heavy haulage demonstration, the motion is doing the job for which it is designed: producing horsepower. For me an engine's motion is at its best on a warm summer's evening, after a day which has been busy enough to keep the rally organisers happy, just ticking over quite effortlessly, without a sound of any sort.

The model drawings state mild steel as the material for the connecting rod. A minority of builders may prefer to use stainless steel or subsequent electro-plating to keep the rods bright, but it is important that all parts, including the nuts, bolts and other fixings are in the same material or finish. If not, the shine on the plate will simply accentuate the tarnish on the nuts and fixings. If stainless steel is chosen, remember that stainless comes in many grades, some of which don't machine very easily, and some which are not particularly 'stainless'! Years ago I was advised to make the motion on my 1½in. Allchin from stainless steel on the grounds that such small motion work is the very devil to keep clean. This I did, and was very pleased with the result, but did find some of the stainless (odd bits from other peoples' scrap boxes) was very hard going in every meaning of the word.



Making a start

Making the connecting rod requires an organised and sequential series of operations. First a suitable piece of bar or rod needs to be selected. This is mounted either between centres or between a chuck and a centre. The bulk of the material is then removed from the middle section. The majority of the metal removal may be achieved by parallel turning using power feeds. However, the final few cuts need to be at a taper. Readers fortunate enough to have a taper turning attachment may continue to use power feeds but others will be using the topslide, which is really no great hardship. It is unlikely that the topslide will have enough travel, so two passes will be necessary. Great care should be taken to blend the two cuts into each other. An alternative would be to set the tailstock over, but my advice is that if the lathe is turning parallel, leave well alone.

A milling machine is then used to put the flats on each end, one for the big end strap and the other to be split to form the sides or 'forks' which fit around the crosshead. Two different methods of machining away the material between the forks are shown in **photos 6** and **9**.

Buttons

The radius on the little end forks may either be filed or machined. If filed, 'buttons' may be made. These are discs of metal, rather like large washers, which are held against the work with a ▶

A 3in. scale connecting rod from stock large enough for both the big end and forked little end. Visible behind the cross-slide, a taper turning attachment set to the required angle is in use. With its feed screw removed, the cross-slide can follow the taper turning attachment setting. (Photo: S. Nipper)

David Hall is using the top slide to machine the connecting rod on his 3in.* Little Samson. *The rectangular bar from which it is being cut will not accommodate the forked little end which will made and silver-soldered in place later. (Photo: B. Camps)

John Freeborn machined his 4in. connecting rod from large rectangular stock. EN1A steel is much more difficult to get in rectangular bar form and the intermittent cut must have been unpleasant. (Photo: P. Kybert)

Once roughed out, the connecting rod was then mounted in a dividing head, or as here a rotary table 'on edge' to machine the flat surfaces. A Myford fixed steady proved just the thing to serve as a tailstock. (Photo: S. Nipper)

bolt or other fixing through the little end. Engineering texts seem to prefer the buttons to be hardened, filing continuing until contact is made. In my younger days a file was a week or two's pocket money and the idea of running my precious files against a known hard surface did not appeal. My buttons were therefore left soft and as such were considered disposable. **Photograph 11** shows two buttons, one each side of the fork, ready to file the radius. An excellent finish may be achieved with buttons, a final polish completing the job to perfection.

If you choose to machine the little end radius, the forks should be located on the axis of a rotary table using a fitted pin to locate it, and the rod is then clamped firmly using the usual studs and nuts from a clamping set. The alternative is to mount the little end on a post and to rotate it very carefully by hand. This method was adopted by John Freeborn for his 4in. *Little Samson* and is illustrated in **photo 8**. Should a builder be considering this set up I must emphasis that should the cutter grab the work the results could be disastourous. The feed, i.e. pulling the rod around the post, must not be 'climb' milling. Climb milling is where the cutting action is trying to pull the work into the cutter and not pushing it away, as is usually the case. In John's own words "*This was a dangerous operation and really the rod should have been mounted on and rotated by a rotary table.*" Very light cuts are essential. Builders who own a disc abrasive machine are sure to prefer to clamp a plate with a suitable locating pin onto the table and round off the rod end by this means which is safe and effective.

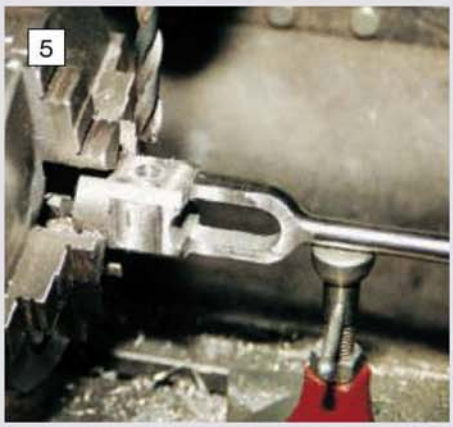
To complete the little end, the two different sized holes need to be drilled and reamed for the little end pin. By rights, the little end pin should be made from silver-steel and hardened and tempered. However, if left soft it will certainly still give many years service before a replacement might need to be considered.

The rod is completed by machining the slot for the cotter (**photo 14**) and drilling the holes for the fixings which hold the strap. However, the slot is probably best made to fit the cotter and the holes certainly should be jig drilled from the strap, so we will need to leave the finishing of this piece for the moment.

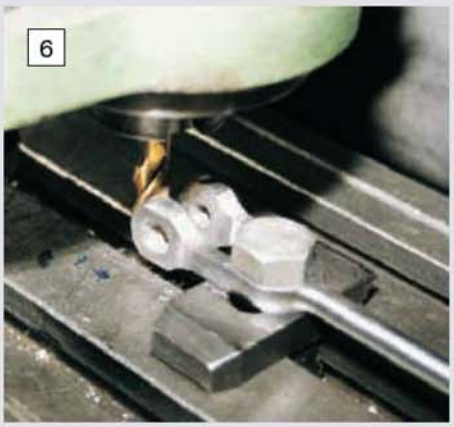
Strap mystery

The fly in the ointment with the connecting rod assembly on *Little Samson* is the big end strap. The drawings clearly indicate that the body of the oiler is integral with the strap. This could have been an oversight by the draughtsman. We have met Savages' draughtsman 'WPW' once or twice earlier in this series: he is clearly extremely competent but not infallible. He may simply have been having a bad day when he prepared the connecting rod drawing on 23 October 1908. Certainly on that day he forgot to dimension the little end brasses as he has added the information in pencil later on (same hand-writing). Also added later in pencil is a small key to stop the little end pin rotating in the rod, a feature not adopted on our model, and several pencil changes to the dimensions of the little end pin itself.

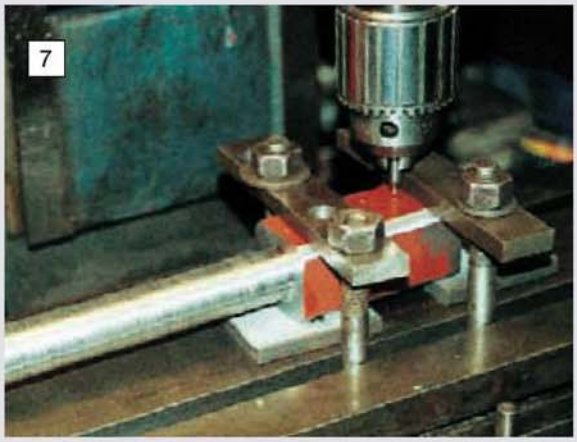
After some thought I decided to draw the strap as per WPW, i.e. the oiler integral with the strap. In practice this arrangement has not been too well received. *Little Samson* builders have unanimously chosen an 'add on' oiler. Without the survival of a full-size engine, the exact oiler detail may remain a mystery and builders are invited to make their own choice.



Left: the little end is drilled in the dividing head using the same set up as when the sides were milled thus ensuring that the hole is exactly at 90deg. to the surfaces. (Photo: S. Nipper)

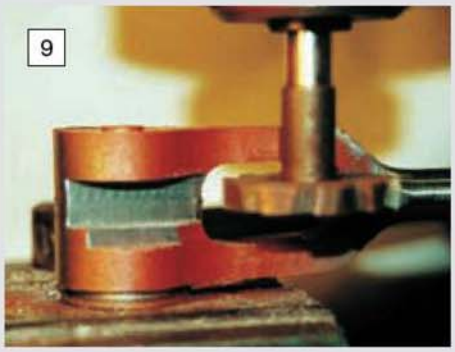


Right: the material between the little end forks was removed with the rod clamped firmly to the machine table. (Photo: S. Nipper)



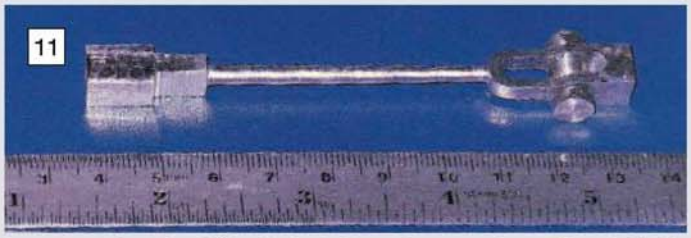
Left: a similar set up to photo 6 except in 4in. scale. (Photo: P. Kybert)

Right: this operation must be attempted with the greatest caution. John is wearing heavy gloves to protect his hands which must be kept well clear at all times. Climb milling must be avoided at all costs and eye protection worn in case the cutter picks up and shatters. (Photo: P. Kybert)

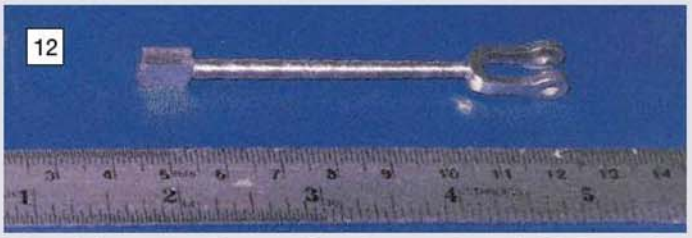


Above: John's connecting rod is now ready for the attachment of the big end strap and bearings. In 4in. scale it is a substantial piece of metal. (Photos 9 & 10: P. Kybert)

Left: a Woodruff or T-slot cutter can be used to remove the material between the little end forks.



In contrast, Jonathan Milne-Fowler's 1in. scale connecting rod is only 3in. long. Both ends have substantial chucking spigots still attached. Note the filing buttons either side of the little end.



The same 1in. scale connecting rod with the chucking spigots removed. (Photos 11 & 12: J. Milne Fowler)

My preference would be to cut the strap from the solid. If, as is popular, the oiler is an add-on piece, it could alternatively be made by pulling a piece of strip around a former. The material would need to be considerably thicker in section to give a machining allowance after bending as the corners are sure to 'neck' or thin down when pulled around the former, removing metal from exactly the place where it is most needed. The bends need to be as tight as can be achieved so the bending process is best carried out at red heat.

If you choose to cut the strap from the solid, beware of bright mild steel which contains all sorts of cold working stresses. These will be released as machining proceeds. The best advice is to normalise the material before machining it by heating to red heat, keeping it hot for a couple of minutes to 'soak' through, and then letting it cool down in the hearth away from any draughts. By this means, the stresses will be released and the crystalline microstructure refined to ensure that the steel is at its toughest for the work and provides the best possible machined finish.

Alternatively, rough out the strap first, leaving it a little oversize all over, and then take small finishing cuts to bring it to size.

Big end bearing

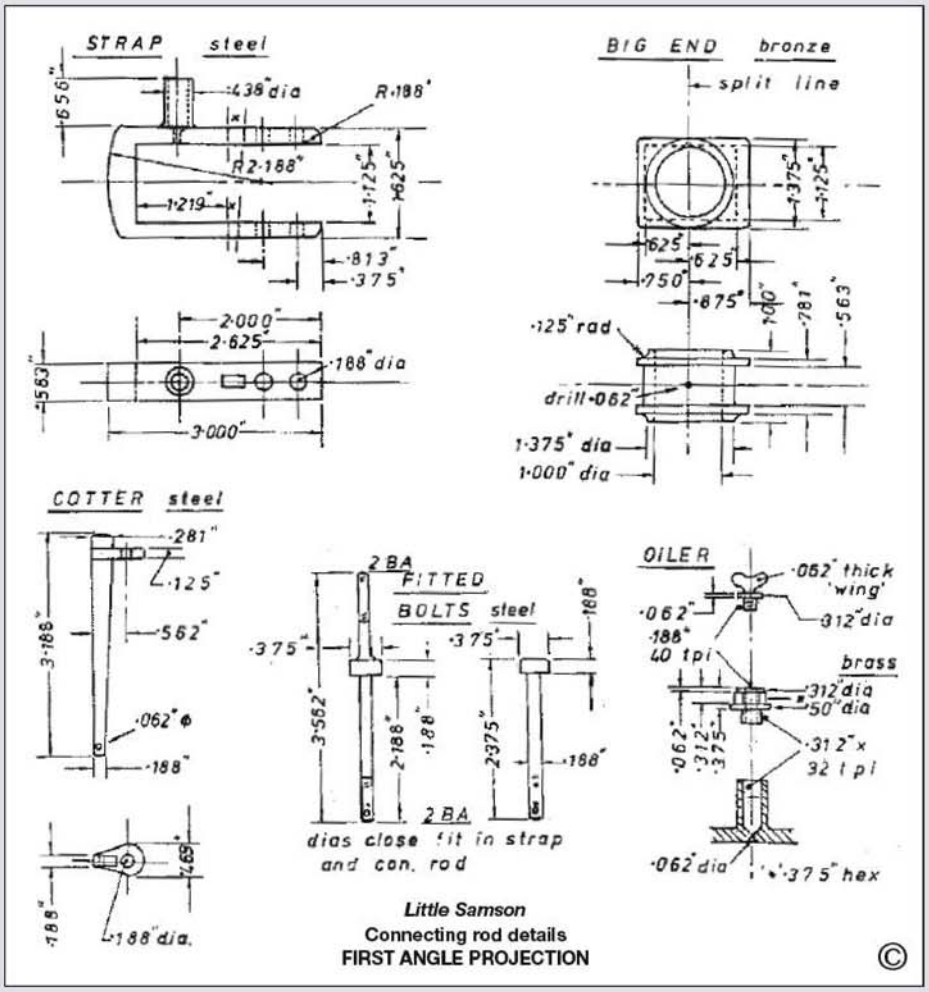
The big end is taken from a piece of bronze or gunmetal bar. A pattern for a casting for the big end was not prepared since a piece of bar was considered a much cheaper option. However, a re-evaluation might be sensible as, apparently, some of the *Little Samson* castings are cheaper than bar material! Builders, quite correctly, look at the price of a casting and wonder if cutting the item from a piece of bar is cheaper. A builder recently checked the price of the back axle driving centre (basically a round lump of cast iron) against purchasing a length of cast bar. I understand that the casting was considerably cheaper and was quite surprised.

The big end halves should be roughed out all over to ensure all the faces are truly at 90deg. to each other and the two halves then re-assembled by soft-soldering. I simply stack the pieces up with a little electricians' resin cored soft-solder wire between them and gently warm them until the solder melts and the two drop together. The now-united block is then machined accurately all over. The strap is used as a gauge for the slots; the bearings should just slide in with neither tightness or slack. The big end hole is then drilled and reamed; this is probably best done in the strap as otherwise the bearing may need to be chucked on the quite fragile bearing flanges. The bore in the brasses (bronzes?) will need to be radiused at each end to conform to the radii on the big end journal. A stub mandrel is therefore turned so the bearing just wrings on; one side is then relieved and the bearing is then turned around for the other.

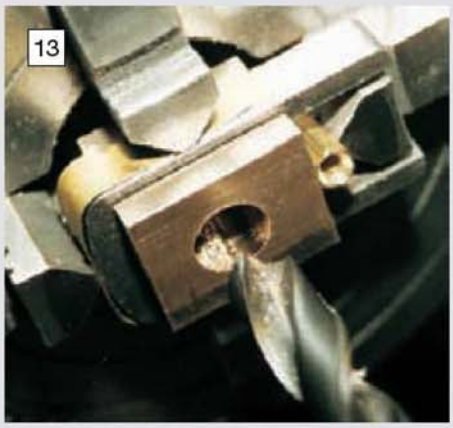
A minimum of heat is used to separate the two halves. Simply hold the bearing on a piece of rod in a gentle flame and wait until they fall apart. A rub on a 'Scotchbright' pad will soon restore their lustre.

Careful drilling

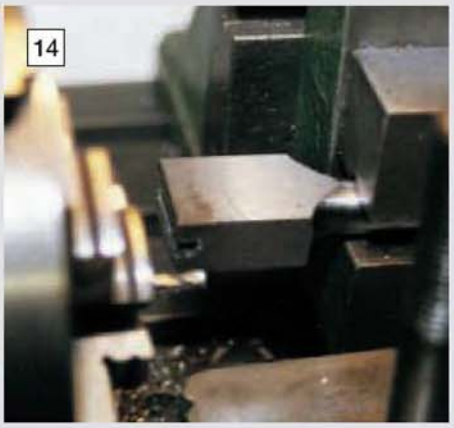
The big end may then be slipped into the strap and the strap in turn slid over the connecting rod. The holes for the pins may then be drilled. Take great care to ensure that the axes of the big and little ends are truly parallel. This condition may be checked ▶



Little Samson
Connecting rod details
FIRST ANGLE PROJECTION



Stan's drilled big end was bored and reamed to size. The two bearing halves were split and re-assembled by soft-soldering. The bearing is held in the strap for easier chucking. (Photo: S. Nipper)

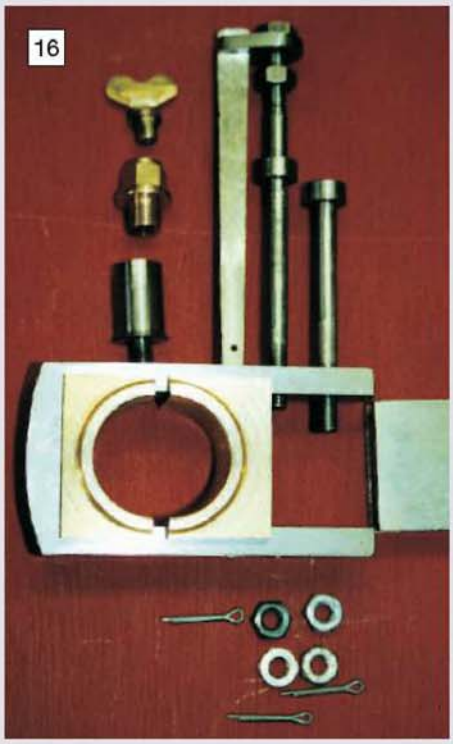


It's good to see a vertical slide in use for milling. All my milling was done this way for many years. The cotter slot is being cut in the end of the rod which has been set to suit the angle of the cotter. (Photo: P. Kybert)

A view of John's connecting rod and crosshead. Note that the little end bearing is simply a circular bush which is considerably easier to make and quick to replace if needs be. The little end pin is stepped to prevent the forks being pulled together when the retaining nut is tightened. (Photo: P. Kybert)

by fitting a reasonable length of silver-steel or ground bar through the big and little end journals and carefully checking the distances between their ends and that they reveal no wind (twist).

The pins should be carefully turned to a snug fit in their holes. A good fit is needed to ensure correct alignment.



Big end components. The wing shape on the oiler cap is exactly as draughted by WPW. (Photo: P. Kybert)

Cotter

The last remaining item to make is the cotter, which closes the big end bearing around the journal. Should wear take place a tiny amount of material may be removed from the mating faces of the bearing halves, or packing removed, so the bearing may be closed around the journal.

The taper on the cotter is not important but it should certainly match the taper in the strap and rod assembly. It is a bit of a 'chicken and egg' situation; either make the cotter first and then make the slot in the rod and strap to fit it, or the other way around. Readers will note the cotter butts directly against the bearing brass. It is usual to insert a steel packing piece between the two to spread the load on the bearing but none was detailed by WPW.

With space at a premium, it seems wise not to add such a packing piece but builders are of course welcome to do so should they wish.

A rather a delicate item

Recently published pictures of the 12in.:1ft. scale *Little Samson* has generated some interest, so to contrast them with some dimensions from its 1in.:1ft. scale baby sister in Australia seems entirely appropriate. In Jonathan Milne-Fowler's own words, the 1in.:1ft. scale connecting rod is *"rather a delicate item to machine."*

Many, if not all of the dimensions are exceedingly small. For example, there is only 0.010in. of bronze bearing material where the split brasses meet. Not wishing to make the bolts for the big end strap smaller than 10BA, the thickness of the big end was increased by 0.015in. making it 0.150in., a fraction over-scale. To machine such a slender rod, chucking blocks were left on each end (**photo 11**). The rod was initially turned parallel at 0.140in. dia. and the tailstock then set over by 0.020in. for the taper turning.

The scale diameter of the taper at the small end is just 0.112 inch. Every care and minute cuts were needed when turning such relatively long lengths at such a small diameter. The rod was then transferred to the milling machine for further operations following exactly the same routines as for its larger sisters. The oiler was made a little over-scale with a wing screw top threaded just 8BA to make room for a more useful quantity of oil.

Misadventures

The subject of connecting rods brings to mind a full-size *Road Steam* misadventure. After the public had departed, a certain three-speed road locomotive left a rally field in the early evening for a run to the local pub. Little to report there, but later on the engine returned in the tow of a large recovery vehicle — vintage of course.

As ever when something has gone amiss plenty of folk were watching, giving advice and generally getting in the way.

The following day, the Monday after the rally, all was quiet and I was raising steam for my own journey home. While waiting, I went across to ask the owners, who were working on their engine, what had happened. It seems that at some stage in the engine's history the fitted bolts that hold the big end strap to the rod had been replaced by ordinary mild steel studding. The studding had eventually given up and the big end had simply come to bits. Fortunately, the connecting rod had dropped clear of the rotating crankshaft, but the strap and bearing assembly, still on the crankshaft, hit the boiler crown leaving quite a mark and the strap was bent almost beyond recognition. The owners had arranged for a new strap to be wire-cut from plate overnight and were in the process of fitting it. Proper fitted bolts were, no doubt, used!

In the case just related the engine was brought to rest all too abruptly. Much more worrying is the other scenario where an engine runs away. I am only aware of two such incidents in recent times, but I guess there must be more. The first was the result of simple ignorance — taking an engine out of gear on a hill without properly scotching the wheel(s).

The second happened to an experienced engine driver, and is certainly no reflection of his engine handling abilities. The engine's HP slide valve buckle had become seriously worn and had been repaired by a silver-solder fabrication. This had come apart and, in consequence, the slide valve ceased to be properly connected to the valve gear. Not only would the engine not run in this condition but also, since an engine's primary braking is through the motion, the braking was lost as well. The engine ran down a hill, which fortunately was not too steep, but the steersman was unable to manoeuvre quickly enough at the bottom to make a turn before the engine decelerated on a subsequent uphill section.

The engine ended up in an unfortunate lady's front garden, but happily no one was injured. An insurance payout replaced her front hedge but did nothing to restore the crews' nerves.

● *To be continued.*

KEITH'S COLUMN

SAINT CHRISTOPHER
A GWR LOCOMOTIVE for 7¼in. gauge

Keith Wilson

describes the operation and construction of an effective ejector for his locomotive.

●*Part XXXI, continued from page 280 (M.E. 4178, 20 September 2002)*

This item spreads itself along the right-hand side of the boiler just behind the handrail. In fact the exhaust pipe up to the chimmuck is located by three special brackets that also support said handrails. It is made up from the 3-section ejector 'input' section plus the cone section, leading into the long coned part and in turn to the exhaust pipe. This leads right forward to the 'elbow' fitting that turns the air/steam mixture into the smokebox, thence up the chimmuck.

This system works well (or Swindon wouldn't have used it) and occasionally too well in some respects, for with an isolated engine (one by itself) it emits noises of a snorting, rasping nature, to the great delight of children of all ages as it is distinctly vulgar. This entrancing phenomenon is known to GWR men as 'cracking the vacuum', but since by definition a vacuum is nothing it is not over-easy to understand whence this name originated, although it is a bit nicer than using the obvious word which rhymes with 'carting'. In full size practice, the device can pull a vacuum of 25 inches.

Vacuum is normally measured in inches. Sounds daft. But it means that if you fill a tube sealed at one end with mercury then up-end it with the open end below the mercurial surface, the mercury will run out of the tube until the resulting column is almost exactly 30in. high, corresponding to an atmospheric pressure of 14.7 pounds per squinch. Note for ease of calculation that this means that 1in. mercury (or just 1in.) means about ½ pound per squinch pressure. (Squinch = my shorthand term for square inch.) Thus 25in. means that the mercurial level at this pressure would be (30 – 25) inches high, an 'absolute' pressure of some 12½ pounds per squinch. This may not seem much, but with a full-size brake cylinder 30in. diameter it amounts to 8835lbf. (pounds force) a little short of 4 tons force. Enough.

In our sizes and boiler pressures, 22in. seems about the limit, but even as low as 10in. provides all the force we need. In fact with a 'scale' 30in. cylinder we have a force of 55lbf., which is more than enough to give you a nasty pinch if you get fingers in the wrong place. Now we all know about old 'square cube' (I trust) and in this case he is working on our side, for locomotive weights in 7¼in. gauge are something like 1/316 of full-size weights. (Cube of scale factor: 7.8 plus about 30-50% to allow for overscale thickness of plates, etc.) In other words, weight (or mass) goes down as the cube of the scale factor, but with the same degree of vacuum, the force reduces as the square of the scale factor.

To further illustrate this, about 5 years ago my eldest son was trying out one of my 7¼in. Kings. Running on Fred Beacham's splendid track near Grandborough, he was 'doing the knots' when the vacuum pipe 'twixt engine and tender came adrift. Driving wheels and tender wheels instantly locked and the finishing distance 'twixt his nose and the chimmuck was not great.

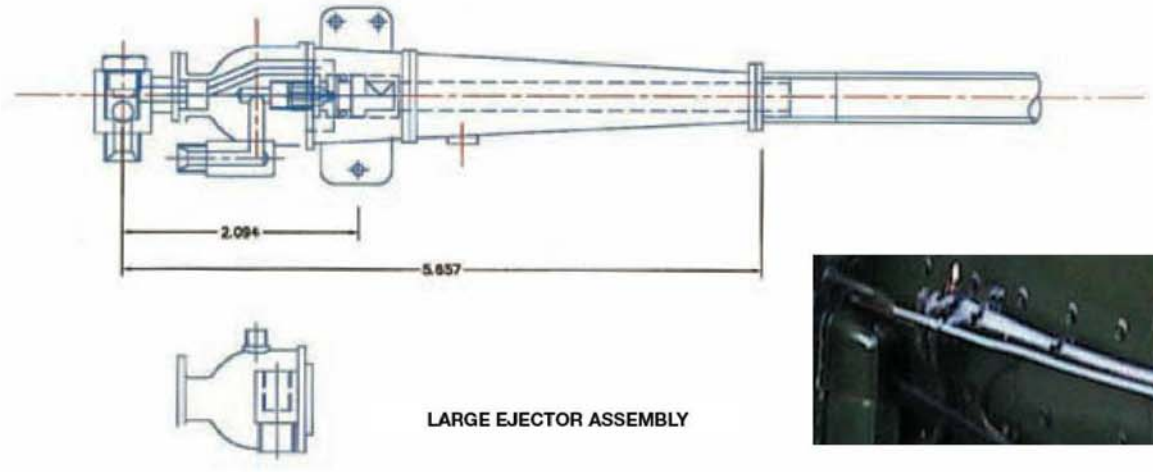
I expect a casting will be available for this lot, but I have had little difficulty in building it up piecemeal.

At the extreme left is a non-return valve. This is a tricky one, not to make, but to be vacuum-tight. I use this term in preference to air-tight because of the low pressures involved. If you make this valve with an O-ring seat it will be better, but the O-ring must be captive, i.e. prevented from rising, otherwise, the ball will not lift but ball and O-ring will rise as a unit, and be most reluctant to return. In practice, it is much easier to keep the ejector working all the time.

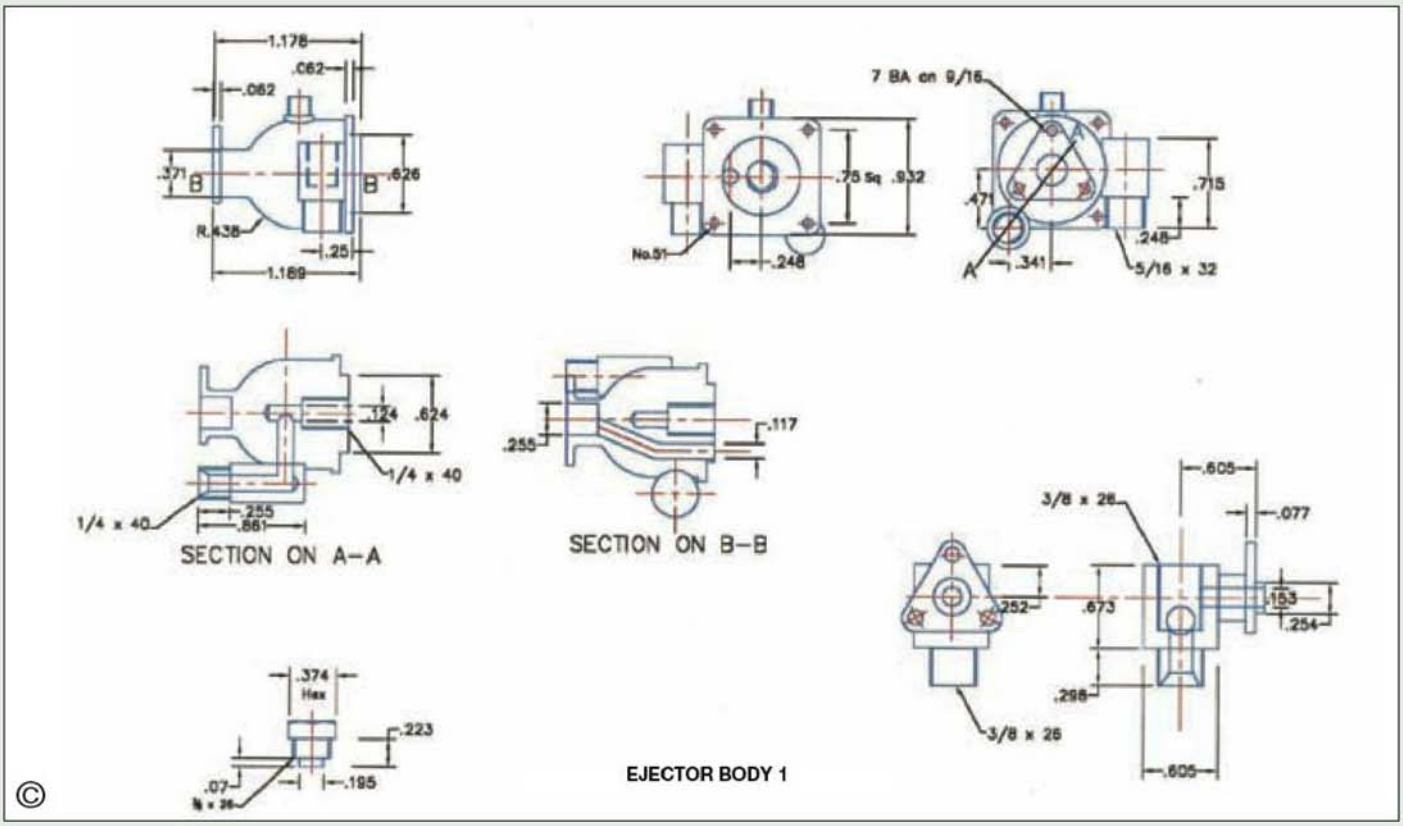
There are several reasons for this. The first is that a vacuum brake system (as you will soon discover for yourself) is a posh term for a series of leaks tied together with pipes. A pinhole in full size is annoying, but that same pinhole in our sizes will knock the vacuum for the proverbial six. Old square-cube in the case of leaks works against us. Don't concern yourself with steam consumption. The 1/32in. diameter hole in the steam cone won't even affect a 3½in. gauge locomotive, let alone our Saint or 47. Further, the air inlet when brakes are applied (anchors thrown out?) is far greater than the ejector's exhausting powers.

This non-return valve (NRV) is bolted to the next section by a triangular flange. This is dead to scale and not as tricky to make as it may beseem. Note carefully the location of the main steam-pipe into this portion. It is downwards at 45deg. towards the boiler although parallel to the main body. It is important to get the two sets of holes through this body part. They must be completely independent. In the case of the full-size beast, there are four sets of cones in this item. The main steam-pipe mentioned above feeds three of these, while the lesser steam pipe coming in at the top feeds the fourth one. Thus there are two systems, the 'small' ejector (the fourth one) and the three together (the 'large' ejector). However, those who decide that they will try to get this set-up inside the 'scale' outside profile will earn my respect … and sympathy. I don't say it cannot be done, I do say it ain't gonna be done by me.

The small clack on the outside of this part takes vacuum from the small ejector to couple into the main train pipe well forward of the cab. I'm not sure exactly where this connection is, but probably about the same point as the air pump. The reason for this is to pull any moisture in the system well clear of the control valve in the cab for if said ▶



LARGE EJECTOR ASSEMBLY



moisture should freeze up and block the train pipe then it would make application of brakes rather difficult! Actually, (belt and braces, as well as carry a bit of string) there is a valve on the tender that will let air into the train pipe, but it is not obvious, nor can I recall seeing it on the Swindon drawings.

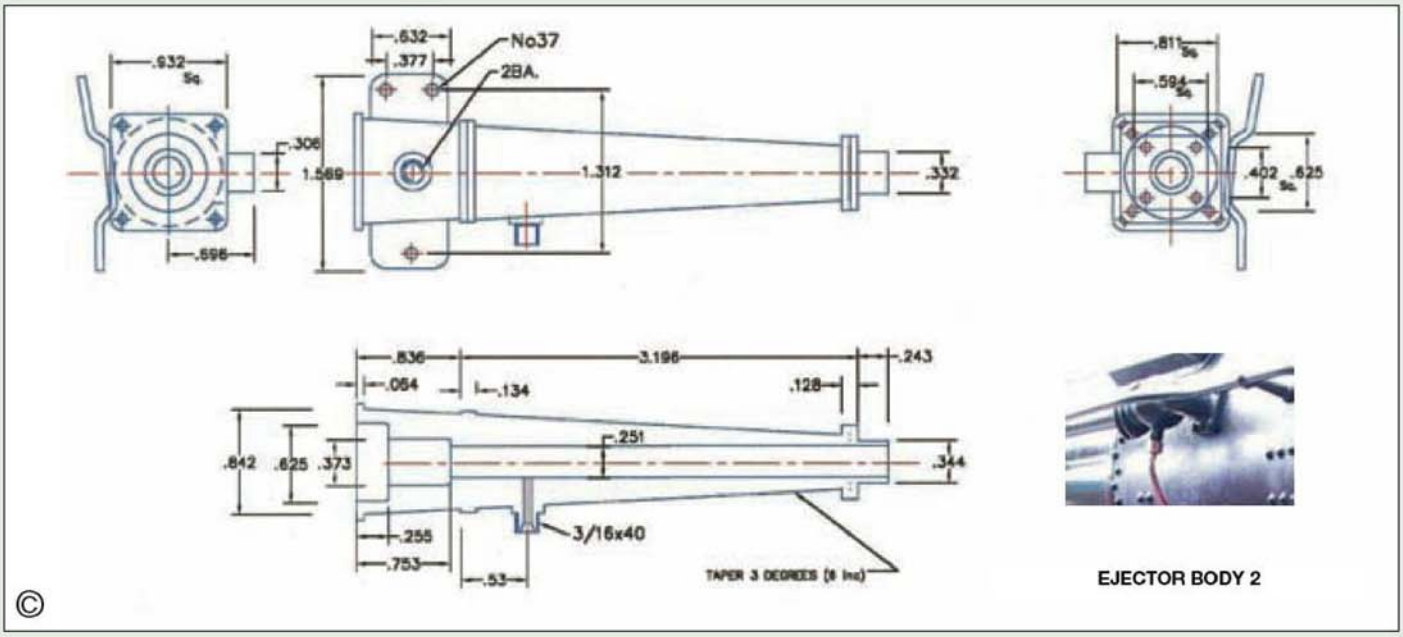
The next section: body 2, is much simpler, for it can be made in one piece (as shewn) with a dummy joint. The outside is a fairly plain turning job as, in fact, is the inside. The dummy joint is easy, just avoid turning away the square section at this point, trimming it to size later. It is just possible to insert 10BA bolts through the little holes in the corners of this joint. Put the heads towards the larger diameter, it is then easy to do up the appropriate nuts. The joint between this and the first section must be absolutely tight, no ifs or buts here. The slightest trace of a leak will prevent a reasonable performance, usually completely.

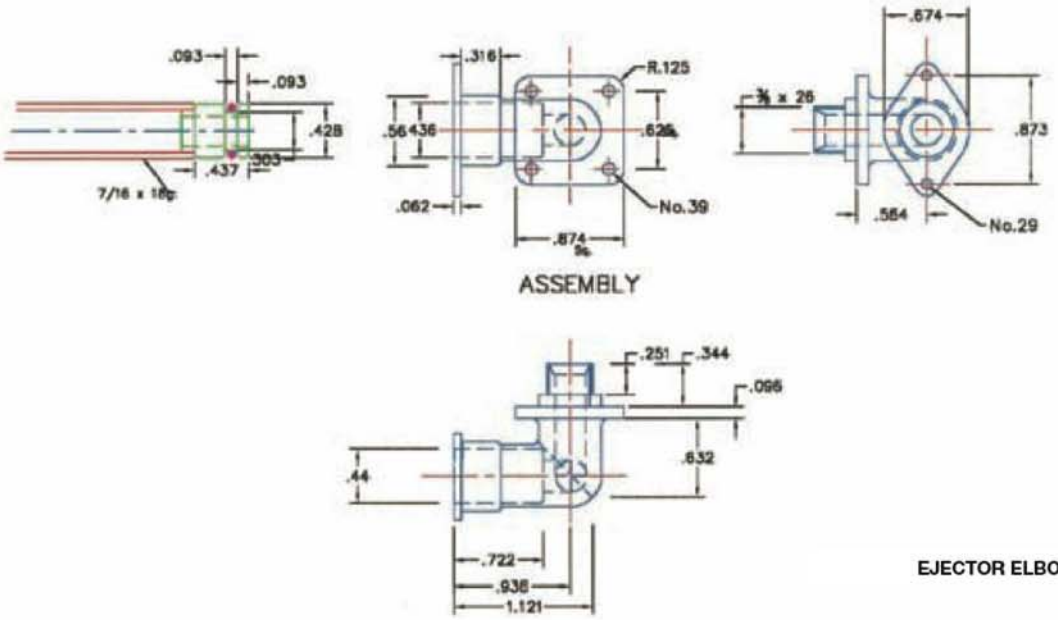
The little spigot or union hanging down about 1/2in. from this joint is a drain. It is fitted up with an open-ended 3/32in. pipe which tucks down to just below the footplate.

I have just spotted an intriguing error in my drawing, too late to correct because it's already gone to the printer. The extreme right-hand end has two sizes shewn, it should fit into the end of the 7/16in. diameter exhaust pipe. It can be silver-brazed or soft-soldered here, one less joint to worry about. The 2BA tapped hole into this item is for a handrail support, and the bent-up bracket is to attach the whole shebang to the boiler cladding.

The elbow at the front can be built up from bits, with a silver-brazed joint at 45 degrees. On no account omit the sliding joint with the long ejector exhaust pipe, for if you do you will get lots of trouble when you first raise steam, for the boiler will lengthen by about 3/16in. (roughly) but the exhaust pipe won't lengthen until the ejector is used. Thermal expansion makes the sliding joint imperative. There is another little drain pipe here, omit it not.

The actual ejector is drawn rather larger than full-size. To make it you will need a couple of small taper reamers. One needs to be fairly long, at 6deg. included angle, the other is 12deg. included angle. Neither is needed of super-precision. If you turn the tapers on the end of a fairly long piece of 5/32in. diameter silver-steel it is easy to either file or mill away just half this diameter to give the cutting edge. Harden and temper to light straw and when complete it may be sharpened if necessary on a flat oilstone; part off to convenient length afterwards. Incidentally, I keep a spare one of these reamers handy on each lathe; they are very useful for removing interior sharp edges.





©

In theory the steam entry to the steam cone should be tapered, but works very well if made as drawn. All those that I have made this way (at least 19 so far) have slammed up the vacuum to 18-20in. on air testing. Another fascinating test is to couple up the ejector to a 6 litre milk carton, turn on and watch it crushed flat in a few minutes.

The dimensions shewn for the venturi section are not 0.001in. critical, but it's better not be too far out. It is extremely important however that there is no leakage — absolutely none — around the joint between cone and venturi section. Bond it in with something like Loctite 252 or 532; soft-solder it if you like. The two O-rings form a seal with the venturi. I have just noticed an omission in this drawing, there must be a 1/16in. hole right across the venturi section where the 0.062in. groove is shewn. It must be there to let the vacuum out(?) This hole must of course be drilled before the steam cone is implanted. The square section on the end is to aid in screwing the ejector into the main body, or in removing it when desired.

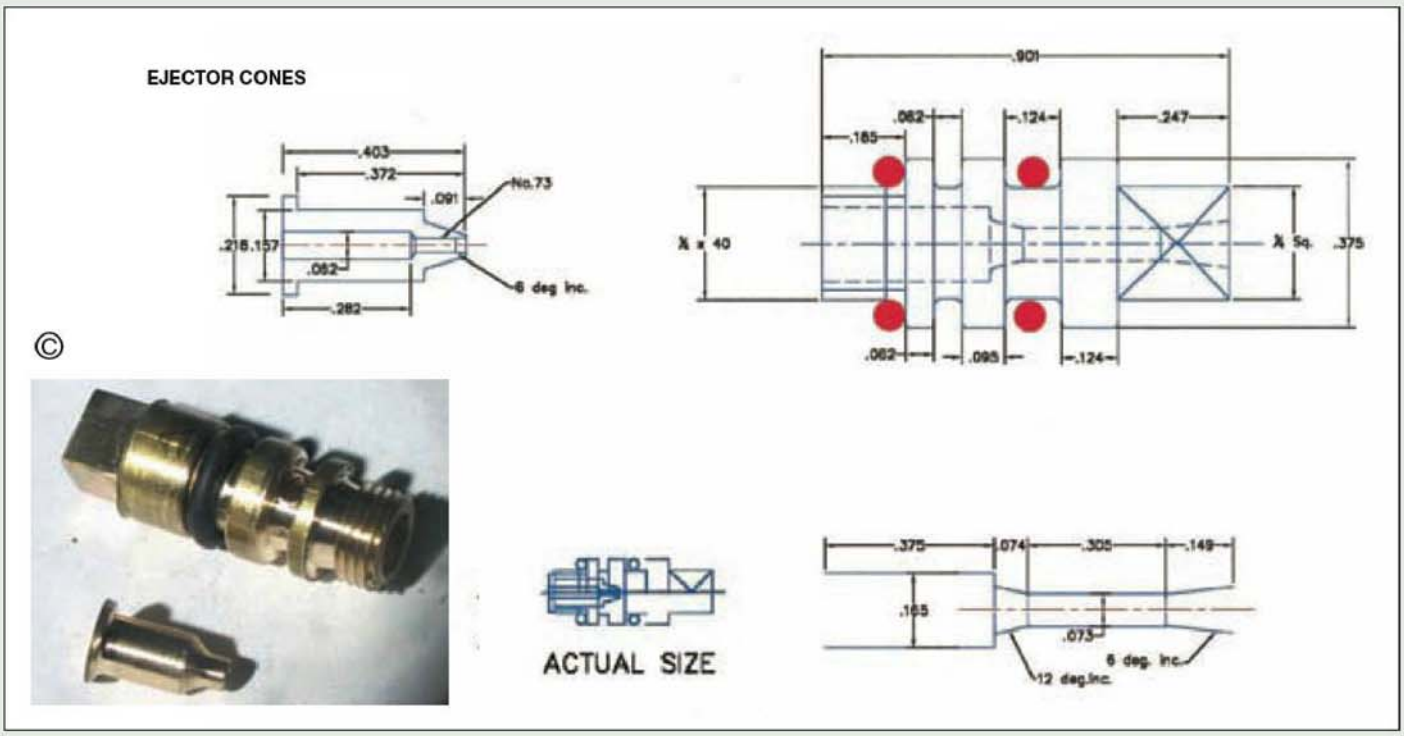
To get this system to work properly it is needful to proceed step by step. If you can knock up a test rig it will be well. Connect this to a vacuum gauge. If you haven't got one then a bit of clear plastic tube leading down into a bucket of water will help, although you won't get a high reading this way. Once you are happy with the suction (a finger pressed across the end of the pipe will teach you much) then insert it into the main body, check again.

It is virtually impossible to do a pressure check on the whole brake system (for one thing it would cattle-up any vacuum gauge used) so the only way is step by step, loosening joints one at a time and re-tightening them, disconnecting units one by one and putting a finger over the hole. This will isolate the leak(s). You won't even get much fun with a stethoscope, although it may be worth a try.

I had an interesting case of this a few weeks ago; I was called in to check on a vacuum system on one of my Kings. On putting the air-line onto I had replaced the missing front vacuum pipe. The tender pipe was badly holed too but it made no difference. I then found that some wiseguy had replaced the pipe 'twixt engine and tender with one too long, this had of course bent up and kinked. Shortening this a little made the system okay, and a fresh pipe on the rear of the tender completed the job.

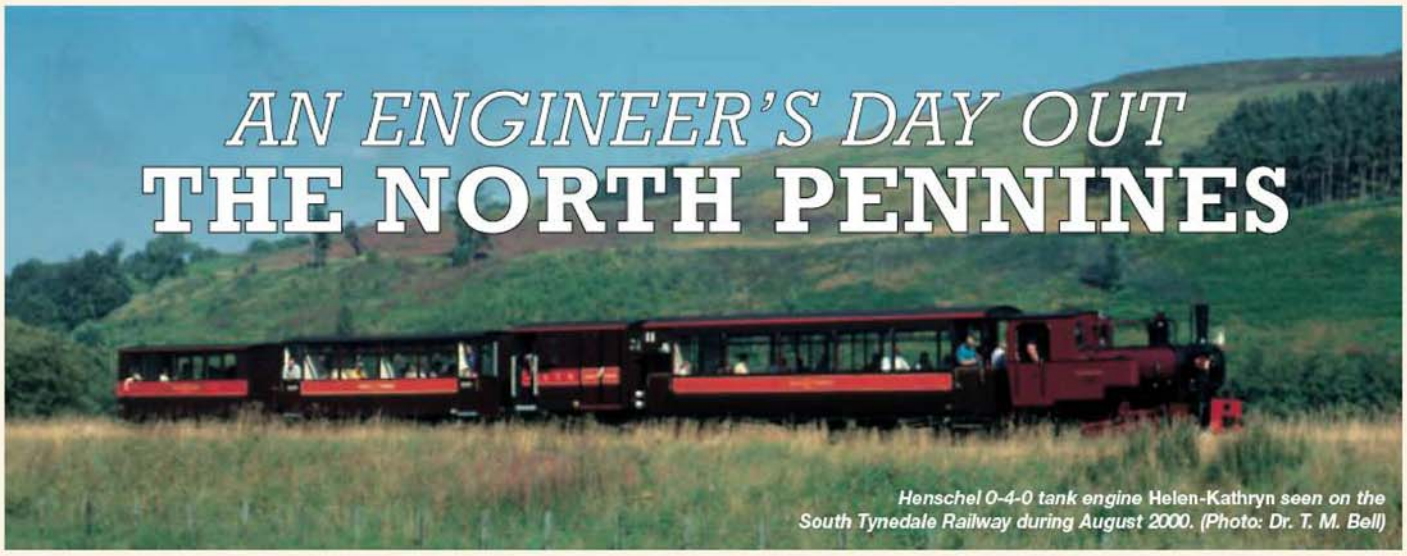
I have searched for a good photograph of this ejector mounted on its locomotive, without as much success as I would wish. However, herewith close up of the ejector cone system, plus a shot of the elbow joint on John Hancocks' *Thirlestaine Hall*. Some details can also be seen on the picture of a King appearing in last *Logger* article.

●*To be continued.*



©

AN ENGINEER'S DAY OUT
THE NORTH PENNINES



Henschel 0-4-0 tank engine Helen-Kathryn *seen on the South Tynedale Railway during August 2000. (Photo: Dr. T. M. Bell)*

Roger Backhouse
visits the Killhope Lead Mining Centre and the South Tyneside Railway Preservation Society.

The high Pennines of County Durham, North Yorkshire and Cumbria form one of the bleakest and most unspoiled parts of England. It is deservedly an 'Area of Outstanding Natural Beauty' drawing walkers, bird watchers and mountain bikers. Yet even in this remote area there is still much to interest an engineer. The region once had some of the richest lead mines in England.

Lead mining was started on a large scale in the 18th century when the London Quaker Lead Company began developments. Unlike coal, usually laid down in near-horizontal seams, lead is more often found in near-vertical lodes. The mining techniques were different, usually tunnelling into a hillside and then excavating upwards and downward along the 'stope' or vein of lead ore. The lead ore, usually galena, was then taken to surface for crushing and processing to concentrate it ready for shipment or smelting.

One of the most important centres is at the head of Weardale where the Killhope Lead Mining Centre is now well managed by Durham County Council. In this remote location it was difficult to transport all the coal needed for steam drainage so the mining company erected the largest diameter water wheel to be seen working in England. (The *Lady Isabella* Water Wheel at Laxey in the Isle of Man is even larger. It too drained lead mines.) The wheel pumped water from the nearby mine via a series of rods.

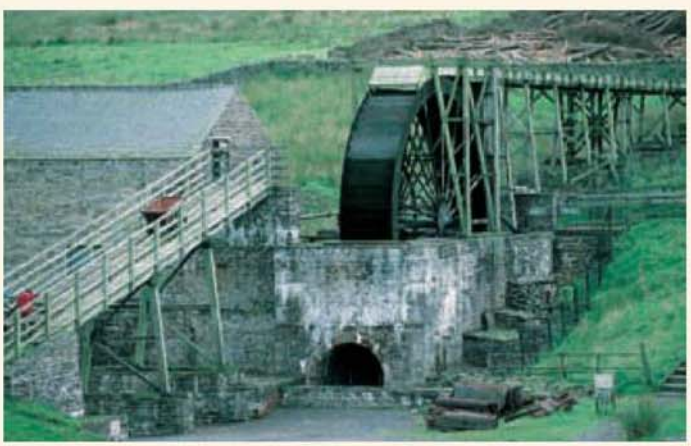
The mine itself is a narrow tunnel into the hillside serving also as a drainage adit. Visitors are suitably equipped with helmets and boots to enter the mine and see re-creations of old lead mining techniques. Inside the mine is another smaller water wheel helping to pump water from the mine. Such underground water wheels were once quite common.

On the surface, the principal activity is ore dressing and the treatment plant has been re-created. Ore was crushed using stamps, then subjected to a flotation process. Much of this cold and wet work was once carried out by boys, but now children

Alston signal box from Ainderby, with Hunslet No. 9 in foreground.

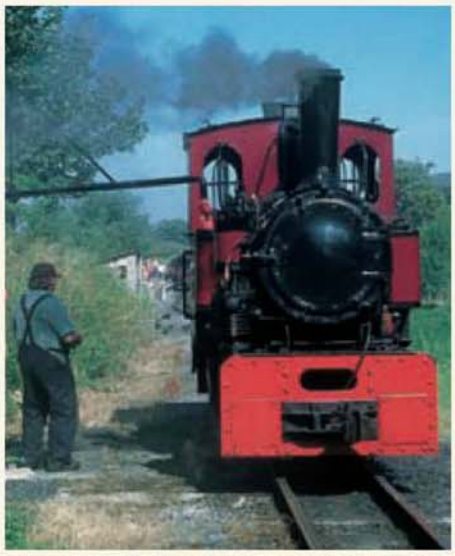
South Tynedale Railway No. 9 Hunslet diesel awaits passengers.

Lead ore processing: washing crushed ore.



Killhope's water wheel at the head of Weardale.

South Tynedale Railway, Signalbox interior (from Ainderby Yorkshire).



Henschel 0-4-0 tank engine Helen-Kathryn, *taking water on the South Tynedale Railway.*

Equipment in the smiths workshop at Killhope Lead Mining Centre.

quite enjoy finding lead ore in the rocks extracted from the mine. The ore was then taken to be smelted, and at one time this was carried out nearby. One method employed a long chimney built up a hillside, vapours from roasted ores being condensed on the chimney walls. Both lead and silver could be extracted in this way. The remains of one nearly a mile long are at nearby Rookhope.

By the late 19th century, lead mining in Weardale was in difficulties. The exhaustion of richer seams and competition from overseas led to great hardship among miners with many emigrating. Lead mining lasted up to the 1940s at Nenthead on the west side of the Pennines. Here too, remains of the mine can be seen and, while not as spectacular on the surface as Killhope, much more of the underground workings can be visited. Pictures of the locomotives used in this mine are displayed at a nearby pub.

South Tynedale Railway. Privately owned No. 12, Hunslet (Fowler design) Chaka's Kraal.

Steam

The major local town is Alston, the highest market town in England. It was also a mining centre which attracted a branch of the Newcastle and Carlisle Railway from Haltwhistle, opened in 1852. It survived Beeching cuts but finally closed in 1976. Part of the line south from Alston has now re-opened as a 2ft. gauge preserved line operating a service during school holidays and at weekends as far as Kirkhaugh. The South Tynedale Railway Preservation Society managed to acquire and relay track to Gilderdale by 1986 and Kirkhaugh by 1999. The Society plans to extend to Slaggyford at a later stage and will launch a fund raising appeal to coincide with the 150th anniversary of the opening of the line.

The run down the valley makes a thoroughly pleasant ride. Although the bridges and earthworks were originally engineered for double track, only single line was laid. Alston Station is much as it was, but the signal box nearby is a fully equipped rebuild of one acquired from Ainderby, Yorkshire, operating manual lifting barriers. Modern engine and carriage sheds are nearby.

Trains are hauled by a variety of steam and diesel traction. The locomotives are an interesting mix and worth a visit alone for anyone interested in overseas steam locomotives. Those in use or readily visible at the time of writing include an 0-4-0 Henschel tank engine, *Thomas Edmondson,* a Hunslet 0-4-2 tank, *Chaka's Kraal,* used for sugar cane trains in South Africa, another privately owned Henschel, *Helen-Kathryn* and a Hudswell Clark diesel mechanical *Naworth.* A Polish 0-6-0 tank engine, *Naklo,* is currently being restored but is expected to re-enter service this year.

Details

South Tynedale Railway, The Railway Station, Alston, Cumbria CA9 3JB; tel: 01434-381696 or 01434-382828 (talking timetable) **www.strps.org.uk** (new members of the Preservation Society welcome)
Killhope Lead Mining Centre, tel: 01388-537505 **www.durham.gov.uk/killhope**
Nenthead Mines, tel: 01434-382037; **www.npht.com**

Getting there

Although the area is remote, all locations are served by public transport. Even Nenthead has a limited bus service, reaching what is probably the highest bus garage in England! Though not as well known as the Yorkshire Dales, Weardale remains an attractive valley and the scenic bus rides are alone worthwhile.

Details of routes, times and fares from North East Traveline 0870-608-2608 (7am-8pm daily) or Durham County Council bus information **transinfo@durham.gov.uk**

A second Henschel 0-4-0 tank engine, this one named Thomas Edmondson.

Ore tubs and mine entrance at the Killhope Lead Mining Centre.

CLUB CHAT
With Stan Bray

UK News

Despite having been busy with yet another bumper rally, members of **Guildford MES** found time to support the local Disability Challengers Fun Day and were able to donate a tidy amount towards the overall sum of £8,000 raised. The society also encourages youngsters throughout the year with their now annual Young Engineer Competition which involves a project for the youngsters to complete. An event for individuals, competitors are urged to obtain advice from their school staff, parents and others. This year's project was the construction of a vehicle to be powered by means of elastic bands to run on a 2½in. gauge track. Unfortunately, the number of entries was well down on previous years and it is believed that the challenge may have been a little too difficult. Judged by a panel of professional engineers, children between the ages of 9-14 from all Surrey schools were invited to participate. The winner was Adam Cudlip from Epsom and Ewell High School. Chris Noble, Southern Area Sales Manager of MEM Circuit and Protection presented Adam with his prize and the Shield at the rally in July. Chris was one of the judges, and his company sponsored the competition. Club Awards for 2002 were also presented during the rally as follows: *Hodgkiss Cup:* Geoff Moore; *Mike Comben Cup:* Folkert Rosen; *Jim Bamford Cup:* James Finch; *Warco Trophy:* Peter Breakwell; *Jeffrey Shield*: Josef Glyass; *Bill Percy Cup:* John Carter; *John Brotherton Shield:* Tony Rest; *16mm Narrow Gauge Cup:* Derek Foster; *Brian Barrow Cup:* Pierre Bender; *Streeter Cup:* Alan Jensen; *Tracy Tools Trophy:* Martin Cooke.

As a way of showing their appreciation for the use of their track site on Three Counties Water Company land, members of **North London SME** annually sets aside a day on which members entertain the management, staff, families and friends of their hosts. Blessed with a warm and sunny day, this year's event gave the society the opportunity to show its visitors the good use they make of the land. There was a large turnout of members representing all the club activities with passenger hauling locomotives, garden gauge railway, boating pool, slot car track, and steam road vehicles all in operation. This, together with a constant flow of refreshments, ensured that the visitors really had a day to remember. The first marine section open day of the season was also a great success. Visitors began to arrive before the 10am official opening time and kept on appearing until mid-afternoon. Following a period of free sailing, the steering competition was run and was won by Mark Wiltshire.

A busy rally day at the West Riding Small Locomotive Society track begins quietly in the steaming bays.

There have been two major events for members of **West Riding Small Locomotive Society** this year, their own annual rally and the *Sweet Pea* rally. Their own rally suffered mixed fortunes: on Saturday, the weather was fine and warm and visitors arrived early, so many in fact that at one stage there was a queue to make use of the new locomotive unloading facilities and with so many locomotives present, for a while it was necessary to double up at the steaming bays. Unfortunately, it poured with rain on the Sunday and apart from a nucleus of visitors who had stayed overnight, visitors and members of the public were conspicuous by their absence. Even so, there was sufficient interest for a reporter from Radio Leeds to interview several owners of models. The society's annual awards were presented at the event. The trophies for the Best Completed Locomotive and Best Non-Locomotive Model went to Rex Stephenson while John Drewell received the award for the Best Un-completed Locomotive. Attracting visitors from five clubs

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.

OCTOBER

To 20 October Talyllyn Railway. *First Class for Sunday Lunch.* Enquiries: 01654-710472.

18 **Rochdale SMEE.** *Video Night.* Contact Mike Foster: 01706-360849.

18 **Romford MEC.** *Adrian Tatum: Colchester Model Railway Club.* Contact Colin Hunt: 01708-709302.

18 **Romney Marsh MES.** *Video Evening.* Contact John Wimble: 01797-362295.

18 **Steam LS of Victoria.** *Gathering.* Contact Graham Plaskett: (03) 9750-5022.

19 **Chesterfield MES.** *Running Day.* Contact Mike Rhodes: 01623-648676.

19 **National 2½in. Gauge Ass'n.** *Hook Get Together.* Contact Clive Young: 01233-626455.

19 **Steam LS of Victoria.** *Club Run.* Contact Graham Plaskett: (03) 9750-5022.

19 **STEAM – Museum of the GWR.** *Meet the Railway Workers.* Information: 01793-466646.

19 **York City & DSME.** *Gary Hall: 3D CAD Modelling.* Contact Ken Bateman: 01904-421445.

19/20 **Claymills Pumping Engines.** *Open Days.* Contact: 01283-509929.

19-24 **Meridienne Exhibitions.** *Midlands Model Engineering Exhibition* at The International Exhibition Centre Donington Park, Nr. Derby (M1 exit 24). 10.30am-5.30pm daily, last admission 4pm, (Wed: 10.30am-8pm). Adults £7, Senior Citizens £6, Children £4, Family (2+3): £20. Enquiries: 01926-614101.

19-24 **Guild of Model Wheelwrights** *at Midlands Model Engineering Exhibition.* Contact Biddy Hepper: 01492-623274.

20 **Bedford MES.** *Running.* Contact Ted Jolliffe: 01234-327791.

20 **Frimley & Ascot LC.** *Club Run.* Contact Bob Dowman: 01252-835042.

20 **N. W. Leicester SME.** *Running Sunday.* Contact John Elliott: 01455-847040.

20 **Oxford (City of) SME.** *Running.* Contact Chris Kelland: 01235-770836.

20 **Peterborough SME.** *End of Running Season.* Contact Tony Meek: 01778-345142.

20 **Rugby MES.** *Running.* Contact David Eadon: 01788-576956.

20 **Saffron Walden DSME.** *Running Day.* Contact Ken Archer: 01763-852911.

20 **Surrey SME.** *Members Invitation for a Steam-Up.* Contact John Cook: 020-8397-3932.

20 **York City & DSME.** *Running Day.* Contact Ken Bateman: 01904-421445.

21 **Lancaster and Morecambe MES.** *AGM.* Contact Harry Carr: 01524-411956.

21 **Peterborough SME.** *AGM & Auction.* Contact Tony Meek: 01778-345142.

21 **STEAM – Museum of the GWR.** *Garry Wragg: The Making of Milestones Museum, Basingstoke.* Information: 01793-466646.

22 **Historical MRS (E. Lancashire/N. Manchester Group).** *John Cockcroft: Finishing Models.* Contact John Sykes: 01706-823989.

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

22 **Sutton Coldfield MES.** *Simon Topman: Manufacture of Whistles.* Contact Roger Timings: 0121-308-5875.

23 **Chingford DMEC.** *John Marsh: 'Narrow Gauge' Film Night.* Contact Martin Masterson: 0208-989-5552.

23 **Harrow & Wembley SME.** *AGM.* Contact Dr. Roger Greenwood: 020-8427-2755.

24 **Cardiff MES.** *Keith Richards: Further Tales from the Mines.* Contact Trevor Jenkins: 029-2075-5568.

24 **Leyland SME.** *Meeting.* Contact Alan Wilson: 01942-715072.

24 **Reading SME.** *Winter Talk.* Contact Graham Bustin: 01189-615450.

24 **STEAM – Museum of the GWR.** *Tim Bryan: The Churchward Revolution.* Information: 01793-466646.

24 **Worthing DSME.** *Jonathan Minns: The Engineerium, Hove.* Contact Chris Devenish: 01903-268158.

25 **Hereford SME.** *J. Sinclair & Dr. Fenn: The Hereford–Shrewsbury Line.* Contact John Arrowsmith: 01432-265151.

25/26 **GW Soc.** (Didcot Railway Centre). *Photographers' Evenings.* Contact Jeanette Howse: 01235-817200.

26 **Historical MRS (Bristol Area).** *An Afternoon with the Wessex Armchair Modellers.* Contact Gerry Nichols: 0117-973-1862.

26 **Hornsby ME.** *Family Day.* Contact Ted Gray: 9484-7583.

26 **Melton Mowbray DMES.** *Club Dinner.* Contact Phil Tansley: 0116-2673646.

26 **Northampton SME.** *Night Run.* Contact Pete Jarman: 01234-708501.

26/27 **Southland SME.** *Great Little Train Show.* Contact Peter Stark: 03-21-89702.

26/27 **STEAM – Museum of the GWR.** *Day out with Thomas.* Information: 01793-466646.

27 **Ascot LS.** *Members' Steam-Up.* Contact Tony Alderman: 01932-854393.

27 **Elmdon MES.** *Running* at Museum of Transport, Wythall. Contact Chris Giles: 0121-458-1291.

27 **Great Western Soc.** (Didcot Railway Centre). *Steamday.* Contact Jeanette Howse: 01235-817200.

27 **Knysna SME.** *Steam Day.* Contact Chappie Chapman: 044-533-0355.

27 **Leighton Buzzard NG Rly.** *Halloween Haunting.* Enquiries: 01525-373888.

27 **MELSA.** *Sunday in the Park.* Contact Graham Chadbone: 07-4121-4341.

27 **Ottawa Valley Live Steamers.** *Steaming Day.* Contact John Bryant: 761-1109.

27 **Steam LS of Victoria.** *Working Bee & Barbecue.* Contact Graham Plaskett: (03) 9750-5022.

27 **Woking MRS.** *Open Day.* Contact Ronald Dewar: 01932-343331.

28 **Bedford MES.** *Wainwright's Autumn Collection.* Contact Ted Jolliffe: 01234-327791.

28 **Hornsby ME.** *Meeting.* Contact Ted Gray: 9484-7583.

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.

George Loryman	*Guildford MES*
Lou Riley	*Docklands & East London MES*
Dennis Parker	*Erewash Valley MES*

across the North of England, everyone who attended the *Sweet Pea* rally was able to use the track for as long as they wished.

There was plenty of support for the annual **Model Steam Road Vehicle Society** rally with just about every type of model traction engine and many other vehicles taking part. As usual, the highlight of the event was the road run, no easy task to organise with such a wide variety of scales among the models. Careful planning before the rally ensured that all engines had a reserved pitch on the rally field, and the use of two-way radios assisted the organisers to run the event without any obvious hitch. A barbecue on Saturday evening provided club Chairman Tony Putterill with the opportunity to announce that he would be standing down at the AGM on 21 October. While everyone was sorry to hear this news it was also appreciated that he has held the post for the past five years, during which he has guided the society through several enforced changes, and it was generally felt that he deserves to be allowed to enjoy the hobby without the ties inevitable for the Chairman. During the rally, the Mayor of Tewkesbury presented the *MJ Trophy* to Jim Etheridge for his 3in. scale Allchin.

At the end of July, **Erewash Valley MES** celebrated in style the 10th anniversary of the opening of the track at Borrowash. As well as the more conventional activities such as running locomotives, nattering, eating, and the like, a number of side shows had been arranged, including a display of models and photographs, tombola, and face painting, all of which took place under the guidance of their very own Fat Controller, complete with top hat and frock coat. A supply of food and drink was maintained throughout, but with so many people present it was touch and go as to whether there would be sufficient to satisfy everyone. Like all the best stories, it seems to have worked out all right in the end. Several members are looking forward to November when the society boiler-making course will start again. This takes place on Saturday afternoons and provides an opportunity to construct a copper boiler under the watchful eye of more experienced members, thus providing useful experience in this aspect of model engineering while saving money to boot!

If the increasing number of rallies is anything to go by, and it surely is, interest in the **Ground Level 5in. gauge Mainline Association** continues to grow. It has become necessary to seek a volunteer to take on the position of events co-ordinator to remove the load at present borne by the association's small committee. To honour the memory of the late Peter Smallwood who did much to set the society on its way, a seat has been installed at the Gilling track of **Rydale SME**, which could be considered as the association's spiritual home. The growing interest in the construction of 5in. gauge goods wagons is reflected in the large number that now appear at rallies. An article which could be of interest to clubs about to lay or relay track is featured in *Turnout,* the excellent society magazine, and concerns the purchase from Dumfries Plastics Recycling Ltd. at Dumfries in Scotland, of recycled plastic for use as sleepers. The material has apparently been found to be quite satisfactory.

With the ready availability of desk top publishing for users of personal computers at home, **Chingford DMEC** is one of several societies which now produces a very professional looking newsletter in the form of a small format (A5) magazine invariably packed with articles of interest. It is unrealistic for the club to consider the production of such a publication from members' subscriptions alone and relies on revenue from the advertising it contains to defray costs. To express their appreciation to those who support them in this way, the society held an Advertisers' Fun Run to which all the advertisers and their families and friends were invited. A good number availed themselves of this opportunity to pay a visit during which a copious supply of refreshments was laid on and they were invited to ride on any of the trains they wished, an invitation that was taken up by most. The weather was kind, giving the club the opportunity to say a big 'thank you' to them for their support, without which the society would find things very difficult indeed. Improvements continue to be made to the very fine set up at Ridgeway Park; the station has been given a face lift, and it has been decided to build a track for garden gauge models on top of a carriage shed with a very low roof.

A lot of heavy concreting work is being carried out by members of **Sutton Coldfield MES** and those involved will breathe a sigh of relief when it has all been finished. Cost was not the only consideration when it was decided that the society should do the work, it was felt that the inaccessibility of the area ▶

29 **Basingstoke DMES.** *Meeting.* Contact Ian Shanks: 01420-561741.
29 **Chelmsford SME.** *Auction.* Contact D. Blake: 01376-324205.
29 **Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797-362295.
29 **Surrey SME.** *How it is Done.* Contact John Cook: 020-8397-3932.
29 **Wigan DMES.** *Brian Perkins: The Aquila Engine.* Contact John Chamberlain: 01744-882255.
30 **Chingford DMEC.** *Keith Catchpole: The World of Colonel Stephens.* Contact Martin Masterson: 0208-989-5552.
30 **Historical MRS (Bedford Area).** *Bernard Weller: Hints and Tips for Modelling.* Contact John Chamney: 01442-851214.
30 **Hull DSME.** *George Newton: Electric Motors & Speed Controllers.* Contact Brian Rylance: 01482-647032.
31 **Cardiff MES.** *Brian Perkins: Building the Aquila Aero Engine.* Contact Trevor Jenkins: 029-2075-5568.

NOVEMBER

1 **Colchester SMEE.** *D. Soggee: Out and About the Railways of Yesterday.* Contact L. G. Hammond: 01376-511686.
1 **Maidstone MES.** *Barry Applegate: Gauge One Ass'n.* Contact Martin Parham: 01622-630298.
1 **North London SME.** *Work in Progress.* Contact Tony Dunbar: 01992-465625.
1 **Portsmouth MES.** *Meeting.* Contact Bob Aldred: 023-92-523366.
1 **Rochdale SMEE.** *John Swarbrick: Constructing a 45xx in 7¼in. gauge.* Contact Mike Foster: 01706-360849.
1 **Romford MEC.** *Competition Night.* Contact Colin Hunt: 01708-709302.
2 **Chelmsford SME.** *Bonfire Night Steam-Up & Barbecue.* Contact D. Blake: 01376-324205.
2 **Keighley DMES.** *Bonfire Night Steam-Up.* Contact K. Parkin: 01274-564866.
2 **Peterborough SME.** *Guy Fawkes Meeting.* Contact Tony Meek: 01778-345142.
2 **Romford MEC.** *Fireworks Night.* Contact Colin Hunt: 01708-709302.
2 **Romney Marsh MES.** *Bonfire Night Steam-Up & Barbecue.* Contact John Wimble: 01797-362295.
2 **The Society of Ornamental Turners.** *AGM.* Contact N. S. Edwards: 01234-359392.
2 **STEAM – Museum of the GWR.** *Meet the Railway Workers.* Information: 01793-466646.
2 **Stockholes Farm MR.** *Bonfire Night.* Contact Ivan Smith: 01427-872723.
2 **Surrey SME.** *Steam into the Dark.* Contact John Cook: 020-8397-3932.
2 **West Riding SLS.** *Bonfire Night.* Contact David Batty: 01924-363908.
2 **York City & DSME.** *Bonfire Steaming Event.* Contact Ken Bateman: 01904-421445.
3 **Frimley & Ascot LC.** *Running.* Contact Bob Dowman: 01252-835042.
3 **Great Western Soc.** (Didcot Railway Centre). *Steamday.* Contact Jeanette Howse: 01235-817200.
3 **Reading SME.** *Running.* Contact Graham Bustin: 01189-615450.
3 **South Durham SME.** *Running Day.* Contact B. Owens: 01325-721503.
4 **Historical MRS (London Area).** *Chris Lyons: Slide Presentation.* Contact John Millbank: 0208-948-0556.
4 **Lancaster and Morecambe MES.** *Meeting.* Contact Harry Carr: 01524-411956.
4 **Peterborough SME.** *Bits & Pieces.* Contact Tony Meek: 01778-345142.
5 **Cardiff MES.** *Fireworks Night.* Contact Trevor Jenkins: 029-20755568.
5 **Romney Marsh MES.** *Roy Clench: Another Slide Miscellany.* Contact John Wimble: 01797-362295.
5 **Stamford MES.** *Mary Watts: Canal Life & Canal Painting.* Contact David Ash: 01780-751211.
5 **South Durham SME.** *Meeting.* Contact B. Owens: 01325-721503.
5 **Taunton ME.** *Meeting.* Contact Don Martin: 01460-63162.
5 **West Wiltshire SME.** *Night Run.* Contact R. Nev. Boulton: 01380-828101.
6 **Bristol SMEE.** *Julian Beele: Dorothea Restorations.* Contact Trevor Chambers: 01454-41508.
6 **Chingford DMEC.** *Bits & Pieces.* Contact Martin Masterson: 0208-989-5552.
6 **Guildford MES.** *Neil Kearns: Restoring Lord Nelson.* Contact Dave Longhurst: 01428-605424.
6 **Leeds SMEE.** *Bonfire Night Steam-Up and Supper.* Contact Edwin Hughes: 01757-707454.
6 **Tyneside SMEE.** *Video Evening.* Contact Malcolm Halliday: 0191-262-4141.
7 **Cardiff MES.** *Tony Bird: Clocks & Tools.* Contact Trevor Jenkins: 029-2075-5568.
7 **Leyland SME.** *Quiz Night.* Contact Alan Wilson: 01942-715072.
7 **South Lakeland MES.** *Meeting.* Contact Adrian Dixon: 01229-869915.
8 **Colchester SMEE.** *H. Pullen: Cartridge Rifles – 1865 to 1914.* Contact L. G. Hammond: 01376-511686.
8 **Hereford SME.** *T. Palmer: Fullsize to Model Scratchbuilt Ships.* Contact John Arrowsmith: 01432-265151.
8-10 **Meridienne Exhibitions.** *The International Model Boat Show* at the Warwickshire Exhibition Centre, Fosse Way, near Leamington Spa. 10.30am-5pm daily. Adults £5.50, Senior Citizens £4.50, Children £3.50, Family (2+3): £14.50. Ample free car parking. Enquiries: 01926-614101.
9 **Chesterfield MES.** *Pie & Pea Supper Running.* Contact Mike Rhodes: 01623-648676.
9 **Sutton Coldfield MES.** *Bonfire Party.* Contact Roger Timings: 0121-308-5875.
9 **West Wiltshire SME.** *Model Railway Exhibition.* Contact R. Nev. Boulton: 01380-828101.
10 **Lincoln DMES.** *Running Day.* Contact Paul Thompson: 01522-888228.
10 **Plymouth MSLS.** *Running Day at Plym Valley Railway.* Contact John Brooker: 01752-671722.

involved made it doubtful that a contractor would have been prepared to take on the job. Once this task has been finished it is proposed to enlarge the clubhouse and a planning application has accordingly been lodged with the local council. A letter from a local resident objecting to the application was published in the club newsletter but it is hoped that this will not stop the necessary permission being granted. All this work has not prevented the society acting as hosts to some 200 or more visitors from **Sutton Coldfield Railway Society**. This super event included a barbecue at which a mountain of sausages and another of burgers all disappeared rapidly when the hungry hordes set about them. The **National 2½" Gauge Association** also visited and once again all available food was quickly devoured requiring further provisions which had to be hastily organised! A visit to Little Hay is always popular with members of the association, not only because it is an excellent track, but also due to the close ties since it was one of the venues used when the association started.

Like many clubs, **St Albans DSME** supports charity. In this case Work Aid and, as there is no income from public running, money is raised from raffles and the sale of small tools and materials on club evenings. A considerable amount is raised this way which eventually finds its way to groups in East Africa. Throughout the summer good use has been made of the track at Chipperfield to which they have access, with a resulting increase in interest in model locomotives among members. The latest copy of the club newsletter features an article detailing the history of the site, which was opened in 1947 by J. N. Maskelyn and has remained in private ownership ever since, although at least one society, now defunct, is known to have used it. In an earlier report (*M.E.* 4175, 9 August 2002) we noted that John Hart's locomotive had been made available for use by St Albans club members. We would like to rectify any misunderstanding by reporting here that the society is fortunate that ex-member John Hart's widow and son have agreed to the loan of his locomotive to the club for use and enjoyment by members.

SUBSCRIBE NOW!

Only 95p

for your first issue!

▲ Aimed at sports bike riders; Fast Bikes packages industry-benchmark road tests, with: topical, humourous, informative and entertaining lifestyle features.

▶ Filled with top chariots, slick tuning tips and the best looking laydees on the planet. Fast Car is the 'Daddy'.

▲ Whether you simply enjoy reading about classic cars or are looking for practical advice, Classics is the essential companion.

GREAT MAGAZINES

Save up to 33%

HIGHBURY HOUSE
Communications PLC

Exclusive Subscription Offer

From the UK's best publisher of special interest magazines.

- First issue only 95p
- Free discount voucher
- Great magazines!

Subscribe today to any of these magazines and get your first issue for only 95p! Then you only pay £2.99 per issue thereafter. This is one of many special subscription offers available on over 40 Highbury House magazines. Look out for more fantastic titles in your next issue.

Just complete your details below or phone our **subscription hotline on**

01353 654434

QUOTE REF: OVM02

PLUS

FREE VOUCHER

offering you a great holiday discount with every subscription!*

Highbury House Communications PLC may share information about you with other companies within the Highbury House Communications PLC group ☐ and with other reputable companies so that we may let you know about products and services which may be of interest to you ☐
If you would prefer not to receive this information, please tick applicable box.
Subscriptions will begin with the next available issue. Open to UK residents only. This offer closes 28th February 2003.
*Terms and conditions apply

YES! I would like to subscribe to:

☐ FAST CAR 6 issues for £15.90 ☐ FAST BIKES 6 issues for £15.90 ☐ CLASSICS 6 issues for £15.90
☐ FAST CAR 12 issues for £31.80 ☐ FAST BIKES 12 issues for £31.80 ☐ CLASSICS 12 issues for £31.80

Is this a renewal of a current subscription? ☐ Yes ☐ No

Method of Payment

☐ Cheque (made payable to HIGHBURY-SPL Publishing Ltd)
☐ Mastercard ☐ Visa ☐ Switch Cardholder's name: .....

Card no: ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐ Issue no: ☐☐ Valid date: ☐☐☐☐

Expiry date: ☐☐☐☐ Signed: ..... Date: .....

My Details

Title: ..... Forename: ..... Surname: .....

Address: .....

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

I would like a gift subscription for:

Title: ..... Forename: ..... Surname: .....

Address: .....

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

PLEASE RETURN YOUR COMPLETED COUPON TO:

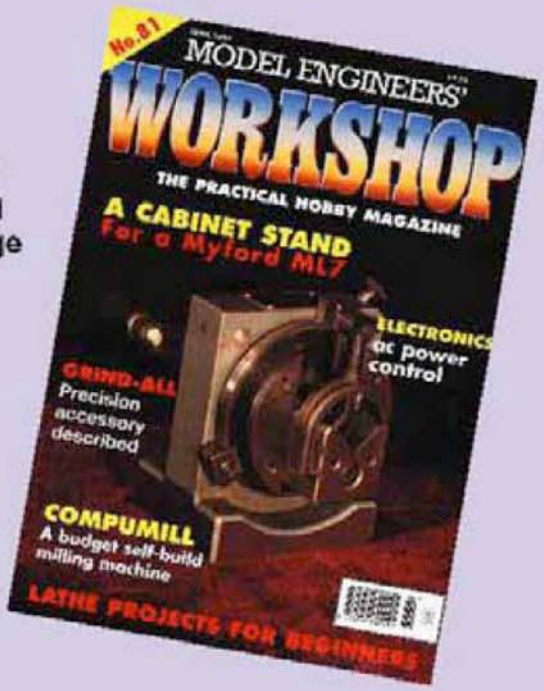
Highbury Subscriptions, Link House, 8 Bartholomews Walk, Ely, Cambs CB7 4ZD
Tel: 01353 654434, Fax 01353 654400, wss@wyverncrest.co.uk

OVM02

SAVE £££'S WITH A SUBSCRIPTION

20% Discount on Model Engineer and Model Engineers' Workshop

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



Subscribe or renew today by completing your details on the form below or phone the credit card hotline now on 01353 654422 quoting A179

❑ Yes I want to subscribe to ***Model Engineer*** for 1 year.
Please start my subscription with the next available issue.

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

Is this a subscription renewal? ❑ Yes ❑ No

MODEL ENGINEER (26 issues)

			20% Discount
One Year Subscription	UK	~~£54.60~~	£43.50
	Europe	~~£69.00~~	£55.20
	USA Airmail	~~$113.50~~	$90.80
	ROW Airmail	~~£74.50~~	£59.60

MODEL ENGINEERS WORKSHOP (8 issues)

One Year Subscription	UK	~~£26.00~~	£20.80
	Europe	~~£31.00~~	£24.80
	USA Airmail	~~$51.00~~	$40.80
	ROW Airmail	~~£33.50~~	£26.80

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

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

❑ Visa ❑ Amex ❑ Mastercard

Cardholder's Name .....

Card Number.....

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

YOUR DETAILS

Title..... First name.....

Surname/Family name.....

Address .....

.....

.....

.....

Post/Zip code.....

Country.....

Telephone .....

Email .....

PLEASE RETURN YOUR COMPLETED COUPON TO:
Nexus Media Subscriptions, Link House, 8 Bartholomews Walk, Ely, Cambs CB7 4ZD
Tel 01353 654422 Fax 01353 654400 e-mail nexus@wyvernerest.co.uk

US/CANADIAN SUBSCRIBERS PLEASE RETURN YOUR COMPLETED COUPON TO:
Wise Owl Worldwide Publications, 1926 S Pacific Coast Highway, Suite 204, Redondo Beach, CA90277-6145 USA
Tel 310 944 5033 Fax 310 944 9963 e-mail wiseowl@sprintmail.com

This offer closes 30 November 2002

❑ Please tick this box if you do not wish to receive any further information from Nexus Media Ltd or 3rd party companies carefully selected by us. A179

THE ESSENTIAL WORKSHOP LIBRARY

from NEXUS SPECIAL INTERESTS BOOKS

MODEL ENGINEERING BOOKS

Building Simple Model Steam Engines
Tubal Cain
This book shows how to build four model steam engines and features designs and plans that even a beginner will be able to follow.
1993 *1-85486-104-2* *210x148mm*
112 pages *Illustrated paperback* *£8.95*

Building Simple Model Steam Engines II
Tubal Cain
More projects ranging from a delightful little turbine to a larger engine in the style of the magnificent Steam Engines of the Highest Class" offered by specialists before WW I. Fully detailed methods of construction with the beginner in mind.
1997 *1-85486-167-4* *210x148mm*
112 pages *Illustrated paperback* *£8.95*

Model Engineering - A Foundation Course
Peter Wright
A new book by an experienced model engineer covering all the basic techniques: understanding engineering drawings, buying materials, marking out, sawing, filing, bending and forming metals.
1997 *1-85486-152-2* *216x189mm*
416 pages *Illustrated paperback* *£16.95*

Model Engineers Handbook
Tubal Cain
This third edition comprises a compilation of tables, facts, procedures and data that the author has found invaluable in his model engineering activities. It provides a real store of information to which you will return again and again.
1996 *3rd Edition* *1-85486-134-4* *210x148mm*
240 pages *Illustrated paperback* *£9.95*

The Model Locomotive from Scratch
B.Terry Aspin
Based on a series of articles by Chuck, the pseudonym used by the author for a series of articles published in Model Engineer. All the text and illustrations have been specially prepared by the author for this book.
1998 *1-85486-165-4* *159x216mm*
96 pages *Illustrated paperback* *£10.95*

Introducing Model Traction Engine Construction
John Haining
This book discusses types in a brief history, choice of model, workshop processes and the tools needed for every stage of construction. Profusely illustrated and full of interesting and useful information.
1985 *0-85242-885-7* *210x148mm*
112 pages *Illustrated paperback* *£6.95*

The Countryman's Steam Manual
John Haining
First published in 1982, this new and enlarged edition covers the design, construction and care of steel boilers in general, with formulae and data used by firms of repute. Designs of three vertical boilers are included - the Sentinel, the Cundec and a 3-inch scale version.
1996 *1-85486-136-0* *210x148mm*
96 pages *Illustrated paperback* *£5.95*

An Introduction to Robotics
Harprit Sandhu
An introduction for the amateur to the ideas and concepts of robotics, a discipline that will eventually radically change the way we work. The first part explains how and why robots work and are controlled, while the second part shows you how to make a simple two-legged humanoid robot that can be programmed to walk from a personal computer.
1997 *1-85486-153-0* *216x189mm*
208 pages *Illustrated paperback* *£9.95*

The Amateur's Workshop
Ian Bradley
All model engineers are occasionally faced with an operation outside their usual experience, with more than 450 line and photographic illustrations, this book is a comprehensive reference book providing information on setting up a workshop and the use of various machines and tools.
1995 *1-85486-120-4* *210x148mm*
256 pages *Illustrated paperback* *£8.95*

The Amateur's Lathe
L.H.Sparey
Virtually the standard work on small (3-1/2 inch) lathework since its original publication in 1948.
1972 *0-85242-209-1* *216x138mm*
224 pages *Illustrated paperback* *£8.95*

WORKSHOP PRACTICE SERIES

Hardening, Tempering & Heat Treatment — WPS 1
Tubal Cain
A comprehensive exposition of the structure of steels and the effects of different heat treatments, particularly in respect of tools. With accurate colour temperature charts.
1984 *0-85242-857-5* *210x148mm*
128 pages *Illustrated paperback + 4 pages of colour plates* *£6.95*

Vertical Milling in the Home Workshop — WPS 2
Arnold Throp
Small workshops, including those of model engineers, are making increasing use of small vertical milling machines. This book explains how to use them (and lathe milling attachments) in clear terms.
1984 *0-85242-863-X* *210x148mm*
96 pages *Illustrated paperback* *£6.95*

Screwcutting in the Lathe — WPS 3
Martin Cleeve
A fully comprehensive survey of the use of a lathe for all forms of screwcutting in all thread forms, imperial and metric.
1984 *0-85242-830-3* *210x148mm*
176 pages *Illustrated paperback* *£6.95*

Foundrywork for the Amateur — WPS 4
B.Terry Aspin
This book is regarded as the perfect introduction to casting work in common metals. This new edition, brings everything right up to date.
1998 *1-85486-188-9* *210x148mm*
112 pages *Illustrated paperback* *£6.95*

Milling Operations in the Lathe — WPS 5
Tubal Cain
This book by Tubal Cain, who needs no introduction to Model Engineer readers, is a thorough and practical discourse on how to use the lathe for all types of milling work.
1984 *0-85242-880-5* *210x148mm*
128 pages *Illustrated paperback* *£6.95*

Measuring & Marking Metals — WPS 6
Ivan Law
Model engineers and many small workshops do not need, or have access to, much of the sophisticated measuring equipment used in industry. Accurate marking out and measurement by more basic means at all stages of work are comprehensively described.
1985 *0-85242-841-3* *210x148mm*
112 pages *Illustrated paperback* *£6.95*

The Art of Welding — WPS 7
W.A.Vause
This book sets out the basic techniques for oxyacetylene welding, brazing, flame cutting and electric arc welding with mild steel, cast iron, stainless steel, copper, brass etc. in sheet, plate or cast form.
1985 *0-85242-864-4* *210x148mm*
96 pages *Illustrated paperback* *£6.25*

Sheet Metal Work — WPS 8
R.E.Wakeford
The author is an instructor in metal work and allied crafts and describes clearly all the processes likely to be encountered by the hobbyist in a model or light engineering workshop.
1985 *0-85242-989-9* *210x148mm*
112 pages *Illustrated paperback* *£6.95*

Soldering & Brazing — WPS 9
Tubal Cain
Joining metal by one form or another of soft and hard soldering, or brazing with various alloys, are run-of-the-mill jobs in model and light engineering workshops.
1985 *0-85242-865-6* *210x148mm*
136 pages *Illustrated paperback* *£6.95*

Saws & Sawing — WPS 10
Ian Bradley
This book examines all types of saw, hand and machine, their use, maintenance and useful tables relating to various applications.
1986 *0-85242-887-1* *210x148mm*
96 pages *Illustrated paperback* *£5.95*

Electroplating — WPS 11
J.Poynter
This title will be of value to model engineers and small workshops wishing to plate with any of the customary metals using simple equipment.
1987 *0-85242-902-6* *210x148mm*
64 pages *Illustrated paperback* *£6.25*

Drills, Taps & Dies — WPS 12
Tubal Cain
In this book, Tubal Cain discusses drills and drilled holes and threading with taps and dies, primarily by hand. Imperial and metric sizes plus conversions are included together with all standard thread gauges.
1987 *0-85242-866-9* *210x148mm*
104 pages *Illustrated paperback* *£6.95*

Making Small Workshop Tools — WPS 14
Stan Bray
Making 14 simple but useful adjuncts to the tool kit for bench and lathe use, taking no more than 1 to 4 hours or involving special materials, yet each able to save considerable time in use as well as aiding accuracy.
1987 *0-85242-886-3* *210x148mm*
92 pages *Illustrated paperback* *£6.95*

Workholding in the Lathe — WPS 15
Tubal Cain
Tubal Cain discusses all the practical aspects of the subject, with many photographs to illustrate specific points.
1988 *0-85242-909-8* *210x148mm*
112 pages *Illustrated paperback* *£6.95*

Electric Motors — WPS 16
Jim Cox
Principles, characteristics, operations, installation, speed control, braking etc. plus generators, safety, testing and a useful section on identifying and applying scrap motors.
1987 *0-85242-916-2* *210x148mm*
136 pages *Illustrated paperback* *£6.95*

Gears & Gear Cutting — WPS 17
Ivan Law
Explanations and reasons for all conventional types of gears are clearly set out in this book together with useful tables and machinery techniques to form an invaluable reference work for anyone dealing with machinery.
1987 *0-85242-911-1* *210x148mm*
136 pages *Illustrated paperback* *£6.95*

Basic Benchwork — WPS 18
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.
1988 *0-85242-920-7* *210x148mm*
128 pages *Illustrated paperback* *£6.95*

Spring Design & Manufacture — WPS 19
Tubal Cain
Every type of spring and all the necessary calculations are clearly explained as well as materials and methods.
1988 *0-85242-915-0* *210x148mm*
96 pages *Illustrated paperback* *£6.95*

Metalwork & Machining Hints & Tips — WPS 20
Ian Bradley
A workshop information pot-pourri combining useful advice and instruction for beginners, with explanations of tools and techniques often familiar in name but not always found described in detail.
1988 *0-85242-947-9* *210x148mm*
96 pages *Illustrated paperback* *£6.95*

Adhesives & Sealants — WPS 21
David Lammas
David Lammas covers traditional adhesives, their advantages and shortcomings as well as synthetic products.
1991 *1-85486-040-8* *210x148mm*
144 pages *Illustrated paperback* *£6.95*

Workshop Electrics — WPS 22
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.
1994 *1-85486-107-7* *210x148mm*
128 pages *Illustrated paperback* *£6.95*

Workshop Construction — WPS 23
Jim Forrest & Peter Jennings
This book contains the details for building the floor assembly, walls and roof and covers the peripheral areas including layout, planning regulations, tools, materials, security and insurance.
1995 *1-85486-131-X* *210x148mm*
144 pages *Illustrated paperback* *£6.95*

Electric Motors in the Home Workshop — WPS 24
Jim Cox
Detailed advice is given on how to identify and make good use of discarded and surplus motors from both domestic and industrial sources and also how to operate three phase motors from single phase supplies.
1996 *1-85486-133-6* *210x148mm*
144 pages *Illustrated paperback* *£6.95*

The Backyard Foundry — WPS 25
B.Terry Aspin
This book covers basic principles, materials and techniques, pattern-making, moulding boxes, cores and core boxes, metals, electric, gas and coke furnaces.
1997 *1-85486-166-0* *210x148mm*
104 pages *Illustrated paperback* *£6.50*

Home Workshop Hints & Tips — WPS 26
Edited by Vic Smeed
A selection of useful hints and tips culled from a wide time-scale of the Model Engineer magazine as relevant today as when they were first printed.
1997 *1-85486-145-8* *210x148mm*
128 pages *Illustrated paperback* *£5.50*

Spindles — WPS 27
Harprit Sandhu
Spindles describes the design construction and use of a variety of spindles that will be of interest to the amateur engineer and dedicmakers.
1997 *1-85486-148-2* *210x148mm*
160 pages *Illustrated paperback* *£6.95*

Simple Workshop Devices — WPS 28
Tubal Cain
This is an updated edition of a previously published title, now an essential addition to any model engineer's library.
1998 *1-85486-150-4* *210x148mm*
144 pages *Illustrated paperback* *£6.95*

CAD for Model Engineers — WPS 29
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.
1999 *1-85486-189-1* *210x148mm*
128 pages *Illustrated paperback* *£6.95*

Workshop Materials — WPS 30
Alex Weiss
This book describes the many and varied materials used by model engineers in their workshops.
1999 *1-85486-192-1* *210x148mm*
192 pages *Illustrated paperback* *£6.95*

Useful Workshop Tools — WPS 31
Stan Bray
This practical collection covers benchwork, the lathe and milling operations, and includes marking-out and machining aids.
2000 *1-85486-194-8* *210 x 148 mm*
104 pages *Illustrated Paperback* *£ 6.95*

Unimat III Lathe Accessories — WPS 32
Bob Loader
The author has become an acknowledged authority on the popular Unimat mini-lathe, developing numerous accessories and techniques to assist the model engineer in getting the best from the machine.
2001 *1-85486-213-8* *210 x 148 mm*
160 pages *Illustrated Paperback* *£ 6.95*

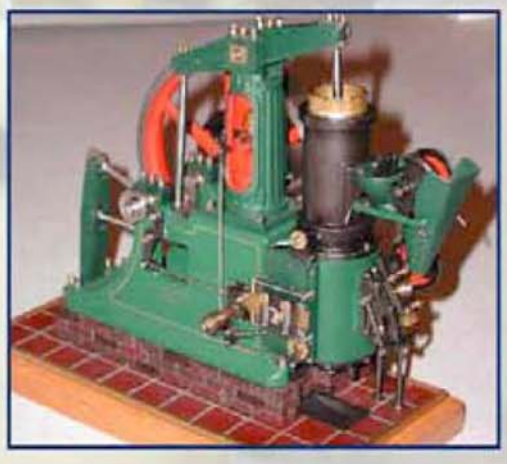
Making Clocks — WPS 33
Stan Bray
This book explains the terminology of the dedicmaker and provides general details of clock constructios including layout of wheels and escapements.
2001 *1-85486-214-6* *210 x 148 mm*
128 pages *Illustrated Paperback* *£ 6.95*

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

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

Competition displays • Free daily lectures • Trade stands • World class models

THE MODEL ENGINEER EXHIBITION



SANDOWN PARK EXHIBITION CENTRE

29th Dec 2002
- 31st Dec 2002

Established in 1907, the original Model Engineer Exhibition is celebrating its 72nd show!

HIGHBURY
Nexus Special Interests

Advance ticket hotline: 01353 654422

Or order online at www.hhc.co.uk/mee

All attractions correct at time of going to press, but may be subject to change or cancellation.

MODEL ENGINEER CLASSIFIED Advertisements

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

MODELS & MATERIALS

"WANTED"

5" GAUGE
LNER "A3" LOCOMOTIVE

Top "Cash" price paid — Fully Detailed to Exhibition Standards if possible
Please contact: Ian Earp-Smith
The Smithy, Thoroton, Nottingham NG13 9DS — Tel: 01949 850323

ANY GAUGE NOW CONSIDERED

DIANE · CARNEY
NAMEPLATES

WORLD WIDE REPUTATION FOR QUALITY

Highest Quality REPLICA PLATES
for Model Engineers and Model Makers in all scales.

LOCOMOTIVES | STATIONARY ENGINES
TRACTION ENGINES | HOMES & OFFICES
SHIPS & BOATS | MACHINE TOOLS

175 Glenbuck Avenue, Glasgow. G33 1DT
Telephone: 0141 557 1948
e-mail: loco.nameplates@ntlworld.com
Overseas enquiries welcome!

We will not be attending the Midlands Model Engineering Exhibition this year but we are otherwise TRADING AS USUAL. Please write/phone/e-mail for friendly service.

INTERNAL COMBUSTION ENGINES

DRAWINGS, CASTINGS, MATERIALS, SPARK PLUGS, TIMING GEARS, ETC AVAILABLE FOR A RANGE OF DESIGNS INCLUDING:

- 0.8CC & 5CC DIESEL
- 6CC TWO STROKE
- 10CC GLOW PLUG
- 2 CYL. 30CC O.H.V.
- 4 CYL. 30CC O.H.C

15cc Chenery Aero Twin

WORKSHOP EQUIPMENT
DRAWINGS AND CASTINGS FOR MILLING ATTACHMENTS, BORING HEADS VERTICAL MILLING MACHINE ETC

RADIAL & STATIONARY STEAM ENGINES

ILLUSTRATED CATALOGUE AND PRICE LIST £1.50

WOKING PRECISION MODELS
27 Petts Crescent, Littleborough, Lancashire, OL15 8ED
Tel: 0780 8446915 (day) 01706 377508 (evening)
e-mail: graham@wokingprecision.f9.co.uk
www.wokingprecisionmodels.co.uk

MJ ENGINEERING

TRACTION ENGINE *specialists*

Traction Engine Lamps

Fully sprung and working (Electrically)

Easy Self Assembly
2" Scale Kit (2 front lamps) £52.45
2" Scale Rear Lamp Kit £11.10
3" Scale Kit (2 front lamps) £92.00
All prices include P&P and VAT

New Catalogue £3.50

M.J. ENGINEERING
PO Box 4683, Ringwood, Hampshire. BH24 1BL
Telephone: Ringwood (01425) 476234

BLACK-IT!

Easy to use Chemical Blacking for Iron and Steel
Produces a professional satin black finish in less than 15 minutes
Standard kit (4 X 500ml) ideal for modelmakers **£27.99**
Large kit (4 x 2 Litres) **£64.99**
Black-it! kit for Brass £18.99
All prices include VAT & next day delivery
Pixel-Plus, Bryncroes, Pwllheli, Gwynedd LL53 8EH
Tel/Fax 01758 730356 Access, Visa & Switch accepted
For more details, visit our web site at www.black-it.co.uk

Model Engineering Supplies (Bexhill)
Visit our new web site – see the complete loco/rolling stock catalogue.
www.model-engineering.co.uk
E-mail us at: diesel@17bexhill.fsnt.co.uk
or birdman@moravel.freeserve.co.uk
Model loco/rolling stock catalogue £1.25 inc. postage.
Model engineering supplies catalogue £1.00 inc. postage.
Visit our shop to see our raw material stocks, used equipment etc.
Phone/Fax. 01424 223702 Mobile 07808 212236
17 Sea Road, Bexhill-on-Sea, E. Sussex TN40 1EE
www.model-engineering.co.uk

SOCKET SCREWS
Cap. Csk. Button. Set (Grub). Shoulder
METRIC. BA. BSF. BSW. UNF. UNC
Hexagonal & Slotted Screws Nuts & Washers.
Dowel & Spring Pins. Dormer HSS Taps & Drills. Draper Tools.
NO MINIMUM ORDER **PROMPT SERVICE**
Send 4 x 1st class stamps for our latest catalogue (refundable)
Special offer * * * * **Workshop Discount Pack** * * * * *
36 packets of socket, hexagonal and slotted screws up to a max. size of 2BA - 5/16" - M8. Various threads / lengths.
Catalogue value of pack is over £35.00
Pack on offer to you for only £19.55 + £2.Aw5 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
Tel: 01634 717256 **www.emkaysupplies.co.uk** *Mail Order Only*
Email: emkaysupplies@onetel.net.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 SAE
www.fynefort.co.uk

PART BUILT MODELS BOUGHT, locomotives, traction engines, beam engines, marine engines, boats, even rusty wrecks purchased. Completed models also bought regardless of condition. Tel: 0121 358 4320 (Birmingham).

FLYING SCOTSMAN 2.5" gauge LNER 4-6-2, advances stage, professional work, rolling chassis, fitted cab, running boards, smoke box, boiler partly built, tender built in brass. £650

GREEN ARROW 2.5" gauge, 2-6-2, three cylinder, advanced stage, professional work, rolling chassis, valve gear, fitted cab, running boards, smoke box, boiler partly built, tender built in brass. £600

GWR 1000 Class 3.5" gauge, 4-6-0, air running chassis, quality work, tender chassis completed with brakes, leaf sprung, new set of drawings, materials £1,000

GREEN KING SOUTHERN RAILWAY 4-6-0, 3.5" gauge, fitted cab, running boards, smoke box, requires boiler, tender finished with brakes, leaf sprung, ME drawings/instructions. £695.

DORIS 3.5" gauge, 4-6-0, rolling chassis with smoke box, fitted brass cylinders, tender parts and body, many spare castings, related parts, complete with spare chassis, drawings. £650.

BRITANNIA 3.5" gauge 4-6-2, well advanced, chassis/running gear all completed to a high standard, smoke box, lubricator, brakes. Boiler requires finishing, tender complete, with drawings £1,350.

Tel 01483 274464 or Mob 0776 2326878.

Delivery and packing arranged - free of charge in UK

CALL TODAY 01322 660070

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

Grandad's Toys

117 HIGH STREET, BURTON LATIMER, NORTHAMPTONSHIRE NN15 5RL (01536 722822)

Retail, Trade & Mail Order

Moulded Clay Miniature Bricks, Roof & Floor Tiles. Scales: 1:10, 1:12 & others. (Send s.a.e. for samples)
www.grandadstoys.co.uk

steam-models.uk.com

A small selection of our present stock of high quality live steam models inc:
5" Gauge LNER A3 Flying Scotsman
5" Gauge Halton Tank
3.5" Gauge Beyer Garrett 4-6-2+2-6-4
3.5" Gauge Evening Star
2" Scale Fowler Super Scenic Showmans Engine

Richard Evison
Steam-models.uk.com
31/32 South Street, Riddings, Alfreton, Derbyshire DE55 4EJ. Tel. & Fax. 01773 541527
Many more steam items available.
www.steam-models.uk.com

"GUNMETAL, BRONZE AND BRASS" in 12" lengths by mail order. For price list S.A.E. to PEMMSA, Unit 6, Riverbank Enterprise Centre, Dewsbury, West Yorks WF13 3RQ.

HARRISON LATHE SPECIALISTS. On site service, pre-purchase inspections on your behalf. Valuations and disposals, etc. Contact Pemmsa 01924 459276 Mobile 07786 146738.

Paul Gammon
Technical Services
PG TS
STAINLESS STEEL SUPERHEATERS
WATER PIPE CONNECTOR KITS
PAINT LINING PEN 1–4
4 Hurst Road, Epsom, Surrey KY19 8SJ
Fax + Tel: 01372 729726
SAE all enquiries please

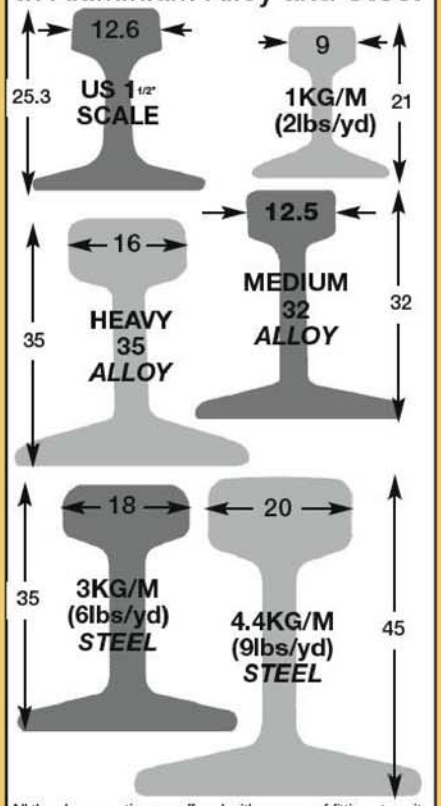
COPPER TUBE, SHEET, BAR
and other non-ferrous metals.
Send 9" x 4" SAE for lists.
R. Fardell, 49 Manor Road, Farnley Tyas, Huddersfield HD4 6UL
Tel: 01484 661081

RAIL

THE MINIATURE RAILWAY SUPPLY CO. LIMITED.

FLAT BOTTOM RAIL

In Aluminium Alloy and **Steel**



All the above section are offered with a range of fittings to suit. Other larger steel rail sections and fittings are also available.

The Miniature Railway Supply Co. Limited.
42 Stratford Way, Boxmoor, Hemel Hempstead, Herts, HP3 9AS, England
Telephone, Fax & Answerphone: 01442 214702
www.miniaturerailwaysupply.com

Dual Gauge 7¼ 5" Gauge

Ground level track, 110ft in 10ft lengths plus 7¼" ground level riding car 6ft long braked on one bogie. Buyer collects.

Tel: 02920861889

SINGAPORE

7¼ Gauge 0-4-0 Saddle Tank Locomotive
Described by Martin Evans' in Model Engineer

Castings available from

TONY BROWN, 76 QUEENS CRESCENT, CHIIPPENHAM, WILTS SN14 0NP

FOR SALE 7¼ gauge Wren Saddle Tank and tender, modified cab, Botler Certificate. £5,500 ono. Tel: 01702 552719 (Essex).

SET OF 9 DRAWINGS FOR Ajax 040 tank 5" gauge. £25 ono. Tel: 0117 9491162 (Bristol).

5" GAUGE 060 Dean goods rolling chassis, cylinders, smokebox, chimney, boiler. £350 ono. Tel: 016974 78558 (Cumbria).

5" 0-4-0 BATTERY ELECTRIC STEAM outline loco and truck. C5 motor parkside controller. £600. Tel: 0777 3475041 (Herts).

PART BUILT(90%) Allchin Royal Chester. 1½" traction engine with remaining castings, drawings and book. £1,200. Tel: 01248 713853 (Anglesey).

PART BUILT Maisie G.N.R. Atlantic 4-4-2, 3½" gauge, most castings included with drawings and book. £490. Tel: 01248 713853 (Anglesey).

PART BUILT schools class 4-4-0 3½", most castings included plus boiler and drawings. £850. Tel: 01248 713853 (Anglesey).

BOILER WANTED for "Simplex" loco. Kit or part built considered. Contact Jack 0208 894 4756 (Twickenham).

5" NORMAN SPINK BRITANNIA, unfinished project, 33% built, professional boiler, boiler certificate, drawings, parts plus photo's. £2,000. Tel: 01305 820363 (Dorset).

PRINCESS MARINA 2-6-0, air running chassis, brass tender, some boiler materials, drawings. £550 ono. Tel: 01422 256969 (W. Yorks).

ROB-ROY CHASSIS cylinders, machined smokebox, professional boiler, drawings, 0-6-2 three and a half inch gauge, vgc. £425. Tel: 01422 256969 (W. Yorks).

WANTED PART BUILT 5" gauge Lion Titfield Thunderbolt, also any drawings, unused castings for same. Tel: 02920308234 (Cardiff).

BRITANNIA 3½"G BOILER all parts made, needs silver solderings, quality workmanship, offers. 3½"

SERVICES

T.K.D. ENGINEERING

Machining, Pattern Making and Build Service for Model Engineers and Model Makers
All types of work undertaken regardless of scale
Over 20 years experience
High quality engineering at competitive rates
Terry Davis
2 Kingscote Road East, Cheltenham, Glos, GL51 6JS
Tel: (01242) 581341

track 30ft fitted hardwood sleepers, l/hand point. £28. Can deliver UK. Tel: 01626 353533 (Devon).

WANTED TETHERCAR PARTS, tyres, wheels, bits and pieces, any condition. Plans, books, spark ignition engines, coils, magneto's, castings. Tel: 01481 726168. engineer@internet.guernsey.gg

WANTED BUY OR BORROW Bassett-Lowke drawings H550 for 2½" gauge 4-6-0 LNWR experiment locomotive. Tel: 01892 669317 (East Sussex).

HYDRAULIC LIFT TABLE

150kg table size 19" x 42" min,ht,17", max,ht,32", two castors braked, fitted with winch and ramp for traction engine and 5"G rails. £150.

Tel: 01903 231520 (W. Sussex)

HI-TEC 3-PHASE CONVERTERS

Speed Controls, Fwd & Rev Switches, 12 volt & 24 volt dc. to mains 230 volts ac full sine wave inverters. Static and Rotary Phase Converters 0.8 kW to 45 kW to run 3-phase 415 volt machinery from a Single Phase.

We can also supply Transformers and Components.

Website: www.phaseconverters.co.uk

BOOST ELECTRICAL ENGINEERING
Tel: 01959 534073 Fax: 01959 532726

JOSEPH CORNER
MACHINE TOOLS

LATHES

COLCHESTER Student 1800x25" metric	£1800
HARRISON M400x60" 1981	£3500
HOLBROOK 6"x20"	£300
GRANDVIL 3.5"x18"	£300

MILLING

BRIDGEPORT Power feed vari speed	£1200
KRV3000 DRO 50"x11"	£2800
BRIDGEPORT 42"x9"	£650
A&S 2E with Bridgeport turret head	£1200
FRITZWARNER 39"x8"	£900

VARIOUS

ELLIOTT 14" Shaper x 2 from	£50
EXE Grinder x 2	£320
JONES & SHIPMAN 540 x 2 from	£700
BRIDGEPORT Slotting Head	£280
EUROSPARK spark eroder	£300

Many more machines available, all machines sold as seen

Tel: 01283 547569 Mobile 07970 949857

WANTED
BRIDGEPORT BELT DRIVE HEAD

or just quill housing (J1 assembly) and 600–700 oz–ins stepper motors

Tel: 01270 587750

R.A. ATKINS

MYFORD SUPER 7B LATHES, from	£1,450
MYFORD SUPER 7 LATHES, from	£850
MYFORD ML7, clutch makers rebuild	£950
MYFORD ML10 LATHES, choice	£500
JUBILEE 30" WOOD LATHE, tooled	£300
HARRISON HORIZ MILL, vert head	£700
UNION TOOL CUTTER GRINDER, tooled	£450
WARCO MINOR MILL DRILL	£475
PROGRESS NO.1 ½" PILLAR DRILLS	£100
WARCO VERT BENCH MILL	£425
MYFORD RODNEY MILL ATTACH, suit ML10	£375
MYFORD PLAIN VERT MILL SLIDE	£100
Q&S BULLDOG 6" HACKSAW	£425
MYFORD METRIC CONVERSION SET	£175

100'S MODEL ENGINEER TOOLS & EQUIPMENT WE URGENTLY REQUIRE TO BUY WORKSHOPS

HUNTS HILL HOUSE, HUNTS HILL, NORMANDY, GUILDFORD, SURREY GU3 2AH
Tel: (01483) 811146 Fax 811243

Seen My CAT!
Now on-line

Models, Machinery, Misc.

www.theengineersemporium.co.uk

Myford

DON'T WASTE YOUR TIME AND MONEY! COME TO THE EXPERTS – WE BUILT THEM!

PRE-OWNED AND FACTORY RECONDITIONED MYFORD MACHINES
(Myford machines with 1 year warranty and genuine Myford parts)

Myford 254 Plus, metric	£3,500
Myford Speed 10, metric, cab stand, mint cond	£1,400
Myford ML7, imperial, fine condition	£1,875
Myford ML7BTL, imp., long bed, cabinet stand	£2,135
Myford ML7, imperial	£1,015
Myford ML7BT, imperial, gearbox	£1,675
Myford ML7BT, imperial, gearbox	£1,890
Myford ML7T, imperial	£1,475
Myford ML7B, imperial, cabinet stand	£1,875
Myford ML7, imperial, cabinet stand	£1,250
Myford V.M.A. Milling attachment	£1,450
Myford VM-B Vari speed mill	£1,900
Elliot 10, M shaper	£399
Extron Centre Lathe, imperial	£2,570
R.J.H. Bandfacer (finisher)	£150

For further details on these expertly restored machines call

0115 925 4222

Myford Ltd, Wilmot Lane, Chilwell Road, Beeston, Nottingham NG9 1ER

THE TOOL BOX

For the best in used hand & light machine tools for *all* crafts

We also purchase good equipment and sell related books, as well as providing a world-wide back-issue service for *Model Engineer* and *Engineering In Miniature*. We don't publish lists, but if there's something you need, get in touch.

Open Monday – Saturday throughout the year

Colyton, East Devon EX24 6LU Tel/Fax: 01297 552868

e-mail: dftoolbox@aol.com **www.thetoolbox.org.uk**

VICTORIA MILL, VERTICAL & HORIZONTAL EQUIPMENT

VICEROY T9C LATHE, C/W 3 JAW CHUCK
VICTORIAN STYLE 3 WHEEL BAND SAW
FOR FLAT BED DRIVE - RESTORATION MATERIAL

OFFERS INVITED

PHONE MIKE ON 01483 200711

WANTED
A FIVE PINT BRAZING BLOWLAMP

Please contact:
Mr F. W. Hall,
38 Elmbank Way,
Hanwell, London W7 3DG

Complete Home Workshops and Models Purchased

Distance no object

Tel: Chris Moor on 0115 925 4222

EMCO UNIMAT3 LATHE

with milling head on drawer base. Many accessories. Cowells 90ME Lathe, some accessories, books, test certificate.

Tel: 01691658211 (Oswestry)

B.C.A. MkIII Universal Jig Boring ß Milling Machine

A precision & robust machine for producing many types of components. Milling, boring, drilling, indexing operations for example.

Swivel R&F head • 10 Spindle Speeds • 8" Rotary Table on compound slides • X.Y.Z. Movements • Many other features

Widely used in all types of manufacturing and model engineering.

Used examples available. P/E Considered. Details from:

Telephone (01425) 622567
Fax (01425) 622789

Tenga Eng Co Ltd
Machine Tool Div, Britannia House
Stem Lane Ind Estate, New Milton, Hants UK. BH25 5NN

DTIs, Slips, Micrometers

Wide range of DTIs by Baty, Mercer, etc, 2" diameter plunger type. Graduated in 0.0001" at £12, 0.0005" at £10, 0.001" at £8. Few other types such as metric, lever retract types, long travel, etc.

Slip gauges E81 workshop grade complete by Marix, Pitter, etc, with 8 year old NAMAS certificate £65, without certificate £55.

Few large micrometers, sizes up to 14" and 275mm £14 to £20, internal and depth micrometers @£20 to £35.

All prices include VAT but postage is extra.

Items are ex-Government and are first come first served, many other items on web site, click on 'Bits for Sale' or contact:

BW ELECTRONICS, 12 MUSSONS CLOSE, CORBY GLEN, GRANTHAM NG33 4NY
Tel/Fax: 01476 550826
Web Site at: www.bwelectronics.co.uk

Ortec

Ortec are manufacturers of low cost, high quality, precision digital readout - DRO for machine tools such as milling machines for the hobbyist and model engineering user. We offer a complete range of readouts from 1 to 3 axis in a variety of encoder lengths.

Phone +44 (0)1481-235708

FOR SALE Tom Senior slotting head. £400 ono. Tel: 01702 292896

EMCO MAXIMAT taper turning attachment – Emco Compact 5 change gears (new), Compact 5 top slide (new). Tel: 01637 830169 (Cornwall).

FLY PRESS overhang bar type No. 4 on special stand, complete with all bolts, etc. £150 ono. Tel: 01268 694662 (Essex).

BOXFORD AVD on stand, face plate, 3-jaw, 4-jaw, fixed and travelling steadys, gearbox, some change wheels, singlephase. Tel: 02392373196 (Hampshire).

CLARKE METAL WORKER with mill drill, few extras. £375. Tel: 01462 684332 (Herts).

BOXFORD LATHE 3/4 jaw chucks, faceplate, makers cabinet. £450 ono. Tel: 01536 485770 mobile 07986 315745 (Northants).

ABWOOD 4" SWIVEL TILT VICE, as new £145, or swop for Harrison L6 vertical slide. Tel: 01708 473013 (Essex).

DRIVE SYSTEM Raglen Little John lathe 1HS/SP motor split, pullys control lever belt, all electric equipment. £80. Tel: 0191 565 2505 (Sunderland).

BOXFORD ALTHE 4½"x 20" model bud power cross feed, chucks, faceplate, change wheels, cabinet, tools. £750. Tel: 01744 739007 (Merseyside).

HARRISON 140 gap bed lathe, power feeds, rare single phase model, original documentation, vgc, bargain. £1,350. Tel: 01724 358050 (Scunthorpe).

TOM SENIOR horizontal/vertical milling machine, late power feed model, coolant, virtually unused condition. £3,000. Tel: 01724 358050 (Scunthorpe).

CORLISS VALVE MILL ENGINE, as seen at M.E. & Wembley, 9½" flywheel, superb. £825 ono. Tel: evenings 0208 909 3097 (Harrow).

STENT TOOL & cutter grinder. £250. Atlas Lathe with stand. £300. Both single phase. Tel: 0777 3475041 (Herts).

WORKSHOP CONTENTS for sale, h/v miller, lathe, shaper, surface grinder, phase converter, ex college, immaculate. £2,500. Tel: 01782 565785 (Newcastle).

EVENSON ENGINEERING

Quality Machines and Tooling

Machine Sales

EX BRADFORD UNIVERSITY MACHINES

Colchester Master 6" x 36" Late fully Tooled £1500
Arboga Maskiner geared Head Pillar Drill 3MT £875
Raglan 5" x 20" Lathe Gear Box P/F Single Phase Fully Tooled £1400
Thommen Chip-Breaker Tool + Cutter Grinder £870
Colchester Chipmaster, taper Turning Rear Tool Post, Bed Stops Fully Tooled £1200
Arboga Geared Head Drill 3MT £850
Edwards 4ft X 16G Guillotine £550
Elliot 00 Mill 27" X 8" Table £1800
J+S 12-12 Hand opp cylindrical Grinder Single Phase £1800
J+S 540 Surface Grinder (Like New Condition) £3500
Elliot 4E Pedestal Drill 4 Morse Power Feeds £850
3 of Harrison L5 Lathes (All Good Condition) ..... £1100-£1750
Harrison Vert Mill 30"-8" Table (Superb Conditions) £1800

LAST 2 UNIVERSITY MACHINES PULTRA LATHE + LORCH - ALL COME WITH EXTENSIVE TOOLING AND ARE IN OUTSTANDING CONDITION

MILLING MACHINES

A.E. Jones Vert/Hort Swivel Head+Table Power Feed (Tom Senior Size) £1350
Bridgeport 42" 9" Variable Speedhead Digital Readout £2800
A & S horizontal mills ..... from £500
Harrison horizontal mills ..... from £700

LATHES

Boxford Cud Metric Cab/Stand PCF £875
2 Colchester Masters 6" 36" One with Clutch £1400
Harrison L6 Gearbox PCF Gap Piece Missing (Verty Tidy) £800
Colchester Bantham 2000 6" 30" Gap Bed Dual Dials £1850
Harrison M250 Fully Tooled £2300
Colchester Chipmaster Tooled Taper Turning Rear Tool Post (Verty Nice) £1450

MISCELLANEOUS

Jones & Shipman dig. form model AT new boxed £550
Bridgeport Slotting Head, excellent condition £800
Viceroy pedestal grinders, 2 off, ex cond (small & compact) £180
Leytool slotting machine, 3" stroke, small footprint, swivel head, rebuilt & painted £1175
LBridgeport milling head, 2 speed motor R8 power quill (fits most mills, ie Adcock & Shipley 1ES) £850
Eclipse magnetic chuck 19" x 12" £300
Flypresses ..... from £50
Colchester Chipmaster lathe (breaking) £350
Harrison spares ..... please phone
Swivel vertical head 4MT, make unknown but will fit Senior, A&S etc with modification £300
Collet chucks, box blocks, vices, angle plates, surface plates etc ..... Please phone
Union Bench Drill £280
Student/Master Collet Chuck 2 of ..... each £100
Student 18" Faceplate £95
Boxford 2MT Pillar Drill (Untidy) £80
Hort Pedestal Sander 15 Disc Ex Uni £350
Hydraulic Stacker Truck Ideal for Lifting Vices and Chucks 800 kg £350
Jones Shipman Bench Centre ..... POA

WE ALSO PURCHASE QUALITY MACHINES & TOOLING • DELIVERY SERVICE AVAILABLE
PLEASE TELEPHONE BEFORE TRAVELLING - WEEKEND & EVENING VIEWING AND DELIVERY SERVICE

More machines always in stock.
Tel: 01274 544409 & 780040 Mobile 07050 272169
4 Duchy Crescent, Bradford, BD9 5NJ

TRUE PHASE CONVERTERS

ESTABLISHED FOR 60 YEARS

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

DANEBURY ELECTRIC LTD
Phone, Fax or Email for Colour Brochure
email: truephasesales@daneburyelectric.co.uk
Web: www.danebury.co.uk
Tel: 01202 524888 or Fax: 01202 530940

ATTENTION MODEL MAKERS

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

TOOLS PURCHASED

Hand Tools and Machinery, whole or part collections - old and modern. Will call.
Tel: Alan Bryson.
Tel: 01823 288135 (Taunton).

COMPLETE HOME WORKSHOPS

AND MODELS PURCHASED. DISTANCE NO OBJECT
Tel: Mike Bidwell on 01245 222743

OLD ENGINEERING HAND TOOLS, AND WOODWORKING TOOLS WANTED, NORRIS PLANES £120 MINIMUM. ALSO UNUSUAL MEASURING INSTRUMENTS AND UNUSUAL SPANNERS. DISTANCE NO OBJECT.
TEL: TONY MURLAND 01449 722992
IN SCOTLAND 0141 3312784

MODEL ENGINEER

LINEAGE/SEMI DISPLAY COUPON (Model Engineer) Advertisement Dept. Nexus Special Interests, Nexus Media, Azalea Drive, Swanley, Kent, BR8 8HU.
No reimbursements for cancellations.

FOR ENTHUSIASTS BY ENTHUSIASTS
NEXUS

PLEASE TICK ONE BOX ONLY

☐ WORKSHOP EQUIPMENT ☐ MODELS & MATERIALS ☐ BOOKS & PUBLICATIONS ☐ SERVICES ☐ GENERAL

PRIVATE SALE/TRADE SALE (DELETE NON-APPLICABLE)

TEL. NUMBER					

ALL ADVERTISEMENTS MUST BE PRE-PAID. NO REIMBURSEMENTS FOR CANCELLATIONS.

I enclose my Cheque/Postal Order* for £ .....for .....insertions,

made payable to Nexus Media Ltd.

(*Delete as necessary) or Please debit my Mastercard/Barclaycard No. Expiry Date

£ ..... for ..... insertions.

Name .....

Address .....

.....

.....Post Code .....

Daytimes Tel. No .....

email ..... @ .....

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

PRICE GUIDE - Tick one box

18 words or less FREE!! (private sales only) ☐

18-25 words, in colour only £10 ☐

26 words + in colour £15 ☐

Private ad, in box, full colour, endless word count - 2.5 x 1 £25 ☐
3 x 1 £30 ☐
3.5 x 1 £35 ☐

HOME AND WORKSHOP MACHINERY

QUALITY USED MACHINE TOOLS

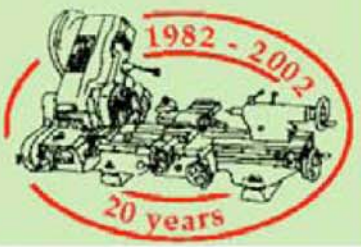
144 Maidstone Road, Foots Cray, Sidcup, Kent, DA14 5HS.

Telephone 020-8300 9070 – Evenings 01959 532199 – Facsimile 020-8309 6311.

Opening Times: Monday-Friday 9am-5.30pm – Saturday Morning 9am-1pm

10 minutes from M25 – Junction 3 and South Circular – A205

www.homeandworkshop.co.uk



LATHES

BOXFORD TUD 4½" x 20" 3 jaw chuck, cabinet stand, hand feeds £990
BOXFORD CUD 4½" x 20", changewheels, 3 jaw chuck, cabinet stand £750
BOXFORD CUD 5" x 22" Mill, c/wheels, 4 way toolpost ..... As new £1,250
BOXFORD AUD 4½" x 20" Mill gearbox, power cross feed, 3 jaw chuck, tools £1,575
BOXFORD BUD 5" x 22" Mill, c/wheels, power cross feed, T slotted cross slide £1,400
BOXFORD 19-20 5" x 20", geared head, power feeds, very late machine £1,950
BOXFORD 1130 5½" x 30", geared head, gearbox, power feeds, cabinet stand, clean machine £2,450
COLCHESTER CHIPMASTER 6" x 20", gearbox, variable speed, 3 jaw chuck, face plate, 4 way tool post Just £950
COLCHESTER BANTAM 1600 model, 6" x 20", geared head, power feeds, gearbox £1,400
COLCHESTER BANTAM 2000, 6½" centre height x 30", between centres, 1¼" bore, 16 speeds, D1 3 camlock fitting, 3 & 4 jaw chucks in very nice condition £3,250
COLCHESTER STUDENT, 6" x 24",geared head, metric / imperial gearbox, coolant £1,625
COLCHESTER STUDENT Square head, 1500 revs / 2 speed motor model, geared head, gearbox, inch/met, power cross feed & gap bed, dual dials, 3 Jaw chuck, taper turning,coolant, etc £2,950
COLCHESTER STUDENT 1900 6½" x 40" + gap bed, 19" swing, 3 & 4 jaw chucks, Dickson tooling, taper turning, dial indicator, coolant, splash back, very nice, metric dials £3,750
COLCHESTER MASTER 6½" x 36", square geared head, power feeds, gap bed ..... Nice order £1,400
COLCHESTER TRIUMPH 2000 7½" x 30" full screwcutting, 3 & 4 Jaw chucks, steadies, taper turning, gap bed, coolant £4,250
COLCHESTER TRIUMPH 2000 7½" x 50" full screwcutting gearbox and power feeds, gap bed, 3 & 4 Jaw chucks, Dickson tooling, faceplate etc ..... now £4,950
DENFORD 250 5" x 20", 3 jaw chuck, two way tool post, dual dials £950
HARDINGE capstan lathe £895
HARRISON L5, 4½" x 24", fully tooled, complete with clutch £950
HARRISON 140, 5½" x 24", geared head, semi gearbox, 3 jaw chuck, gap bed, power feeds, clutch £1,400
HARRISON 140, 5½" x 24", geared head, gearbox, gap bed, power feeds, tooling, coolant £1,725
HARRISON M250, 6" x 30", long bed, gearbox, power feeds, chucks, Acurite III DRO on cross slide, dual dials ..... In very nice condition £3,250
HOBBYMAT MD65 2½" x 12" Screwcutting Lathe with changewheels and some tooling £425
LITTLEJOHN 5" x 24" gearbox, power cross feed, 3 jaw chuck, 4 way tool post, cabinet stand £750
MYFORD ML10 3½" x 13", changewheels, 3 jaw chuck, rotating centre and cutting tools £725
MYFORD ML7 3½" x 19", changewheels, 3 jaw chuck, we have a large selection of this popular model £750
MYFORD ML7B 3½" x 19", gearbox, 3 jaw chuck and tooling £1,250
MYFORD ML7 3½" x 31", changewheels, 3 jaw chuck and tooling £1,125
MYFORD SUPER 7 3½" x 19", changewheels, 3 jaw chuck and tooling ..... Choice £950 - £1,150
MYFORD SUPER 7B 3¾" x 19", gearbox, 3 jaw chuck and tooling £1,250
MYFORD SUPER 7 3½" x 31", changewheels, 3 jaw chuck and tooling ..... Choice £1,400
MYFORD SUPER 7 3½" x 19", 3 jaw chuck, power cross feed ..... Late model Choice
MYFORD SUPER 7B, 3½" x 19", gearbox, Power Cross Feed, cabinet stand, tooling £2,750
MYFORD SUPER 7B, 3½" x 31", (long bed) power cross feed, inductioned hardened bed, industrial stand and doors, green machine £2,950
RAGLAN CAPSTAN 10" x 24" 6 Station Turret, cut off slide, collet chuck (lever) & collets, bar feed, variable speed, coolant £975
SMART AND BROWN 1024 Toolroom lathe, full screwcutting gearbox and power feeds complete with 3 & 4 jaw chucks, collet set, steadies and equipment ..... in very good condition £2,250
TAYLOR SPINNING Lathe 7" x 20", two speed motor ..... A rare machine in Nice Order £750
VICKERY TDS 1 GDL 5" x 20", gearbox, power slides, 3 MT tailstock complete with fixed steady £1,400
TOO MANY LATHES TO LIST!!!

MILLING MACHINES V - Vertical, H - Horizontal

ADCOCK AND SHIPLEY IE5 Horizontal/Vertical Head, 30" x 6" powered table and feed gears, coolant £1,625
BOXFORD VMB0 variable speed / 30 INT head, table 21¼" x 6" + allwood vice and collet chuck £1,950
BRIDGEPORT Series 1 - 2 HP Variable speed R8 head, powered (gearbox) table, 42" x 9" £2,250
BRIDGEPORT Belt head 2 speed (short motor) head, R8 powered head, variable speed 42" x 9" table ..... Very nice £2,250
CENTEC 2B Horizontal, 1" arbor, table powered, 3 ph motor, single phase main motor £725
CENTEC 2B Vertical/Horizontal, quill feed 2MT head, 25" x 6" table, pedestal model £1,400
ELLIOT DOWNHAM mini-borer, very late machine complete with collets and chuck (power down feed) £2,250
ELLIOT 100 OMNIMILL 3 Morse taper quill universal head, 26" x 7½" powered table ..... Just In £1,850
ELLIOT TURRET MILL R8-10 speed 70-3000 rpm, table 45" x 10" (power-ext) £1,500
EMCO FB2 Vertical/5 speed quill feed head 2 MT, powered 24" x 6" table, full coolant tray and cabinet stand 3 phase and does not like a converter so only ..... Now £1950
HARRISON horizontal, 31" x 6" powered table £625
HARRISON H/V 30 INT swivel head & clutch, 30" x 6" table/powered £1990
HARRISON VERTICAL 30 INT swivel head & clutch, 30" x 6" table/powered £1990
HOBBYMAT HEAD ONLY for a Hobbymat lathe with metric graduations £425
RAGLAN VERTICAL MILL 2 Morse taper, 2 speed motor, variable selector 175-2320 rpm, cabinet stand £950
SIP RF30, milling/drilling machine complete with accessories ..... New £799
TOM SENIOR M1 horizontal, 25" x 6" powered table, 1" arbor £575
TOM SENIOR M1 V/H, 25" x 6", 2 morse taper, 1" arbor ..... Selection £1,200 - £1,450
TOM SENIOR 'S' TYPE 2 morse taper quill feed motorised head, 28" x 6½" table / rise and fall, coolant £2250
TOM SENIOR ELT MAJOR, 2 morse taper quill feed head, powered 37" x 6½" table in extremely nice condition £3,200
TOS FQ3 AV vertical turret mill, 40 INT, 54" x 10" table, power all-ways ..... Please ring to view £1,950
VICKERY AEW vertical mill, 30 INT swivel head, powered table 34" x 8" ..... Very clean £1,625

DRILLS

ARBOGA Eh 25 / 25" Radial Drill speeds (6) 100-2900 RPM ..... Just In £1,425
ASQUITH 14-54 001 Mk2 (5m) Radial Drill ..... Immaculate coming in £3,950
FOBCO ½" Bench, tilting table £125
FOBCO ½" Pedestal drill tilting table £245
MEDDINGS ½" pedestal drill £245
MEDDINGS 2 Morse taper pedestal drills ..... Choice £275
MEDDINGS MB2 10 Speed 2MT Bench 240 volts drill £350
MEDDINGS MB5 10 speed 2MT pedestal drill, table rack £575
POLLARD CORONA Pedestal ½"/1 morse ..... From £100
SIP HDP 600 B ½" / 2MT Bench Drill, table operated by rack, speeds; (16) 182 - 3000 rpm ..... New £175
STARTRITE MERCURY ½" 4 speed bench drill £225
STARTRITE MERCURY ½" pedestal drill, 240 volts ..... As New £300
WARCO 3MT Pedestal 9 speed drill, speeds; 150-2200rpm, table operated by rack £495

GRINDING / BUFFING

CLARKSON MK3 Tool and cutter grinder ..... as is £400
JONES AND SHIPMAN 540 Surface Grinder &Magnetic Chuck ..... Ex College/Seen no work £1650
MILFORD 10" Pedestal Grinder £125
R.J.H. Buffing Machine, pedestal model Buffalo £125
VICKERY Grinder, pedestal model £145
VICKERY Buffers, pedestal models ..... Each £250

MISCELLANEOUS / FABRICATION MACHINERY

OXFORD ARC welders ..... Choice
DUNMORE toolpost grinder / Bxford size or similar £125
CARL ZEIS p1 projection dividing head ..... In excellent condition £625
BCA 12" horizontal / vertical rotary table ..... Very Nice £425
Quantity of slips, height gauges, squares, straight edges, micrometers, cubes, angle plates, scales, weights (Mod) and miscellaneous measuring tools! ..... Just in
FLAMEFAST DS 120 ceramic chip forge £345
FLAMEFAST DS 100 hearth £140
Bridgeport slotting head £750
MARLCO broaching press £425
KEMPOMAT 230 tig welder £425
TRANSARC 150 + Transtig 150i £625
STARTRITE 18-V-10 vertical bandsaw complete with welder attachment £1650
JONES AND SHIPMAN 4" x 24" bench centres £245
TOM SENIOR slotting head £450
STARTRITE 18-p5 Woodworking / non ferrous bandsaw £950
DIAMOND flat saw, variable speed £345
RJH GT 125 Flatbay, variable speed £345
SMART AND BROWN / CLARKSON HG-H5 toggle presses ..... Each £195 / £275
ARKANS 2MT long milling spindle ..... As new £75
MYFORD TRI-LEVER Attachment £245
VERONOT Clocks, Long/Short/Metric and Imperial models ..... As new £40
FLAMEFAST LD300 Soldering Iron Stove £75
GRANITE 18" x 12" Surface Plate £140
VEROSHEAR Nibbler ..... Just in £425
TRIUMPH Bumard 4 Jaw Chuck £245
TRIUMPH FACE PLATE D/H £70
VANCO Linisher ..... Very Nice £345
ESEWAT hardness Tester Type R £425
JONES AND SHIPMAN Broaching Press + Stand £375
CLARKSON Mk I Radius Grinder Attachmen £425
ABB Inverter & ½ hp motor, wired up £250
FLAMEFAST moulding bench £100
SIP 7" bandsaw, horizontal & coolant ..... New £750
WELLSAW hacksaw ..... Choice £240 - £345
BRIDGEPORT CHERRY high speed drilling head £725
MYFORD dividing head £395
STARTRITE su316d cut-off saw £750
DUPLEX d29 toolpost grinder £345
EDWARDS cast iron set rolls £325
BOXFORD (Imperial only) thread dial indicator £55
HOFFMAN ROTARY TABLES ..... Selection
ABWOOD 6" swivel/tilt machine vice ..... Each £345
BURNERD, D13 6 jaw Griptru chuck £345
VANCO, 1" Slotter / vertical + extractor £425
BURNERD, D14 lever collet chuck + collets £400
BURNERD, LD lever collet chuck + collets £400
VERTEX Dividing head ..... New £345
VERTEX 5" - 6" - 10" rotary tables ..... New From £135
BOXFORD Turret attachment 4½" + quantity of drill chucks £525
MYFORD ML7 / Super7 rear tool post £40
MYFORD 254S rear tool post ..... New £40
MYFORD Vertical slide / fixed type (boxy) £99
OLIVER - ADRIAN FILER ..... Now £49
LOCKWOOD quad headed 2nt Die Holder ..... New £40
LOCKWOOD quad headed 3nt Die Holder ..... New £40
LOCKWOOD Test Bar / 2nt Bored ..... New £39
LOCKWOOD Test Bar / 3nt Bored ..... New £42
MAGNETIC chuck - 18" x 6" fine pole ..... Never used £325
TOM SENIOR Model E pedestal stand £150
UNION tool and cutter grinder stand £135
HARDINGE Capstan type toolpost £175
50 INT Tooling, Selection ..... Just in
STARTRITE 352 woodworking band saw £975
STARTRITE 14-S-5 woodworking band saw £775
ALCOSA GF 0801 Rapid Melting Furnace £300
GASRO BF 020-2, 24" Box and Fan general use folder £325
MYFORD Burnerd Griptru 3 Jaw Chucks ..... Boxed £250
COLCHESTER / HARRISON D13 Burnerd 4 Jaw 6" light body independent chucks ..... Boxed £175
RJH 4" Linisher / Vertical (Build in Extraction) £525
KILNS various ..... £200/£425
MICROMETERS and associated measuring tools ..... Still packaged as new
POTTERY WHEELS, kilns and associated equipment ..... Just In Cheap
SPECAC Powder type press £225
HARRISON L6 Metric Gearbox ..... As is £250
HARRISON L6 Tailstock £245
NEW FROM NEW ZEALAND - Machine vice, 55mm. Jaws precision miniature type ideal for vertical slides and smaller milling machines £85
SIP 1 TONMOBILECRANE Manufactured 2000 ..... As new £375
MITUTOYO grade A set of slips £245
MARLCO KNURLER S (clamp type) £75
F.J. EDWARDS 24" hole cutter £325
Large bench vice £70
LINK1.5 ton vehicle crane + top hat £625
MITUTOYO 103-913 metric set micrometers £275
NORTON / EDWARDS arbor presses ..... £75 / £145
AJAX 6" hacksaw £40
SURFACE plates from 12" x 12" to 36" x 36" ..... Very nice from £30
WEBER 1½ ton mobile garage crane, late blue colour £495
ELLIOTT 1250 STURDIMILL vertical head ..... One off (rare) £525
RJH brother 4" wide belt, pedestal £345
STEEL STOCK Just arrived ..... to callers only
ELLIOT U1 / U2 Slotting Head £475
SWAGE BLOCKS ..... £125 / £145
J & S Universal grinding vice ..... Choice £275 / £325
BOX TABLES: Grade A and B, many sizes ..... £40 - £100
SLIPS / GAUGES Metric / Imperial, New Sets, 87 / 61 piece ..... £215 / £145
HORIZONTAL METAL BANDSAW 5" x 4½" capacity ..... New £170
COLCHESTER STUDENT / MASTER Round head, faceplates,small / large ..... £50 / £80
QUALTERS AND SMITH 6" Hacksaw £345
Boring Heads 2 / 3 Morse, R8 Taper, Max. Capacity 4½" round bar ..... New, each £90
OKONI Machine Bed Clamps (pair) ..... Special £24.50
HEIGHT GAUGES by Chesterman, Shardlow, Moore and Wright ..... From £95
ELLIOTT 10M Shaper, 10" stroke £325
DIE Bones ..... From £45
TRANSWAVE 2HP Converter ..... new £295
TRANSWAVE 5.5HP Converter ..... New £395
TRANSWAVE 12K - RT rotary converters ..... From £495
CROMPTON PARKINSON ½ HP, resilient mount, Bonford / Myford Super7 Type motor ..... New £140

WE ARE CONSTANTLY CHANGING OUR STOCK FASTER THAN THE ADVERTS CAN KEEP UP WITH US!!!

PLEASE PHONE 020 8300 9070 TO CHECK AVAILABILITY OR TO OBTAIN OUR LIST

DISTANCE NO PROBLEM!! DEFINITELY WORTH A VISIT ALL PRICES EXCLUSIVE OF V.A.T.

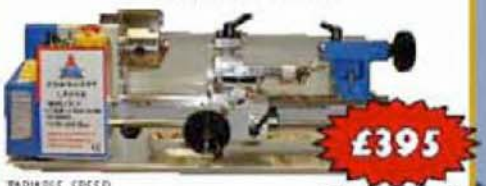
SEE US AT DONNINGTON 19-24 OCTOBER Stand B2-B6

newall
Newall Measurement Systems

- 2-Axis DRO from **£615**
- Made in the UK
- 5 year No-Fault Warranty
- 10 micron Accuracy

Conquest Lathe

NOW INCLUDES TEST CERTIFICATE



£395

VARIABLE SPEED

*Price Includes VAT & Delivery**

STANDARD ACCESSORIES

- 80mm 3-jaw chuck
- 1-10mm drill chuck & arbor

CHESTER U.K. LIMITED
MACHINE AND TOOLING SPECIALISTS

920 Lathe Deluxe

- Swing over bed: 229mm
- Swing over cross slide: 133mm
- Distance between centers: 500mm
- Spindle bore: 19mm
- Taper in spindle nose: MT3
- Motor: ¾hp
- 6 Speed: 100-1800rpm
- Net weight: 100kg

STANDARD EQUIPMENT:

- 4" 3-jaw chuck with 2 sets of jaws
- 7" 4-jaw chuck with reversible jaws
- Steady rest • Follow rest
- MT2 Dead centre
- MT3 Dead centre
- 4-way tool post
- Face plate
- Tool Box & Tool Kit
- Tray & Splash guard

£699

*Price Includes VAT & Delivery**

Model B-Super

- Swing over bed: 420mm
- Distance between centers: 500mm
- Mill drill spindle taper: 19mm
- Drillstock barrel travel: 80mm
- 7 speeds: 60-1300rpm
- Swing over cross slide: 160mm
- Spindle taper: MT3
- Draw bar: M12
- Cross slide travel: 180mm
- Motor: ¾hp
- Net weight: 155kg

STANDARD EQUIPMENT

- 4" 3-jaw chuck
- 2 dead centers
- 1/2 drill chuck
- Change gears
- MT3 chuck arbor

£725

*Price Includes VAT & Delivery**

Centurion

- Swing over bed: 420mm
- Distance between centers: 520mm
- Mill drill spindle taper: MT3
- Drillstock barrel travel: 80mm
- 7 speeds: 160-1360rpm
- Swing over saddle: 160mm
- Spindle taper: MT3
- Draw bar: M12
- Cross slide travel: 200mm
- Motor: 2 x ¾hp
- Net weight: 230kg

STANDARD EQUIPMENT

- 4" 3-jaw chuck
- 2 dead centers
- 1/2 drill chuck
- Change gears
- MT3 chuck arbor

£1100

*Price Includes VAT & Delivery**

Champion Mill

- Drilling Capacity: 20mm
- End Mill Capacity: 25mm
- Face Mill Capacity: 63mm
- Table Size: 150x650mm
- Number of Speeds: 4
- Speed Range: 400-1640rpm
- Spindle Taper: MT3
- Tilting Head: 90° Left & Right
- Motor: ¾HP

From

£585

*Price Includes VAT & Delivery**

Eagle 25 Mill/Drill

- Mill/Drill Capacity: 25mm
- Table Size: 190 x 585mm
- Fine Feed
- Number of Speeds: 12
- Speed range: 100-2150rpm
- Spindle Taper: MT3
- Spindle Travel: 100mm
- Motor: 1hp

Price

£699

*Price Includes VAT & Delivery**

STANDARD ACCESSORIES

- 1-13mm Drill Chuck & MT3 Drill Chuck Arbor
- Eagle Face Mill Cutter
- T3 Tilting Vice
- M12 Drawbar
- NVR Switch Gear
- Interlocked Chuck Guard
- Manual and Parts List

Eagle 30 Mill/Drill

- Mill/Drill Capacity: 32mm
- Table Size: 210 x 740mm
- Fine Feed
- Number of Speeds: 10
- Speed range: 80-2300rpm
- Spindle Taper: MT3
- Spindle Travel: 130mm
- Tilting Head
- Motor: 1hp
- High/Low Gearbox

Price

£899

*Price Includes VAT & Delivery**

STANDARD ACCESSORIES

- 1-13mm Drill Chuck & MT3 Drill Chuck Arbor
- Eagle Face Mill Cutter
- V100 Machine Vice
- M12 Drawbar
- NVR Switch Gear
- Interlocked Chuck Guard
- Manual and Parts List

626 Turret Mill

- Milling Capacity: 25mm
- Drilling Capacity: 32mm
- Table Size: 152 x 740mm
- Fine Feed
- Number of Speeds: 9
- Speed range: 190-2100rpm
- Spindle Taper: MT3 or R8
- Tilting Head
- Motor: 1½hp

Price

£1340

*Price Includes VAT & Delivery**

STANDARD ACCESSORIES

- Oil Sight Lubrication
- Halogen Work Light
- Machine Stand
- Drawbar
- Manual and Parts List

Craftsman Gap Bed Lathe

- Swing over bed: 300mm
- Swing over gap: 450mm
- Swing over saddle: 170mm
- Distance between centers: 570mm
- Spindle bore: 56mm
- Spindle bore taper: MT5
- Cross slide travel: 150mm
- Compound travel: 89mm
- Tailstock barrel taper: MT3
- Tailstock barrel travel: 92mm
- Range of speeds: 50-1250rpm
- Motor: 1 1/2 hp
- Net weight: 390kg

£1550

*Price Includes VAT & Delivery**

STANDARD EQUIPMENT:

- 6" 3-jaw chuck with 2 sets of jaws
- 8" 4-jaw chuck
- Steady rest
- Follow rest
- Stand • Face plate
- Splash guard
- Threading dial
- 4-way turret tool post
- 3MT dead centers
- T-Slotted cross slide
- Halogen work light

Super LUX Mill

- Milling Capacity: 25mm
- Drilling Capacity: 32mm
- Table Size: 240 x 800mm
- Fine Feed
- Number of Speeds: 6
- Speed range: 95-1600rpm
- Spindle Taper: MT3
- Tilting Head
- Motor: 1½hp

Price

£1500

*Price Includes VAT & Delivery**

STANDARD FEATURES

- Powered Head Elevation
- Dot Inch Stand
- Angle Tilting Head
- Manual and Parts List

Call for our latest Catalogues
01244 - 531631

Visit our website
www.chesteruk.net
For our Special Offers

Email us at
sales@chesteruk.net

CHESTER UK LTD
Clwyd Close
Hawarden Ind. Park, Hawarden
Nr. Chester, Flintshire CH5 3PZ

***INCLUSIVE OF DELIVERY IN UK MAINLAND ONLY**