

# MODEL ENGINEER

Vol. 192 No. 4222

28 May - 10 June 2004

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Association  
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Details inside  
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| Max distance spindle to table     | 320mm                            |
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Mike Chrisp (01442-269366)

### Technical Editor

Neil Read (01604-833670)

### Assistant Editor

Kelvin Barber (01525-850938)

### Club News Editor

Malcolm Stride

### Technical Consultants

John Haining, Stan Bray,

J. Malcolm Wild FBHI,

D. A. G. Brown

### Editorial Administrator

Sarah Mead (01689-886677)

## PRODUCTION

### Design

Elizabeth Marfell

### Production Manager

Colin Blake

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## SALES & MARKETING

### Group Sales Manager

Colin Taylor (01689-886649)

### Sales Manager

Tony Robertson (01689-886650)

### Marketing Executive

Daniel Webb (01689-887209)

## CIRCULATION

### Circulation Director

Andy Bone (01689-887244)

### Non-newstrade Distribution

Mike Reynolds-Jones

(0121-788-3112)

## MANAGEMENT

### Publisher

Jez Walters

### Divisional Publisher

Dawn Frostdick-Hopley

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## On the cover ...

Of the many steam road vehicles  
 produced by the famous company  
 of Aveling & Porter, the vast majority  
 were road rollers of one sort or another.  
 Our cover shows a fairly early 10 ton  
 roller built in 1900 for Hove County  
 Council and worked by them until 1946.

It remained in commercial use by  
 A. Pannett & Co. of Brighton before being  
 sold for preservation during the 1970s.  
 Currently owned by Paul and Ian Vickery  
 of Markyate in Hertfordshire, it has been  
 the subject of recent full restoration.

Turn to page 628 of this issue for further  
 insights into the products of Aveling and  
 Porter where you will find part II in the  
 Road Steam series about this celebrated  
 engineering firm who pioneered many  
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(Photograph by Mike Chrisp)

### NEW SERIES: NORTH AMERICAN STEAM LOCOMOTIVE BUILDER'S PLATES

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Make your electric locomotive fit the  
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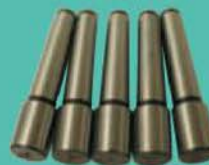
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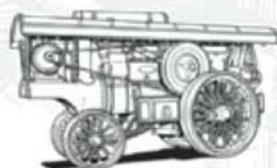
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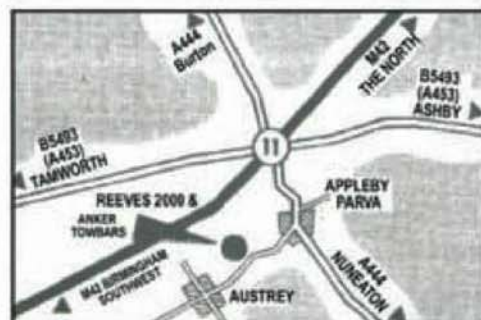


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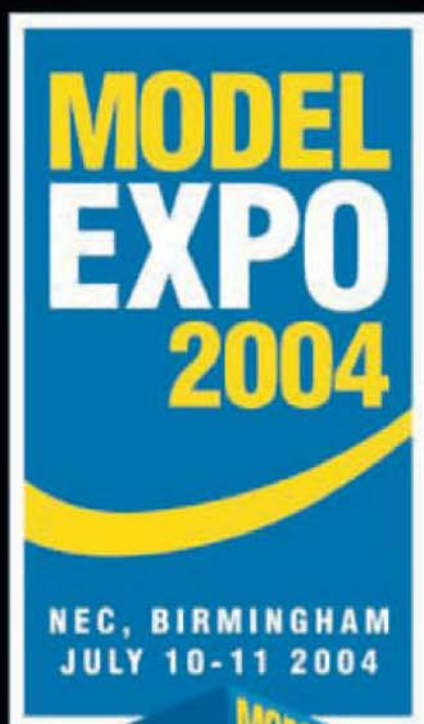
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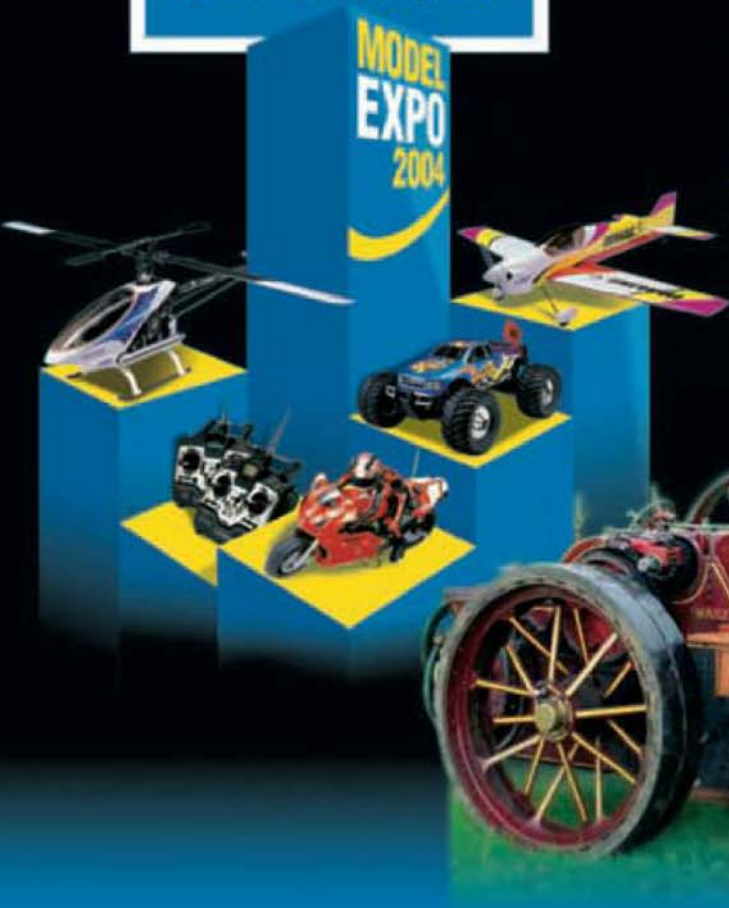
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# SMOKE RINGS

With the Editors

## Resources

Each issue of *Model Engineer* is prepared with a content which we hope will interest most readers. The range and diversity of topics embraced by our rewarding hobby means that we never expect to please all of you all of the time, but we hope that you all find something to enjoy in each magazine. This preamble is prompted by the feature contributed to this particular issue by David Lloyd-Jones. Much involved with the Isle of Man Railways, David's article *The Art of Research* contains a wealth of very useful and helpful advice to those whose aim is to prepare a model which is faithful to the prototype it represents.

During the long and illustrious life of this magazine, much has been published describing just how the creators of particularly fine models went about obtaining the information necessary for building their accurate representations in miniature. There is insufficient space on this page to list all these marvellous model engineers, but I'm sure that many reading these words can immediately think of numerous examples. At least one can be found in the pages of this issue.

Fortunately, since we all differ from one another so much, our aims and objectives are also very different. For every builder who may spend considerable time and energy creating a masterpiece which is perfect in every detail, there will be others who may prefer to produce a miniature which represents the prototype while being sufficiently rugged to take the knocks likely to be experienced by a working model used on a regular basis.

Years ago, when I was still involved with teaching engineering, the educational pundits of the time came to the conclusion that jobs in engineering would not be 'for life' as had previously been the case. City & Guilds of London Institute, for example, introduced what it called Craft Studies courses to replace the older and very successful Craft Practice courses. A key feature of these then new Craft Studies courses was a requirement to develop in the students an ability to find information for themselves. As a result, the emphasis of the courses changed — whether for better or for worse is not a topic appropriate for these notes. The aim was to encourage a flexibility of approach so that when one type of work disappeared, those faced with redundancy would be able to turn to another without too much difficulty. Events have certainly demonstrated the relevance of concerns expressed at the time.

The point at issue is that a wealth of information is available, if only we know where to look and how to use what we find. Experience usually teaches that research of this nature cannot be completed instantaneously, but then model engineering itself is a hobby which requires a great deal of patience and perseverance. Perhaps this means that model engineers make the best researchers! Whatever else, it can be very satisfying to know that what we have produced truly represents what we set out to model.

In his article, David Lloyd-Jones draws our attention to the power of the internet. The first letter in this issue's *Post Bag* is from Chris Orchard who has picked up a previous enquiry from Ray Henshaw concerning Martin Cleeve's design for a swivelling lathe top-slide.

With access to the Northampton SME library, Chris has made a notable contribution to Bill Phillips' *Model Engineer* index which can be found on the internet. It is Chris who has painstakingly taken the index back to the very first issue in the very first volume of *The Model Engineer and Amateur Electrician* published 1 January 1898. Readers wishing to access this comprehensive index are invited to visit [www.groundlevel.demon.co.uk/me\\_index.html](http://www.groundlevel.demon.co.uk/me_index.html) where they will find not only the complete *Model Engineer* index from Volume 1 to date but also links to similarly comprehensive indexes for our companion UK publications *Model Engineers' Workshop* and *Engineering in Miniature*.

We owe a considerable debt of gratitude to the contributors to *M.E.*, *M.E.W.*, and *E.I.M.* for making available so much information of the variety described by David Lloyd-Jones, and it is thanks to the likes of Bill Phillips, Chris Orchard, Colin Usher and David Hoskin that we have such ready access to it.

## Whissendine 2004 Miniature Steam Rally

It's that time of year again! Melton Mowbray DMES will be holding its 19th Miniature Steam Rally at Whissendine, near Melton Mowbray, Leicestershire, during the weekend 5/6 June. Run by model engineers for model engineers, a splendid event is promised, and this year attendance by the public is welcomed on both days.

Saturday is for owners and enthusiasts who enjoy running their engines, and includes two road runs through the village, the first at lunchtime and the second later in the afternoon. More than 60 engines are expected to participate in this event, ranging in size from 1 1/2 in. (1:8) to 6 in. (1:2) to the foot scales, as well as a full size steam roller, steam traction engine and steam wagon. Demonstrations and rides will be available. The day concludes with a hog roast, bar and social activities in the clubhouse.

Sunday is for owners to put their engines

through their paces, with some giving rides and others demonstrating their capabilities. An exhibition of model engineering will be presented in the clubhouse, and there will be displays around the rally field. The bar will be open at lunchtime and food will be available.

The society's miniature railway tracks, catering for 2 1/2, 3 1/2, 5 and 7 1/4 in. gauges, will be busy throughout the weekend.

Light refreshments will be available. There is no charge for admission and all are welcome. The event will be clearly signposted from the A606 Melton Mowbray to Oakham road.

## Reeves 2000

Bill Barton, Managing Director of Reeves 2000 has written expressing concern about references to A. J. Reeves & Co. in David Piddington's letter published in *M.E.* 4217, 19 March 2004.

While the observations in the letter related to the old company, Mr. Barton notes "we are now the subject of numerous rumours, namely that we are about to close again."

He continues "We are delighted to report that, now in its fourth year as Reeves 2000, the company has fully recovered. The full range of drawings, castings and accessories, etc. are now once more available, largely from stock."

Bill observes that a very considerable investment has been made to bring the company back to full health "and now it is more than paying its way." He notes "New developments include the establishment of a full scale boiler shop, the introduction of new products, including a range of very high quality fittings and boiler pumps, known as the International Range, and a number of new items are in preparation."

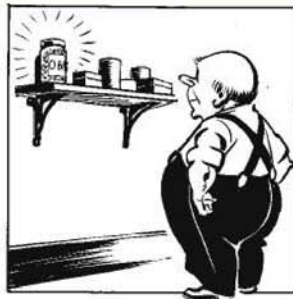
"Reeves 2000 has in fact exceeded all expectations and, after just 18 months in its new permanent home, an extension is about to be built."

"Reeves 2000 is proud to be a British company which is once more a world leader in its field."

We regret any misconstruction concerning the wellbeing of Reeves 2000 arising from the letter concerned and look forward to reporting further development of this company.

## CHUCK the MUDDLE ENGINEER

by B. TERRY ASPIN





# POST BAG

## ML7 topline rotation

SIRS, - I write with reference to Ray Henshaw's enquiry published in *M.E.* 4219, 16 April 2004 under the heading *Assistance sought* and concerning ML7 topline rotation.

I have located several references and record below the volume/issue/page number of the relevant issues.

*M.E.* 121/3038/228: *Topslide Set-Up*, a letter from G. Beecraft — a neat sketch and neat solution.

*M.E.* 127/3185/126: *Topslide*, a letter from F. E. Spinks — as above but involves drilling and tapping the cross-slide.

*M.E.* 128/3216/285: *Swivelling Angle*, a letter from H. G. Archard — reminder to readers of G. Beecraft's solution.

*M.E.* 139/3469/700: *A First Affaire with a Lathe* (series by Derek Beck), picture and details on page 703 — a Rolls Royce version of G. Beecraft's solution.

*M.E.* 142/3535/405: *ML7 Topslides*, a letter from B. Shaw — describing his solution.

*M.E.* 145/3614/908: *A Topslide Modification*, an article by S. H. Abigail — probably the ultimate, similar to the Super 7.

I don't think Martin Cleeve ever detailed his rotating topline modification, but hope the these references will be of help to Ray.

However, in *M.E.* 148/3675/228, 3679/496 and 3681/618, Martin did describe a topline for the EW 2 $\frac{1}{2}$ in. lathe, which Ray may wish to adapt to the Myford.

Chris Orchard, Northamptonshire.

## Lacquers and lacquering

SIRS, - In response to Mr. Roger Castle-Smith's call for advice (*M.E.* 4219, 16 April 2004), it is not obligatory to lacquer clocks. If assembled with cotton gloves, and if they are housed under a shade, skeleton clocks will retain their polish for a considerable time.

In the shop where I used to work, it was the practice to lacquer normal standard plate movements. Only the static parts of the movement and those parts likely to be handled were treated. Thus the plates and pillars, the cocks and bridges, the weight cases, if made of brass, and the pendulum bob, would all be lacquered. The wheelwork was not treated. The lacquer used was Gedge's Duralac obtainable from most suppliers including Meadows and Passmore, R. E. Rose and Horological Solvents.

The lacquer was applied by

suspending the bottle onto a cotton wool ball which was then

squeezed out and applied quickly to the component. It is just a matter of applying a thin film. A brush is not used as this would necessitate plugging all the pivot holes to keep the lacquer out. The advantage of using a shellac based lacquer such as Duralac is that it is easily removed in the ammonia based cleaning solution during servicing. Some of the modern lacquers are not so easily removed. Mr. Castle-Smith mentions Ercaline. Both this and Frigilene are excellent lacquers available from Walsh.

Most lacquers dry very quickly which makes them difficult to apply to the frames of a skeleton clock because by the time you have gone around the edges they will have dried before the the faces of the frames have been done, and the overlap will be noticeable.

I was discussing this problem recently with the tutor at West Dean clock restoration course Roger Still. He advised spraying the lacquer while the component is suspended in order to cover all surfaces quickly. He also stressed the importance of warming the work and the spray can itself within reason. The spray is Clearspray Lacquer from Horological Solutions, Procter Street, Bury, Lancashire BL8 2NY.

He also suggested that perhaps the safest way for ornate frames was gold plating.

John Wilding FBHI, Sussex.

## Finishes and lacquers

SIRS, - I noticed the letter in a recent issue from Mr. Roger Castle-Smith who was asking about lacquering. As you know, I have made several horological items and have always used ordinary Auto Spray aerosols. I have found the product available from Halfords in recent years to be quite satisfactory.

Most of my working life has been in research work associated with the scientific industry in which brushed shellac base lacquer was used, almost always a lovely golden colour. However, when the highly skilled craftsmen who applied it retired in the 1960s it was replaced by sprayed synthetic lacquers, sadly not always gold coloured.

I am not an horologist and do not particularly like the highly polished surfaces favoured by clockmakers, preferring the grained surface used by the instrument makers. This is obtained by carefully used abrasive papers and I subsequently protect my work with clear lacquer, using



Mr. Geoff King's has modified his '08 shunter by fitting a leading 4-wheel bogie to negotiate the tight curves on his garden railway in Co. Sligo.

an Auto Spray aerosol.

All of my replicas are finished in this manner and it seems to last very well; my long case clock, completed in 1966, is still okay as are my other replicas in the Bury St Edmunds Museum.

Don Unwin, Cambridgeshire.

## Strange but true

SIRS, - After completing a 200ft. garden railway track, my *Rob Roy*, *County Carlow* and my re-designed *Lucky 7* scaled down to 5in. gauge all ran okay.

However, the 08 shunter didn't like it at all! I built this locomotive to the Rex Nicholls design using a car dynamo, wheel brace, sprockets and chain drive to the rear axle. I resolved the problem by removing the front two wheels and cutting the frames away to fit a 4-wheel bogie 'borrowed' from the 5in. gauge *Lucky 7*. I admit that the result looks somewhat strange, but the locomotive runs beautifully.

My 08 0-6-0 is now an 08 4-4-0, a complete solution for those who have tight bends.

Geoff King, Co. Sligo, Ireland.

## Steam turbine with integral condenser

SIRS, - Mr. David Kirby's letter and photographs published in *M.E.* 4201, 8 August 2003 raised indirectly some awkward questions relating to design problems on turbines in general, i.e. silencing diffusers and nozzle exit angles, among others.

My search of post-1924 *M.E.s* revealed no trace of similar applications. Condensers actually made were of more efficient separate non-interacting variety. No details of performance appeared.

A model marine propulsion unit appears the most likely use, but expectations of high power resulting from greater heat-drop should be withheld.

Mr. David Kirk mentioned a speed increase on condensing, which could result from:

- 1: the nozzle effective exit velocity increasing (by some 10-15%) but at low efficiency ( $V=0.75$ ),
- 2: expansion within the rotor flow

channels giving increased reaction. Whether this effect, described by H. Faltin, applies to 'one-sided' Stumph flow channels is unknown.

Both Faltin's and Christlein's papers (see Kearton) are worth study, giving measured data on full-size under-expanding nozzles.

A machine of low wheel/steam speed ratio would maximise the 'pick-up' jet (wheel-exit) velocity, and render the running rpm acceptable to gearing. Development would be a challenge, but simplicity and a 25% increase in power may appeal.

R. Pridmore, Sheffield.

## Gun browning at home

SIRS, - Mr. Norman Smith's letter on how gun browning was done at his Birmingham Small Arms works (*M.E.* 4220, 30 April 2004) made my hair stand on end! Yet you can try this at home, folks. A small bottle of much the same evil chemistry costs under a tenner. It turns steel a warm brown which looks great on tools and blends in repairs to old machinery.

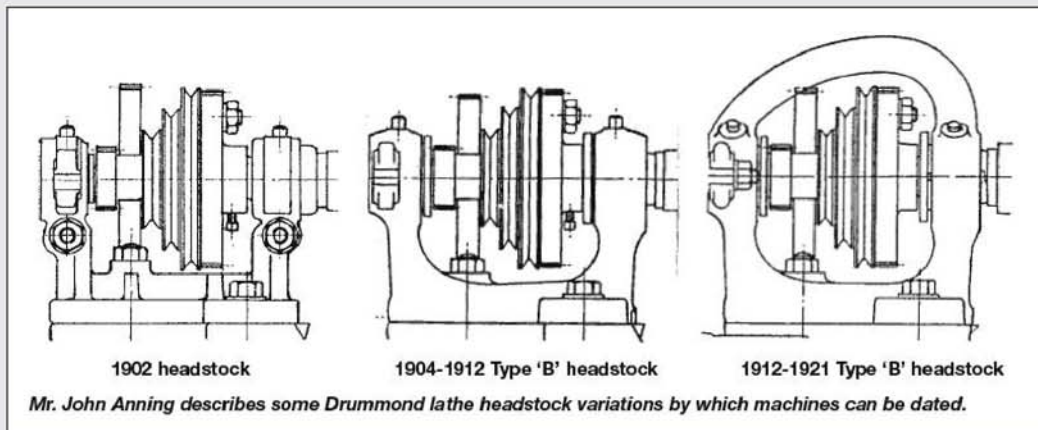
I would rather patinate models than paint them. They still look like metal, and there is no softening of detail or interference with function. Patination tones down the rawness of new metal, building an illusion of distance and age. It can be shaded to build up realism, from a mere hint of grey on sliding parts, to deep rust in dank corners. This particularly suits out-door subjects like ship and trains. A model of, say a well-used excavator, could well be patinated all over. As a bonus, patination is far quicker than painting. A batch of castings can be ready to use in ten minutes.

For steel, try Birchwood Casey 'Plum Brown' from a gun shop. If you are uneasy about country sports, try the antiques trade, which uses it to buff up their muskets. For brass, try Liberon 'Tourmaline Brown' from a wood-finishing shop. Both firms also produce ranges of metal blacking products, as of course do several advertisers in *M.E.* Surf the web if you can't find the stuff locally.





Mr. David Halfpenny's lost wax cast axlebox pedestals are straight from the packet, pickled, wire brushed, treated with browning fluid, buffed and oiled. The tiny wrench (right) has been buffed to show highlights and shadows.



Ready-mixed brews cut out most, but not all, of the danger and variability of home recipes. Experiment, be consistent, and handle with great care.

David Halfpenny, Derbyshire.

## Drummond lathes

SIRS, - I have read with much interest the letter from Mr. Ray Trimbley in *M.E.* 4218, 2 April 2004. He comments upon his recent purchase of a Drummond lathe similar to the one refurbished by Ron Etter, the restoration of which was well covered in *M.E.* 4209 and 4211 (28 November and 27 December 2003).

Both these gentlemen have stated that the lathes in question are designated as a model B; in a wish to clear up any further misunderstanding, I have been in touch with Tony Griffiths, owner of that excellent website [www.lathes.co.uk](http://www.lathes.co.uk) to agree a new wording under the Drummond database. The genuine Drummond B Type was introduced in 1912 and remained in production until 1921 and is easily recognised by the sculptured integral arch over the bearing housings as part of the headstock casting.

In 1904, or thereabouts, Drummond introduced their famous patented 'draw-in bearing' on the headstock which was housed in mating tapers machined into the headstock casting. Both headstock bearings were initially adjusted by expensive 'C-spanner' nuts, but these were soon abandoned in favour of 2 by 3/16in. Whitworth cheese headed

screws which pulled up on stout steel washers against the back of the larger end of each of the bronze split bearings. This less-expensive arrangement was retained until 1921 in various guises on all 3 1/2in. Drummond lathes until 1921 when the C-spanner bearing was re-introduced and used on the Drummond Type M lathes until the end of production by Myford c1946. An article on the development of the Drummond headstock bearings by Norman Gardner appeared in *M.E.* 3159, 25 January 1962.

The trouble arises over the designation 'B' because the first headstock with the 'draw-in bearing' was designated the Type B headstock. Hence we have the Drummond 3 1/2in. lathe with the Type B headstock and this is why after nearly 100 years there is this confusion. For the pedants among us, the line drawings from the pen of the late Richard Bird show clearly the original 1902 headstock and the post-1904 Type B headstock together with the headstock on the B Type lathe of 1912. If my readers are still confused, please don't worry it is all harmless fun!

I was interested to note that Mr. Trimbley has suggested that he believes his lathe is a later model than that of Mr. Etter and wonder what evidence does he have? These lathes were being constantly modified in a number of details and I was intrigued to read of the designation MCH B No 7236 on his lathe. I have examined many of these lathes and have hardly ever come across one with any

designation and am certain that the beds had not been reground. I have not come across such a high number on a 3 1/2in. lathe before as the Drummond records do not reveal the number of pre 3 1/2in. 1912 lathes made. I want to suggest that MCH are the initials of the assembly fitter or inspector, B refers to the Type B headstock and 7236 may or may not be the number off the production line.

I can't help feeling that old Arthur Drummond, who died in 1951 aged 86, would be highly amused that he had started a minor controversy over the simple designation of one of his lathes all those years ago which is really a very small molehill but could easily have developed into a mountain!

John A. Anning, Devon.

## In praise of the Bristol Hydra

SIRS, - I have been reading Brian Perkins' account of the construction of his *Hydra* engine with increasing awe! Being a relative beginner myself, I am amazed by his achievements over 30 months, given the complexity of virtually all

of the components. I have found his articles of particular interest as I hope to try building an i.c. engine myself, albeit a more modest one than the *Hydra*.

As a very recent subscriber to *Model Engineer*, I unfortunately missed your reader survey, although I think I would have skewed the statistics somewhat being a 'mere' 30 years old! I am maybe less of a locomotive fan than some; I have been working on a large-scale model car to my own design for the last 3 years (and counting...). It is almost entirely scratch-built and I am trying to reproduce most of the main components and systems in miniature, e.g. brakes, transmission, electrical system and maybe one day the engine! I wonder if any of your readers are involved in similar projects?

Alex du Pré, Bristol.

## Synthetic cast iron

SIRS, - I am probably the hundredth to advise that the method of cast iron production used by Ernie Henne (*M.E.* 4218, 2 April 2004) is actually right bang up to date, as this method is basically the present commercial means of cast iron production.

The process allows complete control of specification, not really possible with the old pig iron route. Using steel as the base means a dramatic reduction in sulphur and other contaminants, the carbon used is often 'Refinery Coke' left after oil refining. The industry no longer follows the route: iron ore plus limestone plus coke to pig iron to Bessemer converter to alloying furnaces.

It would take too long to explain but basically it is a sort of direct steel production from the furnace. This is then made up into various steel alloys or in the case of cast iron by the above addition of carbon plus silicon, chrome or whatever other alloying addition is required.

It is nice to see a model engineer refuting the slur that 'we live in the past.'

Peter King,  
Christchurch, New Zealand.

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Correspondence for *Post Bag* should be sent to The Editor (*Model Engineer*)

PO Box 310, Hemel Hempstead, Hertfordshire, HP3 8XL

fax: 01442-269366; email: [mike.chrisp@virgin.net](mailto:mike.chrisp@virgin.net)

or to [nread@highburyleisure.co.uk](mailto:nread@highburyleisure.co.uk) or to [kbarber@highburyleisure.co.uk](mailto:kbarber@highburyleisure.co.uk)

Letters sent to The Editor (*Model Engineer*), Berwick House, 8-10 Knoll Rise Orpington, Kent, BR6 0PS; fax: 01689-886666 may be subject to forwarding delays.

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Sir Bors de Ganis, Peter Fagg's memorable 5in. gauge Southern Railway King Arthur class locomotive was awarded a Gold Medal, the Bradbury Winter Memorial Challenge Cup and the Charles Kennion Memorial Trophy at the 2003 Model Engineer Exhibition. (Photography by Dr. Jonathan Minns)

## THE KNIGHT AND THE EARL

**Peter Fagg, Andrew Breese and John Walters** describe two award winning locomotives and the creation of a special photograph of them.

**S**ir Bors de Ganis is a 5in. gauge model which represents a Southern Railway King Arthur class locomotive 4-6-0, No. 763, Works No. 23209, built by the North British Locomotive Company Limited in May 1925. This locomotive was the first of 30 which were a development of former London & South Western Railway 4-6-0 design of 1918 by A. W. Urie CME of the LSWR 1912-1922. They were solid engines with ample proportion to bearing surfaces and motion, but had their steaming problems. When Maunsell became CME of the Southern Railway in 1923 the running department appealed to him to do something about the engine's shortcomings.

J. Clayton, personal assistant to Maunsell, redesigned the front end, draughting, blast pipe and chimney. The valve travel was increased and air flow to the ashpan improved. After these improvements they became good reliable locomotives and were only displaced from top link duties with the advent of the Bullied pacifics. *Sir Bors de Ganis* was withdrawn in October 1960.

My aim was to build this locomotive as it entered service in 1925. It was intended to have as much scale detail as possible, but to be capable of hard work on club tracks. The use of 1/4in. gauge glass more or less set the scale for boiler fittings as I believe this is the smallest possible glass that will provide a reasonably true reading. Smoke deflectors were not fitted when new, but they were the first British locomotives to be so equipped.

Drawings for the main frames, front bogie, valve gear, cylinders, tender frames and bogies were prepared. These were taken from full size drawings purchased many years ago from Brighton Works. I had taken a great many detailed photographs of King Arthurs just at the end of British Rail steam and access to the S15 at the Bluebell Railway was invaluable for further photographs and dimensions.

My next step was to source necessary castings. The wheels were not a problem, but it was

obvious that I would need to make patterns for the cylinders and spring hangers. Cylinders were cast in meehanite iron and the spring hangers in high tensile brass. All other castings were to be made as fabrications as this really provides exactly what is required.

The boiler is based on the well proven Martin Evans design for *Springbok*, silver-soldered throughout. Boiler feed is by two injectors to the D. E. Lawrence design. However, it takes longer to make all the jigs and reamers than it does the



Valve gear on the King Arthur is of ample proportions, giving plenty of room to fit bronze bushes and to retain the motion pins with taper pins as full size practice.





### Cameras never lie!

The lower photograph is basically a composite: a copy of the coloured print published in the journal of the Stephenson Locomotive Society, prime mover in the preservation of *Gladstone*, and a digital photograph of the model *Gladstone* alongside the model 'Arthur'.

An immediate problem concerned the perspective; owing to the considerable difference between the focal lengths of the digital camera and

the camera that had provided the photograph on which the SLS print had been based. A solution was found in the *PhotoShop* computer program.

The differing outlines of the 'Arthur' and *Lord Nelson* made the use of a one-piece mask impossible, so the original locomotives were simply painted out of the print and the digital photograph, with its background removed, was superimposed on the remaining trackwork.

The fit of the parts was improved by increasing

the perspective of the track and decreasing the perspective of the new locomotives. The dot-screen visible in the colour print was removed by blurring, then sharpened to restore detail to edges; and the colour balance of each layer was harmonised. Cloning and airbrush tools allowed pieces of image to be duplicated, allowing track to be moved!, and missing background was restored where appropriate. Finally, the layered image was flattened and a few last details were added.

four injectors. The full size locomotive is fitted with a cross-head vacuum pump which acts as a feed pump on the model. The safety valves are to the Holmes design made of 316 stainless steel with bronze valves.

Steel leaf springs are fitted throughout, hardened then tempered in a bath of lead, they seem to give the right amount of springing. I am sure this must be an improvement of Tufnol which appears to me to give far too soft a suspension. Upon completion of the locomotive each axle was weighed and adjusted to give 48lb. on the bogie and 48lb. on each driving axle.

Cylinders are fitted with cast iron rings from

the Bradford Piston and Piston Ring Company, lubrication is by displacement from a large oil tank under a lift-out section of the footplate and controlled by two sight glasses in the cab.

The valve gear on the King Arthur is of ample proportions so this gave me plenty of room to fit bronze bushes and retain the motion pins with taper pins as full size practice. The expansion link is of gauge plate, hardened and tempered. The square drive to the return crank is screwed into the crank pin. It was necessary to keep facing the shoulder off until the correct setting was achieved. It has been retained by Loctite and pinned.

Driving wheels are pressed onto the axles and fitted with square keys. This makes quartering very easy. The axles were clamped into a square block of steel to machine the keyways. A jig was made up to hold the wheels on the lathe to slot the keyways to ensure their correct relationship to the crank pins.

Chimney, dome and safety valve cover were all machined from the solid. Cab fittings have been positioned as full size where possible. The blower valve is out of place because, on the full size locomotive, the handrail on the driver's side was used for the control rod to a valve outside the smokebox. Water gauges are fitted with taper cocks and packed glands.





Andrew Breese with his LBSCR Gladstone class locomotive Arundel on the Beech Hurst track with Gordon and the late Phyllis Briggs as passengers. (Photo: Gerry Collins)

Painting and lining was perhaps the most frustrating part of the whole job. I had acquired a painting and lining drawing from Brighton Works many years ago which was to prove invaluable. The paint used is Precision Paints' Authentic Colours. Brass was carefully prepared and cleaned thoroughly then etch primed. Spray was with a small touch-up spray gun and an airbrush. After lining and the application of transfers, the whole locomotive was varnished.

When exhibited at the 2003 Model Engineering Exhibition, the locomotive was awarded a Gold Medal, the Bradbury Winter Memorial Challenge

brown in Marsh's time and then olive green on the formation of the Southern Railway in 1923. The pioneer engine was restored to its original form by the Stephenson Locomotive Society after withdrawal in 1927 and placed in York Railway Museum.

Work on my 1 $\frac{1}{16}$ in. to the foot scale version of No. 180 *Arundel* was started in 1972 and completed in 1992 when it was entered in competition at the Model Engineer Exhibition at Olympia and awarded a Silver Medal and the Kennion Memorial Trophy. Original works drawings were used together with many photographs

and several visits to the Railway Museum in York.

Cylinders are cast iron with slide valves underneath and channel section guide bars as prototype. The boiler is fitted with radiant superheaters and a stainless steel 'brick' arch. The locomotive has now been running for 10 years and has covered 300 miles. It steams and rides as well as apparently the prototype did.

A year ago I came across a 'coloured-up' photograph published by the Stephenson Locomotive Society in 1927 of the restored Gladstone alongside the Southern Railway's brand new 4-6-0 *Lord Nelson* — no doubt a staged publicity photograph. I was aware, that my friend Peter Fagg was nearing completion of his magnificent 4-6-0 'King Arthur' class locomotive, and it occurred to me that we might stage a similar

Cup and the Charles Kennion Memorial Trophy.

### Arundel

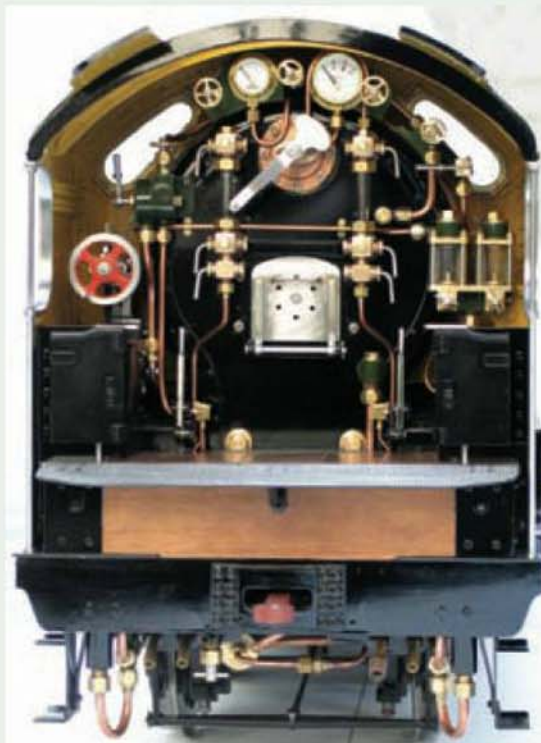
William Stroudly introduced the 'Gladstone' 0-4-2 express engine in 1882 for the fastest and heaviest traffic on the London, Brighton and South Coast Railway. Eventually the class numbered 36 locomotives. Critics at the time suggested that the use of large diameter driving wheels at the leading end of an engine intended to run fast was foolhardy. However, the Gladstones proved to be steady and smooth riding machines. Originally painted in the famous yellow ochre livery with elaborate lining, many of the class went through two more livery changes — amber



By reference to numerous photographs and an S15 at the Bluebell Railway, this 5in. gauge model represents the original locomotive as it entered service in 1925.

photograph with the two locomotives lined up in exactly the same position. So instead of 'Admiral' and 'Premier' we would have 'Knight' and 'Earl'! Peter readily agreed to this and the photography took place at the British Engineerium in Hove.

Acknowledgements are due to the Stephenson Locomotive Society for permission to use their original photograph, to Dr. Jonathan Minns of the British Engineerium for the photography and for the use of the Engineerium facilities, and the computer skills of John Walters.

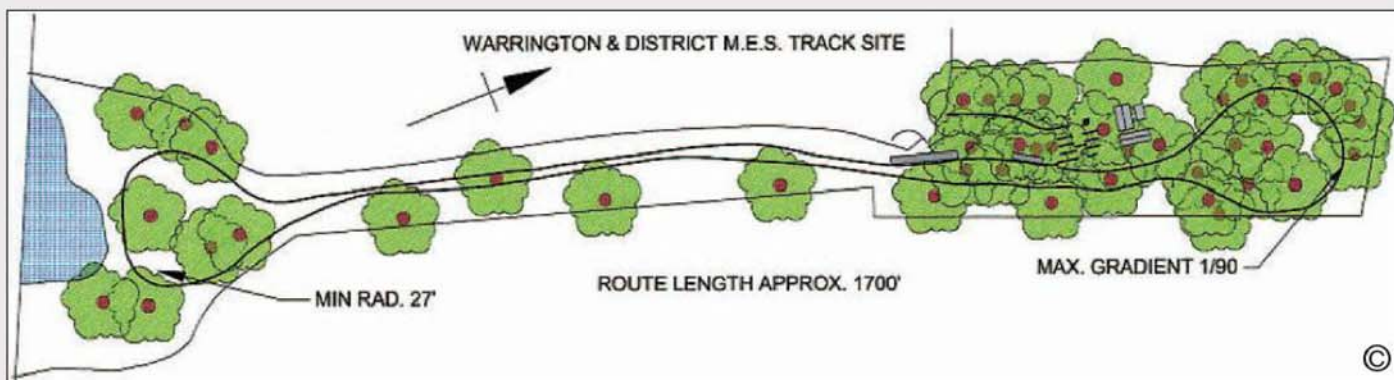


The backhead fittings of Sir Bors de Ganis are representative of those on the full size locomotive.



Andrew Breese's LBSCR Arundel looks well having covered some 300 miles during 10 years' running.





# NAME NARROW GAUGE IMLEC

**Barry Harrison**

invites competitors and visitors to an annual event, scheduled this year at Warrington 5/6 June 2004.

Many will remember the Mad Hatter's Steam Parties organised and run by Warrington & District MES in days gone by; unfortunately these events had to be abandoned when a portion of land occupied by the Society for over 30 years was sold off and regular access to the track was lost. The Society was eventually forced to vacate this land some 8 or 9 years ago, losing their club house, the steaming bay area, approximately one third of the track, and of course their access route.

This major challenge to the Society was eventually met by relocating some 200m of track (along with a new club hut and steaming bays) into an adjacent section of protected woodland,

although this was not a simple matter since only two dead trees could be felled and excavations for foundations were restricted to no more than 100mm depth. With everything having to be fitted in and around the healthy trees, the new route is

an interesting one which wends its sinuous way through the woodland in a series of tight(ish) bends combined with a number of steep gradients here and there — a challenge to drivers and well-suited to a locomotive efficiency competition.

With the new facilities up and running, and most of the remaining original track rebuilt since it had deteriorated somewhat during the extended period when members had no access at all to the site, WDMES are now able to hold their first major event for several years: the 2004 Northern Association of Model Engineers Narrow Gauge International Model Locomotive Efficiency Competition, to be run on 5th & 6th June.

Always an interesting and enjoyable weekend, the Society is delighted to be able to host the competition and is looking forward to welcoming competitors and visitors to their track adjacent to the village of Daresbury, where Lewis Carroll, author of the 'Alice' stories, was born.



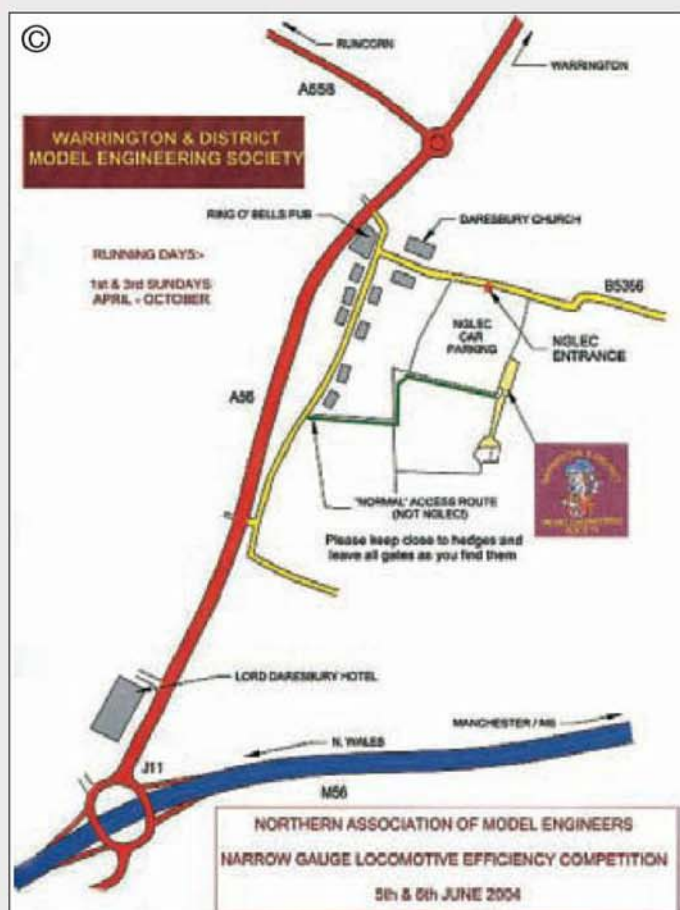
*A Lion among the bluebells.*



*Heavy traffic!*



*Passing the pond.*







Mrs. Pat McMahon poses with the completed organ and gives some idea of the overall size of the finished project.



Checking the position of the pipes in the wind chest. Their locations were marked but it always pays to check and check again.

# THE ANGEL SHOWMAN'S ORGAN

**Raymond McMahon**

introduces a project which satisfies his fondness for fairground music.

●Part I

Several years have passed since I built my first Showman's organ as an accessory to complement my 1:3 scale Showman's traction engine. Since its construction it has given me a great deal of pleasure. Being somewhat large (6ft. long) it needed a trailer to transport it but, at the time of construction, this was not deemed to be a problem (see *M.E.* 4145, 4 May 2001).

Recent events convinced me that it would be to my advantage to construct another organ, although that was only part of the excuse! This one would be designed to fit into the average large hatchback or estate car, thus freeing the trailer for transporting the traction engine. Several options were open to me as to the type of organ I wanted this time. Fairly obviously it had to be of different appearance to the first one. Preferably it had to have a new pipe arrangement, which would give it a different sound. This time, no drums or glockenspiel would be fitted, but it would have more pipes to compensate. Construction would be more compact

and less heavy to facilitate transport.

Over the intervening years since the first organ was built, the world of electronics has moved on. The electronic chips that contained the tunes and provided signals to operate the solenoid valves of the original organ have been replaced with a computer disc. This has made everything within the electronics cabinet smaller, lighter and simpler to operate.

The basic 30-key organ which I chose is available as a kit of parts. It is specially packaged and designed for the home builder. A selection of beautifully hand-crafted pipes is available, including bass, accompaniment, Bourdon melody, violin and bass helpers. These all come pre-tuned, and a bass and snare drum as well as a cymbal and glockenspiel are available as extras. The basic kit includes the wind-chest, blower and player system so it is simply a matter of choosing the bits and pieces to meet your requirements and, perhaps more importantly, your pocket.

For my new organ I decided to augment the basic unit with an additional second rank of Bourdon and violin pipes, and a second rank of bass helpers. This extra set of pipes, I thought, would add to and enrich the quality of sound. For the benefit of those who have never ventured into

the world of organ building, it may be appropriate to describe what is involved in order to produce the finished article.

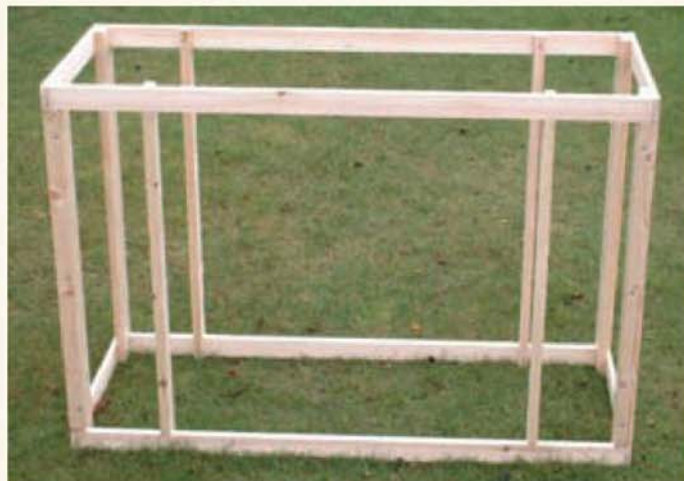
The wind chest is supplied as a complete assembly. A substantial box, it contains all the solenoid valves that open and close to admit air to the various organ pipes. A large 12 volt blower fan unit has to be screwed to the underside. The top of the wind chest is supplied pre-drilled to suit the selection of pipes which have been ordered, and each hole is numbered to suit the appropriate pipe.

The first job is to fit a set of legs to the underside of the wind chest to make it free standing thus providing ground clearance for the blower assembly mounted underneath. It should be noted that any screws fitted into the wind chest should not penetrate the wall; doing so introduces a potential source of air leakage or the protruding screw end may foul some of the internal components.

Before assembling the pipes in place, I made up a simple wooden frame for the wind chest. This allows the fitting of panels to the right and left-hand sides of the chest; there is also a rear panel. These panels serve two purposes: they throw the sound forward and provide an attachment point for fitting brass brackets to support the large right-angled bass pipes. Pre-printed beauty



The violin pipes laid out prior to installation. Note the code numbers on the mounting spigots.



The frame made up to carry the main components of the organ was fabricated from planed strip wood.





*Brass support brackets were fabricated to support the larger pipes.*

board is ideal for the purpose. It is attractive and well-finished, although in reality most of it is hidden by the pipes. The panels are glued to the frame, but it is important that the frame unit can be removed from the chest. Eight screws in total hold it in place, front and rear.

My new organ required the fitting of 56 pipes. Fortunately they all come numbered and their positions are marked on the wind chest. Before gluing them in place it is as well to have a trial assembly, mounting them in their correct positions to check that everything is in order. I used  $\frac{1}{2} \times \frac{1}{16}$  in. brass strip for the support brackets for the larger pipes. Some are just plain straps while others are bent at right angles for attachment to the rear and side panels.

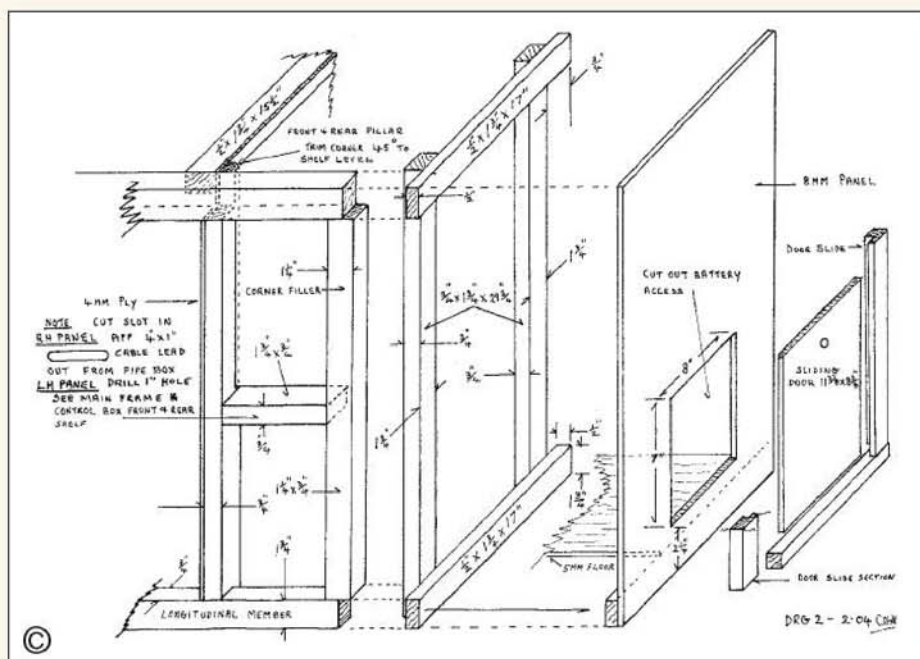
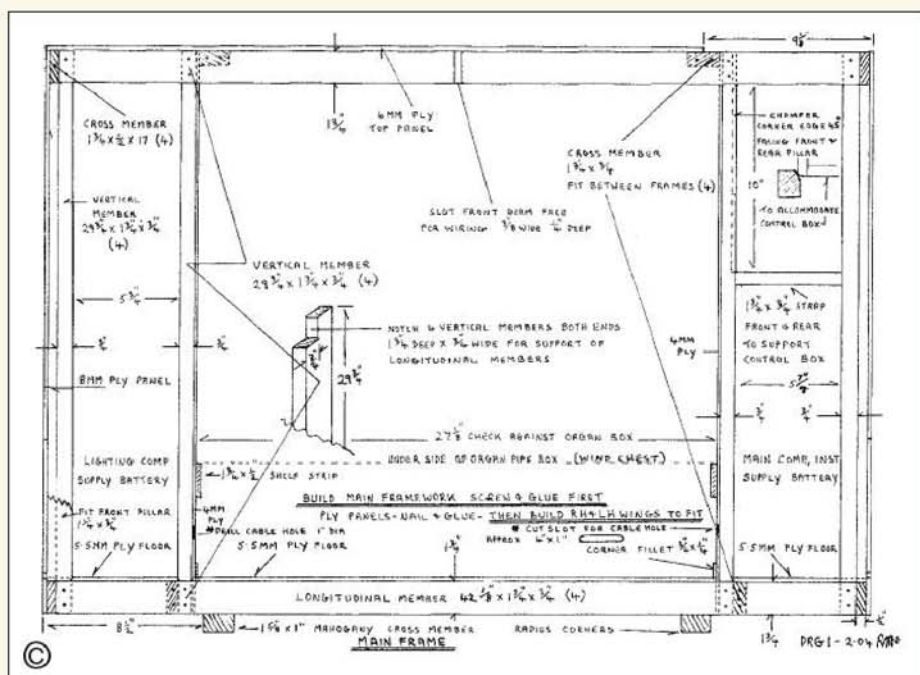
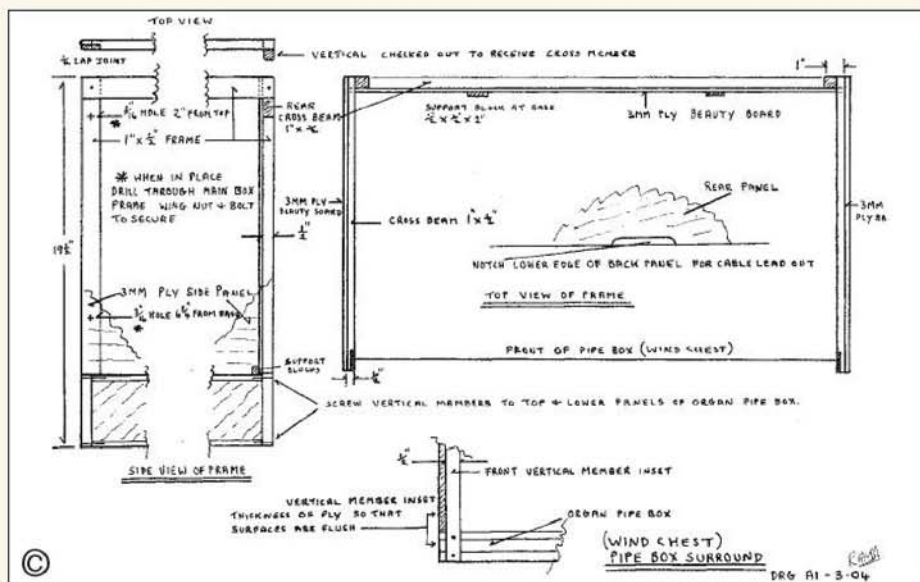
It is important that before gluing the pipes in place their positions are checked and checked again and that any bracket fixing screws do not penetrate through the wall of the pipe into the airway. It is as well to take care that only a minimum amount of glue is used for fixing the pipes; an excess of surplus glue could find its way down to the solenoid valves underneath and prevent them from working properly. The cables from the wind chest are led out to the rear via notches cut into the bottom edge of the rear panel.

Framework for the case is made up from 12 x 45mm ( $1/2 \times 1\frac{3}{4}$  in.) and 20 x 45mm ( $3/4 \times 1\frac{3}{4}$  in.) planed all round white wood. As a member of the old school I must admit to preferring my dimensions to be stated in inches!

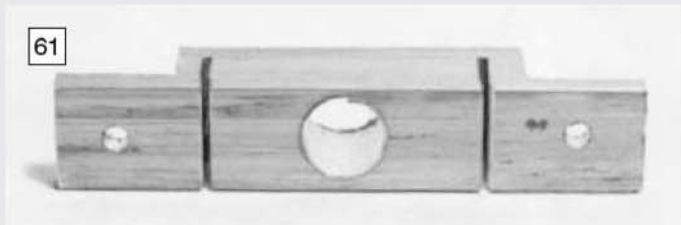
●*To be continued.*



*An example of the simple joints used to construct the frame.*



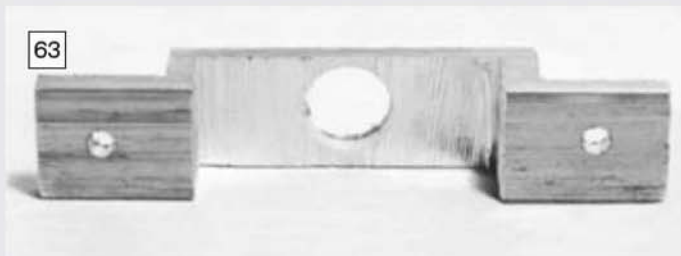




61 With the holes drilled, work on the bridge continues with two short saw cuts.



62 Diagonal cuts are made to remove some of the waste material.



63 The remaining waste is removed with a single cut.



64 The bridge is finished by careful filing to size and shape.

# WORLD TIME DIAL CLOCK

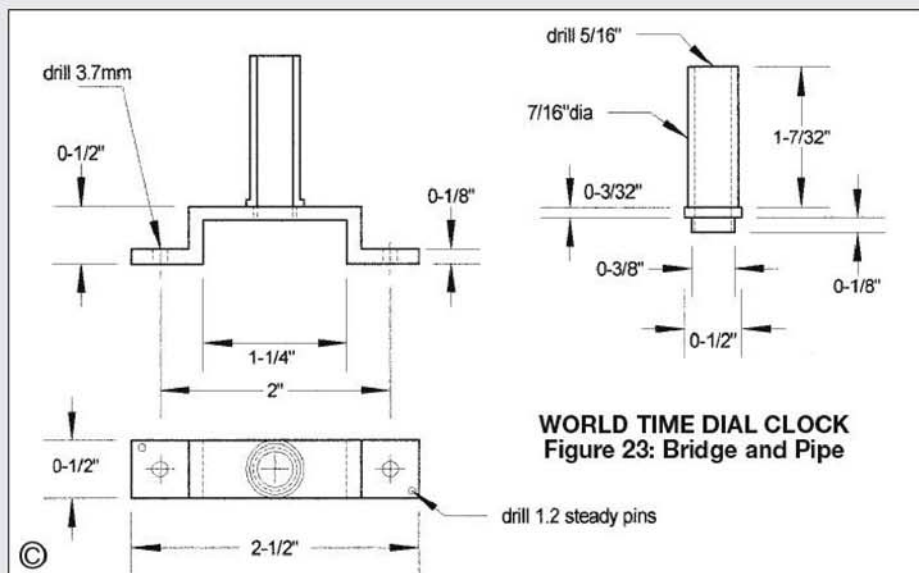
## Ian Beilby

continues work on his clock with the bridge and the hour arm, pointer and pillar.

●Part VIII continued from page 511 (M.E. 4220, 30 April 2004)

There are many ways of making the bridge; it can be filed up from a casting, fabricated using brass strip and angle, or made in the same way as the back cock, using a strip of brass and detachable pillars. A lot depends on the tools and skill of the individual constructor. I find one of the simplest methods, and one described by John Wilding in his book *How to make a Weight Driven Eight Day Wall Clock* is to make the base of the bridge from  $\frac{1}{2}$ in. square brass. This is simply marked out as in fig 23, the waste cut away with a junior hacksaw or a bandsaw, and then filed to the lines.

I find it easier to drill the holes in the base before cutting out the angles since there is more material to hold and clamp to the drilling table. The position of the pipe and the fixing screws that have been marked out on the top of the bridge are centre punched and the work taken to the drilling machine. The  $\frac{3}{8}$ in. hole is drilled for the pipe, followed by the 4BA tapping drill for



the two fixing screws in the feet of the bridge. These two holes will be opened out to 4BA clearance later.

Horizontal and vertical cuts are then made to produce the right angles of the bridge feet, followed by two vertical cuts forming the inside of the bridge (photo 61). Work on removing the

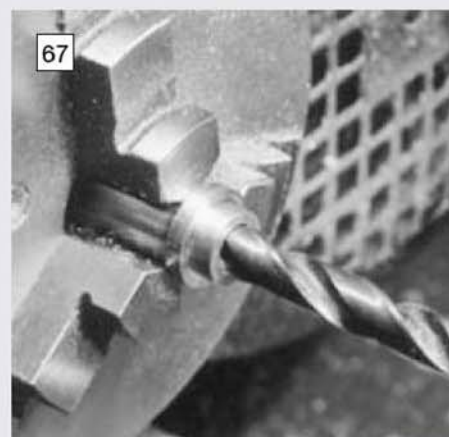
central portion begins with two diagonal cuts from the centre into the base of the inner vertical cuts just made. It should then be possible to fit the blade in order to remove the remaining scrap from the centre of the bridge (photos 62 and 63). The sawn face will require to be filed to the marked line, care being taken to ensure that the



65 The pipe is faced, centred and turned to size.



66 The pipe is reversed and the register turned.



67 Work on the pipe is completed by drilling.

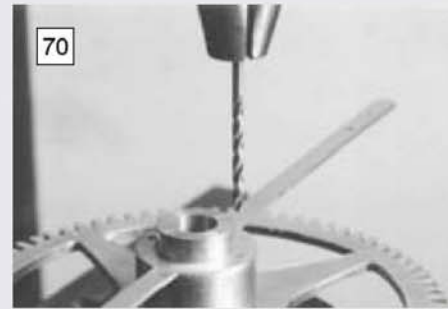




Bridge and pipe ready for assembly.



The pipe is fixed to the bridge using Loctite.



The hour arm is used to locate the collet fixings.



Hour pointer, arm and tapped fixing post before assembly.



The hour pointer assembly can be made and dismantled as required.

surfaces are finished flat and the corners left sharp (photo 64).

The pipe is made from  $\frac{1}{2}$ in. brass rod. A  $1\frac{3}{4}$ in. length is faced and centre drilled and, using tailstock support, is reduced to a diameter of  $\frac{7}{16}$ in. for a length of  $1\frac{17}{32}$ in. (photo 65). The pipe is then reversed in the chuck and brought to length, observing the dimensions in fig 23. The  $\frac{3}{8} \times \frac{1}{8}$ in. dimension can then be machined and the pipe drilled  $\frac{5}{16}$ in. (photos 66 and 67). The pipe can now be secured to the bridge with Loctite (photos 68 and 69).

### Hour arm and pointer

The hour arm can be made from  $\frac{1}{32}$ in. thick material; either brass or steel will serve. I happened to have some  $\frac{1}{32}$ in. brass and used this for my clock. The arm is marked out as in fig 24 and the positions of the various holes that need to be drilled in the arm are centre punched and drilled before cutting the arm to shape.

The two holes for the moon-activating pin should be drilled 1mm, and the other holes initially drilled with a 10BA tapping size drill. The centre hole is then drilled  $\frac{7}{16}$  inch. The arm is then cut to shape with a piercing saw, and filed to the line.

Since the arm is attached to the hour wheel collet with two 10BA screws, the wheel and collet should be placed on a  $\frac{7}{16}$ in. rod and the hour arm used as a template to drill the two 10BA tapping holes for the fixing screws in the collet (photo 70). The holes in the collet can now be tapped 10BA and the three holes in the arm opened up to 10BA clearance.

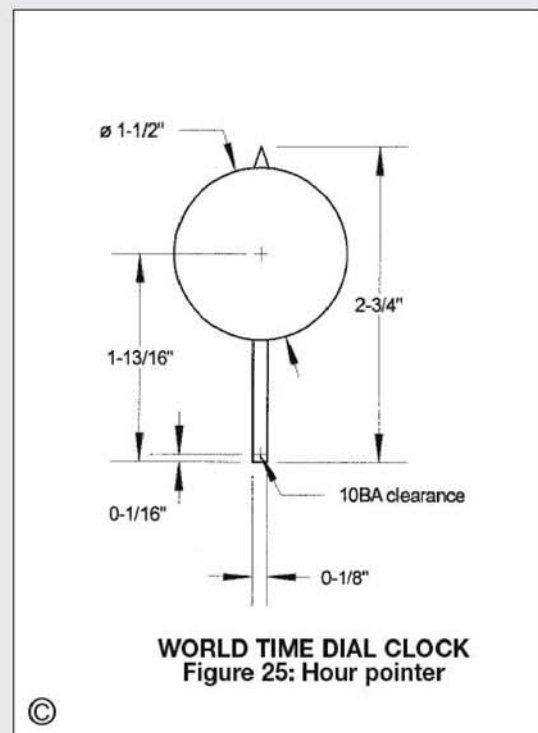
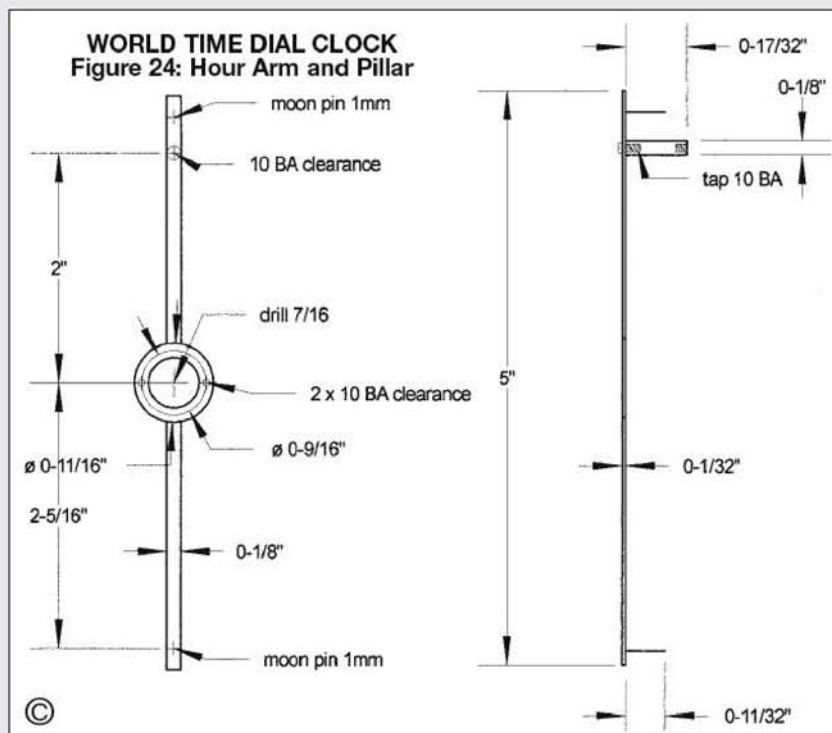
The arm should be supported on a stake, and two finely tapered clock pins which activate the moon disc should be driven into the 1mm holes drilled previously. At this stage the pins should be longer than required and left over-length to allow for adjustment later when the dial and moon disc are fitted.

The hour pointer is marked out and cut from 22 gauge brass sheet (figure 25). The hole for the 10BA retaining screw is again best drilled before cutting and filing the brass to shape. The pointer will eventually be painted to depict the sun, but this should be left until the clock is nearer completion (photo 71).

The pointer is attached to the arm with a  $\frac{17}{32}$ in. length of  $\frac{1}{8}$ in. brass rod drilled and tapped 10BA at both ends. This rod is then fixed to the arm with a 10BA screw, and the pointer mounted likewise. The rod could be riveted or silver-soldered to the arm, but I have found screwing the components together affords more adjustment, and the components can be assembled and dismantled with ease if required at a later date (photo 72).

In the next part we will fix the bridge to the frontplate, make the minute hand and the dial pillars, and make a start on the dial plate.

●To be continued.





# TRIPLE EXPANSION ENGINES A GLANCE WITHIN

**Ted Wale**

in Canada, brings us the results of his initial research into these most interesting engines.

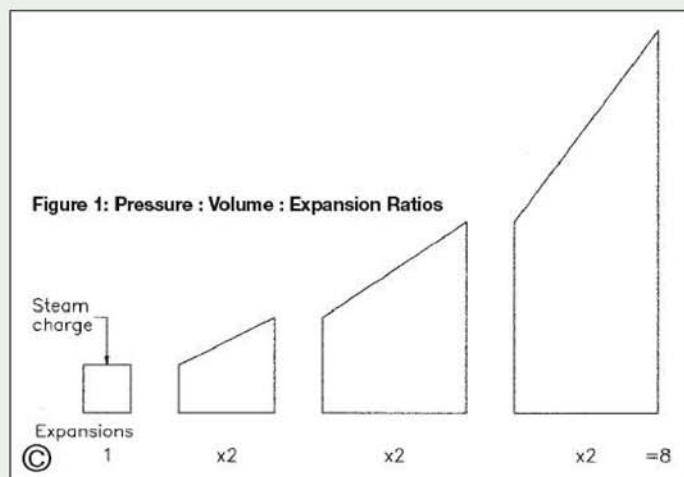
One club evening I was discussing my growing interest in triple expansion engines with a fellow member who was also the person who arranges the presentations made by members each month to the club in general — a dangerous person to talk to about new interests. In the end he persuaded me to talk about what I had already found. I made it very clear that I had neither made nor even started to make such a beast, although I do have a set of castings, but I had done a fair amount of reading on the theory, and it was the result of this research that I would present; all of it arising from other authorities' work.

I am aware that a significant number of our club members believe in what our President calls 'reverse engineering', and are very good at it. I am not. In model engineering, reverse engineering, which in this context is not the same thing as is widely used in the computer industry, is, I am told, based on the precept of first: make it, second: make it work, third: record what has been made on drawings, fourth: find out the theory which makes it all happen. Very often, pressure of the next project means that the last two steps are conveniently forgotten. I cannot work that way. I have to understand the theory of operation, then decide on the project parameters, i.e. weight, size, power or what have you. Then I sit down and design and draw the model to meet these parameters. At that stage I can make it with confidence, if not with immediate success. I am only in the first stage of this process, trying to understand how triple expansion engines work. I have come across some very interesting and, for me at least, some unexpected things.

A triple expansion engine is one in which the steam from the boiler enters the first, or high pressure cylinder, in which the cutoff is relatively



*Dave Whalley's fine model of the magnificent No. 6 engine, one of two triple expansion engines installed at Kempton Park Waterworks. Standing 34ft. from bedplate to valves, the full-size engine developed 1008hp at 25rpm to operate three 30in. diameter x 66in. stroke ram pumps and pumped 24,000,000 gallons of water per day. The high, intermediate and low pressure cylinders diameters are 29, 54 and 86in. respectively.*



early at, say 10%-15% on light load, to no more than 60% on full load. This charge of steam expands in this first cylinder and, at the end of the stroke, is passed to a second cylinder where it expands further, and then to a third cylinder for more expansion, from which it is vented to the condenser for recycling to the boiler as water. The pressure : volume : expansion ratios are shown in diagrammatic

form in **fig 1**. One of the basic design targets is to get each cylinder to contribute an equal amount of work in each cycle. This minimises vibration and strain on the engine bed.

There are two main categories and many different types of these machines (**fig 2**). The steam has to move from one cylinder to another, and it can do this in two basic ways. It can go directly as in the so-called Woolf engine where the exit port of one cylinder is connected directly to the inlet port of the next by the shortest possible route. Alternatively, on leaving the first cylinder it can enter a large vessel or receiving chamber from which the next cylinder is independently fed. Not unexpectedly, this variant is called a Receiver type engine. These two different configurations make possible very different designs and characteristics of performance. Each design type has its uses.



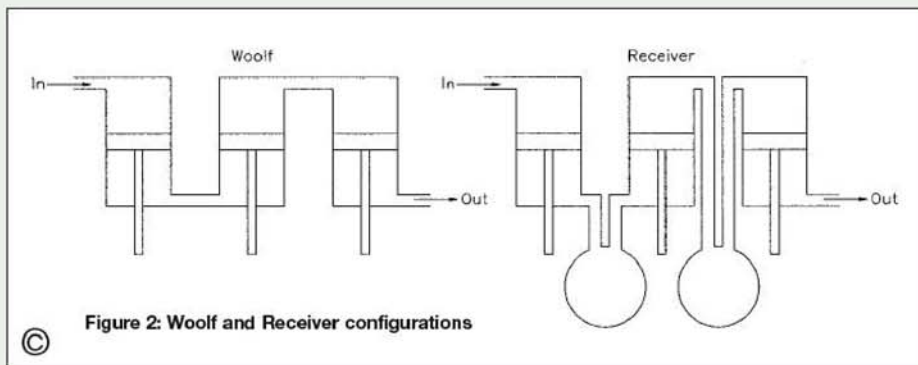


Figure 2: Woolf and Receiver configurations

For example, owing to their compactness, virtually all marine engines are of the Woolf type. There is usually insufficient space in the engine room to permit two large receivers to be connected between the cylinders of a triple expansion engine, or three receivers necessary if the power plant is a quadruple expansion engine. On some commercial vessels, designed particularly for long economical hauls, some attempt at receiver operation was, and still is, made by making the transfer pipes larger and longer. William Kent talks of this (ref 1). This is in the interest of the greater fuel economy inherent in the receiver type of engine. In military craft, and particularly naval fighting vessels, a design with maximum power and minimum weight has clear advantages over fuel efficiency. The straightforward Woolf design is then used. The result is shown in the many excellent models displayed at various times in our exhibitions. These can still be seen in a few restored steam driven vessels around the world, although most are necessarily small and use compound rather than triple expansion engines.

A further marine power plant variation involves the steam from the reciprocating triple expansion engine to discharge into a low-pressure turbine rather than directly into the condenser (fig 3). This results in slightly less power in the triple expansion engines but greater overall power because the pressure drop to -14psi in the condenser, and the discharge pressure of the low-pressure cylinders is used to drive the turbine, reducing the waste of energy in the condenser. This was the layout of the power plants of the *Olympic*, *Majestic* and their famous sister ship the *Titanic* where three propellers were driven.

Stationary engines that were used in mines, drove mills and powered smelters and other production equipment, had completely different design priorities. Space was not limited, weight was unimportant, reverse was rarely if ever needed, rapid speed change, as used in ship's manoeuvres, was not required. Fuel and steam economy were, however, of prime importance. Heavy machine parts and a huge flywheel gave nearly constant speed under load variations when used with a relatively simple governor.

These stationary engines were nearly all of the large Receiver type, usually with re-heaters in each receiver. In addition, simplicity of operation — with the complexity in the design and not in the controls — was the order of the day. Battleships have highly trained personnel in the engine room. Even merchant ship's engine rooms were better staffed than mill engine houses where one engineer was on duty for perhaps six, twelve hour shifts a week, while for the rest of the time his locally trained oilers and cleaners handled the controls if necessary.

That, then, is a very brief overview of the world of the triple expansion engines which ruled the world of mechanical power generation throughout the first two to two and a half centuries of the Industrial Revolution. Now we can take a look inside these beautiful pieces of machinery in order to get an idea as to how and why they operate.

There is a boiler, which converts heat from burning fuel into steam at a certain pressure and temperature. It is almost always superheated so that it is dry steam, and behaves very much as any gas. Suppose we calculate that we can get the mechanical work that we need by expanding 'x' cubic feet of steam by 'y' times each minute. From this we can determine the cylinder size and the number of times per minute that we have to charge the cylinder. So we have engine size and

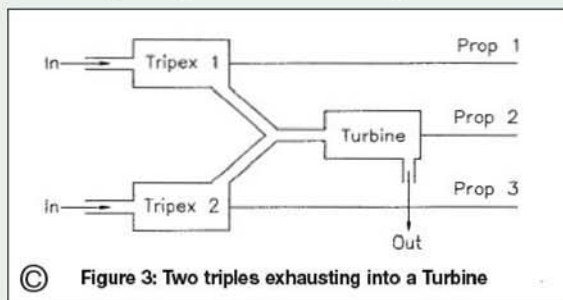


Figure 3: Two triples exhausting into a Turbine

speed. We can do this with a single cylinder and the technique will work as many railway locomotives, traction engines and agricultural machines show. However, as the power increases and the performance requirements increase we run into several difficulties.

To illustrate these difficulties suppose we determine that we are going to expand our steam from 150psi down to 10psi, i.e. a ratio of 1:15. We have a large cylinder into which we put a charge of steam of  $1/15$  the cylinder volume at the top of the stroke — this is equal to a valve cutoff of 6.67%. As the steam expands and its pressure falls to 10psi at the end of the stroke, it cools by the normal refrigeration effect, and the cylinder is relatively cool at the end of the stroke.

The next charge of hot, dry steam that enters

this cold cylinder will immediately be chilled. Pressure will fall and condensation is likely to occur. As the stroke continues and the steam expands it will re-evaporate as wet saturated steam and continue to push the piston while itself losing temperature until the valve opens at the end of the stroke. The sudden drop in pressure into the condenser then causes the steam to clear the cylinder in a drier state. A lot of potential work has been lost. Also, to get the work we need, the cylinder has to be a very large, so that the size of charge of steam we need is able to go into  $1/15$  of its volume.

So, this huge cylinder and piston has to be designed to withstand the 150psi input although most of the stroke is at a much lower pressure. Inchley (and others) tell us that the mean effective pressure in any engine operating on the expansion of the driving gas (in psi) is given by:

$$MEP = (P_i / r) (1 + \log_e r) - P_b$$

where  $P_i$  is the inlet pressure (absolute)  
 $P_b$  is the outlet pressure (absolute) and  
 $r$  is the ratio of expansions.

Kent gives this same information but in a more complicated form to allow for secondary effects, which Inchley (ref 2) deliberately disregards in the interest of simplicity. From this we can calculate that, with an inlet pressure of 150psi, an outlet pressure of 15psi (giving an expansion ratio of only ten) the MEP will be about 32psi. With a single cylinder, we require a structure capable of withstanding the 150psi of the inlet pressure. The result would be an extremely heavy, extremely large, high friction, very inefficient cylinder/piston/valve assembly. If, however, we divide this work between several cylinders we divide the pressure and temperature gradients by three for each cylinder thereby making them smaller, lighter and more efficient.

In a Woolf engine with slide valve or piston valve control on each cylinder, the inlet and outlet pipes, valves, etc. are the same pieces of metal. So the new charge of hot steam is cooled by this metal which itself has been cooled by the previous expanded steam just vented. A significant loss of efficiency occurs here. Also, as with all slide valves driven by an eccentric, the valve operation is not instantaneous but occurs over a significant portion of the start and end of the cycle.

In a stationary engine where space is available a different valve gear, such as the Corliss, can be used. The inlet valves and the outlet valves are

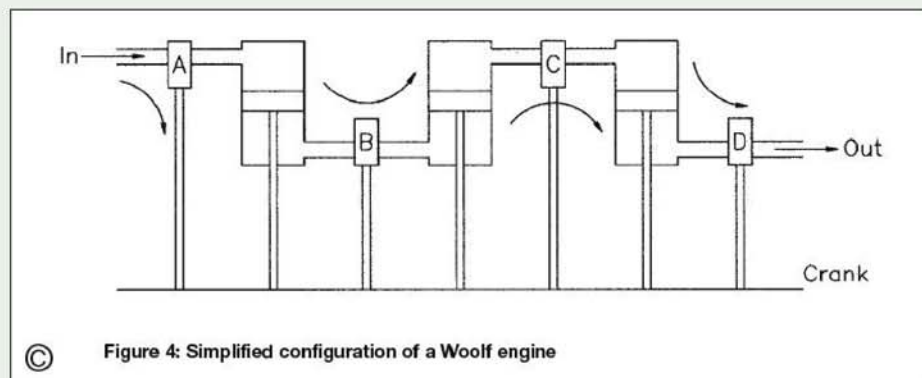


Figure 4: Simplified configuration of a Woolf engine





Two views of Peter Southworth's superb model of a Hawthorn Leslie 4,500hp triple expansion marine engine fitted with Marshall valve gear, patented in 1879 and derived from Hackworth valve gear. F. C. Marshall was a managing director of Hawthorn Leslie which built the ship Hanoverian launched in 1902 with a displacement of 24,140 tons and equipped with two full-size engines which the above model represents. Two 18ft. 6in. propellers drove the ship at 15 knots; it was sold to White Star Line in 1903, renamed Cretic and eventually scrapped in 1929.

separate, so the cold outlet valve does not cool the new steam charge. Where reversing is not needed, it is also easy to spring load the valve action to snap it open or shut at a particular point in the cycle. In such a stationary engine the receivers can be made large enough for the input to the receiver from the previous cylinder, and the output to the next cylinder from the receiver to have little effect on the receiver pressure (see below). Thus, each cylinder is operating at a near constant inlet pressure and a near constant back pressure. It is almost like having three simple engines with three boilers, except that the same steam charge is passing through all three.

It is fairly clear that we arrange to divide the work load equally between the three cylinders. Now, work done is equal to the expansions happening (as pointed out at the outset), so the trick is to make the number of expansions the same. As the number of expansions multiply — i.e. two in each cylinder equals eight overall as we saw at the beginning — the ratio we need is given by the cube root of the overall expansions for the whole engine:

| Expansions |                        |
|------------|------------------------|
| Total      | Per cylinder (approx.) |
| 10.5       | 2.2                    |
| 12.0       | 2.3                    |
| 14.0       | 2.4                    |
| 15.5       | 2.5                    |

In practice the expansions in the high-pressure cylinder are often a little less than this, while those in the low-pressure cylinder are a little more.

In a pure Woolf engine, shown in very much simplified diagrammatic form in fig 4, it is not difficult to see that the cranks must be at 0deg or 180deg for the system to work. The valve gear at 'A' admits the steam and cuts it off as required by the load. The gear at 'B', 'C' and 'D' is only to connect the inlets and outlets correctly for two-stroke operation and contributes no early cutoff to the second and third cylinders. The full charge of steam, as set by valve gear 'A' cutoff, fills the full stroke of the intermediate and low pressure cylinders. Such an engine requires that a small auxiliary engine rotates the main shaft for re-start

should the crank stop at dead centre, but this is no penalty since one is needed for start up from cold anyway.

In a receiver engine as in fig 5, the phase relationship of the cylinders is not limited to the opposites, and so it can be varied for optimum freedom from vibration, minimum stress on any part of the journals and bearings, equality of exhaust line, etc. Valves 'A', 'B2' and 'C2' can all contribute cutoff to their following cylinders if needed while 'B1', 'C1' and 'D' are only there for correct stroke connection. I do not propose to discuss this variation of cutoff of the last two cylinders here. It is concerned with load variations on the engine. It is one of the many interesting design exercises that appear at the next level down of investigation into these devices.

Three cranks at 120deg is the obvious and correct crankshaft layout, the only question being in which order to connect them. Wyllie favours high-low-intermediate while Mud favours high-intermediate-low. The first gives a generally horizontal exhaust line so minimising the size of the receivers, the twisting loads on the crankshaft, and most importantly the temperature range. I said at the beginning that some interesting facts emerge — see here where the disposal of the crank sequence affects the temperature range, of all things. The second increases the range of effective load and speed with a penalty in the other areas.

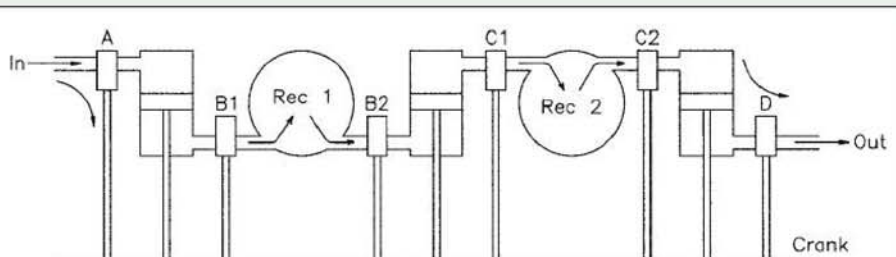
This load/speed variability is important where the load varies considerably, as for instance in a mine. Morrison shows that high-low-intermediate

feeds steam into the receivers at a compression rate of 19% which keeps the receiver pressure and therefore the temperature relatively constant. The high-intermediate-low sequence increases the receiver input compression to 37% and requires receivers three times the size to come close to a level pressure line per revolution.

Representing the configuration normally used, fig 6 shows a different diagrammatic layout for the stationary engines. The expansions and work theory are exactly the same, but the configuration is quite different. Two piston rods are used with two cylinders on each rod. Because of the large size of the low-pressure cylinder, it is separated into two cylinders which operate in tandem as one. The piston rods are set at 90deg on the flywheel arbor so the engine is self-starting.

As mentioned earlier, separate receivers allow for reheat of the steam between cylinders. Seaton showed that with this reheat, cylinder condensation is virtually eliminated under any conditions of operation, and particularly under light load, resulting in a more level power output/steam charge input graph. Two methods are favoured for providing this reheat. In the first, the boiler steam is superheated sufficiently to allow it to flow through the reheaters before reaching the high pressure cylinder while still being at a high enough temperature to be safely above any condensation point.

In the second system, the boiler steam goes directly to the engine input valve and separate reheater lines are run from the same or a separate boiler. Supplee opines that there is little difference



© Figure 5: Simplified configuration of a Receiver engine





This large engine is located in Trencherfield Mill, a museum at Wigan Pier. The cylinder at the lower left of this picture is for high pressure steam. The cylinder at the lower right is for intermediate pressure steam. The other two cylinders, which are for the low pressure steam, operate in tandem.

in overall cost as the higher cost of larger boiler superheaters in the first is balanced by the cost of the separate system in the second. It is more a matter of layout convenience and overhaul facility. A large penalty is paid by not using reheaters, so large a penalty that only the smallest of these big installations omitted them.

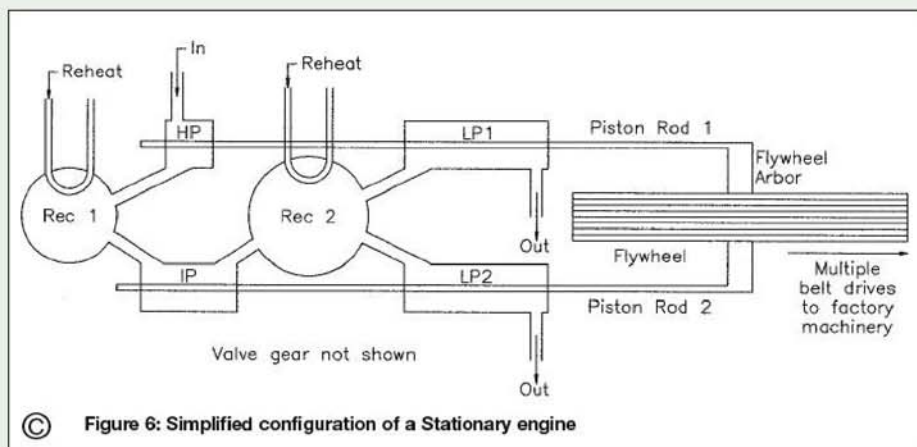
If superheating is not used then the temperature of the inlet steam has to be so much higher to obviate condensation anywhere in the cycle, resulting in the lagging being much heavier and cumbersome. Also a large amount of heat migrates from the heavy cylinders to their mounts producing local cold spots and giving potential condensation, among other problems.

Now we can turn to the physical realisation of these various configurations. With all multiple expansion engines the key parameters are:

1: The inlet pressure from the boiler and the outlet pressure both in absolute — this gives the number of expansions.

2: The size of the low-pressure cylinder. Everything relates to the low-pressure cylinder as the design always equates the expansions at each stage.

Starting from these two, and with the required power output discussed at the start, we can calculate such parameters as cylinder size, stroke and cutoff. As stated earlier, the ratio of expansions in each cylinder, and so directly the ratios of the cylinder volumes, is the cube root of the ratio of the total number of expansions needed at full power. Reduction of power can be by throttling, so reducing the inlet pressure with the same charge of steam, or it can be by varying the size of the steam charge (i.e. by cut off) at the boiler pressure. Both of these change the number of expansions used by the fixed engine size. Virtually all engines, Woolf or the Receiver type, use the same length of stroke for all cylinders. So



the ratio of cylinder volumes is the same as the ratio of the square of piston diameter. This assumes a constant ratio within each cylinder assembly of clearance, end cap volume, piston thickness, piston initial load and drop; which is very difficult to achieve and is usually run separately into the detailed design calculations.

Having balanced the work done in each cylinder under full load by making the expansions the same, the power output on lighter loads is reduced by one of the two methods mentioned above and the expansion balance, at least at the front of the engine, is disturbed. In a pure Woolf engine there is little to be done about it. In a modified Woolf engine with some small receiver volume, some correction is possible if the later valve gears are independently controllable, which is most unusual because of the complexity.

In a receiver engine, where each cylinder is fed independently from a relatively constant pressure source, independent adjustment of a full valve gear on each cylinder allows for full balancing of the expansions and work under all power demands. This inherent operating flexibility allows for piston diameters to be varied somewhat in design for structural optimisation.

Depending on boiler pressure, the ratios of total expansions can vary from 10 to 15 at full load to as high as 25 on light load. While there is complete agreement on full load conditions, various authorities have varying opinions as to the best cylinder ratios to accommodate this varying performance under reduced load.

Kent gives 1:2.35:5.53 for a boiler pressure of 130psi and expansions of 13 up to 1:2.71:7.37 for a boiler pressure of 160psi and expansions of 20.

Ball favours higher ratios with HP/LP as high as 1:8 or even 9. For marine Woolf engines ratios as low as 1:5 are found and justified in some circumstances.

|      | Boiler Pressure (psi) | Cylinder Ratios         |                  |                     |
|------|-----------------------|-------------------------|------------------|---------------------|
|      |                       | Terminal Pressure (psi) | Expansions (No.) | Cylinder Ratios     |
| Kent | 130                   | 10                      | 13               | 1 : 2.35 : 5.53     |
|      | 160                   | 8                       | 20               | 1 : 2.71 : 7.35     |
| Ball | 160                   | 8                       | 20               | 1 : 2.78-2.81 : 8-9 |

Once the ratio of HP to LP cylinder is decided, the cutoff in the HP cylinder is found, as it is inversely proportional to boiler pressure at any given load.

HP cut off =  $R (P_n / P_i) \times 100\%$   
where:

$P_n$  = terminal pressure

$P_i$  = boiler pressure

$R$  = HP/LP ratio

So, if  $R = 7$ ,  $P_n = 10$  psi and  $P_i = 150$  psi then:

HP cutoff = 46.7%

to give equal expansions and equal work in each cylinder under full load.

The horse power of an engine is fixed by swept volume per minute of the LP cylinder and by the mean effective pressure mentioned earlier.

Horsepower =  $(\pi D^2 / 4) (SR / 33000) (\sqrt{P_{ia}})$   
where:

$D$  = diameter of LP cylinder

$S$  = stroke of piston

$R$  = rpm

$P_{ia}$  = boiler pressure.

Disregarding frictional losses, operating inefficiencies, etc. this can be reduced to:

Horsepower =  $(D^2 SR \sqrt{P_{ig}}) / 8500$

where  $P_{ig}$  is the gauge pressure.

Note that the HP cylinder and the IP cylinder do not appear in this. They have already been set and are only a means of achieving the necessary expansions in a practical form.

We have come full circle and returned to the initial statement that the work can theoretically be done by a single cylinder of adequate size. In one sense it can be said that all we have done by using three cylinders and three steps of expansion is to make that theoretical single cylinder a practical proposition.

I have deliberately kept as much arithmetic out of this article as possible. Many more formulae need to be worked through before a practical design results. Cylinder pressure diagrams go a long way to showing what is happening at each stage of operation and are essential in laying down the starting parameters and checking the end result. To explore these would extend and complicate this article in which, as yet I have only taken a glance.

If this brief introduction is of sufficient interest, I may perhaps produce a follow-up which takes the plunge into the more involved mathematics.

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## Peter Spenlove-Spenlove

introduces us to a variation on the common roller chain.

On leaving school in the years before World War Two, boys might be sent to work in an engineering works to learn the trade alongside skilled, time-served men. I was one such lad and clearly recall that we had to do the job properly. At first, the work rate was not too important, however, at the onset of war in 1939, every hand had to be used to maximise production as part of the general war effort.

There was an upsurge in vehicle production, both for road and rail use and of tanks of all shapes and sizes in which to store materials; tanks, that is, for fluids not battles! These tanks usually required cladding with steel sheets and plates riveted onto angle iron frames. The main factory probably used dedicated punches and presses but in wartime sub-contracting factories and repair depots would have to mark out and drill rows of rivet holes. Light aluminium alloy skins on aircraft frames also needed long rows of rivets and repairs often had to be performed in the corner of some field in inclement weather conditions.

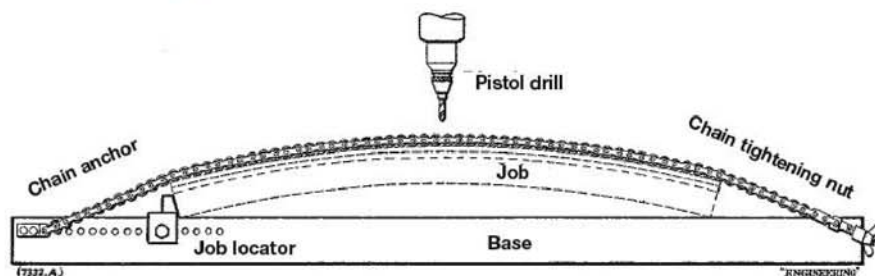
All manner of tools were devised to maximise output. One such tool was the 'jig chain' made by Renold, famous makers of transmission chains and sprockets. Renold realised that by replacing the sprocket sized rollers on each pin with much larger rollers of chain pitch diameter (minus 0.002in.) and a groove, the chain could be used as a drilling jig. The chain could be stretched taught to hold the work while a hand held pistol drill or centre punch guided by the semi-circular adjacent grooves could be used. These large grooved rollers were case hardened.

Chains with an anchor block at one end and a wing nut and screw at the other could be supplied in various lengths to standard pitches ranging between  $\frac{3}{8}$ in. to 1 inch. Rollers for three drill sizes were available for each pitch, as determined by the requested groove diameter.

The accompanying 1940 sketch shows a typical application. Industrial locomotives need a curved roof sheet mounted on an angle iron frame. A base unit with positioning blocks could be made and the jig chain tightened over the roof sheet and angle iron. Holes could then be drilled through for the rivets. Larger holes could be produced by using the jig chain to locate their positions by spotting through with the drill to suit the chain. The technique was very quick and simple and it is easy to see how the method could be extended to suit work on a locomotive or an aircraft wing. A trainee could do this work as accurately and almost as quickly as his master.

If this special chain is not available, it is still possible to use a standard chain. It would be necessary to make up some suitable end fittings and a rectangular steel block made to fit in the space marked 'x' shown in the accompanying drawing. This block would need to be drilled centrally to suit the pilot drill in use and hardened to withstand wear.

# THE RENOLD JIG CHAIN

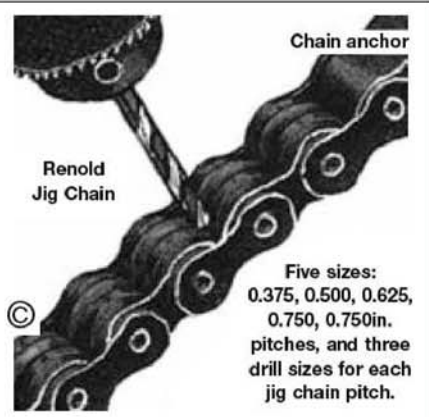


©

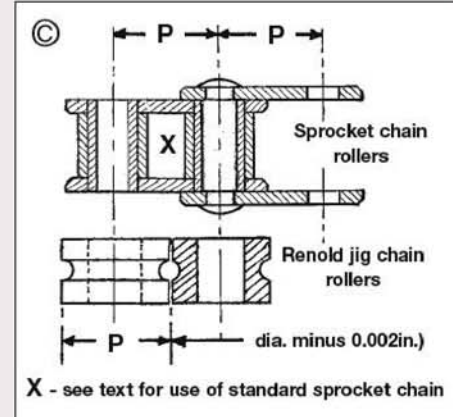
From Engineering, 19 July 1940

Clearly, the jig chain can only be used to clamp and drill convex and flat work with care and it is as well to use small clamps to hold the chain in place at two or three locations, or to drill a few

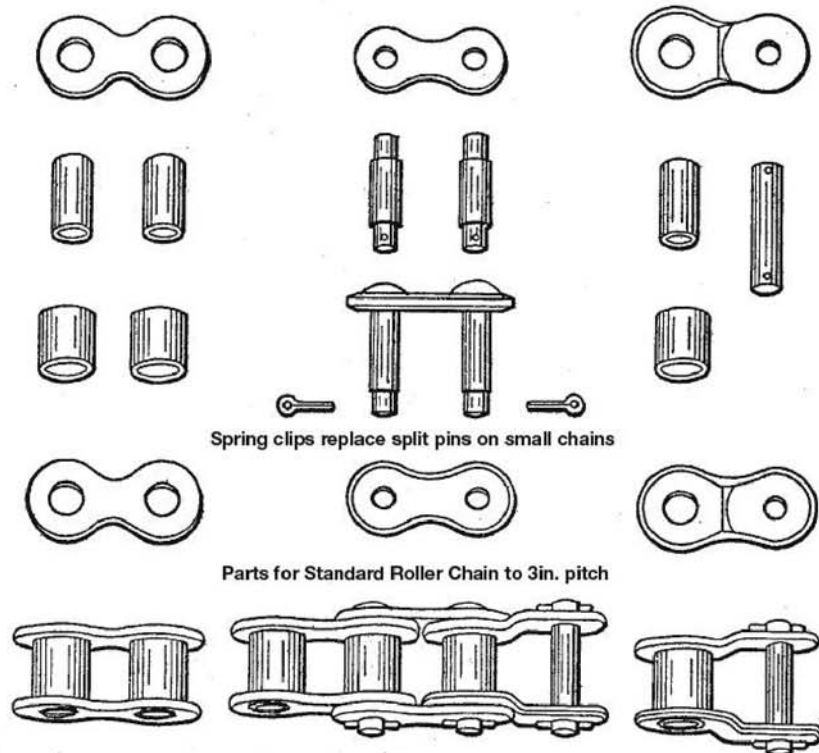
initial holes for screws and nuts before drilling the remainder. The method eliminates elaborate marking out and facilitates the drilling of a nice straight row of rivet holes or whatever. 



©



X - see text for use of standard sprocket chain



©



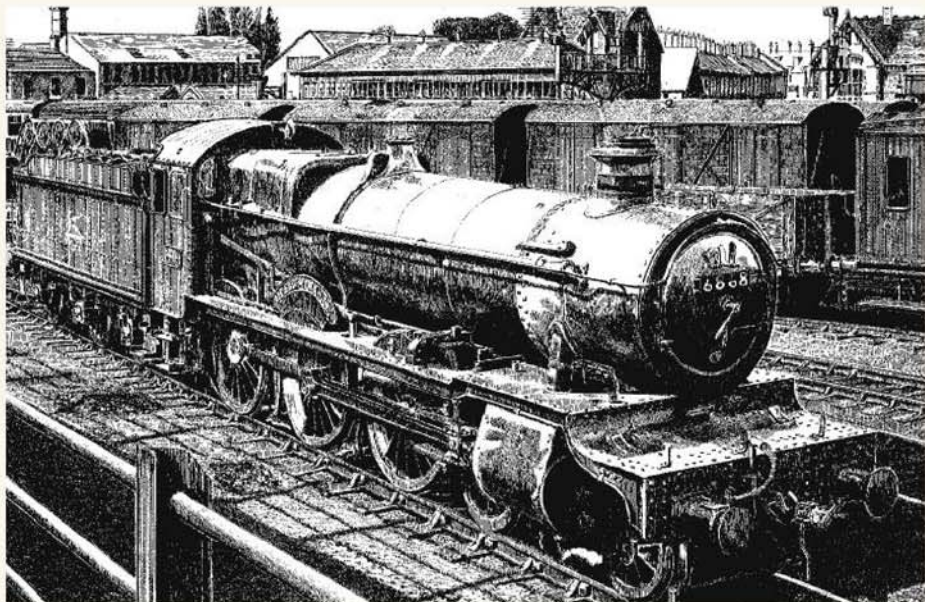
## Neville Evans

discusses the cylinders for both full size and miniature locomotives.

●Part VI continued from page 504  
(M.E. 4220, 30 April 2004)

The Grange and Manor cylinders are, as most people know, unique to these locomotives. The only difference between them is that the smoke box saddle, which forms half of the casting, carries a smaller smoke box in the case of the Manor, due to the smaller boiler used by these locomotives. The cylinders of the two locomotives however, are identical, having been cast from the same patterns. The Great Western, cunningly enough, was able to add different smokebox saddle patterns to the appropriate cylinders. As the cylinders were not inclined to the centre line of the motion, one pattern sufficed for both left and right hand cylinders, and one set of jigs and fixtures was sufficient for the machining thereof. It's called 'engineering'.

There are probably as many theories as to why the valve and piston rod centres were moved apart by a further 2in., as there were locomotives. I have heard that it was because the motion of



# PENRHOS GRANGE

scrapped Churchward Moguls was used complete, and therefore the valve chests had to be lifted by 2 1/2in. to accommodate the fact that on the Moguls the cylinders were 2 1/2in. above the centreline of the motion. This won't wash

however, because the increase in dimensions on the Grange cylinders is from 15.625in. on the Hall to 17.625in. on the Grange, which is only 2 inches. There is also the fact that due to the rocker arm and the die block hanger link being parallel to one another and the same length, you can place the pivot for the rocker arm anywhere within reason in the front end of the engine. It just means that the valve rod has to be shortened by 3/4in. or so.

I am firmly of the opinion that the drawing office staff at Swindon took the opportunity to improve the cylinders by modifying the steam chest. They managed to enlarge it slightly as can be seen by the accompanying art work, and also to separate it from the fluctuating temperatures of the main bore. It is possible that because the increase in the length of the steam passages had the effect of increasing the clearance volume of the cylinders, the locomotive became more sweet running than the Halls. One thought that does intrigue me however is that in cylinder design, Hawksworth's two main line engines, the Modified Halls and the Counties, reverted back to the earlier Halls, although of course the cylinders were bolted on to the mainframes and were separate from the saddle in these two magnificent classes.

## The model cylinders

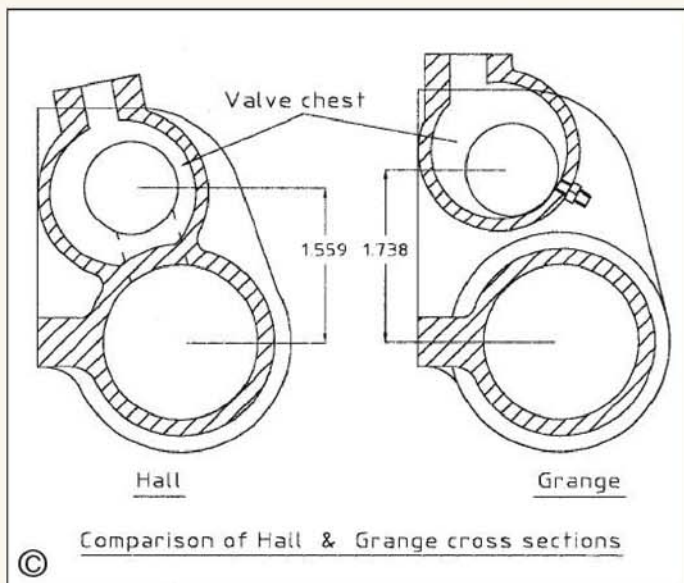
I have taken the opportunity afforded by modern pattern making techniques to completely redesign the cylinders in an effort to bring them out of the 'drilled passage' era. Following the lead established by Trevor Shortland and Doug



Manor cylinder; note the cleading.



Rear view of Manor cylinder; note the round valve rod and glands.



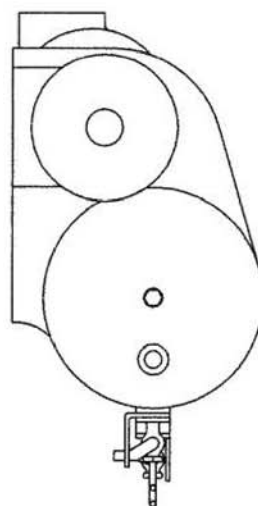
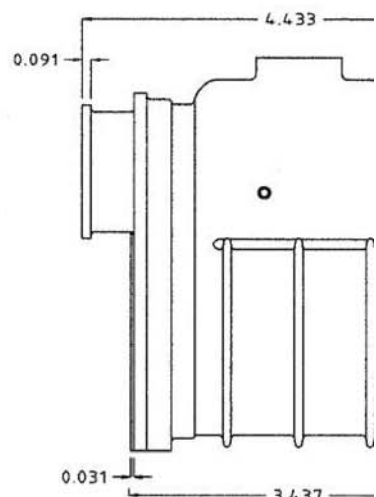
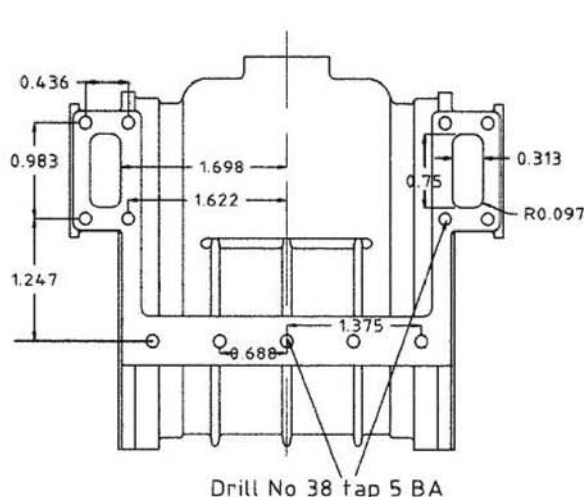


Hewson among others, Dr. Peter Thomas who is a director of Polly Models and Bruce Engineering, and also one of the pioneers in the design and manufacture of CNC machining centres (what else can you call them? — they are neither a lathe nor a milling machine although they perform the functions of both) has undertaken to produce the patterns for the Grange cylinders to modern standards, and I would expect the first castings to be available by the time this article is in print.

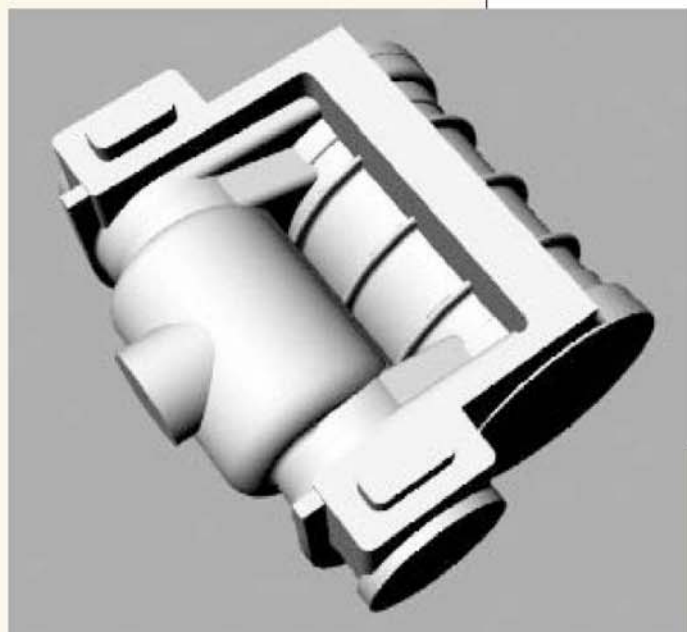
Despite the protestations of they who hunger and thirst after absolute authenticity, I have resisted the temptation to cast these cylinders complete with saddle as per the full size engine. It is far more sensible to follow the lead of the Great Western Railway, with the Modified Hall and the County, and to use the bolt-on cylinders and saddle as three separate parts. In the smaller sizes we have the obvious and compelling reasons of cost and ease of machining, I am certain that the appearance of the locomotive will not suffer in the slightest, which is after all what we desire.

A convenient feature is of course that we can now make another design for cylinders which will fit the other five locomotives in this series, that is: Saint, Court, Hall, Modified Hall and County, as well as any other GWR outside cylinder locomotive that uses a 30in. stroke. Please note that I have followed the lead of the Great Western Railway in naming the Saints and the Courts, as separate classes. The Saints had cylinders 2½in. above the wheel centre line. The reason for this was that Churchward had originally standardised the layout of his larger super locomotives on the 2800 class, the 2-8-0 heavy freight engine, and the other locomotive that used a No. 1 boiler.

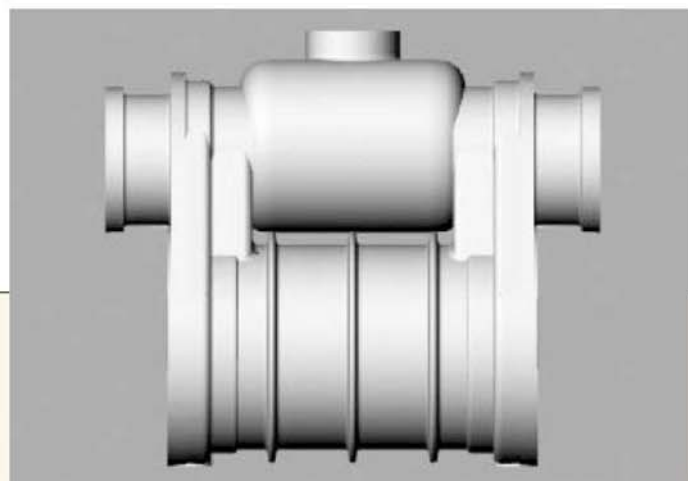
The cylinders of these hugely powerful locomotives with their small wheels, had to be raised to clear station platforms and other obstructions. To economise on pattern costs the earlier 4-6-0 express passenger engines used the same cylinder and smokebox saddle castings as did the 2800s, which perforce meant that they too had elevated cylinders. That's the accepted theory anyway, the actual gospel truth seems to have been buried in the sands of time, leaving



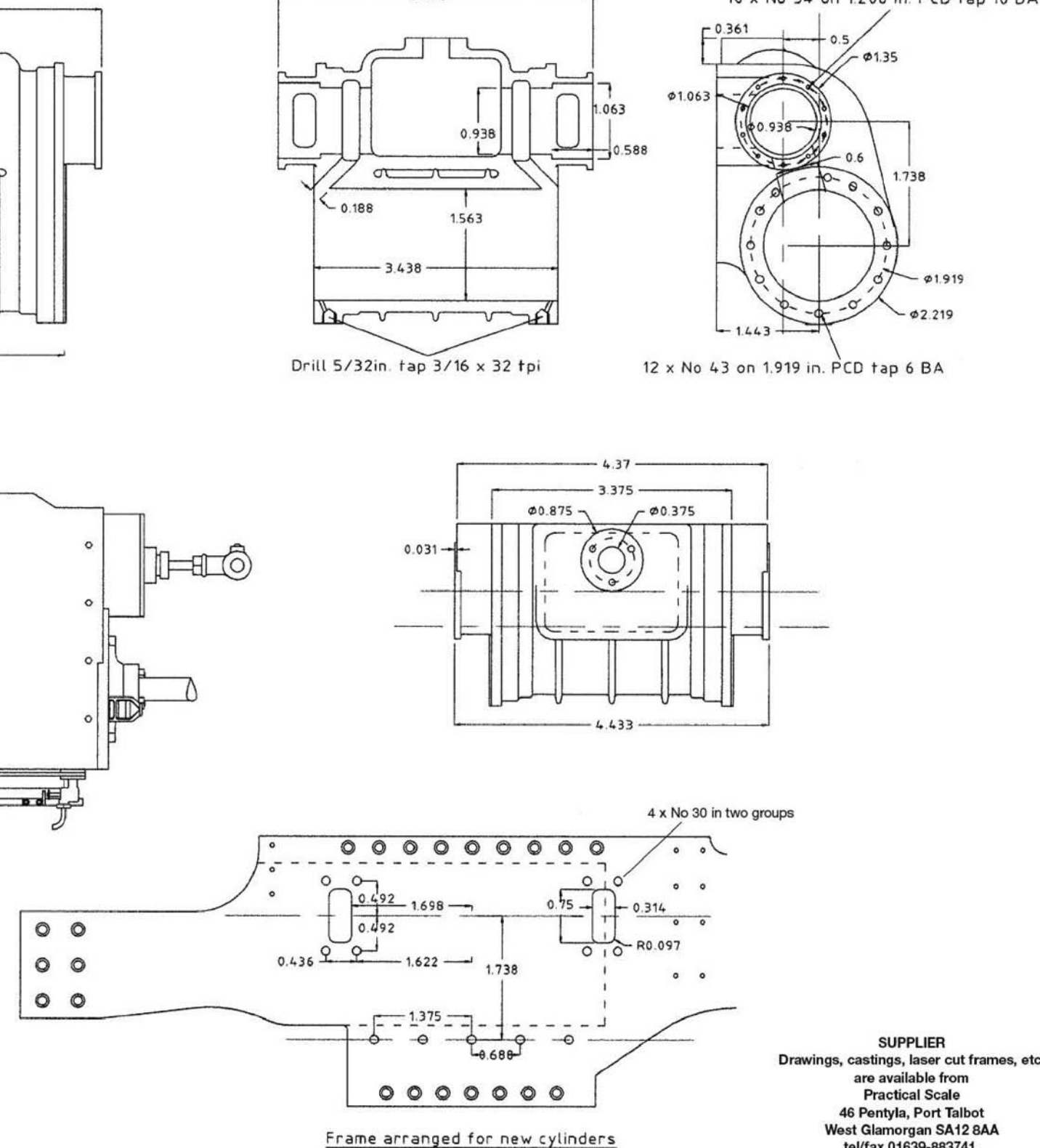
Complete assembly with cleading



Dr. Peter Thomas' computer images of the Grange cylinder pattern showing (left) details of the rear face and (below) a front elevation. Note that no core prints are shown.







CYLINDER BLOCK & MAIN FRAMES

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

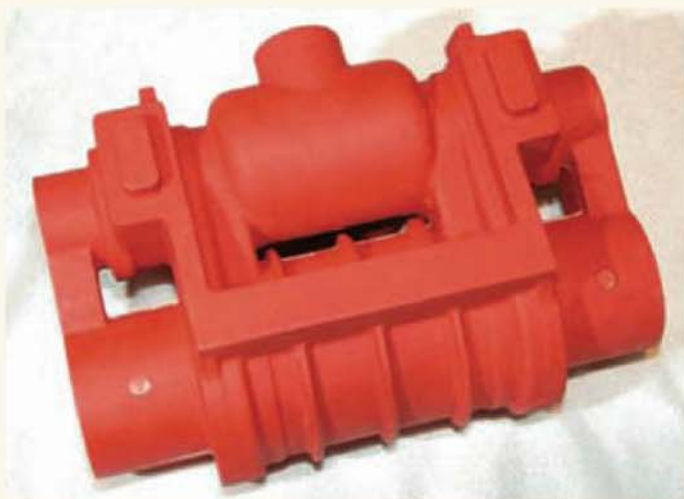
only intriguing conjecture. With the Courts, for the first time, the cylinders were dropped onto the centre line of the coupled wheels where they remained until the end of the 4-6-0 on the GWR.

As many people will know, the next projected series will be on the Maunsell Schools class. One

of the problems with multi cylindred 4-4-0s is that of positioning the centre of gravity so that the locomotive isn't front heavy. Mike Smart, with whom I'm in frequent communication (no point in having an oracle around if you don't consult it) produced a magnificent Midland

compound about 30 years ago, identified the problem prior to running into it and solved it by machining off large lumps of amorphous casting. While this proved to be the answer in the short term, when we come to a published design of the 21st century, we obviously have to do a bit better. ►





Penrhos Grange cylinder pattern. This view shows the rear of the cylinder.



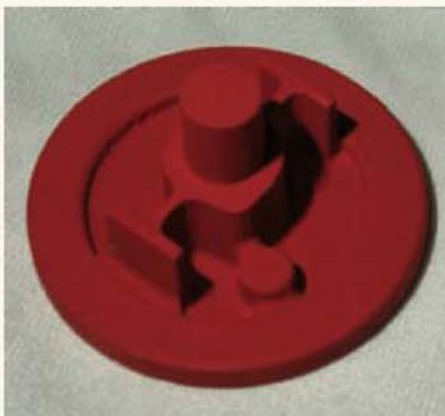
Penrhos Grange cylinder patterns with core boxes and rear cover.

The problem is to get the centre of gravity as far aft as possible, between the two coupled axles. The first thing to do is to reduce the thickness of the various cylinder and valve chest walls to a reasonable figure, just as I have done with the Grange cylinders. Over the last few months however I have come to the conclusion that heat treated LM25 aluminium alloy, as I used for decades in the construction of motorcycle engines, would fill the bill wonderfully well. I was looking at a motor that I built 20 years ago just the other day. It's been used for racing and road work, developing about 50bhp. It has never had a spanner laid on it and the inside of the crankcases were still highly polished as if they were new. This finish, incidentally, was straight from the tool. The bearings were tight, there was no corrosion anywhere, not even where stainless steel fastenings had been screwed in. The iron barrel liner retained its original tight fit in the aluminium alloy barrel muff and basically the little motor should have been left alone for another 20 years.

I have therefore decided, as an experiment, to have a set of castings from the Grange patterns cast in LM25 aluminium alloy and to heat treat them as for the motorcycles. I shall use valve and cylinder liners of phosphor bronze tubing, which is commercially available in appropriate sizes at about £40 per metre for the main bores, or £1 an inch, if you prefer. I'm using an aluminium alloy piston and PTFE rings with an 'O'-ring underneath. The ring will have a staggered joint, to reduce leakage and should reduce friction to a minimum. The normal production batch will of course be in cast iron as is the usual practice, using cast iron rings either of the 'Clupet' variety or single rings from cast iron.

The passages on the full size locomotives run straight down from the valve liner ports into the main bore and therefore are as short as possible, helping to reduce clearance volume to a minimum and minimising internal resistance. In our smaller application I have angled the passages so as to make it easy to clean them out with a thin file or somesuch. This also has the effect of moving the ports a bit closer to the middle of the cylinder, thus enlarging the volume available in front of the valve where exhaust steam at low pressure has to find its way out and up the blastpipe.

The valve chest itself is practically scale size and should contain a handy volume of steam, ready to be used. These cylinders are based on Keith Wilson's highly successful work. A few years ago, at the Cardiff track, I can



Penrhos Grange rear cylinder cover patterns.

remember watching one of his GWR 4700s (the huge mixed traffic 2-8-0) in 7<sup>1</sup>/<sub>4</sub>in. gauge, slowly following its driver as he walked back to the steaming bay, like a faithful hound at its master's heel, almost silently and with perfectly measured exhaust beat. I can remember thinking that here was a lovely piece of valve gear and cylinder design work. Imitation is the sincerest form of flattery.

### Machining the cylinder castings

We can make a start by machining the bolting face of the cylinder. I hardly need stress how important it is to make sure that the back face of the cylinder block is machined absolutely square and flat. Peter has therefore left the minimum amount to clean off this face. I am simply going to hold my block flat on the Linisher table for a few seconds to remove any excess metal, and leave it at that. Those who wish can hold the block in the milling machine and use an end mill, or use any other set up that comes to mind.

While on the subject of lathe work in general, could I please heartily recommend that old faithful *The Amateur's Lathe* by L. H. Sparey. Originally published in 1972 (ISBN 0-85242-288-1) it is still available for £8.75 plus post and packing from Highbury (call 01689-886660), Camden, and elsewhere, and has never been surpassed as an essential reference book. All beginners should have a copy and Deryck Goodall, who is by no means a beginner, constantly refers to his de-luxe, bound volume.

The next operations deal with the two main bores. The cylinder bore and the more complex valve liner holes have to be parallel to one another, within reasonable limits. Actually it's hardly a matter of life and death if they do

diverge by a small amount. My normal method is to mount the offending article on the saddle of the trusty Super 7 and to use the heftiest boring bar that I can get through the hole. The slight snag is that one must be very careful not to squeeze the cylinder too hard with the clamp that has to go over the top, with the obvious result that the bore finishes up slightly oval.

No matter, as I then repair to my pal Idris up the road for a half hour chat while we lap the bore round and true. All very well if you have these facilities to hand. The idea of light alloy cylinders however has set me on another path. Due to the light weight of these artefacts and the fact that I intend to line them with phosphor bronze tube, I'm going to use an angle plate mounted on my big face plate. The advantage is that I can maintain a more accurate bore straight from the tool, because the boring tool only has downward pressure exerted on it. Other bonuses include the ability to clean up the important back cylinder cover flange so that it is at exactly at right angles to the bore. The complete assembly can then be moved on the surface plate to bore the holes for the valve liners and covers.

The cylinder liners themselves will be turned in two halves from one piece of tube. I shall follow my established practice of leaving one thou. clearance between liner and casting and assembling with Loctite or similar. The notches at the ends can be finished dead square and streamlined off inside to taste, and a slight taper can be worked in to facilitate assembly and to enable rebore to be undertaken without having to make new covers. This last operation is at the discretion of the builder, as I've never had the slightest trouble in fitting rings in even the smallest bores, and the great thing about a separate liner is that you can always press it out and fit a new one.

### Frame modifications

It will be noticed that I've included a detail drawing, showing the extra holes necessary for mounting the new cylinders. The standard lasercut frames will now be supplied by Bruce Engineering (who incidentally will in future be handling all the drawings and castings for the two Highland locomotives, as well as the Schools), and can be used unchanged. Just ignore the hole in the middle which is covered by the cylinder block anyway.

●To be continued.



**David Lloyd-Jones**

urges us to enjoy the experience of finding out for ourselves, but warns us to take nothing for granted!

**T**here comes a time in many model engineers' lives when curiosity gets the better of them and they want to know more about a certain steam locomotive, traction engine or stationary engine. This quest for more and more information on a particular subject requires an enthusiast to indulge in the ancient art of research. The very mention of the word 'research' sends most people in to a state of deep shock, reminding them of their school and university days, poring for hours and hours over a pile of dusty old books in a dingy library.

Doing research for your own pleasure, instead of as a necessity, is a great deal different and the simple satisfaction of one's own curiosity can be very rewarding. The answers to many questions are available through the traditional media such as magazines, books and video, but more recently, that great invisible online encyclopaedia on the worldwide web has also become a vast source of information.

But where to start? There are mountains of information to sift through, and not all of it is historical steam era material as might first be expected. A lot of today's modern image is available which, in a few years down the line will itself become historical material, too. Whether concerning pre-grouping, the big four, post-war British Railways, up-to-date privatised railways, broad, standard or even narrow gauge, a little prototype research will reveal much more about these subjects.

Some information is easy to find, although other aspects of research can involve quite a chase. For example: what colour were your local council steam rollers in the 1950s? The actual location of a picture of one in your local town, and finding it in colour during that period can be quite a challenge. But, when something is finally unearthed there results a great feeling of accomplishment.



*A classic, timeless photograph of The Isle of Man Railway's engine No. 12 Hutchinson coaling at Douglas shed. In fact, all that betrays the true date of the photo (17 April 2000) is the barcode label on the foreground oil drum!*

## THE ART OF RESEARCH

Fortunately, we humans are naturally curious and love to find things out. Research itself can entertain us, even those frustrating dead ends and situations when one answer to a question quickly leads us on to even more questions. And finally, when we do succeed in tracking something down, such as the exact shade of reddish-brown used on the Lynton & Barnstaple carriages in 1893, or the correct rivet patterns on the side of a certain make of traction engine, we really feel as if we have achieved something.

If you're willing to give it a try, research can be lots fun. What follows are notes about some

of the material available to model engineers, and the best ways of using this information. Nobody can possibly know everything about even one railway — although you will meet a few that probably think they do! — so what is really important is knowing where to look for answers to all your questions.

### Books

In last 20 years, there has been a real explosion in transport publishing. More information and previously unseen photographs have now appeared in print than ever before. High quality modern



*Left: railway museums provide an excellent resource for research on full size subjects. Seen here at the Port Erin Railway Museum on the Isle of Man is No. 4 Loch, a locomotive of 1874.*

*Above: No. 4 Loch's chimney - detail views such as this are invaluable when building a model.*





Those who seek detailed information concerning artefacts relating to their chosen topic will usually find examples in one or another of the specialist museums around the UK. These groups accompany the large exhibits at Port Erin on the Isle of Man.

scanning and printing techniques have allowed early colour pictures of the various forms transport to be reproduced to match the exact colours viewed by the original photographer.

There are very few transport subjects that have not yet appeared between hard covers, and several titles on the same subject will often be found. This leads us on to one of the most important tools in a researcher's arsenal when in the search for the truth — cross referencing.

As you read through a couple of reference books on the same subject, you might come across a conflict between dates, names or other details. One book might quote 1 July 1873 as the date of the opening of a railway, while another might give it as 30 June 1873. Three books might have the same date while a fourth has a different date. Which is correct?

It has also been known for an error to be repeated by an author of a later book, who has used the earlier book as a reference source. In these cases, a researcher has to resort to other means, such as searching through contemporary newspapers in a local museum or library to verify and authenticate the source. It becomes the model engineer's version of the *X Files* — the truth is out there and it's your job to find it! In this respect, money spent building up a decent railway book collection on your favourite locomotive or make of traction engine is money well spent.

## Magazines

You doubtless noticed when you picked this magazine off the rack, that there are lots of other transport titles. Steam, modern, narrow gauge, industrial vehicles, overseas, trams, historical, modelling, etc. You name it, and pretty much every transport subject is covered by one or more magazines. Nobody can read them all, let alone afford to buy them all! Most people have a few which they buy on a regular basis and odd ones they purchase occasionally as and when a particular issue contains information they require. You may even have noticed that reading magazines in newsagents has become a new national pastime — some 'customers' even having the audacity to note down information from magazines in the shop.



Some pretty unusual and useful material can be found in magazines. Many features go into great detail on subjects which otherwise would not find their way into books due to limited information or interest. However, there are problems associated with searching through large numbers of magazines for old features and drawings. Many magazines don't have a proper index systems, and those that do, the information might only include the title of an article, which may have little or no real relevance to the feature.

Collecting magazines doesn't come without its difficulties either. First, they take up a great deal of valuable living space and secondly, they weigh very heavily indeed. My own personal answer to the space and groaning attic floorboards problem is to cut out the sections that I think might be useful for future research and place them into a file. The remaining 90% or so of the magazine, which probably contains a lot of advertising, is simply consigned to a local paper recycling bin.

## Videos

While colour pictures in magazines and books are a wonderful source of information, moving action in colour is even better. Running alongside the boom in book publishing has been flood of material on video, and more recently on DVD. Much contemporary and vintage footage has been made available.

Perhaps, one of the more enjoyable ways to carry out research is to sit in your favourite comfy armchair with a VCR remote in one hand and a pencil in the other with a pad handy and ready to note down something that can help your quest. If you miss it, it is a simple matter to pause and re-wind the tape or disc. Video research can take rather longer than say, reading a book or a magazine, as you may end up simply watching the trains or steam engines go rolling by. If you have recently joined the growing trend and purchased a DVD player, you may find the number of titles to be very limited. However, its popularity is growing daily, and soon many new films will only be available on DVD as VHS video becomes as obsolete as steam locomotives.

## Company material

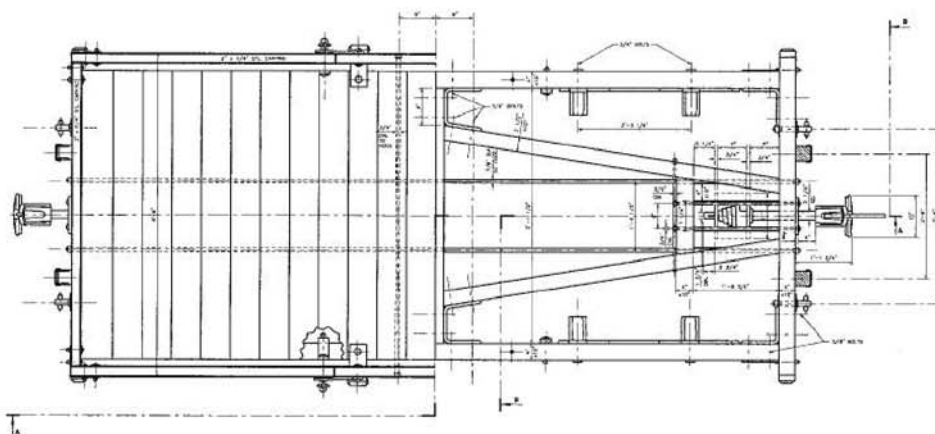
Another away to glean important information is to go to right to the source. Material published by manufacturers, whether for their employees or customers, can be of immense value. Old company timetables, rule books, tickets, drawings and even accounts and records of minutes of meetings can provide us with masses of facts and figures.

## Historical societies

One of the main reasons for the availability of so much information to researchers these days is the growth of historical societies which have preserved and published a mass of material. Published on a regular basis, their newsletters, magazines and books are of great assistance to the enthusiast. Many also now have websites full of online information, discussion lists and newsgroups.

Often, a good place to start research on a given prototype is to join such a society and participate as much as you can. It appears that there is a historical society for nearly every type of transport, but if you can't find one for your particular traction engine, locomotive type, etc, find out if anybody is interested in forming a society to provide mutual help by gathering information on that prototype. Being pro-active will reap many benefits in the quest for information.

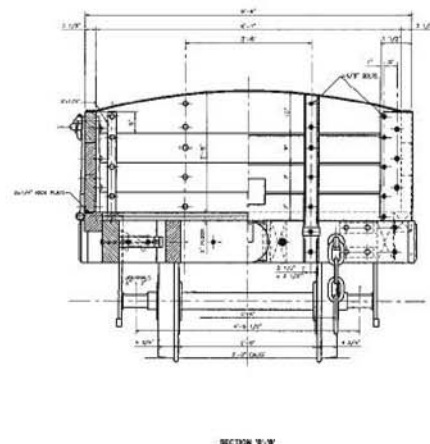




This drawing of an Isle of Man H wagon, the originals of which are long gone, was produced by The Isle of Man Steam Railway Supporters and prepared by David Booth who researched and built a full size replica of this vehicle a few years ago.

#### GENERAL ARRANGEMENT OF ISLE OF MAN RAILWAY 'H' WAGON OF 1873

Scale 1 1/2 Inch to the Foot  
David Booth 22.12.1996



## Transport museums

Museums of transport are an absolute must for research. There are numerous railway and industrial museums located all over the UK. Here you will find actual preserved stationary engines, traction engines, steam locomotives and rolling stock along with collections of old photographs, documents and other memorabilia. But of course, for model engineers, the key places to visit, regardless of your particular interest is the National Railway Museum in York and the Science Museum in London.

## Online research

The newest form of research involves 'going online' and searching the massive invisible archive of the Internet. If you can name it, you will find it on the web. Sites range from extremely professionally produced pages to enthusiast's own personal home pages, but all can be equally as interesting.

However, while the web seems to have the answer to just about everything, a careful researcher will be wary about relying on information from these pages, because many sites are neither edited nor checked for accuracy. That said, many historical societies and modelling associations now have their own web pages, complete with online information and links to other useful sites.

Those new to computers and the Internet often find it frustrating trying to find the information they seek using search engines such as Google, Lycos or Alta Vista. There is a definite knack to using a search engine to gain the information quickly. The secret is in defining the search so as to cut down the number of webpages identified

and through which you then have to trawl.

The simple expedient of typing 'UK' before your inquiry restricts the search to UK sites only. Putting speech marks around a question, i.e. 'Beyer, Peacock locomotives' will reveal only those sites which contain that exact string of words. It is useful to know that by re-defining your question, i.e. 'locomotives built by Beyer, Peacock', will give a completely different set of results.

Perhaps once you have completed your research on one subject, you might consider sharing all the information you have gathered with other modellers by creating your own website and getting your own little piece of cyberspace.

You may find the following few sites useful to get you started:

[www.google.com](http://www.google.com)

One of the best search engines on the net.

[www.hmrs.org.uk](http://www.hmrs.org.uk)

Historical Model Railway Society.

[www.nrm.org.uk](http://www.nrm.org.uk)

National Railway Museum, York.

[www.link-rail.com](http://www.link-rail.com)

Loads of useful links to other railway sites.

[www.nmsi.ac.uk](http://www.nmsi.ac.uk)

Science Museum, London.

## Hot tips for researchers

### Right under your nose

The obvious could be right under your nose. Check out your local public and university libraries which often have surprisingly large numbers of transport books and magazines on their shelves. Don't forget that your local public library may be able to get the title you are after through the inter-library loan scheme. Libraries often contain a good source of useful

old documents and photographs in their local history collections.

## Others with a similar interest

Seek out others with a similar interest; they may have already found the answer to your questions and offer a great shortcut to achieving your personal quest. They can be found through historical societies and by writing letters to appropriate magazines asking for assistance. Most people are friendly and more than willing to help. Many long-term friendships have been struck up through the search for more information.

## Invest some time and money

Be prepared to spend money on building up a personal collection of transport books, photographs and videos on your chosen subject. Be prepared for travel to a railway line, museum or other location which houses an important piece of equipment in which you are interested, to take a noticeable chunk from your bank balance!

## Be patient

Some information can be found easily while answers to other questions may take an entire lifetime to seek out and find. Learning about the prototype is a process, not a project — the more you learn, the more you'll probably want to know.

## Conclusions

I've only briefly scraped the surface of research and hopefully this feature will encourage you to start chasing after and finding answers to those questions. Research can be very addictive and once started, it can be very difficult to give up. You have been warned!





# ROAD STEAM

**Martin Wallis**

takes a look at the development of this company's other products.

● *Part II continued from page 509*  
(M.E.4220, 30 April 2004)

The first of these two articles was devoted to Thomas Aveling and his most famous product, the steam roller. This time we will look at other products designed and manufactured by this prodigious Kent company, starting with some Self Moving Portables.

By 1850, portable engines were becoming increasingly common on larger farms and country estates for driving assorted farm equipment. To move these, teams of horses were employed. It is not known exactly who first had the notion of making the portable self moving by taking the drive from the crankshaft via a chain to a wheel, but it is evident that Thomas Aveling was among the pioneers. His first engine, a portable purchased from Clayton & Shuttleworth, was delivered to Rochester in 1859. The engine was fitted with a wooden front axle on a central pin, and a horse in a single pair of shafts ahead of the engine provided the steering. The wheels were probably replaced by more sturdy examples and the chain sprocket bolted to the inside of one of the wheels.

Just a year later in 1860 Thomas Aveling built his first engine, which was very similar in most respects to the Clayton & Shuttleworth, except that the horse steering was dispensed with in favour of a pilot or fifth wheel steering (photo 1). Several engines were then built, the design being improved each time, the most notable development being moving the cylinder from a position above the firebox to a forward location on the boiler

barrel behind the chimney. Such an engine is illustrated in photo 2.

Leaving the undocumented Victoria Colliery engine mentioned last time to one side, the oldest surviving Aveling is No. 721, completed in October 1871. The engine was purchased by the Road Locomotive Society in the 1950s from the late Herbie Naylor's yard in Lower Fant Road, Maidstone, restored by Aveling Barford, and lodged in the Science Museum in South Kensington. I remember it being there for a great many years but on my last visit the venerable old engine, along with *Caerphilly Castle*, and seemingly the vast majority of their antique machine tool collection, was no

longer evident. I am, however, now advised that No. 721 is now back on display.

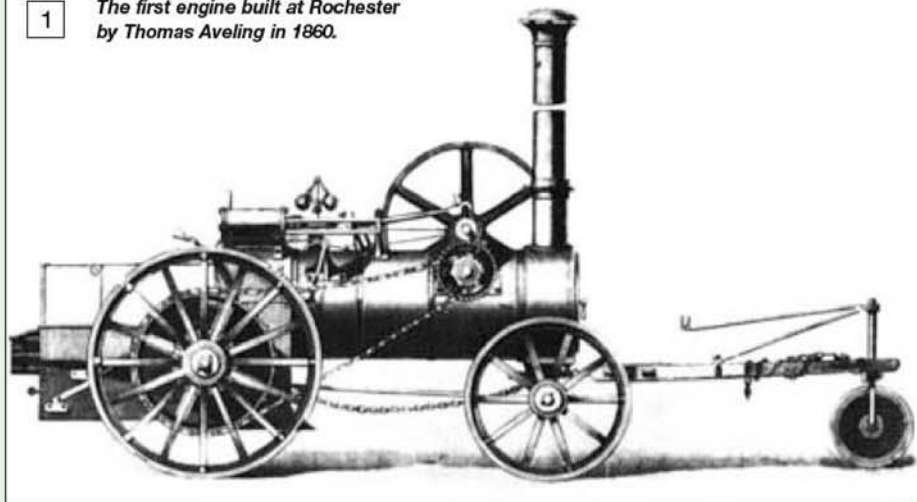
## Hornplates

Apart from the development of the steam roller, Thomas Aveling is known for inventing the hornplate arrangement on boilers. Previously all the bearings and shafts were held in cast brackets which bolted to the sides or the barrel of the boiler. All the jarring from the road, and the forces from the motion and gears, would be transmitted through the nuts and bolts which would inevitably fret and eventually leak. The hornplates arrangement has the sides of the outer firebox extended backwards and upwards to give flat plates to which the bearing brackets and the spring gear (if fitted) could be bolted.

The Aveling & Porter Catalogue of 1909 claims the credit accordingly:

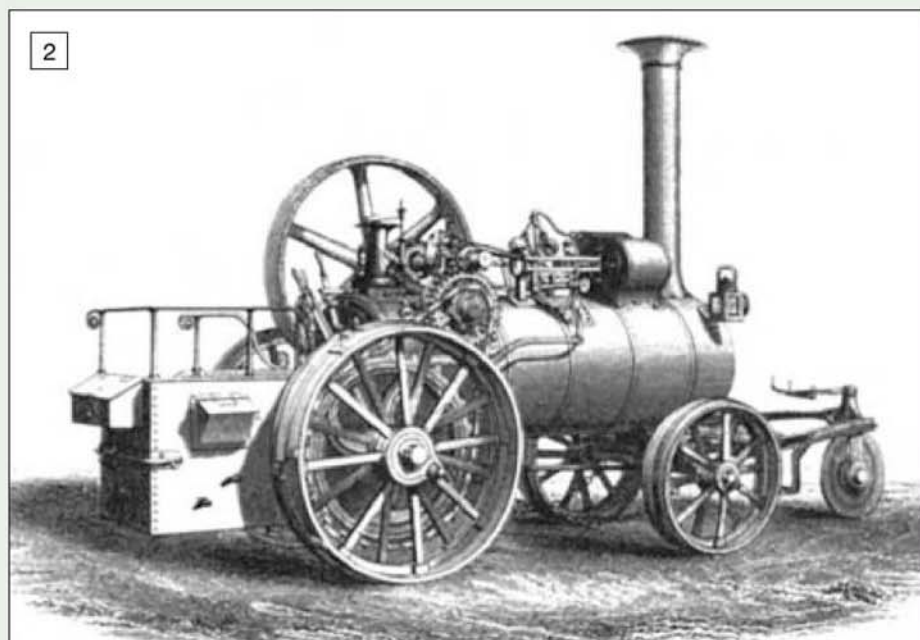
*"It was the universal practice up to recent years, to mount the principle working parts of locomotive engines on cast or wrought iron brackets bolted to the boiler, and the strain thrown upon the boiler by the unequal working of the crankshaft, counter shafts, and driving axle always manifested itself sooner or later in leakage at the numerous bolt holes, and in corresponding corrosion of the boiler plates. The greatest skill and care were not able to mitigate the consequences of this defect of construction until Aveling & Porter patented the arrangement of brackets since fitted to all of their engines, which entirely overcomes the evil referred to, and at the same time provides more stable and convenient bearings for the working parts of the engines than under the usual system of construction. By prolonging the side plates upwards, perfect brackets are formed without the necessity of bolting them to the boiler, and these brackets are so shaped as to carry the bearings of crankshaft, counter shafts, and driving axle, and, therefore, to effectively relieve the boiler from their strain."*

1 The first engine built at Rochester by Thomas Aveling in 1860.



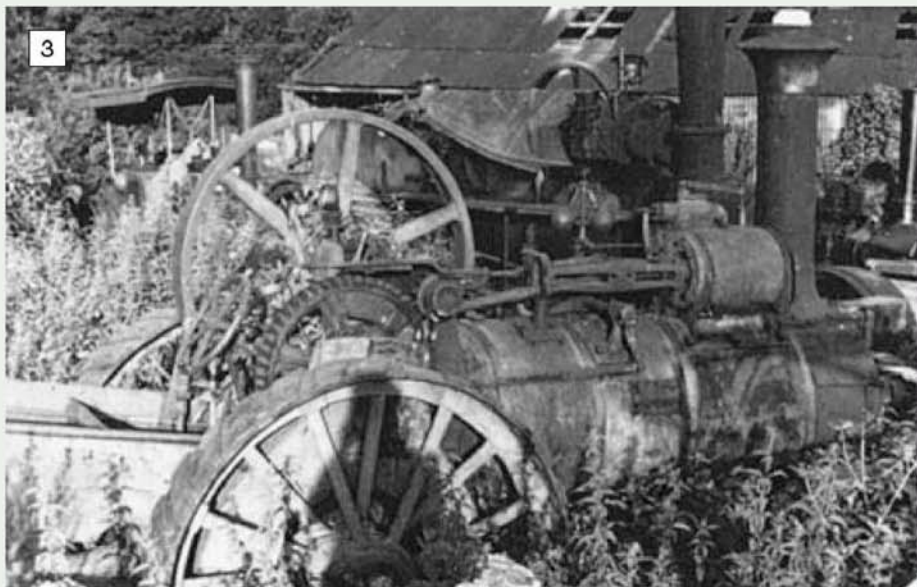
## AVELING & PORTER SOME NOTES ON A COMPANY AND ITS PRODUCTS

2



By 1866 the cylinder had moved to the front but the engine still retained the fifth wheel tiller steering. The chimney cap is particularly elegant.





One of the oldest traction engines to survive is this Aveling engine No 721 of 1871. Note the early style governor and that the spokes are cast into the 'T' rings.

### Compounding

While the compounding arrangement was not invented by Thomas Aveling, he was the first to fit it to a traction engine, with all the associated increases in efficiency and savings in fuel and water that resulted. Sadly, Thomas Aveling died before the system was fully exploited, and it was Thomas Lake Aveling who put it into full production.

On the subject of compound engines the Aveling & Porter Catalogue states:

*"There is no doubt that they are growing in favour, and deservedly so, for their advantages over single cylinders are really pronounced, and far outweigh the single disadvantage of greater first cost. Their comparative silence, steadiness, and economy of fuel while working are indisputable. They can be, in general, recommended to buyers."*

It seems the first Aveling compound had tandem cylinders, i.e. one in front of the other, but this was quickly changed to the side by side arrangement with the cranks at 90 degrees.

### Ploughing engines and tramway locomotives

Aveling and Porter also built ploughing engines but few survive; in this country we have No. 6457 imported in 1993, and a pair of ploughing engines Nos. 8890 and 8891 *Field Marshal Haig* and *General Byng* both in the Thursford Collection in Norfolk. I have been advised that the Aveling ploughing engines were well thought of, many drivers considering them better than the Fowler BB, but as far as I know no comparative trials were done.

Many, if not most, major traction engine manufacturers adapted their usual product for running on rails: the tramway locomotive. The Aveling engine was made in gauges from 3ft. 6in. to standard gauge, manufactured with or without a cab, could traverse a curve of 35ft. radius, and was offered with compound or duplex cylinders. Happily a small number survive into preservation, one of which was the Garrett yard engine *Sirapite* which, I understand, is to return to the Garrett Museum at Leiston in Suffolk. Aveling and Porter stated that *"they will ascend inclines of 1 in 20"*, the flywheel could be *"used for driving fixed machinery, enabling the locomotive to be used as a powerful semi-fixed engine"* and that *"they are capable of hauling a much greater load than*

*ordinary direct-acting tramway engines, with half their consumption of fuel."* A preserved example of an 0-4-0 is shown in photo 10.

### Steam wagons

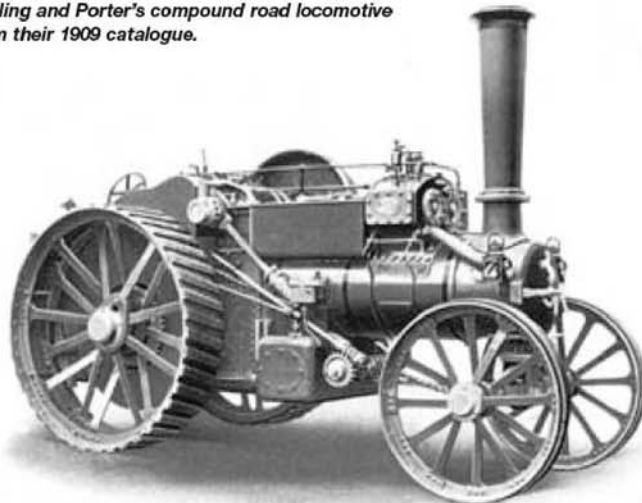
In common with most other engine builders, Aveling & Porter designed a steam wagon, choosing the overtype engine and a conventional layout of gears, axles and wheels. The only notable difference was the firebox which was a flat topped design of the Belpaire type where the inner and outer crown plates were flat and stayed together with threaded rod stays.

The first engine was built in 1909 and there were two models: the FGR which was a 3 ton wagon, and the FGP which was a 5 ton wagon. The 5 ton wagon had a heating surface of 75sq. ft. and a grate a little over 2½sq. feet. The working pressure was 200psi. The boiler fed compound cylinders of 4.625in. and 7in. bores by 7in. stroke, which developed some 23bhp at 257rpm. The vast majority of wagons had traction engine style chain steering with only the last few wagons being fitted with Ackerman steering.

A small number were tipping wagons, power tipping being achieved hydraulically with the water pressure being supplied by the boiler feed pump, a

4

Aveling and Porter's compound road locomotive from their 1909 catalogue.



### AVELING & PORTER'S COMPOUND ROAD LOCOMOTIVE.

This is in most respects like the locomotive just described; where it chiefly differs is in being fitted with high and low pressure cylinders.

It will be noticed that the valve chests are placed on the outside of both high and low pressure cylinders, admitting the use of larger valves and ports, giving much easier access for the steam, and very considerably increasing the power of the engine.

The crank-shaft is of the best steel, cut from the solid ingot; the counter-shafts and driving axle are also of the best steel, all of ample dimensions.

The additional cost of the compound engine is not a serious one, and is very soon repaid by the economy in fuel it ensures; for in it the steam is used twice over, first in the high and afterwards in the low pressure cylinder, and is not discharged through the exhaust until its pressure has been reduced almost to that of the atmosphere itself. In other words, there is more duty got from the steam in a compound engine than in a single cylinder engine, for the same expenditure of fuel.

Another advantage of the compound engine of great importance is that of its subduing the noise of the exhaust when at work; for, perhaps, in no class of engine is silent working more essential than for a road locomotive or a steam road roller, seeing that their use is chiefly in towns or on busy suburban roads. This comparative noiselessness is, of course, due to the low pressure at which the steam is discharged into the atmosphere.

The fittings and outfit are as already described on the previous page.

AVELING & PORTER, Limited, strongly recommend Road Locomotives mounted on their arrangement of laminated steel springs to hind and front axles, and consider that all hauling engines should be so fitted.





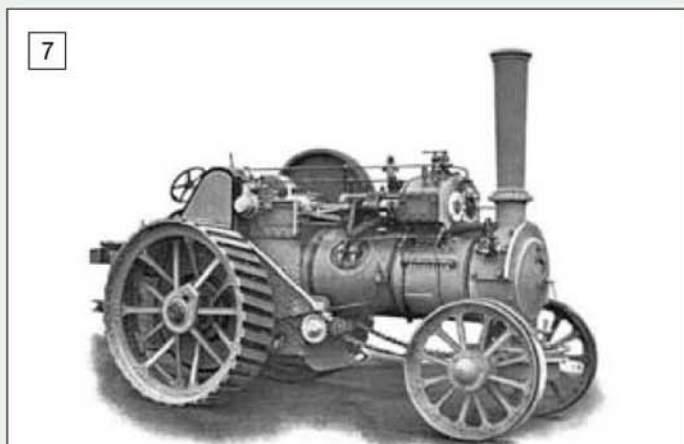
Left: a piston valve engine No. 11137 completed in March 1925; weight 8 tons. Right: sadly 31 (to date) Aveling & Porter rollers have been converted for duties they never performed in their working lives. In this case steam roller No. 7778, completed in October 1912 has become a showman's engine.

three-way cock directing the water to be delivered to the boiler, the tipping gear, or if it was not needed, returning it to the water tank. In all, 292 were manufactured. The wagons were well thought of, but the dominant position held by Fodens made the home market difficult. I believe there is only one surviving steam wagon, No. 9282 completed January 1922 and weighing 5 tons.

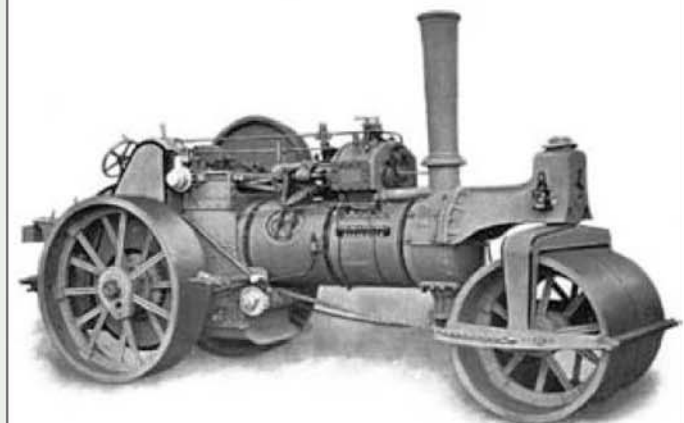
### Boom years

The First World War brought a boom in sales, large numbers of rollers being sold to the War Department for road and airfield construction. Sadly, as with all road steam manufacturers after the war there was a sharp downturn in sales, further exacerbated by large quantities of government surplus war machinery being auctioned off at

knock-down prices. The Rochester works tried hard, production was streamlined in an effort to cut costs and a new standard range of steam rollers ranging between 6 and 20 tons was developed using as many interchangeable parts as possible. The move from slide valves to piston valves was made at this time with improved fuel economy as the reason, but also the ease with

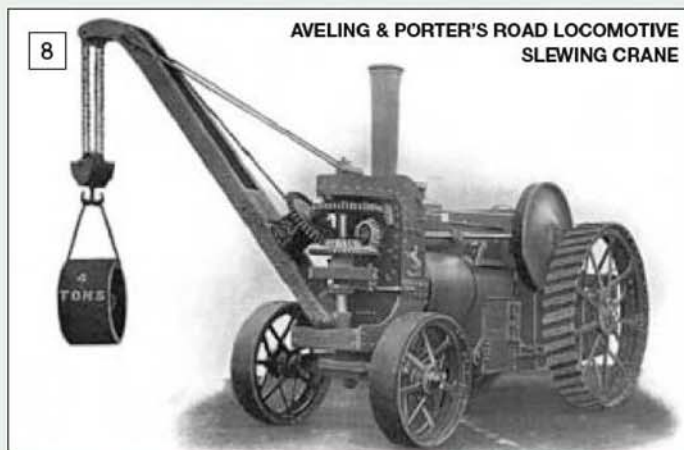


COMBINED ENGINE (as a Traction).



COMBINED ENGINE (as a Roller).

An Aveling & Porter convertible engine. Two sets of wheels are provided along with a front axle for the traction engine and a headstock for the roller. The smokebox door must presumably be removable as in roller form it cannot hinge.



The Aveling & Porter slewing crane arrangement (from the 1909 catalogue) which "can be employed with much economy either in loading or unloading lighters and wagons, on wharves and at railway stations, and in many other kinds of work for which the rigid jib is not so well adapted".



This fine example of an Aveling & Porter ploughing engine is No. 8912 built in 1918. Note the top feed to the boiler and the toolbox on the running board.



10



Left: Aveling & Porter Compound Tramway Locomotive called Sir Lancelot. Right: the Aveling & Porter type FGR wagon works number 8949 completed in November 1918. Note the 'Y' cast wheels at the back, the rubber tyres and the Ackerman steering.

11



which piston valves could be made was a manufacturing economy.

While the improved fuel economy may well have been real they were not popular with customers because a piston valve engine which takes water over (primes) may give rise to a hydraulic lock which could wrench the cylinders covers off. A slide valve is more forgiving in this respect because it can lift off the valve face and

release the trapped water. After a relatively brief period Aveling reverted to slide valves.

### Agricultural and General Engineers

Sadly, despite all the organisation and cost cutting, by 1921 Aveling were in a sorry state and became one of the founders of the A.G.E. (Agricultural and General Engineers) association, which eventually included 12 other companies.

The A.G.E. concern tried to mastermind the production and sales of the products across the companies, each company playing to its strength, while preserving as much individual autonomy as possible.

As part of this, Aveling were supposed to get an increased share of the steam roller market but at the cost of other products; for example, some 12 Aveling & Porter steam wagons were erected by Richard Garrett & Sons Ltd. of Leiston Works in Suffolk using parts supplied from Rochester. However, the last wagon, No. 11111 was delivered to a customer 14 January 1925 having been built at Rochester, but used a boiler made by Garrett. It is clear from the engine records that sales were difficult, for example wagon No. 9279 was sold 23 December 1921 whereas No. 9277, part of the same batch, remained unsold and did not find a purchaser until 6 December 1923.

Another company within the A.G.E. enterprise was Barford & Perkins. William Barford of the Queen Street Engineering works in Peterborough were contemporaries of Aveling's Rochester works, specialising in agricultural implements and horse drawn rollers. Thomas Perkins joined the company in 1872 but rather than devoting themselves to steam they considered and then embraced the internal combustion engine and soon became the leading manufacturer of oil engine rollers. Inevitably when the two companies were pulled under the same umbrella, the strengths of the internal combustion roller were not lost on the A.G.E. marketing department.

12

An early Aveling Wagon with steel shod wheels.



## AVELING & PORTER'S STEAM WAGGON.

Recognising that a Steam Waggon will, in a number of cases, possess certain advantages over a Steam Tractor with separate trailer, AVELING & PORTER, Limited, have given particular attention to the manufacture of an efficient Steam Waggon, and this is illustrated above.

The boiler is of the Horizontal Multitubular type, strongly built, and the compound engine motion is very similar in design to that of their Steam Tractor.

The main frame is built of channel steel girders, coupled with steel plates and angles, forming a rigid structure, mounted on strong laminated steel springs fore and aft.

The front is carried on a steel turntable with arms connected to the main frame of the waggon, and the rear on cast-steel axle boxes with gun-metal bearings of ample surface.

The whole of the gearing is of cast steel, and the chain drive is so arranged as to produce the best results with an absence of wear and tear. Differential gear is fitted to the main axle.

The wheels are fitted with cast steel tyres, to comply with existing regulations, and are of ample strength throughout.

Large water tank and fuel bunker is provided.

All levers, &c., are controlled from the foot-plate, and one man can easily drive and take complete charge of the waggon.

Pump, injector, water elevator and the usual lamps, tools, &c., are supplied.

### Aveling & Barford

With continued falling sales for both Aveling & Porter and Barford & Perkins, by 1928 it was decided to establish even closer links between the two companies, still within the confines of the A.G.E., and the company Aveling and Barford & Perkins (Sales) was formed. Consideration was given to moving the Barford & Perkins staff and machines to Rochester where there was adequate redundant space to accommodate them. However, A.G.E. went into liquidation before any action was taken. Sadly Thomas Lake Aveling had died in 1931 and it was only the commitment and determination of Edward Barford that secured a future for Aveling & Barford. For a while Aveling & Barford produced both steam and diesel rollers but the steam days were numbered. In all the Rochester works produced 12,700 engines, over 8,000 of which were steam rollers.







An early brass Alco plate of the new standard layout; the contemporary spelling of Pittsburgh is correct. The plate was from a Western Pacific 0-6-0.



A smaller standard brass plate for attachment to the cylinder/valve chamber of a narrow gauge 2-6-0 locomotive.

# NORTH AMERICAN STEAM LOCOMOTIVE BUILDER'S PLATES

**Eric Ellis**

introduces us to this involved topic and writes specifically about Alco.

●Part I

Not long ago, a letter was published in *M.E. Post Bag* seeking details of a Lima name plate for a Shay locomotive. It occurred to me then that information on foreign firms was not always easily found here, in comparison with the wealth of data available on UK manufacturers. I also thought then, and still do, how model steam locomotives always look better with such plates; a subject which probably does not get much attention when struggling with silver-solder and copper sheet.

This series of articles is intended to help with North American builders' plates. It is not by any stretch of the imagination a definitive work on the subject. Many generalisations and some suppositions have, by virtue of limited space and lack of available information, been used. However, it may assist others in the same boat as the gentleman with his Shay.

There were a considerable number of steam locomotive builders' plants in the first sixty or seventy years of railroads in North America. From the 1820s onwards, both railroads and

private contractors were engaged in the new technology, and they ranged from those who built just a few, to those who built many. From San Francisco to Cincinnati, in New Jersey and New England, and other places too, the foundries cast and lathes turned. It could not last, of course. Financial problems, lack of sales, troublesome products, bad management, slumps, and plain bad luck all took their toll. Many disappeared. Undoubtedly, they all marked their products in some way, such as with ornate cast scrollwork with their names included between and just above the four driving wheels of 4-4-0s, or cast into valve chamber sides. However, there do not seem to have been builders' plates, as we understand them, until the 1850s, but when this became standard practice for all builders is uncertain.

Some early North American steam locomotives had cast names and, until the end of steam, many had cast front number plates with the name of the railroad, or possibly the builder, included. In due course, the cast names were discontinued. Eventually, very few North American locos were named, and those that were had the name painted on, (e.g. Richmond Fredericksburg and Potomac 4-8-4s). Painted, and very occasionally cast numbers appeared on headlights, smokeboxes, cabs, domes, or tenders, and sometimes in more than one place. The builder was recorded, along

with a construction/build number (not on all locos), together with a date (again not always), on a cast plate bolted, or riveted to the locomotive.

Finish could be painted over the same colour as the smokebox, or rim and lettering polished with background painted, or polished all over, or both painted a different colour to the background. I have to say that this was when new, and on the whole a polished finish was not maintained in service.

Builders' plates were normally fixed to the smokebox side, about halfway up, unless smoke deflectors or other equipment were in the way, or shielded them from view. They could also be on the side of the smokebox saddle, or the side of the cylinder/valve chamber. Tank engines sometimes had them on their bunkers. Most locomotives had two, but some had one. Locomotive photographs exist showing no plates at all. One can only speculate that a new smokebox had been fitted or the plate had simply disappeared and the holes had been plugged to prevent air ingress. A few locomotives had the plate attached to the frames, and in reality they might have been anywhere — Canadian Pacific used the dome on 4-4-0 No. 374.

Materials used in manufacture were cast iron (cast with a curve to roughly the radius of the smokebox) or flat (brass, sometimes cast curved, or flat and rolled), and aluminium alloy. The New York Central Niagaras had aluminium alloy plates.

Shapes and physical sizes varied enormously. Baldwin for example produced a 16<sup>1</sup>/<sub>4</sub>in. diameter round plate at one time, and Alco Cooke a 9 x 4<sup>5</sup>/<sub>8</sub>in. rectangle. Shown to illustrate these articles are photographic examples which show lettering styles, and layouts. Occasionally, etched or cast sunken lettering and numbering were used with no rims, but the vast majority had raised rims, lettering and numerals. Font styles were also varied, being truly delightful at times.

Few model engineers have not heard of Baldwin, Alco, or Lima, but how many know of Juniata, Angus, Davenport, or Richmond? Let us start with Alco. On 24 June 1901, the American Locomotive Company came into existence to compete on more effective terms with the huge

Table 1

| Maker        | Location       | Dates     | No. built | Notes                                       |
|--------------|----------------|-----------|-----------|---------------------------------------------|
| Schenectady  | New York State | 1848-1948 |           | Last steam engine built 1948                |
| Manchester   | New Hampshire  | 1849-1913 | 1,793     |                                             |
| Cooke        | New Jersey     | 1852-1926 | 3,000     |                                             |
| Dickson      | Pennsylvania   | 1862-1909 | 1,400     | Different totals given by different sources |
| Rhode Island |                | 1866-1908 | 3,400     | Different totals given by different sources |
| Pittsburg(h) | Pennsylvania   | 1867-1919 | 2,700     |                                             |
| Brooks       | New York State | 1869-1928 | 4,200     | Different totals given by different sources |
| Richmond     | Virginia       | 1886-1927 | 4,500     |                                             |
| Rogers       | New Jersey     | 1832-1913 | 6,300     | Joined Alco in 1905                         |



Baldwin Company of Philadelphia. Eight existing builders were involved, their shortened names, locations, dates, and approximate numbers of steam engines built during those years are listed here in Table 1. Some of the starting dates may be approximate, and relate to company beginnings as machine shops before they became involved in locomotive building.

Locomotive and Machine Co. of Montreal, Canada, joined in 1904, and became Montreal Locomotive Works. They ceased to be totally controlled by Alco in the 1940s, and information on the company will be covered in a future article.

The head office was in Schenectady where the greatest number of engines were built. After Brooks ceased production in 1928, Schenectady continued for another 20 years. It too finished steam locomotive building in 1948, with seven Pittsburgh & Lake Erie 2-8-4s being the final order (the very last build number allocated to the batch was 75851, though that does not mean that Alco built 75851 steam engines).

Outstanding power units built included the Milwaukee Road streamlined 4-4-2s and 4-6-4s for the Hiawatha services; the New York Central 4-8-4s, 4-6-4s, and 4-8-2s and the Union Pacific's 4-6-6-4s, 4-8-8-4s, and 4-8-4s. An attempt to establish 3-cylinder drive in North America in the 1920s was only partially successful. Their Northern Pacific 2-8-8-4 had a grate (or should it

be great) area of 182 square feet.

Early Alco plates were a continuation of the old company's shapes and build numbers, but it seems that in 1902 a new numbering sequence started at 25000 for all plants (by 1902 Baldwin was at 20000). Then a new common plate shape followed, with each plant having its own name cast in. Examples of the late pre-amalgamation, and early post-amalgamation plates were illustrated in the *National Railway Historical Society's Bulletin Vol. 66, No. 4, of 2001*. A wonderful collection of shapes, sizes, and lettering styles, whose owner Theodore A. Xaras, and the NRHS, have kindly consented to the reproduction of in this article (see below).

Photograph 1 shows an early brass Alco plate of the new standard layout. Note the serifs and radiused sides. All other plants, except Montreal, whose lettering was different, followed this style,

but with their own plant location. There is a great variance of certain dimensions even on individual plates; for example rim and lettering/number depths, thicknesses, and depth of hollow backs. I have not, therefore, included such details in these notes. The reason for the variations is, apart from fettling and some abrading and polishing of the raised parts and drilling of fixing holes, they were unmachined castings, which performed no function other than identification. The spelling of Pittsburg is correct for the time,

(note the missing h). There is a story about that for which there is no space here. The loco was a 0-6-0 for Western Pacific.

During World War One, Alco produced (as did Baldwin), a series of narrow gauge locomotives for the British War Department, mainly for use on temporary tracks. In both cases the plates were oval with an outer and inner raised rim enclosing the builders name, build number, and date. The centre portion had the familiar WD with arrow, plus indent number. Davenport and Vulcan, with Baldwin, built similar engines for the US Army.

Photograph 2 illustrates a smaller standard brass plate, which was attached to the cylinder/valve chamber of a narrow gauge 2-6-0 built for export. New are the straight sides, introduced in the late 'teens/early twenties, plus two circular spacer bosses on the back around the



A cast iron plate attached to an Alco locomotive built in 1923 for the Norfolk and Western Railway.



A wonderful collection of shapes, sizes, and lettering styles, reproduced here by kind permission of the NRHS and their owner Theodore A. Xaras.



fixing holes to stand the plate over any high spots. The plate is flat, with a hollow back.

The two photos show the two types of plate and their design that were fixed to the vast majority of Alco steam locomotives, but there were exceptions besides the WD examples. Southern Pacific had some oval plates on locomotives built up to 1908. Kansas City Southern were similar with the class cast in during the 'teens and twenties, and Norfolk & Western had rectangular cast iron plates as shown in **photo 3**. These had a hollow back, and two cast-in raised circular bosses there around the bolt holes.

And that is not all. In the dying years of steam production, Alco fixed a new design of plate to some of its last builds — about 150 of them, starting in 1946. The Pittsburgh & Lake Erie 2-8-4s previously mentioned had these. They were larger than the previous standard, rectangular

with radiused corners and three lines in the top-half stating: AMERICAN, LOCOMOTIVE COMPANY, SCHENECTADY N.Y. (font as before). Two fixing, bolt holes were provided, also as before. The build number in the bottom left quarter, the date in the bottom right quarter, and Alco in script together with a stylised streamlined locomotive integrated with a gear wheel in the bottom centre. A beautiful design. Incidentally, the tender shop at Alco had been shut down by 1948, and Lima did the work, with their builders plates fixed on the tender side behind the cab.

My thanks go to several people and organisations who have helped with photographs and information for this series of articles: They include Jeff Smith and the NRHS, V. Edwards who took photos 1, 2 and 3 featured in this article, Alco Historic Photos, and a special

thanks to Alan Miller for the time and trouble he went to.

## References

- 1: *Early American Steam Locomotives* by John H. White Jr.
- 2: *A Short History of American Locomotive Builders in the Steam Era* by the same author.
- 3: *Guide to North American Steam Locomotives* compiled by George H. Drury, published by Kalmbach.

All three books are first class, and can be recommended to anyone with an interest in American steam.

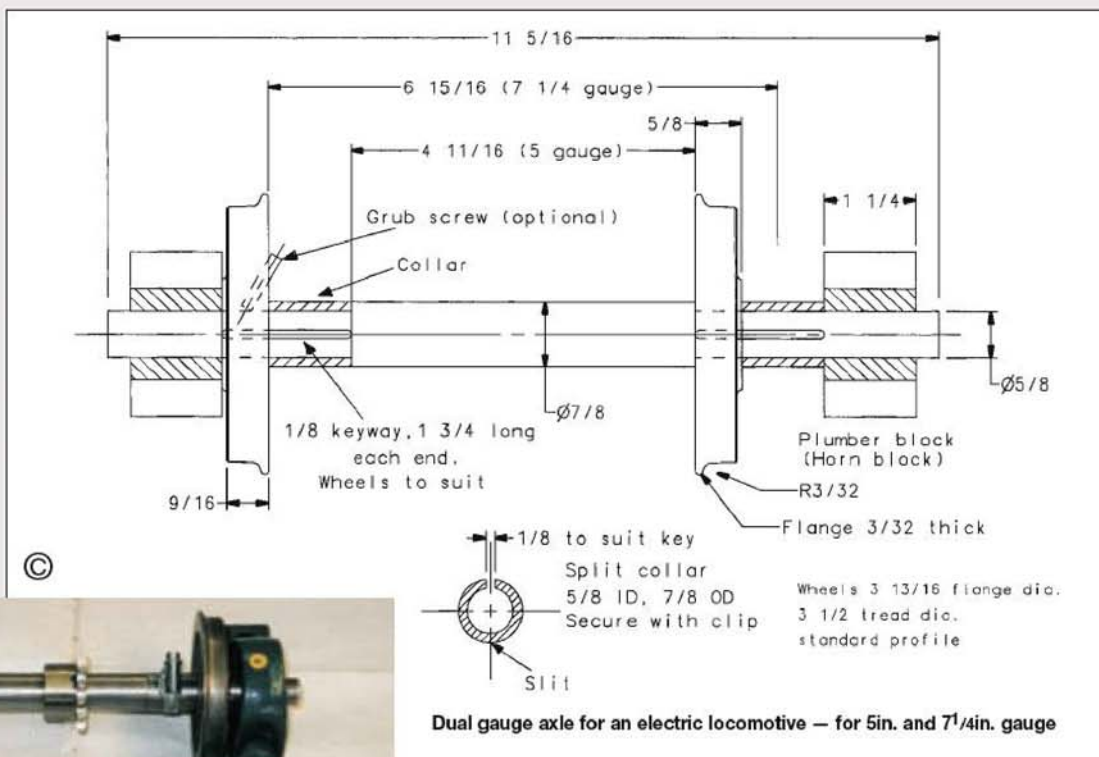
Undoubtedly there are mistakes and gaps in the articles, and I would be delighted to hear from anyone who could expand or correct such information.

●To be continued.

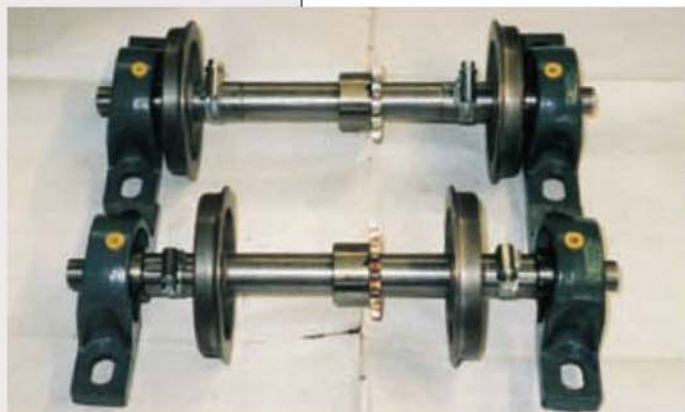
# A DUAL GAUGE LOCOMOTIVE AXLE

**Mariner** describes a versatile wheelset design.

I cannot recall ever seeing in *Model Engineer* a dual gauge locomotive. My local club is going ahead with building a 7 1/4 in. gauge track, as well as their current 5 in. one, and it seems that quite a few other clubs are doing the same. My next locomotive was going to be a large electric one based on a New England engine so I therefore decided to make it dual gauge if possible. I have made my axles as shown in the accompanying drawing,



Dual gauge axle for an electric locomotive — for 5 in. and 7 1/4 in. gauge



Slacken clips, remove split collar, shift wheels, replace collar, tighten clips and 'Hey Presto!' the loco is ready to run on either 5 in. or 7 1/4 in gauge track.

and I include a photograph of two wheelsets, one of which is set at 5 in. and the other at 7 1/4 in. gauge.

Changing gauge is a simple matter of removing the clips and the split collar, moving the wheels along the shaft on the keyway,

and replacing the collars and clips on the inside of the wheel for 7 1/4 in. and the outside for 5 in. gauge. This is done without having to remove the bearings (hornblocks or plummer blocks).

The longest part of the operation is doing up the clips and I intend to get some quick release clips, or make some of my own, at a later stage. There are two bogies - four wheels each bogie. I am delighted with this idea. One thing is for sure, you could not arrange it on a steam engine!







An inexpensive keyless chuck purchased from a market stall.



Turning a taper using the top-slide set round to the required half angle.



Preparing to cut the thread. The taper is mounted in an appropriate sleeve in the lathe headstock.

## SETTING UP THE CLARKE CL300M LATHE A REPAST OF TAPERS

**Neil Wyatt**

shows how to machine tapers on the CL300M lathe.

●Part II continued from page 500  
(M.E. 4220 30 April 2004)

Together with Brown and Sharpe, Jacobs, Jarno and a few others, Morse tapers are one of several series of standard fittings which fall into the class of 'self holding' or 'driving' tapers. With an included angle of only a few degrees, the wedging action of such tapers makes it possible to gently twist two components together to achieve a firm and accurately concentric fit. For this reason such tapers are almost universal on lathes and other machine tools. The CL300M has a No. 3 Morse taper (MT3) taper in the headstock and an MT2 taper in the tailstock. I do not have figures for Morse tapers to hand, but for the American standard taper, the allowable error in the taper is just 0.002in. per foot, in the direction which increases the taper. On a taper just 3in. long that is just 0.0005in. allowable error in diameter.

A great many tools and accessories can be made which require a Morse taper fitting. Making these tapers will demand some precision, so why should we bother? While it is easy to buy 'blank arbors', turning our own is an excellent way to get to

understand our lathe's capabilities. If you are a new lathe owner, it is likely that you have no tailstock drill chuck, so here is a good place to start.

Hidden among the junk tooling on sale on many market stalls and car boot sales, some reasonable tools are waiting to be found. Good deals on reasonable quality keyless drill chucks are often to be had. These are generally fitted with a standard 1/2in. x 20UNF thread which is standard for some portable equipment. This may not mount the chuck as accurately as the usual taper, but the rigidity of my lathe set-up means that the screw-fitted tailstock chuck is more accurate than the taper-fitted chuck in the wobbly quill of my drill press!

Using the CL300M, the obvious conundrum is how to turn a taper at one end of a bar and then hold it to cut a thread on the other end. No problem if you have an MT2 to MT3 conversion sleeve, but the first time I did this exercise I had no such sleeve and had to devise another method. Stock for the arbor, a 4 1/2in. length of 1in. dia. mild steel bar, was gripped in the 3-jaw chuck, and a 1 1/2in. length reduced to 1/2in. diameter. The shoulder where the reduced section meets the 1in. dia. of the bar was accurately faced, as the chuck will bear against this. A small groove was also cut here with a parting tool to provide a 'run out' for the screw cutting tool.

If you are following suit, now screwcut the 1/2in. section at 20 threads per inch using a tool ground with a 60deg. point. The correct sequence

of change gears is driver 40, intermediate 60 (or any convenient size), driven 50. A large metric screw thread (which also has a 60deg. thread form) can be used as a template for the tool. Before screwcutting for the first time, practise using the leadscrew feed with the tool well back and away from the work. Disengage the half nuts and put the leadscrew into 'forward' gear at the back of the headstock (this engages the chain of change wheels).

Start the lathe running slowly and engage the clasp nut by firmly pushing down the lever on the apron. Everything will start moving towards the headstock (faster than you expect, if you are only used to the snail-like progress with auto-feed gears in place). Keep the lever fully down using gentle pressure, then pull the lever up to stop the carriage well before anything gets near the chuck! Practise a few times until you are confident you can stop the tool tip in the run-out groove cut every time. Note that if you do not hold the lever down, it may ride up, spoiling the accuracy of the thread.

It is now time to decide which method of screwcutting you wish to use (see panel). Make sure the tool is set at centre height and wind the tool in using the cross-slide feed screw until it just grazes on the work surface. Set the cross-slide index dial to zero and move the tool to the right of the work. Now advance the tool by about 0.010 inch. Take a cut, just as you did on the practice runs, being sure to stop the tool in the



Setting the top slide angle using a centre and a dial test indicator. The DTI reading should not vary throughout the top slide's travel.



Checking a turned taper for fit in a commercial Morse taper sleeve. The quality of fit can be determined using engineers blue or a marker pen.



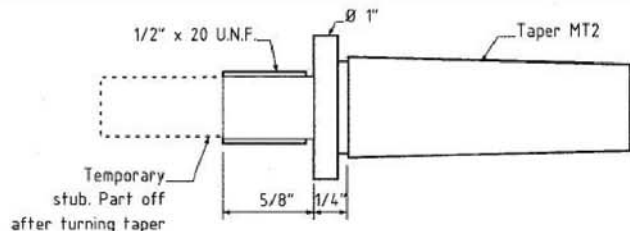
run-out groove; wind it out and return to the start. Make two further cuts about 0.005in. deep, and finally carry on taking just 0.002-3in. at a time. Once the thread is nearly to full depth try the chuck for fit. If necessary take another 0.001in. pass.

Once the chuck runs smoothly onto the thread, change the gear train back to the normal for fine feed (20:80, 20:80) and skim off the first half of the thread to provide a stub for reversing the arbor in the chuck. At this point also take a light cut off the first 1/2in. or so of the lin. diameter section of bar. This dimension is not critical, but a good finish will help setting up.

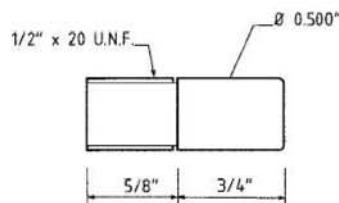
Now reverse the work in the chuck, holding it by the plain stub extending from the end of the threaded portion. Ideally, hold the work in a 4-jaw chuck and set it to run true with a dial indicator on the surface just turned on the lin. portion. If you have no 4-jaw chuck, use the 3-jaw. You then have to decide whether to accept any small error in concentricity or correct it by using pieces of thin shim or cigarette paper under the appropriate chuck jaw(s).

In theory, turning a taper is easily achieved. The top-slide is set to a suitable angle and cuts are taken solely by traversing the top-slide by hand. It is setting the correct angle correct that is the challenge. Assuming the tailstock is set up accurately, the classic way of doing this is shown in the photographs. The work is centre drilled and a fixed centre clamped between the work and another centre in the tailstock. A dial indicator, mounted horizontally in the tool post with its tip on the centre line of the taper, is moved back and forth. The angle of the slide is adjusted until there is no movement in the pointer along the entire length of the taper.

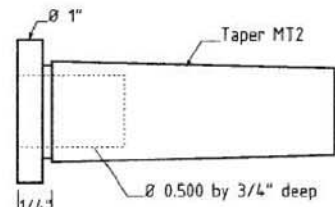
There are a few flaws with this method. You do not need to be a genius to realise that you need two centres and a tailstock drill, to do this. Moreover, even a small error in tailstock alignment makes the exercise pointless. If you do not have the equipment to set up the work in this way, start with a tool at exact centre height and set the top slide to an angle of about 1 1/2 degrees. Use the dial on the



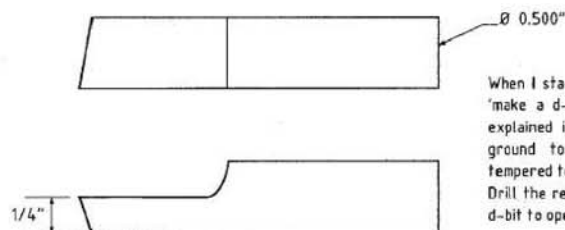
Arbor M.S. one piece construction



Stud P.G. Silver Steel



Arbor M.S. for two part construction



When I started model engineering, I kept reading 'make a d-bit', but this was so simple, no-one explained it. It's just a section of silver steel ground to the shape shown, hardened and tempered to a straw colour. Drill the recess in the arbor 31/64", and use the d-bit to open it to half an inch.



A selection of Morse taper shanks with one adapted to fit a small chuck.

slide or a commercial taper as a guide. To turn a satisfactory taper you will need almost all the full top-slide travel. Make sure the gib strips for the slides are correctly adjusted and wind the top-slide back as far as is possible without it becoming loose. Manipulate the saddle and the cross-slide to set the tool at the end of the work piece.

All cuts are taken with the top-slide, setting initial cut depth by advancing the cross-slide by 0.010 inch. Note how rapidly the taper advances along the work with each cut. Test the taper as soon as it will enter an MT2 socket. An MT2-3 adaptor sleeve makes this easy, but if you do not have one you can use the tailstock. You cannot 'wobble' the tailstock to check for a good fit, so how do you do the test? Traditionally, engineer's blue (micrometer blue) would be used, but a line drawn with a broad tip 'magic marker' pen is just as good.

Push the taper home, then gently rotate the chuck and taper by hand. If the line is smeared along its length, well done! If otherwise, gently adjust the taper no more than a touch, take a cut of no more than a few thou and re-test. This becomes a horribly recursive process — with the accent on the 'curse', especially when you 'over correct' — but you will eventually find that the mark is being worn along its whole length. At this point you will probably find that the taper will fit very firmly and easily in the socket. The sudden change is often quite obvious. There should be no wobble at all. (If you do have a dial test indicator, making the necessary adjustments in angle are greatly facilitated if the diti is placed against the end of the top slide at 90deg. to the direction of travel. The angular adjustments can then be controlled by counting 0.001in. and over correction is less likely — Ed.)

It is now a case of taking sufficient further cuts to ensure the whole length of the taper enters the socket. Aim to finish each cut at the same point, so that a neat cylindrical collar is generated between the taper and the threaded portion. To

get a good finish, the final cut should be shallow, taken with a tool having a small flat on its end and the work rotating more rapidly than previously. To further improve the quality of the finish, turn the feed screw handle by using both your hands, trying to keep a steady feed rate to apply an even torque rather than using just one hand on one end of the handle. Traversing the tool backwards 'crossing the thread' of the original cut can bring a final improvement. Turning the top-slide handle by using an electric screwdriver with a section of 6mm Allen key is a useful tip for getting a really smooth finish.

If you really struggle to get a good taper, here are two ideas I have not yet tried. LBSC suggested rough turning an over-length blank, and then turning two narrow raised strips to exact size at each end of the taper. Once these were a perfect fit, they could be machined away to create a full length taper at the correct setting. Another tip, this time from Stan Bray is to 'waist' a taper by machining away the central section of a recalcitrant taper. This will be particularly useful if you struggle to get your cutters on exact centre height.

Once you have a perfect taper, do not move that top-slide. I turned three more tapers, and I am sure I will wish I had made more. It is worth noting that, although in theory it is possible to produce MT3 tapers to fit the headstock mandrel in this way, there is a problem. The top-slide simply does not have the travel to cut a full length MT3 taper. Nonetheless, short tapers have many uses, and you may well decide that this will be adequate for any job you have in hand.

The final job for the chuck adaptor is to face the small end and part off the plain end section to leave a suitable length of thread. This can be done without changing the setting of the top slide, simply by angling the tool holder.

I tried to cut the thread on a second arbor by holding the work in an MT2-3 adaptor sleeve, mounted in the mandrel. Of course, the wretched



thing slipped on one of the last cuts, and I ended up with a useless two-start thread. I cut it off, re-faced the end and drilled it  $\frac{31}{64}$ in. dia. x  $\frac{3}{4}$ in. deep. I then used a D-bit to open out an accurate  $\frac{1}{2}$ in. dia. bore and fitted a silver-steel stud. A length of 0.500in. diameter silver-steel was threaded for half its length and Superglued into the hole. Out of interest, D-bits are said to be more accurate and give a better finish than reamers. In this case I found the fit was so good that air pressure would hold the stud in the hole, and I needed the judicious

use of my rubber mallet to coax it in with Superglue on it. This may mean that the adhesive film is rather thin, but with well over a square inch of contact and light duty, I do not expect it to fail.

Chucks such as that described usually take drills up to  $\frac{1}{2}$ in. dia., but struggle to hold those of about  $\frac{3}{32}$ in. (1.5mm) or less. One way around this is to grip a small pin chuck in the larger chuck, but my pin chuck has a very poorly aligned shank. I have a number of smaller chucks, which rely on being screwed up a thread

to close the chuck. I decided a medium size chuck from an electric screwdriver could be permanently recruited for this job. It fitted an M8 x 1.75mm threaded bolt. I fitted one of the MT2 arbors in the MT3 sleeve and turned and threaded it using a suitable die. Although it is not particularly accurate, the result looks rather neat! My last two tapers are reserved, one for a box tool to be described later in this series, and one for Justin — Justin Case, that is.

●To be continued.



Two examples of screw cutting tools. That on the right is ground from a parting off tool.

### Editorial note

The foregoing article deals with the turning of tapers and touches on the subject of screwcutting in the lathe. These notes are designed to guide the beginner who is taking the first tentative steps in turning and needs to screwcut a thread. Beginners to lathe work are often rather worried about the prospect of screwcutting yet, with the right tools and approach, the process is no more difficult than conventional turning.

Satisfactory screwcutting requires the correct tools. It is possible to buy screwcutting tools ground for the job but traditionally the lathe operator would grind one up from a parting off tool. Photograph 1 shows just such a tool on the right. On the left of this photo is a home made tool holder having an inserted bit made from a piece of  $\frac{3}{16}$ in. dia. high speed steel. Tools of this type are often more convenient to use as the cutting bit can be set to suit the helix angle of the thread. Although the cutting bit in this tool holder is quite small, it must not be thought that it cannot do real

work as the bit shown was ground to cut a left hand, 20DP worm having a depth of 0.142in. (photo 2). Only those engaged on professional work or the comparatively wealthy will wish to use the sintered carbide tips now available for those who produce threads on computer controlled, automatic production machines.

Whichever type of tool is chosen, it should be ground to the correct V-shape to suit the thread being cut (55deg. included for Whitworth form threads, 60deg. for metric and Unified and  $47\frac{1}{2}$ deg for BA). Top rake should be no more than 7 degrees. Some attempt should be made to form the flank clearance angles such that they lie at the helix angle of the thread. This is particularly important for deep threads and is one of the advantages of the tool holder using a round inserted tool bit (photo 3). It also pays to grind the thread form asymmetrically so that the tool can approach shoulders as closely as possible. This can be seen on the converted parting off tool in photo 1.

There are two main methods of screwcutting a standard V-thread in the lathe:

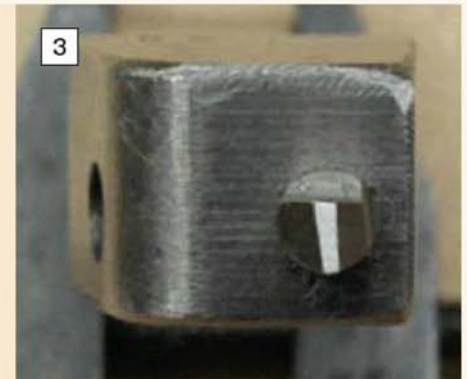
1: with the top-slide is set round to half the thread flank angle and the depth of cut applied through the top slide feed screw.

2: with the top-slide left in its normal operating position and the depth of cut applied through the cross-slide feed screw. So that the screwcutting tool is not required to cut on both flanks at the same time, the top-slide is advanced approximately half the depth of cut applied to the cross-slide at each pass.

Method 1 is reckoned to be slightly quicker and gives a nice clean thread, but the second method avoids disturbing the top-slide setting and is often favoured by professional turners. Each method has its own adherents and they have been discussed at length over the years. Try both ways and stick to the method which suits you. The choice is yours so please do not write to *Post Bag* extolling the virtues of your approach! However, cutting the thread by plunging the tool directly into the work is best avoided. Unless the thread is very shallow, this method is unlikely to result in a clean thread and may overload the tool due to chip crowding.

One refinement of method 1 worth mentioning is to set the top-slide round at an angle slightly less than the half angle of the thread — e.g. 25deg. for a Whitworth form thread instead of  $27\frac{1}{2}$  degrees. This causes the trailing edge of the tool to continuously skim the trailing flank of the thread and removes the scuffing caused by the chip leaving the cutting zone.

The tool should be set square to the work and photo 4 shows this being done with a screw



Screw cutting tools should be ground such that the flanks follow the helix angle of the thread.

cutting gauge, something which is also useful for grinding the tools to the correct profile.

Some workers rely on eye to judge the depth of thread, but it is worth trying to work to direct measurement. The depth of thread is usually given in tables so when using method 2 to produce your thread the depth required can be read directly off the cross-slide. If method 1 is in use then the top slide movement will be larger and given by the formula:

$$\text{top slide travel} = D / \cos \theta$$

where D is the true depth of thread and  $\theta$  is the angle between the top-slide and cross-slide. Such information can be calculated and tabulated for the common threads in use. For the mathematically allergic, work to a top-slide travel of  $1\frac{1}{8} \times D$  and you will not be too far out.

Like most techniques, screwcutting requires practise before it can be done with confidence. Accept the odd failure and analyse what went wrong. By this means you will be able to improve your approach and take most routine screwcutting jobs in your stride.

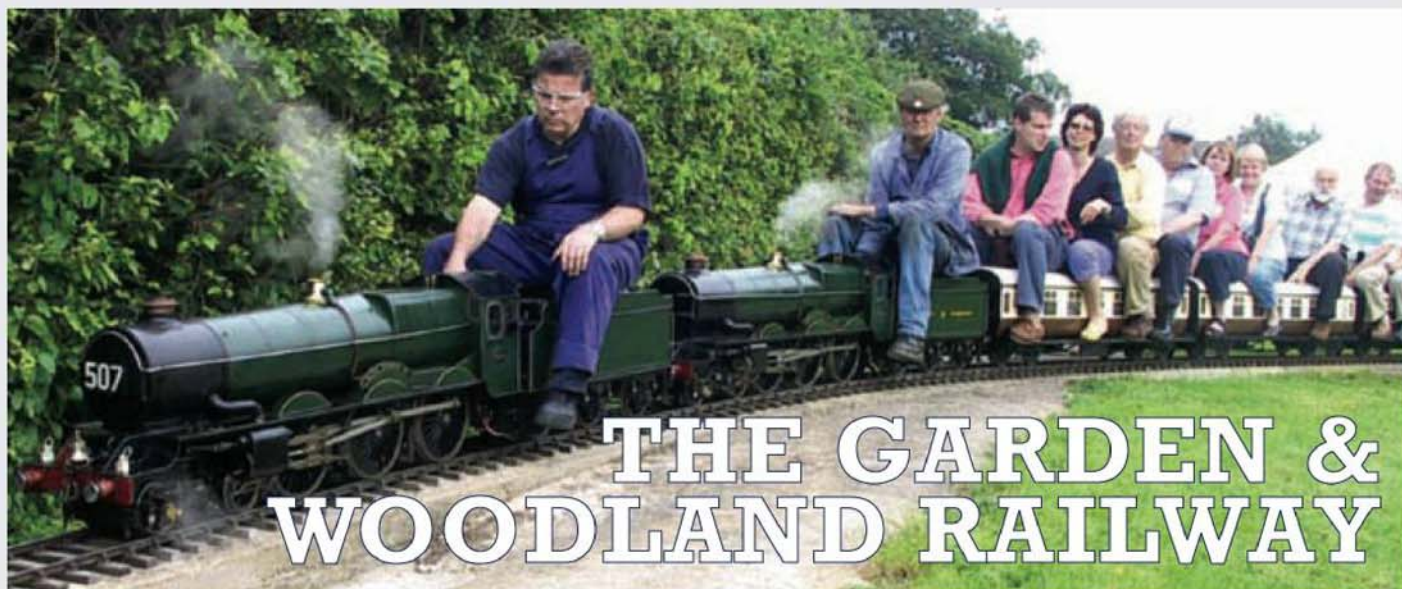


An example of a left hand, 20DP worm turned using the inserted bit type of tool shown.



Using the screw cutting gauge to set the screw cutting tool square to the work.





# THE GARDEN & WOODLAND RAILWAY

Double headed Kings topping the 1:25 gradient. Well-known model personality Bob Symes is seventh passenger from front in check shirt.

## Keith Wilson

gives us a glimpse of a superb and very well equipped private railway.

This magnificent miniature railway may not be the largest railway in this country, but any rivals as to quality must be exceptionally good to stand a chance. Started in 1970 as a 5in. 'elevated' line, heaving locomotives up and down rapidly palled; the decision was therefore made to convert to 7 $\frac{1}{4}$ in. gauge ground level, super-detailed. I have often been asked for details of this line, and the answer is always "the facing-point locks utilise scale nuts and bolts." This sums up the line well, but a further description is justified in view of the fact that it is much further advanced; albeit never will it be finished.

Using scale bullhead rails mounted in chairs on Jarrah-wood sleepers from Australia, the general appearance is already startling, in spite of there being as yet no ballast; the sleepers being mounted on a total of some 150 tons of concrete, levelled off and super elevated (on curves) to within  $\frac{1}{16}$  inch. The concrete obviously could not be laid all at once, so separate concrete sections are locked together with 3 off  $\frac{1}{2}$ in. steel bars. Uneven settlement is therefore unlikely.

Some lineside facilities must perforce be of non-scale sizes, but as far as humanly possible are scale within themselves: thus semaphore signals look about right if made to 10 $\frac{1}{4}$ in. scale due to the different angle of perception of persons '8 times full size'. Tunnels must be far larger than 'scale' (obviously!) but are 'tailored' to suit passengers, and do not look too un-

proportional. The engine shed looks superb, but inside the standing floor is 5in. below rail level so that locomotives may be inspected, etc. at eye level, and if much underneath attention is required, outside are two sections of track that can be elevated at one end hydraulically so that locomotives are about 45deg. tilt; thus every underside part can be reached easily, and thereby hangs a tale.

A King was 'up' when there came an alarming screeching sound that set everyone's nerves on edge, fearing a somewhat rapid descent into the nether regions. Locomotives have the front coupling linked onto a bracket that holds it stationary on the track, it was feared that the front coupling was failing, as previously a large diesel-type was discovered to have the front coupling held by a  $\frac{1}{16}$ in. split cotter. However,



Facing point lock.



Signal gantry.



Tunnel mouth.



Turntable and rear of locomotive shed.



Ted with two Kings, County, Castle, Prairie, etc.





*Kings on the level, in sync.*



*A King entering a tunnel.*



*Dean Goods tender, King, Prairie and parcels van.*

the screech was rapidly traced to the fire iron sliding forth from its space, along the top of the running plate at the left side of the firebox.

There are, at time of writing, three possible 'paths', i.e. separate circuits that can be used simultaneously. They are known as high level, low level, and shuttle. The high level has the steepest gradient, upwards at 1:25 in the anti-clockwise direction, but much less in reverse. The low-level is not level, but is more in the form of a main line run.

The two portions of the shuttle line are likewise not level; one part acts as double track with the low-level line, but has a short loop connection with the high-level line. Parts of the high line go over the low line, hence the gradients. For useful facilities as well as the above, the remarkably realistic turntable can be unlocked, rotated, and locked by the driver from the driving position, a great boon.

### Locomotive stud

As might be expected, the locomotive stud is strictly Great Western. From small to large, we have a *Midge* 2/0-6-0T, a Dean Goods (2301 class, 0-6-0), a large *Prairie* (2/2-6-2T, 3150 class), a *Saint* (2/4-6-0 29xx class), a 47 (2/2-8-0, 47xx

class — 'Churchward's Masterpiece'), a *County* (2/4-6-0 1000 class), a *Castle* (4/4-6-0 4073 class), two *Kings* — (4/4-6-0 6000 class), a *Great Bear* (4/4-6-2 '111' class — although there was only one) a diesel of the Western class, and what is believed to be the world's second best *Duchess*. (It was made by the late Harry Powell, and lacks the working steam coal pusher in the tender). For the curious, I did not make this one, *Midge* or the *County*.

I use here Tuplin's configuration; thus 0-6-0 is an 0-6-0 with just 2 *inside* cylinders and no others, 2/0-6-0 is an 0-6-0 with two *outside* cylinders and no others, and 4/4-6-2 is a Pacific with 4 cylinders. A very useful nomenclature, that I have not seen used elsewhere.

There is also a heavy experimental shunting locomotive, battery powered, controlled by radio. Very useful, with remote controlled couplings for good measure. For rolling stock, 7 'main-line' and 6 'suburban' Aristocrat carriages are stashed away in their own shed; numerous assorted freight vehicles occupy some sidings.

The engine shed is made with scale-sized bricks, and looks extremely realistic. It took some years to build, but even a dead-scale Rome was not

built in one day (I wasn't the foreman on that one!) Bridges and tunnels are built with scaled bricks/stonework, and frankly "if you seek the mote in Ted's eye, look for the beam in thine own." Visitors with GWR locomotives are welcome, but check in advance.

As far as I am aware, the heaviest load was 60 passengers, with two *Kings* and the *County* up front, and the *Prairie* shoving behind, it went round three laps: it was on the return to the station that it was noticed that the *County* had lost all steam pressure and was therefore part of the load! Unfortunately, the 47 had earlier blown a superheater and was *loco de combat*.

An interesting thing came to light some years ago; if two locomotives are coupled together (double-heading) and if they are similar types, they will very quickly pull into synchronisation. That is to say, they will get into step perfectly, if one is on, say, left-hand dead centre, then the other one will be there too. This may be seen regularly at Bettws-y-Coed, where there is a 'krocodil' which is in effect an electric Garratt. The two portions pull into sync, and one might be forgiven for expecting the dummy pantograph from falling off completely. 



*A very pretty Dean Goods locomotive.*



*King, plus King, plus County, plus long train. A total of 60 passengers!*



# CLUB CHAT

With Malcolm Stride

## UK News

**Basingstoke DMES** has a new secretary in Guy Harding who can be contacted at the society address: Unit 5, Viabes Craft Centre, Harrow Way, Basingstoke, Hampshire RG22 4JB or by e-mail at [honsec.b.d.mes@btinternet.com](mailto:honsec.b.d.mes@btinternet.com) Outgoing secretary Ian Shanks is taking over the post of Chairman. Having completed the purchase of a piece of land, members are in the process of repairing fences and trimming trees ready for developing the new site. It is hoped that the society will be able to remain at their current venue long enough to allow progress with developing the new site while still using their existing facilities. This will depend on the local council which has taken over as landlords. The club has carried out an analysis of members' views as to the facilities required on the new site. On a less happy note, the club suffered a recent break-in but the miscreants were disturbed and got away empty-handed. The club is not holding a special visitors' day this year but welcomes visitors from other clubs on their regular members' days.

Members of **Bedford MES** have been very busy around the site during the winter months. Activities include commencing the erection of a concrete garage, rebuilding and re-aligning some of the track,

re-building a point on the triangle, cutting down and removing dangerous tree branches over the station and cutting up and removing trees brought down by the high winds of not long ago. Regrettably, only two of these latter were trees which the club wanted to lose. On top of all this, rapid progress is being made with the new station building at Hammer Hill, steaming bays, and ballasting the ground under the track spans. Following the receipt of quotes for printing the newsletter, the society has "bitten the bullet" and purchased a "large, fast, commercial double-sided printer to do the job in-house." Member Alan Beard is in charge of this acquisition. I'll wager he did not anticipate that model engineering involved running a printing machine! In addition to other tools, the club has been given a gas fired smelting furnace which brings "the dream of being able to undertake our own castings a step nearer." The new hydraulic unloading ramp was commissioned at the 'Ten Years at Summerfields' and used for the first time. The lucky man to be the first to use it in anger was Dave Jerome from the **Amnerfield Miniature Railway** with his BR Class 2 2-6-2T. I wonder — did he realise he was testing the new facility? Many more used the ramp during the weekend which remained fine and warm throughout. The society has been pleased to welcome

several new members with a variety of model engineering interests.

Members of **Birmingham SME** have completed a revamp of their garden railway layout in only eight weeks. This includes a double dual gauge (32/45mm) crossover giving access to the steaming bays. The revamp involved making new decking and supports for the track, all of which was done during the winter. The winter work on the revised layout for the Kineton Bank continues, but is proving anything but uneventful. During the work a four-axle tipper lorry delivering hardcore to the site "went lop-sided" when the driver parked on the verge. Said verge promptly objected, resulting in a fully loaded tipper bogged down at a very precarious angle. The problem was resolved by bringing another wagon alongside and transferring the load using a JCB. The bogged down vehicle was then extracted using the same JCB. All of this closed the lane to the site for the morning and resulted in the working party being unable to work until everything has been cleared.

At the time of writing, members of **Bournemouth DSME** are busy preparing for the official opening of their new track. This will have taken place by the time you all read this, so we hope it was successful. We will no doubt be able to report the event fully later in the year.

Past 'Freditentials' by Editor Frederick Bilney for the **Bradford MES** newsletter have carried comments about the proposed model

boating pond to be built inside the confines of the raised track. Drawings are being prepared for this venture which is to commemorate the society's 100th anniversary in 2008 and aims to reunite the sections of the club on one site. Boating Commodore John Shelton has put out a call for anyone who can give advice or has experience in building ponds or laying large areas of concrete, or "who knows someone who does." As someone who started their model engineering activities with model steam boats, I welcome the news of this new facility being created rather than the usual sad tales of the loss of sailing waters. Another headline in the newsletter was "Lion Sighted in Northcliff Woods." This lion was not of the furry type but John Mills' locomotive of that name being tested for the first time. The only problem involved the injector, otherwise the locomotive ran well and easily coped with a load of two adults. Well done John; as the report commented: "it is a brave man, or a very confident one, who steams his locomotive for the first time with an audience." The newsletter also carries photographs of several spark arrester designs ranging from gauze cylinders to folded gauze screens. The club has suffered an attack of vandalism with some stored paving slabs having been smashed, and stones being removed from the rockery for use to 'dam' the stream. Am I alone in looking wryly at the effort expended by government on

## 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.

### MAY

- 28 **Chichester DSME. Steam on Sunday.** Contact Brian Bird: 01243-542266.
- 28 **Historical MRS (Essex Area).** Gary Stanford: Network Rail 'Track Maintenance Progress'. Contact Jem Harrison, 27 Colne Place, Basildon, Essex SS16 5UZ.
- 29 **Bedford MES. AGM.** Contact Ted Jolliffe: 01234-327791.
- 29 **Brighton & Hove SMLE. Public Running Day.** Contact Mick Funnell: 01323-892042.
- 29 **Woking MRS. Visiting Locos Day.** Contact Ronald Dewar: 01932-343331.
- 29/31 **Bedford MES. Exhibition & Traction Engine Rally.** Contact Ted Jolliffe: 01234-327791.
- 29-31 **Great Western Soc. (Didcot Railway Centre). Spring Holiday Steamings.** Contact Jeanette Howse: 01235-817200.
- 29-31 **Guild of Model Wheelwrights at Harts Barn, Longhope, Gloucestershire.** Contact Biddy Hepper: 01492-623274.
- 30 **Amnerfield Min. Rly. Public Running.** Contact David Jerome: 0118-9700274.
- 30 **Guildford MES. Members' Running Day.** Contact Dave Longhurst: 01428-605424.
- 30 **High Wycombe MEC. Public Running.** Contact David Savage: 01494-527402.
- 30 **MELSA. Sunday in the Park.** Contact Graham Chadbone: 07-4121-4341.
- 30 **SLS Victoria. Working Bee & Barbecue.** Contact Graham Plaskett: (03) 9750-5022.
- 30 **Teesside Small Gauge Rly. Running.** Contact Mike Aslin: 01642-724255.
- 30 **Woking MRS. Friendly Locos Day.** Contact Ronald Dewar: 01932-343331.
- 30/31 **Bristol SMEE. Public Running Days.** Contact Trevor Chambers: 01454-415085.
- 30/31 **Cardiff MES. Open Days.** Contact Trevor Jenkins: 029-2075-5568.
- 30/31 **Elmdon MES. Public Running.** Contact Chris Giles: 0121-458-1291.
- 30/31 **Malden DSME. Public Open Days.** Contact John Mottram: 01483-473786.
- 30/31 **Northern Mill Engine Society. Open Days.** Contact John Philp: 01257-265003.
- 30/31 **Oxford (City of) SME. Public Running.** Contact Chris Kelland: 01235-770836.

- 30/31 **Talylln Railway. Tom Rolt Vintage Rally.** Enquiries: 01654-710472.
- 31 **Brighton & Hove SMLE. Public Running Day.** Contact Mick Funnell: 01323-892042.
- 31 **Northampton SME. Monday Steam-Up (Visitors Welcome).** Contact Pete Jarman: 01234-708501 (eve).
- 31 **Saffron Walden DSME. Running Day with Barbecue (Public pm)** Contact Jack Setterfield: 01843-596822.
- 31 **Stockholes Farm MR. Spring Bank Holiday.** Contact Ivan Smith: 01427-872723.
- 31 **Surrey SME. Public Running.** Contact John Cook: 020-8397-3932.
- 31 **Taunton ME. Public Running Day.** Contact Don Martin: 01460-63162.

### JUNE

- 1 **South Durham SME. Meeting.** Contact B. Owens: 01325-721503.
- 1 **Stamford MES. Andy Clarke: Kit Locomotives.** Contact David Ash: 01780-751211.
- 1 **Taunton ME. Stationary Engine & Locomotive Running.** Contact Don Martin: 01460-63162.
- 2 **Bradford MES. John Holroyd: Around Britain by Rail.** Contact John Mills: 01943-467844.
- 2 **Tyneside SMEE. AGM.** Contact Ian Spencer: 0191-2843438.
- 2 **West Wiltshire SME. Steam-Up.** Contact R. Nev. Boulton: 01380-828101.
- 2-5 **Guild of Model Wheelwrights at Royal Bath and West Show, Dulverton Pavilion, Near Shepton Mallet.** Contact Biddy Hepper: 01492-623274.
- 3 **South Lakeland MES. Meeting.** Contact Adrian Dixon: 01229-869915.
- 3 **Sutton MEC. Bits & Pieces.** Contact Mike Dean: 0208-657-5401.
- 3 **Talylln Railway. Chris Awdry's Duncan Day.** Enquiries: 01654-710472.
- 4 **Vale of Aylesbury MES. Track Night.** Contact Clive Ellam: 01296-623433; Ian Meikle: 01844-291590 or Bob Jones: 01296-29468.
- 4 **Canvey R&MEC. Steam-Up with Food.** Contact Brian Baker: 01702-512752.



## 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.

Roy Doar

John Hockham

Erewash Valley MES

National 2 1/2" Gauge Association

inordinate amounts of health and safety legislation and that expended in satisfactory policing?

We have received a leaflet describing the **Ellenroad Engine House** at Milnrow near Rochdale. This houses the "world's largest steam mill engine" and the Whitelees Beam Engine. The engines are in steam on the first Sunday of each month (except January) and further information is available from 01706-881952. A model engineering exhibition will accompany the June steaming day.

Members of **Erewash Valley MES** are making good progress with their ground level track. Their target is to have a complete circuit ready for their 30th anniversary celebrations in July.

As a result of many enquiries about their railway to the local **Ulster Folk & Craft Museum** near their track, members of the **Model Engineers Society of Northern Ireland** allowed themselves to be persuaded to try public running at their track in Cultra. As they had a locomotive in steam, the decision was taken to "try running" and after an hour and a half nearly "£50 in donations had been received from delighted passengers." The society's gauge one track was officially opened by Jim Crozier; this will no doubt spur on the *Project* locomotive builders to greater efforts. The newsletter carries a photograph of a "sad looking Reliant Robin" which is apparently "awaiting conversion to steam with the insertion of a boiler and engine." Having witnessed a similar vehicle catch fire on London Bridge many years ago, I hope the insulation will be good — it took very little time for all that fibreglass to get well alight!

Members of **City of Oxford SME**

are preparing for their 'Dreaming Spires' rally which is to take place on Saturday/Sunday 24/25 July 2004. A new feature this year will be a 'Bring & Buy' area for those attending. Further information can be obtained from Chris Kelland (01235-770836) or Denis Mulford (01235-861778) or by e-mailing [dreamingspires@cosme.org.uk](mailto:dreamingspires@cosme.org.uk). For those unfamiliar with the Cuttesslowe Park site, they have a 3 1/2 and 5in. dual gauge raised track and 5 and 7 1/4in. dual gauge ground level track in addition to roads available for traction engines.

The other *Club Chat*, produced by **Peterborough SME**, carries a photo of the J. N. Maskleyne Trophy which was won by member Tony Meek for his locomotive *Princess of Wales*. Tony described the trials and tribulations of making the transfers for the locomotive numbers. He eventually used a computer to print the outlines onto transfer film and then painted the film using the outlines as a guide. Those who saw the results at the recent Model Engineer Exhibition at Sandown Park will be in no doubt that the method worked. The New Year's Day run was not well attended by those with locomotives, the only runner being Maurice Grainger with his 5in. gauge Britannia built from a Winsor kit. It is reported that "after some tweaking by the club experts, the engine now runs a lot better." Sid Bates provides further information on the 'Dubbin' saga previously mentioned in this column. It all started in the early days of the society when member Alan Harding obtained "umpteens tins of Dubbin" which he brought to the auction to boost society funds. Because the demand was slow, the tins were put

with other items to get them sold. Lo and behold, next year at the same event a large number of the tins reappeared for sale and the same sales method was used. This apparently has gone on and on with odd tins still turning up for sale, having been sold about 25 times. A postscript to this is that my predecessor on this column, Stan Bray, recommends the use of Dubbin as a tapping compound. So all those who are hoarding tins, bring them to the next sale — you might make a profit! The club locomotive has received an overhaul over the winter with attention to the bogies and motors and the fitting of a "dead man's handle."

Another locomotive receiving attention over the winter has been *Hernia* belonging to **Plymouth Miniature Steam**. At the time of writing, all that remains is "just re-assembly." Progress has also been made on the new passenger car sets. The society enjoyed a good turnout on New Year's Day with eight locomotives, of which two were steamers. Editor Ian Jefferson also tested the re-springing on his GWR 'Toad' brake van. Since this now remains on the track, he deemed the job "a complete success." At the AGM a small presentation was made to member John Grant as "the most improved apprentice." Well done John. On the same topic, the society reports that the number of junior and novice members is increasing, which must be seen as very good news for the future of the society. One of the apprentices (aged 13) is keen enough to be seeking a small lathe. Further information about the club can be obtained by contacting Chairman Malcolm Preen on 01752-778083.

*Uncle Leslie's Diary* in the **Reading SME** newsletter reports that the 'Wednesday Warriors' have been busy replacing further concrete beams on their raised track. Things went so well this time that 21 beams were replaced in the recent sessions. The old beams have been incorporated into a retaining wall on the outside of the cutting. Member Ron Welch has been busy making tools and accessories for the lathe and keeping the workshop in order which latter is a never-ending job. The ground level signals have also been modified and raised concrete 'pyramids' have been cast for the post supports so that they stand out and can be found easily when setting up for running. The club is pleased to have gained eight new members this year.

The **Society of Model & Experimental Engineers** reports that at the time of writing their journal they had 26 people enrolled on their first basic training course this year. Over 100 requests for information on the courses has also been received. Is this a sign that people are now realising that these basic skills are dying out?

**Southport MEC** is holding an open day on 17/18 July this year at the Victoria Park track. Further details may be had from Craig Skelland on 0786-797-3443 or e-mail [craig.skelland@orange.net](mailto:craig.skelland@orange.net)

Members of **Surrey SME** assembled at their Mill Lane headquarters for an illustrated talk by the 'SS Shieldhall' team.

The **Teesside Small Gauge Railway** reports near readiness for the 2004 running season. The club's heavy duty battery electric locomotive has been given new motors and brake modification and, on the passenger cars, one wheel on each axle has been made free running to

- 4 **Maidstone MES (UK).** *Evening Run.* Contact Martin Parham: 01622-630298.
- 4 **North London SME.** D.A.G. Brown: *CAD is Easy!* Contact David Harris: 01707-326518.
- 4 **North Norfolk MEC.** S. Kinch: *Restoration of a Riley.* Contact Gordon Ford: 01263-512350.
- 4 **Rochdale SMEE.** *Quiz Night.* Contact Mike Foster: 01706-360849.
- 4 **Romford MEC.** *Competition Night.* Contact Colin Hunt: 01708-709302.
- 5 **Annerfield Miniature Railway.** *Diesel and Electric Open Day.* Contact David Jerome: 0118-9700274.
- 5/6 **Guildford MES.** *Golden Anniversary Celebrations.* Contact Dave Longhurst: 01428-605424.
- 5/6 **Vale of Aylesbury MES.** *Miniature Traction Engine Rally & Model Engineering Show.* Information: 01296-655720.
- 5/6 **Dockland & E. London MES.** *Passenger Running at Belhus Woods Country Park.* Contact P. M. Jonas: 01708-228510.
- 5/6 **Llanelli DME.** *WMLC.* Contact P. C. Bassett: 01554-820294.
- 5/6 **Melton Mowbray MES.** *Whissendine 2004 Miniature Steam Rally.* Contact Phil Tansley: 0116-2673646.
- 5/6 **Warrington DMES.** *NAME NG IMLEC.* Contact Barry Harrison: 01928-724447.
- 5 **Isle of Wight MES.** *Track & Pond at Broadfields.* Contact Ken Stratton: 01983-531384.
- 6 **Basingstoke DMES.** *Public Running.* Contact Guy Harding: 01256-844861.
- 6 **Ellenroad Engine House.** Elizabethan Way, Milnrow, Rochdale, Lancashire OL16 4LE. *In Steam plus Model Engineers Exhibition.* Enquiries: 01706-881952.
- 6 **Frimley & Ascot LC.** *Public Running.* Contact Bob Dowman: 01252-835042.
- 6 **Great Western Soc.** (Didcot Railway Centre). *Didcot Steam & Railcar Day.* Contact Jeanette Howse: 01235-817200.

- 6 **Leyland SME.** *Charity Day plus Ground Level Public Running Day.* Contact Mark Entwistle: 01772-422411.
- 6 **Malden DSME.** *Public Open Day.* Contact John Mottram: 01483-473786.
- 6 **Oxford (City of) SME.** *Public Running.* Contact Chris Kelland: 01235-770836.
- 6 **Plymouth MSLS.** *Running.* Contact John Brooker: 01752-671722.
- 6 **Royston DMES.** *Running Day.* Contact Jeff Dickinson: 01763-261670.
- 6 **Saffron Walden DSME.** *One Day Rally (Open to all Clubs).* Contact Jack Setterfield: 01843-596822.
- 6 **South Durham SME.** *Running.* Contact B. Owens: 01325-721503.
- 6 **Steam LS of Victoria.** *Public Run.* Contact Graham Plaskett: (03) 9750-5022.
- 6 **Surrey SME.** *Members' Steam-Up.* Contact John Cook: 020-8397-3932.
- 6 **Sutton Coldfield MES.** *Steam-Up.* Contact Eric Basire: 0121-378-3992.
- 6 **Taunton ME.** *Public Running Day.* Contact Don Martin: 01460-63162.
- 6 **Teesside Small Gauge Rly.** *Running.* Contact Mike Aslin: 01642-724255.
- 6 **Guild of Model Wheelwrights at Worcester Courtly Museum, Hartlebury Castle, Kidderminster.** Contact Biddy Hepper: 01492-623274.
- 6 **Wimborne DSME.** *Running Day.* Contact Eric Basire: 01202-897158.
- 7 **Lancaster & Morecambe MES.** *Members' Running Evening with Supper.* Contact Harry Carr: 01524-411956.
- 7 **Peterborough SME.** *Bits & Pieces.* Contact Tony Meek: 01778-345142.
- 8 **Basingstoke DMES.** *Meeting Night.* Contact Guy Harding: 01256-844861.
- 8 **Dockland & E. London MES.** *Bits & Pieces.* Contact P. M. Jonas: 01708-228510.
- 8 **Historical MRS (North West Area).** *Don Rowland: Of Accidental Interest.* Contact David Goodwin: 01224-880018.
- 8 **King's Lynn DSME.** *Meeting.* Contact Mike Cootie: 01533-673728.
- 8 **Sutton Coldfield MES.** *AGM.* Contact Neal Harrison: 0121-378-3992.



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ease the friction on bends. The ground level 7 1/4 and 5in. track now has extra expansion joints and cross-ties welded to further secure the track width. The steam locomotive has only required basic annual attention. PR Officer Mike Aslin was pressed to write to this journal by member Norman Ash who expressed the view that "he valued the information produced in Model Engineer." We thank Norman for his appreciation. Further information about the society can be obtained from Mike at m-or-a@aslin.freemove or by visiting the website www.communicate.co.uk/ne/tsgf Club members are constructing two steam locomotives and one petrol hydraulic locomotive. We look forward to hearing more news from the society now that Norman has started the ball rolling.

Tyneside SMEE is preparing for a 60th Anniversary Open Weekend which incorporates a Martin Evans Commemorative Rally, an event which will have taken place just before publication of this issue. The society is producing a booklet to commemorate the event which will

include photographs of members' work. The society enjoyed an 'Audience with Jack Hayes' in February. Jack had 75 jokes on his list but had to omit some "as being unsuitable for a mixed audience." Jack apparently had the audience "creased with laughter" even before he began his "evening of jokes and anecdotes."

The Vale of Aylesbury MES is holding a miniature traction engine rally and model show on 5/6 June at the Buckinghamshire Railway Centre, Quainton. Further details from 01296-655720.

Members of Wigan DMES were busy preparing for attendance at the Northern Association Exhibition and had to obtain extra tables for all the planned exhibits. At a recent meeting, Brian Woodward presented a selection of slides illustrating the rapid decline of steam in the 1960s. The society is holding an open day on Sunday 25 July at its Haigh track site. Further information may be had from Secretary John Chamberlain on 01744-882255.

At the Wolverhampton DMES AGM, it was agreed that a raised dual gauge (5in. and 3 1/2in.) circuit

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would be added to the Baggeridge track for the benefit of those who operate in those gauges. Keith Wilson was elected Honorary Life Vice President in recognition of his "services to model engineering."

Another society with an important anniversary this year is York City & District Model Engineers which is celebrating its 75th year of existence. Members are combining

the celebration with the official opening of their ground level track — the Charles Erskine Memorial Track. A more private members only celebration will also be held in September. The club has had an offer of obtaining a video projector *gratis*, but the catch is that they will have to buy a new lamp at a cost of around £400! Investigations into wholesale prices continue!

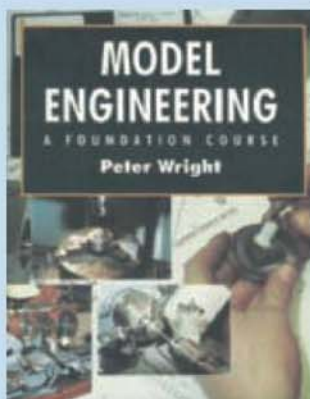
- 9 Cardiff MES. Kids Out Day with Cardiff East Rotary Club. Contact Trevor Jenkins: 029-2075-5568.
- 9 Leicester SME. Invitation Evening. Contact Raymond Wallis: 01162-858824.
- 10 Brighton & Hove SMLE. Workshop Evening (Prior Notice Required). Contact Mick Funnell: 01323-892042.
- 10 High Wycombe MEC. Track Evening. Contact David Savage: 01494-527402.
- 10 Leyland SME. Traction Engines/Road Vehicles Night. Contact Mark Entwistle: 01772-422411.
- 10 Sutton MEC. New Drivers' Run. Contact Mike Dean: 0208-657-5401.
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- 12 Chesterfield MES. Efficiency Trials. Contact Mike Rhodes: 01623-648676.
- 12 Hereford SME. Visit to 9 1/2in gauge railway at The Downs School. Contact Richard Donovan: 01432-760881.
- 12 National 2 1/2in. Gauge Ass'n. Summer Rally at Westland & Yeovil MES. Contact Clive Young: 01233-626455.
- 12 South Lakeland MES. Open Day. Contact Adrian Dixon: 01229-869915.
- 12 Woking MRS. Rotary Beer Festival. Contact Ronald Dewar: 01932-343331.
- 12 York City & DSME. Summer Workshop. Contact Pat Martindale: 01262-676291.
- 12/13 Dockland & E. London MES. Passenger Running at Belhus Woods Country Park. Contact P. M. Jonas: 01708-228510.
- 12/13 Guild of Model Wheelwrights at Belvoir Castle Grantham. Contact Biddy Hepper: 01492-623274.
- 12/13 Harrow & Wembley SME. Open Weekend. Contact Dr. Roger Greenwood: 020-8427-2755.
- 12/13 North Wiltshire MES. Gala Weekend. Contact Les Stiff: 01249-521658.
- 12/13 Peterborough SME. PMLR at Thorpe Hall. Contact Tony Meek: 01778-345142.
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- 12-14 MELSA. Queen's Birthday Weekend. Contact Graham Chadbone: 07-4121-4341.
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- 13 Great Western Soc. (Didcot Railway Centre). Father's Day Steamday. Contact Jeanette Howse: 01235-817200.
- 13 Guildford MES. Public Open Afternoon. Contact Dave Longhurst: 01428-605424.
- 13 Guild of Model Wheelwrights at Broomfield College, Broomfield, Morely, Ilkeston. Contact Biddy Hepper: 01492-623274.
- 13 Harlington LS. Public Open Day. Contact Peter Tarrant: 01895-851168.
- 13 Hereford SME. Public Open Day. Contact Richard Donovan: 01432-760881.
- 13 Hornsby ME. Running Day. Contact Ted Gray: 9484-7583.
- 13 Leeds SMEE. Running Day. Contact Colin Abrey: 01132-649630.
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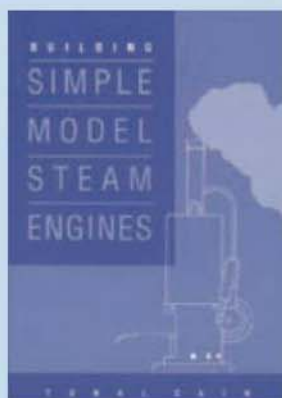
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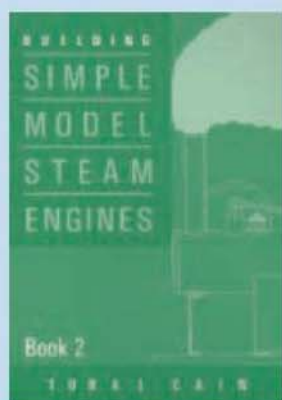
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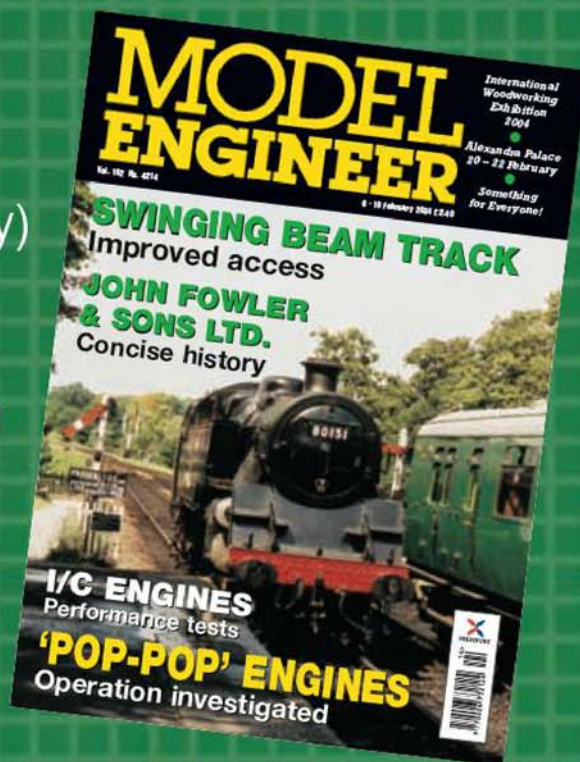


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