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4-17 January 2008

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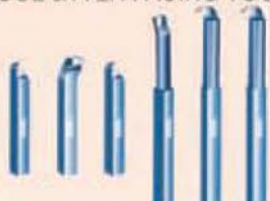
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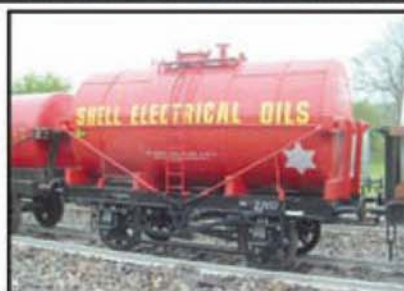
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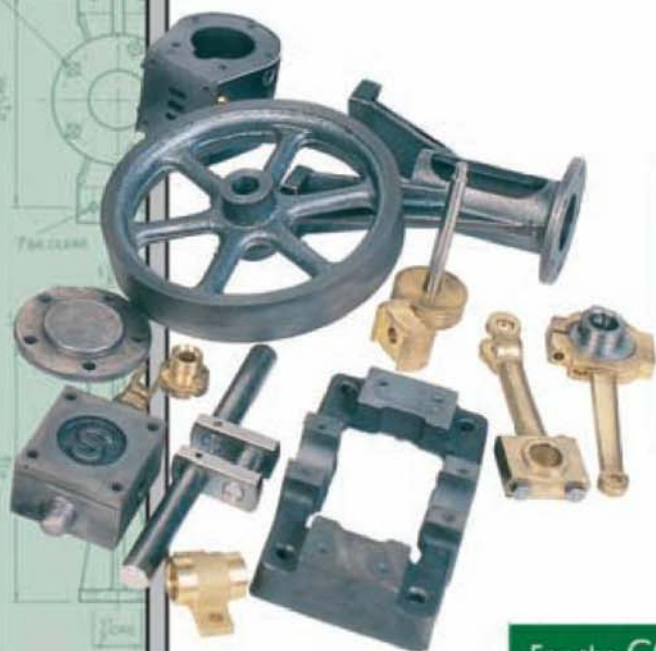
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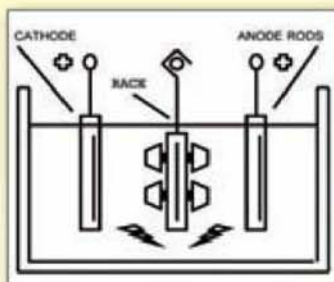
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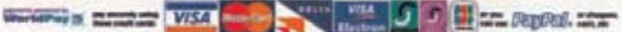
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GOOD NEW YEAR READING JUST FOR YOU!



Edward Thompson of the LNER • Grafton • £14.70

Interesting, engineering biased, biography of Edward Thompson, the last CME of the LNER. In railway circles, Thompson is regarded as suspect because he played about with some of Gresley's designs, but he also built one extremely successful design. He is of interest to model engineers because this successful design was the B1 class 4-6-0s, the basis of Martin Evans' very popular 5" gauge design, and also because LBSC's *Heilan Lassie* in 3 1/2" models one of Thompson's modified Gresley designs. Given that Thompson also tinkered with other designs familiar to model engineers, and was an interesting, if troubled, character, this makes a very good read. 152 very well produced pages, and around 140 B&W photos. Paperback.



Steam Trains... In Your Garden • Wilson • £36.90

Already a huge best-seller, all the way from Oz comes this, quite simply, brilliant book showing you how to build a 16mm gauge live steam locomotive, plus some passenger and freight rolling stock. If you have always dreamed of building a real steam locomotive, have a lathe (which needn't be big) and some patience, then you can build your dream from this book. The locomotive on which the design here is based is a 2' gauge John Fowler 0-4-0 shipped to Australia in 1923, but as is admirably shown in this book, the basic design can be modified to Hunslet, Peckett, even Decauville outline. And it can be built for gas or coal firing. 189 beautifully produced pages with full drawings, sketches of set-ups and loads of colour photos. Hardbound.



The Wonders of Machinery Hall

• 1892-93 • AMERICAN MACHINIST • £12.80

Machinery Hall at the World's Columbian Exhibition, held in Chicago during 1893, had a floor area of 14 acres, but over 700 would-be exhibitors were turned away for lack of space. Thanks to this book, based on articles from AMERICAN MACHINIST magazine, and including photographs and drawings from this and other sources, you can see the incredible displays there, ranging from a 72" stroke quadruple expansion Reynolds-Corliss engine, driving a 30' diameter flywheel with a 76" wide face, which provided the electricity for the whole Exhibition, through various other engines and machine tools from many countries, down to displays of English terra-cotta drain pipes and baths. It must have been a mind-blowing display, even if probably very noisy, this fascinating book made us wish we could have been there. 192 pages. Vast numbers of B&W photos and engravings. Large format. Paperback.



Mixed Gauges • Snell • £51.90

John Snell has been involved in preservation since 1951, when he accompanied the late Tom Rolt and David Curwen to Towyn as the only permanent (English) staff on the Talylyn Railway, before it opened as the very first preserved railway in the world, and he retired in 1999 after 28 years as General Manager of the Romney, Hythe & Dymchurch Railway. In the intervening period, whilst not always been professionally involved with railways or preservation, he has been actively involved in both. He has also travelled, inevitably perhaps given he was born in Fiji in 1932, spent the war years in New Zealand, and returned to Britain for further education thereafter. It is his travels which are recounted, and especially illustrated in this wonderful book; if you were into the railways of that strange place 'abroad' as well as the U.K., from the late 1950s to the 1970s in particular, this book is incredibly nostalgic and will bring the memories flooding back. If you are too young, see what you missed! The text is a delight, being informative and interesting, with a dry humour, and, the photographs will take your breath away. Whilst the locomotive or train is usually the centrepiece, these are not sterile photographs of lumps of machinery, but are full of life with lots of incidental details, which is why we have gone for a large format - 245 mm x 297 mm, with over 50 photographs printed full page. And there are a lot of photographs of railways worldwide - 386 in full colour and 48 in black & white, the earliest taken in Fiji in 1945. With 256 hardbound pages, this is a BIG book in every way. If you love the steam locomotive, be it running on rails - broad, standard or narrow gauge, you will enjoy this book immensely for many, many years to come. Buy a copy and give yourself a huge New Year treat!

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Coming up

With this issue we look forward to Vol. 200, which starts here. We have some interesting items lined up over the next few months. As Ayesha comes to a conclusion, we hope to be starting a new locomotive series by Peter Rich, a model of a superb prototype which can be built by the relatively inexperienced or even an ambitious first locomotive for those with the necessary workshop skills. For the more experienced among us, Neville Evans and Keith Wilson will keep us occupied.

We have two other locomotives in preparation, one of which will be ideal for an absolute beginner, or a 'quickie' for experienced builders. Coming up shortly we will describe a new steam turbine locomotive in Gauge 1. Staying with locomotives we hope to have some interesting notes on injectors and superheaters.

Nemett is just putting the finishing touches to the design of his new twin cylinder engine and will be taking readers through how to build it. In addition he will continue to keep us up to date with the world of I/C.

We have a number of useful items of workshop equipment waiting to be described, and we shall be testing some more commercially available items.

We will continue to look back at historic prototypes as a source of inspiration for modellers, and provide ideas for days out for engineers.

For the clockmakers we

are looking forward to finding out how Roger Castle-Smith achieved that incredible and durable finish on his Gold Medal winning clock.

To maintain our balance of items to ensure we have something to interest any reader, we shall be describing a variety of other projects.

As ever we will strive to make it a 'good read' as well as being informative. You can contribute, too. *M.E.* is not known as 'ours' for nothing. We are always delighted to receive articles from readers, and (usually!) we take great delight in receiving your letters.

Just to make sure we are on track, we also plan to have a readership survey.

Much binding

When the next issue with the index to Vol. 199 is published, that will mean it is time to go get some sets of issues down to Dorset for binding. We are sometimes asked who does our excellent binding, so for those of you who like to keep them bound why not ask our people. Their work has always been top quality and reasonably priced.

Speak to David at DJ Bookbinders on 01929 481419.

We also have a few recent bound volumes spare in the office. Please call customer services for details.

Thank you, Lorna

It was a pleasure recently to hear from Lorna Minton, who some of you will remember taking some nice model engineering pictures in the 1950s, when she was a

photographic student, and later in the 70s. The photo shown is of LBSC's *Tugboat Annie* taken when she was invited with her father, Rowland Proctor, to visit Curly and his track.

Eventually Lorna gave up photography in favour of art, and is now a botanical artist (RHS Gold Medal). See www.palmito.demon.co.uk. Recently Lorna sorted through her photographic files and kindly let us have some for the *M.E.* archive.

MEX 2008

This year's International Model Engineer Exhibition will be on September 19-21. Once again we are holding it at Ascot racecourse. We will be giving more details later when we have further developed our ideas on the models to be shown.

Meanwhile please make sure that the dates are in your and your club's diaries.

Do you own...?

We would very much like to hear from you if you own an original locomotive built by one of the 'greats' of *Model Engineer*. If you own, or know the whereabouts of locomotives built by LBSC, Martin Evans, Don Young, Keith Wilson, Neville Evans, etc., etc., can you please contact the Editor at the office address or T: 01689 899255 E: david.carpenter@magicalia.com

Musical museum

We were delighted to hear that the Musical Museum in Brentford has re-opened in its new premises. Originally in an old church with water pouring through the roof, the museum acquired a brand new building shell as part of a local development.

We have been holding an article by Roger Backhouse for some time, pending the opening of the new building, and now we can include it in this issue. If you get the chance do pop along. It is just along the road from the Kew Bridge Steam Museum so visiting the two can make a super day out.

www.musicalmuseum.co.uk

Tugboat Annie pictured at Curly's railway by Lorna Minton, 1957





Model engineering health

SIRS, - The *Smoke Rings* editorial (M.E. 4310, 12 October 2007) has stimulated me to think about the health of our hobby.

While the need to constantly recruit new and young practitioners has featured in readers' letters since the dawn of *Model Engineer*, it is in the last couple of decades that the queues at model engineering exhibitions have

presented a uniform sea of grey heads. I remember, at the last Model Engineer Exhibition to be held at Olympia, being at the edge of a conversation between a pair of older model engineers who were condemning the presence of 'soft' model making at such exhibitions, i.e. Airfix kits, military modelling, robots etc. This attitude ignores the need to encourage youngsters into the hobby; there can be few model engineers who did not

start by simple model making as a lad (or girl).

They seem to take a more enlightened attitude on the continent. Visitors to the exhibition at Sinsheim will have seen the large number of family groups attending and the vast arrangement of indoor miniature railways offering rides and knowledgeable stewards happy to chat with youngsters.

The operation of a miniature railway in a public park helps to recruit new members. At

3F conversion

SIRS, - Congratulations to Geoff Dowden on his meticulous conversion of the 5in. gauge Jinty design to a Midland 3F tender engine, serialised in *Model Engineer*. I had been mulling over this possibility a couple of years ago when I was introduced to Geoff who had beaten me to it!

My own version of the 'Express Goods' has this summer run on air hauling a compressor up my drive (see photo) although I cheated having a friend machine the cylinder block and wheels and have since ordered a commercial boiler.

It may interest readers how this came about. Many years ago a friend, Eric Wright, who has since passed away and I bought Barry scrapyards Jinty No. 47279 and restored it to traffic on the Worth Valley Railway. We considered converting it to a 0-6-0 Midland 2F tender engine, none of which had been saved. Unfortunately the G5 and half-size boiler fitted to the Johnson and Fowler Jinties is unique to them. The 2F tender locomotives had a G6 type boiler, the 3F Express Goods a saturated G7 boiler and the Midland 4F a superheated G7S (although the last two have the same external dimensions).

Several features on Midland locomotives are common to different classes. Most, although not all 3F goods locomotives had 5ft. 3in. driving wheels as did the 4Fs. but a few 3Fs had 4ft. 11in. wheels compared to the Jinty's 4ft. 7½ inches. However, the Jinties had driving wheel spacing of 8ft. 6in. as did the 3Fs and 4Fs, whilst everything between the frames on the Jinty and 3F Goods - slide valve cylinders and arrangement of Stevenson's valve gear - is the same. Thus Martin Evans' 5in. gauge Jinty design is a good basis for a 3F Goods 0-6-0 tender model.

For the 5ft. 3in. equivalent driving wheels on the conversion, like Geoff I used Martin Evans' Stratford LNER J39 class castings.

Coming to the boiler, in full-size the barrel lengths on the 3F and 4F tender locomotives are surprisingly the same as the Jinty but the latter has a smaller diameter barrel and shorter length firebox. Crucially the space between the rear of the cylinder block and the frame stretcher immediately in front of the firebox is the same. This made the fitting of a correct scale 3F boiler to the Jinty frames quite feasible. The 3Fs and 4Fs had larger boilers, common in diameter with several other classes including Midland 2Ps, Compounds and small-boilered Somerset and Dorset 2-8-0s. For my model I will use a shortened version of Martin Evans' Somerset and Dorset Belpaire boiler with a common 5in. dia. barrel shortened to suit and matched to a shorter firebox. This appears to fit the Jinty frames well. Geoff has used a modified Pansy (GWR Pannier) on his model.

For the tender I will also be using the correct Johnson 6-wheeled version from Martin Evans' Midland 'Spinner'.

As far as I am aware no one had attempted this conversion before Geoff and the whole design falls into place quite neatly. I don't think my 'Express Goods' will have the detail of his example but I would like to thank him for allowing me to 'pick his brains' after 19 years of donkeywork!

Phil Jervis, Wakefield.



Phil Jervis' Express Goods chassis in test mode.

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 Magicalia Publishing Ltd. Correspondence for *Post Bag* should be sent to: -

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Responses to published letters are forwarded as appropriate.

Frimley, nearly all of our junior members have joined as a result of first coming for rides and adult members have been attracted to the hobby from seeing us there.

Local authorities or other public bodies and commercial organisations own the grounds of a large number of club tracks, possibly the majority. There is then often a *quid pro quo* whereby only a low rent is required in return for the provision of pleasure and entertainment to rate-payers.

Those model engineers who build in the smaller gauges can carry suitable loads for their locomotives without carrying passengers. I build and operate large and small locomotives of 2½, 3½ and 7½in. gauges so I have experience of both ends of the spectrum. However, while it is very satisfying to haul a good load of passengers with a large 7½in. gauge locomotive, running light engine is not so enjoyable. Furthermore, the thanks and appreciation given by passengers we carry makes it all worthwhile. (We at Frimley regularly receive donations of cakes and tins of biscuits from the public at Christmas in appreciation of our efforts.)

There has always been a proportion of locomotive users who have bought rather than built, and these are most likely to be found on a private railway, without a public passenger service. On the other hand, while purchasing of locomotives has recently become more common within clubs, experience shows that such locomotive owners soon find that maintaining a steam locomotive, and even a Diesel outline locomotive, requires either workshop facilities or some very good friends. Reliable commercial maintenance is hard to find, is slow to respond and needs very deep pockets. Consequently, I know of many model engineers who have, out of necessity, developed their model-engineering skills by this route and so contribute to the hobby.

With regard to the need to avoid commercialism, I know of one club, which, in revising

its constitution when becoming a limited company, placed in its constitution a duty to spend capital in such a way as to maximise return. Surely, what is important is to ensure that the constitution of a club maintains as its principal objective the health of the model engineering hobby.

Peter Gardner, Hants.

Primus jets

SIRS, - Tony Finn of Yorkshire recently made some comments on primus stove jets (*M.E.* 4310, 12 October 2007).

These are freely available in South Africa and sold by most hardware stores. A lot of the population still use these stoves for cooking, because no electricity exists in their villages and so production of stoves and jets is still current. Also freely available are LPG gas jets for various appliances. If Louis Parkes (*M.E.* 4308, 14 September, 2007) can contact me I will be happy to obtain the jets he requires.

John Fielding (aka 'Inchanga'), Durban, South Africa.

Tinsnips

SIRS, - I must take Peter Spenlove-Spenlove to task over left and right-hand tinsnips (*M.E.* 4312, 9 November 2007). They are not necessarily made for left and right-handed workers and all the so-called left-hand scissors I have seen are actually ordinary right-hand scissors fitted with plastic handles angled for the left-hand.

When operating right-hand scissors in the right hand, the thumb naturally pushes to the left when pushing down to cut, the fingers pull right. This has the effect of pressing the blades together to make a clean cut. Left-handed people have the opposite effect on the blades and have difficulty making a clean cut.

Consider cutting several radial cuts around the periphery of a disc of paper or card, with right-hand scissors. The sectors will naturally twist in the same direction and it will form a rotary fan blade. Left-hand scissors would twist in the opposite direction.

Tool quality

SIRS, - A near beginner approached me to ask for advice. He had bought some 'job lot' reamers at one of the exhibitions and found that one would not cut at all while another one appeared to cut hopelessly oversize - what was he doing incorrectly? I reassured him, after looking at the reamers, that he was not at fault, but rather he had been unfortunate enough to purchase some rogues, which should never have been sold.

For the benefit of other beginners, and perhaps also for those who have not already been bitten, I thought it would be helpful to note that while the model engineering fraternity is blessed with normally good suppliers, some tools provided by them leave a lot to be desired. The photo of two slitting saws illustrates my point. The one on the right originated from a reputable manufacturer, namely Wolferal; it is an excellent saw of the quality which one would expect from the likes of Dormer and SKF. But, just look at the one on the left, which came from one of our regular suppliers. The teeth are exactly as received without the saw having been near a work piece. A rat with triangular teeth could have done a better job of gnawing the periphery! Having noted the teeth, I then, as a matter of curiosity, mounted the saw and found that it was eccentric relative to the bore by about 1/16in.; so at best it would only have cut on a few teeth.

It would be unfair to mention the supplier's name as there are others who have also supplied me with items which have also had to do a U-turn back to source; but a reputable replacement was provided. So it is, I am afraid, only too often a case of 'Buyer Beware'.

If you want to be certain, stick to the well-known brands.

Roger Castle-Smith, Bucks.

Roger Castle-Smith's slitting saws.



If you are making a coppersmith's joint in sheet copper, (which looks like a castellated joint, but is not,) several cuts, say ¼in. long and square to the edge of the sheet, are made every ½in. along one edge to be joined, the alternate cuts are made with left and right-handed tinsnips.

The result will be that alternate tabs will naturally lift up and the others down. The edge of the opposite piece of copper to be joined, which is plain and straight, is placed between the tabs which are then hammered down flat, fluxed and soldered. This is a traditional coppersmith's joint and cannot readily be made without the use of left and right-hand tinsnips.

There are of course other

situations, such as making straight or curved cuts from both ends.

On another note, would e-mail correspondents please give their county, etc.

Tony Webster, Northamptonshire.

Can we also take this opportunity to remind readers to provide full contact details when sending in letters for publication, no matter what means they use to contact us? We are often sent information to pass on to readers and this can be difficult to do without such details. We will not publish anything other than the county/country without specific instructions to do so. Can we also suggest that readers quote the relevant magazine issue number when responding to letters or commenting on articles?

CENTENARY MODEL ENGINEER EXHIBITION

THE TRADE STANDS

PART 1

Malcolm Stride reports on the full range of items available to visitors.

One of the important areas at any model engineering exhibition is the trade exhibits.

Many model engineers 'do their shopping' for future projects at shows and gain from special offers and also the considerable saving on carriage for their, often heavy purchases.

This year at Ascot a total of 37 traders were present ranging from those larger companies supplying machine tools and other major items down to companies supplying the all important smaller items including small tools and adhesives.

This year the report will stick to a simple alphabetical sequence so that there can be no accusations of favouritism. All the contact details were taken from the material supplied by the Trade for the show guide.

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43 Hoddeson Industrial Centre, Pindar Road, Hoddeson, Hertfordshire EN11 0FF.
T. 01992 450780.

W. www.machine-dro.co.uk

E. alan@allendale-elec.co.uk

Allendale were showing an extensive range of digital readout systems and metrology equipment for model engineers. The systems provide many advanced



functions to save valuable time in setting up. The product range includes a pantograph tapping machine with an air driven tapping attachment.

Avanquest Uk Ltd.

Sheridan House, 40-43 Jewry Street, Winchester SO23 8RY.
T. 01962 835081.

W. www.turbocad.co.uk

E. ptracey@avanquest.co.uk

Avanquest are the UK distributors for the well-known and popular TurboCAD 2D CAD system. The system offers easy file sharing and compatibility with the latest DWG, DXF and 28 other file formats and it comes with free telephone support and inexpensive training to get you started. Visitors could purchase the product of their choice from several versions available at the show.



BB Engineering Services

Unit 12, Penamser Ind. Estate, Porthmadog, Gwynedd LL49 9YD.

T. 07976 539675.

W. www.bbeng.co.uk

E. info@bbeng.co.uk

For many general engineering supplies including abrasive tapes and stones, springs, gasket materials, pneumatic components and fittings as well as files, BB Engineering was the stand to visit.



Bidwell Ltd.

The Old Brickfields, Burnham Road, Woodham Mortimer, Maiden, Essex CM9 6SS.

T. 01245 222743.

Bidwell has been established for 27 years and now focuses on the hobbyist, in addition to model engineering. The company was selling many interesting items including machinery, general engineering and inspection equipment, live steam models, marine and automotive scale models, kit and scratchbuilt, new and pre-owned.



Blackgates Engineering

Unit 1 Victory Court, Flagship Square, Shawcross Business Park, Dewsbury, W. Yorkshire WF12 7TH.

T. 01924 466000.

W. www.blackgates.co.uk

E. sales@blackgates.co.uk

Blackgates are long established suppliers of drawings, castings, tools and materials for most popular model engineering designs. These include the drawings

and castings formerly available from Norman Spink, and the designs of Dave Goodwin and Michael Breeze.

The company also provides boiler material kits and completed boilers for more than 200 well known designs.



Cammett Ltd

Adlen House, Eardisland,
Leominster HR6 9BD.

T. 01544 388514.

E. cammettco@btinternet.com

W. www.cammett.co.uk

Cammett had a range of small 'hold and fold' tools and Iwata airbrushes and compressors on show. Also seen on the stand was thin walled stainless steel tubing and an interesting looking kit for the *USS Monitor*.



Chalk Garden Rail

4 Brew House Yard, Gravesend,
Kent DA12 2EJ.

T. 01474 351672.

W. www.chalkgardenrail.co.uk

E. chalkgardenrail@btconnect.com

The garden rail gauges are



becoming ever more popular and Chalk Garden Rail are well known for a large range of large garden rail components including those from Piko, Peco, Aristocraft, Bachmann, LGB and many other items.

Chester UK Ltd.

Clwyd Close, Hawarden
Industrial Park, Hawarden,
Chester CH5 3PZ.

T. 01244 531631.

W. www.chesteruk.net

E. sales@chesteruk.net

Chester showed an extensive range of machine tools and tooling consumables including some new products. Many attending the Exhibition visited the stand in order to take advantage of the special show offers. A representative from Chester's southern distributors, TPH Machine Tools based in Rainham, Essex, was also on the stand.



College Engineering Supply

2 Sandy Lane, Codsall,
Wolverhampton WV8 1EJ.

T. 0845 166 2184.

F. 01902 842284.

W. www.collegeengineering.co.uk

E. sales@collegeengineering.co.uk

College supply a range of standard machine tool castings, cast iron blocks and bar, plastics, ferrous and non-ferrous metals, silver steel, silver solder etc. A large range of materials was available at the show for that new project. A price list can be obtained by sending a SAE to the above address.



Cotswold Heritage Ltd.

Bird Industrial Park, Long
Marston, Stratford on Avon,
CV37 8RP

T. 01789 721444.

W. www.cotswoldheritage.com

E. info@cotswoldheritage.com

Cotswold Heritage Ltd. is associated with good quality kits for a range of stationary steam engines, boilers and other associated accessories. Manufactured within the UK, the range caters for those requiring finished ready-to-run models and easy to assemble pre-painted kits as well as castings, drawings and materials for those model engineers with the necessary workshop facilities.



Cup Alloys (Modelling) Ltd.

15 Sandstone Avenue,
Chesterfield S42 7NS.

T. 01246 566814.

W. www.cupalloys.co.uk

E. sales@cupalloys.co.uk

A wide range of brazing and silver-soldering products for the model engineer were on display on this stand including rods, wires, foils, pastes, fluxes, and brazing torches.

The alloys satisfy BS EN 1044 and FED 97/23/EU and are used by professional boiler makers. Many visitors sought the advice of the staff, and hopefully made a purchase, during their visit.



Digitise Ltd.

Business & Innovation Centre,
Sunderland Enterprise Park
(East), Wearfield, Sunderland
SR5 2TA.

T. 08700 119394.

W. www.digitise.ltd.uk

With the increasing interest in CNC from model engineers, sophisticated CAD packages are becoming more popular and Digitise were demonstrating the Alibre Design 3D CAD package on the SMEE stand. This package combines 3D CAD facilities with the ability to produce 2D drawings and other outputs from the result.



Emco/Pro-Machine Tools

17 Station Road Business Park,
Barnack, Stamford PE9 3DW.

T. 01780 740956.

W. www.emcomachinetools.co.uk

E. sales@emcomachinetools.co.uk

Those looking for a choice of small machines and accessories could surely find something suitable from the EMCO and WABECO Machine Tools ranges of lathes and milling machines on this stand.



Hafix Industrial Products

Park Royal House, 23 Park
Royal Road, London NW10 7JH.

T. 020 8969 3034.

E. sales@hafixs.co.uk

W. www.hafixs.co.uk

Hafix is described as "the high performance glue with a long shelf life". In today's modern modelling world with



ever more exotic materials being used, such adhesives are becoming ever more important. Hafix can be used with most materials including porcelain, china, crystal, glass, metal, wood, MDF, rubber, plastic, ABS, and PVC.



HJH Tooling

Southcroft, Chapmanslade, Westbury, Wilts BA13 4AU.
T. 01373 832756.

E. hazeljhjtools@aol.com

HJH is a small independent trader supplying high quality new and used engineering tools for model engineers and had a range of tools and other useful items on show.



Home & Workshop Machinery

144 Maidstone Road, Fooks Cray, Sidcup, Kent DA14 5HS.
Tel: 020 8300 9070.

E. stevewm@btopenworld.com
W. www.homeandworkshop.co.uk

Home and Workshop Machinery had a wide selection of equipment and machine accessories at the show and their stand was always busy with those looking for that special tool, instrument or piece of kit.



JB Cutting Tools

The Cottages, Hundall Lane, Hundall, Sheffield S18 4BP.
T. 01246 418110.

The range provided by JB Cutting Tools has grown over the years and this year was no exception with a wide range of tungsten carbide and ceramic milling and turning inserts available for visitors.



LA Services Ltd.

Bramcote Fields Farm, Bramcote, Warwickshire CV11 6QL.

T. 01455 220340.

W. www.theengineersemporium.co.uk

E. info@theengineersemporium.co.uk

L.A. Services Ltd. or the 'Engineer's Emporium' as it has become known, is a family run business that supplies a large range of casting kits for home machining together with some fully machined kits and second-hand models. The company also provides a range of other services including restoration projects, new builds, boiler re-tubing and certification.

Le Tonkinois Varnish

T. 01628 629892.



W. www.letonkinoisvarnish.co.uk

E. mail@letonkinoisvarnish.co.uk

For those looking to finish that woodwork or cabinet making project, Le Tonkinois varnish and the Flexidisc sander will have been of interest. In addition to the products some superb examples of finished wood items were on display.



Magicalia Publishing Ltd.

Berwick House 8-10 Knoll Rise, Orpington, Kent BR6 DEL.

T. 01689 899200.

W. www.myhobbystore.co.uk

E. customer.services@magicalia.com

For those looking for back issues, books, binders, some bound volumes, or to take out a subscription for *Model Engineer*, *Model Engineers' Workshop* and *Model Boats* this stand was a must. Many visitors also just visited to get to know the editorial staff and to have a chat.



MJ Engineering

The Forge, Cricket Hill Lane, Yately, Hampshire GU46 6BB.
T. 01252 890777.

E. sales@mjeng.co.uk



MJ Engineering had a wide range of parts and accessories for the traction engine builder on show. These included the Fowler 3in. scale traction engine, rolled chimneys, and wheel and other castings.

Model Engineering Products

17 Sea Road, Bexhill-On-Sea, E. Sussex TN40 1EE.

T. 01424 223702.

W. www.model-engineering.co.uk

E. mep1@btconnect.com

Diesel outline locomotives are becoming very popular and for those wishing to see a range of 5in. and 7¹/₄in. gauge battery locomotives; this stand was an essential visit with several locomotives and other items on display.



Model Engineers Laser

Miller House, Main Street, Hampole, Doncaster, Yorks DN6 7ET.

T. 01302 721611.

W. www.modelengineerslaser.co.uk

E. sales@modelengineerslaser.co.uk

The use of laser cut parts for frame and other components is becoming more and more common and, with over 2,400 different parts having already been produced for model engineers, this stand was the place to visit to get that model done fast. Parts can be produced from customer's drawings, provided they are fully dimensioned.

● To be continued.



MILLING CRANKSHAFTS

John Olsen

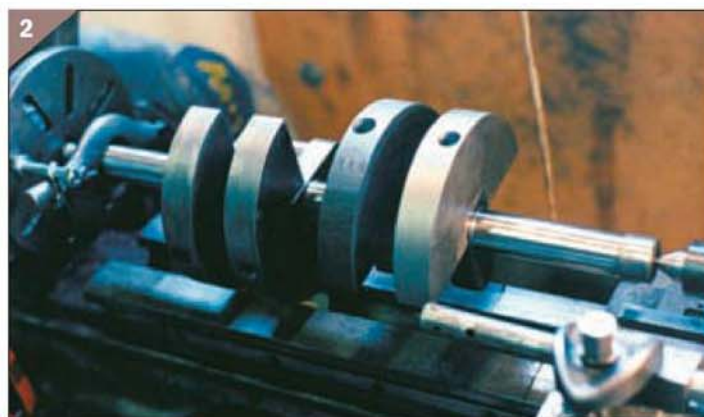
explains a technique which should prove popular now that milling equipment is more common-place in workshops.

Professor Chaddock suggested the possibility of milling crankshafts in *Model Engineer* many years ago. Despite this the method has not been widely adopted. Now that milling equipment of various sorts is now more common in the model engineer's workshop, perhaps an explanation of the technique may be of use to many readers.

Crankshafts have been made in many ways. Some people make them up in pieces and press or braze them together. This can give good results, but evidently requires skills that I do not possess as none of my attempts were ever any good. Although it may sound like a more difficult approach, I have in fact had better results with crankshafts machined from solid. The traditional method for one-piece shafts is to turn them in a lathe, starting by marking out and drilling centre holes on the ends of a suitable bar. These correspond to the centres of the main journals and the big end journals. The bar is then turned between centres and

1. Milling the Spheroidal Graphite Iron casting for the Leak compound engine. Excess material left in the corners will be used to form a radius. The dog clamped on the centre in the Vertex dividing head clamps onto a stud screwed into a tapped hole.

2. Finish turning the balance weights in the Myford ML7. The short end portion held in the grinder can be seen. This was turned down to match the main journal.



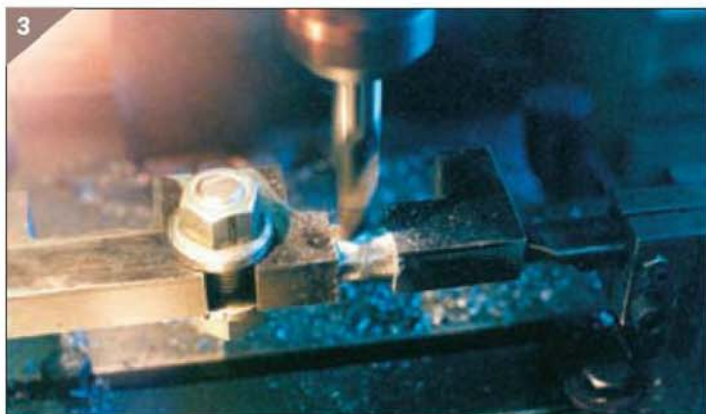
each journal is turned to suit. Simple enough to say, but this requires turning tools that will reach down between the webs of a crank and turn the journal at the bottom. Such long thin tools tend to be limited in the rate at which they can remove metal. The shaft must also be driven by a lathe dog, and the combined torque and end loads may make the shaft collapse.

This makes it desirable to remove as much material as possible before starting the turning. Any available process may be used for this, including chain drilling, the hacksaw, and the chisel. I once used a shaper to remove as much as possible, taking the crankshaft to the stage of being a slightly oversize square replica of the desired shape. While that helps, the corners are not nice to turn away with a long skinny tool.

By taking a centre drilled blank crankshaft and mounting it between centres on a milling machine, most of the material may be removed with a slot drill. The advantage of this is that the slot drill may be just under the size of the desired space between the webs, leaving just

a little to face off each side. Such a slot drill is much more rigid than the long spindly lathe tool. The slot drill will not leave a finish on the journal that you could run a bearing on, so you will need to leave the journal slightly oversize and take a last skim with the long skinny tool. This tool can also leave a radius on the inside corners, as is desirable. Sometimes the depth of the web is such that a long series milling cutter will be needed. Slot drills are preferable to end mills for this work since they can plunge downwards to put more cut on. I have mostly used standard or long series two-flute slot drills, but have also tried a three-flute cutter.

My initial applications of this technique were on a Unimat 3. This lends itself to the purpose, provided you have the optional bar to allow mounting the milling attachment on the cross-slide. I used this arrangement to machine a crankshaft for a Stuart Double 10. This is probably about as large a crankshaft as you could mill and turn on the Unimat. For that one I did not have any special mechanism to control



3. Milling a journal for the Stuart number 1. The bolt and washers support against end loads.

4. Milling the chucking pieces from the nearly finished shaft.

5. The blank for the Stuart triple crankshaft with the marking out aids.

6. Milling begins with one of the big end journals.

the rotation of the crankshaft so it was provided with a lathe dog and rotated by hand.

This is workable with a small crankshaft and a small cutter, but is not advised for anything more serious. For larger shafts and milling cutters, it is very desirable that the crankshaft should be secured to one of the spindles and the rotation controlled by some positive means. The best approach that I have found is to use a Vertex dividing head mounted on the table of the mill, with its tailstock mounted on the other end. My Vertex does have the disadvantage that the dog provided clamps onto a tapered centre, which can move in the spindle of the dividing head.

The taper in mine is Brown

and Sharpe rather than Morse and is not tapped for a draw bar. Sometime I will get around to making it a new one. Drive can be taken from the screw on faceplate provided but, as may be imagined, this is also prone to rotate under milling loads. I have used Loctite in both cases to discourage rotation. In any case, a little extra rotation is not too much of a problem for crankshaft milling, so long as it does not become totally loose. It is more of a concern for activities like gear cutting.

Those who do not have similar dividing equipment should consider that a pair of centres plus a positive means of rotating the shaft is all that is needed. The centres must be the same height, and should be reasonably well aligned with the travel of the mill. This may sound a little casual, but remember we are still going to make the last finishing cuts on the lathe. So long as the extra left for the lathe exceeds any error all will be well.

The accompanying photos show the technique in action. The first example in **photo 1** is a large crankshaft almost completed. The main journals



have all been done and the last big end is being milled.

It will be noted that the journals have been left with material to form the radius in the corner. This crankshaft was not finished on the lathe, as it is rather too big for my Myford. It was sent in to a professional automotive crankshaft grinder, who provided the excellent finish seen in **photo 2**. This is with balance weights added. These are being trued on the outside using the Myford. It will be seen that offset turning of the big end journals would not have been possible. Clearance over the saddle would have been a bit problematic! The enlarged portion on the end of the main journal was the piece used in the crankshaft-grinding machine to hold the job. Removing these and trueing the balance weights were the only operations done in the lathe on this crankshaft. This is the crankshaft for my compound launch engine, based on the 3 + 5 x 3in. Leak design.

The second example is a single throw crankshaft for a Stuart Number One, **photo 3**. This was for a set of castings that was rather incomplete, I hasten to add through no fault of Stuarts. They came up at a club auction, and at the equivalent of about £5 for a Number 1 and a Double 10, I was not going to complain about a few missing pieces such as cylinders. For the crankshaft a suitable blank of black mild steel bar was chosen from the junk pile and annealed. This is always a good move when machining complex components from bar, especially bright drawn but also for any material of unknown

provenance. The bandsaw was used to remove excess material. It will be seen from the photos that the big end journal was done first, before removing any excess from the main journals. This leaves more stiffness in the bar. Once the big end is machined, it is supported by bolting it up good and tight with a pair of flat washers. If you plan the order of machining to suit, you can remove the offset chucking pieces before doing the main journals (**photo 4**), although I seem to have left them on in this case. Wire the dog so that the job cannot move both for the milling and the turning part.

The final series of photos illustrates my 'magnum opus', at least so far in this field. This is the crankshaft for a Stuart Triple. As received this set of castings was rather incomplete, containing only the bedplate. I bought this cheaply at a club auction, mainly because it would give the opportunity to do a really interesting crankshaft. I chose to machine the entire shaft including all the eccentrics from one piece of free cutting steel. In order to do this it was necessary to





play with the valve gear design to allow the advance on the eccentrics to be 60deg. rather than the 55deg. specified by Stuart. Practically this will make little difference to the performance of the engine, and it allows the same three centres at each end to serve for all six eccentrics. Care must of course be taken to provide each cylinder with a pair of eccentrics that will be useful to it.

The work was begun by facing the bar on each end. It was marked out with the height gauge and a jig was made to allow drilling the centre holes on each end, **photo 5**. The extra centres for the eccentrics can be seen in the jig. A single line scribed along the length of the bar with the aid of V blocks allowed setting this to the equivalent position at each end. Some thought should be given to making sure the centre holes at each end of a shaft are properly aligned as it is possible to machine the crank pins on a twist if the centres are out of place. This would not be conducive to good big end life.

Having drilled the centre holes, the job was transferred to the milling machine and

the machining began with the big ends, **photo 6**. This order makes sense to me since once they are done, you can support the gap with a block. The machining of the main bearings is done with the job rotating on its main axis, so is less prone to cause trouble. In this particular case, I roughed out the main bearings with the mill, leaving them more oversize than normal. Next I machined the eccentrics, and finally brought the mains to size, **photo 7**. The eccentrics were the hardest part, due to the need to turn them to two diameters to leave the ridge that retains the eccentric strap.

For this particular shaft, I retained the spacers with Loctite. With after the fact wisdom, I do not advise relying on Loctite alone, as the heat of milling is sufficient to weaken the bond. Fortunately no disaster ensued, one spacer simply showed signs of moving a little. I suspect that this would have been a serious problem had the shaft been rotating fast. It is a good idea to make the spacer a good tight fit between the webs, and the Loctite will help but it should also be retained by another means.



Making the spacer in two pieces so that it has a hole to clamp around the crank pin will allow it to be retained positively, while also allowing the crank webs to be machined on one or another of the settings. With this shaft they are machined on the same setting as the main bearings and then the sides of the web are machined away. This leaves a balance weight opposite the pin. Some shafts do not have weights, and some machine the ends of the webs on a centre between the shaft centre and the big end centre. In either case it is desirable to be able to machine the ends of the webs, so it is preferable not to allow the support block to obstruct this.

Each journal was finished in the lathe immediately after the milling, **photos 8 and 9**. This ability to transfer a part quickly from one machine to another without loss of accuracy is a major advantage to turning between centres, a technique that is far too frequently neglected in favour of chuck work.

The finished result shows that this is a viable technique for making quite complex shafts, **photo 10**. It will perhaps have occurred to others that if a tool post grinder with a

7. Finish turning the second journal in the lathe.

8. With all big ends completed milling begins on the main journals. These were roughed out before milling and turning the eccentrics.

9. Nearing completion. The completed journals in the centre are supported by a piece of pipe turned to length and split to allow squeezing it into place.

10. The finished shaft after milling the webs away to make balance weights.

sufficiently large but narrow wheel was available, the journals could all be ground. This would require a grinder that turned slowly enough to allow a wheel that could reach into the deepest space, which will be that between the webs. Although many do not like the idea of grinding in the lathe, this would be well worth considering for long slender shafts like this one. Considering the small number of such shafts likely to be attempted, the trouble of covering all slides and cleaning up carefully would be well justified for the benefits. Even without such refinements, I am sure that others will find that milling shafts is a better approach than turning.

ME

STUART MOD SHAPING MACH

PART 2

Continued from page 679
(M.E. 4314, 7 December 2007)

Anthony Mount continues the description of this model of an early 20th century shaping machine starting with part 3, the table.

A little casting looking like an angle plate is supplied for the table and this bolts to the apron and would carry the work piece on a full-size machine. All the edges and faces need to be machined. Holding the item presented a problem, as it is quite small.

One face was filed flat and two packing pieces made up of equal size to go either side of the web and clamp the filed face within the machine vice. The other face was then machined flat with an end mill. This face was then clamped within the machine vice and the filed face machined. At the same settings the front and bottom edges were machined.

It was now possible to clamp the casting on machined faces in the machine vice to be able to machine the ends. With the casting to size the bolt holes could be drilled.

The three grooves in the top face represent T-slots, and can be produced with either a $\frac{1}{16}$ in. slot drill, risky as this size of cutter is very flimsy, or with a $\frac{1}{16}$ in. thick slitting saw, much



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safer as the saw is much stronger than the slot drill. The completed table in primer is shown in photo 11.

Pulley (part 17)

Though not a casting the pulley blank is supplied as a length of cast iron bar and this can be machined at the same time as the castings to finish off the cast iron work.

Set to run true in the 4-jaw independent chuck and face off the end and centre. Give tailstock support and turn down to the largest diameter. Turn the steps flat first of all, but you will notice that they are crowned for the flat belt to run around. The crowning is achieved by a little free hand juggling of top and cross-slide handles and the judicious use of a fine file to merge the slight

steps into a smooth curve.

Drill through and open out to a close fit on the shaft. Bright mild steel as supplied for the shaft is always made slightly under nominal size. If you ream the hole it will be a loose fit on the shaft. If you have a small boring tool the hole can be drilled under size and opened out to fit. I used metric drills and found that a 7.8mm drill gave a very nice fit on the shaft.

Part off the pulley, reverse in the chuck with the jaws on the 1in. dia. step and, with very light cuts, face off the end and turn the small spigot. Alternatively, hold the pulley on a $\frac{5}{16}$ in. expanding arbor and face off the end. Cross drill and

tap for the grub screw. A completed pulley can be seen in photo 12.

That completes the cast iron work so we can now clean down our tools and start on machining some steel.



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Apron nut (part 1)

If you have one, put up the 4-jaw self-centring chuck on the lathe (or alternatively the 4-jaw independent chuck) and holding a piece of $\frac{1}{4}$ in. square mild steel bar face off the end and turn down a $\frac{3}{16}$ in. diameter spigot that is threaded $\frac{3}{16}$ in. x 40tpi.

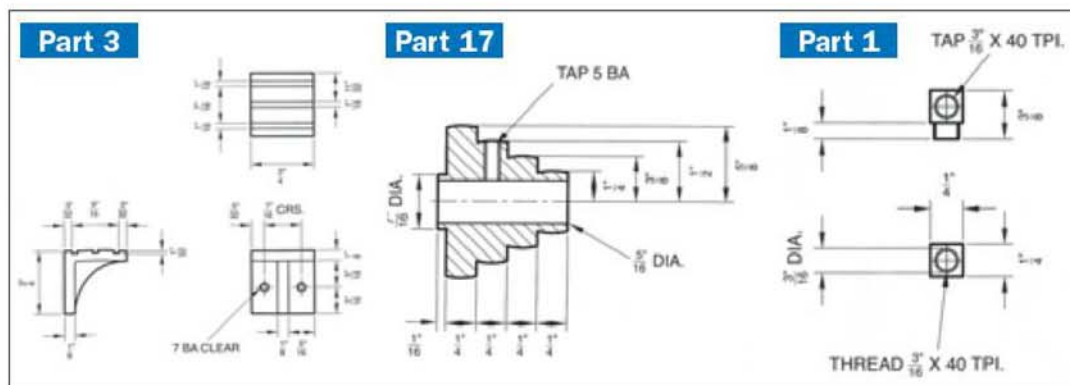
The thread is only $\frac{1}{8}$ in. long and most dies have a lead on the first few threads that will leave a tapered thread, however after completing the thread

11. The finished table in primer.

12. The completed pulley.

13. The apron.

14. The finished leadscrew.



ELSLINE



13

as far as you can, turn the die around as the back often has a much smaller chamfer or lead and some have almost none at all, which allows you to form a complete thread almost up to the shoulder.

Hold the bar in the machine vice on the milling machine and drill through and tap $\frac{3}{16}$ in. x 40tpi. Transfer back to the lathe to part off the nut. The thread for the leadscrew could be left until later and, with the nut in position, the hole can be spotted through from the slide bed.

Apron (part 2)

The apron is made from mild steel bar and all the work can be completed on the milling machine. The lathe may be the king of tools, but on many projects there is more milling than turning.

The mild steel bar can be held in the machine vice and the first thing is to use a slot drill to machine a slot, a little under size, where the dovetail will be. Change to a dovetail cutter, and here you may come upon a problem. When the machine was being designed $\frac{3}{16}$ in. dia. dovetail cutters were available. I got mine from Chronos, who advertise regularly in *M.E.*, but it now seems that they are unavailable. Hopefully, this will change and you will be able to obtain one. You can just get away with a $\frac{1}{2}$ in. one here but not when you come to make the tool slide.

If you cannot get a $\frac{3}{16}$ in. dovetail cutter then you will need to make one yourself from silver steel. You do not need to make a multi-tooth one, a

single tooth one (something in the style of a boring tool) will do. You only have a small amount of metal to remove as the majority of the metal can be machined away with a slot drill.

While set up in the machine vice drill and tap for the nut, locate the position with co-ordinates. Note that the hole is flat bottomed and you need to go as deep as possible without breaking into the slot at the front.

Turn over and put in the slots, which can be clearly seen in **photo 13** of the completed apron. Do this with a small slot drill or preferably with a slitting saw. Drill and tap the two holes for the table (angle plate).

A word of caution on bright mild steel bar. It gets the bright

finish from being cold rolled and this process imparts stresses into the material. When you machine it these stresses are released. If the machining is equal around the bar it will generally stay flat, if unequal the bar may bend.

The stresses can be removed before machining by heating the bar up to red hot, holding it there for a while and then letting it cool slowly. The old advice was to put it in the fire in the evening and let it cool down overnight. But if you have central heating this is difficult to achieve. Black mild steel, which is hot rolled, does not have this problem.

Leadscrew (part 5)

The leadscrew starts off as a length of $\frac{3}{16}$ in. dia. stainless

steel rod, however I changed my material to free cutting bright mild steel (FCBMS) as it is

much easier to machine. Turn down one end to $\frac{1}{16}$ in. dia. and thread 5BA. Make sure your knife tool is sharp as thin rod like this can easily bend away from a blunt tool leading to a tapered cut. Have only just enough material proud of the chuck to keep it as stiff as possible.

Pull out more material from the chuck and thread it $\frac{3}{16}$ in. x 40tpi. Pull out yet more material and turn down the other end and part off. Reverse in the chuck and, to protect the thread, hold the screw in a split brass bush for threading the other end 5BA. **Photograph 14** shows the completed screw.

Slide bed (part 6)

Machined from mild steel bar the slide bed is another job for the milling machine. Start by squaring off the ends and bringing it to finished length using the side of an end mill

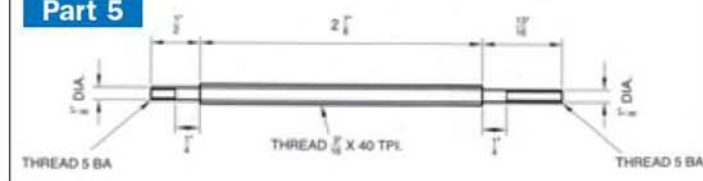
and with the material in the machine vice. Drill a hole each end of the slot and join the holes together with a slot drill.

Use an under size slot drill as in this size they can bend and wander a bit especially as you will need to take a number of passes because of the thickness of the material. With the slot formed, the sides of the slot can be cleaned up bringing it to the correct width.

Drill and tap the fixing holes and upend the slide to drill the end holes for the leadscrew bearings. With the material in the air, so to speak, it is not at its most secure and a largish or incorrectly ground centre drill can cause the blank to wobble, so start off with a small centre drill. This may be one of the odd cases where a more secure setup can be found by using the vertical slide in the lathe.

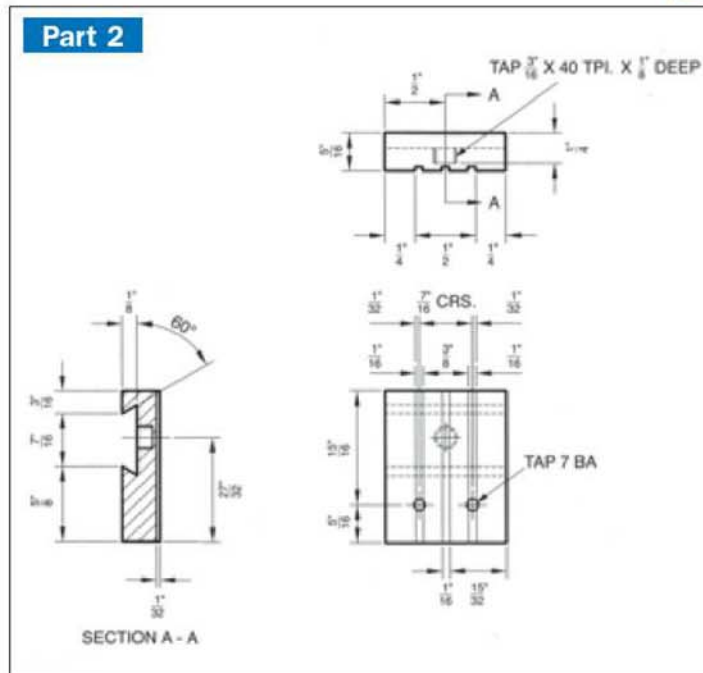
Clamp the bar horizontally in the machine vice to form rebates with an end mill either side of the slot and then use a dovetail cutter to finish off the

Part 5



14

Part 2



15. The finished slide bed.
16. The cross feed handle.
17. The crank disc.

15. The finished slide bed.
16. The cross feed handle.
17. The crank disc.

section. As mentioned before there are no gib strips to adjust the fit so take great care in the machining of the slides. When complete it should look like **photo 15.**

The leadscrew is supported in bronze bushes each end of the slide. Only a short length of material is supplied, insufficient to machine both bushes and maintain a good grip on the material in the chuck. So either use an additional piece of bronze or silver solder the length you have to a piece of mild steel, which can then be gripped in the lathe chuck.

Face off the end and then drill and ream the centre hole. Turn down the end to give a tight push fit in the slide and part off. Reverse and face off the flange to length.

A simple little job, using a length of 1/8 in. dia. mild steel

rod. Turn down
the end to $\frac{3}{32}$ in.
diameter. Set over the
top-slide about $1\frac{1}{2}$ deg. and
turn the taper then part off.

The handle to turn the apron leadscrew is made from $\frac{7}{8}$ in. dia. mild steel rod. Face off and drill and tap 5BA. Turn the boss and partly part off. Form a couple of chamfers either side and merge them with a file to form the rounded edge to the handle.

Mount a $\frac{1}{8}$ in. dia. cutter in the toolpost, shaped like a D-bit and plunge in to form the sinking moving it from side to side to form the full width. Even a cutter this narrow is prone to chatter so take only light cuts. Complete the parting off and reverse in the chuck to face off and to repeat the operation with the D-bit.

Set up the dividing head on the cross-slide and index round to drill the four lightening holes and the smaller hole for the tapered handle. Complete the job by pressing in the handle or use Loctite to produce the handwheel shown in **photo 16**.

The simplest job on the whole machine, just part off a couple of $\frac{5}{16}$ in. dia. mild steel washers from a length of bright mild steel bar.

The second simplest job is the crankshaft, which is a straight length of $\frac{5}{16}$ in. dia. bright mild steel rod. Face off both ends bringing it to finished overall length and lightly centre both ends for appearances sake.

The crank disc is a short length of 1in. dia. bright mild steel. Hold it in the lathe chuck and face off, centre drill through, open out and finish

by boring to a tight push fit on the crankshaft. Turn the small spigot, and then transfer to a dividing head to put in the crankpin hole. **17**

Part off in the lathe then bore out soft jaws to take the crank disc and clean up the parted off face.

Change to the milling machine and, clamping the disc in the machine vice, locate the tapped hole positions with

co-ordinates and drill down to tapping size. It is best to at least start the tap off at the same set up to get the thread true. **Photograph 17** shows the completed disc crank.

The drive bolt passes through the ram and carries the end of the connecting rod; hexagon bright mild steel bar is supplied for this component. The problem with long small diameter parts is that they are liable to flex under the cutting action of the tool and end up tapered instead of parallel.

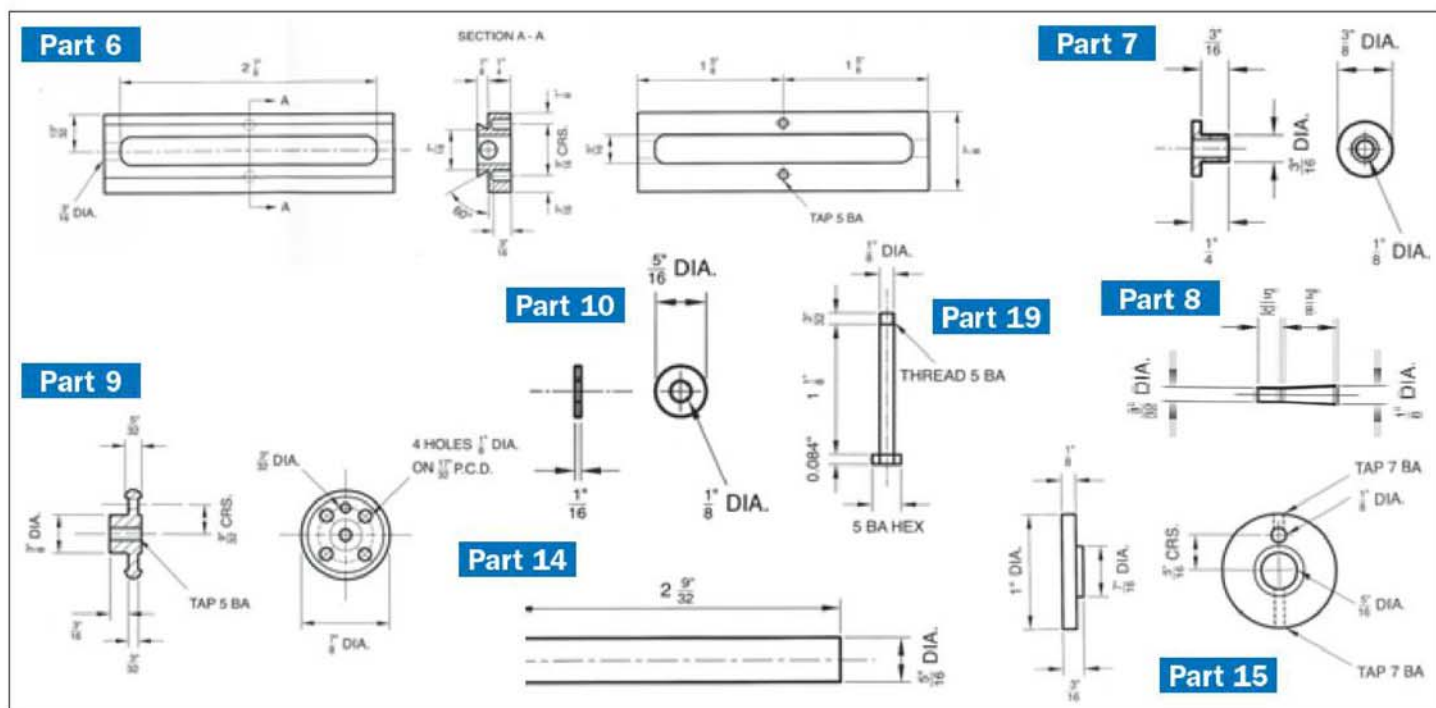
First job is to sharpen the tool so that the cutting forces are reduced. Try the tool out on a piece of scrap material to get it set to the correct diameter. Machine the bolt in one pass using a very slow feed, if not satisfied try two more passes at the same setting to work out any spring.

Thread the end 5BA.

As threading usually throws up a burr dress off the top of the thread with a very fine file

to ensure it passes through connecting rod.

● *To be continued.*



AN ENGINEER'S DAY OUT THE MUSICAL MUSEUM

Roger Backhouse visits an unusual London museum which now enjoys a new purpose-built home.

In Brentford, not far from the Kew Bridge Steam Museum, is one of London's most unusual museums. The Musical Museum has one of the best collections of mechanical music makers in Britain with examples of almost every type of machine and the opportunity to hear live music. Live music? Yes, these are not reproductions, for in almost every case the notes are made by an instrument, programmed and played according to electrical, pneumatic or mechanical controls. While people love music they are not always willing or able to master the skills of an instrument and mechanical music filled an important gap before sound recordings became commonplace. It is a specialist and fascinating branch of technology which has a growing number of enthusiasts.

Like many unusual museums this originates from the enthusiasm of one man, the

late Frank Holland, originally to display his collection of player pianos which still form a large part of the collection. However, it has developed to cover the range of instruments from street pianos to a Wurlitzer theatre organ. The museum offers guided tours so that visitors can see and hear instruments being played.

Some of the first mechanical music devices were musical boxes. They were popular on the continent from the end of the 18th century and owed much to clock making skills. The first used hundreds or thousands of pins set in a cylinder to pluck tuned metal strips. This could only play one of ten tunes and that but of short duration. Nor could these cylinders be mass-produced easily. The principle still remains in use.

One of the major advances in mechanical music was the adoption of the control mechanism used in the



Jacquard loom. This used linked punched cards to control the loom and create patterned textiles. These can still be seen controlling huge fairground organs of the Marengi and Gavioli types, unfortunately not represented in this collection no doubt for space reasons but similar domestic instruments used the system and these can be seen. Less exotically they controlled street barrel organs. A later application was the Hollerith card used to programme IBM computers until the 1960s.

The more robust machines used a punched metal disc as in the Polyphon, developed in Germany in the 1890s where a tracker bar actuated notes which was just like the cylinder. Similar discs could be easily punched out which were easy to store and libraries of tunes could be built up. By 1914 even automatic changers had been developed but they could not overcome the fundamental weakness that even with a big disc only short tunes could be played.

The most used control was through punched paper tape or paper rolls. Their greatest

1. Hupfeld Phonoliszt-Violano violin player of 1908 used pneumatic mechanism. Each violin has just one operating string, others are for harmonics and appearance.
2. Piano player attachment - this operated by pressing keys directly.





3. Operating mechanism of Welle Organ.
4. Wurlitzer console. Operating mechanisms and instruments are hidden as they would have been in a cinema.
5. Violin player.
6. Clarabella café organ built by Popper and Co. of Leipzig. The rolls below actuate lights and movement as well as music.
7. Polyphon.
8. Organ with figures.

use was in player pianos of which the museum has many fine examples. The roll would feed over a tracker bar with holes. Air would feed through the appropriate hole and through a network of pipes to operate the playing of the keys. In earlier player pianos these pipes were lead, making them extremely heavy machines but were later replaced by rubber tubing. One of the early stages demonstrated in the museum

is the 'piano player' or 'push up'. It is a mechanical roll operated device powered by pedals, which, placed in front of a piano keyboard, would operate by levers a row of 65 wooden 'fingers' placed above the keyboard.

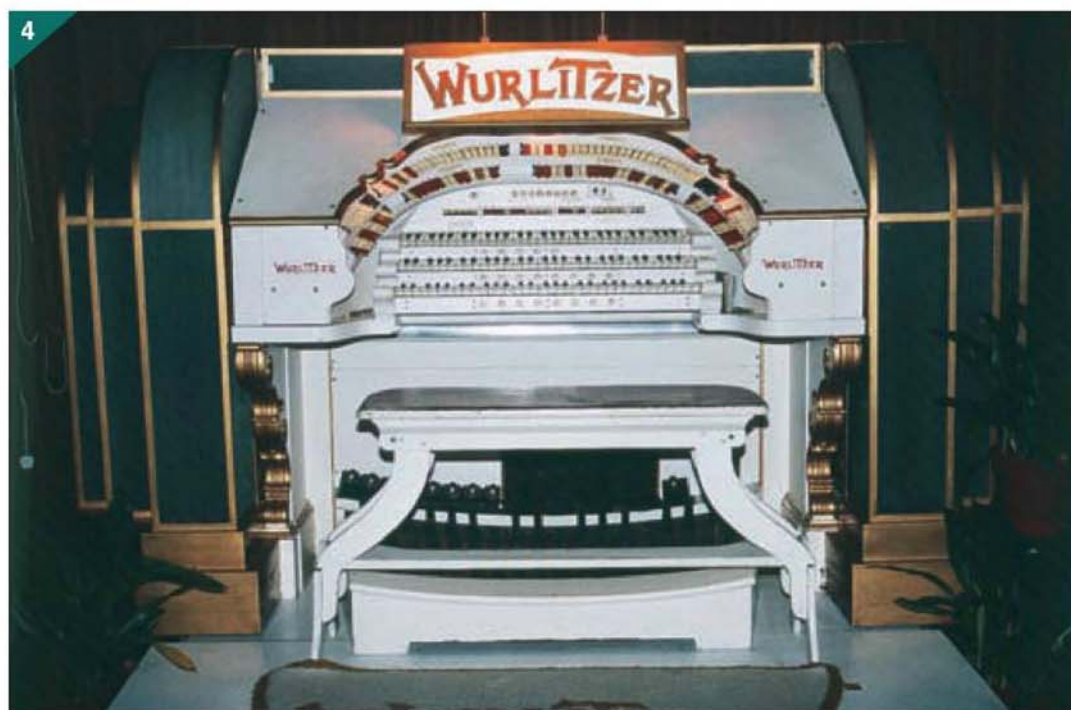
These devices were soon superseded by the player piano or 'pianola'. These were integral with the piano and played through internal mechanisms rather than

directly striking the keys. The human 'player' could add expression by using levers set in front of the keys. Although originally pedal powered these were later replaced by electric mechanisms.

Player pianos became very sophisticated. Firms like the American Piano Company (Ampico) and the Aeolian Company (Duo-Art) developed reproducing grand pianos of near concert quality. These used a technique devised by Edwin Welte of German to include the subtle nuances of expression, phrasing and tempo on a piano roll. A pianist could record on this system and have work reproduced as originally played. We can still hear the 'live' performances of George Gershwin, Dame Myra Hess and Sergei Rachmaninov. Musicians dispute whether a 'real' performance is better than a good audio recording but the sound of reproducing pianos in the museum is superb.

Rolls were also used to operate pipe and reed organs. These reached high levels of sophistication, craftsmanship, musical quality and expense. Hearing these played one can appreciate the quality but even at the turn of the 19th century they could cost £600 or more. Even bigger reproducing pipe organs were built for large private homes by firms like Welle and Aeolian. They could play orchestral type music imitating flutes, woodwind and strings. The museum has two fine examples.

The culmination of this type of instrument came with the theatre or cinema organ. Once every large cinema had its mighty Wurlitzer or Compton. (They were always 'mighty'). Seated at the console the organist would rise majestically from the floor at the start of every performance. The museum's Wurlitzer, like other models, incorporates the ideas of a British organ builder, Robert Hope-Jones, using hundreds of organ pipes, percussion instruments and a range of sound effects. Although intended for a human player the museum example





is fitted with a rare music roll attachment to operate controls. Some Wurlitzers still survive, including one at the Gaumont State Cinema, Kilburn and another preserved by the Northern Theatre Organ Association in Howden-le-Wear, County Durham.

Not every venue's mechanical music was so big. Coin-operated machines were popular in bars and cafés where volume mattered more than sound quality. The more elaborate orchestrions attempted to imitate the sound of a small orchestra. Many were made in Germany originally using wooden barrels to control playing, but later replaced by the ubiquitous paper rolls. The 'Clarabella' is a café type machine which gives a spectacle of moving pictures and lighting effects operated by a network of belts and pulleys backed by strident music. Less flashy orchestrions with better sound were also

used in private homes.

Mechanical music is easily dismissed as glorified musical boxes but the museum has enough instruments to demonstrate high quality sound. Two of the most remarkable are violin players. The rare example of a German Phonoliszt Violana was intended for well off homes and pneumatically operated. Its smaller American counterpart, said to have been used in 1930's speakeasies, was the Violano-Virtuoso. This was a coin-operated violin player totally electrically controlled. Not only does the mechanism play the violins but also it keeps the strings in tune.

Visiting the museum

The museum offers 90-minute guided tours in which many instruments are demonstrated. Tours are often highly entertaining as the volunteer guides are real enthusiasts for their subject. Volunteers also carry out much of the conservation of machines and music rolls.

The Musical Museum is at 399 High Street, Brentford, Middlesex TW8 0DU, T. 020 8560 8108. It is easily reached by public transport being less than 10 minutes walk from Kew Bridge Station (trains to Waterloo) and 20 minutes from Gunnersbury (District line and mainline services to Richmond, Stratford and North Woolwich.) Buses 65, 237 and 267 stop outside near the door. It is close to Kew Bridge Steam Museum and visiting the two makes for an excellent day



out. Car parking is limited but also available nearby in North Road or Potteries Road west of the museum.

Opening

Tuesday to Sunday 11am - 5.30pm (last admission at 4pm). Entry £7 adults, £5 concessions, children under 16 free (must be

accompanied by an adult).

The museum re-opened in November 2007 and the new building includes a tearoom with riverside views, a shop with lots of old records and music rolls, and a concert hall. See their website for details and map etc. www.musicalmuseum.co.uk

ME





SPRING CLIPS

for spark plugs and other purposes

PART 2

Continued from page 684
(M.E. 4314, 7 December 2007)

Peter Spenlove-Spenlove completes his description of how to make replicas of the once common spark plug clip.

The spring clip in place. It is ideal for plugs subject to vibration. The ignition lead is usually fitted with a spade connection whose hole is slipped over the thread and under the clip.

To make the next loop, put a suitable peg in the second hole in the mild steel block and simultaneously pull both wire ends to opposite sides as in the drawing marked C (fig 3). Again, make sure you pull the wires tightly round the peg. This completes the middle hole, which is the one that goes on the plug thread. However, the worker should take care to get the wires to cross over correctly. This is apparent from the photographs in this and the previous article.

You can test that the second hole will grip the thread of the plug by checking the fit on a suitable drill shank. However, go easy as the wire is still soft so do not force the fit.

Now put a peg in the third hole. The size is not critical so

a piece of 3mm dia. rod will do. With the wire still firmly clamped in the Molegrips, pull both wire ends simultaneously round the pin. Stop when the angle between the wires is at about 50 to 70deg. as in the drawing marked D (fig 4). Again, note the cross over as you pull the wire so that the tails look similar and tidy.

Spring temper

With flat and round nose pliers, bend the ears to provide finger grips, snip off the surplus wire and tidy the ears. If all looks well, heat treat to spring temper. This is best done in a kiln or muffle furnace. Heat evenly and rapidly dunk the part in water held at the mouth or door of the kiln to avoid it cooling. Don't use pliers to pick up the red hot spring. Either scoop it into the water if the kiln floor is smooth or tie a piece of thin iron wire to the spring and quench the spring on the wire.

The quenching will have made the spring very brittle so do not test it yet. It needs tempering to 'blue'. I do my springs in the domestic oven in a tin lid of sand. Bury the spring lest gas flames heat

exposed spring parts too much. Electric ovens are easier in this respect. It is difficult to say how long the tempering will take but bury several pieces of wire along with the spring. Remove one and use a small sharp file on it. If the file skids then leave the sand and contents to cook a little while longer.

Try another wire five minutes later. If the file can mark it then it is softer now. Try bending it to see if it is springy. If so tip the tin lid and contents into water. However, if the wire snaps (use gloves while trying this test) it is still too hard. Give the heat treatment another minute or two. None of these operations will harm the oven and the thermostat can be adjusted ready to cook the Sunday roast after you have finished your work for the day.

Bulk quantity

A bulk quantity of soft springs is probably best heat treated by the local spring maker who has the proper equipment. Give him a sample of the wire and, if available, the wire makers specification and recommendations. Also, tell him what your spring is to be used for.

M.E.



Fig 3

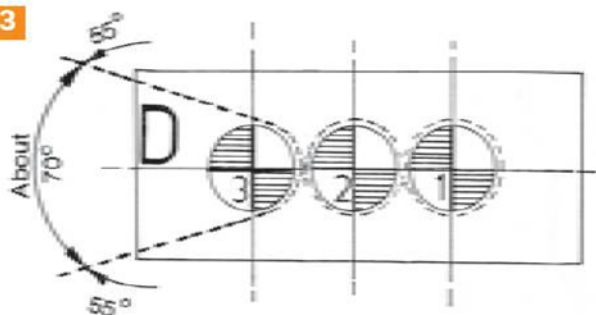
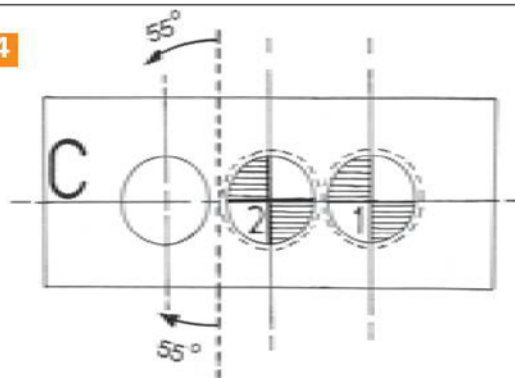
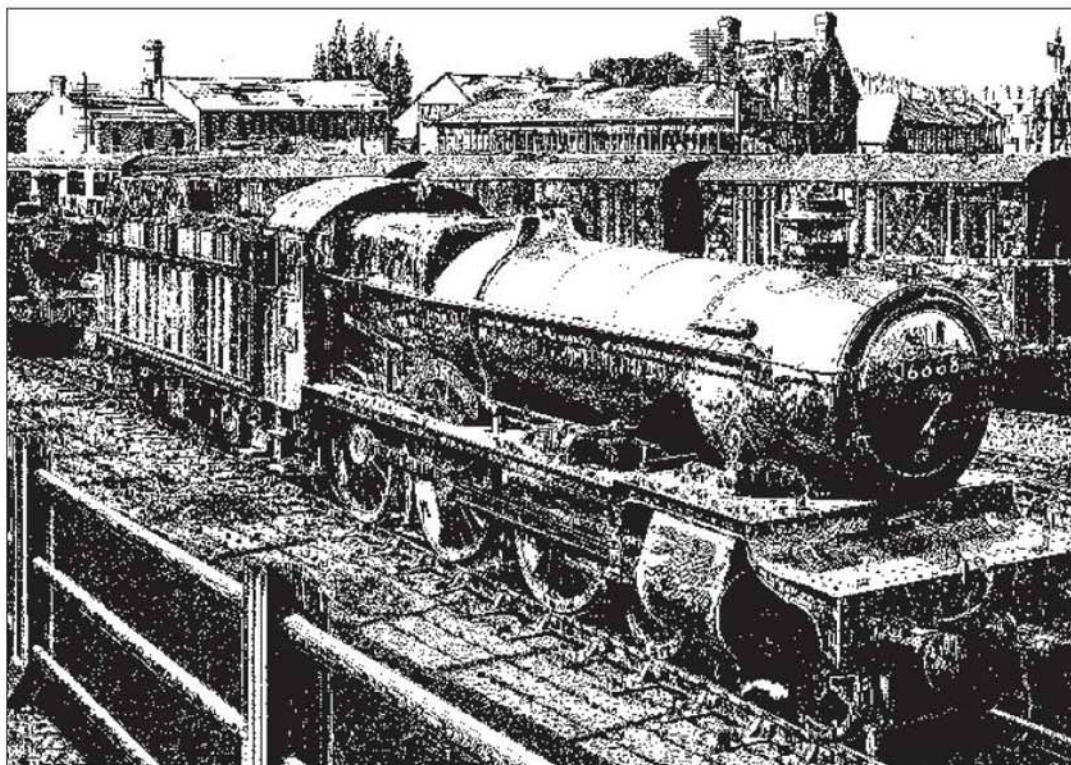


Fig 4





PENRHOS GRANGE

PART 30

Continued from page 688
(M.E. 4314, 9 December 2007)

Neville Evans
offers some
modifications to the
Ewins oil pump and
discusses lubrication

I had a long chat with friend Andy Clarke of Polly Models yesterday. Andy, who is always a source of inspiration and good sound common sense, commented that imperial sized roller clutches were a ridiculous price and couldn't we go metric? Yes of course we could, with great benefit to all concerned. Four millimetre clutches are readily available at half the price of an imperial, they are also larger, stronger and more rigid than the old $\frac{1}{2}$ in. I/D ones. I append a modified drawing which I can thoroughly recommend as an improvement on the original.

While on the subject of oil feeds in general, I should point out that

after a great deal of experiment with tubes, chokes and the rest, I can categorically say that an equal quantity of oil feed is obtainable with a single pump, provided that large(ish) pipes are used, which feed into small chokes, and that the provision of a double pump for a two cylindered locomotive is not necessary.

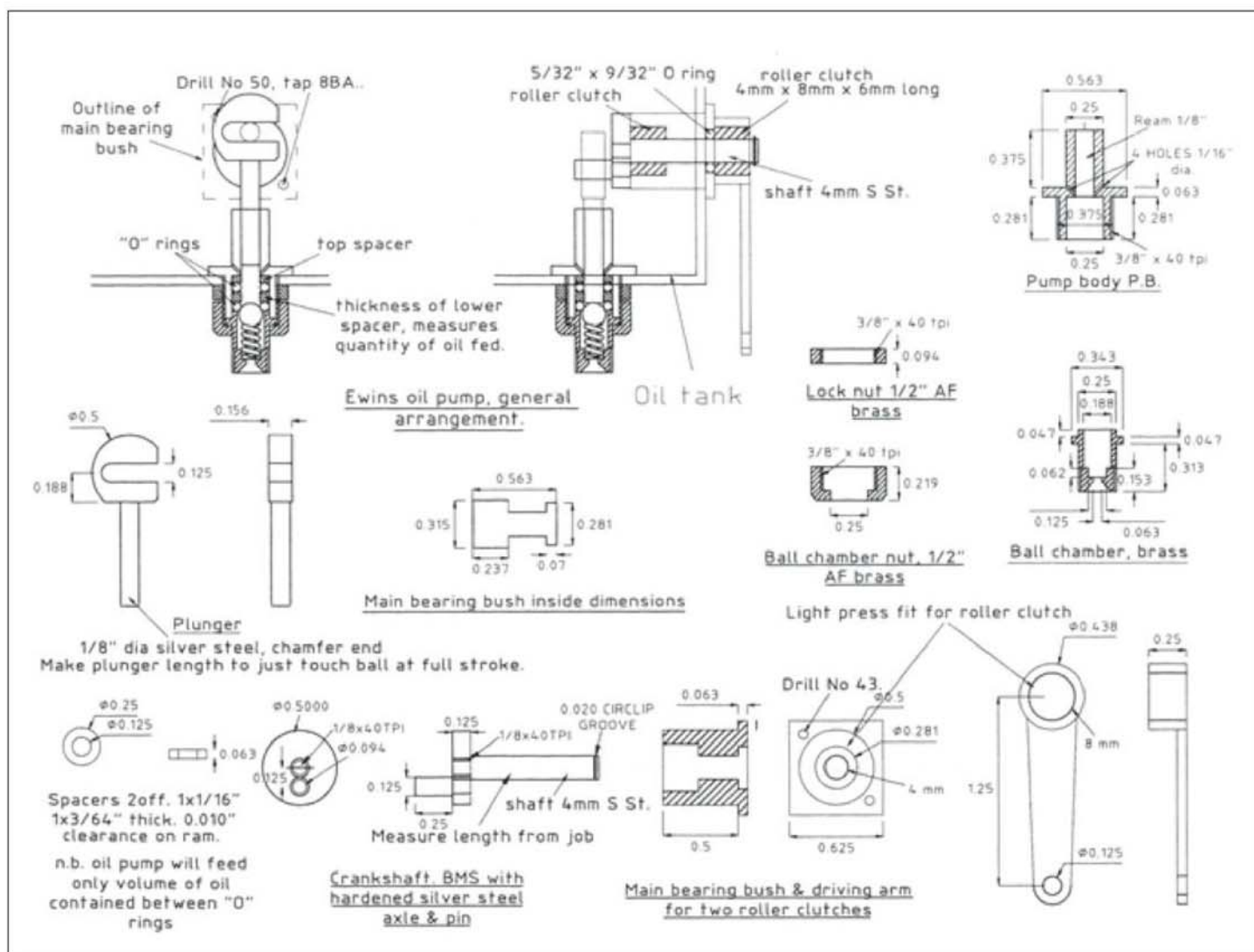
Andy and also I discussed the matter of twin pumps at some length and we agreed that if they are essential, then the ideal arrangement probably takes the form of two flat mounted horizontally opposed instruments with a common drive. If required we can simply use the existing parts to quickly assemble such a device.

Hydrostatic lubricator with sight feed

As I said last month, displacement lubricators were fitted as original equipment for most GWR locomotives and so I am adapting my friend Ivor (the engine) Roberts' system which works very well and supplies just the right amount of oil. I took the opportunity to talk to the usual band of fellow conspirators (as curly Lawrence, or LBSC as he signed his articles, would have called them). The consensus, as aptly summed up by David Aitken, was that hydrostatic is simple, so don't over design it to make it more complex. My sentiments exactly. Simple displacement type lubricators are of course as old as the hills. They work on the principle that oil is lighter than water and so if water is introduced to the bottom of an oil tank, it will remain as a layer underneath the oil. If more water is introduced and there is a hole at the top of the tank, then oil displaced by the water will flow out of the tank. In a hydrostatic lubricator, which works on the



Sight feed with side take-off.



same principle, water at boiler pressure is fed underneath the tank, oil then flows into the steam chest, which is obviously at a lower pressure than the boiler (otherwise no steam flow) and Robert is one's avuncular relative.

Snag No. 1, too much oil. Cure No. 1, place a metering device in the oil line so that it is possible to control the amount of oil fed to the steam chest.

Snag No. 2, the oil will continue to feed when the throttle is shut. Cure No. 2 shut off the oil, possibly automatically when the throttle is closed, or with a stop cock on the backhead.

Snag No. 3, how do you know how much oil is being fed? Cure No. 3, feed the oil through a glass tube filled with water or other suitable liquid, and simply count the number of drops in a given time. I would suggest that the adjustable feed mechanical

lubricator that I shall describe later could, with advantage, also use a sight feed.

Snag No. 4, hot steam is liable to mix with the oil at the bottom of the tank and form a grotty emulsion which gums everything up and renders the sight feed unreadable. Cure No. 4, introduce a condenser, just a simple spiral of copper tubing, between the boiler and the oil tank. The logical place for the condenser is up in the cab roof, where it is out of the way yet accessible for maintenance, and in a particularly draughty part of the cab, which promotes efficient cooling.

In Britain it was usual to provide separate oil feeds for each cylinder. In foreign practice however it was common for one pipe only to be fitted to the vicinity of the cylinders, from whence separate feeds were provided for each point of application. Whatever system

was employed there were some features that were common to all. The delivery pipe in full size was arranged to have a steady fall, the inclination being greater than the most severe gradient over which the locomotive had to run. Whether this is necessary in smaller sizes is a bit of a moot point, we must remember that the oil is driven from tank to cylinders by pressure differential between the two points. The greater the difference, the faster the movement. Pockets and horizontal lengths of pipe were to be avoided and chokes were located as near as possible to the point of application. These chokes in our size can conveniently take the form of a No. 60 hole in the union to which the pipe is coupled.

The basics of our system are then:

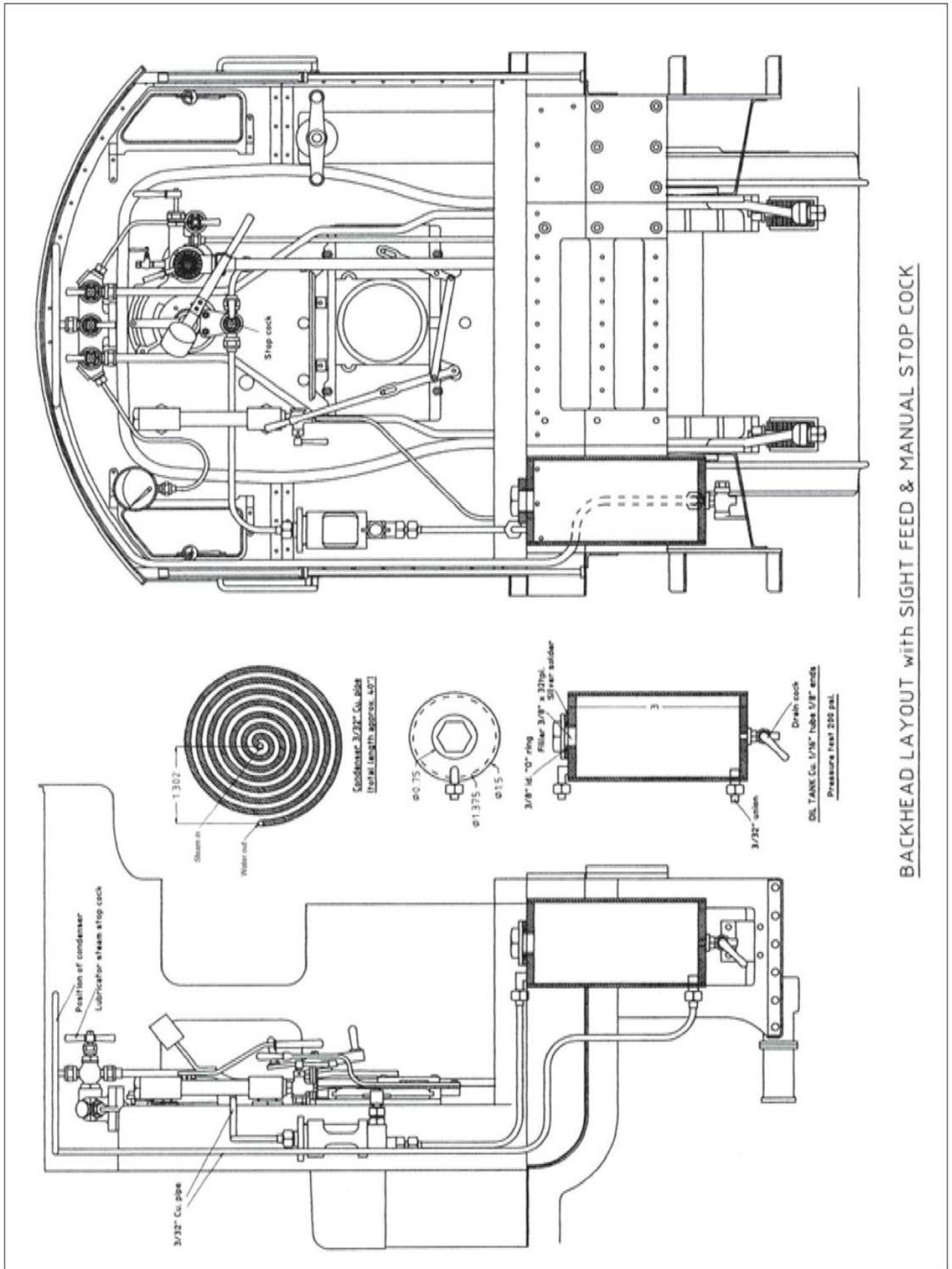
1. Steam is fed from the boiler via the top turret, and is

cooled to below condensation point in the condenser.

2. The hot water enters the oil tank at the lowest level and pushes oil out of the top through a sight feed apparatus. The drops of oil pass through either an automatic or a manually operated stopcock, which is closed when the locomotive is stationary.

3. The oil stream is fed to the smokebox via a hollow stay and separates into two equal length tubes and thence into the cylinders by way of the chokes, which have the effect of equalising the oil flow to the valves and bores.

4. A point that should be borne in mind is that we have a tendency to over lubricate the bores and therefore ourselves, by a factor of many hundreds. Common sense tells us that a drop of oil is of the same size in a 1:12 scale locomotive or a full-sized one. If a full



BACKHEAD LAYOUT with SIGHT FEED & MANUAL STOP COCK

sized 'Hall' can make do with three or so drops per minute while working flat out, then in our little cylinders, where the area of the bore is 144 times smaller, we need hardly any oil at all. The trouble is that nobody knows exactly how much is too little, we therefore work on the 'better safe than sorry' principle, oil is cheap so splash it about.

The next point that we need to discuss is that of complexity. I am of the 'if it ain't there it can't go wrong' school. Ivor likes his automatic jockey valve, David Aitken and I don't mind switching oil on and off manually. I have therefore left the jockey valve as an optional extra. One thing that I'm sure of is that the so called atomizing steam

into the jockey valve is not necessary in small sizes. In full-size its job is probably to carry the minute blobs of oil along the comparatively large diameter pipes in a cocoon (so to speak) of steam, but at smaller scales this doesn't really apply, and could in fact lead to the depositing of a tank full of oil into the boiler. Think what would happen if you left the oil switched on and the boiler cooled down leaving a vacuum therein. Could be embarrassing.

Condenser oil tank and sight feed

The condenser is fed from the turret via a stopcock and consists of a coil of $\frac{3}{32}$ in. copper tube. The oil tank is straightforward, bear in mind that it is subjected to full boiler

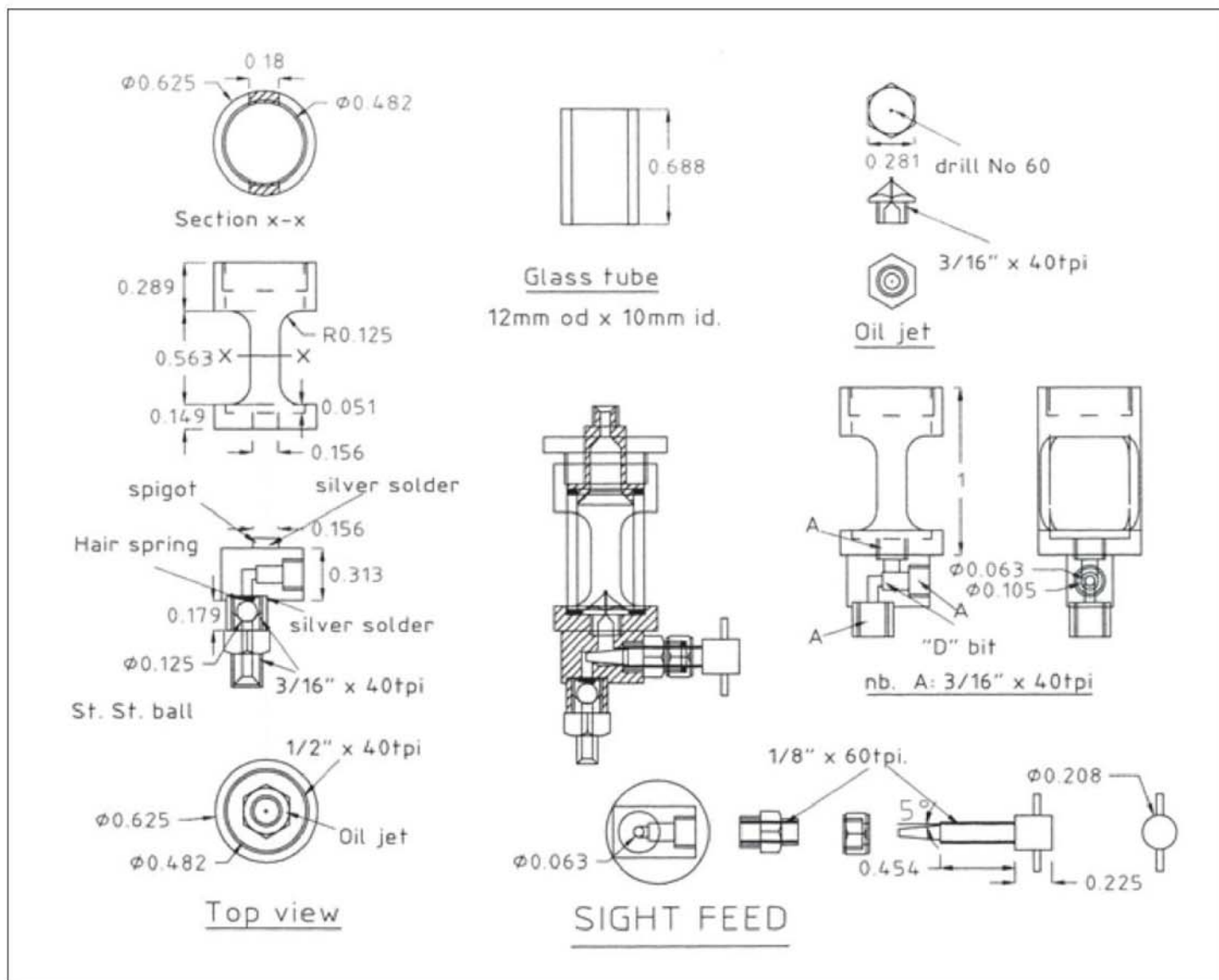
pressure and must therefore be tested at the same pressure as the boiler.

The sight feed is basically a 12mm glass tube 1mm thick. I prefer a one piece body and have shown a screw top version, that I think came first from John Hill. It is much simpler to make than to draw in a legible manner. Points to mention are that the taper on the metering valve is very slight, so it will probably be necessary to measure from the job. The $\frac{1}{8}$ in. ball, which acts as a non-return valve, is held in place by a small light spring. There is a thin red-fibre washer at each end of the glass, which should be obtainable from Polly Models by the time you read this. I'll include some filling instructions in the next gripping article.

Cock-up corner

I had a phone call from Derek Tulley just now. Derek is building the first 'Schools' and reported that there was a discrepancy on the O-ring front, between the reference that I gave in 'Stowe' Part 5 (M.E. 4284 13 October 2006), for the O-ring that sits underneath and seals the piston ring proper. The correct reference should have been HSV-120/80. This is the reference for a Viton 80 ring 1in. I/D and $\frac{3}{32}$ in. thick, to seal a Fluoroscint ring 0.375in. O/D. by $\frac{3}{32}$ in. thick, to run in a gunmetal cylinder. These rings are obtainable from the 'O' Ring Supermarket (T. 01452 733106). Ask for John Stockton, a most pleasant young man who will dispatch your order with great despatch.

● To be continued.



SENTINEL DG8 WAGGON

PART 4

Continued from page 691
(M.E. 4314, 7 December 2007)

Alan Beasley completes the description of the modified chassis of his waggon before discussing the engine.

23. A plan view of one of the side beams.

24. The parts of a king pin assembly.

25. Oil feed pipe detail.

26. Steering ball joint components.

My solution to the bump steer problem was to mount a relay bell crank lever to the middle of the front axle tube. This point moves very little vertically compared to any individual wheel. The horizontal part, as in photo 22 (M.E. 4314, 7 December 2007), connects to the steering box drop arm, and the vertical bit to an extra link as part of the front axle tie rod. The whole bogie assembly is held in relation to the chassis by two radius arms that mount to the main axle tube, these are not present in photo 22.

A plan view of one of the side beams is shown in **photo 23**.

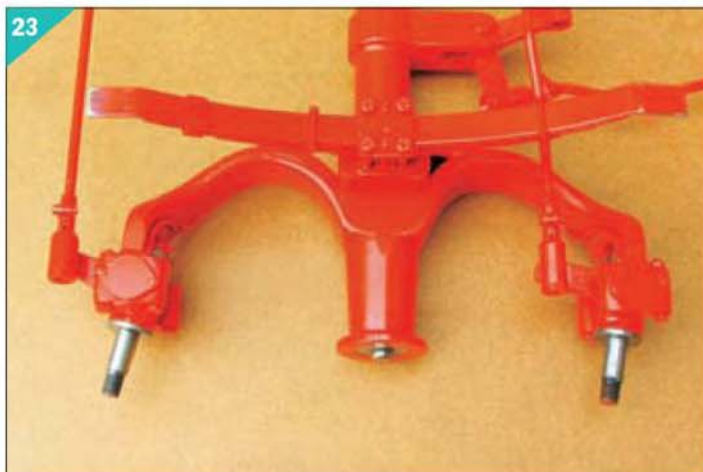
The Sentinel pattern wheels are quite deeply dished so that the tyre is beneath the king

pin axis. Hence the support beam has to have a deep inward curve to clear the tyre when on full lock. The side beams are silver-soldered steel fabrications, consisting of the central bearing bush, the two curved arms and the split blocks at their ends to clamp the king pin bushes. The side arms were profiled flat from 2 x 3/16 in. bar, and then bent red-hot over a block of aluminium which had been cast to the required shape. In the full-size waggon, these arms were hollow tubular steel castings. The small diameter curved rod like items on the inside of the beams are oil pipes for the axle lubrication system.

Photograph 24 shows a dismantled king pin assembly. The stub axle runs in a bronze

bearing pressed into the horizontal bore. A hole is drilled down to this bearing through the top king pin bearing, sealed by a short countersunk screw, and is cross drilled to the groove as shown. The oil pipe can be seen entering the top side arm bearing, and a corresponding hole in the king pin bearing shell thus allows the oil to get to the axle bearing.

Photograph 25 shows how the oil pipes are connected by banjos to the central bearing block, and then by drillings to an annulus round the main axle ends. Cross drillings and an axial bore in the main axle lead to a union on the back face of the main axle, just inboard of the spring seats. These may just be visible as silver dots in photo 22. A coiled piece of





27. The assembled steering box.

28. Outside view of the front wheel.

29. Dished rear view of the front wheel.

30. The redundant front axle beam for the DG6 waggon.

31. The assembled engine.

$\frac{1}{2}$ in. dia. copper tube from each side then connects to a dual-ram manually operated oil pump fitted in the rear side front of the cab.

This probably seems an awfully complicated way to oil the wheels, but I found that on the original DG6 model the wheel bearings had a very short life when relying on oil can lubrication due to the dust and grit that seemed to get in to them. Now a few strokes of the cab pump forces all the contaminated oil out and clean oil in. The proof of the pudding is that the axles and bearings did not need replacing at this rebuild.

I made all the steering linkage joints as ball and socket type and to approximately scale Sentinel size. **Photograph 26** shows a dismantled joint prior

to repainting. The ball, which is 6mm in diameter fits into two PTFE cups, not as the original, but one may as well use modern materials. The side of the cup in the body is filed away just enough to allow the ball stud to be forced in, the other cup is filed away a bit less, so that when assembled there is no way that the ball can pull out. One or more 2BA crinkle washers are used as shims to take up any play in the assembly. These joints have lasted well, with no lubrication other than the grease applied at initial assembly.

The steering box is of conventional worm and wheel variety and was designed, in outline, to be like that fitted to the DG6 waggon. On the DG8 it is fairly heavily loaded, so tends to suffer from play and really needs a redesign with some beefier gears.

Photograph 27 shows the steering box assembly ready to be fitted to the waggon.

The Sentinel front wheels are quite deeply dished in order to get the king pin axis within the tyre footprint so I realised that I would have to cast them. It

took a lot of thought to work out how to do it, (maybe a subject for another article) and **photos 28 and 29** show the outside and inside views of a machined aluminium casting, the least good one of the original batch of three made for the DG6. A flanged steel hub sleeve is bolted in the central hole to fit to the stub axle. Note the beads at the rim to retain the rubber tyre, I was able to use those as supplied for the Clayton model, soaked in hot water they could be persuaded to stretch over the slightly larger diameter Sentinel wheels and did not need gluing on.

DG6 front axle

The DG6 front axle was also quite an interesting manufacturing exercise. I must admit that when I first examined the full size waggon and saw how the axle was curved round behind the boiler I did wonder how on earth I was going to make it. **Photograph 30** shows the model axle without the stub axles and wheels. Again it is a silver-soldered steel fabrication.

The central I-beam section was machined from a piece of

bar and then bent hot round a suitable former. The end sections were fabricated from bits of $\frac{1}{8}$ in. bar and plate, with slots and small screws holding all the bits together prior to silver-soldering with a highish temperature grade. The three parts were then machined to fit each other to give the correct overall dimensions, the joints being under the spring seats, and the assembly completed. Note the screwed unions on top of the king pins that were used for the first try out of the force-feed axle lubrication system.

Engine

The engine of the model was fairly comprehensively described in *Model Engineer*, starting in M.E. 3850, 2 June 1989. Hence I am not going to describe it in great detail here, but just give a brief description and some pictures and some detail of the remedial work required. A photograph of the complete rebuilt engine ready for installation in the chassis is shown in **photo 31**. I made the top crankcase cover out of Perspex to allow the engine internals to be viewed; this has

been removed as have the drive chain sprockets.

When I started the design of the engine I only had the engine description to go on from ref. 1 (*M.E.* 4308, 14 September 2007), I did not have any plan drawing of the engine to assist me. Hence, what I designed is not quite an exact miniature of the DG engine, but the engine is based on the design principles of the Sentinel DG unit, and to overall, outside size and shape as far as practical for a working model and as my fabrication facilities would allow. Having seen the engine plan drawings of ref. 2 (details in *M.E.* 4312, 9 November 2007), I am not sure an exact miniature would be a practical proposition from an assembly point of view, unless one has one-sixth scale hands!

I made the patterns and core boxes for the engine crankcase and produced the casting in aluminium alloy. I am not covering the details of these processes in this article.

The engine has two duplex cylinders, with push rod operated poppet valves at each end of the cylinders, the inlet valves at the top, the exhaust at the bottom. Tubular trunk guides space the cylinders from the aluminium crankcase and carry the crossheads. Gear driven camshafts at the front end of the crankcase drive the valves, the pair of camshafts slide laterally across the crankcase to provide different cam profiles, i.e. cut-offs and reverse, to the cam followers. The lever arm in the photo at the front of the crankcase top operates the camshaft position. The two-throw crankshaft has sliding spur gears at its extremities that mesh with corresponding

gears fixed to the spur gear differential at the rear of the crankcase. This thus gives two road gear ratios, and a neutral position. The gears were not intended to be changed on the move but I can usually make an up change without horrid noises! The gear selector shaft projects through the crankcase top between the crankshaft and differential. The half shafts project from the differential through the crankcase side covers and are keyed to carry the chain drive sprockets.

The boiler feed pump with a brass expansion bottle, to the side of the trunk guides, is driven from the crankshaft to the camshaft idler gear, thus gearing it down, and a crankshaft driven steam oil lubricator pump is on the far side of the crankcase. The crankcase is part filled with a modern engine oil to give splash lubrication to the internal parts, and apart from some gear scuffing, all the bearings were in good condition and with absolutely no corrosion in spite of some moisture entry due to worn piston rod glands and crossheads. A small magnet had been screwed to the floor of the crankcase and this usefully collected the steel particles.

As mentioned earlier, the main known engine problems were worn half shafts and bearings and wear on the poppet valve stems and guides.

Photograph 32 shows half of the differential with the new half shaft in the centre bolted to the output gear and one of the two pairs of differential spur gears, all being 32DP. The flange behind the main gear housing is where one of the input gears bolts on and the end of the half shaft, with a key in the key way for the chain



drive sprocket, is to the left. On close inspection of the chain sprocket it was clear that new ones were needed, the primary drive chains were also replaced as they had stretched by about one link in 50.

Examination of the crankshaft showed that there was no discernable wear in the main or big end bearings, showing the advantage of gritless lubrication! **Photograph 33** shows the crankshaft complete with the camshaft drive gear on the extreme left and the low and high road speed transmission gears, which are slid as a pair via forks which sit in the grooves. The crankshaft is of built up construction, using 'C' section roll pins and Loctite 601, with bolted on balance weights, which made the construction easier. The shaft was 1/2 in. dia. precision ground steel rod and the crank pins were case hardened on the journals before assembly.

Dismantling showed quite a lot of wear on the piston rods and also on the little end bush and crosshead pin so these were all replaced. The trunk guides were honed out to correct for wear and also some scoring due to a loose crosshead pin at some earlier time and new brass crosshead sleeves made to fit.

32. View of half the differential assembly.
33. The built up crankshaft assembly.
34. Piston rod, con-rod, crosshead and associated parts.

Photograph 34 shows a connecting rod, piston rod and crosshead, little end pin and a piston and lock nut. The big end uses split bearing bronze shells, these were made from surplus solid bronze bearings split and re-machined to be circular again. The joint line was placed slightly angularly offset to the cap joint, and clearance grooves in the shells to the bolt shanks prevent any tendency to rotate. On final assembly the cap nuts are split pinned, it looks a bit more authentic than Nylocs.

New pistons were made, as being of aluminium alloy they had worn a bit and had suffered a little due to corrosion. The cylinders were gunmetal, and I chose to use soft packing to prevent cylinder wear. I think that the weight saving more than repays the limited aluminium piston life, and also the complete absence of cylinder wear, especially on engines like this that can rev. to over 2,500rpm.

● To be continued.



RACHEL

A wall steam engine

PART 7

Continued from page 694
(M.E. 4314, 7 Dec. 2007)

Stan Bray
completes the steam
valve and goes on
to the unusual big
end bearing for this
attractive engine.

43. The casting for the big end bearing is forked to accommodate the twin connecting rods, this creates a difficulty when it comes to machining and so a piece of brass was soft soldered between the two arms of the fork in order to give support.

44. As the part that forms the bearing is at this stage solid, it was easy enough to hold the casting in the 4-jaw chuck and machine the ends of the fork level. Make sure the arms are at 90 deg. to the chuck face by checking with a square.

The valve frame (item 17a) can be machined from a length of rectangular bar and, after cutting to length, the ends faced in the lathe, using a 4-jaw chuck. Mark the position of the screw hole and centre punch it, set the bar in the lathe with the centre punch mark running true and drill and tap it rather deeper than shown on the drawings. An alternative method that requires a slightly smaller piece of material is to silver solder a short length of drilled and tapped rod in place of the drilled and tapped hole. This idea also saves having to file the semi-circular piece round the hole to shape.

From here on it is simply a case of milling and filing the block to shape, before drilling the holes for bolting it to the steam chest. The drawings specify mild steel for the frame and needle valve. If the model is to be steam driven, using steel means that in no time at all the parts will become rusty and unusable; brass was therefore used for the frame and stainless steel for the needle.

The valve bolts on to the

steam chest and this means it goes over the top of the raised section of the steam chest cover. To obtain a good fit it was found necessary to reduce the height of the raised section on the cover and its width as well. Steam enters the valve via the lower pipe and exits via the upper one, from there it is taken in a U-bend to the steam chest. This involves making a very tight bend in the tubing and to do this it is essential that the tubing is well annealed before starting and that it is kept that way through out all bending operations. The short length of pipe that protrudes at 90deg. appears to have no practical purpose and there are two possibilities as to its use. Firstly, it could have been for a lubricator, in which case it would almost certainly have been a type with a hand pump. The second possibility is that it may have had some connection to the governor, which in itself has no obvious means of controlling steam flow. It is difficult to see quite how this would have worked but it is the most likely explanation.

The cylinder assembly is now almost complete but there is still the question of lagging. This can either be done with thin metal or with hard wood strips whichever one prefers. It can be held in place with thin brass strips and almost certainly round head screws would have been used to secure the strips in place, somewhere around about 8BA would be the appropriate size.

Big end bearing (item 18)

Described on the drawings as the connecting rod camshaft, because it doubles as a bearing and part of the connecting rod, a gunmetal casting is supplied for the bearing, which



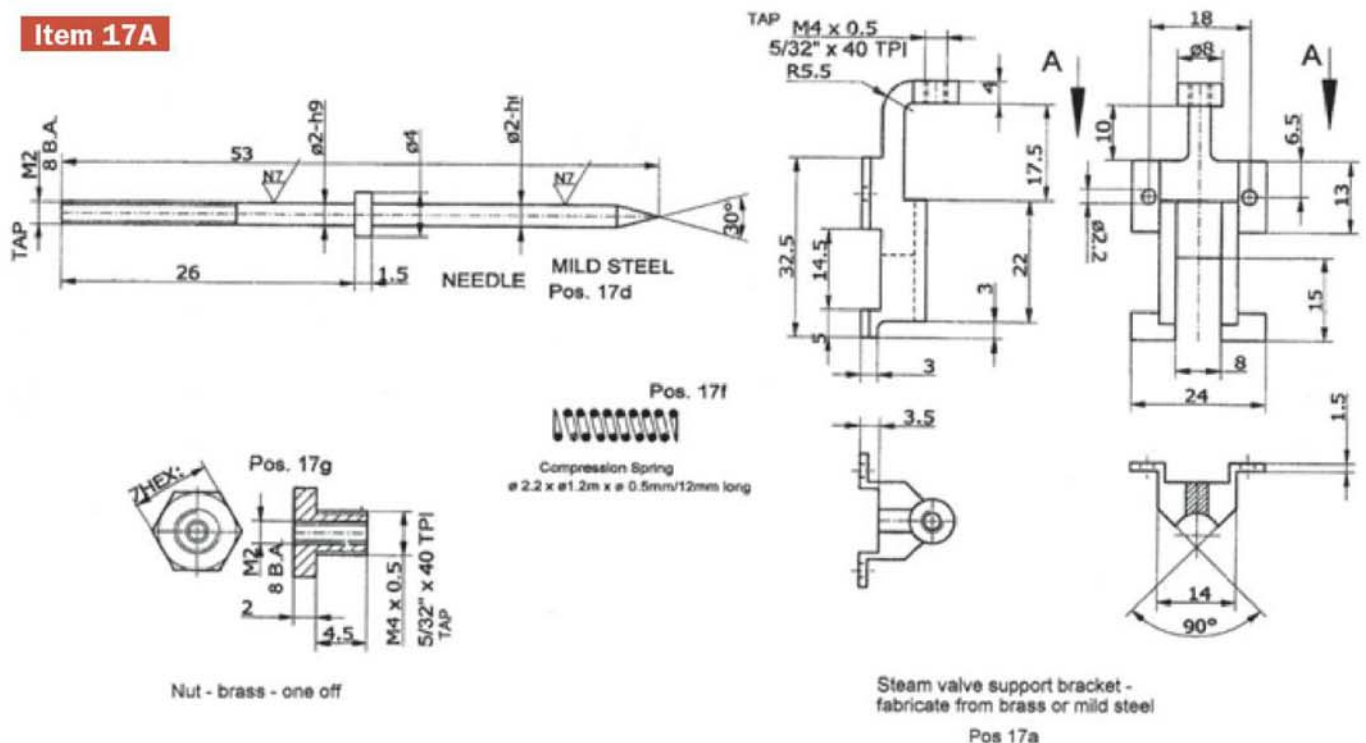
as one can see is rather more complicated than the usual type of bearing, nevertheless the principles involved in the machining process remain basically the same. It is certainly necessary to make a start by having a good go at fettling and fortunately because of the material from which the casting is made this is not too much of an onerous task. Having brought it to a decent state it is now time to think what is involved as far as machining is involved and basically this falls into three categories. The casting has to be bored to fit the shaft, it has to be split to allow it to go over the shaft and there has to be a means of securing it when it is fitted. The normal procedure is to drill and tap the holes for joining the sections, then to cut it in half and finally to bore it to size. The other task so far not mentioned, because it will come later, is the drilling and tapping of the two prongs.

The prongs in fact create their own difficulties as they appear rather fragile and also get in the way of the more normal type of machining operations. To solve the first problem and to make them much stronger and therefore less prone to damage, a start was made by soft soldering a piece of scrap brass between them. This can be removed later by simply melting the solder and brushing away any surplus that is left.

Normally one would expect



Item 17A



to start by drilling the holes to take the joining bolts and this would be done in the lathe. Every reader will no doubt have different equipment and with many lathes it might well be possible. This was found to be impractical on the lathe used to make the engine, as the prongs referred to above fouled the rear of the 4-jaw chuck. So, after much thought it was decided to drill the holes for the upper assembly with the part in the drilling vice and, using an ordinary twist drill, the necessary holes were drilled tapping size. Once drilled the casting was spot faced.

Should any reader not understand the meaning of spot facing, there is nothing magic about it, a tool identical to a counter bore is put in the drilling machine and just lightly touched on the casting. This leaves a nice flat-machined circle on which nut or bolt heads can rest. Of course there is a problem, but there always is and problem solving is one of the main enjoyments of our hobby. It is the fact that it will prove to be almost impossible to buy a tool suitable for the spot facing and so it will have to be made, but surely making small tools is another enjoyable, as well as

satisfying, aspect of the hobby.

There is absolutely nothing in making the tool, simply machine a small piece of silver steel so that the end will just fit in the drilled hole, without any friction when rotated. File or mill two identical flats just above this little spigot you have made and then file on two cutting edges, harden and temper to a straw colour and then just hone the cutting edge and you have a spot facer. The whole job takes less than half an hour and the tool can be kept for any future occasion when it might be required.

The position of the centre of the bore was marked off and dot punched and the piece put in the milling vice in order that a slitting saw could be used to make the cut. However, before that could happen, the penny dropped. By running a milling cutter across each face the two would be perfectly flat, as well as being parallel and so that was the way it was done.

The position of the cut line was marked off with the work still in the milling vice and once the saw was lined up the cut made. The holes in the top section were opened out to clearance size and the bottom ones tapped; the two pieces



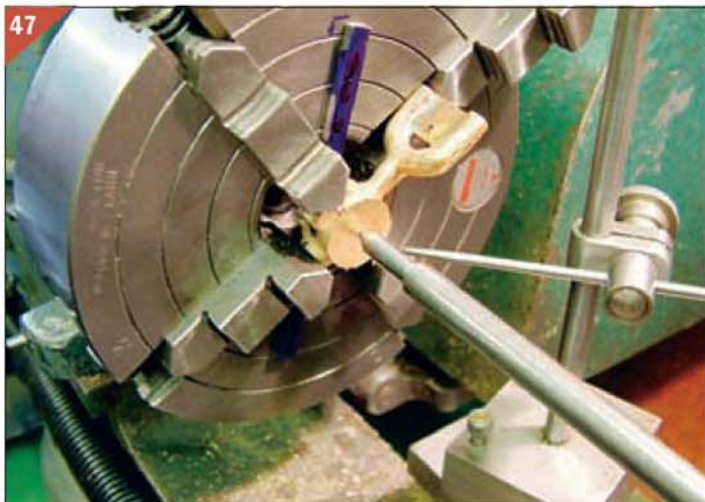
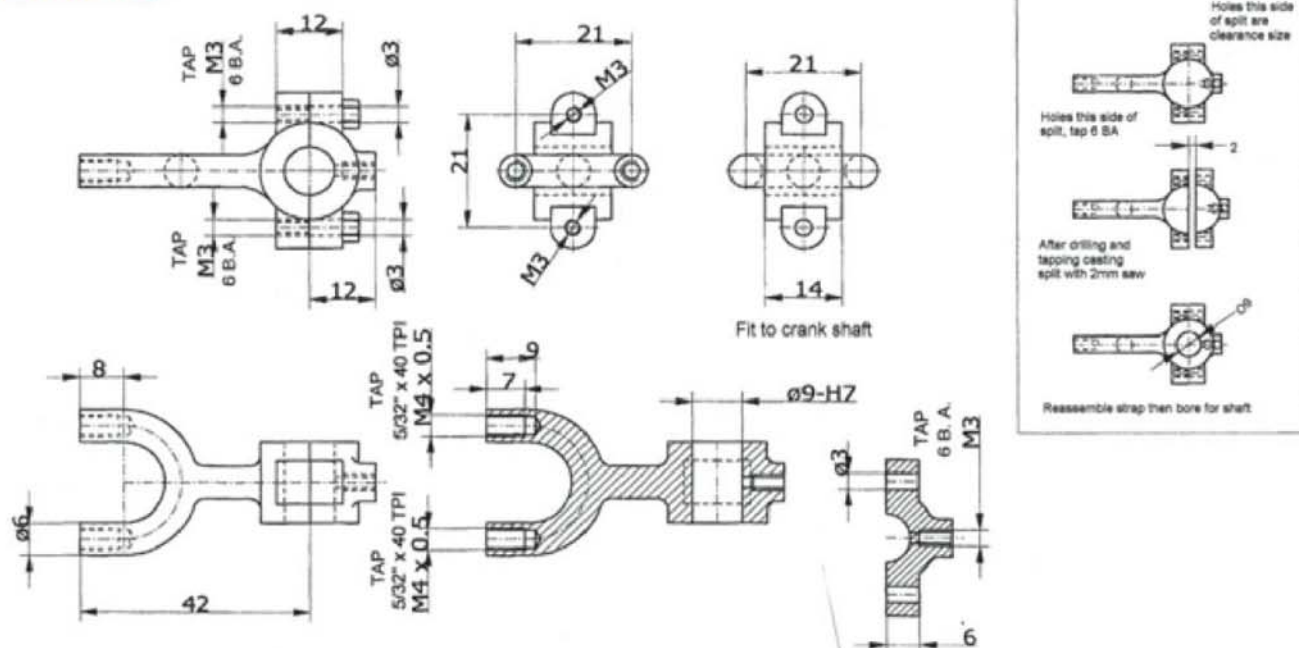
were then reassembled and screwed together, so that the position of the bore could be marked off and centre punched.

After much head scratching it was found that the bearing hole could if one so wishes be drilled using the drilling machine,

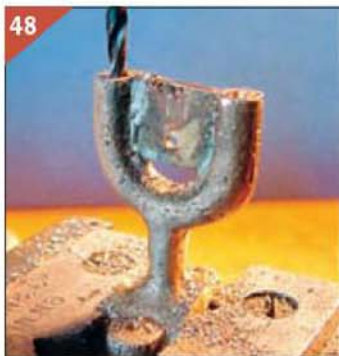
46. The casting having been drilled tapping size for the connecting bolts, it can now be sliced in half with a slitting saw. The holes in the top section can be opened to clearance size, the other tapped to hold the studs. During this operation the outside can also be machined in order to obtain a good finish.



Item 18



although the finished result is not as neat as when such tasks are done in the lathe. If you are using the drilling machine make sure that the casting really is at 90deg. to the drill as a mistake now will mean it will be impossible to



rectify at a later stage.

Many readers may well find that the bore can be made with the casting in the 4-jaw chuck of the lathe, it will depend of course on the type of machine. Using a Myford ML7 it was found that it could be done with the chuck, setting up involving using one jaw in reverse. When setting up for this, a piece of flat bar should be pushed through the gap behind the casting, the bar being long enough to fit on the chuck face. After the initial tightening of the jaws, which should be just sufficient to hold the piece while the set up is being made, give it a smart

tap with a plastic mallet and it will then settle back against the bar and you will know that the bore will be perfectly square when completed.

We are now left with the problem of drilling and tapping the two prongs but first the ends must be smoothed and the lengths corrected, if they should happen to be slightly different to each other. To get the length correct the casting can again be set in the 4-jaw chuck and light skims made across both legs, using a very sharp tool. Here we see the value of soldering in a piece of flat strip during the early stages of construction.

Although the legs or prongs can be faced off quite easily,



47. The two parts have been temporarily rejoined with screws and after marking out it was found to be possible to bore the casting whilst held in the four jaw chuck, once again the brass insert proved to be invaluable.

48. It might be possible to hold the casting in a 4-jaw chuck in order to drill and tap the prongs. However, it is quite practical and not at all difficult to set the work in a machine vice and use the drilling machine. It is also a good time to remove the plate that was soldered in, before starting drilling operations.

49. Completed valve attached to the cylinder.

trying to set up to drill and tap them is a different matter altogether and after a number of unsuccessful attempts it was decided to use the drilling machine. A start was made by marking off the position of the holes, the casting set in the drilling vice and the first prong centre drilled and drilled, the operation was then repeated for the second one and both were tapped by hand while still held in position in the drilling vice. Finally the piece of scrap that had been soldered in was removed and the casting given a general clean up.

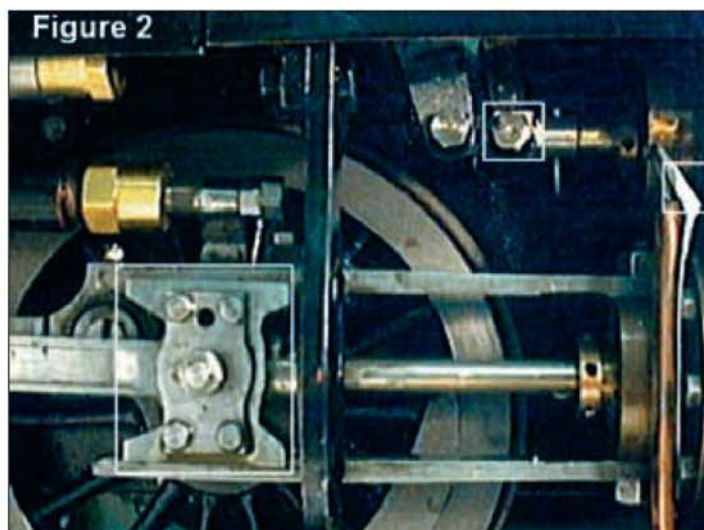
● To be continued.

WATCH YOUR GEAR - WITH A WEBCAM

David Turner suggests a method of checking valve gear setting.

There have been excellent articles on model locomotive gear setting in *M.E.* over many years, notably that on valve events by Don Ashton (ref. 1) recently and Allan Wallace's simulation programme (ref. 2). So, perhaps the present account of a possibly useful method of assessing the operation and accuracy of a working engine, without dismantling, it may also be of interest.

All who have enjoyed that wonderful first running of a first loco, (warmed by the support and understanding of their home club) will sympathise with my developing dissatisfaction afterwards and reluctance to dismantle when realising that the running was perhaps



not as good as it should be even not as good as it was at first run; beats uneven, poor pulling, tendency to jam on priming and so on. If only

one could see if there was a simple explanation, identifying perhaps just one eccentric slipped or a link worn.

In the heroic days of mainline ➤



Fig 1. General view of location of the WebCam near front end of Firefly
Fig 2. A frame selected from video with chosen features for measurement marked in white.

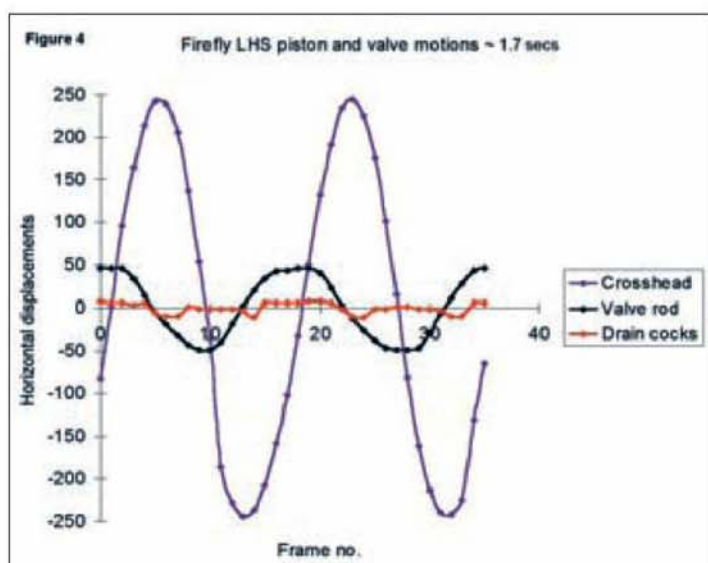
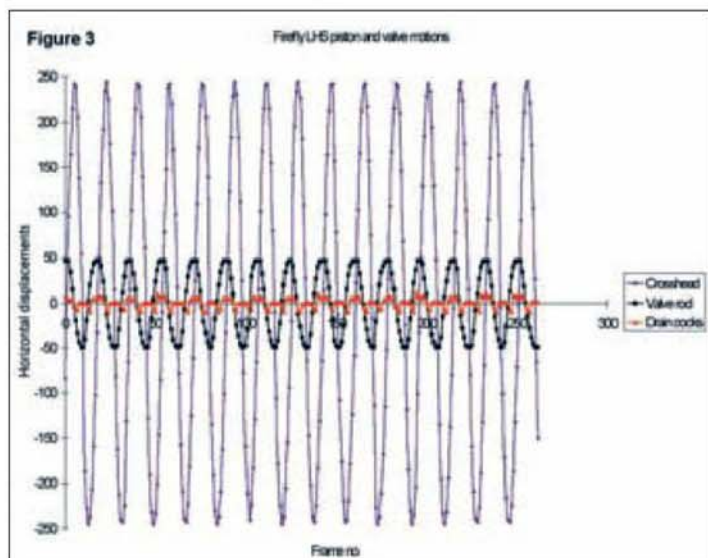


Fig 3. Movements of the LHS piston, valve and admission telltale over a 10 secs period.

Fig 4. 2 cycles of the data shown in Figure 3 expanded

Fig 5. Valves and admissions motions plotted against Piston angle (see text).

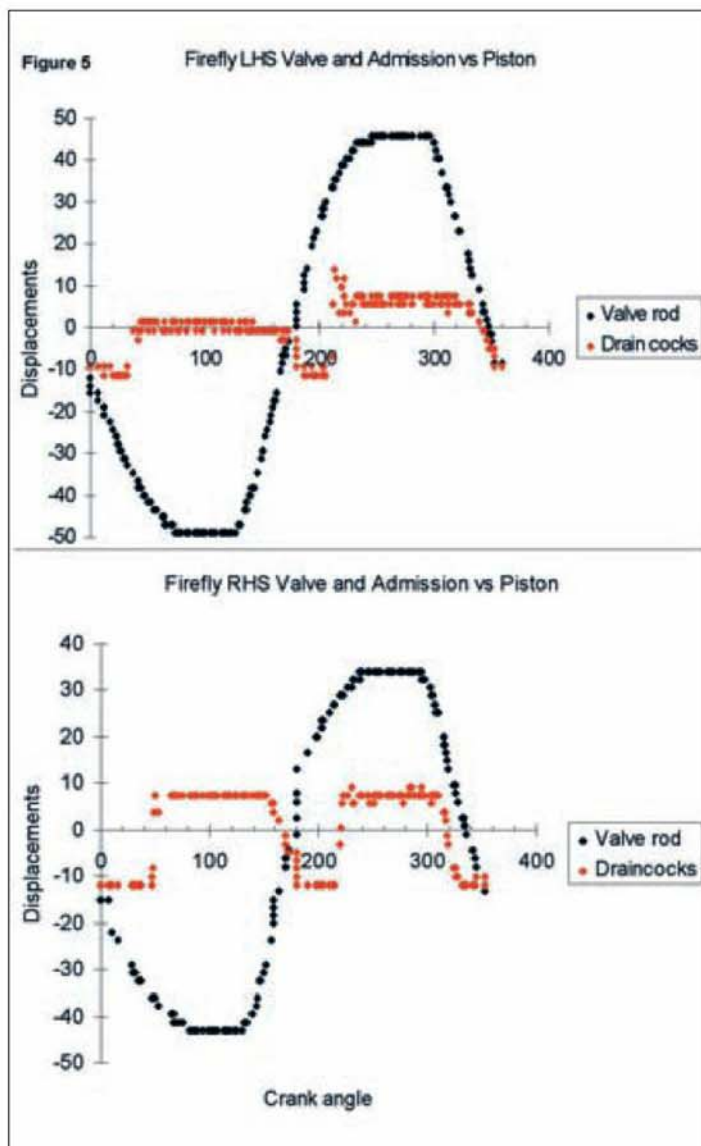
steam when they wanted to know how the front end was doing, high speed runs on rollers was possible or even a sort of shed by the smokebox out on line was possible.

Now, perhaps a video camera could see and record for later analysis the motion of key parts such as the crossheads and valve shafts. A video camera using $\frac{1}{250}$ second exposure could freeze a motion of about 0.004in. in a typical model.

How to do it?

Let us set the engine, a Firefly 3½in. gauge here, on rollers and fix a Webcam (Phillips Toucam 640x480 pixels, for example, connected to a computer) at right angles to the piston shaft at a distance great enough to encompass both the crosshead at the ends of its travel and of the valve shaft (see **fig 1**). Keep it as close as possible however to make best use of the camera's spatial resolution.

At the 15cm distance used here the 640 pixel image width covers 3.75in. so 1 pixel relates to about 0.006in. on the model. Bear in mind that only parts at the same distance from the camera will have their motions mapped to equal scale in the image. Errors arising from objects in different image planes



can however be corrected for by simple trigonometric adjustments. For distance differences, as in what follows, of only a few mm however they can be ignored. The lenses found on good Webcams seem quite free of pin-cushion or barrel distortion so a linear moving object is mapped to a straight line in the image.

Run the locomotive on air and set the speed down to 60-120rpm so that in a period of 10 seconds (s), 10 - 20 revs of the gear can be recorded. Normal record speed to AVI movie files will be 30fps maximum. Under these conditions each revolution of the crank will be recorded in 30 frames so an angular discrimination of only 12deg. is obtained. (Later we shall see that by using all the data from 10sec. worth of video - 300

frames - we can get an angular discrimination of 1 degree)

Thus the relation between piston and valve positions can be seen but one more thing is needed - admission timing.

In LBSC days a well-known trick in static set up was to listen to the cylinder draincocks for this found the moments of admission start and end.

We can emulate this in real time by arranging to see this through the motion of a paper tab puffed by the driving air from the drain cocks (figs 1 and 2). Then the video can watch the 3 important and time related events: piston travel, valve shaft movement and admission.

Data analysis

Now viewing the video is enjoyable and informative up to a point and stepping

through it frame-by-frame to select the moment at which admission starts and ends (the tab moves) to estimate the cross head position and crank angle is simple; even better however to use existing video computational methods which automate these frame-by-frame measurements.

Astronomical software is very useful here since selected objects can be tracked as they move through a video sequence.

This is exemplified by using the excellent programme K3CCDTools written by Peter Katreniak (ref. 3), a freely available tool on his web site). Starting at the first frame a key feature, say the crosshead, is selected using a mouse pick (a white squares in fig 2) and the program runs to analyze the sequence of frame offsets require to centre this object and these numbers are filed.

It is remarkable that even an object such as the crosshead, which partly disappears behind the motion plate for some frames can be tracked. Careful choice of lighting for the recording and mask size in the analysis are important.

We may use a spread sheet to process and plot these lists of displacements vs frame number and so see the movement of the selected part.

Figure 3 shows an example of the raw data for the left-hand side cylinder showing the three curves for simultaneous piston, valve and admission telltale

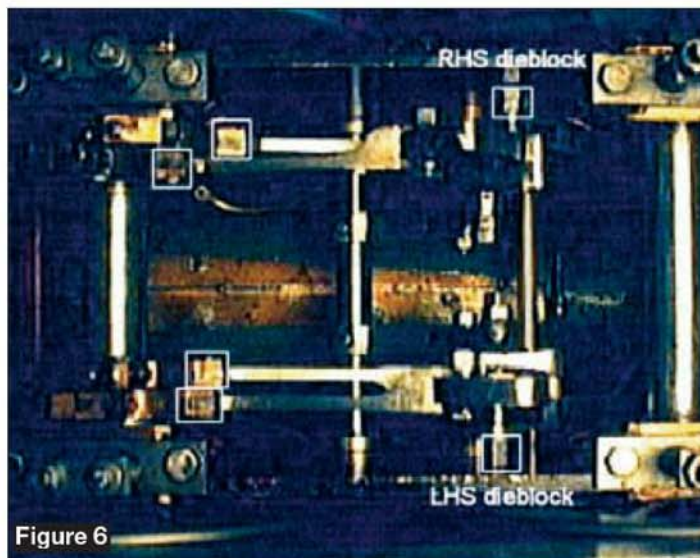


Figure 6

movement plotted against frame number over a 10sec. period (about 15 revs). **Figure 4** shows the first two revolutions expanded.

Clearly there are largish gaps between data points with only around 20 frames/revolution. These gaps are covered, however, if we instead plot valve and admission movements against piston travel (angle) for then successive revolutions combine. **Figure 5** shows this with both left and right-hand side compared. The abscissa runs from 0-360deg., a full piston stroke, the ordinate is in pixel units (1 pixel = 0.006in. approx). Some striking features appear.

1. The valve travel is about 60 thou less on the right-hand side.
2. Negative lead is larger for the right-hand side and both

are far too large; 30 and 45deg. left and right.

3. The 'flat top' for the valve motion curve indicates lost motion.

What causes these defects?

It may be possible to apply our detective methods further back to the expansion link region. To do this the Webcam looks up from below (**fig 6**) and we record as before and pick the die blocks to measure using their locking nuts. The same 60 thou left/right difference appears (**fig 7**) so it is down to the eccentric straps or sheaves. Here the trail stops since these are two-dimensional movements and simple interpretation fails. It seems, however, that the strap motion curves (**fig 8**) suggest that one in particular

Fig 6. WebCam view of the Firefly eccentrics and expansion links from directly below.

Fig 7. The die blocks motion followed over 1.8sec.

Fig 8. Firefly eccentric straps motion followed over 1.8sec (horizontal components only).

is abnormal; the right-hand side forward strap. Now we know where to start the attack.

Further improvements.

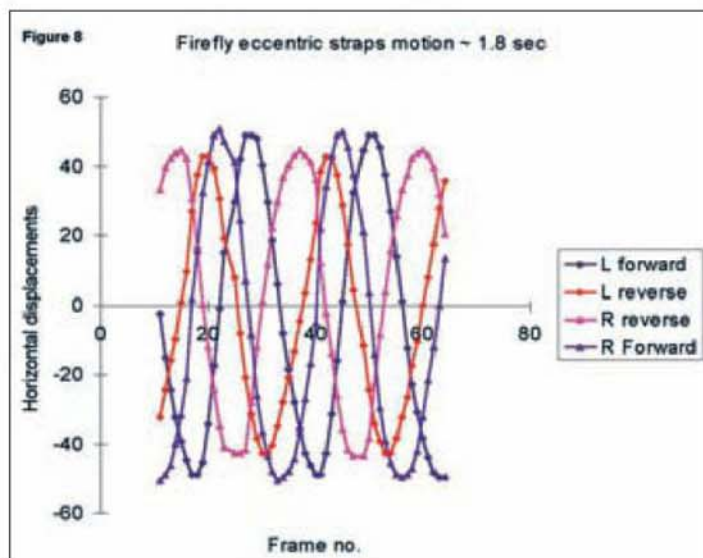
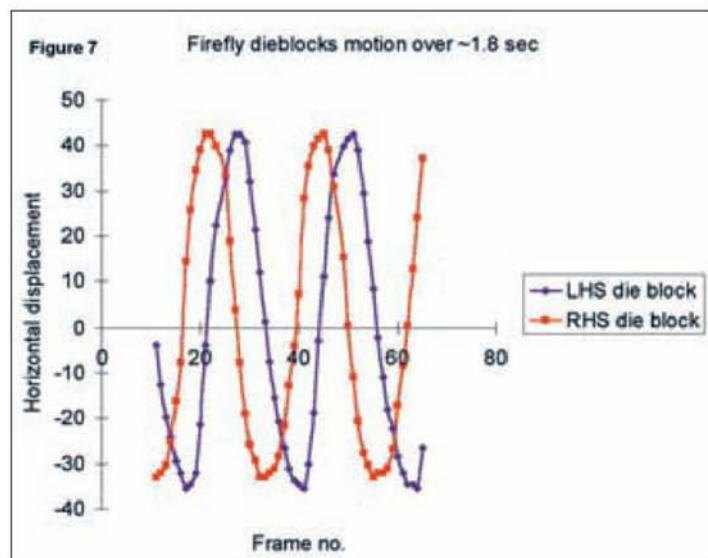
More pixels and a faster CCD would allow using a longer focus lens so moving the camera away from its target and reducing the (already tolerably small) geometrical errors.

Attaching bright tabs to all the parts that need to be measured would make the tracking easier and increase precision. Also to run a steam test something other than paper tabs for the puff detection would be essential. They quickly get messed with oil on air anyway.

Though there are improvements to be made I hope that this description may encourage further experiments along these lines. **ME**

References

1. Don Ashton, *Model Engineer* Vol. 199, No. 4314, p.695
2. Allan Wallace allanw@avocetconsulting.com.au
2. Peter Katreniak www.pk3.org/K3CCDTools



The birth of a locomotive

Stephen Wessel describes the story of Aquila, a newly published narrow gauge locomotive design for 5in. gauge. Our story starts in Porto Velho, Rondônia, Brazil, 1910...

Sr. Jorge da Silva Branco, chief engineer of the infamous Madiera-Mamoré Railway sat sweating at his desk pondering the latest crisis. Construction of the branch from Sao Carlos under his personal superintendence had already claimed 10 lives. Worse still was the collapse of their concrete viaduct with total loss of the Baldwin Mogul locomotive which had been lent to him.

The whole project had been his idea: a 15km extension to take *turistas* to the falls. Now he kicked himself for hiring those expensive city types from Sao Paulo to design it.

They should have used steel; you knew where you were with steel. He wished he had bullied them into it. Granted, it was a difficult route, straight through some of the thickest forest of the Amazon headwaters, to the very edge of the gorge. But his *turistas* would come and they would pay handsomely. He knew it.

This was the new century after all. Some of the carriages had even been modernised - even some electric lighting. Losses from the rubber business would be recouped and his star would shine once again.

After this event, they would grind him down, cajole, even threaten him until he agreed to give up. "Your useless branch gives us nothing but trouble", they would taunt, "and you've already lost one of our best engines in the swamp. Indeed! Your line from nowhere to nowhere!"

Branco stood up heavily, crushed a small scorpion under his boot and spat. He would rebuild the wretched bridge, with his own hands if those *idiotas* would let him, then get another locomotive. Only this time it would be his choice. He did not get on, to

put it mildly, with the Henschel agent whom he considered a boastful little creep. The *Americanos* had suddenly and dishonestly pulled out of their long standing contract. That left the English. How such a minute country could be so influential in everything that counted was beyond Branco's imagination, but it did have a reputation for fine engines, with brassy bits. He liked brass. It reminded him of the slivers of gold they sometimes found as boys in the forest streams.

He slumped down again and began to sketch. "So...it will have a big firebox to burn the rubbish coal they were supplying. It must pull at least four of those special carriages. It must..."

The afternoon heat gradually sapped all remaining energy from the overweight engineer but an idea had been born. He would pay the English agent a visit in the morning.

Of course, that account is fictitious, but ever since the completion of my freelance engine in 1994 I have been tempted to seek out its imaginary full-size forebear. There are several contenders and readers may form their own opinions.

The engine described here has travelled over 250 miles on my ½ mile railway and been a great success, so I published the design. I will describe the conception, design process, some of the more unusual features and the track performance of this very large 5in. gauge locomotive. At the time of writing, a second Aquila is under construction by a friend and I hope it may be the first of many.

Designing a new engine

As I sat at the drawing board, and it was a board in those days - not a computer, the design appeared to come straight out

of my head which was filled with images, many very indistinct, drawn from real life, books and photographs over a long period. The brain jumbled them about and finally guided the pencil tentatively over the paper. A bit of this and a bit of that until the whole looked balanced and pleasing. I was not trying to go beyond traditional steam locomotive practice, instead I felt somewhat bound by aesthetics and eventually quite stuck in the Edwardian period that produced so many finely proportioned machines of all kinds.

When designing started, I was living a town life. My 5in. gauge railway was in storage awaiting the day when it might find a new home somewhere in the country. I felt certain it would be re-laid (hopefully expanded) and that it would stay a 5in. track. Siren voices sang the praises 7½in., but I could not see the point. In my tiny basement workshop, a 7½in. narrow gauge locomotive would certainly have never got out.

What might be needed on the imagined future railway, was serious tractive power. My little 0-4-0 shunter did not have it, nor did most 'standard gauge' 5in. designs, when given long passenger trains and stiff gradients. There is never enough adhesive weight. I didn't know where this new railway would be, but assuming it to be dead flat might well create an extra house-hunting

1. The driver's eye view shows the easy-access to all the controls.
2. The Marquess of Alhampton, an Aquila-class which shows her ride-on tender-unusual for a 5in. gauge locomotive.



ocomotive

constraint, so it seemed prudent to design for gradients of around 1 in 50 just in case.

Driving on ground level 5in. railways usually presents posture problems. In the future, I saw these looming ever larger with increasing age. Considering every marketed 5in. gauge design from the point of view of driving comfort, power and aesthetics, I concluded I had two choices. Either I could set about modelling a big colonial style prototype, perhaps a Hunslet, and face endless problems tracking down drawings and all necessary information, or I could have a go at designing it myself.

The decision was not difficult. Having forsaken my professional engineering background many years earlier in order to build musical instruments for a living, there remained a slight sense of guilt that my theoretical

knowledge was rusting away. Here was an opportunity to exercise some of it and, at the same time, slay a few personal devils like my dread of technical drawing.

It seemed, initially, a daunting task. One could mount a boiler on wheels, give it a boxy cab and a stovepipe chimney easily enough. One could call it a locomotive, but would it have style? It might haul you around the garden, but would it transport the mind back to any particular era or country? Above all, would it have historical significance or indeed mean anything at all?

The very word 'freelance' seemed to suggest total disconnection from the strict world of the modeller in which, as we all know, rivets are not merely counted but silently worshipped. Locomotive engineers of the past, or the present, were and are unconstrained by such nonsense. They simply design what is or was needed for a particular task. My job would be the same, on a smaller scale, with the proviso that the result would have to look like a model of something from an earlier era.

So I sat, as if in Branco's filthy old office, and pondered my requirements. These were:

1. Heavy enough to accelerate a sensible load up a sustained 1 in 50 gradient.
2. Overall length must not exceed current workbench space.
3. Must have an open-back cab so drivers can reach and see everything with ease.
4. Never run out of steam except through dire incompetence.
5. Have a firebox big enough for me to go away and have lunch without losing the fire.
6. Include a respectable tender designed as part of the whole, not just a driving truck added later. It should be long enough to sit on comfortably.
7. Ever so slightly rakish good looks, appropriate to passenger working as well as freight,

reminiscent of the early 20th century.

8. Include one or two special but hidden features to improve running and management, also to make the building of it more interesting.
9. Not look like a typical quarry engine, nor have any 'Emett' type features.
10. Two cylinders with outside Walschaerts valve gear.
11. Not be over-complicated, but straightforward to build, drive and maintain.

The design gradually crystallised. The wheel arrangement and overall shape emerged quite early on. As drawing progressed, the general scale of the engine, taken mainly from the height of the cab roof above footplate, settled on 2in. to the foot or 1:6. Establishing this made detailed design much easier. In particular, smaller parts like fittings did not need to be over-scale as in so many 5in. models.

General proportioning was helped by constant reference to existing designs both in full-size and in model form and numerous photographs of both historical and existing engines. Model engineering books and magazines proved invaluable for valve gear and boiler design.

All the way along I took care that my locomotive looked like something that might have





3. The steam operated air-pump is visible on the running boards of Aquila. Its performance was prototypical until the steam pipe was lagged (see text).

4. At an outing to the Bath & West Railway, Aquila pauses at the station.

really existed somewhere in the world. It took on a distinctly British export look when the tender was added (**photo 2**). The 'prototype' might even be working some half derelict branch in Peru or Angola. This thought was exciting, as my paternal great grandfather had pioneered the original Antofagasta – Bolivia railway. Perhaps they had used engines rather like this one.

The locomotive needed a name. I chose Aquila (Latin for eagle), taken from the star of the same name. Hopefully, this is not in current usage among published locomotive designs. This is the 'class' name by which the design will be known.

Engine description

The always popular 'Mogul' arrangement combines relative simplicity with good tractive effort. It was to have been a 2-6-2 layout, but the huge firebox I wanted together with overall length limitations meant there was little room for a trailing truck. The heavy tender keeps the engine dynamically stable.

I have not attempted to save weight anywhere in the design. Some components, like frames and stretchers are certainly heavier than they need to be to carry the likely stresses. The extra heft

makes it easier and quicker to build while costing little. Providing the mass doesn't draw attention to itself, like having side tanks full of lead, an extra bit of weight certainly improves pulling power.

The firebox is wider than the frames and has a square grate of almost 42in. square and maximum fire depth of about four inches - quite big for 5in. gauge. There is a combustion chamber as well, the front of which becomes the 'rear' tube plate.

The boiler, a conventional round-top design with a seven-inch copper barrel, was built commercially, mainly through lack of workshop space. Pete Carr of Kingswood Boilers made an excellent job. It makes plenty of steam without the fire becoming white-hot or getting drawn out of the chimney.

The large fire size makes for easy management. I have been able to leave the engine unattended for up to three hours - in my garden and not in public, health and safety enthusiasts please note! On my return, it was found simmering with about 75psi and a dull, but viable, fire. I always use steam coal rather than anthracite because the blast is on the soft side and I like plenty of acrid smoke anyway.

As a narrow gauge engine, the frames are outside the wheels. The 4ft. long chassis is built with a mixture of cast and plate frame stretchers.

In the interests of adhesive weight the engine has side tanks, for water (not lead!), with the feed being via a double acting axle pump. The

tender supplies water for the injector(s) and hand pump.

Axle boxes and axles

Cast iron axle boxes are fitted with needle bearings to aid free running and hopefully to give longer life than plain ones. After 14 years and 250 miles there is no discernible slop and the engine moves quite freely when cold, so maybe these bearings were justified. I calculated that there would be no need to harden the axle journals as the specific loading on the bearings would be so low it would actually be off the manufacturer's scale of load versus hardness required. Instead I gave them the best possible turned finish, almost a polish, then took trouble to fit the bearings and seals with scrupulous cleanliness. Re-greasing can be carried out through axle centre drillings, which have a screwed plug to keep dirt out. The published drawings show both the needle bearing and a bronze bearing alternative.

Valve gear

Walschaerts gear is used because of its excellent steam distribution and it is visually a delight. The balanced slide valves, easier to make than the piston type, will probably last longer before 'blowing', too. The method is well known, involving a large diameter O-ring rubbing on the inside of the valve chest cover. The space inside the O-ring is vented to atmosphere. The O-ring should be the Viton sort

and should not be subjected to very high superheat.

Has anyone ever done any measurements of valve chest temperatures? I suspect that due to the usual fall in pressure between boiler and steam chest, slide valves remain cooler than one might expect, even with superheat. I have only replaced these rings once, and then due to wear rather than overheating. I knew when this was needed having noticed wisps of steam coming from the vent holes.

Super heater

The conventional, copper superheater does not extend into the firebox but protrudes a little way into the combustion chamber. The original, which lasted about 10 years, failed recently at the spear ends. Stainless steel has a very poor heat conductivity compared to copper, although it may have a longer life I doubt that it provides much superheat unless it is the radiant sort.

Regulator

One other novel feature is the regulator. It has always struck me as rather unfortunate that so many regulators don't shut sufficiently tightly for the hydraulic test. Blanking off the steam pipe for this test is a great nuisance. Also, if the regulator needs removing for any reason, life is made easier by having it at the backhead end. Finally, I do prefer a smooth action, with no lost motion, that is immune to steam pressure loading. The valve, faced with a PTFE disc,



moves coaxially and is driven by a peg running in a helical slot, much like a coarse thread. The helix angle is given a 'soft start' so that initial opening is gentle. The back of the valve is exposed to steam pipe pressure via a drilled hole to 'unload' it of boiler pressure. So many regulators are very stiff to move, especially at full pressure. This whole assembly is compact and fits just inside the boiler backhead.

Tender

This is a straightforward 40in. long, bogie type, with the seat carefully arranged for a comfortable driving position, but not too high (**photo 1**). There is a big coal-bunker forward of this and also a tool space. Under the seat is a large water tank and there is room for an electric air pump and battery if required. Air reservoirs are slung underneath. The tender body is about 3in. narrower than the engine (another worry on paper, as of course the widths would normally be the same. The reason was to keep the outside footboards within the loading gauge of my railway. Future builders might prefer to widen the tender, but I see no point as the slight narrowness is unnoticeable.

Brakes

Such a heavy engine requires effective braking so I decided this would be an opportunity to try out a proper compressed air system, perhaps carried through to the train. I was much taken by an article written some years ago by Brett Rogers in the *7½in. Gauge Magazine*, in which he described a comparatively simple fail-safe arrangement avoiding the dreaded triple valve. His idea makes use of double acting air cylinders instead, which of course can be made easily enough. Most commercial miniature railways would probably choose to use an electric air pump, but it is more amusing to have a Westinghouse-style steam driven air pump mounted on the running plate (**photo 3**). It can then be left with the steam supply just cracked open to

provide a slow tick-over.

The originals apparently needed to be beaten with a shovel occasionally to get them going after a stall. The model is just the same! I had endless trouble getting it to run continuously. There had never been a problem when using workshop air, but as soon as the unit was installed on the locomotive and running in steam, its working became extremely erratic. Eventually, I discovered that it was being fed mainly with hot water rather than steam. Lagging the steam supply pipe transformed it into quite a reliable little pump.

Air is stored in a main reservoir at about 70psi, and reduced to 40psi through a small commercial regulator to feed the train pipe.

The most difficult component of the whole system was the driver's valve. Even in 2in. scale this has to be very small if it is to look right and getting it leak-proof taxed my patience to its limit. In fact, altogether there are about 50 connections (at the last count) in the system as well as this valve, every one of which must be 100% air-tight, otherwise you run out of air very quickly. At least, with a pressurised circuit you can find the leaks easily enough with soapy water, unlike a vacuum system where you cannot.

Brake shoes on the locomotive are cast iron.

Performance

I was very nervous indeed the first time I took Aquila to the track. She is so much wider and heavier than any standard gauge model. Apart from some early derailments, due entirely to having forgotten to balance the weight properly between the four axles, she followed the wobbly track sections perfectly. The tightest curve we have on the main line is about 25ft. radius which is fine, but there is a tighter spot (20ft.) on a siding where she binds. By reducing the flange thickness on the centre axle I am sure Aquila would negotiate more or less anything, in true narrow gauge fashion.

The steepest section on

the railway is a 1 in 30 climb lasting about 120 feet. She will accelerate up this bank from a standing start with eight passengers. So we now have traction! The railway opens every year for the village fete and Aquila has done mighty service for these occasions, running happily all day with full trains and few problems.

More recently I have taken her to the Bath and West Railway (East Somerset SMEE), to put her through her paces on a larger scale. This dual gauge (5 and 7½in.) track is built with steel rail, plastic sleepers and a concrete bed for stability. Having run light around the track to check Aquila on pointwork, we coupled a rake of three of the best and heaviest 7½in. gauge carriages, put in six stout passengers and set off. The current (unfinished) route starts with a 1 in 60 climb around a 43ft. radius, levels out then falls for something like 100 yards. The return trip involves a very long slog up a 1 in 100 gradient, which then steepens slightly as the station is approached. I was delighted that Aquila managed it with aplomb. She slipped a bit here and there but never failed. Plenty of steam all the way and at the end of the day no clinker to speak of. It was good to have to drive her really hard. The big 7½in. engines romp up and down without noticing the gradients but driving them is

that much easier.

The only sadness as a result of Aquila's success is that my little dock tank engine, built when I was a mere youth, hardly gets a look in these days. Having done sterling service on a former railway, which she had to herself, she is now considered underpowered and was only steamed once this year apart from her boiler test.

Conclusion

For those needing serious motive power for a 5in. track Aquila might be the answer. She is a lot easier to drive and distinctly more comfortable than most large 'standard' gauge tender engines. Having well over double the adhesive weight of most 5in. locomotives (including the 'Pacifics') she would pull almost anything over severe gradients and definitely be capable of semi-commercial hauling if required. I like to think Sr. Branco would have come up with something similar and then got one of the great British companies to build it.

The original paper drawings were, of course, never finished. It has taken nearly six months of spare time to convert them all, via a CAD programme, into a form comprehensible to others. Copies are now available exclusively from Reeves 2000 along with castings, laser cut frames, motion rods and fly cranks. Reeves 2000, www.ajreeves.com T. 01827 830894 **ME**

Aquila at a glance

Wheel arrangement:	2-6-0T
Length:	49in. (89in. with tender)
Width:	16in.
Height:	21in.
Driving wheels:	6in. diameter
Two cylinders:	2in. bore x 2¾in. stroke
Walschaerts valve gear	Boiler: 7in. diameter
Working Pressure:	100psi
Grate area:	42 square inches
Heating surface:	1,110 sq. inches
Capacity:	12 litres
Weight:	320lb empty, 380lb full
Tractive Effort:	70lbf

Notes:

1. Excludes superheater.
2. 83 bar-litres for boiler inspection regulations.
3. Measured on dry aluminium rail.



Malcolm Stride reports

Notices

The annual spring main line rally at the **Ryedale SME** Gilling East track site in Yorkshire will take place over the weekend of 24-26 May this year. For more information contact David Myers (E. david.myers@talktalk.net or T. 01388 661255).

UK Club News

The annual locomotive rally at **Birmingham SME** attracted 36 locomotives in the larger passenger hauling gauges and another 19 in gauges '0' and '1'. The most unusual of the larger locomotives was the 0-6-0+0-4-0 steam turbine locomotive.

Bournemouth DSME is looking for a new webmaster following the departure of the previous incumbent Kevin Martin who has now left home. Kevin's departure has also meant that his father David, who is society Chairman, has had to purchase his own computer and has already put it to good use by acting as newsletter editor whilst Dick Ganderton was away on holiday.

During the summer Bernard North and his Saturday Team at **Bristol SMEE** have fabricated several 10ft. long track panels ready for the raised track relaying project to continue

after the running season has finished. A big effort was planned before the Santa Specials to be followed by a more leisurely approach after that. The 3½in. Gauge Rally at Ashton Court was another very successful event with the initial damp weather giving way to sunshine during the day. Twelve locomotives attended and all drivers seemed to enjoy themselves, probably helped by the chocolate and fruitcakes provided by Wendy Phillips. Perhaps I should do a report on this event next year?

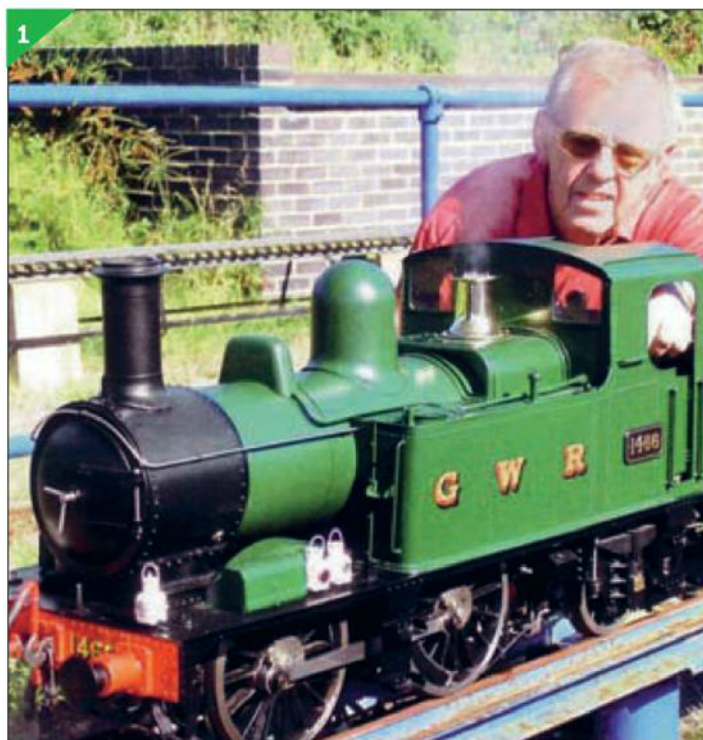
Good progress continues to be made with the ground level track at **Erewash Valley MES** with the track at the North side of the site now connected to the points adjacent to the car park. This means that three-quarters of the ground level track is now complete. The next job is the ground level steaming bay. The member's visit to the Nottingham Society was made by fewer members this year because of the inclement weather. A "few brave souls defied the weather" and in spite of it had a good time.

Don Faulkner has completed the trials of his Avonside dock tank locomotive at **Frimley & Ascot Locomotive Club**. After a couple of minor problems, the locomotive now steams well

and spent a full day passenger hauling in October last year. The proof of this effort was a large clinker the exact size of the grate. Phase Two of the signalling system is under way and all points are now fitted with interlock display LEDs. Potential new projects include: raised track or new cut-off loop, right-hand run-round, mid circuit passing loop and modifications to the gantry. The track fun day included a shunting competition which was enjoyed by all, albeit with much scratching of heads and differences of opinion, supplemented with loads of tea and cakes.

The newsletter editors at **Harrow & Wembley SME** are standing down having been in the post since 1994. I have appreciated their efforts since I have been producing this column and I am sure all the Harrow members have done the same. New volunteers have been found to take over and so the service will continue uninterrupted. The new lease has now been approved by the committee and took effect from October. The youth group day out was to the International Air Tattoo and involved a 5.15am wake-up call for those taking the trip. From the reports, the early start was worthwhile and everyone had a very interesting and enjoyable day.

The last running day of the season at **Northampton SME** provided the most passenger rides ever for a Sunday afternoon session with over 1,050 rides being taken. The night run was well attended again despite the cold weather, with Sue and Bill Huckvale serving up bangers and mash that proved a very tasty and warming counter to the cold evening air. With the end of the running season site development projects have started including construction of the ground level point to go into the section of feed rail, four work trucks have now been constructed to move materials and tools around the site, three bridges to cross the ditch at the bottom end of the site are in progress, the ground level turntable is being



1. John Hewitt with his newly completed GWR 14XX locomotive at Nottingham SMEE.

2. The new 1:24 scale Flying Coaster fairground ride from the 1970s from Doug Roseaman Engineering.



modified to reduce the rolling friction and improve the locking mechanism, and replanting in some areas of the site where trees or undergrowth have been removed is in progress.

The experimental anti-clockwise running at **Norwich DSME** was not successful and has now been abandoned. The problems were mainly to do with driver's sight lines when running in the opposite direction and some drivers apprehension when descending the gradient into the station. Unfortunately the *Dyak* suffered a "derangement of its valve gear" soon after returning to service. Repairs are in hand.

John Hewitt, from **Nottingham SMEE** bravely used his new GWR 14xx class locomotive (**photo 1**) for the inaugural run to open the new Parkgate Branch Line extension on 26 August last year. The locomotive is reported as coping bravely with the trainload of VIPs, much less nervously than the driver. The tape was cut by Bill Ford, Chairman of the **David Clarke Railway Trust**.

Peterborough SME has been granted a two-year only extension to its lease at the Thorpe Hall track site so will be looking for a new venue in the intervening period. We will be pleased to pass on details of potential suitable venues from readers in the area. Those members making

the trip to Ascot in the club-organised coach had a very eventful journey. The coach was overtaking a caravan when the caravan wheel parted company with its axle and bounced off the coach windscreen before bouncing twice on the roof on its way to the central reservation. Considerable damage was caused to the coach and a replacement coach arrived within 20 minutes. Thankfully nobody was hurt although a couple were, unsurprisingly, a little shaken. A reminder for all to check wheel nuts regularly, I think.

The annual efficiency competition at **Reading SME** had three locomotives entered this year, with one being driven twice under different drivers. The winner was Chris Jones with his GWR King, achieving an efficiency of 1.055%. Chris was also the winner last year with a different locomotive, so it must be the driving that does it.

Work is now finished on the garden railway extension at **Romney Marsh MES** and the new tracks have seen lots of activity. The club premises are now connected to the new main drainage system in New Romney after several years of waiting. The portable track was brought out of retirement for a "one off" event at the Kent County Showground. The event was in connection with the Kent Scouts Anniversary

Jamboree and around 1,500 passengers were carried over the two days. The January evening meeting is "Another Slide Miscellany" by Roy Clench and is on 15 January.

The **Society of Model & Experimental Engineers** gained several new members at the Model Engineer Exhibition and all the available places on the basic training course were taken up. The major work on the Marshall House Headquarters is now complete thanks to the activities of several members. In common with previous years, the society is organising a trip to Sinsheim in this month. The society has launched the SMEELEC (SMEE Low Energy Challenge) which will be staged at the Model Engineer Exhibition this year. Further details can be obtained from the SMEE website at www.sm-ee.co.uk or by e-mailing smeelec@yahoo.co.uk or by writing to the organiser at: SMEELEC Competition Organiser, 35 Singleton Road, Broadbridge Heath, Horsham, Sussex RH12 3NP. E-mail is the preferred method of communication.

The Summer Outing of the **Society of Ornamental Turners** was a visit to two workshops, those of Sir Richard Lynch-Blosse and Michael Brooks a short distance away. Both workshops provided the visitors with a fascinating assortment

of machinery and both had an emphasis on automation with the ability to have several projects on the go at the same time. Apparently hosting workshop visits is a good way to ensure that the workshop gets tidied up. Details of the society can be obtained from sotsecretary@aol.com. Quarterly meetings are held at the Uxbridge Masonic Centre, Hillingdon, Middlesex and the next meeting is on the 9 February 2008.

The anniversary exhibition of the **St. Albans DMES** was a success with all three halls full of exhibits. The August Bank Holiday straight running and tethered hydroplane regatta took place again this year and had some reasonable weather for the occasion. As someone who started his modelling activities with such pursuits I think it is good to see these activities still taking place in these days of radio control and ready to run models.

The station building at the Merley Park track site of the **Wimborne DSME** has gained a smart new clock, courtesy of the local recycling centre, from which it was rescued. With some spit and polish and some new artwork on the face it looks very smart. A new notice board advertising the club activities has also been put up on the approach road by the sports and social club which owns the site.

World Club News

Canada

At the November 2007 meeting of **Toronto SME** Roger Cole gave a presentation on Ship Models made by Prisoners of War in the period between the Napoleonic Wars and 1812. Roger started by giving a history of the several wars of this period (between England and France, and England and America) when considerable numbers of French and American prisoners were held in prisons in England. These prisoners were held in old ship hulks anchored offshore as well as (land) prisons near Portsmouth and Plymouth. Roger showed plans of the Dartmoor Prison, built between 1806 and 1812, designed for 7,000 prisoners that ultimately held over 9,000. The ship models were mainly modelled in ivory or bone that the prisoners obtained by purchase, which, strangely, they were permitted to do, or from the meagre meat ration that they were provided with. These models are fine in detail but lacked scale as they were made from memory. In this period the carvers of Dieppe were renowned for their skills and it is likely that some were captured and held in these prisons. It is also likely that more than one prisoner made each model.

At the same meeting Dave Sage brought in the *Olympus* engine, complete with test stand that was originally made by (the late) Albert Hutton. Dave has been refurbishing the engine since April for the family. A 12 Volt motor at 4,000rpm is used as a starter and then is switched to be the load. The 30cc, 0.875in. stroke x 0.802in. bore, 4-cylinder, double overhead cam, four valves per cylinder engine idles at around 14,000rpm and has been run up to 23,000rpm. This is the only *Olympus* engine ever built – a Mr. Booth in the UK started one, but he gave up finding it too complex and difficult!

New Zealand

Following the successful conclusion of fund-raising to train guide dog Gabby, **Auckland SME** is to raise funds for a repeat performance for this worthy cause. Several special working bees have been held in August and September resulting in the completion of several projects on the track, rolling stock and clubhouse.

The October running day at **Otago MES** was held in "brilliant weather after the wind" and there was a good turn out of boats and locomotives. The working parties have installed concrete paving round the west side of the pond and also made great strides with the safety fencing round the tether car track. Planning is well under way for the festival week in February.

Trade News

Fairground model news

Doug Roseaman Engineering has announced a new set of model plans in 1:24 scale for a Flying Coaster ride (**photo 2**) from the 1970s. The plans are fully detailed being based upon measurements taken from a full-size ride.

The model can be made to build up and take down from its scale centre truck; is fully working and can be lit with bulbs or LEDs using a programmed lighting controller.

Despite being highly detailed and close to the prototype, the model is straightforward to build and uses a minimum of special parts. Those who like fairground transport will be pleased to find a well detailed centre truck and paybox, both of which can be used as display pieces in their own right. The drive in the model is based upon the very successful, quiet and easily controlled arrangement used in the MFD3SD Waltzer, many hundreds of which have been built over the years.

Construction is split into logical sections and the instructions give full details of how to make and assemble the parts. All parts are drawn

individually and then as part of assemblies which show how the parts fit together. These features make it easier to understand the construction.

Packs of parts and materials, jigs and technical advice are all available to speed the building of the model and 124 photos of the full-size ride and the model are also available on CD or as prints.

The plans and instructions are £49 inc. p&p.

This is the first new Model Fair Design in over 20 years - all previous designs - Ark, Gallopers, Organs, Trailers, Waltzer etc. continue to be available.

Doug Roseaman Engineering can be contacted at 101 Westbrook, Bromham, Chippenham, Wilts SN15 2EE.

Precision abrasive water jet cutting

Sciss Ltd. provide a water jet cutting service for model engineers. Most materials can be cut including all metals, plastics, glass, ceramics and composites to a tolerance of +/- 0.127 millimetres. Items can be up to 50mm thick with a maximum part size of 1,400 x 2,540 millimetres. The process does not use heat and leaves a smooth unhardened edge. Drawings can be accepted in DXF format or on paper.

Sciss Ltd. can be found at Unit 9, Larkstore Park, Lodge Road, Staplehurst, Kent TN12 0QY, T. 01580 890583, E.

sales@sciss.co.uk

Stuart Models Puffin Marine steam plants

For those who operate steam-powered model boats, Stuart Models has launched a range of power plants based on a ready to run twin-cylinder oscillating engine – the Puffin. The Puffin is available as a stand-alone engine or incorporated into two complete "Puffin Marine Power Plants", one with a vertical boiler, the other a horizontal layout.

The engine or complete power plants with horizontal boiler are available from stock.

Stuart Models can be contacted at Braye Road, Vale, Guernsey GY3 5XA (T. 01481 242041; F. 01481 247912). Those with on-line access can use email at sales@stuartmodels.com or visit the website at www.stuartmodels.com for downloadable catalogues and details.

Shesto launches new website

For 100 years Shesto has specialised in sourcing and supplying quality miniature precision tools. The company has put together one of the most comprehensive ranges of precision tools anywhere in the world.

The original Shesto website went live in 2001. Over the years there have been many updates and improvements to the site, but now a completely redesigned site has been launched offering many advantages to visitors and customers.

The new site gives details of

In Memoriam

It is with the deepest regret that we record the passing of the following members of model engineering societies. The sympathy of staff at *Model Engineer* is extended to the family and friends they leave behind.

John Brooker
Gerry Chester
Robert Graham
John Hawker
Lionel James Lawrence
Derek Mavin

Plymouth Miniature Steam
Nottingham SMEE
Centurion SME
Nottingham SMEE
Harrow & Wembley SME
Society of Model & Experimental Engineers
Society of Ornamental Turners
Bristol SMEE
Bristol SMEE
Nottingham SMEE
Romney Marsh MES

John McWilliam OBE
Alan Porritt
Norman Rossiter
Elsie Towle
Jack Weller

stockists all over the UK (region by region) as well as details of distributors around the world.

The range of tools featured is vast. There are three sections specialising in tools for hobbies and crafts, jewellery manufacture and repair and supplies for the beauty trade. There are more than 2,500 often hard-to-find quality tools featured as well as links to clubs and societies, technical and trade publications and many other useful websites of interest.

There is a facility to add reviews and tips on every product which will be useful

feedback for potential customers as well as the possibility of checking up on the history of previous purchases at any time from any computer with access to the internet. The new website is at www.shesto.co.uk

Shesto also invites all club secretaries and webmasters to visit the site and click on 'Links' to submit details of their particular organisations for inclusion on the site.

Humour Time

The following came from the **North London SME** newsletter:
A burglar broke into a house

one night. He shone his torch around looking for valuables, and when he picked up a CD player to place in his sack, a strange, disembodied voice echoed from the dark saying, "Jesus is watching you."

He nearly jumped out of his skin, clicked his torch out, and froze.

When he heard nothing more for a while, he shook his head, promised himself a holiday after the next big score, then clicked the light on and began searching for more valuables.

Just as he pulled the stereo out so that he could disconnect the wires, clear as a bell he heard, "Jesus is watching you."

Freaked out, he shined his light around frantically, looking for the source of the voice. Finally, in the corner of the room, his torch beam came to rest on a parrot. "Did you say that?" He hissed at the parrot. "Yeah," the parrot confessed, then squawked, "I'm just trying to warn you".

The burglar relaxed. "Warn me, huh? Who in the world are you?" "Moses," replied the bird.

The burglar laughed. "What kind of people would name a bird Moses?"

"The same kind of people that would name a Rottweiler Jesus".

DIARY DIARY DIARY DIARY DIARY DIARY DIARY DIARY DIARY DIARY

JANUARY

- 2 **Birmingham SME.** Peter Wardle: Ship's Engineerrooms. Contact John Walker: 01789 266 065.
- 2 **Bradford MES.** Bits & Pieces. Contact John Mills: 01943 467844.
- 2 **Bristol SMEE.** Video Evening. Contact Trevor Chambers: 0145 441 5085.
- 2 **Leeds SMEE.** Meeting. Contact Geoff Shackleton: 01977 798138.
- 3 **Bournemouth DSME.** Tech-Chat. Contact Dave Finn: 01202 474599.
- 3-7 **Hutt Valley MES.** Manukau Live Steamers Convention. Contact Gavin McCabe: 567 4487.
- 3 **Leyland SME.** AGM. Contact A. P. Bibby: 01254 812049.
- 3 **Sutton MEC.** Bits & Pieces. Contact Bob Wood: 020 8641 6258.
- 4 **North London SME.** Meeting. Contact Rachael Chapman: 01442 275968.
- 4 **Portsmouth MES.** Members' Videos. Contact John Warren: 023 9259 5354.
- 5 **SM&EE.** Technical Video Share. Contact Maurice Fagg: 020 8669 1480.
- 5 **York City & DSME.** Paul Butler: British Transport & Misc. Films. Contact Pat Martindale: 01262 676291.
- 7 **Leicester SME.** Keith Hale: Key to successful Silver-Soldering. Contact John Lowe: 01455 272047.
- 8 **British Columbia SME.** Frostbite Meet. Contact Sean Laurence: (604) 931 1547.

- 8 **Crawley ME.** AGM. Goffs Park Light Rly. Contact Allan Sinclair: 01293 888203.
- 8 **Dockland & E. London MES.** Meeting. Contact John Slocombe: 01708 222658.
- 8 **Oxford (City of) SME.** Frank Benfield: Historical Transport Films. Contact Chris Kelland: 01235 770836.
- 8 **Tyneside SMEE.** New Year Steam-Up. Contact Malcolm Halliday: 0191 2624141.
- 9 **Birmingham SME.** Speaker: Cyril Millward. Contact John Walker: 01789 266 065.
- 9 **Chingford DMEC.** Geoff Ashdown: A Lifetime of Modelling. Contact Ron Manning: 020 8360 6144.
- 9 **High Wycombe MEC.** Trevor Wood: R.N. Lifeboat Institution. Contact Eric Stevens: 01494 438761.
- 9 **St. Albans DMES.** Frank Banfield: Old Films. Contact Roy Verden: 01923 220590.
- 10 **Halesworth DMES.** Meeting. Contact Chris Walliman: 01362 695735.
- 10 **Sutton MEC.** Video & Chat Evening. Contact Bob Wood: 020 8641 6258.
- 10 **Worthing DSME.** Dave Dunstall: Shoreham Airport Historical Association. Contact Bob Phillips: 01903 243018.
- 11 **Brighton & Hove SMLE.** Peter Hill: West Blatchington Mill Past & Present. Contact Mick Funnell: 01323 892042.
- 11 **Colchester SMEE.** Geoff King: Making Injectors. Contact K. Wraight: 01255

- 11 **Hereford SME.** Bits & Pieces. Contact Nigel Linwood: 01432 880649.
- 12 **Dublin SMEE Ltd.** Meeting. Contact Colm de Brun: (01) 868 2549.
- 12 **Glasgow & S.W. Rly Ass'n.** George A. Davidson: Southern Railway Locomotive Policy. Contact Bruce Steven: 0141 810 3871.
- 13 **Sutton MEC.** Track Day. Contact Bob Wood: 020 8641 6258.
- 13 **York City & DSME.** Running Day. Contact Pat Martindale: 01262 676291.
- 14 **Erewash Valley MES.** Meeting. Contact Peter Siddall: 0115 9255397.
- 14 **Melton Mowbray DMES.** Auction. Contact Phil Tansley: 0116 2673646.
- 14 **North London SME.** Meeting. Contact Rachael Chapman: 01442 275968.
- 15 **Chesterfield MES.** Meeting. Contact Mike Rhodes: 01623 648676.
- 15 **Nottingham SMEE.** John Heeley: Building a Goblin Jet Engine. Contact Graham Davenport: 0115 8496703.
- 15 **Romney Marsh MES.** Roy Clench: Another Slide Miscellany. Contact John Wimble: 01797 362295.
- 16 **Birmingham SME.** Quiz Evening. Contact John Walker: 01789 266 065.
- 16 **Bournemouth DSME.** Meeting. Contact Dave Finn: 01202 474599.
- 16 **Bristol SMEE.** Paul Tracey: Turbo CAD. Contact Trevor

- 16 **Chingford DMEC.** Mike Chrisp: Going for Gold. Contact Ron Manning: 020 8360 6144.
- 16 **Leeds SMEE.** Meeting. Contact Geoff Shackleton: 01977 798138.
- 17 **Isle of Wight MES.** Meeting. Contact Malcolm Hollyman: 01983 564568.
- 17 **Sutton MEC.** Paul Whittle: Toy Train to the Clouds. Contact Bob Wood: 020 8641 6258.
- 19 **Chesterfield MES.** Public Running. Contact Mike Rhodes: 01623 648676.
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- 21 **Leicester SME.** Richard Yeoman: GW Holiday Routes. Contact John Lowe: 01455 272047.
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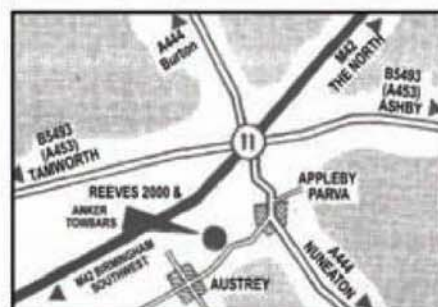


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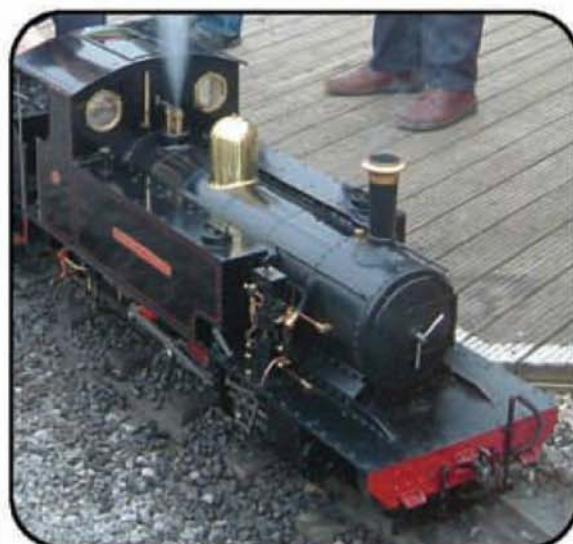
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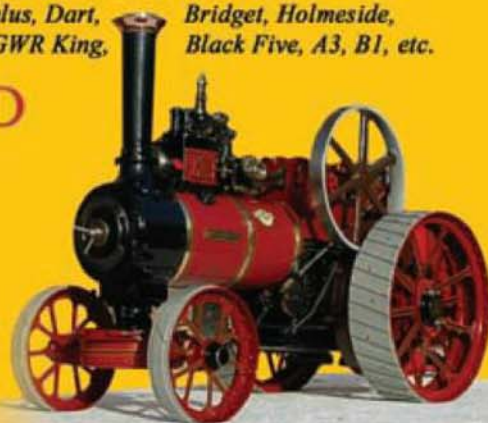
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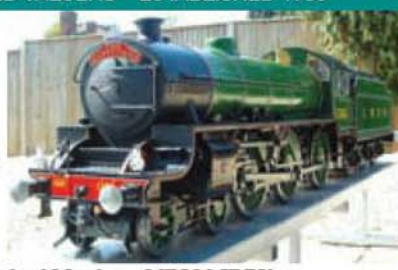
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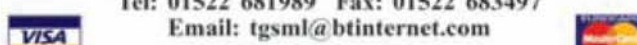
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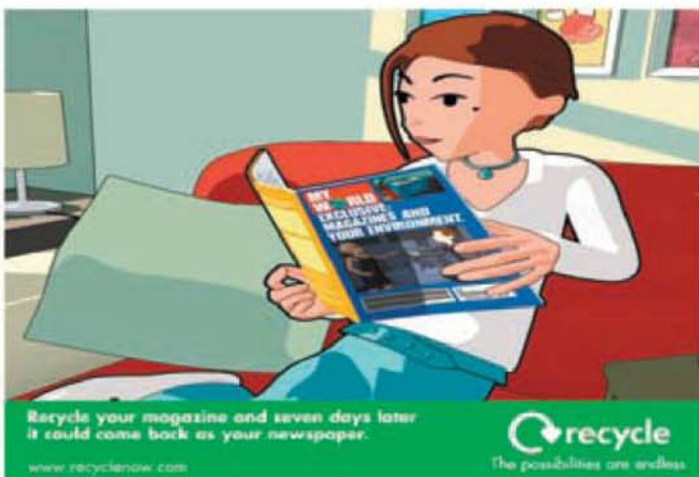
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