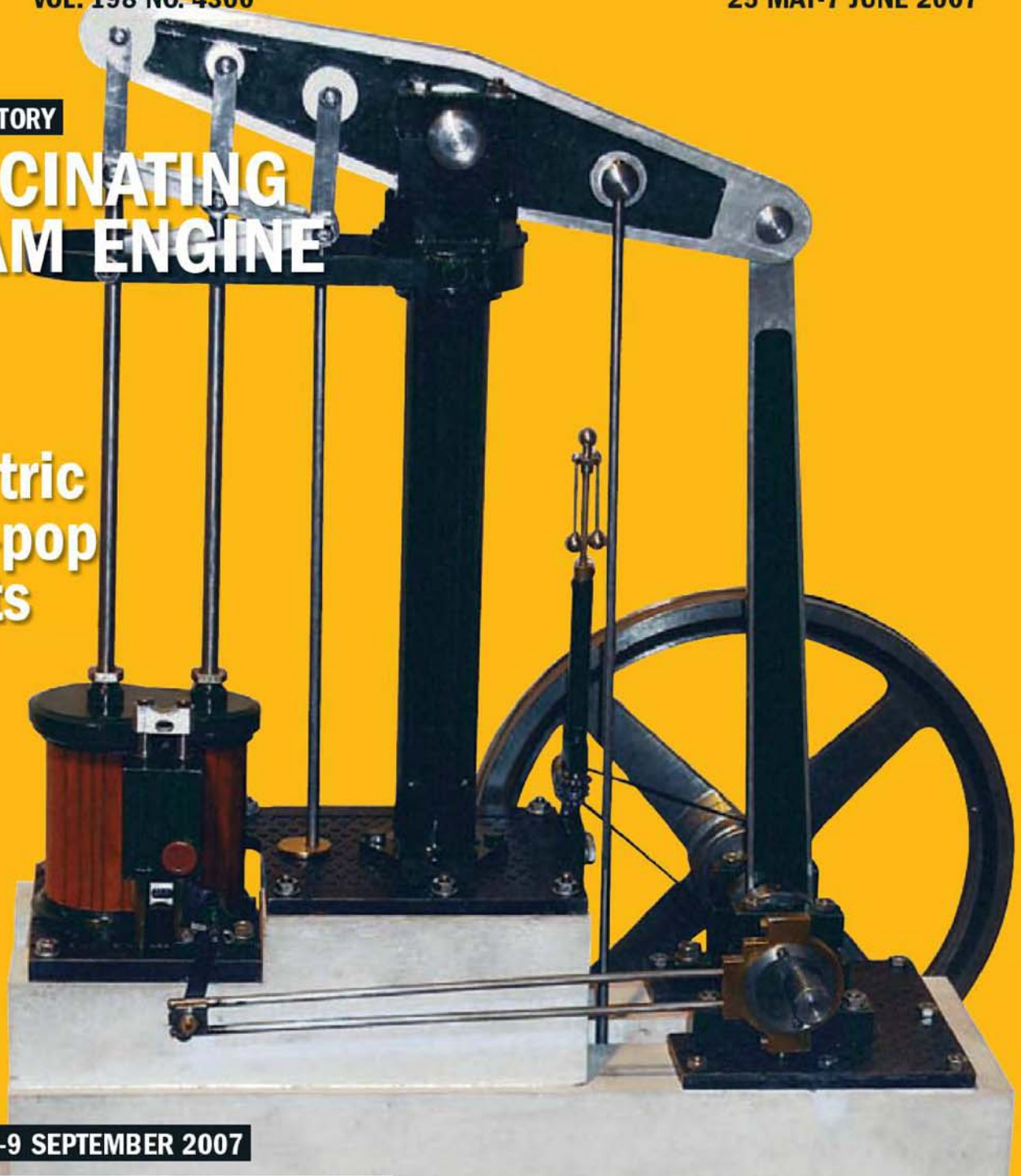
MODEL ENGINEER

VOL. 198 NO. 4300

25 MAY-7 JUNE 2007



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IN THIS ISSUE

Vol. 198 No. 4300 25 May - 7 June 2007

ON THE COVER...

John Wilson describes the model beam engine he made for display, complete with push button operation, for the Royal Gunpowder Mills, Waltham Abbey, Essex. The model follows the prototype and is built on three levels in 1:12 scale. It was constructed entirely from odds and ends from John's scrap box.

TURN TO PAGE 649 FOR YOUR EXHIBITION ENTRY FORM

Advertisement Index

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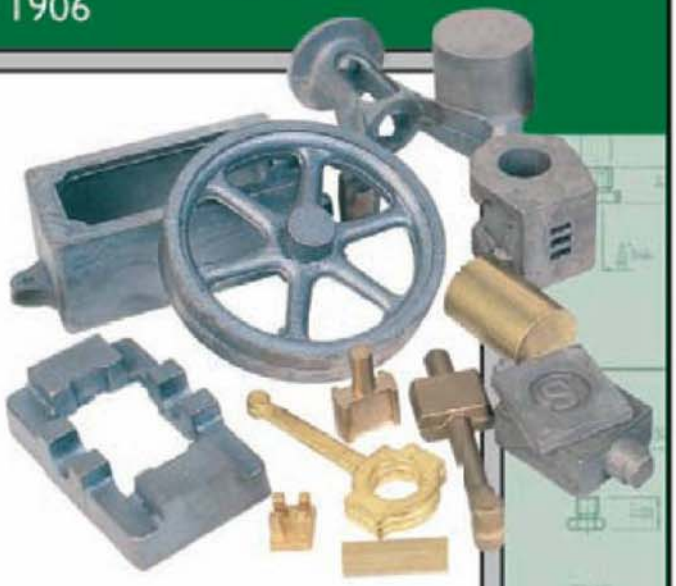

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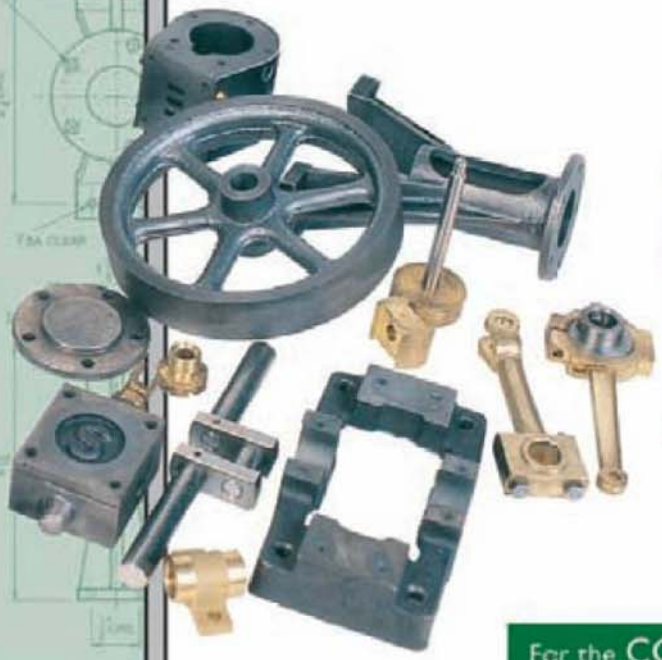

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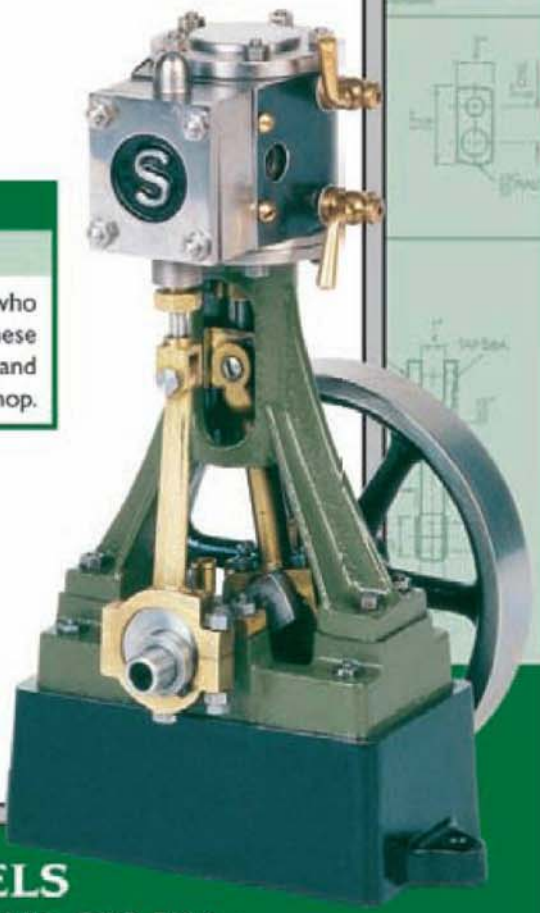

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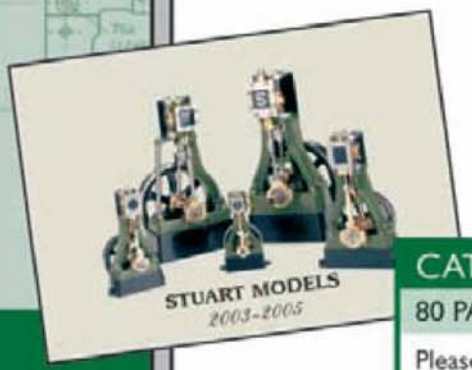

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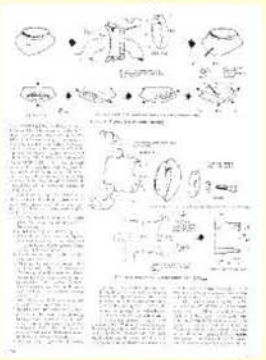
Kozo's Construction Manuals for 21st CENTURY MODEL ENGINEERS - No. 5

In our totally biased opinion, the Japanese designer Kozo Hiraoka is the best model locomotive designer writing today. Because English is not his native tongue, Kozo makes extensive use of drawings, rather than text, to show machining or assembly operations and these makes his books extremely clear, especially for the beginner. All his designs are for 3½" gauge, but include aids to help buildithem in larger gauges, and the geared engines do not require castings. The Switcher design calls for wheel castings, but these can be fabricated. All five books include full drawings in half size. Four of the five designs to date are based on American logging geared locomotives, but one is a conventional rod engine. Not only are all five great projects in their own right, these are fantastic books for the beginner or more experienced model engineer to have on their shelves, whether they build the locomotive(s) described or not. All are high quality books in every way.



With all due respect to the great designers of the past - Greenly, Evans, LBSC, Young and others, Kozo Hiraoka's books are ideally suited to newcomers to model engineering in the 21st Century because, even if you have only just bought your first lathe, drilling machine and (ideally) milling machine, and have never used them before, the quality of instruction in these itles is so high that, with patience and time, you can build a working model steam locomotive from any of these books.

Building the New Shay • £43.80

In this book, which he says will be his last full construction project description, Koza comes full-circle, returning to his first locomotive type - the *Shay* geared locomotive. However this design is based on a much later design of *Shay*, dating from the 1920s, and is both slightly larger than the first design, but includes the improvements which were brought in during the 30 or so years since the previous prototype was built. If it is possible, this book is even more detailed than the earlier ones, and it also includes extra chapters on building the design in 7¼" or 7½" gauges, the safety of copper boilers, safety valves, tube joints, O-rings for live steam use, and making small hexagonal screws. 326 pages in all, including a number of fold out ones. The drawings are metric. Hardbound

The four other construction manuals by Kozo Hiraoka are:

Building the Shay • £43.80

Kozo's first book, describing the building of an 1890s *Shay*. 194 pages. Metric drawings, numerous photos and sketches of set ups.

Building the Heisler • £43.80

The *Heisler* differs from the *Shay* in that the power unit is a V twin driving a central drive shaft to the outer bogies, the wheels being connected by driving rods. Full Imperial drawings, numerous photos and sketches of set ups.

Building the Climax • £43.80

This describes building the third (and prettiest) of the three geared locomotive types - the *Climax*, including a description of how you can make your own skew-bevel gears - an operation previously thought impossible on an amateur model engineers' equipment. Metric drawings

The Pennsylvania A3 Switcher • £43.80

This project is for a conventional locomotive, based on a small American prototype. Like Kozo's other designs it is designed for 3½" gauge, but can be scaled up to 7 ¼" gauge, involves no castings other than possibly the driving wheels, everything being built from the solid or fabricated. The drawings are imperial, and the descriptions are, as always brilliant. 264 pages.

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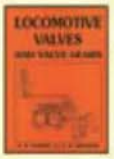

J. H. Yoder and G. B. Wharen

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HOW (NOT) TO PAINT A LOCOMOTIVE Christopher Vine

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THE MAINTENANCE & MANAGEMENT OF SMALL LOCOMOTIVES H. E. White

As the title implies, this is a very comprehensive work on all aspects of building and operating a live steam locomotive. 12 chapters cover the locomotive, its running, track, right through to passenger carrying. A must for any steam enthusiast's library. **£16.95 (C)**

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Plans are coming together extremely well for the International Model Engineer Exhibition at Ascot, September 7-9. At the time of writing it looks as if we could see the greatest assembly of models ever assembled under one roof. Be sure to be there.

We estimate that there will be around 1000 models at Ascot, representing the best of model engineering, from the UK and around the world. Just some of them are listed here.

We will have there LBSC's famous Ayesha of 'Battle of the Boilers' fame alongside a number of new versions being built to the 'Words and Music' of Tony Weale in these pages.

We hope to have more of LBSC's models, and others built to his designs. We hope that readers will add to the tally by exhibiting loan models in a special LBSC display. Just pop an entry form in the post.

No Centenary exhibition would be complete without a display by Roy Darlington and the Stirling Society. Roy will be displaying his latest creations and old favourites.

Sir Hugh Ford is the only President of the Institution of Mechanical Engineers to have built a locomotive. His Dean Armstrong 4-4-0 is based on a prototype of one of just four locomotives built at the turn of the Century. It is widely regarded as the most attractive engine ever built. Sir Hugh started his career as an apprentice at Swindon.

All of Cherry Hill's models of the last 30 years will be on show. They have kindly been loaned for the exhibition by the Institution of Mechanical Engineers, which was donated these exquisite models of unusual traction engine prototypes by Cherry.

Ron Jarvis is nearly as old as the Model Engineer Exhibition, and has produced a series of models that give a unique insight into the earliest days of steam in the early 18th Century. Many are Gold Medal winners. We hope to see his latest model, and the entire collection at Ascot.

Anthony Mount will be displaying all of his steam and hot air engines, many of which have been described on these pages. They will be seen running throughout the exhibition.

From the Netherlands we have a special display by the Nederlands Vereniging van Modelbouwers, the leading modellers organisation there.

There will be a competition for builders of the Nemett NE 15S I/C engine described recently.

Peter G. Smith's wonderful models of Royal State coaches will be on display. Many are Gold Medal winners.

Herbert Stumm from Germany is one of the top model engineers in the world today, and his models of interesting and unusual prototypes always create great interest.

We also hope to see designs by the other 'greats' from the past in *Model Engineer*, including Edgar T. Westbury, Martin Evans, John Haining, Tubal Cain, Don Young, Stan Bray, Dave Lammas, George Thomas, Bill Hughes, Les Mason, etc, etc, etc. Again if you have a model of one of these designs, we would very much like to see it displayed at Ascot. Please fill in an entry form and tick the loan model box.

We also hope to see other models described recently in the magazine, along with what is always the best display of competition and loan entries on show at any exhibition.

For those who also enjoy the opportunity to shop while at the exhibition, there will be bargains galore on trade stands. All the best names will be there, offering just about anything you are likely to need for the workshop - much of it at special Centenary discounted prices.

Make sure you are at this Centenary celebration. It's a long time 'til the next one!

Call for your tickets now on 0870-444-5556 (this is not a premium rate number) between 8am and 11pm weekdays, or 9am to 9pm weekends. Or visit **www.model-engineer.co.uk**

Advanced tickets cost just £5.

Brilliant Colin Baldwin.

Brilliant

Our photo is of Colin Baldwin, father of our advertisement manager, Paul, taken during a tandem parachute jump at Headcorn, Kent, on 14 April.

"Brilliant" is how Colin described the experience.

He made the jump for charity. Colin is suffering from cancer and, so far, £4,000 has been raised for his nominated charity, Harris Hospicecare, which will be caring for him.

If any readers would like to add to the tally, please contact Paul Baldwin on 01689-899217, or send a donation to him here at:

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Magicalia Publishing Ltd.
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8-10 Knoll Rise
Orpington
Kent BR6 0EL

STOP PRESS

As we go to Press, we have just received news that the threat to outlaw the imperial system has vanished. The EC says that during recent consultation, respondents successfully made the case to be allowed to use imperial measures alongside metric beyond 2009.

European directive on imperial sizes

SIRS, - I have just received my copy of *M.E.* 4291, 19 January 2007 and refer to the piece under *Smoke Rings* – Imperial denouement, European Union Directive 80/181.

It has infuriated me so much that I have left my workshop to put fingers to keyboard.

If, as indicated in *M.E.*, it will be illegal to market items with packaging showing Imperial units I would like to know how they should be marked. Surely the law at the moment makes it illegal not to accurately describe packaged contents. So how can a box of Whitworth bolts, a 1in. micrometer, or 6in. rule be otherwise described? What will happen to all the model engineering design drawings at present presented in imperial measurements? *M.E.* mentions Imperial sized pipe fittings which also include hydraulic fittings.

I do not see what business it is of interfering EU politicians. If I need an Imperial item of tooling etc., I should be able to purchase it without potentially breaking the law. I also believe that Imperial measurement is part of our industrial heritage and while we move forward into the metric system there should not be a law that makes the selling of Imperial items illegal. After all an Imperial sized item will only be purchased as and when required.

What really is worrying is that the manufacturers of Imperial tools will stop making them in the near future, perhaps with the exception of US companies.

What can be done?

The idea of individual model engineers writing to their MP is good but we all know that only a handful will actually do it and there will be no way of knowing how many or what the response was. What is needed is a coordinated response involving all other affected parties such as the vintage vehicle people, clock makers, model boat builders and aircraft enthusiasts as well as full-size locomotive restoration groups and manufactures and retailers. Others involved need to be brought in on the act, *Engineering in Miniature, Motor Cycle* and of course *M.E.*'s sister magazines Let's have some letters from model engineers overseas who still depend upon the availability of Imperial items for their hobby.

The hobby needs to get some broader representation, perhaps under the heritage flag and the Federations. We could also investigate obtaining Royal patronage, for example the Duke of Edinburgh or HRH Prince Edward.

What can *Model Engineer* do? First off I think it would be great if *M.E.* could publish the directive 80/181 in full and if possible identify the collective clowns that came up with the idea.

Could we get a petition going through the magazine? Let's call in the help of model making legal eagles.

We also need a detailed and succinct statement, say half a page, that we can use when writing to MPs or working up a petition. We all need to be singing from the same hymn sheet.

I believe that if 80/181 goes through it will represent an infringement upon our rights as British people. We have the right to be able to go into a shop and ask for an item produced to imperial measurement and to be able to see the details of the item printed on the packaging.

Finally, the thread for mounting cameras to tripods is 1/4in. Whitworth (1/2in. on larger and professional cameras), that's not going to change in a hurry though it would appear that should you want to make a camera mounting, finding a suitable male threaded bit, could be a problem!

Harold Pearson, Cambodia.

Mystery horizontal engine

SIRS, - I wonder if any of your readers can help identify the photographed steam engine? It was given to me by Richard Randall of Skipton around 1955 but he can't remember any details. From what he told me at the time it must have been made pre-war or just after the war ended perhaps by a Frenchman. It is of 1.25in. stroke x 0.75in. bore with a 5.5in. diameter flywheel and a slide valve driven from an eccentric.

The cylinder block and bearing pedestals are brass castings. The flywheel spokes are rectangular and only 130thou. thick which makes me think that it may have been turned up from a solid steel disc and the spokes filed out. The bearings are dummy split and originally simple holes in the castings.

One incorrect feature was that the slide valve was screwed onto the stem and not floating, so the gasket thickness determined how steam-tight the valve was. The steam port plate was of bronze, very neatly dovetailed into the casting. The ferrous parts had

Eddie Hamlin's mystery steam engine.

Write to us

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

Responses to published letters are forwarded as appropriate.

been nickel-plated but without any under plating so most of it has come off.

As received the bearings were quite sloppy and the shaft looked to be too small in diameter in relation to the flywheel. The cylinder and trunk guide were lapped out back to circular, and a 5/16in. diameter shaft fitted with bronze bushes. The original piston was a simple plug possibly of cast iron but it now has a new one with two O-rings and the slide valve is now correctly driven.

The nickel plating suggests that it may have been put into an exhibition and possibly an apprentice's work piece.

Eddie Hamlin, by e-mail.

European directive on imperial sizes (2)

SIRS, - After reading your editorial about E.U. directive 80/181, I met my Member of Parliament at his surgery in Ilminster and gave him a letter setting out most of your editorial comments.

I also let him read your editorial, and showed him the advert (by GLR) on the opposite page and some of the pages in Reeves catalogue as an illustration of the volume of business conducted in Imperial units. I assured him there were many other businesses involved such as EKP locally.

He immediately taped a letter to the Trade Minister and promised me a copy together with a copy of the Minister's reply.

I also phoned the secretary of my club (Taunton Model Engineers) who would be seeing the chairman that day; the chairman also has interests in full-size locomotive restoration.

Our club has members in about five parliamentary constituencies and I suggested that each MP could be approached. A national canvas of MPs might be effective in spreading the message that our hobby should be exempt from the directive, with suppliers free to advertise on their packaging.

It may not matter if one is starting a new model from new plans but think of the problems in re-annotating an old plan into metric fasteners and what about reamed holes if your tool box has not got the proper tool within when doing a rebuild! Readers should rally to the cause!

J. M. Hancock, Somerset.

Thoughts on a steam aeroplane

SIRS, - Back in the year 1958 I was present at the last flight of the flying boat service up to the South Sea Islands of the East coast of Australia. The motorboat pulled away from the Sunderland type flying boat, the warp went down and the engines opened up. Off it roared in the Stradbroke Island direction, up into the air and it was gone. I started my motorbike and went back into the bush where I had some land and was logging and trying to avoid the mosquitoes.

My 4⅝in. Portass lathe had just arrived from home in the UK and I had mounted it on an old gas stove, modified of course and minus the burner rings. The oven made a store for equipment. My copies of *Model Engineer* were sent out to me by my mother, in the style of the 'post run'. It was flung over the fence into the front garden by a contractor. Yes, I lived in the bush, which fortunately had mains electricity but nothing else.

What's all this to do with steam aeroplanes? I did not think about a lot else accept my 'primary production', which didn't provide a lot and cash is very necessary for any engineering. However, I could think and sketch, which only costs time. Well, the years have rolled by, the lathe went to a chap in Ipswich Q.L.D. (I wonder if it is still there?) and I returned to 'Blighty'. There was someone else's daughter, kids, rates and other things all designed to keep you 'skint'. But my ideas were developed and brought up-to-date and this is the present situation:

A single-seater aircraft with a single or twin engine and a crew of three. Solid fuel is the norm and would be selected pellets. I refer to the boiler as an *Evaporator*, the engine as an *Expander* but the condenser remains a *Condenser* as does the 'Hotwell'. All are essential parts of the system.

The Evaporator would be a twin system with interconnecting pipes and valves. Automatic firing is specified with small fuel from a hopper fed to a granulator just above the furnace. It takes about seven seconds for a piece of coal the size of a split pea to heat up and gas and then flame. It is probable that the furnace would be a fluid bed activated by the exhaust turbine, which will power several other auxiliary systems. Feed pumps will be positively powered, as the time the main Evaporator goes 'critical' could be only four seconds.

The furnace would be under pressure, of course. The best quality insulation would be used and any vibration tracked down and eliminated. As for the Condenser, there seems to be requirement for a receiver/heat exchanger for the various exhausts before letting the steam travel through the leading edge of the wings. It all ends up in the Hotwell via a filter for re-use.

Remember, it takes approximately three times the power to take off than it does to fly and this power needs to be readily available during, for example, landing. Variable pitch propellers are therefore considered desirable.

So that is a quick rundown on my efforts so far. There would be difficulties, but each problem is an opportunity. Could my flying boat take off from Sharpness UK and arrive in Redland Bay, Q.L.D. in a few days time? A mock-up could be made from some sheets of plywood with some rollers (scaffold poles) underneath to enable data to be collected. This could form the basis of a more workable design. No doubt someone could do a computer job but who wants to sit and look at a screen all day?

If there is any interest I could provide more details but because of my present workload I am unable to complete the design myself.

John R. Bayley, Cheltenham.

Static electricity from steam

SIRS, - C. Wood from Sussex (*M.E.* 4295, 16 March 2007) asks about steam generated static. The locomotive may well be earthed to the track but the cloud above it certainly is not. As in nature, clouds carry static electricity and when they accumulate sufficient charge, lightning results!

Ken Willson, Hants.

In defence of the LCDR

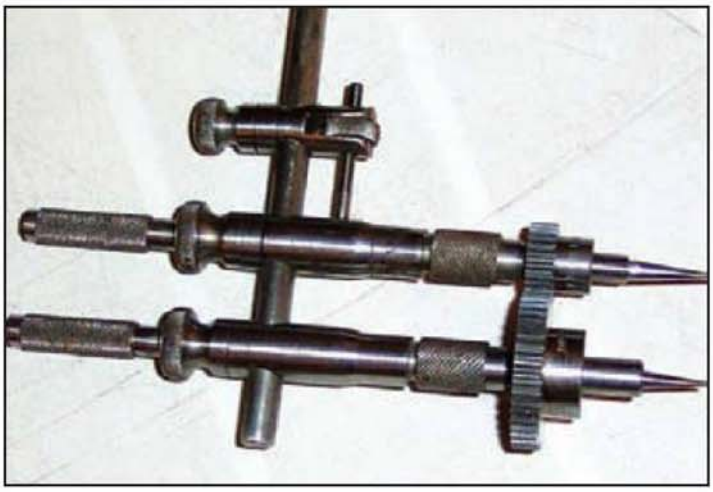
SIRS, - I always look forward to Ron Isted's articles on *Edwardian Elegance* as they are always informative and thought-provoking. However, I would like to put forward a defence for the LCDR which came off rather badly in his article on the SECR (*M.E.* 4295, 16 March 2007)

I have always had a soft spot for the LCDR (London, Chatham and Dover Railway), ever since I started my first real model engineering project in the 1970s. This was a *Europa* class engine designed by William Martley, the C.M.E. of the Chatham. The *Europa* class engines were the most competent and handsome of any locomotive running south of the Thames.

The animosity between the LCDR and the SER (South Eastern Railway) was real enough and indeed kept the SER poor and the LCDR virtually penniless. The root cause was a mutual mistrust between the two companies, compounded by a personal battle between Sir Edwin Watkin of the SER and James Staats Forbes of the LCDR The much larger and wealthier SER always thought that given time the LCDR would fall into their lap and they did everything in their power to make this happen.

There were stories of rival engines being chained to the tracks and fights between rival staff over passengers. I don't know what the board of the SER thought when they heard that their archrivals were building a line deep into the SER heartland to Ashford and then on to Folkestone but I can imagine!

There were lines built purely to counter the opposition, such >>



Hubert Elffers use of trammels as a depthing tool.

as the SER line from Strood over the Medway and into Chatham, parallel and in direct competition with the LCDR line. The railway bridge, however, is still in use today, the original LCDR bridge having been dismantled and replaced by the present road bridge.

The LCDR was always run on shoestring, (except Staats Forbes salary) using doubtful practices to obtain capital, such as issuing preferential shares in the completed line to the contractors. The ordinary investor never received a penny in dividends.

These practices caused the company to go into Chancery in 1864 when their merchant bankers, Overand & Gurney went bankrupt and the whole pack of cards came tumbling down in the subsequent crash.

The company was forced to build an expensive line from Rochester into London over highly unsuited railway land. It was also lumbered with the eccentric locomotive designs of Thomas Crampton, which caused untold damage to the permanent way and was hugely expensive to maintain.

It was not until William Martley took over that the locomotive stock was overhauled and new designs entered service. Its locomotives were always well maintained and smartly turned out.

The company was innovative, they were the first to use lock and block signalling, continuous brakes and they introduced cheap workers fares between Blackfriars and Victoria. Admittedly this was the only way that the company was able to get Royal Assent for the City line.

There had been numerous attempts at a merger between the SER and the LCDR and indeed on occasions with the LBSCR as well. They all came to nought, chiefly due to mistrust. On one occasion just before finalisation of the deal the unstable Folkestone Warren stretch of the SER line collapsed and the LCDR felt that this gave them an advantage and called off the deal at the last moment.

However the writing was on the wall and the two companies co-operated in the Dover to Deal joint line and they entered into traffic receipt sharing agreements, which naturally enough both companies tried to circumvent. It was not until the retirement of the chief protagonists that the merger finally happened in 1899 when the SECR joint managing committee was formed and the LCDR no longer existed.

This is by no means an exhaustive history but just a little taster of the flavour of the old LCDR.

Marcus Rooks, by e-mail.

'One-off' depthing and long grub screws

SIRS, - I have made the apron for a small lathe now being constructed, and when fitting the gears for the manual movement of the saddle, I encountered a problem; I was puzzled how to calculate the spacing of the gear shafts, to ensure an accurate mating of the gears. The watch-making fraternity use a tool called a 'depthing tool' for this purpose. Making one for a 'one-off' use did not seem a good idea. I then remembered that I had a set of trammels, which seemed to fit the bill. I turned two bushes to fit onto the two marking scribers, and then mounted the gears on the bushes - and the deed was done, as indicated in the picture. I used the trammel scribers to mark the positions for drilling the two holes in the apron and the gears engage perfectly.

The saddle of the lathe has a long overhang at the front, thus needing very long (50mm) adjusting screws. M5 Allen grub screws are not made in this length, so I cut some long screws out of studding and equipped them with screwdriver slots. I was not very pleased with the appearance, and wished that I could use Allen screws, which are much neater.

Countersunk Allen screws are made in this length, and the size of the Allen key is nearly as small as that for grub screws. I turned the countersunk heads off the screws, and to my delight produced long grub screws! These countersunk screws had threads only part of the length, whereas I needed threads all the way. I wondered if a die would cut on the relatively hard Allen screws. I ran the die to the end of the thread, held the threaded section in a collet chuck in the lathe, with the spindle locked, and then ran the thread without any trouble, using the die and stock, by hand. They look very neat.

Hubert Ellfers, Hertfordshire.

Machine vice

SIRS - I read with interest Mr. John Crocker's letter in (*M.E.* 4291, 19 January 2007) concerning the Warco new design of machine vice as detailed in my article in (*M.E.* 4284, 13 October 2006)

Contrary to his feelings of insufficient rigidity I have not found any during the time I have been using it, now over a year of constant use. The front jaw is secured from sideways and lateral movement by a tongue, and the two M8 Hexagon cap head screws have held it secure against all the force I have tried to apply.

The other jaw does not have a tongue but again I have found the two screws quite adequate and the possible movement of the jaw against the other one before tightening up the screws of the second jaw does afford the chance to get the two jaws quite parallel to each other and a firm force along the whole length of whatever is being held in the vice. The recent introduction of large V-jaws has greatly added to the versatility of the vice.

At the recent Alexandra Palace exhibition the designer was demonstrating the vice throughout the show and I asked him if he had had any other adverse comments about the vice, there have been none so far.

Two new much smaller vices working on the same principle have recently been introduced.

Anthony Mount, Devon.

Bronze rings in bronze cylinders

SIRS, - I read with interest the letter by Mr. A. F. Howard (*M.E.* 4296, 30 March 2007) enquiring about bronze rings in bronze cylinders.

I have done this experimentally on my 3/4 scale A3 Pacific, but only on the piston valves, not on the main bores where I used O-rings.

I used phosphor bronze to make the rings to run in gunmetal bores. On compressed air the engine runs well. So far, after about six hours of running in, no discernable changes have occurred apart from the expected bedding in and easing of slight stiffness. However, only when the locomotive is finished and running on steam will I know whether or not the rings are effective.

I hope this is of interest.

David R. Machin, by email.

Jean Le Bot and Romain Gransard
from Rennes, France,
reveal details of an ingenious pop-pop boat where the pressure oscillation of the motor's diaphragm is induced by electro-mechanical means rather than thermally.

An Electric POP-POP BOAT

One of the most fascinating aspects of the pop-pop boat lies in the contrast between its simplicity and the difficulty in explaining exactly how it works. At first glance, it would appear that the aspiration and expulsion (intake and exhaust) of water should counterbalance one another and thus provide no thrust.

However, in a delicate, but very rigorously conducted experiment, Dr. H. R. Crane showed that in such a boat the only thing that counted was the water expulsion time; the re-intake time had very little real effect on propulsion. These findings were reported in *M.E.* 4051, 26 September 1997 and also in *The Pop-Pop Boat* (see reference 1) .

Later, in the *Post Bag* pages of *Model Engineer*, 'Conservation of Momentum', Mr. O'Connor confirmed this (*M.E.* 4067, 8 May 1998). He based his reasoning on an imaginary experiment where a brick was thrown from a boat and then hauled back on a length of line. He drew attention to the fact that we were not correctly applying Newton's three laws of dynamics to pop-pop boats.

R. Gransard, one of the authors and, at the time, a student in an engineering college preparation class, set himself the task of establishing exactly what the dynamic theory of the pop-pop boat motor was. The calculation is a pretty, little mathematical exercise which requires a sound knowledge of the speciality, but there is no point in going into it in detail here.

Prototype Testing

Even when they grasp the theory, elderly physicists still love to check things experimentally. So, the authors built a pop-pop motor in which the pressure oscillation was not induced thermally by evaporation-condensation, but mechanically by the movement of an oscillating diaphragm.

Photograph 1 shows the general arrangement of the prototype. A small electric motor drives a crank and link assembly through a reduction gearbox. This causes the rubber diaphragm to move through an amplitude of 4 millimetres. The periphery of the diaphragm is secured to a metal casing at which are attached the usual two pipes of a pop-pop motor. The total swept volume for each cycle was 1.7 cubic centimetres.

To test the thrust, we used the balance which we made for testing thermal pop-pop motors. Its structure and application are shown in **fig 1.**

Figure 2 shows a curve of the variation in thrust plotted against the speed of the motor, that is, the number of pulses per second. Several items of information can be deduced from it.

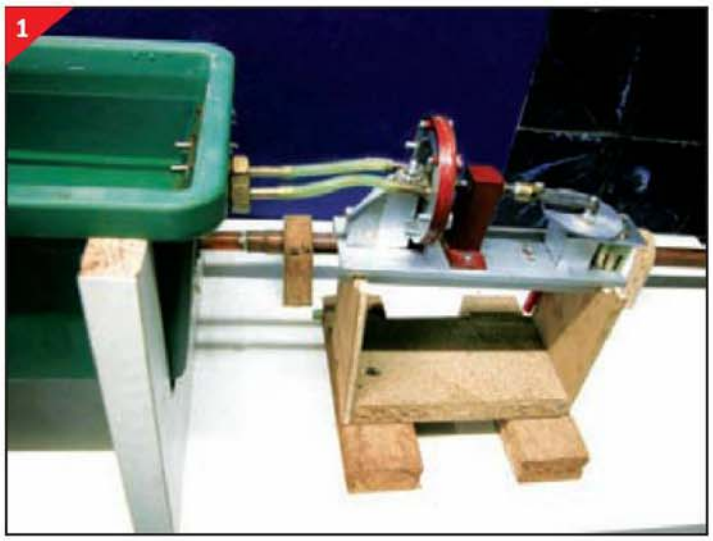
First, for anyone who has understood Newton's laws, there is no need for inlet and outlet valves to produce a pulse-jet propulsion unit.

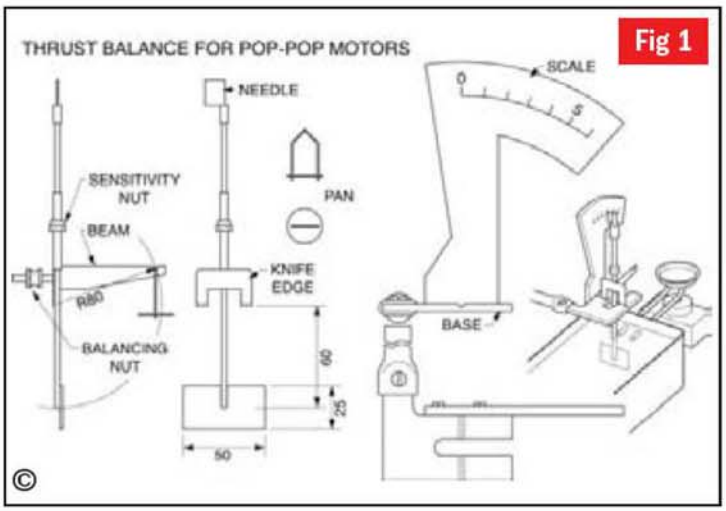
Secondly, it seems surprising, but, there is a maximum peak on the thrust-frequency curve, between 8 and 10 Hertz. It appears that when the frequency exceeds a given value, the piping resists, by an increasing amount, the alternating movement of the water.

We noted that the maximum power established itself at a frequency close to that which occurred spontaneously on thermal pop-pop motors of comparable dimensions.

Finally, the maximum thrust was considerably higher than that of a thermal pop-pop motor with a diaphragm casing of the same diameter. On this electric model engine, the volume swept at each oscillation is certainly higher than that of a thermal pop-pop motor with a >>

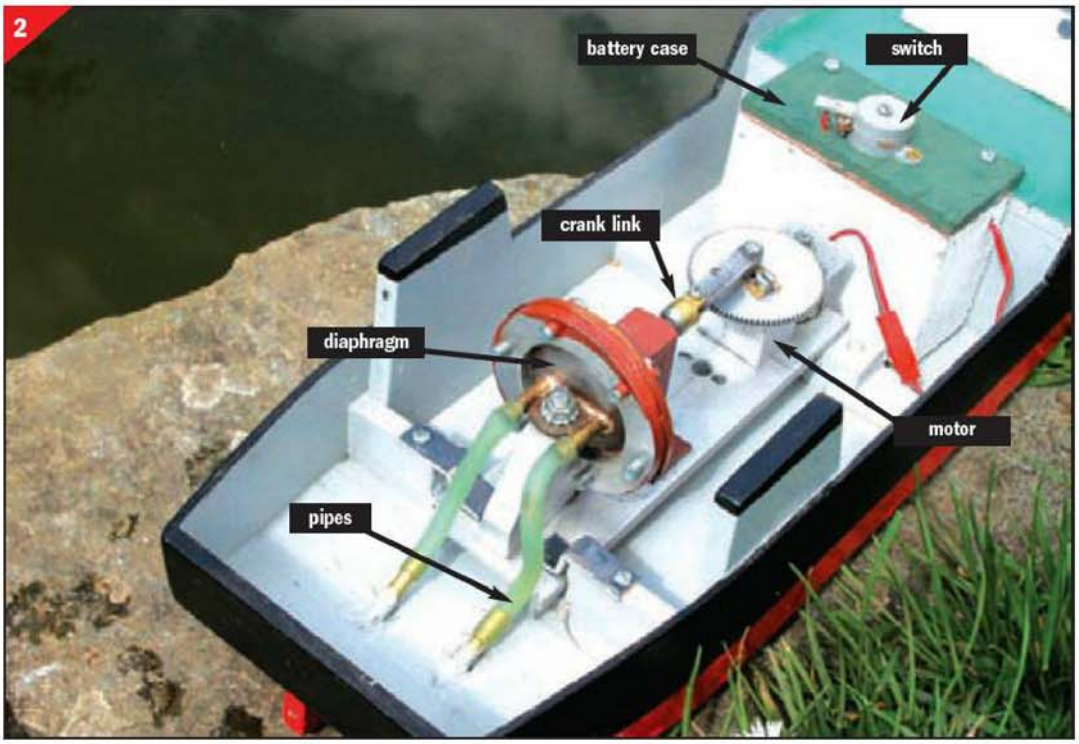
1. General arrangement of the prototype electrically-operated pop-pop motor.





2. Electric pop-pop motor as fitted into test boat.

3. The maiden voyage of Abeille-Whisky in the garden pond.



similar size boiler. The limitation of the thermal motor is in the metal diaphragm stiffness.

Sea trials

All that remained was to check the propulsive ability of our new electric arrangement. The motor was mounted in a model of a off-shore supply vessel, the general layout of which was suited to this type of experiment.

Photograph 2 shows the equipment fitted in the ship. The case contains the 1.5 Volt battery which provides the maximum thrust determined on the test rig. Atop of the battery box is mounted the on-off switch. In **photo 3** the vessel is undergoing her first 'sea trials' on the goldfish pond in the garden. She was christened the *Abeille-Whisky* having been launched on the same day as the full-size salvage tug *Abeille-Bourbon* in Brest, France. More on this vessel can be found on the internet at **http://commons.wikimedia.org/wiki/Category:Abeille_Bourbon**

Our craft goes very well, but slowly, which is not surprising in view of the low power of the motor compared with her 'tonnage'. The combined weight of the model and the motor is 1,015 grams. By a happy co-incidence, the noise the power-unit makes sounds much like a diesel engine idling. We are looking into making another motor more suitable for the boat with a simpler mechanical arrangement and a larger swept volume.

Conclusions

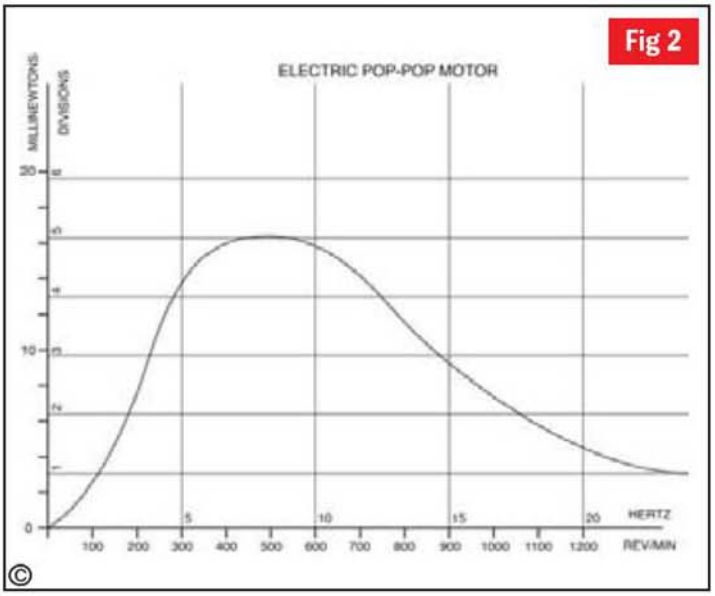
By shedding more light on the presumed mystery of the aspiration/expulsion motor, our theoretical investigation, confirmed by the tests run on *Abeille-Whisky*, marks a phase in the history of pop-pop motors.

An easy experimental route has been opened to examine the optimum ratio between the diameter of the pipes and the volume of the reservoir. The decisive phase in our knowledge of pop-pop motors will only come when we have mastered the difficult thermal problems associated with vaporisation-condensation.

On a previous occasion, I proposed a distinction in terms between the true diaphragm-type pop-pop motor and spiral wound motors, by calling the latter, PWE's (Pulsed Water Engines). Now, we shall have to introduce further classifications: EPWEs (electric pulsed water engines) and TPWEs (thermal pulsed water engines). **ME**

References

1. *The Pop-Pop Boat. The Physics Teacher*. Mar 1997. v35:3. pp. 176-7.
2. *M.E.* 4051, 26 September 1997.
3. *M.E.* 4067, 8 May 1998.
4. http://commons.wikimedia.org/wiki/Category:Abeille_Bourbon



A SAWDUST HEATER

Alec Farmer
the well-known professional model boiler builder offers the design of a sawdust heater he encountered during his time in industry.

During my working life, heat provided for comfort in the workshops came in many forms. High-pressure steam radiators, slow combustion stoves, ducted hot air, electric radiators, and often none at all. One place, a radiator shop in Aston which I remember, was situated in a corrugated galvanised iron shed. As you may well imagine it was very cold in the winter. The only heating was by a sawdust stove. Each bench worker had a thick steel plate, which was placed on the top of the stove to heat up and then these were placed by the bench and one stood upon them. At least your feet were warm, but not much else.

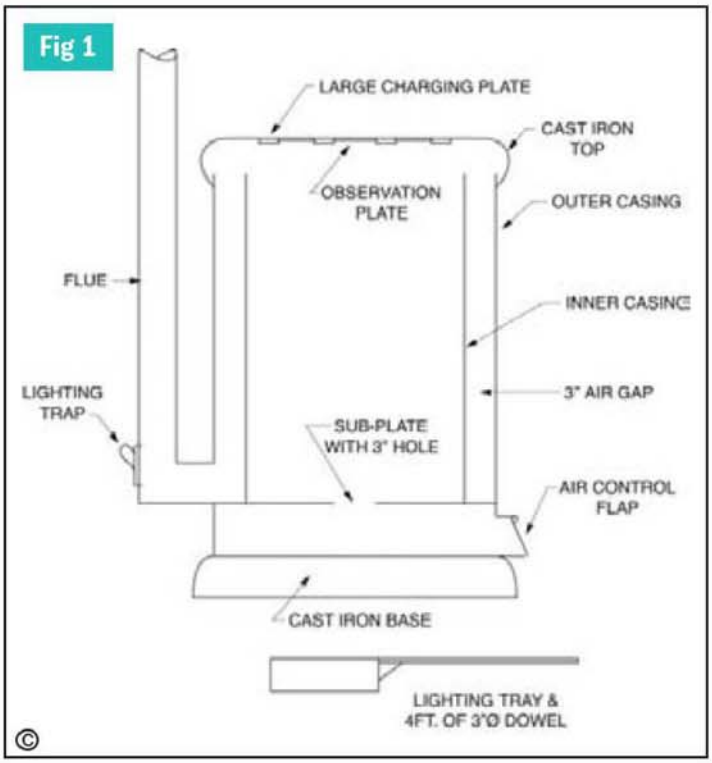
The provision of heating in the workplace is now strictly regulated, and one of the reasons for this article is to introduce you to the method of heating, the sawdust burning stove, that I discovered while working in the radiator shop in Aston. I had hitherto never seen one of these appliances before, and I have never seen one since.

In those days, sawdust was plentiful and cheap. I take my hat off to the man who discovered the way to use it in a stove. **Figure 1** should explain the general construction of this remarkable heater.

You will note that the stove was constructed as two concentric cylinders. The inner one, with a sub-plate, has a 3in. diameter hole, while the outer one reached the bottom of the stove and was equipped with a sliding door at the front as in a slow combustion stove. The space between the sub-plate and the bottom was about 3 inches. There was no firebrick lining to this stove.

Notice, too, that the smoke stack from the stove is not positioned at the top, but close to the bottom of the stove connecting with the annular space between the two cylinders of the sides. A small trap door was provided at the base of the smoke stack. A small lighting-up tray on a long handle was provided to ignite the sawdust.

The heater had one draw back: once lit it could not be replenished and the burning cycle had to run its course. It would not burn anything but sawdust, but it did that very well and provided a large amount of radiated heat.



Preparations

To light the sawdust stove, the top lids were removed. All burnt residue was pushed through the hole in the lower sub-plate and the ashes raked out of the base chamber.

A long, three-inch diameter wooden pole was inserted down into the stove and pushed into the hole in the centre of the sub-plate. Whilst the pole was kept centred, sawdust is tipped into the void surrounding the pole and tamped down. If the sawdust was slightly wet, burning would take longer. If dry, the heating period was shorter.

When removed, the wooden pole left a 3in. diameter hole through the sawdust packing, just like a cotton reel. The top plates were replaced.

Lighting-up

The lighting-up procedure was as follows. The lighting tray was filled with sawdust and paraffin poured on it. A piece of rag or cotton waste, also soaked with paraffin, was lit and inserted into the smoke stack lighting trap and this door was shut. This provided an up-draught in the smoke stack which drawed the flames from the tray up through the centre core passage in the sawdust.

Finally, the paraffin-soaked sawdust in the tray was lit, and when it was well alight, it was pushed into the bottom chamber until it was immediately beneath the vertical core.

The sawdust would smoulder slowly in the chamber with very little flame or smoke. The heat and combustion gases were deflected into the annular space between the two cylinders of the stove and then up the smokestack. In about ten minutes the sides of the outer shell would begin radiating heat.

The rate of burning was controlled by the sliding wood plate at the bottom of the outer cylinder on the side opposite from the smokestack. The heat generated could be considerable. With the control door wide open, the top and sides of the outer cylinder could reach red heat.

For those with the proper equipment (arc-welder, bending rolls, etc.), construction of one of these efficient heaters might be a possibility. If you have access to free or cheap sawdust, then this stove becomes a valuable asset. **ME**

MACHINE TOOLS

Emco Unimat DB200 and 1000

Tony Griffiths looks at the popular early versions of these versatile little multi-purpose machine tools.

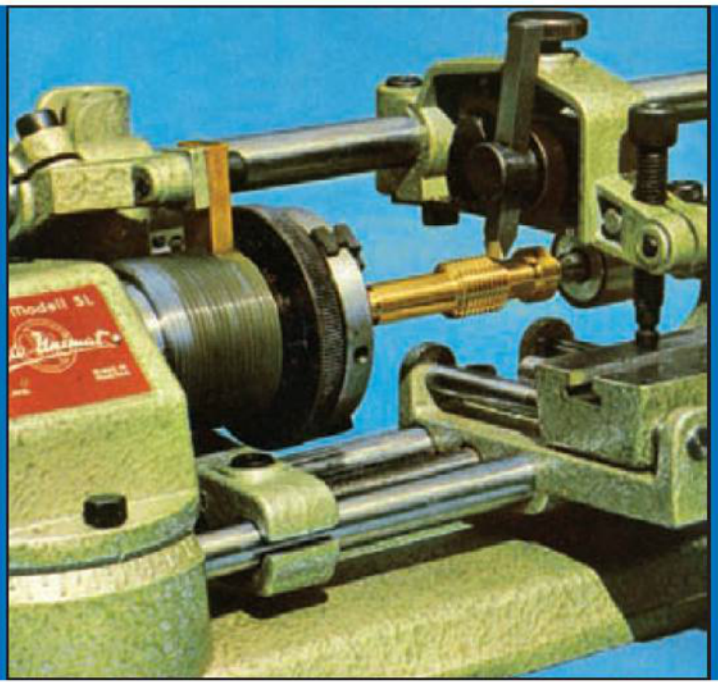
The Emco Unimat was introduced in 1953, by Maier & Company in Austria, the first of the firm's incredibly popular range of small multi-purpose machine tools. Although tiny, just 1.42in. centre height by 5in. (later 6.75in.) between centres, it was perfectly capable of decent work, while being light enough to be lifted on and off the workbench with one (strong) hand. The original model stayed in production until 1977, with a production run of around 300,000, at which point it was replaced by the more modern looking Unimat 3, an entirely conventional looking lathe and one not nearly as adaptable to so many different uses.

In Europe the original Unimat was designated SL 1000, and as the DB250 in the United States.

Although an almost continuous series of small and larger changes altered many details of the lathe's construction and appearance, the general arrangement of all models was identical: a pair of bed bars was carried between supports formed at each end of a cast 'bed tray' that was made first of cast iron and later a zinc alloy. A central leadscrew was used to drive the carriage up and down the bed rails though at first (the carriage) had no form of lock -later models were given a clamp bolt at the rear that also acted as a form of adjustment to the sliding fit. The cross slide followed the same design and, just like the English Drummond Little Goliath of 25 years earlier, ran on two bars instead of conventional machined ways.

The headstock could be swivelled on its mounting and, fastened to its end face (and so rotating with it), was an aluminium bracket that carried the motor and (on most versions) an additional speed-reduction pulley. By reversing the pulleys and rearranging the belt runs, 11 speeds of approximately 900 to 7200rpm could be obtained.

With its unique headstock design, ingenious drive system and clever mountings everything points to the lathe being designed from the outset as a multi-purpose machine that could be gradually equipped with a range of profitable accessories to allow its use as a metal or wood lathe, miller, drill press, polisher, grinder, jig saw, saw bench, wood planer or jointer, sander or even - with the headstock detached from the bed and fitted with a grip - as a hand drill. The conversion process from one mode to another was generally well thought out and simple to execute: for example, to complete the important conversion, from turning to milling and drilling, the headstock, complete with its motor-drive system, was removed from the bed and remounted on an aluminium bracket carried on a 24.5mm diameter steel bar that plugged into the hole formerly occupied by the headstock's mounting stud.



Accessories added to the great versatility of the Unimats.

In order to provide a vertical feed the headstock spindle and its bearings were mounted within a cylindrical cartridge, with a rack, formed along its rear surface, engaged by a splined bar inserted into a hole bored through the top face of the headstock. By this means the cartridge, under the tension of a large spring, could be propelled in and out of the casting by 5/8in. or so - a movement that was also employed to help mount various accessories when in horizontal lathe mode.

Originally the splined drive-bar was fitted with just a very short, plain handle but later a black knob was added and finally the handle (retaining the ball), was lengthened. To excite the anoraks among us, some 6 variations on the handle have so far come to light.

While the exterior dimensions of the cartridge were one of the few things to remain unchanged throughout production, its contents did not. The first example used a crude system, similar to that employed in a bicycle hub, with crowded (loose) balls contained between cones with the single-groove drive pulley held in place (overhung, at the left-hand end of the cartridge) by an M12-1 nut, the adjustment of which was used to set the bearing pre-load. The outside face of the front cone was ground to an abutment flange for items screwed onto the spindle nose - although this arrangement may have caused problems with the bearing adjustment, with heavier interrupted cuts tending to tighten the cone and reduce the clearances.

Later arrangements were more sensible, with the use of two single-row, self-adjusting sealed-for-life ball races (NSK bearings part number E13-305) and with wavy Belville washers providing the thrust. An alternative precision cartridge, the Clockmaker's Sleeve Order No. 1022 was also eventually offered; this was designed to appeal to workers dealing with very small components, and accepted tiny B8 collets. As a point of interest, the spindle from this unit was also used in the Toolpost Grinder (part number VS2-460) that Emco offered for their larger V7, V8 and V10 lathes.

In order to form a chronological sequence, and so help owners categorise their lathe, the various changes to the cast-iron models (in so far as they have been discovered) are listed as 'Mk. numbers'. It must be emphasised that the manufacturer did not use these, nor were the alterations given any publicity at the time.

Mk. 1a

The first production machines are very rare, and this is the earliest known example on which research can be based. Despite being intended as a mass-production unit evidence shows that, at first (no doubt because of the still-severe economic conditions at the time), the Emco factory would have had a limited number of automatic production machines and a good deal of hand-work went into each example. There is also an indication that little time or material was wasted with, for example, the castings having an indifferent cosmetic finish and wrongly spotted and partially-bored centres holes corrected - but with the initial damage to the component ignored. As it would have provided the easiest and most reliable route into production the first version (like nearly ever other amateur lathe of the time), had its base and other major castings in iron.

The first lathe, with an overall length 16in., was shorter than later versions and the base unit just 12 3/8in. from end to end that allowed a capacity of only 5in. between centres. Unique to the first one or two years of production the base's other main identifying features were its middle section, formed into a convex chip tray (with a flattish bottom), raised ridges running along the front and back walls and the boring of the casting at both ends to accept two solid-steel, 12mm diameter bed bars each retained by a horizontal grub-screw. That section of the base on which the headstock fitted was rectangular in shape, with a flat front, and bored to accept a large 'inverted-cone' that allowed the headstock to be rotated or quickly detached. A pin, screwed in through the left-hand face of the casting, engaged against the cone, and drew the headstock down and locked it in place. Unfortunately there was no provision for aligning the headstock, other than fitting the tailstock ram with a centre and pushing it into the spindle hole - while simultaneously tightening the locking screw.

There was no provision for locking either the saddle or the cross-slide to their bars, and all feedscrews had a 'right-hand thread' - giving that annoyingly counterintuitive situation where turning a handle to the right produced a moment towards, instead of away from, the operator. One feature found on this model, but on no subsequent versions, was a tiny oil hole drilled vertically through the front wall of the carriage by which means the end of the cross-feed screw, where it passed through the casting, could be lubricated.

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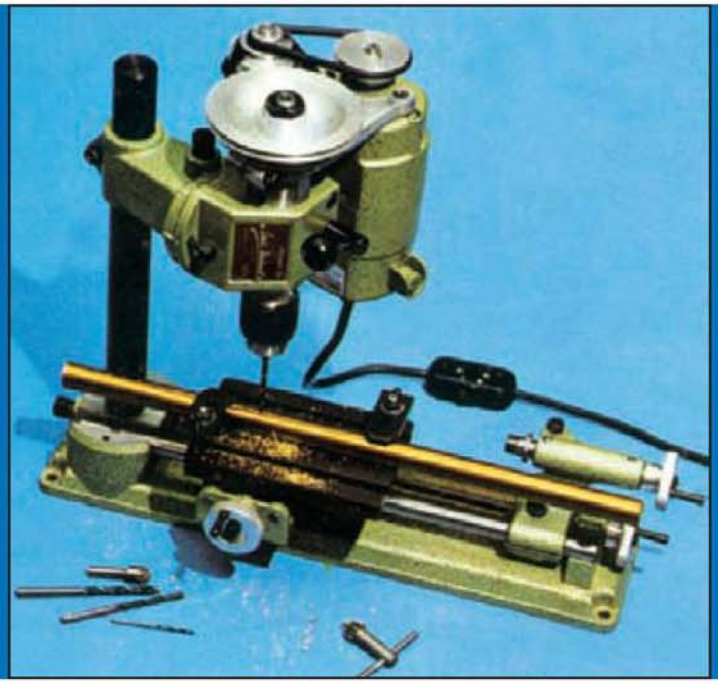
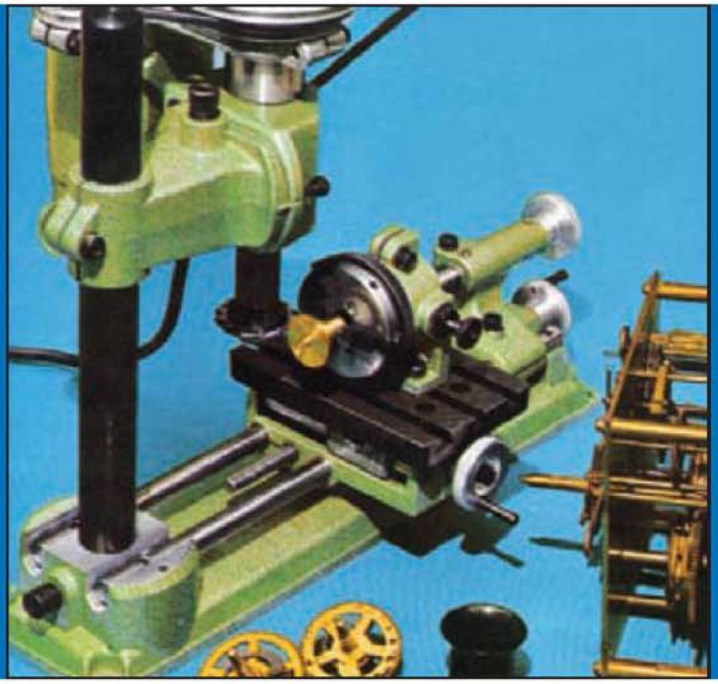




The smaller turned-parts on the lathe were probably made on a Swiss Auto - an ideal machine for making quantities of precision miniature components - with the plain steel, 28mm diameter handwheels having a diamond knurl around their outer edge, straight pins for handles and tiny micrometer dials. It is likely that more than one kind of handwheel was fitted on the production line, with some being of a slightly different diameter to others.

In comparison with later machines the drive pulleys exhibited several significant differences: they were thinner in section and of a much lighter, even delicate construction. Manufactured in fully-machined cast aluminium they had deep V-grooves and were mounted in the reverse direction and with the pair used on the motor and idler stud (at 49mm) larger in diameter. The original belts were in the form of coiled steel wire 'springs', not an ideal material to run against aluminium. The motor bracket, later a neat diecast affair, was a rather rougher aluminium casting with only the holes machined. From the start of production the motor bracket came with an idler pulley - but machines have been found without this fitting (possibly to ease the fitting of an accessory) and hence only six instead of 11 speeds. A later offering was a 'slow-speed' bracket with two idler pulleys designed to allow slow spindle speeds and so more effective use of a 'chase-type' screwcutting attachment.

Constructed as a one piece casting the first tailstock had a spindle retaining nut just inboard of the handwheel, and a very pronounced rearward cantilever (to maximize the machine's limited between-centres capacity). Because of its construction, and the fact that the bed bars were socketed into the base casting, it was necessary to dismantle the entire lathe if the tailstock was to be removed.

Instead of a taper the 3/4in. travel ram was fitted with a parallel socket and a external thread identical to that used on the headstock. An examination of the castings used on early lathes show them to be of inferior finish to those used later, though no doubt their material quality was entirely satisfactory. The vertical pillar was 24.5mm in diameter, 240 mm long and with an installed length of 200 millimetres. The hand-grip used to convert the headstock into a drill was quite rounded, perhaps a little smaller than the latter iron production version and much more comfortable to use.

The ball-bearing, 40 watts, 4000rpm brush motor was made in Holland and resembled those used on contemporary sewing machines, rated for intermittent use only. In order (no doubt) to give the unit a 'machine-tool' or 'technical' appearance it was finished, apart from the black-varnished field-lamination area, in an attractive crackle-black paint to match the lathe. To check if a motor has plain bearings look for a small hole in the (protruding) bearing housing at each end. The hole leads to a felt washer that wicks just oil, less any dirt, into the sintered-bronze bearings.

Having established the lathe in production Maier then set about both improving production methods (which necessitated changes to the lathe's construction), and ironing out some of the deficiencies that were becoming apparent as owners began to explore the lathe's potential.

Mk. 1B

This version retained all the main characteristics (and deficiencies) of the Mk. 1A with the important exception that the bored holes for the way bars were replaced with V-grooves into which the bars sat to be held in place by screws passing vertically though them - as on all subsequent models - so allowing much quicker construction and disassembly. Some examples of this version have also been found with saddle and cross-slide locking screws, but such fittings appear not to have been standard until the Mk. 2A. The tiny instruction book issued with this model was marked as being the 2nd edition and was originally typed on an A4 sheet but reduced to A5 and bound in grey card.

Mk. 2A

The iron base casting, now with a better finish, was lengthened to approximately 14 1/2in. and allowed an increase in capacity to 6 5/8in. The tailstock cantilever was reduced and the casting became a two-piece affair with the sections held together by screws. Both saddle and cross-slide were fitted with locking screws and the feed-screws changed to a left-hand thread, so allowing a 'normal' feel to be imparted to their use. The handwheels, 35mm in diameter, were relatively thin, with knurled rims and locking screws on the end of the feed screws, instead of through the wheel's boss.

The cross-slide lock was arranged by the simple and effective means of splitting the right-hand half of the casting from front to back and using an M6 socket -headed screw set (positioned at the front between feed screw and the right-hand 8mm-diameter cross-slide bar) to squeeze the parts together. However, this was not the first type of lock and earlier versions were equipped with a cruder system where, on the right-hand side front of the casting, an 11mm wide tapped boss was incorporated that took an M6 x 8mm grub screw bearing directly onto the way bar. So as not to mark the bar a small brass button was used on the end of the screw. Although the system worked well enough it did not have the clamping power of the later type and would probably not have stood up well to the demands of heavier milling cuts. As a further confusion early machines have been found with two locking screws on the cross-slide, one at the front and another other at the back.

Improvements were also made to the headstock with the spindle being given a register flange and a reversible pulley, so allowing a greater range of speeds.

The 3-jaw chuck and the drill chuck delivered with this lathe were identical to the ones supplied earlier with the ring-scroll portion of the 3-jaw (the part gripped to turn the scroll) being diamond knurled and drilled with six tommy-bar holes. The entire body of the drill chuck was also given a diamond-knurl finish. It is likely that this model was delivered in several finishes: the original crackle-black, a silver-grey, plain-grey and late ones possibly in a silver-blue 'hammer' effect.

Mk. 2B

Although the major components continued unchanged this version was the first to incorporate a means of aligning the headstock with the bed bars. Upon first assembly the base casting and headstock were jigged and a small vertical slot cut across the junction of their front faces. When the faces were correctly aligned (by using the tailstock method previously outlined) it was possible to insert into the slot a small setting piece - a disc washer given by the handbook as being 0.748in. diameter. However, one measured has been discovered to have an OD 0.734in., and ID 0.333in. and a thickness of 0.1577 inches. While the O/D and I/D are plain machined the flats were ground.

The motor was the now-familiar larger plain-bearing Dutch unit with the centre portion painted ether black or in a colour to match the rest of the machine. Several styles of handwheel were used, all turned from steel and plated silver or black. Towards the end of the Mk. 2B production run it is believed that the first of the new (and cheaper to produce) die-cast handwheels with the delightful 'wasp-tail' handles was introduced. Some versions of this lathe have been found with two locking screws on the cross-slide, one in the normal position nearer the front and the other in line with it further back. Realising that one 6mm screw clamping the casting to the slide bar was entirely adequate, Emco did not persist with this

modification. Unimats of this age were also given a more robust carriage assembly with the whole of the casting, including the front and back walls through which the way-bars passed, noticeably thickened.

Colours, as ever, pose a problem and instead of a single, standard finish, examples have been found in crackle-black, a light plain (flat) grey and others in either silver-blue or silver grey - with the latter two in a 'hammer-effect' paint.

Mk. 3

This lathe saw the introduction of the third type of base. This was not just a mere lengthening but a completely new shape with a convex instead of concave centre section - yet with the headstock support end still rectangular in form and an identical design of headstock-alignment washer.

It is likely that only two motors were used on this version: the Dutch-built type and, towards the end of production, a larger induction type. By the late 1950s crackle-black finishes were being phased out and Emco follow suite by producing the majority of the Mk. 3 lathes in a variety of finishes, among which silver-blue appears to have been predominant. The 'pea-green' pre-1959 Emco brochure shows just such a machine, with the larger Dutch motor with an example known to have been delivered to its first owner in April 1958.

Mk. 4

The last version of the original type of Unimat incorporating a cast-iron base was notable for the introduction of a rounded 'step' in front of the headstock through which a simple vertical alignment pin could pass. There was also a slight bevelling of the upper corners of the headstock support - an alteration that would be reflected in the forthcoming diecast design - and the headstock itself may also have been increased in size slightly but with corners of a tighter radius (measurements are awaited) and its milling post-retaining pin moved to a position parallel to the spindle cartridge.

The early Mk. 4 had blackened steel handwheels with wasp-tail handles, a red nameplate, the Dutch 95-Watt motor and a silver-blue hammer-finish paint. Versions made in the mid years of production can be recognised by the use of die-cast handwheels (still with wasp-tail handles) and a red-silver-red badge. The last Mk. 4 can be identified by a larger black-finish nameplate carrying the word Unimat (but no model designation) with handwheels changed yet again, this time to a turned-aluminium type, as also used on the next model to appear, the SL, with single-line knurling around their edges. The motor was a U90 type and the finish either a pale grey-green hammer effect, or plain grey. However, there was a degree of overlap between the machines with even mid-production examples found (occasionally) with the early red nameplate, U90 motors and aluminium handwheels.

The Mk. 4 was finished in a hammer-effect pale grey-green and supplied with the lathe were two accessories that would become very familiar in years to come: a rather light faceplate and drive dog - both in die-cast aluminium.

At some point during the early 1960s the factory went over from an iron base to one formed from a pressure die-casting in a heavy-duty grade of zinc or ZAMAK. The change of material enabled the rate of production to be greatly increased and, by eliminating some machining operations (the finish of the castings was equal to a ground surface) costs reduced. The use of dies enabled the appearance of the base to be cleaned up somewhat and allowed an almost full-length, vertical flat face to be used.

The next change of base was to an aluminium casting, painted hammer-effect green and with minor mechanical alterations only, including rather crude, cast-in degree-graduation marks on the front of the headstock. By the time the last model SL-1000 lathes were on sale the handwheels were in a rather horrid plastic but with clear, white-painted graduations that are preferred by some owners.

In the 1950s and 1960s very few European countries used the same voltage for their domestic supplies and Emco had to supply a wide range of motors to cover every possibility.

Failure of Unimat motors is very common and the causes manifold. However, before fitting a remotely mounted sewing-machine motor as a replacement it is worthwhile dismantling the faulty unit and checking to see if the delta capacitor (for commutator suppression) buried inside the motor casing behind the rear of the armature, is faulty. This unit contains three small capacitors within the single casing and it is not unknown for one to have short circuited to earth internally. If a physically similar replacement capacitor cannot be found an electrically compatible one (in the UK a Maplin Electronics part no. HW07H, delta cap.) can be mounted in an external box on the rear of the motor with a new on/off toggle switch on top.

Some headstock collets can be interchanged: both E-16 and ES-16 types work in the ER-16 body but an E/ES-16 nut, without the extraction lip, must always be used - and even then the face of an E/ES-16 collet may protrude from the face of the nut. If an E/ES-16 nut is modified to increase the 30-deg. taper diameter then the combination of ER-16 collets in an E/ES-16 body is also possible.

Although the DB200/SL1000 remains a very popular machine on the second-hand market Emco unfortunately no longer supply any parts, accessories, written material or service help.

How long-lived and reliable are these original Emco lathes? In April 2006 the writer met a model engineer who had been given one as a present for his 21st birthday some 40 years previously. Although it had been in regular use it still retained its original motor (he had been careful not to exceed the time-limited running) and even one drive belt. Nothing had broken or worn out and he was entirely delighted with it. Of course, collectors have moved into the market and very early black-finish machines - and most of the accessories from any year - are very sought-after and command high prices.

For more details see:
www.lathes.co.uk **ME**

Early Emco Unimat recently acquired by the author.

FAILURE OF 0-10-0 ENGINE NO. 58100

THE LICKEY BANKER

Dennis Monk
searches back through his memory and note-books to bring us a definitive record of events that took place over 50 years ago and were briefly mentioned in an article that appeared earlier this year.

Ivan Law, in his article on steam operated cylinder drain cocks (*M.E.* 4292, 2 February 2007) mentions that engine No. 58100, the Lickey Banker (*Big Emma*, or *Big Bertha* as she was known at Derby) had failed through water entering the cylinders (**photos 1** and **2**).

This occurred back in 1954. I was newly back from National Service in the RAF and was working for the London Midland Region Chief Mechanical Engineer's Inspectorate. Being the junior on the section, it fell my lot to examine engines that had failed in service. These were known as casualties and the person carrying out the investigation was known as the Casualty Investigator.

The Lickey Banker was the first casualty I had to investigate and in doing so I embarked on an extremely steep learning curve; obviously the reason for the junior being given the job.

Failure report

From my report written at the time, I find that the engine failed at 12 noon on the 5 January 1954, while banking a freight train up the Lickey Incline. The driver reported that they were nearing the top of the incline when the failure occurred. The regulator was fully open, the engine was in full forward gear; there was no tendency to prime and no slipping. The boiler pressure was 140psi, with the water level at half a glass. The engine came to a stand almost immediately.

The Bromsgrove Shedmaster examined the engine and found that the left-hand inside connecting rod had broken. This was removed and the engine drawn on to Bromsgrove Shed, where an examination was carried out on 6 January 1954.

Apart from the broken connecting rod (**photo 3**), which was also bent, the left-hand front and rear inside cylinder covers were broken. Cylinder covers, for some years prior to the failure, had a relief groove machined on the inside. In the event of water collecting in the cylinder the centre, weakened by the groove, would burst out with a good chance of saving the cylinder. The cylinder covers did not have these grooves machined in them, with the result that damage was sustained at the front of the left-hand inside cylinder casting, as shown in the accompanying sketch, **fig. 1**.

There was also damage to the left-hand inside piston and both left-hand inside and outside crosshead cotters were bent and loose. This evidence was consistent with water having been present in the cylinders.

Incidentally, because of the

1: Class 5XP engine No. 45660 Rooke awaits banking assistance for Lickey Bank outside Bromsgrove signal box (photos: Dennis Monk c.1955).

proximity of the cylinders to the second cranked driving axle, the first axle was also cranked to clear the connecting rods. It was after the connecting rod buckled that it fouled the dummy cranked axle and was thus broken.

Obviously, the question arose as to why water had been present in the cylinder. The engine did not have pressure relief valves fitted to the cylinders, but she had been in service for 34 years without this problem occurring previously, so far as was known.

Investigation

The main steam pipe-superheater system was blanked off in the dome and tested hydraulically. This proved to be sound, with nothing to suggest that water could be carried over to the cylinders.

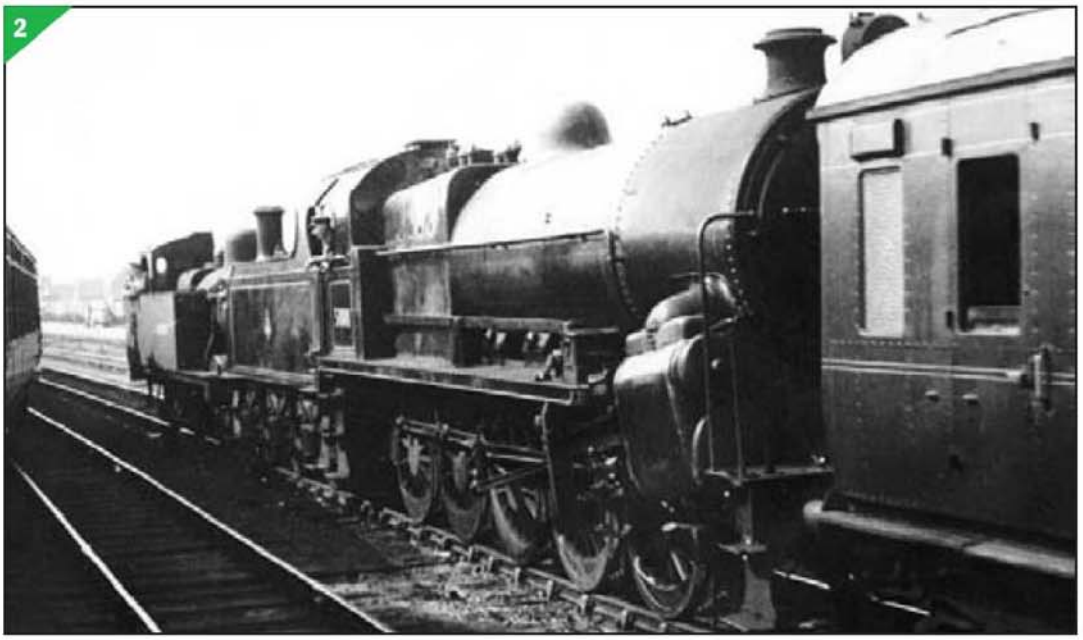
Under test, the blowdown valve was found to be defective, with water and steam passing the ball valve seating and the drain pipes were partially blocked. The cylinder drain cocks were in working order, but the spring-loaded plunger, which held the driver's control lever in the open position, was found to be jammed. This would allow the control lever to drop due to vibration and thus close the drain cocks.

It was concluded that the defective blowdown valve caused the left-hand inside and outside cylinders to take water following closure of the cylinder drain cocks due to vibration.

Repair

A visit was paid to the Locomotive Repairs Engineer in Derby Works to explain the situation. He said that he thought that there was a spare set of cylinders for the Banker and suggested that I went down into the shops to see the Erecting Shop Valving Chargehand; which I did. We went to the cylinder stockyard and there, under a pile of cylinder cover castings lay the spare set of cylinders.

A cylinder cover was removed and the liberal coating of grease was cleaned off to find the cylinder bore as good as the day



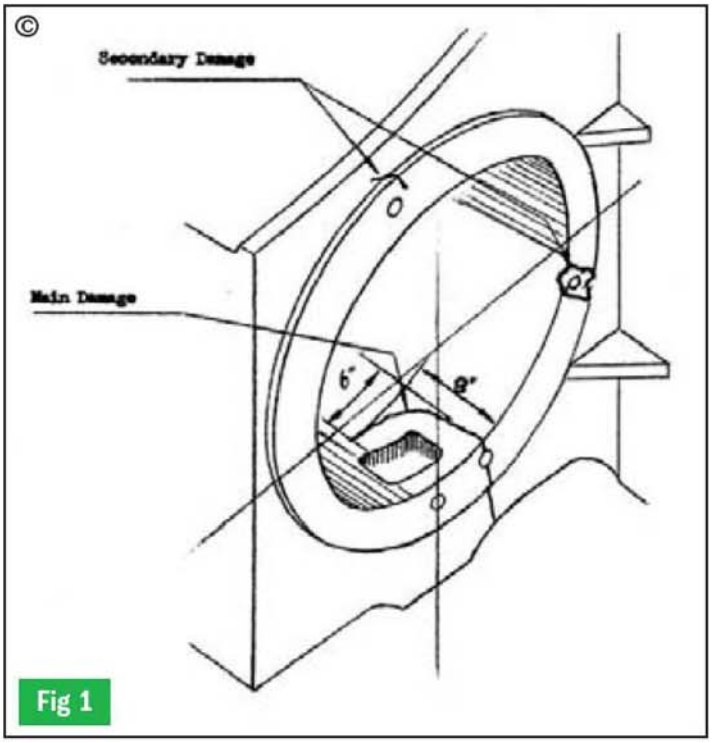


Fig 1

2. The Lickey Banker and an unknown Class 3F tank assist engine No. 45660 in the attack on Lickey Bank.

3. The damaged left-hand inside connecting rod of engine No. 58100.

Fig 1. Sketch showing damage to the front of the left-hand inside cylinder of engine No. 58100.

it was machined 35 years earlier. The engine was ordered 'on to works' and the new cylinders along with a new left-hand inside connecting rod were fitted. This extended the engine's life, but some two years later the dummy crank axle mentioned earlier was found to require renewing as the journals were down to scrapping size. As there was no replacement available, it was decided that the engine should be withdrawn from use and scrapped. **ME**

A MODEL BEAM ENGINE
for display at the Gunpowder Mills

John Wilson
describes a beam engine he built for display and operation by push-button at the Royal Gunpowder Mills, Waltham Abbey.

In April of 2006 I volunteered to build a semi-scale model of a beam engine similar to a type used at the Royal Gunpowder Mills, Waltham Abbey Essex. Readers can find out more about this historic site on the web.
http://www.royalgunpowdermills.com

The aim of the project was to show visitors to the museum what the steam engines looked like. Each beam engine powered six incorporating machines for the manufacture of gunpowder. There were at least six on the site, arranged as shown on the plan view of a mill (**fig 1**). The engine was centrally located along with the boiler, coal stores and chimney. The incorporating machines were located on either side, powered by drive shafts located under the floor.

The initial information I had to work with was a reference to a compound engine built by Benjamin Hick & Son, to a James Watt design, of 30hp, running at 18rpm with two 14ft. diameter flywheels. I was also able to take some basic dimensions from an excavated engine pit, so I knew the shape and size of the engine base.

Because the Gunpowder Mills lies in a flood plain, and the crankshaft and drive shafts to the incorporators are below ground level, to protect against flooding the machinery was built into a cast iron tank which ran the full length of the building and engine house.

The model engine is built on three levels as was the prototype. The height of these was determined by measuring the height of various platforms from the bottom of the tank. For example, from the base of the cylinders to the tank floor is 8 feet. The crankshaft pillow block mounting is 5ft. 10in. from the tank bottom and the column support base is 9ft. 9 inches. Although the support column for the beam in the model is a single piece, it is more likely to have been an A-frame.

The foundations for the cylinders were 12in. thick stone blocks; those for the crankshaft support were 18in. thick stone. The column was mounted on brick-work.

Model scale and materials

The model is made entirely from odds and ends and scratchbuilt. All the materials came out of my scrap bin, apart from the wooden base, which is made from hardwood scraps supplied by one of the volunteers at the Mills. Most of the drawings were in my head.

I decided on a rough scale of 1:12 (one inch to one foot) because I can not turn anything larger than 10in. diameter on the lathe. So, the flywheel dictated the scale. Finished dimensions of the model are 14 3/4 long, 5 7/8 wide by 19in. tall. The crank shaft throw is 1 inch.

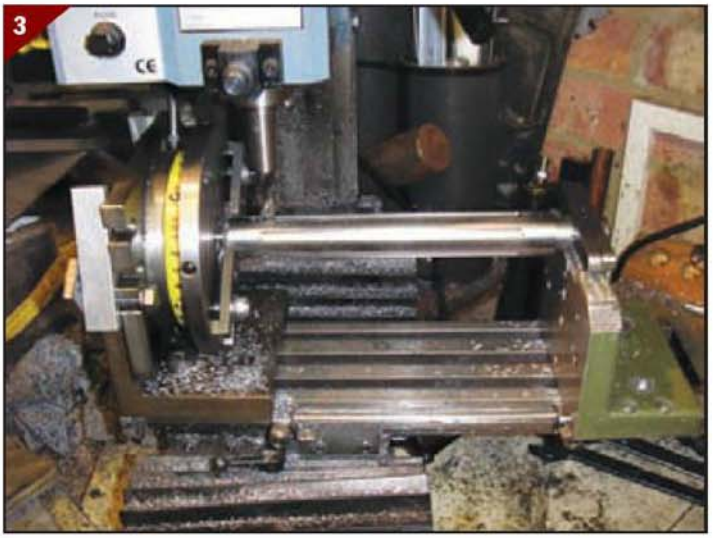
Cylinders

The prototype cylinder sizes were unknown, so, I settled on

1. Finished cylinders painted and lagged.

2. Machining the flywheel from a cast iron pulley.

3. Fluting the column.



diameters of 1in. for the high pressure and 1 3/8in. for the low pressure because I had those sizes of thin wall tube.

Note the cylinder base plate has had a checker plate finish added, as has the base plate for the column. The checker plate effect was achieved by making a series of cuts across each table using a 1/8in. dia. (3mm) end mill at a depth of 0.010in. and at 60deg. to each other.

The finished cylinders with wood lagging (micro-ply sheet) are shown in **photo 1**. Note the brass stuffing boxes, slide valve linkage and the main steam stop valve.

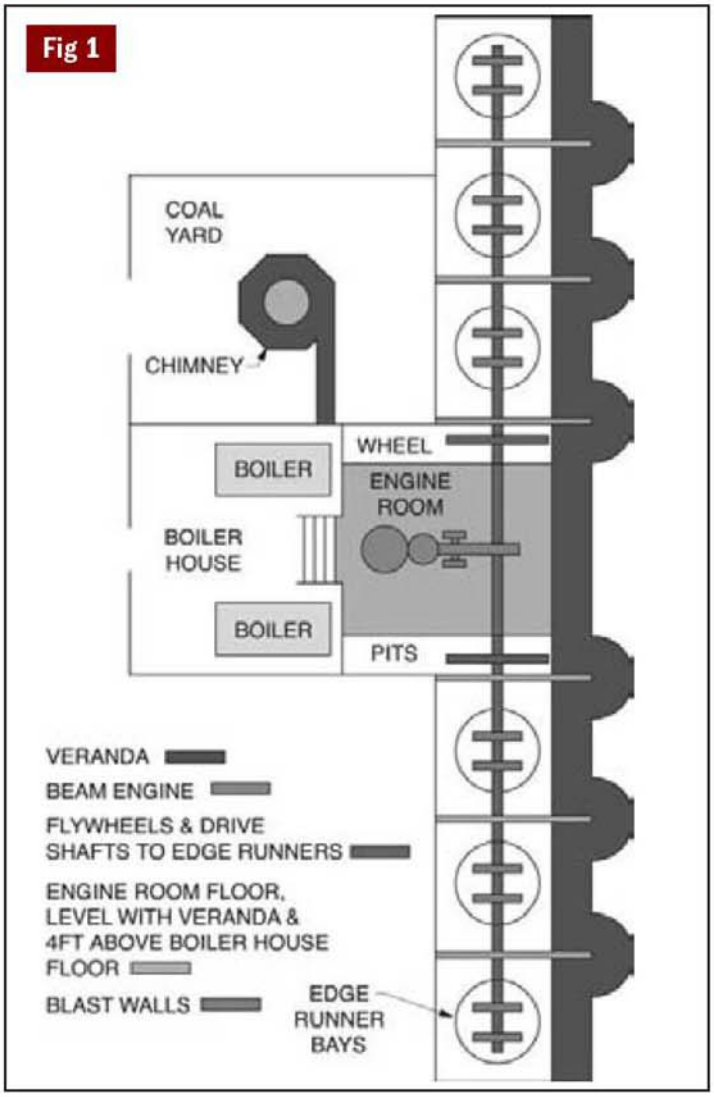


Fig 1. Plan view of mill building showing centrally located beam engine driving six incorporating machines.

4. Test fitting of column, flywheel, connecting rod and other parts to the base.

5. Working out the dimensions for the beam.

Flywheel

The finished diameter of the flywheel is 8in., though it should be 7 inches. I started with a 9in. dia. cast iron 'A' section pulley and by the time I turned off the 'V' portion, the rim was too thin to take down further. **Photograph 2** shows the machining of the flywheel spokes on the mill using my home-made indexing table, see *M.E.* 4279, 4 August 2006.

Column

The column, made from a section of 1in. dia. aluminium alloy scavenged from old machinery, is shown being fluted in **photo 3**. Again, this operation used the indexing table. **Photograph 4** shows the column, flywheel, connecting rod, eccentric, eccentric strap and crankshaft plumber blocks loosely mounted on the base.

Note that the column base plate has not yet been machined to look like checker-plate, whereas the crank shaft base plate has. These bases are fixed to the wooden foundation with 5mm studding, which has been glued into the wood using epoxy adhesive much as the chemical bolts used to fix full scale machinery to the floor today. The pillow blocks, crankshaft and connecting rod are made from some experiments with a hot air engine. The eccentric and its sheave are from an 0-6-0 'Rob Roy' 3 1/2in. gauge locomotive.

Beam and Motion

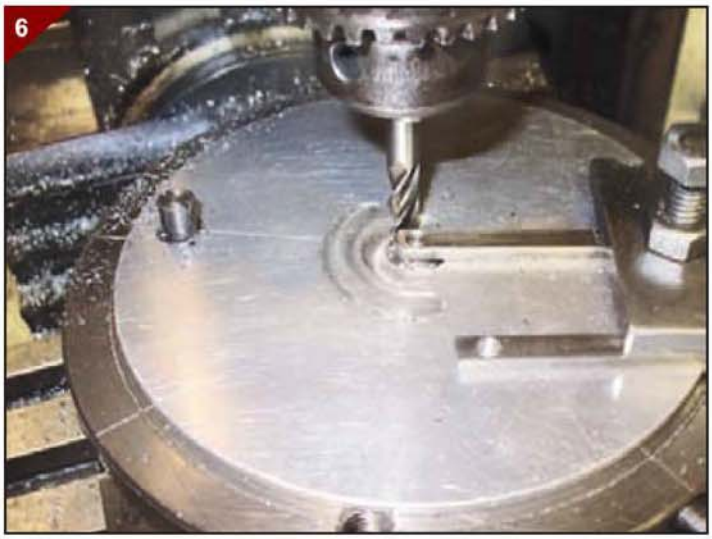
The entablature, the arm at the top of the column which carries the parallel link motion, has been fitted and the bar of aluminium alloy (flat stock of 1/2 x 2in.) used for the beam has been positioned to work out various dimensions on the beam and entablature, **photo 5**.

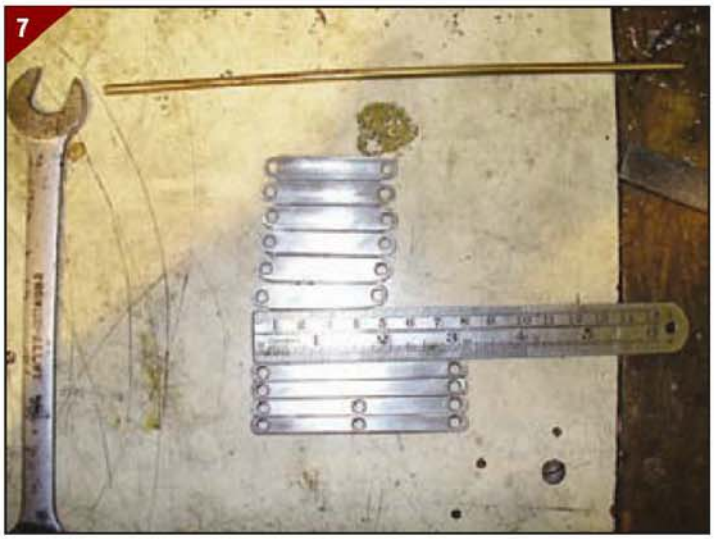
The end of one of a parallel link is being shaped and a complete set of the finished links is shown **photos 6** and **7**.

The drive for the governor is taken from the flywheel as shown in **photo 8**. The two miniature bevel gears are obsolete parts from a franking machine. The weights and governor arm pivot are the ball ends off carburettor linkages, from the days when cars had these.

Electric drive

To make the engine rotate for visitors, a Meccano drive was fitted on the crankshaft, **photo 9**. The original drive was going to be a Monoperm motor gearbox running through a set of Meccano gears. However, the gearbox was too noisy and because of its all plastic construction and I had doubts about how long it would last under load, even though the >>





motor is only run while the visitor pushes a button. So, I purchased a Como Drills planetary gearbox of all metal construction which is much quieter. It has a fixed ratio of 516: 1 which gives a speed at the crank of approximately 18rpm.

Final Assembly

Photograph 10 shows the engine nearing completion, with only the air pump rod to be fitted to the parallel link motion and the governor removed for adjustment. The different heights of the foundation between the cylinders, column A-frame and crank can be clearly seen.

The completed engine is finally in place at the Royal Gunpowder Mills and is shown awaiting its protective cover before being put on display, see front cover.

Epilogue

Since starting this project, the remains of a beam engine have been found in the second mill building. They had been left in the engine house when the engine became redundant and rubble was tipped over them and a concrete floor laid over this. The parts so far identified comprise the crankshaft, plumber blocks, both flywheels, an iron tank (possibly the condenser) and a number of shafts with bevel gears attached. It is hoped that the museum will agree to the remains being excavated and displayed for the public.

The discovered engine is of a different design from the one on which my model was based. For a start, the flywheels are 12ft. diameter, not 14ft. as in the earlier Benjamin Hick engine.

The cylinder foundations remain and suggest a single cylinder engine, not a compound. Additionally, it is not clear what purpose the shafts with bevel gears attached had, but no doubt these puzzles can be solved when and if the engine is properly excavated.

ME

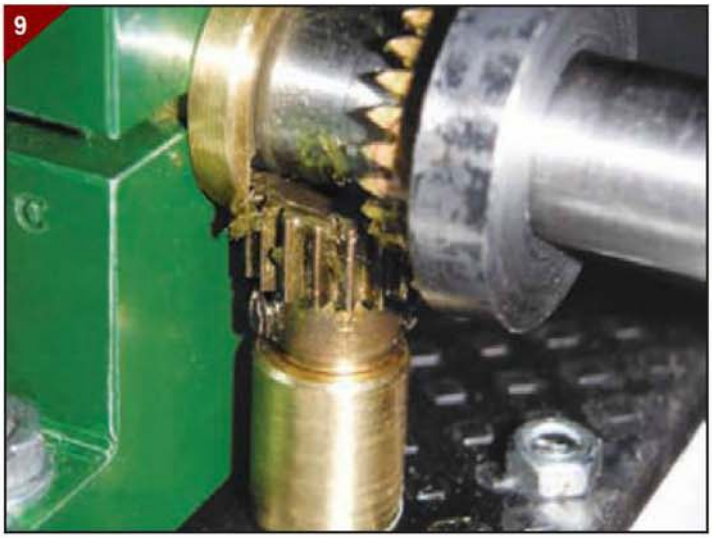
6. Making parallel links.

7. The completed links.

8. Detail of the governor and its drive. (see text).

9. Meccano gear drive fitted to the crankshaft.

10. The nearly complete engine with only a few parts missing.

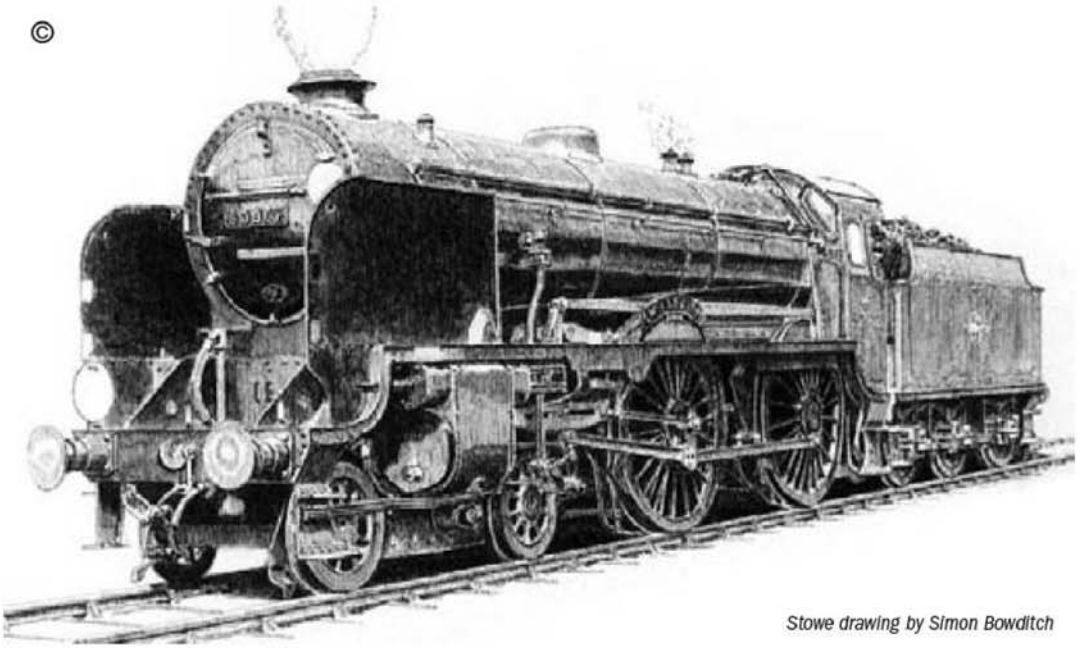


STOWE - SOUTHERN RAILWAY
'Schools' class locomotive

PART 12

Continued from page 516 (M.E. 4298, 27 April 2007)

Neville Evans describes the platform and drop end for this delightful model.



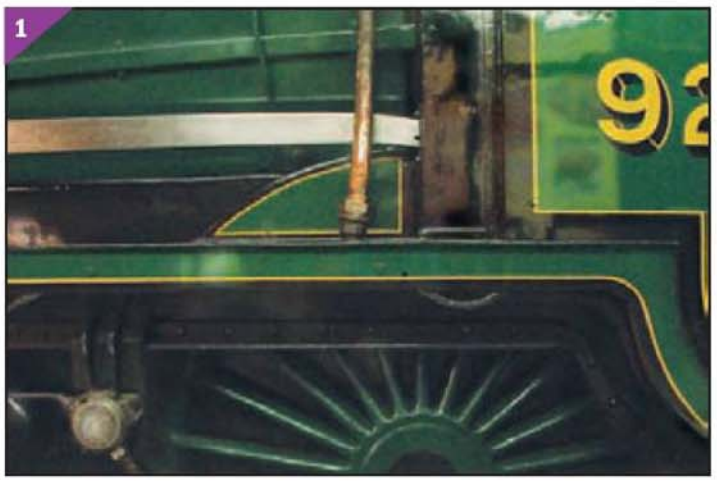
Stowe drawing by Simon Bowditch

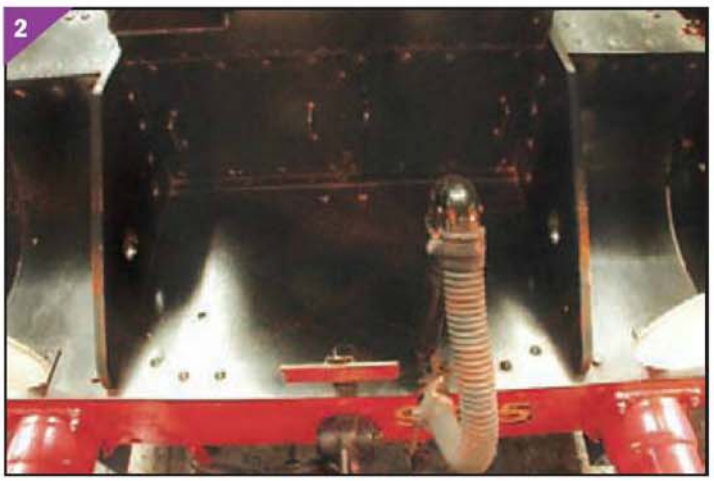
The next item on the agenda is the platform and drop end set up. I honestly think that I could make the whole lot in about a quarter of the time that it has taken to draw it. It must be borne in mind that I have to draw quite accurately so that Pete Thomas can perform one of his magic cut-out tricks, so as to produce these rather complex pieces in a ready useable form. I can't foresee any real snags for those of us who prefer to do the cutting out ourselves. I have had to thicken up the various sheet sizes; for instance it isn't really very wise to use any sheet thinner than 1mm in brass (i.e. 0.039in.) for items like the platforms that have to stand a certain amount of wear and tear in general handling, as well as when actually running. I generally like to use 22 gauge tinplate for superstructure work as it is stronger than brass, readily available, at least in my local area, easy to work, takes paint beautifully and is extremely cheap. Pete Rich uses a lovely material called Zintec, which is what we used to call flanging quality steel, coated with zinc. Try your friendly neighbourhood laser cutter for scrap pieces of this stuff as with a bit of luck and for a few quid you'll be able to buy enough to build a dozen locomotives.

I have drawn the platforms largely as they were originally built, which means that apart from the few round headed rivets on the front drop end, the platforms were largely flush rivetted. As the engines aged, and it became expedient to save time and money, rows of round headed rivets >>

1. Left-hand rear splasher. Note the fairing for the reverser mechanism.

2. Smokebox platform and doors.





appeared in rather obvious places, including, sadly, around the front of the smokebox. Some people like them, others including myself, don't. As I've said many times in the past, if you are going to all this trouble to build an engine, then pick your locomotive at a given time, get some good photos and use them as reference. With preservation of course the engines may have changed quite a bit, as modern techniques such as welding are used more often in order to keep them on the road.

I find that a much neater and in fact quicker job results from building up the platforms and splashers with actual small copper rivets and flushing them off by lightly countersinking on top and carefully tapping them down. Take great care not to bruise the flat sheet by careless use of the hammer. I make a practice of, before hitting anything, always making sure that the head of the hammer is lying flat on the sheet. I then try to hold my elbow in exactly the same position when rivetting. With even a little practice this of course becomes automatic.

Splashers and name plates

The front splashers are quite straightforward with the possible exception of the angle that fixes them to the platform. This particular artifact typifies the choices that are presented to us in modelling an engine in a comparatively small scale. To make the angles in perfect scale they would need to be slightly under 1/8in. in height and about 0.011in. thick. This is an obvious problem in a working model as the minimum thickness for practicality is about 1/32 inch. If however we make the angle to these dimensions, that is 1/8 x 1/32in., its proportions would be incorrect, so I have made the angle a bit larger than scale in both height and thickness to maintain proportion. I don't think that it looks too bad, but if it offends the purist then he can take appropriate action and use smaller stuff. Note that in later days many of the class had round headed rivets on the fixing angles to replace the flush variety that they started out with. I think that all the preserved locomotives have been treated in this manner.

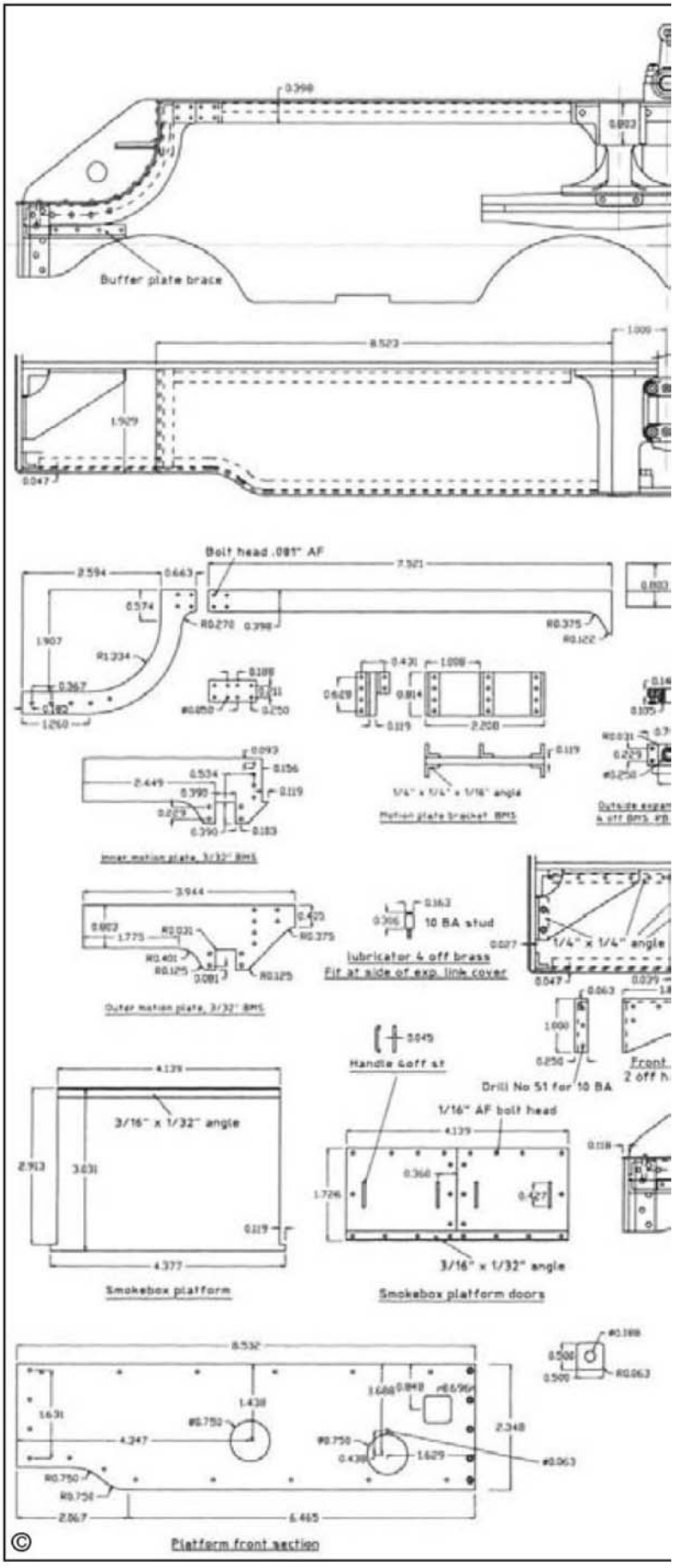
The name plates are of a type that I haven't met before. Derek Tulley, without whom incidentally this project would probably have, if not come to a grinding halt, been infinitely more difficult, has just pointed out that the front of the front splashers (if you follow me) is shaped to support the number plate. I hope that the drawing isn't too difficult to follow and that the plates will shortly become available in the brass, so to speak.

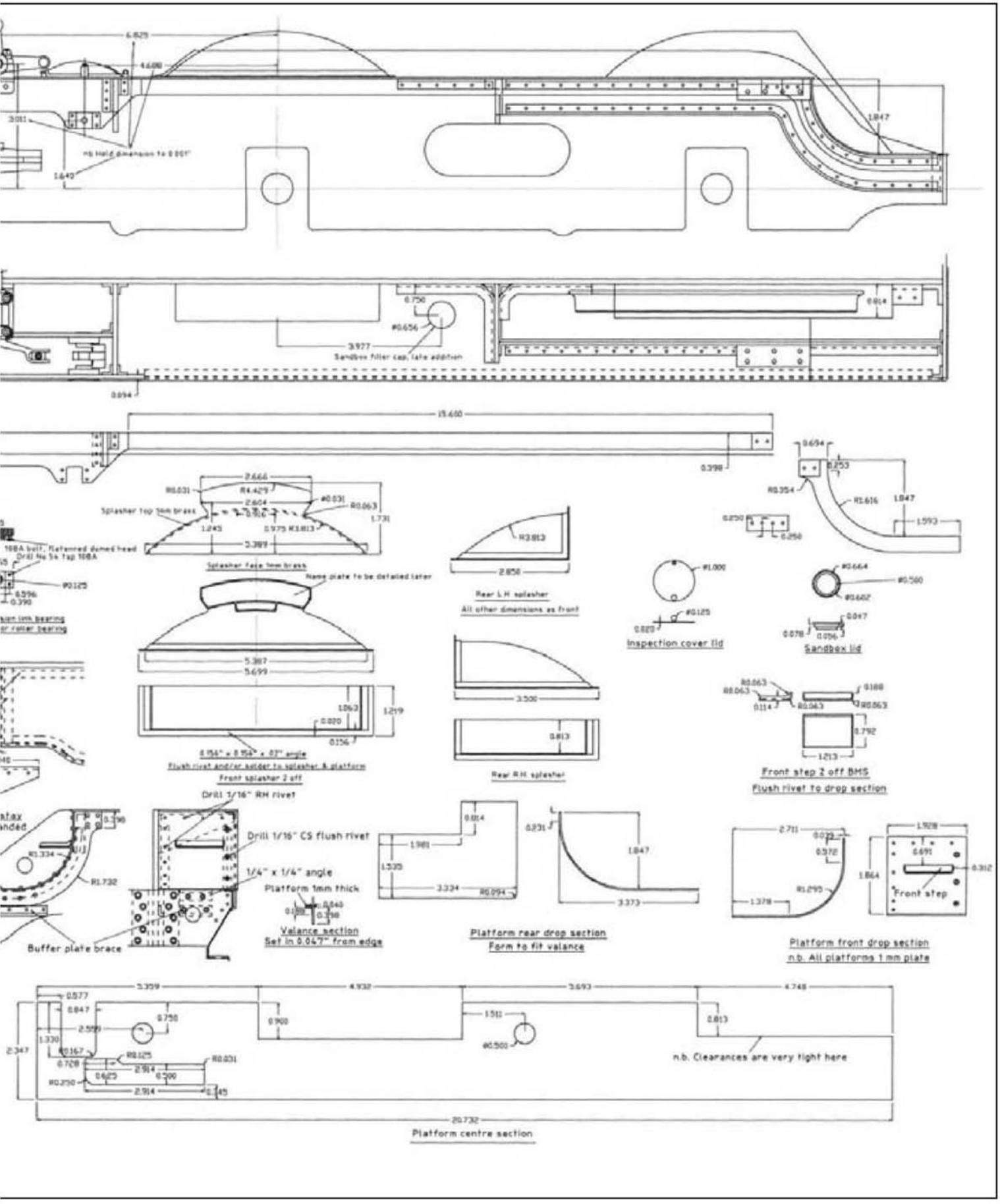
The rear splashers should present no problems but please note that the left and right sides differ in length, as the left-hand one abuts the reverser fairing box. Note also that both splashers continue into the cab in full size, so as to accommodate the rear coupled wheels, but we can conveniently add extensions when we come to the cab itself.

Motion plates

From 3/32in. or 2mm bright mild steel plate. These two plates form the inner and outer supports for the expansion link bearings, and therefore they must be securely mounted fore and aft. The actual bearing blocks are made from steel, and so must either be lined with a pressed in bronze bush, or preferably fitted with roller bearings of the type that I usually specify. One of the greatest advantages of the rotating bearing is of course that it need not be lubricated as frequently as a plain bush, which is a rather oblique reminder not to leave out the oil hole in the plain bush.

One point that Derek has brought up is that I make a practice of measuring vertically and horizontally from the datum lines which run through the axle and cylinder centres. These lines should be scribed onto the frames as the very first operation. I particularly draw attention to the necessity for the utmost accuracy in laying out the weighbar and expansion link. I have quoted plus or minus 0.001in. so try your very





best or you won't get accurate valve events much to Simon's annoyance, not a pretty sight.

Smokebox platform doors

These, or rather this, item is a dummy which occupies a prominent place underneath the smokebox door proper. It is therefore incumbent upon us to get it right. The little bolt heads should not be too big nor the four handles too small. The >>

whole show is fastened to the front middle platform as a unit by means of an angle as per the drawing.

Cock-up corner

Not a bad selection this time. Derek Tulley reports that the cut-out that I specified underneath the expansion link stay, to accommodate the swing of the inside con-rod, is not required as the rod barely touches the rear of said stay. There is a slight snag however, as with the cut-out the bottom fixing bolt of the left-hand expansion link trunnion is left half hanging in mid-air. If you've already made the stay simply move the bolt 1/8in. higher and all will be well. If not, ignore what I've just written as the full size drawing has already been amended. Derek is however concerned that the expansion link rod may foul the rear of the stay, so get ready with your Swiss files just in case.

Practical Scale

I was most intrigued to note the article *Locomotive building using modern methods* by Michael Jones our new assistant editor in *M.E.* 4298, 27 April 2007. I feel that a little explanation is called for, so that people don't get the wrong idea about my efforts over the last many years. Practical Scale started about 22 years ago, with my design for a GWR 1400 tank locomotive for Reeves. I started work on this locomotive as a reduction in scale of Martin Evans' *Dart* from 7 1/4in. to 5in. gauge. After a few hours I realised that, for various reasons, this idea wouldn't work. I then started afresh with a set of works drawings, the result being *Didcot*. During the design of this engine I was in constant touch with Doug Hewson who shared an enthusiasm for small engines that were closer to scale, but still gave a good account of themselves on the track.

The next 14 years however were spent in the design, development and production of the Manxman motorcycle, my redesign of the Manx/International single, overhead camshaft Norton. This venture came to an end when I sold the business seven years ago, an event which coincided with my being invited to design an engine for *Model Engineer*. The result of this invitation was the two Highland Railway twins, the *Big Goods* and the *Loch*. I had decided long before the end of this series that the next locomotive would be a Grange. My Friend Ivor 'the engine' Roberts had built one of Martin Evans' Manors, which, though a splendid little engine, suffered from lack of boiler power and adhesive weight. The Grange was conceived in three ways, as a straight adaptation of the Torquay Manor, as a scale model as close to the original as possible, or as a sort of 'half-way house' between the two. The scale model very quickly took over as the major effort, complete with scale bogie and cylinders. It was at this point that Professor Peter Thomas entered upon the scene. Pete (as he prefers to be known) was exactly what I was looking for, an outstanding mind coupled with top class practical ability. I was very happy for Polly Model Engineering Ltd. to take over the running of Practical Scale.

We therefore have an excellent team. I do the designing and the production of drawings, Pete produces the machined patterns such as the magical opening windows and the platework, to astounding accuracy, and many other things. Simon Bowditch does the theoretical computer work and Mike Williams who combines a good engineering degree with a toolmaker's apprenticeship at Rolls-Royce in Derby, and is a true artist in metal, is presently putting the finishing touches to my *Loch*. After this he will be doing lots of intricate pattern work for the Schools. It was Mike in fact who made the GWR axlebox and safety valve cover patterns, together with many more to the same standards from which our lost wax castings are made. I'm sorry if this seems to contradict that paragraph entitled *Penrhos Grange*, but I've always believed that it's so much better to get things right from the start. The horse did go before the cart, and I did design the cylinders and chassis as part of a plan, not as a series of accidental happenings.

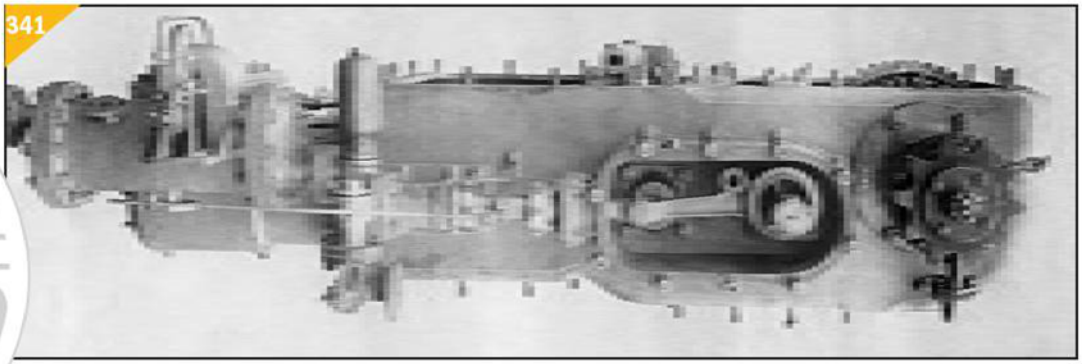
Another point that I feel I should make, is that my GWR tender designs do of course follow the Collet pattern in that the tops are flared as can be seen from the heading photo. The straight sided tenders were to the ideas of Mr. Hawksworth and were used on the County, and the Modified Hall before they were dragged along behind Castles and a few other locomotives.

To be continued.

3. A good view of Cheltenham's *splasher and name plate.*

4. Side view of Repton's *motion.*

5. A general view of the platform's top.



SAVAGE'S UNIVERSAL CARRIER

PART 32

Continued from page 520 (M.E. 4298, 27 April 2007)

The late Stan Nipper and Martin Wallis complete the boiler feed pump for this fine quarter scale model.

A good feed pump has to be functionally sound, i.e. reliably deliver the required quantities of water to keep ahead of the boiler's demands, and aesthetically acceptable - which presumably means of scale size and prototypical appearance.

I believe it fair to say that these days much greater efforts are made with regard to scale size and layout. In the past traction engine feed pumps tended to be what I considered to be in the 'house brick' style; i.e. a rectangular block fixed to the side of the boiler with a round pump barrel sticking out at an appropriate angle. I have viewed many beautifully made models spoilt by an inappropriate and over scale feed pump. Doubtless, given reasonable craftsmanship, such pumps work brilliantly but they do not look right.

For the *Little Samson* feed pump lost wax castings were prepared, the finish being excellent but the cost somewhat daunting. Since the 3in. to the foot *Universal Carrier* is proportionately bigger than the 3in. to the foot *Little Samson*, and given that the pump is geared down so to deliver the same amount of water, the pump is larger in size. A sand casting was therefore considered the best option. This was, in retrospect, a mistake as, while a sand casting was less than half the price of a lost wax alternative, a greater degree of fettling is unfortunately required.

Maintenance

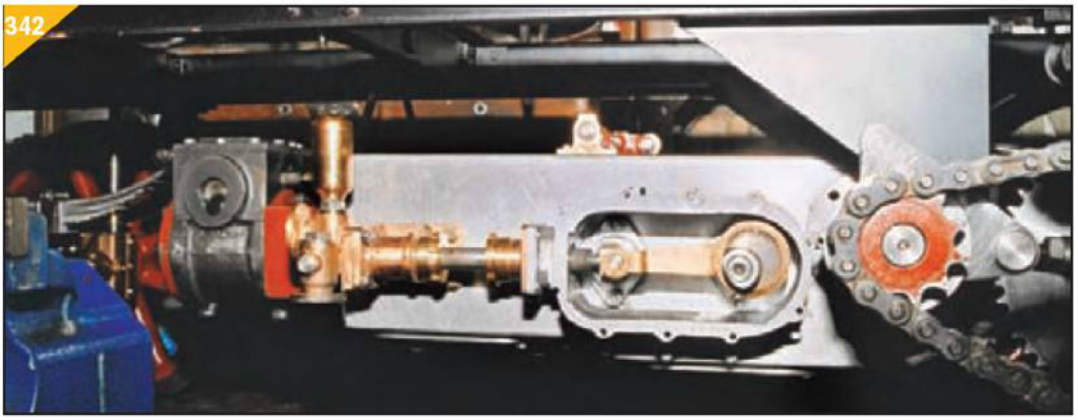
Unless the model is going to be 'show cased' the issue of pump maintenance is certainly worth a few moments consideration. Savage's use of flanges with four studs are certainly unhelpful from the point of view of quick assembly/ disassembly but they are prototypical and I trust readers agree that they are worth the effort. The solution is to be able to remove the valve housing assembly (complete with four stud flanges) quickly and easily. I would suggest a pipe union under the engine where it cannot be seen in both the feed and delivery pipes. To remove the valve housing simply undo the pipe unions and then the four studs and nuts that hold the valve housing to the pump barrel and the assembly may be removed from the model.

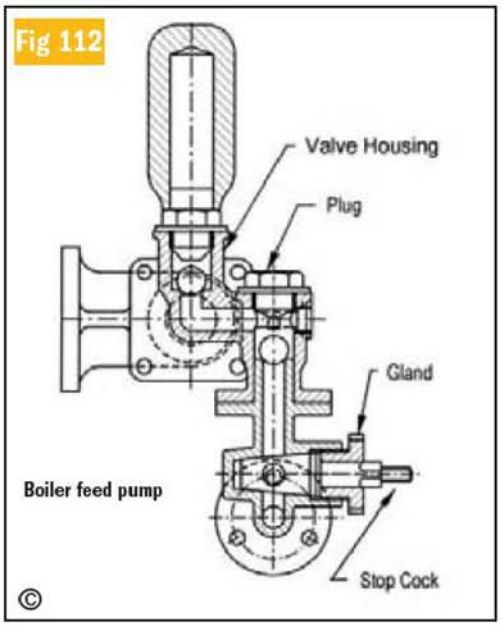
If you have a steel boiler you may be considering boiler treatment, and you may hear stories that such treatments will cause endless problems with the feed pump and/ or injector 'blowing back'. There is truth in this, I have seen it happen on several occasions, however a few simple procedures will avoid it completely. Firstly, always put the treatment directly into the boiler before steam is raised and never into the feed water tank; this means the pump and injector are always passing clean untreated water so they will not get 'gunged up'. Secondly, so my boiler inspector tells me, some of the anti- >>

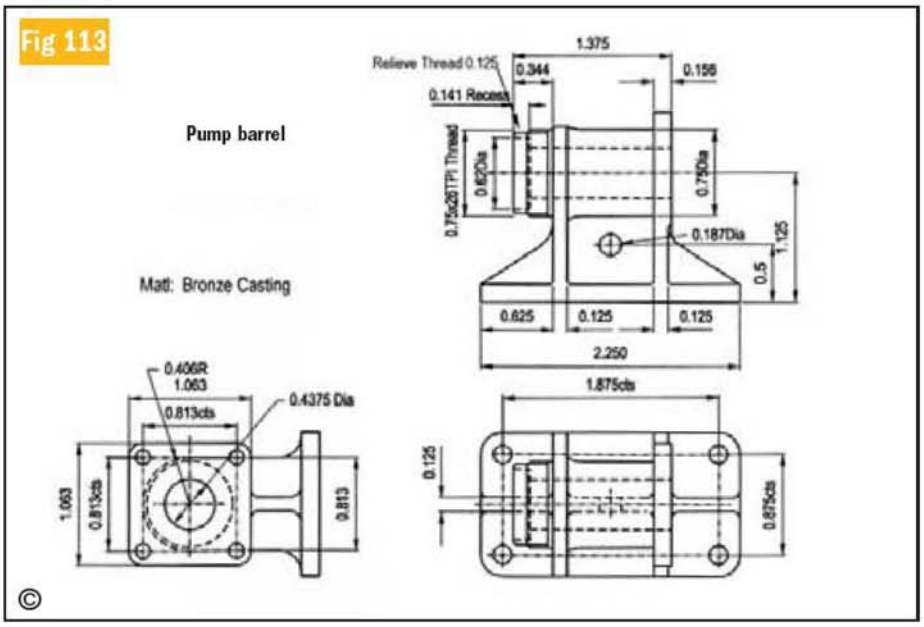
341. Savage works photo of the water pump.

342. Stan's feed pump assembly on the side of the crankcase. Note both the main glands are slotted to be adjusted with a small C-spanner (photo: Stan Nipper).

343. The pump barrel and valve housing (photo: Stan Nipper).







oxidant characteristics of the treatment will be lost as de-oxygenating the water in the tank is a waste of time as the air just above the water will be putting the oxygen straight back in again. I am uncertain about the chemistry of this but it sounds convincing.

Good practice is to remove, clean, and if necessary re-seat the boiler clack valves on a regular basis, I do the injector clack each year (main source of feed water) but the pump clack much more infrequently as it seems to look after itself much better. I always use boiler treatment and over 12 years hard steaming on my Fowler I have lost no measurable plate thickness on most of the boiler, just 0.5mm has been lost in some parts of the firebox which is entirely acceptable.

Bypass

It is usual model practice for a feed pump to be working all the time. When the boiler is full a bypass valve is opened allowing the pumped water to return to the water tank. However, the prototype *Universal Carrier* did not have a bypass valve. When the boiler was full a stop cock simply interrupted the water supply starving the pump of water. This is normal full size practice for some engine manufacturers. The only real drawback appertains to feed pumps mounted on the side of the boiler as, if they are allowed to get too hot, they will fill with steam and then no longer lift to prime themselves from the back tank. Conversely if a bypass valve is fitted the constantly circulating water may heat the water in the back tank which is unhelpful for injectors, a problem I think exclusive to an engine sitting 'on its peg' all day at a rally and not relevant to a working engine where the back tank is constantly being re-filled.

Should a builder choose to fit a bypass, a T-piece in the boiler feed pipe is easy enough to add and a valve and pipe added to return the water to the tank. If a bypass is added the stop cock should still be fitted for appearance's sake but the valve may be omitted.

Reservoir

The air reservoir, or damper, is a prominent feature of the assembly (see **photo 341**) and should be added, even if only for the sake of appearance. Such reservoirs were/are common on stationary engine water pumps but less so on road steam engines.

The purpose of the reservoir is to smooth the delivery of water. On the delivery stroke the air in the bottle is momentarily compressed and on the return stroke recovers. It will not completely smooth the water delivery but ought to relieve some of the shock, thus significantly prolonging the life of the boiler clack(s).

On the model the reservoir is a silver-soldered fabrication, the volume of the air column depending on the size of the drill used. Remember, the length of the boss limits the lift of the delivery ball, about 0.03in. being a reasonable amount. If the ball lifts too far it will cause unnecessary wear on the valve seat.

Pump barrel

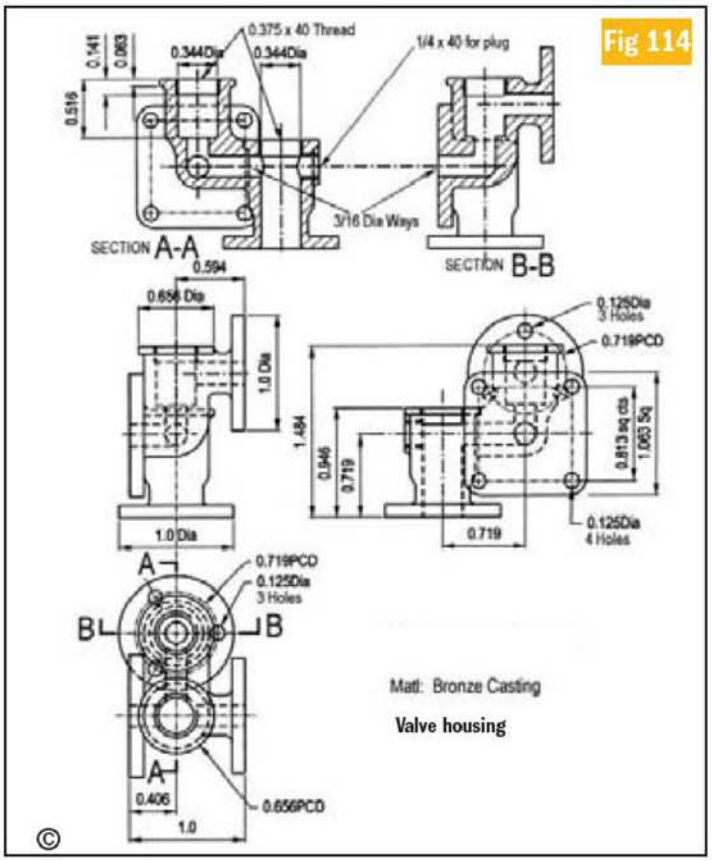
The pump barrel is a routine piece to machine. Milling the

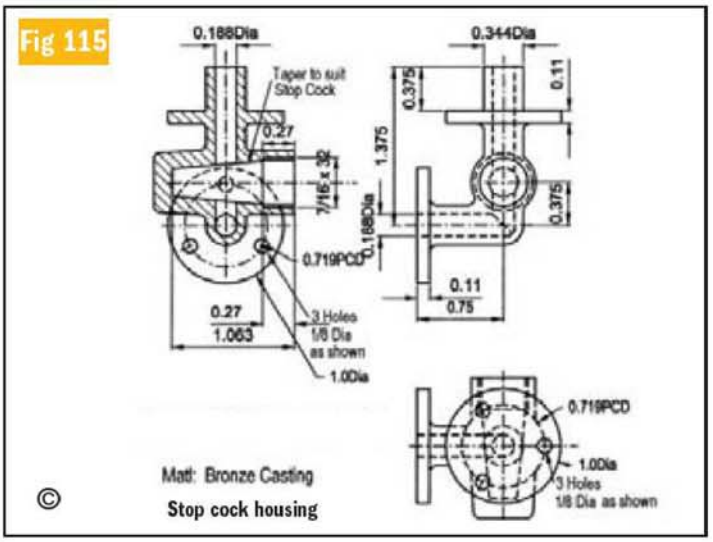
344. Machining the sides and base of the pump (photo: John Thompson).

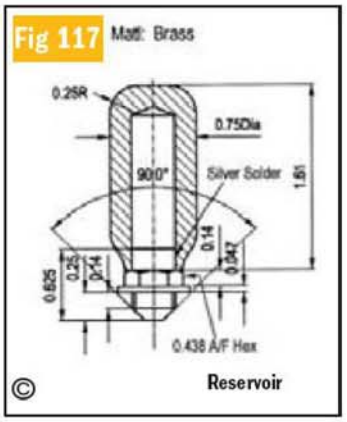
345. A start being made on drilling the 'delivery' clack box (photo: Stan Nipper).

346. The casting was turned over to drill the delivery passageway (photo: Stan Nipper).

347. The four holes that fix the valve housing to the pump being coordinate drilled (photo: Stan Nipper).







base and sides, see **photo 344**, is straightforward but it must be remembered that the height from the centre of the pump ram to the base flange must match that on the aluminium pump housing. The exact dimension is unimportant but they must both be the same so when fitted to the machined side of the crankcase they correspond exactly.

The 0.75in. x 26tpi thread will need to be screw cut as the base flange obscures access for a die, a screw cutting tool of the boring variety will be needed. An alternative would be to open the bore in the pump body out to say 0.625in. and to then soft solder a gunmetal sleeve in with the thread already formed. A neat job would be very hard to spot and, since the barrel will never get hot, soft solder is plenty strong enough. The single 0.188in. dia. hole is, it is assumed, a drain hole.

Valve housing

I would normally call this item the feed pump clack box but 'valve housing' is the Savage works drawing terminology so valve housing it is. The drawing might look daunting to a beginner, which if taken all at once may indeed be fair comment, but if broken down and taken a step at a time is just as easy as any other part of the wagon. A glance at **photo 343** will show what the little beast looks like and a quick look at the assembly drawing offers a view of the various drilled holes.

It may be seen that there is only one valve seat in the valve housing, the delivery ball clack, and this is the part that requires the most care. If the seating is to be machined on the milling machine first drill and ream the 0.188in. hole, the reamer being used more to ensure the hole is truly round rather than attain an exact size. The hole is then enlarged with a brand new 0.312in. slot drill by either slowly winding up the knee with the quill locked or by worm and wheel quill feed but with the quill locking clamp engaged. Either method will be fine but do not simply plunge the hole as, in gunmetal, new cutters are notorious for grabbing. A small boring bar in the boring head may then be used to enlarge the hole to the tapping size for either 3/8in. x 40tpi or 3/8in. x 32tpi depending on what the builder has readily to hand.

The valve seating may just as easily be machined in the lathe. The casting could be clamped to the faceplate and the job drilled, bored, reamed and the recess bored with a small boring bar. Remember to stone the cutting edge to be as sharp as >>

348. Chucking spigots are provided to aid machining the stop cock housing (photo: John Thompson).

349. The back face of the feed water flange being carefully machined for the fixings (photo: John Thompson).

350. A silver steel D-bit was made to machine the female taper for the stop cock (photo: Stan Nipper).

351. Detail shot of the stopcock, operating lever and gland (photo: Stan Nipper).

352. The fixing holes for the stop cock housing were jig drilled from the valve housing (photo: Stan Nipper).

353. The blanking plug hexagon was machined from stainless steel on the rotary table (photo: Stan Nipper).

354. Slots were provided on the stop cock gland so it may be adjusted with a C-spanner (photo: Stan Nipper).

355. Water pump pipework as applied by John Thompson (photo: John Thompson).

possible. The faceplate route would be my personal choice as I find boring in a lathe has more 'feel' than a boring head in the milling machine, but that may be because my boring head is rather robust and not suited to such small jobs.

The remaining machining is just a matter of facing across and turning the delivery and feed flanges, drilling the passageways and making the blanking plugs.

Stop cock housing

The suction valve ball seats on the top spigot of the stop cock housing and should, as before, be machined with care. Chucking spigots are provided to aid machining, the spigots should be machined parallel first so when reversed the target diameters are running true. Once machining is complete the spigots are sawn off and discarded.

The internal taper in the casting may be bored with a small boring bar by putting the top-slide over, remembering to machine the taper plug cock at the same setting. If both the boring and turning tools were exactly at centre height the two tapers will match perfectly. An alternative (see **photo 350)** is to turn the plug cock and, at the same setting, turn from silver steel a D-bit. The D-bit, once hardened and tempered, is used to form the female taper in the housing.

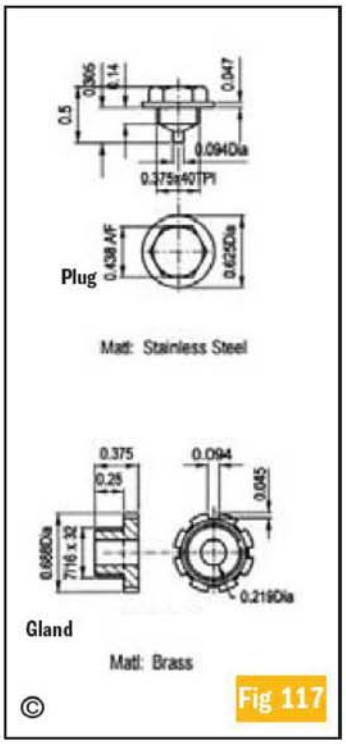
The gland for the stop cock may be slotted for a C-spanner rather than knurled (**photo 354**), and the prototype in photo 341. A small C-spanner will need to be made which may be kept in the locker under the driver's seat. If preferred the gland may be knurled.

Seating the balls

The methods described should produce a neat, round, and importantly sharp corner on the valve seat. To bed the ball to its seat a single gentle tap via a piece of aluminium rod is all that ought to be required, other builders may prefer to lap the seats using Brasso as a very fine abrasive.

Pipe runs

On the prototype the engine exhaust enters a feed water heater adjacent to the LP cylinder, the cylinder behind the pump in photo 341, a feature which will probably not be included on the model drawings, but has been built by at least one builder (see photo 331, *M.E.* 4298, 27 April 2007) in the last article. The feed pump passes water directly into the feed water heater, the water exiting via a similar flange at the other end of the heat exchanger. The main reason for the feed water heater's omission is that undertype wagons are prone to rather wet exhausts, especially when un-superheated, so a further cooling of the exhaust would be rather unhelpful.



The water delivery pipe from the tank situated behind the back wheels runs horizontally forwards in a straight line to the stop cock flange. A reach rod runs diagonally from the cab side, by the driver's seat, down to the stop cock on the feed pump.

To be continued.

PHILLIPS OR POZIDRIVE?

Peter Spenlove-Spenlove

explains how to find the right screwdriver to fit those different types of screw head.

According to a tool shop and a motorcycle service shop, many DIY folk do not realise that the indented, cross-shape in screw heads can be one of two types - Phillips or Pozidriv. The buyer asks for a Phillips screwdriver and receives something that looks about right in a blister pack so it cannot be exchanged once opened. No-one has thought to tell the amateur that a rather similar looking cross-slot and screwdriver system came into use in the UK after the Phillips system was established worldwide. That new system was called Pozidriv.

It is much better as the driver is less likely to skid out of the recess. Assembly shops like Pozidriv screws because a screw can often be placed on a driver for insertion in difficult places. Phillips screws often drop off too easily even if the driver is magnetised. The three big screws in **photo 1** are Pozidriv - note the four 'rays' pattern on the heads. The small screws are Phillips head and one has a slot for the traditional flat blade screwdriver that has been added to facilitate electrical work in the home. This one held the two halves of an appliance plug together.

Assuming the screw and its driver are new and not worn, the Phillips screwdriver usually feels slightly slack in the recess whilst the Posidriv one is a close fit in a properly designed screw. For this reason it is vital that paint and dirt are removed from screw head recesses. The motorcycle mechanic said he often had to drill out screws on engines because the owner used the wrong screwdriver and chewed up the head beyond use.

Photograph 2 shows the different screwdrivers in detail. Those on the left are marked Phillips on their 1/4in. dia. shanks. Four simple gashes have been milled before hardening. The right-hand, Pozidriv ones are marked Posidriv No. 2 on their shanks. It looks as if a forming operation has been done on them after milling but before hardening. Because of the subtle difference between the two types always choose the best quality screwdrivers. Cheap ones are a waste of money and they could end up chewing up a screw thread and making a repair job very difficult. One UK manufacturer fits tough, shatter resistant plastic handles - red for Phillips and blue for Posidriv.

Although it is relatively easy to restore a flat blade screwdriver it is not really possible to repair a cross-point. Convert it to a flat blade type but grind it gently to avoid ruining the temper. If you overdo it reharden and temper it to blue. I have ignored the miniature cross-headed screws found on cameras and watches in this article. A model shop sold me a set of tiny drivers that were called Phillips by the shop but none would fit the Japanese made screws I wished to turn. I suspect that a special set of standards applies to these. **ME**

1. A selection of cross-headed screws. The larger ones are Posidriv and the smaller of the Phillips pattern.

2. Close-up views of screwdrivers. On the left is one for Phillips screws and on the right a Posidriv one.

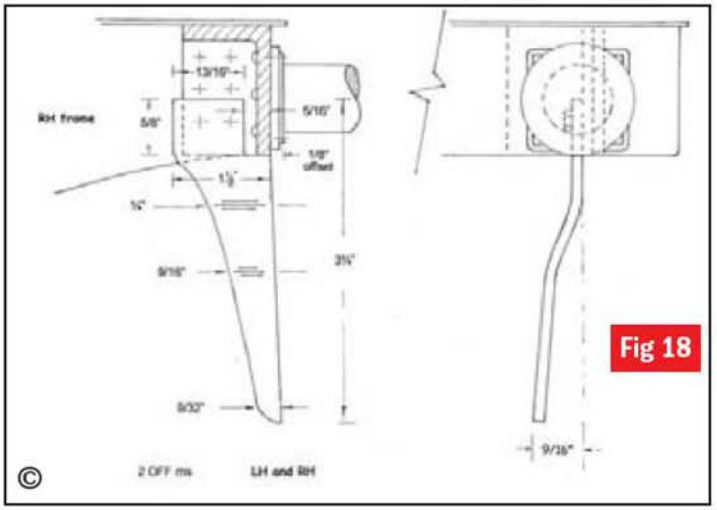


Fig 18

3F TO 3F
An ambitious conversion

PART 5

Continued from page 507 (M.E. 4298, 27 April 2007)

Geoff Dowden describes the construction of tender details.

I used the *Princess of Wales* G/A drawing as a guide and, as before, produced a cardboard former to establish the brake hanger dimensions. As I was unable to trace a supplier of suitable brake blocks, I utilised the set on the cast ring originally purchased for the locomotive, not quite the detail shown on the drawing but they looked okay to me. At this stage in the proceedings I realised that yet another pair of holes needed to be drilled in the frames, this time just above and to the rear of centre of the lower tender footstep, in order to provide the location for the brake cross-shaft bush. Unfortunately, this detail was omitted from the *Princess of Wales* G/A drawing and by examination of a number of photographs, the position that I eventually determined is shown in **fig 19**.

In order to simplify the practical aspect of this operation as much as possible, I thought it best to dismantle the chassis for marking and drilling the hole position on the frames. As it was not now possible to clamp the pair of frames together for drilling purposes, I made a simple little jig for the hole drilling operation that would guarantee accurate alignment of the shaft on re-assembly. The holes were drilled out to 15/32in. and tapped 1/2in. x 40tpi

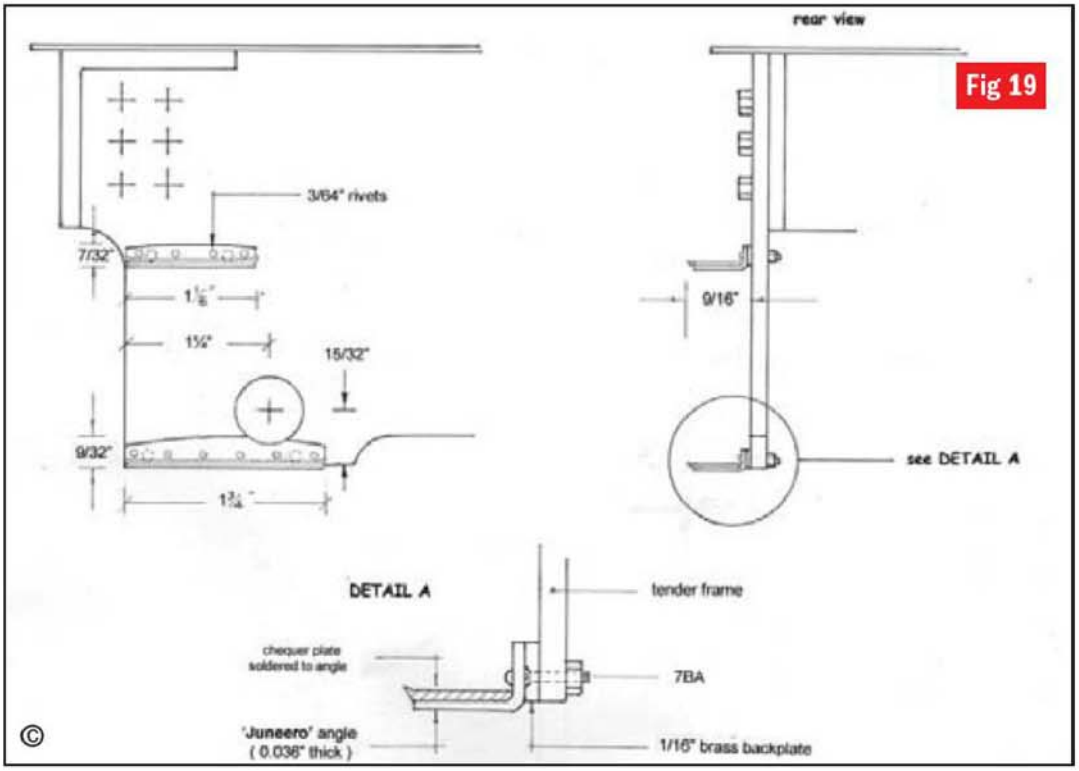
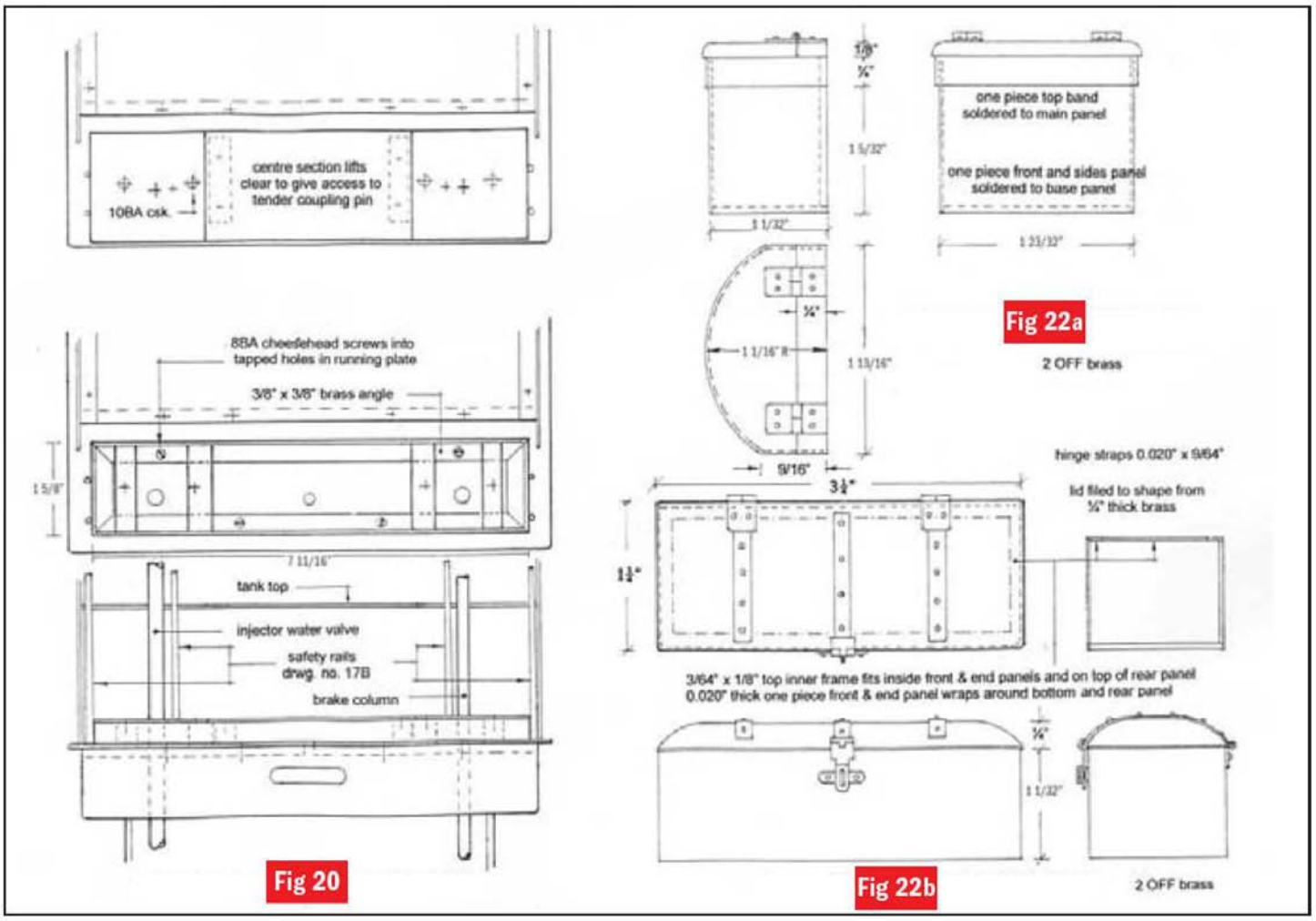


Fig 19

Fig 18. Tender guard irons.

Fig 19. Tender step detail.



followed by fitting of the two phosphor bronze bushes as shown in fig 17A (*M.E.* 4298, 27 April 2007). Production of the brake beams, forks, associated pull rods, a pair of adjusters, cross-shaft and the two brake levers followed enabling the complete set to be assembled on the re-built chassis.

Now was the time when I had to decide where to position the brake column on the tender footplate in order to dimension and locate the brake levers on the cross-shaft. It seemed logical to construct the brake column first, so a design was produced, fig 17B, bearing in mind that the handle would have to be capable of being removed later as photographs show that the spindle passes through a horizontal plate which is fastened to the top of three vertical rails and secured to the tender sidesheet at the rear end. Once the column had been made and temporarily fitted on the footplate platform, which is located 1/2in. above the tender bottom, the length of the brake control lever to house the driving nut was established. Duly constructed and fitted the whole arrangement was able to be tried, tested and adjusted in order for it to function as intended, which I was delighted to observe that it did. Just the right moment to concur with Del Boy Trotter's maxim of "Who Dares Wins" I thought!

Guard irons

As for the locomotive, I had to prepare dimensioned drawings for these features to produce the cardboard templates prior to formation from 1/8in. thick mild steel material as shown in **fig 18**. *The Princess of Wales* G/A drawing seems to indicate that the securing point for the guard irons is located behind the buffer beam inside the frames. On the model, this is not possible by virtue of the fact that the buffer beam fixing angle return occupies this same space behind the frame. However, this minor difficulty is easily resolved by utilising the bottom pair of 5BA angle fixing bolts to secure the top of the guard irons. Additionally, I decided to drill three holes where shown on the G/A drawing and Loctited in three 3/64in. snap head rivets to simulate fixing of the irons immediately behind the frames.

Steps

Unlike the locomotive, the steps are attached as individuals directly to the tender frames, or so I assumed by reference to photographs that show a row of rivets in the upstand just above the step. As I had no wish to replicate this particular method of attachment, a little thought was required to conceive a suitable alternative. My solution is shown as **fig 19** which I think will be self-explanatory.

Attention could now be given to the task of fitting some plating, so the floor, sides and end sheet were marked out to suit the overall chassis length and height, including sufficient extra to cater for the flare on top of the side and rear sheets as shown in *Midland Locomotives Volume 4*. To avoid the soul destroying task of hand sawing and then hours of laborious filing after separating the section from a large sheet, I very gratefully accepted the offer of a friend of a friend who sliced up the sheet in seconds on his works guillotine, (another timely example of the phrase 'It's not what you know but who you know that matters'). However, I would prefer to think that it is a sort of camaraderie that seems to exist between the various professions that surround or are absorbed into this fascinating hobby of ours. Whatever, it is reassuring to know that this valued help and >>

Fig 20. Tender footplate detail.

Fig 22a. Tender footplate locker details.

Fig 22b. Tender toolbox detail.

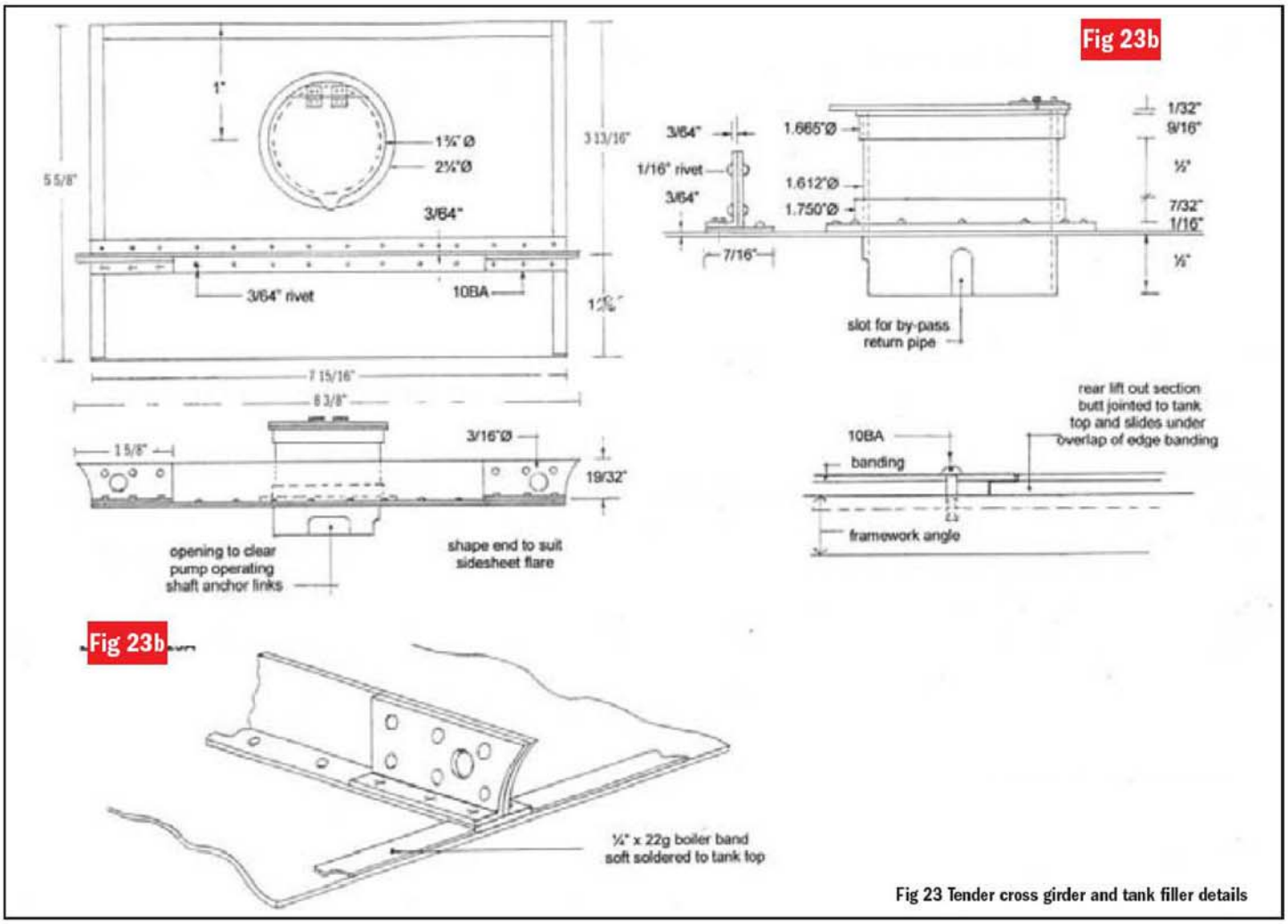


Fig 23 Tender cross girder and tank filler details

assistance is out there on the occasions when it is most needed.

The guillotined plates did not require any squaring up treatment, so the first operation was to secure the floor in the usual manner by attaching a couple of small pieces of brass angle to the inside top of each frame and a 2BA brass screw through a clearance hole in the floor plate and tops of the buffer and drag beams. Before final assembly all the screw heads will be given a surround of soft solder to prevent any water leakage when the tender is doing its job.

The next task was to create the flare at the top of the side and rear sheets and I recall that there was a long delay at this point while I made various enquiries about the best method of achieving the desired result. None of the club members had a set of bending rolls that could accommodate a 24in. width of sheet brass and in my case to make matters worse, I had had the sheets cut to size, allowing only the necessary addition for the flare, so there was no opportunity for the edge of the sheet to be bashed over a dolly or bent over a bar and the spare sliced off.

To cut a long story short, an acquaintance of mine, who I had come to know initially through a work contact and later for his interest in O-gauge, and who owns a metal working business, offered to sort it out and when I called some time later to collect the sheets I was absolutely delighted with the result. Ever eager to learn, I asked how he had managed to produce such a superb result. "I don't know," was his somewhat surprisingly reply. "I didn't do it. I gave the job to a friend of mine who owed me a favour and just told him to put a 1in. radius along one edge"!

Under the circumstances, I thought the situation at least required me to part with some currency but he wouldn't hear of it, insisting that it was nothing more than one of those 'scratching backs' occasions. Nevertheless, as it was approaching Yuletide, I made sure that Father Christmas called with a drop of liquid refreshment as a small gesture of my gratitude. As far as I am concerned, the value of assistance or expertise given, from wherever it originates, is immeasurable, and on this occasion, it brought about an extremely satisfactory end to a particularly frustrating period.

Fabrication could now begin again in earnest with the securing of the side and end panels to the tank bottom as described many times in *Model Engineer* by the use of brass angle screwed to the floor. Following satisfactory erection of the sides, the end panel was trimmed to fit between, except the flare bit, when the excess length of the sides was removed. The mitre for the flare between the sides and end was then carefully filed to radius to produce a snug fit at each of the top corners. At the outset, I was unconvinced that this technique for the mitre formation would produce the desired result, but as was the case several times earlier, I was thankful for the benefit of some excellent advice.

Footplate

It appeared from photographs that the tender platform was approximately the same height above the frames as the locomotive footplate. A box-like section was therefore designed to fit in front of the vertical coal plate with a central lifting top section, or 'lid', in order to give access to the tender coupling pin. The width of the 'box' across the frames was critical, as a sufficient width of the tender bottom had to be retained at each side to allow the two outer vertical rails to be located in the small area of

plating which then remains forward of the coal plate. The arrangement and construction details of the box section are shown as **fig 20**.

Coalplate

I was now able to place the tender behind the locomotive on a short section of track, made from two lengths of T-section aluminium screwed to a few sleepers of scrap skirting board, I was mortified to note that when coupled up, the distance from the tender buffers to the firehole door was a little over 30 inches. A quick experiment revealed that this distance was just about equal to my arms length reach plus a coal shovel! I realised that the top of the coal plate and other obstacles on the tender front would probably inhibit the firing procedure, or at least, their presence was not going to help matters. Obviously, the brake column and injector water valve on the right-hand side, are permanent fixtures and cannot just be taken out of the way on running days.

I therefore decided to design the coal plate in such a manner that the whole thing could be lifted out to leave only 2in. or so of water tank upstand at the front and so maximise all the available space. **Figure 21** (see next time) illustrates my solution. However, if in practice I find that the presence of the coal plate is not too much of a burden during firing activity, then the coal plate and its accoutrements will remain in situ and nothing has been lost.

Lockers and toolboxes

I had not tackled anything such as these features previously, so regarded their construction with some degree of trepidation and as the toolboxes especially, are a rather prominent feature on the superstructure, there was no justifiable reason for them not to be included. Consequently, I produced **figs 22a and 22b** and set about manufacture of two pairs, one semi-circular pair of lockers for locating either side of the footplate against the coal plate and a pair of rectangular toolboxes for mounting on top of the coal plate bulkhead, to be positioned lengthways parallel to the tender side sheet. For the latter task, I opted out of attempting to fashion the toolbox lids by bashing some sheet metal over a former. I considered that this method would take forever and doubted that it was within my capabilities anyway, so instead, I chose the far simpler method of manufacture by simply filing a correctly dimensioned chunk of brass bar to the appropriate profile.

A little arm aching, but even with a few rest breaks, the job did not take an inordinate amount of time and I would gamble considerably less than if I had attempted the use of a former and bending techniques. The only downside is that the lids, quite naturally I suppose, are comparatively heavy for their size when opened, but as the boxes are purely cosmetic and will spend 99.99% of their time in the closed position, I considered this fact not to be a problem. In retrospect I also believe that it was much easier for me to fit the hinges and locking strap to the solid block rather than a scrap of thin sheet, but as I have no experience of the latter, this theory must remain a matter of pure conjecture!

The tank top

I now felt that it was time to fit the tank top and marked out its position on the side sheets allowing for the slope and short flat section to the rear of the coal plate shovel opening. A section of brass sheet for the tank top was guillotined to width and then bent in the two places to match the marking and form the appropriate profile. It was then cut to length 5 5/8in. short of the inside of the rear plate as I intended that this rear section of the tank top would not only be a snug fit, but if necessary, would also be capable of being readily detached to give access to the tender hand pump, the operating lever of which is positioned centrally under the water filling opening.

From the 4mm drawing in *Midland Railway Locomotives Vol. 4*, I noted that there appeared to be a girder of sorts across the tender top, and on one particular photograph of a tender, (I only ever found two that showed any detail of value of the superstructure top), it appeared to be provided with local thickening and a largish hole at each end, probably for lifting the tank top I thought. The familiar three-quarter front view shots so beloved of the railway photographic fraternity are excellent and I enjoy seeing them, but unfortunately they are of little use when searching for upper superstructure detail. I did my best to interpret what could be seen, produced **fig 23a** and set about the task of putting it together. A 9/16in. wide x 3/64in. thick brass strip has two parallel rows of 3/64in. snap head rivets inserted and secured by soldering into small countersinks underneath, or Loctited in. Either way, the stumps are snipped off and filed flush in the usual manner. Two angle brackets formed from 1/32in. thick brass sheet, are then bent up and drilled as shown. The brackets and the flat strip are then fastened together by 8BA hexagon head steel bolts or round head brass screws as preferred. I used the steel bolts and live in hope that the paint will prevent any unwelcome appearance of rust. If this fails, I will replace them by making a special purchase of brass hexagon headed bolts. A 5/8in. x 3/64in. thick brass strip is then riveted to the vertical face of the brackets with 1/16in. diameter rivets and transferred to the drilling machine for insertion of the two 3/16in. diameter holes. I am not totally convinced that this is as per prototype as there was insufficient detail on the book drawing and the photograph was inconclusive, as of course, it could only portray a one-sided view of the girder. Nevertheless, the image on the tender looks reasonably authentic and I suppose there aren't too many buffs around who could dispute its accuracy!

The tank filler

The 1 5/8in. diameter filler was located in accordance with the 4mm drawing, its centre 2in. from the rear edge of the removable plate and on the centre line of the tender. Once again, **fig 23b** was prepared from my observance of the photographs. The drawing should be self-explanatory but perhaps a word about the lid hinge arrangement may be useful. The overall shape of the lid was firstly produced from a 2in. diameter disc of 1/32in. thick brass sheet with the front extension finished by hand filing, but expert turners may perhaps be able to machine the whole thing at one go. The rear portion of the disc, to which the hinge will be attached, was then sawn off with a very fine Xacto blade and the two faces minimally cleaned up with a fine file. One of a pair of standard, commercial brass hinges, purchased from my local model shop, then had its original four holes filled in by tapping 8BA, screwing in bits of chopped off 8BA brass screws, soft soldering over and filing and cleaning up both sides. It was then marked out, allowing for a saw cut to bisect it in the middle, and re-drilled with the eight 3/64in. diameter holes. The hinge was then sawn in half and the edges cleaned up, when the two portions of the lid were carefully aligned on a piece of plate glass so that the four leaves of the two hinges could be correctly located and superglued in place on the lid. The eight holes were then run through the lid, slightly countersunk on the underside, 3/64in. rivets inserted and almost all of the protrusion snipped off so that the rivet stubs could then be lightly hammered into the countersinks and filed flush with the underside. The lid was then clamped to the top of the body with uniform overhang all round, the top ring having been previously soldered in position, thus enabling the static rear portion of the lid to be similarly secured at the rear of the filler opening.

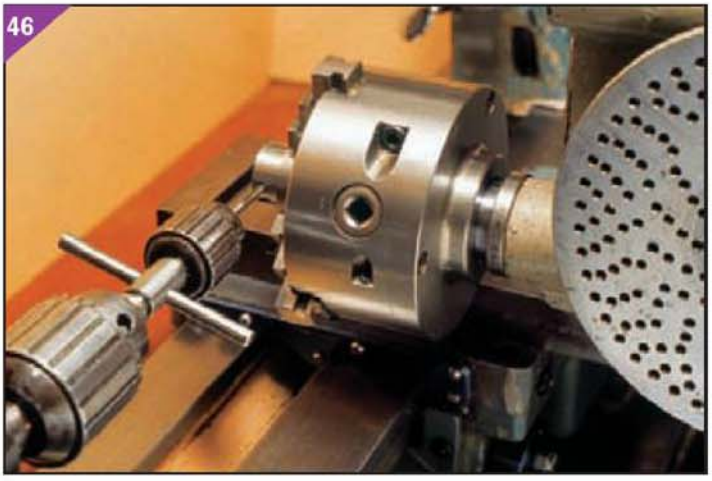
To be continued.

PART 7

Continued from page 530 (M.E. 4298, 27 April 2007)

Bill Steer continues the construction of this simple tool with details of the ratchet housing.

A compact RATCHET BRACE



46. Tapping the 5BA hole in the side of the ratchet housing, with the workpiece set up in a dividing head mounted on the lathe cross-slide.

We can now proceed with the ratchet housing. This is shown in **fig 21.** In essence it consists of a steel collar that encloses the ratchet wheel and supports the pawl; it is rotated by means of a small lever. The main difficulty in making this item is in cutting out the cavity for the pawl — it's quite small and fiddly! Broaching might well be a contender if this component were to form part of a production run. As a one off, it could be made with the aid of a small precision milling machine using co-ordinate methods, or even an engraving machine equipped with an enlarged template. Spark erosion might be another possibility. For most of us though, these techniques are not likely to be available and hand methods will be the order of the day. Even so, this will involve some fairly tricky marking out. Fortunately, the exact size of the cavity, and that of the pawl, is not too critical and we can make these parts as a fitted pair.

We could begin by taking a suitable length of steel rod, with a faced end, and mark everything out on this surface. Unfortunately, should we choose to do so, we would very soon find that the guide lines for those areas containing important detail, have rapidly become obliterated with scratches etc. as other areas are worked upon. One obvious way of overcoming this is to complete the more critical regions first, but this is not always practical. The other alternative, and the one I adopted, is to machine away as much material as possible using methods based on indexed positioning etc., before marking out, and only then, concentrate on those areas to be finished by hand. A disadvantage of this is that it is sometimes necessary to use a fitted insert to provide a datum in a region that has already been machined away. This

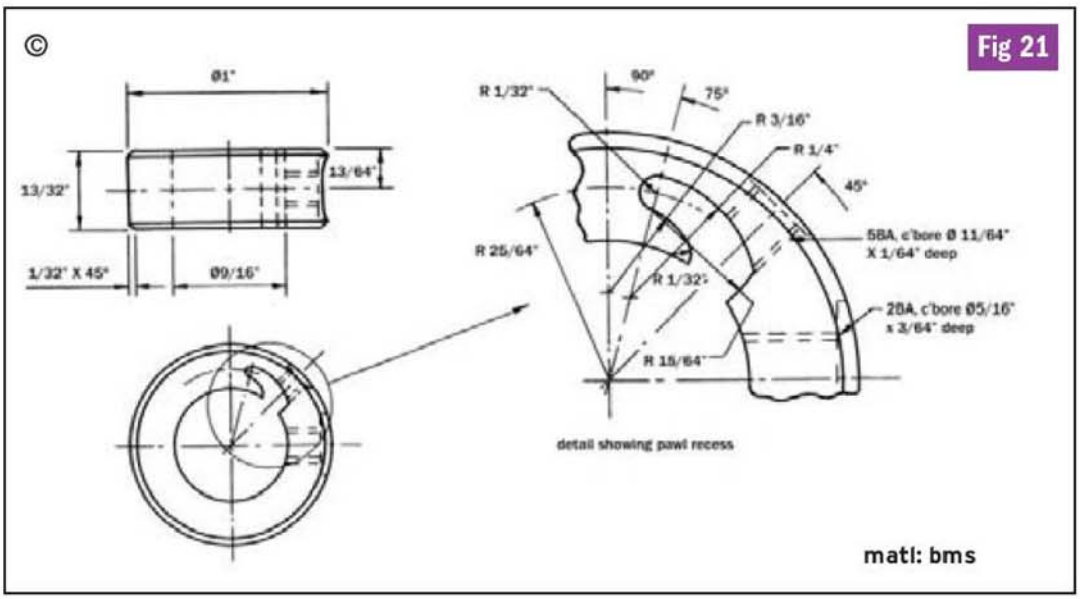
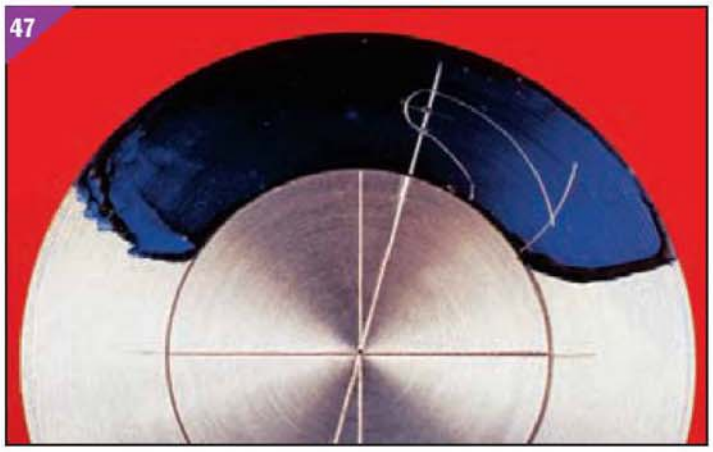
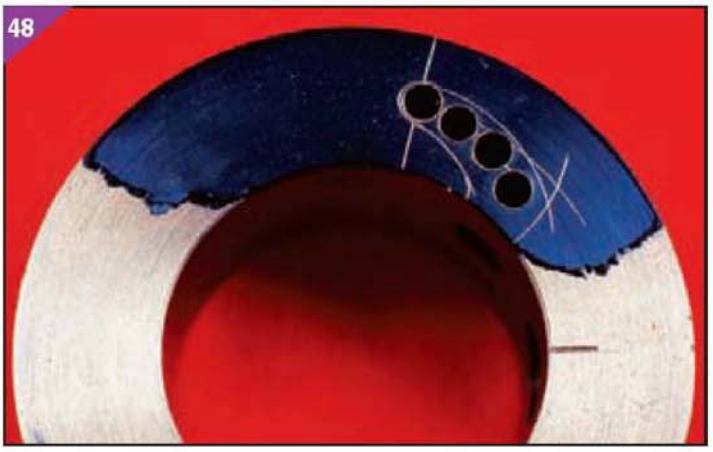


Fig 21. Ratchet housing.





47. The ratchet housing marked out with the aid of a removable insert.

48. A number of small holes have been drilled as a first stage in cutting out the recess for the pawl.

applies to our ratchet housing, but I considered the little bit of extra work well worthwhile.

Start with a short length of mild steel, 1 1/8in. diameter. Grip in the 3-jaw chuck, with about 9/16in. protruding. Face, centre and drill a hole 1/2in. dia. for a depth of about 3/4 inch. Using a small boring bar and tool, open up this hole to 9/16in. diameter. The exact size should be such that it presents a running fit to the registers on the end cheeks, with which it engages. The outside can now be turned down and finished to a diameter of 1in. over a length of about 1/2 inch.

At this point we need to make a couple of fiducial marks, one on the face and the other on the side, for future reference. First, lock the lathe mandrel against rotation, using back gear (or other means) and apply hand torque to the top of the chuck to overcome any free play. Then using a really sharp, pointed tool, set at exactly centre height, manipulate the slide ways to scribe a very fine, radial line across that half of the face nearest the front of the lathe. This line should run up to the central hole, but need be no more than 1/16in. long. Keeping the mandrel fixed, make a second line along the cylindrical surface. This should start about 3/32in. inwards from the face and be about 7/32in. long. We will come back to these lines shortly.

The next operation is to drill and tap the holes in the side, for the lever arm and spring retaining cap. These are best done using either a rotary table or a dividing head; I used my Turpin dividing head. This was set up on the cross-slide in such a way that the centre height of its mandrel coincided with that of the lathe but its axis was at right angles to that of the lathe. Without removing the workpiece, the 3-jaw chuck was transferred from the lathe to the dividing head. The chuck was then rotated until the fiducial mark on the cylindrical surface was at centre height (an eyeglass was used to compare the position of the mark with that of the very sharp tip of a brand new centre, held in the lathe mandrel). Next, using the face of the workpiece as a reference, the cross-slide was moved in 13/64in. to locate the position of the first hole. This was centred, drilled No.22, and counterbored before tapping 2BA. Five turns of the handle of my dividing head then rotated the work through 45deg. enabling the second hole (drilled, counterbored and then tapped 5BA) to be produced (**photo 46**).

Having completed these holes, the chuck, still holding the work, was transferred back to the lathe and the embryonic housing parted off, leaving it just a little over 13/32in. long.

Marking out

As mentioned previously, before we can mark out we shall need a close fitting insert to provide a datum for our construction lines. To make this, take an off-cut of steel, at least 5/8in. dia., face the end and turn down the outer surface until it is a gentle push-fit in the bore of the ratchet housing. The length of this reduced section should be just a little over 1/2 inch. Now, using a 60-tooth gear to index the mandrel, bring your lathe tool up to the face of the work and by moving the cross-slide scribe a fine horizontal line right across the surface. Rotate through 90deg. (15 teeth) and scribe a second line. Rotate through a further 12 1/2 teeth and scribe another the line set at 75deg. to this. Unfortunately none of the standard Myford gears provides a simple division to give this angle, however with care this approximation will provide sufficient accuracy for our purposes — if you are unhappy about this then by all means use a gear train, your rotary table, or sine bar etc.!

Once these basic reference lines have been established, part off the insert, making it the same length as the embryonic ratchet housing.

Coat the face of the housing with marking out blue, leaving the small fiducial mark exposed. The insert can then be put into position and rotated until its base line (the second one to be scribed) coincides with this. Now set the workpiece on a V-block and, without moving the insert, adjust its position until the 75deg. line on the latter is horizontal. Using a surface gauge, extend this line on to the ratchet housing. Marking out can now proceed in the usual way, but since we are dealing with a very small cavity, fine lines are needed; it is therefore worth sharpening the points of your dividers using a slip stone before commencing. Also, unless your eyesight is exceptionally good, an eyeglass or loupe will be found to be of considerable assistance. **Photograph 47** shows the ratchet housing with the basic marking out completed but with the insert still in place.

Excavating the cavity

Begin excavating the cavity, by carefully drilling a number of small holes to remove as much material as possible (**photo 48**). Then using a piercing saw, join up the holes, cutting as near to the marked edge as you can without going beyond it (**photo 49**). Take your time over this; some writers advocate the use of cutting fluid with piercing saws, but generally I prefer to work with a dry blade, which seems to cut more freely. With most of the metal now cut away, use an Abrafile (spiral saw blade) followed by needle files (I found a small oval one to be particularly useful) to complete the profile. It is worth leaving the cavity a shade undersize at this stage and starting work on the pawl so that the two may be fitted together as a pair.

The pawl

This is shown in **fig 22**. Since this is quite a tiny item it is best to perform as many operations as possible with it >>

49. Using a piercing saw to cut between the holes.

50. Filing the pawl to shape while it is still attached to the parent material.

51. The finished pawl.

52. The finished ratchet housing.

still attached to the parent material, severing only when it is nearly completed. We begin with a length of 1/2in. dia. silver steel. This should be held in the 3-jaw chuck, faced, centred and drilled 3/8in. for a depth of just over 1/2in. (since the hole will form one side of the completed pawl, you may prefer to bring this to size using a small boring tool as this will produce a better finish). Remove from the lathe and either saw down by hand, or mill away the excess material to leave the embryonic pawl standing proud of the stock material. This can now be carefully filed to the basic profile, taking care to get the 17/64in. width as near correct as possible and keeping the edges upright and parallel to each other (**photo 50**). At this stage, and before making the recess for the spring and cutting away the corners to clear the end cheeks, the pawl should be tried in the cavity in the ratchet housing. Work should then continue on the latter to produce a good fit. The pawl needs to be reasonably constrained circumferentially but its sharpened end should freely move in a near radial direction. Again, take time to get this right.

With the pawl tucked inside its cavity, the position for the spring recess can be determined. This recess is best made with a small fraizer or burr about 3/32in. diameter. The two cut-aways can be produced with a warding file, making sure that the distance between them is just a shade less than the thickness of the ratchet wheel. Finally, the pawl can be severed from its parent stock. It is best not to finish it to length just yet, but to wait until the ratchet housing is completed — like this, it must be free to move between the constraining cheeks.

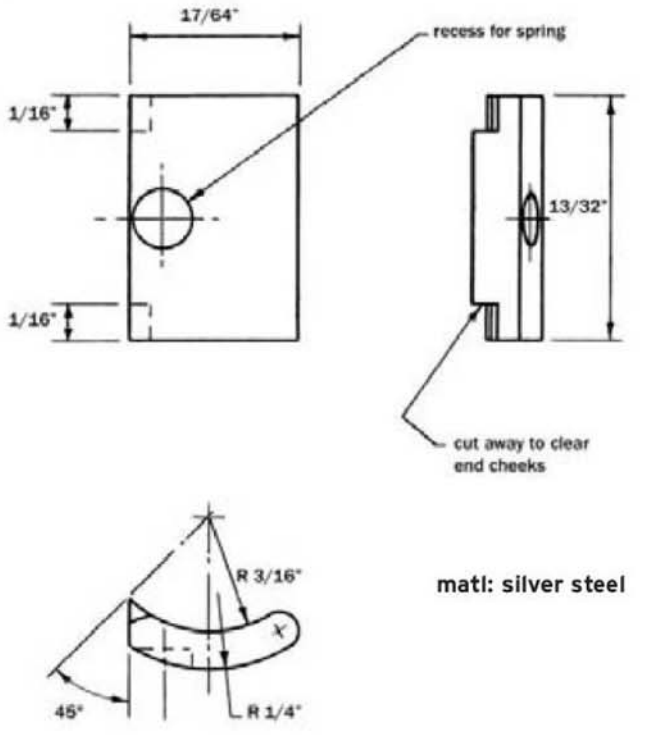
After final assembly and testing of the brace, the pawl should be hardened and then tempered to a purple/blue colour, using a sand bath. The finished pawl, after a final polish, is shown in **photo 51**.

Completing the ratchet housing

With the cavity now finished, the housing can be returned to the lathe and carefully faced to size. Its overall length should be a thou-or-two less than the width of the gap between the cheeks when they are assembled, together with the ratchet, on the mainshaft. When the correct fit has been obtained put the small chamfer on the two outer edges. The finished housing is shown in **photo 52**.

To be continued.

Fig 22 ©



THE MODEL ENGINEER EXHIBITION
7th - 9th September 2007 Ascot

Please return completed form to:
Model Engineer Competition,
9 Tranmore Lane, Eggborough,
E. Yorkshire DN14 OPR

ENTRY NO.

OFFICE USE ONLY

CLASS	ENTRY NO.

ENTRY FORM - COMPETITION & LOAN MODELS

PERSONAL DETAILS (Please print)

Surname _____ Forename(s) _____ Age: _____

Address _____

_____

_____ Post Code: _____

Home Tel No _____ Daytime Tel No _____

Model Club or Association _____

Have you entered before? (Y/N) _____

Do you purchase or subscribe to a Magicalia Publishing Ltd magazine? (Y/N) _____

How many years have you been a modeller? _____

Mail Order Protection - please tick this box if you would prefer not to receive mail from other companies which may be of interest to you ☐

MODEL DETAILS – PLEASE TICK BOX IF MODEL IS FOR LOAN ☐

Entry Class (competition entries only) _____

Model Title (to be used for catalogue and display card) _____

Model Description _____

_____

_____

Model Scale _____ Length _____ Width _____ Height _____ Weight _____

Type of construction _____

_____

Parts not made by you and commercial items _____

_____

Have you supplied a photograph? (Y/N)

Are you supplying Judges Notes? (Y/N)

Value of Model (Magicalia Publishing Ltd will not insure the model unless a value is entered) £ _____

Name and address of your local newspaper _____

_____

N.B. Please make a copy of this form and any photographs enclosed for your own reference.
Please note that Magicalia Publishing Ltd will not accept liability for any loss of documents or photographs submitted with this form.

To help you get the best from The Model Engineer exhibition

These notes are written purely for guidance. Full information is contained in the Competitors' Information booklet which is sent to every entrant as part of the information package. If you have an item and are unsure as to the Class into which it should be entered, leave that section blank and we will take care of it. The Judges have the right to move any competition exhibit into another class if they feel that by doing so its chances of gaining higher marks or a more appropriate award are improved.

If the item is offered as a Loan exhibit please indicate this by writing Loan on the form in the box identifying the Class. Loan models are not judged but carry all other privileges associated with competition entries.

Part built models are particularly welcome in the Loan Section; visitors like to see work in progress, and entry does not preclude the item being entered in competition when completed.

The classes listed below are those associated with mainstream model engineering.

Club exhibits

Where a club is exhibiting, each model should be entered on a separate entry form and clearly identified as a club exhibit by entering Loan/Club in the class section box. This ensures that we have a full record of all models on display during the show and facilitates matters of administration and insurance.

Additional forms

If you do not wish to deface your copy of the magazine we are happy to receive photocopies of the entry form, one for each model. We will be pleased to send out extra forms if required, so if you know of a modeller who is not a reader of one of our magazines but who you think may wish to participate, please advise them to contact our Exhibitions Office, or simply photocopy the entry form for them.

The success of the show depends largely on the number of models on display. Your work could well be the stimulus which inspires someone else to start in the hobby. There can be no doubt that this event is our showcase on the world of modelling in all its aspects. Every modelling discipline needs more and more participants, and it is by displaying not only the crème-de-la-crème, but also examples of work of a more achieveable standard, that people are encouraged to join into the wonderful world of modelling, in whatever aspect.

We look forward to seeing a sample of your work at the show!

Engineering Section

A1 Hot air engines.
A2 General engineering models (including stationary and marine engines).
A3 Internal combustion engines.
A4 Mechanical propelled road vehicles (including tractors).
A5 Tools and workshop appliances.
A6 Horological, scientific and optical apparatus.
A7 General engineering exhibits – not covered by the above

Railway Section

B1 Working steam locomotives 1" scale and over.
B2 Working steam locomotives under 1" scale.
B3 Locomotives of any scale, experimental, freelance or based on any published design and not necessarily replicas of full size prototypes, intended for track duties.
B4 Scratchbuilt model locomotives of any scale, not covered by classes B1, B2, B3, including working models of non-steam, electrically or clockwork powered steam prototypes.
B5 Scratchbuilt model locomotives gauge 1 (10mm scale) and under.
B6 Kitbuilt model locomotives gauge 1 (10mm scale) and under.
B7 Scratchbuilt rolling stock, gauge 1 (10mm scale) and under.
B8 Kitbuilt rolling stock, gauge 1 (10mm scale) and under.
B9 Passenger or goods rolling stock, above 1" scale.
B10 Passenger or goods rolling stock, under 1" scale.
B11 Railway buildings and lineside accessories to any recognised model railway scale.
B12 Tramway vehicles.

Marine Models

C1 Working scale models of powered vessels (from any period). Scale 1:1 to 1:48
C2 Working scale models of powered vessels (from any period). Scale 1:49 to 1:384
C3 Non-working scale models (from any period). Scale 1:1 to 1:48
C4 Non-working scale models (from any period). Scale 1:49 to 1:384
C5 Sailing ships and oared vessels of any period – working.
C6 Sailing ships and oared vessels of any period – non-working.
C7 Non-scale powered functional models including hydroplanes.
C8 Miniatures. Length of hull not to exceed, 15in for 1:32 scale, 12in for 1:25 scale, 10in for 1:16 scale; 9in for 1:8 scale. No limit for smaller scales.
C9 For any model boat built from a commercial kit. Before acceptance in this class the kit must have been readily available for at least 3 months prior to the opening date of the exhibition and at least 20 kits must have been sold either by mail order or through the retail trade.

Scale Aircraft Section

D1 Scale radio control flying models
D2 Scale flying control-line and free flight
D3 Scale non-flying models, including kit and scratch-built
D4 Scale flying radio controlled helicopters

Model Horse Drawn Vehicle Section

G1 Carriages & other sprung vehicles. (Omnibuses, trade vans etc.) Wagons, carts and farm implements. Caravans.

Junior Section

J1 For any type of model, mechanical or engineering work, by an under 14 year old.
J2 For any type of model, mechanical or engineering work, by an under 16 year old.
J3 For any type of model, mechanical or engineering work, by an under 18 year old.

All entries will be judged for standard of craftsmanship, regardless of the modelling discipline, i.e. a boat will not be competing against a military figure. Providing a model attains sufficient marks it will be awarded a gold, silver or bronze medal.

Model Vehicle Section

K1 Non-working cars, including small commercial vehicles (e.g. Ford Transit) all scales down to 1/42.
K2 Non-working trucks, articulated tractor and trailer units, plus other large commercial vehicles based on truck-type chassis, all scales down to 1/42.
K3 Non-working motor bikes, including push bikes, all scales down to 1/42.
K4 Non-working emergency vehicles, fire, police and ambulance, all scales down to 1/42.
K5 Non-working vehicles including small commercial vehicles (e.g. Ford Transit,) scale from 1/43 or smaller.
K6 Any available body shells including Concours, in any scale or material, to be judged on appearance only.
K7 Functional model cars/vehicles which must be able to move under its own power of any type. Can be either free-running, tethered radio controlled or slot car, but must represent a reasonable full size replica.

DUKE OF EDINBURGH CHALLENGE TROPHY

Rules and Particulars

1. The Duke of Edinburgh Challenge Trophy is awarded to the winner of the Championship Award at the Model Engineer Exhibition.
2. The trophy remains at all times the property of MAGICALIA PUBLISHING LTD.
3. The name of the winner and the date of the year in which the award is made will be engraved on the trophy, which may remain, at the discretion of MAGICALIA PUBLISHING LTD., in his/her possession until required for renovation and display at the following Model Engineer Exhibition.
4. Any piece of model engineering work will be eligible for this Championship Award after it has been awarded, at The Model Engineer Exhibition, a Gold or Silver medal by MAGICALIA PUBLISHING LTD
5. No model may be entered more than once.
6. Entry shall be free. Competitors must state on the entry form:
   (a)That exhibits are their own bona-fide work.
   (b) Any parts or kits which were purchased or were not the outcome of their own work.
   (c) That the model has not been structurally altered since winning the qualifying award.
7. MAGICALIA PUBLISHING LTD. may at their sole discretion vary the conditions of entry without notice.

COMPETITION RULES

1. Each entry shall be made separately on the official form and every question must be answered.
2. Competition Application Forms must be received by the stated closing date. LATE ENTRIES WILL ONLY BE ACCEPTED AT THE DISCRETION OF THE ORGANISERS.
3. Competitors must state on their form the following:
   (a) Insured value of their model.
   (b) The exhibit is their own work and property.
   (c) Parts or kits purchased.
   (d) Parts not the outcome of their own work.
   (e) The origin of the design, in the case of a model that has been made by more than one person.

NOTE: Entry in the competition can only be made by one of the parties and only their work will be eligible for judging.

4. Models will be insured for the period during which they are in the custody of MAGICALIA PUBLISHING LTD.
5. A junior shall mean a person under 18 years of age on December 31st in the year of entry.
6. Past Gold and Silver medal award winners at any of the exhibitions promoted by MAGICALIA PUBLISHING LTD. are eligible to re-enter their model for the 'Duke of Edinburgh Challenge Trophy'.
   Past winners at any of the exhibitions promoted by MAGICALIA PUBLISHING LTD. will not be eligible for re-entry into the competition unless it has been substantially altered in any way.
7. MAGICALIA PUBLISHING LTD reserve the right to:
   (a) Transfer an entry to a more appropriate class.
   (b) Describe and photograph any models entered for competition or display and to make use of any such photographs and descriptions in any way they may think fit.
   (c) Refuse any entry or model on arrival at the exhibition and shall not be required to furnish a reason for doing so.
8. Entry into the competition sections is not permitted by:
   (a) Professional model makers.
   (b) Anyone who has a financial interest in the direct supply of materials and designs to the public.

NOTE: If unsure, please contact the Competition organisers prior to the show.

9. The judges' decision is final. All awards are at the discretion of the judges and no correspondence regarding the awards will be entered into.
10. Exhibitors must present their model receipt for all models collected at the end of the exhibition and sign as retrieved.
11. The signed release for each model must be presented to security staff when leaving the exhibition complex with display model(s) after the close of the exhibition.

IMPORTANT NOTE: PLEASE MAKE COPIES, INCLUDING PHOTOGRAPHS, OF ALL INFORMATION RELATING TO YOUR MODEL, AS MAGICALIA PUBLISHING LTD WILL NOT ACCEPT LIABILITY FOR ANY LOSS.

CLOSING DATE 24TH AUGUST 2007

From Malcolm Stride

Notices

Guildford MES is holding its annual rally on 21/22 July this year at the track site in Stoke Park Guildford. This year is an important milestone, being the 40th (Ruby) Anniversary of the very first Guildford Model Traction Engine Rally.

Harlington Locomotive Society is holding a 'Visiting Clubs Day' on Saturday 16 June. The event is not open to the public but to members of other clubs only. For more information contact Peter Tarrant (t. 01895 851168).

Kinver & West Midlands SME is holding a double open event over the holiday weekend of 25-27 August. On Saturday/Sunday 25/26 the Kinver Diesel weekend is the event and on Monday 27 August an open day for steam and diesel locomotives is being held. The club has 2180ft. of 3½ and 5in. dual gauge raised level track and everyone with an interest is invited to attend.

There is limited camping/caravan space available and those requiring such facilities should contact Allen Bellamy (t. 01746 761008), Pete Dawson (t. 01384-8732630), or Mike Harrison (t. 0121 602 2019).

The **Vale of Aylesbury MES** Annual Miniature Traction Engine Rally will take place on Saturday/Sunday 2/3 June this year at the Buckinghamshire Railway Centre, Quainton Road Station, Quainton near Aylesbury. Miniature road vehicles of all types are welcome and on Saturday will have the freedom of the railway centre. There will be a barbecue on the Saturday evening and on Sunday there will be a morning road run to the Swan public house together with a full afternoon program. There is limited space for caravans (advance notice essential). For further information contact Clive Ellam (t. 01296 623433, e. cnellam@aol.com).

UK Club News

In common with many societies, members of **Bedford MES** have been busy during the winter season. Projects in progress include levelling the area where the Portakabin used to be, building a water treatment facility, replacement of a dual gauge diamond crossing with a single gauge unit, new platforms for all tracks at Badgers Holt and lots of work on the track alterations.

The good news at **Birmingham SME** is that the society has been awarded a lottery grant under the 'Awards for All' scheme. The main purpose of the grant is to fund a replacement footbridge over the raised level track by the clubhouse. In addition refurbishment of the clubhouse will be completed with new windows, treatment of exterior woodwork and new floor coverings inside. Work on the gauge 1 track extension has started with some other tracks being swapped to allow the gauge 1 track to be on the outside so that an extension along the field can be constructed.

Following the previously reported storm damage to the bridge at **Bradford MES**, the repairs have now been completed. The opportunity was taken to increase the height of the railings and to accommodate a gentler slope into the centre of the track. At the club auction late last year, one of the lots was an ex-dentist's glass-lined mahogany drawer unit. Unfortunately the auctioneer could not open the unit to display the contents but managed to persuade those present to bid "sight unseen". Peter Horsfall was eventually successful and, once he got the unit open the next day, discovered that he had bought a very large quantity of assorted tools and other model engineering items. As he says, next time a box with contents unknown comes up at auction others may be more willing to speculate. Did some pessimist mention 'pig in a poke'? Two tanks of fish were removed from the Bradford Moor boating lake because of low oxygen levels following the hot weather. The environment Agency relocated the rescued fish to the Leeds Liverpool Canal and Harold Park at Low Moor.

Trials of two types of anti-tip rail have taken place at **Brighton & Hove SMLE** to evaluate the best option for the station area track. The rails are obviously successful because it is reported that it is possible to stand with ones entire weight on one foot board without derailing the passenger car. The design to be adopted uses galvanised tube for the rail which requires less support than the alternative flat steel section.

Following the AGM at **Bristol SMEE**, Mike Keighley has been elected chairman, taking over from Bob Lilley who had served in the post for three years. The society is looking forward to celebrating its 100th Anniversary in 2009 and Mike is asking for suggestions for events so that planning can start this year. Mark Phillips has stood down as joint editor of the (excellent) newsletter and at the AGM was awarded the Eric Griffiths Trophy for services to the society. The second phase of the raised track replacement at Ashton Court is now almost complete. Since last October the gang have laid 49 ten-foot long track panels. A new team is already prefabricating track panels to be laid during the next winter session. The Santa Special Day was marred by the loss of a brand new marquee which took off during the overnight gale causing damage to the station roof in its flight. Most of the broken parts from the roof surround where found and repairs were quickly carried out.

Ten lady members of **Cardiff MES** attended a short course on "Essential Food Hygiene" in order to become familiar with the latest thinking on such topics. A planning application has been submitted for rebuilding the clubhouse, and if successful contractors could begin work after the public running season has ended. Work on the track extension will start once the amended lease has been received from Cardiff City Council. Some members travelled to Sinsheim for the annual gathering and commented that "travelling

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around was easy by public transport, especially the trams which were clean, fast, on time and very cheap". Is there a message for someone there? The raised track is being re-laid using profiled rail and work will continue after the running season finishes.

The "table top" outdoor layout at **Chichester DSME** is to be re-sited and developed to make it a larger feature of the site. The club workshop has had a clear out over the winter so that "the approach to the machines is more of a preparation for real engineering and less of an adventure in its own right."

The George Ovendon Cup was a awarded to Ken Gibbons for his enthusiastic support over many years at **Canterbury DMES**.

Congratulations are due to **Chesterfield DMES** which celebrates its 75th Anniversary on 21 July this year. In spite of this there is no time for members to rest on their laurels, work continues at the site with two new containers installed on the site, new points being constructed and lots of tidying up in the area. Following some advice in the last newsletter that the springs in a certain type of clothes peg were stainless steel, some members went out and bought some only to find that they weren't. Several wives are now wondering why their husbands have suddenly taken to buying them clothes pegs!

Progress is continuing apace on the track at the **East Somerset SMEE**. The track, sited in the Bath and West show ground, is being laid with reformed plastic sleepers and trains can now run down to the lake on both sides of the stream. The reversing link is in place and once the two sets of spring-loaded points have been constructed and installed, the construction will have reached part of the planned Phase 4. This means that the track work will be almost a year ahead of the planned schedule. David Hale has completed the new carriage shed which can accommodate two rakes of three carriages. Four new members have joined since September 2006. Because of the progress made, Saturday afternoons are now designated as the members running time.

Guildford MES is producing plans for redeveloping the clubhouse and after approval by the members will start the process of gaining local council approval. Dave Darnell and his team have refurbished the 7¼in. gauge passenger trolleys ready for the running season. In addition they have built six new guard's vans. A new efficiency competition for locomotives with a dry weight of less than 50lbs is to be held in August. This is to encourage owners of small locomotives who do not enter IMLEC.

High Wycombe MEC is also planning a locomotive efficiency competition in June so that members can test out the performance of their locomotives. The event will not use a dynamometer car but will use a points calculation based on the weight of the train, the distance travelled and the amount of coal used.

The **Model Engineers Society (NI)** was given a talk by Andrew McLaslan on the miniature truck models that he produces. In addition to producing his own models Ian also produces kits for trucks, mainly for the cabs. Interest in model aircraft is reported to be growing in the club although a picture in the newsletter of the remains of an aircraft in the rubbish bin illustrates the perils of this aspect of modelling.

The ground level track extension at **North London SME** has made good progress during the winter with the track bed almost complete. The boating lake paving slabs are being re-laid and are reported as "looking good". The speaker at the February meeting was Tim Watson who gave a talk entitled "Models, Microscopes and Molars" which described his experiences working in dentistry with the confocal microscope (invented by Marvin Minsky in 1955) and the building of his fine N gauge model locomotives. Tim had some slow motion movies of dental cutting and grinding in progress which was fine except for those with an appointment the next day! The garden railway goes from strength to strength with regular attendance on Wednesdays and also occasionally at weekends. Some maintenance work has been carried out on the track supports and battens.

The editor of the **Nottingham SMEE** *Kingpin* has second sight because he purchased an external disc drive and backed up all the data on his computer only three weeks before said machine crashed and destroyed all his data. He issues a warning to everyone to "back up your data regularly and keep your application software where you can find it". He now has a new computer and like all of us who have suffered such things is backing the data up regularly. The society has obtained a spark erosion machine which is now installed in the club workshop.

Winter activities at the **City of Oxford SME** have resulted in improvements around the station and clubhouse areas. Concrete has been laid around the raised track traverser/station area, replacing the grass which used to get cut up in wet weather. The area for the proposed clubhouse has gained a new public entrance (with help from the City Council) with a new gate and pathway. This has allowed the extra area for the clubhouse to be opened up and levelled. The society has set up an email discussion group on Yahoo for members.

The next training sessions at the **Society of Model & Experimental Engineers** are scheduled to start on 15 September 2007 and run on the second Saturday of each month at the Marshall House headquarters. The society Gauge 1 track was formally opened in April by Maurice Fagg driving a locomotive through the tape. Work has started on a major refurbishment of Marshall House including replacement of the roof, refurbishment of the stucco and repainting of the house front.

The summer club outing for **St Albans DMES** is a trip to the Watercress Line and the Milestones Museum in Basingstoke. Having visited Milestones for the first time a couple of weeks ago, I am sure those going will have a very enjoyable day. The society has purchased a laptop computer to produce the newsletter and to use for slide shows at meetings. The results of the gales earlier in the year are still being dealt with because there are still a couple of precarious trees leaning over the track. This must add a certain spice to steaming sessions. The March talk was by David Wright, who gave an illustrated presentation on the efforts of Joseph Bazalgette to clean up the sewage disposal in London in the 1850s. This involved building several pumping stations including the now preserved Crossness site which still forms part of the system for London's drainage.

The February talk at **Stamford MES** was given by Geoff Hanford and described his ground level 5in. gauge garden railway. Geoff also talked about the ground level track at Gilling run by **Rydale SME**. The Ralph Ley Rose Bowl was presented to Ian Payne for "his outstanding work in preparing exhibitions for the society".

The track repairs at **Worthing DSME** are now complete with major work undertaken on the south-east corner of the circuit. John Fuller has written an article on the correct use of Lithium Polymer cells in models. Unlike Nicad or other types, these cells can be charged in parallel and John emphasises the point that the correct charger must be used for these cells. Use of the wrong charger can cause a fireball. John also mentions that at the F3A model aircraft aerobatic championships held in Poland, an electric powered model was competitive against the most powerful glow-engined models.

World Club News

Canada

New seat covers have been made and fitted to the chairs in the station at the **British Columbia SME** by a group of

the ladies with assistance from some of the men. The project was so successful that the group may be asked to re-cover some of the riding car seats that need repair. The riding cars have had some winter maintenance to the running gear and new paint where needed.

New Zealand

David Turner, a visitor to the **Hutt Valley MES**, arrived at a meeting with what was described as "a smaller project" under his arm which turned out to be a NE15S built from the series in this journal. They seem to be popular in the Southern Hemisphere as there are several built or being built in Australia. David has since joined the society.

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.

Gordon Allen	*City of Oxford SME*
John F. Andrews	*Cardiff MES*
Derek Birks	*Bristol SMEE*
Rudy Blonk	*New Jersey Live Steamers*
Jay Duke	*New Jersey Live Steamers*
Phil Hains	*Harrow & Wembley SME*
Alan Riches	*Harrow & Wembley SME*
Ken West	*North London SME*
Harry Whitlock	*Worthing DSME*

Interesting Websites

The following websites will be of interest to readers:

www.transportarchive.org.uk – this site covers three topics; the great Central Railway, Bristol Aircraft and The Bridgewater Canal.

www.bletchleypark.org.uk – lots of information on the Bletchley Park code-breaking centre.

www.steaminthewoods.com – full of information on the logging activities of America including the well-known Shay, Heisler and other locomotives.

Workshop tips

A useful tip for selecting tapping drill sizes in the absence of the usual tables came from **Chesterfield DMES**. The method is to take the pitch of the thread and subtract that from the diameter to get the required tapping drill size. As an example, a 3/16 BSF thread has a pitch of 32tpi, so subtract 1/32in. from 3/16in. to get the drill size of 5/32 inch. Apparently this works for metric threads as well, but I accept no responsibility for any broken taps lodged in almost finished cylinder castings!

DIARY

MAY

26-28 **Bedford MES.** *Min. T.E. Rally Weekend, members and guests only Sat. Public Sun & Mon.* Contact Ted Jolliffe: 01234 327791.

26 **Brighton & Hove SMLE.** *Track Day.* Contact Mick Funnell: 01323 892042.

26 **Frimley & Ascot LC.** *Beaver's Scout Run.* Contact Bob Dowman: 01252 835042.

26 **New Jersey Live Steamers, Inc.** *Special Work Day.* Contact Karl Pickles: 718 494 7263.

26 **Romney Marsh MES.** *Boiler Testing.* Contact John Wimble: 01797 362295.

26 **SM&EE.** *Gauge 1 Informal Meeting.* Contact Maurice Fagg: 020 8669 1480.

27-28 **Bristol SMEE.** *Public Running.* Contact Trevor Chambers: 0145 441 5085.

27-28 **Cardiff MES.** *Open Days.* Contact Don Norman: 01656 784530.

27 **Chichester DSME.** *Steam on Sunday.* Contact Brian Bird: 01243 536468.

27 **Edinburgh SME.** *Open Day & Track Running.* Contact Robert McLucke: 01506 655270.

27 **Guildford MES.** *Members' Running Day.* Contact Dave Longhurst: 01428 605424.

27 **Harlington LS.** *Charity Open Day.* Contact Peter Tarrant: 01895 851168.

27 **High Wycombe MEC.** *Public Running.* Contact Eric Stevens: 01494 438761.

27-28 **Malden DSME.** *Public Running.* Contact John Mottram: 01483 473786.

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

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

27/28 **Northern Mill Engine Society.** *Open Days.* Contact John Phillip: 01257 265003.

27 **Norwich DSME.** *Public Running.* Contact Shirley Berry: 01379 740578.

27/28 **Nottingham SMEE.** *Public Running.* Contact Pete Towle: 0115 987 9865.

27 **Saffron Walden DSME.** *Public Running.* Contact Jack Setterfield: 01843 596822.

27 **Staines SME.** *Public Running.* Contact Stan Bishop: 01784 241891.

27 **Worthing DSME.** *Public Running.* Contact Bob Phillips: 01903 243018.

27 **York City & DSME.** *Best Work of the Year.* Contact Pat Martindale: 01262 676291.

28 **Brighton & Hove SMLE.** *Lion Day.* Contact Mick Funnell: 01323 892042.

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

28 **Model Steam Road Vehicle Soc.** *Bank Holiday Steam-Up.* Contact Geoff Miles: 01869 247602.

28 **New Jersey Live Steamers, Inc.** *Memorial Day Run.* Contact Karl Pickles: 718 494 7263.

28 **Northampton SME.** *Bank Holiday Steam-Up.* Contact Pete Jarman: 01234 708501 (eve).

28 **Reading SME.** *Children's Festival.* Contact Brian Joslyn: 01491 873393.

28 **Saffron Walden DSME.** *Public Running & Barbecue.* Contact Jack Setterfield: 01843 596822.

28 **Stockholes Farm MR.** *Bank Holiday Running.* Contact Ivan Smith: 01427 872723.

28 **Westland & Yeovil DMES.** *Track Running Day.* Contact Gerald Martyn: 01935 434126.

29 **Romney Marsh MES.** *Track Meeting.* Contact John Wimble: 01797 362295.

29 **Wigan DMES.** *Roy Holt: Early Running on the East Lancs Railway.* Contact John Chamberlain: 01744 882255.

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

30 **Hull DSME.** *Jim Willson: Personal Experiences in the Chemical Industry.* Contact Tony Finn: 01482-898434.

31 **Sutton MEC.** *Chat Night.* Contact Bob Wood: 0208 641 6258.

JUNE

1 **Aylesbury (Vale of) MES.** *Track Night.* Contact Andy Rapley: 01296 420750.

1 **Canvey R&MEC.** *Steam-Up with Food.* Contact Brian Baker: 01702 512752.

1-3 **New Jersey Live Steamers, Inc.** *Spring Meet.* Contact Karl Pickles: 718 494 7263.

1 **North London SME.** *Jim Macdonald: Around & About.* Contact David Harris: 01707 326518.

1 **North Norfolk MEC.** *Sheringham Boating Pond.* Contact Gordon Ford: 01263 512350.

1 **Portsmouth MES.** *Meeting.* Contact John Warren: 023 9259 5354.

1 **Rochdale SMEE.** *Quiz Night.* Contact Bob Denyer: 0161 959 1818.

1 **Romford MEC.** *Competition Night.* Contact Colin Hunt: 01708 709302.

2-3 **Aylesbury (Vale of) MES.** *Miniature Traction Engine Rally.* Contact Andy Rapley: 01296 420750.

2-3 **Dockland & E. London MES.** *Public Running.* Contact P. M. Jonas: 01708 228510.

2 **Ickenham DSME.** *Public Running.* Contact David Sexton: 01895 630125.

2 **Romford MEC.** *Trackside Afternoon.* Contact Colin Hunt: 01708 709302.

2 **SM&EE.** *Competition Day.* Contact Maurice Fagg: 020 8669 1480.

2 **Southport Model Engineering Club.** *Southport Model Engineering Club Diesel Day.* Contact Gwendoline Baguley: 01704 568456.

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

3 **Basingstoke DMES.** *Public Running.* Contact Guy Harding: 01256 844861.

3 **Birmingham SME.** *Summer Gala.* Contact John Walker: 01789 266 065.

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

3 **Bristol SMEE.** *Fun Day.* Contact Trevor Chambers: 0145 441 5085.

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

3 **Leyland SME.** *Charity Day.* Contact A. P. Bibby: 01254 812049.

3 **Malden DSME.** *Public Running.* Contact John Mottram: 01483 473786.

3 **Northampton SME.** *Public Running.* Contact Pete Jarman: 01234 708501 (eve).

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