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ABC

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Components to complete construction of this variant of the original design. Part II.
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On the cover ...

This view of the steaming bays observed during IMLEC 2003 at Bristol SMEE's Ashton Court track reveals an interesting line up of motive power ranging from Ray Hillman's 2-8-4T NG Hunslet Dholpur *in the forground, Geoff Moore's 4-6-0 LNER B1* Impala, *Paul Tompkins' 0-8-0 NER T9* Netta, *Andrew Harvey's 3-cylinder 4-6-2 USA NG Pacific locomotive No. 1699 and Mike Harrison's 4-6-0 GWR* Crynant Grange *on the farthest bay. Our respected contributor Neville Evans attended the event and presents some personal views, opinions and analysis in his regular feature which in this issue begins on page 325.*

(Photograph by Mike Chrisp)

KEITH'S COLUMN: SAINT CHRISTOPHER
A GWR LOCOMOTIVE for $7^1/_4$in. gauge
Continuing with the tender platework and paying particular attention to all the rivets typical of the genre. Part XXIII.
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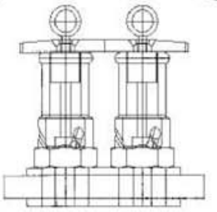

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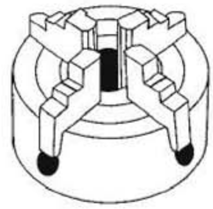

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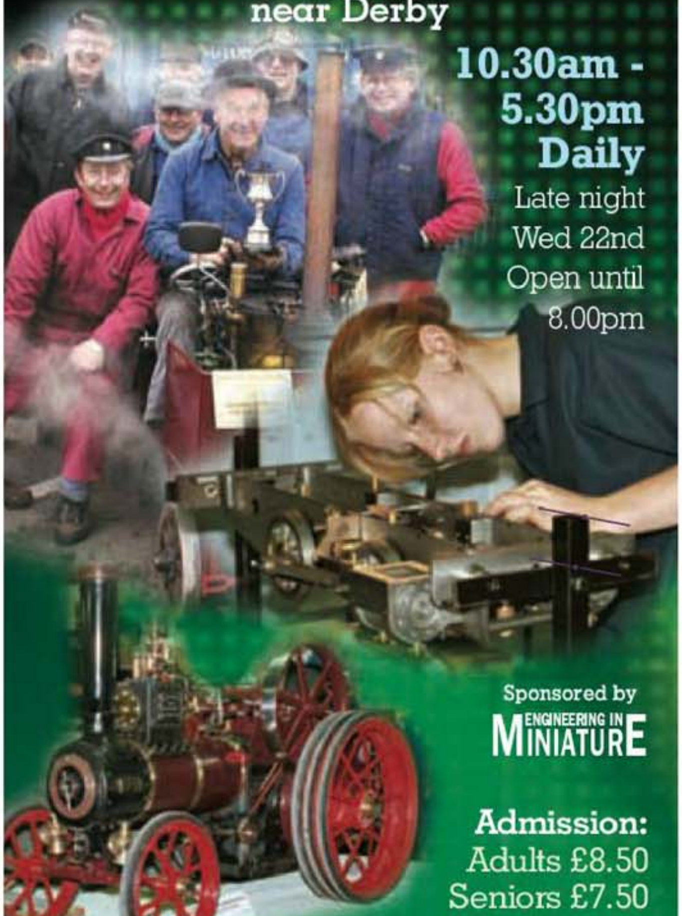

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Colchester Triumph 2000 Travelling Steady £ 75.00
Colchester Triumph 2000 D1-6 14" Faceplate £ 100.00
Colchester Triumph 2000 S/C Gearbox Casing £ 150.00
Colchester Triumph 2000 Tailstock £ 250.00
Colchester Triumph 2000 Gap Piece £ 75.00
Colchester Triumph 2000 50" Rear Splash Guard £ 100.00
Colchester Student 1800 Changegear Guard £ 30.00
Colchester Student 1800 Headstock Sleeve £ 20.00
Colchester Student 1800 Rack (new) £ 75.00
Colchester Student 1800 Headstock Internal Gears POA
Colchester Student Roundhead Rack £ 25.00
Colchester Student Roundhead 12" Faceplate £ 65.00
Colchester Student Roundhead Americal Toolpost £ 20.00
Colchester Student Roundhead Headstock Sleeve £ 25.00
Colchester Student Roundhead Change Gears,each £ 15.00
Colchester Student Roundhead Travelling Steady £ 30.00
Colchester Student Roundhead 18" Faceplate £ 85.00
Colchester Student MkII Apron Assembly £ 175.00
NEW 160mm 3 Jaw Chuck, LO Fitting £ 185.00
NEW 200mm 3 Jaw Chuck, LO Fitting £ 225.00
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Colchester Mascot Roundhead 12" 4 Jaw Chuck £ 100.00
Colchester Mascot Roundhead 10" Catchplate £ 30.00
Colchester Mastiff D1-10 Camlock 20" Faceplate,Drilled £ 100.00
Colchester Mastiff D1-10 16" 4 Jaw Chuck £ 250.00
Colchester Bantam 2000 Capstan Attchment £ 350.00

MACHINE ACCESSORIES
Tripan Toolpost & 14 Holders £ 500.00
Bilz Type 4-1211 Radius Turning Attachment £ 450.00
Mitsui Seiki 450mm Swivel & Tilt Rotary Table,VGC £2500.00
12"x6" Swivelling Table,T-slotted £ 150.00
Walter R-S 400TG (400mm)Swivel & Tilt Rotary Dividing Table £ 850.00
Hofmann 300mm Rotary Table £ 300.00
Alexander Inclinable Rotary Table fitted 4" Chuck £ 250.00
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SIP 350mm Rotary Table,Choice of 3 £ 500.00
Hofmann 8" Rotary Table,VGC £ 350.00
Vertex Horizontal/Vertical 6" Rotary Table,(New) £ 135.00
Vertex Horizontal/Vertical 8" Rotary Table (New) £ 250.00
Vertex Horizontal/Vertical 10" Rotary Table (New) £ 300.00
Vertex Horizontal/Vertical 12" Rotary Table (New) £ 350.00
15" Rotary Dividing Table,Table Marked£ 250.00
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Jones & Shipman 4613-013 4" Swivel & Tilt Machine Vice £ 175.00
Jones and Shipman 4" Sine Vice,immaculate £ 500.00
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Gressel 4" Swivel Machine Vice £ 500.00
Abwood 6" Swivel & Tilt Machine Vice £ 350.00
Abwood 8" Swivel Machine Vice £ 275.00
Abwood 6" Machine Vice £ 150.00
Apex 4" Universal Vice (as new) £ 150.00
Record No.2 Bench Vice £ 20.00
Elliott 4" Dividing Head & Tailstock,Excellent Condition £ 325.00
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5" Centre Height Dividing Head, No Chuck £ 250.00
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BSO Dividing Head £ 250.00
Cooke Troughton and Simms Optical Dividing Head £ 500.00
Nikken 50 INT Q.C Tooling Set,M.T. Adaptors,Drill Chuck,Collet Chuck & Collets £ 450.00
Burnerd Multisize Collet Chuck & 12 Collets Key op.D14 Mount £ 350.00
Clarkson 30INT Autolock Chuck (small) with 4 collets £ 85.00
Clarkson 40INT Autolock Chuck (large) with 2 collets £ 100.00
Clarkson 40INT Autolock Chuck (small) with 4 collets £ 80.00
Clarkson 40INT Dedlock 200 Chuck£ 50.00
Clarkson 40INT FC3 Holder £ 25.00
Clarkson Large/Small Adaptor and 4 collets £ 100.00
Clarkson 50INT Autolock Chuck (lge) 2 Imp. collets £ 100.00
Clarkson 50INT Autolock Chuck (small) 4 Imp. Collets £ 85.00
Clarkson 50INT Dedlock 200 Chuck 85.00
Clarkson 50INT FC3 Holder £ 45.00
Clarkson Autolock Chuck Collets.... Large.....each £ 15.00
Clarkson Autolock Chuck Collets,Small,Imp..£15.00 Metric£ 20.00
30INT-2MT Adaptor £ 35.00
40INT-1 & 2MT,3MT & 4MT Adaptors each £ 25.00
50INT-2,3,4MT Adaptor each £ 30.00
R8-2MT and R8-3MT Adaptors £20.00 - £ 22.00
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Bristol Erickson No 10 Tenthset Boring Head, 30 INT £ 100.00
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D'andrea TS3 40INT Boring & Facing Head (not boxed) £ 550.00
D'andrea TS3 50INT Boring & Facing Head,Boxed £ 950.00
D'andrea TS4 Boring & Facing Head 5MT (Boxed) £ 750.00
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Fette F3 Thread Rolling Head with 4 sets Metric Dies £ 400.00
Fette F3 Thread Rolling Head with 3 sets Metric Dies £ 300.00
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Herbert Chaser Grinding Attachment,1.1/2" Diehead Chasers £ 150.00
Herbert Chaser Grinding Attachment,1" Diehead Chasers£ 100.00
Archer No 2 Tapping Head £ 125.00
Jones & Shipman UX8060 Grinding Wheel Balancer,VGC £ 350.00
Diaform Wheel Forming Attachment,,VGC,Choice £ 250.00
Pratt 12" 4 Jaw Chuck (Backplate Mount),Boxed,Unused £ 175.00
Burnerd LC10 Multisize Collet Chuck &3 Collets £ 250.00
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Burnerd Multisize Collet Chuck and Collets,D13 Mount £ 350.00
Pratt 12" 4 Jaw Chuck L2 fitting £ 150.00
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Toolmex 160mm 4 Jaw Independent Chuck (New) £ 110.00
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Toolmex160mm 6 Jaw Chuck £ 250.00
Toolmex 125mm 4 Jaw Self Centering Chuck (New) £ 120.00
Toolmex 125mm 4 Jaw Independent Chuck £ 100.00
Toolmex 125mm 3 Jaw Chuck (New £ 85.00
Toolmex 100mm 3 Jaw Chuck (New) £ 80.00
Toolmex 100mm 4 Jaw Self Centering Chuck (New) £ 115.00
Toolmex 80mm 3 jaw Chuck (New) £ 70.00
Toolmex 85mm 4 Jaw Independent Chuck.NEW £ 85.00
Jaws for Pratt Burnerd 6 Jaw Chuck,Fit 250mm Chuck Part No.2658-26884 £ 75.00
Burnerd 548BLK Soft Jaws,Fit 10.1/2"-12" 3 Jaw Chuck £ 25.00
1" Straight Shank Drill chuck £ 20.00
3/4" Straight Shank Drill Chuck £ 15.00
1/2" Straight Shank Drill Chuck £ 15.00
1" & 1.1/4" Autolock Collet for Large Chuck £ 15.00
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52 peice 3/8" Clamping Kit,suit Tom Senior,Harrison Mill,etc £40.00
52 piece 1/2" Clamping Kit £ 50.00
Schaublin 70 Capstan Attachment £ 350.00
Pultra 8mm Collets3 for £25.00 each £ 10.00
Pultra 10mm Collets each £ 15.00
Pultra Vertical Slide £ 160.00
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Viceroy TDS 1 1GBL, PF Apron,Feedscrew,Leadscrew and Screw Cutting Gearbox £ 350.00
Raglan 6" 4 Jaw Chuck with Backplate£ 100.00
Raglan 4" Pratt Burnerd 4 Jaw Chuck£ 65.00
Southbend Tailstock,Complete£ 100.00
Taylor Hobson Engraver Type Tables each £ 65.00
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7" x 7" Co-Ordinate X & Y Table £ 200.00
Smart & Brown Model A Saddle Assembly £ 75.00
Smart & Brown Model A Screwcutting Gearbox £ 150.00
Smart & BrownModel A Leadscrew & Feedshaft £ 65.00
Smart & Brown Model A 6" 4 Jaw Ind Chuck £ 85.00
Smart & Brown Model A Travelling Steady £ 60.00
Smart & Brown 1024 Topslide/Compound Slide £ 150.00
Smart & Brown Step & Ring Collets,Models A & M £ 25.00
Southbend 4.1/2" PCF Saddle & Apron Assy with topslide £ 200.00
Hardinge Screw Nose 3 Jaw Chuck £ 100.00
Hardinge HLV Retracting Topslide Assembly £ 250.00
Hardinge L6/B Indexing 4 Way Toolpost £ 100.00
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Bridgeport Horizontal Attachment £ 250.00
Bridgeport Quillmaster Type JA Attachment £ 325.00
Deckel FP1 Vertical Head £ 450.00
Victoria No.3 Slotting Head £ 350.00
Schaublin 102 Vertical Slide c/w Simple Dividing Head £ 750.00
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Dorma 8 Position Multi Drilling Head,5MT £ 650.00
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The following machines came from a Watch Manufacturer.
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Elcomatic Twin Head Special Purpose Machine £1500.00
Similar Triple Head Special Purpose Machine £1500.00
Tousdiamants Facing/Milling Machine (Choice of 3) £1500.00
ETS Gevoisier Slitting Machine £1500.00
Old Watch Case Lathe £ 250.00

WORKSHOP EQUIPMENT
Nikon Measurescope Toolmakers Microscope, X,Y & Rotary Stage,VGC £ 450.00
Crown 18" x 18" Black Granite Surface Plate £ 175.00
24" x 24" Black Granite Surface Plate £ 200.00
48" x 36" Black Granite Surface Table and Stand £ 375.00
36" x 36" Cast Iron Surface Table & Stand £ 300.00
Ward Forsyth V050 Hydraulic Press £1500.00
Honemaster 24/24 DH Shot Blasting Cabinet with Dust Extractor,3ph £ 475.00
Pryor EP34 Pneumatic Letter Marking Press £ 200.00
Chubb Fireproof Safe, 70 " Tall x 30" x 26" £ 500.00
Rosengrens Fireproof Safe 71" Tall x 27" x 34" £ 500.00
36" x 30" Cast Iron Surface Table £ 250.00
12"x18" Surface Plate £ 60.00
5.3/4" Dia. Lapping Plate £ 40.00
Windley 10" Dia. Lapping Plate £ 50.00
Windley 12" Dia. Lapping Plate £ 60.00
630mmx500mmx390mm Webbed T-slotted Angle Plate £ 250.00
Eclipse No.323 5"x4.1/2"x3.3/8" Box Cube £ 65.00
9" x 7" x 6" Box Cube £ 75.00
12" x 10" x 9" T Slotted Box Cube £ 85.00
M & W Metric Radius Gauge (new) £ 7.00
Number Drill Gauges 1- 60 £ 5.00
General 255M Screw pitch Gauge 9 - 40 TPI £ 7.00
Craftsman 9 - 4030 Screw Pitch gauge 4 - 84 TPI £ 10.00
M & W Metric Wire Gauge,New £ 6.00
M & W 398M Feeler Gauge £ 15.00
Preinme 3"x15" Sine Bench Centres £ 350.00
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12" x 9" x 9" Angle Plate £ 60.00
Pair Toolmex V Blocks 40mm x 36mm x 45mm £ 40.00
Pair Toolmex V Blocks 45mm x 40mm x 70mm £ 50.00
Pair Toolmex V Blocks 90mm x 70mm 125mm and Clamps Unused £ 100.00
Pair Toolmex V Blocks 63mm x 45mm x 70mm and Clamps Unused £ 65.00
Habit Magnetic Sine Bar £ 100.00
Transwave 5 HP Capacity Phase Converter, New £ 400.00
Transwave 3 HP Capacity Phase Converter, New £ 305.00
Spare Circular Tables for Imported Pillar/Bench Drills £ 35.00
33" x 10" x 6" Ammunition Boxes £ 5.00
Jones and Shipman 8612-001 Assembly Press £ 100.00
Gabro BF620 Box and Pan Folder,Stand,Choice of 2 £ 500.00
Gabro 2M2 Guillotine Notcher,Stand £ 350.00
Gabro 4M2 Guillotine/Notcher,Stand £ 400.00
Gabro 3M2 Guillotine/Notcher,Stand,VGC £ 450.00
Flamefast DS130 Ceramic Chip Forge £ 275.00
Flamefast DS200 Brazing Hearth £ 325.00
Flamefast DS120F Combined Brazing Hearth/Forge £ 225.00
Flamefast DS100 Brazing Hearth £ 100.00
Flamefast Moulding Bench £ 325.00
Flamefast Wall Mounting Fume Extractor, 240 volt,Very Good Condition, Choice of 3 £ 150.00
Large Anvil, Worn £ 150.00
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Blacksmiths Leg Vice £ 75.00
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Sweeney & Blocksidge 6A DB Flypress £ 450.00
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Denbigh No 5 Flypress £ 250.00
Denbigh No 3 Flypress £ 250.00
Denbigh No.2 Flypress £ 125.00
Norton 2S Flypress £ 150.00
Norton No.4A D/B Flypress £ 450.00
Norton No.6DB Flypress on Stand,Immaculate condition £ 550.00
Norton No 8 Flypress,Stand £ 425.00
Herbert Bar Straightening Press on Stand £ 275.00
Kingsland 4' Hydraulic Guillotine £1250.00
Edwards 3' Foot Op Cast Iron Guillotine £ 450.00
NEW 6" Heavy Duty Bench Lever Shears £ 100.00
Prior Interchangeable Type Set,1/4" £ 75.00
Pryor Interchangeable Type Set 1/8" £ 75.00
Prior Automatic Numbering Stamp,3/8" Letters,1" shank £ 250.00
RS No.813-654 Wire Wrapping Tool,240v £ 75.00
Cebora Puntatrice 20 KVA Spot Welder £ 750.00
Smart & Brown H3 Toggle Press £ 185.00
Smart & Brown H5 Togglepress (choice of 5) £ 250.00
RMT Type 10VSO/9SB Air Press,Stand £ 350.00
Plymouth EMK 1400 Mobile Welding Fume Extractor,1ph,VGC £ 375.00
Mubea Cropper,Shear,Notcher £ 250.00

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THE MODEL ENGINEER EXHIBITION

Sandown Park, 29-31 December 2003

Established in 1907, the original Model Engineer Exhibition is celebrating its 73rd show!

SANDOWN PARK EXHIBITION CENTRE

29th - 31st Dec 2003

OPENING TIMES

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SMOKE RINGS
With the Editors

New premises

A recent re-organisation of Highbury House Communications plc has brought together the staff concerned with the Business to Business titles and located them at Swanley. In consequence, those who worked on the consumer magazines originally located at Swanley have moved to new premises in nearby Orpington. *Model Engineer* and our sister magazine *Model Engineer's Workshop* are two of the titles affected. We understand that despite inevitable difficulties, the move was accomplished with minimal disruption to routine.

Details of the new location are published on the contents page of each issue but are repeated here: *Model Engineer* is published by **Highbury Nexus Special Interests Limited, Berwick House, 8-10 Knoll Rise, Orpington, Kent BR6 0EL; tel: 01689-899200; fax 01689-899240.**

Readers should note that Administrative, Advertising, Marketing and Sales personnel are located at Orpington but that the Editorial team are still based in their home offices. It may be helpful to remind readers that correspondence of an editorial nature may be routed by way of the Orpington office but will avoid forwarding delays if sent directly to any member of the Editorial team, as follows:

Editor: **Mike Chrisp, PO Box 310, Hemel Hempstead, Hertfordshire HP3 8XL; tel/fax: 01422-269366; e-mail: mike.chrisp@virgin.net**

Technical Editor: **Neil Read, tel/fax:01604-833670; e-mail: neil.read@nexusmedia.com**

Assistant Editor: **Kelvin Barber, tel/fax: 01525-850938; e-mail kelvin.barber@nexus adsl10.demon.co.uk**

For the convenience of all, these details are included with *Post Bag* in every issue.

metal-trader.co.uk

Julian Noad, founder of metal-trader.co.uk explains the background to the formation of this new business:

"After having worked in the metals industry for more than 35 years, with retirement at the age of 55, I found that my time was being spent in my garage with my Myford lathe, machining components for stationary model steam engines.

"The thought of combining my experience of non-ferrous and ferrous metals with my interests in computing, the internet, and model engineering, gradually developed into the formation of ***metal-trader.co.uk*** *with the aim of improving the availability of small quantities of a wide range of materials for the model engineer at sensible prices.*

"The ***metal-trader.co.uk*** *stocklist covers a wide range of more than 600 items in brass, copper, aluminium, bronze, stainless steel, silver steel and continuous cast iron.*

"The minimum metal order value is £5 plus post and packing, and with many items costing only a matter of a few pence, you can get a lot of metal for your money!

"A free copy of the ***metal-trader.co.uk*** *stocklist can be obtained by application to* ***metal-trader.co.uk at Greenways, Iles Green, Far Oakridge, Stroud, Gloucestershire GL6 7PD, 'phone 01285-760818, fax: 01285-760819, e-mail: sales@metal-trader.co.uk***

Bill Hall

Tom H. Jones, fellow model engineer and Bill's close friend writes:

"I am sad to report the death of Prof. W. B. Hall (Bill) on 6 August 2003.

"Born in 1923, Bill started an engineering career as a craft apprentice with The Manchester Ship Canal Company where he worked on steam engines of all kinds as well as the massive hydraulic systems that operated the lock gates. He must have reached high academic standards in his part time HND studies because he was selected to work at Farnborough on bomb sight design during WW2.

"With his academic ability established, he was one of the first twelve people to join the Atomic Reactor Design Team at Risley, near Warrington in 1948 from where he continued his studies to gain a first class honours degree. He later moved to Sellafield (then known as Windscale) to lead Reactor Research and in 1959, was invited to apply to take the first Chair in Nuclear Engineering at Manchester University which involved his speciality, Thermodynamics. He subsequently became Dean of the Faculty of Science and finally Pro Vice Chancellor.

"Research and development was Bill's passion. He was always inquisitive and a great experimenter, and he carried this over into his love of model engineering and steam.

"Bill had a unique mix of sound practical ability and a great mind to handle the theory. He appreciated equally people with brainpower and those with good practical skills. He was always down to earth and disliked those who put on airs and graces.

"Bill was generous with both material things and with his time, always keen to share with others the knowledge that he had.

The late Professor W. B. (Bill) Hall

"He was very adept at computer programming and put this to good use in his hobby. He wrote articles on his experimental work for these pages and has also made freely available his computer-based programs for valve-gear testing and other facilities helpful to model engineers. One such facility is an engine indicator using a miniature pressure sensor and digital signal processing which he named 'The Eskdale Indicator' after the beautiful Cumbrian valley where he spent his retirement with his wife Mary. He had contacts both nationally and internationally who appreciated his sharp mind and skilled hand.

"The Ravenglass and Eskdale Railway (la'al Ratty*) benefited from his skills which he applied to the valvegear of three engines and to balancing problems to their considerable advantage. Their locomotive,* Bonnie Dundee *is fitted with 'Southern' valvegear to Bill's design.*

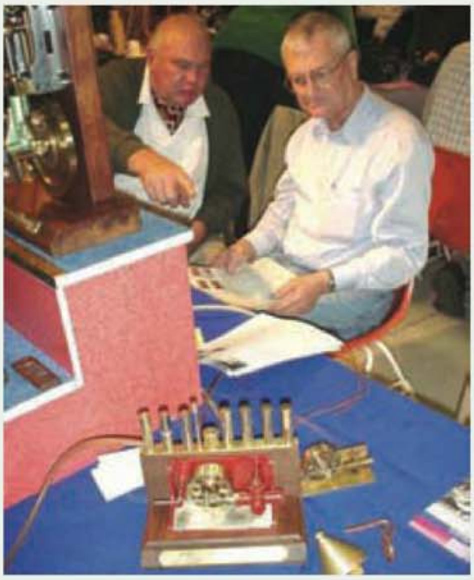
"Bill was active in his experimentation right up to the time of his death in his 81st year.

"All those who knew him will miss him greatly, as will his family, Mary, four daughters and nine grandchildren."

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

POST BAG

Above: the inexpensive toggle action drilling machine clamp as recommended by Peter Spenlove-Spenlove.



Right: one of Henk Salij's photographs taken at the Arnhem Exhibition showing Marinus Kik (left) in conversation with Colin Andrews about his experiments with Twisty *(foreground).*

Bulpitts of Birmingham

SIRS, - This recollection was prompted by Marcus Rooks' letter published in *M.E.* 4202, 22 August 2003 concerning Bulpitts of Birmingham.

Bulpitts were a firm of Brassfounders and Holloware Manufacturers and were still in operation in the 1970s. Their holloware was titled 'Swan Brand' and I believe the mark is still about, although the goods appear to be made in the far east.

Mr. Bulpitts' chauffeur, a gentleman by the name of Bruton, lodged with us in the 1940s and frequently gave Mother a lift to the shops in a superb Rolls-Royce from which he would leap out and open the door for her, saluting as he did so. In those austere days, you can imagine how that went down outside the fishmongers!

Ted Holloway by e-mail.

Do it yourself - safely!

SIRS, - While doing a bit of 'do it yourself' in the home or garden, most of us have rushed to the workshop to drill or open out a hole in a piece of wood or metal. It is such a quick job that we seldom sort out the appropriate clamps, straps and bolts and rely on our hand grip to hold the work. What happens? At the moment of break-through, the drill snatches and the work rides up the flutes of the drill or it spins and damages our hand. More haste, less speed!

The answer could be a quickly deployed clamp based on the popular Mole grip toggle locking pliers; the tool illustrated seems to fill the bill. A hand nut secures it to the drilling machine table and, like the normal Mole grip system, a screw in the handle adjusts the grip from zero to some three inches. One of these should cope with most normal DIY jobs. Precision drilling for model work, should, of course, be carried out using strap clamps or a machine vice.

The stud is said to be suitable for use on tables up to 3/4in. thickness. However, if the drilling machine table is siffened with cast ribs beneath, it may be helpful to make a drilled spacing collar to clear the ribs. My Fobco machine has such ribs close by each table slot. I have ordered a pair and if I find that the nut is brazable (i.e. steel), I will silver-solder an extension onto the hand nut. Then I shall have no excuse for not using safe clamping when in a hurry.

A list price gleaned from the Tilgear catalogue (Winter 02/03 list) is £5.95 but to this must be added UK carriage and VAT. Ask for item No. 2, drilling machine clamp. If you have discarded your free copy of their list supplied with your copy of *M.E.*, Tilgear can be contacted by mail at Freepost NW5014, Potters Bar, Cuffley, Hertfordshire EN6 4BR; tel: 01707-873434. Personal callers can visit Bridge House, Station Road, Cuffley, Hertfordshire EN6 4TG (usual disclaimer!)

Peter Spenlove-Spenlove, Leicestershire.

Hot air engines

SIRs, - I was most interested in Peter Monery's article on hot air engines (*M.E.* 4192, 4 April 2003). I think his argument about gas quantity in the engine is more or less correct, but perhaps could be restated as follows. When the power piston is at TDC then the initial conditions in the engine should be atmospheric temperature and pressure. Heating the air causes it to expand but since the volume is fixed, the pressure rises.

This causes the power piston to descend, expanding the gas. If the gas is made to do work in this way then its heat content is converted into work. At BDC, because of the expansion and doing work turning the crankshaft, the gas will be cold again and with the system being at maximum volume, the pressure will now be less than atmospheric. The atmosphere outside the piston causes the return stroke, re-compressing the gas to initial conditions.

The point which I think causes confusion in most people's minds, certainly mine initially, is the paradox of heating and cooling at the same time. In fact you are not since the hot air engine has hot and cold ends which are not necessarily heated or cooled. To run as an engine, heat is applied to the hot end and, as described above, if the engine were 100% efficient no cooling would be required. However, in practice the conduction of heat from the hot end, friction losses from the power cylinder, and heat transfer from the movement of air all raise the pressure after BDC and reduce the amount of work done by the atmosphere.

Some work has therefore to be put back in by the flywheel pushing the piston over TDC. All of these actions will cause the cold end to become heated and thus some cooling is required to remove this heat.

Judging by the fact that the few cold ends I have touched while the engine is running have been barely warm, I can only conclude that most of the excess heat has a regenerative effect and preheats the cold air returning to the hot end. Note that if the cycle is reversed, the crankshaft is driven and proper cooling is provided at the cold end, then the hot end will become cooler than ambient, taking heat from the surroundings and acting as a refrigerator.

Incidentally, I wonder how Peter Monery's engine works with holes apparently right through the pistons?

Keith Roper, Surrey.

Super Simplex castings

SIRS, - I wonder if you, your staff or readers can help me?

My father, an avid reader of *Model Engineer* since the 1940s, is currently building the 5in. gauge *Super Simplex* to Martin Evans' drawings published in *M.E.*

As a present for him I (a stripling of an *M.E.* reader since only 1980) am looking for castings for the boiler chimney and dome saddles. I have checked with a number of *Simplex* suppliers via *M.E.* advertisements, but none can source the *Super Simplex* specific castings required by the larger boiler. Does anyone know where I might source these two vital components?

Paul J. Weighell, Gt. London.

International *Twisty*

SIRS, - Last November we had our big model exhibition in Arnhem.

We were delighted that Colin Andrews visited us and we had a nice and interesting discussion with each other about our hobby. We had not expected that Colin, designer of the *Twisty* machine, would be with us. He spent the whole day at the exhibition. So, you see what one model in your magazine can do.

I promised to send Colin some pictures and enclose a couple with this message which may make another contribution for *Model Engineer* magazine.

As previously noted in *M.E.* 4179, 4 October 2002, Marinus Kik, one of our club members, made Colin's model with the different pistons. The photograph shows Colin and Marinus in discussion.

Thank you for mentioning our event in your magazine.

Henk Salij, The Netherlands.

Fine copper wire

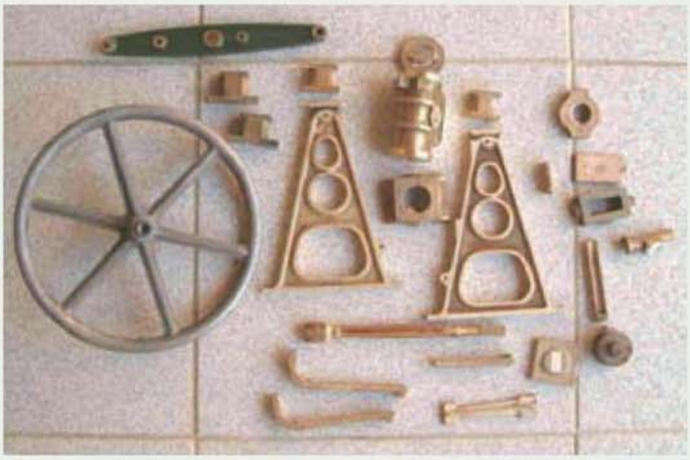
SIRS, - With the intention of having a shot at making ignition coils, I have built a coil winder and an impregnation plant. I now need 28swg and 44swg enamelled copper wire but so far my efforts at finding a supplier have been unsuccessful. Can any reader please advise me?

N. Dakers, Manchester.

Efficiency

SIRS, - In preparation for the Micro Steamcar Challenge, an efficiency competition for tiny steam turbines and steam engines, I came across a startling phenomenon which your readers may find interesting.

In one of my designs I use an elastomerically valved oscillating steam engine, where the rocking cylinder squeezes silicone rubber tubing supply and exhaust lines to



Correspondent Luis Trincão in Portugal built this Little Katy *engine (left) from castings imported from USA. His current project is the* Vulcan *beam engine designed by Edgar T. Westbury. The photograph above shows the castings, some of which, including the A-frames, beam and flywheel have been machined. Are there any other model engineers in Portugal?*

achieve the valve action. This means the cylinder is not in direct contact with the base like the normal oscillator, but is suspended only on its pivot pin.

During testing, it was free running at around 1000rpm in equlibrium with its single flame boiler. When I applied another much smaller flame directly to the cylinder, the speed increased radically, to at least 3000rpm. When the flame was removed, the speed remained high for about a half a minute and then gradually dropped back to its original value.

The surprising implication of this is that with only a small addition of heat input, the efficiency improved threefold. I often test my engines on compressed air and the way the heated engine ran was reminiscent of this, giving me the impression that the extra heat prevents condensation throughout the working cycle, far more so than mere superheating does.

Perhaps someone knows of similar results, perhaps even from the distant past when steam engine efficiency was of great importance.
Stan Reynolds
Durban, South Africa.

Springbok and *Dockleaf*

SIRS, - I was particularly interested in *M.E.* 4197, 13 June 2003, for two reasons, the first being the reference to *Springbok* which had been built by Vauxhall apprentices. I was a Vauxhall apprentice in Luton sixty years ago! The second was the letter from Neil Wyatt concerning tiny steam engines.

Recently I have been experimenting with the *Dockleaf* design '00' scale locomotive which I tackled all those years ago and which never got finished. The incentive to get back at it now has been a fortuitous e-mail contact with a gentleman in Brazil who is deeply immersed in tiny live steamers.

E-mail and CAD (his, not mine) have put a whole new complexion on information sharing (I wonder what Nevile Shute would think about it) and we are both interested to find out what other people have accomplished in this tiny scale format.
Francis G. Wilks,
Ontario, Canada.

Multi-tool

SIRS, - The Stewart 'Handy Worker' multi-tool shown in *M.E.* 4198, 27 June 2003, is a unit used for the sharpening and setting the reciprocating blade of a hay mower.

These blades had replaceable triangular shaped teeth which were riveted onto the main bar. The grinding wheel was thicker in the centre and tapered to the outsides. the anvil was to adjust and straighten any bent teeth. The mowers were available both in horse drawn and tractor mounted versions.
Neville Wilson by e-mail.

Model engineering in Portugal

SIRS, - I refer to the note in *Post Bag* (*M.E.* 4200, 25 July 2003): under the heading *Llave inglesa* and previous mention of adjustable spanners.

The Portuguese name for an adjustable spanner is 'chave Inglesa', very similar to the Spanish version. As a curiosity, in Portuguese a box spanner is a 'chave de tubos' where 'chave' means key, and 'tubos' is tubes in English. Now, taking a small (free) logical exercise and combining Portuguese and English, if a 'chave de tubos' comes from a tube, then a 'chave Inglesa' must come from England. There you have the 'proof' of the adjustable spanner's place of origin.

Please feel free to publish these lines if you find them of interest. I'm a beginner in model engineering which in Portugal isn't a common hobby. All the knowledge I have came from *M.E.*, *M.E.W.*, the books from the *Workshop Practice* Series, the Internet and two friends, both retired, one a lathe worker and the other an industrial boiler maker.

It's very difficult to find machinery and materials here. I have to order them from England. It's even harder to find someone in Portugal with whom to share experiences.

I send you some pictures of my first model, a *Little Katy* imported from USA. I'm now erecting a *Vulcan* beam engine. I would like you to publish my contacts in order to find other Portuguese model engineers and try to make this hobby more popular in Portugal.
Luis Trincão,
Torres Novas, Portugal.
Mobile 'phone: 966000512; e-mail: luis.a.trincao@mail.telepac.pt

How i.c. engines work

SIRS, - Readers may be interested in **www.keveney.com** a website which I picked up from *Vintage Airplane*, the magazine of the American EAA Vintage Aircraft Association.
G. G. Hugesdon, Surrey.

Craft skills

SIRS, - In *M.E.* 4196, 30 May 2003 there appears to be a consolidation of a fairly recent new trend, that of 'creating your own kit of parts'. We have a feature on Water Cutting, *Keith's Column* extolling the virtues of laser cutting, a quarter page advert by Doug Hewson that includes laser cut components. There is also Camden's half page advert with a book about LBSC and the 55 models he built, all by hand and lathe.

I prefer to use the words *"I built it"* to describe my own humble efforts. I am happy to buy in pressure gauges and injectors on the grounds that in their day the major locomotive works did exactly the same thing. However, where do we stop? When cutting out a set of frames, the instructions were invariably to file one long edge square and true and mark out from that. Now all we do is to have a session with a CAD program, send an e-mail and a week later, super accurate frames, brake parts, traction engine wheel spokes, etc., etc., arrive through the letterbox.

I am not against any form of progress, but will future builders be able to put their hand on their heart and say truthfully *"I made it"*? Will competition entries be divided into those who have used craft skills and those who have used CAD skills? Will the day soon come when instead of a series describing the building of a model in the magazine over many months, we are e-mailed a program for us to forward to our chosen supplier and a week later a completed exhibition quality model arrives in the post? We could have a new model every month!

I am sorry to appear flippant, but as technology is available to further all walks of life, we should not forget that we hold craft skills which must be passed on to future generations. The construction of any type of scale model must reflect the time and effort that goes into its creation, and not merely use technology to save time.

No criticism of the magazine is intended; keep up the good work.
Lawrence Tatton,
Nottinghamshire.

Cutter sharpening, oil guns and marking blue

SIRS, - Does anyone know of a professional sharpening service for end mills and slot drills?

Has anyone modified the Myford oil gun so that it lubricates the lathe and not your sleeve?

Has anyone else discovered that an old nail varnish bottle cleaned out with acetone makes the perfect means for storing and applying marking blue?
J. Lake, Hampshire.

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The horological mandrel comprises a faceplate with riser blocks having integral clamps and a pump or spring loaded centre.

One of the riser block and clamp assemblies shown in close up. The design means that there are no loose parts to come adrift at high rotational speeds.

A HOROLOGICAL MANDREL

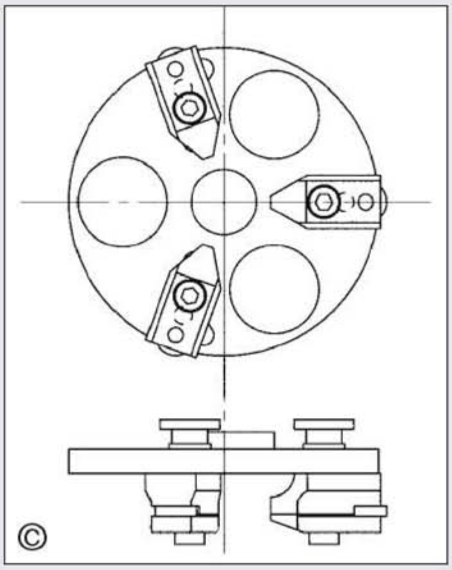
Neil Read
describes a useful accessory for the small lathe.

The word 'mandrel' is one that occurs from time to time in engineering. In general engineering practice it refers to a shaft or spindle used to locate a workpiece, usually by the bore, to enable turning or grinding operations to be carried out on the outer diameter. Mandrels come in a variety of forms and in all sorts of sizes. The tapered mandrel may be familiar to readers and is perhaps the most common type. This is really made to accommodate just one size of component and has a very slow taper to enable the part being machined to be pressed firmly on to it. A different mandrel is required for each size of bore. There are also adjustable mandrels and those with sleeves that will take a wider variety of work sizes, but these are not usually as accurate as the fixed size type. The word 'mandrel' is also a perfectly acceptable alternative name for a lathe spindle and can be used to describe parts of the tooling used in, for example, bending machines.

Incidentally, as an apprentice I was always taught to pronounce the word mandrel as *"marndrel"*. When I asked why when the spelling suggested otherwise, I was told it was to draw a clear distinction between the tool and the mandrill which is a blue faced monkey (*Mandrillus sphinx*) native to western Africa. I was also told not to ask silly questions. Well, I did not see too many mandrills running about the factory where I worked but listened to my elders and betters and so, in conversation, *"marndrel"* it is.

Design features

As we have seen, the use of the word 'mandrel' in general engineering is somewhat casual and can have a variety of meanings depending on the context. However, in horology the term has a more specific meaning. It is used to describe a special purpose faceplate that can be fitted to a lathe (**photo 1**). It is also the name for a complete machine embodying a faceplate of that type. As you would expect, horological mandrels (Britten's *Watch and Clock Makers' Handbook* uses the spelling *mandril* but Donald de Carle uses the more common *mandrel*) vary in detail from one make to another but most seem to have certain features in common. These can be listed as:



One of the riser block/ clamp assemblies dismantled to show the individual components.

1: The work sits on riser blocks which have integral clamps and jacking screws (**photos 2** and **3**).
2: The faceplate has large holes bored into it both to lighten it and improve visibility of the work piece when using it.
3: Two of the clamp assemblies are fitted into what a patent lawyer might term 'arcuate slots'. These orientate the clamp assemblies such that a workpiece can be removed from the clamps just by slackening the clamp screws; there is no need to slide the riser block/clamp assemblies out of the way. It could be argued that this arrangement does nothing for the primary balance of the device, but faceplate work usually involves some imbalance, and the parts are relatively light.
4: A 'pump centre' is provided to facilitate the centring of an existing hole in workpiece.

Among other things, the horological mandrel is used for drilling watch plates and checking that clock wheels run truly on their arbors. It occurred to me that a mandrel would be a useful accessory for my Pultra lathe and would be just as handy for model and general engineering as it is to the clock and watch trade. The photographs show the results of my work and I have included drawings for those who wish to make a similar device for themselves. Perhaps unusually, I decided to split out the pump centre from the mandrel itself.

Mandrels are usually mounted on a shank (8mm) to suit the spindle of the horological lathe to which they are fitted and the pump centre runs through the shank. Because I wanted to use the device on other equipment in the workshop I made the faceplate to screw onto the spindle nose of the Pultra and passed the pump centre through a blank collet. You may have different views on the matter and can vary the design accordingly.

There is nothing very sacred about any of the dimensions and you can make what modifications you like. Free machining mild steel was used for all the components drawn. I would advise against making the device too large. It is really quite a delicate tool and should be reserved for small, fine work. For larger heavier items, rely on the standard faceplate. By making it small and light the mandrel can be run at relatively high speeds

The mandrel mounted on the lathe spindle with the pump centre in position through the lathe spindle bore.

The riser block/clamp assemblies on the faceplate. All adjustments can be made by hand apart from the final locking of the cap head screws.

and the integral riser blocks and clamps ensure that nothing can come loose.

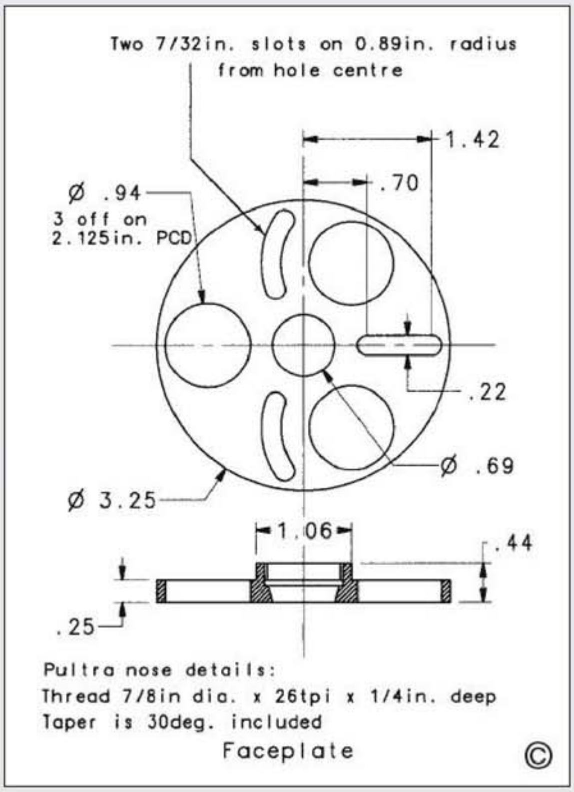
Pump centre

The only thing I have not drawn out is the pump centre. As mentioned, this was made using a collet blank and the pump centre itself, which is hardened at the business end, fits in a carefully reamed hole. The other end is supported by a brass bush which screws into the 3/8in x 26tpi thread in the end of the standard Pultra draw bar. Pultra owners will be able to recognise what I have done and copy it easily.

Readers who do not own a Pultra lathe will not be interested in that aspect of the design anyway. My pump centre is made from 7/32in. dia. silver-steel and, as mentioned, is hardened at the sharpened end. The spring needs to be selected with care. I find it is best not to have it too strong. Ideally, it should be possible to push the sharp centre back with the finger without giving yourself blood poisoning. **Photograph 4** shows the pump centre in place on the machine.

Manufacture

For those less experienced readers I will include a few notes on how to make the various parts. I have to confess that it was not made on the Pultra itself but was machined mainly on my Myford with a little help from the milling machine.

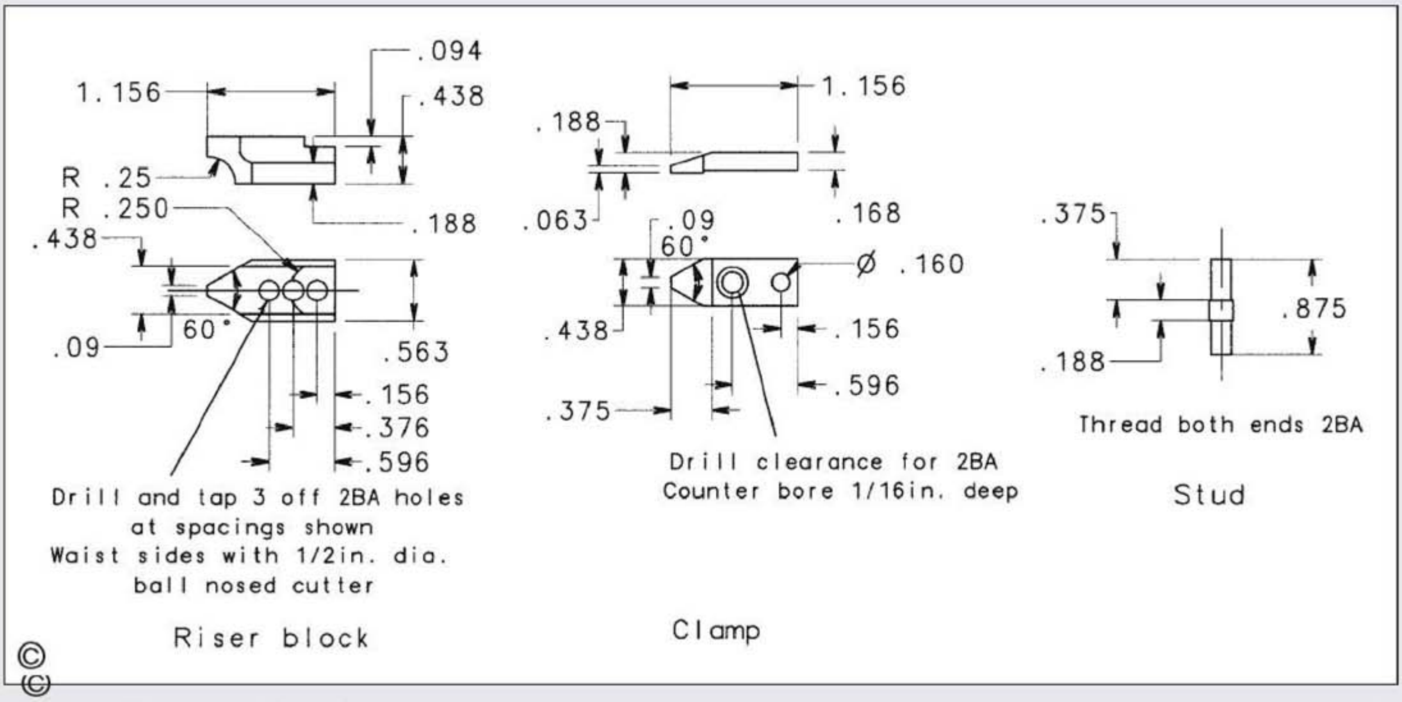


The faceplate itself can be turned from a steel blank. Machine the back first and cut the female thread and register to suit your lathe spindle. Reverse in the chuck and face off to within a few thousandths of an inch of size. Mark out the large holes and the position of the radial slot. Drill and bore the large holes to size on the faceplate. Try to make them all the same size as it helps when the time comes to mill the 'arcuate slots'.

These slots were milled with the aid of a rotary table. The two adjacent large holes (0.94in. dia.) were picked up in turn on a plug located in the centre of the rotary table and the cutter offset by the required amount from the table centre. The radial slot can be milled by aligning the marked-out lines with one of the table axes.

When everything else has been machined, mount the faceplate on the lathe and take a final skim off the surface thus bringing it to finished length. Make sure the spindle nose and the female socket are clean, free from dirt and lightly oiled before doing this.

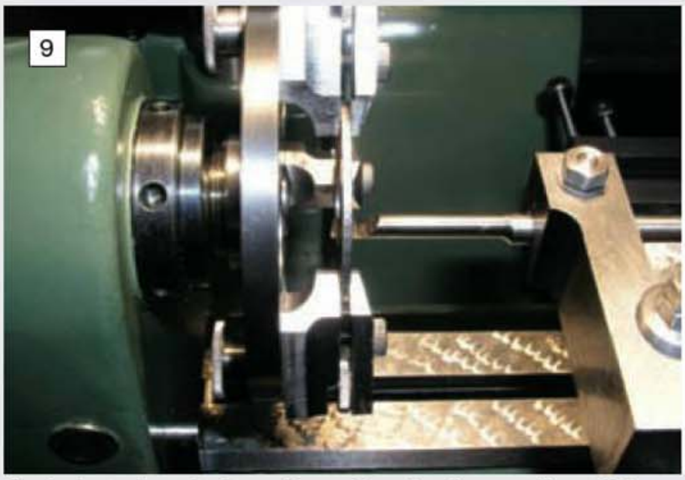
The riser blocks need some care as they have to be parallel and all the same height.



The mandrel being used for the boring of a small, thin plate. The riser blocks hold the plate well clear of the faceplate.

Setting up of the work is helped by the pump centre even if the hole in the work is too large to locate on the point.

The large holes in the faceplate allow the progress of the boring tool through the workpiece to be readily seen.



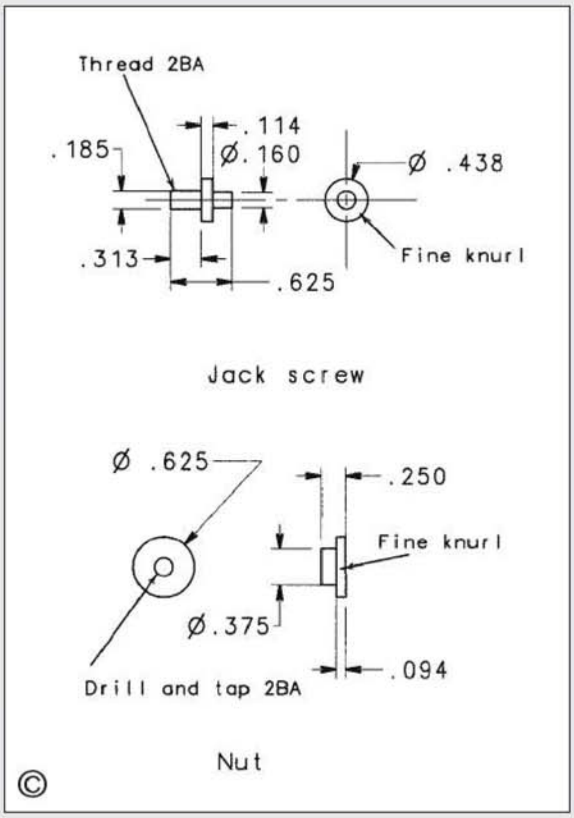
The boring tool can also be easily seen from the side, something which is often not possible if solid packing or a packing ring are used.

You could true them up *in situ* on the faceplate after they have been milled, but try to get them right in the first place. I used a length (enough for the three risers) of bright mild steel for these and to reduce the risk of distortion during machining the material was normalised before I started. Bring the material to the required section by milling or shaping. I put the 'waisting' in by means of a 1/2in. dia. ball nosed cutter, but a plain step would suffice. It would have been easier to draw too! Face off one end to make it clean and square.

Set up the material in your milling vice, either on the vertical slide or your vertical milling machine. Pick up the centre of the end face with a wobbler. It is now possible to index the table along and pick off each of the required holes in the blocks. I cut off each one as it was finished, faced the bar and proceeded with the next one. The tapered nose was done by standing the blocks upright in a vice and milling each side in turn with an inverted dovetail cutter. The curved relief in the underside was done with the periphery of an end mill.

The clamps were made in a similar way to the blocks; everything fitted together nicely and without torture. I relieved the underside of my clamps by 0.02in. so that the clamping pressure is only on the tapered end.

There is little to say about the studs and nuts; they are simple turning jobs. The studs were turned from 7/32in. dia. steel reduced at each end for the 2BA thread. While at the lathe, make some nice thick washers to go under the nuts. Mine are 7/16in. dia. and 1/16in thick. You will need three 1/2in. long 2BA cap screws to complete the assembly and attach the clamps to the riser blocks. **Photograph 5** shows the clamp assemblies in place on the faceplate. If your mandrel is going to get a lot of use it would pay to case harden the riser blocks and clamps, but watch out for distortion. This would not be too easy to correct after hardening and would really need surface grinding facilities. I left mine soft, so if I have to remake them in twenty years time it will be my fault.



Photograph 6 shows my mandrel being used to bore a small plate. Although the pump centre was not able to centre this particular part which already had a largish hole in it, it did help in setting the part by eye before using the dial test indicator to complete the setting (**photo 7**). The design of the mandrel makes such boring operations easy as there is very good visibility of the work and the work is well clear of the faceplate. **Photographs 8** and **9** show how the cutting tool can be seen from the side and rear with ease.

This little piece of lathe tooling does not take long to make and should repay the time taken many times over. Make it as carefully as you are able even if you are not a watch or clock maker. I am sure you will find many uses for it in years to come and may want to show it off to friends and relations.

THE JUNIOR
A STATIONARY INTERNAL COMBUSTION ENGINE

Stan Bray
brings this series to its conclusion with a description of the governor and silencer, and offers advice on final assembly and starting.

●*Part XI continued from page 503 (M.E. 4194, 2 May 2003)*

Although this article deals with the final assembly of our *Junior*, in fact, as we shall see, the engine had to be dismantled several times before it was fully working. However, a complete assembly will be required in order to make and fit the governor.

Most of the requirements for the assembly have already been dealt with, but it will be necessary to make 7 brass or bronze 5BA studs in order to secure the water hopper to the cylinder. Seven brass nuts will also be needed, and it is suggested that four of these are made rather longer than normal. These four are located inside the water hopper where, if ordinary nuts are used, they will be difficult to fit. If they are made a little longer than usual and one end drilled clearance size for part of the length, it will be possible to slip them on with tweezers where they will rest awaiting their turn to be twiddled with a box spanner.

The governor adds a nice cosmetic touch to the engine, but it must be said that it takes a great deal of fiddling with to get it to operate. Basically it is a series of levers which, in the fully open position, rest on the sleeve that in turn rests on the weights which swivel in the yoke. As the engine picks up speed, the weights swing out, pushing the sleeve, which operates the linkage to move the throttle control to a partly closed position. Clearances are minimal and the only way to make some of the parts is by trial and error and, depending on one's ability and patience to do so, there is then sufficient movement for the governor to operate.

It may well be that most builders will be content for the speed regulation to be made via the carburettor, nevertheless the engine would be far less attractive without the governor. Unfortunately, a general arrangement drawing of the governor assembly is not very practical but hopefully readers should be able to work things out from the photographs.

Sleeve

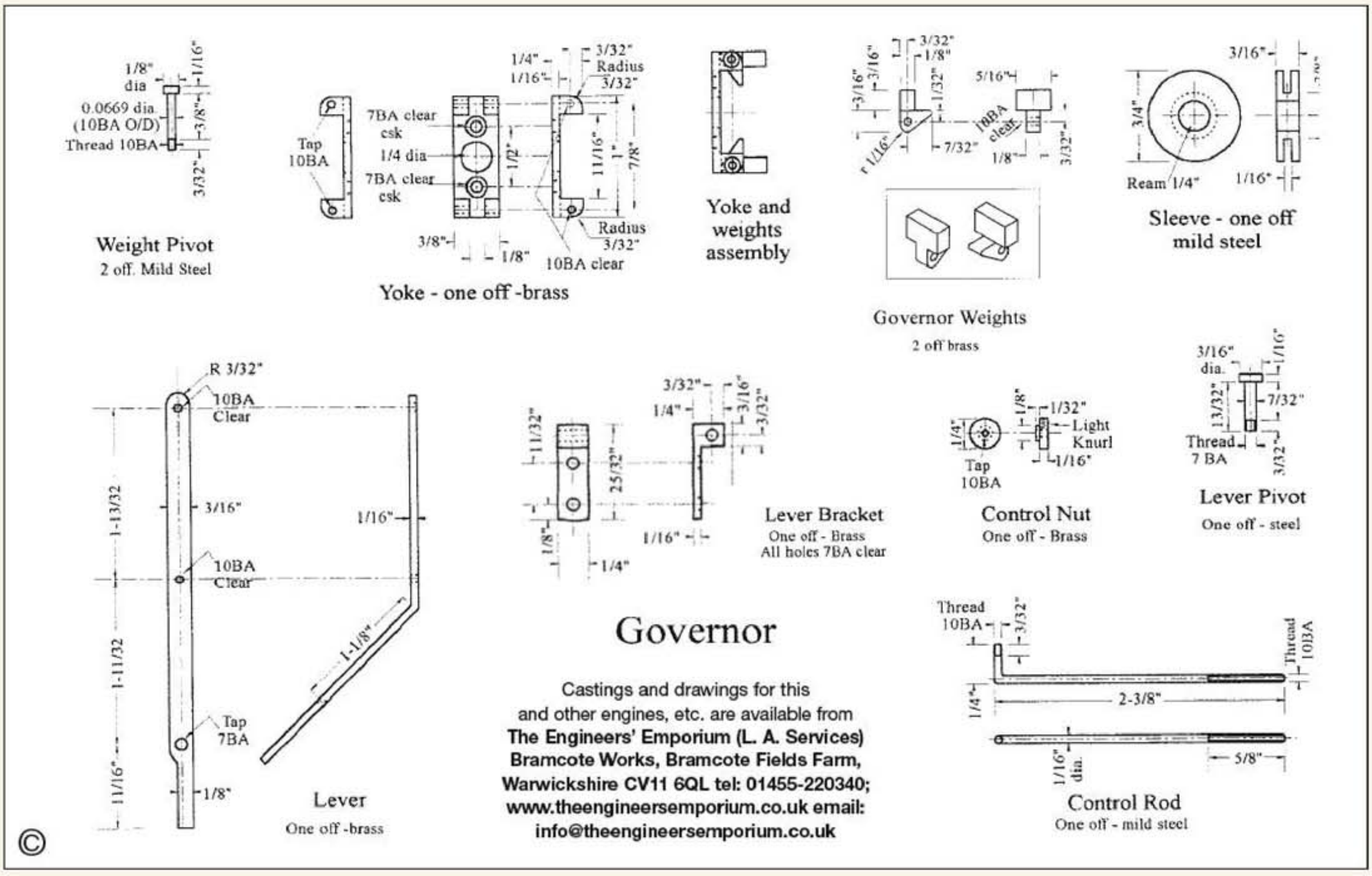
On the whole, construction of the governor is not too difficult, but there are a couple of places where improvements can be made. For a start, the sleeve is shown as made of mild steel and, while this will work perfectly well, it is to run on a steel crankshaft and in no time at all scoring and wear is very likely to occur. It is therefore a good idea to make it of bronze.

It is a very easy machining job and, other than taking care to see that the central hole runs true to the periphery, there is nothing in it. The slot can be made with a parting tool and, while the bottom of the slot should really be square, it may be found convenient to grind a slight angle on the tool. This will not affect the working of the sleeve but makes it easier to cut the slot, particularly if the bronze used is either very hard or very 'sticky'.

Yoke

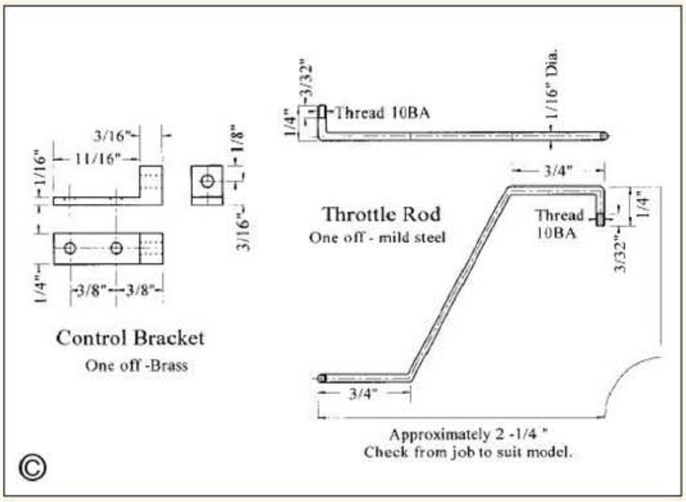
The yoke is shown as made from brass, and there is no reason why this should not be so. The actual manufacture is again fairly straightforward. Simply take a piece of brass, mill a piece from the centre and then mill a slot through the end pieces that have been left.

The only difficulty that arises is that the flat section which acts as the base is only 1/16in. thick, and it is impractical to hold this size in the normal milling vice. There are various ways of dealing with the matter. First the yoke can be soft-soldered to another piece and un-soldered when all the machining operations are complete. Alternatively, it can be made from a piece of brass considerably thicker than needed and, when the centre has been removed, machine the block to leave the required 1/16 inch. Afterwards,



Castings and drawings for this and other engines, etc. are available from **The Engineers' Emporium (L. A. Services) Bramcote Works, Bramcote Fields Farm, Warwickshire CV11 6QL tel: 01455-220340; www.theengineersemporium.co.uk email: info@theengineersemporium.co.uk**

The components required for the governor. Fits between moving parts need to be sloppy and the components tailored to each individual engine.



machine the slots in the end. Any attempt to machine these before gripping the piece in the vice will almost certainly mean the slots will collapse under the applied pressure.

Three holes are required in the reduced section; these need to be accurately placed. One hole is to clear the crankshaft, the others are countersunk for screws to hold the yoke to the wheel. All three can be drilled and then a piece of 1/4in. dia. rod passed through the wheel and the yoke, and the securing holes spotted from that.

It is worth changing the diameter of the screw for this fixing. The original drawings show 7BA and while this size will fit, it is very tight to the edge of the centre boss. To prevent any possibility of the holes breaking out, 8BA was used and the reduced diameter of the countersunk head also made it easier to drill the yoke.

Holes are required at each end with which to pivot the weights. Drill through both sides of the slot in one go with a tapping size drill, then open out to clearance on one side, and tap the other.

Weights

The weights are made from brass and, once again, the actual manufacture is simple enough and should pose no problem. However, it has to be confessed that when trying to work from the original drawings it was very difficult to imagine quite what the components were going to look like. For the benefit of readers both orthographic and isometric drawings are included here.

The easy way to machine the weights is to begin with a piece of 3/8in. square bar held vertically in the vice and to remove metal each side to leave a 1/8in. wide tang. Cut the piece to length and hold it in the machine vice by the tang to machine the actual weight. All that is then left is to drill the pivot hole and file the tang to shape.

It is essential that the movement of the weights is free and sloppy as the working of the governor depends on their easy movement, which also applies to all the moving parts in the governor sub-assembly. The edges of the weights are shown as square but having left them that way it was soon discovered that they could just catch on the edge of the groove in the sleeve; matters were improved by filing a small chamfer on the edge.

The control rod and throttle rod are quite straightforward but need to be bent as the governor is assembled and worked out from the job. The lever also needs to be made as work progresses as it is inevitable that the bends will vary from model to model. The lever bracket fits under the crankshaft bearing utilising the two holes shown on the drawing of the cover.

Missing from the original drawings is the fact that a light spring is required between the bracket and the adjustment knob on the control rod. It really does have to be very light for the governor to work and eventually a spring from a ball point pen was found to be reasonably successful.

The governor was assembled by trial and error with the sleeve in place but with the wheel and yoke removed. It was found that by increasing the thickness of the long section of the lever bracket it was possible to get a little more movement on the throttle control.

Glow plugs

Most of us are likely to be familiar with the spark plug to which, to some extent, the glow plug can be likened, even though there are considerable differences. The spark plug is assembled from two metal sections insulated from each other with a material with the ability to withstand the high voltage current. This will generally be a ceramic, but a number of model engineers with an interest in internal combustion engines have successfully used epoxy resin as the insulator with considerable success. In operation, a high voltage is applied across the electrodes at the appropriate moment to cause a spark to jump across the two, igniting the mixture of gases in the cylinder.

The glow plug also has two metal sections that are insulated from each other apart from one or more fine platinum wires. These wires glow with sufficient heat to fire the mixture and do not depend on a high voltage. Although a battery is often connected to the plug to get the platinum wires to glow initially, the heat created by compressing the mixture is usually sufficient to maintain temperature once the engine is running. As the piston recedes and the engine cools so do the wires on the glow plug, only to reach operating temperature again as the mixture is once more pressurised sufficiently to raise the temperature of the electrodes. It is important to remember that although terminals for wiring will be fitted to the glow plug when it is purchased, there are not for general use.

As already mentioned, it may be that a small electric current might be required when starting the engine and maintained until the temperature of the mixture rises sufficiently to heat the wires without the application of a current. This is usually supplied by a 1.5V single cell battery, but beware, although the voltage is low, the current consumption is high and so a reasonably good quality battery should be used.

It is not always necessary to use a battery. Some glow plugs will heat up sufficiently following a few turns of the engine and it may well be worth trying that method prior to connecting a battery.

Probably because it has less time in which to cool completely, most glow plugs work best with fast revving engines. A wide variety of plugs are available. These are designed for different temperature ranges and so the best advice is to go to a real specialist in the subject and get what he or she considers to be the most suitable plug for this engine. Your local model shop may stock glow plugs but whether or not the salesperson has a good knowledge of their capabilities might be a different matter.

Finally, we return to the similarity between glow and sparking plugs, and in particular to the fact that, as many of us are only too aware, a sparking plug can break down for a variety of reasons. These include the use of plugs of the wrong length or wrong heat range, incorrect fuel/air mixture and bad timing as well as general misuse. The same problems can also cause the failure of the glow plug. So, if the engine does not run straight away when it is finished, do not immediately assume the worst. It could well be the glow plug which is causing the problem. If it does not fire after being turned over a few times, without the plug being connected to the battery, try connecting one to see what happens. It should then be possible to at least get a splutter. If you do, check that the plug is the correct length.

Eventually the wires will erode and the glow plug will require replacement. This is no different to the effect that we see when the electrodes of a spark plug wears down.

Spark plugs

Some readers may prefer to use a sparking plug rather than a glow plug. Using one will involve making a suitable contact breaker that can probably be fitted to a flywheel. A coil will also be required. Small spark plugs and tiny ignition coils are available from good model shops.

Spark plugs can be home made. After all, they are only two pieces of metal insulated from one another, and at one time a popular way to make them was by moulding the body from epoxy resin. That too is something with which individual builders may wish to experiment.

Starting and running

Having fully assembled the engine and fitted what was considered to be a suitable glow plug, a length of flat belting was wrapped around a flywheel to spin the engine up in order to start it. After several attempts with the glow plug connected to a battery the result was complete failure. From correspondence received it appears that others have had similar results. Fuel was getting through so, believing that petrol might not be suitable, a small quantity of model aircraft fuel was poured into the plug hole and a further attempt made. This time the engine coughed into life but quickly faded and stopped.

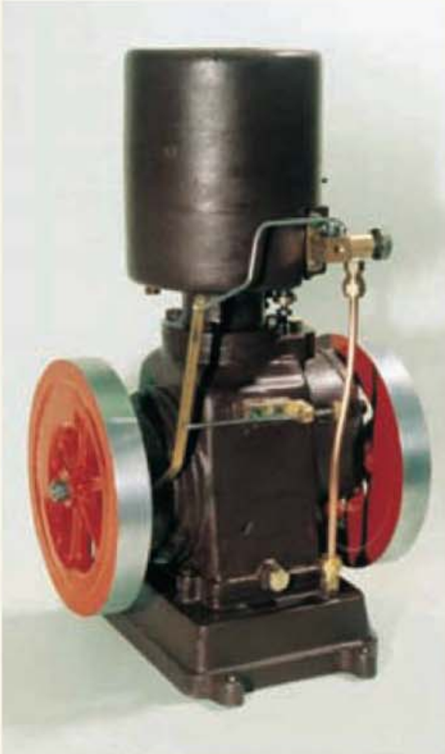
It was time to telephone a few friends who had experience of engines fitted with glow plugs. The general consensus seemed to be that the type of plug in use was incorrect and there were various promises of different types to try. Waiting for their arrival was unfortunately rather frustrating, but arrive they did, only for the same result to be achieved.

More telephone calls and some personal discussions later, the only positive outcome was that all those consulted and to whom the engine was shown agreed that there was no reason why it should not work. Most appeared to believe there was no need to connect the plug to a battery and one positive suggestion was that the engine might have too much compression. My own opinion until then was that *more* compression was needed, but apparently glow plugs do not work well if compression is increased.

With desperation becoming evident, the engine was dismantled and the expansion chamber enlarged a little. The result — still no surge of power, just a few coughs and splutters. The thought occurred to me that the fuel pipe might not be allowing sufficient fuel through and a larger diameter pipe was fitted with a more encouraging result. Instead of coughing and spluttering three or four times, the engine coughed and spluttered five or six times, but no matter how I tried, that was all I got.

The engine was dismantled once more and everything checked. During the process the thought occurred to me that the flywheels were not exactly particularly heavy, so I adapted a chunk of 4in. dia. brass to fit on the side without the yoke screwed to it. What a difference! This time it was 'all systems go' and the engine was even tried successfully without the starting mixture. Various glow plugs were also tried, some giving better results than others. Unfortunately since they were all unidentified donations it is not possible to say which was the most suitable and the answer to enquiries about the best type to use is still awaited.

There is no doubt that the main problem where running is concerned is the material from which the flywheels are made. They are not heavy enough, and this will need to be remedied, either by putting a heavier rim on the existing wheels or by replacing the flywheels supplied with cast iron or brass. At least it has been demonstrated that the engine will work and it is impossible to think why such an obvious solution to the problem did not occur earlier. After all who has ever heard of the use of a lightweight flywheel?



The finished engine seen here with the original cast flywheels. Note the governor details.

Another thing to beware of is the softness of the material used for the flywheels. The tapered hole tends to gradually enlarge as pressure is brought to bear by rotating the wheels and no doubt the holes will soon become enlarged and the wheels will then become loose. Builders are urged to seriously consider changing the material from which the flywheels are made. Should there be any concern about spoiling the appearance of the engine by using disc flywheels, readers may take heart from the fact that many of the original engines of this type had discs.

Silencer

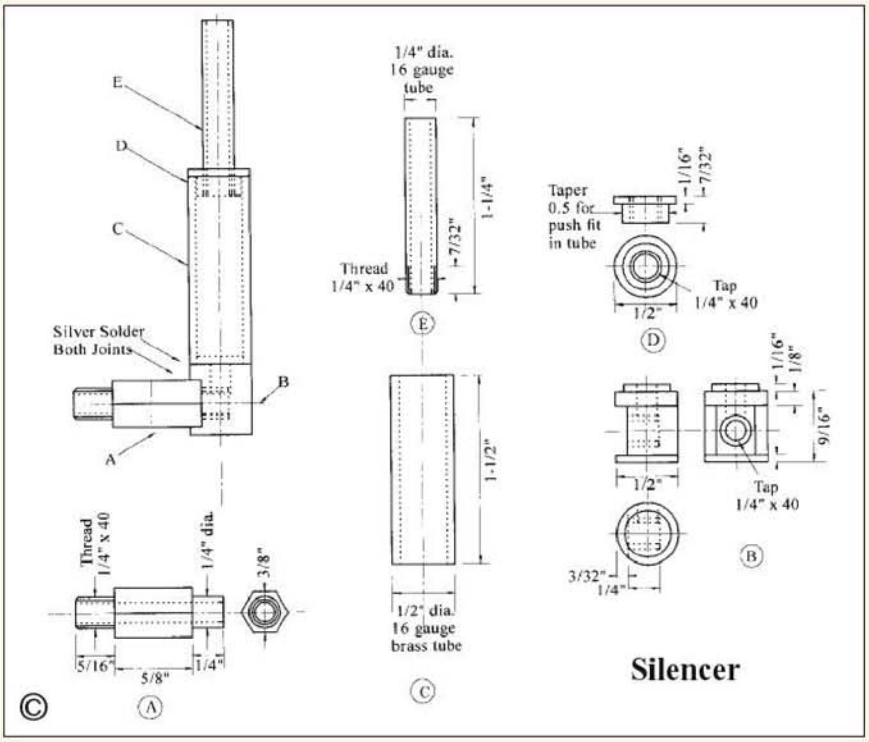
Mainly for the sake of appearance, a small silencer was made from some odd bits of brass tubing. The prototype would certainly have had a silencer and for the few minutes it took to make it certainly improved the appearance of the model. It consists of five parts which are shown on the drawing. Readers need not, however, stick to the drawings, as a quick look around a rally field where full sized engines are running will quickly demonstrate that a wide variety of contraptions are used to do the job.

To make the silencer shown here, take a length of 3/8in. hex. brass bar, thread one end to fit the engine and machine the other end to 1/4in. dia. for about 1/4in. length. Drill right through 5/32 inch. Take a short length of 1/2in. dia. brass bar (assuming the tube used for the silencer is 1/2in. diameter) and turn a step to fit inside the tubing for about 1/16in. in length. Drill the face where the step is 5/32in. dia. about 1/4in. deep. File or mill a flat on the periphery of the bar to a depth of about 3/32in, leaving the end of the piece that fits in the tube full diameter for at least 1/16in. Silver-solder all three pieces together,

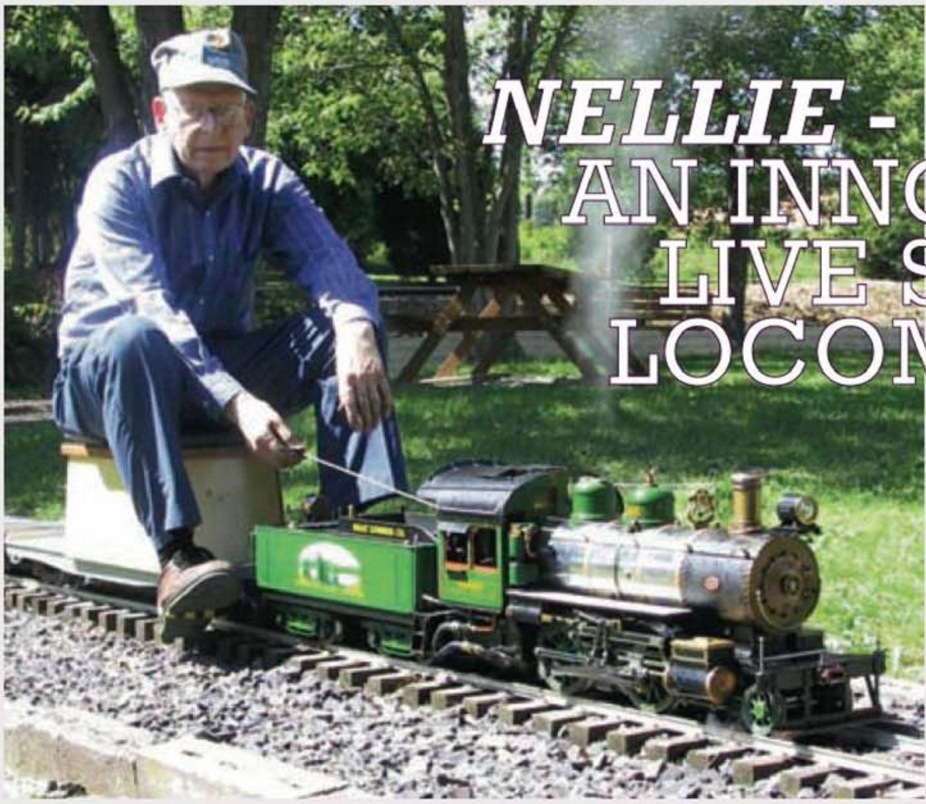
Make sure that the open end of the tube is thoroughly deburred and machine a short length of 1/2in. diameter bar to a really good press fit in the tube. Drill and tap the bar 1/4in. x 40tpi. Put a short length of the same thread on a piece of 1/4in. dia. tubing, screw the tubing into the plug, push the plug into the tube, and there we have an attractive and effective silencer.

All in all the model is very attractive and construction is generally straightforward. The situation regarding the flywheels is a little unfortunate and it is just possible, although rather doubtful, that after an extended period of running those supplied will contain sufficient momentum for the engine to operate. The situation regarding the glow plugs is a difficult one compounded by the fact that as well as different firing capabilities, glow plugs also come with a number of different threads and it seems probable that those most likely to suit this engine may have a larger diameter thread than specified. Nevertheless, the engine will work provided one is patient and ensures that the assembly is correct.

A small problem that may arise is the possibility of sticking valves. There is no provision for supplying oil to the stems which, unless lubricated, will almost certainly stick. A drop of oil applied before starting helps but the stems dry out fairly quickly and will need to be closely watched.



NELLIE - AN INNOVATIVE LIVE STEAM LOCOMOTIVE



Author taking Nellie for a relaxed run on the Pennsylvania Live Steamers ground level track. Throttle extension in hand and other essential controls conveniently located on back of tender, the driver has full control of his locomotive without obscuring its aesthetic details.

Robert G. Thomas in Philadelphia introduces a novel scheme for manhandling a heavy live steam locomotive.

●*Part I*

My *Nellie* is a 1in. scale 4$^{3}/_{4}$in. gauge 2-4-0 live steam locomotive built by my late father George in 1966. It is representative of a type sometimes used in timber regions of North America around the end of the nineteenth century. What sets this particular live steamer apart from numerous others with which we are all familiar, is its unique design which enables the boiler to be separated from the chassis in a matter of minutes, simply by removing a few bolts, without manually disconnecting any pipes or linkages!

Conversely, combining boiler and chassis assemblies for normal operation is a rapid one-man operation requiring only lowering the boiler onto the chassis and bolting them together, once again without further attention to any interconnections. The heart of the design is a pair of flat mating surfaces across the centre of the saddle. The upper half of the saddle is permanently attached to the smokebox, the lower half is integral with the cylinder block. These interfacing surfaces have three matching ports for

1: steam from superheater to cylinders,
2: exhaust from cylinders to blast nozzle,
3: feed water from axle pump to boiler.

The remainder of my article describes how the basic concept for *Nellie* arose and was further refined into a locomotive possessing extraordinary advantages over traditional designs in terms of ease of handling and maintenance at home and at the track. This is not a 'construction' article, although certain constructional details will be included when they contribute to the clarity of an explanation.

Finally, I have no illusions that the methods described here, despite any advantage I might attribute to them, will be embraced by those model engineers for whom fidelity to scale and strict adherence to prototypical construction practice are absolutely essential. However, for builders possessing a flexible view of their hobby, who can accept internal changes (as we all do with boilers, tender tanks, etc.!), or who can tolerate an innocuous non-scale device, the practical benefits of the novel construction to be described here can be realised without significantly altering the appearance of the locomotive. Whether or not to accept those compromises are decisions that can only be made by each builder in consultation with Inspector Meticulous.

Historical background

By the time he retired as a teacher, George had built three live steam locomotives. The first was a 2$^{1}/_{2}$in. gauge Baltimore and Ohio 4-6-2 constructed from castings and drawings marketed in the US in the late 1920s by British émigré Harry Coventry. It provided great fun for us on a 32ft. circle of track in our back garden, attracting considerable local interest, especially when we ran it at night at the head of a scale freight train.

When the war ended and a local club was formed nearby, George's interest turned to 1in. scale, resulting in completion of a 4$^{3}/_{4}$in. gauge 4-6-0 in 1950. This massive Camelback (centre cab) locomotive had a 6in. boiler barrel and Wooten firebox of 80sq.in. grate area, endowing it with prodigious hauling capability at the expense of

Author lowering Nellie's boiler on to chassis in the first stage of assembling the 'kit'. Although not shown here, the grate and ashpan would ordinarily have been set in place on the chassis rear cradle before the boiler is lowered. Note proprietary connectors on tender water hoses.

This flat surface on the chassis portion of Nellie's split saddle registers with a corresponding one on the boiler with three connecting ports for (from front) steam from superheater to steam chests; exhaust from cylinders to blast nozzle in smokebox; and water from axle pump to feedwater heater in smokebox. Assembly bolts screw into the threaded holes at the four corners.

considerable human effort for transportation and handling at the track and for routine maintenance. But physical effort didn't matter then, after all everybody was young and strong in 1950!

With weight in mind, the next engine built was a 1in. scale version of a handsome 4-4-0 designed by William Mason and manufactured at his Taunton, Massachusetts works in 1857. Locomotives of that era in the US ran on lightly constructed track, often literally 'thrown on the ground', so they had to be very compliant to accommodate road undulations and were themselves lightweight to minimise track damage. At 76lb. the model is similarly light, well within the capability of a fit individual to lift and carry, although somewhat 'slippery' on grades of 1 in 60. Often referred to by British friends as a 'Cowboy Engine', this locomotive was the subject on the front cover of *M.E.* 3542, 6 August 1976.

George's enthusiasm for 1in. scale was undiminished when he retired in 1964, but he recognised that by the time he completed another locomotive, his stamina might have declined to the extent that any conventional locomotive within North American loading gauge and with reasonable passenger hauling capability would be too heavy for him to handle alone. This depressing inevitability arose from witnessing the plight of many friends who started building large locomotives in their later years only to be frustrated when the completed engines were too burdensome to enjoy.

After pondering this dilemma at length, George saw that the fundamental solution lay in a medium-size locomotive that would easily come apart into two sections, each within reasonable weight limits, and possessing a convenient means for quickly separating or combining them. Here was the path to a practical locomotive whose two major parts could be lifted in or out of a car's boot and carried to the steaming bay or workshop without undue physical strain by just one man 'of a certain age'. As finally built, *Nellie's* chassis weighs a modest 48lb., and at 54lb., the boiler slightly more.

Before working out mechanical details for separable sections, thought was devoted to the wheel arrangement that would be most appropriate for a two-piece locomotive of moderate size. After lengthy deliberation, the decision was made to build a 2-4-0, on the basis that the two-wheel pony truck would materially reduce the tendency for vertical and lateral bobbing and lurching associated with an 0-4-0 or 0-6-0, but without appreciably increasing the locomotive's overall length or diminishing its traction. A general arrangement was envisaged that approximately centred the boiler barrel over the driving wheels. The firebox is thus located completely behind the rear drivers, supported by a cradle-like extension of the frame, where it tends to counterbalance cylinder weight and simplifies ashpan and grate arrangement. The wisdom of that approach has since been borne out by the completed locomotive, whose longitudinal balance point is located exactly between the two driving wheels and which exhibits excellent high speed behaviour on the track.

Assembling the 'kit'

The boiler section is fastened to the chassis at the front of the locomotive by four vertical bolts which pass from the interior of the smokebox, through the interfacing surfaces, and into tapped holes in the cylinder portion of the saddle. The flat mating joint, $2^3/4$in. long by $2^1/8$in. wide, is sealed with a single gasket 0.032in. thick with clearance holes for the fastening bolts and the steam, exhaust and water ports. It is permanently glued to the boiler-half of the saddle. A flat jointing surface is easy to machine, avoids complications that might arise from use of multiple 'O'-rings, and has shown no tendency for leakage at any of the ports, even after hundreds of assembly/dis-assembly operations with the original gasket. To assist in acquiring proper alignment during assembly, the interface on the boiler side of the saddle is recessed about $^1/16$in. within a narrow frame that just fits around the cylinder saddle, so that when the boiler is lowered on to the chassis and wiggled slightly, a 'clink' is heard as the two saddles mate, indicating correct alignment.

By now sceptics are likely to be saying, *"All well and good, but how do you get your hand in the smokebox to insert and tighten those four blinking screws?"* The answer is, you don't have to put your paws in the smokebox at all. George's ingenuity came to the fore again with design of special bolts, inserted and tightened by means of three purpose-made tools that make the job quick and easy. The bolts are made from ordinary $^1/4$in.-20 UNC steel bolts with $^7/16$in. A/F hex. heads. The tops of the heads are turned to a dome shape, retaining about $^5/32$in. height of the original hexagon. A $^1/4$in. I/D x $^3/8$in. O/D x $^3/8$in. long steel sleeve slipped over the shank up to the head of each bolt is silver-soldered in place.

Front-end assembly of the locomotive is accomplished quite simply. Although a description of the procedure tends to be rather wordy, details of the assembly process and the special tools employed will be apparent from accompanying illustrations. First, the boiler is lifted over the chassis and carefully set down on the cylinder saddle, listening for the 'clink' confirming alignment; the firebox end is automatically supported in its proper position by the frame cradle. One of the four special bolts is snapped into a slot at the forked end a of $^1/8$ x $^1/2$in. flat mild steel handle about 6in. long, where it is lightly retained by pressure against its head from a flat spring riveted to the handle. The bolt is manoeuvred with the handle through the front of the smokebox and pressed downward into a mounting hole, then the handle is pulled straight out, releasing its hold on the bolt. This process is repeated for the remaining three bolts.

Smokebox interior showing two of four holes for front-end assembly bolts. The large curved pipe carries steam from superheater to front interface port; copper wire wrapping protects it from erosion by high velocity ash emerging from flues. The short vertical chamber with hex. cap is a 'dope cup' for supplemental cylinder lubrication. The tubular grid at left is a feedwater heater. The small pipe at right carries steam from a cab-mounted valve to a small cylinder mounted outside the smokebox for drain cock actuation.

Inasmuch as the interior of the smokebox is cylindrical and thus does not present a proper seat for the bolt heads, bushes with clearance holes and horizontal bolting faces, and with curved bottoms to match smokebox interior radius, are silver-soldered inside the smokebox at each of the four bolt locations. These bushes also serve to raise bolt heads above the bottom of the smokebox to facilitate manipulating the bolts into their holes and tightening them.

The next operation is to run up each bolt almost fully tight. This is conveniently done with a second tool made from a piece of flexible shafting about 9in. long 'liberated' from the centre of a speedometer cable or similar source. A $^7/16$in. hex. socket wrench is soft-soldered to one end of the shaft, and a knob is fixed to the other end. When the flexible shaft is lowered through the locomotive's chimney and slowly rotated, the socket wrench tends to twirl in a circular path over a domed bolt head, which it captures quite easily. This apparently miraculous gift of nature has to be seen to be appreciated, but it really does work quite reliably due to slight residual curvature in the flexible shaft, causing the wrench to follow an easily controlled path over the bolts. Once on a bolt head, it is a simple matter to run up the bolt finger tight. Again, it takes longer to describe than to carry out this process.

The third and final operation at the front end is to fully tighten all four bolts. This is done with a stepless roller-clutch type of 'ratchet' wrench with its handle bent to fit around the blast nozzle and other obstructions in the smokebox. Emphasis is on stepless, or at least a wrench having rather

Three special assembly tools are (from top) a forked-end handle with flat spring to retain bolts for insertion in smokebox holes; socket wrench on flexible shaft for running up bolt; ratchet socket wrench with handle modified to avoid smokebox obstructions used for final tightening. The same tools are used in reverse order for rapid dis-assembly of the locomotive.

Close-up of assembly bolt in forked handle. After a bolt has been lowered in a smokebox mounting hole, the handle is pulled straight back, releasing it and leaving the bolt in place. The domed bolt head assists capture by both hex. socket wrenches, and the collar under the head elevates it to facilitate access.

fine steps, as opposed to a coarse ratchet action, which would make tightening the bolts difficult due to severe restrictions on angular rotation of the handle imposed by smokebox obstructions. In contrast, a roller clutch or small-step ratchet will not appreciably limit handle 'start' and 'stop' positions. That completes front end assembly, and we are almost finished putting the locomotive together!

Now we briefly turn our attention to the back of the locomotive, where the firebox is supported by a robust rectangular cradle extending behind the frame. Three internally threaded $^1/_4$in.-20 UNC bushings are silver-soldered in the rear cradle stretcher below the drag beam. Ordinary $^1/_4$in.-20 x $^3/_4$in. alloy steel socket-head screws, modified by reducing the threads to root diameter at their ends, are screwed into the bushings so the unthreaded ends enter matching clearance holes in a downward extension of the rear mud ring. Thus, while the boiler and chassis are rigidly held in a fixed relationship at the saddle junction, the rear of the boiler is free to move longitudinally relative to the chassis, sliding on the smooth, threadless screw end sections to compensate for minor construction discrepancies and differential expansion between the boiler and frame.

That's all there is to assembly; we now have a conventional one-piece locomotive ready for service after no more than five minutes assembly time!

Prejudice and preferences

Simplicity of assembly and dis-assembly would not be possible without clever accommodation of the three auxiliary functions of water management, drain cock actuation, and valve gear control. Non-traditional methods have been employed to eliminate all pipes and mechanical links between the boiler and chassis that would otherwise detract from the fundamental precept of the two-piece concept. Methods actually used for *Nellie* will be described shortly, but it is first necessary to explain historical preferences that have influenced operation at our local track for over 50 years.

My club, the Pennsylvania Live Steamers, has had ground level tracks exclusively since our founding in 1946 when our first $2^1/_2$in., $3^1/_2$in. and $4^3/_4$in. multigauge track was built. (Yes, you did read that correctly: $2^1/_2$in. gauge ground level can be highly satisfying, but that's another story!). The original members of PLS were of one mind about 'The Right Way' to operate a miniature locomotive on a ground level track, that being from a relaxed position on a comfortable riding car behind the tender so as to not desecrate the locomotive's appearance with an out-of-scale driver (especially with big feet) perched atop the tender. This admittedly narrow-minded opinion was reflected in the club motto, *Errabundi Saepe, Semper Certi* (Often Wrong, Always Certain).

Three socket head screws with threads turned down at their ends, screw into the drag beam, providing sliding support for the firebox on the chassis.

Some deviations from convention are thus still adopted as standard features on many of our engines, including a bypass valve within easy reach at the back of the tender; an extension rod from the regulator to the driver's hand; and an unobtrusive extension from the reverser to the back of the tender to permit optimum adjustment of cut-off. The necessity to occasionally get up from the riding car to tend the fire is an inconvenience willingly accepted to preserve the aesthetic splendour of the steam locomotive in stride. Of course none of this is applicable to operation on elevated tracks, where access to operating controls is usually unrestricted.

●*To be continued.*

Advantages of Southern valve gear low profile and accommodation of short-coupled wheel arrangement are apparent here. Note absence of a combination lever; the vertical component of elliptical motion at the end of eccentric rod is transferred through a rocking shaft and bellcrank to the valve spindle for lap and lead. Cylinder drain cocks are operated from cab by the piston rod of a small cylinder on the smokebox pressing against a chassis-mounted drop link to the cock mechanism.

The Mark 1 gyro on the left compared with the much improved Mark 2 at right.

DABBLING WITH GYROS

David Wilcox,
unable to purchase a 'toy' gyro, describes how he made one and then introduces us to the basic theory of these fascinating devices.

This article was prompted by my inability to buy my 10 year-old grandson a traditional toy gyroscope; you know, the sort that we spun up with a length of string and balanced on top of a diecast Eiffel Tower about 4in. high. Depending upon how fast the rotor was spun up, it would balance for perhaps 10 or more seconds, then slowly and with increasing speed, gyrate round the tower and finally topple over. The nearest I could find, for about £4.99, was a Chinese made electrically driven top about 3in. dia. powered by a pair of 'D' batteries. It was underpowered, literally ate batteries and when inevitably it was dropped on the floor, the rotor was put out of balance and that was the end of that. So why not set to and make a traditional toy gyro?

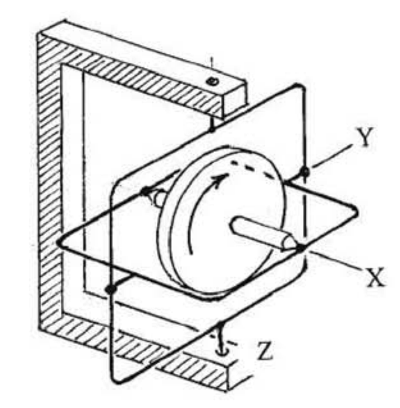
Over a weekend, I knocked up the Mark 1 gyro shown on the left in **photo 1** above, but this was not a great success for reasons which I will explain. The following week I constructed a Mark 2 model which is, I think, every bit as satisfactory as the gyros of my childhood. Much later, gyros continued to hold a certain fascination; initially, as an army light aircraft pilot, I was curious to know how some flight instruments worked. Subsequently, I spent over 30 years closely associated with guided weapon system engineering where gyros in one form or another lie at the heart of missile guidance control systems. So first of all, a little simple theory.

Basic theory

A free or space gyroscope consists of a heavy metal wheel rotating at high speed, universally mounted in a pair of gimbals so as to have three degrees of freedom:

1: Spinning about the X-axis,
2: Tilting about the Y-axis,
3: Turning about the Z-axis.

The inner gimbal is free to pivot within the outer gimbal and the outer gimbal can pivot within the frame (**fig 1**). When the rotor is made to spin at high speed, the device will exhibit two fundamental properties: gyroscopic inertia or rigidity, and precession. There is often a little mystery connected with precession because if you try to turn or tilt a spinning rotor, it seems have a will of its own. Both these properties depend on the principle of the conservation of angular momentum as derived from Isaac Newton's second law which, in effect, says that the angular momentum about a given point remains constant unless acted upon by an external force.



© FIGURE 1: A FREE OR SPACE GYRO

The two properties of the gyroscope may be elaborated as follows.

Rigidity

Rigidity is the property which resists any force which tries to change the plane of rotation of the rotor. (See **fig 2** for a general definition of gyro planes and axes.) This property depends on three factors:

1: the mass of the rotor (m),
2: the distance at which the mass acts from the centre or radius of gyration (r),
3: the speed of the rotor (omega or ω)

Those who did physics at school may remember that the moment of inertia of a wheel is defined as

I = Sigma [(m) x (r)^2]

i.e. the summation of the mass of all the particles making up the rotor times the radius squared of all the particles, items 1 and 2 above. And then the angular momentum (H) of the rotor becomes

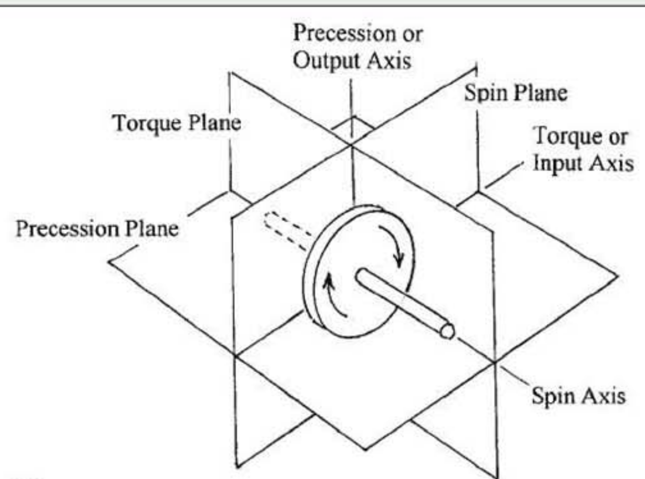
H = I x ω (the angular velocity: omega).

From this we can deduce that the mass of the rotor should be concentrated at the periphery of the wheel so that (r)^2 has greatest effect. For example, 1gram at a radius of 1cm has a moment of inertia of 1gram.cm^2 but that same 1gram at a radius of 2cm has a moment of inertia 4 times greater. Doubling the speed of the rotor merely doubles the angular momentum.

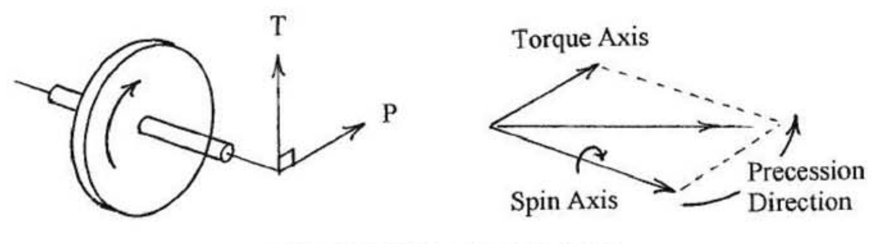
Precession

Precession is the angular rate of change in the direction of the plane of rotation of the rotor due to an applied force. The change in direction takes place, not in line with the applied force, but always at a point 90deg. away in the direction of rotation. Put another way, precession is always in such a direction as to align the spin axis of the rotor with the axis of the applied torque. So the output axis (or axis of precession) is always at right angles to the input axis (or torque axis).

Alternatively, this can be represented by vectors, one aligned with the spin axis and the other with the torque axis. The resultant is the direction in which the spin axis has moved towards alignment with the torque axis. How precession occurs, I will attempt to explain in an appendix and I will also describe a gyroscopic lash-up which demonstrates the principle.



© FIGURE 1: GYROSCOPE PLANES AND AXES



© FIGURE 4: VECTOR REPRESENTATION

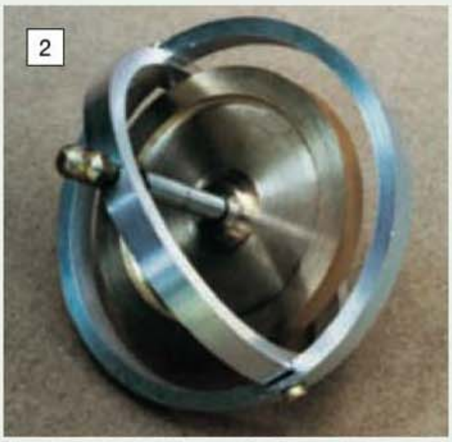
Toy gyro

Now for the toy gyro: Mark 2. This consists of a brass rotor secured with Loctite 601 Retainer to a mild steel shaft running in brass cone bearings mounted in a single annular gimbal. The drawing (**fig 5**) shows the detail. A further annular ring is fixed at right angles to the gimbal in the plane of the rotor, merely to enable the gyroscope to be held in one hand while running it up to speed with a length of string with the other.

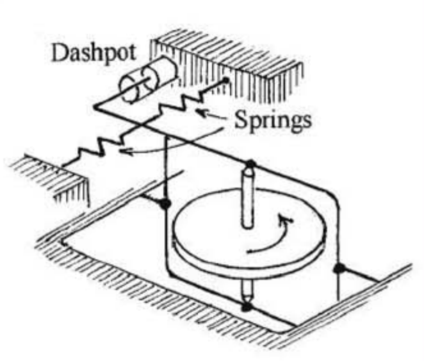
The photographs show that the rotor has been undercut in order to concentrate the rotating mass closer to the periphery. While this is not essential, extra mass which makes a relatively small contribution to angular momentum will only add to the friction at the bearings. In order to run the rotor up to maximum speed, the shaft should be as small a diameter as possible, but the hole through the shaft has to be big enough to allow a length of string to be threaded easily. The hole should be bevelled slightly otherwise the string will wear out rapidly, The ends of the shaft should be turned to 60deg. points to match the 60deg. female brass bearing.

The gimbal ring was machined in the lathe from a sheet of $\frac{3}{16}$in. thick aluminium alloy and likewise the cross frame, the inside diameter of the latter being the mid diameter of the gimbal ring so as to accommodate housed joints at their intersection. While these annuli are still in the lathe, it is important to mark the four 90deg. points using a dividing mechanism. I use a dividing plate fixed in the back of the lathe mandrel. An 8BA nut and bolt unite each housed joint on assembly.

The brass cone bearings (60deg. female) were turned and screwed 4BA from hexagonal stock so as to leave a ball shape at one end. This ball will fit into a socket on an Eiffel Tower. The gimbal ring was tapped 4BA at points 180deg. apart and the bearing screws, each given a dab of Screwlock, were then adjusted so that the rotor ran freely with no end shake, having given the bearings a drop of oil. The end of a piece of string, about 18in. long, was inserted in the shaft hole, wound up about 20 turns, given a sharp pull and away it went. A very satisfying weekend's work.



The Author's Mark 1 gyro with its undersized rotor; note how the rotor is undercut.



© FIGURE 3: A RATE GYRO

Earlier, I mentioned the Mark 1 (**photo 2**). It worked, but not very well because the diameter of the rotor (only $1\frac{1}{4}$in.) was too small to achieve enough angular momentum. There was also too much useless mass close to the rotor axis and, of course, the relatively higher friction of the bearings. I seem to recall that the toy gyros of yesteryear generally had a rotor diameter of about 2 inches. The diameters which I have played with have been predicated by the brass bar I had in stock. Incidentally, children's tops often have a diameter of about 6in. and can be pumped up to a speed of perhaps only 200rpm and yet remain stable for a few tens of seconds. This clearly demonstrates the radius squared element of angular momentum.

Returning to the 'toy' gyro. Within a few seconds it will start to gyrate round the tower leaning at an ever increasing angle until it topples. Why is this so? The answer, of course, is precession. Consider a gyro which is beginning to lean a little (it would be difficult at the start to plant it absolutely vertical). The weight of the gyroscope is acting through the centre of gravity of the whole, which we can suppose is at the centre of the rotor which is now offset from the point of support. So gravity is exerting a couple, or torque, on the gyro. If the rotor is turning clockwise when viewed from above, the gyro will start gyrating clockwise since the precession is acting at 90deg. to the gravitational torque. As the rotor runs down, its gyroscopic rigidity collapses and the gyro topples. I found that my gyro would remain erect for in excess of a minute when the ball end was set on the smooth top of a baked bean tin.

The classic demonstration of precession is the bicycle wheel, weighted with lead on its periphery, rotating in a shaft held, axis horizontal, by someone standing on a revolving chair. Spin the wheel, rotate its axis clockwise or anti-clockwise in the vertical plane and lo and behold, the person turns right or left depending on the direction of rotation of the wheel. A notable example of precession is the behaviour of rotating helicopter blades which exhibit strong gyroscopic rigidity. Cyclic pitch is used to control the direction of flight by tilting the disc plane in the desired flight direction. Assuming clockwise rotation when viewed from above, in order to tilt the disc forward, the cyclic pitch control must be applied 90deg. in advance.

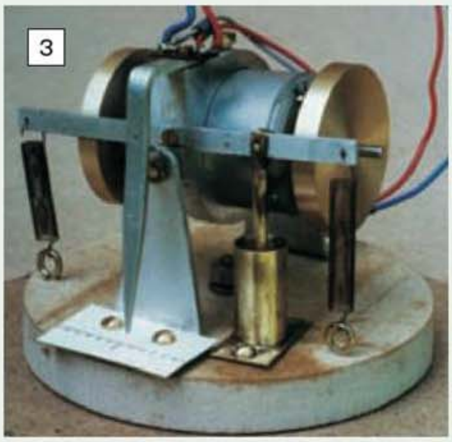
Practical gyroscopes

In real life, gyros are essentially of two types.

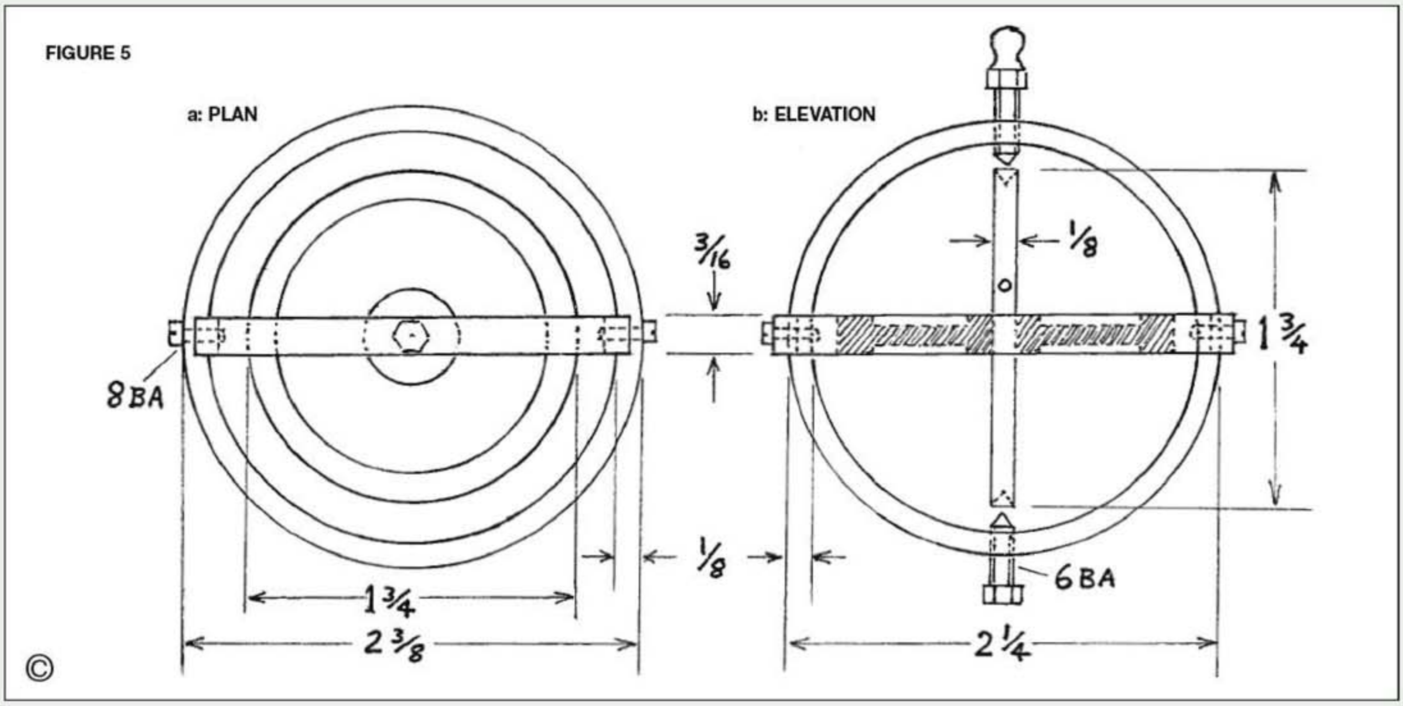
1: Free Gyros (fig 1) which have a double gimbal and are said to have three degrees of freedom, including rotor spin. In this type, the wheel axis will remain pointing in a constant direction in space, whatever the outer frame is doing, provided that no external torque acts upon it. An example is an aircraft artificial horizon instrument which can do this within certain limitations.

2: Rate Gyros (**fig 3**) which have only two degrees of freedom, i.e., a single gimbal between rotor and fixed frame. In its simplest form, a spring is attached between gimbal and frame. This spring produces a torque proportional to the amount the rotor axis deviates from the zero position. If the outer frame is rotated, then precession occurs in a direction at right angles to this rotation and the spring is stretched. This causes torque to act in the opposite direction, consequently the rotor axis will reach a new position of equilibrium in which the deflection from the zero position is proportional to the external angular rate, provided the rotor speed remains constant. The spring rate is chosen to suit the range of angular rates likely to be encountered. This is the basis of an aircraft turn rate instrument.

Rate gyros are the most common form of gyroscopes used in guided missile control systems and in inertial navigation systems, are now micro-miniaturised, precision engineered and highly sophisticated and rather than springs, they use torque motors to counter the precessional force. They may be engineered to measure angular rates of hundreds of degrees per second down to fractions of a degree per second.



The Author's simple rate gyro rig; note the dashpot for damping and pointer for indication.



How the gyro is spun depends largely on the application. Simple aircraft instruments used air jets impinging on buckets cut in the periphery of the rotor, the air pressure being derived from a Pitot in the airstream, or a pneumatic pump. Short range guided missiles often use a gas drive derived from a cordite charge which typically might run up the rotor to 60,000rpm in less than half a second and then freewheel. Modern gyros are most likely to be driven electrically, the rotor itself forming part of the motor.

Simple rate gyro demonstrator

I thought it would be instructive to make a simple rate gyro which could at least demonstrate rather crudely the proportionality of torque (deflection) to an angular rate input. The rig is illustrated in **photo 3**. Using string to run up the rotor was ruled out because rotor speed would vary and rigidity would be insufficient. A small 12 volt DC electric motor was chosen, having a double ended shaft and rated at 8500rpm. (Squires Code DCM610, price £2.95. Squires are mail order only, tel: 01243-842424, and they publish an excellent catalogue. I hasten to add that I have no connection with this firm).

A motor with a double ended shaft allowed a rotor to be attached to each end enabling a point of balance to be found somewhere near the centre of the motor at which to fix the gimbal. A close fitting collar or yoke was fabricated from 3/16in. thick aluminium alloy to fit over the motor body and secured with a set screw at the point of balance. An identical pair of rotors about 1 1/4in. dia. were fixed to the shaft with Loctite 601 Retainer. Bolted to the collar are a precession deflection pointer, an aluminium bar (to each end of which are attached the torque springs) and a pair of insulated terminals for the 12 volt connection to the motor and to the 12 volt supply.

In addition, the outer end of the dashpot piston connecting rod pivots on one end of the bar. The dashpot is essential to provide viscous damping to the system which would otherwise tend to be unstable due to the natural frequency of the set-up. The dashpot consists of a bevelled piston acting in a close fitting brass cylinder of about 3/8in. internal diameter. The piston/cylinder were generously lubricated with a thick oil and a tiny hole 0.35mm was drilled in the bottom of the closed cylinder to prevent hydraulicing. On reflection, this hole should have been drilled through the piston to prevent oil dripping out of the cylinder.

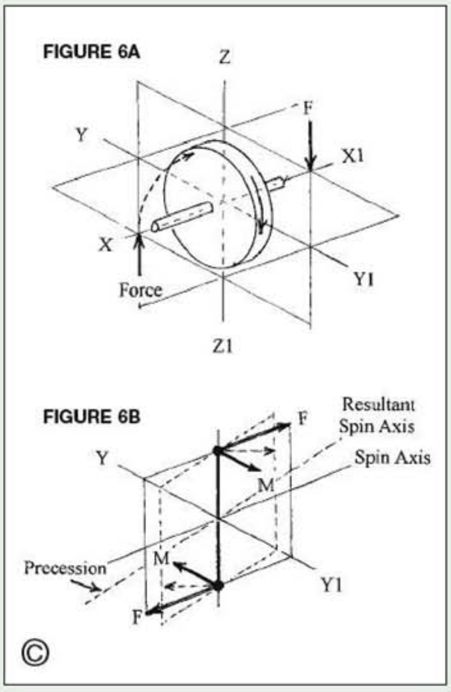
The extent of deflection of the pointer will depend on the strength of the springs chosen and the rate at which the gyro is rotated in the horizontal plane. To make it easier to rotate, the gyro is mounted on a simple turntable. The 12 volt DC was supplied to the motor via thin flexible leads designed to minimise any torque acting on the turntable.

The gyro seemed to have plenty of rigidity and the set-up worked exactly as expected but, to be honest, demonstrated little more than the humble bicycle wheel.

Conclusions

As far as I am aware there are no obvious applications of gyroscopes in the field of model engineering and in any case it is not yet possible to go out and buy gyros which are both affordable and do not need a lot of complex electronics to control them. However, some models may well exhibit gyroscopic effects. For example, model turbine driven vehicles, where the axis of the turbine lies in the direction of travel, may well experience a gyroscopic couple when the vehicle turns. If the turbine is rotating clockwise viewed from behind, then when the vehicle turns to the right, the front of the vehicle will press down harder but when it turns to the left, the weight will tend to be lifted off the front wheels.

I believe that in cars with transverse engines and front wheel drive, the gyroscopic rigidity of the engine can account for a degree of under or oversteer. Whether these effects are likely to be significant, I cannot judge. The rotating blades of flying model helicopters will, of course, exhibit gyroscopic effects. If any readers are aware of useful applications of gyroscopes to model engineering, I would be interested to hear of them. Doubtless in future years, as models become ever more sophisticated and entwined in electronic control, simple rate gyros might well find a place in our hobby.

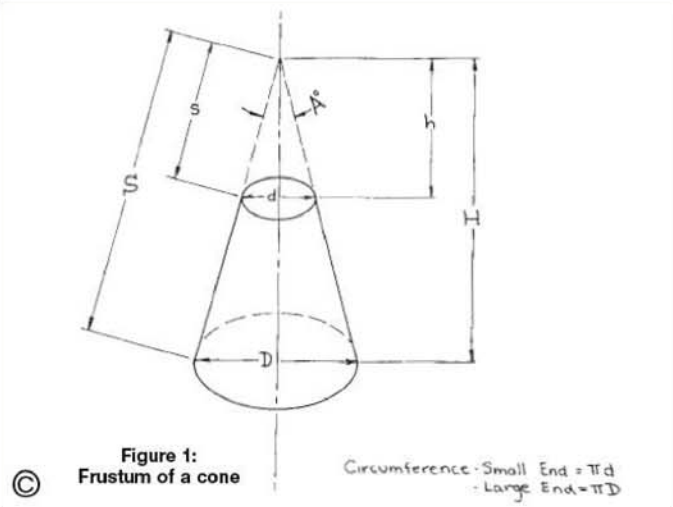


Appendix: determining the direction of precession

Consider the rotor in **fig 6a** being acted upon by a force or torque F at X and X1, carried round the Y or torque axis to the rim of the rotor itself. In **fig 6b**, consider two particles of the rotor at opposite sides of the rim having motion M in the direction of rotor spin. When force F is applied to the particles, there will be a tendency for each particle to move in the direction of the force. The particles will turn about the Z-axis so that their direction of motion is along the resultant of M and F. All the other particles of the rotor will be affected in the same way and so the solid mass of the rotor will precess about the Z-axis at an angular velocity proportional to the applied force.

Postscript

Subsequent to dabbling with gyros, I finally managed to find a traditional toy gyro in a Marlborough toyshop, made by TEDCO of Hagerstown, Indiana, USA, price £4.50. The diecast rotor was 2 1/4in. dia. and ran in plain bearings in a spot welded frame. It was robust and performed very well.



© Figure 1: Frustum of a cone

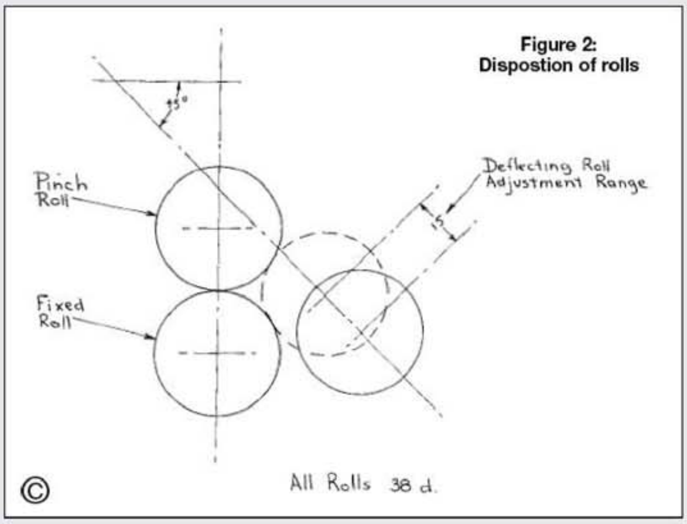


Figure 2: Dispostion of rolls

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ROLLING CONICAL FORMS

Philip Amos

in Australia, responds to a reader's enqiry with information on how he carries out this task.

In *Post Bag, M.E.* 4188, 7 Feb 2003 Dr. Figureau asked for information concerning the use of a Warco 'Triple Machine' to roll conical shapes. If his machine is similar to mine the following may be of some assistance.

My machine is described in *Model Engineer's Workshop* No. 51 (July 1998) where the rolling of cylindrical shapes is described, and it is emphasised that the rear or deflecting roller adjustment must be the same at each end or else slightly conical shapes will be produced instead. Likewise, the workpiece must be fed in square to the rolls or a helical form will result.

The nature of pinch type rolls is such that they leave a flat portion at one end of the work, which must then be turned end for end and put through the rolls again to arrive at uniform curvature of the full length of the workpiece.

The minimum diameter that can be rolled is governed by the diameter of the pinch rolls themselves, 38mm in my case. Thus, only truncated cones are possible, with this figure as the smaller diameter 'd' (see **figure 1**). The largest diameter depends on how far one end of the deflecting roll can be displaced while keeping the other end close to the pinch rolls (see **figure 2**). Measurements on my machine make this difference about 15mm but, due to the spring back which always accompanies bending, this figure does not directly relate to the rolled diameter.

The workpiece blank for a cone looks like that shown in **figure 3**. The blank must be continually jiggled through the pinch rolls while rolling so that a conical form is achieved. Guide lines drawn on the surface with marker pen (as shown on the drawing) help. More than one pair of hands is really needed; one person to manipulate the blank while the other turns the rolls, but watch your fingers. To confirm the technique I cut a blank as shown in drawing 3 from 26 gauge galvanised sheet steel and rolled this to a conical shape. My 40-year-old son did the handle turning of the rolls while I did the jiggling.

It is a rather tedious process: loosen the pinch roll screws, insert blank, tighten screws, roll a little, then repeat after realigning the blank so the next guide line is parallel to the pinch rolls. This is all done at the end of the machine having the deflecting roll most opened, position I shown in **figure 4**. It is then repeated for positions II, III and IV. The deflecting roll is then opened at its previously closed end and closed at its previously open end. The cone frustum is slipped off the top roll and replaced end for end. Final rolling to finished size can now be effected.

The rolling operation took us about 45 minutes to complete. Conical shapes may possibly be better achieved by spinning, but that is quite another story.

Figure 3: Work piece blank

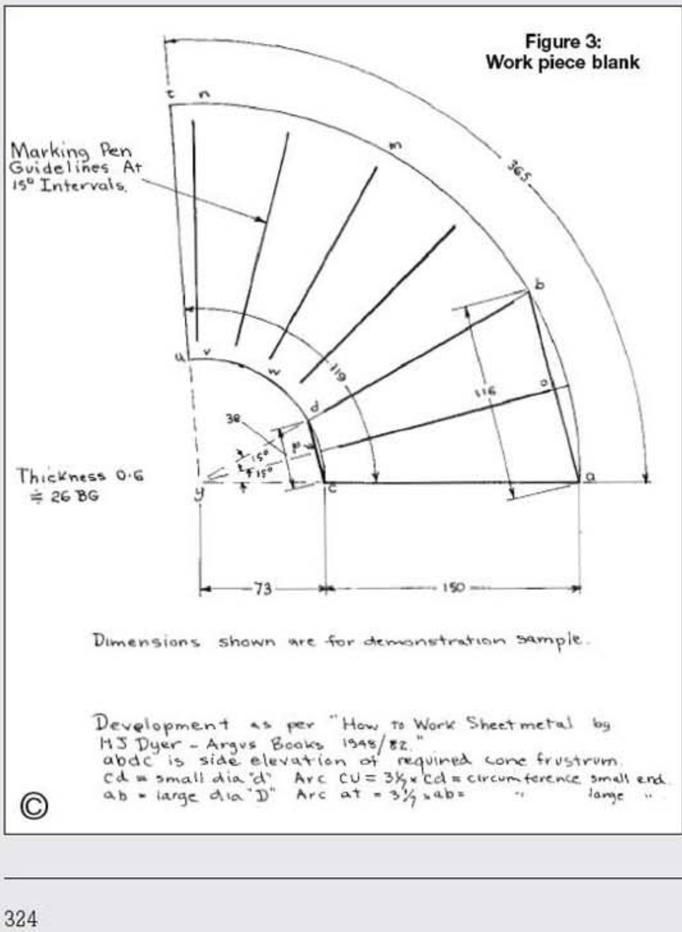

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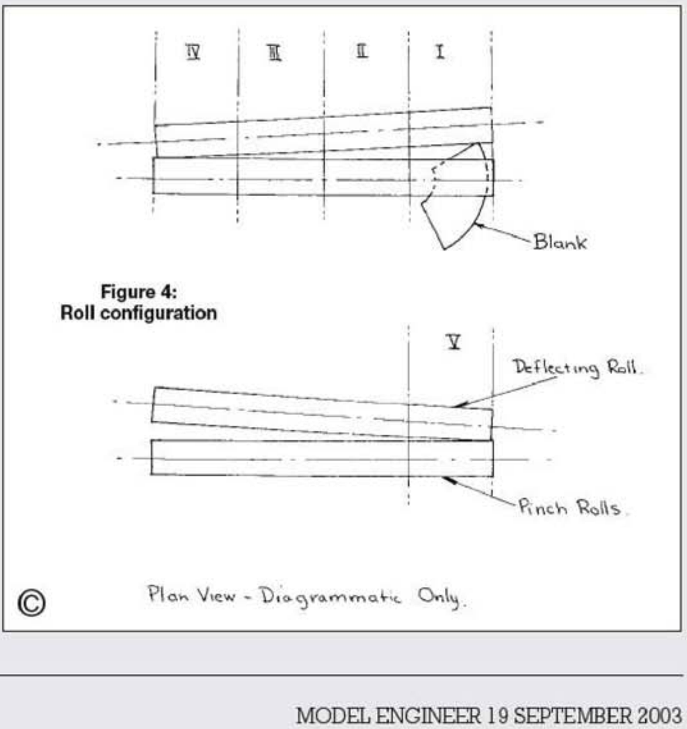
Figure 4: Roll configuration



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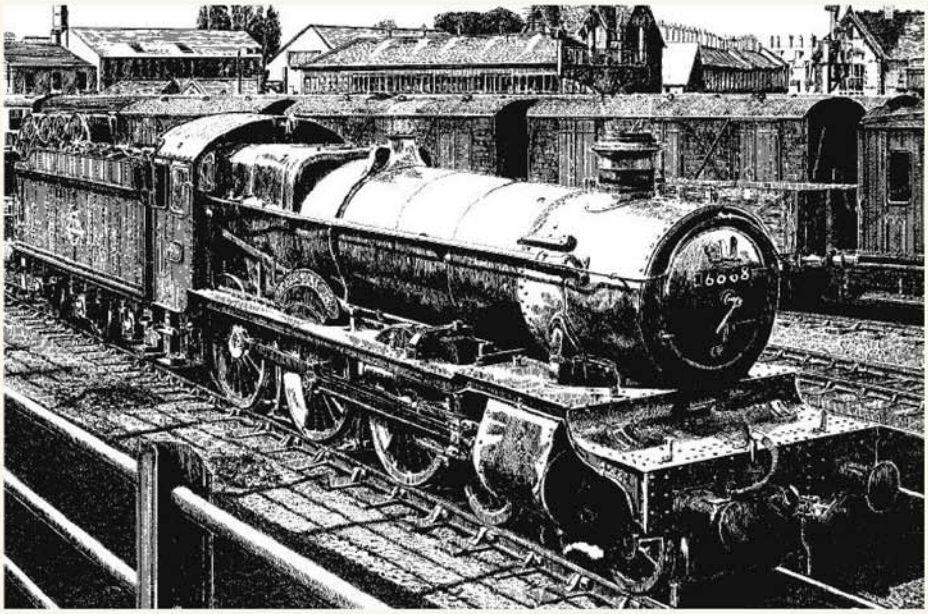


PENRHOS GRANGE

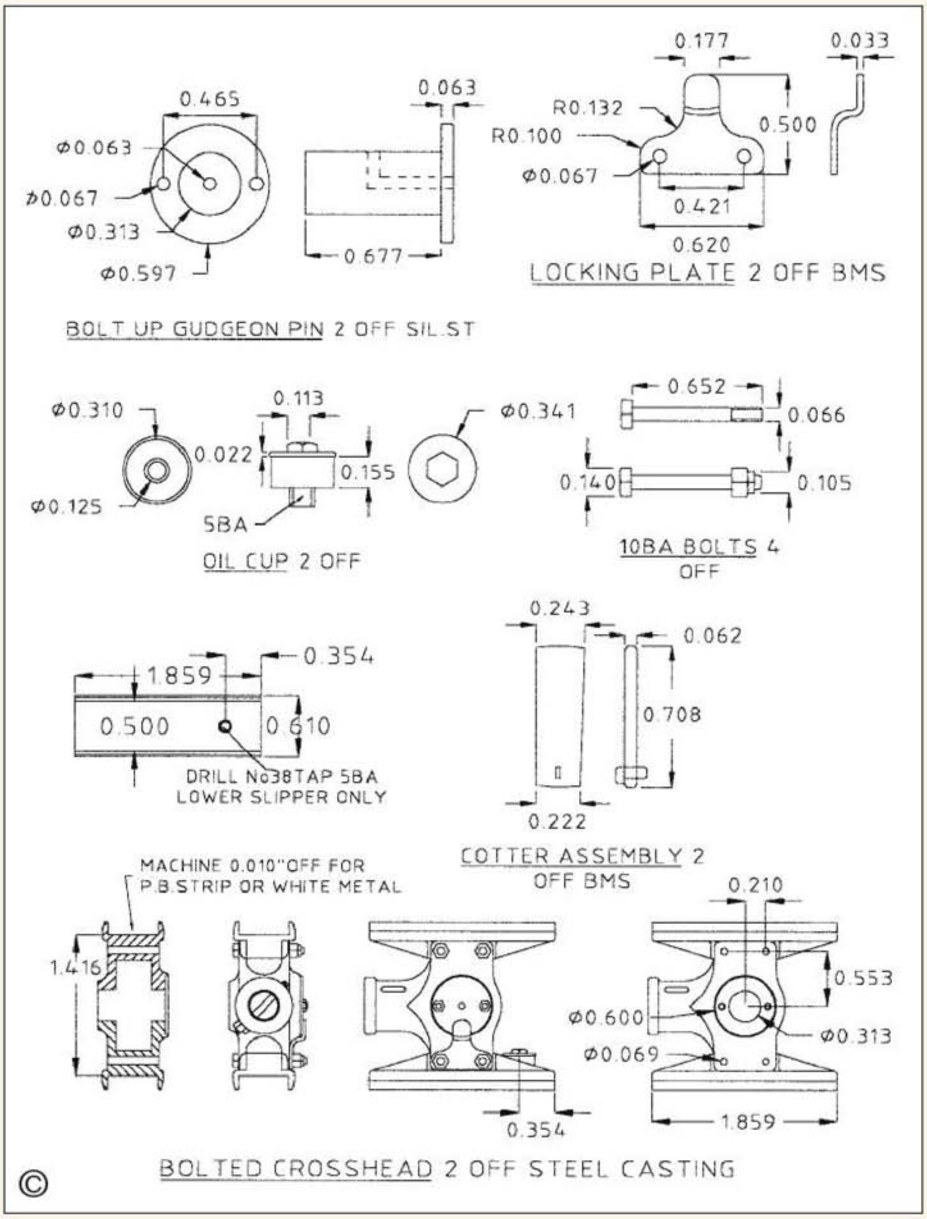
Neville Evans

discusses crosshead design and construction, both full size and miniature, for this fine GWR 68xx locomotive and presents a personal view of this year's IMLEC hosted by members of Bristol SMEE.

●*Part IV continued from page 260 M.E. 4190, 7 March 2003.*

Not an easy thing to make, this crosshead is not so difficult to produce as a steel investment casting. The pattern is in course of production as I write, and I'm hoping for great things of the final product. By the time you read this it should be available from Practical Scale (tel: 01639-883741).

The Great Western Railway outside cylinder crosshead started life at the turn of the last century when it was used throughout the range of new Churchward Super Locomotives. The original concept, of which many hundreds were made, was of a three piece assembly held together by means of four bolts. The centre piece was driven onto a tapered piston rod and held with a cotter. The slides were lined with white metal on the sliding surfaces. Minor modifications, such as extra oil boxes and the like were made, but no real change came until the slides came to be welded to the centre part, I think in the late 1920s.



The last major modification was a one piece crosshead, as can be seen on the original *Torquay Manor*. It must be emphasised that standardisation on GWR locomotives meant that the original equipment as used on No. 100 *William Dean* could be fitted to the *County of Middlesex* and *vice versa*. Please don't write in to tell me that the *vice versa* would be rather improbable because *William Dean* was broken up long before No. 1000 *County of Middlesex* was built; certainly much swapping around took place. Ivor Roberts and I tried to photograph crossheads at Didcot but found great difficulty as most of them had been painted black, black crossheads in a dark engine shed don't make for good cinema.

Magic Modeller Mike Williams pointed out, during the thinking stage, that if we followed Plan A, and cast in four dummy securing bolt heads, we would need two patterns, as the right hand side crosshead carries the drive for the vacuum pump. Actually we are going to doll up the vacuum pump so as to use it as a crosshead feed pump in the usual manner. We have therefore decided to compromise by modelling the welded three piece crosshead as used on most locomotives at some stage. Modellers of 'Saints', '2800s', 'Prairie Tanks', etc., will be able to drill through No. 51 and fit four 10 BA bolts, with full and lock nuts. The welded up ones will of course need larger holes in appropriate places. All will be made plain on inspection of the drawings.

I have specified a screwed piston rod joint which is simply pinned in place. Sticklers for appearance will be able to machine a slot right through and bash in a long thin cotter pin as per the drawing. The do-it-all-myselfers (and why not?) will be able to do it all themselves by ▶

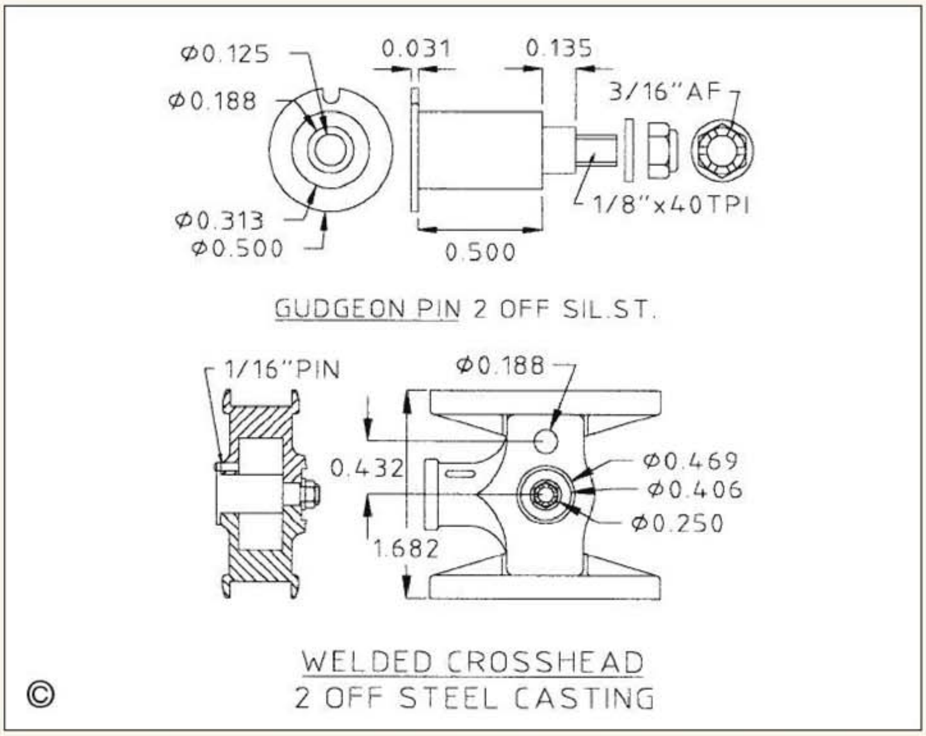
following the drawings for *Torquay Manor*. I shall include the information for the later one piece crosshead, when we come to the 'Halls'.

The earliest photograph that I can find of this device, is of *Adderly Hall* as built in 1928. Whether it was used before this time I cannot say. As to the sliding surfaces, there are two possibilities: we can either make provision for inserting a 0.010in. or so phosphor bronze strip in the top slider (actually, brass would do just as well), or machine out a recess, fill it with white metal, and machine back to size.

The gudgeon pins of the two crossheads that we are concerned with at the moment differ in that the earlier pin is assembled from the outside (Hurray!), being held in by two 10BA studs and a locking plate. The welded up one however is held in by a castle nut from the outside and has to be pushed out from the front (Boo!) which is not such a good idea as it's a bit of a wangle to reassemble. Make sure that the pins are a push fit in the crosshead, with the minimum of sideplay. I honestly don't think that we need expanding tapers and the like for a 5/16in. pin. After all you don't have such complications in an infernal combustion engine where, I suggest, conditions are a little more extreme.

Having gazed upon this crosshead until my eyes seem to be crossed in my head, I must say that it appears to me to be a thoroughly bad design. It is far too big, and therefore far too heavy, especially when it is being reciprocated at the end of a 30in. stroke. It must also have been very expensive to manufacture. If one considers the job it has to do, which is to constrain a rather fragile piston rod and gland set-up, then one wonders at the complication of it all. The simplest slide bar and crosshead is that fitted to the early mill engines, which were non reversing. This meant that the thrust from the crosshead was only applied in a downward direction, *if the engine ran clockwise* (see diagram below).

When applied to a locomotive however, whether railway or road, which perforce has to reverse, there has to be provision for the crosshead to be restrained in the opposite plane as well. In a passenger tender engine, which normally only pulls loads in a forward direction, the bottom slipper on a two slipper crosshead hardly ever touches the bottom slide bar at all and is therefore redundant most of the time. The situation on a tank engine is, of course, totally different. When pulling a load backwards, all the force is taken on the bottom bar, which is why the standard BR class 4MT 4-6-0s had the elegant Maunsell crosshead and slide bar, whereas the 4MT tanks carried the LMS two bar system. There is no doubt that the Gresley/Maunsell crosshead, with its combination of large surface area where it is needed most,



Winner of IMLEC 2003 was this LBSC designed Minx owned by Geoff Moore and driven by John Ellis.

coupled to the lightest possible weight, beats all the others hands down.

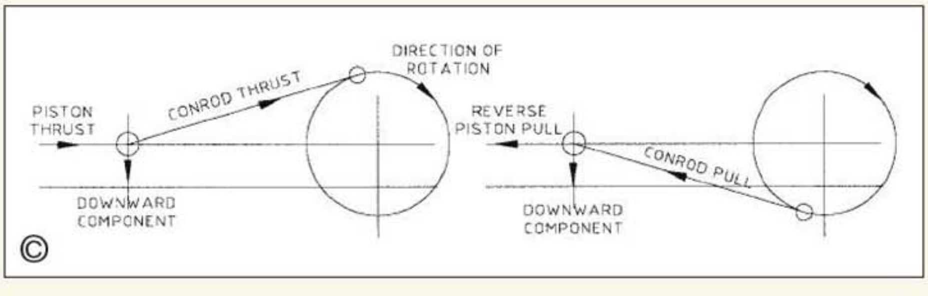
IMLEC 2003 at Bristol

This last weekend (time of writing) was spent at the Bristol society's track, watching what turned out to be a fascinating and very enjoyable International Model Locomotive Efficiency Competition. The weather was perfect, the organisation was superb which meant that the entire event ran like clockwork, the refreshment marquee was ran by a bevy of delightful ladies, who had produced some great food and all in all, I thought that if not the best ever, it couldn't have been far off!

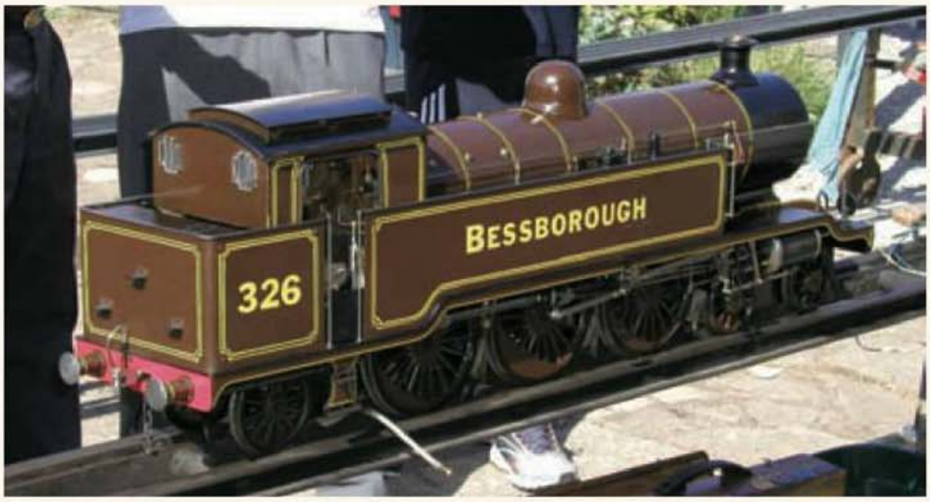
A few weeks previously I had been treated to a dissertation on 'How to Win the Competition' by one of the chosen few. All you needed was a huge locomotive with a vast grate area, a super-high boiler pressure, and half a hundredweight of lead distributed around the frames to give the required traction. He wouldn't dream of entering himself because it was beneath his dignity and his engine, a model of a 'turn of the last century' 0-6-0 was too small to be competitive. How wrong can you be! The worthy winner was a 50 year old *Minx*, built by my dear old chum Geoff Moore and driven with consummate skill by John Ellis.

The *Minx* was one of Curly's first excursions into 5in. gauge and was fully serialised in the late 1940s, together with *Maid of Kent* which was a SECR L1 4-4-0 and one of the most popular of the larger designs of its day. The *Minx* was a semi-scale-ish, Southern England-ish sort of goods engine, an 0-6-0 tender locomotive, which could be built in a variety of guises. Geoff's model has inside cylinders, Joy valve gear and a Belpaire firebox — in other words a *Maid of Kent* boiler.

In the 'words and music', as LBSC called his wonderful instructions, he mentioned that it would in fact be possible to swap fireboxes and



The large 2-8-2 US NG Pacific owned and driven by Andrew Harvey of Sherbourne (centre).



A neat and attractive engine, LBSCR J2 Bessborough *built, owned and driven by David Neish.*

A general view of the steaming bays showing a colourful array of 5in. gauge competing locomotives.

recommended it as a good idea. It seems that, as usual, he was right. The only departures from the original are that the pistons are made of aluminium alloy, carry 'O'-rings and run in gunmetal cylinders. This set up, with the rings slightly slack in the grooves, has proved to be totally reliable, despite the fact that the superheaters are radiant and extend to the back of the firebox. A stainless steel arch is fitted, nearly a third of the length of the box. The loco weighs about 135lb. in running order, carrying a small amount of lead ballast to bring the centre of gravity back to somewhere near the driving axle.

The *Minx* seemed to revel in the excellent coal provided by the host club, as indeed did all the other engines. Much of the credit is due to John Ellis, who drove the little locomotive like the master he is. I noticed that he slowed on the lowest part of the track so as to be able to exert maximum drawbar pull for a longer period on the climb to the station. I have been talking to Geoff, (who incidentally finished a very close second with his Gold Medal winning *Impala*, last year's winner) on the 'phone this morning. He told me that as a passenger behind the *Minx,* he noticed a maximum of 50lbf. pull, whereas he couldn't get anywhere near that figure with the larger *Impala* with three more people on board.

The facts speak for themselves. At half an hour each, the run times were the same; the distances run were the same to the nearest foot and yet the *Minx* returned a huge 565,400ft.lbf. of work done against the *Impala's* 442,000ft.lbf. Can anyone explain? The only thing that I can think of, barring a discrepancy in the dynamometer car readings, which I think we can reasonably discount, is that cunning old John was using his engine in a more fuel effective manner. If anyone can think of a better explanation, then please let's all hear it.

While the Sunday runs were taking place, the Dragon was photographing some of the engines which struck me as being of particular interest. One locomotive that caught my imagination was the huge Yankee 2-8-2 which included such features as a working and very effective steam reverser, a double acting feed water pump, Baker valve gear, three cylinders and a conjugated valve gear for the middle cylinder. The proud owner/driver, Andrew Harvey, who hails from Sherborne, down Dorset way, told me that the engine had been built by Tony Mattock, who seems to specialise in these vast, spectacular American locos. Andrew was given the NCB award for the most coal used, but tells me that he had a wonderful time, which is what it's all about anyway!

Bessborough, was built, owned and driven by David Neish. I have a soft spot for the huge tank locomotives that were built in the first quarter of the twentieth century. In my opinion, the two LBSC classes, one Pacific, the other Baltic, were among the best proportioned engines ever designed in Britain. They shared many features, as one would imagine, as they were both designed in Brighton, the earlier two, *Abergavenny* and *Bessborough* under the signature of Mr. D. E. Marsh, the seven 'Baltic' tanks, being brought out later by Lt. Col. L. B. Billinton.

The earlier engines differed from one another in that Marsh retired at the end of 1910, a month or so after the completion of *Abergavenny.* The second locomotive didn't appear for another two years and differed from the first in that it featured outside Walschaerts valve gear, which drove the inside valves through rockers, in place of the inside Stephensons valve gear of *Abergavenny*. *Bessborough* therefore became the mechanical prototype of the Baltic tanks, which used the same arrangement of motion. The smaller copy was driven in a quiet and very competent manner by Mr. Neish, to finish in a well deserved third place.

What did I learn? Chiefly that you can cut down on internal resistance to a large degree by using 'O'-rings, which barely touch the cylinder bores. That an aluminium alloy piston in a gunmetal bore seems to wear very little over the years. That you can use high superheat with the above combination, without trouble. That old Curly Lawrence knew a bit about locomotive design. That the Bristol club can run a splendid event without seeming to break sweat. Thank you, everyone.

●*To be continued.*

Left: North Accumulator Tower; centre: Magazine, and right: Footbridge over the canal .

HYDRAULICS AT THE ROYAL GUNPOWDER MILL

John Wilson

explains how he made a model to demonstrate the use of hydraulics at the Royal Gunpowder Mill, Waltham Abbey

Having taken early retirement in the Spring of 2001, I decided to offer my services as an unpaid volunteer to the Royal Gunpowder Mill, Waltham Abbey since when I have had a very interesting time with them. In early 2002 the Education Manager asked me to develop some simple projects to demonstrate the use of hydraulics, particularly in respect of their use at the Mills.

Before I go any further, perhaps I should explain how hydraulics were used at the Royal Gunpowder Mills. To do so we have to go back to 1364 and the battle of Crecy which was the first recorded use of gunpowder by English troops. At this time the powder (charcoal, Saltpetre and Sulphur) was mixed by hand in mortar and pestles, but this limited the amount and quality of the powder produced.

Leaping forward to 1665, the production of gunpowder at the site of what is now the Royal Gunpowder Mills, is believed to have begun under the ownership of the Hudson family.

In 1702 William Walton purchased the site and production continued unto 1787 when William Congreve, realising the importance of a consistent quality of gunpowder, persuaded the Government to purchase a number of private mills to guarantee both supply and quality. Thus the Royal Gunpowder Mills was created.

Early in the development of gunpowder, it was found that pressing the powder in screw presses (**fig 1**) gave a considerable improvement in the quality of the resulting product. With the invention of the hydraulic press by Joseph Bramah in 1795 (**fig 2**) powder quality took another leap forward, so that tests carried out at Marlborough Downs by Congreve between 1809 and 1810 show the quality of the powder from the Government owned mills out-performed that from privately owned mills.

The test consisted of firing a 10in. naval mortar using 9lb. of powder. The Royal Gunpowder Mills consistently fired to 4,430 yards with the Royal Mills at Faversham coming a close second with 4,360 yards. The best private mill was Pigou of Dartford with 4,270 yards and the worst was Gorbridge in Scotland with 3,801 yards.

The next step forward was to turn Bramah's presses from hand power to water power by building two water wheel driven four-cylinder piston pumps to deliver a pressure of 70tonf./ft.^{2} to their respective presses (**photos 2** and **4**).

The final stage was the introduction of steam power to the hydraulic system, and with it a network of hydraulic pipes spread out around the site to power various presses. No information can be found on the engine other than it was probably a horizontal compound, possibly of 30hp.

Obviously it is desirable to give a steady and constant pressure on the hydraulic main, and to this end two accumulator towers were built, the first to the north (**photo 1**) and the second about a quarter mile to the south. Again, no records can

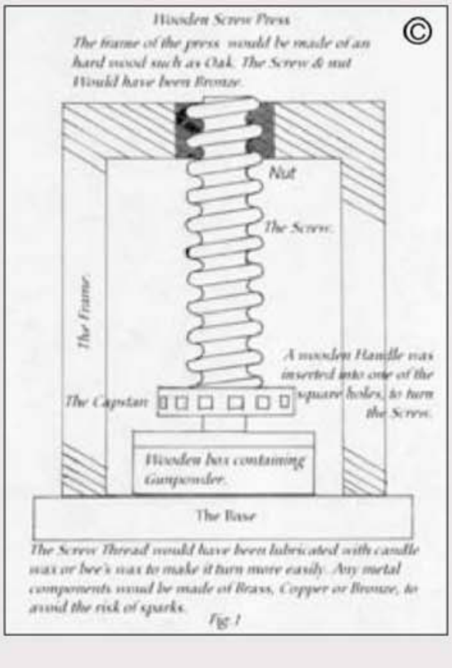
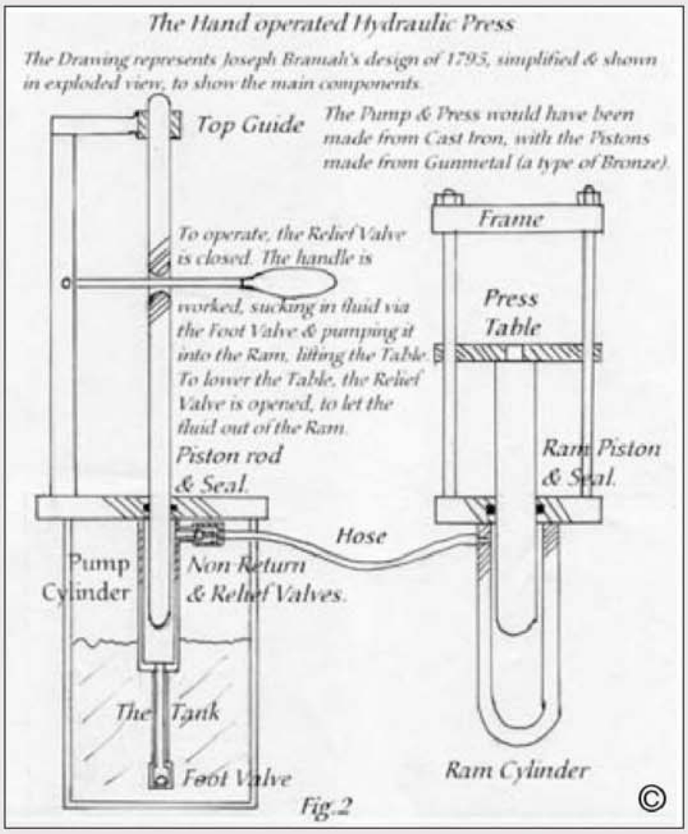


Fig 1

Left, the Traverse or Blast Wall with the Waterwheel and Pumphouse on the right. The Press is just out of sight behind the Traverse.



The Author's completed model. Left: the Pump and Reservoir; centre: the Accumulator, Gauge and Control Valve and right: the Press.

be found to suggest how big the accumulators were. The bridge to the right of the tower in photo 1 is for foot access across the canal.

For those not familiar with the principle of the accumulator tower, it is basically a large cylinder with a free moving, weighted piston sliding into it. The hydraulic fluid (usually water) is pumped into the base of the cylinder, lifting the piston and weight. Once under pressure, the accumulator serves two purposes. First, it acts as a 'battery', storing energy until required; secondly it also acts as a damper to smooth out the action of the piston pumps as they reach the end of their stroke, when there is a pressure fluctuation. The tower also damps the action of valves being opened and closed.

The project

We now come to the project I decided to build to demonstrate the described principle. Wherever possible I used scrap materials; the only things purchased were 9 off 6mm x $^{1}/_{8}$ BSP hose fittings and 2 metres of nylon tube.

Photograph 3 shows the model at rest. The single acting hand pump is to the left and consists of a piece of $^{1}/_{2}$in. silver-steel for the pump and a piece of $1^{1}/_{4}$in. mild steel hexagon for the cylinder. To the right of the pump is the accumulator consisting of an old air cylinder of $^{3}/_{4}$ bore by 4in. stroke mounted vertically in an aluminium alloy flange and secured with Loctite.

The weight was constructed from two baked bean cans soldered together after first cutting out the bottom of the lower can. Into the baked bean cans are inserted two tins which once held new potatoes, pre-soldered and again with the base of the lower can removed. To centralise the potato cans inside the baked bean cans, packing pieces were inserted and the gap between the cans then filled with lead shot. To keep the shot in place I then ran a blowtorch over the lead to melt the top layer and used soft-solder and flux to bond the lead to the walls of the cans to a depth of about $^{1}/_{2}$ inch.

Finally, an aluminium alloy plug was made to a sliding fit over the stepped end of the piston shaft and a tight fit in the weight. This allows the weight to be removed for transport. I don't know what the final weight of the accumulator was as I haven't any kitchen scales with a large enough range to weigh it, and my bathroom scales died years ago from the abuse of my weight on them.

To the right of the accumulator is the pressure gauge rescued from an old foot pump, and in front of the gauge is the control valve, again made from $^{1}/_{2}$in. dia. silver-steel for the spindle

The Press was driven by a water wheel powered four-cylinder piston pump.

and $1^{1}/_{4}$in. hex. for the body. The valve ports are simply two flats cut 90deg. apart on the valve spindle. So, as you see it now, with the spindle turned to the left, the press cylinder is venting back via the central port to the rear port and then to the reservoir. With the valve lever turned to the right, the central port to the cylinder is connected to the accumulator (front port on valve body) and the press will then close, assuming the accumulator has pressure stored in it.

The last item is the press. For the ram, I used an old $^{5}/_{8}$in. by $^{1}/_{2}$in. bore air cylinder with a spring return. I should point out that all the presses used on the site had rising tables, with the early types, such as is shown in photo 4, being single acting and using gravity to open them. The more modern cordite presses were double acting, using pressure to open as well as close them. The sliding and fixed parts of the press were made from some 2in. by $^{1}/_{4}$in. plate and the base was odd bits of scrap from other jobs, all mild steel of course. Beneath the wood frame which carries the components you can just see the reservoir for the oil (an old tin). I had no light hydraulic oil to hand, so I made up my own mix *al la* Sharp and Brown surface grinders, one part lubricating oil oil to one part paraffin.

The base, by the way, is a piece of old whitewood shelving. The whole rig works very well, with no oil leaks and the accumulator holds a pressure of 18psi which is ideal as we don't want the youngsters sticking their fingers in the press and squashing them do we? As regards pressure a heavier weight on the accumulator piston would raise the pressure considerably. While experimenting I got it up to 25psi with only a small additional weight.

Addendum

For anyone interested in finding out more about hydraulics and/or the UK Gunpowder industry, I can thoroughly recommend two Shire publications: *The Gunpowder Industry* by Glenys Crocker and *Hydraulic Machines* by Adrian Jarvis.

ROAD STEAM

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

Martin Wallis
brings his acclaimed series to its close with notes on lagging and cladding, motion plates, name plates and painting and lining.
●*Part XVI continued from page 211 (M.E. 4202, 22 August 2003)*

Sitting here writing Part 41, the final few details of *Little Samson*, is quite sobering. The series has now run for almost four years and a great deal has been covered. Regular readers will be well aware of the team work nature of the undertaking, most of the pictures being the work of *Little Samson* builders. It will seem very odd to move on, but move on I must. However, the bits as yet not covered are as follows:

Mechanical lubricator

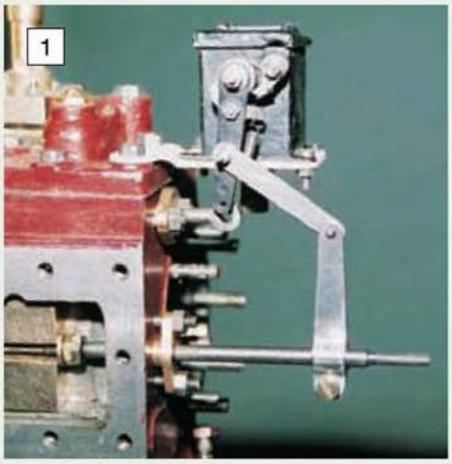
Some full size *Little Samsons* had mechanical lubricators, and others not. Those without mechanical lubricators had displacement lubricators, which will certainly deliver the oil but are notorious for delivering it in 'gulps' rather than the steady supply of a mechanical pump. The mechanical pump will also pump oil according to the speed of the motion: the faster the engine runs, the more oil is delivered.

Most builders will buy their mechanical lubricator either complete in a ready-made little box with lid, or just as the internal 'works' to fit in a box of their own devising. The commercial lids are usually pressed brass affairs, which push on. I would prefer to make up my own box myself and fit a hinged lid. Apart from looking better, it is not possible to drop and lose a lid that is hinged to the box. A close scale box, which is rectangular rather than square in section, is easily achievable. A bracket will be required, either sharing the cylinder head studs, or fixed by studs and nuts from the vertical face of the cylinder above the trunk guide. Stan's mechanical lubricator arrangement is shown in **photo 1**.

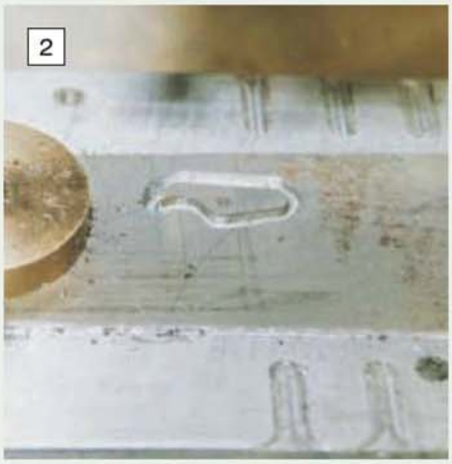
Lagging and cleading

Any discussion on lagging and cleading will inevitably need to consider the materials to be used. The lagging is the thin layer of insulating material below the sheet metal covering which is called the cladding. The boiler cladding is held in place with brass bands secured beneath the barrel with small brass fixings.

Many years ago the lagging would probably have been asbestos matting or asbestos string wound around the barrel. These days, quite rightly, asbestos is unacceptable for health and safety reasons and substitutes are used. I understand that several proprietary materials are available but thick felt, fibreglass, or wool matting is probably just as good. My two penn'orth is for using nothing at all, just fresh air. The logic is that oil, water, and general grime will run down the cylinder and drip off the motion eventually being soaked up by the lagging. A sodden oily mat has minimal heat insulating properties. Using self-adhesive tape, I therefore simply fix a few pieces of wood ($^1/4$in. square on 3in. *Little Samson*) to pack the lagging away from the barrel, the lagging holding the wood in place. I have used this method successfully on

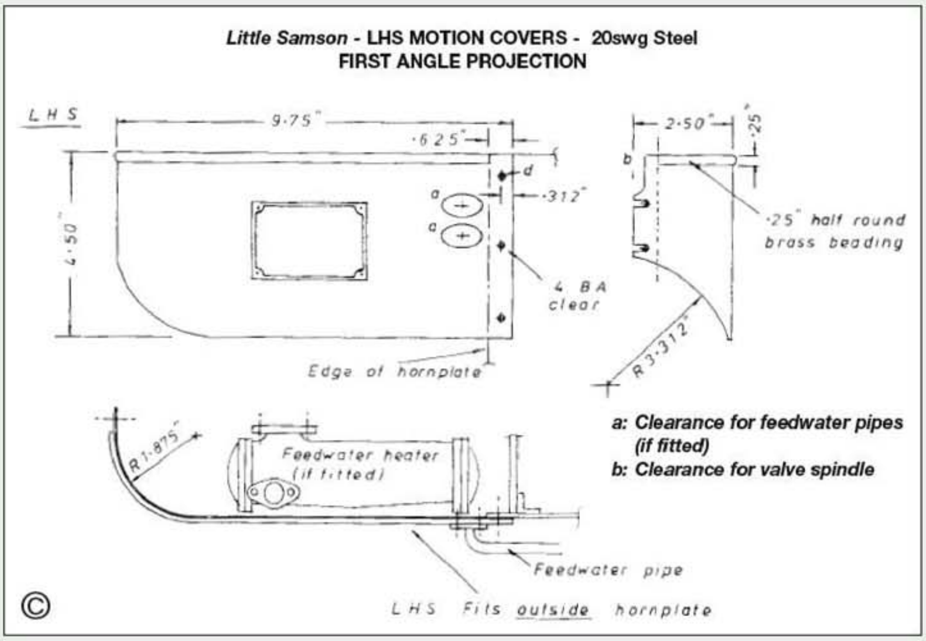


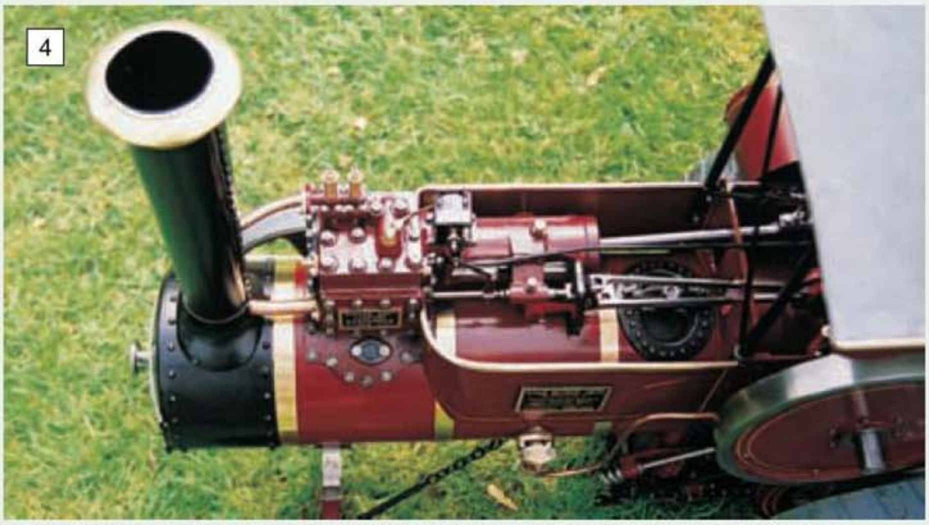
Stan Nipper's 3in. scale mechanical lubricator. The drive is picked up from the valve rod.



The wonders of CNC: cutting out the pawl for Stan's mechanical lubricator.

Right: the completed LHS motion plate; it is finished with half round brass beading. (Photos 1 - 3: S. Nipper)





Plan view of the fitted motion covers showing the room available for fitting a feed water heater. Note the large cut out in the boiler cleading for the manhole.

A washer is placed over a bolt fitted in the clack boss to mark out the clearance hole in the lagging.

Left: four freshly painted lagging plates are laid out to dry. The cladding is in two halves, split at the top and bottom. (Photos 4 - 6: S. Nipper)

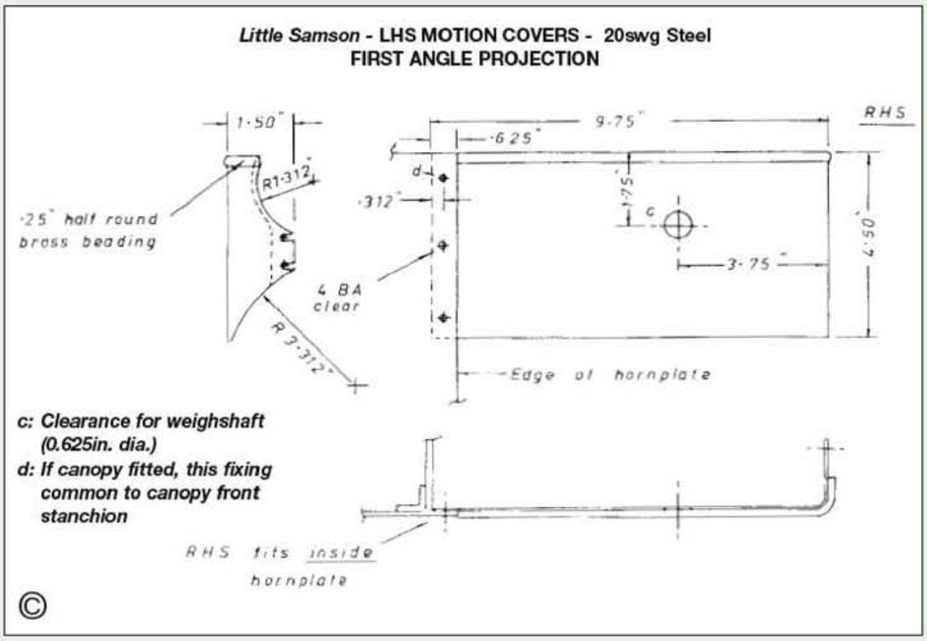
all my engines, except for the half size Fowler where timber has been used.

For the cladding I use sheet steel. The paint will stick much better although there are some very good etching primers around if brass is preferred. I have never seen rusty boiler cladding on a model, there is too much oil around. Steel is also cheaper. Don't be tempted to use galvanised steel, the paint will not stick. The lagging should be packed away from the boiler to come flush with the outside of the smokebox. A rectangular slot will probably need to be cut in the cleading to clear the expansion link lifting arms when in their lowest position, i.e. for forward running. This is best established on assembly.

On fire

Full size road steam engines used wood lagging; a wooden hoop was pulled around the barrel to which longitudinal strips of wood would be pinned.

Several years ago when arriving at a rally I was greeted with the news that a certain showman's engine had caught fire, and that a fire engine had been called. The lagging had caught fire just below the blast pipe under the exiter bracket. Just how it became ignited I have no idea, but it was burning steadily as witnessed by the lack of paint. The lack of oxygen under the cladding slows combustion considerably but also made it virtually impossible to get water onto it. The front two brass bands were loosened and water squirted in. I know of only one other engine to have suffered this fate, it was put in the shed on a Sunday and by the Friday afternoon of the next week when next visited the cleading was minus most of its paint. When removed there was, I am told, enough charcoal for a whole season's barbecues!



Motion plates

These are made from sheet steel and topped with a brass bead. Some builders will opt for brass rather than steel for the side panels; the same observations applying as for the lagging. In 3in. scale each motion plate is fixed to the hornplate by three 4BA fixings, if a canopy is not fitted, and to the cylinder by two 4BA fixings. Studs and nuts are better than screws or bolts as it is easier to remove and refit the motion plates. Fitting the nuts at the cylinder end will still be a fiddle, working inside the confines of the motion, but that cannot be helped. The works photos detail the right-hand motion plate fitting inside the hornplate, a neat arrangement, sharing the canopy support nuts and bolts, but with a canopy, a much easier assembly would be afforded by fitting it outside. This is left to the builder's discretion.

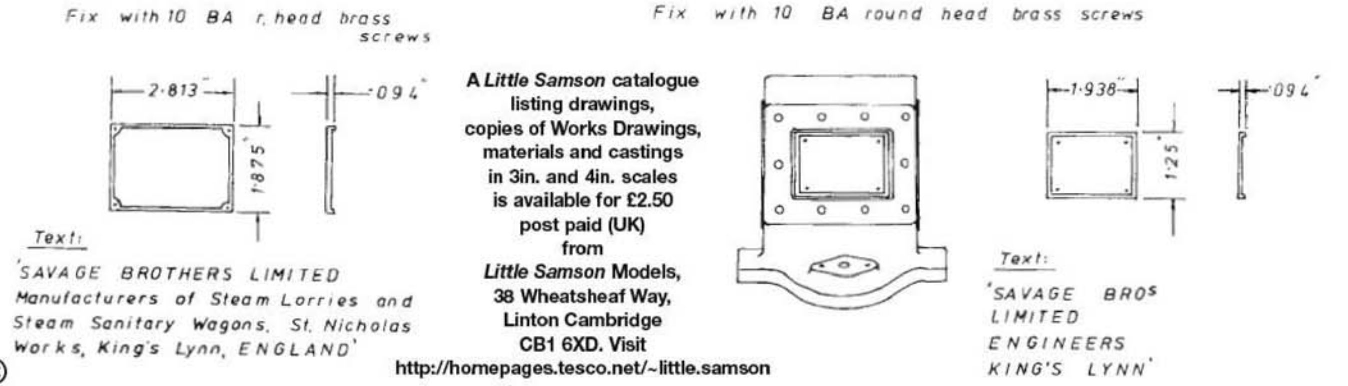
The left-hand motion plate has quite a tight bend of about 0.25in. radius, and is profiled to meet the cylinder and boiler barrel. Card templates are essential to finalise dimensions. The clearance hole for the weighshaft should be confirmed on the model. The right hand motion plate will need a few clearance holes for the pipework if a feed water heater is to be fitted.

The brass bead is best soft-soldered on, achieved with a row of little G-clamps, moving them along the joint as soldering progresses. I do not advise riveting, even with brass rivets, as you will always see them. I am not thinking so much of mechanical marks and blemishes, which may be carefully draw filed away, but when tarnished a slight colour mismatch is almost inevitable. Make certain all the flux is removed for if it isn't, in due course it will lift the paint.

Nameplates

I can say with some confidence that the nameplates are close scale, and I am very pleased with them. They are detailed in the works photographs with greater or lesser clarity, depending on the picture, and happily examples still survive. I was indeed given the loan of

Little Samson **- MOTION COVER & VALVE CHEST NAMEPLATES - LOST WAX CASTINGS**
FIRST ANGLE PROJECTION



A *Little Samson* catalogue listing drawings, copies of Works Drawings, materials and castings in 3in. and 4in. scales is available for £2.50 post paid (UK) from *Little Samson* Models, 38 Wheatsheaf Way, Linton Cambridge CB1 6XD. Visit http://homepages.tesco.net/~little.samson

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several Savage nameplates including, as previously mentioned, the round plate which fits on *Little Samson's* gear guard. Such an opportunity was not to be missed and all were photographed and, with permission of course, copied by casting in aluminium alloy.

Our miniature nameplates are neat little lost wax castings which require a minimal amount of cleaning up. The lettering has to be in 'mirror writing' and this was produced on a CNC machine. The font chosen was so close a copy of the original as to be indistinguishable, well worth the hunting through the 50 or so fonts the software had in stock. To prepare the pattern, molten wax is injected under pressure into metal moulds with a little machine of my own devising. Heat to melt the wax is provided by a soldering iron element with a thermostat to regulate the temperature, brute force for injection by the rack and pinion on the drilling machine. I do not know what pressure this will deliver but I do know that if the moulds are not properly shut, molten wax will be fired over 20 feet!

A minimal amount of cleaning up is necessary. The round nameplate may be given a very light skim in the lathe and the rectangular one gently filed. The rectangular plates are thin enough to be used as purchased but if builders wish to take a skim off the back, the internal stresses may be relieved and the casting may distort. I had experience of a cast nameplate on a different 4in. scale model which was much too thick as supplied. When machining the back it distorted so badly it had to be corrected with a mallet, but despite this heavy handed treatment it seemed to come to no harm.

There is a lot of text on the motion cover name plate which, in 3in. scale is quite small. Happily the lost wax process seems to cope very well. The surface of the text needs no more than a rub

7

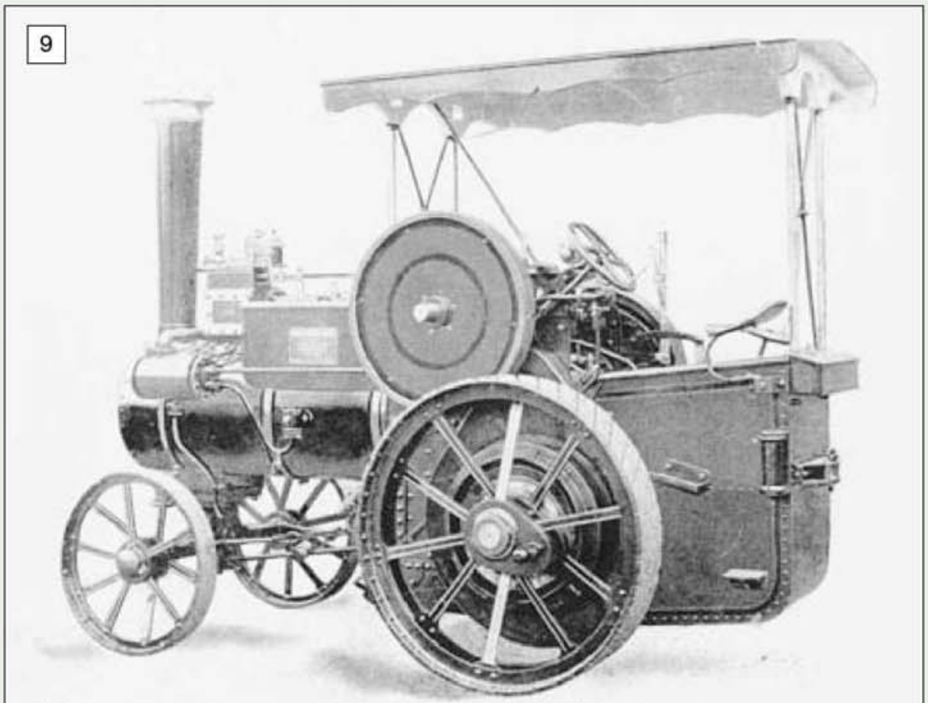
8

Above left: an original Savage nameplate, almost certainly from a* Little Samson. *(Photo: M. Wallis)

Above: a set of 4in. scale name plates before cleaning up. (Photo: P. Kybert)

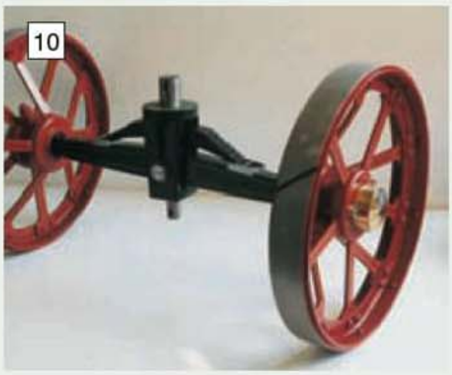
Below: David Hall's painted and lined front wheels. (Photo: B. Camps)

9



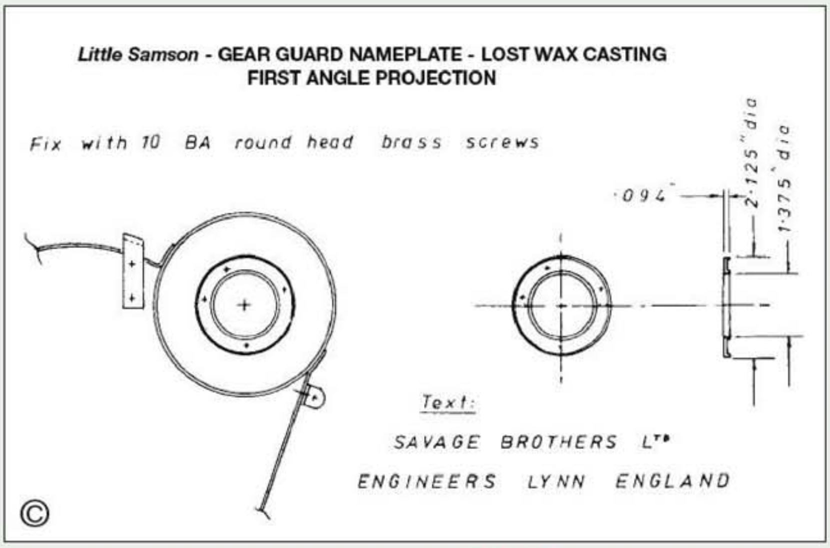
Works photo of a little Samson on steel wheels. The lack of sign writing on the canopy suggests the engine has yet to be sold. Both displacement and mechanical lubricators have been fitted.

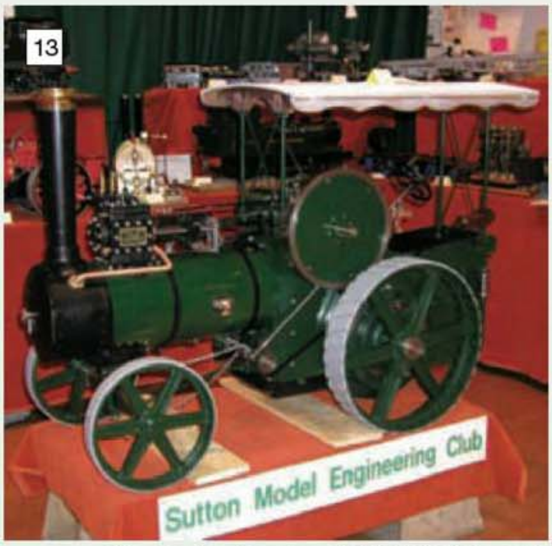
10



Stan's Little Samson *at its first steaming.*

Stan Nipper and the first Little Samson *to be completed. Stan's pictures, comments, observations, and encouragement have played a key part in the writing of these 41 articles. (Photos 11 - 12: S. Nipper)*





John Freeborne's engine at MEX 2002. This model has provided the illustrations for the 4in. scale engine build, plus many pages of helpful comment which, with the photos taken by his friend Peter Kybert, have been invaluable. (Photo: P. Kybert)

with a dead smooth file. It is then painted and allowed to dry thoroughly, the face of the letters may then be rubbed with dead smooth wet and dry paper used wet, to remove excess paint and return the lustre. Some folk like to give their nameplates a dusting with clear varnish to prevent tarnishing.

Painting

Painting and lining has been covered in some detail in *Road Steam* before (see *M.E.* 4077 and *M.E.* 4079, 25 September and 23 October 1998). Some builders will choose spray painting and others will prefer to apply their paint with a brush. I have had every satisfaction with brush painting, choosing a warm but not hot day and taking precautions to avoid dust and other stray particles which may spoil an otherwise excellent paint job. Make sure to use a good quality enamel or similar paint, a trip to any model engineering exhibition offering plenty of choice.

Regrettably I have no definitive details concerning the correct colours for *Little Samson* despite studies of Road Locomotive Society folios and visits to the Kings Lynn museum where the Savage records are held. So, maroon has proved popular, which was the chosen colour of the Savage centre engines, Mr. Hearle has painted his black — readers will recall the pictures a few articles back. John Freeborne has painted his 4in. engine green, including the nameplates, and certainly looks good for it.

Lining

The best picture of a lined out *Little Samson* is included in **photo 9**. The basic scheme is a thick black line with a thinner line each side of it. If the engine is painted maroon I would guess the thick line to be black with yellow lines both sides of it. A black or green engine would have a thick red line and two thin yellow lines each side of it.

Whether lining with a draughtsman's bow pen, a roller pin striping tool or Bob Moore's Master lining pen (see *M.E.* 4085, 15 January 1999) it is well worthwhile to make guides or templates to run the tool or pen against. The circular lines on the flywheel should be done with the lining pen held in a pair of compasses with the point dead in the middle of a plug in the bore. Lining on a flywheel which does not run concentrically looks awful, especially when the engine is ticking over.

There is not really enough depth on the canopy side boards for full block lettering. However, the photographs prove that most contemporary engine owners did manage to fit some in. No doubt the modellers who wish to will also find a way.

Our completed *Little Samson* may now be taken to a local club or society for its steam test and I trust will then give the owner years of happy steaming. Three have now been steamed and I am pleased to say have given every satisfaction.

Road Steam: what next?

Well, as readers are aware a 3in. Savage steam wagon series is very much planned with builders working on examples both to prove the drawings and to provide pictures for the series. However, rather than run two construction series back to back an interlude will now follow considering *Road Steam* design and practice with reference to both full size and model engineering practice. It is hoped readers will appreciate the change and it will also give the wagon builders more time to get further ahead.

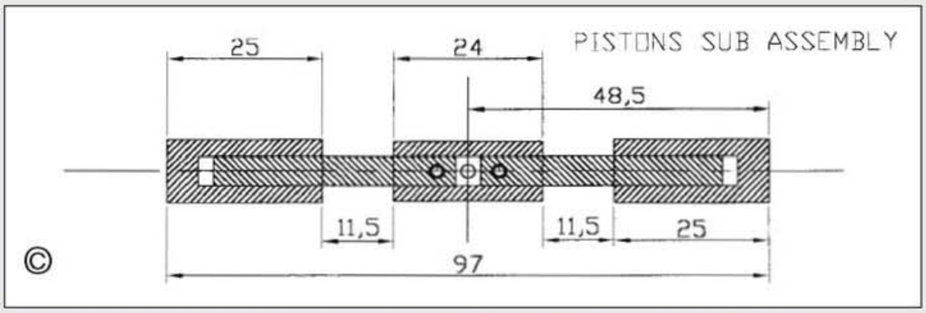
I must take this final opportunity to thank all the members of the *Little Samson* team for their help and assistance. A third engine finished is the beautifully made engine by David Hall and photographed by Brian Camps. It will almost certainly have been steamed by the time this article is in print.

In addition Jonathan Milne-Fowler, working in Australia, has sent me many pictures and notes of his wonderful 1in. *Little Samson* which, due to moving house, has been rather overtaken by the series. The 12in. to the foot *Little Samson* has made steady progress but, likewise, was slowed by other activities, namely the need to build a new workshop to give the builder enough room to assemble it. In due course it is hoped to publish an update of both these two engines.

A TWIN-CYLINDER TWISTY

Les Kerr
in Australia, continues his description, starting with the pistons

●*Part II continued from page 219 (M.E. 4202, 22 August 2003)*



I used a piece of 1/2in. dia. cast iron for the pistons. Working in the lathe, drill and ream the 3/16in. hole. Running the lathe at high speed, reduce the diameter by a small amount at a time until it will just fit into the cylinder. Part off to length and clean away any burrs on the ends.

Piston connecting bush and piston connecting rods (2 off)

Chuck a piece of 1/2in. dia. brass in the lathe and drill and ream the 3/16in. hole. Reduce the outside diameter to 9.5mm. Part off to length. Drill and tap the centre hole 6BA as shown on the drawing. Take an 80mm length of 3/16in. dia. silver-steel and fit it into the bush so that an equal amount protrudes from each end. Fit and tighten a 6BA screw to hold the rod firmly in place. As there is no adjustment on the timing in this engine each piston should be identified, and the end of the connecting bush into which it fits. I did this by scoring two lines on both parts on the left side and one line on the other.

Offset the drill 5mm along the X-axis and drill and tap the hole 8BA. Open out the hole to 2.4mm to a depth equal to the thickness of the tube plus the diameter of the hole in the tube. In my case this was 0.45 inch. Repeat for the last hole. Undo the 6BA screw and carefully remove the 3/16in. dia. rod. Cut the rod in half and, using the centre of the hole as a reference, reduce the rods to the sizes shown on the drawing.

Connecting bush screws (2 off)

Turn up two screws from a piece of 1/8in. dia. brass, as per the drawing. Make sure that they are a tight fit in the piston connecting bush.

Piston sub assembly

Using the screws, fit the two connecting rods into the correct holes in the connecting bush.

Make up two temporary spacers as shown in the drawings. Be as accurate as possible with the 11.5mm length. Fit the two 11.5mm spacers and the pistons onto the end of the rods. Check that the length between the ends of the pistons is 97mm. If it is slightly out, adjust the thickness of the spacers so that the end of each piston is exactly 48.5mm from the centre of the middle hole in the connecting bush. Once complete, secure the pistons using Loctite. Clamp the assembly until the adhesive cures. Undo the two screws and remove the two spacers. Clean away any excess Loctite.

Cylinder sub-assembly

Mount the two cylinder supports onto the cylinder and, using 2 off M4 x 25mm hexagon head screws, attach the supports to the base. Remove the cylinder. Make up temporary spacer 2 that is used to ensure that the cylinder is centrally spaced between the supports. Also note the orientation of the cylinder as shown on the cylinder sub-assembly drawing. Fix the cylinder to the supports using Loctite. Remove temporary spacer 2.

Using 8BA x 1/4in. hexagon head screws, attach the cylinder covers to the collars. Secure the assemblies each to the end of the cylinders using Loctite. Avoid using too much Loctite, as we do not want the covers to be permanently attached to the collars. Once the adhesive has started to set remove the covers and wipe away any excess Loctite.

Ball shaft

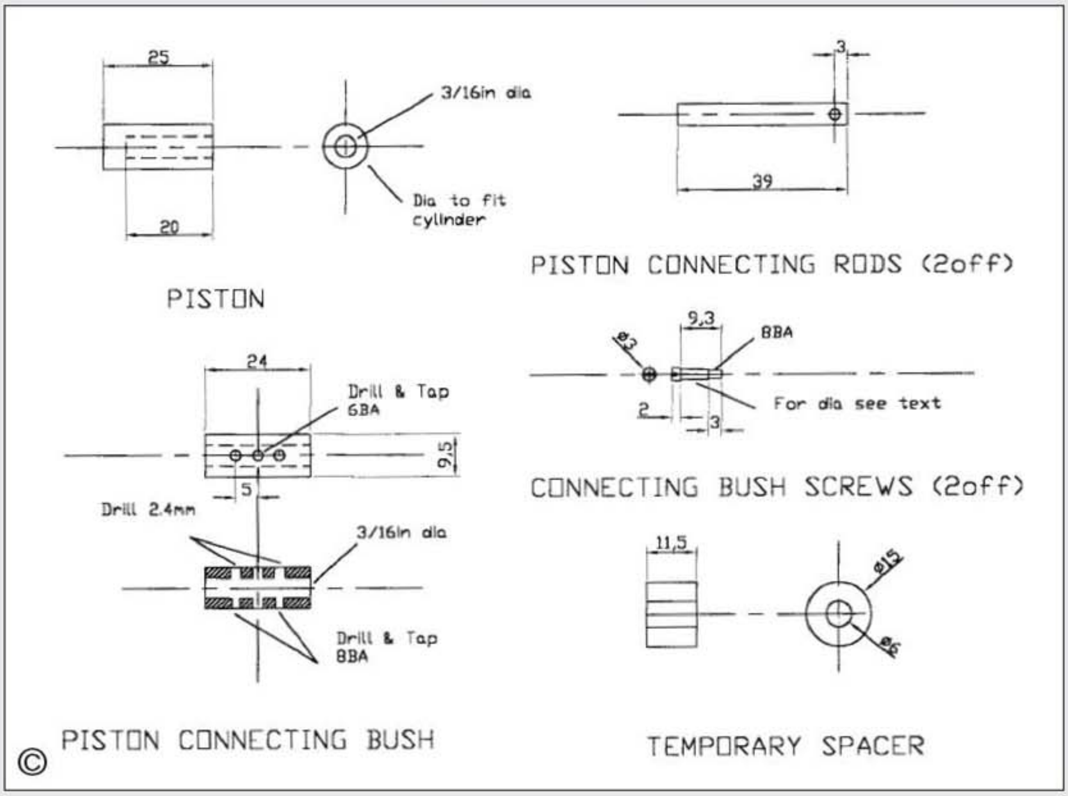
I made this out of a bronze ball and a piece of 1/8in. dia. brass rod. Steel would be a better choice. Hold the ball in the 3-jaw chuck and drill a 2.8mm dia. hole 2.85mm deep. Chuck a piece of 1/8in. dia. rod and reduce its diameter for 19mm so that it just fits into the ball. Thread the end 6BA for 10mm. Part off to a length of 17.54mm. Fit the ball onto the end using Loctite so that the total assembly length is 19mm.

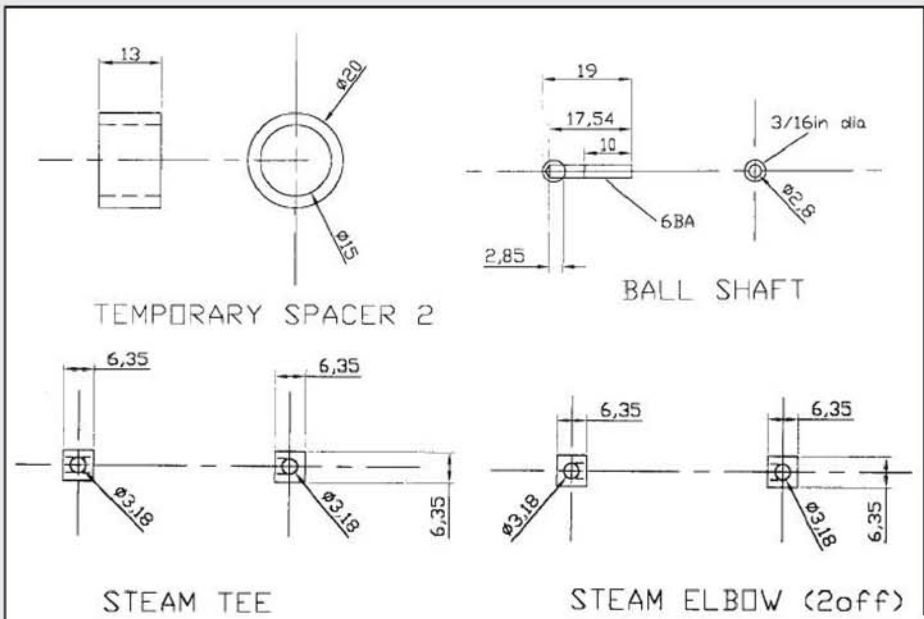
Initial assembly

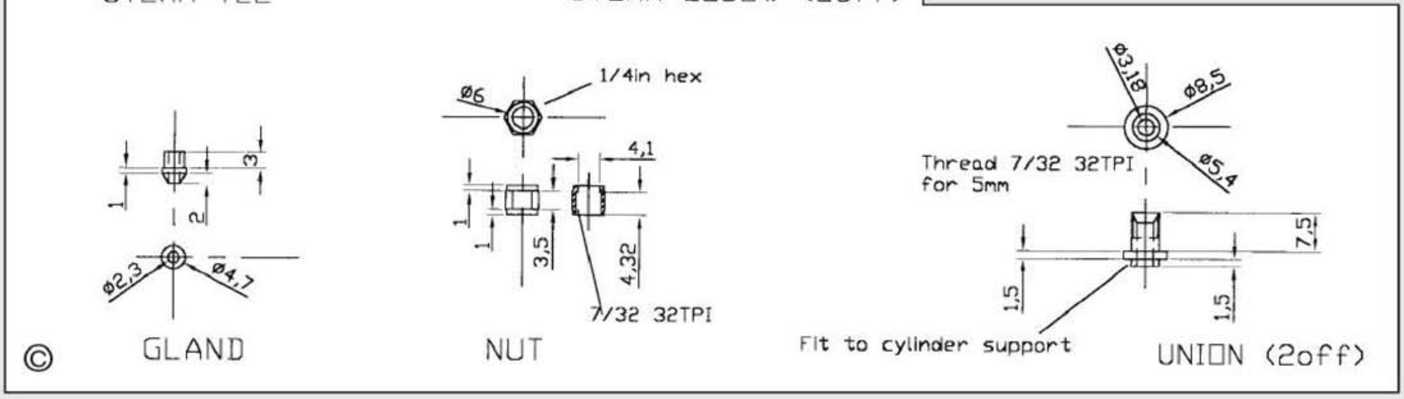
Undo the 2 off M4 screws and remove the cylinder with its supports from the base. Clean all the parts to ensure they are free of oil and debris. Push the crankshaft into the bearings and, using grub screws, fit the two pulleys as shown on the drawing. The pulleys should rotate freely.

Slide the connecting bush into the centre of the cylinder and fit the correct pistons via the cylinder ends into the bush. I found that the tip of a scriber is the easiest tool to use to align the two holes. At the same time mark the cylinder supports with the number of the piston that slides into that end. Lock the pistons in place with the two screws. Screw the ball shaft into the connecting bush.

Mount the cylinder assembly







onto the base and at the same time align the ball with the hole in the small pulley. Again mark the base at each end with the number of the piston that is mounted there.

By rotating the large pulley, the piston assembly should move from one end to the other and at the same time rotate back and forth. At this stage it will be naturally quite stiff.

Adjust the amount the ball shaft screws into the connecting bush so that there is no chance that the ball can escape from the small pulley. If everything is okay, the piston should miss each end of the cylinder bore by 3.5mm.

Piston ports

The next thing we have to do is cut the slots in the side of the pistons. To hold the pistons in this and the lapping process, I made up a set of split jaws. I chucked a piece of 1/2in. dia. brass hexagon about 1in. long and drilled and reamed a 3/16in. hole all the way through. Using a scriber I marked the hexagon flat where the outside of chuck jaw No. 1 made contact. This way the hexagon, once removed, could be returned to exactly the same position in the chuck. Using a slitting saw I split the hexagon into two parts along the axis of the hole.

By holding a 2mm dia. scriber with a 60deg. angle point in the cylinder ports one at a time and moving the large pulley slowly, the scriber will scratch two ellipses on each piston. These ellipses are shown on the piston ports diagram. Dismantle the assembly.

Using a 2mm dia. slot drill and holding the piston using the split jaws, align the centre of the cutter over the edge of the minor axis of the ellipse. Machine the ports as shown to a depth of 1.5mm. On the exhaust ports drill the 2mm holes to a depth of 1.5mm and using a miniature drill such as a Dremel or similar unit, extend the slot as shown. Repeat for the second piston.

Using an external lap in the lathe, polish the surface of the piston to obtain a smooth sliding fit in the cylinders.

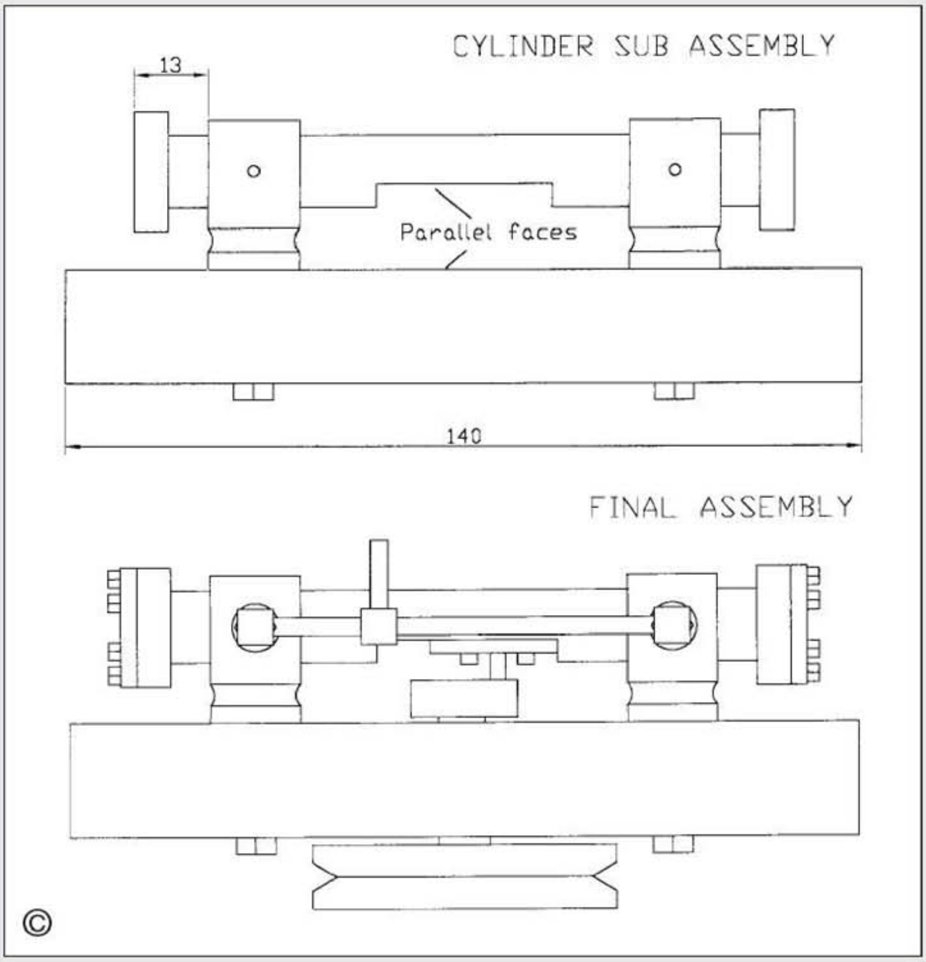
Cylinder support and unions

To a depth of 1.6mm, enlarge the 2mm hole in the cylinder supports to 5.4mm. Be very careful to avoid going through into the cylinder.

Make up the two unions and secure these in place into the inlet ports using Loctite.

Steam connectors

I used 1/8in. dia. pipe for connecting the steam and have attached drawings of the associate fittings if ▶



you need to make them. Some of us prefer to buy these already made.

Final assembly

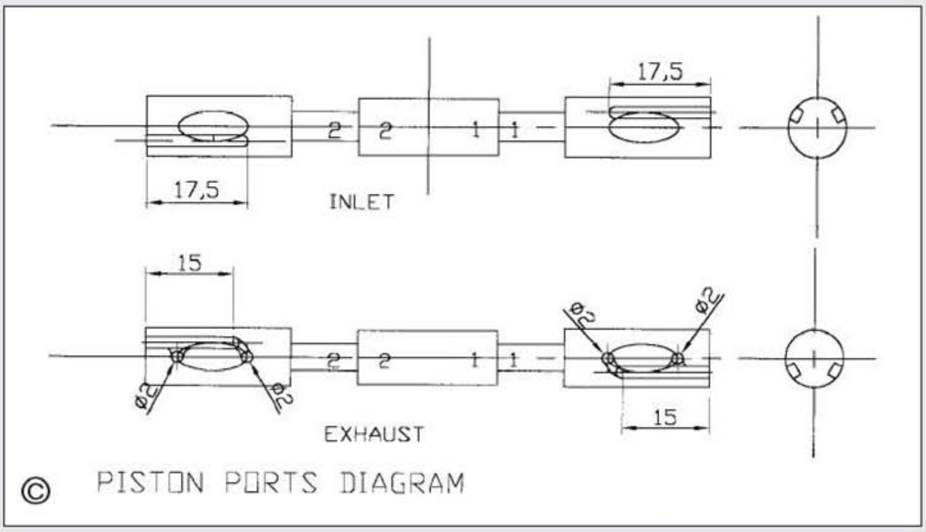
Thoroughly clean all debris, burrs and oil from the sub-assemblies. Re-assemble, mounting the engine on a suitable base, bearing in mind the following points.

1: No. 2 piston should fit into the No. 2 end of the connecting bush and slide into the No. 2 end of the cylinder.
2: The ball shaft should be fitted as previously described and held in place with Thread Locking compound.
3: Connector screws should be locked in place with Thread Locking compound.
4: Gasket cement should be applied under the cylinder covers.

Once assembled light oil should be applied into the cylinder, bearings and the 3/16in. hole in the small pulley. The engine should now rotate freely with very little effort.

Apply air at 30psi to the inlet and run the engine for about an hour to bed in. Apply oil frequently during this period of running in.

The engine is now ready for steaming. I recommend that you use an in-line displacement lubricator to minimise wear.



TAPPING AID TOOL

Roger Castle-Smith
extols the virtues, and describes the construction of a useful workshop accessory.

I have devised a tapping tool which I would not be without. Simple and quick to construct, it can be used with a drilling machine or lathe and will allow very small or very large objects to be tapped with accuracy. Many methods have been described in *Model Engineer* over the years but some have involved the time-consuming construction of quite expensive tools while a number of the simpler ones have shortcomings.

Photograph 1 shows the basic set of components. The chuck is from the Jacobs stable with part number 1BA and is internally threaded 3/8in. x 24tpi. This chuck incorporates a central hole so that a screw can be inserted into the end of the mounting stub; this prevents unscrewing of the chuck during reverse rotation. Millhill Supplies (tel: 01491-838653) obtained it for me. The first part of the mounting, in black, carries a hole for a tommy bar while the parallel shank is 1/4in. silver-steel. The thread for the chuck should be machined and the hole for the 1/4in. stub reamed; the latter is retained with Loctite 603.

To ensure concentricity, I took the finishing cuts on the chuck register and thread having secured the two chuck mounting parts together with Loctite and then holding the 1/4in. shank in a collet. Those without collets can obtain a high order of accuracy using a 4-jaw chuck and a little patience! There is a tiny continuation hole in the end of the 1/4in. hole to allow air to escape during assembly.

The second major component is a simple sleeve about 1 1/2in. long reamed 1/4 inch. The L-shaped bracket, comprises a 1/2in. square mild steel shank with another sleeve, also reamed to 1/4in. I/D and retained with Loctite. A cap screw and washer allows the bracket to be attached to a drilling machine table. Finally, there is the tommy bar. Parts were blacked using the BlackIt product as advertised in these pages.

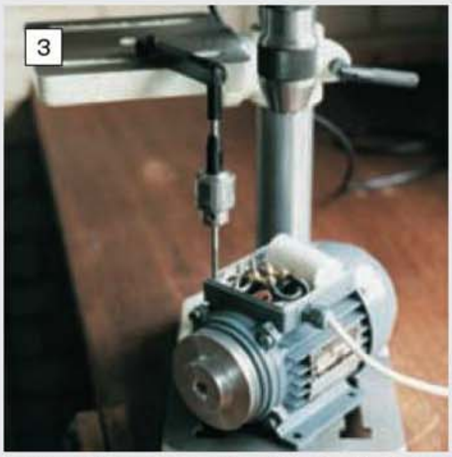
Photograph 2 shows the sleeve being held in a drilling machine chuck with an item to be tapped on the movable table. The chuck which I used is man enough to fully tap holes up to about 4BA but will comfortably allow threads of up to 0BA to be started accurately and then finished using a normal tap holder. Small threads from around 5BA to 12BA can be tapped with maximum feel by simply gripping the chuck or its tail, the tommy bar being used for larger sizes.

If there is insufficient room above the movable table, then it can be swung aside and the item to be tapped is placed on the base of the drilling machine. All is not lost even if this does not provide sufficient headroom! **Photograph 3** shows the bracket mounted on the movable table with a hole being tapped to accommodate a fixing screw for a motor terminal box cover. When the table is moved right to the top of the column, very large objects can be accommodated.

Finally, and far from least, the sleeve can be held in the lathe chuck for tapping objects held on, for example, a vertical slide, or in the tailstock chuck for the delicate tapping of holes mounted at the headstock end.

Components for the Author's Tapping Aid

Threads up to 4BA in size can be tapped in situ.



Larger work can be accommodated on the base.

KEITH'S COLUMN

SAINT CHRISTOPHER

A GWR LOCOMOTIVE for 7^1/4in. gauge

Wilson's Words of Wisdom:
When things go wrong, it is easier to look for a scapegoat than to seek a remedy.

Keith Wilson
moves on to deal with the tender platework, keeping more than half an eye on fitting all those rivets!

●*Part XLIII continued from page 214 (M.E. 4202, 22 August 2003)*

By now those who are making this locomotive should be ready for some platework; tender-wise that is. I have discussed the ideal materials for tanks once or twice in the past, and do not recall any disagreements. Brass is ideal and I would not recommend anything else. I suppose some plastics are a possible alternative, possibly also zinc, but I doubt if zinc is tough enough to withstand riveting and I doubt if anyone makes suitable zinc roundhead rivets. But then how can rivets be used in the case of plastic? For rivets 'make' a tender, if visible on the prototype. I have shewn some photographs of full-size and miniature 4000 gallon tenders, not too easy to see the difference, even though I sez it meself.

Some good folk have made 'rivet-machines' which will put pimples in a sheet to look a bit like rivets, but I have yet to be convinced that they are worth it; to me the pimples just don't look right.

Dear old Curly was not over-keen on rivets for appearance sake, as (correctly) he pointed out that they don't aid operation in any way, and take some time to put in. However, in all fairness it would have taken him a deuce of a lot of time to locate the correct positions for the rivets, for I doubt very much that he could have obtained drawings, or close-up photographs. Lack of calculators and computers would not have helped either, as to get a reasonably close approximation (we can never be exact even with such devices) takes up time — lots of it, and don't I know it! Of course, once the rivets are located, if only on paper, the work is at least halved.

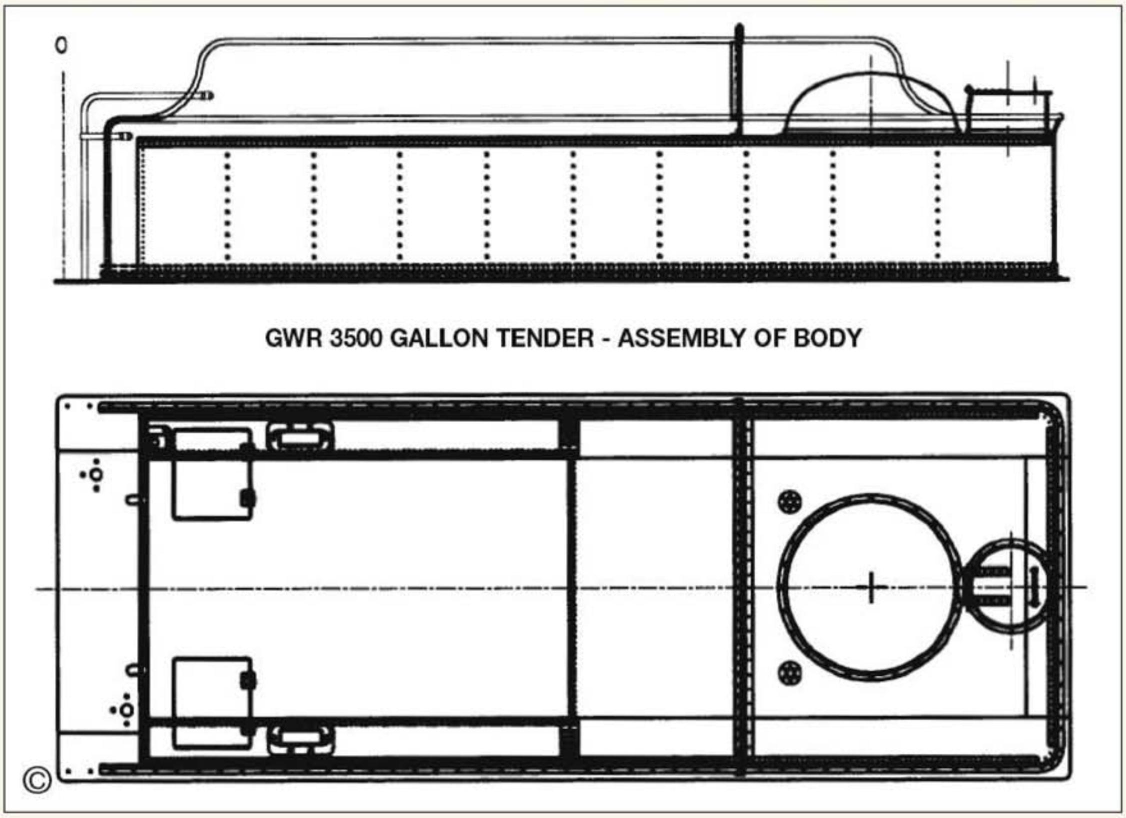
Working from photo-enlarged microfilmed Swindon drawings, some success is achievable, but it is not plain sailing, not by a long chalk! For rivet positions are not dimensioned and, in the main, not even shewn. Thickness of lines must be taken into account, and the fact that photographs and drawings do not always agree. So a certain amount of juggling is essential.

Now, one must be very careful about figure juggling, for it is an incredibly common feature of pressure groups and governments alike. It is surprising (or is it?) just how often a decimal point is mysteriously displaced by a 'misprint', always in the direction convenient to the people concerned, and is rather difficult to spot.

However, there is juggling and juggling. To get the right numbers and spacings of rivets is not the lightest of tasks, for nine times out of ten spacings and numbers do not 'add-up' and one begins to realise that in a long row of rivets the spacings are not necessarily identical. Also, if you put your mug close-up to a tender and look along the line of rivets, a shock (not electric) is usually guaranteed; seldom are they making quite so near a straight line as you might think!

One easy way to handle rivet locations is, of course, by means of a jig. To discuss some jig-making methods might prove fruitful, so here goes. You can scribe a line along a piece of steel (preferably at least 3/16in. thick) and then use a scriber and rule to locate holes, following up with a centre punch and drill. This is probably the least accurate way.

A much better way was described about 45 years ago (by Mr. F. Few), to set up a piece of steel between centres on your lathe, and use the feed-screw wheel to locate a guiding sleeve containing a centre punch to mark out each position. A backing plate is used to take the shock of hammer-hitting the blunt end of the sharp punch.

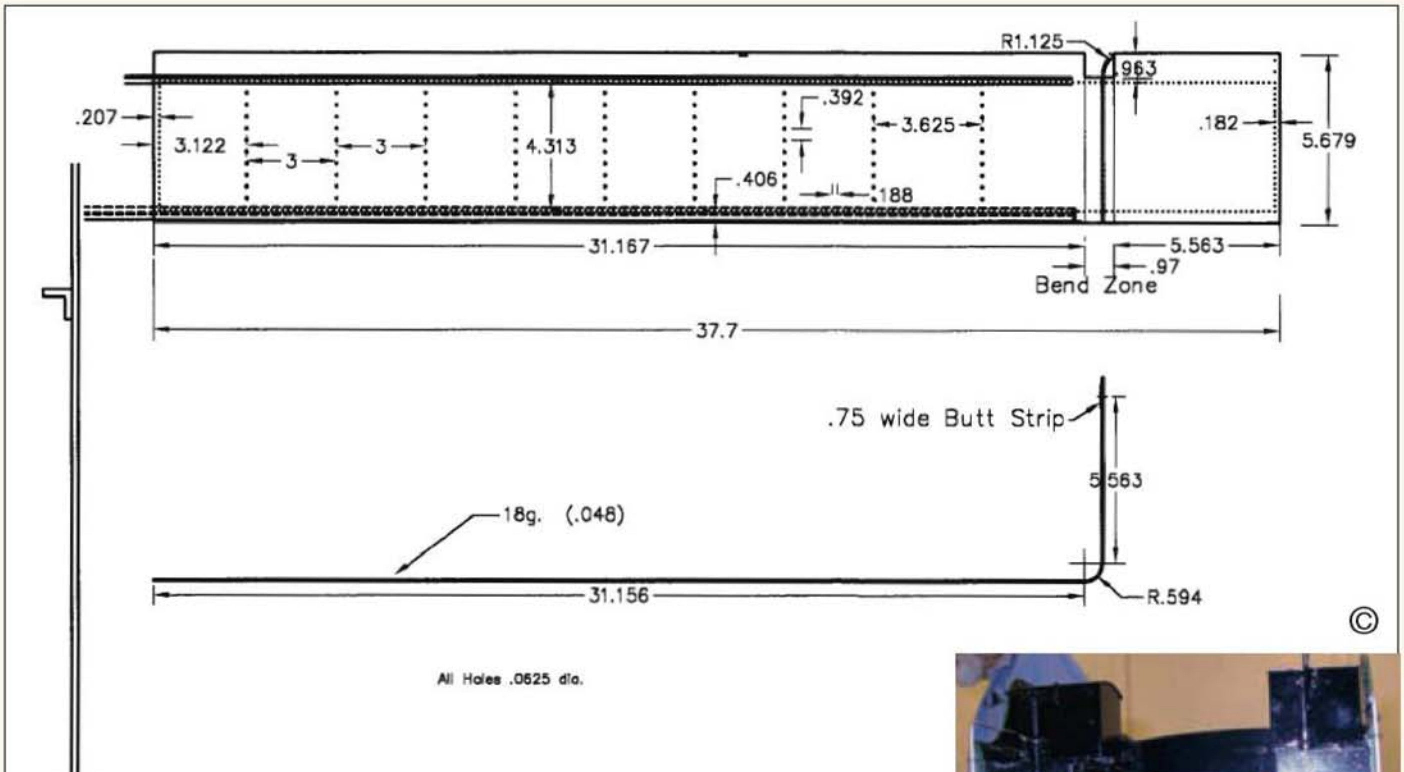


GWR 3500 GALLON TENDER - ASSEMBLY OF BODY

This is a pretty accurate way of proceeding, but there is a snag that the small drills needed might well decide to run out, given as little as half the chance. A centre punch can enable a drill to run out.

It is suggested that jig-boring methods have the edge. For this you set up your steel bar on the milling machine table, fit a small centre drill in the vertical attachment, and use the slide handle graduations or digital read out device to locate each hole within 0.001in. on both X- and Y-axes. A 1/16in. drill is more likely to follow a hole than a centre-pop.

A double jig is advised, starting with a 1/2 x 3/16in. steel strip. A jig with 7/32in. spacings just 5/32in. from one edge and another set of holes with 7/16in. spacings 5/32in. from the other edge will take care of accurate location of 95% or so of required holes for all the ▶



GWR 3500 GALLON TENDER - BODY SIDE

The front of a 7 1/4in. gauge 3500 gallon tender. Note snubbers, weighshaft and footplate.

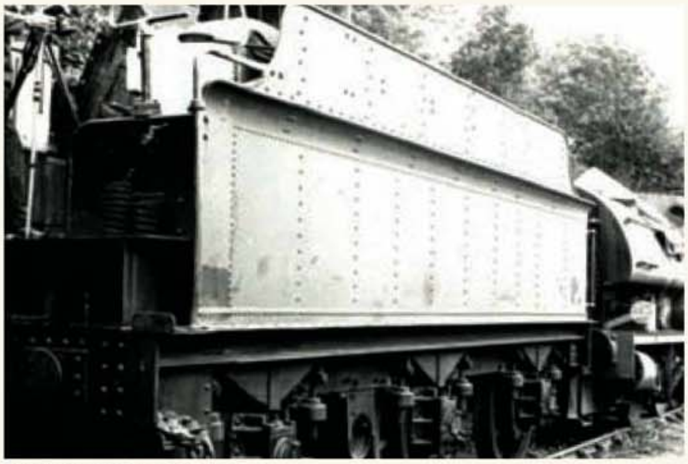
tender bodies.

Two jigs, same spacing, or a simple factor — doesn't make sense — or does it? I may be an old fool (silence at the back there!) but occasionally I get it right. Using alternate holes in the 7/32in. jig gives the same results, in theory, but only if you *never* miscount. It looks easy, but there seems to be something remarkably hypnotic *(jusht votch mine eyes, you vill go to schleep and maik ein fine djig)* in drilling holes in long rows, and even to get out-of-step once will produce more than *"Oh dear. Tut tut!"* when discovered. Much more!

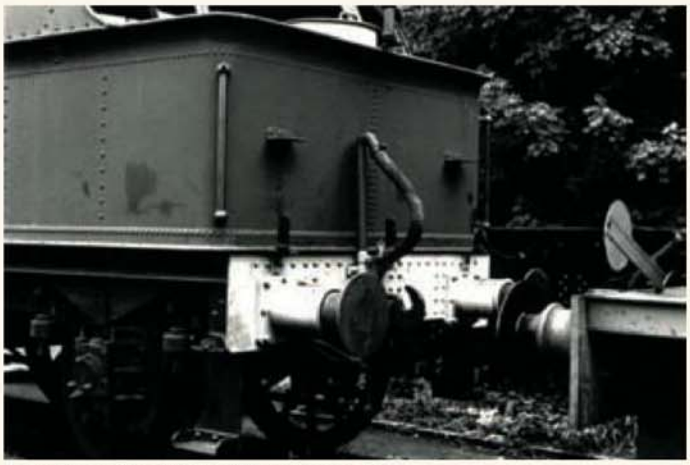
To get the correct length of side before bending is never very easy, but the dimensions shewn are about as near as can be calculated. Bends are not quite as simple as they may look, and to get a bend exactly where it should be is not a light task. In theory, if the centreline, i.e. halfway through the plate, is taken as the 'neutral zone' you will not be far out, but the snag is that for tight bends relative to plate thickness the halfway point is not the halfway point after all. I am not sure of the exact figures as the matter is rather specialised, but I do remember reading it up some 40 years ago in Camm's big engineering handbook. It seems to work anyway, I suggest nothing else matters.

The flared top of the tender side is a bit tricky; I have not yet found a really good way of making it. I have tried making the two sides side by side (bejabours) and sawing along the parting line after bending, and I have tried just bashing the flare over a suitable sized bar with a soft hammer; each has its drawbacks for brass can be confoundedly springy. However, a source of heat in one hand, and an 'ammer in t'other can work wonders. Note that this flare will almost be totally eradicated when the main bend is made. Further heating and bashing, this time with a small ball pein hammer, will teach it manners.

The row of holes/rivets along the bottom of the sides presents a minor problem for they have to go through three sections. The safest way is to clamp the 7/32in. jig along the bottom, drill all the holes through (this should be done before any bending) and after bending, tack (soft-solder) the 1/4in. brass angle to the inside and drill all the rivet holes. Line up the outside 1/2 x 1/4in. angle using some bits of 1/4in. thick steel to get the overlaps correct, a few tacks of solder will make everything tight, drill through all the rivet holes and bung in rivets. Note that the inner angles can be omitted near the main bends, but the outer must be continuous. It is very hard to do this bend in the angle, as if overheated even a little bit the outer web will stretch and tear. One possible solution is to cut



A full size 3500 gallon tender.



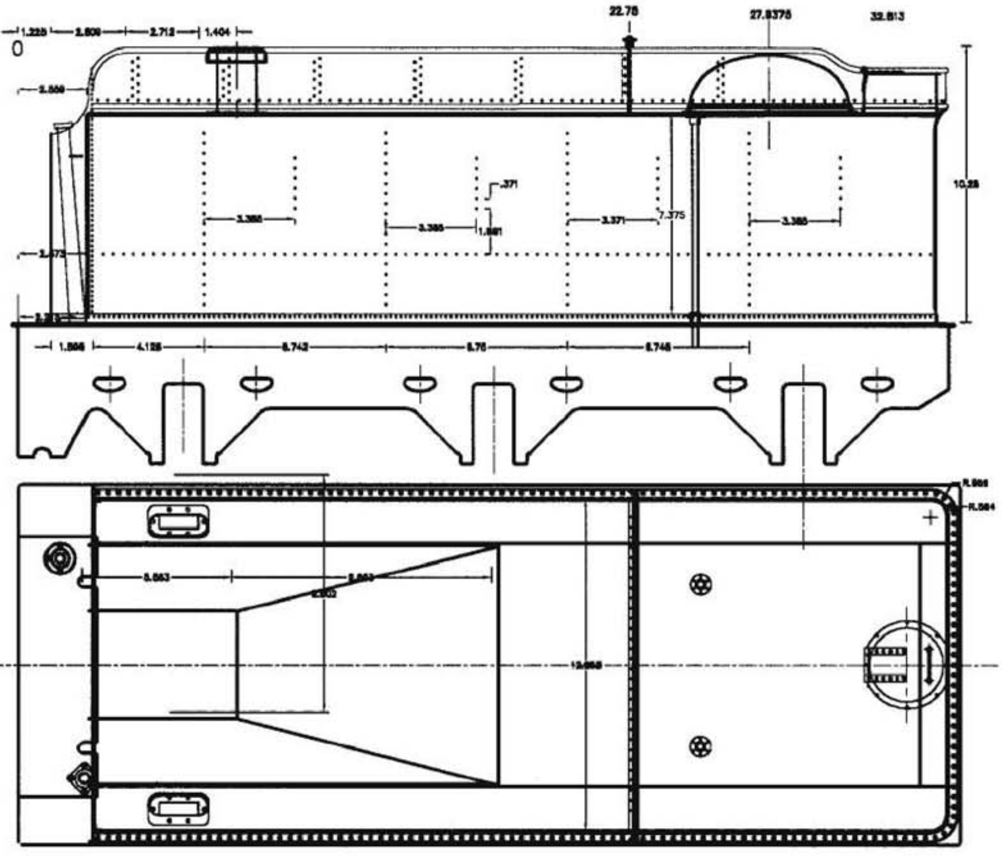
Rear view of the full size 3500 gallon tender.

out about 7/8in. of the outside web, cutting a piece of 1/16in. brass sheet to fill the gap later.

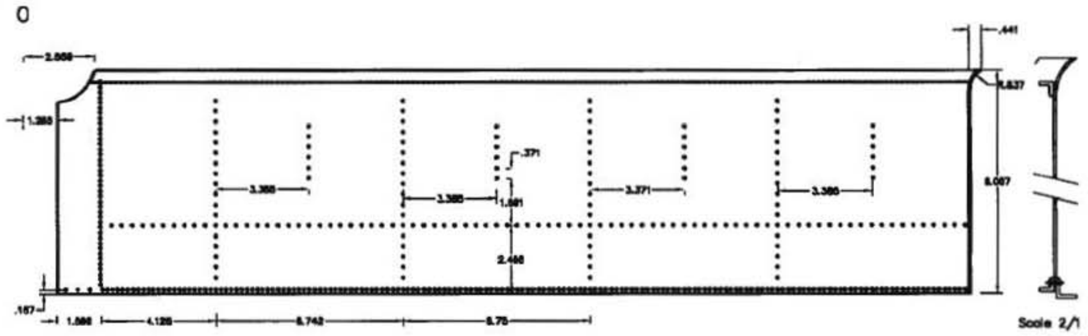
On no account should the rear butt-strip be omitted. At this stage, the joining of the two sides at the back produces a very awkward and flimsy assembly, but until some more bits are made and fitted there is not a lot to be done about it. In the case of the 4000 gallon tender, there is a long row about a third of the way up from the base; this is for attaching a long piece of angle on the inside. There are also some cross-braces connecting the sides, they are pivoted onto these angles. To support the flimsy (at present) side assembly, soft-solder a piece of brass across the two long angles. It can be removed later.

To drill these rivet holes, my favourite tool is a little hand-drill produced originally by Black & Decker, now made by Minicraft and stocked by many suppliers, including Chronos (tel: 01727-832793. If my memory is correct, these gadgets like 12 volts and can take up to 2 amps. However, mine seems to have lasted for many years on 16 volts, and if stalled mops up 10 amps when a hasty switch off is indicated. I reckon this gives me at least 16,000rpm instead of 12,000; the 16,000 is a bit nearer the mark for 1/16in. or smaller drills in brass.

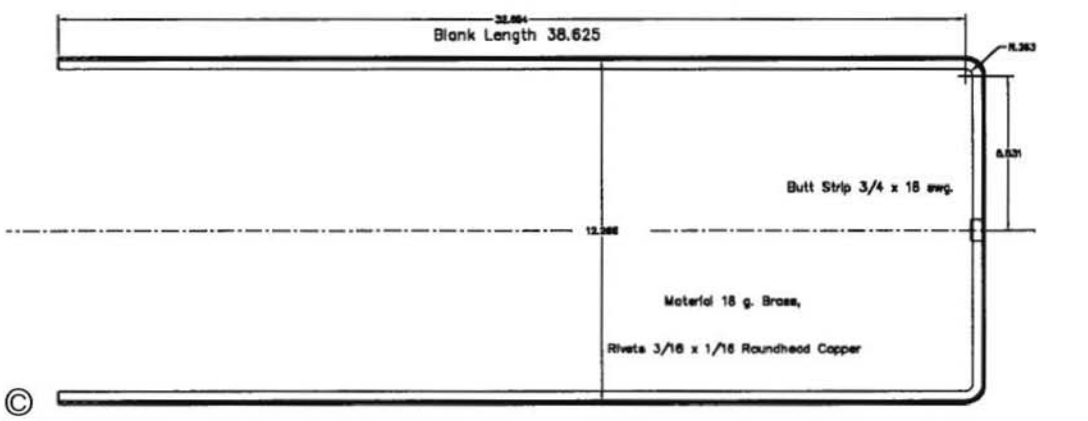
A tip for when these weeny drills break or go blunt: a small fine grit grindstone mounted on a small mandrel in the lathe works wonders when backed up with a jeweller's loupe (eyeglass) of about 10x magnification. The normal size grindstone, even fine, is rough compared with drill diameter and it is not unusual for a small drill to dig in and snap off, after which there is not enough flute left to make it any darned use at all.



© GWR 4000 GALLON TENDER - BODY ASSEMBLY



GWR 4000 GALLON TENDER - TANK SIDE



©

In the early days, tenders had rails around the top of the coal space. I do not know when they were replaced by the present type of guard, but certainly it did not extend beyond the 3000 gallon size.

The 47 must, of course, have the 4000 gallon tender, unless you are modelling 4700 itself in its new condition in which case you would need to use the smaller boiler: No. 1, as currently described for the Saints.

Saints almost invariably had the 3500 gallon tender, but one at least ran for a time with an experimental (as far as I know) 3500 gallon tender made a bit deeper with a well tank to push up the capacity to 4000 gallons. The special tender made to suit *Hampton Court* on the 10¼in. railway at Stapleford Park was based on this tender. The late John Gretton produced the photograph of the full size combination when he ordered it.

●*To be continued.*

John Hancocks from the North Wiltshire club prepares Thirlestaine Hall for the day's work. On the adjacent sidings can be seen a 9F, Simplex, Sweet Pea, a Britannia and a J39. Dave Lewin's Sgt Murphy completes the picture.

John Arrowsmith reports on last year's event which was hosted by the Hereford Society of Model Engineers.

SOUTHERN FEDERATION AUTUMN RALLY

When the Hereford Society was asked if it would consider hosting the Autumn Rally it caused quite a bit of discussion within the club about whether we could handle this type of event. It is one thing to hold an internal event, but when you come to organise a National Rally then it is something different. It was eventually agreed that we would host the rally and so the planning started.

The day of the rally, September 21, seemed a long way ahead, but it was surprising how quickly the time seemed to go. However, the weekend at last arrived warm and fair with a good forecast. We hoped that all our plans would work out and that everyone who came would have a good time. The first participants arrived on Friday afternoon together with Brian Thompson,

James McQuaid a 5in. gauge 0-6-0 German based prototype.

Graham Gains from the Orchard Line awaits the signal from the turntable to the main line.

A $3^1/2$in. Canterbury Lamb belonging to Graham Gains waits on the elevated steaming bays.

Joe Middleton from the Oxford club concentrates on the road ahead with his $7^1/4$in. Koppel.

A fine selection of motive power and rolling stock in the ground level sidings. The Hereford Waterworks Museum is in the background.

Chairman of the Southern Federation of Model Engineering Societies. The first of the trade stands also arrived in the guise of Bruce Davey of Bruce Engineering. By this time the first engine, Dave Lewin from Coventry with his 5in. gauge *Sgt Murphy*, was in steam and enjoying his first run around the ground level Broomy Hill Railway.

Saturday dawned a little grey but dry, and it soon became apparent that we were going to have a very busy day. Society members from all over the UK were arriving all the time, so that the steaming bays and storage sidings were at full capacity. The elevated track was also in full swing with a wide variety of locos and driving trucks.

Over the weekend we noted that 44 locos had been registered of which 39 were steam and 6 electric, and representatives from 31 different clubs. The farthest travelled in UK were the members from Sunderland and Romney Marsh, but of course our visitor from Australia had the honour of being farthest from home.

Warren Williams from the Hornsby Club in Australia, was here to represent the Australian Association of Live Steamers. The presentation of their trophy for the best working loco of a Commonwealth prototype was made to John Hancocks from the North Wiltshire club, but the three judges found it very difficult to make their decision.

So many fine locomotives performed on the day that judging the best seemed an impossible task. Eventually it came down to the $7^{1}/4$in. gauge 6026 *King John* of Tony Newberry from Taunton and John Hancocks with his $7^{1}/4$in. Modified Hall 6965 *Thirlestaine Hall*. John just pipped Tony to take the trophy, which was presented by Warren Williams. This was also a first for the event, as a $7^{1}/4$in. loco had never won the trophy before. *Thirlestaine Hall* was a worthy winner and was greeted with acclaim by the assembled crowd. An excellent barbecue organised by Peter Judge of the host club, rounded of a wonderful day's activities.

Tony Newberry with 6026 King John *pauses by the signal box with his train and the Mayor of Hereford, Councillor Alan Williams, and Richard Donovan, Chairman of the Hereford Society.*

The Hereford Society would like to thank the Southern Federation for allowing them to host this event. We certainly enjoyed, the two days and hope that everyone who came also enjoyed themselves. Perhaps we may do it again sometime.

Finally no report of this kind should forget the marvellous support provided by the ladies of the Hereford Society for all their hard work. They provided a fine selection of food and refreshments for the whole weekend, which ensured Society members and the general public on Sunday were always well looked after.

All photos, unless otherwise credited, are by Derek Foster.

I know that all readers, whether as visitors or with a locomotive, will be welcome at this year's Southern Federation Rally at Saffron Walden on 21 September. Contact Jack Setterfield (tel: 01797-362295) for further information.

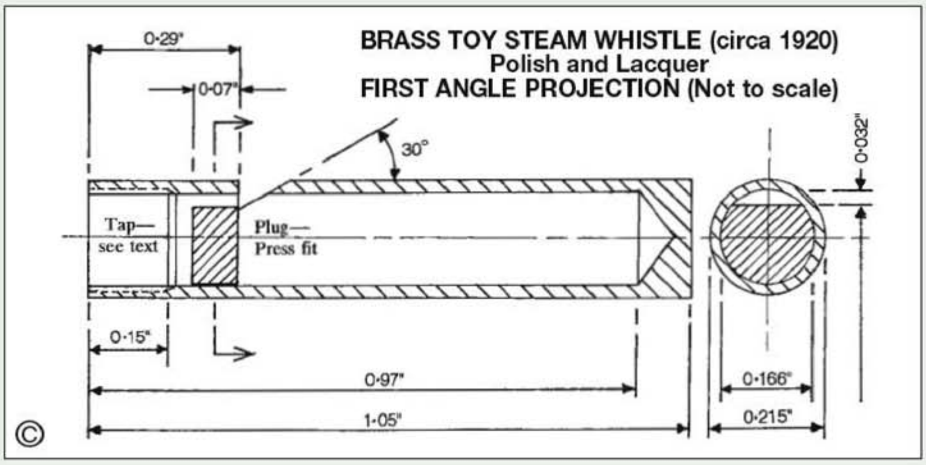
The Bishop of Hereford, Bishop John Oliver poses with King John *before the next departure. (Photo: Jim Farmer)*

Double heading and fully laden, Ken Houltby with the $7^{1}/4$in. V2 The Snapper *as lead engine, leaves the station with 6965* Thirlestaine Hall *as train engine.*

PETE'S PAGE

A TOY STEAM WHISTLE

Peter Spenlove-Spenlove describes a simple fitting to replace one which may have been lost from a favourite steam toy.



During recent years, there seems to have been an upsurge of interest in antique steam toys, collectors and enthusiasts meeting at public gatherings to demonstrate their steam toys in action. These toys are not made by model engineers, but in factories which mass produce boilers in simplified form, usually with oscillating engines mounted on thin steel platforms. Some types include toy workshop machinery driven by a spring belt from a pulley on the engine. Other popular toys represent moving vehicles including traction engines and road rollers. One fitting which seems to be common on all these toys is a tiny steam whistle, blown in excess to the delight of the youthful owner and much to the annoyance of adults who had to endure its very high-pitched shriek. Also usually to be encountered at these public gatherings are traders who buy and sell old toys; some can supply parts as well.

In the early 1930s I was given a steam boiler and engine with some 'Trix' perforated strip (Trix was a form of construction system not unlike Meccano), all being second-hand. It was worked intensively, consuming copious quantities of methylated spirit in the process. Eventually the poor little thing gave up the ghost. The soldered joints on the boiler melted and leaked; the con-rod big end (a pierced hole through the flattened end of the piston rod) had worn so big that it kept falling off the crank pin; its tinplate chimney and furnace were full of rust holes and a new coat of paint made an awful stink when next lit up. I don't know what happened to this toy, but I kept its little whistle and tap.

One trader I spoke to said that the whistle is occasionally missing on old toys. As I still had mine, I thought it might be helpful if I made a dimensioned sketch in case any readers needs one or has been asked by a friend to make one. In *M.E.* 4167, 19 April 2002, D. A. G. Brown described how to make a *proper* whistle *"…which might be heard across the County of Rutland."* My toy whistle is squeaky and its sound can be heard in the next room — if the radio is silent! The threaded fit to the brass tap ('whistle valve' to steam people) is extremely sloppy and does not resemble any normal modern standards. Readers should therefore choose a thread to suit fine thread taps and die which they have available, or to fit an existing valve; 3/16in. x 40tpi (ME thread) or 2BA might be considered. With less than 50% engagement, the thread inside the whistle is very 'truncated' but at least it does not need to resist boiler pressure!

The valve body is turned to 5/16in. dia.using a form tool. The normal taper plug is 1/16in. dia. but is retained by a washer riveted (not nutted) in place. The through steamway is drilled 0.080in. with the handle across the valve body (not in line). The handle is turned from black Tufnol rod and polished. An inserted steel stud screws into the plug extension. The handle is 7/8in. long by 1/4in. diameter. Metal is no good as the heat would burn children's fingers! I hope that this information will help those who have lost their whistle. The brass whistle plug is a press fit in the whistle and set level with the notch; sizes being altered to accommodate your tooling.

If you don't mind its pathetic squeak, and require a replica whistle for an old toy, make your whistle approximately to the sketch and photos. But if you want a more sensible sound, try a few tests first, with short pieces of tube. With a finger over one end, blow across the other end. Note the pitch of the note. Tubes of a larger bore tend to give a 'fatter' sound than a narrow bore tube of the same length. Consider the air blown pipe organ. You may see fat pipes and thin pipes of the same length. The pitch of the notes is the same, but the quality of the sound is different. You will also find that high pressure steam as opposed to mouth blown air can alter the sound, so be prepared to experiment to get a 'good' tone.

SEQLEC 2003

Applications for entry are welcome for the
Thirteenth 7 1/4in. gauge Locomotive Efficiency Competition for the

BRISTOL CUP

to be hosted by

READING SOCIETY OF MODEL ENGINEERS

at their track at PROSPECT PARK, Bath Road, Reading, Berkshire on

SUNDAY 12 OCTOBER

Please contact Gary Williams, 96 Highfield Park, Wargrave, Berkshire RG10 8LE
tel: 0118-940-1405; mobile: 07944-272-106 e-mail: GAZZA@wargrave16.freeserve.co.uk
for an Official Entry Form

Limited space is available for caravans or camping on the Saturday night preceding the Competition strictly by prior application to Gary Williams

ALL VISITORS WILL BE VERY WELCOME, MODEL ENGINEERS AND THEIR FAMILIES PARTICULARLY SO.

CLUB CHAT

With Malcolm Stride

UK News

The **3mm Society** newsletter gives details of 'Chassis Tutorial' meetings arranged by the society at various locations. This approach might be of benefit to the larger scales as well. How about a valve setting tutorial or some such for the live steamers? Perhaps at the Model Engineer Exhibition? For information on the small scale events contact Andrew Shillito on 01622-719830 or Allen Doherty on 0161-794-7480. The Gloucester Group are holding an open meeting at Watermoor Church Hall, Cirencester on Saturday 20 September from 12:00 until 17:00.

Ashcombe MR (at Ashcombe School, Dorking) reports that after another academic year, the track is in good order and all signals and vehicles are working and in running order. They have also been fortunate with outdoor work and monthly running nights since Easter in that none of these have been rained off. The summer term visit was to the Bluebell Railway's 'Wartime Weekend' where visitors were fortunate to see Fred Dibnah (My Hero!) and a film crew making an engineering history programme.

The members of **Bridgend DMES** had a very enjoyable open day on 4 July. A good static display of work was on show including a range of hot air engines by Julian Wood and many fine examples of model engineering by club members. The day was to celebrate the successful completion of a new club $7^1/4$in. gauge petrol/hydraulic locomotive and the completion of raised track modifications and new steaming bays. Secretary Anthony Price reports that there is still a lot of work to do with the complete relaying of the ground level track. The club welcomes new members and Anthony can be reached by telephone on 01656-661282, or at **awprice@onetel.net.uk** or at 6 Grove Road, Bridgend, Mid-Glamorgan CF31 3EF.

The President and Chairman of **Cambridge MES** did their best to take members through the AGM *"...with a light touch on the regulator"*. This society is another having to raise subscriptions to cover increased insurance costs. This appears to be becoming very common if *Club Chat* is anything to go by. The club suffered a burglary and lost a club welder, whacker and television set. The disappearance of a dozen chickens from a neighbour on the same night is being connected. The eventual new measures to protect the site will not be disclosed in the newsletter. On a more agreeable note, the club reported a record day for the first public running day of the season with over 700 tickets being issued. The queues were kept down by five trains of two or three carriages. After trials it is intended to fit at least one carriage on each train with working vacuum brakes controlled by either the driver or the guard. A plea for low voltage blower supplies in the low level steaming bay has been answered after 15 years with the provision of 12 and 24 volt supplies *"...sufficient to suck a newly kindled fire straight out of the chimney"*.

Dockland and East London MES report two major news items. The first is the completion and delivery of the new club locomotive, a 5in. gauge *Tich* named *Dockland Flower*. The engine has had its first outing hauling passengers, much to the pleasure of the club members. The second piece of news is that the first sections of track for the new extension have been laid after much on-site construction work by members. The members have also been busy taking their portable track to new venues including Weald Park in Brentwood. The society meets on the second Tuesday of each month; further information from Peter Jonas at 82 Ingrebourne Gardens, Upminster, Essex RM14 1BW or by 'phone on 01708-228510.

The **Lindsey Model Society** running weekend is reported as being very successful with visitors from afar having an enjoyable day running various trains around the track. Several members brought rolling stock to ensure a good selection in the various yards. Some members have mastered the use of correct head codes but one member is reported as carrying *The Observers Book of Head Codes* with him to ensure correct coding. Trains were running on the Saturday until about 7pm after which everybody enjoyed an excellent barbecue. The sight of all the signal lamps lit after dark made for a very atmospheric scene. The society is making plans to introduce a more formal method of controlling trains, possibly using a 'wagon ticket' system and 'consignment notes'. This system has the advantage of not needing a timetable and can be kept going for long periods with something always going on, which must be good for spectators.

The **Maxitrak Owners Club** has notified us of the correct date for the Annual General Meeting/

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.

SEPTEMBER

- 19 **Canvey R&MEC.** *On the Table.* Contact David A. Clark: 01375 846921.
- 19 **Centurion SME.** *Mr. Pratley: Pratley Products.* Contact Rudy Du Preez: 012-9986780.
- 19 **Rochdale SMEE.** *Video Night.* Contact Mike Foster: 01706-360849.
- 19 **Romford MEC.** *Ralph Hebron: After Harrison – Genius on the Cheap.* Contact Colin Hunt: 01708-709302.
- 19 **Steam LS of Victoria.** *Gathering.* Contact Graham Plaskett: (03) 9750-5022.
- 19-21 **Bedford MES.** *Invitation Weekend.* Contact Ted Jolliffe: 01234-327791.
- 20 **Chesterfield MES.** *Running Day.* Contact Mike Rhodes: 01623-648676.
- 20 **Hereford SME.** *Visit to Evesham Vale Light Railway.* Contact Richard Donovan: 01432-760881.
- 20 **Malden DSME.** *Families Day.* Contact John Mottram: 01483-473786.
- 20 **Maxitrak Owners Club.** *Maxitrak Open Day + AGM at the Factory.* Contact Eric Penn 0208-979-4335.
- 20 **Moors Valley Railway.** *Wessex Narrow Gauge Exhibition.* Contact Jim Haylock: 01425-471415.
- 20 **Steam LS of Victoria.** *Club Run.* Contact Graham Plaskett: (03) 9750-5022.
- 20 **Worthing DSME.** *Visit by Harlington ME.* Contact Bob Phillips: 01903-700642.
- 20 **York City & DSME.** *Ask The Panel.* Contact Ken Bateman: 01904-421445.
- 20/21 **Kew Bridge Steam Museum.** *London Open House Weekend.* Information: 020-8568-4757.
- 20/21 **Lincoln DMES.** *70th Anniversary Open Weekend.* Contact Paul Thompson: 01522-888228.
- 20/21 **Scottish Model Engineering Trust.** *$7^1/4$in Gauge Weekend.* Contact Jeremy Bull: 01738-441975.
- 21 **Andover DMES.** *Open Day.* Contact R. W. Hanman: 01980-846815.
- 21 **Frimley & Ascot LC.** *Club Run.* Contact Bob Dowman: 01252-835042.
- 21 **Guildford MES.** *Competition Day.* Contact Dave Longhurst: 01428-605424.
- 21 **Hornsby ME.** *Sailing Day.* Contact Ted Gray: 9484-7583.
- 21 **N. W. Leicester SME.** *Running Sunday.* Contact John Elliott: 01455-847040.
- 21 **Nottingham SMEE.** *Running.* Contact Gerry Chester: 0115-9259096.
- 21 **Romney Marsh MES.** *Autumn Track Meeting.* Contact John Wimble: 01797-362295.
- 21 **Rugby MES.** *Running.* Contact David Eadon: 01788-576956.
- 21 **Saffron Walden DSME.** *Southern Federation Autumn Rally.* Contact Jack Setterfield: 01843-596822.
- 21 **Talyllyn Railway.** *First Class for Sunday Lunch.* Enquiries: 01654-710472.
- 21 **York City & DSME.** *Running Day.* Contact Ken Bateman: 01904-421445.
- 22 **Bedford MES.** *Work Holding, Jigs & Fixtures.* Contact Ted Jolliffe: 01234-327791.
- 22 **Cardiff MES.** *Visit by Brean Modellers.* Contact Trevor Jenkins: 029-2075-5568.
- 22 **Hornsby ME.** *Meeting.* Contact Ted Gray: 9484-7583.
- 23 **Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797-362295.
- 23 **Sutton Coldfield MES.** *Derek Brown: Injectors.* Contact Neal Harrison: 0121-378-3992.
- 24 **Chingford DMEC.** *Alan Rose: First Steps in Scale Model Boat Building.* Contact Martin Masterson: 0208-989-5552.
- 24 **Harrow & Wembley SME.** *Club Evening.* Contact Dr. Roger Greenwood: 020-8427-2755.
- 24 **Historical MRS (Bedford Area).** *David Ventry: A History of Permanent Way.* Contact John Chamney: 01442-851214.
- 25 **Leyland SME.** *Bring & Buy.* Contact Mark Entwistle: 01772-422411.
- 25 **Worthing DSME.** *Jonathan Minns: Brighton Engineerium.* Contact Bob Phillips: 01903-700642.
- 26 **Bristol SMEE.** *Visit by Brean Modellers.* Contact Trevor Chambers: 01454-415085.
- 26 **Hereford SME.** *Meeting.* Contact Richard Donovan: 01432-760881.
- 26 **Historical MRS (Essex Area).** *Russell Newlands: BR Standard Class 6 'Clans' and the Construction of BR 72010 Hengist.* Contact Jem Harrison, 27 Colne Place, Basildon, Essex SS16 5UZ.
- 26 **Lancaster and Morecambe MES.** *Final Running Day of Summer.* Contact Harry Carr: 01524-411956.
- 26-28 **Frimley & Ascot LC.** *$7^1/4$in. Gauge Society AGM & Rally.* Contact Bob Dowman: 01252-835042.
- 27 **Esk Valley MES.** *End of Season Track Day.* Contact Alan Burdekin: 0131-669-0823.
- 27 **Historical MRS (Bristol Area).** *Peter Davis: Talk.* Contact Gerry Nichols: 0117-973-1862.

Peter Dunkley's superb pair of 5in. gauge Sulzer Type 2 locomotives were awarded First Class Certificates at the Tenth Annual National Model Engineering and Modelling Exhibition at Harrogate (see Wigan DMES report below).

Maxitrak Factory Open Day as 20 September 2003, *not* 27 of that month as originally reported to us.

Members of **North Norfolk MEC** are looking forward to their AGM on 3 October which is to be followed by a 'good mardle'. My spell checker did not find 'mardle'; it must be a technical term peculiar to North Norfolk! The club also has a talk on Charles Babbage planned for 7 November, to be given by Dr. Cook. Further details from Gordon Ford on **Zordie@btopenworld.com** Gordon also has a personal interest in making contact with a Mr. Plummer who ran the superb 'Cardean' 4-6-0 locomotive at the **Reading SME** open day in 2002. Unfortunately we at Reading (okay, me!) have no record of Mr. Plummer's home club.

Eric Clifford, Exhibition Co-ordinator for the **Northern Association of Model Engineers** has provided advance information of the Association's planned exhibition to be held in March 2004. The exhibition is designed to show off members' work and to publicise the Association. It is to be held at the Risley Conference Centre, Birchwood Park, Warrington, Cheshire during the weekend of 27/28 March 2004. It will be open from 10am to 5pm on the Saturday and 10am to 4pm on the Sunday. Admission will be £2:50 for adults and 50p for children over 5 years of age. The Conference Centre is situated near the M6, M62 and M56 motorways and has good car parking and catering facilities. Road vehicles and traction engines will be running outside and a portable railway track will be in operation. Further information from Eric at 46 North Promenade, Thornton Cleveleys, Lancashire FY5 1LN or by 'phone on 01253-860970.

Kingpin, the newsletter of **Nottingham SMEE**, has a picture of a good collection of parents and children all ready to *"...throw themselves onto waiting trains"* and pay for it. The society had a trip to the Harrogate Exhibition by *"posh omnibus"*, the outing having been organised by Graham Davenport. The relaxing trip ensured that members arrived with plenty of *"shopping energy"*. Newsletter Editor Geoff Starbuck reported that he had lost a pin from the return crank rod of his locomotive *Repton* during a recent running session. He substituted a 2BA nut and bolt to continue running. The good news is that some time later member John Lopez found the offending pin. The newsletter also carries a very technical history of the development of the Stirling hot air engine which contains a lot of information on performance and efficiencies.

Staying with the subject of hot air engines, **Stamford MES** has welcomed Roy Darlington as its third honorary member following his acceptance of their offer. As reported recently in this column, Roy has close connections with Stamford. The society reports a steady gain in new members from all over the area, which must be good news for the future. The well attended July club meeting heard three presentations by members on 'Pumping Engines', 'Injectors' and 'Very Useful Gadgets for the Workshop'.

Wigan DMES recently held a very successful 'Diesel Day' with visitors from several other societies and eight engines in attendance. Peter Dunkley ran his pair of 5in. gauge Sulzer Type 2 locos which won two first-class certificates at the Harrogate show. Congratulations are obviously in order for Peter. The second notable event was the visit by members of **Butterley MRS** on 28 June. The newsletter included a good selection of colour photographs of the occasion provided by member Geoff Crank who is reported to be the proud owner of a digital camera and a new colour printer. The emphasis on the Standard Class 'is excused' because Geoff has also restarted work on his own Class 2 after a long layoff. The photos certainly show a superb selection of locomotives from Butterley. This busy club also hosted a group of 18 children from Chernobyl early in July. The weather started wet but brightened up steadily as the day progressed. The children all enjoyed their visit, particularly the Belgian chocolates they were given. The club received a 'Thank You' at a special supper later in the week when the children put on a little show to express their appreciation. At their June meeting members had a talk on ship modelling by Harry Barrow which was very well received and was described as a *"...wonderful evening of information, tips, reminiscences and anecdotes"*. Harry did not have slides, just two superb landing craft models and a box of bits and pieces from which items were selected to illustrate the point in question.

27 **Hornsby ME.** *Family Day.* Contact Ted Gray: 9484-7583.
27 **Maidstone MES.** *Visit by Beech Hurst.* Contact Martin Parham: 01622-630298.
27 **Rugby MES.** *Night Steam-Up.* Contact David Eadon: 01788-576956.
27 **Surrey SME.** *2½in. Gauge Rally.* Contact John Cook: 020-8397-3932.
27/28 **St. Albans DMES.** *Society Exhibition.* Contact Roy Verden: 01923-220590.
27/28 **Talyllyn Railway.** *AGM.* Enquiries: 01654-710472.
28 **Amnerfield Miniature Railway.** *Running.* Contact David Jerome: 0118-9700274.
28 **Bromsgrove SME.** *Diesel Day.* Contact John Pagett: 0121-453-1161.
28 **Bure Valley Rly. (Friends of).** *End of Daily Services.* Contact Paul Conibeare: 01263-733858.
28 **Cardiff MES.** *Open Day.* Contact Trevor Jenkins: 029-2075-5568.
28 **Chichester DSME.** *Steam on Sunday.* Contact Brian Bird: 01243-542266.
28 **Gas Turbine Builders' Ass'n.** *Flying Event.* Contact: Tom Wilkinson: 01508-570977.
28 **Guildford MES.** *SMEE Day.* Contact Dave Longhurst: 01428-605424.
28 **Harlington LS.** *Open Day.* Contact Peter Tarrant: 01895-851168.
28 **King's Lynn DSME.** *Track Day.* Contact Mike Coote: 01533-673728.
28 **MELSA.** *Sunday in the Park.* Contact Graham Chadbone: 07-4121-4341.
28 **N. W. Leicester SME.** *Enthusiasts Day.* Contact John Elliott: 01455-847040.
28 **Nottingham SMEE.** *Running.* Contact Gerry Chester: 0115-9259096.
28 **Ottawa Valley Live Steamers.** *Steaming Day.* Contact John Bryant: 761-1109.
28 **Staines SME.** *Running Day.* Contact Mike Kingham: 01932-788793.
28 **Sutton Coldfield MES.** *L&NWR Rally.* Contact Neal Harrison: 0121-378-3992.
28 **Talyllyn Railway.** *First Class for Sunday Lunch.* Enquiries: 01654-710472.
30 **Basingstoke DMES.** *Meeting.* Contact Ian Shanks: 01420-561741.
30 **Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797-362295.

OCTOBER

1 **Bradford MES.** *Norman Hill: 3D Photography.* Contact John Mills: 01943-467844.
1 **Bristol SMEE.** *Brian Haines: Vintage Film Shorts.* Contact Trevor Chambers: 01454-415085.
1 **Chingford DMEC.** *Bits & Pieces.* Contact Martin Masterson: 0208-989-5552.
1 **Guildford MES.** *Des Adeley: 2½in. Gauge Locomotives.* Contact Dave Longhurst: 01428-605424.
1 **Leeds SMEE.** *Keith Collins: East African Railways.* Contact Colin Abrey: 01132-649630.
2 **Cardiff MES.** *Bits & Pieces.* Contact Trevor Jenkins: 029-2075-5568.
2 **South Lakeland MES.** *Meeting.* Contact Adrian Dixon: 01229-869915.
2 **Sutton MEC.** *Bits & Pieces.* Contact Mike Dean: 0208-657-5401.
3 **Canvey R&MEC.** *Meeting.* Contact David A. Clark: 01375 846921.
3 **Maidstone MES.** *Roy Clench: Forms of Transport Slideshow.* Contact Martin Parham: 01622-630298.
3 **North London SME.** *Bring & Buy.* Contact David Harris: 01707-326518.
3 **North Norfolk MEC.** *AGM.* Contact Gordon Ford: 01263-512350.
3 **Portsmouth MES.** *Meeting.* Contact John Warren: 023-9259-5354.
3 **Rochdale SMEE.** *Sid Mortimer: The Steel Rolling Mill.* Contact Mike Foster: 01706-360849.
3 **Romford MEC.** *Competition Night.* Contact Colin Hunt: 01708-709302.
3-5 **Durban SME.** *Vintage & Steam Country Fair* at Rawdons Estate, Nottingham Road. Information: 033-2636087.
4 **Isle of Wight MES.** *Track & Pond.* Contact Ken Stratton: 01983-531384.
4 **Leighton Buzzard NG Rly.** *Steam Glow.* Enquiries: 01525-373888.
4 **SM&EE.** *Pursuit Dynamics: The Application of a Steam Jet.* Contact David Boote: 01202-745862.
4 **Welling DMES.** *Open Day.* Contact Reg Hawes: 0208-859-1952.
4 **York City & DSME.** *Rocol Ltd: Metal Cutting Fluids.* Contact Ken Bateman: 01904-421445.
4/5 **Kew Bridge Steam Museum.** *Festival of Steam Models.* Information: 020-8568-4757.
4/5 **Moors Valley Railway.** *Tinkerbell Rally.* Contact Jim Haylock: 01425-471415.
5 **Ascot LS.** *Members' Steam-Up.* Contact Ivan Hurst: 01276-28803.
5 **Basingstoke DMES.** *Running.* Contact Ian Shanks: 01420-561741.

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.

Frank Biddle	*Birmingham SME*
Richard Cox	*Reading SME*
Trevor Martin	*Birmingham SME*
Pauline Padgham	*Romney Marsh MES*
A. D. 'Ted' Tait	*Leeds SMEE*
Alf White	*Reading SME*

World News

Canada

British Columbia SME are now halfway through their 75th Anniversary year and their 10th Anniversary on the present Confederation Park tracksite. So far the year has been a great success with lots of fun being had and the number of rides matching or exceeding their best previous year. The canopy (reported previously) is providing shelter from the sun and it is proposed to make the passenger maze removable so that the covered area can be used for special events. The club is looking for a volunteer to carry out advertising and publicity so that the job is not split between several people. The society had an entry in the local 'Hats Off Day' parade but were disappointed that the float could not be pulled by their own traction engine which had problems with injector clack valves after much effort had been expended to prepare it for the event. To add to the problems, the replacement clack also leaked and had to be removed and repaired. All this meant the engine was not available on the day.

Richard Vickers of **Ottawa Valley Live Steamers** had his $7^1/4$in. gauge 0-4-0 *Jessie* chassis on display at the recent Heritage Weekend. It is hoped that it will soon be running on steam. The weekend was very successful with visitors from several other clubs, some with locomotives. There were 15 locomotives in all in $3^1/2$, 5 and $7^1/4$in. gauges. First out on the $3^1/2$in. gauge track was George Lovett with his 4-6-4 'Hudson' locomotive. He was soon followed by others. The only sad note was the emergence of the *"Dreaded Tea Bandit"* who consumed the contents of member Peter Voisey's tea flask, leading him to refer to himself as *"Tealess in Ottawa"*. The club sent a letter to Minister Hudak thanking him for his efforts on behalf of five clubs that applied for, and achieved, exemption from the local 'Amusement Items Regulations'. The club is now back in the business of giving children rides. Perhaps this is something that clubs in the UK could investigate — exemption from some of the more ludicrous regulations that we are plagued with.

New Zealand

After their recent AGM, members of **Hutt Valley MES** had a presentation by Bill Yemm about his boyhood holidays on the West Coast and subsequent study of the bush tramway which operated out there. Drawings of the Ogilvie bush railcar used were printed in the newsletter. A twin four wheel bogie design, it is approximately 20ft. in overall length, powered originally by a Buick 6 petrol engine. The wheels on the bogies are of two different sizes, the wheels on the outer axle being larger than those on the other. The transmission was via a three-speed gear box and transfer box to the outer axle of each bogie. The air braking compressor was derived from a motorcycle engine and driven from the drive shaft to one bogie. These cars were used to transport the bush workers to the working site. The illustrated railcar is now at the McLeans Island site, Christchurch under the care of the Canterbury Steam Preservation Society. As a newcomer to model engineering, Murray McKenzie has been working on an 'upside down' engine to a design he saw in a book. The engine is very like the Stuart 'Real' engine.

Members of **Maidstone MES** are carrying out minor repairs to the elevated track after a thorough inspection. About a third of the track has been rebuilt on a solid cast-in concrete base. It is intended that the rest of the track will be completed to the same standard. Some re-alignment work has also been carried out on the $7^1/4$in. gauge track in the station area. This is to make better use of the concreted area and to better separate loading and unloading areas from the through lines. At a recent meeting, Alan Kemp brought a number of parts for his $7^1/4$in. gauge 0-6-0 Koppel locomotive and outlined the history of the company, Orenstein & Koppel, which manufactured the prototypes. This was illustrated with a range of information downloaded from the internet of both the historical locomotives and modern products of this company which included an 800 ton hydraulic excavator. One item which caught my eye was a report that a locomotive builder has had the steam manifold of his Garratt locomotive gold plated to make it easier to keep clean. It is claimed that this is now common practice.

Tom Frew has accepted the Secretary's job at **Southland SME**. Tom can be reached on **tgf@ihug.co.nz** A box has been placed in the train shed for any unwanted, pre-loved, partly damaged or working order items that members would like to donate to the club. There is a specific comment in the newsletter declaring that *"...wives will not be accepted!"*

South Africa

The Editor of the **Centurion SME** newsletter wonders whether model engineers are attracted to the hobby because it enables them to return to an earlier more sedate kind of time, albeit for the short time that we are in our workshops building steam engines. An interesting comment about the National Steam Meet, which by now will have taken place, concerns boiler certificates. The society running the event has produced a boiler declaration form to be completed on arrival for those without boiler certificates. This forms a signed declaration that the boiler has passed a test complying with accepted model engineering standards. It would be interesting to see the effect of trying that in the UK (apoplexy in the insurance and health and safety sectors!) but it seems to give model engineers the responsibility for their own work rather than passing it over to a third party.

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5 **Chesterfield MES.** *$2^1/2$in. Gauge Rally.* Contact Mike Rhodes: 01623-648676.
5 **Leyland SME.** *Ground Level Running & Hot Pot Lunch.* Contact Mark Entwistle: 01772-422411.
5 **Nottingham SMEE.** *Running.* Contact Gerry Chester: 0115-9259096.
5 **Romney, Hythe & Dymchurch Railway.** *Double-Header Day.* Information: 01797-362353.
5 **South Durham SME.** *Running Day.* Contact B. Owens: 01325-721503.
5 **Surrey SME.** *Members' Steam-Up.* Contact John Cook: 020-8397-3932.
5 **Sutton Coldfield MES.** *Steam-Up.* Contact Neal Harrison: 0121-378-3992.
5 **Talyllyn Railway.** *First Class for Sunday Lunch.* Enquiries: 01654-710472.
6 **Isle of Wight MES.** *Meeting.* Contact Ken Stratton: 01983-531384.
6 **Lancaster and Morecambe MES.** *Project Night.* Contact Harry Carr: 01524-411956.
7 **Romney Marsh MES.** *Bits & Pieces/Bring & Buy.* Contact John Wimble: 01797-362295.
7 **South Durham SME.** *Meeting.* Contact B. Owens: 01325-721503.
7 **Stamford MES.** *Lionel Brown: Clocks.* Contact David Ash: 01780-751211.
7 **Surrey SME.** *Bits & Pieces.* Contact John Cook: 020-8397-3932.
7 **West Wiltshire SME.** *Chat Evening.* Contact R. Nev. Boulton: 01380-828101.
8 **Chingford DMEC.** *Alan Williams: History of Belgian Tramways.* Contact Martin Masterson: 0208-989-5552.
8 **Norwich DSME.** *Meeting.* Contact Paul Reed: 01603-462925.
9 **Cardiff MES.** *Bring & Buy.* Contact Trevor Jenkins: 029-2075-5568.
9 **High Wycombe MEC.** *Meeting: Welsh Highland Railway.* Contact David Savage: 01494-527402.
9 **Leyland SME.** *Visiting Guest Speaker.* Contact Mark Entwistle: 01772-422411.
9 **N. W. Leicester SME.** *Meeting.* Contact John Elliott: 01455-847040.
9 **Sutton MEC.** *Stationary Engines Run-Up.* Contact Mike Dean: 0208-657-5401.
9 **Worthing DSME.** *Marine Evening.* Contact Bob Phillips: 01903-700642.
10 **Colchester SMEE.** *J. Jolly: The Mangapps Farm Railway & Collection.* Contact L. G. Hammond: 01376-511686.
10 **Hereford SME.** *Mystery Soup/Video Evening.* Contact Richard Donovan: 01432-760881.
10 **Historical MRS (Sussex Area).** *Peter Bloxham: Ten Years of 0-Gauge.* Contact Terry Cole, 17 Coombe Drive Steyning West Sussex BN44 3PW.
11 **Guildford MES.** *Night Run.* Contact Dave Longhurst: 01428-605424.
11 **Hereford SME.** *Invitation to Kyre Valley Railway.* Contact Richard Donovan: 01432-760881.
11 **Midland Federation ME.** *Quarterly Meeting.* Contact Paul Humphries: 01902-661275.
11 **Nottingham SMEE.** *Night Run.* Contact Gerry Chester: 0115-9259096.
11 **Oxford (City of) SME.** *Family Day.* Contact Chris Kelland: 01235-770836.
11 **Reading SME.** *Club Running.* Contact Graham Bustin: 01189-615450.
11/12 **Chesterfield MES.** *Steaming at Papplewick.* Contact Mike Rhodes: 01623-648676.
12 **Bristol SMEE.** *BRIMLEC.* Contact Trevor Chambers: 01454-415085.
12 **Canvey R&MEC.** *Last Sunday Running.* Contact David A. Clark: 01375 846921.
12 **Cardiff MES.** *Open Day.* Contact Trevor Jenkins: 029-2075-5568.
12 **Elmdon MES.** *Running at Wythall Transport Museum Open Day.* Contact Chris Giles: 0121-458-1291.
12 **Harlington LS.** *Open Day.* Contact Peter Tarrant: 01895-851168.
12 **Leeds SMEE.** *Running Day.* Contact Colin Abrey: 01132-649630.
12 **Leyland SME.** *Diesel Day.* Contact Mark Entwistle: 01772-422411.
12 **Maidstone MES.** *Heywood Society Members Run.* Contact Martin Parham: 01622-630298.
12 **Malden DSME.** *$7^1/4$in. Gauge Open Day.* Contact John Mottram: 01483-473786.
12 **Nottingham SMEE.** *Running.* Contact Gerry Chester: 0115-9259096.
12 **Sutton MEC.** *Track Day.* Contact Mike Dean: 0208-657-5401.
12 **Talyllyn Railway.** *First Class for Sunday Lunch.* Enquiries: 01654-710472.
12 **Guild of Model Wheelwrights** *at Autumn Show,* East of England Showground, Peterborough. Contact Biddy Hepper: 01492-623274.

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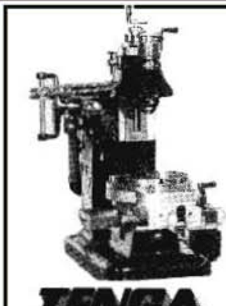

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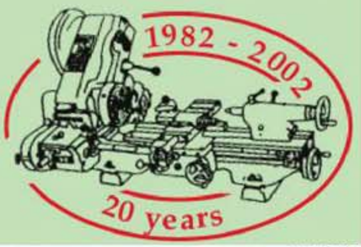

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ASQUITH 14-54 001 Mk2 (5mt) Radial Drill £3950
BOXFORD 2MT pedestal drill.......£295
FLOTT TB6 precision bench drill 450 – 9000rpm.......£425
FOBCO 1/2" Bench, tilting table.......£325
FOBCO 1/2" Pedestal drill tilting table £345
MAS RADIAL DRILL complete with box table and power up on head in very nice order, 3 morse taper.......£1850
MEDDINGS 1/2" pedestal drill.......£245
MEDDINGS 2 Morse taper pedestal drills (new type lighter drill)....... **Choice** £275
POLLARD CORONA Pedestal 1/2"/1 morse....... **From** £100
SIP HDP 600B 5/8" / 2MT Bench Drill, table operated by rack, speeds; (16) 162 – 3000 rpm....... **New** £175
STARTRITE Mercury 1/2" 4 speed bench drill.......£225

GRINDING / BUFFING

CLARKSON MKI Tool and cutter grinder complete with universal head and centres....... **JUST IN** £550
EAGLE MODEL 3 hand surface grinder in very nice order with magnetic chuck (14" x 7") £845
EAGLE 186W surface grinder complete with fine pole chuck £1225
JONES & SHIPMAN SURFACE GRINDER complete with 18" x 6" magnetic chuck and coolant.......£2250
MILFORD 12" Pedestal Grinder £325
VICEROY Grinder, pedestal model £145
VICEROY Buffers, pedestal models .... **Each** £250

MISCELLANEOUS / FABRICATION MACHINERY

TRANSWAVE 12.5hp / 9.6kw static converter as new.......£550
HEGNER Fretsaw.......£345
CLARKE strip heater, 110 amps in very good order £75
CLARKSON drill and tap lead grinding attachment complete with followers in nice condition £425
MAYSMITH CYLINDRICAL attachment for any grinder in as new condition £475
MARLCO INDEXING COLLET FIXTURE + COLLETS.......£75
MITUTOYO 7-8", 9-10", 10-11", 11-12" micrometers just in .... **EACH just** £45
ABWOOD SWIVEL/TILT 4" vice in all round good condition.......£245
ABWOOD SWIVEL/TILT 6" vice in all round good condition.......£375
CLARKSON DRILL POINT grinding attachment in nice condition.......£425
CLARKSON RADIUS MK1 grinding attachment in nice condition....... **BOXED** £345
New from New Zealand:- Machine vice, 55mm. Jaws precision miniature type ideal for vertical slides and smaller milling machines such as BCA now with the swivel base.......£134
Vice on own.......£85
Swivel base on own.......£49
CROMPTON PARKINSON _ HP, resilient mount, Boxford / Myford Super 7 Type motor .... **New** £140
MYFORD RODNEY HEAD MILLING HEAD FOR the Myford ML10 Lathe £550
MYFORD TRI –LEVER for the Myford ML7.......£245
MYFORD DIVIDING HEAD in very nice condition.......£395
MYFORD CAPSTAN ATTACHMENT new and never bored for the lathe so unused £750
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LPA 2S, 40 INT boring head £375
ARCHER tapping heads....... **FROM** £70
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STARTRITE 18-S-5 Woodworking / non ferrous bandsaw (5 speed bandsaw) £950
DIAMOND fret saw, variable speed.......£345
RJH BT 125 Fretsaw, variable speed £345
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BURNERD, LO lever collet chuck + collets.......£400
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MYFORD 254+ rear tool post .... **New** £40
MYFORD Vertical slide / fixed type (copy)_ £99
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LOCKWOOD quad headed 3mt Die Holder .... **quality equipment New** £40
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STARTRITE 14-S-5 woodworking band saw £775
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HARRISON L6 tailstock £245
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MITUTOYO grade A set of slips £245
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TRANSWAVE 5.5HP Converter....... **New** £385
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