

MODEL ENGINEER

Vol. 202 No. 4342

2 – 15 January 2009

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ISSUE IN THIS ISSUE IN THIS ISSUE

Vol. 202 No. 4342 2 - 15 January 2009

11 SMOKE RINGS

News, views and comment on the world of model engineering.

12 THE CLUB STANDS AT THE MODEL ENGINEER EXHIBITION

Malcolm Stride reports on the clubs who supported this year's Model Engineer Exhibition.

16 AN ENGINEER'S DAY OUT THE NETHERLANDS RAILWAY MUSEUM IN UTRECHT

Roger Backhouse visits this Dutch museum.

20 OLD WINE IN NEW BOTTLES A TOULET IMPERATOR

John Wilding describes the hands, dial and base of the clock.

23 A COUNTERWEIGHT FOR THE VERTICAL MILL

Joerg Hugel improves his milling machine.

24 MUSINGS ON CAMS

Dave Fenner looks at cam design.

27 A PATH TO GOLD

Clive Fenn describes how he built a Gold Medal-winning locomotive.

30 McONIE'S OSCILLATING ENGINE

Anthony Mount describes how to make split bearings and other parts.

34 BRITISH RAIL CLASS 86 ELECTRIC LOCOMOTIVE

Ken Toone describes his gauge 1 version of this locomotive.

36 JACOBS CHUCKS

John Harris overhauls a chuck and suggests another use.

38 CLASS 66 LOCOMOTIVE IN 7 1/4 in. GAUGE

Roger Bunce looks at the latest locomotive from Abbots Engineering.

40 FITTING A DRO TO A WABECO MILL

David Haythornthwaite shows you how to fit a DRO to a mill.

43 DIARY

Forthcoming events.

44 NEWS

Club news for the UK and the rest of the world.

46 POST BAG

Letters to the editor.

50 A SILVER SOLDERING JIG

John Slater adds an extra pair of hands.



ON THE COVER...

Photographed on a bright summer day, Samantha is a fine example of a preserved Foden steam wagon and is sure to bring back memories of summer sunshine to you, the readers'.

(Photograph by Kelvin Barber)

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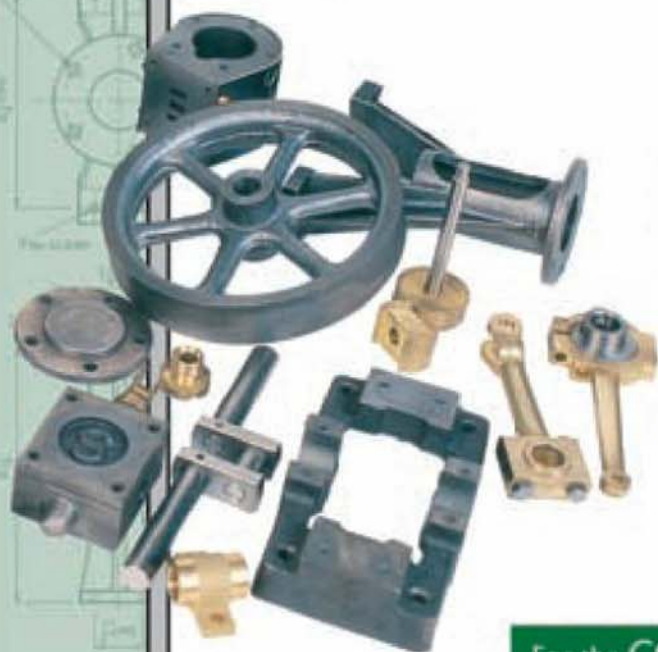
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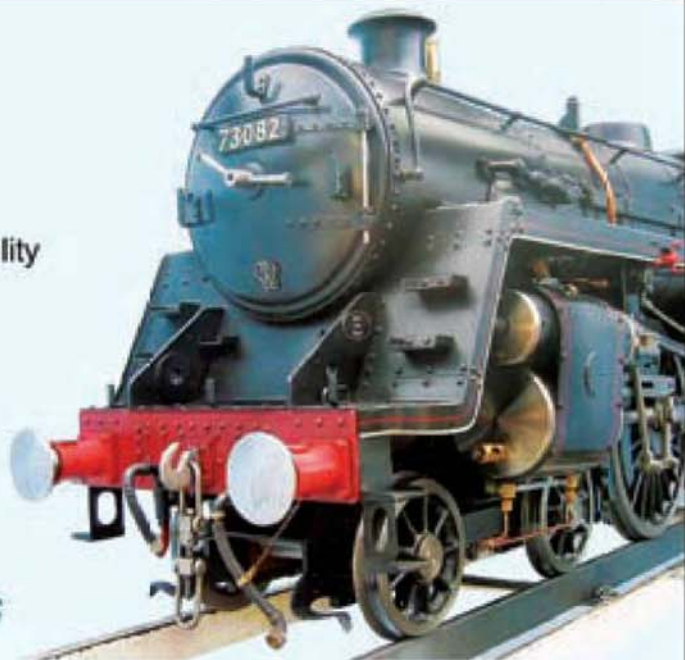
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New Year NEW BOOK!

(available 6th January 2009)

Workshop Projects

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This latest Camden publication contains drawings and building instructions for no less than twelve items of very useful workshop equipment. All bar one of these have been described, in a different format, in the pages of this magazine, and lightly revised for this book. Two of the items are for general use in the workshop, nine are lathe accessories, and the last is a very neat wood turning lathe. If you are in a tearing hurry to build your railway locomotive, model traction engine, IC engine or whatever, you will rush out and buy the workshop equipment you need, but if you are of a more contemplative frame of mind, and want to save money, making your own tools and machine accessories can be very satisfying.

As designed, most of the accessories described here are intended for use on Myford Series 7 lathes but, with a bit of thought (and measuring) can be adapted to fit any other make. The specific projects show you how to build die holders, a machine clamp, a cross drilling jig for the lathe, a swan-necked turning tool holder, a tailstock die holder, a machine vice for the Myford, a floating toolholder, a saddle stop for the Myford, a milling head for the Myford, a collet chuck for the Myford and a rotating centre. Finally there are also full drawings and construction details for the 'Chipmunk' Wood Turning Lathe, a superb and practical machine for anyone wanting to try wood turning.

After an engineering apprenticeship in the aircraft industry, Dyson Watkins has been involved in production engineering, and especially in education, having spent many years as a lecturer in engineering in South Wales. He has always favoured a 'hands on' approach, and enjoys working in his own workshop. Given this background, it is no surprise that this book contains practical projects for practical model engineers, as well as useful ideas and 'asides'.

104 A4 format pages. 30 B&W photos. 86 drawings. Also included is a very useful selection of appendices.

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ROGER BUNCE
Technical Editor

Sponsored events in 2009

I have just found out that *Model Engineer* sponsors three events each year. The first is IMLEC and I believe this is being held at Bristol this coming year. The 3½in. and 5in. raised tracks will be used.

We also sponsor the Curly Bowl and I have discovered that the **Stafford & District MES** are holding this event on 5 and 6 September 2009. This will be held on the 2½in., 3½in. and 5in. gauge tracks at the hosting society.

Thirdly, we sponsor the SEQLEC and a society with a 7½in. gauge ground level track should be fine. I don't know if anyone has offered to host this event so if your society has been promised this event, please let me know.

Also, if your society is willing to host any of the three events in 2010, again, please get in touch. I would like to sort out 2010 early so it is not a last minute rush. (This would also allow representatives from 2010 to visit the 2009 event to gain active knowledge)

Competition details and contacts for entries will hopefully be published as soon as we get offers of hosting.

Contributors wanted

I am starting to receive some new articles from contributors. Hopefully, by the time you read this, I will have had a good response to my request for articles in issue 4341. Still more will be required though. There are plenty of subjects of interest to readers'. One subject requested is an article on making piston rings. Are there any takers on this?

Guidelines are available to prospective authors and can be emailed direct or sent by post. We do pay well for contributions so get writing and send me your articles. Articles on any relevant model engineering subject are welcome especially about any models you have constructed. Drawings can be redrawn if necessary. Photographs need to be fairly high resolution although a top of the range camera is not a necessity.

News and Post Bag

These two items have now been pulled back in house. Malcolm Stride has been editing club news for many years but this is his last issue as news editor. I would like to thank Malcolm for the service he has provided over the past years. Malcolm is continuing with his *I/C Topics* pages and will cover other events for me from time to time. He is also going to prepare the next index.

I will be doing the News section and, as editor, I think I ought to do *Post Bag*.

Let me know what you think of club news. I get a tremendous amount of newsletters and information through the letterbox and via email. How much of it do you want me to print? I would like an overview from you of what you think about all the news, not the response "print my local club's news only". I have deliberately restricted news to 1½ pages for my first few issues; tell me if you think this is enough, too much or if more is required?

In a similar vein, I have restricted *Post Bag* to two pages at the moment although 4343 and 4344 will have three pages of letters each because of dropping the Free adverts after the Christmas period.

While active letter pages are a sign of a healthy magazine with a good readership base, would readers prefer a page or two more of articles or a page or two more of letters? Again, tell me what you think?

Evening classes

The following email was received from Ted Fletcher of Scarborough.

"I read Malcolm Stride's article on page 581 of *M.E.* 4338, 7 November 2008 and would like to tell of our experience here in Scarborough. The Northshire County Council used to run the Model Engineering course under the umbrella of evening institute classes. When the government allowed Technical Colleges to become sort of private companies, the County Council then rented the workshops from the College, but without

any documentation etc. Later on the College requested full documentation from the evening class organiser; she failed to comply and we were left high and dry, piggy in the middle.

I attempted to get the College to run the course but they were only interested if the course had some form of theory and examination, which after 20 or so years of attendance we felt we didn't desire or need and their course duration was three years. We asked what happens after three years, the reply was in effect we hit the buffers. I shopped around the country a bit and found that most Colleges/Model Engineering courses had received the same or similar treatment; they didn't want us, full stop.

After two years without a course I approached the College and asked if it was possible to hire the workshops as a private group, yes you can was the reply so now twelve of us likeminded people attend the workshops on Tuesday evenings. Things are not cheap any more, for 20 evenings of two hour duration it costs us £2,093, that includes the cost of a tutor which is obligatory, he has passed all the government hurdles/tests. So, we prepare a couple of days before hand so that we get our monies worth on the night. I hope you will pass the above on to readers".

If anyone else knows of an evening class in their area, I will be pleased to mention it in *Smoke Rings*. Please contact the editor.

Roving reporters

There are many events held up and down the country that are worth reporting in *Model Engineer*. I would like to make contact with readers who would be willing to write up an event for the magazine; the article will be paid for. If you are attending a well-supported event or local exhibition that might be of interest to readers, please contact me. We have coverage for the Guilford Exhibition, the Bristol Exhibition and Harrogate. I also have someone to cover The London and The Midlands Exhibitions.

Free adverts

The Free Private Adverts are alive and well, although I have not scheduled any for issues 4343 and 4344 due to the Christmas break. You are welcome to use these pages to dispose of any relevant engineering equipment. (No traders please.)



The Club Stands



MODEL ENGINEER EXHIBITION



MALCOLM STRIDE

Malcolm Stride visits the club stands and reports on what they had to show visitors.

This year there were 18 club stands exhibiting and entertaining the visitors. They provided a good collection of models, both completed and under construction for visitors to examine and discuss with the stewards on the various stands. After much deliberation the Best Club Stand Shield was awarded to the National 2½" Gauge

Association not only for their excellent stand, but also for the way in which those present interacted with the visitors and responded to questions. This interaction is one of the most important parts of this award and, if done correctly, will ensure that visitors take away a good impression of the club, and also the show.

Ascot Locomotive Society (photo 1)

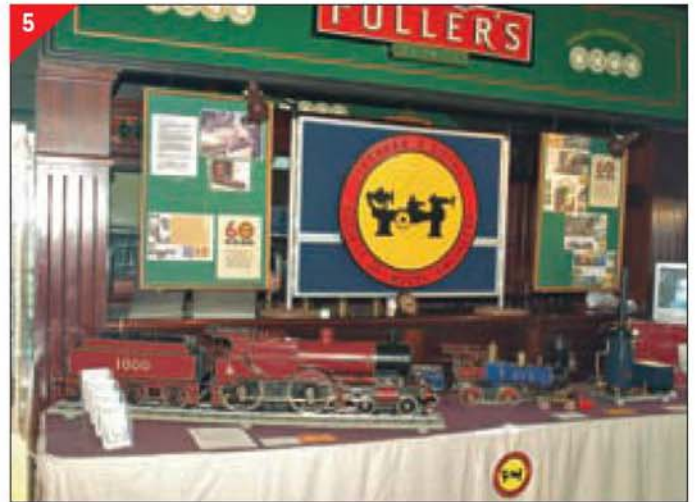
The society had a small stand at the show itself, but was also running at its track site close by on the racecourse grounds. One of the attractions on the track was the Big Boy locomotive being driven by Ian Rough.

Gas Turbine Builders Association (photo 2)

This stand is always well patronised by visitors and, in addition to the excellent display, the group ran demonstrations outside. Tim Coles' gas turbine locomotive represented the group on the Sinsheim track and it attracted quite large crowds when it was running (see *M.E.* 4339, 21 November 2008 cover photo).

GWR Preservation Group (photo 3)

They were one of several groups with items for sale to raise funds for their preservation activities. In this case I have picked the diecast scale vehicles on the stand.



I/C Engine Builders Group (photo 4)

Another group that always attracts plenty of interest is the I/C Engine Builders who had a very wide-ranging display this year from small 2-stroke engines, to Bill Connor's Gold Medal Manx Norton and Mike Sayers' Gold Medal-winning 1:3 scale Bentley 3-litre 4-cylinder (see M.E. 4336, 10 October 2008). Bill and Mike are seen discussing this latter engine.

Ickenham DSME (photo 5)

Ickenham are regular visitors to the show and this year had a very wide-ranging display including the live steam locomotives and the vertical boiler steam plant seen in the photograph. Round the corner on the display was a selection of other models including a nice small gauge layout.

Lynton & Barnstaple Railway Trust (photo 6)

This was another group tempting visitors to raise funds for preservation activities. They had a very wide range of books on offer in addition to mugs, possibly for those needing another beverage receptacle for the workshop!

Napier Power Heritage Trust (photo 7)

This group had a very diverse range of Napier related items on display with various models, including the Deltic locomotive seen here. There were also several full-size artifacts on the stand such as the tools and full-size connecting rod in the photograph.

National 2½" Gauge Association (photo 8)

This smaller gauge is proving ever more popular and the display included examples of several of the designs

promoted by the association, including the new diesel outline class 66 locomotive parts seen here. There was also an interesting Polish OL49 locomotive being built using a cardboard cut-out book as the template for the parts.

Pinewood Miniature Railway Society (photo 9)

This local society showed a small selection of locomotives together with a number of wagons. The locomotives included a vertical boilered type and also a Metropolitan Growler. There was also plenty of information describing the society activities.

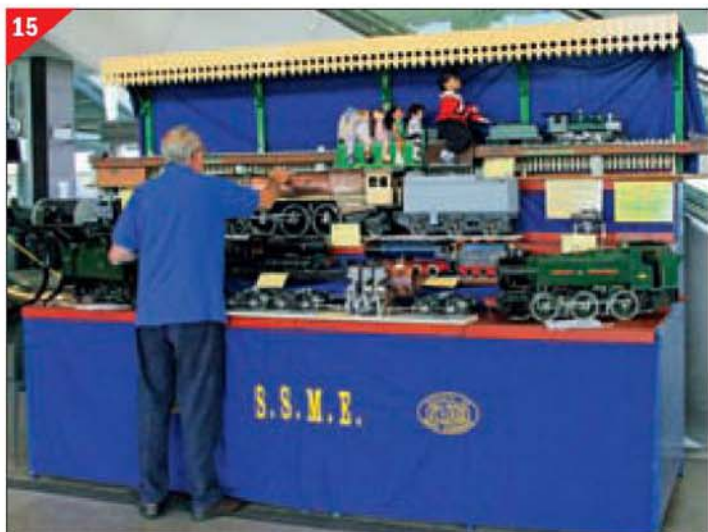
Reading SME (photo 10)

The Reading display was very varied and included a number of larger gauge locomotives together with some examples in the smaller gauges, I/C engines, stationary engines, an Atkinson wagon and a tool and

1. A visitor admiring the show display from Ascot Locomotive Society.
2. Some serious concentration from the gas turbine builders.
3. A good selection of scale cars to grace a small gauge layout.
4. Bill Connor and Mike Sayers on the I/C Engine Builders Group stand.
5. Part of the varied display from Ickenham DSME.
6. A wide range of items ready for the visitor on the Lynton & Barnstaple Railway Trust stand.
7. A very informative display from Napier Power Heritage Trust.
8. Components for the new Class 66 design at the National 2½" Gauge Association stand.
9. Locomotives of the Pinewood Miniature Railway Society.

cutter grinder. There were plenty of models under construction including the V8 Rover engine by Mike Perry.





Ruislip Lido Railway Society (photo 11)

This society had a large selection of posters, jigsaws, mugs and other memorabilia for the visitor, all to raise funds to support the railway.

Society of Model & Experimental Engineers (photo 12)

The SMEE had a large presence at the show which included an extensive stand and the lecture programme being run during the three days. The displays were divided up into various categories

and I am sure all visitors found something of interest. Joerg Hugel always helps to keep up the experimental side of things, this year with his vibroscope equipment.

Society of Ornamental Turners (photo 13)

This group always attracts many visitors with the live demonstrations during the show and this year was no exception. Visitors are enjoying a demonstration of one of the many techniques used in this specialised activity.

South African Locomotive Group (photo 14)

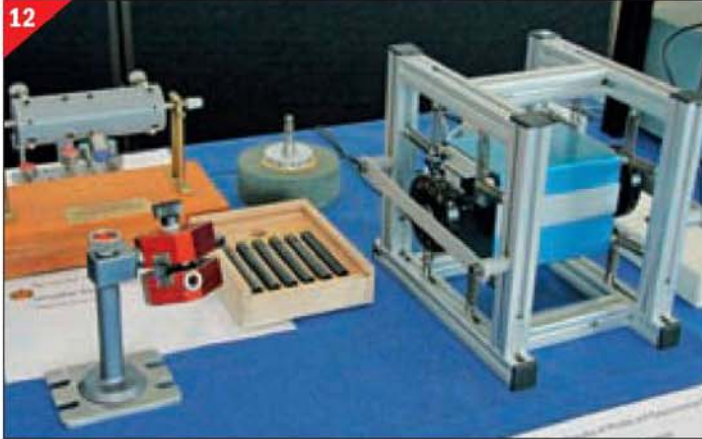
This group is for those interested in models of South African Railway locomotives. Because the gauge of the prototype railways is 1 metre narrow gauge, the models do make impressive pieces of equipment, around 8ft. long for a 3½in. gauge tender locomotive (at centre in photograph). Most of the models in this display were built by Ron Etter (see M.E. 4340 for more of his collection).

Staines SME (photo 15)

The society has a very neat and compact stand which is taken to several shows and events during the year. Younger visitors always like the small gauge train running back and forth along the back of the stand on its proper raised track. The society had an impressive group of locomotives displayed in a very small space.

Stirling Engine Society (photo 16)

Stirling engines are a very popular subject these days,



not least because of the activities of the Stirling Engine Society and Roy Darlington in promoting them at events such as this. Roy is busy extolling the virtues of such devices with plenty of examples in action around him.

City of Sunderland MES (photo 17)

This society made the long trip down from the North again this year and brought the fine selection of models that we have come to expect. These included some very fine I/C and

stationary engines, together with a couple of locomotives and a small traction engine. All these were brought down in the back of one car!

Victoria Model Steam Boat Club/Blackheath MBC (photo 18)

Last but not least, these two long-established clubs pooled their resources again this year to put on a display of straight running and scale model boats for visitors to admire. Many older visitors will have had memories of such things

while younger ones will wonder why people paddle around in water when radio control is easier and saves wet feet!

The clubs put on a good display and I am sure visitors had many queries answered by the knowledgeable stewards. I would like to thank all those societies that put in the effort to display models at the show and to congratulate the National 2½" Gauge Association on their Best Club Shield award.

ME

10. The Reading SME stand attracted a lot of interest with a varied selection of items.

11. The Ruislip Lido Railway Society stand.

12. Joerg Hugel's vibroscope on the SMEE stand was for balancing grinding wheels.

13. The Society of Ornamental Turners held a demonstration on their stand.

14. An impressive line-up of 3½in. gauge South African Railway locomotives.

15. The Staines SME stand had a wide variety of models in a small space.

16. Roy Darlington promoting the benefit of Stirling cycle engines.

17. A collection of superb and unusual models from the City of Sunderland MES.

18. Victoria Model Steam Boat Club had a collection of boats on display.



AN ENGINEER'S DAY OUT

The Netherlands Railway Museum in Utrecht



ROGER BACKHOUSE

Roger Backhouse visits a collection in Holland which is part museum, part theme park.

1. 1902 Utrecht built tram.

2. Hupkes design of 1914 built by Schwartzkopf in Berlin.

3. Locomotive 3737 Jumbo, a 4-6-0 of 1911 built in Amsterdam.

4. Underside view of the Sharp Stewart 4-4-0 No. 107.

The Netherlands Spoorweg Museum is an impressive collection from a railway system with many British links. Utrecht is at the heart of the Dutch railway system and the collection is fittingly sited here in the lavishly decorated former Maliebaan Station. The first railway in Holland opened in 1839 from Amsterdam to Haarlem. A Northumbrian driver, John Middlemiss, came over to show Dutch drivers how to drive the new British locomotives. His story is told in 'The Great Discovery' themed area. This starts in a North East mining village, moves to a recreation of Robert Stephenson and Co's drawing office and finishes in a mock up of the line's opening with the first locomotive *De Arendt*.

Foreign influences

The strong British influence continued in Holland for many years. An 1864 Beyer Peacock 2-4-0 is on display along with another 2-4-0 which remained in service from 1884 to 1939. A Sharp Stewart 4-4-0 is also on show above the main hall.

However, other influences spread from Germany. The locomotive *Nestor* was built by Borsig of Berlin in 1880. A 4-4-0 designed by W. Hupkes was built by Schwartzkopf, also in Berlin, in 1914 but the Dutch developed their own distinctive designs. Their Amsterdam workshops built 3737, a 4-6-0 of 1911, which ran 3 million kilometres up to its retirement in 1958.

The British influence returned after the Second World War when Dutch railways were

badly damaged. On display is *Longmoor*, the 1,000th locomotive sent to Europe after D-Day, an example of the War Department 2-8-0s. British electric locomotives surplus to requirements from the Woodhead line went to Holland; though I didn't see one on show here.

The first diesel train ran in the Netherlands in 1934 and created an immediate sensation. However, diesel did not replace steam. The standard Dutch diesel shunter was almost identical to the British model. An example, with electrics by Dick Kerr of Preston, is displayed along with a Henschel built small shunting engine of 1940. A later Alstom main line freight diesel is also on show.

Even some Swiss steam locomotives found their way to Holland after 1945, when

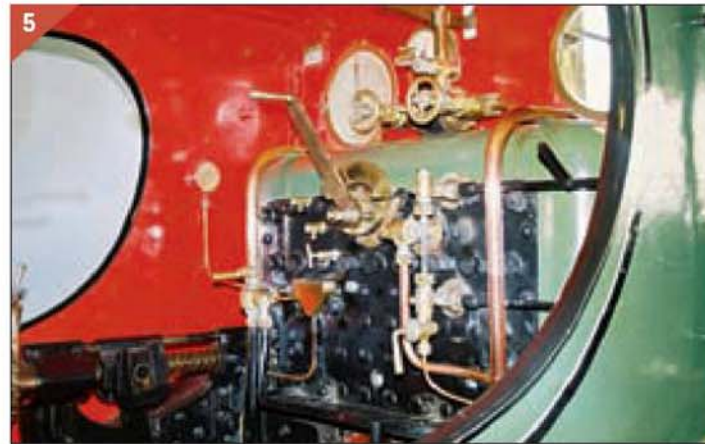
Switzerland had surplus steam engines following electrification. Latterly Dutch railways show strong French influence with Alsthom built stock but, nevertheless, they have a distinctive character of their own.

American influences also came to Holland. One of the first electric lines was the Zuid Hollandsche Spoorweg Maatschappij (ZHSM) which ran a US-style interurban between Rotterdam and The Hague. A 1908 passenger car of American style and immaculately restored is on display. Both 2nd and 3rd class have wooden seats, a practice which lasted in Holland until the 1920s.

Main line electrification began in 1924 from Leiden to The Hague. Now almost all lines are electric. The museum has a good line up of electric stock including locomotives and motor coaches, together with post office vehicles.

Rolling stock

Several other coaches, including Wagons-Lits stock, are on display. They are well restored and museum



policy seems to be to restore exhibits. During my visit teams of painters were hard at work on various pump trolleys and a Utrecht built steam tram of 1902. (Holland once had an extensive network of these secondary tramlines).

Wagons, locomotives and carriages are just a part of what makes a good museum. Sections of the stores, including a large number of models, are open to the public though exhibits behind wire frames are tantalisingly difficult to photograph. I particularly liked the wooden models of

moving bridges in the 'Great Discovery' area. These smaller exhibits help bring the daily operation of railways to life and say something about the lives of railway workers. For example, the trade union banners displayed, much smaller than their British equivalents, remind one of the role of railway worker's unions.

Outside the main building is a coaling stage and water tower next to a signal box from Groningen. At the other end of the main building is a turntable and examples of different types of permanent way.

5. Cab view of the Beyer Peacock 2-4-0 of 1881.

6. Beyer Peacock 2-4-0 of 1881 was in service to 1939.

7. Side view of Beyer Peacock 2-4-0 of 1881.

8. Third class coach of 1910 built in Amsterdam.

9. Coaling stage, water tower and signal box.

10. First electric line Rotterdam to Hague American style car.

Other attractions

Even the finest exhibits will not hold children's interest forever. There is a play area outside, ➤





11. Henschel diesel shunting locomotive of 1939 on turntable.

12. Line up of Netherlands railways electric locomotives.

13. Longmoor War Department 2-8-0, the 1,000th locomotive sent to Europe.

14. Mallebaan Station, the museum entrance.

15. Nestor built in 1880 by Borsig of Berlin.

16. Beyer Peacock 2-4-0 locomotive No. 13 of 1864.

17. Cab detail of Beyer Peacock 2-4-0 locomotive.

18. Some beautiful railway themed tiles on display.

19. A replica of the Robert Stephenson and Co. drawing office.

20. Recreation of Robert Stephenson's works.





more suitable for under 8's, with child-operated pump trolleys and rope-operated ferries. During school holidays a 10½in. gauge track operates, running a Thalys replica on the day of my visit.

Another themed area is 'Steel Titans' best described as a ghost train ride; it certainly isn't a 'tunnel of love'. It is well done but doesn't quite fit in with the rest of the museum. Rather more to my taste was the 'dream trips' area where actors present travel experiences from rail's golden age. Here's your chance to hear from the 'cook' on the Orient Express and other travellers.

On the way out don't miss seeing the ticket hall and attendant rooms which are done on the grand scale. The station barber's salon from Dordrecht is a reminder of the times when stations were the centres for their communities.

Railway museums are difficult to bring to life - the sheer size of exhibits can be overwhelming. I find both the National Railway Museum at York and Locomotion at Shildon disappointing in this respect despite their excellent

collections. The Netherlands Railway Museum comes close to succeeding though I feel that more use of film and photographs would help visitors appreciate the human dimension of railways.

Reaching the museum

Holland is one of the easiest countries for a UK visitor, not least because almost everyone speaks excellent English. At the time of writing 'One' railway offers a return trip from 'One' Great Eastern stations, including Liverpool Street, to any station in Holland for just £50 return via the classic Harwich - Hook of Holland route. It's also possible to go via Eurostar to Brussels and change for trains to Rotterdam and Utrecht. Dutch rail services are excellent with a minimum half-hourly service on most lines. Their rail passes also offer good value for money. If you must fly, Schipol Airport with good rail connections is less than an hour away. The museum is just over a mile if walking from Utrecht city station but has an hourly dedicated shuttle train from the main station.

Opening is 10-5 daily except Mondays (open all week in school holidays). Admission at the time of writing (July 2007) was 13.50 Euros (About £9.50) and 10.50 Euros for children. It is expensive but you see a lot for your money and it is a museum that needs at least three hours to visit properly. Entry is free with the Dutch Museum card.

Contact details:

T. +31 30 230 6206.

W. www.spoorwegmuseum.nl

Also in the vicinity

Utrecht itself has a lovely old city centre, crossed by canals and always within sound of the cathedral Carillon. The

many museums include a mechanical music collection, old scientific instruments at the University Museum and a water board museum in a former water tower that opens less frequently. There is a wind-powered sawmill too. Not far away are the magnificent Cruquius pumping engines at Haarlem and, at Arnhem, the Open Air Museum with its steam-powered dairy, trams and a trolleybus connection to the centre of town. Elsewhere in Holland several lines operate preserved steam locomotives including the Miljoenenlijn in South Limburg.

W. www.miljoenenlijn.nl

ME



21. Reproduction of how the first Netherlands train would have looked.
22. Replica built in 1958 of the first locomotive in Netherlands, De Arendt.
23. Sharp Stewart 4-4-0 NRS 107.

Old Wine in New Bottles

A Toulet Imperator



JOHN WILDING

John Wilding MBE FBHI concludes the series by describing the hands, dial and base of the clock.

Continued from page 679
(M.E 4340, 5 December 2008)

We are now ready to make the hands (fig 5). The minute hand is cut from $\frac{3}{16}$ in. thick mild steel and the centre is drilled No. 9 prior to tapping $\frac{7}{32}$ in. x 40tpi. Care should be taken when tapping this hole to ensure that the tap is truly at right angles to the hand. The hour hand can be made from 18 gauge mild steel. The centre hole is drilled $\frac{1}{32}$ in. and to do this the hand should be securely clamped in the 'finger plate' (photo 26). It will be noticed that this work is done before the profile of the hand is cut out. The hand is riveted onto its collet, also shown in fig 5. One way of making this part is to hold a short length of $\frac{7}{16}$ in. dia. brass in the 3-jaw chuck and turn to $\frac{1}{32}$ in. dia. for a length of $\frac{3}{16}$ inch. After parting off, the work is reversed in the chuck and the other end turned to $\frac{1}{32}$ in.

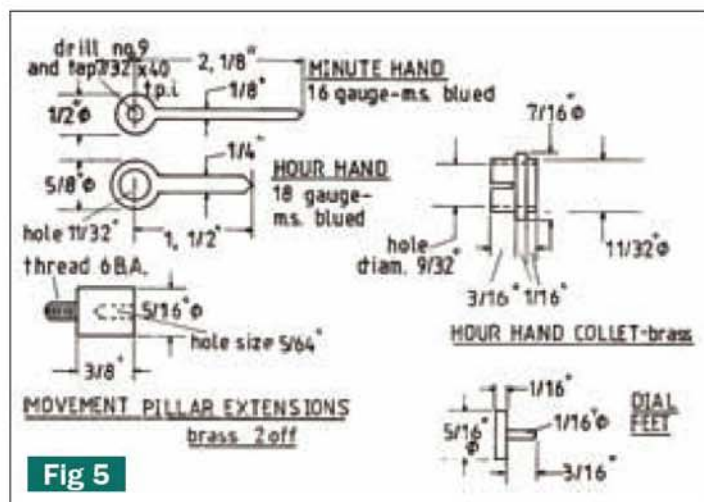


Fig 5

26. Method of clamping for drilling a hole in hour hand.

27. Set-up for securing the rivet in the hour hand.

28. Cutting slits in the hour hand collet.

29. Easing collet tension using a round smoothing broach.

30. The hands and components of the daisy wheel motion work.

31. Wooden face plate fitted to the Myford standard face plate.

dia. for a length of $\frac{3}{16}$ inch. It is easier to rivet the hand onto the collet before the centre hole is drilled. **Photograph 27** shows the work clamped in the finger plate. Riveting begins by using a small round punch and then the work is held down on a steel stake for completing the riveting using a hammer. The work is

then returned to the lathe for tidying up the rivet and drilling the centre hole.

The final operation is to make two saw cuts at the back of the collet, to do this the work can be supported on a tapered brass mandrel held in the vice (**photo 28**). The sawn slits can be closed up gently in the vice but,



if this is overdone, the grip can be eased by rotating the work on an oiled smoothing broach (**photo 29**). A general view of the hands and motion work parts is shown in **photo 30**.

Dial

This is in the form of a chapter ring (**fig 6**). By the time this article appears in print my publisher, RiteTime, will have a printed chapter ring available ready for sale. However, for those who would like to make their own, the brass ring can be trepanned from brass sheet:

A ½in. plywood disc is fitted to the lathe face plate and a ½in. brass pin secured at its centre (**photo 31**). A square sheet of brass is screwed to the wooden faceplate and, with the lathe in backgear, the two cuts made with a small parting tool (**photo 32**). It is important that there is sufficient side clearance on the outside edge of this tool. Again, my publisher is planning to have a paper dial available, which can be glued to the chapter ring.

The chapter ring is secured to the two diametrically opposite movement pillars, which protrude from the front plate of the movement. However, the chapter ring needs to be brought forward by about ⅜in. and this is done using two extension pillars

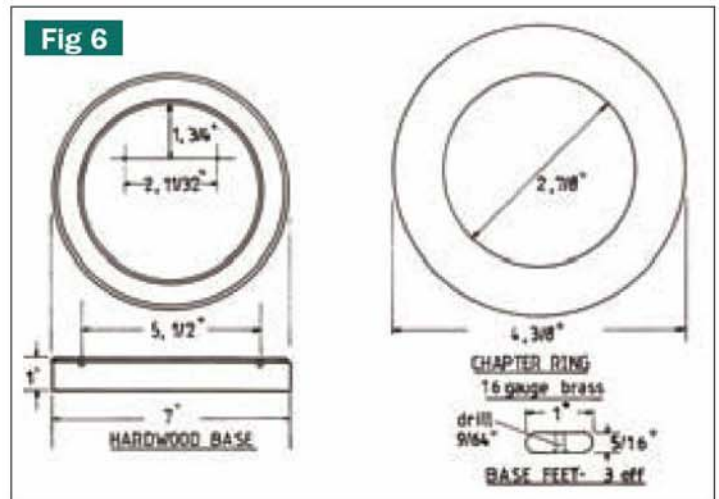
(**fig 5**). These screw into the tapped holes of the movement pillars. Unfortunately, I was unable to find what this thread was despite making many enquiries. However, a 6BA tap can be used to re-tap the holes to make them a convenient thread size.

Dial feet

The dial feet are also shown in **fig 5**. They are cemented to the back of the chapter ring and their ¼in. dia. shafts secured in the extension pillars using 10BA screws.

Base

The base is shown in **fig 6**. The size is not critical but was chosen to suit the glass dome available from Meadows and Passmore (**ref 4**). The wood should be hard - I used mahogany. **Photograph 33** shows the base being machined in the lathe (Note the acute rake angle on the homemade turning tool). The groove is 5½in. dia. and is shown being formed in **photo 34**. The actual dome should be used to check the size of the groove. Don't make the groove too tight. There needs to be plenty of play, because the dimensions of the wood can change over time. The base is then sanded and can be finished with, for example, Rustin's Danish Oil.



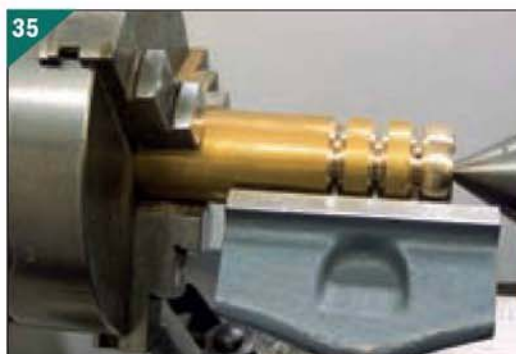
Bun feet

Three bun feet are required (**fig 6**), and can be machined as shown in **photo 35**. The stock is partially parted off, with three cuts of the parting tool and then the curved edges formed using a graver on the hand rest. The centre hole is drilled ⅝in. dia., which will give clearance for No. 6 wood screws. The holes must be properly countersunk so that the screw heads are flush with the base of the feet. The three feet are secured ½in. from the edge of the base. One foot should be at the back and the other two disposed equally towards the front. To prevent scratching furniture, green baize discs are fixed to the underside

of the feet. I used self-adhesive baize. A punch can be used to cut the baize and the end grain of a piece of wood used to protect the cutting edge of the punch (**photo 36**).

Figure 6 gives the positions of the mounting holes in the base for the two pillars. The 2¼in. measurement should be checked as this can vary between clocks.

I am pleased to report that the reeded tubing, which I thought might be unobtainable, can be supplied by Meadows & Passmore in 9in. lengths. One length is enough to make two clock pillars. Since this makes a distinct visual improvement to the clock, I have provided a ➤



32. Trepanning the chapter ring.

33. Machining the base.

34. Machining the groove for the glass dome.

35. Turning the brass bun feet.

36. Punching out a baize disc.





37. Underside of the base with securing nuts and washers.



38. Polishing a component with abrasive paper glued to a board.



39. Revolving lap to polish the ends of components.

40. Bluing small screws.



41. Use of a home-made collet to hold square section work in a 3-jaw chuck.

42. Four clocks on test.



drawing showing how to make fluted pillars (**fig 7**). These are held firmly to the base using large brass washers and large square brass nuts (**photo 37**).

Polishing

The square section clamping pieces can be polished using abrasive paper on a flat board (**photo 38**). Begin with fine emery paper, then Micromesh cloths finishing with 8000 grit. The ends of these parts can be polished using a rotating lap in the lathe, the final grade of abrasive was Crocus cloth, cemented to a Perspex backing piece (**photo 39**). This is a useful set-up for polishing the impulse faces of both dead beat and recoil pallets - a mirror finish is quickly obtained.

The screws should be blued to match those of the movement. The effectiveness of bluing depends on achieving a good polish on the screw head before you start bluing. The set-up shown uses a spirit lamp (to give a low heat), and a brass strip with holes to hold screws (**photo 40**). This allows colour changes to take place slowly. When the correct colour is reached, the screw is tipped out into cold water.

When I first started this project I had no idea

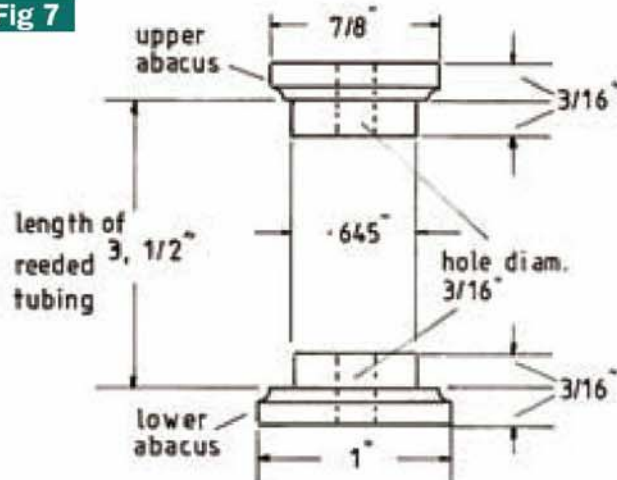
how many of these timing machines were about. I now find myself doing 'production runs'! In this situation one tends to look for short cuts to some of the machining operations. It is laborious changing chucks when turning square material. To avoid this I made a simple jig for holding square material in the 3-jaw chuck (**photo 41**). Although this is not as accurate as using the 4-jaw independent chuck it is sufficiently accurate for the facing operations needed here.

Photograph 42 shows four of these clocks on test! In my workshop I have a further seven of these movements to convert into clocks! I feel that it is worthwhile because the original quality of the Swiss movements is so high and it would be a shame if they were not given the chance of a new life. **ME**

Reference

4. The following items for this clock are available from Meadows & Passmore, Brighton, T. 01273 421321: Dome 0623 002415, reeded tubing 0691 340915, 15mm high brass numerals 0611 001515 (see photos 1 and 2, *M.E.* 4336, 10 October 2008).

Fig 7



A Counterweight for the Vertical Mill



JOERG
HUGEL

Joerg Hugel improves his Emco mill.

1. Movement measurements on a spindle head.

2. The counterweight with two rods for guidance.



The skilled operator of a lathe or milling machine is familiar with backlash and for operating the horizontal slides he has the machine under control and moves the slides in one and the same direction. Then the nut and feed screw are in a defined position, normally held by the forces between tool and work. I said normally because there are situations when the tool digs in and then a disaster can occur. Climb milling with the tool pulling and the feed pulling in the same direction is prone to this problem.

There is no difficulty in the vertical direction when a knee mill moves the table up for the in feed of the cutter into the work but the opposite is true for milling machines that move the spindle down to the table. If they are based on ways with dovetails or equipped with a cylindrical column the sliding parts must be given some friction to make the guidance sufficiently stiff. The nut position in relation to the feed screw now becomes uncertain because the head is pulled down by its own weight. This problem is solved with a counterweight for the spindle head.

For my Emco FB-2 mill I've made and installed such a device. To check its effectiveness a test was performed; the movement of the spindle head, seen in **photo 1**, was measured in the X-, Y- and Z-directions with three DTI's. The spindle

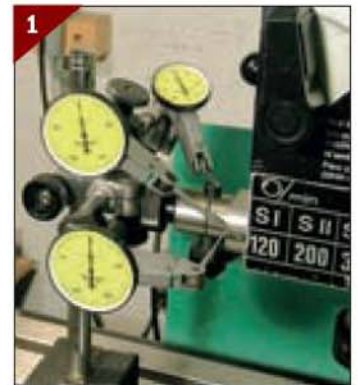
head was fed down and then repeatedly clamped and unclamped to the column; the positions for a characteristic test are recorded in **Table 1**.

The coordinate system is conventionally denoted with X and Y for the table and Z for the vertical direction. In the column for Z without counterbalance the backlash effect explained above is clearly seen. For a trapezoidal feed screw the value $50\mu\text{m}$ is in the usual range and is by no means a bad figure; similar values are found for the horizontal screws if the table is pushed manually in the direction of the in feed.

Design principles

The mass of the Emco spindle head is somewhat more than 20kg; for the tools 5kg were assumed. The counterbalance and its guidance are seen in **photo 2**; the weight is 35kg. Located at the rear side of the milling machine stand the balancing mass is built up from seven rectangular iron bars; these are screwed together with two M6-threaded rods. Additionally two holes are provided for the 6mm guide rods mounted to the stand at the top and bottom with aluminium angles and also seen in photo 2.

The linkage between the spindle head and counterweight is an iron girder mounted on the top of the column with two pulleys, each with two grooves, to guide a wire rope.



Hooked to the counterweight is a rod with a pulley on its top end. The ends of the rope are fixed to the spindle head. From one end the rope runs vertically up to the first pulley, then horizontally to the second one and further on down to the rod's pulley. A hairpin turn is performed and the second half of the rope goes back to the spindle head in the way described. My rope is made from stainless steel of only 1mm total diameter and is twisted from seven strands; each wire contains seven strands of 0.1mm diameter. It is available from the suppliers for clockmakers and is intended to bear the weights of pendulum clocks. The tensile strength is nominally 670 N, the load is static and so the safety factor is about 3.8. With the pulley on the rod each wire bears exactly the half load.

The counterweight is simply put out of action if it is rested say on a piece of wood by moving the spindle head upwards. Then the wire rope becomes loose and the pulley rod can be unhooked from the counterweight. This procedure may become necessary, if the column with the spindle head needs to be turned round for an operation away from its normal position.

ME

Spindle Head	Without Counterbalance			With counterbalance		
	X / μm	Y / μm	Z / μm	X / μm	Y / μm	Z / μm
Unclamped	0	0	0	0	0	0
Clamped	-20	0	10	-20	0	-10
Unclamped	-20	0	-50	-10	0	-10
Clamped	-20	0	-30	-20	0	-10

Table 1. The results from the clamping test.

Musing on Cams



DAVE FENNER

Dave Fenner considers the theory and practice of I/C engine cam design.

1. 1966 publication from 750 motor club - a veritable mine of information.



Some little while ago I avidly digested Nemett's excellent series of articles describing the Nemett 15. In one of these, the cam profile was discussed, but if my memory serves correctly, the geometric shape was determined in a fairly arbitrary manner by setting out four arcs, and then afterwards subjecting it to mathematical analysis using the Ron Chernich program which indicated a maximum acceleration of 85g. At that point I wondered how this figure might relate to practical limitations. Conversations with motor sports competitors and a look back over some of yesteryear's publications then prompted a series of somewhat scattered and unfocused trains of thought.

The problem with 2-strokes...

In the field of model engines, the quest for out and out power has tended to be dominated by 2-stroke development, much of this for model aero team racing and speed, back

in the days when 'control line was king'. While commercial 4-stroke model aero engines now make up a significant sector of the market, this is now oriented towards radio control, where tractability may be more important than ultimate horsepower and very high rpm. In full-size motor and motorcycle sport, the picture is rather different. Emission controls have all but sounded the death knell for the 2-stroke, which is widely seen as noisy, smelly and smoky. In addition, gearboxes of six speeds or so allow the effective use of engines with relatively narrow power bands.

Last 40 years

Over the last 40 years or so, engine design has moved from the traditional two valves per cylinder (which reigned supreme for about 80 or 90 years), to four or even five per cylinder today. If we ignore less usual arrangements such as Ducati's desmodromic setup, or the pneumatics used by some Formula One engines, it is fair to say that the opening and closing motion of a valve is normally controlled by a cam working against a spring.

Since the 1960s, the approach to motor sport has changed dramatically. Back in those and earlier days, the amateur competitors were predominantly self-financed and the supply of ready made, over the counter competition goodies was fairly limited and pretty expensive. While there are still many today who compete for fun on a proverbial shoestring, many will delve into their wallets for bolt on power enhancement from firms such as Burton Power and Kent Cams, who offer a bewildering assortment of proven products for popular applications.

Again, harking back to the 1960s, the 750 Motor Club published an excellent little book entitled *Design*

for Competition, which is a collection of articles and reports on talks given by various 'leading lights' of the time. My copy (photo 1) is dated 1966 and subtitled *The third edition of the special builder's guide*, Edited by Jeff Ward and John Pitchers, it not only gives technical information on many of the theories relating to vehicle handling and engine tuning, but also offers an interesting insight into the more 'social' aspects of the sport.

The London Special Builders Group was clearly very active and managed to attract a number of eminent speakers. This was a time when successful competitors and designers were prepared to divulge at least some of the secrets of their success, such success frequently being the reward of intelligent ingenuity rather than a large budget.

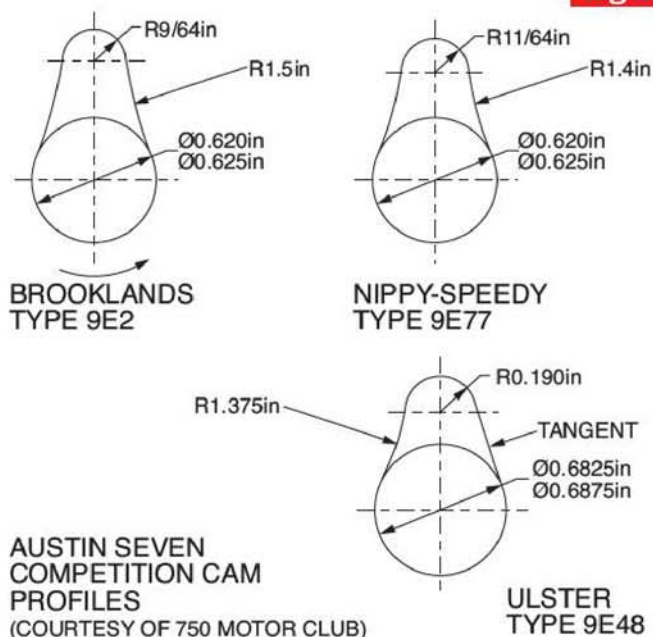
Looking over some of the articles, one cannot but be impressed by some of the instances of elegant simplicity and ingenious approach to solving the problems thrown up by the continuing quest for lower lap times.

A couple of articles focus on camshafts: That by K. Dixon and D. Boorer gives shapes for several accepted Austin 7 designs (fig 1), courtesy of the 750 Motor Club; concave flank arcs were made possible by convex followers. A dissertation by Jack Cotton entitled: *Valves and Cams - or why your springs break*, takes the reader back to basics, considering in sequence, the displacement, velocity and acceleration diagrams. A calculation based on typical parameters indicated that competition valve springs would impart a maximum acceleration of 320g.

Trade secrets

At this stage, a quick internet and library search revealed little in the way of published

Fig 1



information on cam profiles and acceptable surface loadings, accelerations, velocities etc. It would appear that the suppliers of modern 'go faster add on goodies' jealously guard their trade secrets. This topic arose again in a conversation with Steve Swan (see *A Metalbashing Masterclass, Model Engineers' Workshop* issue 124), during which we drifted on to discuss hot camshafts, and the relative lack of information (beyond essential timing data) regarding the details of cam profiles. Steve was expecting delivery of a new 'improved cam' and had available a damaged cam from one of his 1964/5 Renault Gordinis. When initially installed, the engine had been dynamometer tested and produced 175hp, not bad for a modified engine based on a 1,300cc block from the 1960s. An exercise was undertaken to measure the profile, as a precursor to comparing it with the newer version.

Cam measurement

The camshaft was first set up in the Myford supported in the fixed steady, to allow a dummy centre to be added (**photo 2**). It was then transferred to the mill and located between the rotary table and the tailstock (**photo 3**). This arrangement allowed accurate rotation, and measurement of the cam lift by means of the dti, which had been fitted with a large size flat foot to mimic the flat followers used by Renault. For this set of measurements and those taken from other cams later, the exact timing details were not to hand, so the angles were measured from a purely arbitrary datum for each shaft. Thus, although the precise opening and closing points were not determined, comparative information was gained regarding profiles and overlaps. Lift figures were measured from the base circle. To take a practical account of valve clearance, it would probably be sensible to add a false axis shifted up say ten thou., then deduct this from measured lift (**fig 2** shows the resultant curves).



A bit of maths

The 1966 article, by Jack Cotton, gave an insight into the calculations involved in determining the motion, accelerations and forces. It all starts with Mr. Newton and those equations of motion that most of us had consigned to the nether archives of the brain box:

$$\begin{aligned} V &= U + FT \\ S &= UT + \frac{1}{2} FT^2 \\ V^2 - U^2 &= 2FS \end{aligned}$$

Where U is initial velocity, V is final velocity, F is acceleration, T is elapsed time and S distance.

For simplicity, we will assume constant acceleration and deceleration figures, one being determined by the surface loading on the cam, the other by the strength of the valve spring. These separate limitations may be used to specify different rates of acceleration. Cotton suggested an analysis which assumed that that caused by the cam might be three times that due to the spring. Looking at the lift profiles for the Renault cam (**fig 2**), it appears that the maximum gradient is achieved at about 70 thou. lift, i.e. about



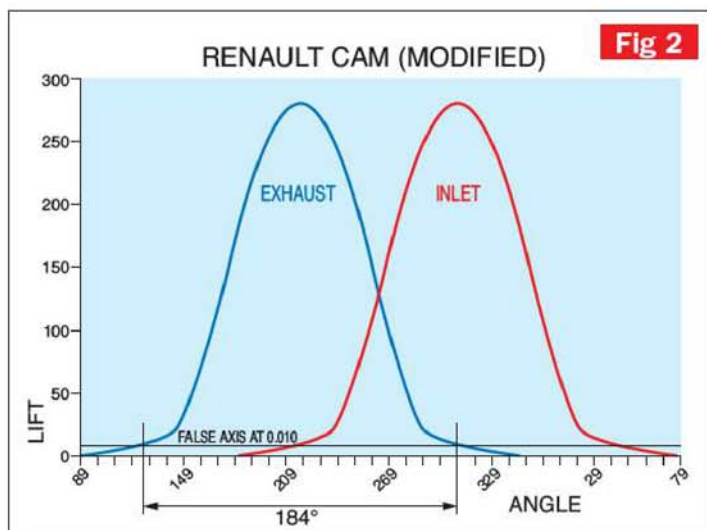
a quarter of the maximum lift. This would tie in very well with the 3 to 1 ratio noted above.

Nowadays, I have a great deal of difficulty remembering anything to do with calculus, but reading the Cotton article reminded me that three diagrams may be used, along with the equations quoted above, to illustrate valve characteristics. The lift or displacement diagram is what was measured. The slope of that curve at any point gives the velocity (first derivative), and if a velocity diagram is drawn, then the slope of it gives the acceleration.

2. Camshaft set up to add dummy centre.
3. Arrangement on mill to rotate and measure lift.

Using the simplification suggested above, and turning it around the other way, we will say that the acceleration due to the cam is constant and equal to 3A, while that due to the spring is also constant and equal to A (**fig 3**). It can then be shown that the duration cd must be three times that of ab. Adopting a total duration of 184deg. from **fig 2**, it follows that points b,c are at 23deg. and point d is at 92





degrees. It is then possible to draw the acceleration diagram fig 3, the velocity diagram fig 4, and the displacement diagram fig 5.

Using this simplification, in section ab the valve train is accelerated from rest to maximum speed. At position bc, this changes to deceleration by the spring, zero speed and max lift being achieved at d. The valve is then accelerated towards closure by the spring in section de, reaching max speed at position ef, before being brought to rest by the cam after section fg.

These diagrams have been constructed on the basis of camshaft angles; however, they can be related to time, given a known speed. If the camshaft speed is N rpm, then a cam event spanning X degrees may be converted to time using the formula:

$$X \text{ cam degrees} = \frac{X}{N} \times \frac{60 \text{ sec}}{360} = \frac{X}{6N} \text{ sec}$$

We can now begin to apply this to the Renault example. For convenience we will round the peak revs of the engine to 8,000rpm, which equates to 4,000rpm at the camshaft. Thus, we can estimate that the duration of the period corresponding to ab to be 0.95 millise, and that for cd is about 2.872 millise.

The total lift minus clearance is about 0.272in. = S

So the first part of the movement, section ab results in

lift of 0.068in. Using the equation $S = UT + \frac{1}{2}FT^2$, and since the start velocity is zero, we have: $0.068 = \frac{1}{2}F(0.95)^2 \times 10^{-6}$ Leading to $F = 150692 \text{ in/sec}^2$ or 12557 ft/sec^2 or $390g$.

For the next part of the movement cd, the travel is 0.204in. and here the end velocity is zero, so a similar calculation gives the deceleration due to the spring as: $F = 49464 \text{ in/sec}^2$ or $128g$ (in line with the 3 to 1 initial assumption). Interestingly, this is considerably lower than the 320g indicated for racing Austin Sevens in 1966.

Small scale application

The above provides a reasonable 'guesstimate' at the magnitude of cam and spring accelerations in a full-size tuned stock motor. Reducing to say quarter scale, but still keeping the 8,000rpm rev limit, would reduce the numbers by a factor of four. Going back to the analysis on the Nemett cam, 85g is not a million miles away from a quarter of 390g, so this may well be a case of "if it looks right..." Also, given that the valve train weights, and hence the inertial loadings for any particular 'g' figure will come down by a factor of 64, it may well be that model I/C engines could be given considerably 'wilder cams'.

Applying a similar set of calculations and using a spreadsheet, it should be possible to arrive at a set of lift figures to set out cams on

the basis of specified constant accelerations. Machining would then follow the method suggested by Nemett, unless a CNC machine was available.

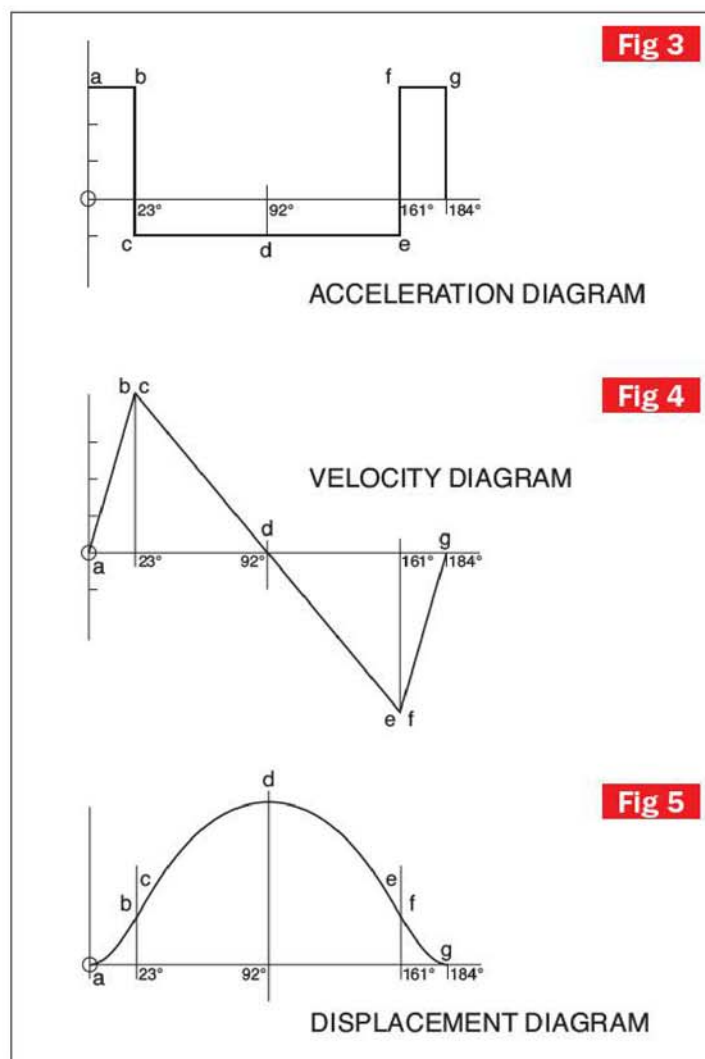
One or two caveats should be noted: It is understood that full-size race cams do not follow faithfully the constant acceleration principle due to spring oscillation effects caused by the sudden shift from positive to negative acceleration. Also, the maximum acceleration available from the spring will vary with the extent of compression.

Yet further points were raised in a discussion with Mike Stewart (of Mike Stewart Performance Engineering), who has probably built more competition engines than many of us have had hot dinners. He first pointed out that the cam is but one link in the overall chain, and must be considered alongside other features including compression ratio. We are used to accepting

that the effective compression ratio of a 2-stroke is determined by the point at which all ports are closed. However, it is often overlooked that in 4-strokes, compression proper will not start until the inlet valve has closed. This can lead to a curious combination of cam timing and ultra high geometric compression ratios especially where the rules dictate intake restriction.

Mike also noted that looking at some of the published information from cam suppliers suggests that there is a scale effect. Timings which give a race cam for a motorcycle engine with small cylinders gives a mere 'cooking performance' when applied to larger car applications. Flame speed and gas inertia also have a part to play.

Hopefully, this article will stir others to add their 'tuppence worth' of practical experience, cam design, cam modification and cam manufacture. **ME**





hanger brackets and above all of this is an angled fabrication which transmits the weight through sliding spilloons.

Side control springing on the trailing truck (Photo 13, view from below)

Side control for the truck is a rather interesting system. Two springs, one forward of the axle, the other to the rear, are encased in cylindrical tubes. These tubes are in two halves and are held together by two rods. Each is supported from the underside of the centre stretcher located in the hind frames. Protruding from each end of the tubes are plungers which are attached to each end of the springs. The other end of the plunger is machined with a taper cup in which rests a rod. The other end of these rods, four in all, is machined with half a ball on the end, rather like the head of a mushroom. These are then held in place by four plates one to each rod and attached to thrust pads fitted to the inside of the frames. It is a fascinating mechanism and very interesting to watch as the truck moves from side to side. This is one item on the Duchesses that must have helped to give them a good reputation for smooth riding - it was often said that they rode like a coach.



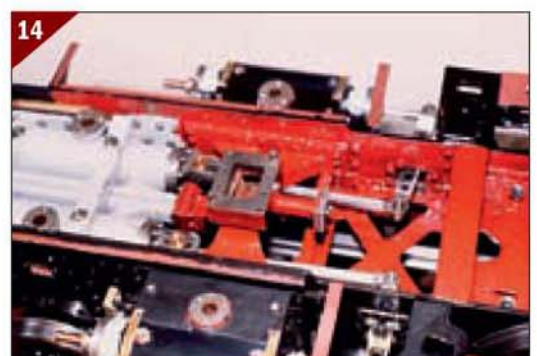
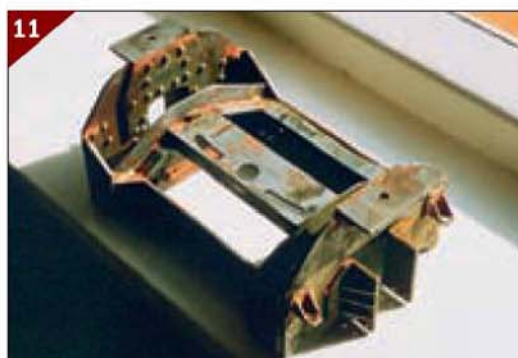
CLIVE
FENN

Clive Fenn concludes his description of building a Gold Medal-winning locomotive.

*Continued from page 688
(M.E. 4340, 5 December 2008)*

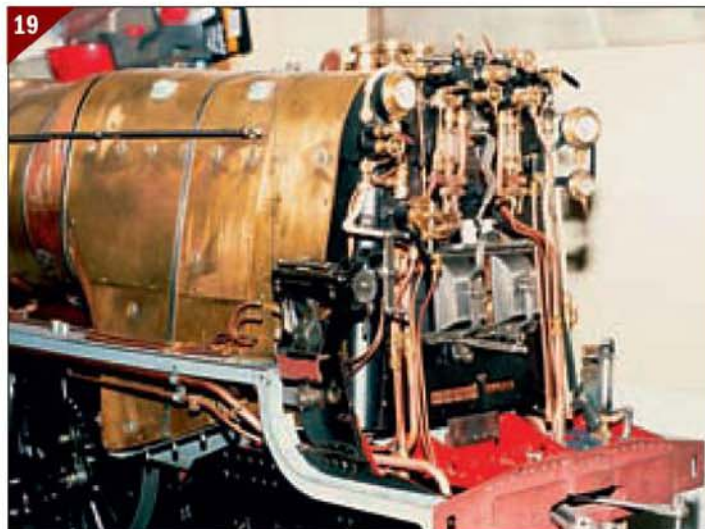
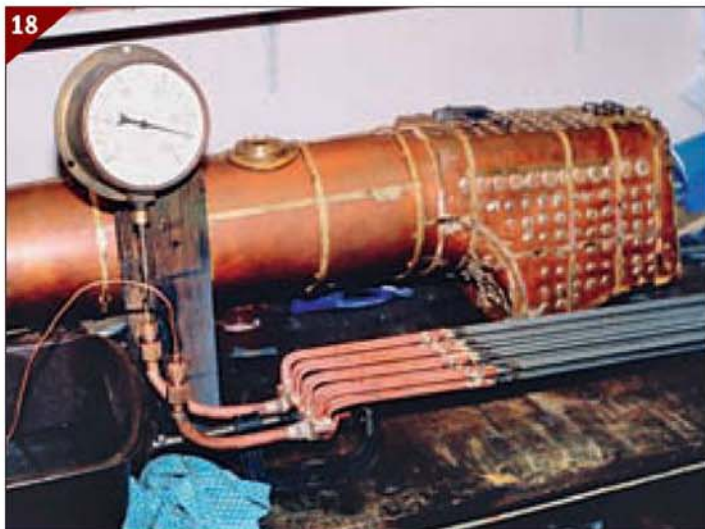
The trailing truck was a fabrication in two halves (photos 11 and 12). The front half is shaped like a letter 'A' with the hole for the pivot pin located at the pointed end. This was attached to the

rear half of the truck using 7BA nuts and bolts. The rear half comprises of a double frame held apart by stretchers front and back. The outside frames take the axle box guides. Either side of these are the spring



Correction

In part one of this article, it refers to the livery of the full-size 6234, "painted in experimental blue grey livery and lined out on the left-hand side only". It should read "right-hand side only".



Outside to inside valve motion (Photo 14)

Machining the motion was straightforward and done in the lathe. The part to be machined was bolted to a stout piece of steel angle and then to the vertical slide. Fluting was done to both sides and had a root radius of $\frac{3}{64}$ inch. The oil boxes on the connecting and coupling rods were milled out. A plate with a small hole was then silver-soldered on top. A piece of matchstick was used to simulate the cork used in the full-size engine. The expansion links were milled out using a rotary table on the milling machine. Using a piece of mild steel measuring about $9 \times 2 \times \frac{3}{16}$ in. bolted to the rotary table, the radii of the embryo links were milled out (remembering to make left and right hand versions). The Duchesses, although 4-cylinder engines, had only two sets of valve gear. The outside gear worked the inside valves via rocking levers located to the rear of the outside cylinders.

These pass through holes in the frames and connect to the inside cylinder valve rods, hence the need for only two expansion links.

Outer firebox assembly (Photo 15)

I do not intend to go into too much detail on the building of the boiler as comprehensive articles covering its construction have already been published (*M.E.* 3926 and 3928, 7 August and 4 September, 1992, respectively). Some points are worth mentioning: The firebox has the correct throatplate curvature and the inner and outer firebox wrappers were formed with the correct scale radius. All stays are of the rod type. There is also a brick arch made from fire clay and reinforced with a stainless steel frame. The grate, which is made of stainless steel, is in four parts so it can be removed through the firehole door. The ashpan, due to its complicated shape, was made

from $\frac{1}{32}$ in. mild steel sheet and coated with a rust-proofing agent. It is of the hopper type and has the correct operating mechanism. There are also front and back dampers and these too have the correct operating mechanism. The firehole doors are made from cast iron and are milled out from below to form a hollow. Louvered slots were then machined in the fire-side of the doors to provide secondary air.

Regulator valve (Photo 16)

Returning to the boiler: it has $33 \times \frac{1}{2}$ in. smoke tubes, $4 \times 1\frac{1}{4}$ in. flues, and a 16 element radiant superheater that uses $\frac{1}{4}$ in. O/D stainless steel tube. The header is a fabricated block of copper with a wet and a dry side. This is bolted to the $\frac{3}{4}$ in. O/D main steam pipe leading to the regulator valve. The regulator valve is of the horizontal slide type and has a pilot valve that slides on top of the main valve. On opening, the pilot opens first then the

main valve. Both valves close together when the regulator is shut.

Safety valves (Photo 17)

There are four safety valves fitted to the rear of the firebox and each one has $6 \times \frac{1}{4}$ in., $60 \times \frac{1}{32}$ in. and $8 \times$ number 56 drill holes in their caps. Each cap took about three hours to machine.

Boiler crinolines and the superheater on hydraulic test (Photo 18)

The boiler cleading is made up from individual thin brass sheets secured to a brass frame known on the railway as crinolines using small hex head 10BA bolts. You have to remember that they did not get one large sheet of mild steel and try to bend it round the boiler. The same applies to the platforms or more commonly known outside of railway circles as the running boards. If such large sheets had been used, maintenance would have been a nightmare. At a recent model

engineering exhibition I was in conversation with Doug Hewson and we both agreed that if you follow full-size practice as far as practicable you will not go far wrong. It might involve more work initially but it pays off in the end.

Backhead (Photo 19)

The backhead fittings were made as close to scale as possible. Tip up wooden seats as well as arm rests are fitted for the imaginary crew. There is also a water tap fitted under the fireman's seat which permits hot water from the injector delivery to enter the slacking pipes situated along both sides of the tender - helps to keep the coal dust down!

Tender and coal pusher (Photos 20 and 21)

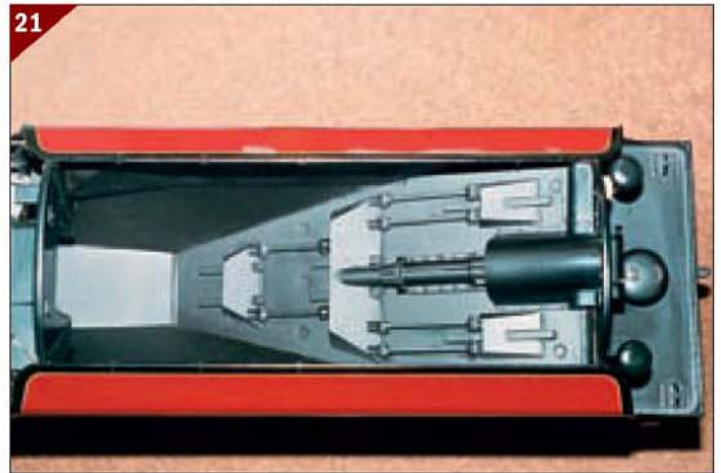
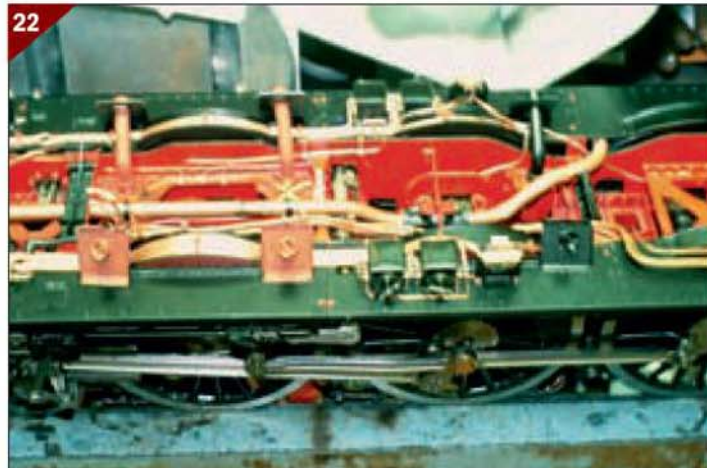
This takes me conveniently on to the tender, which is the Stanier 10-ton fully welded type. All the internal baffles are faithfully reproduced, as are the two water valves that look like top hats and are in a well tank situated between the first and second axle. Operation is the same as on the full-size locomotive. A walking stick type handle is pulled up to open and pressed down to close. The water gauge is also faithfully copied and is situated on the bulkhead behind the driver. The indicator moves up and down by means of part of a plastic wine cork secured to the end of a 1/4in. dia. stainless steel rod. The brake gear is also fully working as is the water scoop and steam operated coal pusher. The latter item was really interesting to



make. It comprises a steam cylinder placed on the coal slope at the top of the rear bulkhead. Connected to the piston are four sledge type rams that push coal forward. Operation is via a handle located on the tender bulkhead behind the fireman. This works a piston valve at the back of the steam cylinder, steam being taken from the manifold on the boiler backhead.

Pipework and lubricators (Photo 22)

The Duchesses seemed to abound with copper pipe going 'every which way' but, thankfully, I was able to obtain a reasonable copy of the Pipe and Rod drawing. I reproduced all this copper piping using very fine copper wire. The working cylinder lubricators utilize four roller clutches - one to each lubrication tank, so each cylinder has its own supply. The lubricators are mounted on the platforms, two on each side of the engine, the drive being taken from the rear of the expansion links.



Finished engine (Photo 23)

I then came to the part I hated the most, painting! It was the first time I had used an airbrush - what a nightmare! It was trial and error, but I persevered and did a reasonable job. I do not think anyone can explain how to paint, the only way to learn is through practical experience. You can read all there is to read, but it all boils down to: "practice makes perfect" - or at least I hope so. Anyway, I must have made a half decent job to please the judges. I am happy with it, and that's what really counts.

Epilogue

Did I really produce that much scrap? - of course I did! - I was not trained as an engineer. My early experience came from metalwork classes at school, some 50 or so years ago. After that I read about engineering, including the work of LBSC and

other eminent model engineers. I also enjoyed listening to my peers. In particular, I would like to acknowledge the help of my late friend Charlie Skivington. He took me under his wing - never doing the job for me - but telling me how to do it. We spent many a happy hour in the Railway Tavern discussing the whys and wherefores of model engineering practice.

Was it worth 24 years of my life? Of course it was! When I walk through the hallway and look at 6234, it immediately brings back the wonderful days of my youth, when I sat by the line at Lichfield Trent Valley and watched Stanier's and Duchesses thunder through.

So to anyone thinking, "I couldn't make that." I would say, "Of course you can: read engineering books, read *Model Engineer*, join a club, and 'get stuck in' - that's what I did!" **ME**



McONIE'S OSCILLATING ENGINE

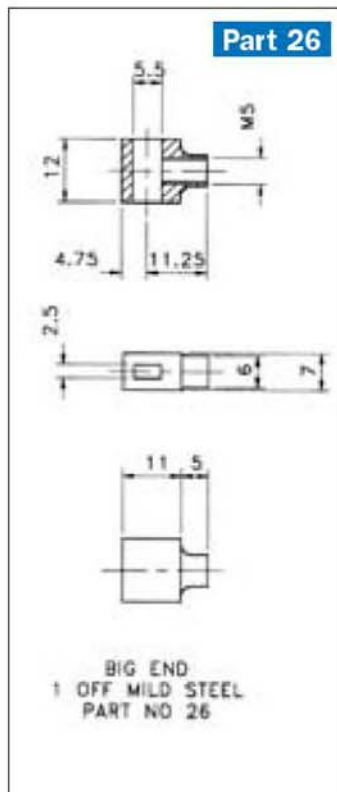


ANTHONY MOUNT

Anthony Mount describes how to make split bearings and other parts.

*Continued from page 691
(M.E. 4340, 5 December 2008)*

- 59. Big end assembly.
- 60. Turning the boss of the rocker arm.
- 61. Machining the centre region of the rocker arm.
- 62. Eccentric strap mounted on the rotary table.



The next part to be made is the big end (**part 26**). Begin by machining a length of mild steel bar to the overall section given on the drawing, but somewhat longer. Hold it in the 4-jaw independent chuck of the lathe and face off the end. Drill and tap the end for the piston rod; you can drill 14mm deep through the mortise position, as this will make it easier for the slot drill. Turn the boss using a round nose tool to leave a generous curve at the root.

Change to the mill and cross drill with two 2.5mm holes each end of the slot for the gib and cotter. Complete the slot with a slot drill, you will need to go in from both sides as 2.5mm slot drills are not that long.

Square out the corners with a square Swiss file. I find most Swiss square files are 3mm square, so I grind off two opposite faces to give a thickness of 2.5 millimetres. The ground surfaces also act as a guide to the file and help to keep it square. The big end is then parted off and the end faced off.

Big end bearing (Part 27)

The big end bearing consists of two separate parts, the half circular part and the rectangular part. Rather like the big end strap, it is easier to make two of each part. Machine two oversize rectangular section bronze bars and soft solder them together. With a large end mill, machine all faces to give a 14mm square section with the joint on the centre line.

To make the half circular part of the bearing, hold the bar in the 4-jaw independent chuck and set it running true. Turn down a length of the bar to 14mm diameter, then drill and ream 8 millimetres. Chamfer

the edge of the hole, then form the groove and part off. Next the bearing needs to be reversed in the chuck, faced and chamfered.

I came upon a problem at this point: when I went to hold the bearing in the self-centring chuck, the inside flange lined up with one of the serrations in the chuck jaws, so it could not be held securely. I find that 100mm dia. chucks do not have serrations but anything larger, such as mine (125mm dia.), does. The serrations are a 'complete pain' and I wish that chuck manufacturers would not use them. As far as I am concerned, they provide no useful service, mark the work and get in the way.

To overcome this problem, I mounted the bearing on an expanding arbor to face the parted end. However, care needs to be exercised, as the soft-soldered joint is easily broken by the force of the arbor.

To make the rectangular part of the bearing, use the mill to machine the grooves in the edge, then back to the lathe to part off and face.

Finally, heat and separate the circular and rectangular pieces to give two sets of big end parts - one set is a 'spare'.

Cotter (Part 28)

I wonder why it's called a cotter and not a wedge? As you can see from the drawing, it is just a length of mild steel strip, made a close fit in the strap, and tapered along its length.

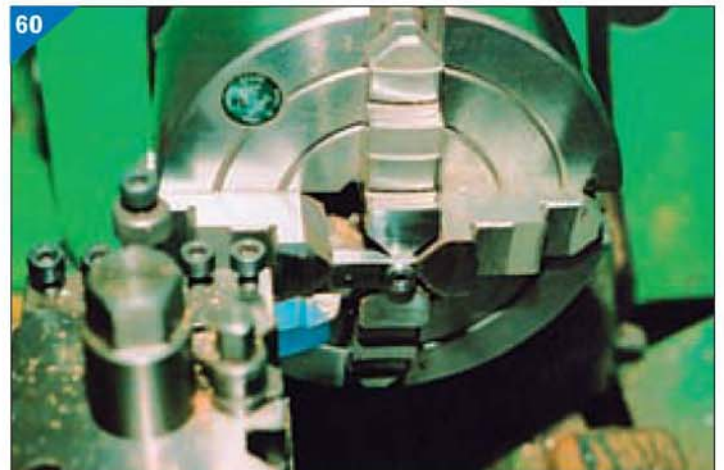
Gib (Part 29)

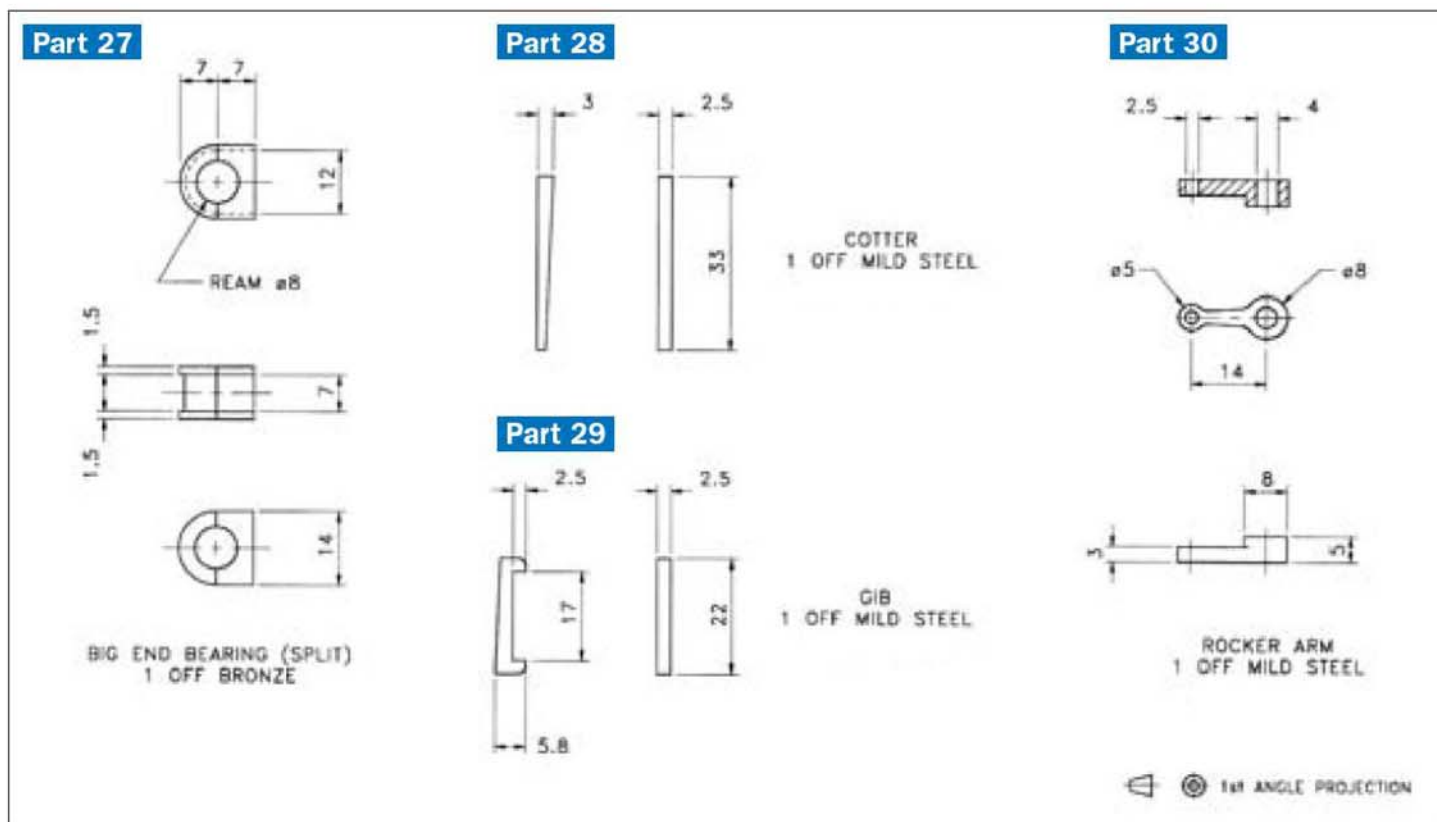
The gib is the same thickness as the cotter but is forked to fit around the strap to stop it from expanding. It is tapered along the length so that the cotter and gib form a matched pair to lock the bearing and strap to the big end.

Both can be milled to size but as they are quite small it is tempting to just file them to shape. **Photograph 59** shows the completed big end assembly.

Rocker arm (Part 30)

The rocker arm can be made a number of ways but as it is quite small you might like to try this method: machine a length of mild steel to a 20 x 6mm





section. Clamp in the machine vice and drill the two holes.

Hold in the 4-jaw independent chuck and centre it on the larger hole. Face and turn the boss (**photo 60**). Hold in the milling machine vice and mill the centre region to form a taper (**photo 61**). File the end regions round and blend them into the centre region.

Valve gear eccentric strap (Part 31)

The eccentric strap is made from bronze bar and is machined all over. Start by sawing off two pieces and, after machining the sawn surfaces flat, soft solder the two pieces

back together along the bearing split line.

The bar is then held in the 4-jaw independent chuck in the lathe and, after facing, is bored out to fit the sheave. I usually bore out a little oversize to allow for cleaning up the soldered faces.

Drill through for the stud holes and use temporary screws to reinforce the soft-soldered joint. Mount the strap on a stepped expanding arbor and face off the other side so that the thickness will fit in the groove of the sheave.

The periphery can be filed to shape or machined using the rotary table. I used the latter.

Photograph 62 shows the strap mounted on the rotary table. I marked out the outline of the strap on the material but I find the lines difficult to see close to an end mill. The light, the angle of view and the swarf all interfere with a good view. It is so easy to machine too deep or go past the mark for the stud extensions!

To help overcome this problem I made a spacing washer to locate the strap centrally on the rotary table. The outside diameter was the same as the finished diameter of the strap, and stepped to locate on the bore of the strap. It was then easier to judge how far to go with the depth of cut. Use an end mill to machine the outside edge and allow for a finishing cut to get a nice smooth finish.

The eccentric strap is a little unusual because 'the nose' to take the eccentric rod is much longer than usual. To machine this, the two parts are first separated by heating to melt the solder. The front piece is then held in the 4-jaw independent chuck (**photo 63**). Centre the end and give tailstock support. If you try to turn it without the centre you



will only succeed in wrapping it around the tool!

With a round nose tool, and the top slide set over at an angle, turn the taper on the nose. Take great care to get a smooth transition between the taper and the radii of the strap. Drill and tap the end 5BA.

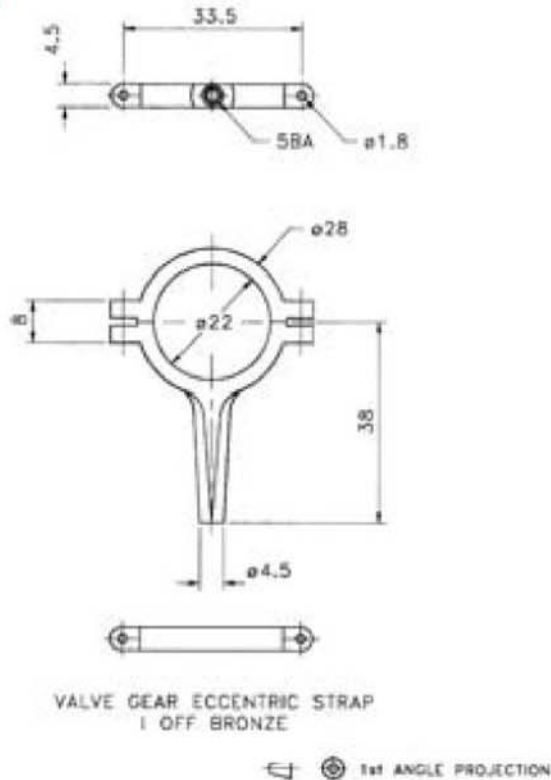
Bolt the two parts back together and file the ends of the ears round. Use fine abrasive paper to remove all tool marks and give a nice even finish.

Valve eccentric (Part 32)

The valve eccentric sheave is a little unusual as it incorporates the pulley for the governor



Part 31



63. Front piece of eccentric strap ready for turning the 'nose'.

64. Partly-machined eccentric sheave.

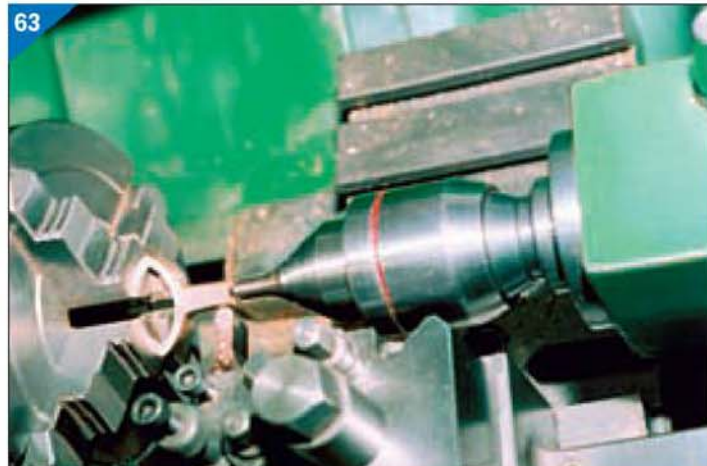
drive. Start by turning down a short length of mild steel bar to 28mm diameter. Face off the end and, leaving enough material for the pulley, reduce the diameter to 26mm, then form the groove with a parting-type tool.

Change to a 4-jaw independent chuck and offset the bar 3.5 millimetres. To check the offset, turn the chuck

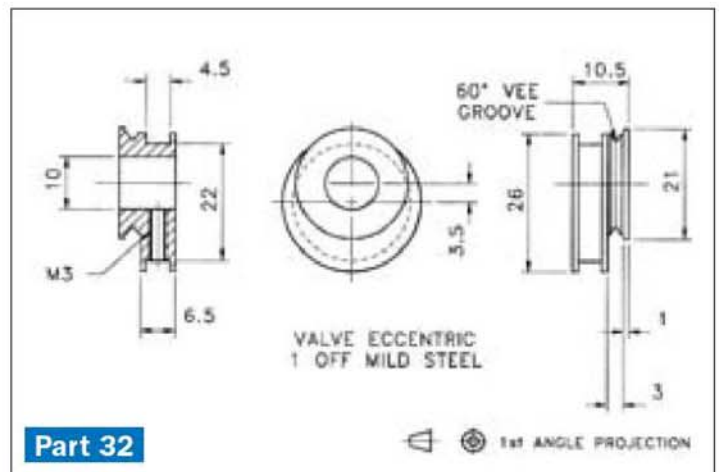
so that the maximum offset is adjacent to the tool post, feed in the tool and zero the dial. Turn the chuck through 180deg. (half a turn) and feed in the tool until it touches the bar. The difference in the readings should be 7 millimetres.

Turn the pulley boss to 21mm diameter and then, using a parting tool, reduce the pulley diameter behind the flange to 19mm. Using a small vee tool, form the vee groove for the governor drive belt - a small screw-cutting tool may be used. The sheave at this stage is shown in **photo 64**.

Centre, drill and ream



63



Part 32

for the crankshaft. I do not recommend parting off due to the eccentricity, instead, saw off the eccentric sheave from the parent bar. I have a small Warco cutoff band saw, which is ideal for this sort of job - beats the hacksaw every time.

Finally, hold the sheave on an expanding arbor and face off the sawn surface.

Valve eccentric rod (Part 33)

This rod presents a few difficulties in machining, not least because it is cranked. With items like this, where there is a chance of things going wrong, I usually start with three blanks and complete each operation on them consecutively then, if it does go wrong, I don't have to start back at square one.

Start with a length of 8mm square mild steel rod, face off the end and centre. Hold in the machine vice of the mill and spot for the cross-drilled pivot hole. Do this both sides but do not drill through as it will

cut into the centre hole (just drilled), and run off course.

Set up in the 4-jaw chuck and give tailstock support. Turn down the main body of the rod to 3.2mm dia., machine over length to allow for possible adjustment later.

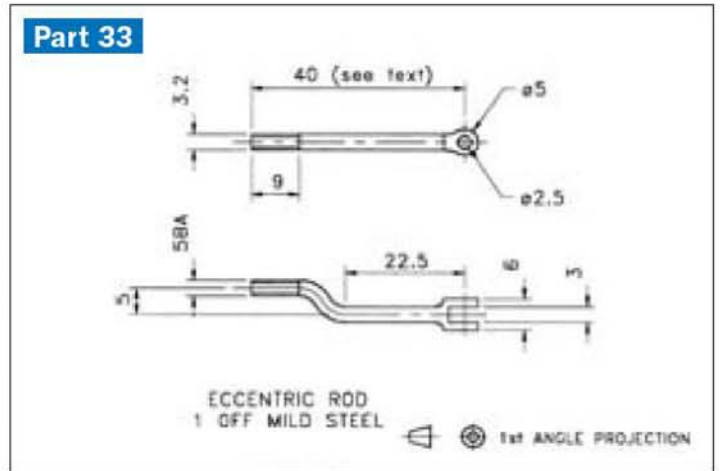
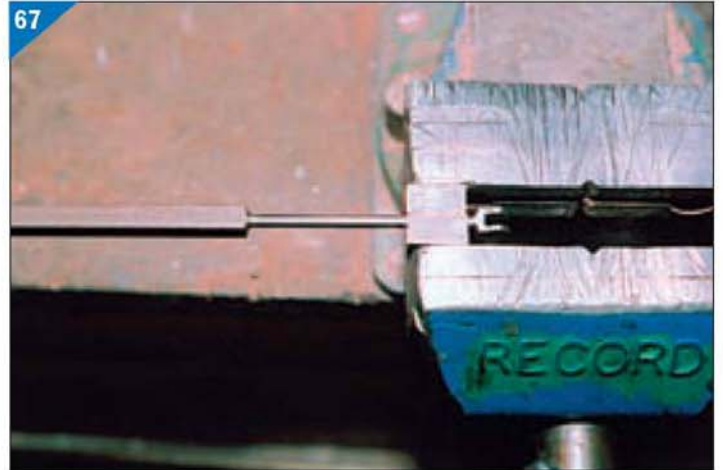
Saw off the redundant centre and transfer to the milling machine. Using a 3mm slitting saw, mill the slot in the forked end (**photo 65**); the pivot holes are then drilled.

To machine the shape of the eye on the end, the rod needs to be held securely - and this presents a problem. I have a machine vice supplied by Warco that has removable hardened jaws. I replaced one jaw with a mild steel jaw and that allowed me to machine a slot in the edge of the jaw. The rod was held securely by both square regions. The slot in the 'soft jaw' provided clearance so that a 6mm end mill could be used to machine the back curve of the eye (**photo 66**).

The rest of the eye was formed visually using a band



64



sander and then finished with a fine file and abrasive paper.

A little clamping tool was then made to enable the crank to be put in the rod, two small pieces of 8mm square section mild steel bar were set up in the independent 4-jaw chuck and a 3mm hole drilled down the joint line. I hope you have more success than me because my drill ran off! I suppose this was because of the intermittent cut. I redid the tool using a 3mm ball nose cutter in the vertical mill

on one length of bar and then cut it in half. With the grooves in the bar facing each other, I then had a 3mm hole.

The position of the bend was marked on the rod with pencil and the rod clamped in the bench vice with the clamping tool adjacent to the bend position (**photo 67**). A 90deg. bend was made (**photo 68**). I bent the bar cold with no problems.

Another clamping tool was then made comprising a small block of mild steel of 20 x

12mm section with a rebate machined at one end. Although the offset of the rod is 5mm, I found that due to the way the rod bent, a depth of rebate of only 2mm was required. Another short piece of material was fitted into the rebate and another 3mm hole was made on the joint line. Once again the rod was clamped in the bench vice between the two blocks and the second bend made (**photos 69 and 70**).

The rod was sawn off from the parent metal and set up in the 4-jaw independent chuck using the first clamping tool. The rod was set to run true, the end faced off, chamfered, and as much of the rod that was proud of the chuck was threaded 5BA.

65. Milling the forked end of the valve rod.
66. Milling the back curve of the pivot eye.
67. Holding the valve rod ready for bending.

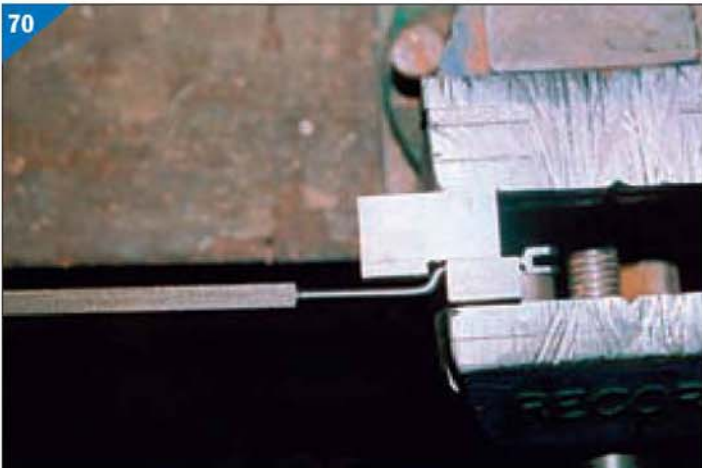
68. Making the first bend in the valve rod.
69. Holding the valve rod ready for the second bend.

70. Making the second bend in the valve rod.

71. The complete rod prior to finishing to the correct length on assembly.

On assembly the correct length of the eccentric rod can be ascertained and then the rod threaded down to the correct length, the existing thread on the overlong rod acts as a guide. The completed rod is shown in **photo 71**.

● To be continued.



British Rail Class 86 Electric Locomotive



KEN TOONE

Ken Toone builds a 10mm sibling for its 5in. gauge big brother.



Some years ago, my home club, the **Birmingham Society of Model Engineers** decided to add an additional track facility, and subsequently built a raised track layout for gauge 1 and gauge 0 models. The layout comprised two complete 150ft. circuits for each gauge together with sidings, crossovers and steam-up bays. This was very well received by the members with more than 70 steam locomotives being added to our boiler test register. I was well into building a pair of gauge 1 GWR County 1000 Class locomotives, when I decided that they were taking too long and I needed something to run.

Going electric

Always one to do something different, I decided to investigate non-steam possibilities. Back

in the early 1970s I built a 5in. gauge Class 86 electric locomotive powered by four car cooling fan motors and three car batteries (M.E. 3454, 1 December 1972). This was immensely successful and is still running today, albeit under different ownership. I still have my original copy of the 1967 *Model Railway News* outline drawing that I worked from and, of course, there is now The AC Locomotive Group website, dedicated to the preservation of these outstanding machines. This site has a wealth of information available, from Class 81 through to Class 89 with some eight actual machines under its wing.

So, how could I condense all that into a 10mm scale outline? Certainly at 585mm over the buffers and nearly 90mm wide there should be enough room

for all the necessary gear. I decided that the basic concept should be much the same as my 5in. gauge locomotive, in that batteries would power four motors via electronic speed control. In addition, in my 'twilight years', to be able to sit in a deckchair and control it by radio would be an added bonus!

Motors and controls

The first step was to find suitable motors. This was very much limited by the back-to-back dimension of the wheel set, but eventually I found that the type 360 motor would just fit between a Gauge 1 Finescale wheel set, with a slight trimming of the rear bearing and allowing for 4mm wide reduction gears. The spur gears, from HPC gears, are 0.5mod and have a reduction of 7.2:1, which is just about the largest ratio it is possible to fit within the confines of the driving wheel diameter. A 10t steel pinion drives a 72T Tufnol gear.

The stall current for each motor is something over 2A at 12V so with four motors there is adequate power available. On-board power is provided by two 12V, 2.8Ah, rechargeable sealed lead acid batteries, individually fused and connected in parallel.

1. Locomotive 86101 Sir William A Stanier FRS (the model).
2. Complete bogie assembly.
3. Framework ready to receive the nickel silver cladding.
4. Pantograph assembly.
5. In 'the paint shop'.
6. Nameplate - Sir William A Stanier FRS.
7. Big brother and its sibling.



Next, how to control this power? I found that Electronize Design manufacture a range of speed controllers and decided that their type FR15HVR controller would be suitable. This solid-state unit can handle 15A and also provides power for the radio receiver, thus avoiding the need for a separate supply.

If radio signal is lost then the model will continue for 10 seconds at the set speed before automatically slowing to a stop. The radio is a Futaba 40Mz, 2 channel, although only one channel is used at present. The radio receiver plugs directly into the speed controller so that mechanical servos are not required.

The only other electric items are the working lights which are LEDs arranged in reverse parallel so that a white light shows at the front and red at the rear, changing with direction of travel. I did fit two small computer cooling fans with the idea that the noise would imitate that of the full-size locomotive, but they were too quiet. I have considered using the spare radio channel to operate the two-tone horns, but have not done that yet since they would have to be located in a separate vehicle because of space limitations.

Construction

General construction is in brass bar and angle with nickel silver sheeting attached. The first step was to make the power bogies. The side frames are cut from 25 x 6mm brass bar, to represent the box section of the original. All joints are soft-soldered, using mainly solder paint. The axle boxes are fitted with needle roller bearings to promote free running. The ones used are some of the smallest available being 6mm outside diameter and 3mm bore. Springing follows the full size practice as much as possible with the motors suspended on the axle. However, the 'Zebedee' springs between the body and the bogies are dummies, added later to suit the particular prototype and name I chose for the locomotive (more of that later).



The main body frame is 12 x 1.5mm angle brass running the full length of the model to which are added the buffer beams and several 1.6mm thick bulkheads. These support 3mm square stringers to provide a framework, which is covered in nickel silver sheet (I used to make model aircraft in my early teens!). All the windows and ventilation grille apertures were machined out afterwards to ensure that they were all positioned in the right place; also, the nickel silver sheet bends more accurately without the holes being cut first. The windows were cut from photographic slide glass and stuck in place with super glue. The ventilation grilles are pieces of brass sheet with a series of fine ratchet-like grooves milled across them to represent the air slots.

The only non-metallic items are the front and rear cab roof panels which were hand-carved from white plastic and the flat roof panel in the middle which is 6mm plastic machined to represent the separate panels.

This plastic panel allows the pantograph assembly, and its adjoining buzz bar system, to be electrically isolated from the body, thus enabling it to be used as a superb radio aerial for the model.

The name

Why this particular name? Looking through the fleet list, it soon became obvious that names like Fury or Hector were just not on because they would be so small on the model that they would not be seen. So, what better than 86101 *Sir William A Stanier FRS* with all its railway history connotations. This is probably one of the longest names in the fleet, and is 79mm long on the model. Diane Carney Nameplates make a superb range of nameplates and are well worth a telephone call.

I decided very early on that the finished model should be painted in BR Blue similar to the 5in. version, but with the full front warning panel in yellow to suit the chosen period. Here again, the internet was able to provide a wealth of information on the various liveries the locomotive has worn during its life.

As I mentioned earlier, it was necessary to add the 'Zebedee' springs to the model to fit in with the name and period. Zebedee was the nickname given to the first locomotive to be converted. These springs were added to the locomotives to control the bad ride, due to the weight of the axle-hung motors contributing significantly to the total unsprung weight.

Performance

Finally, how does it perform? With an all up weight of just under 10kg, drawbar pull is good at around 3.2kg. However, the maximum speed is perhaps a little over scale when running the engine light. Using the larger scale formulas, which suggest that 1kg of tractive effort will pull 30kg of rolling load, trainloads should be good. With this in mind I have recently completed six Mk. 2F open second coaches including an open brake coach. These are finished in the Inter-City blue/grey livery of the mid-1970s to match the locomotive. Watch this space!

Contact details

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Electronize Design,

Sutton Coldfield.

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T. +44 (0)121 308 7411.

Diane Carney Nameplates,

Milnthorpe, Cumbria.

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I should add that I have no connection with any of the companies mentioned.

ME

JACOBS CHUCKS

Overhauling and another use



JOHN HARRIS

John Harris offers a money saving suggestion

If like me you occasionally could do with a collet chuck to enable a turning job to be removed and replaced in the same place, but cannot justify buying one, the answer might be to use a Jacobs drill chuck. Jacobs chucks are remarkably accurate devices and, although they are not a perfect replacement for a collet chuck, they are adequate for non-critical use. Sizes up to ½ inch in diameter can be removed from a No. 34 Jacobs chuck and replaced with a good degree of accuracy and they are cheap if you look in the right places! All you will need is the chuck, a mount and for safety reasons, a drawbar.

Over the years I have accumulated several Jacobs No. 34 chucks from car boot sales, auto-jumbles and recently one arrived as a gift. This 'gift' was a reminder that there is high quality equipment in places that can be overlooked. I was given an old Desoutter electric drill which blew the workshop RCCB when I switched it on. It was not worth any effort to investigate what was wrong with it as electric drills are so cheap nowadays. It was destined for the scrap merchant, but it did have a rusty Jacobs No. 34 chuck attached. The No. 34 model is desirable as it is a substantially built, heavy-duty chuck. It is

marked with size ranges of 0 to ½in., but takes 1mm to 13mm components!

Jacobs keyed chucks usually come with the JT mounting taper but there are other fittings. The chuck I was given was marked 34B, the size ranges and the letters THD and 5/8 - 16. This indicated that the chuck was screwed onto the spindle of the drill and the thread size and pitch. The thread is a right-hand thread. Removing the chuck was very difficult, as removing chucks from their mounts frequently is. Although these chucks are robust they do not like abuse, they are precision instruments. After failing to unscrew the chuck using a reasonable amount of force I resorted to holding the chuck in the lathe, parting off the spindle behind the mounting flange and turning the flange away to release the tension on the thread. The remaining part of the mount unscrewed without a problem.

Overhaul

To use the chuck as a substitute collet chuck, my first job was to overhaul the chuck and check for any wear. An idea of the condition of a chuck can be had by opening the jaws about half way and checking if the sleeve has any slack. Until it has been stripped, cleaned, greased and reassembled it



is difficult to be sure of the chucks condition. Stripping a chuck is straightforward but once again it is worth emphasising they don't appreciate brute force.

Although it is possible to press the sleeve off the chuck body with a large socket it is better to make up two tubes to remove and replace the sleeve. The sizes of these tubes will depend on the size of chuck being overhauled. The tube to remove the sleeve should be a sliding fit over the rear (mount end) of the chuck body, rest squarely on the narrow land of the sleeve and be long enough to press the sleeve fully off the body. The tube to replace the sleeve should be long enough to press the sleeve fully home and be a sliding fit over the front of the chuck, resting against the teeth on the sleeve.

A vice can be used as a press to remove the sleeve but I use the small screw press described in issue 68 of *Model Engineers' Workshop*. If a vice is used as a press, plain jaws or pieces of angle iron used as vice jaw protectors will prevent damage to the chuck body.

Before starting, inspect the sleeve and front of the body to ensure there is no damage which will stop the sleeve being pressed off. Retract the jaws so they are just inside the body of the chuck. This is to protect the chuck jaw threads from damage as the pressure is applied. The tube is placed over the rear of the chuck body and the front of the body is placed on the press anvil. Operate the press with care, the sleeve will be a tight fit over the split nut halves but excessive pressure should not be required. When

1. The chuck details.

2. Pressing the sleeve off.

3. The chuck disassembled.



the sleeve slides off the split nut and before it releases the nut - stop!

Dismantling

The chuck can now be dismantled easily, but if it is taken or comes apart without marking where the jaws were fitted, time will be wasted on reassembly trying to get the jaws in the right order. The jaws can slide out easily so take care this doesn't happen. Remove the split nut; this can only be fitted in one way on reassembly. Look carefully at the chuck body and if you are lucky there will be numbers stamped on the body next to the holes where the jaws slide. The stamping of these numbers seems to be arbitrary, some chucks have them and some don't and others don't have all of them. If they are there take one jaw out at a time and mark the jaws so they will be returned to the same hole. If the body isn't numbered, permanently mark the body before taking the jaws out and then mark the jaws to suit. The jaws are very hard which makes marking difficult. I write the number on pieces of masking tape and stick them to the jaws. Check the jaws for any damage or chipped teeth. Clean the jaws one at a time to ensure they don't get mixed up. It does not seem to be possible to buy replacement jaws and split nuts anymore, so if any teeth get damaged the chuck is scrap.

Clean the body and check the jaws will slide smoothly,

allowing for some resistance, in their respective holes. The fit of the jaws in the chuck body determines the amount of wear the chuck has had and its suitability for use as a substitute collet. The jaws should be a good sliding fit. If there is any undue resistance find the reason and remedy it, making sure the jaw does not become slack.

Reassembly

Grease the chuck jaws and place them in the correct holes. Set the jaws to the closed position ensuring they are aligned, smear grease on the split nut threads and bearing surface then fit the split nut to the jaws.

If the jaws are not in the right position the split nut won't fit. Adjust the jaws so the split nut ends close and the jaws are aligned. Holding the split nut tightly closed with one hand, rotate the chuck body to extend and retract the jaws to be certain of the alignment. Set the jaws half open, hold the split nut making sure it is still fully engaged and slide the sleeve over the front of the chuck body until it traps the split nut. Stand the rear of the body on the press anvil and use the tube that fits over the front of the body to press the sleeve home. Once again, take care that undue force is not used. If there is a problem sliding the sleeve back on to the body it is likely to be the split nut not seating properly because a jaw has rotated slightly or is out of alignment.

Presuming the assembled chuck is working smoothly with no slack it is now the basis for a substitute collet chuck. If the chuck has a Jacobs Taper mount the next step is straightforward. Obtain a chuck mount with drawbar provision and which fits the lathe mandrel taper. I use a mount with an adapter to fit the lathe mandrel so the chuck also fits my mill.

Safety modification

For safety's sake a modification should be done to the chuck and the mount - attach the chuck to the mount with a screw. Put the chuck mount in the lathe with the drawbar but without the chuck. Drill and tap the end of the mount to take a screw the head of which will fit between the chuck jaws. Some chucks will have a hole drilled through the rear of the body to accept a screw. Chucks without a hole in the rear of the body will have to be fitted to the mount and have a clearance hole for the screw drilled through the rear of the body. The screw should be Loctited and firmly tightened so that the chuck is securely attached to the mount.

Home-made mount

If like me you have a chuck with a threaded body you will have to make your own mount. Chuck mounts with threads to fit threaded bodies are available but they have tangs and are not threaded for drawbar use. To overcome this problem I purchased a blank end arbor threaded for drawbar use, turned it to suit and



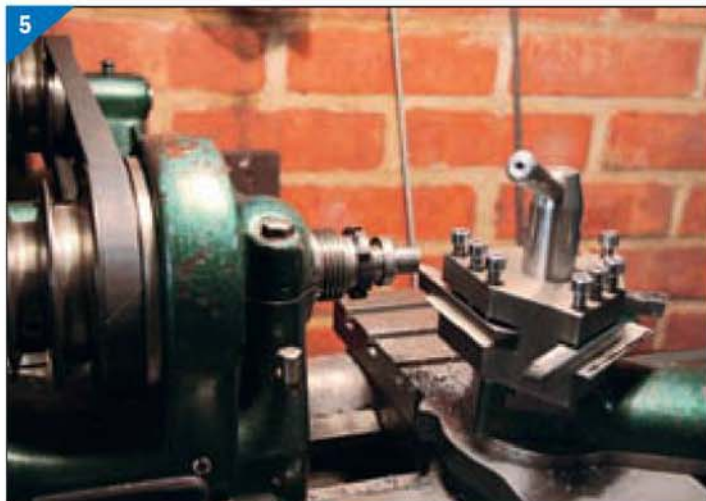
4. Pressing the sleeve on.

5. Screwcutting arbor.

6. The chuck in use.

screwcut a $\frac{5}{8}$ x 16 thread on it. I then Loctited the chuck to the mount and I had my substitute collet chuck.

The use of a drill chuck as a substitute collet or 4-jaw chuck has provided acceptable accuracy on many occasions such as taking a job out of the chuck to test a fit and then return it for a further cut. Jacobs Chucks no longer appear to have a manufacturing plant in Sheffield. Their website speaks of factories in the US and China. They do have a website though at: www.jacobschuck.com ME





Class 66 Locomotive in 7¹/₄in. gauge



ROGER
BUNCE
Technical
Editor

Roger Bunce looks at the latest locomotive from AME.

Abbots Model Engineering (AME) is a small family owned company based in Telford, Shropshire. The company was established in 2005 and produces locomotives and rolling stock in 5in. and 7¹/₄in. gauge. Their products are accurate scale models of 'the real thing' and include battery-driven locomotives, passenger trucks, driving trucks and wagons. These are available as standard 'off-the-shelf' kits of parts, or AME can supply

them as finished products, from a pair of bogies, to a finished locomotive complete with driving and passenger trucks. In addition, AME also design and manufacture special products, such as rolling stock, to customer specifications. In order to satisfy demand, AME has just moved to new much larger premises, with additional hi-tech machinery and more storage space. However, much of the production machining, such as turning, milling and laser cutting, is done by local companies and, where possible,

AME use local suppliers for materials and other needs.

Class 66

AME have been producing a Class 66 Locomotive in 5in. gauge for two years and, in response to numerous requests, decided to produce the locomotive in 7¹/₄in. gauge (**photo 1**). Work began in July 2008 and running trials were completed in October 2008. AME are delighted with the performance - a remarkable achievement in such a short time. The locomotive was first

exhibited at The Model Engineer Exhibition, Ascot 2008, and was enthusiastically received.

Full-size locomotive

The Class 66 Locomotive is made by General Motors, Electro-Motive Division, in London, Ontario, Canada. It replaced the Class 59 Locomotive and was introduced into service by EWS in 1999. More than 600 locomotives have been made to date. Their main application is hauling heavy freight and enterprise (mixed goods). The Locomotives are used by many companies including Freightliner, DRS, EWS and GBRf, so there are many variations of livery. The Locomotive has an impressive specification: 3,300bhp, top speed 65/75mph, typical load 2000 tonnes. The Locomotives are expected to remain in service for the next 30 years. General Motors are producing a new UK Class 66, which should be running in the UK in 2009/10; once the details are known, AME will be producing it in 5in. and 7½in. gauge.

Model construction

Along with all their other locomotives, the 7½in. Class 66 can be supplied as a part-built kit or completely finished. The chassis is similar to their very successful 5in. gauge Class 66 chassis. It is made from 4mm thick laser-cut steel and welded together.

The bogies are again similar to those of the 5in. gauge locomotive. They are made from 6mm thick laser-cut steel parts and bolted together. The bogies have full independent suspension on all wheels. This gives excellent traction on uneven tracks, and allows bends of 50ft. radius to be negotiated. Each six-wheeled bogie is fitted with two 250W motors and the wheels run on sealed ball bearings. Power is transmitted via a pinion on the motor shaft to a gear on the wheels. The motors have considerable power reserve and have overload protection. The braking system is the regenerative type.

AME supply the body completely built. However, if supplied as part of a kit, the body is primer coated and the customer paints and adds logos themselves. The bodywork is made from biscuit jointed MDF, which is two-stage chemically sealed for protection against the 'British weather'. The whole body unit is easily removed to allow access to the batteries and control system. The locomotive is fitted with scale details including: ventilation grilles, doors, sand boxes, exhaust, fuel tank, handrails and lamps, as standard.

The locomotive is powered by either two or four 12V batteries wired for 24V. Batteries are purchased separately by the customer. The control system can be supplied by AME and there is a choice of several types available. The locomotive normally has the following controls: a hand held controller, two tone horn (car type), and switching for lights,

In addition, AME can provide several types of realistic sound generation systems.

Livery

Just like the full-size locomotive the model is available in various liveries, for example, photos 1 and 2 show the locomotive in Freightliner and GBRf liveries respectively. AME can provide a variety of liveries or customers can paint the model to suit themselves. AME can also supply graphics and logos for customer's locomotives.

Performance

The model is designed as a powerful passenger hauler and is ideal for those 'punishing birthday parties' and passenger hauling on public running days. This is not a locomotive for the faint-hearted: it is 2.67m (105in.) long and has a top speed of around 8 - 10mph with a load in excess of 15 passengers. That is near enough the scale

speed of the full-size 66 - fast enough for anyone!

Demonstrations and thanks

AME can arrange a demonstration and test drive of their 7½in. gauge Class 66 locomotives and many of their other products on most Sundays in the late spring and summer (including Bank Holidays), at the Phoenix Society's track, based at the Telford Steam Railway, Horsehay, Telford - contact AME for an appointment.

AME would like to thank the Phoenix Model Engineering Society for their help, expertise, and use of their track for the development, testing, and demonstration of their products.

M.E. wishes AME every success with their new locomotive. For further information contact: Peter Grigg, T. 01952 616628.

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W. www.abbotsmodeleng.co.uk **ME**



Fitting a DRO to a Wabeco Mill



DAVID
HAYTHORNTHWAITE

David Haythornthwaite changes his milling machine digital read out.

1. Onyx System on the Wabeco.
2. Onyx glass scale and retaining clip.
3. Completed Z-axis.
4. Checking alignment of glass scales.



I have owned a Wabeco 1210 mill for some years. Three years ago I fitted a B&W digital readout with a 334 display, which transformed my way of working with the mill. Recently I decided to change my milling DRO for an Onyx system from Jade Products and I decided to write up the experience.

My First DRO system

When originally contemplating the fitting of a digital readout, I was faced with whether to fit it to my lathe or my milling machine and being a substantial cost item, I thought that I could

not afford to do both. However, BW Electronics offered a very compact system where the actual reading head was a clip-on sensor, and these sensors could be quickly moved from one machine to the next, thus creating a DRO which would service more than one machine. This seemed to be ideal for me, and indeed proved to be so.

One big advantage was the compactness of the whole system. The sensors are very compact and unobtrusive in use. I actually prefer this method of readout to any other on the Myford ML7. You could look at my lathe and not know that it had a DRO fitted to it. I can also keep my taper turning attachment permanently in place without conflicting with the DRO. I now keep the BW unit permanently on my lathe and it is a shame that this excellent unit is no longer offered for sale, having gone the same way as many other British produced goods.

I recently decided to buy a separate DRO for the Wabeco milling machine and finally chose an Onyx system from Jade Products.

See www.Onyx-Dro.co.uk

The Onyx System

The first thing to do was to assess the travel of the Wabeco in all three directions. It is imperative that the glass scales have a greater maximum travel than the travel of the slides on the machine unless physical stops are fitted to stop the excess travel breaking the glass scales. An examination of the machine showed that I would need the following scales:

X Direction 520 mm
Y Direction 170 mm
Z Direction 320 mm

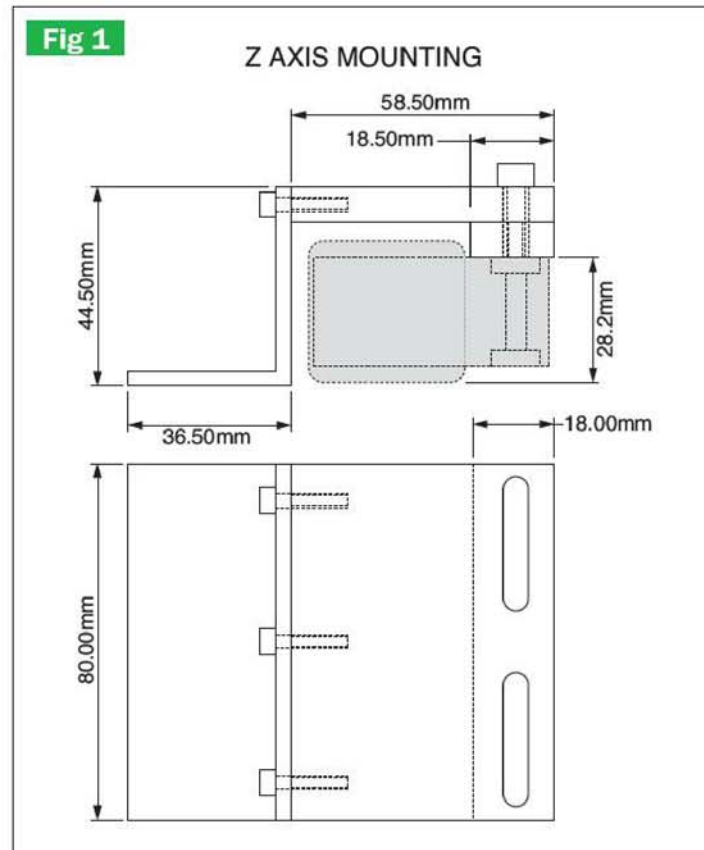
You should note that the above figures are for the model 1210. The model 1200 has a shorter Y table and consequently shorter travel.

I ordered the 3-axis milling system (DRO-3M) from Jade by telephone. They were most helpful in my choice of scales and were very apologetic to be out of stock for two weeks. However, 10 days later they rang to say the items were in stock and after a 'plastic transfer' the goods arrived. One advantage of the Jade system is that there is one price irrespective of the glass scales chosen and I suspect that long table Wabeco owners come out of this quite well.

Fitting the system

The DRO arrived well packed and after having a cardboard fight for several minutes I was able to assess what I had bought. The display unit is a very substantial unit in an aluminium diecast box which has a swinging arm to enable it to be fixed to a wall or to the machine itself. If fixing to the machine then ensure that there is no vibration to the unit when milling. I fixed to a wall behind the machine. There is also a powder-coated tray to fit below the display for data sheets, chuck keys etc.

The three glass scales come with the reading head permanently attached to the scale by small orange plastic fixings which hold the two parts in the correct location to each other whilst fitting. These should be removed completely after fitting and according to Jade the reading head should be left captive until completely fitted. This is not always possible as the heads are held captive at the very end of the travel - which may not be where you wish to fix the head to the machine. The Y and Z-axis units came bolted into a very nice aluminium housing and the Y-axis unit came with an aluminium extrusion to act as a protective apron and which was just a shade too long to fix to the Wabeco table. A glance at **photo 1** will illustrate this. All scales were fitted with metal clad cable which should be plenty long enough to reach the display



unit wherever you put it. I didn't measure the cables but they must be around 3 metres long.

On opening the parcel I was impressed by the fact that several heavy aluminium brackets with slots and tapped holes were supplied and also several heavy alloy plates, also slotted and tapped. There was also a large quantity of metric cap head setscrews, some steel shims for packing the reading head into alignment and a comprehensive, but confusing, 63-page operation manual apparently written by a student of English, somewhere in China! There were, virtually no fitting instructions, but as Jade said on the phone, every machine is different. There was a tiny 4-page leaflet giving some guidance about fitting and I was alarmed to see that the recommended tolerance on lining up the glass scales was + or - 0.1mm or 4 thou.

Having been impressed by the nice brackets which looked as though they would almost clip together, I then realised that few of the slots or threaded holes, actually lined up with any other holes in the equipment. I also looked at the fixing through the

side of the reading head on the glass scale (**photo 2.**) This carries two holes tapped 5mm and has a recess for a 5mm nut or bolt head. Trying to figure out how you can use a recess for a 5mm nut on a threaded hole made me realise that I had failed the IQ test yet again! Jade products recommended using the four tapped holes underneath the reading head, two of which are visible in the photo.

Do not expect to have this fitted in an evening. Doing this carefully and photographing the progress, took me several evenings and a bit of the weekend. It has, however, been worth the trouble.

Z-axis scale

I chose to fit this axis first as it seemed the easiest. You are recommended, where possible, to fit the glass scales to the moving parts and to fit the reading heads to the body of the machine. Here on the Wabeco I decided to fit the glass scale to the machine body (static) and to fit the reading head to the milling head carriage (moving). This looks absolutely easy. You could drill and tap the milling head slide to take the reading head

and fit the glass scale to the body of the machine to the rear. However, this layout, with the glass scale to the rear and the reading head to the fore, would leave the glass scale vulnerable to coolant splashes and swarf and would make the nice, supplied, housings absolutely useless in a protective sense. I therefore decided to mount with the reading head to the rear and to construct a 'bridge' to transmit the movement of the milling head to the reading head - bridging the glass scale.

Figure 1 shows the dimensions of the arrangement and **photo 3** illustrates the fitted items.

The housing for the glass scale consists of an aluminium alloy base 7.7mm thick x 31mm wide and a cover. I first separated the cover of the glass scale housing from the base and fitted the base to the body of the machine adjacent to the dovetail slide. When fitting this, remember to leave enough room below for the ends of the cover and enough room in front for the thinner side of the cover - otherwise you will find that you cannot put the cover on later. The housing base has pre-formed slots in it and I carefully drilled and tapped my

precious milling machine using a mains driven pistol drill, followed by the tap.

The glass scale housing base plate was bolted to the body of the mill and the glass scale itself was bolted to the base plate. Once in situ, the alignment was checked in both planes using the arrangement shown in **photo 4**. Attach the dial indicator to the milling head in some way and wind the head from the top position to the bottom position. Adjust the mounting bolts of the glass scale until there is no more than one thou of dial movement from top to bottom.

I made the bridge bracket illustrated in **fig 1** from a piece of 2 x 3/16in. steel angle iron bolted to a slice of one of the supplied aluminium brackets, utilising their pre-formed slots for fixing to the reading head. The arrangement was clamped to the milling head to line up with the reading head of the DRO and the milling head carriage was carefully drilled and tapped, two 4mm setscrews being used to attach the bridge bracket. Another slice of aluminium was cut from a supplied bracket, using the band saw, to act as a packing piece to allow the reading head to be bolted to the bridge bracket. Do ensure that when you bolt the reading head to the bridge bracket, there is no tendency to distort the reading head in any direction. Obviously the bridge bracket must be made in such a way as to ensure that there is no twist present in the mounting, otherwise accuracy will be reduced.

Fit the cover; plug the cable into the display unit and power up to prove that it works. One down - two to go.





B in **fig 2** was made up from a strip of 25 x 7mm aluminium strip from the scrap box. This plate was bolted directly to the machine using recessed 4mm cap head setscrews and the glass scale base plate was then bolted to that. This necessitated putting a new slot into the base plate as shown in **fig 2**. The new slot in the base plate is not in line with the original ones, simply to place it in the middle of the packing strip.

Once the base plate was fitted, I bolted the glass scale to it and aligned it as previously described. I chopped down the remaining supplied bracket and attached it to the underside of the reading head and then finally drilled and tapped the body of the machine 4mm to attach the bracket. This is illustrated in **photo 7**. Be careful just where you attach the reading head bracket to ensure that you have the full range of Y movement without breaking the glass scale.

Setting up and using the DRO

Once you have plugged all three scales into the display unit, you should check that they are all reading in the correct direction as indicated in the instruction manual. This is easily changed, but is important if some of the more exotic functions are to work correctly. You have the ability to store 200 auxiliary zero points on all axes and the display unit will act as a workshop calculator.

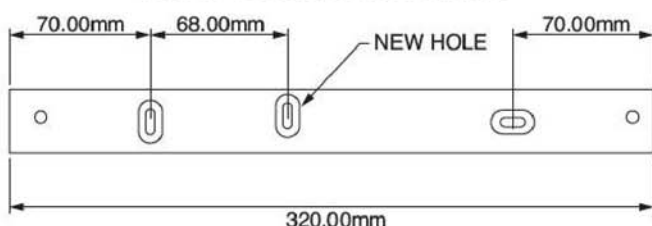
The unit seems to be robust, repeatable and reliable in use. It actually enhances the appearance of the Wabeco and does not get in the way. If you have never used a DRO before, it completely transforms your way of working and almost makes marking out a thing of the past.

ME

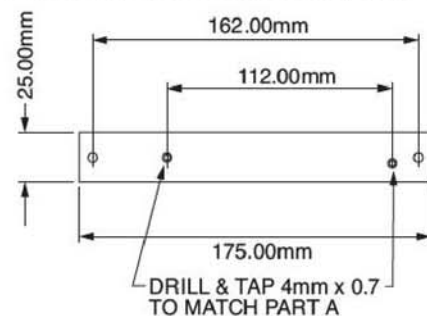
Fig 2

Y AXIS MOUNTING

PART A - ORIGINAL HOUSING BASE



PART B - ADDITIONAL MOUNTING PLATE



neat. The aluminium apron is slightly too long and is too deep to clear the table locking screw. I therefore shortened it to 695mm long and reduced the depth to 50mm for the entire length using the band saw in the vertical position.

Table clamp handle

The table clamp handle is too short with the glass scale in position and needs extending. I took a piece of $\frac{3}{16}$ in. silver steel 30mm long and threaded it through at 6mm to make a sleeve. The sleeve was screwed onto the original handle and a 6mm setscrew screwed into the end, locking the whole thing up with Loctite. Sawing off the setscrew head gave me the extended handle seen in **photo 6**.

Y-axis scale

Again room is tight, and I decided to fit the glass scale to the moving part with the reading head static as recommended by Onyx. Careful planning resulted in a situation where the glass scale did not extend beyond the rear of the machine nor was it in the way at the front. As with the Z-axis, the glass scale housing must be dismantled and the base plate fastened to the end of the table dovetail slide. However, the scale needs to be packed out to stand away from the machine side and so plate

5. Fitting the X-axis glass scale.

6. Extended table clamp handle.

7. Fitting the Y-axis glass scale.

8. Y-axis with housing fitted.

X-axis scale

I tackled the X-axis next. There are two existing 4mm holes on the front of the table which are almost correctly spaced (but 7mm too far apart) to fit the glass scale directly to the table. I utilised one existing hole and drilled a second hole, fixing the glass scale directly to the table with 4mm setscrews and substantial washers. The reading head is 18mm deep, so I left it secured on its safety clips at the end of the scale and stood the scale on a 19mm parallel whilst fitting and checking alignment. The Y-axis leadscrew handle was in the way for fixing the reading head, so I removed the

leadscrew. I drilled and tapped for two 4mm setscrews which cleared the badly designed 5mm tapped holes in the reading head. This is illustrated in **photo 5**.

Be very careful with your heights here as a 1mm clearance beneath the reading head only just gives room above the glass scale to fit the aluminium cover apron. Even at 1mm clearance below, I had to draw file the top of the apron, after fitting, to ensure that it did not come above the table edge. However, the final result is very



JANUARY 2009

- 3/4 **Northern Mill Engine Society.** New Year Steam-Up. Contact John Phillip: 01257 265003.
- 3 **SM&EE.** Alan Berman: Meccano. Contact Maurice Fagg: 020 8669 1480.
- 5 **Peterborough SME.** John Hennessy: Mechanical Calculating. Contact Lee Nicholls: 01406 540263.
- 5 **Lancaster & Morecambe MES.** Meeting. Contact Mike Glegg: 01995 606767.
- 6 **Oxford (City of) SME.** David Price: Old tools and their uses. Contact Chris Kelland: 01235 770836.
- 6 **Romney Marsh MES.** Roy Clench: John & Sheila Percival's Slides. Contact John Wimble: 01797 362295.
- 6 **Taunton ME.** Tom Dominey presents. Contact Nick Nicholls: 01404 891238.
- 6 **Bradford MES.** Bits & Pieces. Contact John Mills: 01943 467844.
- 6 **Stamford MES. AGM.** Contact Derek Brown: 01780 753162.
- 7 **Birmingham SME.** Library & Chit Chat Evening. Contact John Walker: 01789 266065.
- 8 **Bournemouth DSME.** Tech-Chat. Contact Dave Finn: 01202 474599.
- 8 **Leyland SME.** AGM. Contact A. P. Bibby: 01254 812049.
- 8 **Sutton MEC.** Video Evening. Contact Bob Wood: 020 8641 6258.
- 9 **Polegate & District MEC.** Steve Danby: Gold Refining. Contact D. F. Pratt: 01323 645872.
- 10 **Glasgow & S.W. Rly Ass'n.** George Davidson: Life & Career of OVS Bulleid. Contact Bruce Steven: 0141 810 3871.
- 10 **SM&EE.** Polly course training day 2. Contact Maurice Fagg: 020 8669 1480.
- 10 **York City & DSME.** Talk: Small Gauge Railways. Contact Pat Martindale: 01262 676291.
- 11 **Sutton MEC.** Track Day. Contact Bob Wood: 020 8641 6258.
- 12 **Melton Mowbray DMES.** Auction. Contact Phil Tansley: 0116 2673646.
- 13 **Crawley ME.** AGM. Goffs Park Light Rly. Contact Allan Sinclair: 01293 888203.
- 13 **Romney Marsh MES.** Social Get-Together. Contact John Wimble: 01797 362295.

- 14 **Harrow & Wembley SME.** Gerry Divine: Trams. Contact Roy Goddard: E.RSGwatford@aol.com
- 14 **High Wycombe MEC.** Derek Wright: The Severn Valley Railway. Contact Eric Stevens: 01494 438761.
- 14 **St. Albans DMES.** Frank Benfield: Old Films. Contact Roy Verden: 01923 220590.
- 15 **Sutton MEC.** Bring along your model. Contact Bob Wood: 020 8641 6258.
- 16 **North London SME.** Members' DVDs & Videos. Contact Rachael Chapman: 01442 275968.
- 18 **York City & DSME.** Running Day. Contact Pat Martindale: 01262 676291.
- 19 **Lancaster & Morecambe MES.** Sale Night. Contact Mike Glegg: 01995 606767.
- 19 **Model Steam Road Vehicle Soc.** Ray Sturdy: 100 years of Triumph. Contact John Bagwell: 01452 304876.
- 19 **Peterborough SME.** Bits & Pieces. Contact Lee Nicholls: 01406 540263.
- 20 **Chesterfield & District MES.** Meeting. Contact Mike Rhodes: 01623 648676.
- 20 **Romney Marsh MES.** Geoff Dunster: Misc. European Railways. Contact John Wimble: 01797 362295.
- 20 **Taunton ME.** Nigel Gettings: Building Gauge 1 Locos. Contact Nick Nicholls: 01404 891238.
- 21 **Bournemouth DSME.** Meeting. Contact Dave Finn: 01202 474599.
- 21 **Bristol SMEE.** David Kent: Welsh Highland Railway. Contact Trevor Chambers: 0145 441 5085.
- 22 **Plymouth MSLS.** AGM. Contact Malcom Preen: 01752 778083.
- 22 **Sutton MEC.** Curry Night. Contact Bob Wood: 020 8641 6258.
- 23 **Hereford SME.** Annual Dinner. Contact Nigel Linwood: 01432 880649.
- 24 **Chesterfield & District MES.** Public Running. Contact Mike Rhodes: 01623 648676.
- 24 **SM&EE.** Gauge 1 informal meeting. Contact Maurice Fagg: 020 8669 1480.
- 24 **York City & DSME.** Auction Night. Contact Pat Martindale: 01262 676291.

- 27 **Romney Marsh MES.** Social Get-Together. Contact John Wimble: 01797 362295.
- 27 **Stafford DMES.** David Keay HM Principal Inspector of Railways. Contact Chris Dobbs: 01889 270533.
- 28 **Bournemouth DSME.** Annual Dinner. Contact Dave Finn: 01202 474599.
- 29 **Canterbury & District MES (UK).** Meeting. Contact Gina Pearson: 01227 830081.
- 29 **Sutton MEC.** Chris Mc Donald: The Life and time of LBSC. Contact Bob Wood: 020 8641 6258.
- 30 **Newton Abbot & District MES.** Models Night. Contact Graham Day: 01626 772739.
- 31 **SM&EE.** Rummage Sale. Contact Maurice Fagg: 020 8669 1480.

FEBRUARY

- 2 **Peterborough SME.** Bits & Pieces. Contact Lee Nicholls: 01406 540263.
- 3 **Stamford MES.** Syd Clifton: Restoring an old lathe. Contact Derek Brown: 01780 753162.
- 4 **Bristol SMEE.** AGM. Contact Trevor Chambers: 0145 441 5085.
- 4 **Leeds SMEE.** Noel Shelley: Small scale Foundry Work. Contact Geoff Shackleton: 01977 798138.
- 4 **Tyneside SMEE.** Phil Work: Welsh Highland Rly. Contact Malcolm Halliday: 0191 2624141.
- 5 **Sutton MEC.** Bits & Pieces. Contact Bob Wood: 020 8641 6258.
- 7 **SM&EE.** David Wright: Irish Railways. Contact Maurice Fagg: 020 8669 1480.
- 7 **York City & DSME.** Malcolm High: Laser Cutting, the follow-up. Contact Pat Martindale: 01262 676291.
- 8 **Sutton MEC.** Track Day. Contact Bob Wood: 020 8641 6258.
- 9 **Melton Mowbray DMES.** Work in progress. Contact Phil Tansley: 0116 2673646.
- 10 **Frimley & Ascot LC.** Meeting. Contact Bob Dowman: 01252 835042.
- 11 **Birmingham SME.** Ken Toone: Simulator Evening. Contact Mike Page: 01564 784006.
- 11 **Harrow & Wembley SME.** Jackie Hart: London Zoo. Contact Roy Goddard: E.RSGwatford@aol.com

- 11 **High Wycombe MEC.** Bits & Pieces. Contact Eric Stevens: 01494 438761.
- 11 **Norwich DSME.** Bits & Pieces. Contact Shirley Berry: 01379 740578.
- 11 **St. Albans DMES.** Colin Gent: HMS Caprice. Contact Roy Verden: 01923 220590.
- 12 **Sutton MEC.** Club Talk Night. Contact Bob Wood: 020 8641 6258.
- 13 **Hereford SME.** AGM. Contact Nigel Linwood: 01432 880649.
- 14 **Glasgow & S.W. Rly Ass'n.** Iain Lothian: That was then, and this is now. Contact Bruce Steven: 0141 810 3871.
- 14 **SM&EE.** Polly course training day 3. Contact Maurice Fagg: 020 8669 1480.
- 15 **Birmingham SME.** Cup Competition Day. Contact Mike Page: 01564 784006.
- 15 **York City & DSME.** Running Day. Contact Pat Martindale: 01262 676291.
- 16 **Model Steam Road Vehicle Soc.** Mick Morris: Steam Locos & Traction Engines. Contact John Bagwell: 01452 304876.
- 16 **Peterborough SME.** Stan Bray: Tales of an Old London Bobby. Contact Lee Nicholls: 01406 540263.
- 17 **Chesterfield & District MES.** Meeting. Contact Mike Rhodes: 01623 648676.
- 18 **Bristol SMEE.** Auction Sale. Contact Trevor Chambers: 0145 441 5085.
- 18 **Leeds SMEE.** Bits & Pieces. Contact Geoff Shackleton: 01977 798138.
- 19 **Sutton MEC.** Gauge 1 Round-Up. Contact Bob Wood: 020 8641 6258.
- 20 **North London SME.** Tony Dunbar: A trip to Train Mountain USA. Contact Rachael Chapman: 01442 275968.
- 21 **SM&EE.** Workshop Topics. Contact Maurice Fagg: 020 8669 1480.
- 21 **York City & DSME.** Richard Green: Holgate Windmill. Contact Pat Martindale: 01262 676291.
- 23 **Canterbury & District MES (UK).** Meeting. Contact Gina Pearson: 01227 830081.
- 26 **Sutton MEC.** Michael Barker-Hemmings: Photographing your models. Contact Bob Wood: 020 8641 6258.



MALCOLM
STRIDE

Malcolm Stride reports

Editor required

The **Southern Federation of Model Engineers** wish to appoint an Editor for their Newsletter as soon as possible. The Newsletter is published quarterly, and the Newsletter Editor is an important Committee Post.

The responsibility would be for all aspects of Newsletter production from various input materials to production of final publication masters in a suitable format, and selection of and liaison/negotiation with an appropriate printer.

Specific duties include:

- Collation of the club news section, using extracts from the various newsletters supplied by affiliated societies. These may be either hard copy or in electronic form, and are likely to include photographs.
- Production of an Events Diary for inclusion in the Newsletter.
- Integration of advertisements, letters.
- Integration of these with Federation notices, articles, minutes etc., to produce the final document. This material would be supplied by the relevant Committee Member as electronic copy.
- Supply of abstracts in a format suitable for use on the Federation's website.
- Attendance at Committee Meetings, which are held every two months on a Tuesday evening, in London, starting at 18-30. Travelling expenses will be reimbursed.

The distribution of the Newsletters is not part of the task as this is managed separately.

For more information, interested parties may contact, in confidence, either the Chairman, Brian Thompson, on 01920 830629 or the Secretary, Ivan Hurst, on 01252 510340.

Model engineering evening classes

Following recent comments in *Postbag* about model

engineering classes, I have received information about a class at Wiltshire College, Chippenham Campus (Cocklebury Road, Chippenham SN15 3QD). The class is listed as 'Model Engineering and Basic Engineering Skills' and runs on Wednesday Evenings between 6 and 8pm. The next term starts on 14 January 2009 and the cost is £50.00 for a six-week term. Further details can be obtained from the college website at www.wiltscoll.ac.uk or by telephone on 01249 464644. I thank Mr. D. G. Clayton-Jones for providing the information.

A warning

The following was in the **Sutton MEC** newsletter and I thought it worth reproducing here because this is the time when many will perhaps be looking for a locomotive for next season.

"Over the past couple of years, two Sutton members purchased second-hand locomotives complete with apparently valid boiler certificates. On attempting to hydraulically test these locomotives they 'leaked like sieves' from various joints, fittings and through the regulator. Neither would pass the Southern Federation hydraulic test without considerable work. Indeed one needed a new boiler.

One certificate had been issued by a well-established model engineering club, the other by a supposedly reputable boiler inspection business. Both certificates were highly detailed, containing all the relevant information, including a serial number for their respective boilers. However, these numbers could not be found on the boilers in question. Please draw your own conclusions.

The moral of this sad tale is that, if at all possible, witness a successful hydraulic test for yourself before purchasing a used locomotive. Steaming a locomotive will not indicate these types of fault.

We would suggest that if any seller will not agree to a witnessed test, then walk away, buyer beware.

UK club news

The signal box at Sutton MEC has been repainted on the inside and is now "sparkling white and clean with the frame stand a nice shade of grey". They are obviously a tasteful lot at Sutton. New storage arrangements have also made the interior of the box "a much more pleasant environment for working and drinking tea". The new LED signals have been proved over the summer. Even in brilliant sunshine they are quite clear in their indications and are a vast improvement on the old filament lamps. The newsletter contains a detailed description of one of the club's strange rituals, which is common to many clubs and may sound familiar. The ritual involves lots of shouting of words such as "As", "Bs" and "corners" in the initial stages resulting in a line of components joined together in the middle. Further stages involve adding further bits with more chanting and swapping of poles; adding plastic covers and other specialist occupations. This takes place on Thursday mornings and is followed by a further ritual on Sunday to return the gazebo to its storage area until next time! Ted Pepper has made a speedometer bogie for use on the gauge 0 track. Ted's system uses a cycle speedometer but is triggered by an opto-electronic switch rather than the usual magnet. This is to reduce the size to fit into the much reduced space on the smaller gauge. The object of the exercise is to be able to check locomotive performance when making adjustments or improvements. The committee has recommended that the control box for electric locomotives should be fixed to the locomotive or driving truck so that one hand can be kept on the brake ready for emergencies. It is also suggested that some form of dead man's handle arrangement is provided.

Saffron Waldon and District Society Of Model Engineers

Lots of new boilers are progressing at the Meridian night class in Royston.

For many years now the Royston-based club members have attended a night class at the Meridian School using the metalwork and woodwork rooms. As well as the usual machine tools there are also a couple of hearths with gas/air torches, oxy-acetylene and a pickling tank enabling several copper boilers to be made.

At the present time there are no less than six boilers at various stages of construction, in fact there is often a queue to use one of the hearths.

- Peter Penfold is building a 5in. *Firefly* - a Martin Evans GWR 2-6-2 tank.
- John Whitehead is building a 5in. Simplex.
- Alan Petri and Mick Cook are building a 5in. Sweet Pea.
- Lewis Stone is building a 3½in. *Miss 10* to 8, a North Eastern 4-4-0 tender loco.
- Mike Burt is building a 2in. Fowler ploughing engine
- Jim Lawson is building a 3½in. *Maisie*, a GNR Atlantic.

Expertise is developing fast and many tips are passed around the group.

The standard of work is very good, under the watchful eye of the boiler inspectors.

Workshop tips

You all know the situation; you have just drilled a hole which has ended up in the wrong place and are pondering how to rescue a workpiece on which many hours have been spent. 'Peregrine' from **Bedford MES** offers the following solution:

"A stop-gap solution"

Have you never drilled a hole in the wrong place through an error in marking out, inaccurate centre spotting, or the misfortune of the drill point wandering away from the centre spot? The latter calamity happened to me recently.

Usually if the workpiece is relatively unimportant it becomes a simple matter of scrapping the item and starting again. In my case the error was on the frame of a locomotive on which many hours (in fact, years) of graft had been lavished. Plugging the offending hole was not practical and filling with weld was also out of the question, so some other form of bodge was required.

I had recently been cleaning up some intricate iron castings, using the time-honoured method of sawing and filing, so the area around my vice was liberally coated with cast iron

dust. I placed a pinch of the dust on an old tin lid and added a drop of Loctite Retainer. Thoroughly mixing the two together produced a thick black goo, which I then packed into the errant hole, ensuring that it was firmly compacted down. I lightly scraped the filling to surface level before covering it with a piece of adhesive tape to exclude any air. After about an hour or so it had set quite solid, but I left it for a day or two more to ensure it cured completely. Re-drilling the hole, half in the parent metal and half in the filling, produced a nice clean edge with no tendency for the drill to wander.

The mixture initially remains pliable for about 10-15 minutes, so there is plenty of time to undertake the filling operation. For a larger hole, or to build up any deficiency in a casting, I would be inclined to use an epoxy resin, such as Araldite, as this would possess more bulk. I assume the same process would work equally well with non-ferrous materials, but that remains to be seen."

Humour time

Definitions of an engineer

Courtesy of members from the 16mmngm@yahoo.co.uk

From: Andrew Spiers

The one I like the best was told to me by a retired RN Commander (Eng)

Q: What's the difference between a Mechanical Engineer and a Civil Engineer?

A: A Mechanical Engineer builds missiles and a Civil Engineer builds targets!

From: Peter Sheppard

A real engineer washes his hands BEFORE he goes to the toilet!

From: Gary Milner

Something recently found on the notice board at work:

It is always good to try something new...Remember: Amateurs built the Ark, but engineers' built the *Titanic*...

And a P.S. by Rob Bilborrow

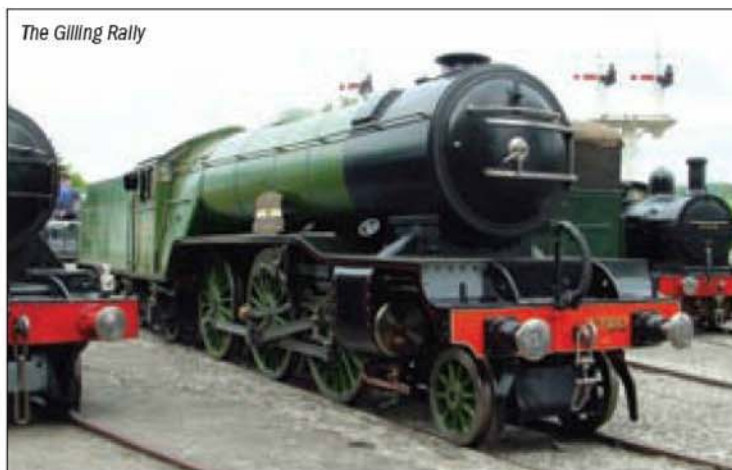
...and the White Star Line's Marketing Department, or whatever they were called in those days, were so keen that it should make a fast passage that the captain felt obliged to go nearly flat out through an ice field rather than slow down or take a more southerly course.

ME

ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT IS
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- I/C engines at the Model Engineer Exhibition
- An Engineer's day out Loch Katrine Steamer
- McOnie's engine
- I/C Topics
- Out And About with Martin Wallis
- Gothic engine
- Keith's Column

PLUS all your regular favourites



The Gilling Rally

ON SALE 16 JANUARY 2009

Contents subject to alteration



FIRST CLASS POST

Write to us

Views and opinions expressed in letters published in *Post Bag* should not be assumed to be in accordance with those of the Editors, other contributors, or MyHobbyStore Ltd.

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In the interests of security, correspondents' details are not published unless specific instructions to do so are given.

Responses to published letters are forwarded as appropriate.

BR and GWR locomotive greens

SIRS, - Having just received my latest issue of *Model Engineer*, I was interested in the article by Peter Rich, about 9F No 92250 (M.E. 4337, 24 October 2008). As I am building a model of *Evening Star* to works drawings I was very interested in the content of the article. Peter Rich is a superb draughtsman and certainly knows his stuff. There is just one small point that Peter makes, and it is a small mistake that numerous people make. He refers to *Evening Star* as being painted in 'Middle Chrome Green'. The official description of BR locomotive green is 'Locomotive Green'; and added to that description is either BR Spec 30, item 30a for the pre-1958 locomotive green, or BR Spec 58, item 12 for the Post 1958 shade. The latter spec is the one used for paint for *Evening Star*. You may say "How does he know all this?" Well I have a tin of paint from the batch that was made to repaint *Evening Star* when she was being repainted after storage, awaiting preservation, in the Brighton Pullman works. Some years after acquiring that tin of paint I became a contractor to BR, manufacturing and supplying them with BR Locomotive Green paint to both BR specs. They always ordered to the descriptions given above.

'Brunswick Green', 'Middle Chrome Green' - these are just nicknames coined by modellers and railway enthusiasts. 'Brunswick Green' is only part of the name: there is 'Light Brunswick Green', 'Mid Brunswick Green' and 'Deep Brunswick Green'. None of which match either the GWR shade or BR shade. 'Middle Chrome Green', although a colour name, in the context of BR and GWR Greens, was just one of the pigments used. The same shades could also be produced using Blue, Black, Yellow and Vermillion.

One point I would like to mention here is that the GWR only ever used one shade of Green. The apparent shade

differences were due to different varnish types and varnishing specifications introduced at specific times. When I was researching the GWR liveries for Precision Paints Ltd in the early 1970s I was lucky enough to be given access to the standard livery panels from Swindon works. Where the varnish coat on each panel was chipped it was possible to determine the actual colour of the Green and the various varnish coats. The final panel dated 1939 was not introduced until 1945. This panel was unvarnished and so showed the GWR Green in its true shade. It was unvarnished because paint technology had advanced so much during the Second World War that good weather-resistant gloss paint could now be made for the first time and varnish was not absolutely necessary to provide any kind of life to the coating.

Certain publications in the past, have provided the name 'China Red' for GWR buffer beams and between the frames. This is also an error. I had access to panels dated 1875, 1881, 1906, 1928 and 1939 (not introduced until 1945). The name 'China Red' only appeared on the Gooch panel of 1875. All the later panels showed the colour name to be 'Signal Red'.

In late 1957 or early in 1958 the British Railways Board took a decision to do away with all association with the old pre BR companies to try to remove the remaining 'partisanship' of the old railway works staff around the country. To this end, they decreed that

the colour schemes used for locomotives and rolling stock should be moved away from any association with the old company liveries.

A certain amount of resistance to this was taken notice of by the Board but their edicts had to be followed, or at least given 'lip-service'. Many works still managed to incorporate old practices such as Swindon Works painting tank locomotives in 'Locomotive Green' and in some cases giving them full Orange/Black/Orange lining.

The primary colour scheme was the express passenger locomotive colour scheme which was taken directly from the GWR post war livery. There were minor differences in the lining, but essentially BR adopted the GWR livery in its entirety. The BR Board decided that it would retain this colour scheme for main line passenger locomotives but the shade must be changed. The BR Surface Coatings Lab at Derby was the place that colours were developed and they subtly changed the shade of Green so that it was slightly lighter and slightly bluer than the GWR shade. Thus they had complied with the requirement of producing a different colour, but as we all know, the later shade was so close to the old shade that after a few days in the railway environment they were indistinguishable from each other. The shade of Orange for the lining was retained as this was not considered important enough to change.

Flash car wash sources

SIRS, - Thank you for your letter concerning Mr. Jones and the 'plash car wash device' (not window cleaner!), M.E. 4336, 10 October 2008.

This whole error has arisen from a misinterpretation of my initial letter from which the word 'Flash' has been incorrectly written as 'Plash'.

I have phoned Mr. Jones to explain this and he has confirmed that these units are unfortunately no longer available. At the time of writing my original letter I was of course unaware of this.

Please accept my apologies for the faint and perhaps confusing state of my letter which caused the whole muddle. Personally I blame the clapped out condition of my old (ancient) typewriter!

Ron Wright, Surrey.

Strangely enough, although the edict had come down from on high, to change the liveries, the old LNWR livery was still retained for mixed traffic locomotives. I've never been able to find an answer for this anomaly.

In his article, Peter mentions the differences in the machining of the driving wheel bosses. I have taken particular notice of this apparent difference as I have had true scale wheels cast for my model of *Evening Star*. I have the detail drawing for the wheels of the 9F. I think the explanation of this difference is due to the fact that these were castings and so varied in the amount they distorted on cooling and also when being machined. The back of the boss would have been the first surface to be machined as a reference face. The next surface would have been the inside face of the rim. From these surfaces all others were measured. If a bit too much had to be taken off the back face of the boss, or the rim, because of casting irregularities then the other surfaces would have been machined to suit thus not taking as much off the outside faces. The drawing, in fact, shows the outer boss face just meeting with the flare at the top of the spokes. To produce this to drawing would be almost impossible wheel to wheel, hence the apparent differences.

As Peter also mentions, *Evening Star* was considered a 'One off'. The way the insides of the frames were painted was a real 'One off'. The only faces that were painted 'Signal Red' were the inside faces of the frames above the horizontal stretchers, the rear of the saddle above the horizontal stretchers and the first two vertical stretchers behind the saddle where they were above the horizontals. All other surfaces were Black, including the vertical stretcher flanges where they were riveted to the frames. This information was gained due to the kind assistance of the National Rail Museum where they allowed me to climb inside the frames to check what colours were used where, right down to the metal.

Bob Shephard, Gloucestershire.

Small vice modification

SIRS, - Following the article on a modification to a vice by Peter Spenlove-Spenlove, the modification I made to a small vice may be of interest.

The photograph gives the whole story. It is the replacement of the tommy-bar with a handwheel. The vice shown is 2 x 2in. opening and the hand wheel is 2in. diameter by 3/4in. thick with a knurled edge.

The vice is portable and the hand wheel gives a very sensitive feel to the vice which I use for small components.

P. S. McMillan, Devon.



The special handwheel fitted to Mr. McMillan's small vice.

BR Standard Class 3 Tank locomotives

SIRS, - Yet again it made very nice reading to see Peter Rich's article (*M.E.* 4338, 7 November 2008) on the British Railways Standard Class 2-6-2 Tank locomotives. Once again he may be interested in a few additional notes. This is in no way meant as any criticism of Peter's article which I thoroughly enjoyed but just some additional information in which any prospective modeller may be interested. Peter did mention that the locomotives had fluted rods for a start but this did not apply to all of them. Locomotives Nos. 82000 to 82019 were all built with fluted coupling rods but from 82020 onwards they were all built with solid rectangular section rods from new and it would appear that the ones with fluted rods retained them until they were scrapped, similarly with the 2-6-4 Tanks which had rectangular section rods from 80079 onwards. Number 80078 at the Swanage Railway still retains its fluted rods and 80079 at the Severn Valley has the rectangular section ones.

Peter also mentions the

modification of adding the handrail on top of the boiler. These were a later addition and some locomotives did not receive them at all. The first one to be fitted with the handrail was 82007 on 26 January 1957 but earlier photos show them without this addition. Also, some much later photos show locomotives still without them. The fitting of the snap top tank fillers seems to be somewhat more haphazard as I think that they were fitted from 82020 onwards but then again there are photos in the RCTS book *British Railways Standard Steam Locomotives Vol. 3* showing later locomotives with the screw down type. One other little quirk is that nearly all of the class were fitted with the LNER type square drive return crank apart from 82044 which was built new with the four bolt LMS type. For anyone interested in modelling one of these locomotives they may be interested to know that I am just having patterns made for the driving and coupled wheels as they are the same as the 76000 Class which is on my drawing board at the moment (though nowhere near ready yet!). Another point of interest is that the front pony truck on the Class 3 2-6-2 Tanks is the BR Standard one but the trailing one is a swing link type to prevent resonance setting up between the two on curves. Whether or not this also applies to the Class 2 I am not sure but perhaps Peter might know.

Doug Hewson, Lincolnshire.

BR Standard Class 3 Tank locomotives (2)

SIRS, - Mr. Peter Rich should be congratulated on his excellent series of locomotive profiles and for his very fine, detailed drawings. I was most interested in his recent article (*M.E.* 4338, 7 November 2008) on the BR Standard Class 3 tank locomotives.

There might be a slight discrepancy in the front elevation of Mr. Rich's drawing, concerning the side control arrangement of the leading pony truck, which was effected by the use of coil springs,

not by the swinging links as shown. However, the swinging link arrangement shown was correct for the trailing pony truck. The idea was, I believe, to prevent any resonance occurring between the front and rear pony truck side controls when running at speed. Further details on this can be found in *A Pictorial Record of British Standard Steam Locomotives* by Edward Talbot.

Mr. Rich was spot on about the allocation of these tank engines to Tyseley shed in Birmingham. They certainly were not liked by the locomotive crews there, and it wasn't long before they were replaced with Tyseley's beloved 41xx class locomotives for working suburban trains in the area. Some of the ex-Tyseley locomotives eventually found their way to Wellington (Salop) shed for working (amongst others) the heavily graded Much Wenlock branch line. A while ago I met an ex-fireman who had worked on these engines on the Wenlock line, and he reckoned the 82xxx locomotives were the "best thing since sliced bread". He also remarked he was sorry to see these locomotives leave Wellington at the beginning of 1960 for other locations.

Whereas some Regions of British Railways were only to keen to be rid of any of the BR standard class locomotives, the Southern Region seemed more enthusiastic about them. Quite a few Class 3 tank locomotives latterly found their way to Nine Elms shed, typically for ECS workings to and from Waterloo.

Unfortunately none of these locomotives survived into preservation, but readers may be interested to know that a 'new build' of a locomotive of this class (to be numbered 82045) has already commenced on the Severn Valley Railway at Bridgnorth. Details of this project may be found at <http://www.82045.org.uk>. So, all being well we should see a new full-size Class 3 tank locomotive in the future, and we may yet even see a live steam model of one too!

Laurence Blundell, Staffordshire.

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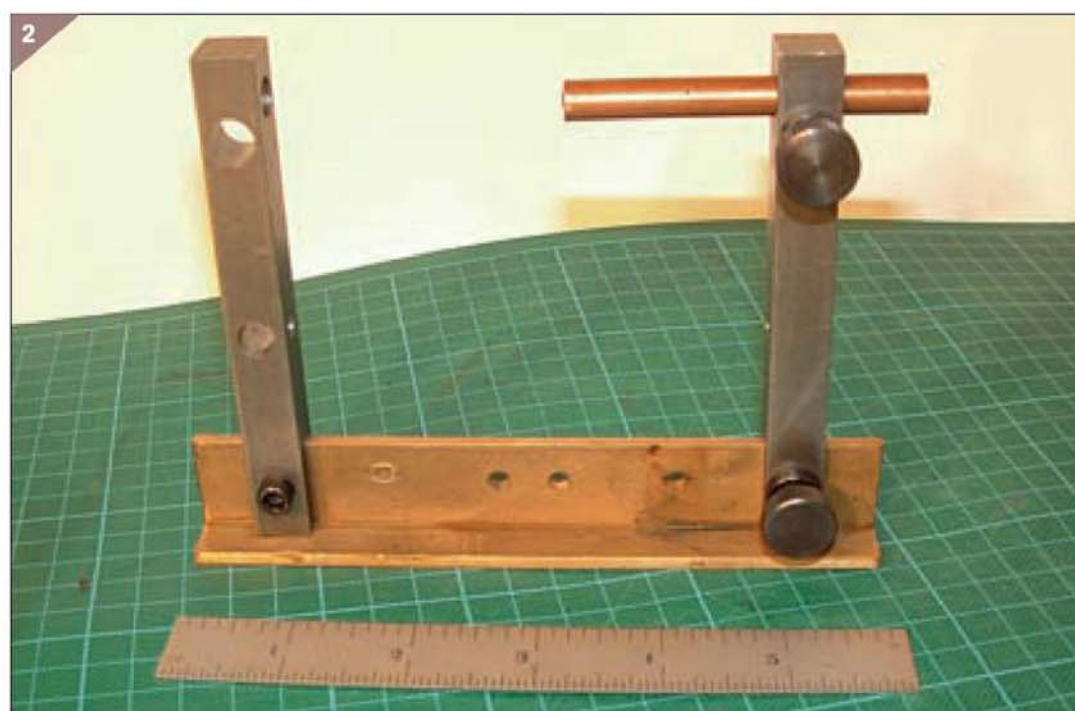


A silver-soldering jig



JOHN SLATER

John Slater adds an extra pair of hands.



1. Two of the finished jigs and parts for number three.

2. Part-assembled jig.

3. Fully-assembled jig before final finishing.

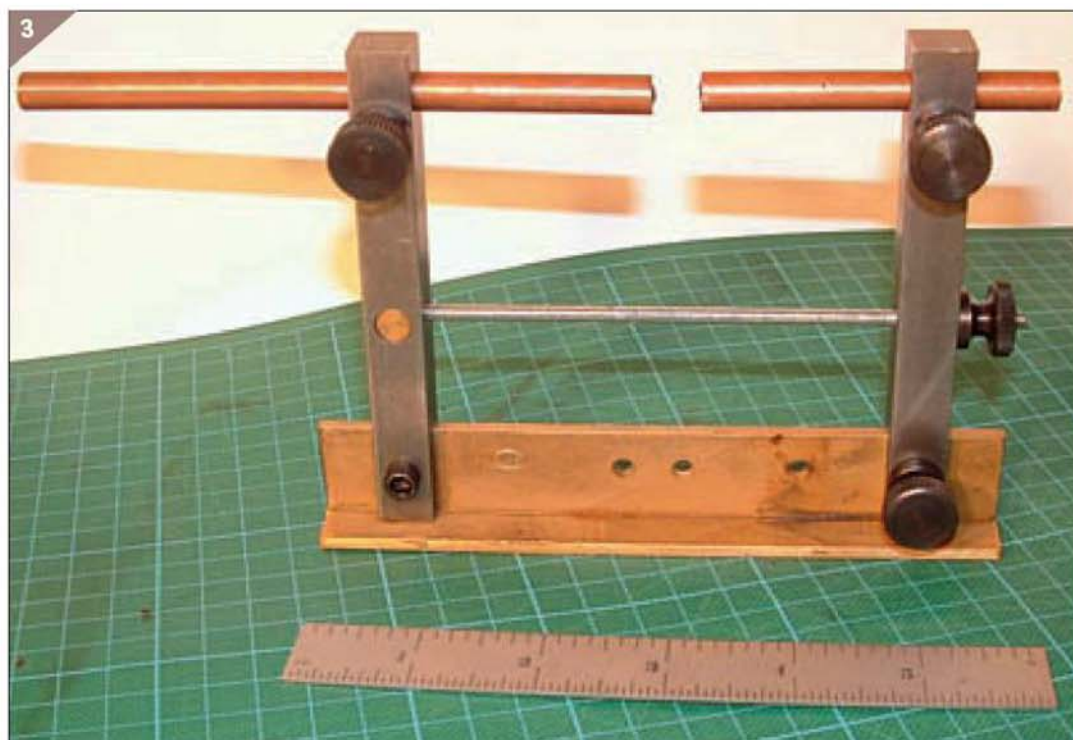
4. Split cotters for the carbon rods made from brass.

This silver-soldering jig is based on the design of the late Tommy Bartlett. He described his version in both the *SMEE Journal* and *Model Engineer* (ref. 1). The clever bit in his design concept is the use of carbon rods to do the clamping of the parts to be silver-soldered thereby preventing the clamp being soldered to the job!

Although I never met Tommy Bartlett he and I were both members of SMEE and we exchanged letters and telephone calls over a number of years. Long-established readers of *Model Engineer* may recall Tommy's *Tips* and other articles he had published in 'ours'. I found Tommy inspirational in many ways and very generous too. Indeed he supplied the carbon rods for the jig(s) to be described.

Tommy's published design for the jig included a brief description and a simple drawing for guidance. He appreciated that the concept was the important bit and that most model engineers who realised his idea would adapt it to the materials they had to hand. So it was with me.

My version (photos 1 - 3) is similar to the SMEE description where a 'T' bar was shown for the base because I happened to have a suitable length of brass 'T' section available. Equally though, two lengths of back-to-back angle could be substituted. The main arms were made from lengths of ½in. square mild steel. Tommy showed simple splits closed with screws to hold the carbon rods whilst I preferred



to use split cotters as shown (photo 4).

Following Tommy's lead I've not given any firm dimensions but have shown a measuring stick in the photos, again in the hope that if you decide to

build one (and I recommend that you do), you too will adapt the basic concept of a stable clamp using carbon rods as the clamping element to the materials that you have readily to hand.

I did most of the work on my drilling machine, drilling and reaming most of the holes using some simple stops and a guide fence to ensure the correct location of the holes (photos 5 and 6).

I actually built a batch of four; three were given to friends and one I kept. I'd like to think that Tommy would have approved. ME

References

1. Tommy Bartlett, *Silver-Soldering Tongs*, M.E. 4150 Vol. 187, 2001, p. 35.



5. Centre drilling one of the arms. Note guide rail and clamping methods.

6. Reaming a previously drilled hole for the split cotters.

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12. UNF OR UNC TAP SET (2 Taps each size) & DIE SET	TAPS E20 SET	DIES E20 SET
13. UNF OR UNC TAP SET (2 Taps each size) & DIE SET	TAPS E20 SET	DIES E20 SET
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16. METRIC FINE PITCH SETS (10 sizes from 14 - 24 mm) TAPS & DIES	TAPS E20 SET	DIES E20 SET
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19. ENDMILL SET 1/4, 1/2, 3/4, 1, 1 1/4, 1 1/2, 1 3/4, 2, 2 1/4, 2 1/2, 3, 4, 5, 6, 7, 8, 10, 12 mm	TAPS E20 SET	DIES E20 SET
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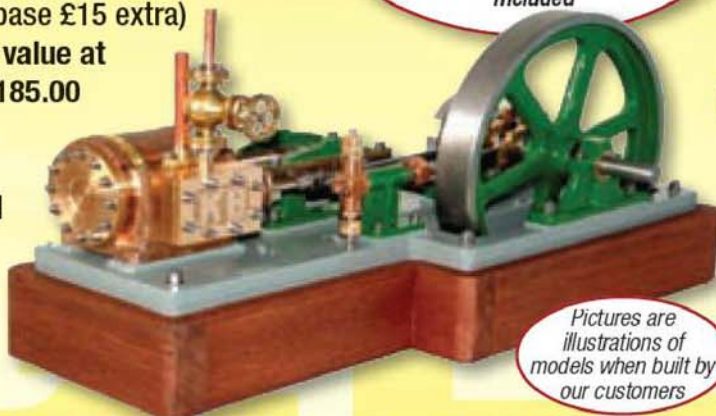
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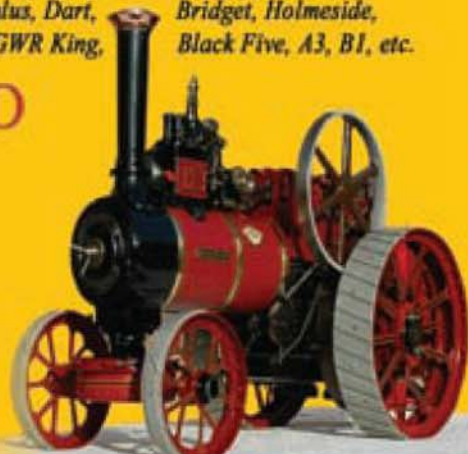
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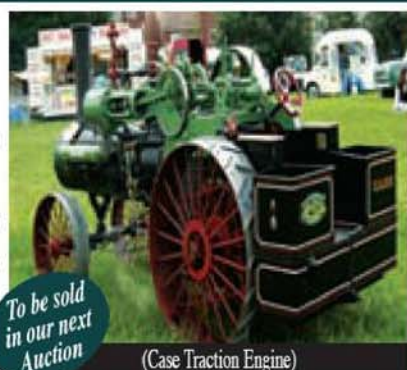
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