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Vol. 202 No. 4352

22 May – 4 June 2009

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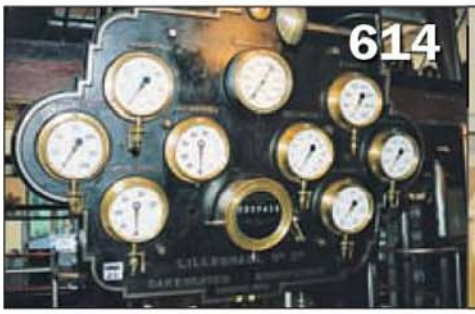

IN THIS ISSUE

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ON THE COVER...

Nick Feast running his Southern Q1 at the Bournemouth track on Easter Monday. See Smoke Rings *on page 611 for more details of this 'speedy' locomotive.*
(Photograph by David Clark)

PLEASE SEE PAGE 610 TO TAKE ADVANTAGE OF OUR LATEST SUBSCRIPTION OFFER

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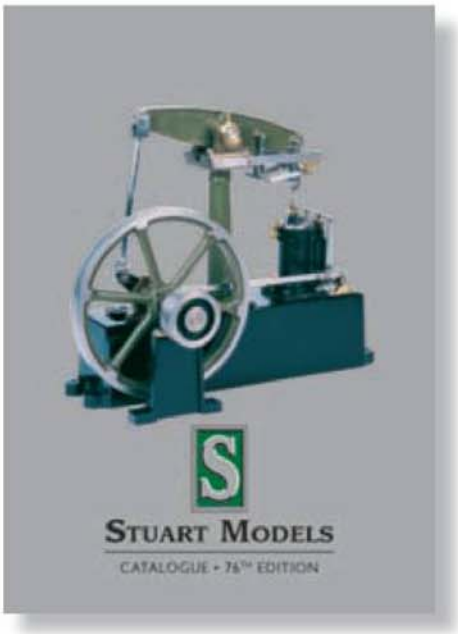

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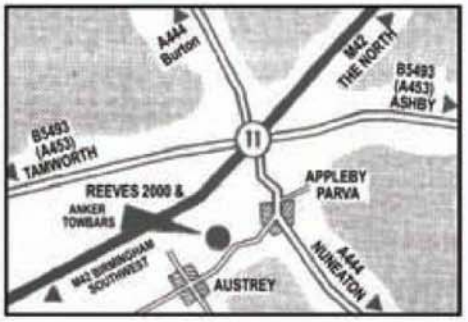

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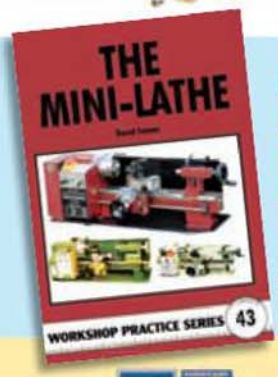

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DAVID CLARK
Editor

News section

In this issue, *News* centres on the **East Somerset Society of Model & Experimental Engineers**. I visited the society just after Easter and it was an enjoyable visit. I would like to thank George White the Chairman and Roger Davis the Honorary President (as well as the other members of the society that were present) for the warm welcome they gave me.

Model Engineer website

By the time you read this, the *Model Engineer* website should be live.

The URL is **www.model-engineer.co.uk**

There are forums to chat to other model engineers, a gallery where you can post photos of your models and a free advert section where you can put your own advert up, with a picture if you wish, and you can also remove the advert yourself when the item is sold.

There will be articles to read and this section will be added to on a regular basis.

The Model Engineer Exhibition

It has been pointed out that our Model Engineer Exhibition has never been called The London Model Engineering Exhibition. We have no connection with the London Model Engineering Exhibition either in the past or currently.

Harrogate show

I did not manage to attend the Harrogate Model Engineering Exhibition this year due to a bad fall which meant that I did not feel up to the long trip. Hopefully I will be able to make it next year. However, Dave Fenner will be doing a short report for a future issue.

Nick Feast and his Q1 locomotive

Next issue includes the start of a new construction series about a 3½in. gauge Southern Railway Q1 locomotive, **photo 1**. I have seen this locomotive and ridden behind it and it can certainly shift. Castings are now available from Polly Models. This is a step forward for me, my first new locomotive design in *Model Engineer*. This locomotive also breaks with the more traditional engines published in the past as the drawings have Metric dimensions. This is how Nick designed it; it was not Metric at the editor's request. I hope this will be a popular locomotive. It deserves to be. As it is designed as a beginners' locomotive, questions about any aspect of construction will be welcome from readers. I am a firm believer that no question is stupid if you don't know the answer.

1

2

Anthony Mount

I have another series starting in the next issue. Anthony Mount has provided a series on the construction of a Stockport Vacuum Engine, **photo 2**. It looks like it is a fairly simple construction job and might well be suitable for the beginner to model engineering. I have delayed publishing this series until Polly Models had a stock of castings. I heard from Pete Thomas that the engine is ready to go for the Harrogate show so I am ready to start publishing the series. Hopefully this will prove as popular as the McOnie's engine.

Stowe

We are nearing the end of Stowe and there will be one more episode after this issue's instalment. Neville is well advanced with his next project, a Garratt locomotive based on two Polly chassis. Neville also has a friend who has built a superb 517 class tank locomotive and although the friend, who has superb workshop facilities, does not wish to write it up as a series he has photographed it so that Neville can write it up for him. Watch this space, steam is coming back to *Model Engineer*.

Boiler inspectors

The **Northern Association of Model Engineers** consider that the most vital people in the model engineering hobby are those club members who volunteer to perform the unpaid duties of boiler inspectors. Without them, steam operation of models would not exist.

In the last decade, more legislation and directives from both national and European sources has arrived and the Association has felt that it should give as much assistance and help as possible to enable inspectors to keep up to date to perform this vital service.

The Association's council has decided to provide a series of seminars and lectures where boiler inspectors can be given as much assistance, help and support as possible.

The programme covers:

- Changes in legislation
- Design and construction
- Updates in boiler testing codes
- Boiler documentation and registration
- Insurance requirements
- Practical testing of steel and copper boilers.

Contact Alan Budd, Hon. Secretary, 39 Langford Road, Arnold, Nottingham NG5 7HR.

POSTBAG

FIRST CLASS POST

Goods wagon construction

SIRS, - I would agree with the recent comment in *Model Engineer* regarding a construction series for goods wagons. I did obtain copies of the articles by D. Hewson. However, I would appreciate something rather simpler: A short history/design discussion would be interesting and a wooden frame wagon would be a great starting point. One such design was published in *M.E.* 3490, 7 June 1974. That design is always rumbling about in the back of my mind, but I just don't understand which pieces overlapped which pieces on the real thing. Obviously there is no chance to see one over here in the States.

Bruce Voelkerding, by email.

Unimat motor required

SIRS, - I have an elderly Unimat 3 lathe desperately in need of a replacement motor. My question is, do you know of a supplier who might be able to supply a suitable motor, or failing this would you be kind enough to print this request for help in the letters page of *Model Engineer*. I feel that by now there should be someone who has met with this problem and hopefully solved it. Any help will be much appreciated many thanks.

John Weight, by email.

Harrison's chronometer under repair

SIRS, - *The Guardian* of 16 March published a fine full-spread photograph of the Royal Observatory's Jonathan Betts starting to dismantle Jonathan Harrison's first chronometer, H1, to repair a broken balance-spring. (The prize-winning version was H4, a much smaller hence practical sea-going, instrument.) H1 had, so the accompanying text tells us, been running perfectly for over 50 years until this breakdown. The repair and general overhaul will probably take about three months, after which it will 'run for centuries'.

Nigel Graham, by email.

French contacts?

SIRS, - I have recently moved to the Paris area (Maisons Laffitte, west of la Defence) via the Netherlands and Belgium and I am currently setting my workshop up again. However, I have yet to find firstly any model engineering groups in the area or, secondly, any metalworking suppliers. Can I appeal to your readers to help me with any contacts or suggestions in this area? - my French is fluent so I am not particularly looking for expats or English outlets, although such contacts would be gratefully received as well. My email address is **simon0362@hotmail.com** if anyone has some information.

Simon Davies, France.

Excel errors

SIRS, - Roger Castle-Smith suggests using Excel for cam profiles such as that on the Equatorial Sundial.

It's a very good suggestion, and Excel can be used for many model-engineering tasks - but beware. The "Radar Plots" are not true polar graphs. They run from 0deg. to 360deg., but don't know that these two values are the same. Consequently, a circle using 1deg. increments will plot 361deg. with a small gap between the 360deg. and 0deg. lines. This is not immediately noticeable because the trace bridges it, and the labels and axis lines are just a blur when plotted in anything less than about 5deg. intervals. The error on a cam so designed will decrease as its radius decreases, so may not matter, but one 'fudge' is to omit the 360deg. values, i.e. plot from 0 to 359.

Excel polar plots also lack most of the axis and grid editing functions offered for Cartesian graphs. It's sometimes possible to remove the resulting clutter by deleting unwanted angle values after plotting the curve, but if that fails you can only 'erase' the surplus by printing them in white. Unfortunately that trick is all-or-nothing.

Taking advice from the considerable pool of IT specialists at work, more dedicated graph-plotting programmes include MatLab and Origin, but these are for professional users, and very expensive. Another suggestion is Gnuplot.

Of the rest I have tried only Origin, and then professionally. It's difficult to learn, but can use data prepared on Excel, it puts 360deg. where it belongs, and offers graph-appearance tools far better than those in

LBSC *Ivy Hall*

SIRS, - My late father started building an LBSC *Ivy Hall* serialised in *Model Engineer* in 1955. Like many other model locomotives it never progressed beyond the frames and wheels, which I still have.

According to Brian Hollingsworth's biography of LBSC it was "a truly dreadful caricature of a GWR Hall class alleged to be a modernised version" and goes on to say that none are known to have been built.

This was unlike the *Lickham Hall* design designed for Reeves in 1956 but not serialised in *Model Engineer*. Many are reputedly running.

Did any *M.E.* readers manage to build an *Ivy Hall*? If they did was it in fact as barbaric as Brian Hollingsworth suggests?

One day I'd like to complete it but there are a good few projects to finish before that! I haven't yet found any plans so if any reader wants to pass on or sell plans I'd like to hear. (E. **arbe1950@googlemail.com** or T. 020 8553 3739 evenings).

LBSC was almost unbelievably prolific in his designs. I wonder if some of the other designs were ever built, particularly in 0 and 1 gauges. Reviving some of the old designs would be an interesting task.

Roger Backhouse, by email.

Write to us

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Excel, making it far easier to edit the grid. The result is an image file. Note that Origin, and possibly other dedicated mathematical plotting routines, use the mathematician's convention of starting with 0 on the x-axis and plotting anti-clockwise, rather than the more familiar compass 'North & clockwise' way.

Alternatively of course, calculate the co-ordinates as subtractions from the maximum-radius datum circle, use a rotary table and mill each point into a circular blank, and carefully file or linish away the little intervening peaks!

Another obvious spreadsheet use is scaling, converting and datum-fixing dimensions from the vagaries of published drawings with their umpteen chain-dimensions and data edges set for drawing rather than machining convenience, to single-datum-point lists for co-ordinate and rotary-table work. It is also ideal for creating simple mathematical models, of, for example, boiler and cylinder-valve designs: use absolute cell-references for the constants and entered variables. It's startling to see how much even a small change in certain variables can change everything else. I have also prepared thread-dimension and change-wheel tables to suit my own machines, printed the results clearly on A4 sheets then laminated them for ready reference.

Spreadsheets are primarily administrative tools, which are why the Excel 'Radar Plots' are weak for engineering use, but this bias can be valuable for indexing your magazine collection to suit your own interests. The Data Filter allows easy tracing of specific topics or authors' names. I created a spreadsheet of advertisers in *M.E.* and other sources including *Yellow Pages*, to help me find tools and materials suppliers. (You could use a database like Access, but it's a lot of extra work better spent making swarf or coal-ash!)

So by all means use Excel, but be aware of its strengths and weaknesses.

Nigel Graham, by email.

A beginner's page

SIRS, - This is intended to be a letter of encouragement. Firstly I must confess that I am not a model engineer nor do I think I ever will be. I am however, a retired aero engineer, and having worked nearly half my life at the English company that makes the best aero engines in the world and then, after emigration, for a company now owned by the one that arguably makes the best airliners in the world, I believe I know a bit about engineering.

I was shown your magazine a few months ago by a friend and I was so impressed by the standard of work of the contributors that I have purchased it ever since. The magazine is an interesting read from cover to cover and gives me a great deal of pleasure. I had no real idea of the model engineering world and I am stunned by the quality of all the models portrayed in its pages. I have long been a steam enthusiast, being especially fond of 'God's Wonderful Railway' even though I come from the heart of the LMS, and to see so many wonderful models of even mundane pannier tanks is a great delight. The content of your magazine is fine by me but I would have thought that a beginner's page would be of use. As the magazine has been running for so long how about an occasional blast from the past? I am sure articles from a couple of generations ago would be interesting, amusing and instructive!

The quality of the letters page is often a good indicator of the quality of the publication which contains them as well as that of the contributor; your job as editor is a difficult one, treading through the minefield of those who 'carp on' about obtuse matters and those who have something positive to contribute - more power to your editorial pen!

I really do wonder if the younger generation will continue the tradition as we grow old and maintain the momentum, I certainly hope so.

Incidentally, my interest in engineering was stimulated by an uncle who gave me my first Meccano Set but that is another story.

Keep up the good work in what I am sure are the fine traditions of a fine magazine.

David Wilson, by email.

About right for me

SIRS, - I doubt that I am adding anything new to the discussion about *M.E.* content, but I felt I should make a positive comment on the content of this week's issue (*M.E.* 4349, 8 April 2009) as this is something I often feel about other issues but never get round to writing. I spent some enjoyable spare time reading *Steam Engines Return to Stockton-on-Tees* and most of the contents of *Postbag* before realising I had run out of time with plenty of interesting things still to read.

These two sections contained parallels with my own model engineering history. As a mid teenager my 3½in. gauge Meccano steam-driven effort led me to an experienced model engineer who suggested I build a simple model locomotive and Tich was advised. The metalwork teacher (Barrow-in-Furness technical school for boys) gave a lot of support to this potential O-Level project but sadly, despite access to full workshop facilities, time ran out and when I left the school I had only the frames and horns completed. Maybe a smaller project like at Stockton would have been better, as these simple engines offer a short project giving a springboard to greater things. In my case, I am grateful to that earlier suggestion to go for Tich (thank you Giles Taylor) as now, 28 years, marriage, family, house and so forth later, I have been able to get something like a workshop (including an excellent ML 7 that is 50 on 15 June).

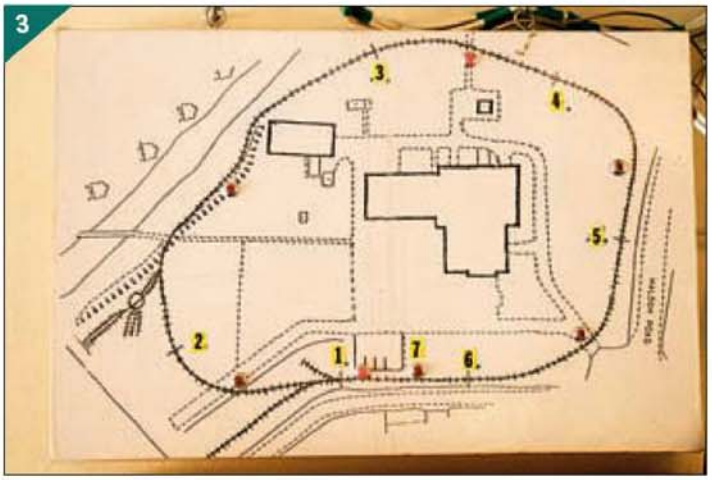
Importantly, this locomotive is giving me the experience and confidence to tackle things, such as cylinders, that may have been more daunting on a bigger locomotive. This was mentioned in *Postbag* of the same issue of *M.E.* with respect to using *Ayesha* as a model for a novice.

The editor of *M.E.* has a difficult balance to make and as I have stated in my response to your recent survey, I generally buy copies of *M.E.* that meet the locomotive/tool/general interest article, but certainly this last issue was just about right for me. Thank you again.

Dave Haynes, by letter.

Lathe displayed outside the Museum of Power.

Portable engine on loan to the museum.



Track plan - Langford and Beeleigh Railway.

Model Darjeeling engine made entirely from recycled materials.

AN ENGINEER'S DAY OUT
The Museum of Power, Langford

ROGER BACKHOUSE

Roger Backhouse visits an engine museum in Essex.

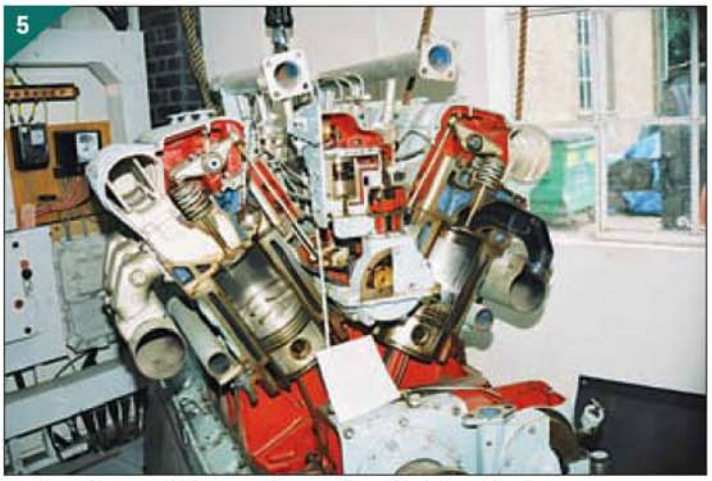
Maldon, Essex, is better known for sailing barges than engineering. This is the heart of maritime Essex where river estuaries come far inland. Yet less than two miles from tidewater is a museum of engineering, with a wide-ranging collection. Essex towns grew rapidly in the early 20th century. Places like Southend mushroomed. To help cope with rising demand Southend Waterworks Company commissioned a new pumping station at Langford near Maldon. This pump house now forms the heart of the museum.

Engines

The company chose three triple expansion engines made by the Lilleshall Company of Oakengates, Shropshire. Originally two were kept running whilst the third remained for maintenance or repair. Although two have subsequently been removed one, Marshall remains. It was commissioned in 1931 and is probably the last steam engine made by Lilleshall. This forms the centrepiece of the museum, dominating all other exhibits. The engine is of the inverted vertical type with three cylinders. Steam entered the high-pressure cylinder (20in. diameter - 500mm) and then powered the intermediate (35in. diameter - 889mm) and low-pressure cylinders (56in. diameter - 1,422mm) to maximise use of steam.

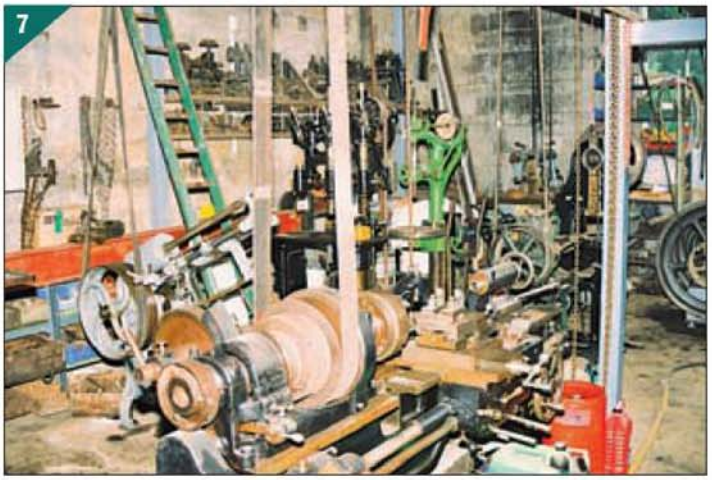
Steam was admitted to cylinders at a pressure of 210psi (14.3 bar). All the cylinders were double acting and are fitted with drop valves for steam and exhaust. A governor keeps the engine to about 32rpm.

This wasn't the only energy saving idea to improve efficiency. All cylinders are steam jacketed to reduce condensation and heat loss. Between cylinders, steam passes through a



Sectioned Paxman Valenta engine used in a High Speed train.

Crossley gas engine.



Belt-driven workshop from Simpson's of Barnsbury North London.

Steam turbine made by MetroVick of Manchester.

heat exchanger - or reheater- conspicuous on one side of the engine, raising the temperature and pressure of steam before it enters the next cylinder. Finally, exhaust steam goes to a condenser below the floor and is reused as boiler feed water.

The engine is linked to a massive 14ft. (4,267mm) flywheel weighing 18-tons. Thankfully the engine was kept well maintained. After all, it managed 36 years solid service and the museum hopes to run it under steam again. The pipes and cylinders were also lagged with asbestos but this has now been removed.

When built the engines were supplied by three Babcock and Wilcox water tube boilers but these were removed and the 150ft. chimney demolished in 1963 when electric pumps took over. Fortunately the company decided to retain the remaining engine, encouraged by the Chief Engineer of the company, Percy Gordon Spencer. Sadly a similar triple expansion engine near the railway flyover in Ilford was scrapped as late as the 1970s.

Pumping power

Pumping was carried out by a combination of three high lift pump rams below the steam cylinders driven from the engine crossheads and three low lift displacement pump rams driven from a crankshaft extension. At peak they could pump about 8,000,000 gallons (36.368m litres) a day. Water came from the nearby rivers Chelmer and Blackwater, stored in two large reservoirs, then pumped by the 'low lift' pumps to the purification works. Water then went via a 28in. (711mm) cast iron main to Southend, Canvey Island, Benfleet and other Essex towns. Booster stations pumped water to the higher areas.

More exhibits

With a remarkable variety of exhibits the museum lives up to its name as a museum of power. Most power sources are represented including a working model waterwheel. Several items can be 'hands on' operated, ideal for children or those of us who still have the inner child.

Essex towns once had quite a substantial engineering industry. Davey Paxman made a variety of machines at their Colchester works. One example is a horizontal compound made in 1892 to drive a Swiss dredger. A 9in. diameter high-pressure cylinder is linked to a 14in. low-pressure cylinder.

Another Paxman engine, this time diesel, was used in diesel electric locomotives. Built in 1960 with 12 cylinders it generated 400hp at 1,000rpm. The museum also displays a sectioned Paxman Valenta engine as used in High Speed trains.

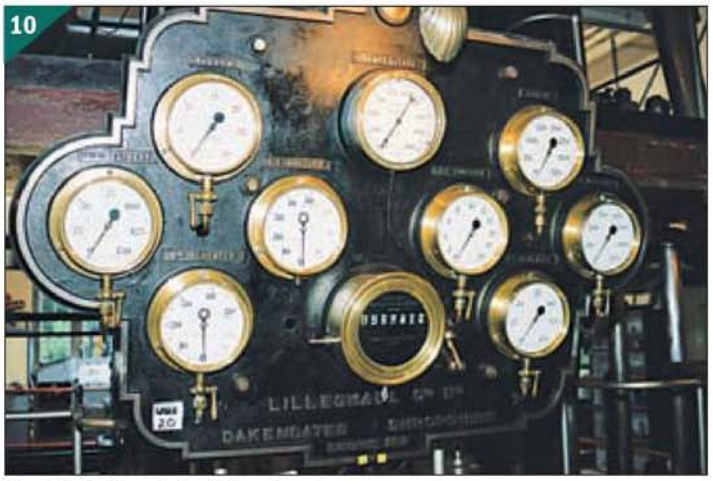
Bentall Engineering Company was based in Maldon for nearby 200 years. Until closure in 1984, when many other fine engineering companies folded, they made a variety of equipment including smaller engines, chainsaws and even a motorcar. Some of their products are displayed here.

The museum also displays car engines, a Rolls-Royce *Griffon* engine of 1934, a Crossley Gas engine and a Lilleshall barring engine, used to turn a flywheel if a steam engine was so inconsiderate as to stop at dead centre.

As might be expected from a water works several pumps are displayed, but these were far removed from the cleanliness of water supplies. They include a Joseph Evans vertical ram pump of 1951 once used to pump milk of lime slurry, another Evans double-acting pump with a reversing eccentric pump and one from Wolverhampton made in 1947 used for pumping tar.

Perhaps the most complex exhibit is the Edwardian belt-driven workshop from Barnsbury, North London located in the >>

Lilleshall triple expansion engine - the centrepiece of the museum.



The Lilleshall engine's dials and meters.

former boiler house. It seems odd to find this in the heart of Essex but it is a fascinating sight, reminiscent of the days when almost all workshops were belt-driven from overhead line shafting. Museum volunteers did an excellent job of re-erecting it here.

Offbeat items

Occasionally items find their way into museums that don't quite belong but add to the fun of the collection. There is a delightful non-working model of a Darjeeling tank engine made entirely of recycled materials by John Scott Mason. Sharp-eyed observers will see the chimney is an aerosol can. The maker must have had a great deal of enjoyment assembling this engine.

Similarly there are a number of domestic items here. Very good for nostalgia - yes vacuum cleaners really did look like that once and no the bags weren't disposable. There are old light bulbs, oil pumps and flat irons. An oddity is a working telephone exchange, though nonetheless all part of the experience!

Other attractions

Just outside the main building is the model village, open on Sundays, and one of the most popular attractions, the Langford and Beeleigh Railway. Its 7¼in. track runs round the museum grounds for just under ¼ mile in a pleasantly undulating route partly along the banks of the River Blackwater. Part of the track is believed to be the oldest in the country, originating on the 1930's Surrey Border and Camberley Railway. The line was used for the 7¼" Gauge Society's Locomotive Efficiency Competition in 2008 proving an excellent venue. Trains usually run on the first Sunday in the month and on Bank Holidays, plus special events.

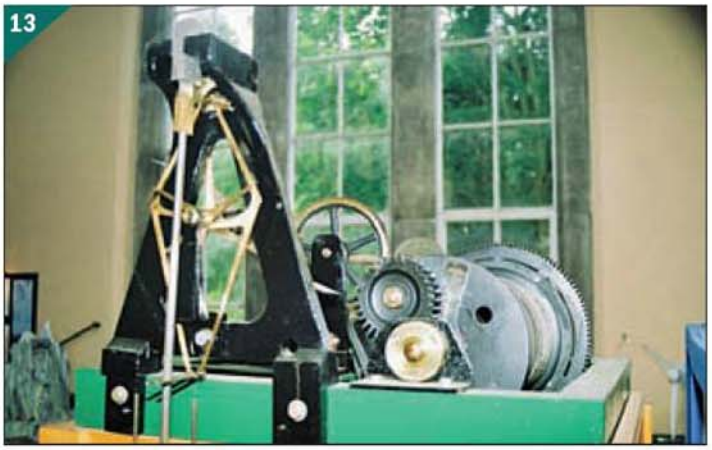
The museum has a tearoom and gift shop. Several special events are held during the year when the railway also operates.

Running the museum

The museum is a registered charity supported by Essex and Suffolk Water as well as the National Lottery. Most daily running is by volunteers who've done an excellent job of restoring and arranging exhibits. More volunteers are welcome. There is an active educational programme and school parties are welcome.

Mini crawler tractor made by Ransomes.

Rolls-Royce Griffon engine of 1934.



Moot hall clock from Maldon.

A collection of vacuum cleaners.

Reaching the museum

Although about a mile from Maldon, public transport is limited but some buses go nearby. The nearest rail station is Hatfield Peverel but Witham has better train services and is around five miles cycling distance. There is plenty of car and coach parking, and a caravan site close by.

Contact details

Museum of Power, Hatfield Road, Langford, Maldon, Essex CM9 6QA.
T. 01621 843183.
E. **enquiries@museumofpower.org.uk**
W. **www.museumofpower.org.uk**

Opening times and charges

- November to Easter - Saturday and Sunday 10.00am to 4.00pm, last entry 3pm.
- Easter to October - Wednesday to Sunday 10.00am to 5.00pm, last entry 4pm.
- Open Bank Holiday Mondays.
- Closed January except New Year's Day Bank Holiday.

Entrance to the grounds for the miniature railway and tearoom is free. However, the following charges apply for access to the rest of the museum.

- Adults: £3.50; Concessions: £3; Children under 6: free; Children aged 6 to 16: £2.
- Families: Two adults + up to three children £9.

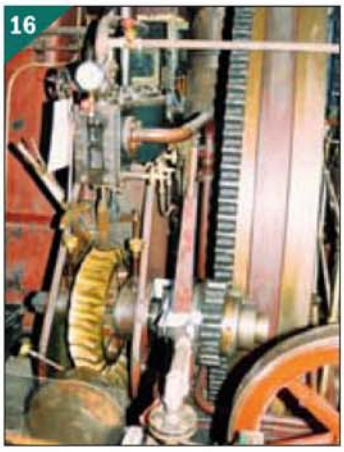
* Reductions for groups of 10 or more.
* Evening group visits available subject to minimum charge of £50.

Events in 2009

31 May - Summer Show: Classic vehicles & Craft stalls. Family entertainment. Refreshments. Miniature steam train rides.
21 June - Heavy Horse Show: Return of this popular event to the museum grounds. Miniature steam train rides.
9 August - Bike Meet: A new event at the museum featuring motorcycles, together with a motorcycle jumble sale. Miniature steam train rides.
September - Date to be confirmed: American Car Show - Show featuring classic American cars together with an auto jumble. Music and family entertainment. Miniature steam train rides.
September - Dates to be confirmed: Heritage Open Days - Free entry to the museum. Miniature steam train rides.
5 December - Santa Special: Proposed event available by pre-booking Miniature steam train rides to see Father Christmas. Present for children included in cost.
6 December - 'Bit of a Do' Christmas Fair: Christmas stalls, Festive musical entertainment, Refreshments, Classic vehicle display. Miniature steam train rides.


15

Smaller engines, some made by the local firm of Bentalls.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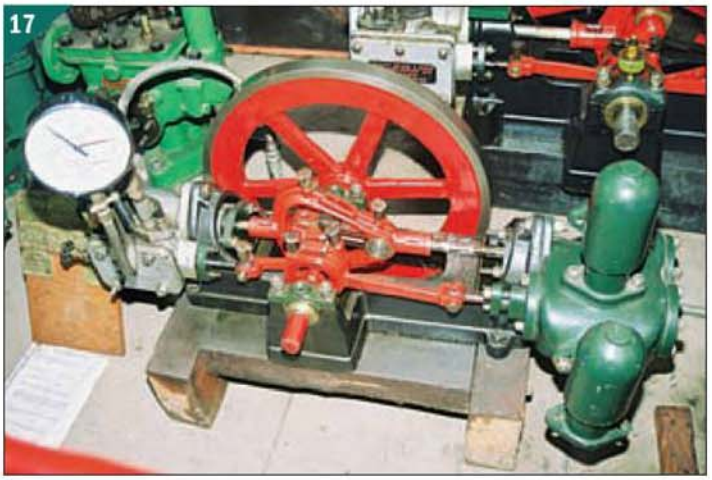
Barring engine made by the Lilleshall Company.


17

Joseph Evans of Wolverhampton 1924 double-acting pump with reversing eccentric.


18

Joseph Evans vertical ram pump of 1951 with reversing eccentric.


19

Davey Paxman horizontal compounds made in Colchester 1892. It once drove a dredger on Lake Zurich.


20

Water flow recorder.

Acknowledgements

I would like to thank all those involved in running the museum and the Langford and Beeleigh Railway for their help with this article. Information about the Lilleshall engine has been taken from the excellent leaflet produced by the museum. **ME**

The Re-Cycle Engine

DAVE FENNER

Dave Fenner concludes the construction of this super little engine.

PART 8

Continued from page 567 (M.E. 4351, 8 May 2009)

The two rockers are shown on their shaft in **photo 79**. The rocker post is shown in **photo 80**; this was sawn from a piece of ⅜in. (9.5mm) thick aluminium (**fig 28**). The surplus material was milled away and then the various holes drilled, and that for the shaft clamp screw tapped. As may be seen in the photo, screwdriver slots were added to two of the screws to speed up assembly.

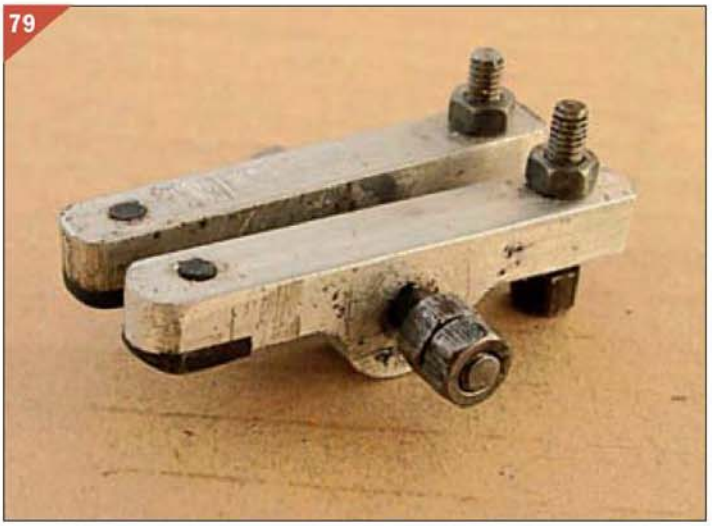
Push rods

As I had previously rebuilt the wheels on the Bonneville, with new rims and spokes, a quantity of old spokes were still lying around, yielding a ready source of 10 gauge high tensile steel wire. Two of these were doctored by trimming to a length of 176mm, then reducing the diameter at each end to 2.6mm for a length of 6.5mm and finally filing each end to an approximate hemisphere. For ease of identification, the exhaust rod was sprayed with red paint.

Inlet elbow and carburettor

A simple block of aluminium was milled to a rectilinear shape. On one face were drilled two 6BA clearance holes, and one 5mm diameter to match the inlet face on the head (**fig 29**). The adjacent side was bored 12mm diameter by 8mm deep to match the available carburettor. This was a Super Tigre No. 12163273 purchased from Tigre Engines, Unit 11 Kingley Park Station Road, Kings Langley, Herts WD4 8GW, T. 01923 269 627. I believe it is intended for a much smaller 2-stroke application, but it seems to work fine here. No doubt other carburettors would also be satisfactory, so if you have a redundant chainsaw, strimmer, or model aero engine, then a unit robbed from such an application could be applied. An additional 6BA hole was drilled and tapped to take a clamp screw bearing on the carburettor stub. I have later found that normal practice on some of the Super Tigre engines is to have a neatly machined clamp offset from the stub, rather along the lines of a typical quill clamp on a pedestal drill. **Photograph 81** shows the elbow complete with red colouration from the Red Hermetite used for sealing here. Also just visible in the picture is the small piece of red plastic placed under the clamp screw to avoid damage to the carburettor mounting stub.

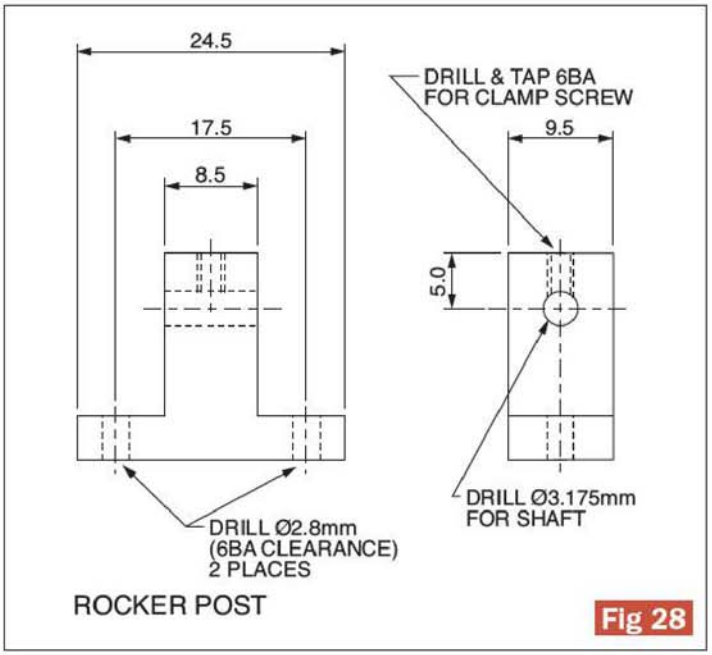
It may be worth noting that the Super Tigre carburettors



Two rocker arms fitted to shaft.

Rocker post shown with its attachment screws and the shaft clamping screw.

The inlet elbow, even mottling of Hermetite confirms flatness of mating faces.



appear to have a facility to rotate the needle jet and hence re-orientate the fuel inlet tube. However, if the position is not as intended, then the jet does not face downstream, and performance will be affected.

Exhaust pipe

A rectangular flange was cut and then drilled with one 6.35mm diameter, and two 6BA clearance holes. The hole pattern would match that on the face of the cylinder head. A length of ¼in. (6.35mm) cunifer tube was then silver-soldered into the hole, and the face filed smooth, as seen in **photo 82**. It would of course be an embellishment to add a silencer, but at the relatively low speed, noise has not been a problem.

Studs

The head is pulled down by four M5 studs. In my best short cut manner I used regular zinc plated mild steel screwed rod, cut to a length of 131 millimetres. These already exhibit signs of corrosion, so it would probably be better to use stainless here. The corrosion is probably exacerbated by the mixture of metals - aluminium, brass, steel, zinc, in contact with the cooling water. It might also be worthwhile adding some car antifreeze to introduce a bit of corrosion inhibitor.

Spark plug

This is one of those cherished artefacts from the 1950s, which has been sitting in a box of aeromodelling ephemera since that era. It came to me, fitted to a Frog 500 model aero engine, which was then converted to glow. The reach on this one is a quarter inch, (6.35mm) and I understand that similar items are available today from Hemingway Kits. Do check the reach of the plug you use, and if necessary, adjust the head dimensions to suit. It would also be possible to make a suitable plug using glass filled nylon as the insulator. As this is intended as a low performance engine, the head temperature would probably allow the use of such material although the life might be limited. **Photograph 83** shows the 1950's plug actually used, alongside a home-made (nylon insulated, surface discharge) version yet to be tried.

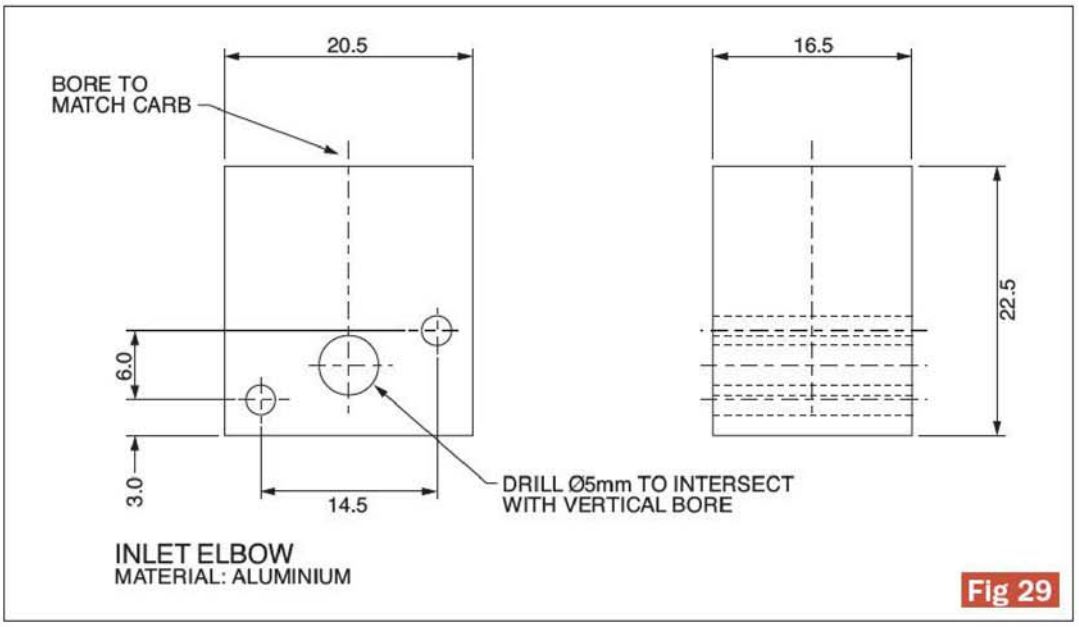


Fig 29

Cooling water reservoir

The underlying theory is the old-fashioned thermosyphon system as used on cars before the days of water pumps. Hot water from the head would pass through the top hose to the radiator, cool, gravitate to the bottom and return to the block via the bottom hose. Here I have not used a purpose made radiator, just another length of brass tube rather inexpertly soft-soldered to a square base with two water pipes added, more cunifer pipe soft-soldered in place. After a few minutes running, the pipes can be felt warming up.

Assembly

One check mentioned in an earlier article, which should be made, concerns the stack dimensions of the cylinder components. Ensure that when the head, liner and base are assembled, there is axial clearance for the brass water jacket. It is also worth taking care to seal certain areas. I used good old-fashioned Red Hermetite on the two cylinder head faces, although Hylomar Blue or various other sealants would probably be satisfactory. For the water system, I opted for Loctite 5699, a non-setting grey flange sealant. This was smeared round the ends of the cylinder liner, the water jacket head and cylinder base joints, and the mating faces of the cylinder base and cylinder stanchion. Also apply sealer to the four nuts and washers which pull down the cylinder assembly.

My sequence for the cylinder parts was: fit studs to head, add liner and water jacket >>


82

Exhaust pipe is a length of brake pipe silver-soldered to a brass flange.


83

Commercial spark plug from the 1950s (top left) and home-made version.

(with sealer), then add the cylinder base, and check that the liner and jacket are both seated correctly. Fit the piston to the con rod and then ease the cylinder assembly over the piston and ring, having previously applied sealer to the stanchion face.

Ignition system

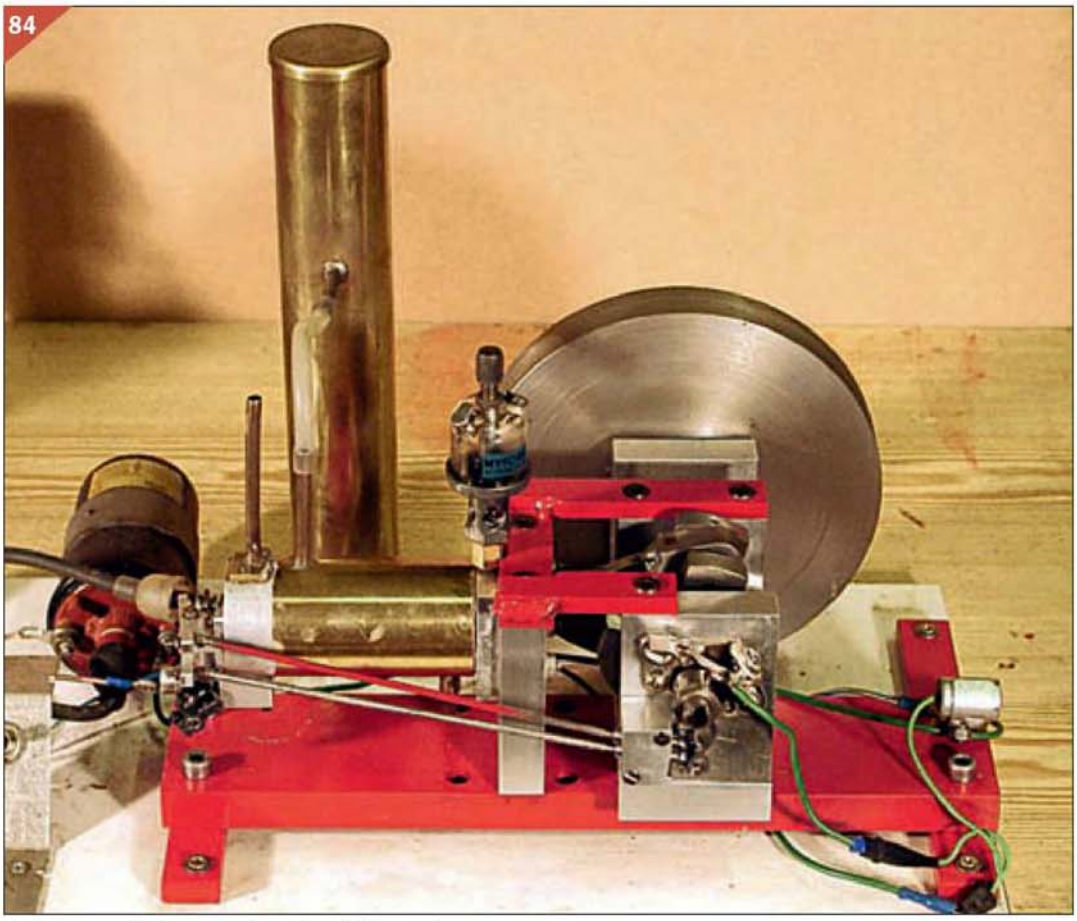
This was described briefly before, and comprises an automotive coil and condenser fed by a 12V battery via a headlamp bulb which functions as a ballast resistor. If the suggested contact breaker set is used, then it will locate in the drilled pivot hole. It is then necessary to add a couple of tapped holes (e.g. M5) for retaining screws. Other more modern systems may be considered, such as the model sized breakerless electronic kit offered by Hemingway.

Timing

The engine is intended to rotate clockwise when viewed from the contact breaker side. I suggest the ignition timing be set either at top dead centre or a few degrees in advance of this. So simply set the crank to TDC and then rotate the CB cam clockwise so that the points are just opening. As we have one spark every revolution it is not necessary to check which stroke the engine is on to set the valve timing. Again, as this is a plodder, the exact timing should not matter a great deal, however as cams are based on data given by Nemett, his timing information will give a useful guide.

First assemble the pushrods noting that the exhaust cam is the one nearer to the bearing housing (and leads the inlet by 105deg.). Set the adjusters to ensure that a few thou clearance exists when the cam followers are aligned with the base circles of the cams. A full-size OHV engine might have typically 12 to 15 thou. (0.3 - 0.4mm) clearance, so for our purposes about 4 to 6 thou. (0.1 to 0.15mm) should suffice. Some clearance is needed to ensure that the valves are able to seat correctly, but again precision is not the order of the day. Too much clearance will simply shift the valve timing a little. Nemett suggested that the inlet should commence opening some 20deg. before TDC, so either use a degree disc and set to this, or keep the crank at TDC, and rotate the camshaft anticlockwise, until the inlet valve just starts to open, then turn it another 10deg. and lock in place.

(I have not tested this, but if it is desired to run the engine in reverse, then it should be possible to swap the push rods at the cam follower ends, so that the inlet cam becomes the exhaust and vice versa, readjust and set the timing with reverse rotation)



Engine assembled once again and ready for running.

Fuel system

For my initial running, I employed a model aircraft fuel tank. I understand that the silicone tubing used for diesel and glow motors is not recommended for petrol. I did, however, use this but was careful to drain and blow through each time after use. The fuel level should be close to the carburettor jet level, higher and it will flood, too low and there may be difficulty drawing petrol up.

Starting

My initial attempts at hand starting failed completely; however, spinning the engine over using a cordless drill proved almost instantly effective. I used the model aircraft technique of finger over the carburettor to draw fuel and it quickly burst into life. Some time was then spent to arrive at the optimum primary and secondary needle settings, as initially it was reluctant to run at a low throttle.

Conclusion

In some model engineering circles, there has been something of a mystique about building I/C engines, the theory being that they require much higher levels of precision than say steam power. This is certainly true for miniature engines where the compression is entirely down to a lapped piston/cylinder. In some respects, building this engine has been an exercise in pushing the boundary in the other direction. Some aspects do require the parts to fit accurately in their allotted positions, but for much of it, a near approximation will suffice.

When the engine is running, the observer is treated to a view of all the oily bits in motion, which in turn promotes interest. No doubt, those keen on a 'Health and Safety' compliant approach will wish to add a crankshaft guard.

I hope readers have found this series of articles useful, and that others will also delve through their stocks of materials and knock up something similar. **Photograph 84** shows the engine reassembled and back on its test stand. A future exercise will be to make a more presentable stand which will hopefully hide all the unsightly wiring and electrical items in a lower compartment.

ME

Detailing a Class 27 Diesel Locomotive

ROBERT McLUCKIE

Robert McLuckie continues to describe the modifications he made to a 5in. gauge kit.

PART 2

Continued from page 497 (M.E. 4350, 24 April 2009)

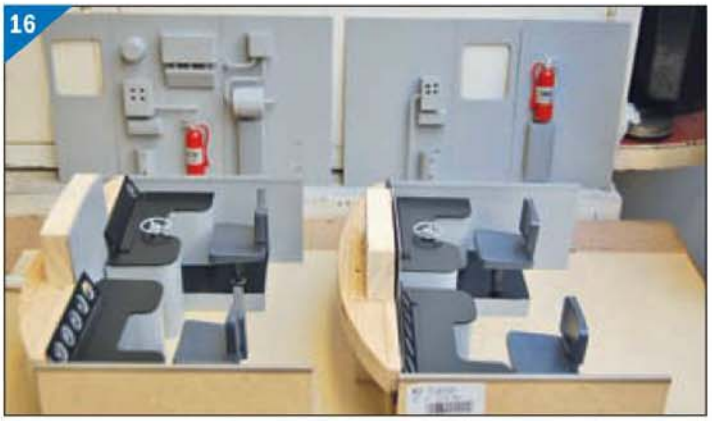
The locomotive dial instrumentation displays were easily produced using the home computer then printed to the correct size and added to the driver's side of the dashboard (**photo 15**). The seats and fire extinguishers were purchased from The Dolls House Emporium as the scale used is 1:12, which is suitable for 5in. gauge. Although the seats were originally for computers, a slight modification was required by removing the bases to suit the locomotive. All of the interior parts were now complete (**photo 16**).

The detailed panels for the two cab bulkheads had to be cut into three sections (**photos 17** and **18**) to allow them to be fitted. All of the interior panels and dashboard units were successfully fitted into place from below and easily manoeuvred into place through the open window spaces (**photos 19**, **20** and **21**). It would have been a great mistake if the windows had been fitted at an earlier stage.

Finally, I reached the stage of fitting the windows. All of the side windows were cut from 2mm thick picture frame glass and located on top of the cab interior side panels, fitting into H-section brass between the MDF and the glass. Clear silicone proved to be effective in holding the glass to the fibreglass sides of the bodywork. Any surplus silicone can be cut away with a sharp knife once it has set.

The front windows required metal frames fitting and these were made from brass U-section available from Kittle >>

One completed driver's side dashboard unit with instrument dials produced from the home computer.



The cab interior parts ready to be fitted to the model. Dolls house fittings used for seating and fire extinguishers.

Front cab bulkhead detail and one seating unit shown on the raised platform.

Rear cab bulkheads were fitted as three parts through the floor access panel. This panel is the floor area shown in light grey.

All parts were easily manoeuvred and glued into place making use of the open window spaces, a bonus at this stage.

All dashboard units in place and only the front aluminium panels are required to complete the cab.

Completed cab interior now ready for the windows to be fitted.

The black painted window frames which were made from fine U-section brass.

Hobby. First of all, a sheet metal window template was produced which was used as a former to shape the brass section. It was necessary to heat the brass which enabled it to bend and shape correctly at each corner. Instead of glass, a semi rigid plastic was used. This is supplied by www.BarloPlastics.com and its main advantage over glass is that it can be neatly and easily cut with scissors. This was especially useful since all corners on the front cab windows have a radius. The brass frames were added to the plastic windows and then each one was fitted from the outside of the locomotive (**photo 22**).

Home-made transfers

One final important detail remained. Many of the Class 27's operated on the West Highland Line between Fort William and Mallaig. A logo was added to these locomotives and this was a white West Highland Terrier. So the model also had to have one but none were available commercially. I then experimented in producing my own waterslide transfers from a photo. I proceeded to Boness Railway to photograph the dog on the side of the locomotive and then this image was downloaded into the computer. Once into the computer, the dog image was scaled to the correct size. The next stage was to print a few dog images onto an A4 transfer sheet which simply prints on your home computer/ printer. Once printed, a thin brush application of liquid decal film finalises the process and after it has had time to dry the transfer is ready to be applied.

I tried a couple of tests and found that the home-made transfers worked well and there were no noticeable difference from ones available commercially. The two West Highland Terriers were applied to each side of the bodywork and were indeed the finishing touch (**photo 23**).

Although this project started out as a simple short term project, it ended up taking slightly longer than expected but it has certainly been worthwhile and a very enjoyable experience. I really do hope that other modellers consider fitting out the cab interiors to their diesel locomotives. (See detail **photos 24**, **25**, **26** and **27**.)

The locomotive looks good at the ESME track and when combined with 5in. gauge scale rolling stock the effect is quite realistic (**photo 28**).

ME

Supplier

Dolls house fittings:
The Dolls House Emporium,
High Holborn Road, Ripley,
Derbyshire DE5 3YD.
T. 080 00 11 44 22.
E. **info@dollshouse.com**
W. www.dollshouse.com

The West Highland Terrier, home-made transfer.

The view of the cab with windows fitted. The final aluminium upper dash panels can be clearly seen.

A realistic photo created by the reflections on the glass and a 5in. gauge Mark 1 coach in the background.

View of the back cab showing the driver's side controls.

Time exposure photograph has increased the depth of field with good focus.

A photo showing the locomotive at the Edinburgh Society of Model Engineers track which is on a private estate to the west of the city.

Early style Brill 21E truck with narrow axle boxes.

Tramcars

ASHLEY BEST

Ashley Best describes some of the construction methods used on his 1:16 scale tram models

PART 3

Continued from page 519 (M.E. 4350, 24 April 2009)

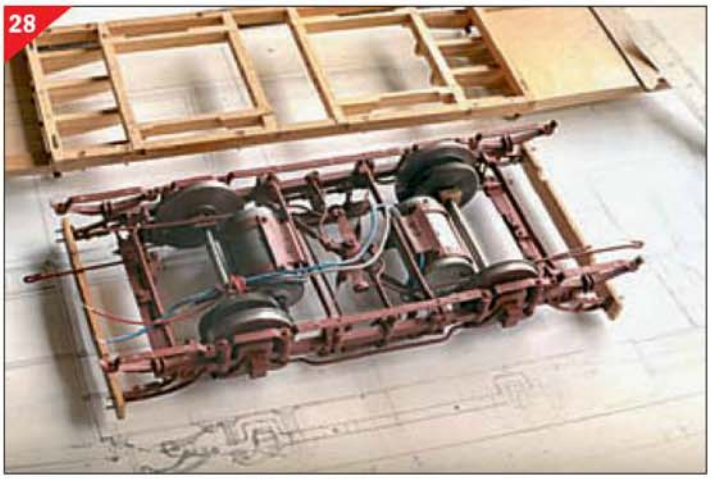
Most 4-wheel trams used the American originated Brill 21E truck or similar variants with suitable wheelbases (**photos 25 - 28**) and a few earlier trams used Peckham girder trucks. The bogie cars used more varied designs of trucks with the American Brill Co. 22E forming the majority (**photo 29**) but British designs appeared quite early and were used with varying degrees of success under some of the larger trams. Thus Rochdale used an adapted and modified Brush truck (**photo 30**) and Bury and South Lancashire used different types of trucks designed by the Electro Mechanical Brake Co. of West Bromwich (**photo 31**). Many trucks on bogie cars were of the maximum traction type in which the driving wheels were larger than the pony wheels and carried most of the weight. The brakes had, therefore, to have compensated leverage to equalise the force on the wheels.

In my models, the truck side frames are built up from brass scraps and silver-soldered. As far as possible all the cross members are bolted in place as on the prototypes.

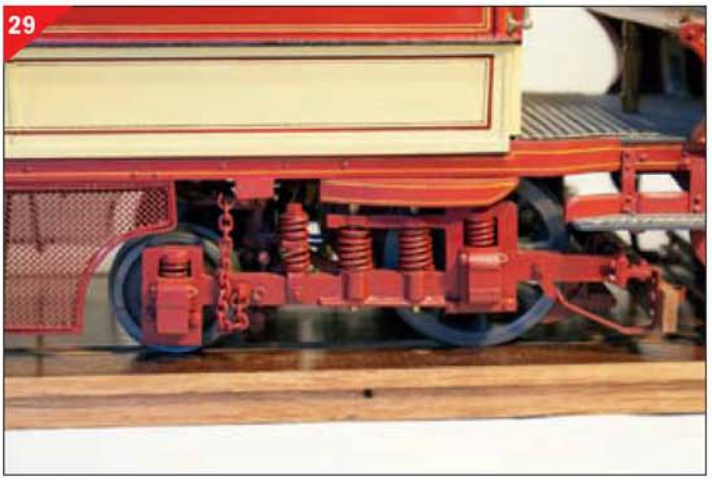
The wide wing axle box 21E truck.

The European McGuire 21EM variant - note leaf springs.

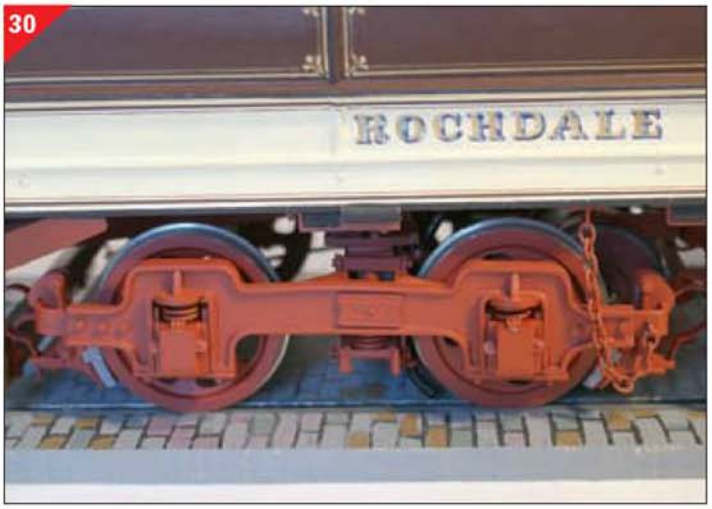
Axleboxes on many 4-wheel cars are the wide-wing type and are white-metal castings (**photo 32**) made from a brass pattern and vulcanised rubber mould. They have a complex shape and only ⅔ of the casts worked, but eventually I built up a sufficient supply. Other axleboxes are handmade from brass and either built up and silver-soldered or milled to shape. The wide wings incorporate spring cups and these need to be milled out to be accurate. This is achieved by making a simple 'D' bit of the correct diameter and as



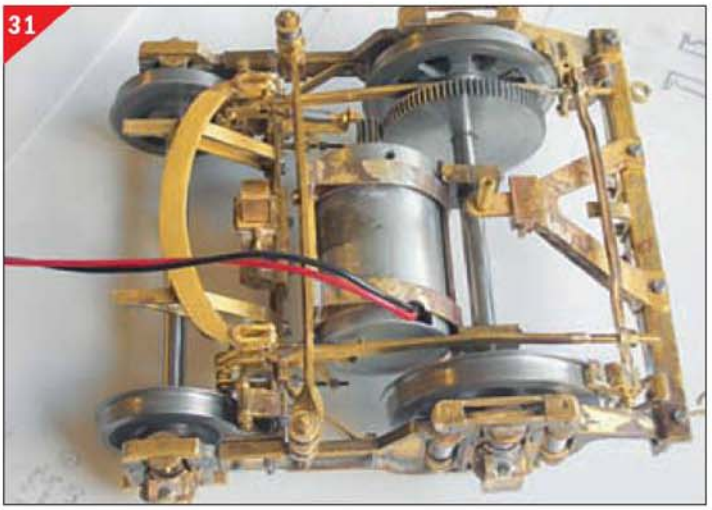
Truck and underframe for Oldham 128.



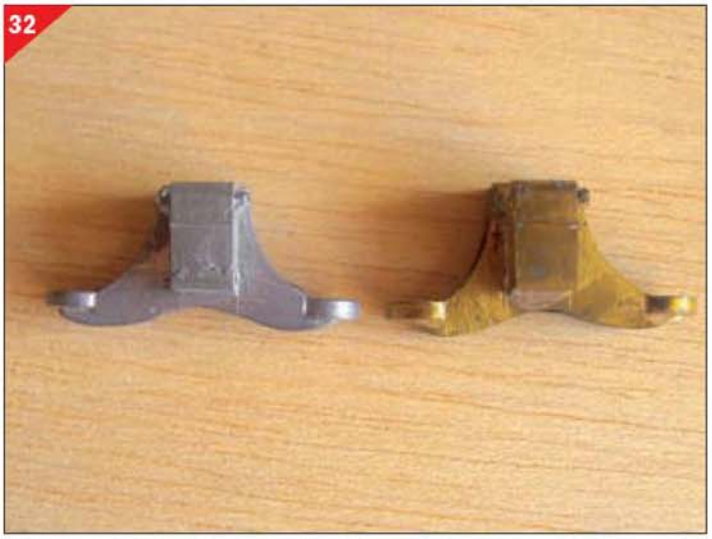
Brill 22E bogie truck.



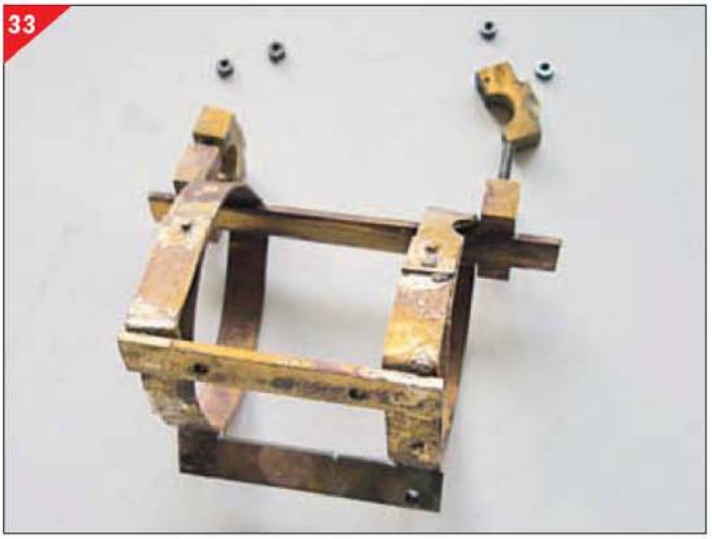
Modified Brush type D bogie on Rochdale 43.



EMB maximum traction design used by Bury.



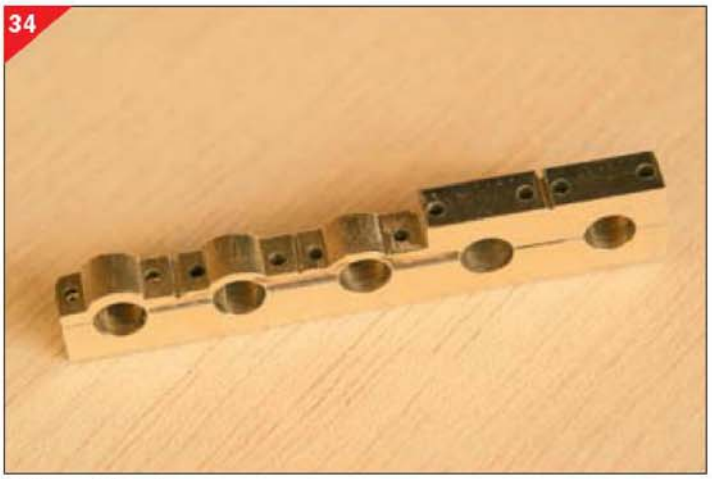
Wide wing axlebox casting and pattern.



Motor support carriage showing split bearings.

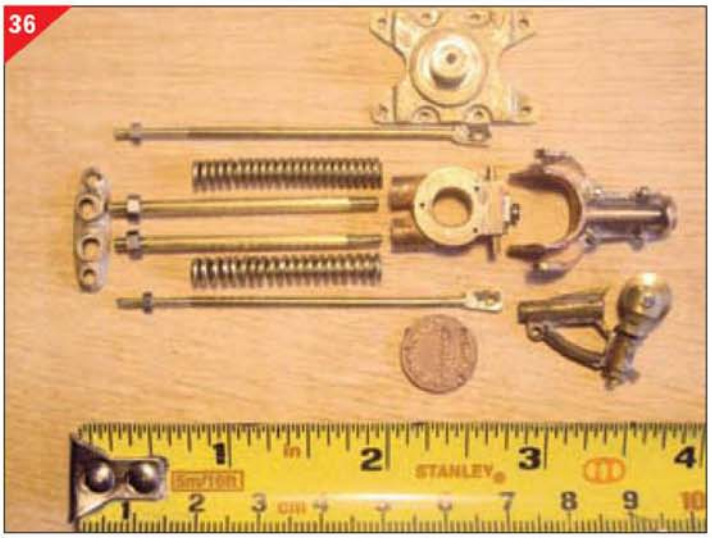
the metal to be cut is white metal, mild steel is satisfactory for the tool. Brake blocks are also white-metal castings made using the same vulcanised rubber moulding technique, but can easily be made from metal, resin or wood equally satisfactorily.

Two motors are fitted as in prototype practice. They are ex-government surplus 5U, 24V D.C. motors that revolve fairly slowly and drive via a single reduction spur gear and pinion of 7:1 ratio. The motors are axle hung and supported on motor beams mounted on spring posts on the side frames. The motors are partly enclosed by a support carriage (**photo 33**) joined to the axle by split bearings secured big-end style with 10BA studs and nuts. These bearings are made by soft-soldering two square section brass strips together and drilling the axle hole directly through the soldered seam and doing all the drilling, clearance and tapping threads for the 10BA studs before heating to melt the solder and splitting (**photo 34**). After a good clean up when all the solder is removed, the two parts are again joined by bolting together and >>



Making split bearings.

BM&R trolley base.

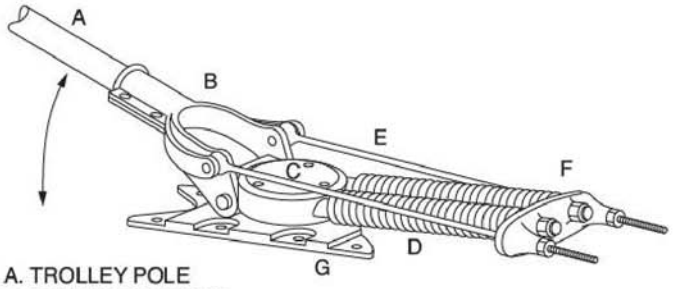


Component parts for trolley base and trolley head.

the axle holes then reamed to the size of the axle. It is then divided up to make the bearings after which the motor frame carriage can be assembled. Great care is needed to do this as it is of course essential that the gears mesh accurately. Any soldering is done with silver solder and the joints are first screwed or riveted together so there is no chance of anything misaligning. The truck has to be finished completely before embarking on the underframe. The top chords of the 4-wheel trucks are drilled to pass the fixing bolts that join the truck to the underframe. These bolts are aligned accurately and with the frame upside down, the truck is fitted and loosely bolted on. The bolts pass right through the frame member and are located with epoxy so that they remain fixed as they are inaccessible as construction continues. With the frame assembled, the platform bearers in place and the truck temporarily fitted, the assembly resembles a flat truck and at this stage, adjustments to height and levelling should be made.

SKETCH OF DWARF TROLLEY BASE

Fig 2



A. TROLLEY POLE
B. FORKED BRACKET
C. SWIVEL BASE
D. COMPRESSION SPRING
E. TENSION ROD
F. THRUST PLATE
G. BASE PLATE

Dwarf trolley base design.

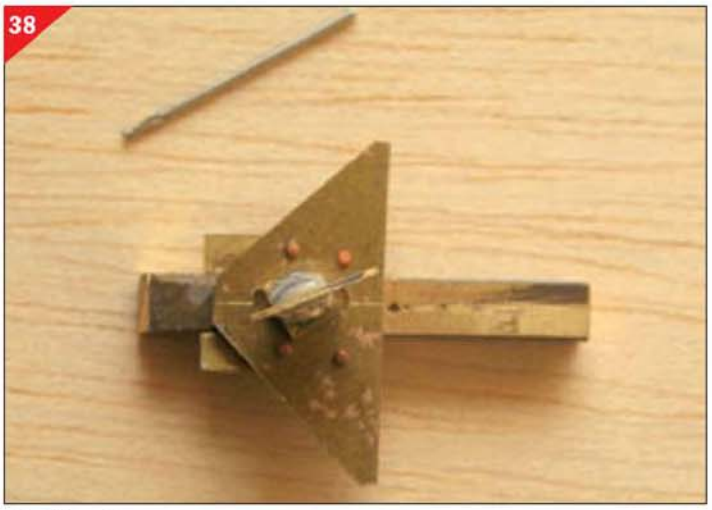
Current collection

The overhead current collection by traditional pole and trolley wheel was used throughout the Manchester area. Most double deck cars used the dwarf trolley base design of Brecknell, Munro and Rogers Ltd. of Bristol (**fig 2**). The company still exists, albeit after many changes and near demise and is now based at Chard. The trolley base is an elegant design and works well in model form. The **photographs 35** and **36** show the completed trolley base, the working of which is easy to understand and the component parts are also shown for clarity. The compression springs are wound from square section wire, by the method already described. The cover plate is attached by 14BA screws tapped into the main body of the unit. The tension rods are ⅛in. dia. threaded 10BA to receive the adjusting nuts. The spring posts are tapped 7BA at each end. The bearing unit can be milled or filed from the solid, or built up and soldered with a drilled and reamed suitable bearing-hole - not critical, but ¼in. dia. or so. The base plate is of two-part sheet, silver-soldered together along with the bearing pivot of suitable diameter. The cover plate can include the maker's name etched on to the surface all in capital letters, but leaving it blank would scarcely matter. The mechanism can be left as a running fit and will remain in position while in use, but can easily be lifted off if desired. A swivel-head trolley is probably the most useful for models although Manchester and Stockport used the fixed-head Estler pattern.

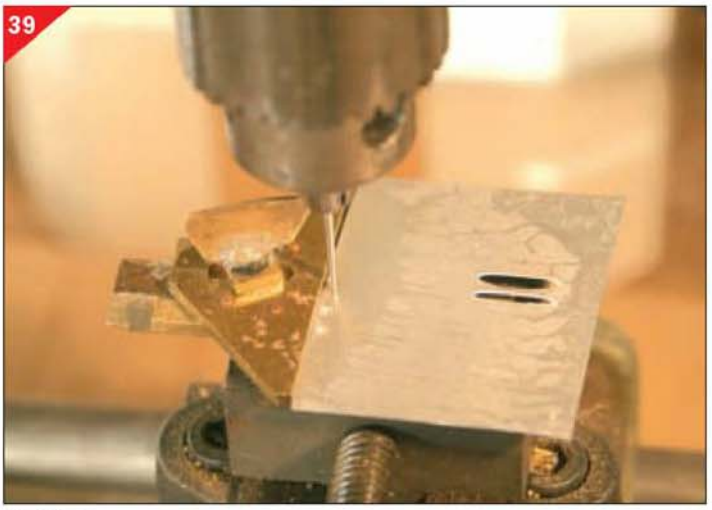
Assembly

The saloon floor and platforms are straightforward and can be glued in place early on. Various holes need to be established at this time to aid the later fitting of lifeguard mechanisms and the handbrake, controllers,

Brake handle mechanism parts with bulkhead door in the background.

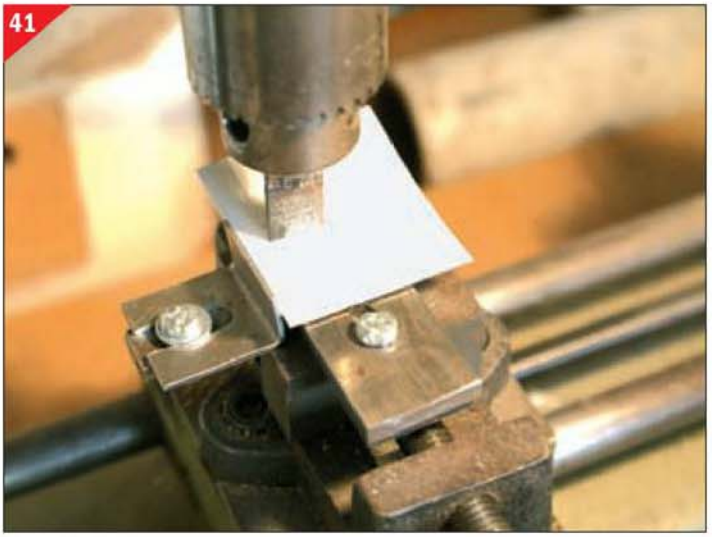


Rivet jig parts.



Rivet jig in use.

Louvre jig.



Louvre jig in use.

resistance box and stairs. Some of these can be drilled out at a later stage, but once the saloon is fitted it becomes more and more difficult. The floor and platform wearing slats are also laid down at this stage.

The brake handle on a tram (**photo 37**), in its simplest form, had at its base a gear or ratchet wheel which could be locked in position by a crude dog pivoted alongside and simply kicked in or out of position by the driver who had previously turned the brake handle to tighten the brakes. This gear or ratchet appeared to be a casting and can be made quite easily by hand filing without the expense of a gear cutting facility. I have used this method successfully on several occasions. A pattern gear is required and a number of good quality needle files. A brass rod of the diameter of the gear is drilled to receive the brake staff and is parted off into the required number of blanks. The pattern gear is then bolted temporarily to the blank and a light spray paint application is made. When the parts are separated the blank will have the gear profile accurately shown in paint. Then with great care the painted areas are removed with the needle files leaving a replica gear. The result is perfectly adequate for its function and looks right.

Rivet simulation jig

The curved dash with headlight is a conspicuous feature of any tram model and requires much care in the making. Generally rivets are seen and are necessary to impart a sense of realism. I generally use a jig to simulate rivets and with care a realistic result can be obtained (**photos 38** and **39**). Brass of 28swg is the preferred material and a simple, but accurate drill press is required for greatest accuracy. The jig is adjustable to allow different rivet positions to be obtained. A surplus discarded drill of 1/32in. dia. has the end of the shank rounded and is thus used to press down on the metal in the jig. Its travel is limited so that it does not punch through - unless designed to, of course. In a line of simulated rivets a few can be drilled through and real rivets passed through to aid the fixing and location of the dash or other riveted part. The rivets are 1/32in. dia. the heads of which are just right for the scale.

Louvre jig

A similar type of jig (**photos 40** and **41**) is used to create louvres (**photo 42**) as they appear on the sides of resistance boxes. My first efforts in achieving accurate louvres were without a jig, but it took ages and caused a lot of failures. The jig is well worth the time and trouble to make.

Trial example of louvres.

To be continued.

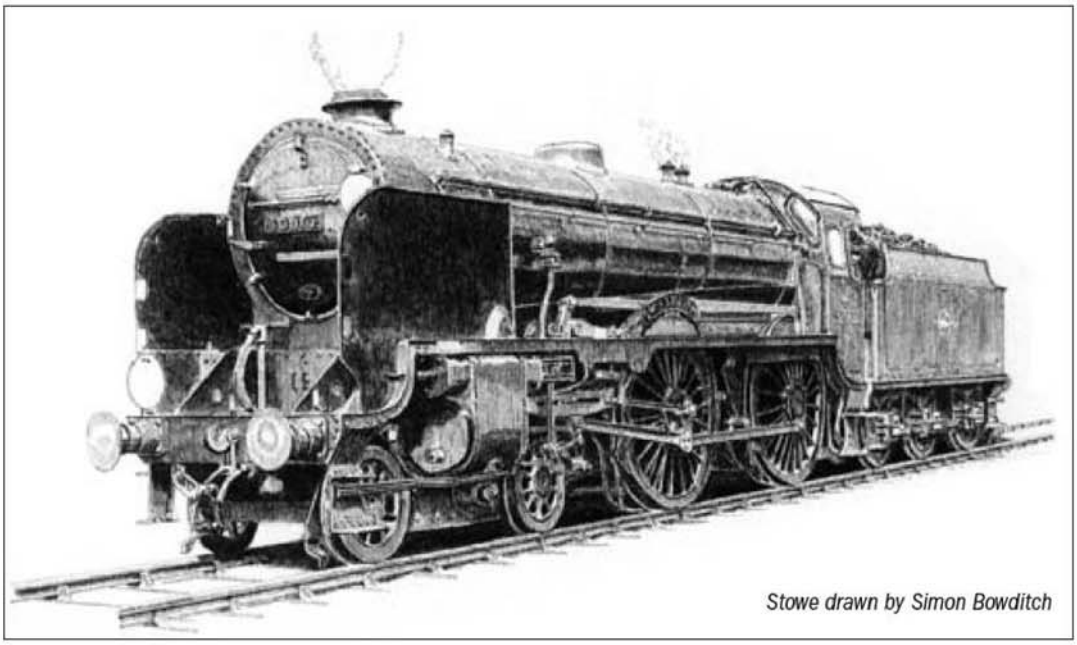
STOWE - Southern Railway Schools class locomotive

NEVILLE EVANS

Neville Evans describes the oscillating oil pump and discusses a new engine.

PART 31

Continued from page 511 (M.E. 4350, 24 April 2009)



Stowe drawn by Simon Bowditch

I have, over the last few years, become ever more conscious of the advance of time, with the consequent decline in mobility and physical ability. For instance, whereas 20 years ago the Dragon and I found no difficulty in pushing a huge and heavy 1,000cc Vincent up our long, steep garden path, we would now think twice before attempting the same task with a pushbike! The obvious follow on is that my rather grandiose taste in model locomotives has also had to be curtailed. Away went the mighty 'King', and the vast 'Cock of the North'. The nearly completed 3-cylinder compound based on the 'Royal Scot' languishes in store up in the top attics, and even the little HR 'Loch', an engine very dear to my heart, is proving to be a bit of an armful. Deliverance was at hand, however, when I picked up the chassis of one of those delightful little 'Poly' 0-4-0 kits and found that it was of no significant weight whatsoever.

The wheels of my mind started to turn, prompted no doubt by an article by an American gent who described a semi-detachable little locomotive that dismantled into two basic component parts for transit. The obvious choice was a Beyer-Garratt articulated locomotive based on two 0-4-0 'Polly' chassis, and using the slightly larger 0-6-0 boiler. Peter Lamberton, (he of the first to be finished 'Lochs') volunteered to assemble the first prototype, and so, fortified by the knowledge that a rather similar locomotive was already running successfully in France, construction was commenced.

It was decided from the outset that the project would take three separate forms. The first locomotive was to be straight 'Polly' so to speak, with as few modifications as were necessary to achieve our aims, which were:

1. Transportability. The engine had to break down into three parts for ease of transport.
2. Ease of assembly, and of course 'dismantleability'(we decided that if there were no such word as this it would have to be invented!)

The second locomotive would be similar to the first, but incorporating Walschaerts valve gear and the third would be a scale model of the small proprietary 0-4-0 Beyer-Garrett as typified by the little engine that ran around the Vivian Steelworks in Swansea for many years.

To concentrate on the first locomotive, the obvious problems that had to be solved in a straightforward manner were those of the valve gear connections, and the steam and exhaust pipes. I thought that the easiest and possibly also the best way of ensuring positive control of forward and reverse, together with cut-off adjustment, was by means of a Bowden cable, which, if securely positioned could both push and pull the appropriate levers and would probably best be moved by a lever reverse in the cab. The modern way of transmitting steam around the locomotive was by means of armoured plastic pipes such as are available from a purveyor of hydraulic equipment. It so

happens that my friend John of Talbot Hydraulics is just the man to advise and supply these items, together with their associated proprietary fittings, so we became suffused with the feeling of euphoria that is a signal that fate is about to administer a kick up the backside.

Photograph 1 is of the engine rough assembled and awaiting shortening of the frames and manufacture of the boiler undercarriage. It is a bit of a lump at nearly 5ft. long, will be capable of being loaded to improve adhesion and with good valve events and four cylinders, it should be able to pull the proverbial house down. I append a sketch of the finished locomotive with a projected Walschaerts modification, which will improve accessibility.

The oscillating oil pump with Goodall valve

Curly Lawrence, who of course wrote under the pseudonym LBSC, pioneered the use of mechanical oil pumps in small locomotives. His preferred pump was of the oscillating type and among the features that he claimed for these artefacts was the ability to deliver reliably, without the use of a clack valve. The pros and cons of this argument need not concern us; suffice it to say that I think that the pump is improved if a non-return valve is included as close to the delivery point as possible, and can guarantee that this particular clack valve, the product of Deryck Goodall's fertile mind, will give a foolproof performance until the sleeve wears out, not that one has ever shown the slightest inclination to do so. Eagle-eyed readers will have noticed the tiny O-ring that appears on the end of the ⅛in. dia. ram in the cylinder. These tiny O-rings can be found inside a throwaway lighter. Keep your eyes peeled in the gutter until you find one, break it apart, and inside you will find a bevy of useful devices for the miniature modeller, including tiny springs and shuttle valves which are used in the non-return valve of the lighter, as well as the tiny O-rings. Seek and ye shall find, but please don't mention my name to any interested policemen!

The sleeve which acts as the non-return valve can be cut from a length of the soft plastic pipe sold in model shops for glow plug engine fuel lines. It doesn't seem to matter what the material is - a nitrile rubber seems to be about favourite, just so long as it is nice and pliable and about ¼in. I/D. Just slip it over the valve screw and fit it into the pump body. One of the few tricky operations is the lining up of the 1.2mm diameter passage that leads oil from the port to the valve screw. Note the chamfer in the end of the valve screw which prevents an accidental blockage in the oil line.

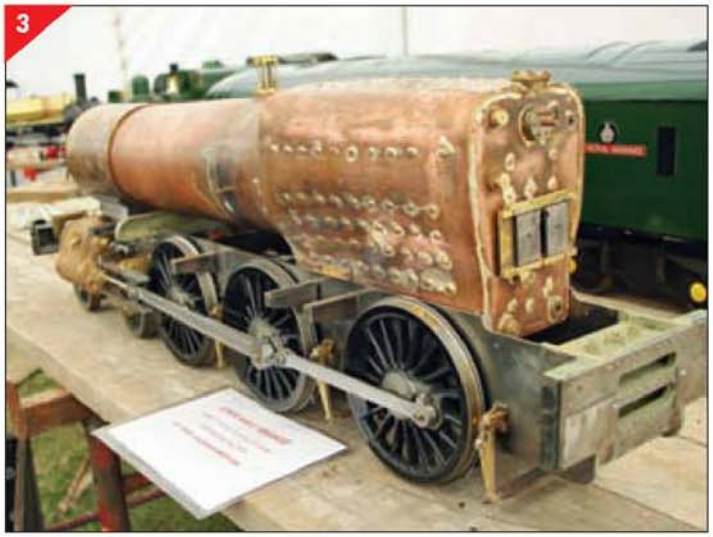
Obviously the lapped faces between the cylinder and the pump body are of the greatest importance. Incidentally, one of the reasons why small oscillating cylinder engines work so well is that the port faces are continuously lubricated by a thin film of oily steam, as are our oil pump port faces. I have described the lapping process over the last many years, but it is so important that a brief resume will do no harm now. Remember, never lap face to face, always lap both sides independently against a true surface. So face off a piece of aluminium about 4in. square in the lathe, remembering to turn some small grooves about ½in. apart before the final cut. Before lapping, charge the aluminium by applying some fine lapping paste, and then rub your cylinder port face up and down interspersed with a figure of eight motion, wash off thoroughly with white spirit or some such, then press up and down against your face plate to make sure that you have a flat polished surface all over. Ditto repeat on the pump body. To find out if you've done a really good job, dry the two parts and wring them together, when they should stick to one another.

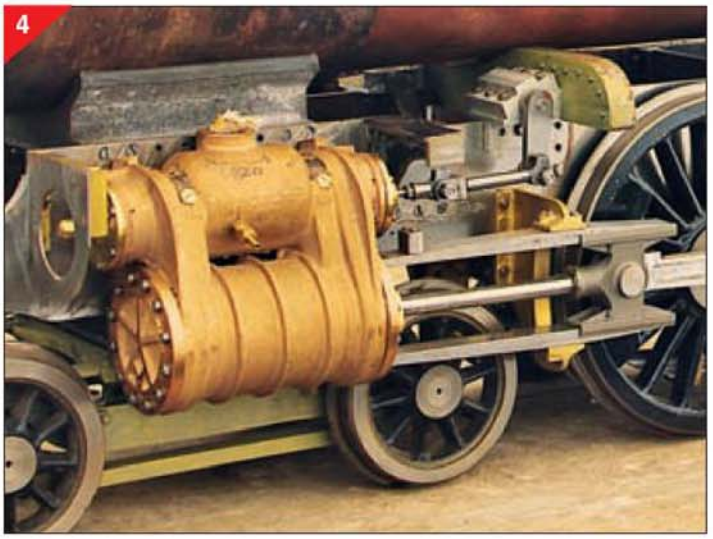
Make sure that you set the two roller clutches in the correct manner so that the pump turns in the required direction when the lever is waggled.

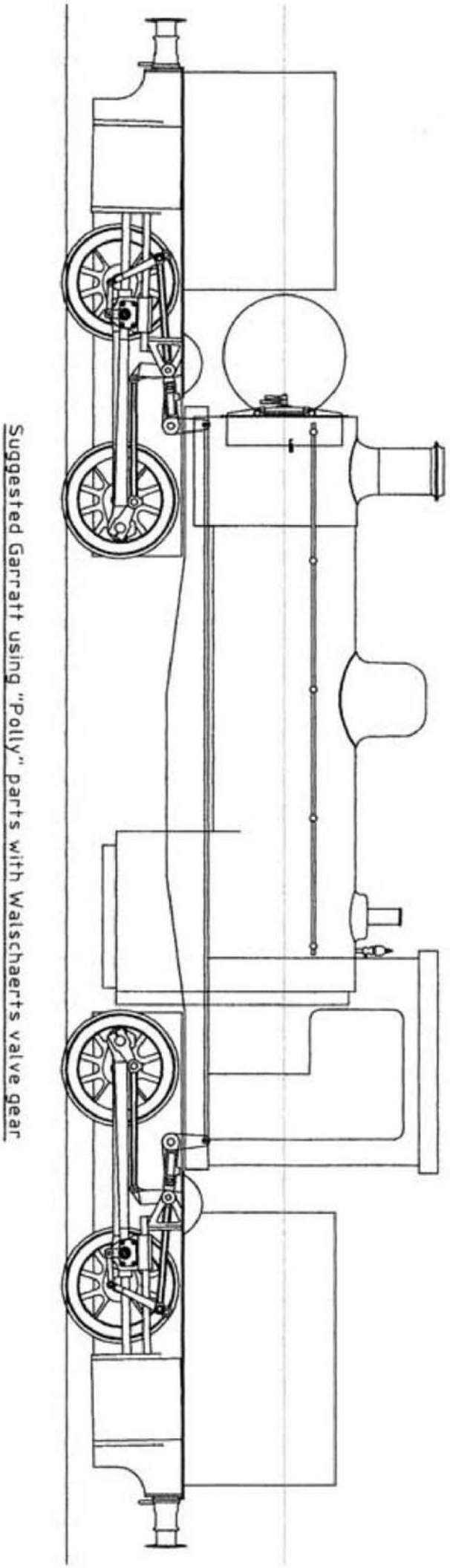
I think that the four GWR views (**photos 2 - 5**) were taken by Pete Thomas at the recent Llangollen Rally. They >>

show work in progress on the magnificent 'Grange' by Terry Vaughan, and Martin Evans' 3,500 gallon tender. I must say that I feel very pleased and gratified with the results of these two gentlemen's work, Both models are being built from castings and parts supplied by Practical Scale, and they typify exactly what Pete Thomas and I have been trying to achieve over the last few years. Thank you so much.

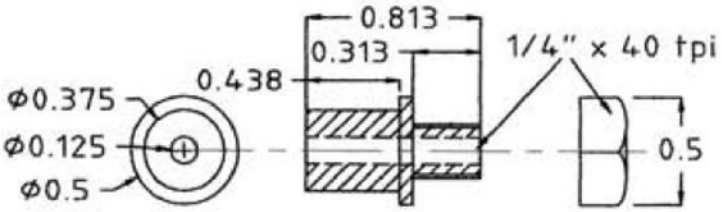
To be continued.



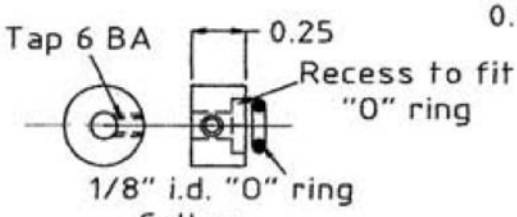




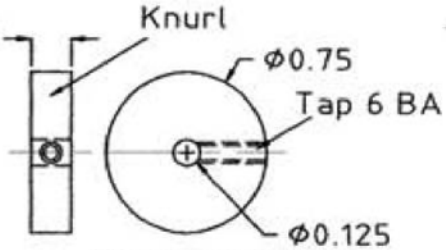
Suggested Garratt using "Polly" parts with Walschaerts valve gear



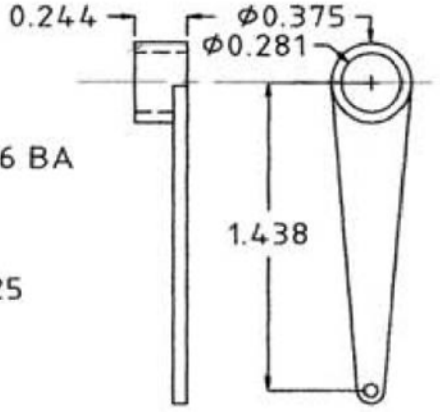
Spindle bearing



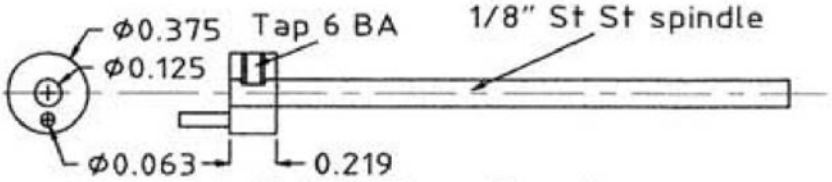
Collar



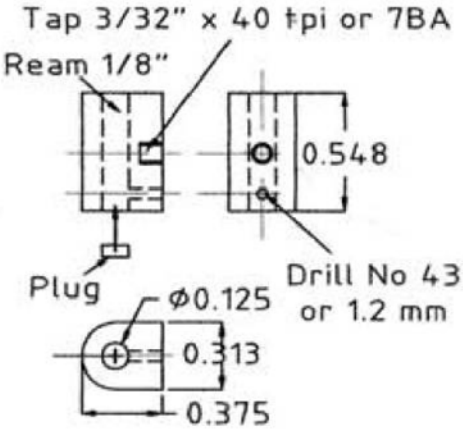
Priming disc



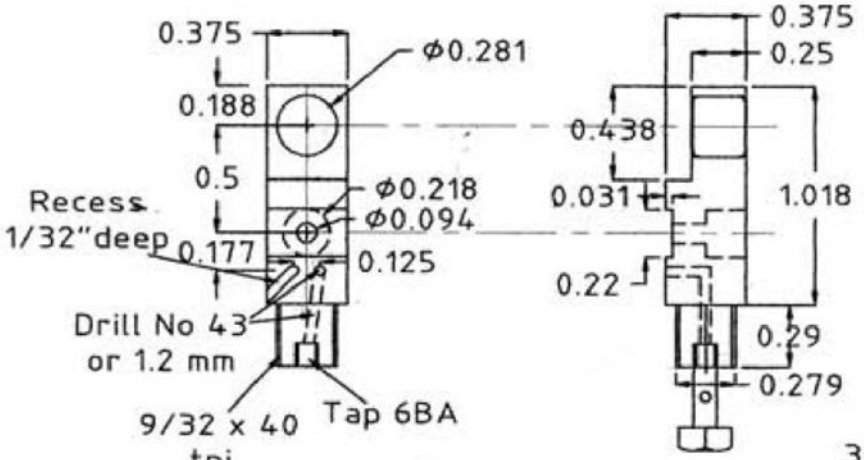
Pump lever



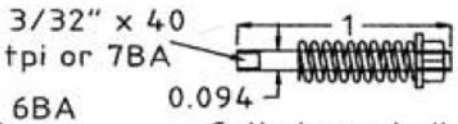
Spindle & crank ass'y



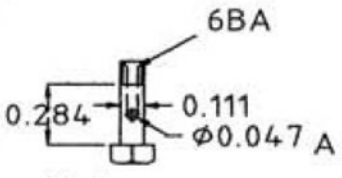
Pump cylinder.
Phos Br or G.M.



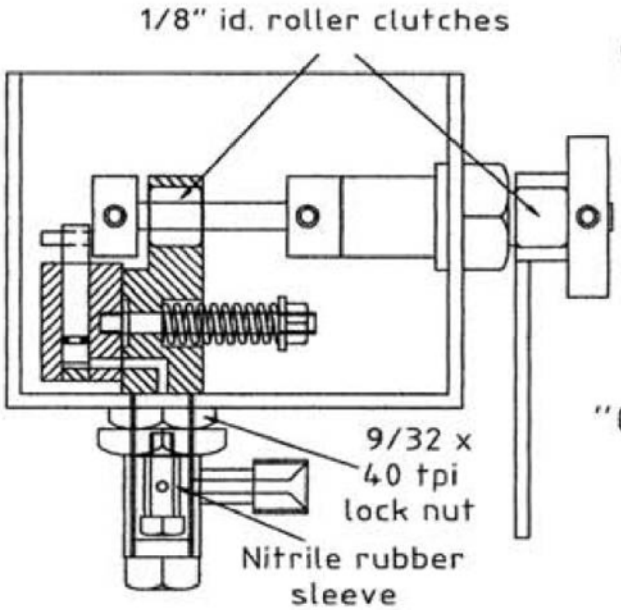
Pump body.
Phos Br. or G.M



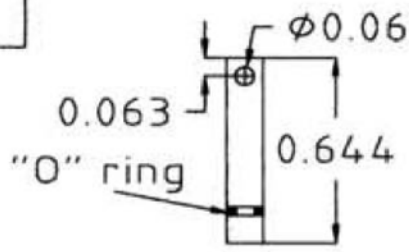
Cylinder spindle &
spring ass'y



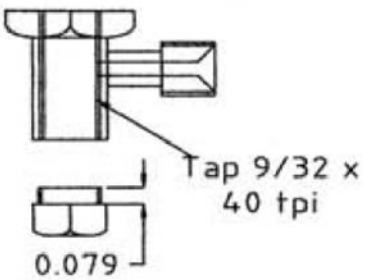
Valve screw



Sleeve, 1/4" i.d.
Nitrile rubber
or similar



Pump ram
1/8" dia
St St.



Musgrave
Non-dead-centre engine

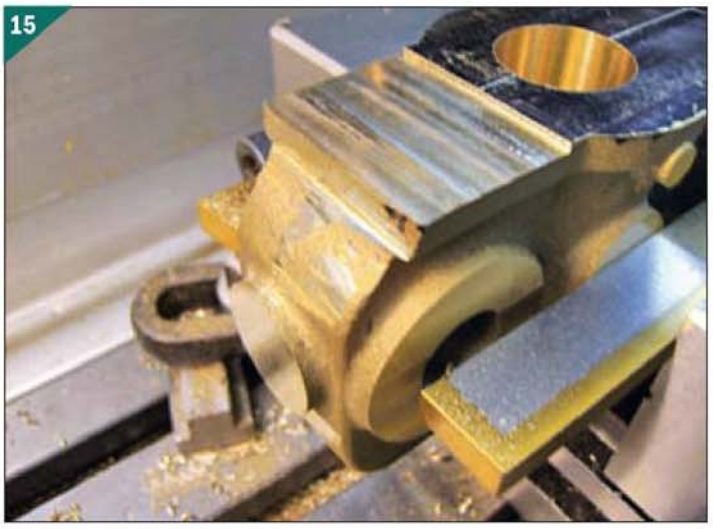
KARL KONRAD

Karl Konrad continues the description of his superb Musgrave model built from a Lothar Matrian kit.

PART 2

Continued from page 515 (M.E. 4350, 24 April 2009)

The holes for the cylinder, rotary spool valve, steam input and output as well as the steam passage and the indents for the columns are all to be found in the cylinder block. First of all, the top surface and the underneath surface were milled then the indents for the columns were made in the underneath surface (recognisable by the upside down 'M') **photo 15**. Finally, the centre of the cylinder block was marked. Measuring from this centre line, the measurements for the cylinder drill holes were worked out with great precision. The distance between the cylinder drill holes in relation to each other has to be precise so that the crossheads and the columns are at right angles to the cylinder rods. The cored cylinder holes were first machined with a large milling cutter (**photo 16**) and then bored to a precise size by means of an adjustable boring head (**photos 17** and **18**).



15

Machined end of cylinder block.

16

Opening out the cylinder bores.

Rotary spool valve, steam inlet, steam outlet and drain cocks

The drill holes are made in the same way as the cylinder holes and during the same operation the holes for the steam outlet as well as those for the drain cocks are also made. **Photograph 19** shows the rotary valve hole being bored and **photo 20** shows the assembly so far.

Drilling the steam passageways

The passageways for the fresh steam to the steam inlets and outlets are drilled vertically from the cylinder block face (**photo 21**). In order to obtain a clean drill hole for the steam inlet, a long bur was used which was long enough to reach the side opposite the rotary spool valve. The hole on the opposite side of the rotary spool assists the steam outlet.

Drilling the steam passageways for the fresh steam from the cylinder to the rotary valve is done at an angle of 37 degrees. With the aid of a digital angle gauge no problems were experienced when aligning, fixing and drilling (**photo 22**).

I drilled the hole for the steam outlet passageway after marking the position on the cylinder block and then I measured the angle and clamped the block into the vice to suit (**photo 23**).

17

Machining a cylinder bore.

18

A finished cylinder bore.

Boring a rotary valve hole.

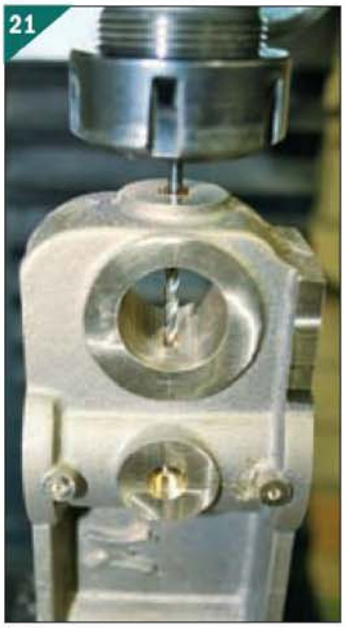
The engine coming together.

Coverings

The cylinder covers, rotary spool valve covering and the inlet and outlet flanges were made on the lathe (**photo 24**). The holes in the cylinder covers were distributed equally with the help of the large back gear on the lathe. The appropriate holes were drilled by means of a small hand drill, which was fixed to a tool bracket. After having done this, the covers functioned as stencils for the fastening screws in the cylinder block.

Rotary spool valve

There are various methods of making the rotary spool valve. I made them from a solid piece of material (**photo 25**). With the dividing head set to



Drilling a steam passage.

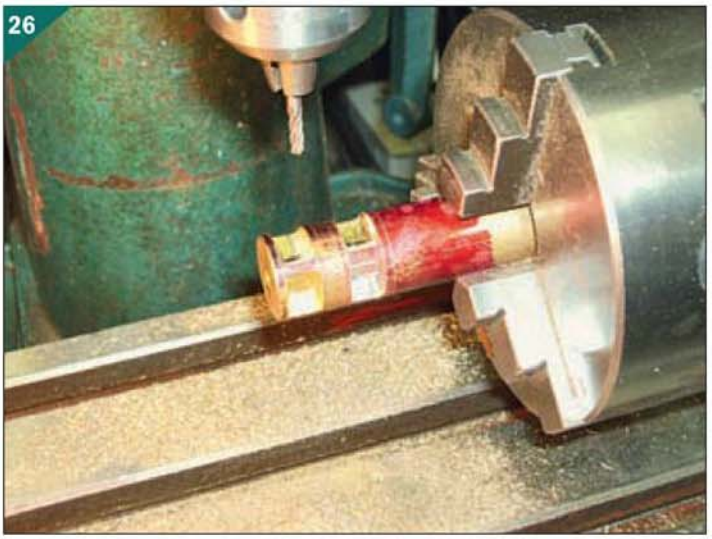
A digital angle gauge makes life simple.

The cylinder block clamped on an angle.

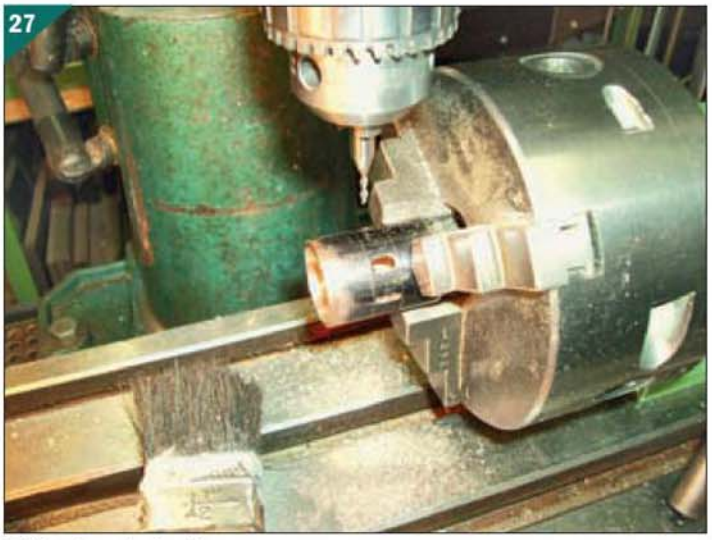
Machining covers and flanges.

>>

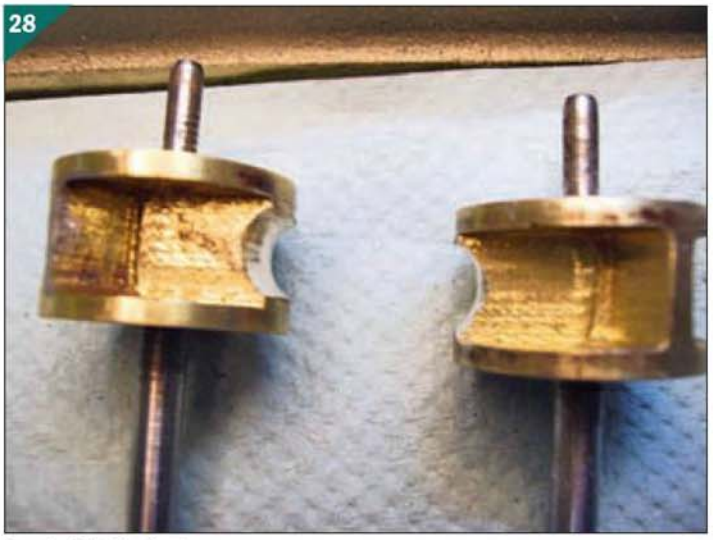
Making the rotary spool valves.



The valves are made as a pair.

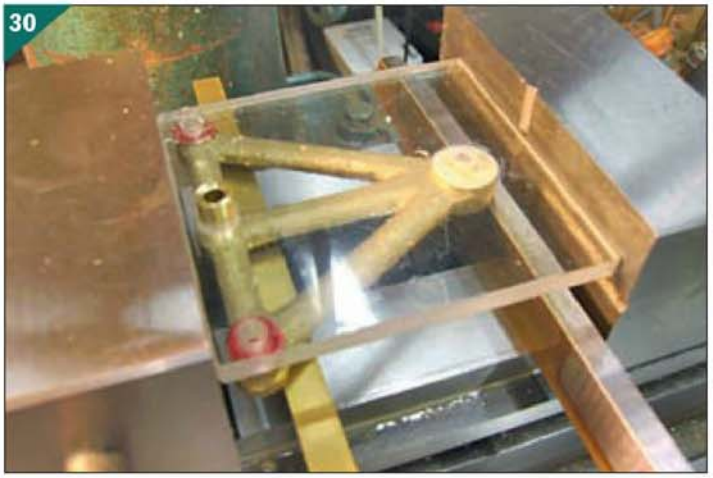


Drilling the valve bushings.



A pair of finished valves.

The triangle is turned and faced then drilled ready for reaming.



The Perspex drill jig.

the angles (**photo 26**), two rotary spool valves were made simultaneously. When they were finished, the valves were separated on the lathe.

The valve bushings were individually drilled on the dividing head (**photo 27**). When mounting the rotary spool valve bushings, a sealing compound (e.g. Holymar) must be used to fill the cavity in the valve bushing. The sealing compound makes sure that there is no uncontrolled escape of steam between the drilled holes.

The finished valves can be seen in **photo 28.** A notch was filed into the wall of the valve to facilitate the exchange of steam between the chambers.

You have to make sure that you can easily move the rotary spool valve positioned on the cam on the axle shaft and that it can be pressed against the cartridge wall when under steam pressure.

Crank triangle

This part, which is responsible for the interaction of the

Using a filing jig to finish the radii.

crossheads and piston movements, seems to be a difficult part to make. However, it only looks difficult. Making the crank triangle presented no problems because the spigots for fastening in the 3-jaw chuck are integrally cast. First of all, the hole in the spigot was drilled and the exterior surfaces of the three eyes were precision turned (**photo 29**). After that I marked the measurements of the crank triangle on a Perspex stencil and drilled the hole for the spigot. This drill hole served as the fixed point for further holes, which were made through the Perspex into the crank triangle (**photo 30**). Needless to say, it is possible to drill the holes without the stencil (this is what Lothar did), but it gave me extra confidence to see the correct distance between the individual holes. After that the radii were made by means of a filing jig (**photo 31**).

Eccentrics and eccentric bushes

The two exterior eccentric strap castings were soft-soldered together after being turned to size and simultaneously finished in pairs (**photo 32**). After all the external steps had been completed, the eccentric was sawn off (**photo 33**), screwed together and the rest of the machining was then completed. Finished components are shown in **photo 34**. The interior eccentric consists of two parts, which, when pushed together, make a unit. Fastening to the axle shaft is done by means of a set-screw. The set-screw is situated on the outside of the eccentric on the eccentric boss and can be put to use when needed.

Pistons

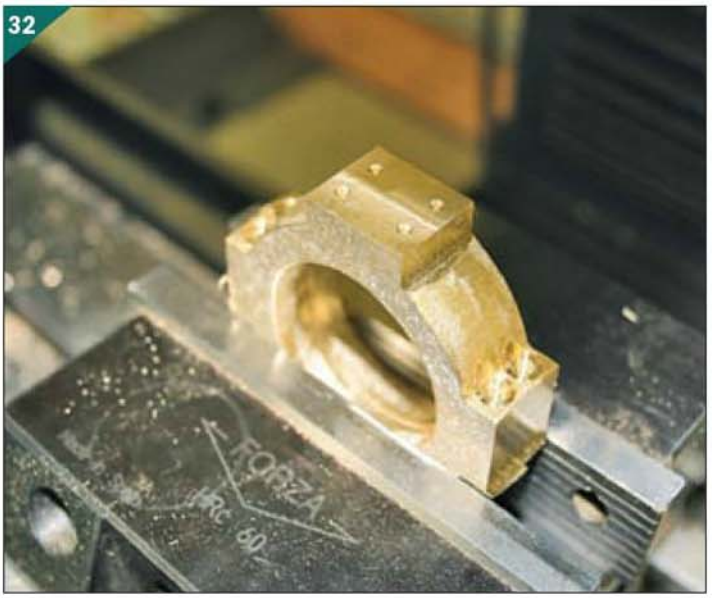
The piston rings can either be O-rings or Teflon rings. If Teflon rings are used, the piston has to be divided and subsequently reset. When using O-rings, attention must be paid to the fact that the width of the O-ring is a few tenths mm bigger than finally required. The measurements can be taken from an O-ring table. A larger notch gives the O-ring the possibility to move at the beginning, when changing direction; this leads to a longer durability of the ring (**photo 35**).

Bearing brackets, bearing cartridges, cranks and crankshaft

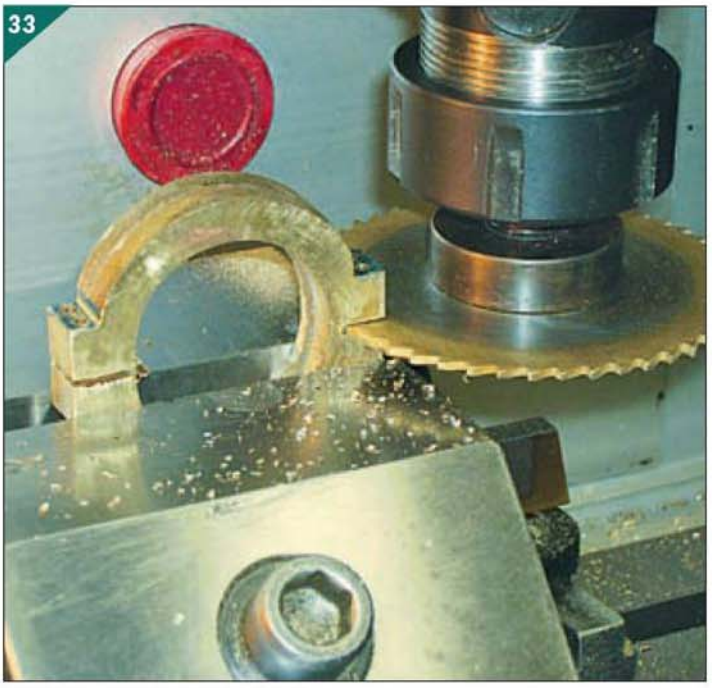
Fabrication of the bearing brackets, bearing cartridges, cranks and crankshaft present no problems; the bearing brackets are recessed in the base plate.

●*To be continued.*

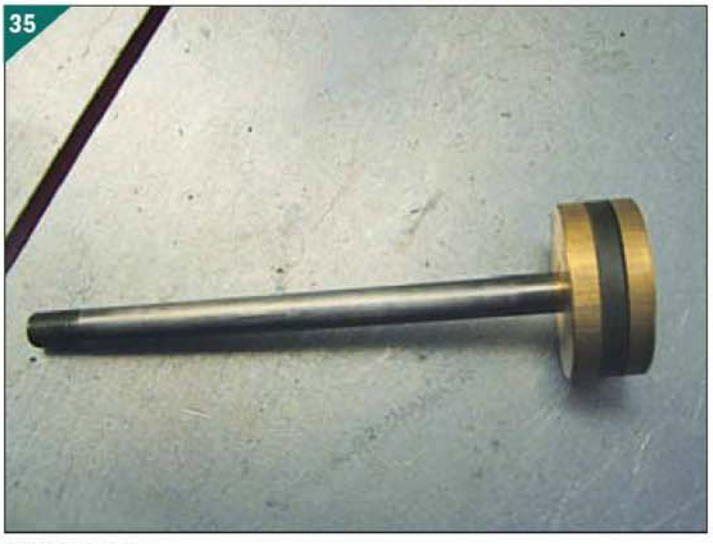
Finished eccentrics and straps.



The straps are made in pairs.



Cutting the eccentric straps in half.



A finished piston.

Model engineering workshop for a small garden

NICK FEAST

Nick Feast introduces his self-built workshop.

When we moved to our present house about 17 years ago considerable 'downsizing' was required in the hobby and leisure department. I had been used to an extended concrete sectional garage large enough to comfortably work on a car and an 8ft. by 12ft. shed for storage. In fact I was able to build a Rickman Ranger kit car in the garage and house several motorcycles as well.

Just as well that my interest switched to smaller scale projects as the new house came with an integral garage barely big enough for a family car and a small garden with only pedestrian access. The challenge was to build a workshop in keeping with the size of the garden, and meet the following conditions:

It must be weatherproof and dry. The previous garage was fairly weatherproof but if the temperature changed a few degrees then condensation soaked everything and rust ensued. A wooden building seemed to be the answer.

There must be space for a lathe and pillar drill at least, and as much bench space as possible.

As I am 6ft. tall and some fairly environmentally unfriendly activity was foreseen, there should be plenty of headroom and adequate ventilation to clear soldering and brazing fumes etc.

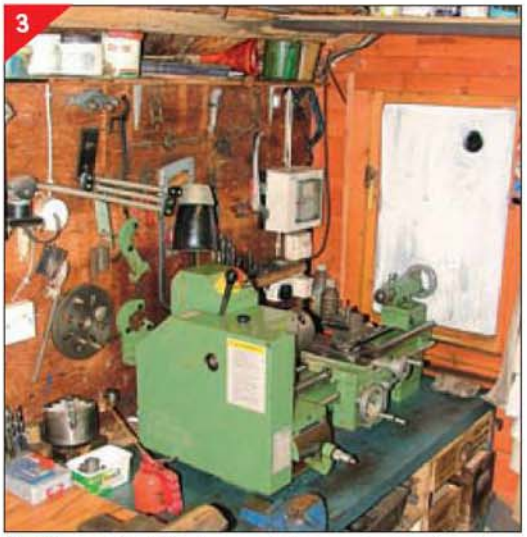
The workshop in the morning sun, bearing the title by which it is known by the rest of the family.

Designed my own

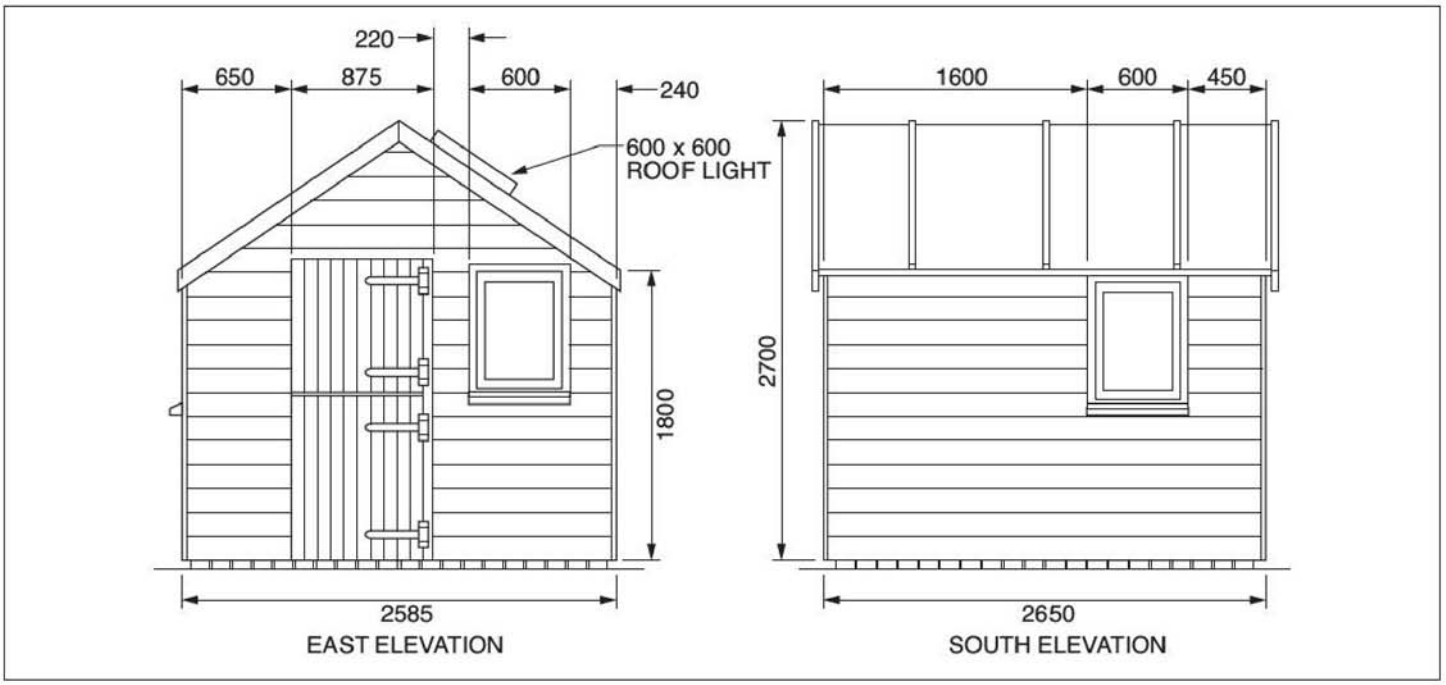
As usual no ready made item fulfilled my needs so I designed and built my own workshop. The drawings show the overall dimensions; these were more or less dictated by an existing concrete base which was level enough to take a damp proof membrane. A course of bricks was laid to fall just inside the outer cladding of the shed so that the frames of each panel sat on the bricks. The floor level was brought up with 40-50mm of sharp sand floor screed finished as smoothly as possible.

Square timber, 50mm or 2in., was used to construct six panels to form the four walls and the roof. I don't believe the timber yard was metricated at the time so it would have been 2 inches. It probably still is 'toobetoo' but sold in metric lengths!

The main workbench is recycled kitchen worktop supported on 50 x 50 steel angle. Up to three 3½in. gauge tender locomotives can be stored on the shelf under the bench, with further storage underneath. Maximum bench space is preserved by having as much as possible fixed to the walls.



The Warco 918 lathe is mounted on a steel engineer's bench. When the removal men tried to move this bench they thought it was still bolted to the floor as it's so heavy! More racking or shelving for lathe tools would be an advantage.



The windows were standard house units; these can often be purchased cheaply if you aren't fussy about the size. These days, of course, internet auctions allow everybody access to bargains undreamt of a few years ago. Walls were clad with ⅝in. shiplap boarding nailed to the frames. These days I would prefer to use screws. Pre-treated shiplap is available in my area at competitive prices from agricultural merchants who sell it for farm buildings. The stable door arrangement allows extra ventilation without too much draught. I also added a roof light above the main workbench, although in reality much of the time spent in the workshop is after dark. However, the big advantage is that in the summer it can be propped open for extra ventilation, sheds can become very hot in the sun.

Power and light

Power is routed underground from the house to a small distribution board incorporating circuit breakers. There are eight power sockets, which is just enough. I should have added more in the bench area to power items such as a hand-held mini drill. Lighting is provided by a double 5ft. fluorescent fitting and a swivelling Anglepoise light which can either illuminate the lathe or the workbench.

The space under the lathe has been filled with shelving and drawers to house raw materials in bar or rod form as well as my collection of sundry nuts, bolts and clutter. Most of this will probably never be used but just might, one day, save a few quid on a project!

The Chester Mini-mill and Clarke ½in. pillar drill are mounted on a homemade steel-framed bench quite close together. The space underneath houses a three-drawer tool chest containing all the hand tools not attached to the walls. Taps, dies, spanners, punches, etc.

The floor was painted with two-part epoxy floor resin to seal it, this is essential to avoid dust problems. As the photographs show, it is possible to fit all the essential engineering equipment required to build model locomotives in a floor plan of around 8 x 8 feet. Since building the workshop I have constructed a Clayton Wagon in 2in. scale and a 3½in. gauge Q1 as well as completing a Maisie. I currently have a 5in. gauge Ivatt 2-6-2 tank in progress but this is about as large as I would want to go in this space.

Extra sweater required!

Even in the coldest weather the small thermostatic electric wall heater soon gets the workshop to a tolerable temperature despite the lack of insulation. I did consider improving the thermal performance by adding insulation material to the outside of the walls, but cost and complication made it impractical. Putting the insulation on the inside was just too complicated; it would mean removing all the contents! Easier to wear an extra sweater and a hat! However, for a new build, thermal and noise insulation would be an advantage, not everyone likes to hear the melodies of sawing, filing and drilling.

After 17 years the workshop has been a great asset, I have spent many hundreds of enjoyable and productive hours in it. A bigger floor area would allow bigger locomotives to be tackled but I am quite happy with 3½in. and small 5in. gauge models.

Smaller gardens are certainly the norm in this area (south coast of England) and some of the infilling now being built can barely accommodate a rotary clothesline in the garden, so space is ever more at a premium. **ME**

ALAN CROSSFIELD

Empire Building

Alan Crossfield continues the description of his award-winning 5in. gauge Bulldog model *Empire of India*.

PART 3

Continued from page 526 (M.E. 4350, 24 April 2009)

Original engines of the 'Bulldog' class were built with outside admission 'D' type slide valves operated by Stephenson's link motion. Whilst the valve gear remained unaltered throughout the lives of the locomotives, piston valves replaced the slide valves at an early stage in their working lives. Although the dates of conversion vary, they do appear to coincide with the superheating of individual engines: the interesting point is that the steam chests retained the arrangement of outside admission. A possible reason for this could have been the cost of resetting the four eccentrics on the crank-axle.

Swindon's arrangement of the Stephenson's valve gear was developed over a long period, dating back to the Dean single-wheelers. On the 4-4-0s the layout was very simple. Four eccentrics positioned between the crank-webs of the driving axle created the movement that worked directly through long eccentric rods to the 'locomotive' type expansion links. From there the route to the steamchest was equally direct having no rocking levers or over cantilevered offsets. The valve gear proved extremely reliable in service and has much to recommend it to the model engineer. In designing the valve gear for the model, Keith Wilson has stuck very closely to the full-size arrangement. The only problem I encountered was that, due to space limitation between the drive-pins of the left-hand-side eccentric rods and those of the right-hand-side, I was forced to resort to a rather unconventional method of retaining the pins in position (more of that later).

The eccentrics, straps and the rods.

Expansion links and die-blocks

These items were produced from gauge-plate. During my early years of model engineering, a milling machine was one luxury I did not possess. I therefore devised alternative methods for producing items like the curved slot in an expansion link. On my first 5in. gauge locomotive these were created by a combination of chain-drilling and filing to shape. It sounds crude but the job was carefully executed and highly dependant on being accurately marked out beforehand. The outline of the slot was marked on both sides of the chosen material - ¼in. thick gauge-plate. Simple twist drills were used to remove the bulk of metal from each slot whilst a variety of files removed the remainder.

Unlike the closed slots of the expansion links, the curvature of the die-blocks could be machined on the lathe. In order to highlight any errors in the link slot, a sacrificial die-block was produced to approximately half the length of the slot. Once the block could enter the slot it was then fixed to a flat plate that would maintain it 'square' against the side of the expansion link whilst allowing it to be 'worked' up and down within the slot. Tight spots were identified with the aid of engineer's blue and eliminated by the use of a Swiss file. Lapping paste was used to complete the slot, by which time the sacrificial die-block was discarded in favour of a new and better fitting one: this item, also produced from gauge plate was hardened, unlike the expansion link, which was not. The locomotive in question, a 2-8-0 Nigel Gresley (a Martin Evans design) is still operating with all the original valve gear components, which, after almost 30 years of operation are showing negligible wear. Needless to say that now, in spite of owning a milling machine and rotary table, I still use the same method to produce expansion links and die-blocks.

Fabricating the smokebox saddle.

Photograph 27 shows the straps and rods of the four eccentrics. The expansion links are shielded from view by what I describe as shroud plates. These items (brass plate 0.048in. thick) are non-prototypical and are my answer to the problem of retaining the drive-pins within the die-blocks and eccentric-rod ends. Hung from the lifting-arms, each pair of plates encapsulates its respective set of drive pins, offering them no lateral movement. Although the plates require less lateral space than a conventional washer and split-pin, the inner plate of each pair still operates in face-to-face contact with its opposite number.

The picture also includes the crosshead driven vacuum pump. In reality this had been converted to a water pump for at this stage in construction it was becoming clear that there would only be space enough for one injector.

The method of fabricating the saddle is shown in **photo 28**. Three ¼in. diameter steel rods temporarily space the shaped end plates of the front and rear. The rods are of equal length, therefore ensuring that the end plates are parallel to each other. Each of the two side plates has been rolled to blend into the curvature of the smoke box. The next operation will be to secure the whole rectangular structure by silver-solder. The steel rods will then be discarded and the front and rear plates trimmed to match the outer profile.

Photograph 29 shows the completed saddle secured in position. Predominantly visible are the steam and exhaust connections. The foremost of these will be host to the exhaust orifice whilst the manifold to the rear will eventually unite the steam supply from the two superheater elements. More importantly the arrangement places the hexagonal unions into positions which, when the locomotive is complete, will allow the use of open-ended spanners through the relatively small smokebox door.

Smokebox

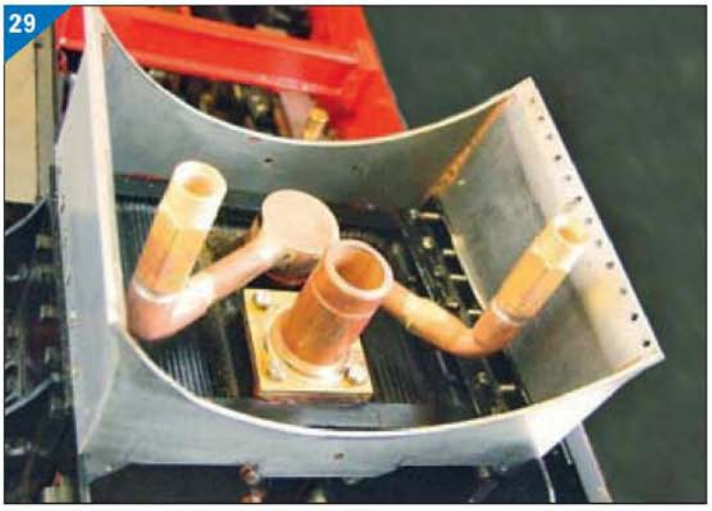
The outer shell was rolled from flat brass (10swg), to produce an outside diameter of 5 inches. Simple home-built bending rolls (George Thomas design) were used for this procedure. On most full-size GWR classes, the seam joint is clearly visible on the smokebox top. On the model, the joint was represented by a scribed line, whilst the real joint was silver-soldered and placed out of sight, on the underside of the smokebox.

Around 100 snap-head rivets are visible on the outer shell; these are 3/64in. diameter and of steel. In terms of location, the rivets form two circumferential rings - one to the front and one to the rear of the outer shell. Rivets on the rear of the smokebox are dummies in as much as they don't actually secure anything. Rivets at the front connect through to a gunmetal casting that forms the smokebox ring; they have been secured in a rather unconventional way. To secure the rivets in the normal manner would have required each hole to pass right through the ring itself and for the drill to exit at the step point of two internal diameters - nasty. Blind holes and Loctite adhesive provided a less harrowing solution.

Chimney

Turn of the century photographs show the 'Bulldogs' carrying a variety of chimneys. Pictures dating from the Edwardian period, however, suggest that some standardisation had taken place, the earlier Capuchon topped chimneys having given way to the straight-topped variety. A gunmetal casting was obtained for the model and I followed a sequence of machining operations starting in the lathe. The gunmetal casting was bored out and faced across the chimney top. The job was then transferred to the milling machine, where the chimney was securely clamped to an equally secure angle plate. The base was then fly-cut to fit the outside diameter of the smokebox. Back to the Myford and the chimney was positioned on a mandrel for the purpose of turning the outside diameter. Only the mid section was dealt with as the upper portion of the chimney was to be sawn off in order to facilitate the fitting of a proper Swindon cap, made from copper. Predictably, the most time-consuming operation was that of blending the flare of the skirt to the base of the chimney. Several files were used, either round or half-round and all with the chimney still positioned on the static mandrel. The latter, still in the grip of the lathe chuck, was rotated and locked in numerous positions in order to allow optimum conditions for filing. Finally, a steel liner was silver-soldered within the gunmetal portion of the chimney, its purpose being to provide an accurate location for both the copper cap and the smokebox petticoat pipe.

Photograph 30 shows the smokebox and chimney. Possibly the most important aspect of anything concerning a locomotive chimney is that it should not appear lop-sided on the model. I normally drill the skirt for the securing screws then temporarily fix the position on the smokebox with a few blobs of epoxy resin. The next stage being the critical one - convincing myself that it's >>



The completed smokebox saddle in position.

The smokebox and chimney assembly.

The spark arrestor.

straight when it's crooked or crooked when it's straight. The human eye can be extremely critical and should be used as the final inspection tool - if it looks right then it is: here's the tip - inspect from a distance! Being too close to the locomotive will not reveal an error, if indeed there is one. I normally view the chimney from around 12ft. away: if I think it looks okay, then I go to bed a happy man. If I still think it looks okay the next day then I spot the through fixing holes and drill and tap the smokebox.

Spark arrestor

At the time of constructing the model, spark arrestors had become mandatory for all passenger hauling steam locomotives operating on the **Leyland Society of Model Engineers'** track in Worden Park. Ten years of operating locomotives so equipped had provided members with valuable experience and insight into the requirements of an effective spark arrestor

Situated within the smokebox itself, the spark arrestor fitted to 3405 consists of a circular screen made from stainless-steel mesh. The mesh is permanently secured to two large rings - one top and one bottom. The whole then completely surrounds the space between the base of the petticoat pipe and the blast-orifice assembly. In operation, exhaust steam from the cylinders passes directly up the chimney in the normal manor, whilst hot gasses from the firebox must pass through the stainless mesh and therefore lose any of the harmful sized particles of hot coal.

The spark arrestor is shown in detail in **photo 31**. The negative aspect of the spark arrestor is that it must be removed for cleaning after every running session. The normal method of removing it is to release and drop the petticoat pipe into the spark arrestor itself. The pair can then be removed as one through the smokebox door.

More authorities and insurers are now insisting that live steam models are fitted with spark arrestors. My advice to anyone building a locomotive and intending to passenger haul, is to construct and fit a spark arrestor in the early stages of building the locomotive. Do not wait until the locomotive is finished - the job will be much more difficult, possibly resulting in the fitting of one of those external contraptions that resemble a tea strainer.

Boiler building

This is another job that many model engineers are happy to subcontract to the commercial specialist. Personally, I think there is a great deal of satisfaction to be gained by producing the heart of a locomotive from a sheet of copper. I suspect one of the problems facing a first time builder is that much of the written material on the subject of boiler building focuses on the use of oxyacetylene as the heat source for all the silver-soldering operations. This is understandable as most books on the subject have been written by professionals and oxyacetylene is what they mostly use. The fact that the inexperienced builder is unlikely to have the latter may influence his decision to buy a commercially built boiler. Having built several boilers for 5in. gauge locomotives, without having to resort to the use of oxyacetylene, I had every confidence that propane would offer a more than adequate heat source for building the 'Bulldog' boiler. Methods of silver-soldering vary and some of those used in conjunction with LPG differ from those in use with oxyacetylene or oxypropane. Another important aspect of 'cooking' with propane only is the need to follow a tried and tested sequence for joining together the various components of the boiler.

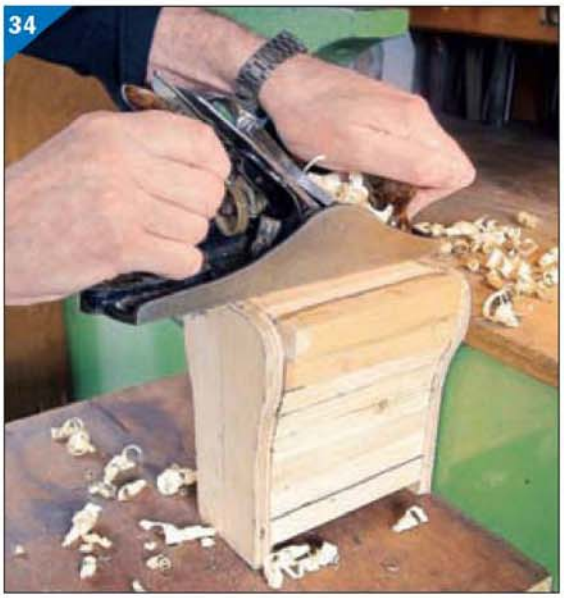
Making a start

Early 'Bulldogs' carried a slightly different boiler to the later examples and to the one now seen on the model. Under the GWR standardisation scheme this type of boiler became the Swindon No. 2. Although the main portion of the barrel is tapered, the No. 2 boiler has a short parallel section at the front end. For this front portion, I utilised a length of seamless copper tube.

Flat sheet was the starting point for the tapered portion of the barrel and I realised that if the sheet could be correctly marked and cut to shape then it would simply be a matter of rolling the sheet until the two edges met. Marking-out the cone is not as straightforward as some might think. This is due to the fact that GWR taper boilers were set so that the bottom of their barrels were horizontal with all the taper being at the top. In the event my marking-out was

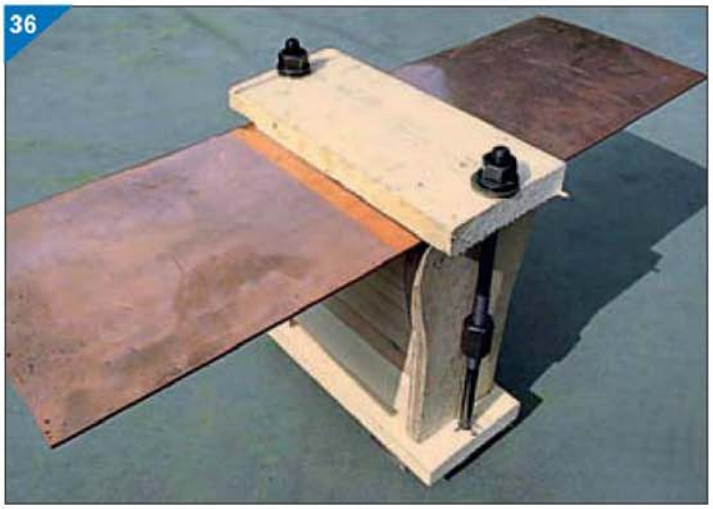
Cutting the firebox templates.

Making the firebox former.



Shaping the top firebox former profile.

The completed former and some flanging plates.



The copper is clamped to the top of the former.

not entirely accurate and I had some remedial trimming to carry out after the rolling process. Conveniently, the flat plate was short enough to be accommodated in the bending-rolls.

Producing the firebox

In order to produce the correct shape for both the inner and the outer firebox wrappers I made new formers from wood. The accompanying pictures show the tools and methods used to produce the former for the inner firebox.

Photograph 32 shows the method of cutting the plywood. When cut to shape, the two pieces will become the front and back profile bearers for the inner firebox former. Although the two shapes are identical towards their lower regions, the upper portion of the firebox backplate is considerably narrower than that of the tubeplate; hence the complex shape and the need to produce a former.

The next stage in the procedure is shown in **photo 33**. Several lengths of 1 x 1in. timber have been cut to equal length and are being used to create the main body of the former. After carefully aligning the front and back profile bearers, the cut lengths are individually positioned and secured using PVA adhesive.

Photograph 34 shows a hand-plane being used in the final shaping process. I suspect there are more efficient ways of producing a firebox former from timber but my choice was influenced by the desire to minimise the production of wood dust in the workshop.

The completed former, plus some of the flanging-plates, are seen in **photo 35**. Some of these had been used to produce previous GWR boilers including a 78xx ('Manor') and a 51xx ('Large Prairie'). Both these boilers are similar to that of 3405 and the flanging plates required little modification.

Photograph 36 shows a flat piece of new copper clamped to the top of the firebox former. The impression at this stage was that the copper would yield easily to moderate force. I had, however, underestimated the strength of the copper in its un-annealed state and was disappointed to make little impression when trying to bend it. The copper sheet had to be removed and fully annealed before recommencing with the shaping process.

The method of persuasion used to create the contour of the firebox can be seen in **photo 37**. The copper sheet had been re-annealed several times before reaching this stage and would require yet more of the same. Fourteen stone and a pair of size 12 shoes proved to be very helpful in creating the final shape!

Photograph 38 shows the setup for marking-out the firebox end. Filing away surplus copper is not one of the easier jobs on a boiler, for although copper is a soft metal it doesn't like being filed; added to that was the fact that the wrapper was difficult to hold securely.

Two girder-stays were fabricated from 3/32in. plate whilst the third was produced from rectangular section copper. The two outer girder stays would eventually connect with the outer firebox crown, but that would be later in the sequence of events. For now, the job was simply to silver-solder the three girder stays onto the crown of the inner firebox wrapper.

To be continued.

Bending the copper took some force.

Marking out the firebox.

Clock making in the Channel Islands

JAMES VARLEY

James Varley visits Dick Stephen at home on Alderney.

Richard Stephen's Alderney residence is home to a treasure trove of his own projects - be it bespoke grandfather clocks or custom-made musical instruments. Master craftsman Richard, a retired physiologist, is renowned in clock-making circles and his Valongis bungalow contains a host of unique time-keeping devices - all built with his own fair hands.

South Africa born Richard, who moved to Alderney in June 2007, has built more than 30 clocks in the last three decades - mainly because he enjoys a complicated, time-consuming challenge.

Richard, 71, who left Johannesburg to study physics and mathematics at Oxford University in 1956, said: *"I like making clocks because they're complicated, challenging and take a long time to do. I also think they look nice and I love the fact that each one is unique."*

1

Dick Stephen with some of his award-winning clocks.

2

Another of Dick's superb clocks.

One of Richard's clocks won him *Model Engineer* magazine's prestigious Claude Reeve Trophy, not that awards are the reasons behind his work.

"Each one offers a unique challenge," said Richard. *"Also, when you've finished you get something that a lot of people appreciate and have a piece that is really worthwhile."*

As one may expect, Richard is especially interested in the physical aspect of clocks, as well as their significance historically.

"A lot of clocks are associated with some aspect of physics, which I find fascinating," said Richard.

"Time keeping was very important a couple of centuries ago and still is today. Back in the 19th century it was imperative to try and obtain accurate time keeping because people needed a regulated clock for a lot of things. So much work was put into generating accurate time."

Richard's garage has been converted into a clock workshop and it is where he spends most of his time - especially as it can take up to four months to develop just one clock. *"It generally takes me three to four months to make a clock,"* said Richard, whose last post was at Leicester Royal Infirmary. *"It is a lot of time but I enjoy doing things which take a while and keep me occupied."*

Richard is happy to use all the modern technology he can get his hands on during the clock-making process and rubbished claims by some in the trade that people should stick to 19th century traditions. *"Some modern clock makers scorn at the thought of using modern technology. For some reason they think everyone should stick to the same practices that the famous clock makers used in the 19th century. However, what these people don't consider is that if the clock makers of that bygone age were about today they*

would jump at the chance to use some of the methods available in the 21st century. The great clock makers were skilled men but they made clocks to make a living and would have adopted anything that made their jobs easier."

Commissions accepted

Richard, who went to Yale and the University of Washington in the United States, is happy to accept commissions, though he revealed that many would-be buyers are often put off by the price.

"It costs a lot of money to make a clock," said Richard.

"The brass alone can cost hundreds of pounds and you generally end up throwing a lot of it away. I charge about £3,000 for an average size clock and £6,000 for a grandfather clock. I don't have a problem with taking commissions, but I'm not interested in repairs."

According to Richard, who is also a keen fisherman, modern-day atomic clocks keep excellent time and will always be more accurate than their mechanical counterparts.

He said: *"Atomic clocks have been developed that keep almost perfect time. Mechanical clocks are never going to be as accurate as they are."*

Richard's life doesn't just revolve around clocks however - he is also a skilled musical instrument maker. In his lounge sits a Forte piano - made by Richard - similar to one Mozart would have practiced on.

Richard said: *"If you look in Mozart's diaries he mentions that he used a Forte piano to practise on. He had to borrow it though as his family couldn't afford to buy him one."*

Process of elimination

As for moving to Alderney, Richard arrived in the northern isle following a process of elimination.

He said: *"I was living in Rutland in a big house and decided I wanted to get away from it all. And, after looking long and hard, Alderney seemed to be the best place to come. I'm not too good on languages so I decided I needed to move to an English-speaking country. It's too difficult to get into America and Canada's too cold - so I dismissed those. I've already lived in Australia and didn't want to go back and I think New Zealand is too far away. You'd have to be mad to live in South Africa, even though I was born there, and I haven't got six million to get into Jersey."*

Dick working on a movement at his workbench.

Richard narrowed his search down to Ireland, Guernsey and Alderney.

He said: *"Ireland didn't seem to offer much and property prices in Guernsey are too high."*

Alderney, it seemed, was Richard's last hope.

"I came for the first time a couple of years ago to look at different properties. I liked the feel of the place so decided to come." **ME**

Making piston rings for steam engines

ALAN BEASLEY

Alan Beasley turns his own.

PART 2

Continued from page 523 (M.E. 4350, 24 April 2009)

A fixture is required to hold the rings for heat treatment. It does three things, clamps the rings flat, sets the gap and provides thermal mass to help hold an even temperature. **Photographs 3** and **4** show examples I have used together with the gap-setting bar. It can be made of any scraps of steel available, but keep it fairly chunky.

Some authors make this jig quite sophisticated with a captive gapping rod, (photo 3) and I think this is worth doing for the small rings because they are small and delicate. Make sure the ring ends abut across the diameter of the gapping bar. Photograph 4 shows a simpler arrangement which works adequately for larger rings; note the top clamp disc is missing, I must have used it for something else! Make the central spigot about 0.05in. smaller in diameter than the ring bore and a little shorter than the ring stack. Load the rings on with the gapping bar in place and clamp the disc on the top just a bit more than finger tight. The outside of the rings can be coated with an anti-scaling compound if available, I have used white correction fluid which is probably better than nothing, which is what the white deposits are.

A small gapping jig.

A larger gapping jig.

The whole assembly now needs to be set up in a brazing hearth so that it can be evenly heated up and held at temperature for some time. The ideal temperature is about 600deg. C, held for about 15 minutes for these sizes of rings. It is undesirable to use higher temperatures as this degrades the metallurgical structure of the cast iron in terms of its use here. This is obviously not easy to do in a hearth, but what I have done is as follows. Set the assembly on bits of firebrick or similar so that its axis is horizontal and you can direct the torch flame onto the thick, or base end. It's worthwhile making up a support for the torch for this task. Then place some firebrick, or really dry house brick pieces around it to make a tunnel so that the flame is constrained to flow round the job. Then heat it up to a very dull red and hold for about 10 minutes, and then allow to cool naturally.

What you do not want to do is apply the flame directly to the rings. This is highly likely to cause uneven temperatures and thus uneven stress relief resulting in a non-circular ring when it is closed up again.

Clean the white correction fluid residue off with a wire brush and unbolt the fixture. If it has worked, the free ring gap should be the same as the fixture, if it is slightly less it shows the stress relief was not complete, but this will probably not matter.

The rings can now be finish lapped to fit the piston ring grooves. The fit needs to be as close as possible whilst allowing the ring to move in the groove. Stone off the sharp corners on the inside of the gap to facilitate installation on the piston.

The final step is to gap the ring in the bore, a general rule of thumb for steam engines seems to be 0.001in. + 0.001in. per inch of bore. If a high degree of superheat is envisaged then a few thou more might be advisable. I used a gap of 5 thou. for the Shay piston rings.

The ring can be fitted to the piston by easing it over the end. I have never found any problems in fitting such pistons to cylinders providing a small 45deg. chamfer has been machined on the end of the bore. Ring clamps are generally not needed for these sizes of rings. **Photograph 5** shows a Shay piston with its rings. It has done about one and a half seasons now, over 100 miles and the rings have a dull polish all the way round.

You may notice that the piston looks quite shiny. That is because it is aluminium alloy, which I have always used for my steam engine pistons. It makes for a much smoother running engine than a great slab of cast iron stuck on the end of the piston rod. The piston must be made a little smaller than an iron one due to the higher coefficient of expansion of aluminium, 26 x 10-6 compared to 10 x 10-6 per deg. C for cast iron.

I have never found piston corrosion a problem, even on my Sentinel steam wagon which had gunmetal cylinders, and an aluminium piston won't rust into a cast iron bore like a cast iron one can. The three extra blind holes on the top are two tapped holes to enable the piston to be able to be pulled from the bore and the location for the tab washer that goes under the piston locknut. Interestingly the rings were quite stuck in the grooves when I removed this piston for the photograph in spite of the cylinders being well oiled prior to the winter lay up. Some WD-40 soon freed them up but at least they were not corroded into the piston as could have occurred with an iron one. Maybe I should make the rings a slightly looser fit in the grooves.

Rings for piston valve bobbins can be made in the same way as above. These rings will be quite delicate; those for the Shay were 0.7 OD, 0.05in. wide with a radial width of just 0.026in. thus giving a D/t ratio of 27. From Graph 1 (see *M.E.* 4350, 24 April 2009) this would appear to indicate quite a high wall pressure but I have found these small rings tend not to hold all of their initial set gap. They certainly seem to work well with a quite low frictional force to move the bobbin.

If rings you have made turn out to be too stiff, i.e. there is too much frictional force to move the piston, all is not lost. The inside of the ring can be bored out a little to reduce 't'. Make a ring pot of the cylinder diameter to hold the rings with a clamp plate on the end and bore out as required. Again, absolute concentricity is required.

5

The Shay piston.

Photograph 6 shows a Shay piston valve bobbin, with one end dismantled to show its construction. The bobbin components are machined from '303' grade stainless steel, which machines quite nicely. Making the bobbin this way makes it much easier to fit the rings, and the positions of the rings in terms of the amount of lap can be adjusted by small amounts relatively easily should this be required. It is also easier to get really good machined surfaces for the ring slots. Because the stainless material is much stronger than cast iron and won't corrode, the steam faces of the ring grooves can have a large chamfer on them so the ring edge is the bobbin edge in terms of valve dimensions.

The end plugs of the bobbin have a hexagon key socket broached into them so that they can be screwed tightly to the body to make a one-piece bobbin assembly. Threads are ⅜in. x 40.

My experiences have shown that it is perfectly feasible to make your own cast iron piston rings, they can be made to suit your exact requirements, will probably be cheaper and it doesn't matter if you should break one!

ME

6

Piston valve bobbin assembly.

TEDDY MYFORD

I thought readers who visited the recent Myford open days might like to know that Teddy Myford collected £64.70 in the RNLI box.

People obviously enjoyed the cake. The money is going to the cotswold branch of the RNLI.

The branch chairman is pleased to have another box collecting from outside the area.

Doreen and Harry Paviour

MAY

23 **Brighton & Hove SMLE.** Public Running. Contact Mick Funnell: 01323 892042.

23 **Chesterfield & District MES.** Open Invitation & Public Day. Contact Mike Rhodes: 01623 648676.

23 **Leighton Buzzard NG Rly.** Narrow Gauge at War. Enquiries: 01525 373888.

23 **SM&EE.** Workshop Topics. Contact Maurice Fagg: 020 8669 1480.

24/25 **Bedford MES.** Public Running. Contact Ted Jolliffe: 01234 327791.

24/25 **Bristol SMEE.** Running Days. Contact Trevor Chambers: 0145 441 5085.

24/25 **Cardiff MES.** Open Days. Contact Don Norman: 01656 784530.

24/25 **Leicester SME.** Public Running. Contact John Lowe: 01455 272047.

24 **Leighton Buzzard NG Rly.** Sand Quarry. Enquiries: 01525 373888.

24 **MELSA.** Bracken Ridge. Contact Graham Chadbone: 07 4121 4341.

24/25 **Northern Mill Engine Society.** Steaming Days. Contact John Phillip: 01257 265003.

24/25 **Nottingham SMEE.** Bank Holiday Running. Contact Pete Towle: 0115 987 9865.

24 **York City & DSME.** Running Day. Contact Pat Martindale: 01262 676291.

25 **Brighton & Hove SMLE.** Public Running. Contact Mick Funnell: 01323 892042.

25 **Canterbury & District MES (UK).** Meeting. Contact Gina Pearson: 01227 830081.

25 **Lancaster & Morecambe MES.** Running Day. Contact Mike Glegg: 01995 606767.

25 **Leighton Buzzard NG Rly.** Industry Trains. Enquiries: 01525 373888.

25 **Stockholes Farm MR.** Running. Contact Ivan Smith: 01427 872723.

27 **Bedford MES.** Half-Term Running. Contact Ted Jolliffe: 01234 327791.

28 **Leyland SME.** Geoff Haslehurst: Turbines. Contact A. P. Bibby: 01254 812049.

30/31 **Aylesbury (Vale of) MES.** Vale of Aylesbury Miniature Traction Engine Rally at Quainton. Contact Andy Rapley: 01296 420750.

30 **Brighton & Hove SMLE.** Public Running. Contact Mick Funnell: 01323 892042.

30/31 **Peterborough SME.** Peterborough Miniature Locomotive Rally. Contact R. A. Meek: 01778 345142.

30 **SM&EE.** Rummage Sale. Contact Maurice Fagg: 020 8669 1480.

31 **Cambridge MES.** Members' Running Day. Contact Tim Coles: 01954 267359.

31 **Leicester SME.** Public Running. Contact John Lowe: 01455 272047.

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

31 **North Cornwall MES.** Sunday Steam-Up. Contact Geoff Wright: 01566 86032.

31 **Nottingham SMEE.** Running Day. Contact Pete Towle: 0115 987 9865.

31 **Otago MES.** Club Running Day. Contact James Woods: 476 1369.

JUNE

1 **Peterborough SME.** Bits & Pieces. Contact R. A. Meek: 01778 345142.

2 **North Cornwall MES.** Meeting. Contact Geoff Wright: 01566 86032.

2 **Stamford MES.** Tim Beasley: Bronze Casting. Contact Derek Brown: 01780 753162.

2 **West Wiltshire SME.** Track Meeting. Contact R. Nev. Boulton: 01380 828101.

3 **Bradford MES.** Meeting. Contact John Mills: 01943 467844.

4 **South Lakeland MES.** Meeting. Contact Adrian Dixon: 01229 869915.

4 **Warrington DMES.** Natter Night. Contact Duncan Webster: 01925 262525.

6/7 **Cardiff MES.** 19th Welsh Locomotive Rally. Contact Don Norman: 01656 784530.

6 **Ickenham DSME.** Public Running. Contact Phil Wimbush: 07759 275353.

6/7 **Melton Mowbray DMES.** Whissendine 2009. Contact Norman Smedley: 01664 434349.

6 **SM&EE.** Stationary Engine Running Day. Contact Maurice Fagg: 020 8669 1480.

6 **West Wiltshire SME.** Official Opening Ceremony. Contact R. Nev. Boulton: 01380 828101.

6 **York City & DSME.** Summer Meeting. Contact Pat Martindale: 01262 676291.

7 **Bristol SMEE.** Running Days. Contact Trevor Chambers: 0145 441 5085.

7 **Frimley & Ascot LC.** Public Running. Contact Bob Dowman: 01252 835042.

7 **Leicester SME.** Public Running. Contact John Lowe: 01455 272047.

7 **Mini Train des Marais, Normandy, France.** Steam Sunday. Contact Michael Honeybun: 00 33 2 33 07 91 77.

7 **NW Leicestershire SME.** Members' Running. Contact Jamie Wilde: 01530 273270.

7 **Nottingham SMEE.** Running Day. Contact Pete Towle: 0115 987 9865.

7 **Pinewood MRS.** Members' Family Day. Contact Paul Archer: 0118 989 4516.

7 **Reading SME.** Public Running. Contact Ian Fothergill: 0118 9421679.

8 **Bedford MES.** Pop-Pop Boats Regatta. Contact Ted Jolliffe: 01234 327791.

9 **King's Lynn DSME.** Barbecue & Members' Fun Run. Contact Mike Coote: 01533 673728.

10 **Brighton & Hove SMLE.** Wrinklies Day. Contact Mick Funnell: 01323 892042.

10 **Hull DSME.** David Nunn: Valves. Contact Tony Finn: 01482 898434.

10 **Leicester SME.** Local Societies Open Evening. Contact John Lowe: 01455 272047.

10 **St. Albans DMES.** Alan Ashberry: Railway Evening. Contact Roy Verden: 01923 220590.

11 **Leyland SME.** Video Night. Contact A. P. Bibby: 01254 812049.

11 **NW Leicestershire SME.** Kevin Grimley: Coracle Making. Contact Jamie Wilde: 01530 273270.

12 **Polegate & District MEC.** David Candy: The GWR Society & Didcot. Contact D. F. Pratt: 01323 645872.

13 **Chesterfield & District MES.** Efficiency Trials. Contact Mike Rhodes: 01623 648676.

13/14 **Harrow & Wembley SME.** Open Weekend. Contact Roy Goddard: E. RSGwatford@aol.com

13 **West Riding SLS.** Annual Visitors Rally. Contact David Batty: 01924 363908.

14 **Bedford MES.** Members' Running Day. Contact Ted Jolliffe: 01234 327791.

14 **Cambridge MES.** Public Open Day. Contact Tim Coles: 01954 267359.

14 **King's Lynn DSME.** Members' Fun Run. Contact Mike Coote: 01533 673728.

14 **Leeds SMEE.** Running Day. Contact Geoff Shackleton: 01977 798138.

14 **Leicester SME.** Rainbow Charities, Public Running. Contact John Lowe: 01455 272047.

14 **Nottingham SMEE.** Running Day. Contact Pete Towle: 0115 987 9865.

14 **Rugby MES.** 2½in. Gauge Rally. Contact Ken Eyre: 01788 842709.

14 **York City & DSME.** Running Day. Contact Pat Martindale: 01262 676291.

15 **Lancaster & Morecambe MES.** Stan Jackson: Coal, its total combustion. Contact Mike Glegg: 01995 606767.

15 **Peterborough SME.** Barbecue & Drive-a-Loco Evening. Contact R. A. Meek: 01778 345142.

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NEWS


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2

The East Somerset SMEE

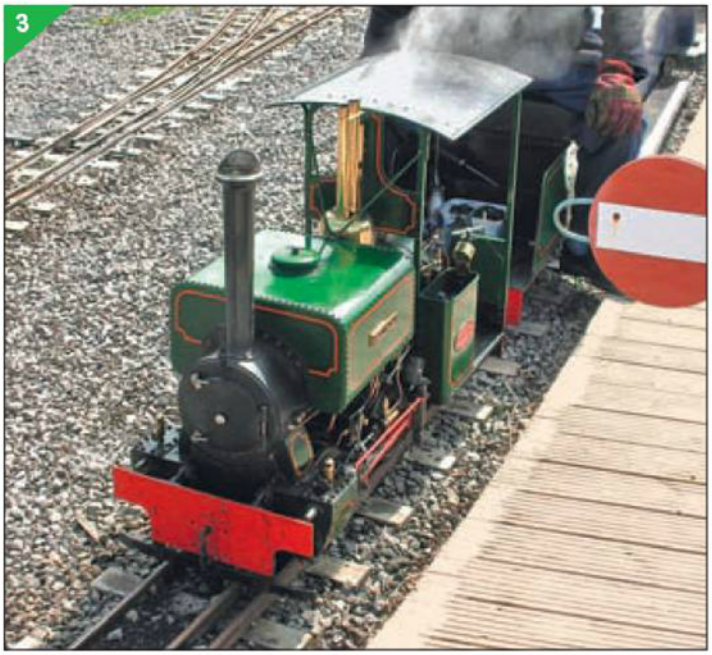
The East Somerset Society of Model & Experimental Engineers is a relative newcomer to the ranks of model engineering societies being founded in 2001. It is based at the Bath and West Showground near Shepton Mallet. There is a large clubhouse and a good length of track catering for 5in. and 7¼in. gauges. They have just installed a new turntable and steaming bays.

During the recent model show the weekend after Easter, Roger Davies was running his much modified *Tinkerbell* which is actually a 2-4-2 (**photo 1**). I had a ride behind this locomotive and the track was very smooth. As can be seen in the photo, the track is very clean and the layout of the site has been carefully thought out.

Photograph 2 shows *Ladybird*, a 7¼in. gauge tank locomotive. The decking in the foreground is the station platform. **Photograph 3** is a 5in. gauge Wren locomotive. All the point work and signals are controlled from the signal cabin, **photo 4**. This is a very well constructed building with a proper lever frame arrangement inside. The bogie passenger wagons in front are very well made and are very smooth riders.

I was made very welcome at the site and thoroughly enjoyed my short stay in Somerset.

Contact details for the society are Roger Davis, the honorary president:
T. 01749 677195.
E. **rogerdavies@essmee.org.uk**
W. **www.essmee.org.uk**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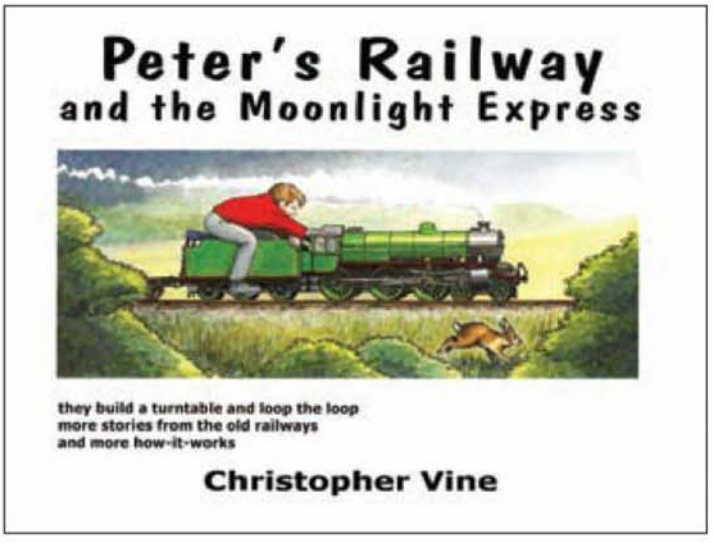
BOOK REVIEW

Peter's Railway
and the Moonlight Express

By Christopher Vine

This is the second book in the Peter's Railway series and it is as good as the first. It is well written and has excellent illustrations. This time, Peter and his grandfather build a turntable and add a loop. Grandfather also teaches Peter to drive the engine. Each chapter ends with a bit of technical information given in a simple non-technical way. I am sure most model engineers will read this book before passing it on to their grandchildren. The book is a thoroughly recommended read.

The book is available from www.myhobbystore.com or customer services on 0844 4122262.



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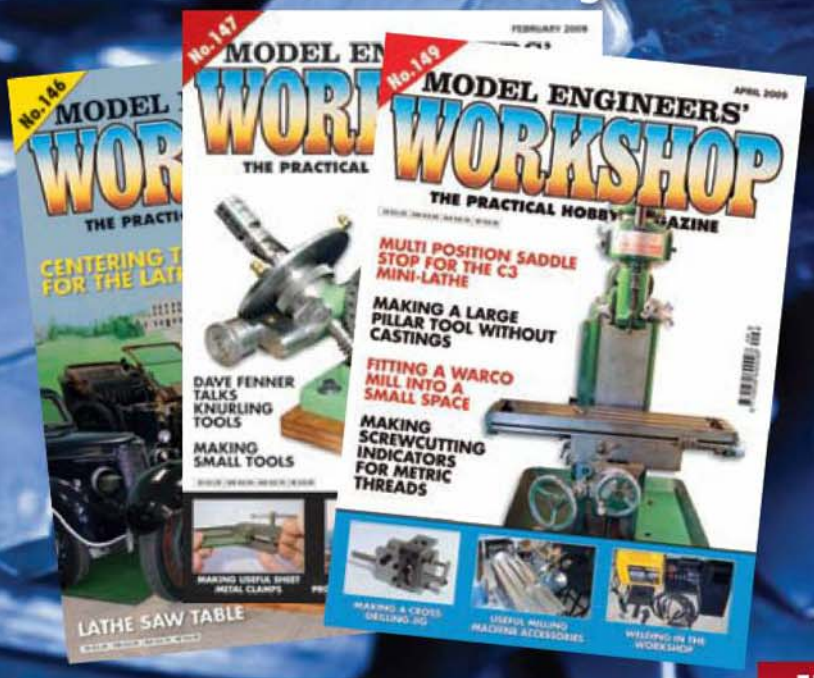

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■ Amolco milling attachment for Myford ML7 and Super 7, good machine, £225. **Tel: 01923 267166 Watford.**

■ Boxford shaper, 8in. stroke, 3 phase, £300. **Tel: 01235 763992 Wantage.**

■ Myford vertical milling machine model VM-C, floor standing, single phase, R8 spindle, 9 speeds to 2680 revs, forward/ reverse, collets, vice, rotary table, chuck, cutting tools, buyer collects, £1000. **Tel: 0208 5613815 Hayes.**

Machines and tools wanted

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■ Vertex boxed R8 collet chuck for screwed milling cutters, 4 imperial, 4 metric collets, £60. Copper tube, 20½ x 6½ 10Gauge, £50. Myford vertical slide as new, £80. **Tel: 01229 833904 Barrow-in-Furness.**

■ Dore Westbury or similar miil. Also manual for 4½in. Boxford lathe. **Tel: 01953 601144 Norfolk.**

Models and parts offered

■ Edward Thomas, 5 inch gauge, new unmachined castings, horns, axleboxes, all wheels, cylinders, motion plates, £125 plus P&P. Derby 4F 3.5 inch by Don Young, full set of new unmachined castings, drawings, construction articles from M.E. cost over £700, complete package, £350 plus p&p. **Tel: 01825 762287 Uxbridge.**

■ Polly 5in. gauge, full boiler certificate, driving trolley and passenger trolley, can be seen working, £3700. **Tel: 01268 732624 Essex.**

■ Springbok rolling chassis, rods, smokebox casting, drawings and write up, £600. Super Simplex, 5in. gauge, frames done, castings drawings and write up, £300. Buyer collects. **Tel: 01229 833904 Barrow-in-Furness.**

■ Stuart compound launch engine, brand new, air tested only, £995 ONO. **Tel: 02825 880514 Ballymena.**

■ 1in. scale Minnie traction engine, engineer built, steamed twice only, pictures on request, offers over £1250. Part built Fowler Showman's engine, main and front wheels completed, professionally built boiler, hornplates painted, chimney completed, some bearings machined, all castings and drawings to complete, pictures on request, offers? **Tel: 01782 515128 Stoke-on-Trent.**

■ 5in. gauge Henschel Somn 20CV, boiler cert, steam cert southern Fed. Excellent runner, £4000 ONO. **Tel: 01302 328729 Doncaster.**

Books and magazines offered

■ Building The Small Lathe by L.C. Mason with tailstock, leadscrew and some other parts. Also 39 copies of Model Engineer. **Tel 01625 876038 Stockport.**

Books and magazines wanted

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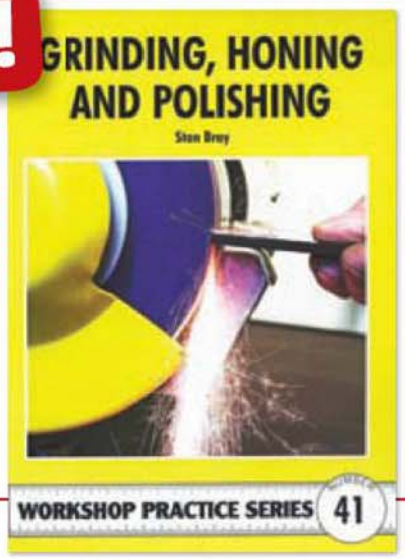

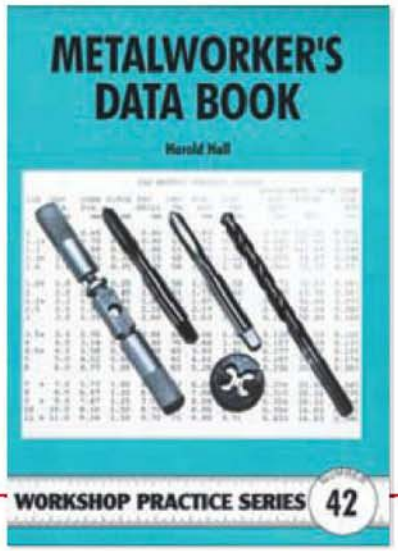

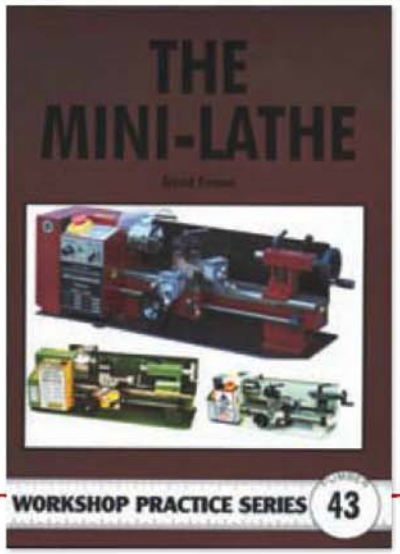

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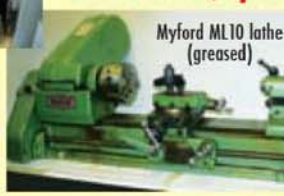

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