

MODEL ENGINEER

Vol. 194 No. 4250

24 June - 7 July 2005

INTERNATIONAL
MINIATURE
LOCOMOTIVE
EFFICIENCY
COMPETITION

2-3 July

NORTHAMPTON
SME

EDWARDIAN ELEGANCE La France

SHAPING BETWEEN CENTRES

ELECTRIC MINNIE



WHAT'S ON IN YOUR AREA?
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WARCO

The widest choice... the best prices!



GH-1322 Lathe ONLY £2,550 inc VAT & Delivery

- 165mm centre height
- 560mm between centres
- Removable gap bed allows 476mm swing 38mm spindle bore
- Supplied with 3 and 4 jaw chucks
- Faceplate
- Fixed and travelling steadies
- Coolant system
- Halogen lighting
- Telescopic leadscrew covers
- Four way tool post

Also available as 750mm between centres.
£2,990.00



BH-600 Lathe ONLY £1,600 inc VAT & Delivery

For a limited period we will include a revolving centre, tailstock drill chuck and a set of 16mm index lathe tools FREE of charge!

Optional equipment

- Quick change tool post hardened and ground, supplied with 3 tool holders and parting off holder with blade £170 inc VAT with fitting kit to suit BH-600 fitting
- Coolant system £130 inc VAT
- Tailstock die holder £39 inc VAT

- THE ULTIMATE MODEL ENGINEERS LATHE
- HARDENED AND GROUND BEDWAYS
- TAPER ROLLER BEARING HEADSTOCK SPINDLE
- TEE SLOTTED CROSS SLIDE
- POWER CROSS FEED
- NORTON THREAD CUTTING GEARBOX
- 2HP SINGLE PHASE MOTOR
- BACK GEAR WITH 50 RPM LOW SPEED
- 1 3/8" SPINDLE BORE

SUPPLIED WITH ACCESSORIES AT NO EXTRA CHARGE

- 6" 3 JAW CHUCK
- 8" 4 JAW CHUCK
- 10" FACE PLATE
- FIXED & TRAVELLING STEADIES
- FOUR WAY TOOL POST
- IMP/MET THREADING
- STAND, COOLANT TRAY, REAR SPLASH BACK



BV-20 Lathe ONLY £525 inc VAT & Delivery

Optional floor stand £99

- FULL ENCLOSED GEARED HEADSTOCK
- SPEED SELECTION BY LEVER
- PRECISION GROUND VEE BEDWAYS
- LARGE BORE SPINDLE RUNNING ON TAPER ROLLER BEARINGS
- COVERED LEADSCREW
- SET OVER TAILSTOCK FACILITY
- INDIVIDUAL ACCURACY TEST REPORT
- SAFE ELECTRICAL INTERLOCKS TO CHUCK GUARD AND GEAR TRAIN COVER

SPECIFICATION:

- CENTRE HEIGHT 4"
- DISTANCE BETWEEN CENTRES 14"
- SWING OVER CROSS SLIDE 5"
- SPINDLE BORE 3/4" CLEARANCE
- SPINDLE SPEEDS (6) 140/1710 RPM • HEADSTOCK TAPER 3MT • TAILSTOCK TAPER 2MT
- RANGE OF IMPERIAL THREADS 8-24 TPI RANGE OF METRIC THREADS 0.4MM - 3MM
- MOTOR 1/2 HP 1 PHASE • DIMENSIONS 38" LONG x 19" WIDE x 15" HIGH • WEIGHT 230 LB



Warco Mini Lathe ONLY £375 inc VAT & Delivery

- 3 1/2" CENTRE HEIGHT X 12" BETWEEN CENTRES
- SUPPLIED WITH 3 JAW CHUCK
- FACEPLATE
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- COOLANT TRAY AND SPLASH BACK
- VARIABLE SPEED 0-2500RPM WITH BACK GEAR FOR MAXIMUM TORQUE
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- ACCURACY TEST CERTIFICATE WITH EACH LATHE
- RELIABLE USA BUILT PRINTED CIRCUIT BOARD - THE HEART OF THE MACHINE
- OPTIONAL ACCESSORIES STEADIES AND VERTICAL SLIDE.

Special offer
Tailstock drill chuck and TCT indexable lathe tool set with each machine.



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- FACE CUTTER
- LATHE TOOL SET
- IMP/MET THREADCUTTING



Warco WMT 300/2 ONLY £1099 inc VAT & Delivery

- SAME CAPACITY AND ACCESSORIES AS THE WMT-300/1 WITH THE ADDED BENEFIT OF A LARGER MILLING TABLE - 17" X 6" COMPARED TO 8" X 6"
- BACK AND PINION FEED TO SADDLE AND LEFT HAND THREADING FACILITY.



Warco WMT 500 ONLY £1399 inc VAT & Delivery

- SIMILAR TO THE SPECIFICATION AND ACCESSORIES TO WMT-300/2. POWER CROSS FEED TO MILLING TABLE/CROSS SLIDE. DEEP THROAT FOR EXTRA MILLING CAPACITY.

Delivery UK-Mainland



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SUPPLIED WITH POWER FEED TO X TRAVEL AT NO EXTRA COST

- ILLUSTRATED WITH OPTIONAL D.R.O AND POWER FEEDS
- TABLE SIZE 26" X 6"
- MOTOR 1 1/2 HP
- AVAILABLE 3MT R8 - METRIC - IMPERIAL



WM-20 MILLING MACHINE **NEW**

ONLY £3,500 inc VAT & Delivery

- INVERTOR DRIVE - INFINITE SPEED CONTROL
- SPEED RANGE 25 - 1480RPM
- TABLE SIZE 9" X 36"
- R8 SPINDLE
- 1.5HP WILL OPERATE FROM 13AMP SOCKET
- WEIGHT 750KGS



ZX-15 Milling Machine

ONLY £550

inc VAT & Delivery Optional Stand £89
Ideally matched to the BV-20 Lathe

Table size	654mm x 150mm
Longitudinal travel	455mm
Cross Travel	145mm
Spindle Stroke	90mm
Spindle Taper	3MT
Diameter of Spindle	63.5mm
Diameter of Column	66.65mm
Throat	165mm

Max distance spindle to table	320mm
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Height with head at top of column	1067mm
Width	775mm
Depth	559mm
Spindle speeds	400-1640
Motor	1 phase 1/2hp with F/R switch
Weight	295lb
Head tilting	90-0-90 worm gear tilt mechanism

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Direct Subscriptions and Back Issues are available from
 Model Engineer, Tower House,
 Sovereign Park, Market Harborough, Leics. LE16 9EF
 Order hotline: 0870 8379600; Customer Service: 0870 8379668
 Email: modelengineer@subscription.co.uk
 (Operating hours: 8am-9.30pm Mon-Fri; 8am-4pm Sat.)
 Rates for 26 issues (annual):
 UK: £55.00 Europe: £80.00 US Airmail: \$130.00
 RoW Airmail: £86.00
 Cheques payable to Highbury Leisure Publishing Ltd.
 Second class postage paid at Rahway NJ USA.
 Postmaster, please send address corrections to
 Model Engineer c/o Mercury Airfreight International Inc,
 2323 Randolph Avenue, Avenue 1, NJ 07001. Uags 0011099,
 US Subscription Agent: Wise Owl Worldwide Publications,
 5150 Candlewood Street, Suite #1
 Lakewood, CA 90712-1900, USA
 Phone: 562-461-7574; Fax: 562-461-7212.
 Email: info@wiseowlmagazines.com
 Website: www.wiseowlmagazines.com
 Visa/MC/Discover accepted.
 Canadian Distribution by Gordon & Gotch Periodicals
 (Toll free 1-800-438-5005).
 Model Engineer is published fortnightly.



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 ISSN 0026-7325

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IN THIS ISSUE

● Vol. 194 No. 4250 24 JUNE 2005 ●

SMOKE RINGS

Editorial news, views and comment.
 PAGE 729

POST BAG

Letters to the Editors.
 PAGE 730

EDWARDIAN ELEGANCE

First in a two-part series on an elegant
 GWR locomotive with a French
 connection. Part XII.
 PAGE 732

AN UPDATED CLAUDE REEVE EIGHT-DAY REGULATOR CLOCK

Guidance on how to cut out the complex
 pierced plates for this handsome
 timepiece.
 PAGE 736

BUILDING A STUART MODELS' LATHE

Work continues with completion of the
 tailstock and the machining of the
 spindle parts and saddle. Part II.
 PAGE 738

AN ELECTRIC MINNIE

A delightful model of a traction engine
 with a distinctly modern means
 of propulsion.
 PAGE 740

SHAPING BETWEEN CENTRES

Another unusual application for this often
 neglected machining process.
 PAGE 742

FOR YOUR BOOKSHELF

Constructing an 8-day skeleton clock and a
 further volume in the Wild Swan
 Publication series on Midland
 Railway locomotives.
 PAGE 743

PETE'S PAGE A SIMPLE SPRING BALANCE

A simple but accurate device suitable for
 manufacture in the home workshop.
 PAGE 744

PENRHOS GRANGE

Further parts for the *Grange*, a drawing of
 the Midland Compound plus photos of a
 full size Saint under construction
 at Didcot. Part XIX
 PAGE 745

ROAD STEAM: THE DIY GUIDE TO SELF- PUBLISHING

Our contributors take a holiday from the
 construction of the Savage Wagon and
 relate some of the perils of publishing
 your own book.
 PAGE 749



On the cover ...

A side lever marine engine built by J.
 Dobbing of Wirral MES and displayed on
 the Northern Association of Model
 Engineers' stand at The National
 Model Engineering & Modelling
 Exhibition 2005 at Harrogate.

This event was well attended by model
 engineering clubs and societies and was
 supported by the Southern Federation as
 well as the Northern Association.
 A short series detailing the highlights of
 this year's Harrogate Exhibition begins in
 the next issue. Make sure you order
 your copy today!

(Photograph by Neil Read)

ROCKING LEVER DRIVES ON GWR AND LMS 4-CYLINDER LOCOMOTIVES

An erudite discussion on this
 fascinating aspect of locomotive
 engineering.
 PAGE 752

IN THE NEXT ISSUE

Looking forward.
 PAGE 763

A PRECISION BORING HEAD

A neat piece of tooling that can be
 made in the home workshop and
 useful on the lathe or
 milling machine
 PAGE 756

BOXES ON WHEELS?

One method of getting into the miniature
 railway scene for those allergic to
 coal and steam.
 PAGE 760

A TALE OF THREE TENDERS

How one reader realised his dream of
 owning a model Stirling single
 locomotive
 PAGE 761

CLUB CHAT & CLUB DIARY

Recent activities and forthcoming events.
 PAGE 763

TURN TO PAGE 738 FOR GREAT OFFERS ON SUBSCRIPTIONS

SPECIAL DORMER PROMOTION! VALID UNTIL JULY 31st 2005 ONLY

All special offer prices shown include VAT and delivery to UK mainland address.



SETS of DORMER A002 TIN COATED DRILLS

Made in England, all these Dormer type A002 HSS drill sets are rather special. The self-centring drills have Dormer's special P5 point for higher positional accuracy, removing the need to use spotting-drills. They are also coated with Titanium Nitride on the working part of the tool, for extra smooth cutting and greatly improved wear resistance. Below 2.0 mm, the drills are uncoated.

FREE!
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and receive a Dormer
Technical Handbook
worth £6.99



51 pce Set 202 comprises 1 of each drill from 1.0 mm (0.040") to 6.0 mm (0.236") by 0.1 mm (0.004") increments. This means you can never be more than 0.05 mm (0.002") away from the size you require! They come boxed in a tough metal presentation case.

List Price £109.35
Offer Price £43.60



41 pce Set 203 comprises 1 of each drill from 6.0 mm (0.236") to 10 mm (0.394") by 0.1 mm (0.004") increments. This means you can never be more than 0.05 mm (0.002") away from the size you require! They come boxed in a tough metal presentation case.

List Price £228.36
Offer Price £89.95



25 pce Set 204 comprises 1 of each drill from 1.0 mm (0.040") to 13.0 mm (0.512") by 0.5 mm (0.020") increments. They come boxed in a tough metal presentation case.

List Price £133.48
Offer Price £54.95



13 pce Set 413 comprises 1 of each drill from 1.5 mm (0.059") to 6.5 mm (0.256") by 0.5 mm (0.020") increments. Also includes tapping drills for metric taps. They come boxed in a tough plastic selector case.

List Price £29.41
Offer Price £11.99



19 pce Set 095 COMPACT comprises 1 of each drill from 1.0 mm (0.040") to 10.0 mm (0.394") by 0.5 mm (0.020") increments. They come boxed in a new design compact metal presentation case.

List Price £73.47
Offer Price £31.90



29 pce Set 18 comprises 1 of each drill from 1/16" to 1/2" by 1/64" increments. They come boxed in a tough metal presentation case.

List Price £168.06
Offer Price £67.95



55 pce Drillboy Set comprises 3 of each drill from 1.0 mm to 4.0 mm by 0.5 mm increments, 2 of each drill from 4.2 mm to 6.0 mm by 0.5 mm increments, 1 of each drill from 6.5 mm to 13 mm by 0.5 mm increments. Also includes tapping sizes for metric taps. They come boxed in a tough plastic size-selector case with wall mounting brackets.

List Price £214.94
Offer Price £84.95

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was formed in 1913, and has built a long-standing reputation for quality, development and brand leadership.

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Dormer C191M Slotdrill or C291M Endmill Set



Each set consists of 6 two-flute slotdrills or 6 four-flute endmills in the following diameters: 6 mm, 8 mm, 10 mm, 12 mm, 16 mm and 20 mm. Please state which you require - slotdrills or endmills.

Cutter Features:

- HSS Cobalt performance
- Screwed shank
- 30 degree spiral flutes
- Low level of noise and vibrations
- Complete with plastic storage case

Special Offer Price
£41.95

Dormer Centre Drill Set - BS1 to BS5



List Price £35.44
Offer Price £13.99

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All photographs are as a guide only
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XP13	DP2 DIV SET	£52.00

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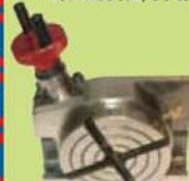
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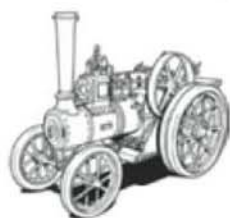
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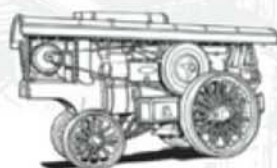


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- BA TAP SET (2 Taps each size) & BA DIE SET: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 BA
- 26 TPI TAP SET (2 Taps each size) & 26 TPI DIE SET (CYCLE OR BRASS THREAD) $\frac{1}{4}$ x 26, $\frac{1}{2}$ x 26, $\frac{3}{4}$ x 26, $\frac{1}{2}$ x 26, $\frac{1}{2}$ x 26
- BSF TAP SET (2 Taps each size) & BSF DIE SET: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1"
- BSF TAP SET (2 Taps each size) & BSF DIE SET: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1"
- BSW TAP SET (2 Taps each size) & BSW DIES: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1"
- BSW TAP SET (2 Taps each size) & BSW DIES: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1"
- METRIC COARSE TAP SET (2 Taps each size) & METRIC DIE SET: 2, 3, 4, 5, 6, 7, 8, 9, 10, 12 m/m
- METRIC COARSE TAP SET (2 Taps each size) & METRIC DIE SET: 14, 16, 18, 20, 22, 24 m/m
- UNF OR UNC TAP SET (2 Taps each size) & DIE SET: 0 to 12 UNF or 1-12 UNC
- UNF OR UNC TAP SET (2 Taps each size) & DIE SET: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1"
- UNF OR UNC TAP SET (2 Taps each size) & DIE SET: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1"
- GAS (BSP) PIPE SET: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1" (2 Taps each size)
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- METRIC FINE PITCH SETS (6 sizes from 14 - 24 m/m) TAPS & DIES
- ENDMILL SET (THREADED SHANK) $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1" or (m/m) 3, 4, 5, 6, 7, 8, 10, 12 m/m
- SLOT DRILL SET (THREADED SHANK) $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1" or (m/m) 3, 4, 5, 6, 7, 8, 10, 12 m/m
- ENDMILL SET, $\frac{1}{8}$, $\frac{1}{4}$, 1" DIA. WITH $\frac{1}{4}$ THREADED SHANK TO FIT COLLET CHUCK
- COUNTERBORE SET (FOR SPOTFACING) $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ OR (m/m) 3, 4, 5, 6, 8 m/m
- REAMER SET (STRAIGHT SHANK) $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1" OR (m/m) 2, 3, 4, 5, 6, 7, 8, 10, 12 m/m
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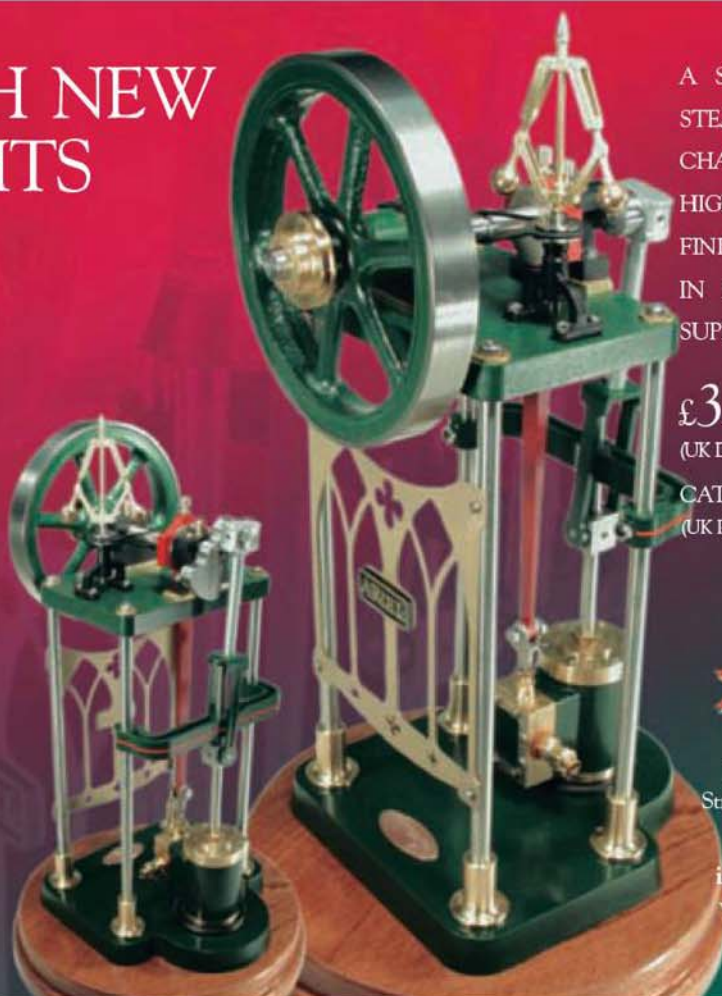
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SMOKE RINGS

With the Editors

Chopping 'em off

The second running of the Basingstoke shunting competition provided a good test of man and machine. The basic idea was a slow-driving race over about 100yds of the most severe incline the club's track could offer, complicated by the presence of a set of five trucks which were to be collected en-route, without stopping. We would not be surprised to see plenty of other clubs holding these challenging tests in the future.

The initial part of the course was relatively flat, leading into an initial uphill curve with a well wagon to be picked up, then a straight section with two weight trucks, and then into the worst of the incline with a right hand curve where the last weight wagon, and, a little later, the coal wagon were held. The last few yards were straight and of a shallower incline.

First on the track was John Hutson's *Jersey Lill*, a large GCR express locomotive. Although it was never really designed for shunting, John's second run was a masterpiece. John demonstrated the power of the loco, and how a careful hand could control the slipping, and resulted in the first successful run of the day with *Jersey Lill* "chopping them off" with a fantastic sound as she crested the incline with all 8cwt in front and John behind; a real pleasure to watch and hear.

Next was Neil Davis's *Gert, Linda*, renowned in the club for its power, traction and reliability. Its reputation proved well deserved, and its design was clearly well suited to the task. First Neil's son Darren took to the track and on his second run put in the time which would take second place, with a solid and impressive run, using every trick he knew to just prevent *Gert* from coming to a stand. After this display Neil showed everyone how it should be done – steam cocks open, regulator open, and judicious use of the driving trolley brakes! It worked. First place.

Next was a GWR prairie tank belonging to Terry Hobbs. His son, Andrew, reversed the trend of father beating son, by putting in a solid run to gain third place, consigning his father to 6th.

Later were competitions for the electric and diesel folk, and the junior members. These competitions concluded with Abi Dowson taking 2nd place in the adult non-electric competition, and winning the junior competition. The adult non-steam competition was won by Guy Harding, on his beautiful Metro growler *Michael Faraday*, in a record breaking time. Another run is worthy of note was by Stephen Newell on his 3 1/2in. gauge *Juliet*. It was recognised that the *Juliet* was never going to shift all 8 cwt, so the weights and the coal were removed, still leaving a heroic load for such a small loco.



Jersey Lill, driven by John Hutson into fourth place at the Basingstoke shunting competition

Diamond NAME

This is the Diamond Jubilee Year of the Northern Association of Model Engineers, and its rally this year will be at Stafford and District MES, located at the Stafford County Showground on Saturday September 17, from 10.00. There is a 450ft. raised track for 2 1/2, 3 1/2, and 5in. gauges, and a 750ft. ground level track for 5 and 7in. gauges.

It is planned to have an exhibition of models and work in progress, plus trade stands. Details about exhibiting are available from Chris Dobbs (01889 270533). Those who would like to run locomotives should call Clive Hewitt on 01785 614113.

Camping and caravanning facilities are available next to the track, but must be booked in advance (speak to Chris Dobbs). Visitors may also be interested to know that the two large tandem compound waterworks engines at Mill Meece, near Eccleshall will be in steam during that weekend, and antique and crafts fairs are scheduled at the Showground on the same day as the NAME Rally.

Join the pride

The Old Locomotive Committee tell us that Lionsmeet will be hosted this year by Brighouse and Halifax ME on August 7. Lionsmeet is an informal annual gathering of all those with an interest in *Lion* in all its manifestations and gauges. The invitation is to bring your *Lion* whatever its gauge or state of completion.

the competition starts at two in the afternoon.

Period dress is optional.

The location is Ravenssprings Park, Cawcliffe Road, Brighouse, West Yorkshire. More info from Alan P Bibby on 01254 812049.

Reeves online

Reeves 2000 tell us that it now has more than 8,000 products and 100 tonnes of stock available to buy online at www.ajreeves.com. The site is said to be fully secure for ordering, and despatch is normally on the day of ordering or the next working day.

The company has made remarkable progress in the past five years, and tells us that it now holds as much stock as the whole of the rest of the industry worldwide. New products include the Doble Steam Car book, drawings and castings for boat engines and road vehicles. More are promised.

One advantage of going online is that it is updated more frequently than the printed catalogue.

IMLEC

IMLEC 2005 is at Northampton this year not Bristol as stated in *M.E.* 4248, 27 May 2005. The contact given is correct, it is Peter Jarman, 01234 708501. Chances are entries are now full, but you might be lucky. Call Peter now.

Success

It was good to hear from Jane Dunn at Evesham College. In April we included some information about the college's model engineering course.

Since then the course has gone from dwindling numbers to being full. There is even a small waiting list. Jane reports that one new member travels 60 miles to attend, while another had invested in materials but needed a course like this to get going.

There is also one brand new recruit to model engineering, a recently retired man looking to acquire new skills and a new interest. Our best wishes to him and all the others.

CHUCK, the MUDDLE ENGINEER

by B. TERRY ASPIN



POST BAG

Lighten up

SIRS, - I retired 10 years ago after teaching a lighting course to architecture students for 40 years. At 75 I, too, need plenty of light. But first know that magnification is much more effective than more light for improving what is technically known as 'visual acuity'. After that more light is next best.

Two approaches come immediately to mind.

1: Dichroic reflector lamps. These are very widely used in supermarkets for lighting the fruit and veg. You can spot them because the back of the lamp looks like it is made of coloured glass. Actually it is a special reflector which reflects almost all the light but transmits the infra red wavelengths out of the back. As most of the electrical power put in appears as heat, anything behind the lamp can get very hot, while what is in front stays cool. They need heat resistant lamp holders and should not be mounted in front of flammable surfaces or materials. Also take great care with your hands. Do not stick one in the old Anglepoise.

2: Fluorescent lamps. There have been huge improvements in these, the new Phosphors have a long afterglow and twin tube fixtures light each lamp alternately to fill in the gaps. The newer compact fluorescent lamps which replace old fashioned bulbs are very good and use a fraction of the electricity for the same amount of light. I have just tried a single new compact 42 watt "spiral lamp instant on" fluorescent as the only light above the lathe and could discern no stroboscopic effect at all on the chuck at any speed. Europe is usually ahead of North America in fluorescent lamp development so compact reflector lamps may be widely available in UK.

Colour rendering for painting purposes is too complex a matter to deal with here. The Industry Colour Rendering Index is misleading for our purposes. The tubes I use for general lighting cost about three times as much as the common "cool white", but they cost little to run and last for years. Do stay away from "daylight" tubes.

For best value fluorescent lamps should be changed before they conk out. They very slowly fade so that in "light for electrical dollar" terms it pays to change them every few years. David Moizer, Canada

Needle Speedy

SIRS, - Physically there is room to

fit a standard HK 2020 'Drawn cup needle roller bearing' into a *Speedy* axle box. You can order them with lip-seals on both sides (HK2020 RS or EE) You can also order them with an 'oil-hole' (HK2020 EE OH) An inner ring is also available. (IR 17x20x20.5) The bore diameter of 17mm can be made to work with a *Speedy* axle. It is 0.044in. bigger than the boss for the wheels.

The 'feeling in my water' tells me that this is a more elegant/reliable/modern solution to the plain bearing. I ordered a set of six which cost me £42. I didn't 'shop-around' because the supplier (DRB Power Transmission near Chester) had been so helpful. I'm planning to add some axle box drillings to the oil-hole and fit a nipple to periodically squirt some clean grease through the assembly.

I've got just one negative point at this stage. The inner race is only 2.5mm longer than the distance between the lip-seals. Curly designed the *Speedy* axle end float at $\frac{1}{32}$ in. or .75mm. Assuming everything wears for it to become, say 1mm, there should be enough to prevent the inner slipping away from the seal as the axle moves sideways. Searching INA's website I now find that you can get inner races that are 30.5mm long!

These bearings and the range of features seem to be more available in metric, one of those occasions where the Europeans help us to fit something in. I doubt if you can easily get an oil hole in an Imperial version.

Geoff Johnson, Cheshire

Andover memories

SIRS, - I read with interest the letter from Gordon Howell (M.E. 4243, 18 March 2005) reminiscing about the Andover traction engine rallies of almost half a century ago. I supported the vintage car section of those rallies with a very early Austin 7 in company with my late father Ted Parks with his Singer Junior and our friends Mike and June Goodwin in their Red Label Bentley (they have still got it - one owner for over half a century!) I well remember arriving early on the day at one of these rallies to see Gordon giving the traction engine drivers a pep talk. He was standing on the hind wheel of a Fowler ploughing engine.

Some months after the rally an annual dinner was held in Andover and all the entrants to the rally were



Big Guns

SIRS, - I was delighted to see David Wilcox's article on the 5.5in. gun. I am familiar with these as I served in a gun battery equipped with these pieces. I am familiar with both types - the riveted and the welded versions as we had both types in the battery (and the Regiment); the welded version was alleged to be about 1 ton lighter but I never noticed any difference when 8 of us lifted the trail with the handspikes! The gun I served on was a riveted type.

Each type had both advantages and disadvantages, the riveted type tended to work the rivets loose around the joint between the trail arm and the towing eye assembly forgings whilst the welded type had a disconcerting tendency to develop cracks along the trail welds.

The lack of a suspension resulted in the gun continually 'squidging' up and down on its tyres and surging on the tow hook when on the move. This was blamed for most of the problems with the rivet securing of the forgings. The cracks on the welded chassis were probably because this guns trail was a bit light for large charges.

Two items of interest to modellers that I noticed were not mentioned in the article but are shown in part in the drawings, the first is that the trail when closed is secured with a 'bayonet' lock near the towing eye (small 'brake lever' seen in the plan view above the RH spade and fig 2.) and a cross bar (shown folded in the plan view and dotted in fig 2.). This also secures the cradle / barrel assembly to take jolts and travelling loads off the balance and elevating gear - which gear also has a lock pin that was withdrawn for travelling. The same pin was withdrawn when reloading from high elevation - two or three crew members bore down on the back of the cradle and swung the barrel back up until the pin re-seated.

There is shown the front cradle clamp fig 3 which with the trail cross bar made everything secure (the barrel / cradle assembly is very heavy and needed all those clamps).

The second item (which is not shown) is that there are two treadles on the front of the carriage that have to be depressed to unlock and release the trail legs so that they can be swung apart - then relock them in the open position. There is also a 'camming' arrangement acting between the trail legs and the axletree that locks out the pivoting arrangement for the axletree when the trail is opened, preventing any movement and stabilizing the piece when emplaced, this is possibly the two ramps on the axletree shown in Fig 12.

Not shown are the canvas sleeves that weather-proofed the top of the balance gear rams on some guns, there was also often a cross bar between the two to hold up camouflage netting.

I cannot remember ever using the handbrakes on the gun, the main brakes were electric and operated by a 24v solenoid, and these may have been a Lucas product. I remember them as being very temperamental and as the plug on the connecting cable often came adrift - a pain in the butt!

There is nothing wrong with David's drawings, he is hiding his light under a bushel, they are excellent and the only (minor) defects are because he has not had the benefit (?) of seeing them in action. I also suspect that nearly all museum exhibits lack many 'operational' bits and pieces. I look forward to the rest of the series.

Peter King, New Zealand

invited. It was at one of these dinners that I first came across a traction engine driver looking most uncomfortable in a suit, that didn't quite fit, attempting to make a speech. A fond memory that! Each year the entrants were presented with a plaque commemorating the event and one year Gordon made a pattern and had these plaques cast

in aluminium. At the following dinner one Jethro Crabb in his speech for the vintage car owners, picked up the fact that Gordon had missed one of the 'e's out of the word veteran. To which Gordon replied "That's 'ow I sez it, so that's 'ow I spelt it". The following year Jethro commenced his speech by saying "I am pleased to see that the

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The Editor (*Model Engineer*),
Berwick House, 8-10 Knoll Rise, Orplington, Kent, BR6 0PS; fax: 01689-886666
or to dcarpenter@highburyleisure.co.uk
Publication is at the discretion of the Editor.

The content of letters may be edited to suit the magazine style and space available. Correspondents should note that production schedules normally involve a minimum lead time of six weeks for material submitted for publication. In the interests of security, correspondents' details are not published unless specific instructions to do so are given. Responses to published letters are forwarded as appropriate.

standard of education in Andover has improved during the last 12 months". Happy memories thanks for jogging them Gordon - keep on in there pal!

Peter Parks, Worcestershire, by e-mail.

Perplexed!

SIRS, - I am in the process of constructing *Princess of Wales*, the Johnson "single" to Martin Evans design and have reached the stage of painting. I believe in painting assemblies as the work progresses (ala Basil Palmer et al) and have followed the livery as described by Martin Evans in the construction series and the livery data sheets from Precision Paints. In both epistles, the predominant colour is of course MR Crimson Lake and I have followed the libretto faithfully only to be confronted by photographic evidence which confounds me to say the least.

I have only recently studied the back issues of *Model Engineer* in my possession to find not one but two examples of this locomotive in a colour scheme which to my eye is anything but MR Crimson Lake of the time.

The most recent example of this colour aberration is on Tony Meeks' award winning example shown in vol. 192, no. 4217, March 2004. The earlier example, which has prompted this letter is John Wilkes' example shown on page 692 of vol. 182, no 4095, June 1999.

I do much prefer the colour scheme of these two impressive examples but I would like to know; is it due to the colour reproduction of the magazine or was the Grand Prix winning locomotive of 1900 painted differently to the rest of the class purely for the Paris exhibition? I have halted further colour work on my effort until this is resolved so please, Tony or John, enlighten me!
Peter Pinson, Worcestershire

Double Row Gnomes

SIRS,- Over the past 10 years I have been building a third scale model of a two row Gnome Monosoupape rotary aero engine, as shown in Bill Gunston's two books, the *'World Encyclopaedia of Aero Engines'*, page 70 and *'The Development of piston Aero Engines'*, page 112. The engine is in effect a double row version of the standard Monosoupape 9B engine and appears to a prototype that never went into production. The photographs show the engine

displayed in an unknown museum. Are there any readers who know which museum?

I would be grateful for any information regarding the following:

A spare parts manual picture, and or, a cross sectional view of a double row Gnome crankshaft.

Details are required of the double throw section.

A photograph of the rear of a double row Gnome showing the layout of the pumps and magnetos.

I am also looking for any technical information on the Siemens-Halske Sh III rotary aero engine.

I enjoyed Frank Taylor's series on the construction of his burnt air engine, and the description of the methods he used to make many of the parts. It is refreshing to see some revolutionary experimentation in the tradition of many model engineers of the past. Brian Perkins articles on his Bristol Aquila and Hydra engines were also of great interest.
Murray Lane, Auckland

Drawing the Line

SIRS - I am not sure whether to react with amusement or a measure of dismay to the letter from John Davies in *M.E.* 4241, 18 February 2005 complaining about the cover of *M.E.* 4237, 24 December 2004, to wit, some well modelled furniture. My wife took delight in the cover, and it did not even occur to me that such an example of first-class workmanship from a different discipline should not be shown on the cover occasionally. I might perhaps draw the line at seeing a scantily clad page 3 "Sunshine" girl on the cover - but that would depend entirely on the quality of the model she was driving!

John C. Bauer, Ontario, by e-mail

Guide Bars

SIRS, - I cannot understand why Mr. Wilson advocates silver steel for guide bars for his locomotive Lillian to be manufactured from this material, having discovered that the only way he can achieve the design dimensions is to glue and screw two pieces of the said material together.

There is a better way and that is to use what is commonly known as

gauge plate or to give it its full title ground flat stock.

This material is a much more refined product than silver steel, is available in many sections both Imperial and metric and as its title suggests is ground all over to close limits. I would also suggest that it is not necessary to harden it, with the distinct possibility of distortion over such a length, even if quenched vertically into a quenching oil (I would not recommend quenching in

water). With bronze or gunmetal crosshead liners in its natural state it should last a very long time before replacement is necessary.

Should hardening be considered absolutely necessary then it will be necessary to use material that is oversize say plus 0.015in. or 0.40 mm, heating and quenching, and possibly tempering to give the bar some strength.

It will then have to be surface ground to size, it is unlikely that the model engineer has a surface grinder to hand, so, I would stick to my first suggestion, and use the material as supplied. Giving it a higher finish using an abrasive such as aluminium oxide cloth or emery cloth.

J.A. Rea, Sussex

Axles

SIRS, - Can I make further observations on the arrangement of needle rollers running on silver steel advocated by Messrs Wilson and Evans?

Philosophising on whether this arrangement will give acceptable life seems fruitless, they have tried it for real and they say it does. An ounce of practice is worth a peck of theory. Narrow gauge wagons made many years ago by Hudsons for the knockabout world of quarries and mines had roller bearings where not only the axles were mild steel, so were the rollers.

According to the metallurgist at work, the only advantage of silver steel over mild steel in this application is that it comes ready ground. Precision ground mild steel would probably work just as well.

Having said all that, SKF supply precision ground, induction hardened shafting made specifically for bearings to run on. This is hardened to 65 Rockwell, with a surface finish better than 0.3um Ra, to use a non-tech term, rock hard and mirror finish. It is available from RS at about £25/metre, but the only practicable method of cutting it would be wire erosion or similar. SKF are prepared to sell it cut to length, and have quoted £11.50 per 150mm length of 20mm diameter if ordered in 10 offs, or £8.50 in 100 offs. It is surface hardened only, so it should be possible to centre drill it, using a collet or steady to ensure concentricity. This is not ridiculously more expensive than silver steel. I'm not sure how you would drill the wheel securing pin, but if the Loctite is doing its stuff why do we need one? Grinding away the hard surface at each end, down to say 18mm would be an option, but would increase the cost.

This opens an opportunity for a supplier somewhere, for complete axle and axle box assemblies, the only variable being the overall length of the axle. If there were sufficient interest, I might be prepared to get a batch made on a cost sharing basis.

I avoided all this by fitting ball bearings to my Sweet Pea, see accompanying drawing. These take axial loads as well as radial, and come complete with shields to keep the dirt out, but they would not have fitted within the confines of a normal 5in. gauge axle box.

Duncan Webster, by e-mail

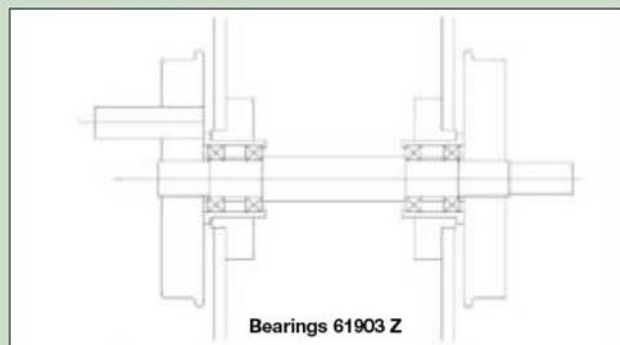
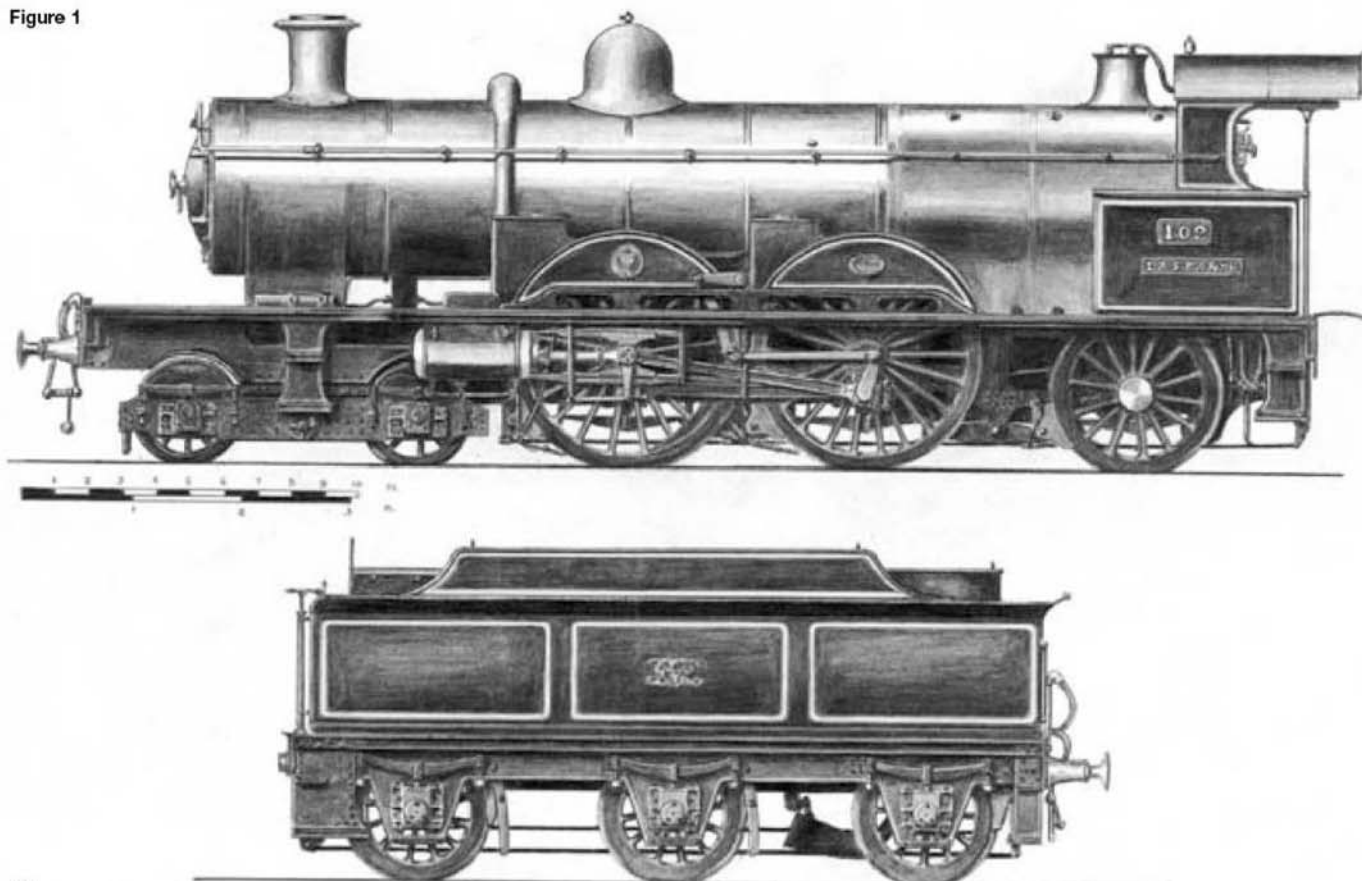


Figure 1



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EDWARDIAN ELEGANCE

Ron Isted

describes the GWR No. 102
La France and the De Glehn
Compounds.

●Part XII continued from page 380
(M.E. 4244, 1 April 2005)

I suppose that in the interests of accuracy, I should describe this elegant lady as a naturalised Edwardian, because she first saw the light of day in France, in 1903 at the works of the *Société Alsacienne des Constructions Mécaniques* (SACM) in the city of Belfort. The man responsible for the design, however, was an Englishman, though you might not have guessed that from his name: Alfred de Glehn was born in 1848 in Sydenham, at that time part of rural Kent, but long since overwhelmed by the London sprawl. His father, Robert von Glehn, had come to England from one of the Baltic States and married a Scottish girl, so maybe Alfred acquired his engineering talent from his mother. After emigrating to France, where he indulged in an early example of political correctness by changing his name to *de Glehn*, he landed the job of Chief Engineer at SACM before he was 30, and there produced the design for the first compound locomotive for the *Chemin de fer du Nord*, (Northern Railway of France).

Locomotive No. 701 emerged from the SACM works at Mulhouse in January 1886, and was the direct ancestor of a long series of locomotives that became famous throughout the world as the *de Glehn* compounds. The 2-2-2-0 wheel

arrangement of this revolutionary locomotive was the same as the LNWR Compound Experiment built at Crewe four years earlier to the designs of F. W. Webb, but with a very different cylinder layout. De Glehn's engine had four cylinders, of which the two high pressure were in a forward position inside the frames and drove the centre pair of wheels, while the low pressure pair were placed further back outside the frames, driving the rear wheels. The engine was equipped with four sets of valve gear, the inside HP valves operated by Stephenson, and the outside LP by Walschaerts, inverted because the valves were positioned below the cylinders, an arrangement not unlike that employed with the Joy valve gear for the outside HP cylinders on the Webb Compounds.

But perhaps the most interesting feature of the French machine, and a great advance on the Webb design, was that the HP and LP gears could be notched up independently of each other. The locomotive was also fitted with a reducing valve, permitting operation as a) a four cylinder compound, b) a two cylinder simple, using only the HP cylinders or c) ditto using just the LP cylinders or d) as a 'reinforced' compound by admitting live steam to the receiver. This fascinating and ground-breaking locomotive, in rebuilt form as a 4-2-2-0, now resides once again in her home town of Mulhouse, at the French National Railway Museum.

While No. 701 as built performed well, the Engineer-in-Chief of Rolling Stock and Motive Power on the Nord, Gaston du Bousquet, realised she could be even better. In close collaboration with Alfred de Glehn, he developed the basic

design to create the prototype of several thousand locomotives, used not only in France and many other European countries, but exported as far afield as India, America and China. Du Bousquet's main alterations to the original design were the reversal of the positions of the high and low pressure cylinders, the use of Walschaerts valve gear for both LP and HP, and much more direct and generously proportioned steam passageways. These modifications were quite substantial, and really it would be more accurate to describe subsequent locomotives as 'de Glehn/du Bousquet' machines.

Another improvement instigated by du Bousquet was to position the inside LP steam chests and their attendant valve gear next to the main frames, i.e. outside the cylinders and main cranks, a layout that enabled the driver to stand more or less upright between the frames in relative comfort when oiling round. Compare this with the cramped and sometimes downright dangerous positions British drivers had to cope with, because of this country's 19th century obsession with inside cylinders with valves between them, or the forest of rods and levers found on many British multi-cylinder designs of the early 20th century. Ironically, the criticism applies particularly to the Great Western Railway 4-cylinder 4-6-0s, whose basic layout owes so much to the de Glehn/du Bousquet compound. And yet you still hear claims that one of the reasons compound locomotives didn't catch on in this country was due to their inaccessibility!

In fact, the de Glehn/du Bousquet arrangement facilitated access to the inside low pressure steam chests, which were above their respective

cylinders, but offset at an angle of approximately 40 degrees. This enabled the covers to be removed from outside, without first having to remove other, sometimes substantial, portions of the locomotive's anatomy. Once again, this is rather different to some of the fitter's nightmares perpetrated elsewhere - no names mentioned! - on which difficulties of access to the inside mechanism could keep a locomotive off the road for a considerable period of time. This French design of a century ago also provided a very direct route for the exhaust steam, unlike the contorted and restricted passages built into so many designs around the world, then and for many years afterwards.

Throughout the last decade of the 19th century, Alfred de Glehn at the SACM and Gaston du Bousquet on the Nord worked in close collaboration to develop their new four-cylinder compound design, producing first a highly successful 4-4-0, followed by a 4-4-2 and a 4-6-0, with further major improvements to the steam circuit. Jumping ahead a little, it is interesting to speculate on the outcome if, instead of the Atlantics, the Great Western Railway had imported one of the 4-cylinder compound 4-6-0s built for the Nord from 1908 onwards. The performance of these locomotives, in proportion to their size, was truly outstanding in terms of both efficiency and their ability to run, in spite of coupled wheels only 1.75m (5ft. 9in.) in diameter. Weighing little more than 70 tons, (nearly five tons lighter than a Great Western Star, 10 tons less than a Castle and almost 20 tons less than a King), these moderately sized 4-6-0s could sustain 2,000hp and haul 400 tons at 75mph, the maximum speed then permitted on French railways. In modernised form, as SNCF class 230D, they lasted almost to the end of steam traction in France and two have survived into the preservation era, one of which, like Alfred de Glehn's No. 701, is a static exhibit in the French Railway Museum at Mulhouse. The second is another 'naturalised Edwardian', and still earns her keep as a performer on the Nene Valley Railway near Peterborough. If the GWR had acquired one of these extraordinary locomotives, Churchward might have changed his views on compounding.

Having said that, the de Glehn/du Bousquet Atlantics, the first two of which appeared in the last year of the 19th century, were themselves pretty phenomenal by the standards of the day. They were certainly the finest express passenger locomotives for their size in the world at the time and the first engine, No. 2641, caused an engineering sensation at the 1900 Paris Exhibition. Indicator tests on this locomotive, using saturated steam of course, showed an output of nearly 1500hp at 77mph - a figure far in advance of any similar sized locomotive at that time in any country, including Britain. Even in their original condition, they could exceed by nearly a third Churchward's famous requirement of 2 tons at the drawbar at a speed of 70mph. It is not really surprising therefore, that with the new spirit of enterprise pervading the Great Western Railway at the beginning of the 20th century, the board of directors sanctioned their Locomotive Superintendent's request for the purchase of one of these outstanding locomotives.

In the autumn of 1903, a total of 13 large packing cases were shipped from SACM Belfort to London's Poplar Docks for transfer by train to the GWR Swindon 'factory'. The contents of these precursors of the container system were intended for the DIY assembly of a 12 inches to the foot, working model of a French Atlantic locomotive - a sort of super Meccano set. (By the way, before anyone leaps up to put pen to paper, I do know that the famous constructional kit was not actually known by that name at the time, but its original version had already been on sale for a couple of years.) My fertile imagination conjures up a vision of a group of men acting like a bunch of overgrown schoolboys on Christmas morning, watching that kit of parts being unloaded outside Swindon works and scarcely able to contain their eagerness to start putting all the bits together. But in this case, the initial euphoria over their early gift from Santa was probably followed by the frustration of trying to cope with instructions in French, not to mention all the dimensions on the drawings in metric units. The Swindon Drawing Office immediately set to work to produce a typical GWR locomotive diagram, '4-4-2 A', which, incidentally, omits any vestige of the fiendishly foreign Walschaerts valve gear. It goes without saying that all the equally devilish metric dimensions were translated into good old Imperial gallons, pounds per square inch, tons, hundredweight, pounds, feet, inches - and truly indigestible fractions, dozens of 'em.

And believe it or not, somebody in the Swindon D.O. actually got it wrong, making a mistake which as far as I know, has never been corrected! The front bogie wheels as shown on the SACM drawings are, like most of the earlier de Glehn locomotives, 900mm in diameter, which is within a few thou of 2ft. 11⁷/₁₆in. The Swindon diagram, however, shows this dimension as 2ft. 11⁷/₈in., a figure that has been solemnly repeated without exception for over a century in every publication that mentions this locomotive - even the (almost) infallible authors from the Railway Correspondence & Travel Society, not to mention the *Model Engineer* and *Electrician*, fell into the trap. This discrepancy of less than 1/2in., however, is a mere bagatelle compared with a much more serious technological inexactitude, (i.e. rubbish statement), that has also been repeated in nearly every publication over the last 100 years or so, but we'll come to that in a moment, along with sundry other factual errors. I mentioned the omission from the Swindon diagram of the Walschaerts valve gear, but curiously enough, the drawings of the first GWR steam railcar, under construction at the same time and also equipped with this gear, clearly show it in full detail.

In spite of any problems with language or mathematics, the SACM's Meccano set (or Polly Kit?) was successfully assembled as *La France* (figs 1 and 2), and entered the official GWR stock list in the same month as the steam railcar, October 1903. The French engine was given the running number 102 and was also allocated Swindon Lot number 146, together with Swindon works number 2025, in spite of the fact that she already carried her SACM works number, 5409, which all goes to show that number-crunching as an administrative pastime flourished long before the advent of the computer age.

The locomotive was very similar to the Nord Atlantics, but one obvious visual difference was the graceful arched roof to the cab, in place of the rather austere and angular shape of the original design. On the French engines, this measured no less than 2.63m (8ft. 7³/₄in.) wide across the corners, so I assume the alteration was made to avoid exceeding the GWR loading gauge at that height. Digressing slightly, I have always been intrigued by the shape of the cabs on the French Nord locomotives of that era, as they are strangely reminiscent of the design of William Stroudley, first produced by that great Victorian engineer in Scotland and then brought south when he moved to the London Brighton & South Coast Railway. It was only when researching this series of articles that I discovered Alfred de Glehn was born not far from the LB&SCR main line to Brighton and I wonder whether, as a young man in the early 1870s, he was familiar with the first Stroudley 0-6-0s and 2-4-0s? The cabs on these engines gave much greater protection to engine crews than was usual at that time and it is perhaps not too fanciful to imagine that de Glehn was sufficiently impressed to take the design with him when he moved to France. The cab fitted to No. 102 and, to an even greater extent, the enlarged version with side windows fitted to Nos. 103 and 104, the later pair of French compounds imported by the Great Western Railway, were certainly far more generous than the native Churchward design, standard on most of the company's locomotives then and for 20 years afterwards.

Other modifications to the original French design did *not* include the smokebox door which, together with the hinges and small clamping wheel, were actually standard SACM fittings, in spite of so many published statements to the contrary. The locomotive was, of course, equipped with Swindon buffers and drawgear, vacuum brake in place of the Westinghouse, and last, but certainly not least, the very elegant chimney. Now that chimney is for me one of the most beautifully proportioned chimneys ever to grace any locomotive, far more so than the plain cast-iron excrescences that blossomed forth on many Great Western locomotives around the beginning of the 20th century. Some might even consider it a rival to the famous copper cap jobs forever associated with the products of Swindon. Another statement regularly regurgitated in various publications over the past 100 years or so, is that *La France* was "virtually a replica" of the first two Nord Atlantics built in 1899, but once again, this simply isn't true. The design, as is logical, is much more akin to the later locomotives built from 1900 onwards, which incorporated several major improvements, including a longer bogie wheelbase and an increase in the boiler heating surface. I'm sorry if this article seems rapidly to be turning into a bit of a catalogue of other writers' errors, but, in the immortal words of Al Jolson, "you ain't heard nuthin' yet". Of all the items on the long list of mis-information that has been glibly copied from publication to publication since the beginning of the last century, the most extraordinary is surely the unanimous assertion that the high pressure cylinders on the de Glehn Atlantics, as originally

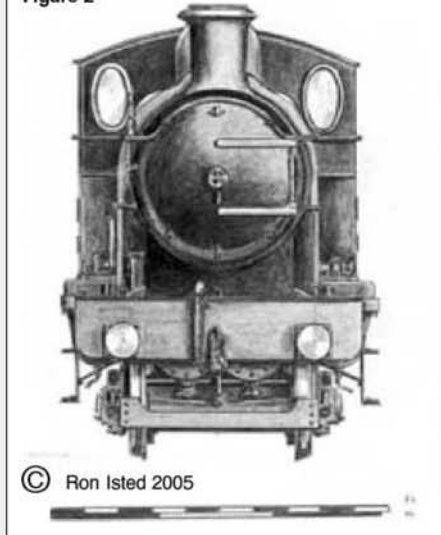
built, were equipped with piston valves. Well, they weren't!

When I first started on the drawings of *La France*, I remember noticing how remarkably neat the square covers over the outside valve chests were, but thought no more about it until a series of works drawings arrived from the NRM some time later. One of them consists of three cross sections of a Nord Atlantic, including one through the HP cylinders and valve chests, showing what appeared to be balanced slide valves, contradicting every one of the great pile of technical tomes I had previously consulted. Not having the courage of my own convictions in the face of all these authoritative volumes, I thought I must be mistaken, so I phoned Phillip Atkins at the NRM. He very kindly checked a drawing there and then, and confirmed the fact that all four cylinders were indeed actuated by slide valves and that I was not having a brainstorm. It would appear from this little tale that a reluctance to undertake proper research, not to mention the sheep instinct, is just as prevalent among railway journalists as in any other walk of life and once again bears out my plea, never take any information on trust, especially if it's official! An extreme example occurs in a book in my own collection where three lengthy, but inaccurate, consecutive paragraphs have been 'lifted' precisely word for word from another publication that appeared a few years earlier, without acknowledgement of course.

Even *Model Engineer and Electrician* must plead guilty, as issue No. 232, 5 October 1905, contained a works drawing of that very same cross section of a Nord Atlantic, clearly showing the balanced slide valves - directly beneath text informing its readers that the HP cylinders were fed by piston valves! If anybody perpetrated such a thing these days, I suspect that a few pretty outspoken letters would quickly appear in *Postbag*, but a century ago nobody seems to have reacted. On the other hand, it is only fair to point out that this magazine first carried the news that the GWR had ordered a French compound as early as January 1903, little more than a month after Churchward had made the announcement at a meeting of the Association of Railway Locomotive Engineers. Six months before the engine actually arrived in this country, *M.E.* No. 104, 23 April 1903, carried another excellent and informative item giving generally accurate technical details and dimensions.

La France began extended trials on 11 October 1903, but did not begin to earn money until nearly four months later. I had assumed that the reason for such a protracted 'probation period' was at least partly due to the necessity for Great Western footplate crews to learn how to get the best out of an extremely complicated piece of machinery. *The Model Engineer and Electrician* No. 115, 9 July 1903, however, after quoting the date of import as being delayed until September, continues: "It will be tested against one of the latest pattern Swindon built engines, the French engine being handled by French drivers only, so that the test may be fair in every respect". This unexpected and almost throw-away line right at the end of the paragraph was amplified four months later in *M.E.* No. 133, 12 November 1903: "The French engine has now been

Figure 2



completed and will shortly be put into experimental service... In order that the test may be as conclusive as possible, French drivers and firemen will be lent from the Nord of France Railway to work the engine on the Great Western, and if necessary, even French briquettes will, it is said, be imported for use as fuel" (!) The latter part of this statement may cause a slight raising of the old eyebrows to anyone who has had experience of French briquettes and/or Great Western Welsh steam coal.

This *M.E.* statement also raises all sorts of interesting questions: how many French footplate crews came to Britain and for how long? Was there a sort of exchange of footplate crews, (highly unlikely in view of the different training methods in the two countries), or did the GWR pay a hire fee to the Nord? Did any of the French crews work any GWR timetabled trains, or were they confined to the test trains only? What about language problems, for example when the French drivers were learning the road or perhaps demonstrating the complex art of driving a de Glehn compound to their British colleagues? On the other hand, did any of the French crews ever have a chance to handle one of the two revolutionary new Swindon 4-6-0s, the first of which was the subject of the initial article in this series? Finally, what on earth did the French *mécaniciens* make of the old Westbourne Park depot, the GWR's principal London engine shed until Old Oak Common opened a few years later, and a dreadfully cramped, primitive and decrepit abomination of a workplace, even by the standards of the day? But when all is said and done, the vast majority of steam railwaymen were fanatical enthusiasts, as I know from personal experience both in this country and in France, and I'm willing to bet that any communication difficulties were soon overcome over a pint of (probably warm) English beer.

On the 2 February 1904, *La France* worked her first scheduled passenger turn, while on 1 July of the same year, she was given the honour of heading the inaugural trip of the brand new 'Riviera Express', leaving Paddington at 10.10am and scheduled to arrive at Penzance exactly seven hours later. I would like to think that a French driver was on the footplate on that historic journey, if only as an observer, as the train's first stop was Plymouth, 245 miles away (via Bristol) in 4 hours 25 minutes - the longest scheduled non-stop run in the world then and for many years afterwards. At that time, the GWR

really was the Great Way Round, since the direct route to the West of England did not open until a couple of years later, reducing the distance to Taunton and stations west thereof by about 20 miles. This new route also saved 20 minutes in time, so the start time was put back to 10.30am and the train became the world-famous 'Cornish Riviera Limited Express', universally known to the staff as 'The Limited'. To call this an inaccurate description is an understatement - many times in later years have I travelled on this train, when a King has made the usual firm-footed start from Paddington at the head of 15 coaches, well over 500 tons, forming the principal train, while two or three duplicates would follow at five minute intervals. The load was, however, progressively reduced by slipping various portions until little more than half the original formation arrived at Penzance.

On that very first run a century ago, our graceful French Atlantic had charge of a six-coach train weighing less than 200 tons. It comprised five of the equally elegant clerestory roofed bogie coaches designed by Churchward's predecessor William Dean, together with one of the latest 68ft. long 'Dining Cars' with elliptical roof - a symbolic mixture of what had been and what was to come. At the time of writing, a superb '0' gauge model of the complete inaugural train, built by Mike Little, is on exhibition at the Great Western Society Small Relics Museum at Didcot, but I fear that by the time this appears in print, the display will have been changed. Some idea of the pure luxury of travel by rail in those halcyon days, (at least on the main lines), may be gained from a contemporary photograph of the sumptuous interior of one of the later clerestory roofed saloons, reproduced on the back of the dust jacket of Jim Russell's *Pictorial Record of Great Western Coaches* Vol. 1, published by Oxford Publishing Co.

Records of performance of No. 102 on the road in her early days are unfortunately few and far between, although she certainly earned her keep, her mileage already approaching 30,000 after less than eight months service. On 20 June 1904, *La France* hauled a heavy Ocean Liner Special, consisting of 12 eight-wheelers weighing 350 tons, from Exeter to Paddington via Bristol (193 1/2 miles) in 198 minutes, eight minutes of which were spent standing in Temple Meads station, giving a running average of 61.1mph. The formidable first 20 miles up to Whiteball summit from the standing start were covered in just 22 minutes, a superb piece of work with such a load. Yet only a few years ago, a writer who had better remain unidentified, claimed that the "French Compounds were not built for hill climbing", a quite astounding statement that was disproved in their native country every day for 70 years or more. Earlier in 1904, the Atlantic took a lighter load of 160 tons from Paddington to Exeter in a net time of only 182 1/2 minutes, equivalent to an average speed of 63.6mph, a very high figure over such a long distance. This trip was recorded by our old friend, railway journalist Charles Rous-Marten, who added, in his usual ponderous style: "the maximum rate attained during the whole run was on the dead-level and after several miles of

absolutely flat road, when 'La France'...reached 84.9mph, the fastest I have ever noted on the dead-level unaided by gravitation."

Back in their native France, the Nord Atlantics were putting up even more spectacular performances. In 1902, one of them covered the 184½ miles from Paris to Calais with a 250 ton boat train at an average speed of 64.4mph and returned shortly afterwards with the slightly lighter Calais-Mediterranée Express at an even higher figure of 67.5mph. By an odd coincidence, this is precisely the same average speed scheduled more than 30 years later for the GWR showcase express, *The Bristolian*, with a similar load. But remember that Brunel's 118-mile 'billiard table' from London to Bristol was a rather easier proposition for high speed running than the 184½ miles of the French main line from Paris to Calais, while a superheated GWR King class locomotive tipped the scale at 89 tons, and had twice the adhesion weight of the saturated 64½ ton de Glehn Atlantic. Even more relevant, the maximum legal speed anywhere on French railways was then only 120kph, (74.6mph), so the hill climbing must have been excellent.

One really crucial figure which seems never to have been revealed, is exactly how the specific fuel consumption and maintenance costs of the 'Frenchmen' imported by the GWR compared with those of the native Swindon products, the early Churchward outside cylinder engines or even the highly successful City class 4-4-0s. This absence of facts and figures is remarkable, because no fewer than 15 locomotives were built at Swindon as 4-4-2s, specifically for comparison with the three French compounds and, as we have seen, French footplate crews (and fuel?) were imported to ensure the tests were as fair as possible. All I have managed to unearth are vague statements that the fuel consumption of the 'Frenchmen' was "slightly better", although O. S. Nock claims that the two larger compounds imported in 1905 were more costly to run than the Swindon products. Cecil Allen is on the face of it more precise, quoting fuel consumption figures of between 37 and 40lb. per mile for *La France* against 34.3 and 40.2lb. for Churchward's Albion. But these figures are completely meaningless without details of loads and speeds - and why the decimal points for one engine and those suspiciously round figures for the other?

GWR No. 102 *La France*: Main Dimensions

Note: these are intended specifically for use in producing a miniature version of this locomotive, so 'internal' measurements, such as heating surface and internal diameter of boiler sections are omitted. The figures for 3½in. and 5in. gauge have been calculated to the nearest 1/64in., using 3/4in. and 1½in. to the foot respectively. Original metric dimensions on the full size locomotive are quoted with Imperial equivalents in brackets, but the tender was a standard Swindon product, as were the buffers on the locomotive.

For gauge 1, halve the 3½in. gauge figures, for 2½in. gauge, halve the 5in. gauge figures, for 7½in. gauge, double the 3½in. gauge figures. Dimensions prefixed by = are approximate only.

Description	Full size	3/4in. scale (3½in. G)	1½in. scale (5in. G.)
Length over buffers, engine and tender	63ft. 51/64	4719/64in.	67in.
Overall length of engine (Note 1)	38ft. 3/64in.	281/2in.	403/8in.
Length of engine main frame	11.015m (36ft. 143/64in.)	277/64in.	3825/64in.
Overall length of tender	25ft. 3/4in.	1851/64in.	265/8in.
Length of tender main frame	22ft. 6in.	167/8in.	2329/32in.
Height to top of chimney	= 13ft. 45/32in.	101/64in.	143/16in.
Height to top of cab roof	= 12ft. 83/16in.	933/64in.	1315/32in.
Height to larger whistle	= 13ft. 4in.	10in.	1411/64in.
Maximum width over footplate	2.91m (9ft. 69/16in.)	753/32in.	109/64in.
Width over footplate forward of cyls.	2.6m. (8ft. 623/64in.)	625/64in.	91/16in.
Height of footplate	1.42m (4ft. 729/32in.)	31/2in.	461/64in.
Maximum width over cab roof	2.54m (8ft. 4in.)	61/4in.	855/64in.
Length of cab roof	= 5ft. 6in.	41/8in.	527/32in.
Width over cab side sheets	2.5m (8ft. 227/64in.)	653/32in.	823/32in.
Distance between C/L cab windows	1.94m (6ft. 43/8in.)	425/32in.	649/64in.
Distance between frames	1.24m (4ft. 13/16in.)	33/64in.	421/64in.
Thickness of frames	30mm (113/16in.)	N/A	N/A
Locomotive wheelbase total	8.5m (27ft. 1041/64in.)	2059/64in.	295/8in.
divided into: bogie wheelbase	2.1m (6ft. 1043/64in.)	511/64in.	75/16in.
rear bogie to front coupled	1.85m (6ft. 53/64in.)	435/64in.	629/64in.
front to rear coupled	2.15m (7ft. 41/64in.)	519/64in.	71/2in.
rear coupled to trailing	2.4m (7ft. 1031/64in.)	529/32in.	823/64in.
Tender wheelbase total evenly divided	15ft.	111/4in.	1515/16in.
Diameter of coupled wheels (20 spokes)	2.04m (6ft. 85/16in.)	51/64in.	77/64in.
Throw of crankpins	320mm (1219/32in.)	25/32in.	17/64in.
Diameter of bogie wheels (8 spokes)	900mm (2ft. 117/16in.)	27/32in.	39/64in.
Diameter of trailing wheels (14 spokes)	1.42m. (4ft. 729/32in.)	31/2in.	461/64in.
Pitch of boiler	2.52m (8ft. 37/32in.)	613/64in.	825/32in.
Diameter of smokebox boiler over cladding	1.6m (5ft. 259/64in.)	315/16in.	537/64in.
Visible length of smokebox	= 5ft. 1in.	313/16in.	513/32in.
Diameter of smokebox door	1.325m (4ft. 411/64in.)	317/64in.	45/8in.
Radius of smokebox door (dishing)	= 3ft. 6in.	25/8in.	323/32in.
Height of chimney above cladding	= 2ft. 61/4in.	157/64in.	243/64in.
Outside length of firebox	2.8m (9ft. 215/64in.)	657/64in.	949/64in.
High pressure cylinder bore	390mm (1523/64in.)	61/64in.	123/64in.
Low pressure cylinder bore	560mm (223/64in.)	13/8in.	161/64in.
Piston stroke (HP and LP)	640mm (2513/64in.)	137/64in.	213/64in.

Note 1: Length of engine (excluding rear cab overhang) 11.05m plus 1ft. 9in. buffer.

One superior characteristic of the French locomotives, freely admitted at the time, was their smooth riding as vehicles. Quite apart from giving the footplate crews a more comfortable ride, this meant they were far less punishing both to the track and to themselves, resulting in higher mileages between overhauls. As a direct consequence of these findings, Churchward produced what amounted to a 4-cylinder simple version of a de Glehn compound, which with progressive enlargement remained the standard GWR heavy passenger locomotive for nearly half a century and indeed until the end of steam on the Western Region of the nationalised British Railways.

All three French Atlantics imported into Britain, but particularly *La France*, have a slender appearance and look smaller and more lightly constructed than is actually the case. This is partly due to the height - 13ft. 45/32in. to the top of the chimney, almost the same as a GWR King, and more than 5in. taller than the two massive-looking Caledonian Railway 4-6-0s for example, featured in a previous article. The main frames were 30mm (almost 13/16in.) thick, and

1010mm (just over 3ft. 33/4in.) deep over the driving axleboxes, but weight was saved by no fewer than eight strategically placed lightening holes, which also aided accessibility. There was no 'cranking in' of the frames, as they were cut away to clear the bogie wheels, small by British standards at just under 2ft. 117/16in. diameter. On the other hand, the bogie wheelbase was long, at 2100mm (6ft. 1043/64in.), although slightly shorter than the Saints and Stars. A little exercise of the grey matter will be required when sorting out clearances on a model, not only vertically to allow for larger than scale flanges and up and down movement, but also horizontally to clear the ends of the inside low pressure cylinders. Perhaps I should say at this point that a working miniature version of *La France* is probably not a good idea for a first attempt for a number of reasons. Anyone who doesn't believe me should take a look at Roy Amesbury's drawings for his 5in. gauge version of No. 103 *President*, starting in *M.E.* 3673, 15 January 1982, especially those for the main frames on pages 100/1!

●To be continued.



This normal size sawing board (9in. x 6in.) is really too small for the plates of this clock.



A stream of air to the cutting area helps clear swarf off the line.



Two piercing saw frames. The larger has a 6in. throat clearance.

AN UPDATED CLAUDE REEVE EIGHT-DAY REGULATOR CLOCK

John Wilding FBHI

discusses how to make the pierced plates of this delightful clock.

●Part II continued from page 617
(M.E. 4248, 27 May 2005)

There are at least three possible options for making the complex pierced plates for this clock:

- 1: By hand with the piercing saw on the V-notched sawing board.
- 2: Using one of the powered fretsaws and
- 3: By using plates which have already been pierced by wire erosion or a similar process. These will require no further treatment such as filing, only polishing, although it tends to be expensive (ref. 1).

By hand

Many constructors will be put off by the seemingly enormous amount of work involved with this method. However, it is not so tedious or difficult as might be imagined. It is necessary to get organised for the work. The sawing board shown in photo 7 (ref. 2) is too small for the size of these plates, the table needs to be some 12in. square. It is highly desirable that some sort of blower or sucker is arranged to keep the line clear of swarf. Roger Drake of RiteTime Publishing loaned me a small electric blower used in his printing business and this produces a gentle stream of air directed on the work as shown in photo 8. The pump is very quiet and should be placed on a rubber mat (ref. 3) on the bench, it will not need screwing or bolting down. I must stress how important it is to use the right brass in this sort of work. Leaded engraving or compo brass (BSS 120) is so much easier to work. No lubrication is necessary when cutting this material.

Whether the work is carried out by hand or motorised, the pattern must be securely glued to the brass. I used 3M's Spray Mount. I carried out some experiments as it is vital that the pattern

is securely attached and does not start to come off half way through the work. The brass is thoroughly degreased then the paper is given a generous application with the Spray Mount can. The instructions say that it should be possible to move the pattern about before it sets and this is true provided you have given the back of the pattern a really good soaking. In any case it is advisable to make the brass blank well oversize to give some latitude in the placing of the pattern.

When the Spray Mount is thoroughly dry the plates are taken to the drilling machine for forming the access holes. Where possible these should be about $\frac{3}{32}$ in. dia. but in the small apertures you may have to use the $\frac{1}{16}$ in. drill. The larger hole is advantageous when threading the blade through from underneath especially in the powered saw.

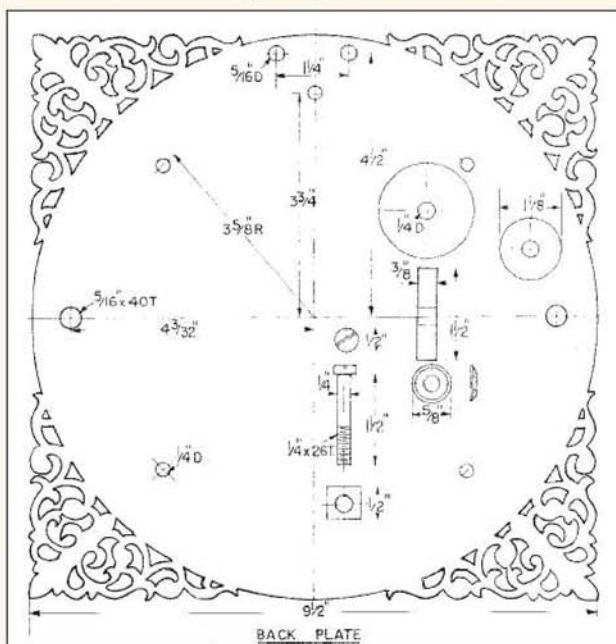
Blades

Many will say that using the right blade and a good make of blade is vital. I suppose this is correct but on the other hand Ron Rose who is a wizard with the piercing saw and who was the

workshop director at 'Strike One' where I learnt the repair side of clocks, seemed to give this matter little attention. He just took a blade from the drawer and put it in the saw frame with hardly a glance at it and off he went. He would cut out racks, snails and locking plates all with the piercing saw and I have seen him cut out a balance for an early lantern clock from $\frac{5}{16}$ in. mild steel. However, here I have attempted to bring some sort of reasoning to the matter and I have tried various grades of blades of different makes. Initially I bought packets of 'Razor' blades from Shesto, these were No. 2 and No. 2/0. The number 2/0 is finer and I used this blade for the dial which is $\frac{1}{16}$ in. thickness and the No. 2 blade for the plates which are $\frac{1}{8}$ in. thick. It is important to be aware that where the pattern is small and intricate such as on the front strip you need a blade whose front to back measurement is small. A deep blade will be more difficult to turn at corners. In any event it is better not to attempt to turn corners which are less than 90 deg., instead go into the corners from both sides so that the two cuts meet in the corner. When drilling the access holes do not just form one hole in each aperture. Drill several, especially where there are sharp corners.

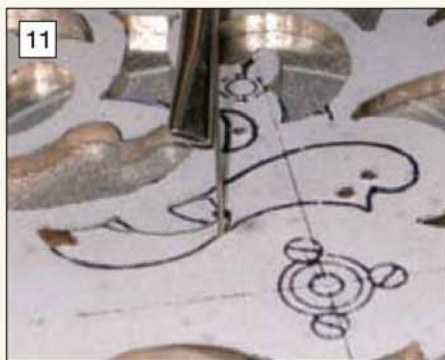
The 'Razor' No. 2 blade is 48tpi. and I found this good both in the power saw and when used by hand. Shesto can also supply a saw frame with a throat clearance of 6in. and this is necessary in order to reach to the centre of the circular plate (photo 9). I also had excellent results with the Eclipse M1 blade, which is 52tpi, in my power saw. Good results were obtained with a Goldsnail blade of No. 5 grade which is 36 tpi. Someone who knew what I was doing sent me some blades to try. Hegner supplied me with an excellent blade G5 which I used for the large circular plate. Using this blade in the power saw I cut out all the apertures without a single blade breakage but I did change the blade whenever the sound of the operation became harsh indicating that the blade was becoming blunt.

I have had three different makes of fretsaw machines over the years. They were all much the same. It is essential that

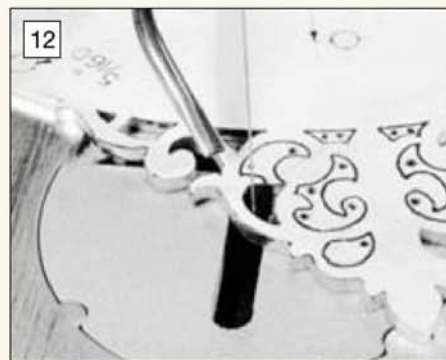




10 Cutting the intricate back plate on the Rexon fretsaw machine.



11 A close-up of the cutting. Note the use of several holes in each aperture.



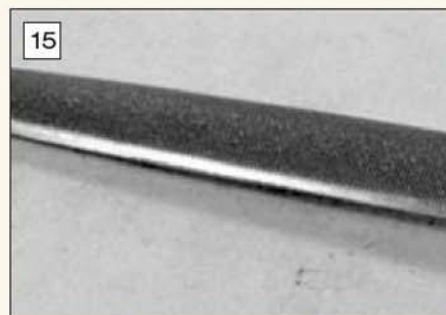
12 The square back plate being fretted out using a No. 2 'Razor' blade.



13 The partly cut out weight pulley, which was done by hand.



14 Curved wooden vice chops were used to hold the circular weight pulley disc for filing.



15 A crossing file that has been given a safe edge on a grinding wheel.

they possess a slow speed. Some are obviously designed for wood cutting which can be carried out at a faster speed than metal cutting. In this type of work it is essential that threading the blade through the holes in the work can be carried out quickly. The machine at present in my workshop is the Rexon and it was necessary to remove a guard at the side of the machine in order to gain convenient access to the lower fixing of the blade. **Photograph 10** shows a general view of the circular plate being fretted out on my Rexon machine using a Hegner G5 blade. A close-up is given in **photo 11**. Notice the number of holes drilled in the aperture. In **photo 12** I show the square back plate being cut and as the pattern here is smaller I used a No. 2 'Razor' blade from Shesto. I enjoy doing this work by hand it is more restful and in the thinner thickness of the brass the work proceeds very quickly (**photo 13**). Every effort should be made to arrange a blower of some sort, which will keep the swarf away from the line you are following. To sum up I am giving some tips which I found helpful.

1: When the blade is inserted in either the machine or hand operated frame it should not be under excessive tension but it should 'ping' when plucked.

2: Try and use a blade which gives not less than three teeth in engagement with the work.

3: A hard sound or vibration indicates that the blade is wearing.

4: I find it easier to cut right on the line rather than to one side.

5: Sometimes it helps to pull the work back from the blade to check the direction the blade is going.

6: I wear a magnifying headband, which focuses at 8in. Arrange for plenty of light. I use an Angle-poise lamp very close to the work.

7: Fitting a new blade and threading it up through the work should take less than a minute.

8: When doing the work by hand use

as fine a blade as possible as a fine blade cuts rather faster.

Those new to this sort of work are advised to start with the weight pulley as the side plates are 1/16in. brass and if the work has to be scrapped, it is only a small piece that will be wasted.

It is advisable to pace yourself on the large plates, just so much each day. I am leaving the dial and seconds ring until later on. The latter is let into the seconds ring and this cannot be done until the precise location of the escape wheel arbour has been found. Anyhow, I am sure the reader will wish to carry on with the construction of the movement and get the clock running on test.

Filing up

The work needs to be held as close to the area being filed as possible. In **photo 14** I show the

large circular plate being held in specially shaped vice chops. The work was then filed with a No. 2 cut 6in. crossing file. This file will be improved by forming safe edges as shown in **photo 15**. The smaller patterns will require the use of needle files and the constructor must be prepared to form safe edges on these (ref. 4). Many feel that having bought a set of quality Swiss files they do not want to deface them. But it is not possible to carry out this sort of work unless the files are prepared with safe edges. Foreign made needle files are very cheap and these can be used on which to form the safe edges. Finally, the edges should be treated with No. 4 cut files; this is as far as I go although some will aim for a polish to these internal edges in which case you need to make a small triangular scraper from a worn needle file and then the work should be burnished with a sewing needle let into a length of wooden dowel rod.

During all this work the paper drawings should still be attached to the plates. However, the final shaping is best carried out by eye with the paper removed, but before this is done the plates should be clamped together for drilling the pillar holes which are common to both pairs.

References

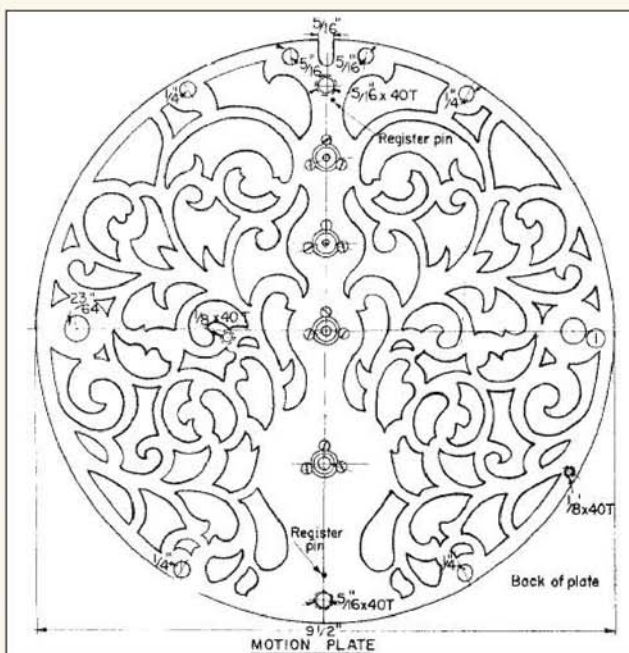
1: The cost of the three plates and the main dial ring 'wire eroded' will be approximately £600, and at least ten orders will be required by RiteTime Publishing before the work can commence.

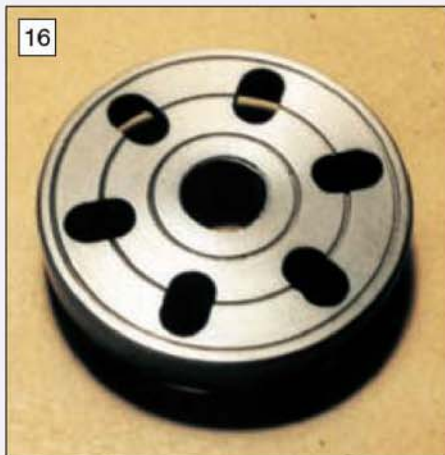
2: The dimensions of this sawing board with the tenon underneath for fixing in the vice can be found in my book *Tools for the Clockmaker* published by Rite Time Publishing.

3: These rubber mats are extremely useful in the workshop and are sold by Pyramid Products; tel: 01623-421-277.

4: Modifying needle files is also covered in *Tools for the Clockmaker*.

●To be continued.

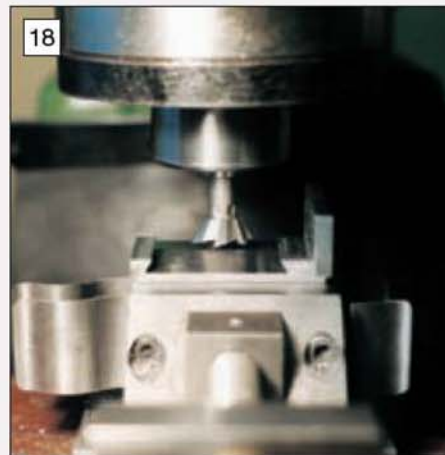




The finished faceplate. This is an important accessory for even miniature lathes.



Machining the cross-slide dovetail on the saddle with a suitable milling cutter.



Here the saddle has been inverted for machining the dovetail for the lathe bed.

BUILDING A STUART MODELS' LATHE

Anthony Mount

completes the tailstock before dealing with some of the other detail parts for this miniature lathe.

● *Part II continued from page 643*
(M. E. 4248, 27 May 2005)

At the same setting the hole can be drilled for the T-bolt clamp. It is shown 2BA clearance on the drawing, but I used a 4BA instead as I think it looks neater and leaves more room for a spanner. The tailstock can now be bolted to the lathe bed, adjacent to the headstock, which should also be bolted in place. I then made up a dummy spindle to fit the headstock with a $\frac{1}{4}$ in. dia. hole through it. This was used as a drill guide to drill the hole through the tailstock. The tailstock was then mounted on a $\frac{1}{4}$ in. expanding arbor in the lathe to bore out the counter bore for the handle seating. Then the two holes in the top were drilled and tapped.

Pulley (part 11)

The pulley is supplied as a piece of continuously cast iron. It is not a lot over length, so the first job was to set it up in the 4-jaw independent chuck and, after facing off both ends, it was drilled and reamed $\frac{5}{16}$ in. diameter. It is now possible to mount it on an expanding arbor and to machine the steps of the pulley.

As you can see from the drawing the steps of the pulley are also slightly radiused so that the flat belt does not fly off. One can do it with a form tool, freehand with a graver or a little juggling with the feed handles and some careful work with a fine file.

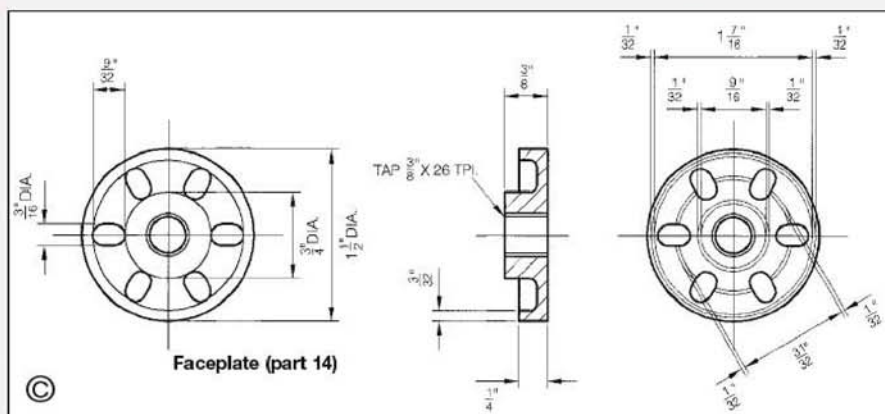
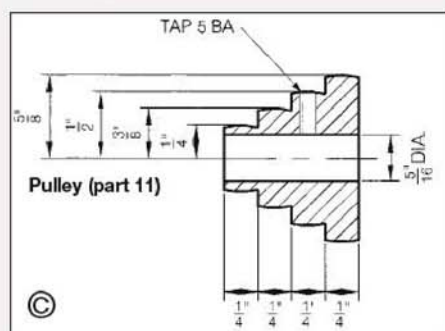
The use of a fine file in the lathe is frowned upon by some, but it can leave a beautiful almost ground finish, and is very useful for merging freehand radii

together. It goes without saying that all files for whatever use they are put must have a good well fitted handle. Gashing the hand with the tang of a file does not bear thinking about.

Faceplate (part 14)

The last of the iron parts is the faceplate. Made from a continuous cast iron slice, it can be held in the 4-jaw independent chuck for facing off. Centre, drill through and tap $\frac{3}{8}$ in. x 26tpi. The thread can be slightly counter bored to clear the partly formed thread at the flange of the spindle nose.

Turn down to form the spigot and then with a small round nose tool form the back recess. It is probably easiest to explain the shape of the recessing tool as a D-bit with a rounded, in plan, cutting edge.



The 4-jaw chuck can be replaced with the 3-jaw self-centring chuck and a stub arbor turned up with a $\frac{3}{8}$ in. x 26tpi thread. Screw on the part machined faceplate and face off to thickness and turn to finished diameter. Using a V-tool machine the grooves in the face.

Mount a dividing head on the lathe cross-slide and set the faceplate and arbor in the dividing head chuck or collet, and index round six times at the perimeter of the slots and drill six $\frac{3}{16}$ in. dia. holes. My dividing head was bored out on the lathe cross-slide so I know it is exactly on the lathe centre line.

Change to a $\frac{3}{16}$ in. dia. slot drill and extend the holes to finished length. To try and get straight slots it is probably best to form the slot in a number of passes rather than try in one pass. A $\frac{3}{16}$ in. slot drill can deflect under a heavy cut. The completed faceplate is seen in photo 16.

Spindle bearings (part 9)

The spindle bearings are in bronze and supplied as two pieces almost to length. Hold in the 3-jaw chuck and, after facing off, drill through and ream $\frac{5}{16}$ in. diameter. Reverse and bring to length. Mount the bearing on a $\frac{5}{16}$ in. diameter expanding arbor and turn down to a press fit in the spindle casting, forming the flange at the same time.

Spindle (part 10)

The spindle material is $\frac{5}{8}$ in. bright mild steel bar. Set up in the 4-jaw with tailstock support and turn the $\frac{5}{16}$ in. diameter portion of the spindle. This of

course needs to be to a good finish and to size to run in the spindle bearings.

Centre, and drill as deeply as possible at $\frac{5}{32}$ in. diameter. Thread the end to $\frac{5}{16}$ in. x 26tpi. Threading might throw up a burr on the crest of the threads increasing the diameter to over $\frac{5}{16}$ in. diameter. This can be dressed down with a very fine file. If the burrs are left it will not pass through the headstock bearings. Part off and reverse,

holding by the $\frac{5}{16}$ in. portion in a collet for concentricity. Turn down the spindle nose, and thread $\frac{3}{8}$ in. x 26tpi. This is best done by screw cutting for accuracy. The thread could be brought to size by a die if you wish. As you are threading up to a shoulder great care is required not to run into the shoulder. So it is advisable not to screw cut the thread under power but to drive the spindle by hand using a handle on the end of the headstock spindle.

Centre the end and drill through $\frac{5}{32}$ in. to meet the partly drilled hole from the other end. Counter bore the hole to $\frac{1}{4}$ in. dia. x $\frac{3}{8}$ in. deep. This hole could be reamed with a machine reamer.

Spindle nuts (part 12)

The spindle nuts are machined from $\frac{1}{2}$ in. hexagon bright mild steel. Place in the 3-jaw chuck, face off, drill through and tap $\frac{5}{16}$ in. x 26tpi. Part off the two thin nuts. All the faces need to be clean and parallel. If they are at all uneven, often the case with the parted off side, then mount them on a threaded arbor for re-facing.

As you cannot thread the arbor right down to a shoulder it will be necessary to use a spacing collar to get from the shoulder to clean threads on which to screw the nuts. I doubt if you have suitable spanners available thin enough to be able to tighten the thin nuts, so a couple of thin spanners will need to be filed up from, say, $\frac{3}{32}$ in. thick mild steel plate. Make a good job of them and they could be displayed with the lathe.

Saddle gear spindle (part 15)

The saddle gear spindle is a simple exercise in turning. Put a length of $\frac{5}{32}$ in. bright mild steel rod in the self-centring chuck and turn down a portion to $\frac{1}{8}$ in. dia. and thread 5BA.

As mentioned for the nut arbor, you cannot produce fully formed threads down to a shoulder because of the lead on the die. However, some dies are only chamfered on one side so it is worth looking at the reverse side of your die to see if this is the case. If it is you can thread down closer to the shoulder.

Whatever the case you will still need either to lightly counter bore the apron, or undercut the thread to ensure that the spindle seats down squarely on the rear side of the apron. Finish by parting off from the parent rod. Face and chamfer.

Saddle (part 16)

The saddle is the most complicated item on the whole lathe and needs some carefully planning to achieve success. The material is supplied as bright mild steel. This does have a problem in that, when large amounts are cut away asymmetrically, it is prone to distortion as the rolling stresses are released. Bright mild steel is rolled cold which means that the stresses induced into the material during cold working are locked in and not released by any form of subsequent heat treatment.

It is usually recommended that cold worked material is stress relieved before starting machining. This is done by bringing it to red heat, holding it at temperature for a while, then letting it cool down in air.

You can alternatively try leaving it a little oversize all round, then cutting away the waste to see how much it will spring then re-machining to finished size.

Start by working out the overall dimensions and machine all the faces to bring to the finished dimensions. They could be milled, but I found it just as easy to skim all the faces while held in the 4-jaw independent chuck.

Set up in the machine vice on the vertical milling machine and by using co-ordinates drill, counter bore and tap all the holes. As you can see from the drawing the section of the saddle is L-shaped. First the underside waste material can be removed. I have a small cut off bandsaw and this was used to remove the bulk of the material leaving just $\frac{1}{16}$ in. to be removed with an end mill in the vertical mill.

The next procedure was to saw off the waste material to the right of the dovetail slide. Then the raw edge was machined back with the end mill. The saddle was then gripped in the machine vice while resting on parallels to keep it level and square. An end mill was used to form rebates either side of the top dovetail.

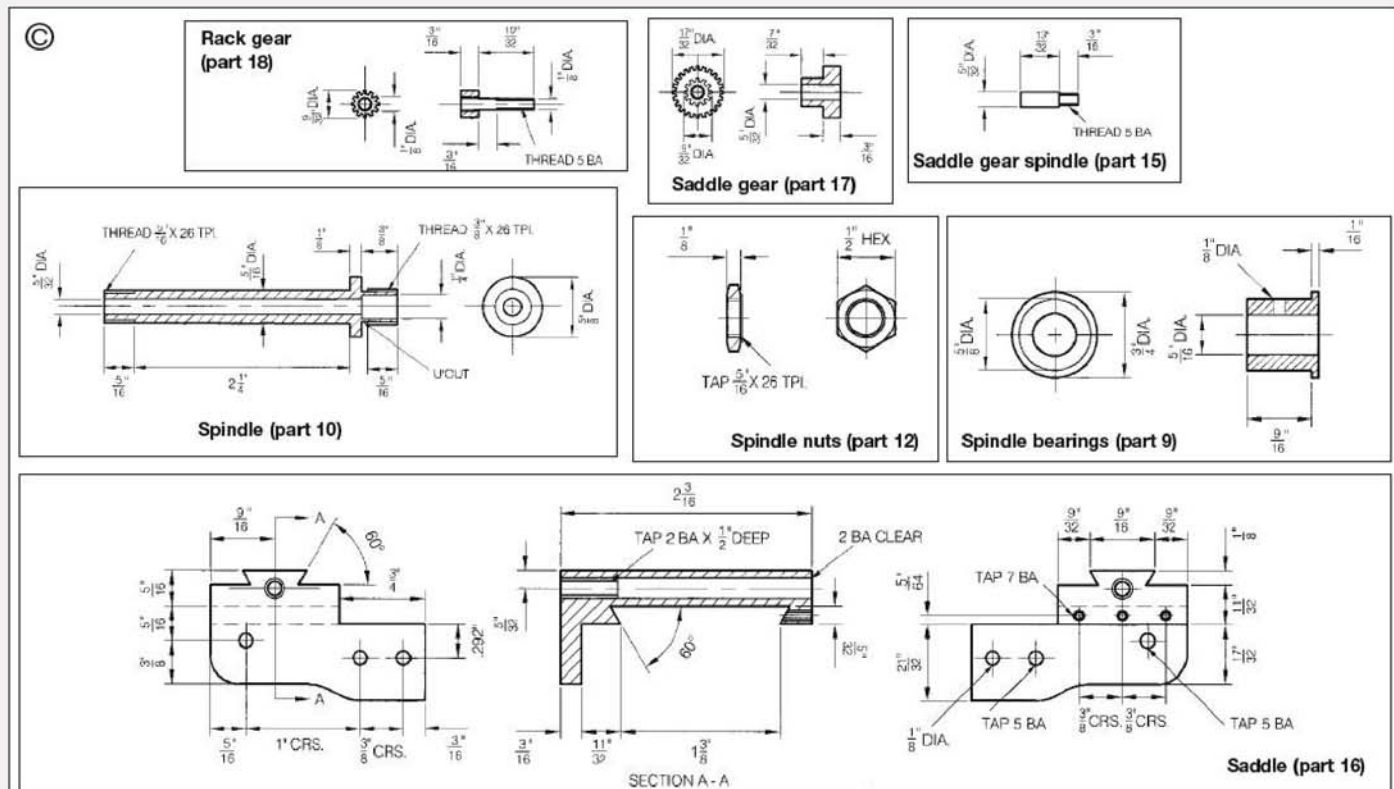
The end mill was changed for a dovetail cutter and the dovetail formed. This can be seen in photo 17. The saddle was then turned over in the machine vice, again on parallels, and the underside dovetail put in, shown in photo 18. A slot drill was used to remove the bulk of the waste and the dovetail cutter just used for the angled edges and a skim off the bottom.

The final job on the saddle is to mill the underside of the apron and to blend in the shape with files.

Saddle gear and rack gear (parts 17 and 18)

The saddle gear is supplied complete as a two step gear and the rack gear as a single gear with spindle and there is absolutely nothing to do to the saddle gear, and all that needs doing to the rack gear is to thread it part way 5BA. It will pay to make up a split brass collet to hold the rack gear while threading, which should be done in the lathe with a tailstock die holder by hand not under power.

●To be continued.





AN ELECTRIC MINNIE

Peter Thurston

describes how he built a model traction engine but avoided boiler problems.

Len Mason's book *Scale Model Traction Engine Building featuring Minnie*, published by TEE Publishing and serialised by *Model Engineer* (Vol. 135 Issue 3361 to Vol. 136 Issue 3401) describes an excellent beginners model. It has detailed descriptions using a 3 1/2in. bench lathe for the turning, milling, marking out and the use of jigs and mandrels for work holding procedures for this 1in. scale model.

In this, my first project, I decided to build an electric motor drive version that could be demonstrated safely in the home at the flick of

a switch and then stand proudly on the sideboard. This construction thus avoids the greater skills and accuracy necessary for the live steam build. Without the heat of steam, silver-soldering is avoided too, using Loctite and Araldite as appropriate.

This also leads to a number of time-saving dodges, yet retains the essential external features of the model. Available castings, a set of drawings and the construction manual were obtained. Some weight was saved by using aluminium instead of steel, and reducing steel thickness where appropriate. My small workshop contains a bench lathe, vertical slide and rotary table, pillar drill and band saw, all of low cost far eastern manufacture.

Boiler and firebox

A dummy boiler and firebox was rolled to the drawing dimensions but using 22G galvo-steel

sheet. The butt joined seam was soft-soldered. Further segments of sheet were soldered inside, over the seam and under the location for the cylinder and motion plate. These reinforcements provided adequate boiler shell thickness for tapping the cylinder, motion plate and water pump fixing holes. The firehole door, water gauge, pressure gauge are dummies.

Motors and drive

Two 16v, internally geared motors, with an output speed 400rpm, were fixed in a 5/8in. thick aluminium plate (fig 1) and coupled by three 60T 0.5 Mod spur gears to a common output shaft. The gears were held on their shafts by grub screws. The motors have an offset output shaft. This allows the motor/gear to be rotated within the plate, to mesh accurately with the adjacent gear, and then locked in place. The motor assembly was mounted within the firebox on 2BA studding and bolted in place. The common output shaft protrudes through the firebox and nearside hornplate and carries a 1 3/8in. O/D pulley. This pulley transmits power through a veebelt to the flywheel to give model speeds, low gear 2.8 in/sec and high gear 4 in/sec.

Hornplates

The hornplates were made in 1/8in. thick aluminium, being sufficient to bear the shafts directly (without the need for the separate bearings). The third shaft and axle diameters were reduced by 1/16in. to 5/16in. and 3/8in. dia. respectively.

Gearing

Since the power required to drive the model is small, grub screws were used to lock the gears to the shafts via drilled 'dimples' and Loctite was used to lock the gear clusters to their sleeves. Thus keys, keyways and silver-soldering were avoided. A slot was, however, milled in the second shaft for the grub screw in the sliding gear sleeve. The crankshaft components were machined for a press fit and assembled with Loctite.

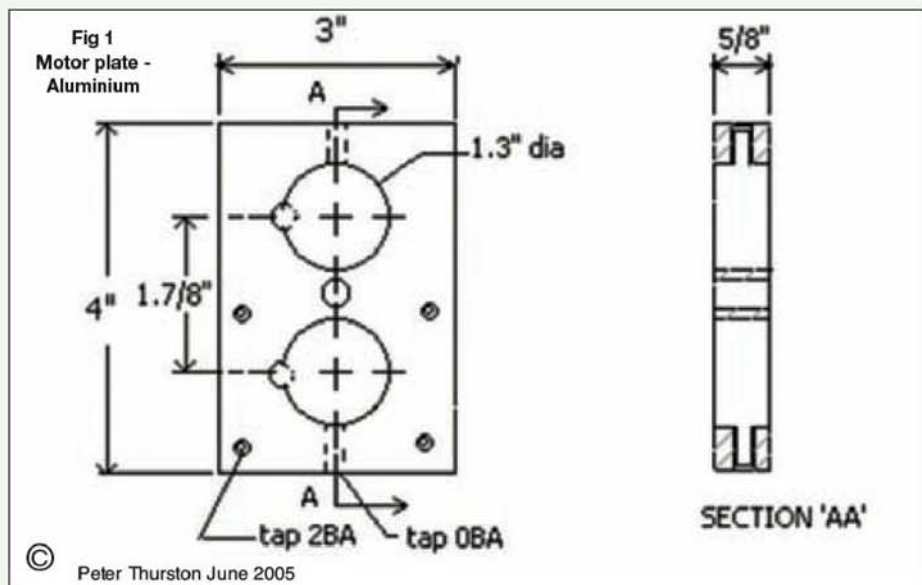
Rear wheels

A rotary table was used to position drillings for the spokes, strakes and mill the hub slots. This is more accurate than marking out via the Mason lathe mandrel dividing gadget, and a lot less bother.

The jig spindle was greased and hub and rim were laid in the jig, outside face uppermost. All the outer spokes were fitted to lay in the hub slots and loosely located on 1/16in. aluminium rivets in the rim holes. Each spoke was then fixed by a couple of spots of araldite at the rim and a generous layer of araldite in the hub slots. The hub outer plate was set on at the same time and the excess adhesive wiped off. The assembly allowed to set for 24 hours, before removal from the jig. The grease on the spindle prevented the Araldite locking hub to it. Then the assembly was turned over and replaced in the jig to similarly fit the inner spokes. The result was a true wheel and no sweat!

Perch bracket

The perch bracket was fabricated from aluminium sheet, 1/8in. and 1/16in. thick.,





part no. 194144-701. There is no adjustment on belt tension. Instead, the drive pulley was turned oversize and then grooved to depth, carefully, by trial, until the pulley, flywheel and belt assembly would slide comfortably onto their respective shafts.

Electrics

The circuit and wiring diagram show the simple transistor electronic circuit used to vary the speed of the motors. The output transistor 2N3055 needs a heat sink and so it is bolted to the offside hornplate. The speed control,



assembled with epoxy adhesive and aluminium rivets. The bearing and push pole bracket were also aluminium.

Smokebox

This, too, was rolled to the drawing dimensions using 22swg galvo-steel sheet, to be a tight fit over the boiler. There being no requirement to remove the smokebox door bar, a double angle bracket, riveted to the smoke box ring, provided the anchor for the door.

Chimney saddle

The chimney/saddle assembly was set level on the smokebox with epoxy adhesive and the rivet holes drilled through once the adhesive had hardened.

Cylinder, valve and regulator chests

These castings were machined only to the external dimensions for fitting of the covers, rods and guides. The piston and valves are, of course, not fitted.

Front wheels

The front wheel components were assembled as described for the rear wheels.

Tender

Construction of this, not requiring to be water tight, is simplified for it holds the rechargeable batteries under a removable footplate. The latter is a piece of 1/16in. thick Tufnol. The footplate is supported on a 1/4 x 1/4 x 1/16in. brass angle frame, riveted to the sides. The tender is bolted to the hornplates by three 2BA screws on each side. The drawstraps are 1/16in. thick aluminium sheet and the drawbar machined from 1/2 x 1/2in. aluminium bar. The coal box hides the wiring and electronic components, hidden beneath the dummy coal (pieces of cork, glued together and painted coal black)

Brake

The brake band is a length of nylon strapping (from a DIY flat pack), to which the hardwood brake blocks are hot glued.

Veebelt drive

The flywheel was grooved to accept a Singer sewing machine 'featherlight' 17 1/2in. long V-belt,

a 25 K ohm variable resistor is held on the coal box division plate. The smaller components, transistor BC337, diode IN4501, and 1W 1K ohm resistor are mounted on a piece of copper stripboard and fixed to the back of the variable resistor by double sided tape. These components are hidden under the dummy coal load.

The DPDT change-over switch, giving three positions. i.e. forward/centre off/reverse direction, is fitted on a bracket and soft-soldered to the front brass angle supporting the footplate. In this position, the switch is operated by a simple Tufnol lever, pivoting on the reach rod. The reach rod quadrant is notched for the three positions.

The motors need 16v to develop maximum power, although the engine moves off quite happily at 12v. The simplest solution for batteries is two 9.6v 600mA nicad paks as used in toy cars. These are wired in series, giving 19.2v and fitted with plug/socket for disconnection for charging. The engine operates for 40 minutes, or so, on a full charge.

Painting

An old cardboard box made a makeshift spray booth. Halfords automotive spray cans were used throughout. The colours chosen were; Wheels:

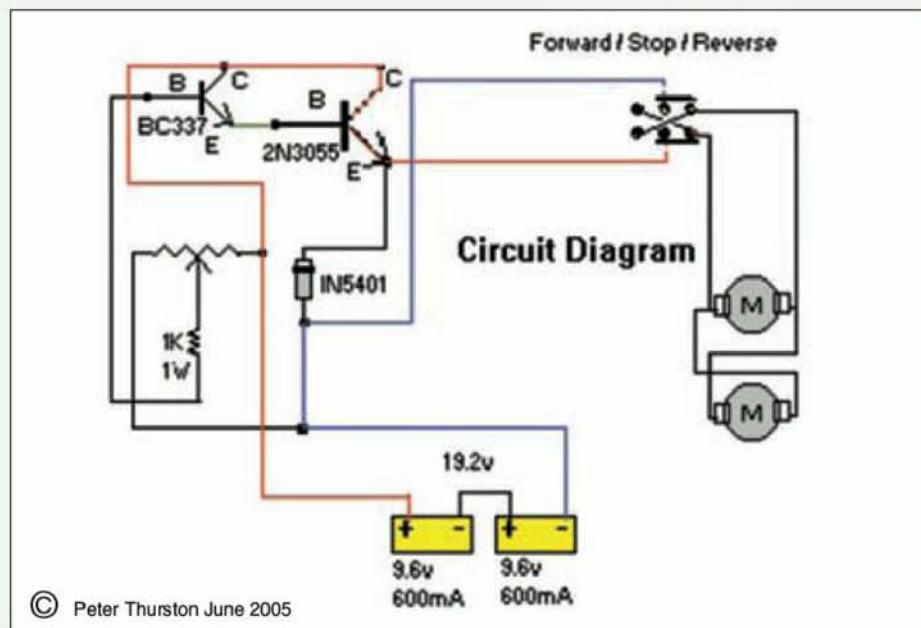
Ford Rosso Red. Boiler and Tender: Rover Damask Red. Chimney and Smoke Box: Matt Black. The model was dismantled into main components:

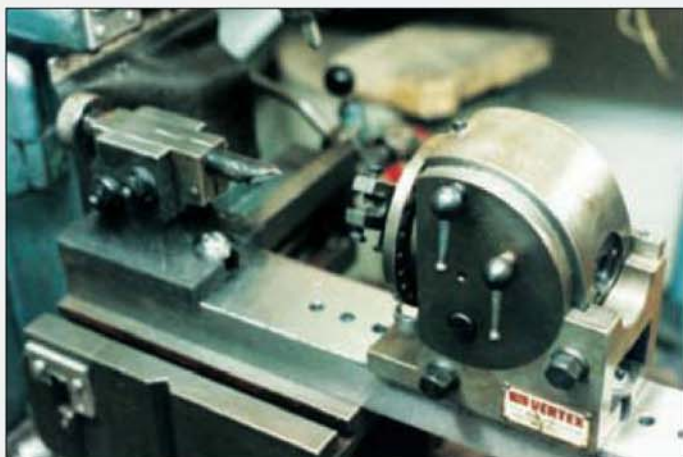
- 1: Boiler/Chimney assembly.
- 2: Hornplates/Spectacle plates.
- 3: Wheels.
- 4: Cylinder/Motion plate assembly.
- 5: Tender.

After cleaning the surfaces with cellulose thinner, two coats of matt grey primer were applied. With the extensive use of masking tape, the assemblies were given at least two coats of the desired colour.

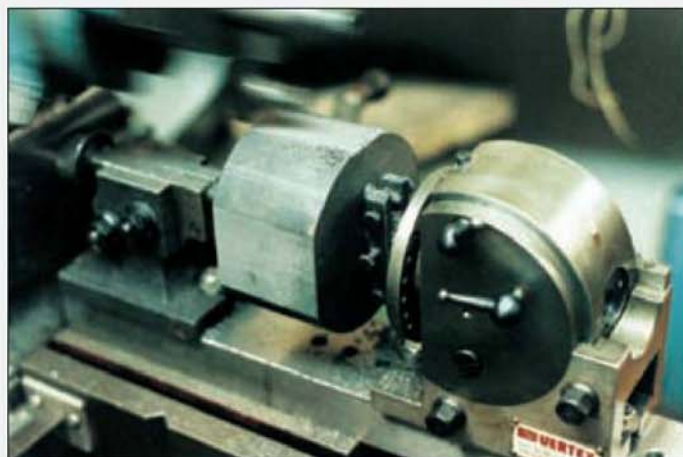
Suppliers

Construction Manual: Tee Publishing.
Castings and Drawings: Blackgates Engineering, Reeves 2000.
Motors & Battery Packs: Greenweld (Motors: part no. X8330/2).
Gears: Muffett Gears.
Aluminium Plate: Bryan Smith, via e-mail: malvern@fsmail.net
Electronic Components: Maplin Electronics.
BA Screws, Studding, etc. Items: Mail Order
Nameplates: MDC Plates.





The Vertex dividing head mounted on the author's Alba shaping machine. The tailstock clamp bolts also fix the bar to the machine's table.



Machining started with simple flats cut at right angles to one another using the dividing head to index the work.

SHAPING BETWEEN CENTRES

John Olsen

of New Zealand describes another unusual application for the shaping machine.

Shapers are no longer common in professional workshops. They have been quietly disappearing for most of the last century. They are still made in some far eastern countries but are not easily obtainable new. The reason for this is that a shaper is slow, especially compared to a horizontal, milling machine. Another reason for commercial operators preferring milling machines is that, once set up, they can be operated by a relatively unskilled operator. This offers the possibility of one skilled person setting up machines for several unskilled operators. In this situation the higher cost of milling cutters and the need for specialist machinery to sharpen them is not a serious problem.

Conditions in our home workshops are quite different. It is possible that there is no cutter grinder to sharpen the expensive milling cutters, while the speed at which work is carried out is rarely very important. A shaper generally only

requires a few, relatively cheap, lengths of tool steel from which almost any cutter required may quickly be made. This is a very attractive feature of shapers. Another interesting point with shapers is that the larger ones are relatively cheap for their size. If you have the room they can be a real bargain. The need for a three-phase power supply for the big machines need not be a major obstacle. My largest machine is currently set up with single-phase power applied across two phases of the delta connected motor. It does not self-start, but a size ten boot applied to the drive pulley ensures that it gets away smartly. Since it has a clutch, it does not need starting very often anyway. Sometime it will get a proper phase converter.

Often the uninitiated tend to regard a shaper as only being capable of planing flat surfaces. This is indeed something shapers do very well, but they are more versatile than that would imply. When comparing to milling machines, they do compare best with the horizontal pattern. Like the latter they are not really adapted for machining pockets or drilling holes. This can be more readily done with a vertical milling machine (*readers should not overlook the possibility of using a slot drill or end mill in the spindle of a horizontal milling machine. This is often a better way of addressing the work than with an overhung, vertical spindle - Ed.*). However, I would contend that the shaper is in fact generally more versatile than the horizontal milling machine, especially in the amateur's workshop where the worker may not be able to afford specialist cutters. The shaper is capable of achieving a better finish on flat surfaces than the horizontal milling machine, while the finish from a vertical milling machine does not begin to compare with either. The shaper can also cut T-slots and dovetails, provided they are not blind ended. Both of these are a little difficult on a horizontal mill. While they are easy enough on a vertical, they do require special cutters that cost money.

For those who prefer to make models of stationary or marine engines, a shaper is especially valuable. Certainly you can perform milling operations in the lathe, but the size of part that can be dealt with by a lathe tends to be

quite limited and the lathe is better suited for vertical milling operations. A 7in. stroke shaper would make a very good companion for a 3 1/2in. centre height lathe. It is just possible to make the Stuart No. 1 with only a Myford Series 7 lathe but, with a 7in. stroke shaper as a companion to the lathe, it becomes relatively easy since all the flat surfaces can be done on the shaper. Any milling that remains is the sort of thing that can be done well by the lathe, such as machining steam ports, spot facing and similar jobs.

The accompanying photographs show one of the applications for a shaper that is not immediately obvious. By adding the necessary equipment to mount the job between centres, a wide range of complex shapes can be produced. This could be used for gears, although as it happens, I have only ever cut gears on my vertical milling machine. The job that can be seen in the photographs is the eccentric straps for a compound steam launch engine based on the design by A. A. Leak and published in *Model Engineer* (series starts M.E. 3691, 15 October 1982 - Ed.). The original used castings for the straps. Although I understand these are still available, the nearest source of supply is 12,000 miles away from me, so I made my own patterns for the parts that required castings. For the straps



As the work proceeds, steps are cut with complex angles between the faces.



The finished eccentric straps machined from cast iron bar.

I decided to machine my own from cast iron bar. As may be seen, mounting the job between centres permits flats to be cut at any arbitrary angle to each other, while circular arcs can also be cut by using the worm on the Vertex dividing head to control the feed. After the correct section was generated, the block was cut into slices just over the desired thickness. These were then faced in the lathe. After facing they were halved and the cut edges faced. They were then bolted back together ready for boring the inside to suit the eccentric.

The attachment is based on a Vertex BS0 dividing head and tailstock, available from several advertisers in *Model Engineer*. Since the table of most shapers is not long enough to allow a very big job, I used a bar to allow the dividing head to be mounted beyond the end of the table. The bar started life as a length of black mild steel, and was surface ground on all sides for me by a fellow club member after I removed all the mill slag with an angle grinder. It was then drilled to allow bolting the dividing head down in a number of positions. Later I acquired a vertical milling machine so I have now milled a shallow

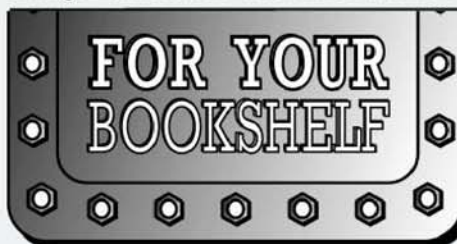
slot $\frac{5}{8}$ in. wide down the length of the bar. This matches the key slot under the Vertex head and tailstock permitting a key to be used for each and so making alignment easier. I will not show any dimensioned drawings since the same thing could be accomplished with different dividing heads and different sizes of shaper.

It is shown in use on my Alba 1A, a ten inch stroke machine. Since it is about as heavy as I would want to place on the table of this machine, it is important to set the table height carefully and set the front support before mounting the dividing head. Since taking the photographs I have acquired an Alba 4S. This is an 18in. stroke machine and would cope with the weight of the dividing head with ease, although the occasion to do this has not arisen yet.

I suppose I should confess that I now have four shapers, my only excuse being that three is too many but four is a collection. The others are a 6in. Ammco, and another Alba. This one is the 14in. stroke model with flat belt drive and loose pulley. Although it is probably fifty years old it has seen so little use that machining marks are still visible inside the bearings.

One lesson learnt recently while using the Vertex head for a milling operation is that the double-ended dog that clamps onto the centre for work driving is capable of slipping. More correctly, the taper appears to move in the socket. I suspect the vibration from the milling was a major factor in this. A draw bar might prevent this, although the Vertex centre is not tapped for one. In future I intend to screw on the chuck back plate that also came with the Vertex dividing head and drive via this. It will need a hole tapped for a drive pin. Fortunately, the taper did not move for the job shown, possibly because there is less vibration when shaping.

In considering the possibilities, do not overlook the fact that the axis of the two centres could, if desired, be at right angles to the stroke, or even at some oblique angle. This might permit some really unusual components to be made. If a rack driven by the ram was geared to the input of the dividing head, helical components could be cut. In any case, I hope this shows that shapers have some interesting possibilities for machining parts other than plain, flat ones. 



Make your own 8 Day Skeleton Clock

It could be argued that we live in a time when things have rarely been better for the amateur horologist. Techniques that were once known only to the trade are now regularly written up in this and other journals whilst there exist a number of specialist suppliers able to furnish private individuals with the necessary tools and

materials. Not least among these developments has been the growth in the number of books designed to help the inexperienced through the various operations and procedures and keep them on track whilst taking their first tentative steps into this fascinating hobby.

The book under review describes how to build an elegant skeleton clock. The project is based on the beginners clock designed by Mr. Eliot Isaacs FBHI and described in a series of articles that appeared in the *Clockmaker* from April 1990 to March 1992. This design was subsequently modified by Mr. Alec Price FBHI to extend its running time. The present design retains little of the original but adheres to the principles of simple, easy manufacture and an elegant appearance. The clock is therefore described as well suited to the model engineer making his first clock although a sound knowledge of engineering practice is assumed.

The book contains the drawings necessary to make the clock and, although hand drawn these were found to be clear and readily understood. A list of suppliers is also included and it should be noted that many of the components that a beginner might find difficult, such as the wheels, are available from one or more of these suppliers.

The actual text is reasonably clear and well written but does not set out to be a blow-by-blow account of how to build the clock. However, the less common operations are covered in adequate detail. The clock described is certainly very handsome and would grace any home. Curiously, the method described for preserving the brass parts from tarnishing is to have them gold plated. This is a method I personally have not come across before but should be effective and, judging by the cover photograph, it does enhance the appearance of the finished timepiece.

Overall this is a welcome addition to the range of books available encouraging amateur horology. It is available directly from the author John W. Parslow; tel: 0115-952-6374. The cost is £20. N.R.

Midland Engines No. 5 The Johnson '2441' Class Goods Tank Engines

This book is one of a range produced by this publisher in association with the National Railway Museum. The book is in large format paperback and is one of a series covering Midland engines, in this case the Johnson '2441' class 0-6-0T locomotives (post 1907 '1900' class or classes S, U and U2). In common with other books by this publisher the book is produced to a very high quality on good quality glossy paper and includes a wealth of excellent black and white photographs together with copies of drawings from the NRM. The centre spread in this instance is a fold out drawing of the general arrangement of the two (condensing and non-condensing) main versions of this class of locomotive. Fifteen detailed drawings are included in total. A comment in the back of the book by the NRM states that "all the original drawings reproduced in this volume are from the archive of the Midland Railway Chief Mechanical Engineers Drawing Office, Derby" so there is no doubt about the authenticity of the material.

For those who are modelling one of these locomotives, the book will be an invaluable source of information providing a level of detailed information to enable the production of a very accurate model of any of the engines in the class. Full information is given on the origins and construction of the class complete with details of any modifications and changes made to the locomotives, usually quoting work order numbers and dates when the changes were made and the numbers of the locomotives affected. Of particular interest to model engineers in all scales will be the very detailed chapter *Painting and Numbers*, which with the associated photographs will provide all the information needed to produce the correct 'paint job'. Highly recommended! **Midland Engines No.5** (ISBN 1-874103-94-1) was written by David Hunt, Bob Essery and Fred James and is published by Wild Swan Publications, price £12.95. M.S.

A SIMPLE SPRING BALANCE



The selection of spring balances available to the author in his workshop.

Peter Spenlove-Spenlove explains how to make this useful item.

Many of us, while working in our workshop, will occasionally need to make up a special compound to perform a particular function. It could be a photographic chemical or metal treatment, enamel or glaze, or a case hardening medium among others.

Workshop reference books give the proportion of individual materials required to make the compound and how to use it. The trouble is that most recipes employ a large proportion of a basic material, say 1kg, but to this amount a tiny quantity of another material has to be added.

It is easy to weigh out the larger quantity on, say a set of kitchen scales, but these scales cannot accurately weigh a tiny quantity of say 1 gram. For this you need another weighing balance suitable for small quantities. It must be sensitive and reliable and, because it will not be used often, it is not worth buying one.

However, it is easy to make one using two tubes and a good quality spring. Here is how. First, find a long extension spring, i.e. the type which is stretched and not compressed in use. Most manufactured extension springs are 'close-coil' wound – that is where each coil is sprung tight against its neighbour. We need the other type in which the coils are very slightly apart.

As our spring balance will weigh small amounts, a close-coiled type will not work as a considerable weight hung on the bottom of it will be needed just to overcome the initial tension.

An open type will start to stretch straight away with a small weight. The amount of stretch (extension) is directly in proportion to the weight

applied and is true and repeatable within the spring's working range. A spring made of good material, well wound and even, can be extended by about 50% when the wire size is small and the wound diameter is large.

As we need to detect an extension of, say 1gm, the spring will need to be made of thin wire and feel particularly 'soft', for example the spring in my balance is 9in. long and $\frac{9}{32}$ in. outer diameter and made with 26swg (0.018in.) spring steel wire (type unknown).

One gram extends its length by $\frac{1}{16}$ in. and it will extend by another $\frac{1}{16}$ in. for each additional gram up to 100. When the weight is removed the spring reverts exactly to its original length.

Having found a spring, with a loop at each end of course, the next job is to find two tubes which telescope very freely, one within the other. The spring, likewise, must be a free fit within the inner tube. Some tubes have a weld line or 'flash' inside and this must be removed. Thin wall brass or light aluminium alloy is suitable.

The finished spring balance should be hung vertically with the material to be weighed in a pan hanging at the bottom. So a hook or loop is provided at each end. The spring is attached to the top end of the large tube and to the bottom of the smaller tube. This means that the small tube will be drawn up into the large one. A weight will pull the small tube out, downwards in proportion to the amount put in the weighing pan.

To calibrate the balance mark a line 'zero' on the inner tube at the end of the outer tube. Do this with the pan empty. Next add known weights and make further marks. If you cannot borrow standard gram weights (from, say, a night school chemical laboratory) borrow a burette or pipette marked in cubic centimetres and use water. One cubic centimetre of water weighs 1 gram.

If the spring is a good one, there is no need to mark every gram with water or solid weights. Mark every 2 or 3, then later, sub-divide evenly with new marks in between the first lot. Mark with figures at say 0, 5, 10 etc. If the tube is soft, i.e. aluminium alloy, a scribe will scratch the figure. Rub some Indian ink or paint in the marks to make them visible.

Do not overload this type of balance. The tubes will part and stretch the spring out of its safe limits and the zero point will be wrong. To prevent this further work has to be done. The top, i.e. outer tube must have a slot cut partly along its length. The top end of the inner tube will be fitted with a little screw and pointer which protrudes from the slot. The weight marks are now placed on the side edge of the slot. Zero is at the top opposite the pointer. At maximum weight the pointer on its screw bumps against the lower end of the slot. This stops accidental over loading. Commercial spring balances are usually constructed in this way.

The diameter and length of the tubes will depend on the sort of spring you select. Try some typical weights within your required range on a spring to test if it can cope with the range of weights and has sufficient resolution, i.e. the space between zero, 1 etc., is wide enough to be read reliably.

Although I have used the gram, there is no reason why other units of weight should not be used, except these weight units will be needed to calibrate the spring balance. For instance, the British ounce (avoirdupois) will need 28.35 c.c.s of water to mark 0 to 1 on the scale:

1 ounce = 28.35 grams (avoirdupois ounce)

1 gram = 0.0353 ounces (avoirdupois)

1 gram = 0.0322 ounces (troy)

1 gram = 15.432 grains

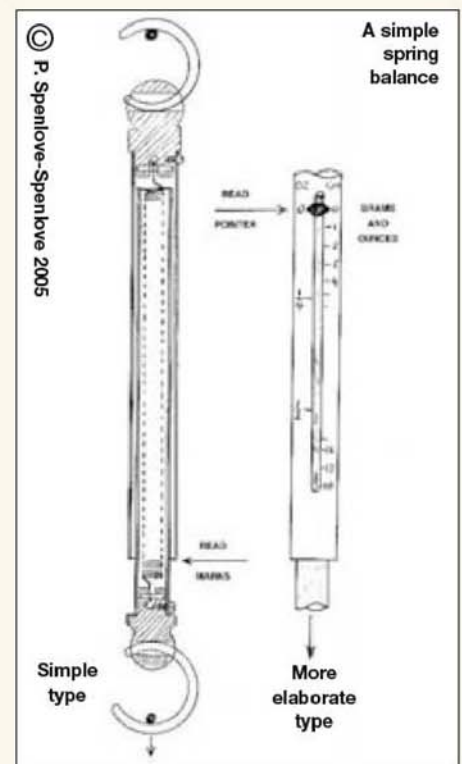
The avoirdupois ounce was the UK standard one. The troy ounce was used for precious metals. Some of these units of weight may be used in old books of recipes and formulae.

When weighing substances with this type of spring balance, it is important to suspend it so that it can hang freely so that the tubes do not rub and cause friction. Agitate the scale pan to check that the 'zero mark' is reading truly and repeatedly.

If weighing nasty solvents or acids, which could spoil the pan, first put a small glass 'jar' in the pan and note the weight reading. I use a 'toy chemical' kit beaker made of thin glass, which weighs 20 grams. A useful substitute is a 35mm film cassette plastic 'can' which at about 5 grams is good for less aggressive chemicals.

The balance far left in the photo is an old type office letter balance weighing up to 4 ounces. The original letter pan was removed. A plastic cup now replaces it. The wire cradle holding the cup has a piece of lead attached so that the index pointer still reads zero.

Third and fifth from left are similar types, with flat faces of brass made for home use such as weighing the Christmas turkey. The fifth will weigh up to half a hundredweight. 



Neville Evans

completes the reverser stand for the *Grange* before moving on to its brakes. Also included is a drawing of the Midland compound plus some photos of a full size *Saint*.

●Part XIX continued from page 628
(M.E. 4248, 27 May 2005)

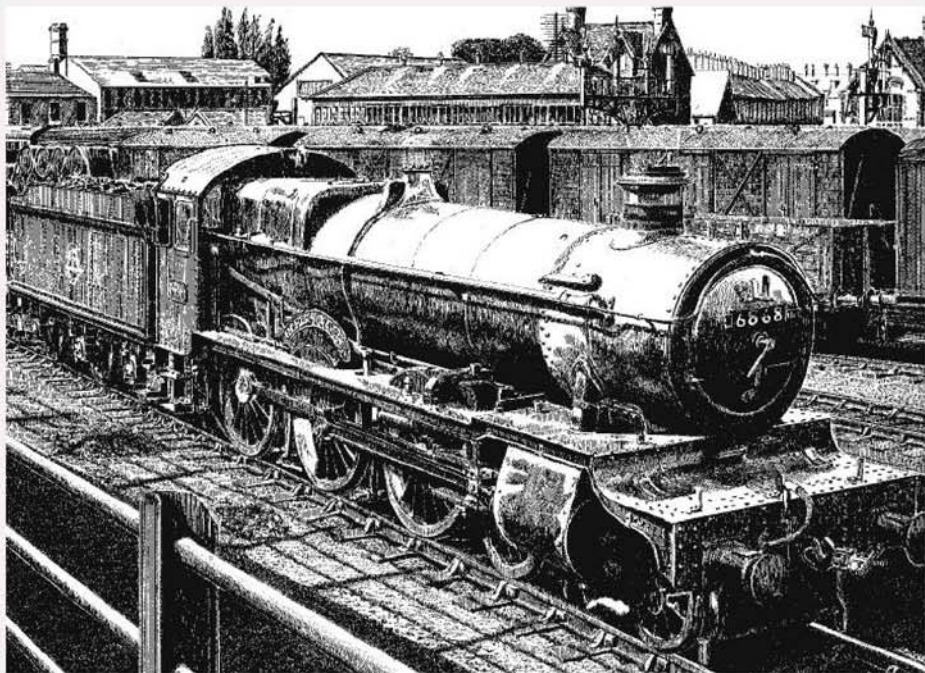
Here then are the drawings of the reverser stand which had to be held over from the last article, together with the reverser stand cover, or rather covers, as it comes in two separate bits. The bottom half is a fixture and fits inside the spectacle plate to which it is rivetted. The top half is more complex and bolts onto the outside of the plate as shown. The rather tricky top piece can be beaten from thin sheet over a former, or there is the possibility of a thin lost wax casting that would seem to suit the job very well. It is however all quite straightforward, and requires no further description.

Brakes

I suppose that the brake block itself is as good a place as any to start. Received wisdom from the full-scale side of affairs, says that the block should be made of soft iron and be provided with as generous a braking area as possible. From the last statement it can be seen that it must be desirable to provide two brake blocks per wheel. This not only doubles the surface area of the brake blocks but also reduces wear and tear on the axleboxes as the braking forces on the wheel rim now cancel each other out, instead of being applied only to one side of the wheel.

Bullied came up with a most ingenious system of self-equalising clasp brakes on his Merchant Navy Pacifics for the Southern Railway. The GWR however, contented them self with a single block and concentrated on extracting the maximum benefit from the simpler arrangement. The blocks were cantled forward at the same angle as the tread coning, which in our case is 2 degrees. This was effected by inclining the hanger bracket pins forward at the required angle as can be seen on the drawing. One possibility that should be borne in mind is that if a locomotive comes to rest with a perhaps red hot brake shoe tight upon the tyre, the tyre may be heated locally to such an extent that failure may later take place. This need hardly concern us however in our rather smaller sizes, particularly as we tend to have solid wheels without separate tyres.

The brake hangers and their associated brackets will be supplied as lost wax castings. Note that there are many different shapes and lengths of these commodities so beware. The equalising beams will be supplied as laser cut items, which require the $\frac{3}{16}$ in. dia. rods on either end to be silver-soldered in at, again, the angle of 2 degrees. The system of equalisation has been calculated very carefully by the chaps at Swindon and ensures that, when correctly adjusted, each shoe comes into contact with the wheel at the same time and with equal pressure. I have decided that it is better in this instance to pass the brake rods underneath the ash pan, as on



PENRHOS GRANGE

the prototype, and to empty the pan through a door in the bottom and the rear damper door. The grate will have to be manoeuvred through the same orifices when a thorough scrub is required. Please feel free to modify, if you would prefer to have a detachable ash pan and grate, which can be dumped by extracting the usual pin. The ash pan drawings together with the drain cocks and piping diagrams will follow in the nearest future.

The brake cylinder is operated by steam pressure as opposed to vacuum, and is I think quite straightforward. Pressure is of course released through the driver's brake valve in the cab, which allows the piston to return, spring aided, to the top of its stroke.

Simple pump drive

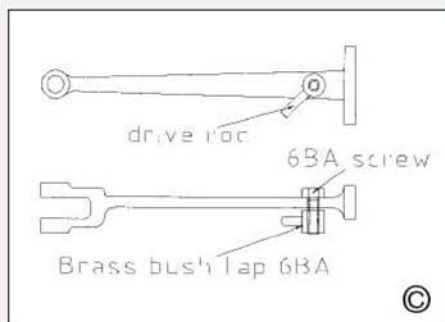
In the now rather distant past, I was faced with the pleasant task of redesigning a class 4 go-kart. That is one with a 200cc engine and gearbox, in fact a small racing car. The obvious tasks were the usual ones of making the chassis lighter, stronger, stiffer and cheaper to make. I decided to look at every part no matter how small and seemingly insignificant. One of the early modifications was to the method of locating the steering column on the frame. The previous system of bushes locating collars and suchlike was dropped and I contented myself with using a 1in. dia., 16 gauge steel tube for the column, together with a phosphor bronze bush

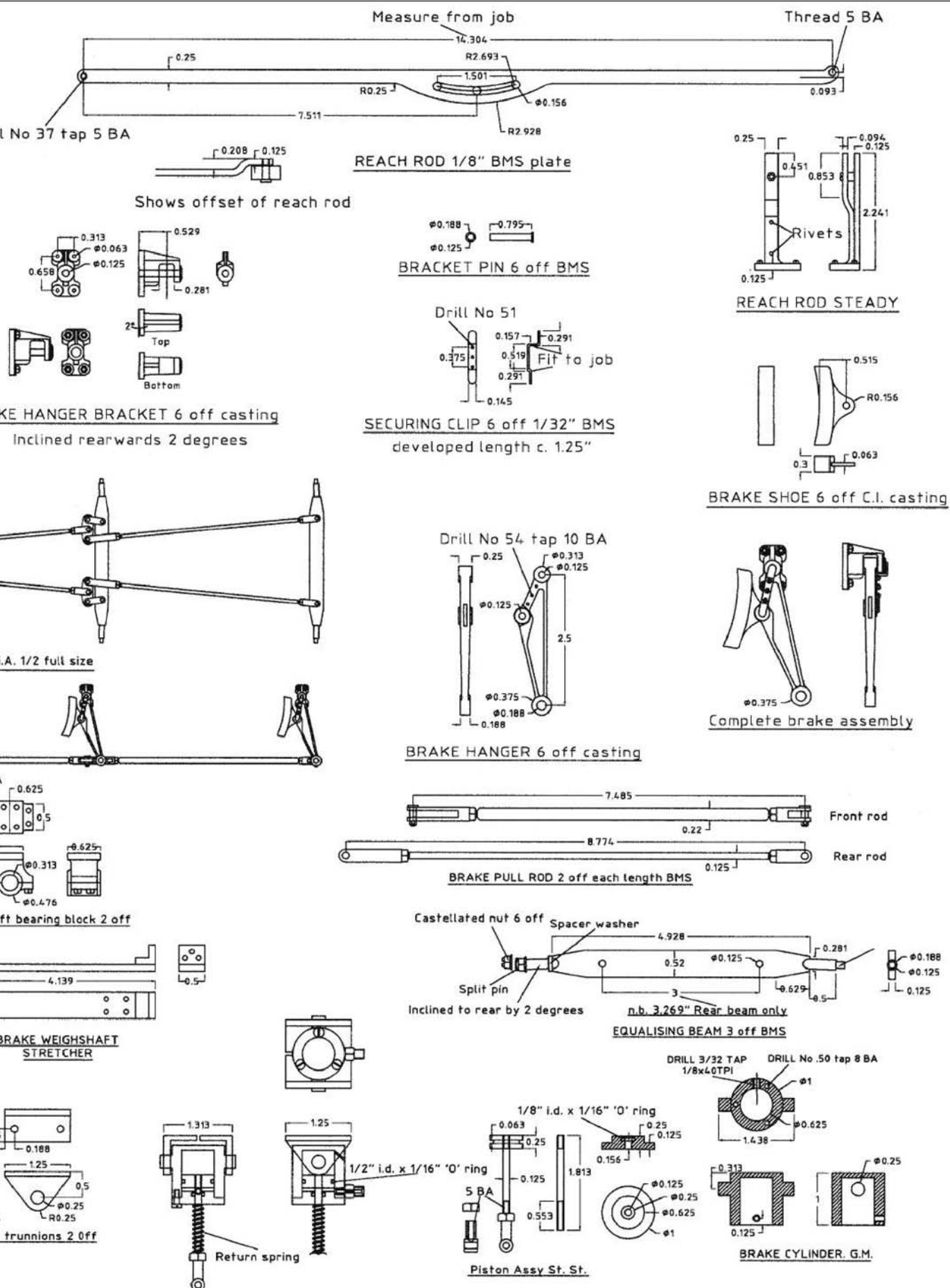
brazed into the bottom end. The bush was tapped $\frac{1}{2}$ in. BSF and was located by a long screw of similar size that was brazed to a suitably relocated frame cross member. This was light, cheap, easy to make and capable of some degree of vertical adjustment.

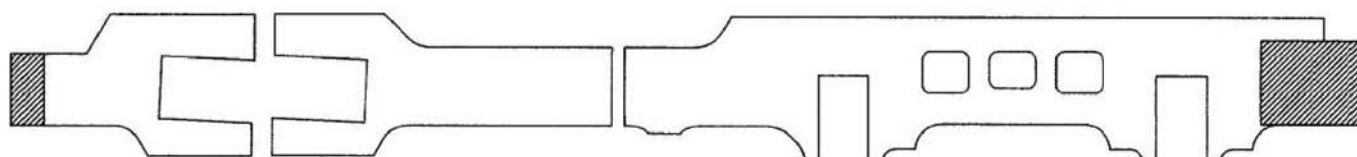
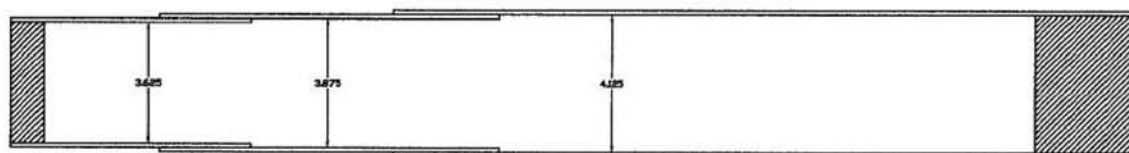
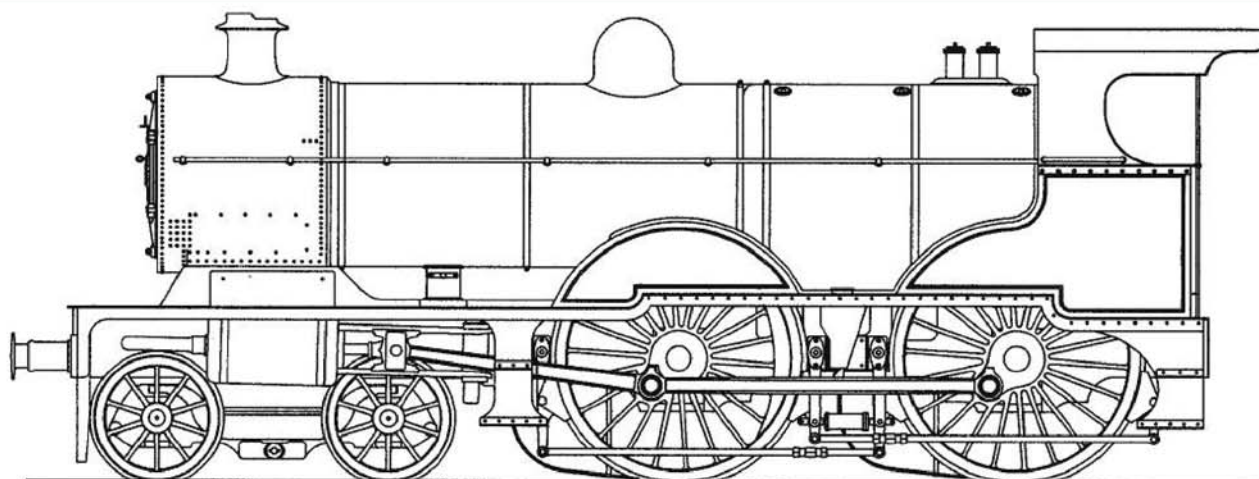
The other day I found myself faced with the perennial problem of 'how to drive the oil pump' which is mounted on the inside of the front buffer beam of the GWR 1400 tank engine that I'm currently fiddling with. I eventually decided to use one of the eccentric rods for the purpose, as it seemed to give the amount of travel that I required and was not too far from the oil pump lever. I then had to drive the wretched thing as close to the eccentric strap as possible, which was of course where there was least room. The answer came to me at 6 o'clock in the morning which is when I get all my best ideas. I was up dressed and had it all sorted before 6:30, which shows how simple it was. I parted off $\frac{3}{16}$ in. of brass round bar, drilled it No. 43 and did the same to the eccentric rod at a suitable distance from the strap, tapped them both 6BA and inserted a screw as can be seen in the accompanying art work. It should at least last the life of the eccentric and carries the added bonus that Goodall (D.) hates the idea, he went off waving his hands in the air and trumpeting about "not sound engineering practice". Most satisfying.

Reader's letters

An interesting letter from Norman Barber on *Researching Loctite* appeared in M.E. 4246, 29 April 2005 in which he states that he has "taken the trouble to study the published literature on the various products available and has carried out tests of his own to confirm that he could achieve the bonding strengths claimed". Most laudable, in fact I have carried out the same research myself over the last 25 or so years and can assure our readers that brass and its associated alloys such as the bronzes do not have the same holding power as has mild







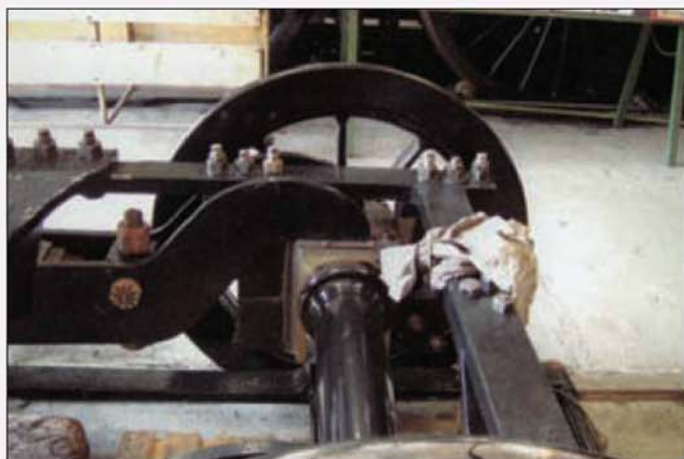
This is the Deeley 7ft. dia. wheel Midland compound locomotive. Note that the frame comes in three parts, the one-piece cylinders are spliced between the front and middle portions.

This arrangement allows room for the bogie to swing and is as the prototype engines.

Photographs below show the new *Saint Lady of Legend* photographed at Didcot in March 2005.

It is similar to the Grange except for the larger, 3ft. 3in. dia. wheels.

©





Martin Wallis

takes a break from the acclaimed series on the *Savage Universal Carrier* to discuss how his recently published book came to appear in print.

I am keen to emphasise that what follows are my experiences, which are not necessarily typical, in self-publishing the book 'Scale Model Traction Engine Design and Construction' under my real name Edward George. It is not intended to be a blow-by-blow account of how to get a book into print; there are plenty of more useful and learned texts on that score. However, I have found it a very rewarding experience and an undertaking I can recommend.

Every book requires an author, a publisher and a printer. 'Author' and 'printer' are both self-explanatory but perhaps 'publisher' might need some clarification. Technically, in the terms of the Copyright Acts, a 'publisher' is anyone who issues or distributes publications to the public. My understanding is that a publisher is the person (or organisation) who 'makes it happen'. Publishers gauge market needs, commission authors to write texts, edit and lay out the said text to make it ready for publication, decide the extent of the print run, commission the printing, and lastly either organise or contract out the marketing and distribution. It should also not be forgotten that publishers also take the financial risk. Their capital is turned into piles of books which may, or may not, sell. Self-publishing involves all of the above.

Road Steam and Little Samson

Rather more than ten years ago I got some acknowledgement for my efforts in the design and construction of my half-size Fowler road locomotive at the Model Engineer Exhibition at Olympia. Mike Chrisp, then technical editor of *Model Engineer*, asked if I would be kind enough to write an account of it - or perhaps a mini series - for publication.

I explained to Mike that I had minimal literary skills. My spelling could best be described as 'creative', and the full stops would undoubtedly all be in the wrong places. Rather unnervingly Mike was not to be put off that easily, he said he would check the spelling and reassemble my writing as required. I ended up saying that if he could list exactly what he required in the form of a writing plan, I would see what I could do. I left the exhibition fully expecting I had heard the last of it. How wrong I was.

W. H. Smith

The *Road Steam* column started on 21 June 1996, and the said issue of 'ours' landed on the doormat with my writings in it. In town there were more copies on the shelf in W. H. Smith, and each and every copy had my article in it. I was in print!

The *Little Samson* series proved popular and quite a number were built. Part and parcel of

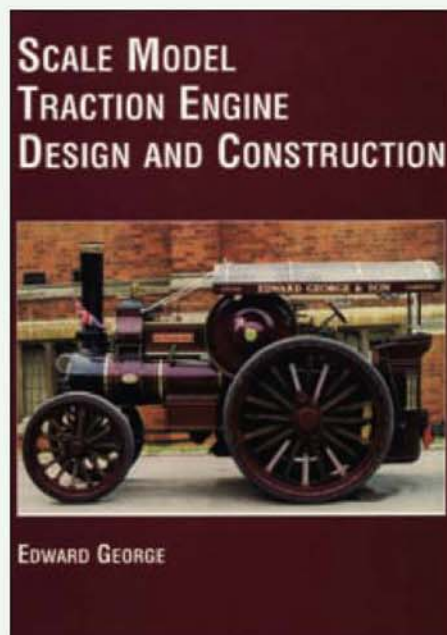
THE DIY GUIDE TO SELF- PUBLISHING OR BOOKS, BOOKS AND YET MORE BOOKS...

writing articles for *Model Engineer* is corresponding with numerous individuals a portion of whom go on to build a model. The most regular queries are from readers who have missed a part of the series.

Ring binding

A great deal of encouragement was forthcoming from *Little Samson* builders. Consideration was given to combining some of the first more general 'Road Steam' articles (for example the articles on fitting solid rubber tyres) with the more specific *Little Samson* writings to make a more general 'guide' to model traction engine construction.

The thought of regularly hand feeding 80 sheets through the photocopier eventually did the trick; some sort of publication had to be printed. A start was made; the initial *Road Steam* texts and the *Little Samson* texts were to be combined and expanded. Illustrations were added to make some page trial page layouts. The extent, based on the *Little Samson* articles seemed to be about 160 sides of A4; which if printed back to back (i.e. on both sides) would need 80 sheets of paper. Bearing in mind the text was to be expanded a booklet of some 100 sheets of paper seemed to be about right. Prices were obtained from high street reproduction and photocopying shops, but they seemed very expensive. However, it was a start.



Rally grapevine

Model traction engine rallies will inevitably host a diverse collection of individuals. For me this is one of their great attractions. It was not too long until I was advised 'you should speak to so and so', which of course I did. The lady in question, Sukie, was the wife of an engine owner and vintage machine tool enthusiast and a medical book editor by trade.

Advice was taken and Sukie certainly became my 'right-hand man', if I am allowed to say such a thing of a lady. Her wisdom was that for the price the high street shops would charge, I might as well get the book professionally prepared, bound and printed. To do this the printers would require the work to be in a software format called Quark XPress, which I understand is the industry standard. A price was agreed, I was to sort out the text in Microsoft Word, scan in the pictures, and Sukie would take it from there.

Double it

Another sound piece of advice I was given was that however long I might think it would take to write a book it would be wise to double my assessment. How true! What was planned to be a simple re-working of existing material turned into something of a marathon.

The preparation of the text lasted a little over a year, the index and final touches being added in June 2004, the book going to press in late July/early August with delivery promised before the August Bank Holiday weekend. In practice delivery was at the end of September.

ISBN number

One of these numbers is worth having and should be applied for. I discovered that the minimum number you could buy was 10, which seemed rather a lot. To get an ISBN number a lengthy form has to be filled in and they ask for a contents page and a sample of the text.

The ISBN stands for International Standard Book Numbers and is a 10 digit number, which identifies one title, or edition, from one specific publisher and is unique to that title or edition. Once an ISBN number is approved and the book published the Copyright Act of 1911 obliges publishers to send a sample book to the British Library, the Bodleian Library in Oxford, the University Library Cambridge, the National Library of Scotland, Trinity College Dublin, and the National Library of Wales.

Finding a printer

Take any book and somewhere on the first few pages will invariably be the printer's name. An



The delivery lorry needed to transport 4 tons of books was as big as a furniture lorry.

hour at a bookshop will soon provide a list of printers, the majority with addresses and web sites. In addition I contacted Camden and TEE Publishing, explained I wanted to self-publish, and was kindly given some further addresses.

I think it fair to say that both publishers and printers probably get their share of 'time-wasters'. The temptation is to quote a high price and hope they go away. This I guess accounts for some of the initial quotes being more than double the apparent market rate.

Far Eastern printers were not ignored, all had agents in this country who were keen to help, and there prices were extremely competitive. As a rule of thumb the price to publish in black and white at home was of similar magnitude to a full colour run from China or Taiwan. I did, however, feel more comfortable with a printer I could visit and converse with directly.

When asking for quotes it is important to have quite a tight specification, which should include details of the origination (from disc supplied), proofs (laser proofs and made up proofs prior to binding), materials (130gsm fineblade smooth, dust jacket 150gsm gloss art) and finishing (fold, gather, section sewn, trim, case bind in wilabin, attach grey end covers, gold foil block on spine, and gloss laminate dust jacket one side only) and last but certainly not least the quantity of books to be printed (plus a working time to delivery).



The first pallet is carefully unloaded using a pallet truck and the truck's hydraulic tailgate.

A short list of printers' quotes was drawn up and each was contacted in turn to finalise a price. The more technical terminology that you can use in the correct context the better - you will be taken more seriously. Over the course of a week the prices steadily dropped, the line being taken that I did not simply want the lowest quote if it was at the expense of quality: which I emphasised was of great importance. The three most favourable companies were all asked to post an example of their work, which was as similar to my book specification as they could. The second lowest quote was accepted, the decision being made on the quality of the sample book requested.

Four tons

It was during the quoting stage that the magnitude of the project was brought into full focus. "I will have to get to our paper supplier and see what I can do" they said, later on the phone rang "yes, good news, we can drop the price by ...". I queried the rather large price drop and the answer came back "well we are talking about four tons of paper!" I was horrified; what ever was I up to? The weight was however quite correct. You start with four tons of paper and as you cut and trim the book some of it will be lost - but it is all put back on with the additional weight of the hard covers and binding.

To get best value for money the total number of printed pages ought to be a multiple of 16, or sometimes on smaller presses, 8. *Scale Model Traction Engine Design and Construction* ended up as 15 lots of 16 printed pages, plus an 8-page full colour insert totalling 248 pages.

Proof reading

This stage is no small undertaking. Sukie's page layouts in Quark were read through very carefully and corrections made. The proofs were in fact read five times, and that was after Sukie had already worked her magic and put all the full stops in their correct places. I then read it for technical accuracy, I re-read it to double-check the picture caption cross referencing was correct, my wife Jean read it (many comments on how boring it all was!), Richard Cawte (good friend) read it, and so did my son Andrew.

Quite a few changes; all happily 'typos', punctuation or spelling, were identified. The proofs were returned to Sukie who made the revisions and the page layouts were sent to the printers. The job had begun.

The printers sent laser proofs to Sukie and myself for checking. These have to be formally signed for, which I did, and were fine with the exception of the colour plates which lacked depth and were a bit 'muddy'. I queried these and was told this was due to the laser proofing, the real thing would be better. I signed the proof form, but added that my expectation was that the colour would much better and I added some of the original colour photographs for good measure. The printing plates were then made and the presses ran. I was then sent the running proofs, a sample sheet from each pile sent for my approval before the book was bound up.

Quality not compromised

Sadly the colour section proved to be little better than the laser proofs. Having got so far I was determined not to have the quality compromised and the discussion went all the way to the managing director. On his desk he had my observations on the colour reproduction on the proof form, the colour pages as printed, and the photographs I had sent for good measure. He agreed the colour on my pictures were much richer than on the printed pages.

The explanation was that I had scanned the pictures on a 3-colour (red, blue, yellow) domestic scanner but printed pages were always in four colours (cyan, yellow, magenta, black). I, as was Sukie, felt the software must exist to make the conversion rather better than appeared to be the case. Evidently not. As I was determined not to have the quality compromised all the colour printed sheets were sent for re-cycling. The colour work was re-originated, new plates made, and all the colour work reprinted. The cost was considerable and unplanned for but, in retrospect, I am sure worthwhile.

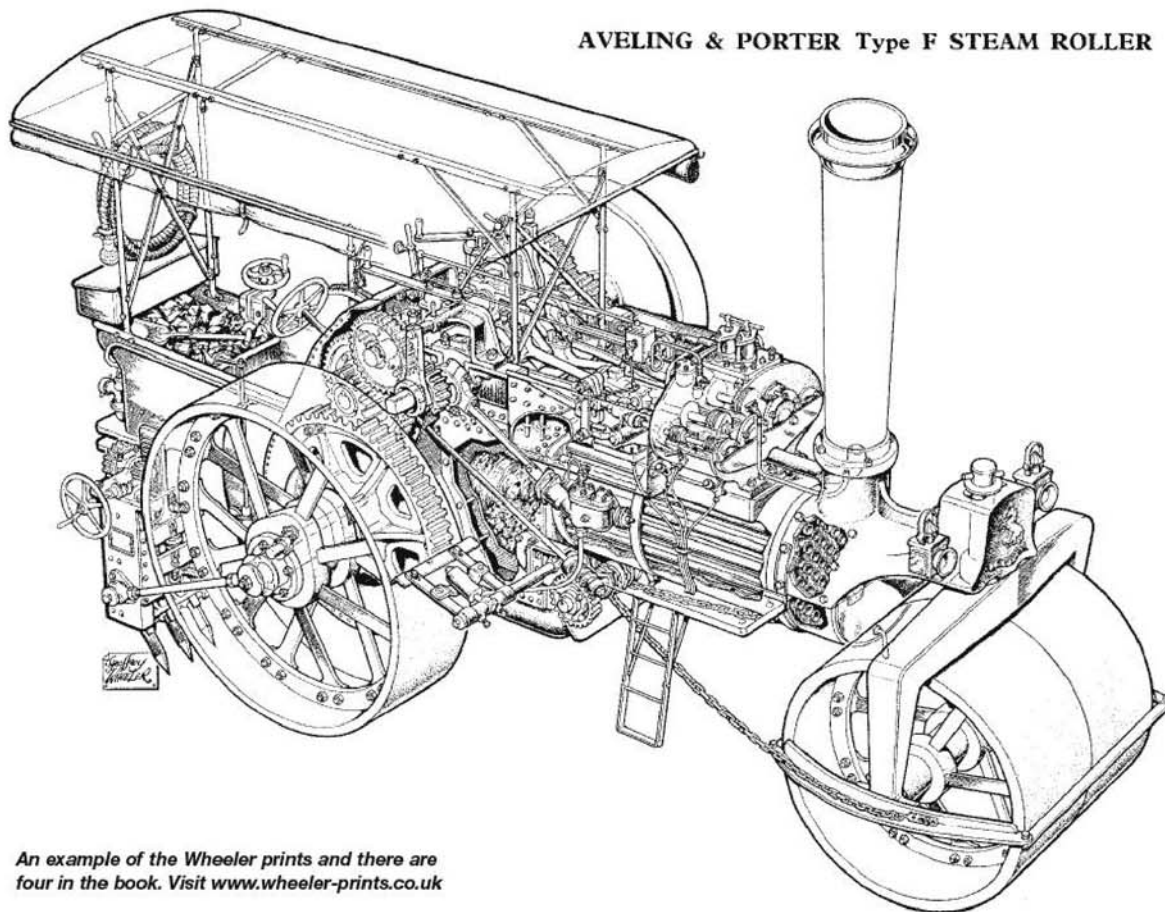
Delivery day

On this day four pallets of books, each weighing a ton, were deposited outside the house. It took four people an hour to carry the books into the house. We had, quite literally, a full house. Books in all the downstairs rooms including the



Two of the four pallets. Each pallet load weighed a ton.

AVELING & PORTER Type F STEAM ROLLER



An example of the Wheeler prints and there are four in the book. Visit www.wheeler-prints.co.uk

©

hallway. The boxes of books in the front room were quite literally from floor to ceiling, with a gap left in the stack to reach through to access the room thermostat!

By the evening the boxes had been tidied a bit, I had made two rather nice bedside tables upstairs from boxes of books, further boxes were used to make a waist high phone table in the hall way, another table in the dining room (I said to carve the turkey on!) and several other piles in available corners



One of the piles of books. Note the cardboard packaging in anticipation of some sales.

Not happy

I could tell my wife was not altogether happy. It was certainly true the house did feel rather smaller than it previously had. Part of the bargain was that the proceeds of book sales would buy a new carpet for the front room, dining room, hall stairs and landing. I was reminded of this several times, but chose not to point out that with much of the existing carpet under four tons of books that carpet replacement might pose some difficulties in the short term.

Marketing

I had been warned that self-publishing would fail at the marketing stage. Without an established promotional system sales would be minimal. I chose to ignore this advice and figured that model engineers were an astute bunch. If there was a worthwhile product out there they would make their own decisions, the 'razzmatazz' and drum rolling of a book launch would achieve little.

Complimentary books were sent for review to all the relevant magazines and likewise several sample copies to the trade. Happily the reviews were very positive, each review was followed up with an advertisement for mail order.

Wonderful folk

I had no need to worry as the reviews and adverts did the trick. By Christmas one of large piles of books was dispatched and a start was made on a second. The house was becoming our own again as the book was indeed selling.

Probably half of the books sold were bought for Christmas presents, several requests were made to post them to work addresses to keep the book a surprise. One of the nicest moments was Christmas Day evening when I opened a small

flurry of 'thank you' e-mails including one from the USA and two from Australia. Model engineers are wonderful folk.

The Scale Model Traction Engine book was printed by HSW Print (Hackman South Wales) www.hswprint.co.uk and typeset by Sukie Hunter; e-mail: [SUKIEH\(ja\)compuserve.com](mailto:SUKIEH(ja)compuserve.com). It is available from Little Samson Models, 38 Wheatsheaf Way, Linton, Cambridge CB1 6XD. £29.95 plus £5 p&p, sorry no credit cards. Visit www.littlesamson.co.uk



Smoke box cuisine. An aside that caught the imagination of many readers.

ROCKER LEVER DRIVES ON GWR AND LMS 4-CYLINDER LOCOMOTIVES

Peter Rich
explains some of the mysteries.

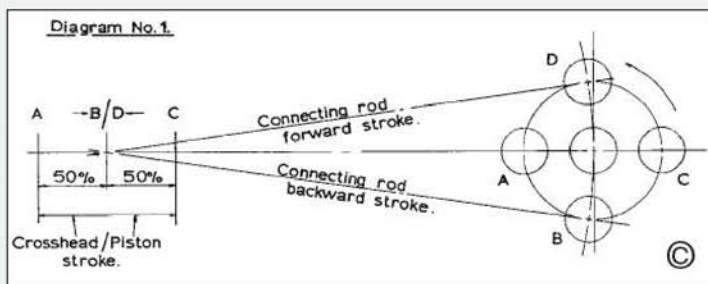
●Part I

I was up on Caerphilly Mountain the other day, having a bit of a practice on the pipes, and was actually playing a tune named *The Train Journey North* by T. Anderson. My mind started to ponder over comments in *M.E.* and other correspondence about the rocking lever drive for the outside piston valves on ex-GWR 4-cylinder locomotives and this prompted me to take another look and re-appraise my thoughts on this subject since studying it thirty odd years ago. I last wrote on this subject in a letter to *Post Bag* in *M.E.* 3672, 1 January 1982 and thought, at that time, that I had covered the subject. However, in view of some recent correspondence with my friend Eric Youldon (Exeter), about the LMS 'Coronation' Pacifics I have re-examined the subject and find that there is always something to be learned.

For the newer members of our hobby, who may not be familiar with these locomotives, I should explain that 4-cylinder locos were first introduced on the GWR in 1906 with Churchward's 4-4-2 No. 40 (later named *North Star*). The design of this locomotive was quite quickly developed into the 4-6-0 express passenger locomotives of the 'Star' class, and later into the 'Castle' and 'King' classes. No. 40 was later absorbed into the 'Star' class and eventually into the 'Castle' class, of which more later.

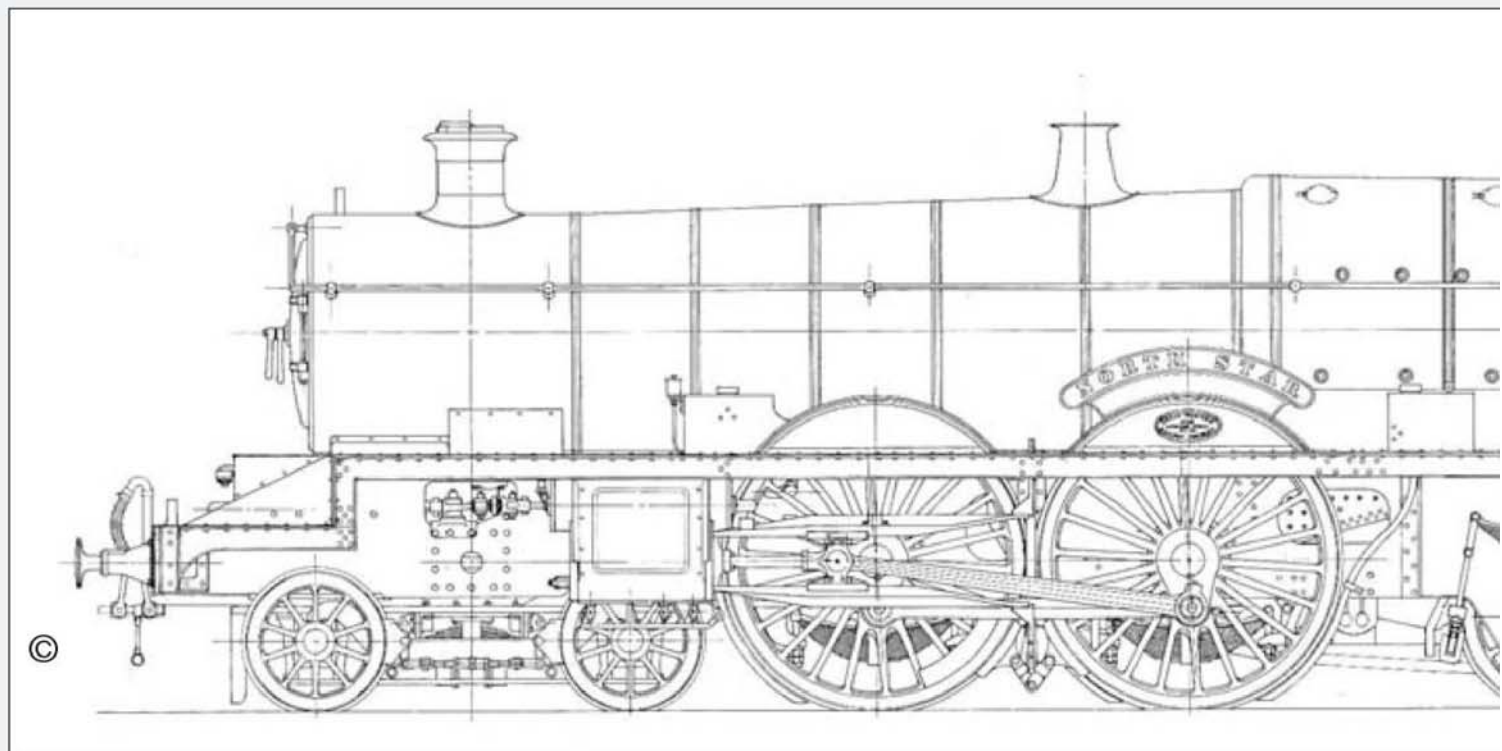
Together with the LMS 'Princess Coronation' class they were all fitted with 4-cylinders, the four piston valves of which were actuated by two sets of Walschaerts valve gear, one valve gear driving two valves. On the GW engines the inside cylinders were situated over the leading bogie wheel and drove the leading driving wheels via a crankshaft while the outside cylinders were over the rear bogie wheel and drove the centre driving wheels. The LMS engines carried their inside cylinders in a similar position but the outside cylinders were between the bogie wheels. The inside and outside cylinders drove the same axles as per the GW locomotives. On all locomotives the right-hand crank was leading and set at 90deg. to the left-hand crank and the outside crank on each side of the locomotives was set at 180deg. to its corresponding inside crank i.e. both right-hand cranks were at 180deg. to each other.

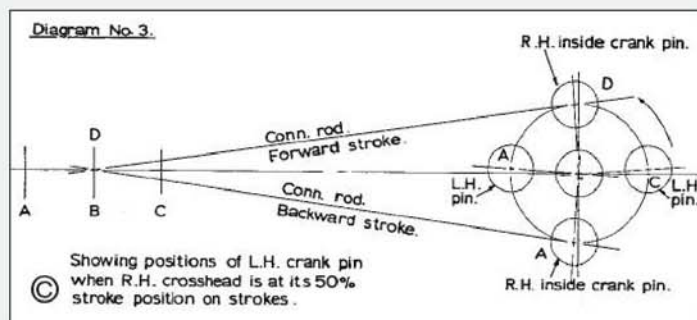
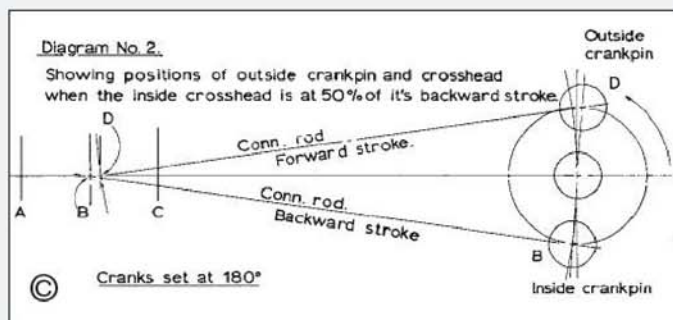
On the GW engines the valve gear was driven by eccentric sheaves on the crank axle, which was the leading driving axle, and directly drove the piston valves of the inside cylinder. A horizontal rocking lever, driven from the inside valve stem, was used to drive the piston valve of the outside cylinder. The same arrangement was used on the LMS engines but was vice versa in that the



outside drove the inside, the valve gear being outside. The rocking lever on the GW engines were cranked backwards while those on the LMS engines were straight and this aspect of the subject has fairly frequently been the point of discussion both in our world and the railway enthusiast's press over many years. However, no one has given what I consider to be a satisfactory explanation as to why they were both different or, indeed, why the GW rocking lever had to be cranked at all. However, it is interesting to note Nigel Gresley also used cranked rocking levers when he rebuilt the Ivatt Atlantic No. 279 with four cylinders. For the moment suffice it to say that the reasons why the GW and LMS rockers were cranked or not cranked has, hitherto, been stated as being due to angularity of the connecting rods (see later).

Before moving on to trying to explain reasons why, it may be useful for those of you who are not familiar with the subject, to explain precisely what connecting rod angularity means in relation





to these locomotives. You will see from my **diagram No. 1** that I have set out a simple piston stroke/ connecting rod/crank diagram. I have marked the positions of the piston crosshead as A, B, C, D and E, together with the related positions of the connecting rod big end. Obviously the stroke of the piston relates exactly to a 180deg. turn of the crank from (A) front dead centre to (C) back dead centre. I am sure you will understand that 50% stroke of the piston (the B/D position) will represent the exact half way between the front and rear dead centres. This is an important point in valve gears that use a combination lever to provide the final drive to the piston valve and any lap and lead designed into the gear. At this point in the piston/ crosshead stroke the combination lever should be at 90deg. to the centre line of the piston valve when the valve gear is set at mid gear position.

Now imagine that I have set my compass out to the length of the connecting rod and struck an arc from the 50% position of the centre of the crosshead to either side of the engine's centre line across the crank axle centre. It will be seen that the arc cuts the crank turning circle in front of the vertical centre line through the axle showing that the position of the connecting rod big end will not have reached a quarter of a turn of the crank on its backward stroke due to its connecting rod's downward angle. By the same token you will see that on its forward stroke, at the crosshead's 50% stroke position, the big end will have turned further than a quarter of the crank's turn due to the upwards angle of the connecting rod. This

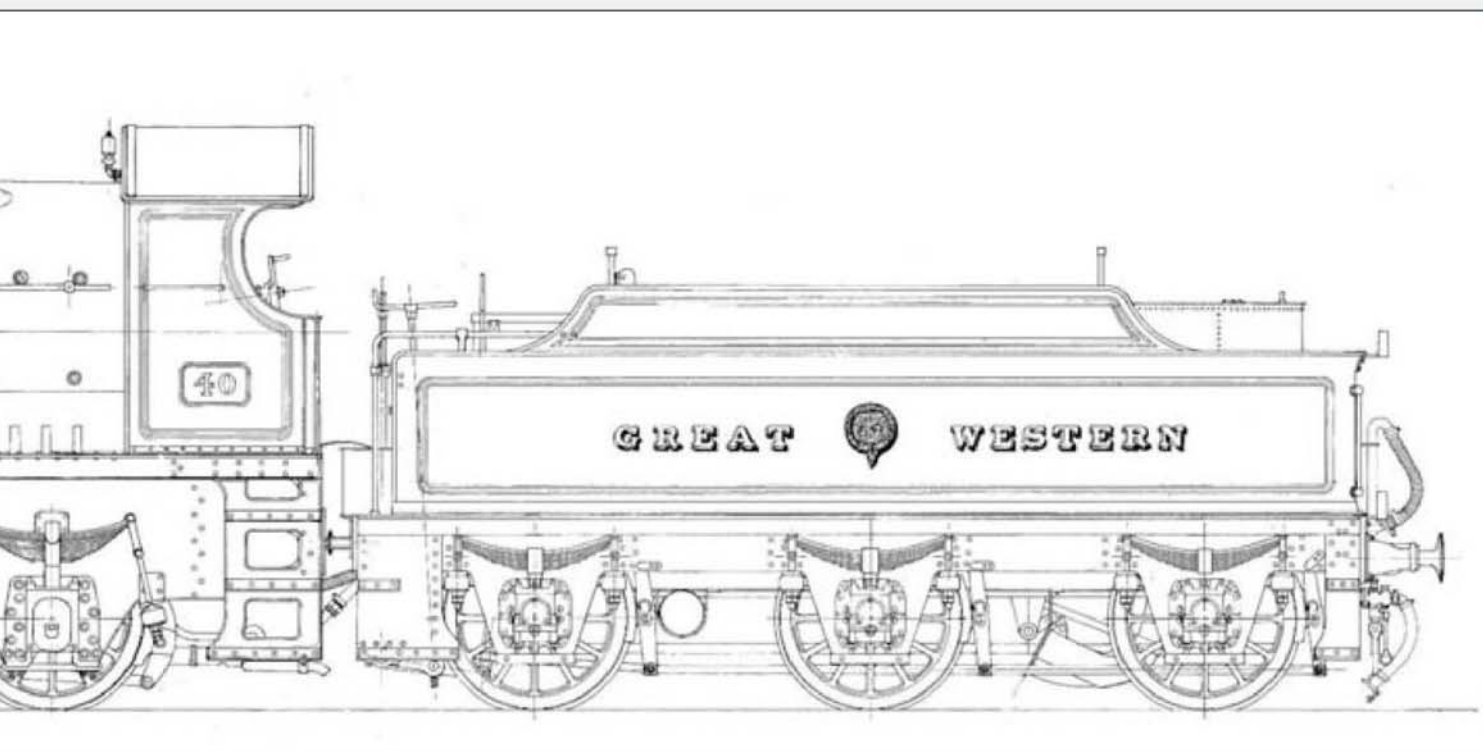
shows that there is a discrepancy between the crosshead's rearward stroke and its forward stroke as far as turning the crank is concerned.

Now let us have a look at what this means when we have two crossheads working at 180deg. to each other. My **diagram No. 2** shows this and it will now be seen that when the inside piston is at 50% of its backward stroke everything I have said above continues to apply to the inside piston and connecting rod. However, because the outside crank is at 180deg. to the inside crank it will be on its forward stroke, and will be short of a quarter of a turn. Its piston will not have reached its 50% stroke point and add to this the angularity of the outside connecting rod it will be seen that the outside piston will be even further displaced towards the rear of the cylinder compared to the inside piston. Rough calculation reveals that there is about a $7\frac{1}{2}\%$ difference between both pistons at this point in their strokes and the discrepancy is always towards the rear of the cylinder alternating between the pistons, depending on which stroke they are on.

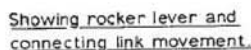
The inside and outside connecting rods on GW locos were almost equal length but there was a 3ft. difference between the rods on the LMS locomotives, the outside being longer. However, as far as angularity is concerned, from setting it out on the drawing board this seems to make very little difference between the inside and outside pistons in that the $7\frac{1}{2}\%$ backset, or thereabouts, still applies.

Rocking levers were not a new idea when first introduced on the GW in 1906 on loco

motive No. 40 there being plenty of other locomotives and steam engines about with valves driven by rocking levers. But No. 40 differed from all subsequent others in that when W. H. Pearce designed the valve gear for this engine he hit on the idea of eliminating eccentrics altogether. He proposed to use the crosshead of one inside cylinder to substitute for the eccentric of the other inside cylinder rather than using the Walschaerts valve gear with its eccentric, which he had already started to sketch out. As will be seen from my general arrangement drawing of this valve gear, the quadrant links (or expansion links, if you like) were fitted with hanging levers which crossed over themselves from each side of the engine. These were driven from the opposite side crossheads by a long straight link similar to the anchor link in Walschaerts gear. The action of these two levers in passing each other when in motion caused this valve gear to be named the 'scissors' gear, however there were a further two movements within the valve gear which never get mentioned but which also contributed to that description as follows. When in forward gear the right hand die block operated in the lower part of its quadrant while the left-hand die block operated in the upper half of its quadrant. The radius rods crossed over, in a scissor-like motion, when moving from forward to reverse gear. In addition to this, in order to allow this to happen, the intermediate weighbar levers had to be separate from each other to allow them to move independently in moving from forward to

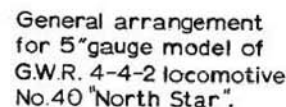


reached its 50% position the left-hand crosshead will already have passed its rear dead centre position. This caused a further discrepancy between the left-hand and right-

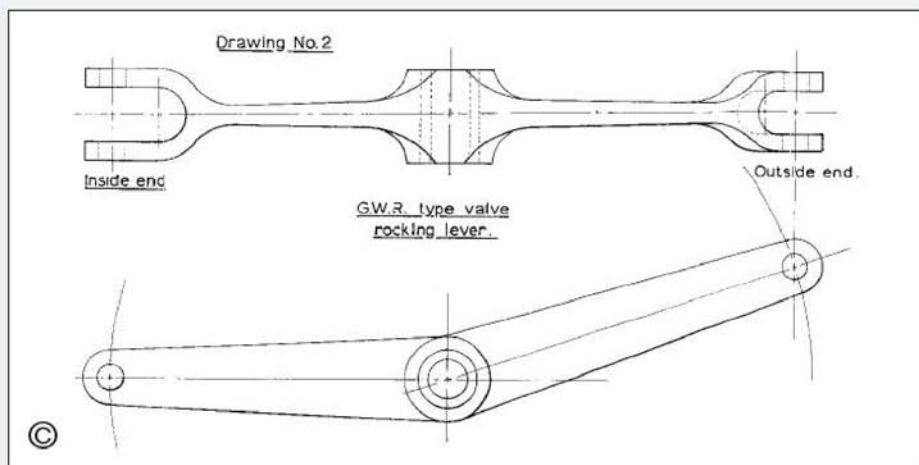


I am sure Pearce realised that, while the inside valves could be set in the normal way, because of the angularity involved, an allowance had to be made in the drive to the outside cylinders valves to delay the closing of the piston valve at the rear end of the outside cylinder but speed it up at the front end. The delay and speeding up was necessary to allow the piston to make up the 7½% discrepancy and equalise the work being done by the inside and outside pistons. With this type of valve gear there was no means by which this could be allowed for within the valve gear drive up to the inside valve stem. Therefore, any allowance had to be provided in the drive to the outside valve, i.e., the rocking lever and its connecting link. Pearce very cleverly provided for this by designing the

rocking lever (see **drawing No. 2**) with its inside arm end driven by a die block in a buckle and made the inside end of the rocking lever move parallel with the valve centre line. With the



outside arm of the rocker he lengthened it and cranked it backwards so that when the inside valve was at its mid-stroke position the inside arm of the rocking lever was at 90deg. to the inside valve stem while the outside arm was cranked back so that its driving pin was exactly on the centre line of the outside piston valve and was connected to the outside valve spindle by an adjustable link. Because the outside arm of the rocking lever was cranked backwards its motion meant that instead of swinging parallel with the outside valve spindle, it swung backwards and inwards and forwards and outwards across the centre line of the valve (see **diagram No. 4**) and due to this connection to the valve being via a link, rather than a die block, the outward and inward motion of the rocker arm caused the link to act in a similar way to a connecting rod and introduce 'angularity' to the action of this valve. My diagram shows that the backward swing of the rocker was not as great as the opposite forward swing. When it started on its forward swing, although the motion of the link and valve stem was in the forward direction, the connecting link progressively lengthened the distance between the rockers driving pin and the valve stem pin until the rocker's driving pin reached the centre line of the valve spindle. Thus, very cleverly, was introduced a small delaying action to the closing of the outside cylinder's rearmost valve head allowing its piston to catch up with the action of the inside piston. Once the outside end of the rocking lever had reached the in line position of the link and valve stem then any further outward swinging motion of the rocker progressively shortened the distance between the drive pin and the valve stem pin. This speeded up the action of the outside valve in relation to the piston. The result of this was that the action of the rocking lever tended to equalise the work being done at each end of the outside cylinder.



Before going on to outline the valve gears, I realise that I have mentioned *North Star* so much that I should give a little more of this locomotive's most interesting history because it was always a unique locomotive. Whatever condition it appeared in it was always different from those in the same class. The official Swindon works drawing shows that, unlike the contemporary 2-cylinder 'Scott' class 4-4-2 locos (the early 'Saints'), it was fully intended that it was to remain as a 4-4-2 because no provision was made for a rear driven axle in its main frame. In contrast the early two-cylinder 4-4-2s had a rear horn gap provided in the mainframe to enable them to be easily converted to 4-6-0s. With No. 40's mainframes it was impossible to cut a rear horn gap into them because two large apertures had been cut into its frame right where the horn gap would have to have been.

Right throughout its life *North Star* carried its foot plating 2 1/2 in. higher than any other GW 4-cylinder locomotive. In 1909 its was rebuilt as a 4-6-0 with new frames of the 'King' series of 'Stars', which were being built at the time, and was fitted with a short cone boiler with this rebuild. It was re-fitted with a long cone boiler in 1911 and renumbered No. 4000 in 1912. It remained as such until it was rebuilt as a 'Castle'

class locomotive in 1929, the 'scissors' valve gear then being replaced by Walschaerts. *North Star* also had a further unique distinction from all other 4-cylinder GW locomotives in that, when first built, the outside faces of its mainframes, footplate hanging angles (valances) and cylinder cleading plates were finish painted in the Indian Red livery of the period. All later 4-cylinder locos had these painted black.

At the time of No. 40's building, in 1906, Mr Deeley of the Midland Railway had applied for a patent for a similar valve gear and its was rumoured that Swindon had received a letter of complaint of infringement of this and that, as a result, Churchward ordered the replacement of the 'scissors' gear by Walschaerts valve gear on the next batch of 4-cylinder locomotives. Another account states that the main reason for its replacement was that it took ten days for valve setting against the one and a half days for normal valve gear. I tend to favour the latter reason because I feel that it is a much more practical reason for changing the design. I cannot see that Churchward would have allowed himself to be intimidated by anyone, he was too big a man at that time.

My drawing of *North Star* accompanying this article depicts the locomotive in its original 1906 condition but with the addition of nameplates.

●To be continued.

IN THE NEXT ISSUE

Report of the exciting models at Harrogate



Continuing construction of the classic MG TC

Delightful model spring hammer



ON SALE 8 JULY 2005
(Contents may be subject to change)

Len Walker

describes a precision piece of tooling that can be made in the home workshop.

I have long fancied a nice precision, commercial boring head, the only barrier being one of cost. I therefore decided to have a go at designing and making my own. I wanted a small to medium range tool to suit a 3 1/2 in. lathe with the emphasis on precision – a much-abused word these days.

The following notes describe the results of much cogitating. However, critical as I am about most things, this little boring head does a good job, feels really solid and is easy to set accurately. It has a capacity of approximately 2 1/2 in. diameter. The main body is turned from the solid thus obviating the need for a separate shank. The tool slide is also solid and easily made from 1 1/4 in. square material. The lead screw used to adjust the head is calibrated into 25 divisions, each division representing 0.001 in., just like a micrometer. The divisions are 0.075 in. apart so estimating parts of 'thous.' is easy.

Machining the boring head is straightforward and, if carried out carefully and in a properly defined sequence, will produce a good quality result. To this end, I have drawn up the sequence I used to machine the two main components; namely the tool slide and the main body. This exercise cost me much time and sweat but if the drawings help someone then



Caption 1:

A PRECISION BORING HEAD

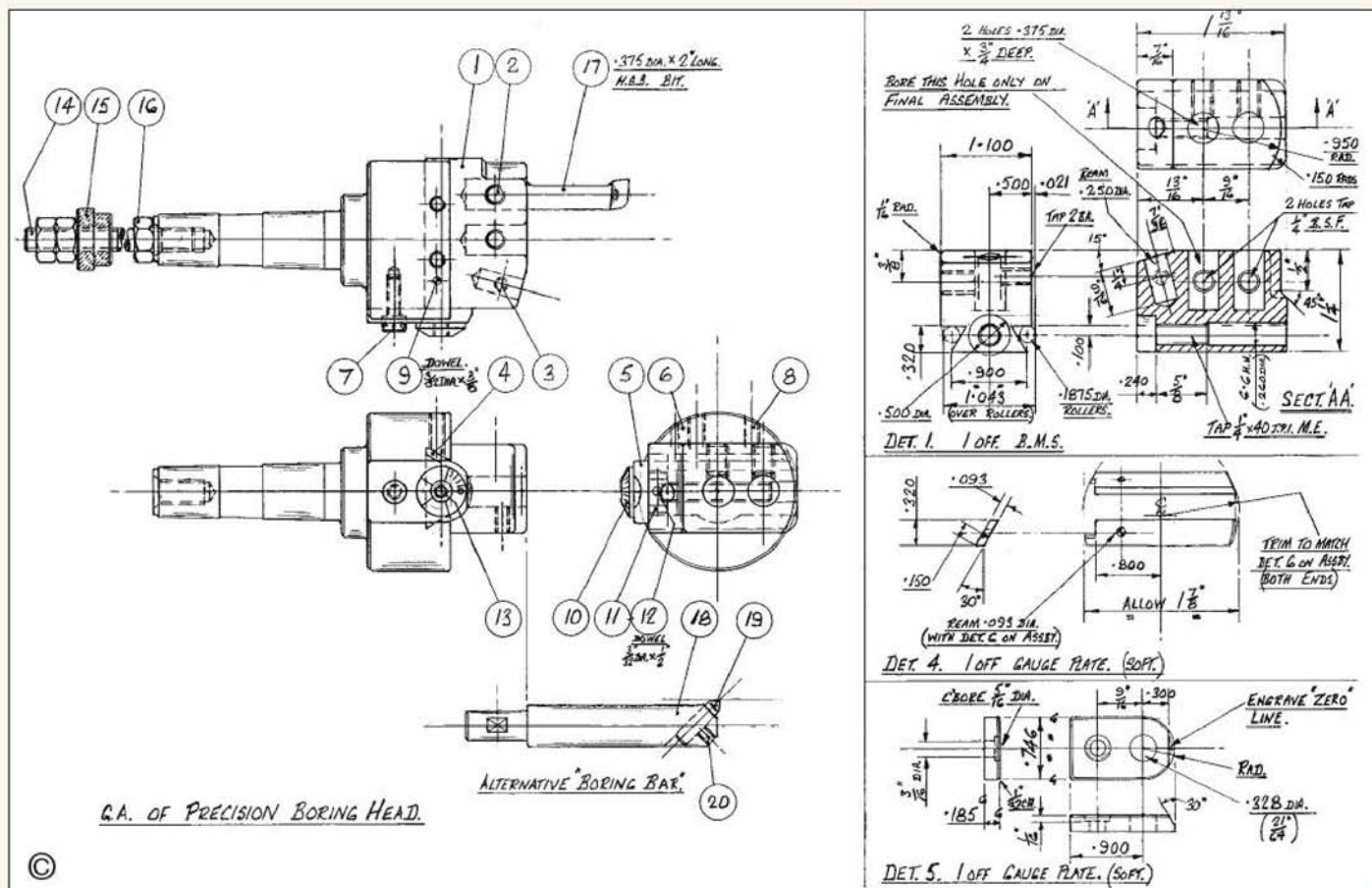
the results will have been worthwhile. The drawings should be used in conjunction with the following notes.

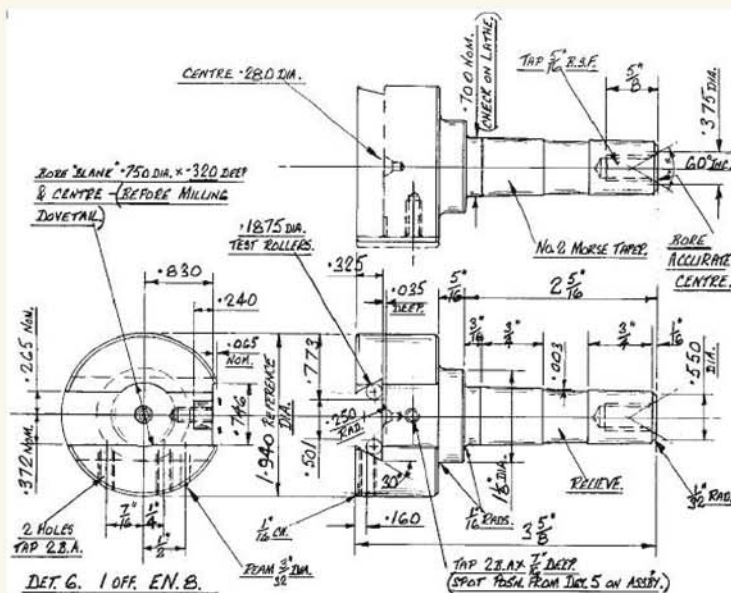
Tool slide (detail 1)

I used a piece of bright mild steel 1 1/4 x 1 1/4 x 2 in. Clean up the blank so that the faces are square and parallel. Mark off the positions of the two 0.375 in. dia. holes and respective 1/4 in BSF grub screws. Machine the 15 deg. face. Hold in a 4-jaw chuck using soft, aluminium alloy strips

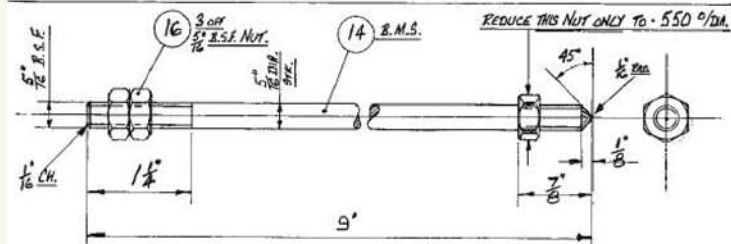
between the jaws and the work to avoid damage. Now, centre the position of the outer 0.375 in. hole using a centre finder and a dial test indicator. Drill and bore to 0.375 in. or until a nice snug fit on a piece of 3/8 in. dia. silver steel. Remove from the chuck and drill and tap for the 1/4 in. BSF grub screw.

Now, check that the jaws of your vertical milling machine vice are parallel to the table. Clamp the slide in the vice using parallels for support. With a dovetail cutter, skim 0.001 to

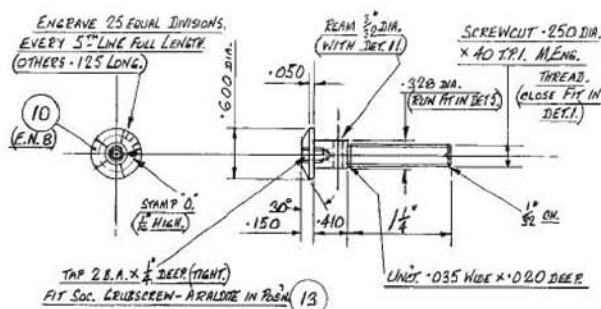




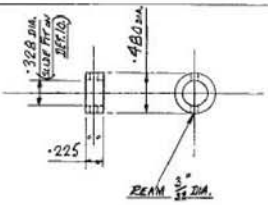
DET. 6. 1 OFF EN. B.



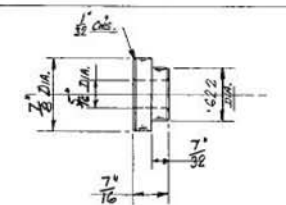
DETS. 14 & 16. 1 OFF THIS.



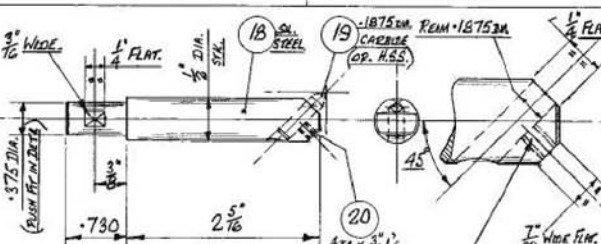
DETS. 10 & 13. 1 OFF THIS.



DET. 11. 1 OFF EN. B.



DET. 15. 1 OFF EN. B.



DETS. 18, 19 & 20. 1 OFF THIS.

ENLARGED VIEW. SCALE: 2 X FULL.

0.002in. off the top face to give a true surface. This will ensure the truth of the dovetail form relative to the table travel. Raise the table 0.320in. and carefully mill the first face of the dovetail i.e. on the face that is 0.500in. from the centreline of the 0.375in. dia. holes. Use a 0.1875in. dia. silver steel 'test roller' to check the relative position as shown in the detail. Be careful to check that you have chosen the correct side before cutting metal as the slide is offset to accommodate the gib strip. Now mill the other side of the dovetail. Continue cutting until the size over the two test rollers is as shown on the drawing. Aim for a good clean finish – do not force the pace and use plenty of cutting oil.

Turn over the part in the vice and mill the 15deg. flat. Remove from the vice, mark out and then drill and ream the 0.250in. dia. hole as shown. Mark off, drill and tap the 2BA grub screw hole.

Mark off the position of the lead screw hole as shown and centre dot as accurately as possible. In the lathe 4-jaw chuck, set the dot to run true and bore 0.500in. dia. by 0.240in. deep. Check the set up with a centre finder and dial test indicator before starting to cut metal. Centre drill and drill, say, 13/64in. dia. right through. Bore a short true start for a 7/32in. dia. D bit and carefully pass this right through. Finally, slowly feed a 5.6mm (0.2205in.) dia. drill through the hole using plenty of cutting oil. Now tap the hole 1/4in. x 40 ME, 3/4in. deep using the tailstock centre to line up the tap accurately. If available, use a ground thread tap and aim for the best possible thread. Take care as this size of tapping drill will give very nearly the full depth of thread and carelessness could lead to a broken tap.

Reverse in the 4-jaw chuck, centre up the lead screw hole and open it up to 6.6mm (0.260in.) for a depth of 15/16in., which should leave a threaded portion 5/8in. long. Remove from the chuck and run the

1/4in. x 40 ME tap right through to clear any burrs.

In case any readers were wondering if I have forgotten the second 0.375in. hole, this is best machined after assembly with the boring head mounted in the lathe headstock spindle. This will ensure that the hole is 'spot on' the centreline of the lathe spindle. The 0.950in. radius can also be turned at the same time.

The gib strip (detail 4)

Use a piece of 1/2 x 3/32 x 2in. of gauge plate for this part. File up to the required width and angle the edges. Aim to make it 0.005in. 'under flush' with the body (detail 6) after assembly. File the small cut out as shown but leave out the 0.093in. dia. hole at this stage.

Lead screw bearing (detail 5)

This is made from 3/4 x 3/16 x 17/16in. gauge plate. If possible, grind the thickness to just clean up at 0.185 inch. Grind the width to a clean up figure of 0.746 inch. This will be a sliding fit in the body (detail 6) later. At this stage, mark off the position of the 21/64in. dia. hole as 7/16in. in from the end to allow for positioning. Mark off the 9/16in. centre distance to the cap screw hole. Note: only scribe the vertical lines as the true horizontal line will be picked up later during assembly.

The body (detail 6)

A piece of 2in. dia. x 33/4in. long EN8 is required for this item. If you have access to a larger lathe, face both ends to length (+1/64in.). For those less fortunate, file one end square and then, using your reversed jaws in the 3-jaw chuck, mount in the lathe and gently skim the other end true. Reverse in the chuck and skim the filed end to bring the part to length (+1/64in.). Again, please use only light cuts. Centre drill, drill and tap for the drawbar. Next, using a small boring tool, bore

an accurate centre (for tailstock support) as shown in the detail drawing. This should be done with the top slide set over to 30 degrees.

Now, using tailstock support, turn the material down to 1in. dia. for a length of approximately 1 1/2 inch. The actual length will depend on the depth of your milling machine vice jaws as this 1in. dia. shank is used to hold the part whilst milling the dovetail. If you can hold a shank 2in. long so much the better! Skim a true diameter and 90deg. shoulder for location.

With the normal jaws in the 3-jaw chuck, grip the 1in. dia. shank and skim the 2in. dia. face true. Turn the outside diameter to a reference size of 1.940in. This is used to position the dovetail, milling cutter. Next, bore a recess 0.750in. dia. x 0.320in. deep and centre drill to 0.280in. diameter. This will allow access to the centre when turning the No. 2 Morse taper shank – most of the hole will be removed when the dovetail is milled.

Grip the 1in. dia. shank securely in the milling vice. Tap the shoulder down firmly into contact with the vice jaws. Alternatively the shank can be gripped in the 3-jaw chuck of a dividing head and set vertically – if you should be so lucky as to have access to such a device. Using a 1/2in. dia. slot drill, remove the bulk of the material from the slot to a depth of 0.320 inch. Now, mount the dovetail cutter in the milling machine spindle and skim the top face of the body to provide a datum. Raise the table 0.325in. and carefully mill one side of the dovetail until the 'over roller' dimension of 0.773in. is obtained as shown in the detail drawing. The other side of the dovetail can now be milled at the same depth setting. The 'between rollers' reference dimension of 0.501in. is given as a guide but use the slide and the gib as a gauge for the final check. Aim for a good fit so that the fit of the slide in the body is not wholly dependent on the gib strip grub screws. This approach

takes care of any accumulated errors and the final result to aim for is a first-class sliding fit.

Grip the 1.940in. dia. in a vertical milling machine vice and tap down well with a soft faced mallet. Mill the 0.746in. wide slot central to the body and to the depth shown. Use the lead screw bearing (detail 5) to gauge the fit. At the same setting and using a $\frac{1}{2}$ in. dia. end mill, form the recess 0.035in. deep x 0.240in. long. This provides clearance for the retaining collar (detail 11) on assembly. De-burr and carefully clear away any milling burrs from the centre at the dovetail end in preparation for the next stage.

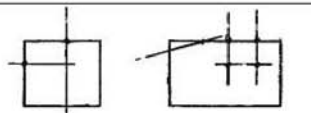
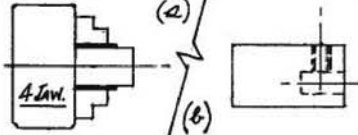
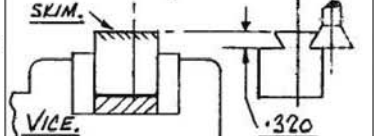
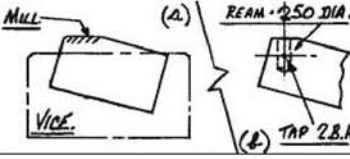
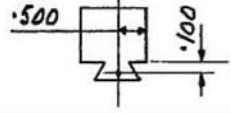
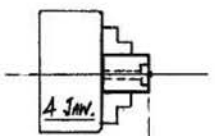
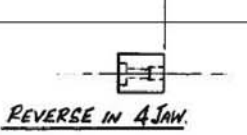
Before proceeding, carefully check the maximum diameter of the Morse taper in your lathe mandrel. Measure at the end face not at the bottom of the chamfer. Use your headstock centre to determine this as it may be a little over nominal size. When satisfied, mount the body between centres and turn the $\frac{1}{8}$ in. dia. to size. Next, turn the shank down to approximately 0.7in. dia. (or to suit your mandrel). Also, turn the 0.550in. dia. on the end to protect the taper from accidental damage.

Set the top slide over to suit a No. 2 Morse taper. The method I use, assuming the lathe centres are in line, is to hold a scrap of bar ($\frac{1}{4}$ in. dia. bright mild steel) in the 3-jaw chuck and face and centre. It is now possible to support a good No. 2 Morse centre between the female centre and the tailstock centre. Using a 0.0005in. dial test indicator, set the top slide until the indicator shows a constant reading throughout its entire traverse length. Take your time and get it right – that way you will have a well fitting taper at your first attempt. When completely satisfied, clamp the top slide firmly and turn the taper. Be very careful as you approach size as 0.001in off the diameter of the shank will allow the it to enter its mating taper approximately 0.02 inch. Slightly relieve the centre portion of the taper as indicated on the drawing.

Mark off, drill and tap the two, 2BA holes for the slide clamp. Also drill the one hole 2.25mm dia. for the gib locating pin. This will be reamed to $\frac{3}{32}$ in. dia. during final assembly. My preference for this sort of operation is to clamp the work to the cross slide at the required height and line up and drill (also start the tap if required) from the lathe 3-jaw chuck. If a small slot drill, say $\frac{1}{8}$ in dia., is touched on the work before drilling then the flat produced provides a true start for the centre drill and then we are off – in style. It takes longer this way but you can rely on the job being right so why 'chance your arm' on the drilling machine when you know the difficulties in obtaining a true start on a curved surface.

Lining up the lead screw bearing

We can now transfer the actual centre line of the lead screw hole in the slide (detail 1) to the lead screw bearing. This method eliminates any 'off centre' errors of the slot and the dovetail in the body as well as any errors in the position of the lead screw hole in the slide. Screw cut a short length (say, $\frac{3}{4}$ in.), $\frac{1}{4}$ in x 40 ME to fit in the slide (detail 1). Without disturbing the piece, turn a sharp, 60deg. cone point on the end and part off. Make a small screwdriver slot at the other end. Assemble the slide and gib strip in the body. Screw in the screwed point you have just made with the point just out of the slide. Rest the assembly on a V block and set the slide horizon-

MAIN STAGES INVOLVED IN MACHINING DET. 1. (TOOL SLIDE.)		
STAGE 1		SQUARE UP BLANK. MACHINE (OR GRIND) ALL FACES SQUARE AND PARALLEL.
STAGE 2		MARK OFF POSITION OF .375 DIA. HOLES - (AND RESPECTIVE GRUBSCREWS.) - ALSO 15DEG FLAT.
STAGE 3		(A) IN 4 JAW CHUCK - BORE "OUTER" - .375 DIA. HOLE (B) TAP $\frac{1}{4}$ " B.S.F. FOR GRUBSCREW
STAGE 4		SKIM TOP FACE - THEN RAISE TABLE .320 MILL DOVETAIL ON .500 SIDE OF CENTRE LINE OF HOLES TAP 2B.A. GRUBSCREW HOLE.
STAGE 5		(A) MILL 15 DEG FLAT. (B) DRILL AND REAM .250 DIA. HOLE. TAP 2 B.A. GRUBSCREW HOLE.
STAGE 6		ACCURATELY MARK OFF POSITION OF LEADSCREW HOLE, AND CENTRE DOT.
STAGE 7		SET CENTRE DOT TRUE - BORE .500 DIA X 240 DEEP. CENTRE, THEN DRILL $\frac{13}{64}$ " DIA. THRU. BORE A START FOR $\frac{7}{52}$ " DIA. 'D' BIT AND PASS THRU. SLOWLY FEED A 5-6MM DRILL (.220 DIA) THRU. ACCURATELY TAP $\frac{1}{4}$ " X 40 T.P.I. X $\frac{3}{4}$ " DEEP.
STAGE 8		REVERSE IN 4 JAW - "CENTRE" LEADSCREW HOLE. OPEN OUT TO 6.6MM. (.260 DIA.) FOR A DEPTH OF $\frac{15}{16}$ " (LEAVING THREAD $\frac{5}{8}$ " LONG.) N.B. CENTRE .375 DIA HOLE BORED ON FINAL ASSY.

tal. Accurately pick up the point on the screw with a scribing block and transfer the true centreline of the lead screw to the lead screw bearing while located in the slot in the body. Separate the parts and accurately centre dot the lead screw bearing hole and the position of the cap screw hole. It is now possible to drill and ream the 0.328in. dia. hole and drill and spot face the cap head screw hole.

The lead screw (detail 10)

The lead screw is made from $\frac{5}{8}$ in. dia. x $2\frac{3}{4}$ in. long EN8. This detail needs your best efforts as an accurate lead screw is essential to provide accurate adjustment to the tool slide. I made a 'dummy run' on a piece of scrap material to prove out the method and this is the approach I used.

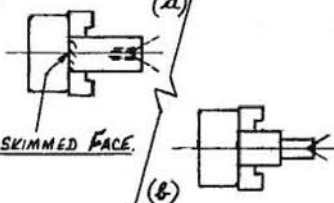
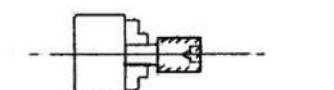
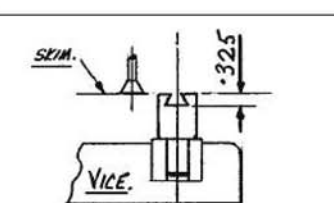
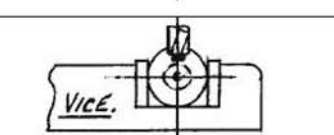
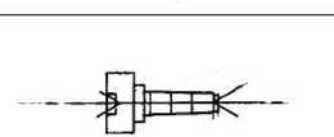
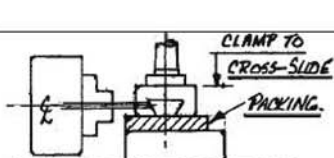
- 1: Chuck in the 3-jaw chuck, face the end and form a small centre.
- 2: Pull out 2in. from the chuck and engage the tailstock centre. Turn the 0.600in. dia. the 0.328in. dia. for a running fit in detail 5 and the 0.250in. dia. undercut and the $\frac{1}{32}$ in. chamfer.
- 3: Accurately screw cut the $\frac{1}{4}$ in x 40 ME thread to within approximately 0.001 to 0.002in. of final size. The thread was finished using a good, preset die in a die holder. Plenty of tapping paste was used to obtain a good finish. I use a mandrel

handle for work of this nature and the accurate control makes the job almost fool proof.

- 4: Part off over length.
- 5: Reverse in the 3-jaw chuck and hold on the 0.328in. dia. using aluminium strips cut from a soft drinks can to protect the finished surface. Face the thickness and then set the top slide over to turn the 30deg. face.
- 6: Centre, drill and tap 2BA (tight) as shown.
- 7: Engrave 25, equally spaced divisions as shown on the detail using a tool on its side and at centre height in the tool post.

A simple, reliable method of doing this (if you have not got dividing gear) is to wind a $\frac{3}{4}$ in wide strip of cartridge paper around your 3-jaw chuck and carefully mark the overlap. Open out the strip on the drawing board and accurately divide the circumference into 25 equal divisions. Rewind the paper on to the chuck and secure with tape. If a heavy, scribing block is now placed by the chuck and its scriber used to provide a zero line, each line on the paper can be brought to the point and the indexing carried out quite accurately. As an old toolmaker, I am a little sceptical of this method but I have used it with complete success on a number of occasions. The hard facts are that we are using a 4in. dia. chuck to scribe a work piece 0.600in dia. so we have a 6.66 to 1 advantage. A setting error of

MAIN STAGES INVOLVED IN MACHINING DET. 6. (BODY.)

STAGE 1		FILE ONE END SQUARE. WITH FILED END IN CHUCK - SET TRUE & SKIM OTHER END
STAGE 2		(A) REV. IN CHECK - SKIMMED END FIRMLY AGAINST CHUCK. TRULY FACE OTHER END TO LENGTH + $\frac{1}{64}$ ". CENTRE - DRILL & TAP FOR DRAWBAR. BORE LARGE CENTRE - FOR TAILSTOCK CENTRE. (B) WITH TAILSTOCK SUPPORT - TURN 1" DIA "SHANK" X LENGTH TO SUIT DEPTH OF MILLING VICE. SKIM A TRUE DIA. AND 90DEG SHOULDER.
STAGE 3		SKIM END FACE TRUE. BORE .750 DIA. X .320 DEEP RECESS. CENTRE DRILL TO .280 DIA. SKIM O/D. TO 1.940 "REFERENCE" DIA.
STAGE 4		GRIP 1" DIA "SHANK" IN VICE - TAP AGAINST SHOULDER. ROUGH OUT SLOT USING $\frac{1}{2}$ " DIA ENDMILL. SKIM TOP FACE WITH DOVETAIL CUTTER. RAISE TABLE .325. MILL ONE SIDE OF DOVETAIL TO .773 DIA SHOWN. MILL OTHER SIDE TO PUSH FIT USING DIM. BETWEEN ROLLERS AS A GUIDE ONLY.
STAGE 5		MILL SLOT. (USE $\frac{1}{2}$ " DIA. ENDMILL). MILL RECESS. (USE $\frac{1}{2}$ " DIA. ENDMILL). CLEAR CENTRE AT DOVETAIL END, OF ANY BURRS ETC.
STAGE 6		CHECK YOUR MORSE TAPER IN LATHE SPINDLE. TURN 1 $\frac{1}{8}$ " DIA. (BETWEEN CENTRES). TURN .700 DIA (APPROX) TO SUIT YOUR LATHE. TURN NO. 2. MORSE TAPER. RELIEVE CENTRE PORTION.
STAGE 7		MARK OFF. DRILL & TAP 2 HOLES 2 B.A. MARK OFF. DRILL & REAM 1 HOLE .093 DIA. N.B. "CENTRE" .375 DIA HOLE BORED ON FINAL ASSY.

0.02in. will result in an error on the work of only 0.003in. In addition, if the divisions on the dial are 0.075in. apart, representing 0.001in. travel on the tool slide, a 0.003in. error in the engraving only amounts to $\frac{1}{25}$ of a division which is $\frac{1}{25}$ of a 'thou' at the tool point. I rest my case, m'lud!

Stamp on a neat $\frac{1}{16}$ in. high '0' as shown and then carefully clean up the engraved face with a dead smooth Swiss file. If you wish, polish with fine abrasive and oil. Fill the graduations with black enamel and, when really hard, re-polish the surface. Finally, screw in detail 13 (2BA grub screw) tightly with a touch of Araldite and leave over night. Polish the face flush. This is a useful 'dodge' as it provides a good socket for neat and unobtrusive adjustment without having to drift the socket into the parent material. I have successfully used this method on several of my projects.

Retaining collar (detail 11)

Detail 11 is made from $\frac{1}{2}$ in. dia. x 1in. long EN8. Using the 3-jaw chuck, face and turn the outer diameter. Centre drill and bore to a good fit on detail 10. Polish the end face. Part off leaving a clean face then polish the parted face also. Centre dot the position of the cross hole. We can now start the assembly procedure.

Assembly

Wedge the gib strip in position using a dovetail shaped section of wood. The small cut out is set just clear of the bottom of the slot in the body. The top face of the gib lies 0.005in. 'under flush' with the body. Set level in a drill vice and transfer the $\frac{3}{32}$ in. dowel hole from the body to the gib strip using a 2.25mm drill. Ream to size and fit the dowel (detail 9) after de-burring the holes. The dowel should be a tap fit in the body and a slide fit in the gib strip.

With the lead screw threaded through the bearing (detail 5) and the retaining collar (detail 11) clamped hard against detail 5, drill the cross hole for the pin (detail 12) which should be a tap fit. Centre dot which end of the collar is next to detail 5. The aim is to produce a lead screw bearing that turns smoothly but without a hint of end-play. A positive method of achieving this is to make a 'clamping tube' out of $\frac{1}{2}$ in. dia. material (aluminium alloy or mild steel) x $\frac{13}{8}$ in. long, ends faced square. Drill through the material with a $\frac{17}{64}$ in. dia. drill and counter bore one end $\frac{11}{32}$ in. diameter x $\frac{1}{16}$ in. deep. Slip over the lead screw collar and bearing assembly and grip endwise in a good drill vice. Take care to get the whole assembly truly horizontal. Good prepara-

tion here, as always, will pay dividends here.

With the lead screw and bearing screwed fully into the assembled slide and body, allow the bearing to take up its own position along the slot. Transfer the position of the 2BA cap screw hole to the body. Drill and tap the body for 2BA x $\frac{7}{16}$ in. deep. Counter sink the hole lightly and make sure the face of the slot is flat. With the 2BA cap head screw fitted and plenty of oil, run the slide to and fro a few times to check for tight spots. Ease where required.

Separate the parts and profile the lead screw bearing to the drawing. Filing buttons can be used to obtain a smooth radius at the one end. Trim the part to the body at the other. File on a flat as shown and engrave a clear index line. Fill this with black enamel and, when completely dry, polish the face.

Drawbar assembly (details 14,15 and 16)

This is a straightforward item. The threads on the drawbar can either be screw cut or cut with a tail-stock die holder. Note that the single nut on the 'entry' end is reduced slightly as shown to clear the bore of the mandrel. The diameter on the drawing suited my ML10 but check that yours is the same.

Boring bars (details 18, 19 and 20)

The boring bar type of tool holder gives a longer reach and you can fit any bar with a 0.375in. dia. shank to suit your own needs. I make mine from silver steel and a useful one can be made from a piece $\frac{1}{2}$ in. dia. x $\frac{33}{16}$ in. long. Face off to length and turn the 0.375in. dia. to a push fit in detail 1. Clamp on the tool post at 45deg. and packed up to centre height. With a $\frac{1}{2}$ in. dia. end mill in the chuck, mill a $\frac{1}{4}$ in. wide flat as shown. Centre, drill and ream the 0.1875in. dia. hole. With a piece of $\frac{3}{16}$ in. dia. silver steel inserted as a guide, file on the $\frac{7}{32}$ in. wide flat and drill and tap for a 4BA grub screw. Finally, file the $\frac{3}{16}$ in. wide flat for the clamping screw. The tool bit I used was a piece of old carbide. This will have a long life but high-speed steel is more than adequate.

Boring the central 0.375in. dia. hole

This was done as a final operation with the boring head and drawbar mounted in the lathe mandrel. Positioning the hole in this way ensures accuracy, which is a boon when dealing with small boring tools. Set the tool slide to the fully retracted 'inboard' position and then advance it, say, 0.010 inch. Lock the tool slide firmly and then drill and bore the central 0.375in. dia. hole to a good push fit on a piece of $\frac{3}{8}$ in. dia. silver steel. This ensures that this hole can be accurately centred at any time. The 0.950in. radius can also be turned at this setting. Remove the tool slide and mark out, drill and tap the $\frac{1}{4}$ in. BSF clamp screw hole.

Strip everything down, add any missing chamfers and give a final polish. This helps keep the old enemy, rust, at bay. Wash the parts down and re-assemble using a light oil such as Myford spindle oil. You should now have a first-class, precision boring head that will serve you well for many years. Why not make a proper wooden box for it to protect it when not in use?

Good luck and work safely.





A small 0-4-0 shunter built for approximately £200. Power is provided by a 12 Volt battery housed in the nose.



A much modified Maxitrex Warship D832 'Onslaught' with full cab detailing and authentic weathering to the paint work.

BOXES ON WHEELS?

Rob Fern
draws attention to a fast growing facet of the hobby.

This is just a little article to both draw attention to and give an insight into the world of non-steam traction. An ever-increasing number of clubs nowadays are hosting 'Diesel days' as this side of the hobby gets more and more popular. We at Kinver and West

Midlands Society of Model Engineers are holding our 7th event of this type on 2/3 July 2005.

We are getting so many visitors to this regular event that we made it into a two day affair with traders, camping facilities and a bit of night running for the die-hards. With around 40 locomotives attending it has become quite an event with all sorts of traction represented from large American locomotives to Blackpool trams and some small German shunters to impressive Austrian electric locomotives plus anything else in between.

The Diesel world is very different from the steam side of things due mainly to cost and ability factors. There are a great number of firms out there who offer everything from a raw casting to a complete, ready to run locomotive with fully machined kits also proving to be very popular. Nowadays, most prototypes have been covered by these companies with the last few missing classes planned for introduction over the next few years.



The choice of prototypes is large. Here we see a splendid Blackpool tram with well-detailed interior complete with lights.



A scratchbuilt U25B made by J. Campbell. Power is via 2 off 200 Watt, 12 Volt motors.



Kit built K6f II locomotive with lights, smoke and sound. It is built from CNC machined aluminium alloy.



A new 'Teddy Bear' D95xx locomotive kit on the club stand at Warley in 2003 with a SD40 in the background.



Hydraulics on shed - memories of Old Oak Common. Left to right, the first three belong to the author, the other two to R. Bushell and J. Campbell.



A nearly finished wooden pattern for the body work of a German V200. The bodies will be moulded in fibreglass.

There are also several suppliers of motors, gears and controllers if you wish to go down the route of building your own machine. For the chronically short of cash there are plenty of old windscreen wiper motors and other components out there to be picked up for next to nothing.

There is of course an alternative to battery power – our friend the internal combustion engine. These seem more awkward, pig-headed and unreliable the smaller they get making them more difficult to get any enjoyment out of than even the most temperamental steam locomotive. I have seen a couple of good ones though, which proves it can be done. The other more popular way is to use moped, strimmer or mower engines with either hydraulic, electric or centrifugal clutch drives.

Straight battery electric has I think proved itself to be the best system for convenience and reliability i.e. low fire risk, no smell, no poor starting. You can also fit a good sound unit to your locomotive to help create the illusion, which is of course no good if you have a small engine screaming away inside!

There are also great differences in material choice, build quality, and detail between



A budget traction unit built up around a 12 Volt cordless electric drill and a German chassis.

locomotives with everything from the cheap lash up built for fun on a shoestring to Brian Waite's fantastic prototype Deltic, which I am sure many of you will have seen at one time or another. This shows what can be achieved and refutes the claim that such models are just boxes on wheels. We tend to find that people who refer to them as such have never tried to make one or, if they have, then you cannot tell what it is supposed to be.

For those who do not wish to use a readily available fibreglass body, the design and construction of their own body work can be a very interesting project in its own right; perhaps enhancing and testing their metal working and fabrication skills or maybe introducing them to the creation of wooden masters and then the skills of fibreglass moulding. There are many different ways of achieving the same end result, which I think is one of the appeals of this side of the hobby.

Whether you build a little freelance shunter from scrap or buy a comprehensive, fully machined kit they are great fun to build and drive. They also enable a good many people to get into large-scale model

railways with little money, experience and skill. Those funnel lovers amongst you can also buy steam outline locomotives powered by electric motors. So the next time you see a boring Diesel locomotive go and have a proper look at it. You may even see it as an interesting alternative to your current project. If you have any questions about the Diesel weekend at Kinver ring **Rob Fern** on tel: 01902-337304 or **John Campbell** on tel: 01384-891244.



A TALE OF THREE TENDERS

P. Lejeune

A saga of two Stirling singles and their tenders - plus a third

Having fairly recently retired and starting to look around for a new project, last year, whilst surfing the internet, (i.e. www.ebay.co.uk) I came across a site named 'Steam'. This site deals almost exclusively with steam Mamod products but occasionally steam locomotives are offered for sale. For many years I have thought about building my favourite locomotive a Stirling Single in 5in. gauge and had actually purchased many years ago from the old Reeves company, a set of drawings, but due to other projects, had not commenced building the Stirling.

I was therefore delighted to see a Stirling locomotive offered for sale on the site. It was the locomotive part only sadly with no tender. The system works as follows:

You place a bid and if you bid just above the previous bid, your bid immediately comes up on the screen with your bidding name. Normally if other people are interested, they will very shortly place a higher bid than yours and their name comes up. Alternatively, you can place a high bid at the top price that you are prepared to pay for the item. If you do this as other people bid, you will see the price go up and up but your name will still show as the highest bidder.

After bidding for some days at the end of the Auction, my bid was the highest and I secured the locomotive. To my amazement within half an hour. I had two e-mails, one from the person who I had beaten congratulating me as the winner and offering me a finished tender and another one

offering me a tender chassis. Unfortunately, the first person backed out as he decided that he would like to build the locomotive himself in the future, but the person who offered the tender chassis sold it to me at a very reasonable price.

After receiving the locomotive and having stripped it down, it turned out to be a very interesting locomotive. The locomotive frames are cast in one piece in brass and the cylinders are also cast in brass. The boiler is also very unusual, being built as a normal fire tube boiler but with the fire box composed of a rectangular ring of 5/16in. dia. copper tube (as shown in photos 1 and 2), the highest point of the coil going into the top of the boiler and, of course, the lowest point in at the bottom. Water feed from the axle pump is fed directly into the bottom coil. A superheater is fitted made from stainless steel tube with welded ends and a mechanical lubricator is also fitted. The



Normal fire tube boiler, but with...



...a firebox comprising water tubes



The complete Stirling single locomotive purchased

locomotive has been run as there was evidence of coal ash in the smokebox.

Having tried the chassis on compressed air when it ran very nicely, also being unsure of the

performance of the boiler, and of course having to make a tender, I decided that I would have two Stirling Singles, so commenced work on two tenders. Then I thought why not make another one?

The spare locomotive could be offered for sale to defray costs of the other two. The complete locomotive as purchased is shown in photo 3.

A start was made on the tender and to save time, the tender frames were ordered from Sciss Ltd. who cut out the steel by using a high pressure water cutting system. As the tender seams are close riveted, a drilling jig was made from $\frac{3}{16}$ in. thick gauge plate by carefully drilling a long row of holes exactly the required distance in from the edge of the tender plate (see photo 4). By lining up the bottom of the jig with the bottom of the tender brass sheets an accurate line of rivets was drilled. Some $\frac{3}{8}$ x $\frac{3}{8}$ in. brass angle was used to strengthen all the joints and all the

holes for $\frac{1}{16}$ in. brass round rivets were drilled right through before riveting.

To form the flared pieces at the top edges some 2in. dia. x $\frac{1}{16}$ in. thick brass tube was ordered and then hacksawed into six lengths. These were again drilled, using the jig and the corners carefully mitred before riveting into place. All the joints and angles were caulked with soft solder to avoid any water leaks (see photo 5).

Work now commenced on the locomotive chassis and again frames and bogie frames were ordered from Sciss. When I came to machine the driving wheels, I found that I could not machine



Drill jig for accurate rivet holes

the rear faces of the wheels on my Myford. Being a volunteer on the Swanage Railway, the manager of our locomotive works kindly let me use one of the large lathes to carry out this task. After returning home, I was able to finish all the turning and boring jobs on the wheels. Two boilers were ordered from Western Steam and have just been delivered - a lovely job! (photos 6 and 7).

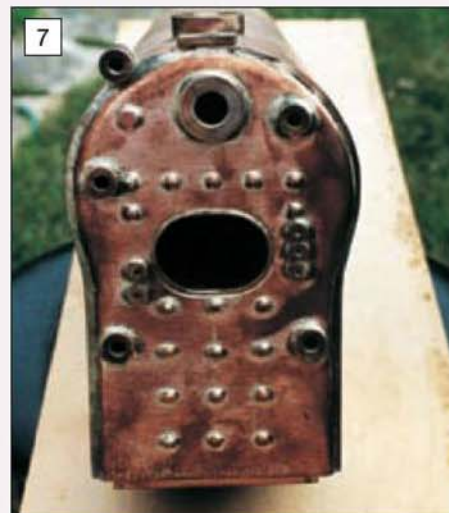
In conclusion, I would be interested to hear from any reader if they could shed any light on the origin of the original locomotive as purchased. Also, is anyone interested in a Stirling Single when they are finished? 



Flared top edges were made from brass tube



Newly made boiler - 'lovely job'



Neat backhead of new boiler

**CLUB
CHAT**
With Malcolm Stride

The Gauge

The National 2½" Gauge Association held a very successful 'Spring Get Together' at the Leatherhead track of the Surrey SME in April. Locomotives included many by famous designers including Chris Barron, Henry Greenly, Curly Lawrence (LBSC)

Tony Meek from **Peterborough SME** reports that 120,000 laps have been completed round the Thorpe Hall track since it was officially opened. The accompanying photo shows Paul Lingard completing the 120,000th lap with his 'Simplex'. This represents just over 26,000 miles in 21 years of operation. I make that an average of 0.1413mph! The society have also introduced a scheme to encourage youngsters to ride on the railway. Each ticket now has one of 24 famous locomotive names on the back and any one who collects all 24 will be given a booklet to stick them in. When the full booklet is

Saffron Walden DSME describe the moving of their new container into its final resting place. This involved raising "the brute" and putting a caterpillar skate under each corner. The container was then

Another society reporting a very successful year last year is the **Stokeholes Farm Miniature Railway** who started the year with a new shed layout which gave more scope and flexibility in their

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.

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.

11/12

- MODEL ENGINEER 24 JUNE 2005

encouraging youngsters to get involved means that Tuesday evenings are now devoted to youngsters who are busy building locomotives and riding trucks.

Keith Roper has written an article about computers and the internet in the newsletter of the **Sutton MEC** in which he describes the phenomenal increase in performance of personal computers since their introduction in the mid-1980s. He also points out that computers don't make mistakes, the mistakes are made by the humans who program them. So next time some commercial organisation blames "the computer" for their mistake, you know what to say! Keith also points out the vast number of benefits the we model engineers can gain from computers and the internet. As a personal example, this afternoon I have transferred some money from my bank account, ordered some computer printer cartridges, updated my accounts, done some work on the drawings for an I/C engine, looked at specifications for a new milling machine, responded to some e-mails and finally written part of this column, all without leaving my desk! The excellent quality of the many club newsletters I receive would also not be possible without the use of home computers (or spending large amounts of money on professional production)



Paul Lingard completing the 125,000th lap of Peterborough track.

The society has updated the entrance to the club house to improve disabled access by replacing the steps with a sloping concrete path. This involved removing a lot of soil and rubble and laying seven tons of concrete. The added benefit has been an increase in space in the car park. The gang are now about to start constructing a "comfort loop" so that drivers can get off the main line near the toilet facilities without having to use the station loop for parking their locomotives. Sutton is another site suffering vandalism with youths breaking in and "playing with a 7 1/4 in. trolley before exiting back through the hole they made in the chain link fence". The club have also spent a large amount of money on felling and pruning trees on the site.

Surrey SME had Tony Drake from the Bluebell Line as their guest speaker in March and were treated to a very informative

presentation on the latest activities of the line.

Some members of **Taunton Model Engineers** suffered the indignity of being awarded parking tickets whilst working on the track. As they say, it seems odd that the council rent the club a building and then do their best to stop people using it! The new track at Creech is progressing well with some 700ft. laid so far and a lot of other work at the site is also producing results. The society have started a 2-4-0 club to increase club funds without raising subscriptions. Members put in £4 each month and half goes into club funds with the other half going into a 'kitty' which will be awarded to a lucky member in a draw at the end of the year.

Tyneside SMEE is another club carrying out lots of work at their site with good progress being made on the steaming bays. One photograph shows a member wielding that essential model engineering tool – the Kango hammer!

West Riding Small Locomotive Society has constructed a new bridge, replaced the kitchen and produced new riding cars for the 7 1/4 in. gauge track. Future projects include a new viewing area for the club house and a new length of track being laid to facilitate disposal of engines after running.

World News

Australia

More proverbs from the **Steam Locomotive Society of Victoria**; "Hard work pays off in the future - Laziness pays off now" and "What happens if you get scared half to death twice?" Answers to the latter on a postcard please...

Canada

Members of the **British Columbia SME** have been busy replacing the decking on the 'Rogers' Bridge' during the close season and after delays due to the inclement weather managed to get it operational in time for the Easter opening.

At the April meeting of **Toronto SME** Jim Small talked about pattern making and showed a small pattern mounted on a match plate. Jim explained how the split patterns are made and then set in the boxes for sand castings. He also explained the requirements for core boxes for the internal shape formation. Jim then went on to show a DVD put together and

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|-------|---|-------|--|
| 19 | Cardiff MES. Steam-Up and Family Day.
Contact Trevor Jenkins: 029-2075-5568. | 25 | Chesterfield MES. Competition Day. Contact Mike Rhodes: 01623-648676. |
| 19 | Chichester DSME. Barbecue & CHILIC 2. Contact Brian Bird: 01243-536468. | 25/26 | Claymills Pumping Engines. Non Steaming Open Days.
Contact B. Eastough: 01283-812501. |
| 19 | Frimley & Ascot LC. Frimley Lodge Park Show.
Contact Bob Dowman: 01252-835042. | 25 | Leyland SME. Summer Solstice Steam-Up. Contact A. P. Bibby: 01254-812049. |
| 19 | Guildford MES. Public Running. Contact Dave Longhurst: 01428-605424. | 25/26 | Model Steam Road Vehicle Soc. MSRVs 2005 Rally.
Contact Geoff Miles: 01869-247602. |
| 19 | Leighton Buzzard NG Rly. Fathers' Day. Enquiries: 01525-373888. | 25 | National 2 1/2 in. Gauge Ass'n. Locomotive Rally at the home of John Jewell. Contact Clive Young: 01233-626455. |
| 19 | North Cornwall MES. Steam-Up. Contact Ray Reed: 01237-424254. | 25/26 | New Jersey Live Steamers, Inc. Members' Weekend.
Contact Karl Pickles: 718-494-7263. |
| 19 | N. W. Leicester SME. Public Running. Contact John Elliott: 01455-847040. | 25 | North Norfolk MEC. Club Barbecue Evening. Contact G. Ford: 01263-512350. |
| 19 | Oxford (City of) SME. Public Running. Contact Chris Kelland: 01235-770836. | 25 | Nottingham SMEE. Efficiency Competition & Barbecue.
Contact Graham Davenport: 0115-8496703. |
| 19 | Plymouth MSLs. Public Running. Contact John Brooker: 01752-671722. | 25/26 | Ribble Valley Live Steamers. Open Weekend.
Contact Mrs. K. Avon: 01254-385170. |
| 19 | Saffron Walden DSME. One Day Rally (open to all clubs) with Barbecue (public running after 2pm). Contact Jack Setterfield: 01843-596822. | 25/26 | Guild of Model Wheelwrights. Sandingham Show.
Contact Biddy Hepper: 01492-623274. |
| 19 | Taunton ME. Public Running. Contact Don Martin: 01460-63162. | 25 | West Riding SLS. Beaver Scouts Rally. Contact David Batty: 01924-363908. |
| 19 | Wimborne DSME. Public Running. Contact Eric Basire: 01202-897158. | 26 | Amnerfield Miniature Railway. Public Running.
Contact David Jerome: 0118-9700274. |
| 20 | Model Steam Road Vehicle Soc. Adam Meredith/Frank Pickett: Lining Out.
Contact Geoff Miles: 01869-247602. | 26 | Bristol SMEE. Public Running. Contact Trevor Chambers: 0145-441-5085. |
| 20 | National 2 1/2 in. Gauge Ass'n. Locomotive Rally at Stockport SME.
Contact Clive Young: 01233-626455. | 26 | Cardiff MES. Open Day. Contact Trevor Jenkins: 029-2075-5568. |
| 20 | Peterborough SME. Barbecue & Drive a Loco Evening.
Contact Tony Meek: 01778-345142. | 26 | Chichester DSME. Steam on Sunday. Contact Brian Bird: 01243-536468. |
| 21 | Chesterfield MES. R. Booth: Round Britain on a Motorcycle.
Contact Mike Rhodes: 01623-648676. | 26 | Guildford MES. Members' Running Day.
Contact Dave Longhurst: 01428-605424. |
| 21 | North Cornwall MES. Club Meeting & Track Evening.
Contact Ray Reed: 01237-424254. | 26 | Harlington LS. Public Running. Contact Peter Tarrant: 01895-851168. |
| 21 | Romney Marsh MES. Midsummer Track Meeting & Barbecue.
Contact John Wimble: 01797-362295. | 26 | Leighton Buzzard NG Rly. Vintage Vehicle Rally. Enquiries: 01525-373888. |
| 21 | South Durham SME. Afternoon Steam-Up. Contact B. Owens: 01325-721503. | 26 | MELSA. Sunday in the Park. Contact Graham Chadbone: 07-4121-4341. |
| 22 | Hull DSME. Midsummer Running Evening & Barbecue.
Contact Tony Finn: 01482-898434. | 26 | Oxford (City of) SME. Public Running. Contact Chris Kelland: 01235-770836. |
| 22 | Leeds SMEE. Midsummer Steam-Up & Barbecue.
Contact Colin Abrey: 01132-649630. | 26 | Steam LS of Victoria. Working Bee & Barbecue lunch.
Contact Graham Plaskett: (03) 9750-5022. |
| 22 | Pinewood MRS. Council Open Meeting. Contact Ivan Hurst: 01252-510340. | 26 | York City & DSME. Running Day. Contact Pat Martindale: 01262-676291. |
| 23 | Brighton & Hove SMLE. Workshop Evening.
Contact Mick Funnell: 01323-892042. | 27 | Bedford MES. Treasure Hunt. Contact Ted Jolliffe: 01234-327791. |
| 23 | Leyland SME. Project Night. Contact A. P. Bibby: 01254-812049. | 28 | Romney Marsh MES. Track Meeting. Contact John Wimble: 01797-362295. |
| 23 | Sutton MEC. Busy Night. Contact Bob Wood: 0208-641-6258. | 30 | Sutton MEC. Evening Steam-Up. Contact Bob Wood: 0208-641-6258. |
| 23 | Worthing DSME. Ian Gledhill with two Viennese Opretas.
Contact Bob Phillips: 01903-243018. | 30 | Wimborne DSME. Have-A-Go Night. Contact Eric Basire: 01202-897158. |
| 25 | Brighton & Hove SMLE. Trackday. Contact Mick Funnell: 01323-892042. | JULY | |
| 25/26 | Cambridge MES. Two Day Rally. Contact Rex Mountfield: 01284-386128. | 1 | Aylesbury (Vale of) MES. Track Night. Contact Andy Rapley: 01296-420750. |
| | | 1 | Brighton & Hove SMLE. Workshop Evening.
Contact Mick Funnell: 01323-892042. |

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.

Jim Stratford
Conrad Todd

St. Albans DMES
West Riding Small Locomotive Society

filmed by Dave Sage on the making of a pattern for a component of his Marine engine.

Roy Elliott then showed his freelance 3-cylinder I/C engine (100cc, 1 1/2 in. bore x 1 1/2 stroke) he has made for a 7 1/4 in. Switcher locomotive. Finished in 2002/3, the locomotive pulls about 750lbs. Roy has spent the winter making some modifications to increase the engine's power by opening the ports, and altering the carburettor. The engine drives the wheels through a belt drive, fluid coupling and an outboard motor gearbox. Engine speed at idle is about 1,300rpm and at full power, 2,000rpm.

Ernie Hill showed his Case traction engine's flywheel complete with clutch and clutch arm. David Bowes showed a vertical cylinder oscillating engine that he has just completed and demonstrated it running on air at about 10psi and at 100rpm approximately.

Bill Huxhold has just started the construction of a poppet valve engine similar to a Lentz Engine he knew of and an example of which he was able to track down still in existence in Austria. Bill will not be using any castings, machining all from solid or making up fabrications. The engine has a fairly complex valve mechanism and the original engines were of high efficiency comparable to Corliss valved engines.

Don Carr explained the use of flanges in locomotive piping and how to design them to use O-ring seals for steam and/or water tightness. For steam assemblies using O-rings it is best to use Viton O-rings the are able to take temperatures up to about 400deg. Fahrenheit.

Alaine Labbe showed the dividing head he is making which will use a 40:1 gear drive. For the division plates, Alaine has devised an ingenious manufacturing method using a wood block former the same diameter as the plates, and then using Power Point software to set out the spacing for the hole drilling.

New Zealand

The recent meeting at **Auckland SME** included items large and small. The small items included a versatile DTI holder in the form of a 'Y' shape with a clamp across the arms of the 'Y' and various holes in the bottom arm to hold a DTI in a variety of positions. The large item was the boiler shell and firebox components for a 7 1/4 in. gauge locomotive being built by Bruce Piggot and based on the *Phantom* design. Graeme Murray brought in his rebuilt "*speed increase milling head*" deemed as "*uneconomic to repair*" at his work.

Maidstone (NZ) MES have had some drainage improvements to their site carried out by the city council which will hopefully alleviate the recent flooding problems. It's nice to see councils supporting clubs in this way and can we extend our appreciation to all councils who help clubs where ever they are. The society had a presentation of knot tying in March during which "*a comprehensive lesson on the knotting of ropes*" was provided.

Hutt Valley MES also had an interesting meeting in March which included John Antliif describing his experiences with an optical centre finder, Brian Wheeler with parts for his Stuart No. 4 engine and a detailed presentation by Ross Johnson on airbrushing techniques.

South Africa

The National Steam Meet hosted by the **Centurion SME** was deemed a great success although as Chairman Rudy du Preez reports "*during some periods it did get a bit crowded*" due to the large number of visitors. The society recorded a total of 122 participants with 57 working locomotives. The station canopy and paving was completed in time for the event and the working parties have finished the

first phase of upgrading the points.

Members of **Durban SME** have finally managed to get rid of four loads of old tree limbs and bush resulting in the main dump now being clear. Other tasks completed included repair of the main flex traverser and continuation of the main steaming bay services plumbing. Derek Northgreaves has finally got the injectors working on his locomotive after "*boiling the injectors in the same nuclear waste (his words) that he cleaned the boiler with*". Derek did admit to "*being silly enough to leave the pot of chemicals on the cooker and was discovered by the other half during my casting spells session*." One of the trials and tribulations of model engineering!

United States

New Jersey Live Steamers have been busy with various projects including work on the transfer table track and replacement of the track and switch near the flag. Member Mike Muldowney is busy making a 30ft. high working model of a medieval trebuchet. The latest version at the time of writing has a new longer throwing arm. The newsletter reports that "*the structure is large enough to alter wind patterns so that the snow swirls round it and creates drifts*". Perhaps all clubs should build one as a vandal deterrent?

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|-----|---|-------|--|
| 1 | Canvey R&MEC. Meeting. Contact Brian Baker: 01702-512752. | 9/10 | Contact David Jerome: 0118-9700274. |
| 1 | Maidstone MES (UK). Evening Run. Contact Martin Parham: 01622-630298. | 9/10 | British Columbia SME. Annual Meet. Contact Sean Laurence: (604) 931-1547. |
| 1 | North London SME. Forum: Heat Treatment. | | East Herts MR. Celebration of Garden Railways. |
| | Contact David Harris: 01707-326518. | | Contact: I. Dinnes: 0208-292-2997. |
| 1 | Portsmouth MES. Fish & Chip Evening. Contact John Warren: 023-9259-5354. | 9 | Cardiff MES. Lord Mayor's Charity Day. Contact Trevor Jenkins: 029-2075-5568. |
| 1 | Rochdale SME. Meeting. Contact Mike Foster: 01706-360849. | 9 | Erewash Valley MES. Barbecue & Raffle. |
| 1 | Romford MEC. Competition Night. Contact Colin Hunt: 01708-709302. | | Contact Jim Matthews: 01332-705259. |
| 2 | Cardiff MES. Steam-Up & Family Day. Contact Trevor Jenkins: 029-2075-5568. | 9 | High Wycombe MEC. SARSPA. Steam-Up for South African |
| 2/3 | Dockland & E. London MES. Public Running. | | Railways/African livesteam locos. Contact Eric Stevens: 01494-438761. |
| | Contact P. M. Jonas: 01708-228510. | 9/10 | Hull DSME. Annual Steam Weekend. Contact Tony Finn: 01482-898434. |
| 2 | Frimley & Ascot LC. Fish 'n Chips 6.30pm and running til dusk. | 10 | Bristol SMEE. Public Running. Contact Trevor Chambers: 0145-441-5085. |
| | Contact Bob Dowman: 01252-835042. | 10 | Canterbury DMES (UK). Public Running Day. |
| 2/3 | Guild of Model Wheelwrights. Blists Hill Open Air Museum. | 10 | Contact Mrs P. Barker: 01227-273357. |
| | Contact Biddy Hepper: 01492-623274. | 10 | Cardiff MES. Chernobyl Children's Visit. |
| 2 | Ickenham DSME. Public Running. Contact David Sexton: 01895-630125. | | Contact Trevor Jenkins: 029-2075-5568. |
| 2/3 | Northampton SME. IMLEC 2005. Contact Pete Jarman: 01234-708501 (eve). | 10 | Harlington LS. Public Running. Contact Peter Tarrant: 01895-851168. |
| 2/3 | Stocktholpe Farm MR. Rally Weekend - Royal Scots. | 10 | Leeds SMEE. Running Day. Contact Colin Abrey: 01132-649630. |
| | Contact Ivan Smith: 01427-872723. | 10 | Sutton MEC. Track Day. Contact Bob Wood: 0208-641-6258. |
| 2 | West Wiltshire SME. GBR Bulkington fundraising for Village & WWSME. | 10 | York City & DSME. Running Day & Barbecue. |
| | Contact R. Nev. Boulton: 01380-828101. | | Contact Pat Martindale: 01262-676291. |
| 3 | Frimley & Ascot LC. Public Running. Contact Bob Dowman: 01252-835042. | 11 | Bedford MES. Bangers & Mash Night. Contact Ted Jolliffe: 01234-327791. |
| 3 | Guildford MES. Disability Challengers. Contact Dave Longhurst: 01428-605424. | 11 | Frimley & Ascot LC. Meeting. Contact Bob Dowman: 01252-835042. |
| 3 | Leighton Buzzard NG Rly. Model Railway Mania. Enquiries: 01525-373888. | 11/12 | Harrow & Wembley SME. Open Weekend. |
| 3 | Malden DSME. Public Running. Contact John Mottram: 01483-473786. | | Contact Dr. Roger Greenwood: 020-8427-2755. |
| 3 | Oxford (City of) SME. Public Running. Contact Chris Kelland: 01235-770836. | 11 | Saffron Walden DSME. Club Night. Contact Jack Setterfield: 01843-596822. |
| 3 | Pinewood MRS. Visiting Clubs Day. Contact Ivan Hurst: 01252-510340. | 12 | Dockland & E. London MES. Meeting. Contact P. M. Jonas: 01708-228510. |
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| 3 | Reading SME. Public Running. Contact Brian Joslyn: 01491-873393. | 12 | Romney Marsh MES. Track Meeting. Contact John Wimble: 01797-362295. |
| 3 | Taunton ME. Public Running. Contact Don Martin: 01460-63162. | 13 | Brighton & Hove SMLE. Wrinklies Running Day. |
| 3 | Wimborne DSME. Public Running. Contact Eric Basire: 01202-897158. | | Contact Mick Funnell: 01323-892042. |
| 5 | Romney Marsh MES. Track Meeting. Contact John Wimble: 01797-362295. | 13 | High Wycombe MEC. Evening at Track. Contact Eric Stevens: 01494-438761. |
| 6 | Bradford MES. Steam-Up & Rubber-powered loco competition. | 13 | Norwich DSME. AGM. Contact Paul Reed: 01603-462925. |
| | Contact John Mills: 01943-467844. | 13 | St. Albans DMES. Cdr. LeQuelne: HMS Belfast. |
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| | Contact Ian Spencer: 0191-2843438. | | Contact John Elliott: 01455-847040. |
| 6 | West Wiltshire SME. Steam-Up. Contact R. Nev. Boulton: 01380-828101. | 14 | Sutton MEC. New Drivers Run. Contact Bob Wood: 0208-641-6258. |
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| | Contact Mick Funnell: 01323-892042. | | Contact Bob Phillips: 01903-243018. |
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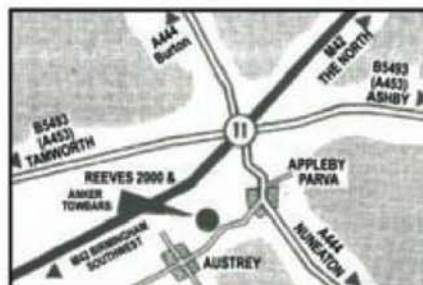


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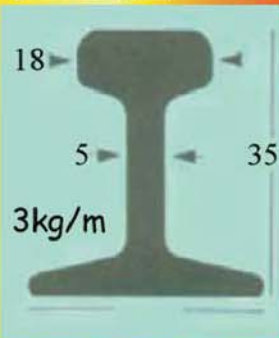
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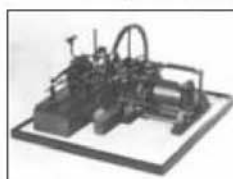


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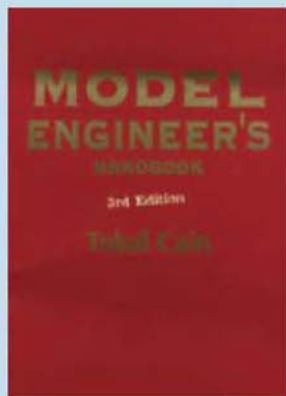
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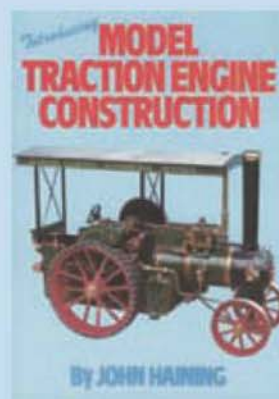
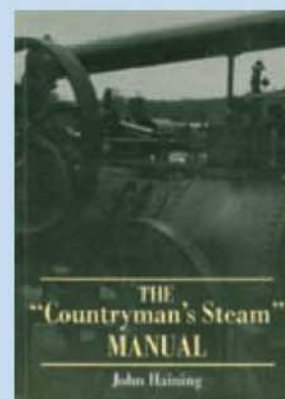
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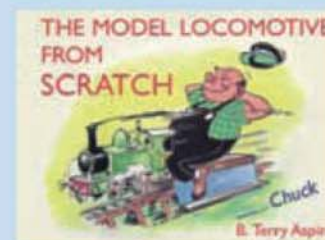
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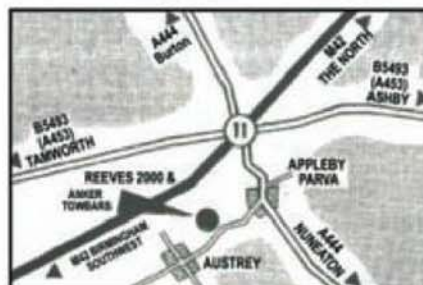


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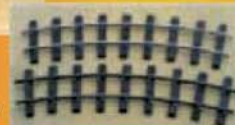
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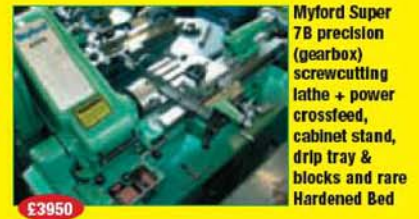
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Myford Super 7B precision (gearbox) screwcutting lathe + power crossfeed, cabinet stand, drip tray & blocks and rare Hardened Bed



Elliot powered surface grinder "as good as it looks"



A selection of tinman's stakes from £20 each



Flott high speed sensitive drilling machine



Colchester Bantam 2000 (very late model) complete with 3 & 4 jaw chucks



Centec vertical head, quill type fits 2A, 2B and 2C if you have the adapter



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



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



Colchester Student 1800 lathe complete with 3 & 4 jaw chucks



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



RJH 4" finisher complete on dust extractor cabinet



Wellsaw 4" hacksaw (240 volts)



Harrison M250 / late bantam only capstan attachment as new



Rishton buffer (The best buffer in its class)



Rishton quality bench grinder



Asquith 14-54 001 Mk.2 5MT radial drilling machine



A selection of lathe steadyies we currently have from £30



Equi-Spacer pitch circle drilling jig



Henry Milns 6 1/2" x 48" geared head, gearbox and gap bed + tooling just in off the lorry



Tom Senior 'E' Type vertical milling machine



Boxford 1130, 5 1/2" x 30"



Jones and Shipman 310 tool and cutter



A selection of surface plates and tables 12" square to 36" x 24"



Triumph 7 1/2" x 48" + gap bed, 2" bore, 3 & 4 jaw chucks + equipment



A selection of surface plates and tables 12" square to 36" x 24"



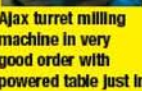
Harrison M250 lathe complete with 3 and 4 jaw chucks, extra gears, with the high 2000rpm top speed almost as new



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



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



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



RJH Swordfish universal saw complete with dust extractor



Flamefast DS130 ceramic chip force, 240 volts, natural gas



Lorch precision lathe complete with collets



Mikron 79 gear cutter



Barber and Coleman (USA) gear cutter



Crompton Parkinson Motors NEW 3/4HP Ideal for Myford & Boxfords etc.



RJH Swordfish universal saw complete with dust extractor



Stanier 50mm jaw size precision swivel vice



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Safag gear cutter



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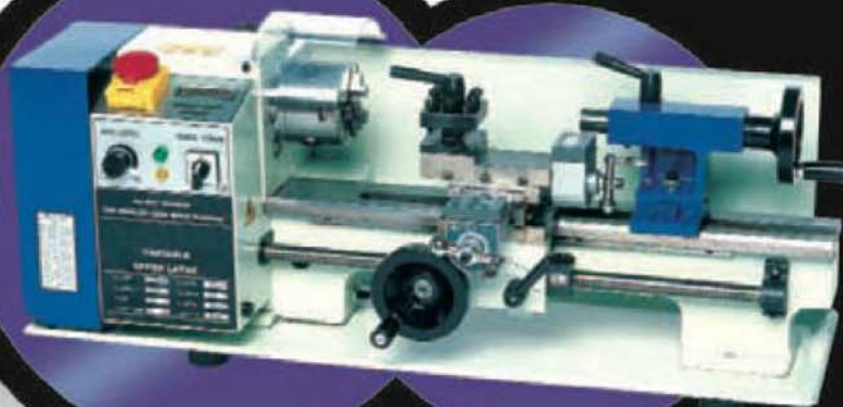


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SPECIFICATIONS

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SPECIFICATIONS

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