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THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 230 No. 4710 • 10 - 23 February 2023

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MODEL ENGINEER

Published by Mortons Media Group Ltd,
Media Centre, Morton Way, Horncastle, Lincs LN9 6JR
Tel: 01507 529589 Fax: 01507 371066

 ISSN 0026-7325
www.model-engineer.co.uk

EDITORIAL
Editor: Martin R. Evans
Deputy editor: Diane Carney
Designer: Yvette Green
Club News: Geoff Theasby
Illustrator: Grahame Chambers
Retouching manager: Brian Vickers
Publisher: Steve O'Hara

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ADVERTISING
Group advertising manager: Sue Keily
Advertising: Angela Price
aprice@mortons.co.uk Tel: 01507 529411
Ad production: Andy Tompkins
By post: Model Engineer advertising, Mortons Media Group, Media Centre, Morton Way, Horncastle, Lincs LN9 6JR

PUBLISHING
Sales and distribution manager: Carl Smith
Marketing manager: Charlotte Park
Commercial director: Nigel Hole
Publishing director: Dan Savage

SUBSCRIPTION
Full subscription rates (but see page 246 for offer): (12 months, 26 issues, inc post and packing) – UK £128.70. Export rates are also available, UK subscriptions are zero-rated for the purposes of Value Added Tax.
Enquiries: subscriptions@mortons.co.uk

PRINT AND DISTRIBUTIONS
Printed by: Acorn Web Offset Ltd., W. Yorkshire
Distribution by: Seymour Distribution Limited, 2 East Poultry Avenue, London EC1A 9PT

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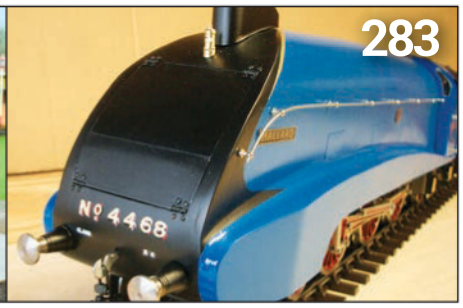

IN THIS ISSUE

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ON THE COVER...

Doug Collins drives David Goyder around the Bromsgrove track behind his superb King George V *(photo: John Arrowsmith).*

This issue was published on Febuary 9, 2023.
The next will be on sale on February 24, 2023.

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Jaw Regrinding - Pete Barker

SMOKE RINGS

MARTIN EVANS
Editor

DIANE CARNEY
Assistant Editor

YVETTE GREEN
Designer

Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
07710-192953
MEeditor@mortons.co.uk

Harrogate

The Harrogate Model Engineering Exhibition is only a month away now. This is a 'two for the price of one' show as it runs in parallel with a model railway show, Model Rail 2023, and the same ticket admits you to both shows. According to the show website (www.theeventsoffice.com) entry will cost £15 for adults but tickets bought in advance are available for £12. Family tickets (two adults and three children) are available for £25, bought in advance, or £30 on the day.

The show is presented by *The Events Office* who organised the Harrogate Model Engineering Exhibition from 1993 to 2009 and advised until 2015. They also organised the Pickering Giant Model Railfest 2007/2008 in conjunction with The Gresley Steam Gala and the A4 Weekend respectively.

This is a show on a large scale, with 40 club stands and 30 traders. Once you have visited all of these there is the Model Rail show to tackle, with nearly 20 layouts, in gauges ranging from 'N' and 'TT' up to '0' gauge. These are backed up by about 25 model rail traders. If you are interested in both model engineering and model railways, then I suspect one day is not going to be sufficient!

You'll be pleased to know that *Model Engineer*, along with *Model Engineers' Workshop*, will have a stand at the show. We'll also be representing our sister magazines, *Model Boats* and *RCM&E*, along with Morton's range of model railway magazines. I'll look forward to meeting you there.

The venue for these shows is the Yorkshire Event Centre in Harrogate (HG2 8NZ) and the show is open on Friday and Saturday, the 10th and 11th of March, opening at 10am until 5pm. Car parking is free and the venue is wheelchair friendly. A courtesy bus will run from Harrogate town centre.

www.theeventsoffice.com

Archaic States of America

One of the great gifts Britain bequeathed to the fledgling United States (along with the language) was the glorious Imperial system of measurement. They became so fond of it that they still use it, making them virtually unique in the world (except for Liberia and Myanmar, apparently). Furthermore, to ensure that their system was unique and, importantly, different to the Brits, they changed the sizes of various units.

At least, that is the popular view. Reader Nick Jarmany has sent me a link to an interesting article in *The Register* that explains the true reasons for the USA's retention of the Imperial system of units.

It seems that in the early days, when the new USA was still friendly with the French, Thomas Jefferson was keen to adopt a more rational system of measurement and had a standard kilogram and a standard metre sent over from Paris. Unfortunately, the ship carrying these two items was captured by British pirates and the two standards didn't reach the USA, spending some time on the island of Montserrat. By the time they were recovered, relations with the French were somewhat less cordial and the Imperial system was retained.

There have been efforts since to adopt the metric system and that has indeed happened – up to a point – but complete adoption has been resisted, mainly for political reasons. Jimmy Carter proposed it but it was opposed by Congress, according to the article. Hearing the metric system described as the 'yoke of tyranny' doesn't help…

So, it would seem that the USA has reason to be *doubly* grateful to the Brits for their (almost) unique system of measurement.

www.theregister.com/2023/01/22/retro_metric_imperial

Three Phrases

Esteemed Contributor Roger Backhouse, who clearly has time on his hands, writes to me with the following:

'While passing though Waterloo Station *en route* to Portsmouth recently I saw a promotion for the Polestar car of which I was previously ignorant. I was intrigued to read under the 'specification – charging' that it uses *three phrase* electricity and I wondered what those phrases could be.

'Graham Astbury suggests the following and I cannot improve on his suggestion:

"the three-phrase electricity is used when there are four bars in each line. I expect that the Polestar is tuned to B#, particularly the long-range dual motor model."

'This may be something you'd like to mention in Smoke Rings. Perhaps other readers have ideas on what the three phrases might be?'

Recalling my own experience with electricity, the three phrases might be something like "Aaarggh! What was that? D*mn!" It also occurs to me that three phrases may be appropriate not only if there are four bars in each line but also perhaps if there are four cars in each lane. Other suggestions are very welcome.

The well-built and positioned club house.

Doug Collins starting to fire up his 5 inch gauge King George V.

We Visit the Bromsgrove SME

John Arrowsmith visits a lively club near Birmingham.

My visit to the Bromsgrove SME benefited from taking place on a bright sunny day, just right for a club visit, and not having been to Bromsgrove for a number of years it was a pleasant surprise to see so much progress. Welcomed by secretary, Peter Maybury the obligatory cup of coffee was soon to hand in the splendid club building members here enjoy. All of the usual facilities are present including a useful kitchen area.

Discussion firstly centred on the club and its origins, the continuing excellent support for the club by the members and the progress that has been made. With 65 members and five honorary members they are able to operate their railways without any real problems. They also have five younger members who are relatives of the senior members and they contribute much to the overall working of the club. The Society has been on the site since 1982 making 2022 their 40th Anniversary year. They have a good working relationship with the Avoncroft Museum of Ancient Buildings and its officers next door; indeed they actually own the club's site. This is a good thing; so many other clubs do have landlord problems, which restricts their development.

The multi-gauge 5, 3½ and 2½ inch gauge track is well laid out and runs extremely well and, with its challenging gradients, is a good test for locomotive drivers. Starting from the station, the track curves left past the covered steaming bays which have an access track running parallel to the main track, that terminates

With the fire lit, the King slowly starts to come to life.

»

This very nice Manor class 4-6-0 belongs to secretary, Peter Maybury.

A very nice 3½ inch gauge A1, Papyrus *on the steaming bay.*

The LMS 2-6-2 tank locomotive waiting to be steamed.

Albert Haywood fires up his Sweet Pea. This one was built by Harry Forrester from the Rugely club.

Richard Taylor with his 2-6-2 tank locomotive, which looks remarkably like an Ivatt, but is in fact a Polly model. Very realistic.

A visiting Class 37 gets some electrical maintenance from Bromsgrove's Clive Wilson and grandson, Josh.

with a traverser in the station. Passing the station the track swings right into a large loop which brings it onto their own 'Lickey Incline' - a long straight to the other end of the site where the track curves left under the road access bridge before passing the club house and returning to the station. Doug Collins gave me a ride behind his superb 5 inch gauge King which demonstrated how well it copes with this testing track. The engine was built by David Douglas and works like the proverbial sewing machine with a crisp exhaust and plenty of power from the four cylinders.

The station is well set out with an overall roof and lots

of seats for passengers. It also has a very interesting system of carriage storage with provision to move the passenger carriages onto the track. The storage shed is built into the station itself but is quite unobtrusive and there is a clever overhead hoist mechanism to store or remove carriages. The carriages themselves were built to the David Hudson design and having served the club well for 25 years, they are currently undergoing their annual maintenance ready for the new season.

The club has a small workshop available with a lathe and drilling machine plus some welding equipment and a couple of sheet metalwork machines - a folder and a set of rolls - but I understand the workshop is only used for maintenance on existing stock; there are no 'new builds' or anything like that presently going on, although members can use it for their own purposes if needed.

The Society has a thriving Garden Railway group within the membership and large, comprehensive layouts both in O-gauge and Gauge 1. Both of these railways were in operation the day I visited with a steady stream of both locomotives and rolling stock on the move. The 32mm gauge track, approximately 300 feet long, is fully scenic with buildings and suitable plant growth whereas the Gauge 1 or 45mm gauge layout is a little shorter but does have some multi-track areas which makes for some interesting passing locomotive movements. The A4, *Bittern* and a rake of Gresley teak coaches contrasted nicely with an LMS Black 5 waiting in the station area. Both layouts are well constructed and have some interesting bridges which make for a fine display on a busy day. As my visit coincided with the Federation AGM there were a number of visitors enjoying the club's hospitality and trying out the track.

Lowering one of the passenger carriages onto the main track.

The club's main motive power; a Class 50 and a Deltic waiting for their first trains.

The traverser in action putting a new engine on the main line.

The club's Deltic waiting for some passengers in the main station.

Visitor Bill Hall with his 5 inch gauge Class 37 waits for the signal to proceed.

Junior member, Josh takes the Class 50 for a spin.

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That just about sums up my visit to the Bromsgrove SME and it only remains for me to thank everyone at the club for their help and information and I hope that, having celebrated their 40th Anniversary during the summer, they are looking forward to the future with the same amount of enthusiasm that has seen the club progress so well over the last 40 years. It was a pleasure to meet you all and to enjoy the excellent facilities that you have. Thank you.

ME

A view of the fine structure supporting the O-gauge layout.

Doug Collins has the King going well as he approaches the station.

Alan Larigo prepares one of his locomotives on the O-gauge track.

LMS power with the Coronation Pacific, City of Glasgow *ready for its train.*

This little Accucraft steam powered train looks good in the sunshine. Two of the coaches are scratch built.

Preparing an American outline Gauge 1 locomotive for some work is Graham Coleman. Note the substantial access bridge.

With a whiff of steam the A4, Bittern *crosses an LMS Black 5 on the Gauge 1 layout.*

A Miniature Oscillating Steam Engine PART 15

Hotspur constructs a three-cylinder reversible oscillating engine.

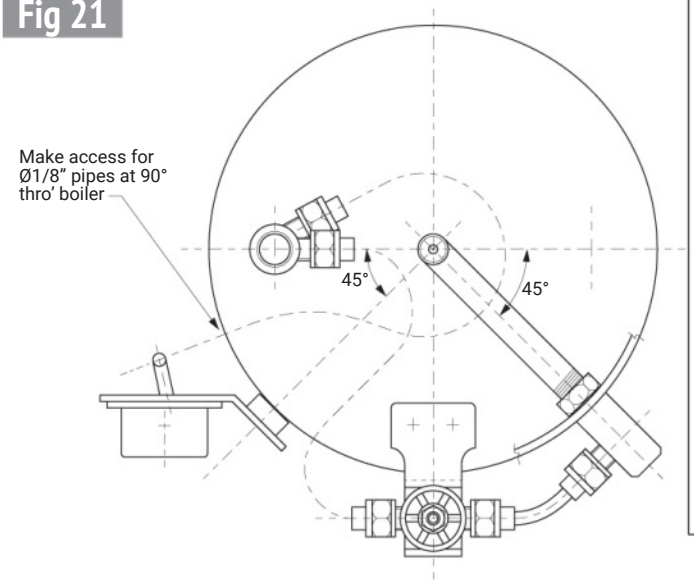
Continued from p.165
M.E. 4708, 13 January 2023

Completing the boiler fittings

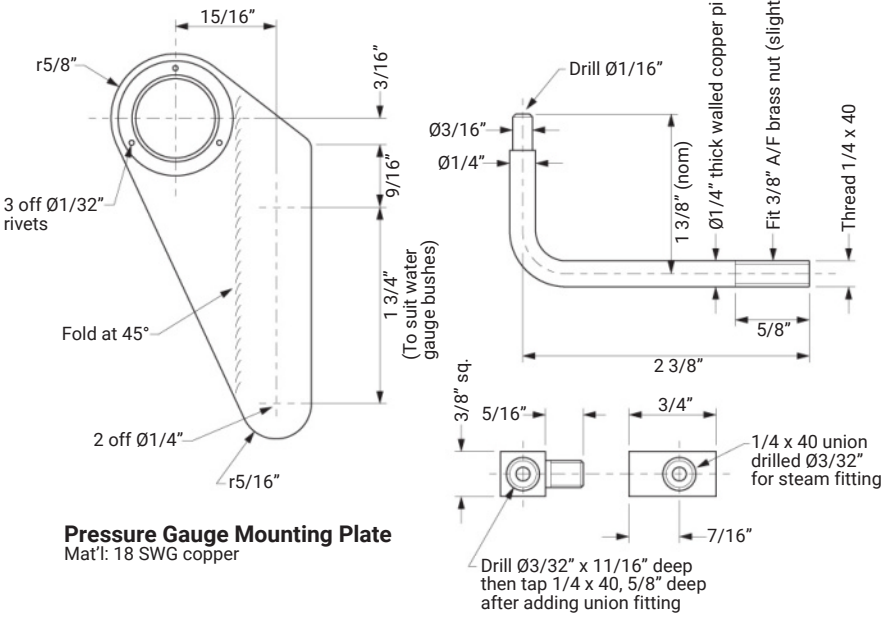
In order for the boiler fire to be generated and kept in a working state, there needs to be a steam blower jet up the chimney and a control valve for the control of the chimney draught. Then, to indicate the steam pressure, there also needs to be an appropriate gauge. The left-hand pillar inside the smoke box top plate that takes the safety valve was described last time and two ¼ inch x 40 threaded unions are used for these two remaining features. **Figure 21** shows the plan of the boiler and the suggested route for the additional pipework and fittings.

All the fittings I have added to the boiler are commercially sourced for speed and convenience and so are the pipe nipples and nuts. Before I go on though, let me offer some warning in respect of commercial pipe nipples and nuts. The ones I have used needed checking as the nipple barrel section would not always pass through the intended hole in the nut so burrs had to be carefully filed away in the nut drilling. Also,

Fig 21



Plan Of Pipe Runs For Blower Valve And Pressure Gauge



Pressure Gauge Mounting Plate
Mat'l: 18 SWG copper

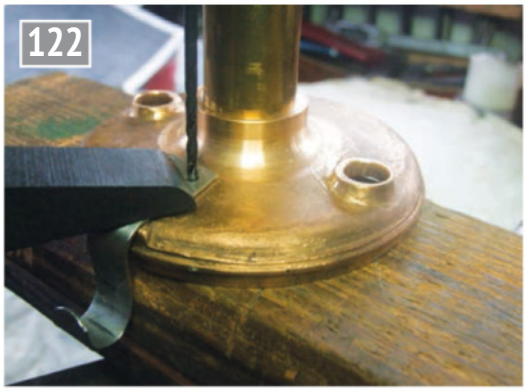
Blower Pipe And Elbow Connection

Hotspur may be contacted on 01600-713913 or **hotspurengines@gmail.com**

the nipple shoulder was too large for the inside diameter of the nut threads, so here it was spun in the lathe and a fine file used to reduce the shoulder size. However, most annoyingly, the threads in the nuts were not tapped to the internal shoulder and a flat ended plug tap had to be used to ensure full engagement. If soldered up without these checks, the pipes and fittings would not have assembled correctly and would have been wasted.

As a starting point I am going to describe the blower pipe itself.

The blower pipe completed and attached to the boiler. The height of the outlet has been extended to ensure it is inside the base of the chimney.



Here the support bracket for the blower valve has been clamped to the crown casting to spot the two fixing holes.

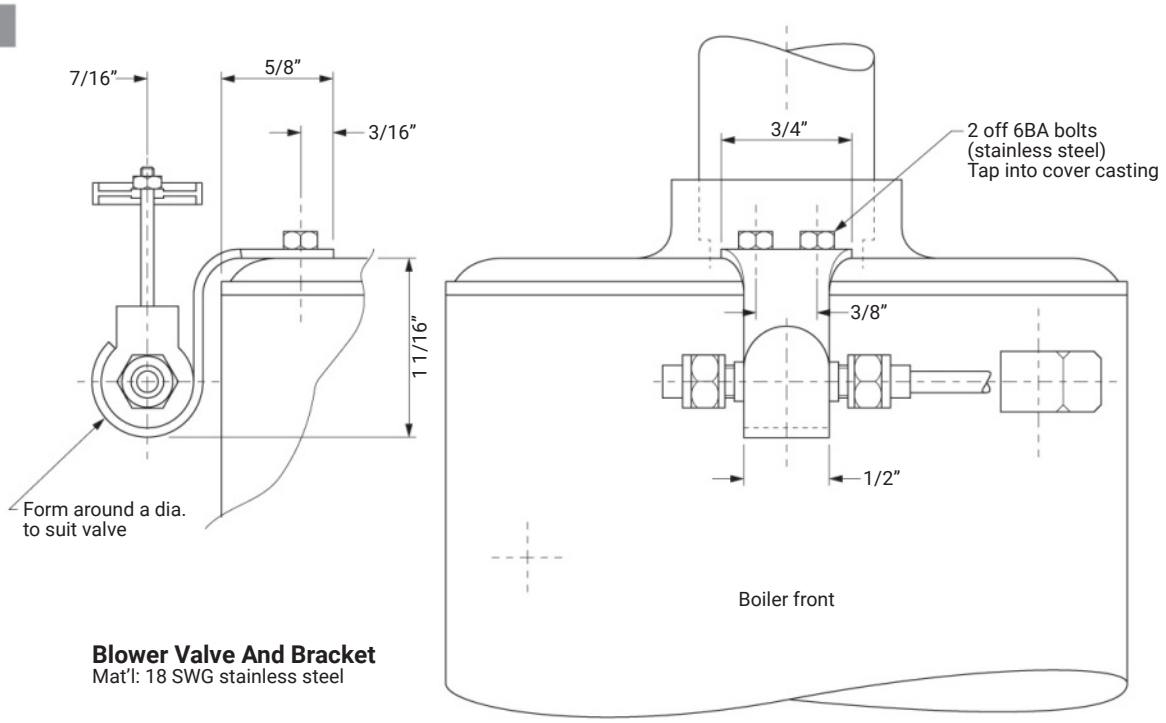
Adding the blower pipe and valve

When I received the boiler kit all those years ago there was blower pipe with the package that had been roughly formed from thick-walled ¼ inch outside diameter copper pipe and it had been threaded ¼ inch x 40 to take a pair of locking nuts. It had also been inserted at the outlet end with a piece of brass tube drilled through ⅛ inch diameter. If this assembly had been left as it was, I doubt if the boiler pressure would have been maintained as a continuous flow for very long as such a large bore would have soon drained the available pressure. It was also clear that the upstand was not quite high enough to be just inside the base of the chimney by around ⅜ inch, so I added a short length of bronze rod turned down to locate in the brass tube and drilled right through 1/16 inch diameter before silver soldering all the joints. It is not expected that the boiler will require more than a gentle up-draught of steam to keep the fire going and hardly any steam flow at all for the alternative gas burners.

It is of course important for the blower pipe to be rigid and the nozzle positioned centrally under the chimney. I decided that the best way to mount it was by drilling a ¼ inch hole in the top of the boiler set 45 degrees round from the centre of the door and ½ inch down from the top edge. This meant that the fitting would easily pass underneath the coil of steam drying pipework and be rigid. The threaded end of the pipe is screwed into a right-angled block on the outside that connects to the steam feed pipe from the valve and has a slightly curved face to suit the outside diameter of the boiler. It is secured on the inside by an equally domed nut. The block has a ¼ inch x 40 threaded union silver soldered on for the connection to the valve pipe nut. The parts are detailed on my small sketch and shown fitted in **photo 121**.

Although the pipe work on either side of the blower valve is quite rigid by itself, I decided to add a bracket formed from 18 SWG stainless steel sheet. This is detailed in **fig 22**. The narrow end has been bent around a piece of round steel bar to match the valve body diameter and this should steady the fitting even though I expect the pipes to be constraining enough. The bend in the top of the bracket is not critical and the top flange is attached to the crown casting with copper rivets. **Photograph**

Fig 22

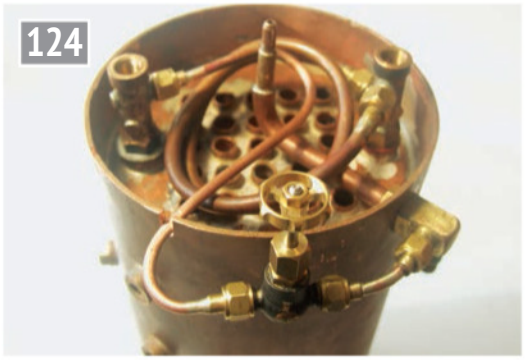


Blower Valve And Bracket
Mat'l: 18 SWG stainless steel

122 shows the bracket holes being spotted through onto the crown casting but this was not completed as per the drawing and was a mistake with the holes on my part. So, I have attached it permanently with rivets and thankfully it will assemble onto the boiler barrel by hooking the valve support over the short, curved pipe and sliding it to the left until it can be fitted over the two steam pillars. A further picture (**photo 123**) shows the outcome.

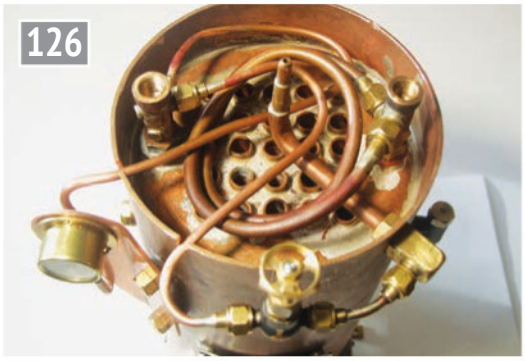
Slots for the two ⅛ inch pipes were then cut in the top of the barrel and the first connection was made to the left pillar. Here again with the steam heating coil already in place the simple route for the blower pipe had to be changed for assembly purposes and **photo 124** shows the result.

The blower valve support bracket riveted to the top casting and the short steam pipe added.



The steam pipe connection to the blower valve now in place.

Here the pressure gauge is being protected whilst the pipe nipple is silver soldered to the feed pipe.



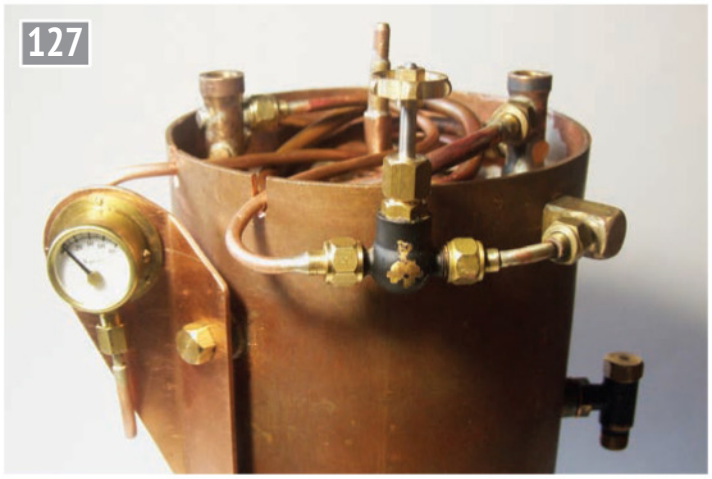
All the pipe work has been fitted although not as drawn (drawing offices rarely get it right!).

Mounting the pressure gauge

A support for the pressure gauge is required next and it seemed logical that a piece of copper sheet could also be used to give material for the washers that seal the water gauge fittings. Bending the 18 SWG plate through 45 degrees so the gauge will face the front and mounting the plate onto the two bushes gave a simple solution. One of my sketches shows the arrangement and the developed shape is given. I have chosen a flange mounted pressure gauge so the radius at the top is to suit the fitting. Mine is a commercial gauge with a range of 0-80 psi that is quite sufficient for the boiler, that will be mainly operating at around 60 psi. When forming the angled bend use a bar that has had at least a 1/16 inch radius added for the fold point as a sharp corner is unnecessary. Marking out and cutting the copper plate profile needs no description but, whilst forming the angle, I found I needed a protractor. The easiest solution was to mark out a two-inch square on a piece of light card and draw a diagonal line that produced what was required.

Prior to mounting the gauge on its plate, I silver soldered the small union nipple to the ⅛ inch copper tube by drilling down 3/16 inch into the tube with a number 40 drill. The gauge was used to hold the pipe fitting on some fireproof board and held in place with a piece of firebrick. Heat was applied to the pipe then gradually moved up till the nipple could take the solder. **Photograph 125** shows the set-up.

I then attached the pressure gauge to its mounting plate with three small 1mm brass rivets. Drilling copper is always a bit fraught and the drill was run at 2000 rpm and was lubricated and fed down very slowly. Again, my pipe layout does not represent what I actually adopted for the route of the pipe and anyone considering building such a boiler may change the layout to suit their purposes. The most important consideration was being able to get a spanner onto all the pipe nuts. **Photograph 126** shows the layout of the pipework added to both fittings with the slots cut into the top edge of the boiler barrel only. Note that I made them deep enough to avoid cutting through the flange on the crown casting. A further view (**photo 127**) from the front gives a better view of the mounting plate for the pressure gauge but the water gauge itself still has to be fitted. A final view of the boiler with the top casting in place (**photo 128**) completes this build with so, given some good weather, the boiler can be fitted with the safety valve and delivery control valve and some precious coal added.



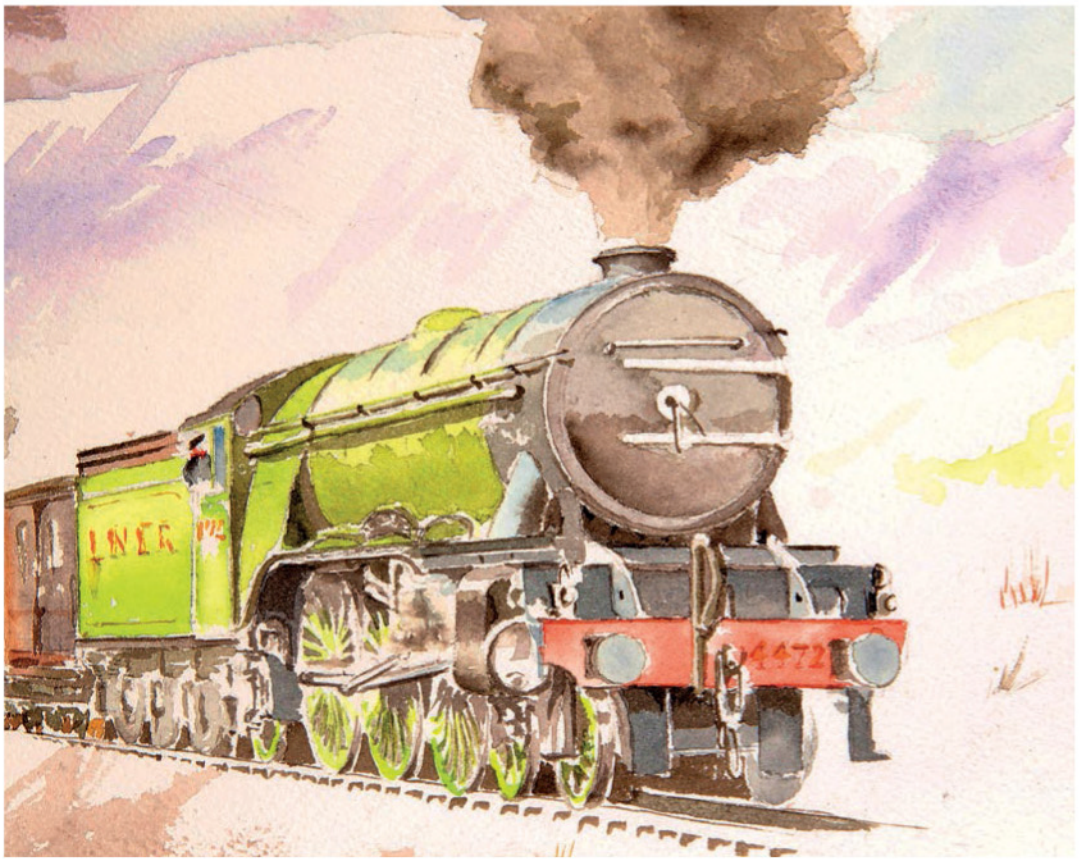
Another view of the mounting plate fitted to the boiler with its pressure gauge.

An overall view of the boiler with the smokebox top in place.

●To be continued.

Peter Seymour-Howell builds a fine, fully detailed model of Gresley's iconic locomotive to Don Young's drawings.

Continued from p.197
M.E. 4709, 27 January 2023



Painting by Diane Carney.

PART 52 – CROSSHEAD DROP LINKS

Flying Scotsman in 5 Inch Gauge

1. Here we have one of the outside crossheads with the extra area left to which the drop link mounting plate bolts too. The inner crosshead doesn't have this extra area. Next, it is back to the machine vice to do some of the last machining operations for the crossheads which in this case involves shaping the rear end.

2. First, each crosshead was held upright in the machine vice and a slot cut at the back edge of the mounting plate raised tab. To make life easier, each crosshead was set up against the far edge of the vice and once machined, the next was put in the same position thus making all slots the same. I have penned a rough line to show what needs to be removed.

Final shaping

We shall now complete the shaping of the main crosshead bodies and fit their mounting plates.

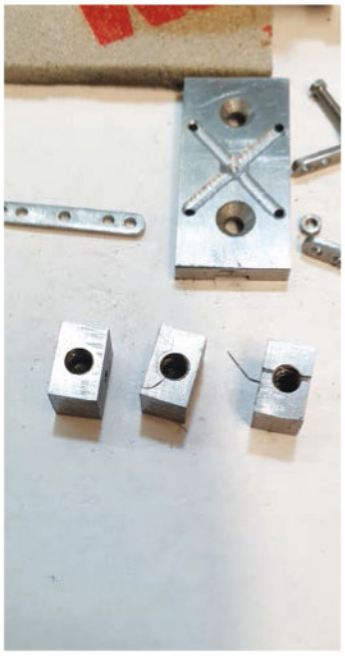
The middle crosshead is a little simpler as it has no drop link and I have simplified it a little more by not machining

the lower tab to which the mounting plate would have bolted too. For this crosshead I have just machined the round raised boss.

3. It was then the turn of the large radius cutter which goes from the back of the curved raised collar to the underside of the slipper leaving a small area uncut. Again, to get all three crossheads the same and to ensure that the cuts matched either side I clocked the crosshead against the edge of the vice. It was then a simple task of flipping each crosshead, mounting it facing the opposite direction and repeating the operation.

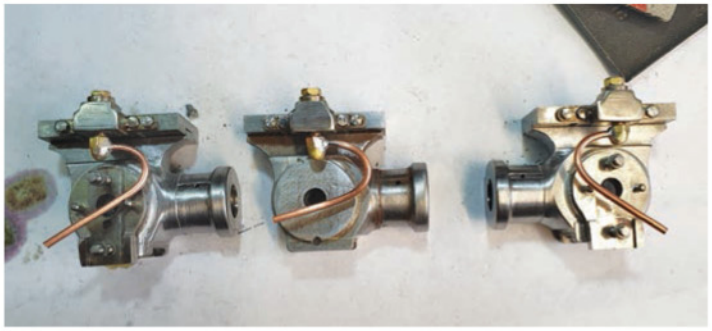
4. Now, back to the rotary table for the very last machining set-up, the final operation being to machine the rear curve around the raised collar, up to the slot formed previously.

5. The dowels were then hammered in and the mounting plate fitted. Here is one of the outside crossheads from the rear with its slipper placed in situ.



LEFT: 6. I first machined up a length of gauge plate and I then cut three slots with a hacksaw to divide them up. I drilled/tapped the centres to form the reservoirs. Then, thinking ahead to the metal mounting strip which will be silver soldered to the back of each reservoir, I cross-drilled each blank 10 BA for me to be able to bolt each strip to the reservoir. RIGHT: 7. Here we see the three blanks now parted and ready for the next stage. Also shown is the slipper and mounting strip.

LEFT: 8. The next stage involved machining a small collar around the tapped hole. For this I threaded a length of silver steel and tightened each blank up tightly for the part to be turned on the lathe. RIGHT: 9. Now, these reservoirs aren't simple rectangles with rounded edges; they have a step on each side with two different angles. The base is also angled out from the centre - it's not flat. The bottom face I ground on the belt sander. Before doing that, I marked out the rough shape of the sides and machined away most of the access material leaving me a sharp corner to give me a datum from which I could hand file the two angled steps. It was then back to the Dremel with a variety of diamond grinders and polishing discs to complete the shape.



10. Next job was to make the oil pipes and here are the crossheads so far with their oil pipes partially fitted. I drilled/tapped 7BA the bottom of the reservoirs and made up some brass nipples for the copper pipe to be soldered into.

Oilers

Gresley A1/A3s have had a variety of different crossheads fitted during their careers. The crossheads themselves are pretty much alike but the parts that are very different are the oil reservoirs and the drop link. The 1934 pattern was the design I chose and this design can clearly be seen fitted to 4472 in 1935 and this is why I have modelled it for my build.

So, with the crossheads finished, I turned my attention to the oiling system and to begin with, made the oil reservoir which feeds to the small end bearing for the connecting rod. For most of 4472's career (certainly under LNER rule) the oil reservoir

≫

was bolted to the outside edge of the slipper. This was first a round shaped reservoir and then a more rectangular shape with a stepped neck and rounded off sides. Today the reservoir is part of the drop link, sitting directly above the gudgeon pin.

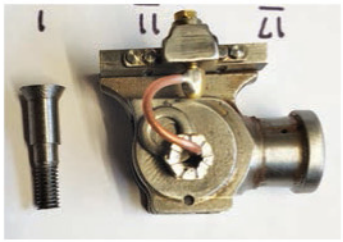
Gudgeon pins

On to the gudgeon pins. I won't give many pictures here as it's basic turning but I will explain my sequence of turning them. First, I cut three lengths of silver steel and roughed out a spigot on each. I then finished each pin to fit the rear of the crosshead, checking each with the crosshead for fit. Next up was the 30 degree angle on the end to fit the countersink in the rear face of the crosshead - each pin in turn was reversed in the chuck, top slide set to 30 degrees and machined. It was then time to machine the step for the pin to fit through the front of the crosshead, mounting plate and, when made, the drop link.

Drop links

As pointed out before, the drop link design varied during 4472's career. My goal here is to try and make something that looks like the drop link in the late 30's but while also following the *Doncaster* dimensions for obvious reasons. This goal is further hampered by the fact that I don't have a drawing for 4472's drop link and the photo's that I have found aren't that clear, especially when trying to view the rear side with its oil reservoir. I have built the crosshead and drop link with the best information that I have to hand - if a part of either is wrong, no, I'm not likely to change it, he says...

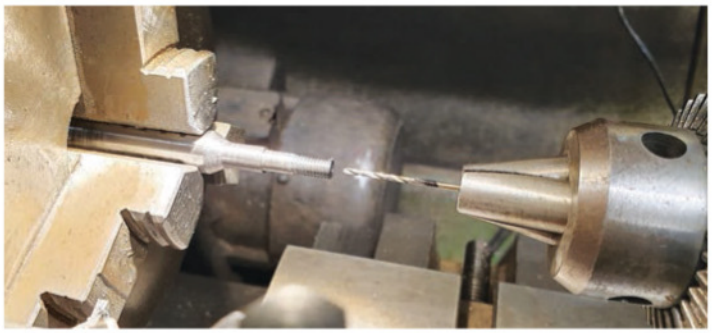
11. Here is a gudgeon pin being checked for fit on the crosshead.



14. The gudgeon pins were then parted and here we see the middle cylinder with its (shorter) gudgeon pin alongside.

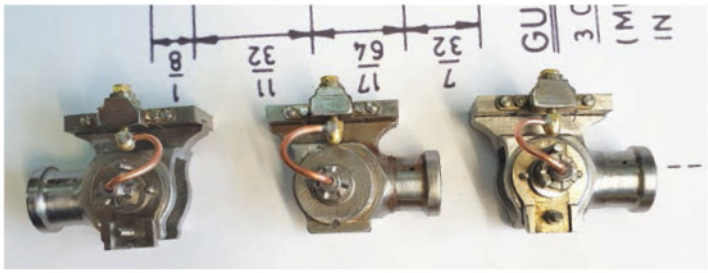
15. Here are the three finished crossheads - from left to right we have the left-hand outside crosshead, the middle crosshead and the right-hand outside crosshead.

16. To start with, I plotted and drilled all of the holes to match those on the crosshead and mounting plates. Whereas I earlier drilled the mounting plates together, for these I have drilled them separately as they are much thicker and I didn't want the small drills to wonder.

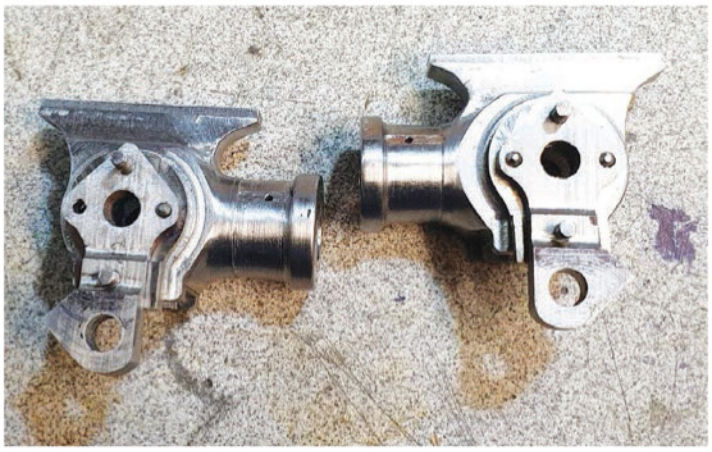


12. I then moved on to the 2BA threaded section, and drilled the oilway hole down the centre. The size drilled is 1.5mm using a cobalt bit and the hole was drilled until it reached just under half way into the journal.

13. The nuts again were simple turning and threading 2BA. I have followed full size and machined a collar around one end which will also be castellated soon. Unlike the other castellated nuts, these will have eight slots instead of the usual six. In this picture, the two on the right have had their central oil way drilled and the one on the left is awaiting the same exercise. Once I have drilled the cross-drill oil way in the journal I'll part off to size.



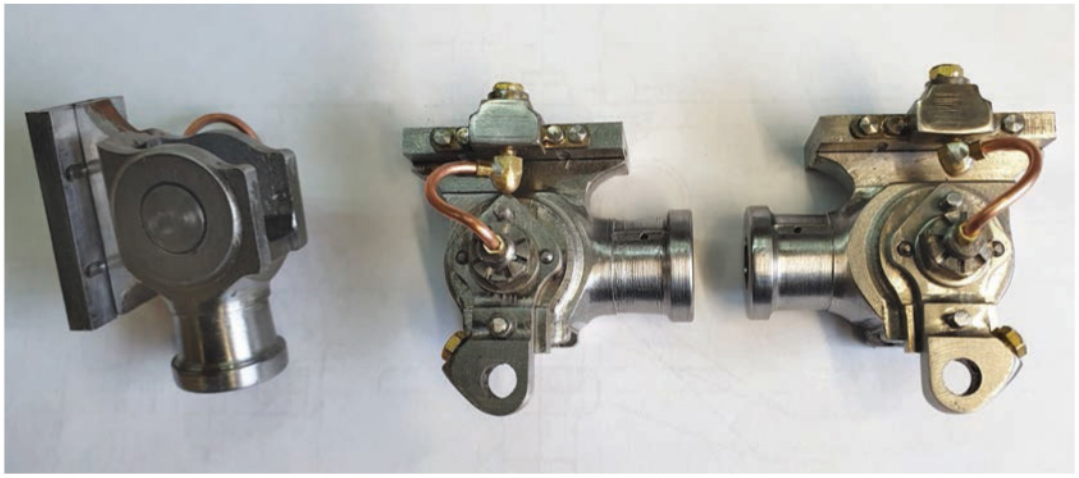
LEFT: 17. Once both blanks had been drilled I bolted the two together and began to profile the lower section. To get the parts to both fit and look like they are how they should be I have changed a few dimensions – in particular, I have used a smaller arc for where the bottom leg meets the upper section. This was done so as to allow the required parallel section to fit between the mounting plate lugs and also to avoid cutting into where the oil reservoir needs to be. RIGHT: 18. With all of the 'square' machining completed I then moved on to the various angles. I began with the angled rear face of the oil reservoir.



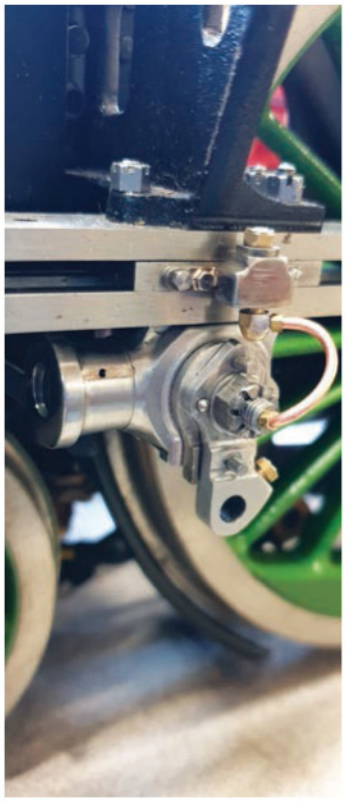
20. Before the elbow grease began I first needed to machine the two steps into the front face. with the steps machined I dry fitted each drop link to its crosshead. I'm happy to say that they both fit very well and are very tight even without the securing nuts. I will hand file the profile now to blend it all in.

19. I then turned my attention to the upper angles. After that, I returned to the rotary table to round off the various ends.

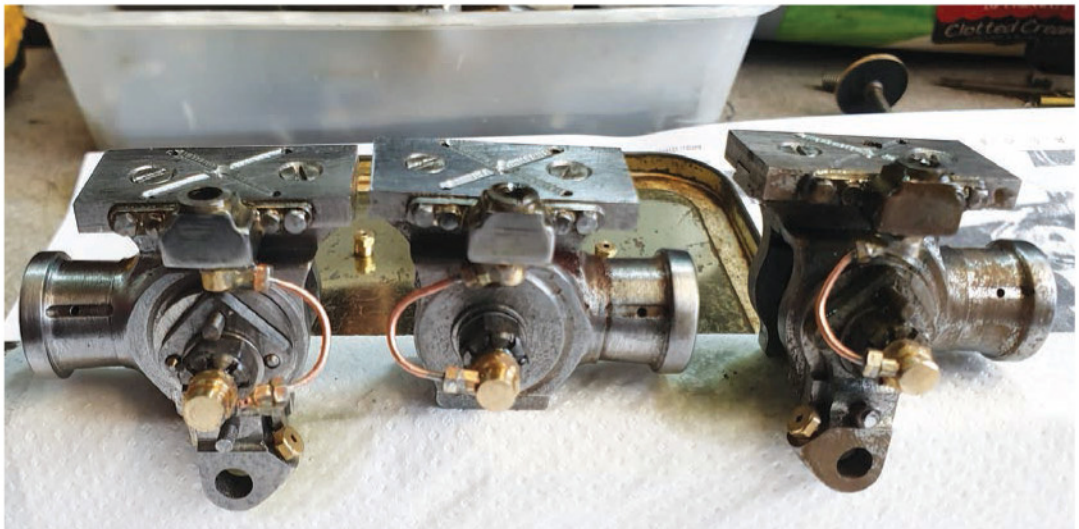
21. One of the last jobs to do for the crosshead was cross-drilling of the gudgeon pin journals, shown in this picture.



22. Here are the finished(?) crossheads with their drop links fitted. They are only temporarily fitted for now as I'll be removing the gudgeon pin a few times while fitting the piston rods and connecting rods later. I have shown the reverse side of the middle cylinder crosshead to try to show the countersunk end.



23. Here is a view of the completed crosshead fitted to the locomotive. A couple of things to point out - the top bolt is very close to the gudgeon pin castellated nut; I think it clears the flat but I think that it may be prudent to make a slightly smaller nut here. You can also see one of the dowels just poking through the drop link.

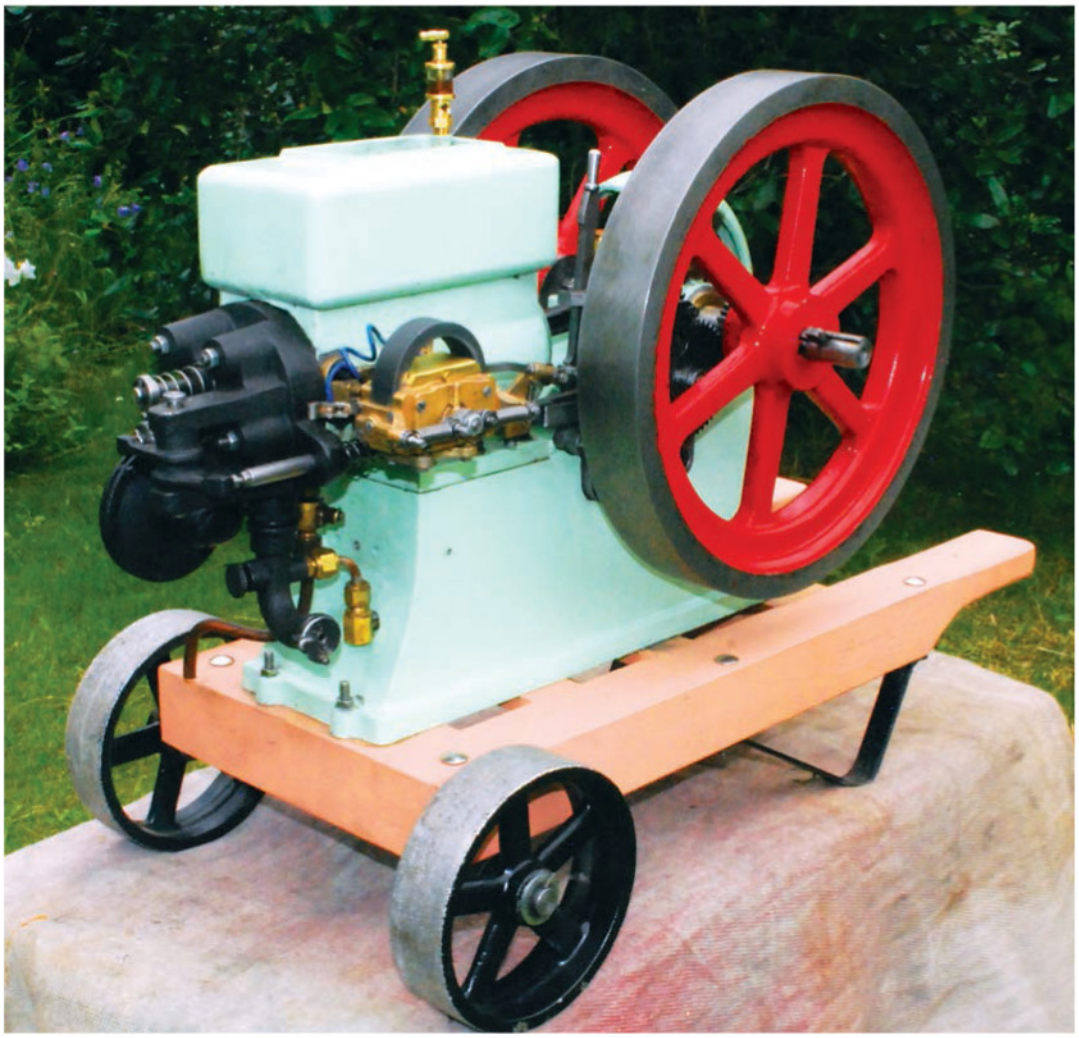


24. After all that, I felt that the oil pipe didn't look quite right so I had another go and this picture shows the revised oil pipes fitted to the crossheads.

●To be continued.

Ian Couchman tries something a little different.

Continued from p.233
M.E. 4709, 27 January 2023



The completed 'hit and miss' engine.

'Hit and Miss' Internal Combustion Engine PART 5

Preparing to machine the cylinder head.

Two-piece valves.

The cylinder head and associated parts

The head is fairly straightforward machining (**photo 47**) although it can be an interesting part to hold, so I won't go into details of how I machined mine. I made the valves in two pieces, screwed together and fixed with high temperature Loctite (**photo 48**). They haven't let go yet...

The drawings show a carburettor with a throttle,

of a type I've not seen on any prototype, so I decided that this needed a re-design. **Photograph 49** shows an original carburettor - a very simple unit. Also, the silencer is shown machined from solid. Castings were called for!

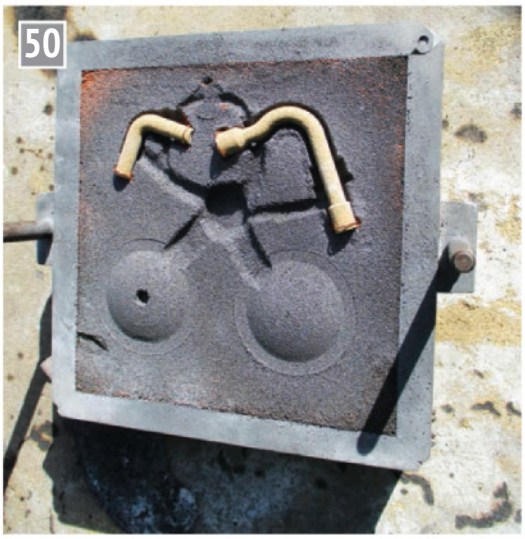
In **photo 50**, the mould for the carburettor, both parts of the silencer and the silencer elbow are rammed up and the cores fitted, ready for some of the hot stuff. **Photograph 51** shows the result. The cores beside the castings give an idea of the bores. **Photograph 52** shows the finished silencer ready for action.

Let's look a bit closer at the carburettor. **Figure 3** shows a couple of sections. You can see that there is a venturi, with a needle valve at its centre. I wanted to cast the venturi but the core was just too fragile (the diameter at the venturi is just 4.6 mm), so I cast a plain bore, machined a separate venturi and fixed it in place with Loctite. There is no throttle, just the needle valve controlling the fuel mixture.

The power output of these engines is, in effect, proportional control, with the engine firing at full power or no power, with the output being determined by the number of firing strokes. The only other control on the carburettor is the choke for starting. **Photograph 53** shows the finished carburettor. A simple device but very effective.

The fuel entry point on the carburettor is above the fuel tank. There's no float chamber, so fuel has to be sucked up from the tank. As a result, a non-return valve is needed to prevent the fuel draining back between strokes, although I can't find any mention of this in the drawings. Initially, I made a common ball valve. This worked but I found that, after the governor had cut in, stopping the firing, it took several cycles after the governor had cut out before it fired again. I believe this was caused by the ball being shaken off its seat (these are not the smoothest engines), allowing the fuel to drain back to the tank, so I had a re-think and made a wing type valve, supported top and bottom (**photo 54**). This, while not perfect, has improved running significantly. **Photograph 55** shows the carburettor and non-return valve *in situ*.

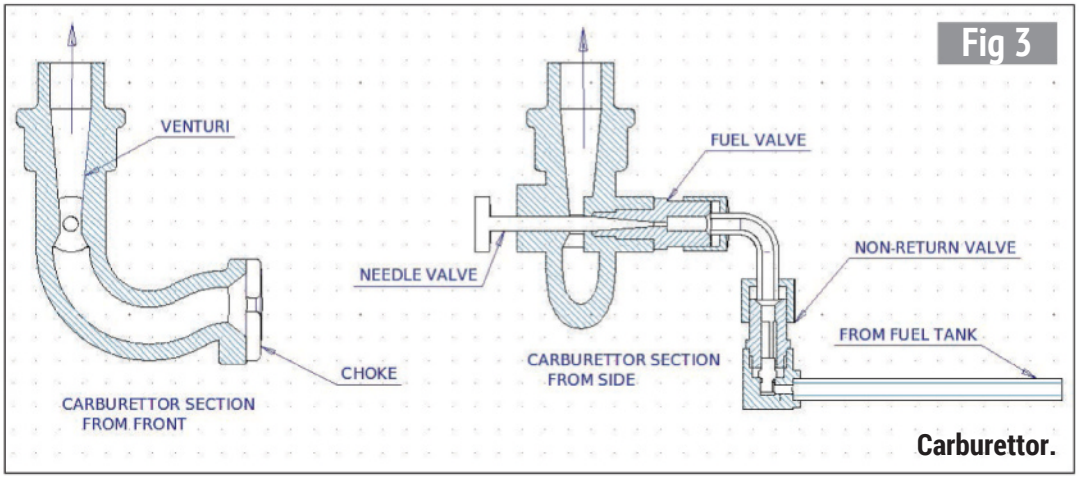
Original carburettor casting.



Preparing the mould and cores for the carburettor and silencer.

The cast carburettor and silencer.

The finished silencer.



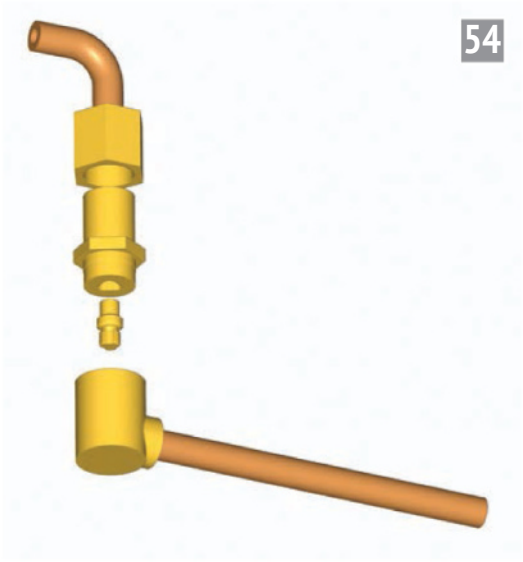
The finished carburettor.

It's worth mentioning the governor at this point (**figure 4**). It consists of a pair of rotating weights driven from the timing gear. As the engine speeds up, the weights are thrown out, pushing a pushrod which in turn applies pressure to the striker plate. Opposing pressure is applied by a spring-loaded plunger which can be moved towards and away from the striker plate pivot, thereby varying the force required to move the plate. When the plate does move, a pawl engages with a block on the push rod, preventing it returning. The result is that the exhaust valve is held open and the magneto is not cocked, so no suction and no spark. As the engine slows, the pawl releases the rod and the engine fires again.

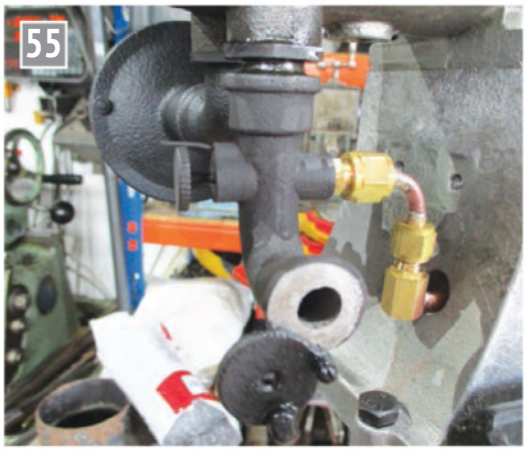
●To be continued.

NEXT TIME

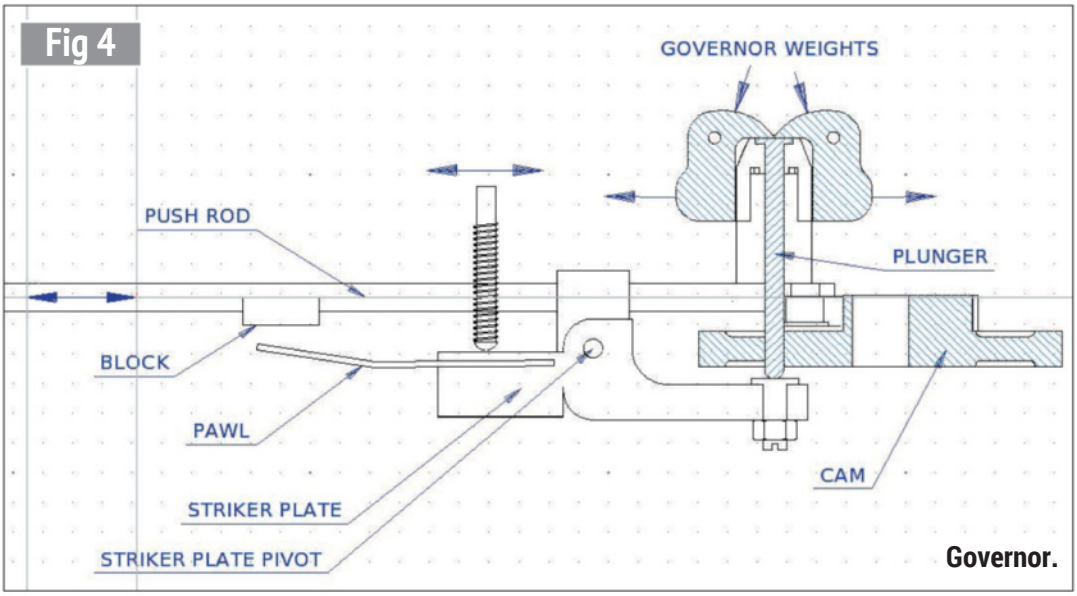
We make a pair of flywheels and deal with the lubrication.



Fuel valve design.



Carburettor and fuel valve in situ.



Governor.

Professor Jörg Hugel

Appreciation

25th December 1938 - 31st October 2022

Roger Backhouse remembers a prominent member of the Society of Model and Experimental Engineers.

Model engineering is a broad church and some within prefer scientific experimenting and development engineering to making models. One was Jörg Hugel, Professor Emeritus at the Swiss Federal Institute of Technology in Zurich, who blended a first-class engineering brain and academic distinction with a remarkably generous personality.

Jörg was born in Stuttgart in 1938 where his father was a Doctor of Chemical Engineering working at Stuttgart University, who later went into industry. His mother was previously a dental assistant. Sadly, the family suffered the traumatic bombing of their home during the war.

Jörg studied electrical engineering at the Stuttgart Technical High School and then the University of Stuttgart, where he obtained his doctorate in 1968. He joined the electrical engineering industry attaining leading positions with significant responsibilities. His professional career began in the Rollei Franke & Heidecke company and from 1970 he headed the test and laboratory equipment division of AEG-Telefunken. Five years later he joined their Power Electronics board with responsibilities

including constructing the 400km long power line from the Cabora Bossa Dam in Mozambique to South Africa. A controversial project at the time, managing work in the international consortium responsible was not an easy task but one that Jörg handled well.

He left industry and in 1982 was appointed Professor of Electrical Engineering Development at the Eidgenössiche Technische Hochschule Zürich (ETH), the Swiss Federal Institute of Technology where Albert Einstein once held a professorship, and which remains the leading Swiss centre for technological teaching and research.

At ETH Jörg conducted research into and development of linear motors and of bearing-less electric motors which have applications in heart pumps. Perhaps because of his experience in business he could develop scientific ideas into workable devices. He authored the book *Electronic Grundlagen and Anwendungen (Electrical technology developments and applications)* and other works. Jörg gained a name for his teaching and his commitment to mentoring students. In 2004 he was made Professor Emeritus, a well deserved honour.

These academic distinctions never stopped Jörg being one of the most approachable of men. He joined the Society of Model and Experimental Engineers (SMEE) in 1993 and he regularly travelled from Switzerland to wear the blue SMEE coat and help on their stands at exhibitions. Through his gentle persuasion, Jörg encouraged me to join SMEE at a Sandown Park show, a membership I've never regretted.

On almost every visit he brought examples of his work, like the beautifully made Unbalance Generator which he accompanied with a booklet he'd had printed. This was just one example of his varied interests, often tackling subjects less frequently described by others. His guide to *Optical aids for the workshop (2009)* is still helpful as it gives both theoretical backing and practical guidance. His latest work for SMEE, *Twist drills geometry and performance* is a particularly important work. Again, he had these printed in Switzerland and donated copies to SMEE for sale.

Jörg's younger brother predeceased him and a sister died in infancy. Sadly, Jorg's wife suffered a long-term illness and was cared for in a home. His funeral in the Reformed Evangelical Church at Balgrist, Zurich, was well attended by former colleagues and ex-students. SMEE was represented by Robert Gründler and Werner Jeggli. In his funeral address the Pastor mentioned the written philosophical messages he exchanged with Jörg every year.

Jörg's generosity was remarkable. Besides his time helping students he gave one million Swiss francs to set up the Else and Friedrich Hugel Fund within the ETM Zürich Foundation to support students. Authority and intelligence are not always found with kindness and approachability but Jörg managed to combine both. He will be greatly missed.

Thanks to Robert Gründler and Norman Bellingham for information used in this appreciation.

ME

Steam Raising Blower

Cliff Almond describes the construction of an electric blower for steam raising.

We have all seen them but no one seems to know where to get one!

I'm talking about the ubiquitous steam raising blower that is a key piece of equipment for model steam locomotive and traction engine owners alike.

So, when I was getting towards the time to carry out the first steam test of my 7¼ inch gauge Hunslet I was expecting to be able to get my hands on one quite easily.

Some initial research and question asking quickly informed me that most people with these had come by them, sometimes, many years ago; with many being adapted from fans and such like, found on old and redundant aircraft. These, generally, operated on a low DC voltage and are ideal for 'our' use.

Some quick research via the well know auction web site did identify some possible parts. However, their cost and adaptation got me thinking.

Then, a good friend of mine came up with an idea he had seen used elsewhere - a plastic (yes, plastic) in-line extractor fan used to ventilate bathrooms. Somewhat sceptical of this, he purchased one and we 'knocked-up' a crude duct to connect the fan to the top of the chimney one hot Sunday afternoon.

Connected to a 12V battery and speed controller, the fan proved to be very efficient. That was until the obvious heat got to both the shroud and the moving parts!

To say it melted would be an exaggeration. But the higher the speed was increased, the quicker and hotter the heat from the firebox got! Some would say that would be obvious, I'm sure. After about 15 minutes 'coughing' and 'spluttering' started emanating from the fan, which turned out to be the heat distorting the casing, making the fan foul the shroud and eventually it just jammed! So - fire dropped - it was back to the proverbial

Blower general arrangement.

Fig 1

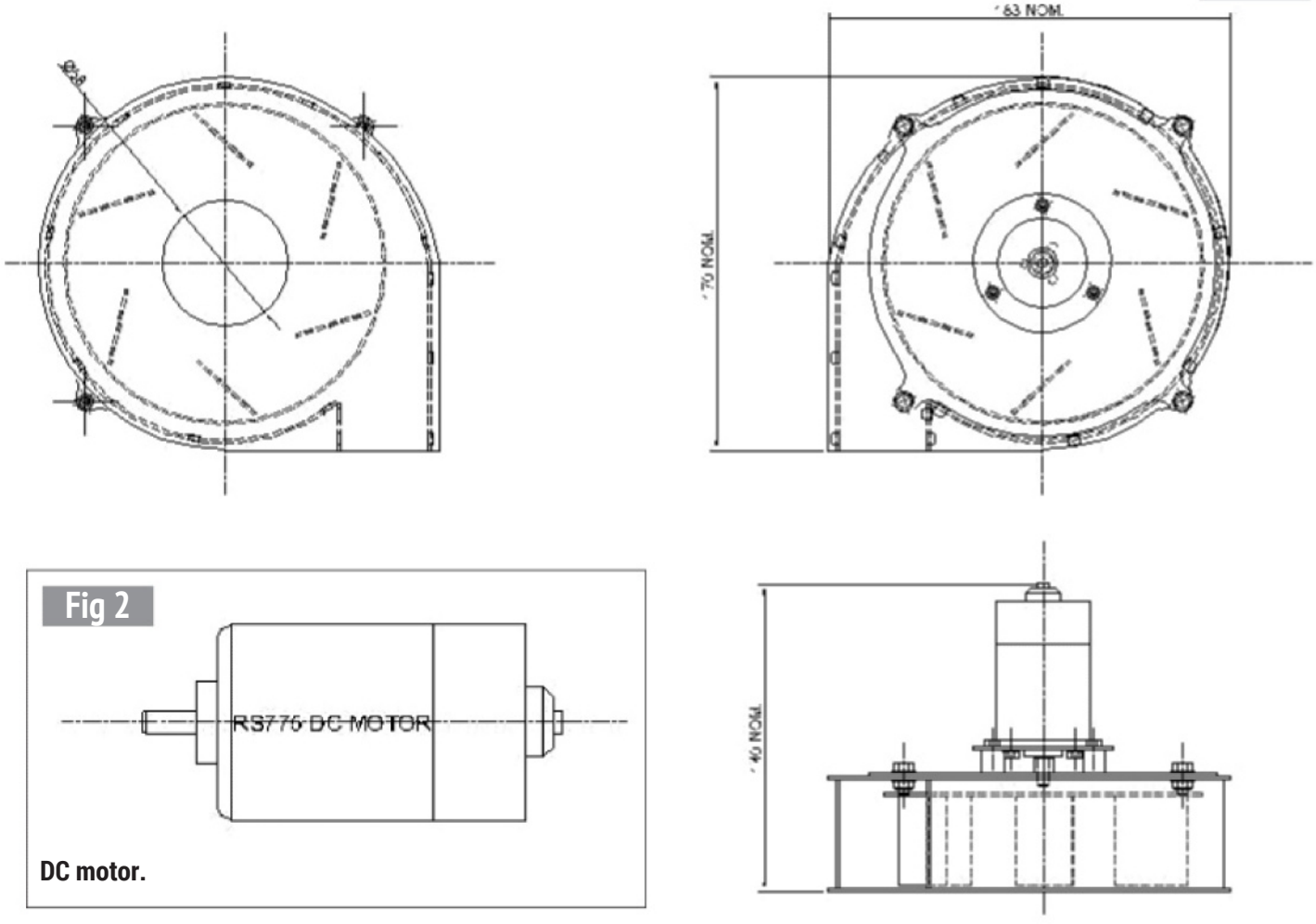


Fig 2

DC motor.

drawing board, with my mate continuing to insist he had used it with success in the past.

I should add at this point my friend is a highly respected safety professional with an electronics background, with a grasp of mechanics only equal to my grasp of electronics!

After some further research I did find a company selling blowers. However, their cost got me thinking about making my own.

The result of this is my 'offering', described here (**fig 1**).

I designed it in one evening and based the overall size, roughly, around a commercially available unit that was suitable for a 7¼ inch gauge locomotive, or four-inch scale traction engine - but was a made from an aluminium casting and imported from far, far away...

It is powered by a 12V DC and easily available popular motor (**fig 2**). These are sold to power large radio-controlled vehicles and (I was surprised to learn) can be purchased online for as little as £10.

Speed control, I considered, was quite important. Some would argue that you only need one speed and it should be as fast as possible. However, my thinking behind this was that, if the motor was simply connected to a battery, it would spin at 10,000 rpm. The fan blades would need to be quite substantial in order to withstand the centrifugal force and balancing the rotating mass would become a challenge, if vibration was to be avoided.

In addition, being able to adjust the speed allows it to be used on small and larger boilers, alike. There is also the ability to 'manage' the fire and temperature in a more controlled manner, where a new boiler is being steamed for the first time, this being particularly relevant to steel boilers.

Electronics is certainly not my area of expertise, working on my trusted rule that if you can't see it, don't trust it! It's a science I have long avoided since trying to wire up a two-way switch in the lounge, only for one of the children to come downstairs and ask why the light in the bedroom kept dimming?

Further investigation of a couple of websites selling these DC motors led me to a company selling simple speed controllers for them.

Basically, these consist of a small circuit board, with a potentiometer - a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider that allows the speed of the motor to be varied from 0 to full speed.

They can be purchased for around £4 online. However, a word of caution - be sure to connect it to the battery and motor correctly. This may sound simple and obvious but the poorly translated instructions which come with these leaves something to be desired! Suffice to say, the first one I purchased simply 'died' when I passed the current the wrong way through it!

I purchased a second one with better instructions and it also came with a neat little plastic box that the circuit board could be secured into, with the speed control knob fitting outside of it.

With the unit being, potentially, vulnerable to water, heat and steam, I have quite long leads attached, that enable it to be kept clear of things. When not in use, I keep it all in a sealed plastic box to protect it.

With the exception of a small adaptor that is Loctited to the motor shaft, that enables the fan to be coupled to the motor, together with a couple of spacers, everything else has been developed from 0.9mm mild steel sheet and laser cut (**fig 3**).

The fan blades did, initially, prove to be a weak point in the design. These are tack-welded to their base, being careful to use minimum tacks, of equal size and setting out (**fig 4**).

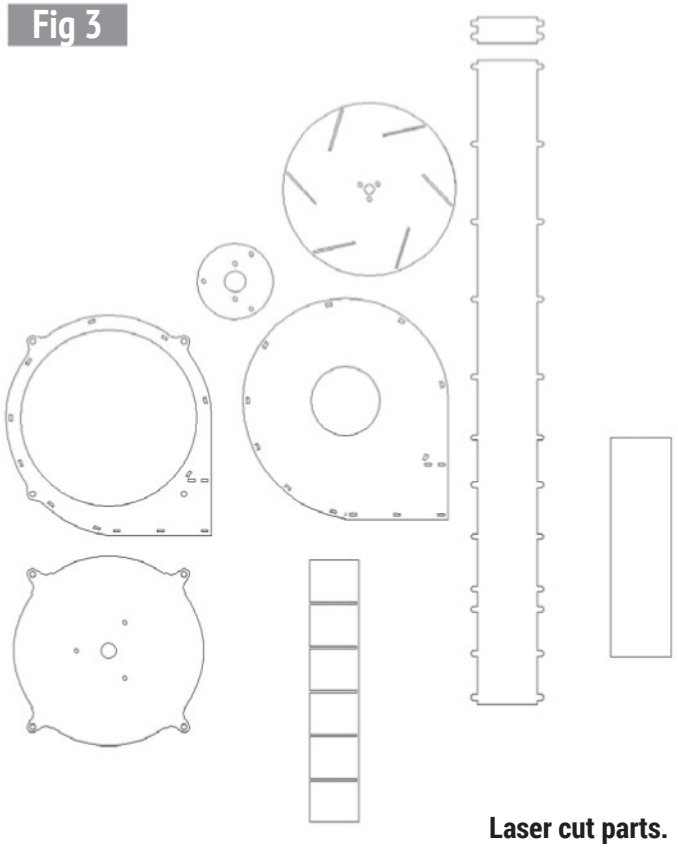
In reality, when the motor was run up to near full speed, the blades started to bend where they were welded, due to centrifugal force, despite their small size and low weight.

I did consider fixing a band around the blades. However, this, I considered, may add more mass and more potential for the assembly not to be balanced so I applied some more tack welds and all has been fine since.

If I was making this again, I would probably make something with a slotted disc and then silver solder everything. However, this may introduce distortion to the assembly, with the efficiency of the fan being, partially, attributed to the small clearance of the blades inside the housing.

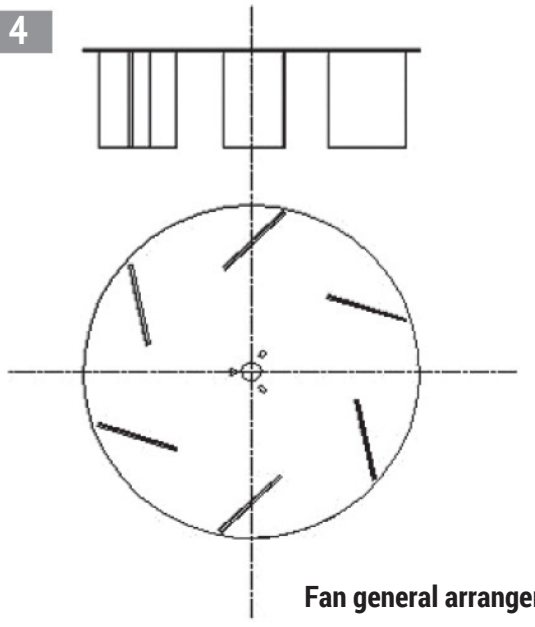
The fan housing is assembled with small tabs that line up with slots in the ≫

Fig 3

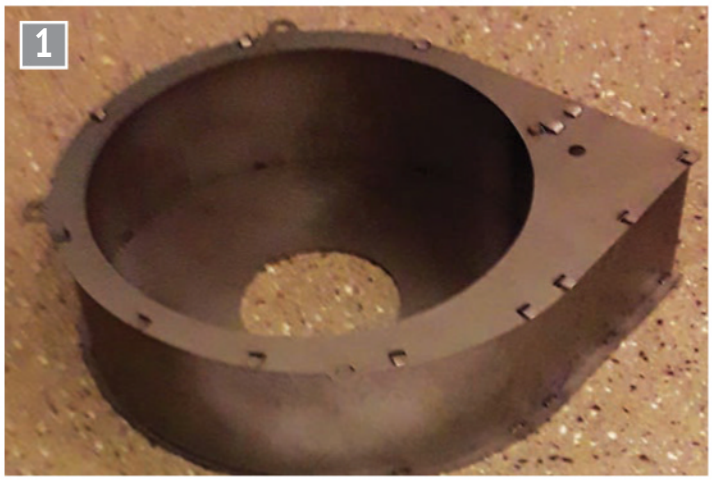


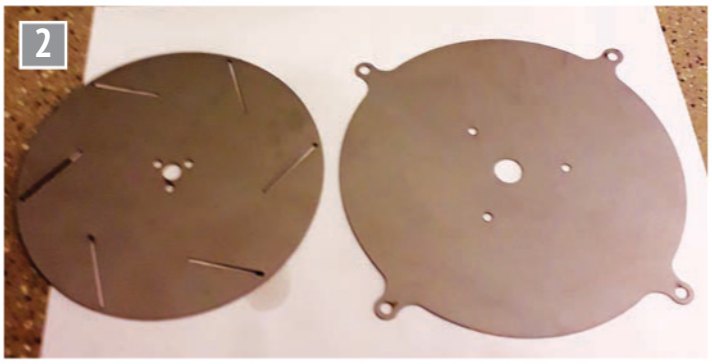
Laser cut parts.

Fig 4



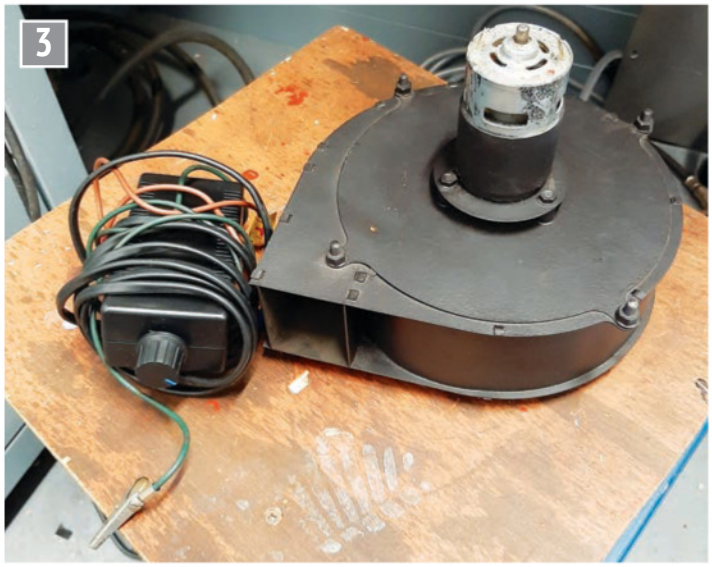
Fan general arrangement.





Fan blade mounting and cover plate.

Assembled fan housing.



Completed blower and speed controller.

Blower in use.

mating parts (**photo 1**). The curved outer of the housing was carefully rolled in a set of pinch rollers until nearly the right curve was achieved. It was then worked by hand until the respective tabs and slots aligned. The tabs were then simply bent over to form a solid assembly.

The housing cover and fan assembly (**photo 2**) simply bolt together (**photo 3**). This will allow the fan to be removed from the motor shaft, should the motor ever need replacing in the future.

The whole unit also has a brass ring bolted under it that matches the chimney on my Hunslet. This was a scrap off-cut I had in the workshop and has a 2 degree taper machined on it, that allows it to sit snugly in the brass chimney cap, but allows it to be 'twisted' and lifted off when it has finished its job.

With a little adaptation this could be fitted with something to allow adaptors to be interchanged to suit different chimneys.

After assembly and checking clearances, I sprayed the parts in heat-resistant matt black paint (**photo 4**). This protects it from corrosion and the inevitable rust, if left untreated and in the proximity of water and steam over time.

Was it worth building? Given I only spent an evening designing it and all the parts, including the laser cut items, and it cost me around £40 plus some paint, I think so. With the cheapest commercially available version I could find at the time, costing circa £120, it was money well spent and an enjoyable, if not unusual, project.

ME

Wainwright's Swansong
The End of an Era PART 9

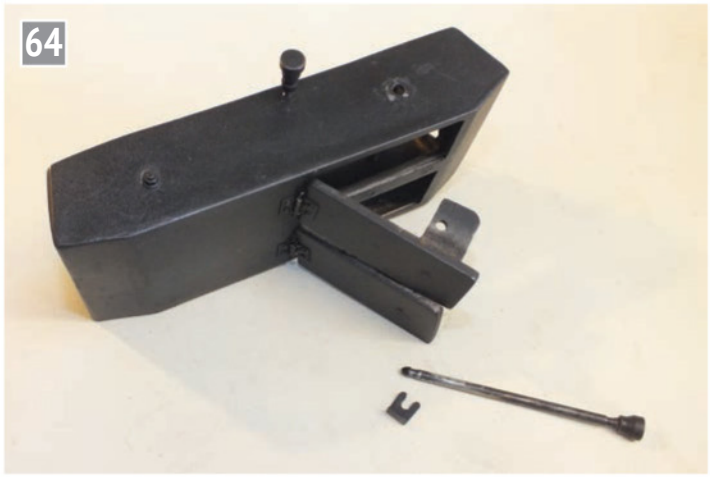
Nick Feast builds a 3½ inch gauge version of one of the last of the elegant Edwardian locomotives.

Continued from p.264
M.E. 4709, 27 January 2023

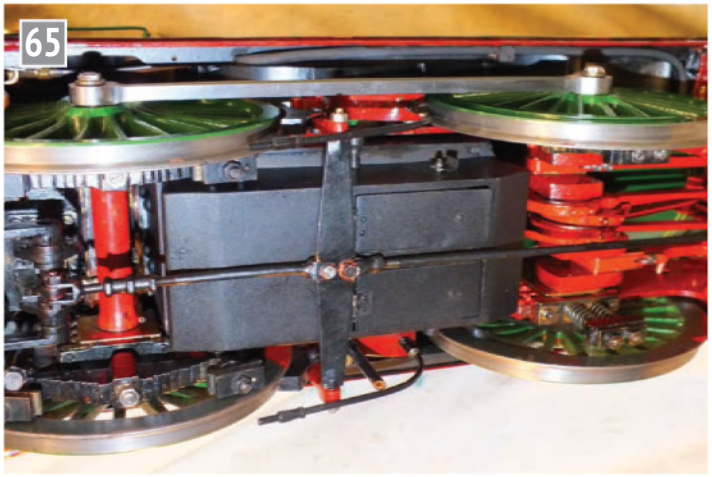
There are a few more items on the locomotive to describe before moving on to the tender. **Photograph 64** shows the ashpan that also has the grate attached to it by the bolts each side at the left end of the casing. It is a simple mild steel fabrication; I have not modelled the front and rear dampers. I have made a pair of hopper doors with a removable pin that also supports the front of the grate. When the pin is removed the contents of the fire and most of the ash are dropped and the hopper doors fall open. Anything that remains in the ashpan can be raked out without the need to remove it from the engine. A second, larger pin attaches the ashpan to the downward extension of the inner firebox, so that the whole assembly can be removed for attention to the fire bars, for example.

In this case the brake rigging will need removal as well. **Photograph 65** shows the view from under the completed locomotive.

Photograph 66 is one that was hiding in the computer and should have been included in Part 3; I had removed the bogie to show the rotary drain valve and how the drains are connected to it. The valve simply exhausts straight down towards the track.



The completed ashpan and grate assembly; in normal operation it is not necessary to remove it as the fire can be cleared through the hopper doors. I wanted to keep the brake linkage as per the prototype.



Ashpan, brakes and sanding pipes installed.

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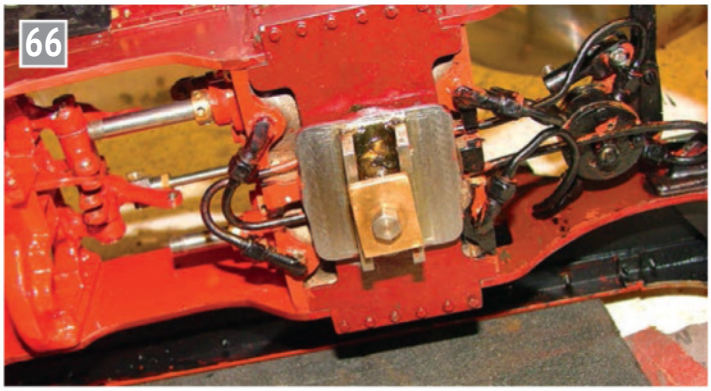
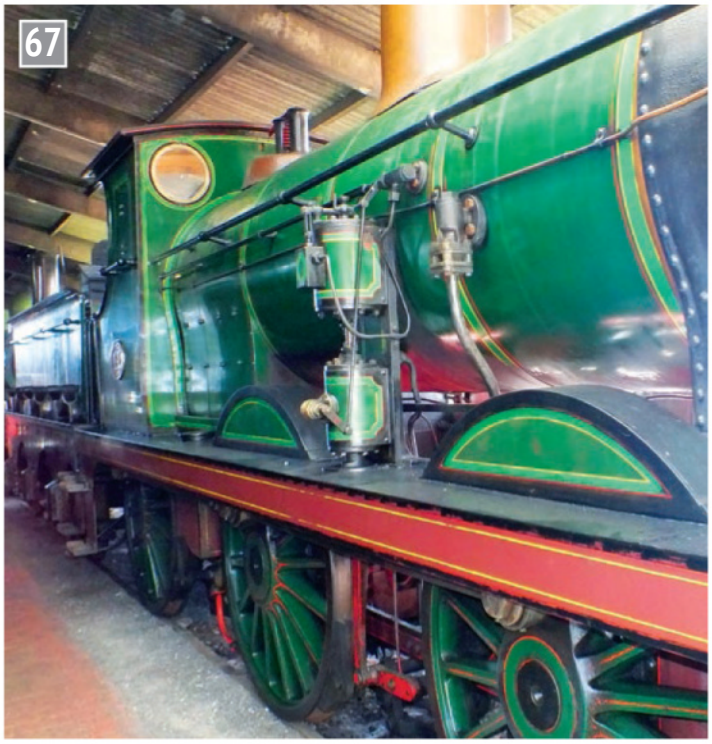
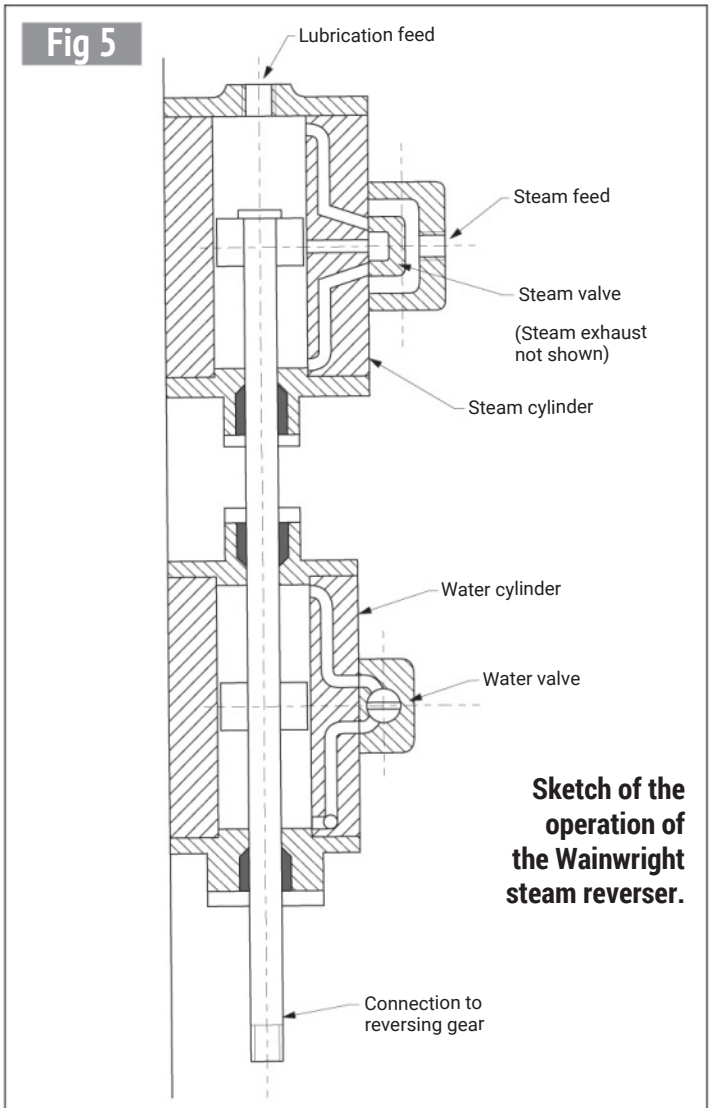


The bogie has been removed to show the cylinder drain pipes and rotary drain valve. The operating cable is not yet connected.



SECR number 65 at the Bluebell. The reverser is the same as the one fitted to the L class and many other SECR designs. Steam cylinder at the top with the slide valve housing on the side. The steam supply is taken from the dome via a pipe inside the boiler. Water cylinder at the bottom with the linkage from the control valve back to the cab prominent.



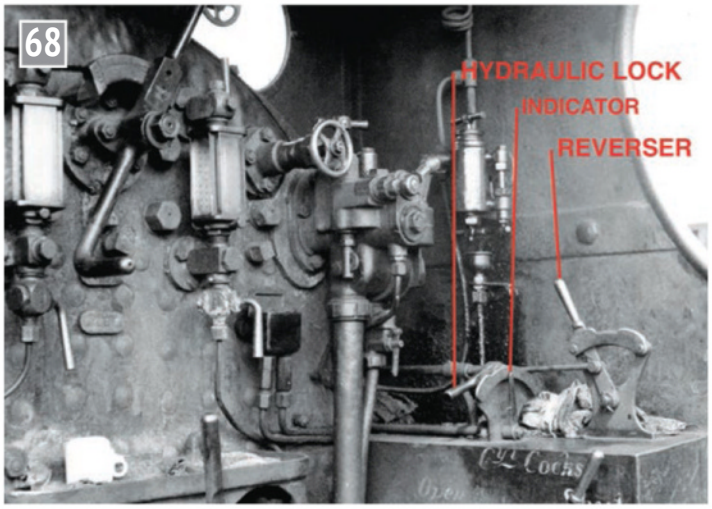


Photo taken in the cab in BR days of C class DS239 at Ashford works. An earlier Wainwright design, the cab layout is very similar to the L.

The steam reverser was a prominent feature on this engine. It was a standard feature on most SECR designs. In preservation it is possible to see the O1 and C class engines in action at the Bluebell Railway with almost identical reversers. **Photograph 67** is the preserved O1 class 0-6-0 (actually number 65!) in the shed at Sheffield Park. The H and P tank engines there are also fitted with them. Later Southern Railway designs such as Q and Q1 0-6-0 locomotives had an horizontally mounted steam reverser of a slightly different design, as did all of the original Bulleid pacifics. The latter were notorious for creeping from the position set by the drivers; more on this later.

Figure 5 shows the principle of the SECR steam reverser, although in fact the water cylinder is smaller diameter than the steam cylinder. **Photograph 68** shows the cab of a C class locomotive, the Ashford works shunter, DS239. This was SECR number 592 and is now the locomotive preserved at the Bluebell.

To operate, firstly the driver must release the hydraulic lock by rotating the control lever through 90 degrees. This opens the valve on the water cylinder. The reversing piston is now free to move under steam pressure so by moving the cab reversing lever forwards or backwards, the D valve on the steam cylinder admits steam to one or other side of the piston.

The Bulleid reverser during overhaul at Ropley. Apparently, a blend of the SECR and LSWR designs, but the principal and main components remain the same as the L class device.

A view of the reverser side of the model. Even though the lining has been simplified compared to the earlier style seen in photo 65, the paintwork is still pretty ornate and was one of the most expensive railway liveries of the time.

This is the water cylinder piston with both new seals and tensioning springs fitted. The steam piston has conventional piston rings fitted.

The reversing rod runs inside the tube to which the locking lever is connected, making the whole assembly very neat.

The valve gear mechanism is connected by a linkage to the indicator in the cab so the driver knows what the gear position actually is. In photo 66 the gear is in mid position and the locomotive is not in steam so the fact that the reverser is in the forwards position is not relevant. Also visible are the cylinder drain cock lever (unusually, for a dead engine, in the shut position), the displacement lubricator, condensing coil just above and the vacuum brake control. Next to it is the blower valve, the two water gauges and the regulator.

Photograph 69 shows the model as completed, showing the linkage to steam valve and water valve on the right side, with the indicator rod running from the reverser shaft below the footplate up to the small shaft on the side of the boiler. I used 40 thou diameter music wire for this. In the background the feed pipe to the left side boiler clack valve can be seen disappearing through a hole in the mainframes. It is fitted under the footplating back to the cab, all part of the effort made to give the locomotive the cleanest visual appearance possible.

Figure 6 is the designer's sketch layout of the reverser that he was hoping to construct, showing that in fact the steam cylinder is larger than the water cylinder. The respective diameters on the full size are 7 and 5 inches.

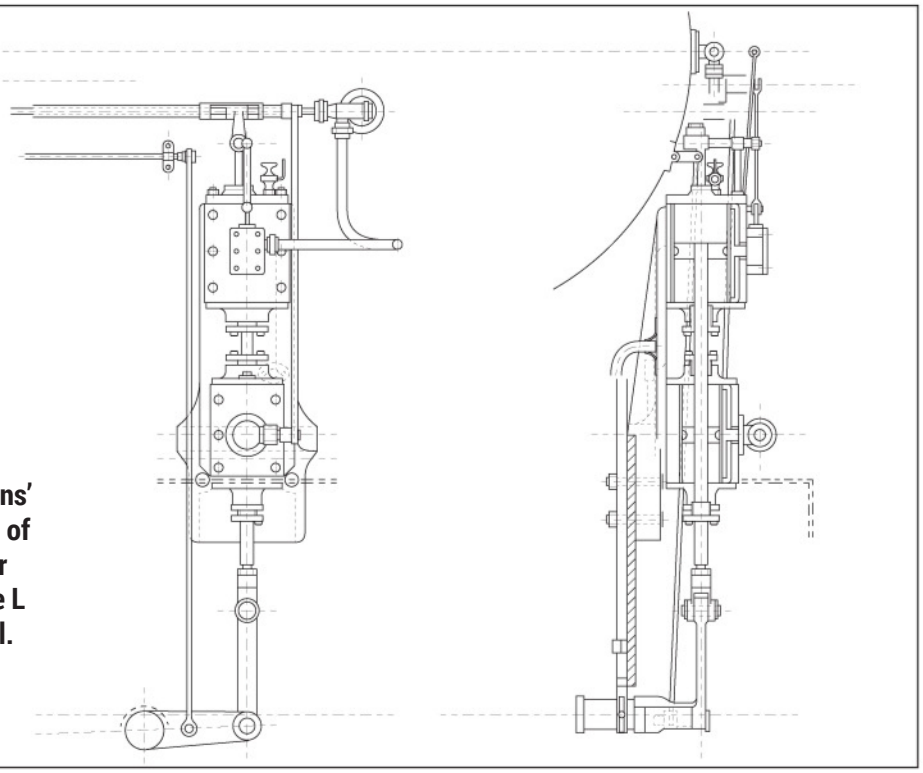
Having worked on the full size Bulleid steam reverser, I decided that such a device could not be made reliable enough in this scale. If anyone has actually succeeded I would like to know. In the case of the Bulleid device that was fitted to unmodified West Country 34105, *Swanage*, at the time I overhauled it in in 2017, there were some obvious faults with it (**photo 70**). The seal on the water piston had been replaced at its last overhaul with a non-original polyurethane lip seal. This had hardened with age and was in several pieces, therefore totally non-functioning. The steam valve appeared to be in reasonable condition but checking the faces of the block and the slide valve (similar in design to normal locomotive slide valve) it was apparent that the surfaces were not truly flat. The combination of these faults would obviously result in wandering cut-off settings.

Photograph 71 shows the water piston on the bench after overhaul. The original design called for leather sealing washers that have been made and fitted with new stainless steel retaining springs. The leather washers had been soaked in mineral oil for several weeks before fitting. It is basically a great big old-fashioned bicycle pump piston.

The slide valve and valve body were dealt with; the latter was some of the hardest material I have ever come across! A file would not touch it so it had to be ground by hand. Eventually the piston and valve were lapped to give a perfect seal; hopefully, when this locomotive finally leaves the workshops, it should be free of the fault that plagued so many original Bulleids.

●To be continued.

Fig 6

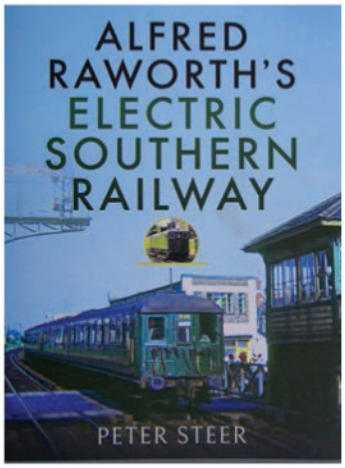


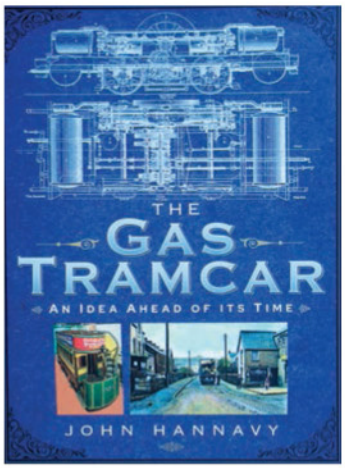
Ray Stephens' GA drawing of the reverser fitted to the L class model.

Book Reviews

Peter Steer

Alfred Raworth's Electric Southern Railway





Alfred Raworth's Electric Southern Railway
Published by Pen and Sword Transport, 2022
ISBN 978-1-52677-841-3
£36, 344pp, hardback

The Gas Tramcar: an iIdea Ahead of its Time
Published by Pen and Sword Transport, 2022
ISBN 978-1-39909-601-0
£31.50, 208pp, hardback

Thinking of southern railway engineers, the names of Drummond, Wainwright, Billington, Maunsell and Bulleid might come to mind - all great steam engineers - but Alfred Raworth? Not a name that comes to mind in railway engineering, yet he's probably the man who did most to ensure Southern Railway passengers could enjoy fast, frequent and cleaner services provided by their electric trains. His life and works are described well in this new biography.

Alfred's father John was a prolific inventor developing textile machinery but then started work for Siemens. He set up his own company where he developed a low-cost tramway car - the 'Demi-car' - and a regenerative braking system. That system was effective but adoption was marred by accidents and legal action over the patent.

Alfred followed his engineering interests, joining both the IEE and the IMechE. He joined the London and Western Railway in 1912, working with Herbert Jones. The LSWR needed to develop electrification to counter tram and bus competition in inner London and some suburban routes which lost them many passengers. They used a cheap and easy to install direct current 3rd rail system at 600 volts. This was compatible with the Metropolitan District Railway system. Meanwhile the London, Brighton and South Coast Railway adopted a 6700V AC overhead system for their line from Victoria to London Bridge. As on the LSWR, their line was a success and passenger traffic increased again.

During the First World War Alfred served in the Royal Navy shore positions and then worked for the Ministry of Munitions, where his organisational skills were put to good use. Before the war ended he was released to the South Eastern and Chatham Railway where the chairman, Henry Cosmo Orme Bonsor, was involved in discussions about electrification. The SECR had been formed by amalgamation of two warring companies under a joint management committee. There were serious deficiencies in rolling stock to put right. Cosmo Bonsor seems to have been a highly regarded natural diplomat but he had a major challenge with the SECR.

Working from first principles, Raworth proposed a 3000V DC scheme with two conductor rails (one 1500V DC positive, the return 1500V DC negative), in effect a three-wire system, avoiding problems associated with an earth return. He had visited the USA where he saw the benefits of the Grand Central Station electrification. His visit was hosted by the General Electric Company so he therefore knew of (but did not see) the Chicago, Milwaukee and St Paul Railroad's use of 3000V DC using overhead wires. However, he preferred conductor rails as these were easier to install.

His ideas also required fewer sub stations. There are clear technical explanations of these developments in the book. One advantage of avoiding an earth return was that there were no problems of stray currents affecting sensitive equipment at the Royal Greenwich Observatory. (Eventually when the Southern adopted 600V DC earth return it paid the Observatory £30,000 to move equipment to Abinger, Surrey.)

Unfortunately, Raworth's scheme ran foul of battles between the three railway companies in the run up to the 1923 Grouping. The Ministry of Transport made clear their preference for a 1500V DC overhead electrification (as used on the Shildon to Newport electrification), leading to complex battles, well covered in the book. Disputes over electricity supply also figured with the Ministry hostile to railway companies generating their own electricity despite a good potential site at Angerstein's Wharf on the Thames.

Although Raworth's scheme was probably more economical, the LSWR's 3rd rail DC scheme was already working and generating dividends. The new Southern Railway General Manager, Herbert Walker, brought Raworth into the fold as 'Electrical Engineer New Works' based at London Bridge whilst his erstwhile mentor Herbert Jones was to be Chief Electrical Engineer based at Waterloo. (The book suggests these two stations were on opposite sides of London when in fact they are barely a mile apart, an odd failing in an otherwise accurate book.)

The Southern continued with 3rd rail 600V DC, developing an incremental programme to extend electrification. Although this was not Raworth's preference he adapted and had the advantage of managing in house resources; consultants and outside contractors were rarely used. Present day electrification schemes could have learned from that approach. He found British manufacturers of rotary converters and other equipment were blatantly price fixing (so much for capitalist competition) and was willing to buy Swedish equipment from ASEA.

So far, the lines had been existing suburban railways but the Southern built a new line from Wimbledon to Sutton to be electric from the start. Then it electrified the main

line to Brighton in 1933, even building an electric Pullman train. Eastbourne and even Horsted Keynes followed with lines to Portsmouth electric by 1938. The men from the Ministry were not pleased that the Southern was using its own scheme and not the Ministry's preferred 1500V DC overhead line. Nor did they like the way the Southern started works before telling the Ministry. But the Southern carried on.

Significantly, when the Ministry made loans to railway companies the Southern spent all theirs on electrification. Portsmouth electrification was a rip-roaring success as were all the other schemes. From 3 million annual passenger journeys in 1936 there were 7.5 million in 1947 and this on a line with limited local and commuter traffic, demonstrating clearly the 'sparks effect'.

Alfred Raworth became chief electrical engineer in 1939 on a salary of £4000 p.a. He oversaw improved power supplies and developed plans to electrify to Hastings. Alas, his plans came to nothing; the Second World War brought its own challenges, though the electric services generally coped well.

O.V.S. Bulled became Chief Mechanical Engineer in 1937. Nicknamed a 'Steam Dog' by Raworth, Bulleid was persuasive in seeking money for new steam locomotive designs. Whilst Southern steam locomotives were in a generally poor state, the author suggests new designs came at the expense of more electrification. Eustace Missenden, who replaced Herbert Walker, was not as committed to electrification so ultimately Raworth's plans fell victim to internal politics.

Alfred Raworth retired in 1945. His electrification plans for Kent were not achieved until 1962 and Bournemouth not till 1967. it was even longer before the sparks effect reached Hastings. That 'Giant of Steam' O.V.S. Bulleid was ultimately the cause of obstructing progress.

Though the Bulleid Pacifics were magnificent engines the attention given to them obscures the real Southern achievement in electrification. This well researched book offers a valuable history of Southern electrification giving much detail not previously widely known. Readers will find information about Durnsford Road generating station, control buildings, substations and power supplies missing from other histories. There is information about the development of Southern electric rolling stock and the electric freight locomotive CC1. Despite some minor errors and misprints it is the sort of book that railway history needs. Heartily recommended.

Roger Backhouse

John Hannavy

The Gas Tramcar: an Idea Ahead of its Time

Most publications dealing with the history of street tramways concentrate on the electric era. This is not surprising as the electric tramcar has dominated the scene for over a hundred years and even now in existing and new tramways it continues as the dominant mode. It was not always so; the early days of street tramways was a time of experiment and innovation.

It started in the mid-Victorian times with horse power. The horse tram was an improvement over the horse bus being smoother and larger as rails overcame the problem of rough roads. There were however major disadvantages. Horses were expensive in upkeep and they were slow and messy. It was understandable that at a time of rapidly advancing mechanical development attempts were made to mechanise tramways to improve speed, capacity and expense. Steam power, already a proven success throughout industry and especially on the railways, was an obvious choice and indeed was soon to be adopted by many operators. Usually it employed a small compact locomotive hauling a passenger-carrying trailer. It succeeded but was not well regarded by the public as it was dirty, noisy and subject to onerous restrictive legislation. Nevertheless, it was used for many years surviving into the twentieth century.

Early experiments with electric propulsion were started in Britain in 1885 when Blackpool opened an electric tramway which became the forerunner of what was come. Only at the very end of the Victorian era did electric street tramways become fully established. Apart from steam power, other methods were tried. Cable tramways were successfully developed, for example in Edinburgh which lasted until 1922 and the San Francisco system runs to this day.

Electric tramways were not without problems, the main one being expense. Tracks are essential for any tramway but electric trams require power stations and a method of current collection, usually overhead wires and supports. Obviously, were it possible to run trams with a self-contained power supply, costs could be dramatically reduced. Several attempts were made to find a satisfactory answer. Accumulators and even compressed air were tried but without success. Accumulator trams were technology ahead of its time as modern battery powered trams demonstrate.

A promising development was the gas tramcar which is the subject of this book, in which all the aforementioned points are comprehensively addressed. The gas tramcar certainly worked and its hitherto neglected status is corrected in this splendid book, which is not just about gas- powered trams, but with impressive research is, in this reviewer's opinion, a thorough and accurate background history setting out in detail the development, causes, successes and failures of what was happening in the early days of street tramways both in this country and abroad. It is to be applauded that a book about the gas tram is not merely a description of the cars themselves but of what made them possible which was the necessary generation of town-gas, which is accurately set out.

The book includes a huge number of high-quality photographs and engineering drawings; some of these latter are splendid examples of the art of engraving showing how, before computers, artists produced drawings of mind-blowing facility and producing excellent reference for model makers. It as a superb book, being a painstaking and comprehensive overview of early tramway developments, supplying a potted history and thus providing an excellent source of reference of more than its main subject, the gas tramcar. It is beautifully produced and will surely become the established reference for its subject. It is highly recommended.

Ashley Best

Adjustments to Stephenson's Valve Gear

Peter Gardner shares his experiences of using Charlie Dockstader's simulation.

Fig 1 Baldwin, conventional link radius

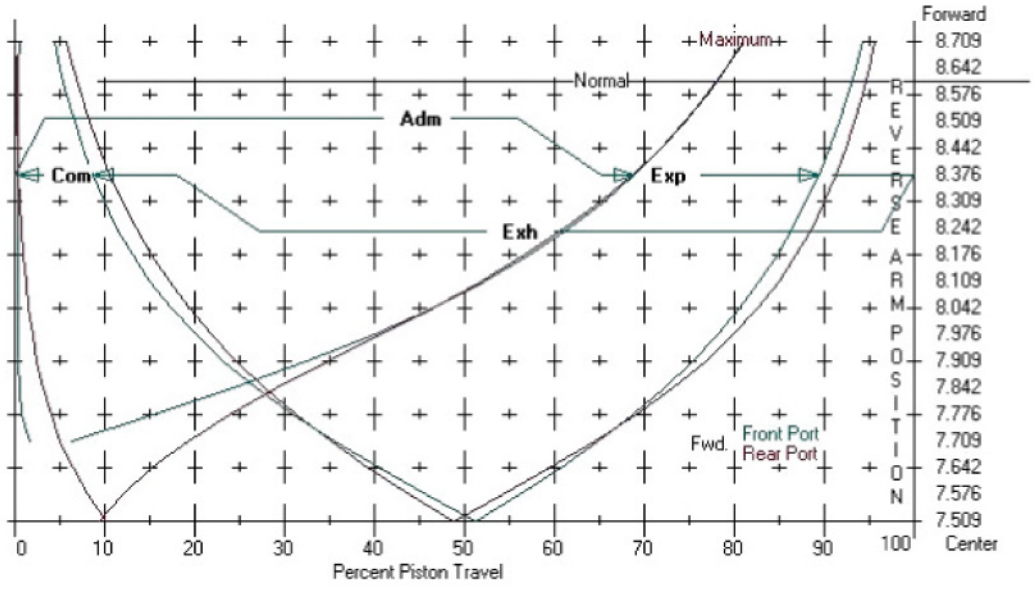
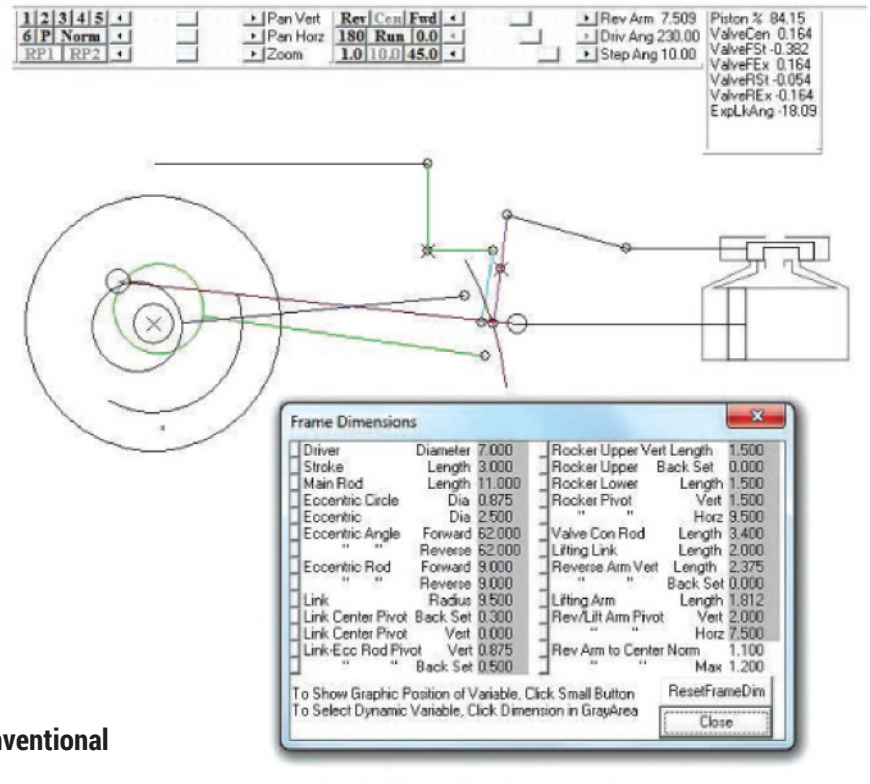


Fig 2



Baldwin, conventional link radius

Introduction

The late Charlie Dockstader was a remarkable American model engineer who, not content with producing some fine models, also produced user-friendly simulations of every type of steam engine valve gear known to man, or so it seems.

The simulations were written in the early days of Windows with the result that the software is remarkably efficient and economic by today's standards and has proved to be compatible with all the later versions. I was using Windows 3.1 when I discovered his software and the only discrepancy I have found with later versions is that the optional sound effects when running have changed from a 'chuff' to a 'ping'.

The simulations were originally available as freeware and since his death several clubs in the USA continue to make the software available.

The simulations cover both locomotive and boat gears and are scaled for 1:8 and use imperial units. The layouts shown are predominantly aimed at American locomotive practice but the editing facilities provide ready means to adapt to English practice. For example, a linear die-block guide for Stephenson's gear can be approximated by the use of a very long suspension link. All component dimensions and positions are editable.

As you might expect some of the terms for components have to be translated from USA to UK.

What I find very reassuring with this simulation is that it is based on pure geometry (rather than mathematics) and that adjustments can be made one element at a time and the consequences immediately observed. This allows for the sensitivity to tolerances and settings to be appreciated as well as design optimisation.

I have one warning; playing with the simulation can be mesmerising and addictive to the point where it can be a time waster. On the other hand, it was the hours of watching and thinking that has led me to the subject of this paper.

Fig 3

Optimised Baldwin 2-6-0

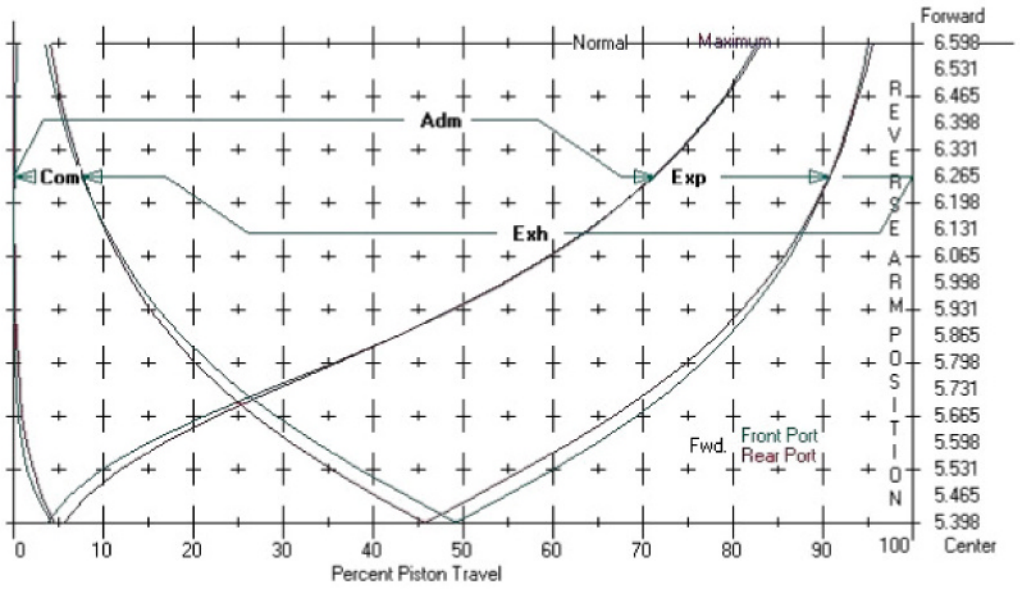
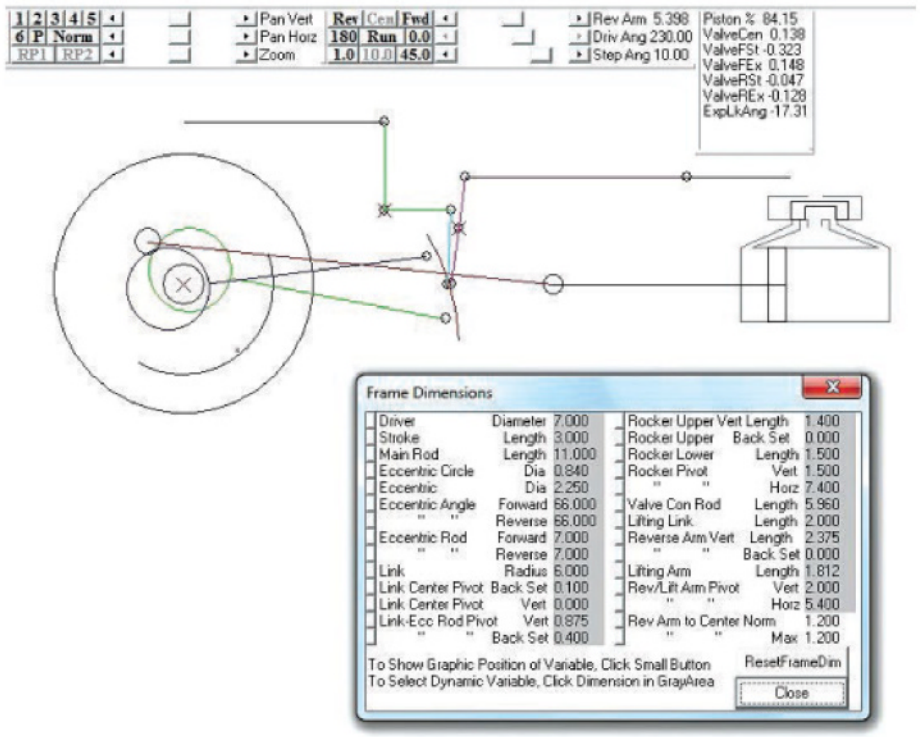


Fig 4



Optimised Baldwin 2-6-0

Using the Charlie Dockstader simulation

Assuming that all of the files available have been down-loaded, double clicking on the valve-gear of choice will present you with a default version of the simulation running. There are running adjustments readily apparent such as reverser position and speed and the ability to pan and zoom the image and add visual and sound effects of the exhaust.

There are buttons which when clicked give options to edit 'Frame' and 'Cylinder' dimensions. The 'Frame' is essentially the valve gear. To the right of the task bar are four buttons that give access to presentations of the overall performance. Being a simple- ≫

minded soul, I primarily make use of the cut-off diagrams and occasionally the sine diagrams. This is where the arguments can start with regard to what are the best criteria for success. When a locomotive is running, the by-stander may listen for evenly spaced exhaust beats and this is essentially a measure of exhaust timing. Alternatively, one might reasonably look for equal work to be done by the front and back of the cylinder, which is mainly determined by the inlet cut-off. Unfortunately, with some valve gears, optimum cut-off and exhaust events are not available together so you have to make a choice. This may be why early designers, particularly in America, sometimes made use of separate cut-off and exhaust valves. My preference is to equalise cut-off for front and rear end of the cylinders as this leads to nearly equal work done by the forward and rearward stroke.

In the simulation image, the front and rear cut-offs are shown dynamically as the simulation runs; it was watching this dynamic simulation and observing that cut-off as the reverser is adjusted that suggested to me that there may be a way to improve the performance of some versions of Stephenson's valve gear. The effect is most marked for gear with short rods.

The first time that I made serious use of the simulation was for the design and construction of a North East Railway T1 0-8-0 (for which I was delighted to be awarded a silver medal at the Model Engineer Exhibition in 2002).

The T1 uses loco link gear with relatively long rods and short travel valves. Simply adjusting the lifting links to represent an approximation to linear drive to the link die block gave very good events without the need to depart from conventional gear dimensions.

My next use of the simulation was for the valve-gear of a 7¼ inch gauge LNER B1, which uses Walschaert's valve gear. Having examined Martin Evans's design, the only change that I made was to reduce the link back-set to the scaled dimension of the full size as this improved the valve events at short cut-off, although at the expense of long cut-off.

The next occasion I had to simulate Stephenson's gear was in the design of a 7¼ inch gauge Baldwin 2-6-0. Compared to the T1 this has relatively short rods and launch links. Playing around with this simulation on my lap-top in front of the television, it was apparent that if front and back cut-offs were equalised in full gear then they diverged badly at short cut-off, and vice versa (**figs 1** and **2**). The usually

Fig 5 **Holmside Standard link radius**

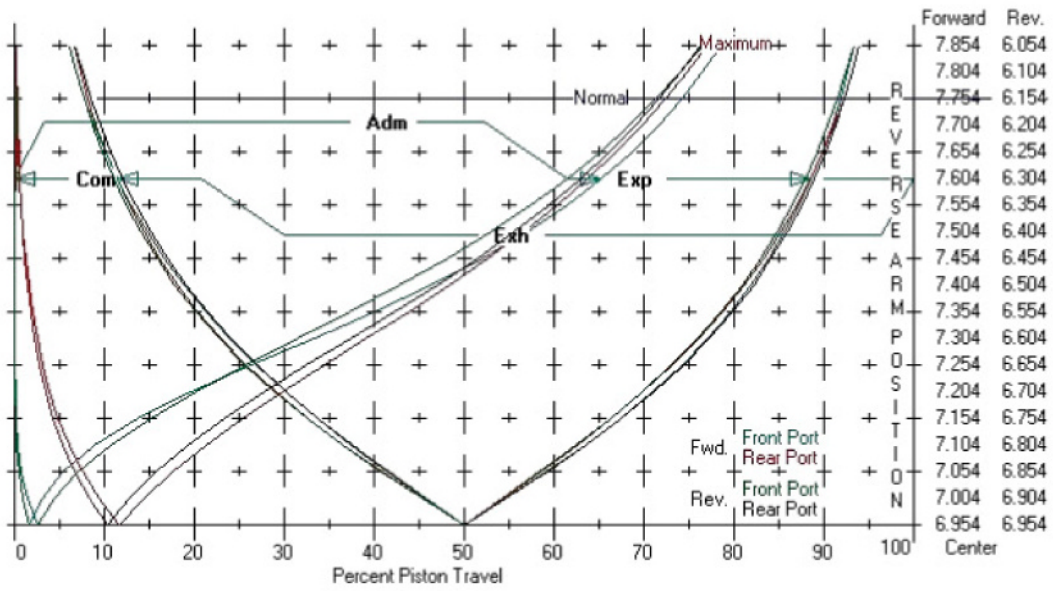
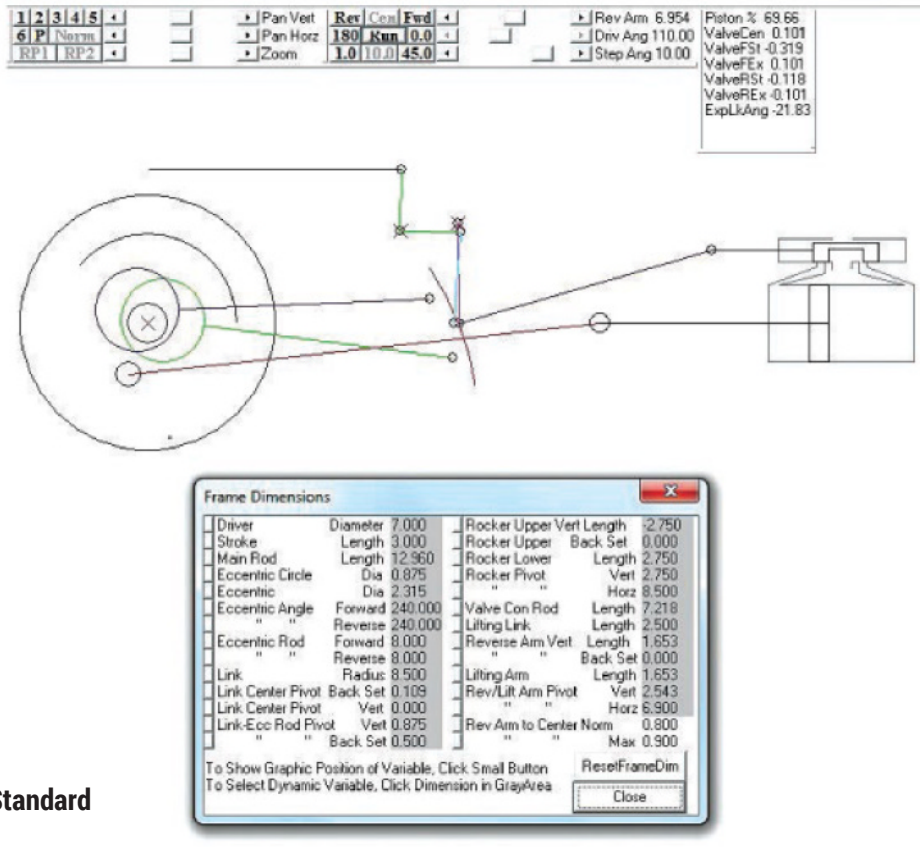


Fig 6



Holmside Standard link radius

recommended fudge is to set for 50% cut-off and put up with the results elsewhere. I found that if cut-off was equalised in full gear (75% say) then in mid gear the front cut-off becomes very short or negative whilst the rear cut-off remains longer. Bearing in mind that the valves operate through a rocking lever, it occurred to me that if the radius of the link was decreased, this would affect the mid gear cut-off whilst leaving the full gear events unaltered. This proved to be the case (**figs 3** and **4**) and the link radius was reduced to 6 inches as against the 7 inches radius that would have been applied conventionally. Whilst it seems to be self-evident that the radius of a Stephenson's link should be equal to the rod centres length plus the off-set, in fact link radius is not very critical and can be changed to compensate for errors that are much more difficult to deduce.

Having satisfied myself of the correctness of my deduction both by simulation and in practice by completing the Baldwin in 2016, I thought it would be interesting to apply the approach to some other popular design.

Holmside, potential modifications

A very large number of locomotives to the Martin Evans 'Holmside' design have been built and shown to be successful. We have two in our society, the Frimley and Ascot Locomotive Club, one of which has been modified to improve the support of the expansion link by lifting from both sides to reduce wear but otherwise they are to drawing. The proportions are not dissimilar to my Baldwin Mogul except for the use of direct drive to the valves for Holmside as against a rocking lever for the Baldwin. A similar discrepancy of front and back cut-off is found using simulation (**figs 5** and **6**) but, because of the direct drive, an improvement is achieved by increasing the radius of the link rather than reducing it.

Fig 7 Holmside Improved using increased link radius

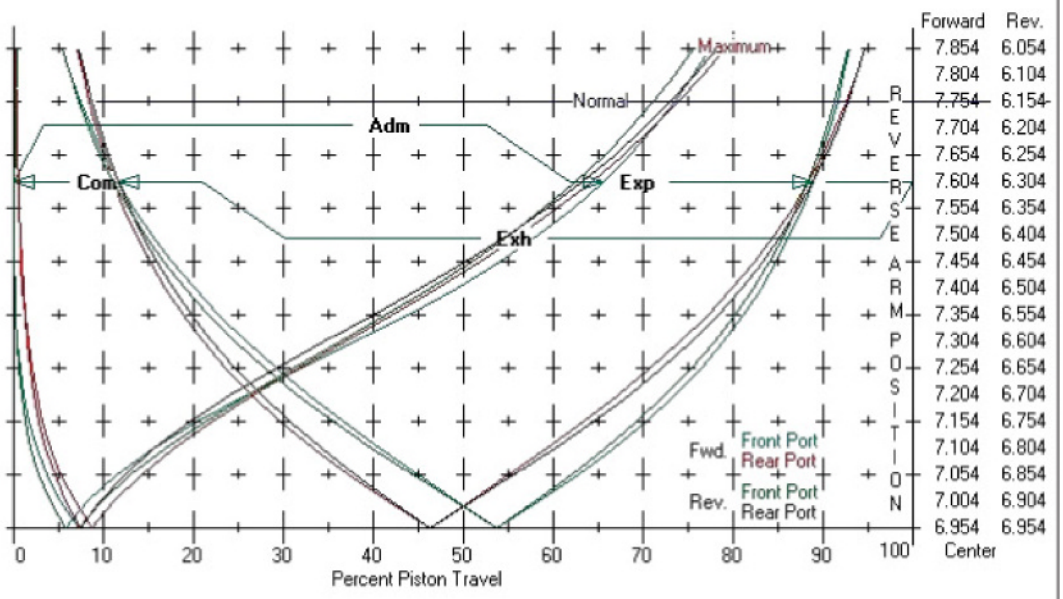
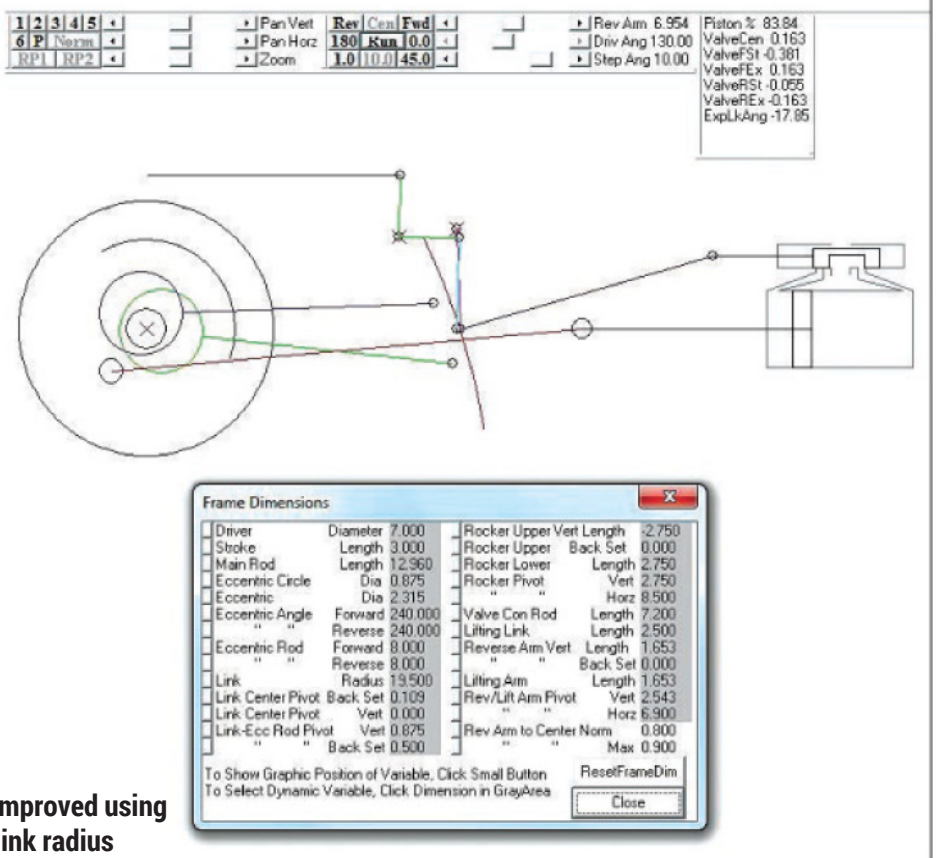


Fig 8



Holmside Improved using increased link radius

As increasing link radius is a slower function than reducing it with regard to valve position, the required increase in link radius is very large, more than double the original, but the improvement in performance at short cut-off very significant leading to smoother performance (**figs 7** and **8**). The down-side is that the exhaust timing suffers a little so an uninformed line-side observer may be critical. The builder may also find it more difficult to machine the link slot to the increased radius due to the difficulty of achieving sufficient rigidity when mounted on a small model engineer's rotary table. I have experience of this whilst machining the link for my latest project, a 7¼ inch gauge Stirling 8 foot Single. ME

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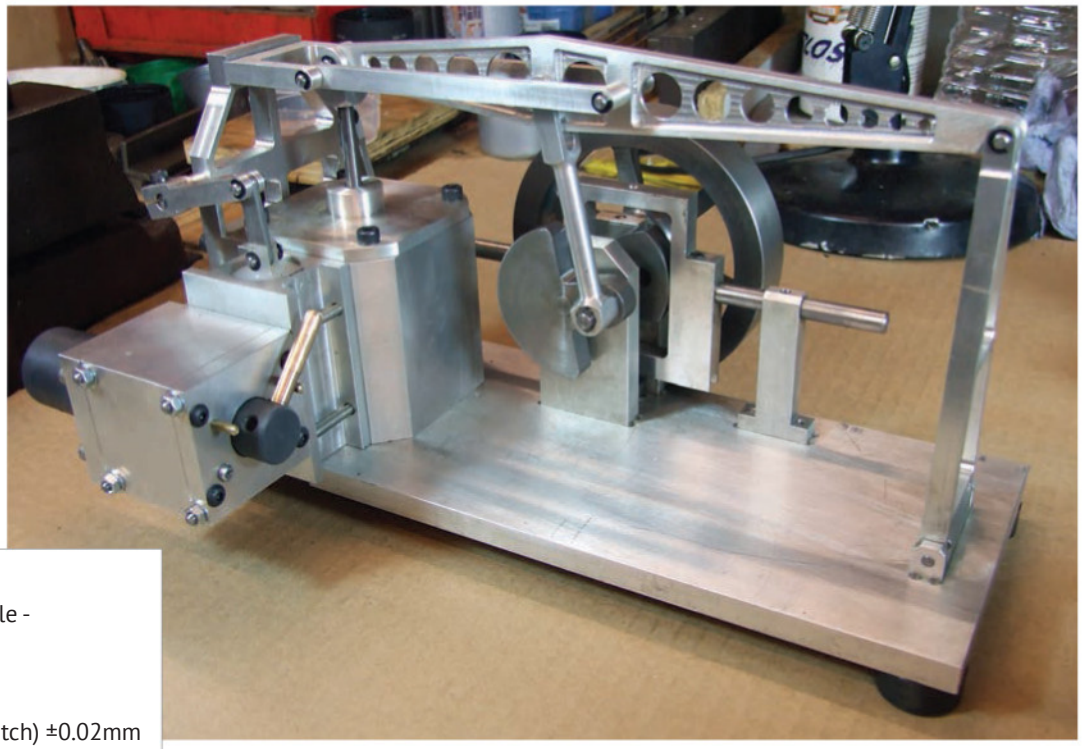
Martin Gearing presents an ideal beginner's project with great potential for the more experienced builder.

Continued from p.193
M.E. 4709, 27 January 2023



All dimensions are in mm
Tolerance for all parts in the article - unless otherwise stated:
Non-functional (i.e parts that do not fit all match) ±0.1mm
Functional (i.e parts having to match) ±0.02mm

Grasshopper Beam Engine

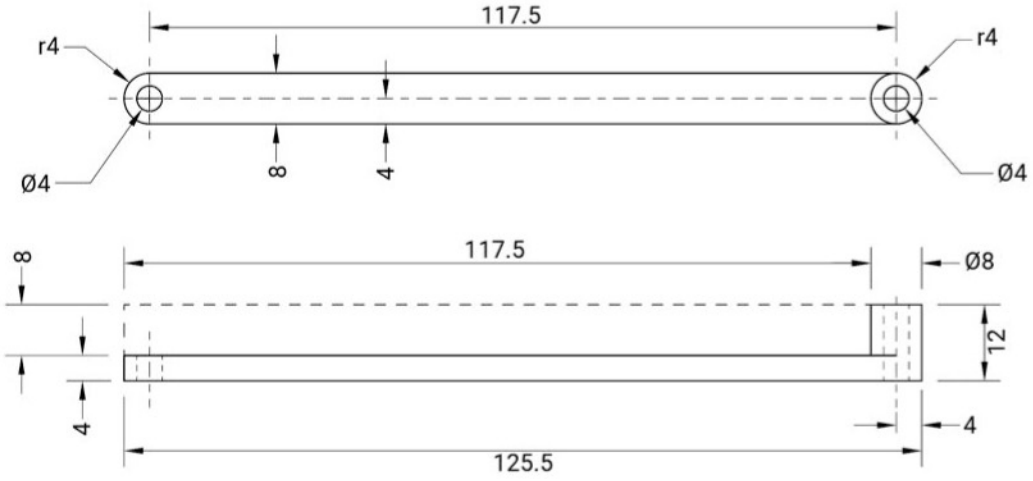
PART 13

Item 24 – Control Link– Two Required (fig 41)

8mm 5038 Aluminium plate

* Cut two blanks from 8mm plate. Check material is 8mm and if over bring to size.
* Place the straightest of the long edges against a suitable parallel to bring the blank 2 – 3 mm above the vice jaws and skim only sufficient to achieve a continuous machined surface before turning over and bringing the blank to 12 x 125.5. Repeat for the second blank.
* Place blank on a suitable parallel that is between 2.5 – 3.5 below the vice jaws and machine away the 117.5 x 8 waste area as indicated. This will produce an 8 square detail 8 tall at one end (**photo 80**). Repeat for the second blank.
* Remove the parallel and zero the spindle to the centre of the blank's width and 4 in from the end of the 8 square detail. Zero the X axis and clamp the Y axis slide.
* Centre drill and drill Ø3.8. Ream Ø4 at the two locations indicated. Repeat for the second link.
* Radius the ends. The end with the raised detail will have to be done in two stages, the first with the cutter just clear of the link all the way around before raising the work to complete the radius on the 4 thick link section it is attached to (**photo 81**). Note – Use a lock nut on the pivot bolt. Repeat for the second link.
* Finish blending the radii with a fine flat file or abrasive paper.

Fig 41



Item 24. Control Link
2 req'd

Item 25 – End Link (fig 42)

8mm 5038 Aluminium plate

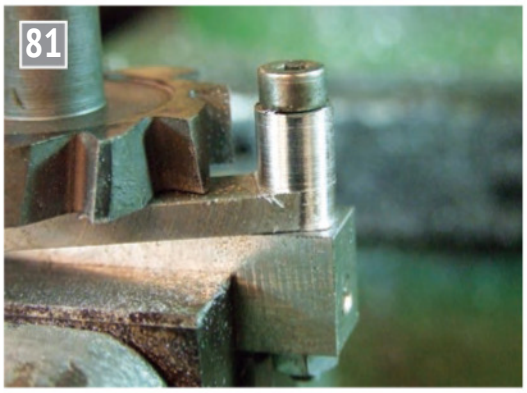
This is the last item that could be made either a simple solid or profiled version. But it must be said that the solid version, whilst simple to produce, would look so absolutely disastrous I haven't felt the need to detail its manufacture! It is however shown in fig 42 for completeness.

Item 25A – Alternative End Link (fig 43)

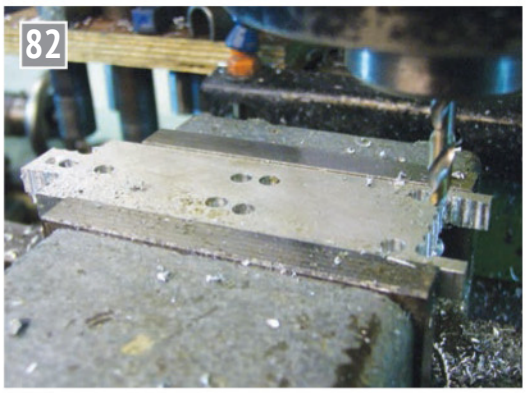
8mm 5038 Aluminium plate

* Machine the edges of the blank cut from 8 thick plate square to 136.5 x 40.
* Clamp the blank on suitable parallels to bring the top face about flush with the vice jaws. Zero the spindle on the centre of the width and right-hand edge.
* Ideally using a stub drill or if not available centre drill first and then drill the 11 Ø6 holes indicated plus one as a pilot

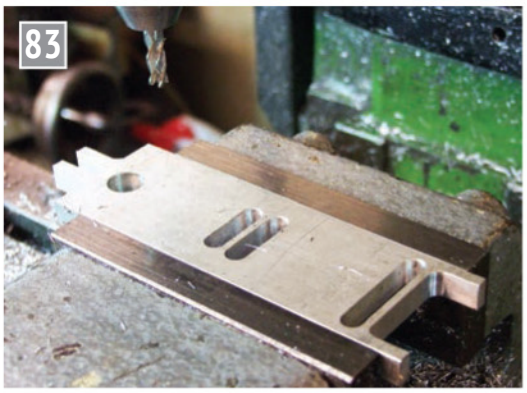
Initial shaping of the control link.



Radiusing the end of the control link.

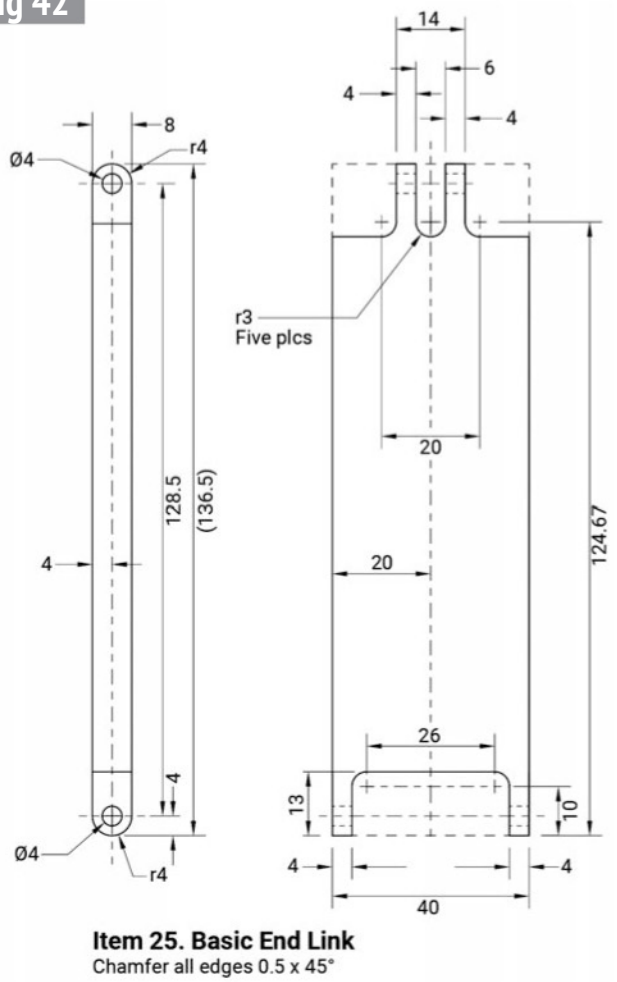


Forming the wide clevis on the end link.



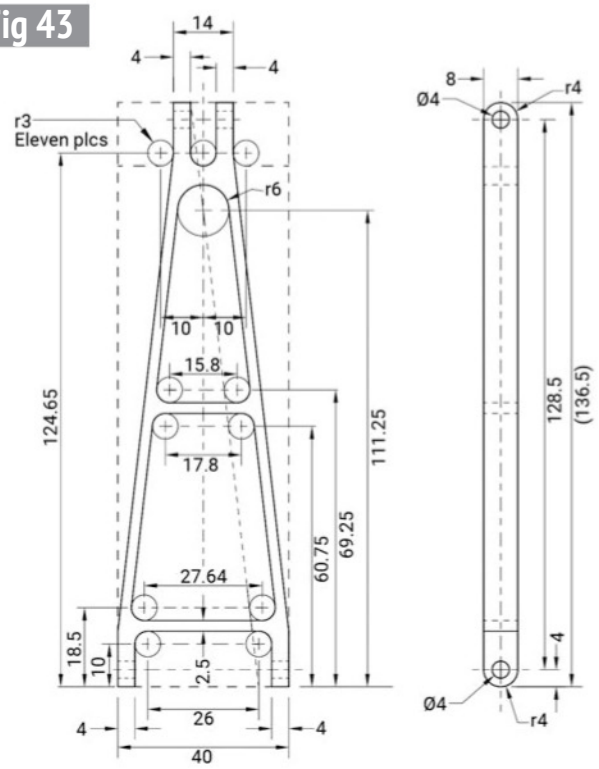
Initial steps in forming the cutouts in the end link.

Fig 42

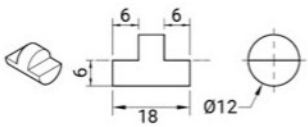


Item 25. Basic End Link
Chamfer all edges 0.5 x 45°

Fig 43



Item 25. Profiled End Link
Chamfer all edges 0.5 x 45°



Ø12 Profiling Pin

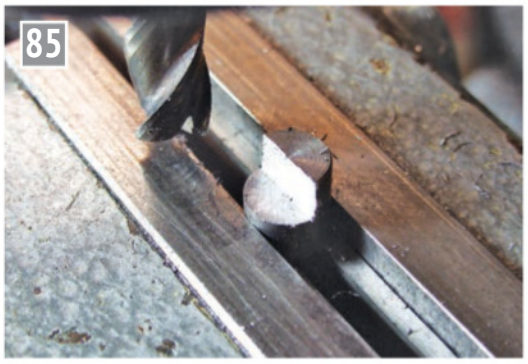
for the Ø12 which may then be drilled - completing the initial 12 holes required.
* The waste for the wide clevis may then be removed, by chain drilling (**photo 82**).
* Using a Ø6 end mill, machine the inside faces of the bottom clevis and the outside faces of the top clevis and the three slots across the blank width between the predrilled holes as indicated (**photo 83**).
* Clamp the blank on edge and zero the spindle on the width and right-hand end. I fitted a small angle plate against the blank at the right-hand/ wide clevis end to provide a reliable reference.
* At the indicated location, centre drill and drill Ø3.8. Ream Ø4 through one leg of the wide clevis, then turn the blank over and repeat the process on the second leg, making sure both legs are in contact with the angle plate before clamping. This method was chosen in an effort to reduce the risk of the long length of unsupported Ø 3.8 drill wandering.
* At the left-hand end at the location indicated centre drill and drill Ø3.8. Ream Ø4 through the clevis (**photo 84**).

To assist in the marking out and machining of the profile, two setting pins from silver steel are required, one Ø6 x18 (pins used for setting the beam are suitable) with both ends chamfered to remove any burrs, and one from Ø12 x 18.

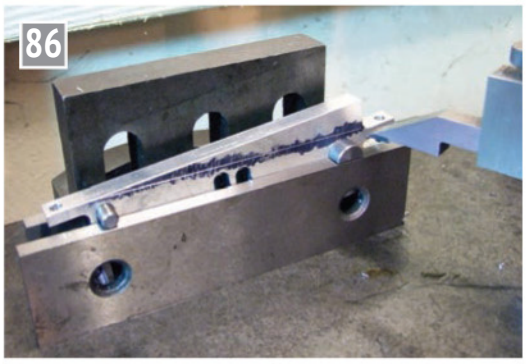
This second Ø12 x 18 pin needs to have two flats machined at each end as indicated on the drawing and is more reliable to use, due to better location than a second plain Ø6 pin.

* Machine one flat at a time, with the pin held in the vice on a suitable parallel, so that at least 7mm protrudes above the vice jaws, enabling measuring accurately the 6mm dimension required (**photo 85**). The second flat is produced by clamping the flat face of the semi-circular section against a fixed jaw and repeating.

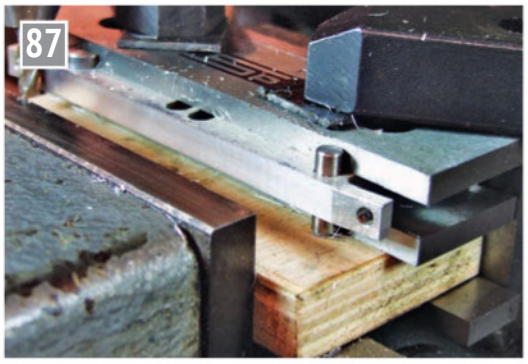
Drilling and reaming the holes in the clevis for the end link pin.



Milling a flat on the setting pin.

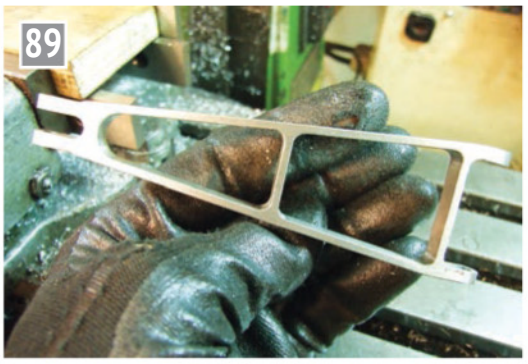


Setting up to cut the tapered profile.



Cutting the tapered profile.

Finishing the cutouts in the end link.



Finished end link.

* Coat the surface of the blank where the expected tapered profile will run. Then, selecting a pair of parallels to raise the blank above a surface table with an angle plate to rest against, fit the semi-circular pin into the Ø12 hole with the flat faces resting on the parallels and the Ø6 pin through the end slot. Set a marking gauge 2.5 above the curved surface of the Ø12 pin and scribe a line along the blank. Repeat the other side of the centreline (**photo 86**).
* Using the same two parallels as used for marking out, set the blank between the two parallels located by the setting pins, in the same manner as used for item 21 (link anchor mount), pushing the 'sandwich' against a wide parallel held against the fixed jaw by suitable wood packing before final clamping.
* Machine the outer profile until the flat surface just blends with the Ø6 hole positioned outside the narrow clevis (**photo 87**). Turn over the blank and repeat on the other side of the centre line.
* Again, using the same method as used for item 21, push the tapered outer edge of the blank against the protruding parallel face before clamping the blank to the surface of a board, using a toolmaker's clamp in addition to a long bar from a standard clamp set.
* Machine the inside of the first cutout between the Ø12 hole and the Ø6 end hole of the short slot, producing a web thickness of 2.5, and raise the cutter.
* Move the cutter over the central web before lowering into the Ø6 end hole of the middle slot and continue onto the Ø6 hole of the long slot, continuing the web thickness of 2.5 (**photo 88**).
* Turn the end link over and repeat the machining of the opposite side. Note – STOP the spindle to remove the waste when it becomes detached.
* Finally, radius the clevis ends in the manner described previously, again remembering always to use lock nuts on the pivot pin (**photo 89**).

●To be continued.

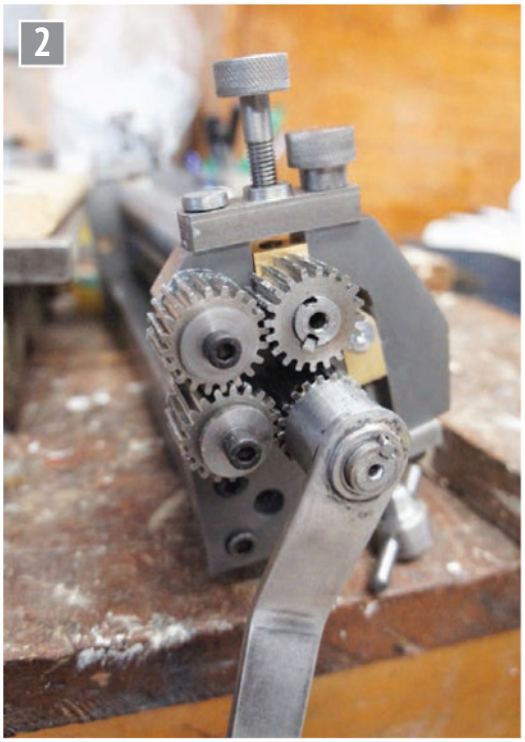
Making a Hemingway Kit Sheet Metal Folder

Bending rolls made from a Hemingway kit.

Roger Backhouse successfully follows the instructions.

Three years ago, I made a set of bending rolls from a Hemingway kit. That was an interesting project and the completed rolls worked well (**photo 1**).

As the self-selected chair of the Institution of Not Very Good Engineers (incorporating the Worshipful Company of Bodgers) I decided to try another Hemingway kit. After not too subtle hints my wife and daughter bought me a sheet metal folder kit for Christmas. Truthfully - 'it was just what I wanted'.

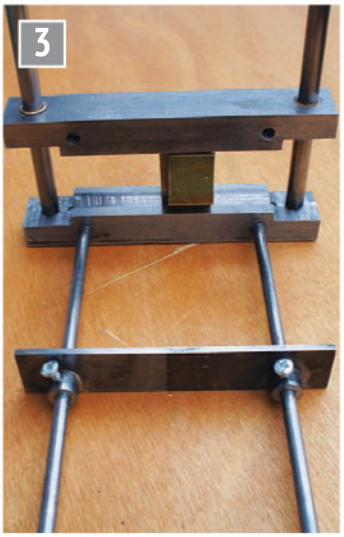


Gears on bending rolls - supplied with the kit.

Hemingway don't do kits in the Airfix sense. Several designs are by well-known tool designers such as G.H. Thomas. Not glued or fitted together, instead you receive plans, an instruction sheet (not fully detailed but still useful), the metals needed and any special parts - e.g. gears, ball races (**photo 2**). So it helps if you have some knowledge of basic metalwork techniques like marking out, drilling, turning and filing. Should you have similar plans you could build the items directly but having the materials provided makes life easier.

Purpose

The sheet metal folder was designed by D. Broadley in 1994. It produces neat right-angle bends in sheet or strip metal (**photo 3**) up to about 16SWG (about 1.6mm). This is an exercise in fairly basic metal working and in theory nothing should go wrong but, all the same, I managed some errors.



The Hemingway box folder completed. It can make neat folds simply.

First steps

It is essential to have a tray, box or tin to keep parts in. Shocking, but I have been known to lose carefully made parts - don't know how or where but I have. Even worse, I have then remade parts only for the others to turn up. It's worth ticking off parts on the plan as they are made to help avoid duplication.

Always check the contents of the kit first, not that Hemingway get it wrong but because it familiarises you with what's there and what it will be used for.

Next, don't work in a rush and don't try working when tired. That's a sure way to make even more errors. I've done it. Big mistake.

Tools needed

I had all the tools needed except for one as will be seen later. The folder was made using a Myford Super 7 lathe but could probably be made on a smaller lathe like a Unimat. I used a Fobco drill for some operations and also my small Warco mill. However, milling and drilling could be done using a vertical slide on the lathe. Apparently, Martin Evans, the

late locomotive designer (not to be confused with the present editor of *Model Engineer*) had a milling machine but always preferred to use his lathe with a vertical slide.

What metalwork knowledge I have comes from long ago school classes and also SMEE training courses, which I recommend highly to anyone starting model engineering.

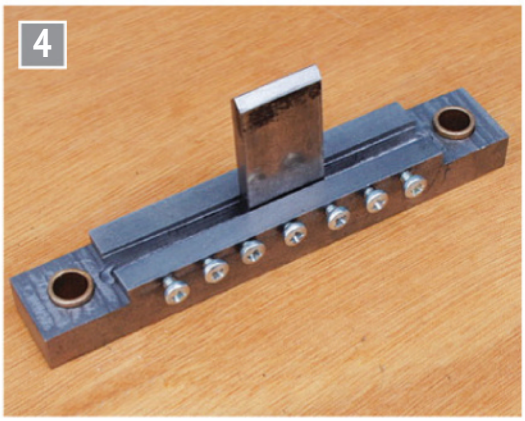
Marking out

Some use marking out blue but this time I used a felt tip pen which is more manageable. If you have my genius at losing parts label each piece once marked out. You may have to put jobs on one side for a while and labelling helps when restarting. Do take time marking out. I've had trouble placing drilled holes exactly. Although I have used an optical centre punch I find that careful spot punching is as good (or as cynics might say of my work, as bad).

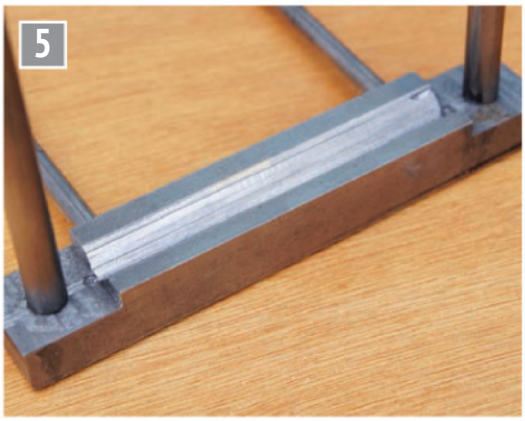
Where holes on different pieces must be in alignment - as on the 'V' bar and blade bar - do not delude yourself that you can mark them out separately. So, clamp parts together for marking out, drilling and cutting. Production engineers use lots of jigs, which is good practice in the workshop too. I found that clamping pieces together led to problems as swarf from the drill breaking through the first piece could force it away from the other so temporary glueing with Araldite as well might be an idea. Heating will destroy the Araldite bond.

Drilling holes and milling slots

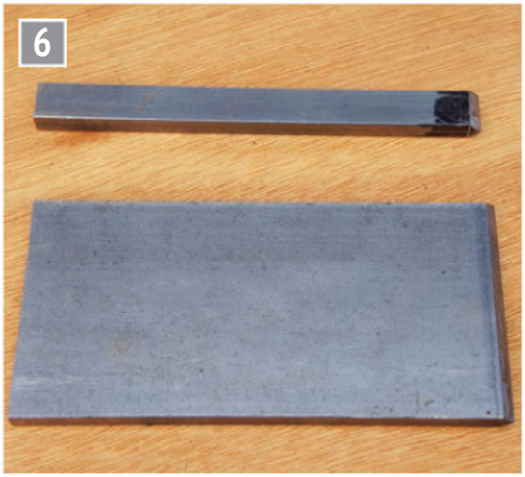
Once marked out I started making a pilot hole with a centre drill, gradually enlarging each hole and then reaming to diameter. Although stopping the drill repeatedly to change drill bits takes longer it really does make more accurate holes than doing all the pilot holes, then all the 2mm holes and so on upwards. That's a tip learned on a SMEE course and it's proved helpful to accurate drilling.



The blade bar slot was machined with a slotting cutter in the Warco mill but it could have been made with a slotting cutter and a vertical slide in a lathe.



The 'V' bar was more difficult to make but thanks to fellow members of York Model Engineers it was made do-able.



Bending bars were marked out and filed to form the inverted 'V' shape at the end. They could be milled instead. Note the traces of felt tip pen used instead of marking out fluid.

The guide bar with bushes silver soldered in place. Using Araldite didn't work.

Despite all the good advice offered here I managed to drill holes in the guide bar too far apart. One for the Clangers Trophy competition perhaps (see M.E.4708, January 13th)? Luckily, I had some same size steel strip that I drilled correctly.

Once the holes were drilled I milled the slots, first the slot in the blade bar, a relatively simple job using a slot drill (**photo 4**). That bar was then drilled and tapped for the M4 screw holes to hold the bending blades in place.

Then I milled the 'V' slot in the base (or Vee bar) This was more complicated (**photo 5**). It's possible to do it with a straight cutter whilst holding the workpiece at a 45° angle but I realised that could be tricky to hold firm. Even I know that workpieces moving on the milling table is not good. Better engineers would of course do it perfectly but I (sometimes) know my limitations.

York Model Engineers to the rescue

It wasn't the US Cavalry to the rescue this time but my fellow York Model Engineers. I discussed the problem of milling a 'V' slot with Richard Gibbon sitting outside the York Model Engineers clubhouse one Wednesday morning. He suggested using a 90 degree cutter - I hadn't thought of that.

At that very moment Glyn Granger emerged from the clubhouse, offered more advice and said he'd loan me a cutter. Wow! "That's what this club's all about" said Richard.

Glyn then kindly posted me three cutters to choose from and suggested step milling with a slotter or mill before using the cutters. Excellent advice which I followed. I managed to mill the 'V' slot slightly too deep though that wasn't critical.

Next stage was the relatively simple one of turning bushes for the guide bar and cross drilling them for the M4 grub screws.

Making the bending blades

Hemingway supply steel for three sizes of bending blade - 1, ¾ and ½ inch wide, all ¼ inch thick. Making the blades wasn't a difficult job. The inverted 'V' tip could be machined in the mill using one of the 90 degree cutters, or perhaps milled in the lathe but I marked out and filed carefully. That seemed to work (**photo 6**).

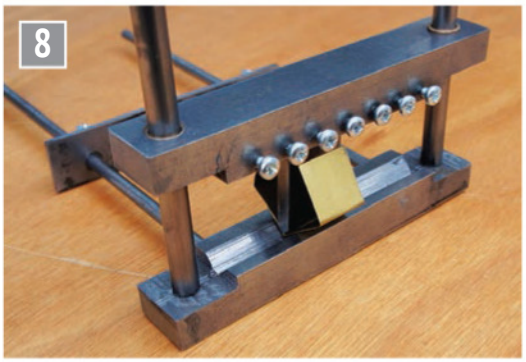
Assembly

In theory not difficult. The guide bar bushes were glued into place using Araldite but this didn't survive contact with reality so I then silver soldered them in place (**photo 7**). That went surprisingly well.

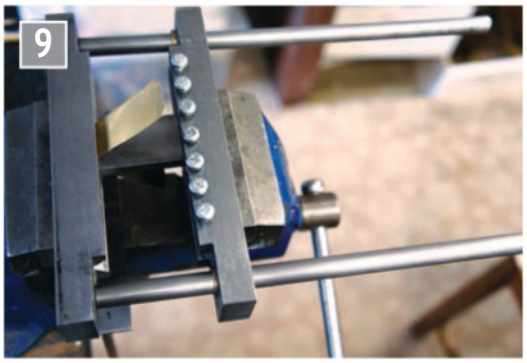
So, the kit was fully assembled. In operation the blade bar presses the workpiece into the 'V' groove (**photo 8**). Hemingway instructions suggest that it can be used in a bench vice. Good idea, but my 3 inch Record vice is too small to take ≫

the assembled kit if it's made according to instructions. However, by making shorter bending blades it would fit the vice (**photo 9**). This device is unlikely to be used for anything large, though others may have different ideas.

You could use the 'Brummagen Screwdriver' (a.k.a "'it it wiv an 'ammer"} to press the blade bar down. That isn't conducive to precision engineering although it works if you are desperate. Hemingway instructions suggest using a car jack to move the bar and include a drawing in the instructions. Maybe a larger vice is in order.



How the bending bars work - the blade presses the workpiece into the 'V' shaped slot.



As set up with the bending tool in the vice. The bending blade was made shorter to fit the tool in the 3 inch vice.

How long did it take? I kept a record of the time on each job. Marking out and milling took the longest, and overall the folder took about 25 hours to make. That seems too long but I made mistakes and no doubt a better engineer could make it in far less time.

However, it was enjoyable to make even if I have little opportunity to make the boxes it is intended for. As with many engineering tools 'you never know when it will come in handy'.

ME

Club Diary 12 February - 26 March 2023

February

12 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

12 Sutton MEC
Track Day from noon – 16:00. Contact: Paul Harding, 0208 254 9749

15 Bristol SMEE
'Modelu' (small model figures), Begbrook Social Club 19:30. BS16 1HY. Contact: secretary@bristolmodelengineers.co.uk

16 Warrington and District MES
Talk – Geoff Stocker, 'Rebuilding the Welsh Highland Railway', St Mary Magdalene Church, Appleton Thorn, 20:00. See www.wdmes.org.uk/events

19 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

21 Taunton Model Engineers
Meeting, Stoke St. Mary village hall – 'More Engineering Tales' by David Hartland, 19:30-21:30. See www.tauntonme.org.uk

26 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

March

2 Sutton MEC
Bits and Pieces evening 20:00. Contact: Paul Harding, 0208 254 9749

2 Warrington and District MES
Natter night, St Mary Magdalene Church, Appleton Thorn, 20:00. See www.wdmes.org.uk/events

5 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

7 Taunton Model Engineers
Meeting, Stoke St. Mary village hall with Dave Morris, 19:30-21:30. See www.tauntonme.org.uk

10/11 National Model Engineering Exhibition
Harrogate show ground. More details to follow.

11/12 Midlands Garden Rail Show
Warwickshire Event Centre. See www.meridienne exhibitions.co.uk

12 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

12 Sutton MEC
Track Day from noon – 16:00. Contact: Paul Harding, 0208 254 9749

15 Bristol SMEE
The Camerton line, Begbrook Social Club 19:30. BS16 1HY. Contact : secretary@bristolmodelengineers.co.uk

16 Warrington and District MES
Talk – John Hastings, 'Building the Patriot steam locomotive', St Mary Magdalene Church, Appleton Thorn, 20:00. See www.wdmes.org.uk/events

19 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

21 Taunton Model Engineers
Meeting, Stoke St. Mary village hall – Annual General Meeting, 19:30-21:30. See www.tauntonme.org.uk

23 Sutton MEC
Afternoon Run from 12 noon. Contact: Paul Harding, 0208 254 9749

26 Bristol SMEE
Public running at the Ashton Court Railway BS8 3PX, noon-17:00. Contact : secretary@bristolmodelengineers.co.uk

26 North Wilts MES
Public running at the Coate Water Railway, 11:00-17:00. See www.nwmes.info

26 Guildford MES
Open day, 14:00-17:00. See www.gmes.org.uk

LNER A4 PART 3 Development - *Mallard*

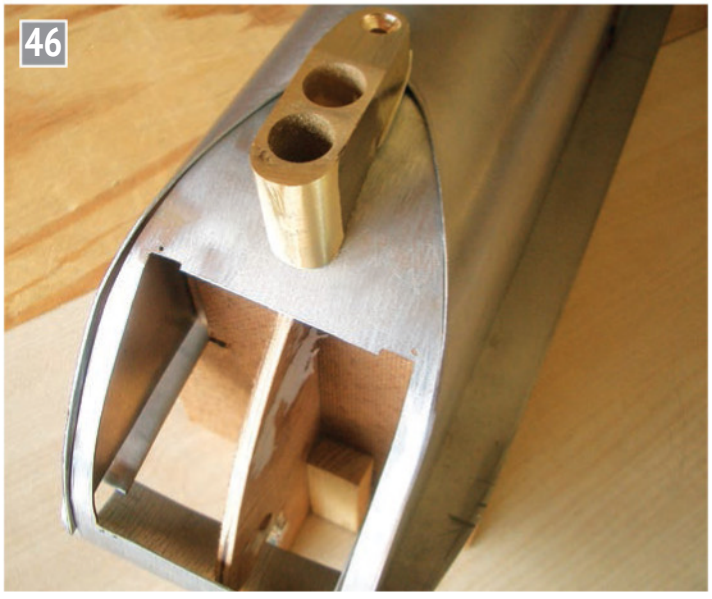
Robert Hobbs restores a rather battered A3 as an A4.

Continued from p.139
M.E. 4708, 13 January 2023

The author's 2½ inch gauge A4 Mallard.

Smokebox castings.

Chain drilling the chimney profile.



Positioning the chimney.

The smokebox was tackled next, by rolling a ring to the correct diameter onto which was fitted the front former and mounting for the door assembly. The surplus ring was cut away leaving the truncated smokebox as shown in **photo 44**, which also shows the door assembly and the tidied up saddle. Concentrating on the front end of the locomotive, the distinctive chimney was machined from brass block, the excess material being chain drilled to create the profile and cut off with a hacksaw. **Photograph 45** shows the brass blank being chain drilled and **photo 46** the profiled

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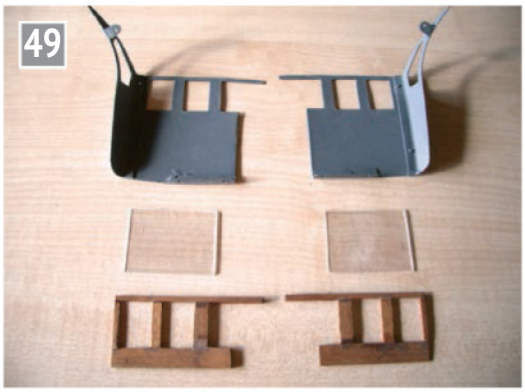
Chimney, whistle and buffers fitted.

Front and rear buffers.

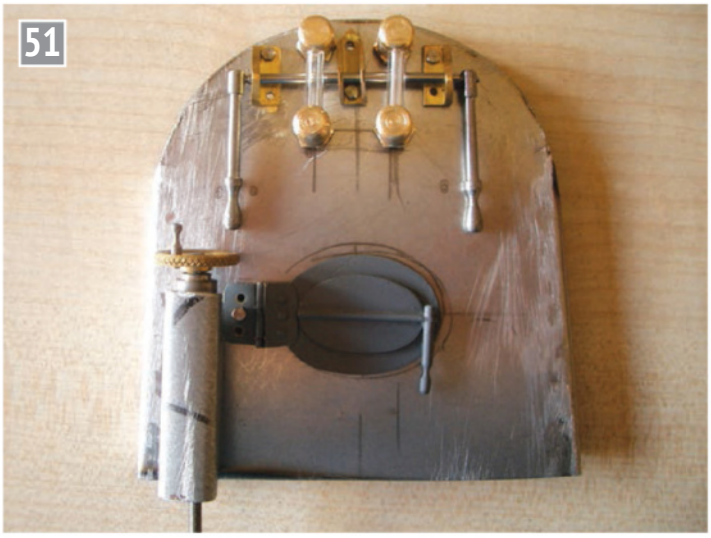


Cab, glazing and wooden cab lining.

chimney positioned on the cladding. The buffers were cleaned up and the threads extended on the front units to accommodate the shaped washer that would allow the stocks to fit the cladding profile (**photo 47**). The rear buffers had been soldered into the rear buffer beam and were released by heating until the solder melted. It was, however, more difficult to remove the buffers from the stocks which were also soldered in place. Once the stocks were released they were drilled and the buffers tapped to create a sprung system for the rear buffers. **Photograph 48** shows the buffers with the rear ones still soldered together. The cab sides and spectacle plates were cut from galvanised steel and profiled accordingly, the window openings being cut in the vertical mill. **Photograph 49** shows these with the glazing and the wooden cab lining. The cab roof and its sliding hatch components were cut to shape and rolled using my 12 inch slip rollers; the hatches and rails were then soldered in place. **Photograph 50** shows the cab with its roof loosely assembled on the chassis with the casing. To finish off the casing a back plate was made from sheet steel, the holes were drilled for the valves, gauges, sight glasses, regulator and firebox door - shown in **photo 51**.

Just to give an idea of the number of components that are required to complete the locomotive, **photo 52** shows the main items laid out on my bench and include the casing after it had received several coats of high build primer.

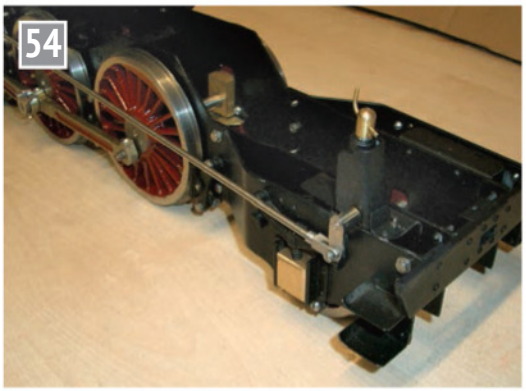
Cab united with the casing.



Boiler backplate with fittings.

Kit of parts, ready for assembly.

Reversing stand.

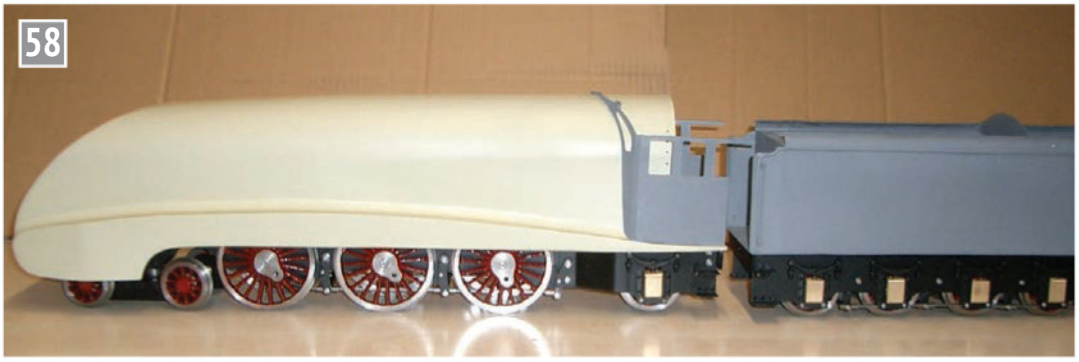


Reverser and reach rod.

Front doors.

Access to the smokebox.

Tender body in primer.



Awaiting top coats.

The reversing stand on the model was a normal brake lever system and being on the right-hand side was wrong and looked cumbersome. The solution was to make a Gresley reversing stand and mount it on the left-hand/ driving side. This was made as a small screw down brake operating system. **Photograph 53** shows the new reversing stand and **photo 54** shows the Gresley stand loosely *in situ* with its new reach rod, now repositioned on the left-hand side of the chassis.

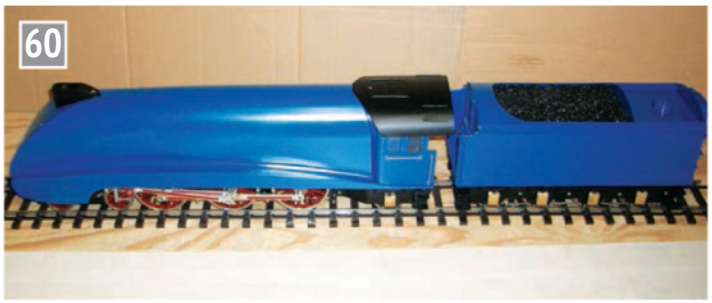
Some of the components had been painted as the build progressed and were ready for assembly, but there were a few outstanding items to finalise before the painting was started in earnest, namely the hand rails and the front doors. The two doors were fitted on hinges at the top and bottom of the leaves, and the smokebox was adjusted fore and aft in the saddle to clear the casing. **Photograph 55** shows the iconic doors in place and **photo 56** shows the location of smokebox and door. To position the handrails, the casing was fitted to the chassis and checked that it was level, then using a scribing block the handrail position was marked along the casing, the curved portion being determined by co-ordinates from the front edge. The holes for the stanchions were drilled and tapped 9BA, which was a little daunting in the 18 swg steel and I had ruined two taps before finishing this task. The handrails on the cab sides were treated in a similar manner and by using the stanchions fixing, the horizontal rails held the window glazing and the wooden trim neatly in place.

The serious job of painting the main items was next, with the tender being rubbed down and sprayed with grey etch primer several times, each time being rubbed down between coats with wet and dry before a decent finish suitable for the top coats was obtained (**photo 57**). Creating a decent shape and finish on the filler used to create the curve between the casing and the running board was quite difficult and took several attempts with different curved wood spatulas with wet and dry to get the shape - each time small indentations being filled with P38 filler. Once the fillet was shaped the casing was sprayed with yellow high build primer and once again rubbed down between coats until a good finish was achieved (**photo 58**). After being left to fully harden for a few days the casing was carefully rubbed down and sprayed with grey primer to match the tender and provide a similar base for the top coats. The tender top coat was sprayed using Halfords car enamel and took three gentle coats before a decent, even covering of the distinctive blue colour could be achieved. The dummy coal infill was made from chippings glued to stiff card and then sprayed matt black (**photo 59**). The 'coal' was slid in to place before the front wall was fitted. The grey painted streamlined

18+

WHAT IS AVAXHOME?

Dummy coal for the tender.

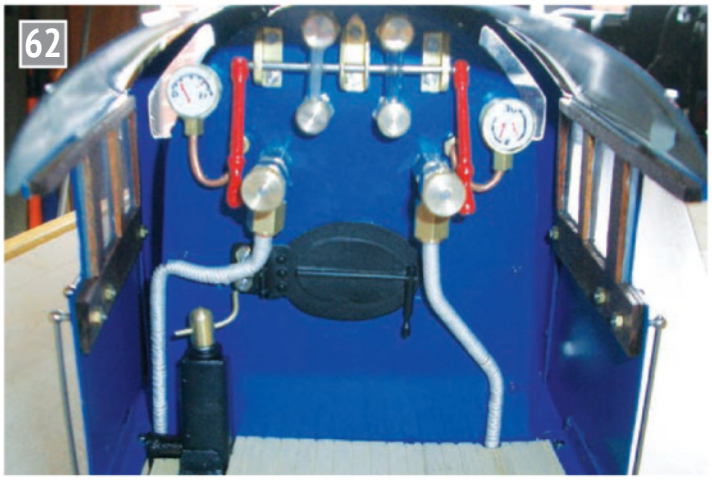


The locomotive acquires its colour.

casing was carefully rubbed down and degreased prior to painting with several gentle coats of blue paint. The casing was painted overall leaving the front doors and side scroll to tackled once the casing had fully hardened. **Photograph 60** shows the locomotive and tender in blue for the first time, which was well worth the wait.

Spray painting the front doors and the scroll in matt black was not something I had looked forward to as this could have undone all the previous good work. After trying a few paper cut-outs to mask the side scroll, however, the rest of the locomotive was covered in paper and the front sprayed; the result is shown in **photo 61**. *Phew!* The two sides were not quite mirror images and a gold flashing was fitted to bring the edges in line; also, it provided a link to the curved handrail, probably enhancing the front end as well. The back plate, which had earlier been riveted into the casing, was

The distinctive front end.



A view of the backhead.

fitted out with the controls made earlier on (**photo 62**). The handrails were fitted to the cab and along the casing side. The front curve was difficult to install using the tapped holes so they were drilled out and the two front stanchions fitted loosely on the rail whilst being positioned and bolted on the inside of the casing. After all the difficulties of converting the *Flying Scotsman* in to a *Mallard* look-alike it was a real pleasure to fit the finely and beautifully engraved nameplate, speed record plaque and the Doncaster works plate which were supplied by Peter Wood from Model Engineer Name Plates. The transfers were a similar joy to fit and were supplied by Simon Thomas at Old Time Workshop, who even sent a replacement **N** by return post when I ruined an **N** on one side of the tender.

The final **photos, 63** and **64** show the finished A4 in all its glory; a pleasure to build and a fitting reminder of a holiday in York with Fiona and Eva all those years ago.

Photograph 65 shows the 2.5 inch *Mallard* and the *City of Stoke on Trent* in my study. In their day they were the fastest way to reach Scotland.

The completed locomotive.

Front end view.

Mallard *and* City of Stoke on Trent.

In the 1930s and 40s they were impressive and are even more so today; if you are lucky enough to see one in steam you will know exactly what I mean.

Completing another locomotive for display has been an enjoyable building project. As some of you are already aware I do not do live steam which means not every item works. I love working things out and having a project on the go in the workshop taxes the brain and keeps one active. Writing the project up and taking the photos, mostly in the correct order, provides a substantial record for my files. Usually my locomotives are numbered with my old apprentice number, 1478; however it would have been irreverent to have used this on *Mallard* so she retains her LNER number, 4468. Earlier on I had started to build locomotives with various wheel arrangements as a long term plan, but with this Pacific my plans have gone off the rails and with a recent purchase from eBay I will be 'going back to school' as it's a 4-4-0 Schools class.

I hope this series of articles gives the reader some pleasure and makes them aware of some of the errors to avoid whilst offering some ideas to put in their catalogue for future reference. Finally my thanks to Diane and Martin for letting me share the *Mallard* project through the pages of *Model Engineer*. ME

The Eating of Elephants

PART 7 – DRIVING SCHOOL

Steve Goodbody finds some things are best tackled in small helpings.

Continued from p.211
M.E. 4709, 27 January 2023

In Part 6 of this series, the author machined more than the typical number of cylinders for a Rob Roy and launched a steam chest through a window, although not in direct retaliation. We left him, telephone in hand, having received two simultaneous offers, and rejoin him on the morning of his school's summer fete where he will help to operate a real working steam engine for the first time. He is very excited.

Preparations

The day of the Beacon School fete arrived and I pedalled up the long hill to Chapel Green in record time and without pause. Knocking on the carriage-house door, I found Bob and Cecil busily preparing the necessary supplies: coal, water, oil, rags, matches and sundry other items.

"Ah, there you are" called Bob. "We left the cleaning and polishing for you, you'll be much better at bending down than we are. Don't forget to sweep the tubes first" he added, removing the tarpaulin from a large object in the corner. And there she sat, Bob's immaculate Allchin traction engine, a doubled-up version of the Bill Hughes design at 3 inches to the foot scale, patiently awaiting attention.

Under Bob's direction, I rolled her into the morning light, the steel strakes crunching and clanking as they traversed the stone floor; it occurred to me that this was the same sound that I had heard in the gloom the day that dad and I had first visited Bob to enquire about a lathe. By far the biggest model traction engine that I had ever seen (at that time, unlike today, engines larger than 2-inch scale were rare), she was extremely heavy and, while easy enough to roll on level ground, it took me a lot of effort and several attempts to get her over the lip of the doorway. Realising that the site of the school fete was nearly a mile away, with at least one decent uphill stretch in the middle, I guessed I was in for a long and tiring push later that morning.

But first things first. Opening the smokebox, which I knew how to do thanks to my progress on Rob Roy, I dutifully swept the tubes, a little puff of soot emerging from each in turn. That done, I closed the smokebox and began to wipe and clean and polish the paintwork, brass and the copper, a satisfying job which I thoroughly enjoyed then - and still do, if I'm honest.

Bob and Cecil, having finished their preparations, came over to inspect my work.

"My, doesn't she look smart! I think we've found our new engineman" quipped Cecil. "Time to get her dirty again" he concluded. And then it dawned on me – why would we push something that can get there under its own steam? The excitement was to begin sooner than I had expected, I realised.

I watched carefully as Cecil filled the boiler and tender with water and turned the flywheel to check that the water pump was working as it should. "Always make sure you can get water into the boiler before doing anything else" he advised, wisely.

Next came the fire and, handing me an old biscuit tin, I was told to fill it with split wood from a nearby bucket. That done, Bob set his pipe aside, added a good splash of paraffin to the tin, and stirred the contents until all the wood was thoroughly soaked. "Now put all but one piece into the firebox, fill the bunker with coal from the bag over there, and let's see if we're ready" he said.

With most of the wood in the firebox, the bunker filled as requested and with my hands much dirtier than before, Bob and Cecil sat down on chairs beside the engine and invited me to do the same. "You're beginning to look like an engineman now, but before we light that fire, what have we forgotten?" asked Bob.

Looking at the engine, I sought to recall the much-thumbed chapter on 'Raising Steam and Driving' from my battered Rob Roy book and other articles on the care of small steam engines which I had enthusiastically read by that time.

"We need an auxiliary blower to create some draught" I began, tentatively.

Cecil nodded and smiled. "Anything else?"

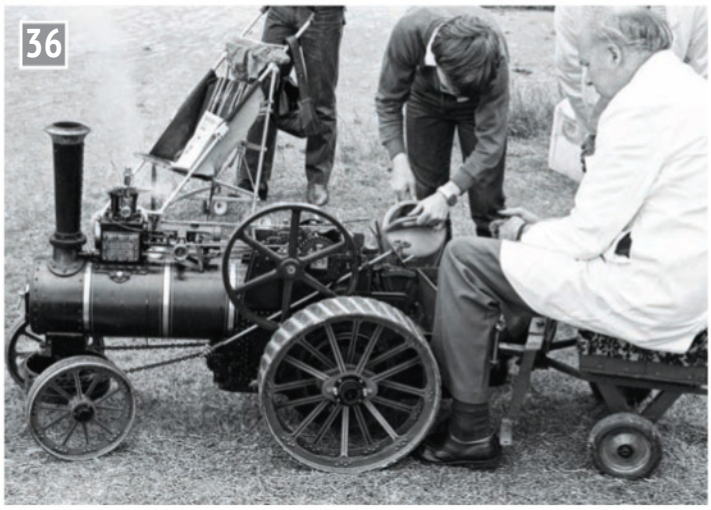
Thinking hard for a few moments, I remembered that the reversing lever should be placed in mid-gear, the regulator closed and the handbrake applied to prevent any unexpected movement as pressure was raised. "The other valves should be shut, too, and the draincocks opened" I added, "and we should fill the lubricator and oil the bearings" I concluded with a smile, now satisfied that I hadn't forgotten anything.

"Very good", said Bob. "And what else?"

My smile dropped. I was sure I had covered everything, so what was I overlooking? "I've tightened the smokebox door" I added weakly.

"Also good, but where's the air coming from to keep the fire alight?" encouraged Cecil.

And then it hit me. The ashpan on my little Rob Roy, like the other small engines which I had read about, had large and permanently open holes, always allowing plenty



1983, and the author refills the Allchin's tender on the day of his first drive.

of air to the fire. But the engine in front of me was much bigger and, looking more carefully, I spotted a feature which I had previously overlooked but would certainly present a problem if forgotten.

"We should open the damper" I replied, triumphantly.

"Right then. Let's get that lot done and light the fire" laughed Bob, refilling his pipe.

I had passed the first test, it seemed.

A smooth start

With the fire lit, pressure raised and the safety valve, pump and injector tested, the driving and passenger wagons were both coupled (the latter being loaded with the supplies for the day) and we were ready to go. Cecil sat on the driving seat and smoothly set the engine in motion while, walking alongside with Bob, I studiously watched what Cecil was doing along the way.

The journey to the fete was uneventful, Cecil drove carefully and the safety valves gently sizzled most of the way. By the time we arrived we had attracted a group of small children all eager for a ride.

As Bob organised the large and expanding queue, I hurriedly unloaded the supplies while Cecil oiled the engine, filled the firebox and called for water. Unbeknownst to me, as I was refilling the tender with the watering can, mum and dad arrived, memorialising the moment for posterity (**photo 36**).

And so, the real work began. Money taken, children loaded, three trips around, children unloaded, water filled, coal decanted, oil dispensed, repeat. With a system established, a continual stream of riders and

Cecil Woods pulls smoothly away with the next load of customers, making it look easy.

Bob Douglas, the engine's builder and the author's mentor, in characteristic pose at the Beacon School fete.

Bob keeping a close eye on the proceedings (**photo 37**), the next few hours passed quickly; I was certainly enjoying myself and Cecil, having total mastery of the engine, was keeping pace with demand (**photo 38**). Then, at two o'clock and prompted by an excited announcement over the public address system, our queue of riders rapidly dispersed to watch the jousting about to begin in the main field.

"Right then, I need a break. Your turn". Cecil rose from the driving seat; I assumed he was talking to Bob.

"Come on, let's see how you get on," said Bob.

And then it hit me: "Oh my goodness – they're talking to me. I'm about to drive a steam engine!"

I was suddenly very nervous. Sitting down on the driving trailer, everything appeared more complicated and intimidating than before.

"Don't worry" encouraged Cecil. "I've left you plenty of water in the boiler and a good fire. You've been watching what I've been doing, so open the regulator, not too much, push the reverser forward, and then open the regulator further as you move off."

Singlemindedness

Now that sounds easy, doesn't it? Those of you who have had the pleasure of driving a single-cylindered traction engine, however, surely know otherwise. Starting is not easy; far from it in fact – it takes practice and skill and at least three hands to move away reliably and smoothly and in the direction you intend.

Furthermore, and perhaps more contentiously, traction engines, like their equine predecessors, undoubtedly smell fear. Now you may scorn this statement, skeptical Reader, but you won't convince me otherwise because, in my experience, a traction engine, especially those of the single-cylindered breed, will always - and I mean always - take full and gleeful advantage of the timid operator. It's in their nature and it's their idea of fun. ≫

Be in no doubt, therefore, that the novice traction-engine driver, just like me, should abandon all hope of a smooth and trouble-free start. They are more likely to win the lottery! Here's how it goes:

Step One - the engine simply refuses to move. While the flywheel languidly rocks back and forth, it mocks all attempts to persuade it into sustained rotary motion. Never mind, worse is to come.

Step Two – with the novice having finally rotated the flywheel away from the dead-spots, the engine starts away, briefly. Unfortunately, the regulator isn't open quite far enough and before the driver can correct the mistake, forward progress ceases after one or two rotations of the flywheel.

Now, from the engine's perspective, it is important to understand that Step Two is simply an intermediate stage which ideally shouldn't be repeated twice in succession lest it become tedious. Hence the chances are good that the engine will now return to Step One, the lazy thing.

However, should the driver discern a faint but malicious chuckling coming from the engine at the conclusion of Step Two, then be warned, for she has decided the time is right to proceed to Step Three, her party piece.

Step Three – Having annoyed the driver with Step One and added a generous splash of frustration with Step Two, the engine has successfully lured the unwary novice into opening that regulator just a little bit further than is prudent. As the reverser is pushed forward, and just when the driver thinks they are once again at inanimate Step One, their neck twangs rearwards as the engine surges into motion like a bat out of hell.

The driver, hanging on for dear life and realising their mistake, desperately tries to correct the problem and shuts off steam. However, upon takeoff, the front wheels leap into the air, Evel Knievel style, causing the driver's hand to miss the regulator entirely or, worse, open it even further. Adding further to their woes, the driver discovers that you can't steer a traction engine when it's pulling a wheelie.

In extreme cases of Step Three, at this point the novice driver might scream. While this is understandable, and the engine will find it satisfying, screaming is not to be encouraged as it draws widespread attention to the driver's predicament and does not engender confidence from prospective customers. They, the cowards, will decide that an ice cream is a much safer prospect than a traction engine ride and depart *en-masse* for a soft-frozen comestible.

Anyhow, after riding the buckeroo for what seems like an hour, but is only a second or two in reality, the novice driver manages to close the regulator. With the crisis averted and Step Three concluded, the engine draws to a gentle halt, docile once again, and emits a happy sigh at a job well done. The driver, sweating profusely and probably shaking, will not sleep well that night. Mission accomplished, thinks the engine.

And so, except for the screaming, which I would never admit to even if I had, that is exactly how my first drive went. Bob and Cecil, knowing the ways of singles, had of course expected this and, over the rest of that day, patiently taught me some of the tricks of the trade. By the time the fete ended, while not elegant, I could at least reliably get things moving, control the speed, steer a course, and manage the fire and water, all with a basic level of competence.

Now, putting Step Three aside, I had of course thoroughly enjoyed the day and was hooked - steam engine driving was everything that I had hoped for. However, while the smells and sights and sounds were as expected, I had discovered that the job was far from easy and a lot of practice would be needed to attain the degree of proficiency that Cecil had repeatedly demonstrated and I wanted to achieve. And so, back at the carriage house, with the engine blown down and cleaned and having put the last of the supplies away, I tentatively asked Bob if I could help him again in the future.

"Well now," he replied. "Cecil and I were talking about that and we think that you would make a good stand-in driver given a bit more practice. How about we have another steam-up in the garden next weekend and iron out some of the kinks?"

I nodded enthusiastically.

"That's good," continued Bob. "Because while you were driving today, a teacher from your old primary school asked if we could take the engine to their fete in a fortnight but Cecil can't make it. Seeing how well you did today, we think that, with a bit of practice, you and I can probably manage on our own by then. What do you think?"

Overjoyed, my head nodding furiously, I promised to do the best I could.

And so, two weeks later, after preparing the engine as previously instructed, we proudly drove her the short distance to Saint Mary's school, me in the driving seat and Bob walking alongside, and spent the afternoon happily giving rides to children only a few years my junior (**photo 39**), the first of many such occasions to come. By the end of that day,

Saint Mary's School, two weeks after his first drive, and the author takes the reins under Bob's close supervision.

with the engine disposed and everything returned to its proper place in the carriage house, I felt that I was beginning to get the hang of driving and firing. I thanked Bob as usual, again grateful for his kindness and generosity, and coasted down Crowborough Hill to home.

On the way, something occurred to me which I had forgotten in the day's excitement – today was the start of the school summer holiday! With six straight weeks of workshop time before me, and barring major disasters, I might be able to light a fire in my own Rob Roy before the holiday was over.

I smiled at the thought, optimistically.

Postscript to Part 7

Now, lest I be accused of scaremongering and alarmism and the spreading of disrepute, let me state for the record that I have applied an element of exaggeration and artistic license in my description of Step Three. In reality, while the phenomenon exists, it isn't nearly as bad as I've made it out. Honest.

You see, traction engines, even single-cylindered ones, are wiser than I give them credit for. They know that, if they were to scare off all the new drivers, then sooner or later there would be no-one left to drive them. Then they'd spend the remainder of their lives beneath a dusty tarpaulin in a cold and dank corner of the workshop, which wouldn't be much fun, and eventually, as a species, they would decline and disappear. In short, tractions engines have heard of Darwin too; they have no intention of falling into that trap.

Which is why, today, there are more miniature traction engines and more miniature-traction-engine drivers, than ever before. For, while every single-cylindered traction engine has its rightful moment of novice baiting and three-step fun, they always take the long-term view and never push things too far - just far enough to implant in us a strong desire to master their driving and to build more of them. Cunning, aren't they?

And that is why, three decades after last driving Bob's wonderful engine and delivering her to a new owner on his behalf, I tried unsuccessfully to locate her whereabouts with a view to purchase. Happily, in the process, I discovered another very similar and exceptionally well-built engine which now sits proudly in my own workshop between outings. To my amusement, and in the spirit of the breed, this successor intuitively delivers those same three steps to every new driver who sits behind her, giving me the opportunity to reminisce and demonstrate some of the tricks of the trade to today's novices (**photo 40**).

In 2020, the author drives another Allchin nearly four decades later (Photo credit: Emma Goodbody).

And so, if you, unlucky Reader, haven't yet driven a single-cylindered traction engine then you should, for you will enjoy it. Furthermore, having been forewarned of the Three Step Plan, you now have an advantage over every novice before you, which should be of some comfort.

But it won't do you any good; you'll still get caught by Step Three.

For everyone is.

●To be continued.

The train.

Gerald Martyn shares his experiences of building 5 inch gauge wagons for the LSWR.

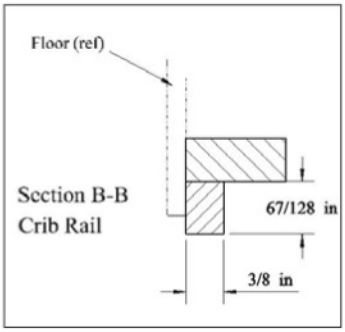
PART 4

Building some LSWR Wagons

Continued from p.143
M.E. 4708, 13 January 2023

CORRECTION

In Part 3, figure 2 (M.E.4708, January 13th) the floor is shown in the wrong position. The correct sketch is shown below.



Ironing

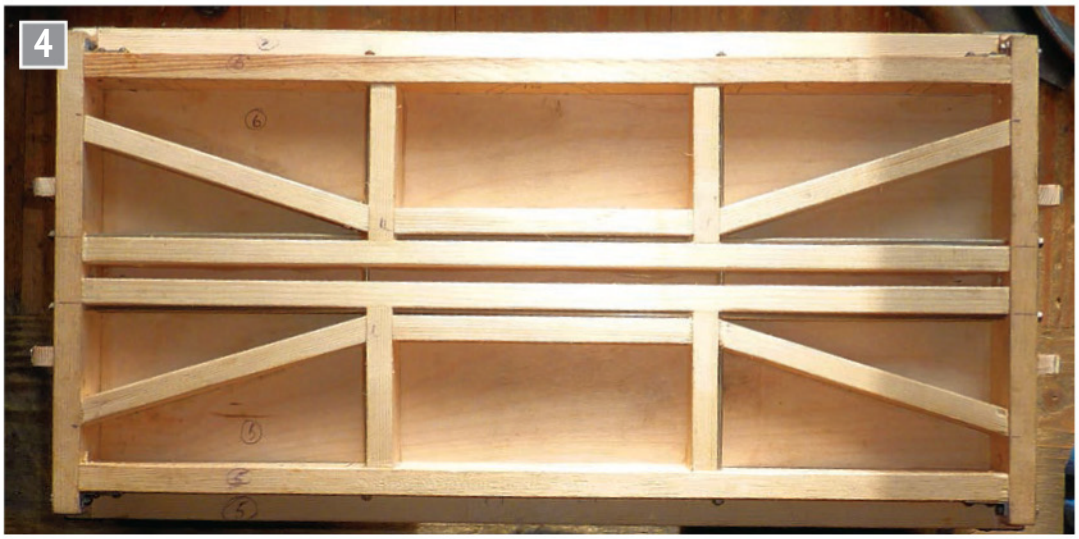
Time for some ironing. Floor planks were cut and ironed on, on the top side only as the underside is normally invisible so they would serve little purpose. The planks run crosswise and are ⅝ inch wide. I found it best to start from the centre and work outwards equally so as to achieve a symmetrical lay with (if necessary) equal odd-size planks each end to finish. The floor bowed a bit but this was easily corrected by ironing all-over to soften the glue then weighting down to slightly oppose the bowing, until cool. A couple of goes were needed to get things just right.

To get ready for gluing, the positions of the beams and buffer beams were marked on the underside of the floor. The inside edge of the side beams defines the axlebox position so were marked-on, and the outside edge of the centre beams relates to the tie bars so was also marked on. The floor is smaller than the wagon so the buffer beam positions were marked using that handy planked tool as a guide. The bits were simply glued together using PVA and weighted down onto a flat surface to dry. This was done in two stages, longitudinals first then the buffer beams. While that lot set the crib rails were made to size, protruding beyond the floor edge by one handy tool thickness. This item buts against the side beams (on my model, there is often a gap on the full size for fittings etc.). Rebates had to be made to allow the brake-hanger to be slid in on one side of the wagon between the crib rail and side beam. With the crib rails held in place holes were back-marked using a drill point through the beams for the W-iron master holes, and the brake vee-hanger holes on the side with the rebates, and the holes drilled. The crib rails were then glued in position, and when dried then a drill was put back through the crib rail holes into the side beams to clean them through. The cross-beams were also be made and glued-in.

Now some metal bits. There are four lengthwise tie-bars and two crosswise, made from 3/32 inch round steel bar with 7BA threads. It's best to buy bar as long as possible as short pieces, say our normal 2ft lengths, result in a lot of wastage of bits too short to use. I made the metal plates which reinforce the buffer beams around the draw-hook out of 22 SWG (0.7mm) mild steel, first checking that the tie bars that go through them will just clear the longitudinal beams. Then I used the plates as templates to drill the holes for the tie bars. What about the cross beams, shouldn't we have drilled them before fixing? Well, probably yes, but I made a little guide tool to fit into the corner from a scrap piece of steel and drilled them from each end using a piece of 3/32 inch tie bar with a diamond-shape drill point filed on. This is done by just filing flats to make a screwdriver type end then making it a bit pointy at about 120 degrees included angle and add a bit of a relief angle behind the cutting edge. There's no need to harden it in any way as it's just for use on wood. I've used extra-long drills of this type to 'back drill' gunmetal cylinder castings through assembled frames to ensure hole alignment. Just remember to back the drill out to clear the chips frequently because they've no other way out. Similarly, the holes for the crosswise tie-bars were drilled and the bars fitted. When all the holes were done then the 'drill' was upcycled (as they say these days) to make a tie-bar.

With the plates are fitted it was hard to resist filing the draw hook holes out to rectangular in the woodwork (with a square needle file) and trying the hooks. The diagonal under-floor beams and short longitudinals were now made and fitted. On the full-size these backed-up the buffers and also provided resistance to lozenging. The floor was made of planks and if these slide against each other than the whole floor can end-up as a parallelogram shape. The diagonals prevent this; triangles make good structure. On the model, with a continuous plywood floor then they serve no useful purpose and can easily be left out to save a bit of work. **Photograph 4** shows all the beams and tie bars in place, and **photo 5** the marked-out position for a W-iron.

Back to the ironing table. Side and end pieces were cut from plywood and planks applied to both sides. Note that the sides overlap the ends, not the other way around. With the fixed pieces glued in place the door panels could be tested for fit, which should be nice and free and not at all tight. The vertical beams reinforcing the ends are the last things to add. That's the woodwork more or less complete. **Photograph 6** shows a wagon at a slightly later stage with the metal corner angles fitted.



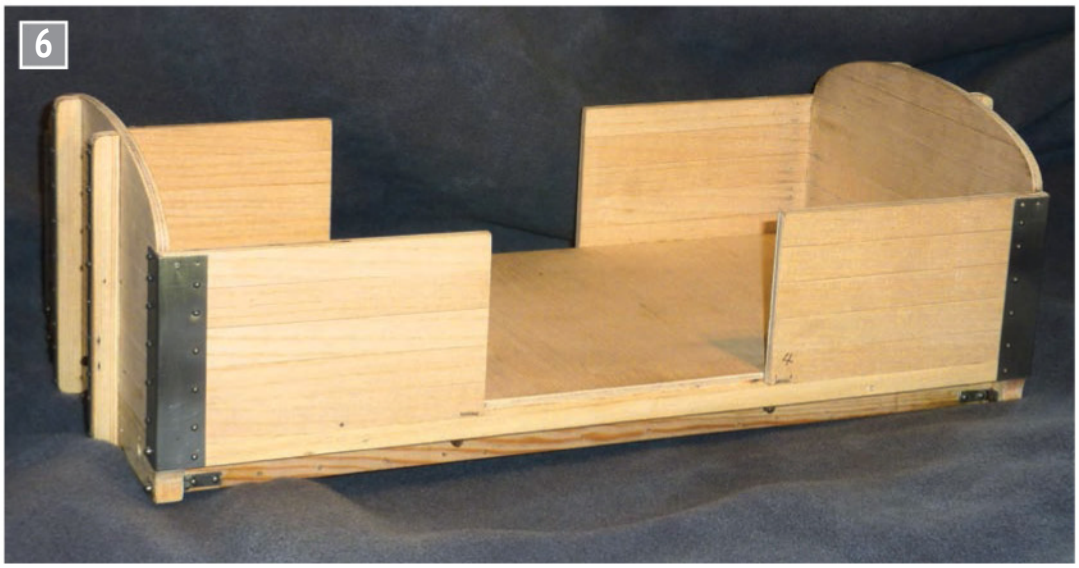
Underside beams.

Starting the metalwork

It's best not to fit the W-irons until fitting the axleboxes much later in the build as the wagon is much easier to handle without these sharp metal bits sticking out. The strengthening straps and fittings, hinges and latches and other metal bits at frame level and above are best made and fitted first, in my view, notwithstanding the urge to get the wheels fitted and rolling. The sheet metal bits around the sides and ends were made mostly from 22 SWG (0.7mm) mild steel. I see you can buy these bits in sets but whether they would be right for, or fit this wagon or yours is another matter. Making them is not difficult, and why are we building this thing anyway rather than buying it finished? Now the mild steel I bought for this job was rather lacking in some ingredient or other, probably carbon. It was very soft and showed no sign of work hardening. Ideal for what we want, actually, but if you tried to sell this stuff to our bronze-age ancestors they'd wonder what all the hype was about. All the bends to make these bits and pieces were done without any heating at all and no cracks were seen even on very tight bends.

W-iron position marking.

I have very little in the way of sheet metalwork tools. A bench shear and cheap set of rolls is about it. To hold sheet metal in the vice I use some pieces of mild steel angle and toolmakers clamps to form a jaws extension. For folding I use the angles, a block of metal (whatever is nearest) and a hammer. To cut the strip for the various straps I don't use the shear (or any shearing process) because it curls and twists. My method is to lay the sheet flat over the edge of the bench and clamp it down with one of those angles, and hacksaw to a line with the saw at a shallow angle to the metal (**photo 7**). If necessary, ≫



Woodwork finished.

a thicker sheet underneath gives support beyond the bench to near the cut. It's easy to control the cut this way and the teeth don't snag the narrow sheet (this seems to be a general rule for hacksawing - shallow angle = easy control, straight across cuts quicker but is liable to snag, wander or worse). A quick session with a file (clamp with those angles again) cleans the cut-edges. Spot-on accuracy is not required for these parts, though I try not to get too careless. I'll not try and describe how to make every part, just hints and tips as appropriate.

We'll start with the corner reinforcing angles. These are just folded from 22 SWG (0.7mm) sheet. A piece cut to height and slightly wider than needed was first folded (angles, blocks and hammer). Then the leg lengths were marked out and trimmed to the lines. Unlike when cutting strips to use, this is where the bench shear works well because the bit you cut off is waste anyway and the bit you want stays reasonably flat on the anvil side of the shear. The job takes just seconds. Holes were marked out, checked they were in the right place near the centre of the planks, centre-popped and drilled, and all edges and burrs cleaned-up. The bottom holes are 8BA clearance because the bolts here will be round-head ones simply tapped into the wood to match the ones below which actually have nuts on the back. Have you noticed that for 8BA clearance you can use a 6BA tapping drill? Because BA sizes are in geometric progression there are other sizes where this shift occurs. Then there's the ones that match Imperial sizes anyway, like 7BA = 3/32 inch and 2.5mm is a good clearance size. I don't have any specific clearance drills and just use what's to hand. Another advantage of a properly thought-out 'Imperial' system perhaps? The next parts are the diagonal side straps, which do a similar job on the sides as the diagonal under floor beams by stopping lozenging. These are made from straight strips bent edgewise to form and this is where the soft steel helps. It will try to escape sideways by buckling at the bend but can be restrained by nipping gently with pliers whilst tapping the strip round with a hammer and just bashing it flat again when it becomes uncontrollable (**photo 8**). The first one was marked out and drilled and checked for fit (the positioning and alignment of the top two holes with those in the corner angles needed care) and then used as a template to help make all the others.

Perhaps now is the time to talk nuts, bolts, and rivets. Round-head bolts were used almost exclusively on these full-size wagons, with hexagon nuts. On the model the metalwork such as W-irons and buffers are held in place by 8BA round-head bolts and 8BA studs. Smaller metal parts were fixed mostly using 1/16 and 5/64 inch soft iron rivets knocked into undersize holes and sometimes with a little Araldite adhesive to strengthen the grip. Some of the 8BA bolts need to be rather long, and plain round heads are unobtainable in the size required. For the fairly long ones I bought a quantity of one inch long 8BA standard hex screws. I made a form tool by touching a piece of HSS on the corner of the grinding wheel, then grinding clearance and top rake etc in the normal way. A piece of brass bar drilled 8BA tight clearance and split using a piercing saw formed a collet to hold the screws in the lathe chuck whilst reducing the hex heads to round. This worked so well I was soon turning them out at better than one a minute. After years of using purchased carbide-tip tools this little job refreshed my knowledge of how really good a sharp HSS tool can be.

The extra-long bolts which pass right through both the crib-rail and side beams were made from studding with nuts Loctited (603) on then turned 'round' as above. Shorter studs are made from 8BA bolts with the heads cut off because - have you noticed - this is miles cheaper per inch than studding. The studs can simply be screwed into wood drilled tapping size, using a power driver for speed (a box spanner in the chuck and double nuts to make the drive, or use the bolt head and cut-off after). This gives reasonable holding power but for extra strength then, again, a bit of araldite may be worked into the hole first. Incidentally, I generally buy the longest fasteners available. They don't cost much more than the short ones and can easily be cut-down. I find that whatever length I buy is never 'just right' so needs some adjustment and it's rather easier to make them shorter than it is longer.

●To be continued.

Hacksawing sheet.

Bending a diagonal strap.

CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.

I bought myself a stick in the summer, a walking stick, which I find more useful than I expected. I can poke errant youths in the kidneys, close doors remotely, i.e. which would otherwise be out of reach, and indicate directions. So useful was it that I have named it *Meg*. (Why? - Because it's me stick…)

I also bought a kit of 'Leonardo da Vinci's' flying pendulum clock. The detailed, working mechanism dates only from the 1880s but Leonardo di Caprio had a similar idea centuries before. It looks most interesting, and was easy to assemble. It is however tricky to get running, being dependent upon the length of the pendulum and the relative heights of the swinging arm and stationary posts. It is also sensitive to the amount of weight in the basket. A full drinks can is too heavy, an engineers' clamp too light. I have some 'liquid lead', for adding weight to model railway engines, so I'll try that. Floor protectors for the legs reduce the skidding about and a weight on a bracket holds down the opposite side, to prevent overbalancing.

In this issue: a *Leader*, an annual newsletter, excuses, a live steam auction, a fun guy grass cutter, Latin? Arabic? More 'leaves on the line' and another sort of pantograph.

The **Gauge 1 Model Railway Association's** *Newsletter & Journal,* December, 75th Anniversary issue, Part II, (cont'd from M.E.4709) has several other notable pictures, and the usual good mix of practical and descriptive articles - John Dixon's LBSC brake van (**photo 1**), replica Model 'T' railcar at Pleasant Point Railway, NZ (**photo 2**) and Tony Armstrong's 'Queen Mary's' articulated teak coaches (**photo 3**). David Viewing describes how James Carson produced a range of flash-steam boilered locomotives in the early 20th century. His Carson, flash-boilered, 1911 live steam 4-6-0 *Experiment* is seen here after its first, modern, good run (**photo 4**). Otherwise, Stuart Hithersay

LBSC brake van (photo courtesy of John Dixon).

Model T in New Zealand (photo courtesy of Richard Donovan).

'Queen Mary's' articulated train (photo courtesy of Tony Armstrong).

covers the 75th celebrations, with photographs and different guests and contributors giving their opinions on the show. Alan Beasley builds a model *Leader*, Richard Donovan describes the replica 'Model T' at NZ's Pleasant Point Railway, Paul East explains the workings of the Fell locomotive, whilst Rob Kuhlman builds a Ruston 88DS kit. Jonathan Taylor, not finding any suitable vehicles from the usual G1 suppliers, adapted a kit or kits to produce a German armoured train. Peter Micenko produced a jig for setting coupler height and Derek Pollard and Chris Tolhurst gave an Aster 'Thunderbolt' a makeover. Apologies to those who were not mentioned - in a publication this size, I can't include every interesting article or picture. Keep the Faith!
W. www.g1mra.com

The Link, January-December, from **Ottawa Valley Live Steamers and Model Engineers**, is not mistitled; one magazine covers the whole of 2022. It brings us up to date regarding committee meetings and the AGM. David Hayman continues the story of his 0-6-0 switcher. Graham Copley discusses the Ottawa light rail system enquiry, concluding that most of those with strong views seem to know nothing about rail or tramways, some of which cost millions which would have been better spent on the light rail project. He then writes the track review, reckoning that the society had a good year. Young James Miller learned to drive an electric 0-6-0 locomotive after two minutes of instruction from Graham, then exerted his authority by having him thrown off the train… and on page 20, a red fox visited the site, and ignored the activity completely.
W. www.ovlsme.com

Stockholes Farm Miniature Railway has Ivan Smith proclaiming that the railway has got through another year unscathed. Jordan has modified his regulator handle on the Q1, so he needed to steam it in order to test it. Of course, Jordan, we believe you… Then it was Ivan's turn - having located a supply of his favourite coal, he had to test it by steaming *Duchess of Athol*. Yes, Ivan, we believe you… He and Barbara visited the Midlands MEX, concluding with the usual glowing reports.

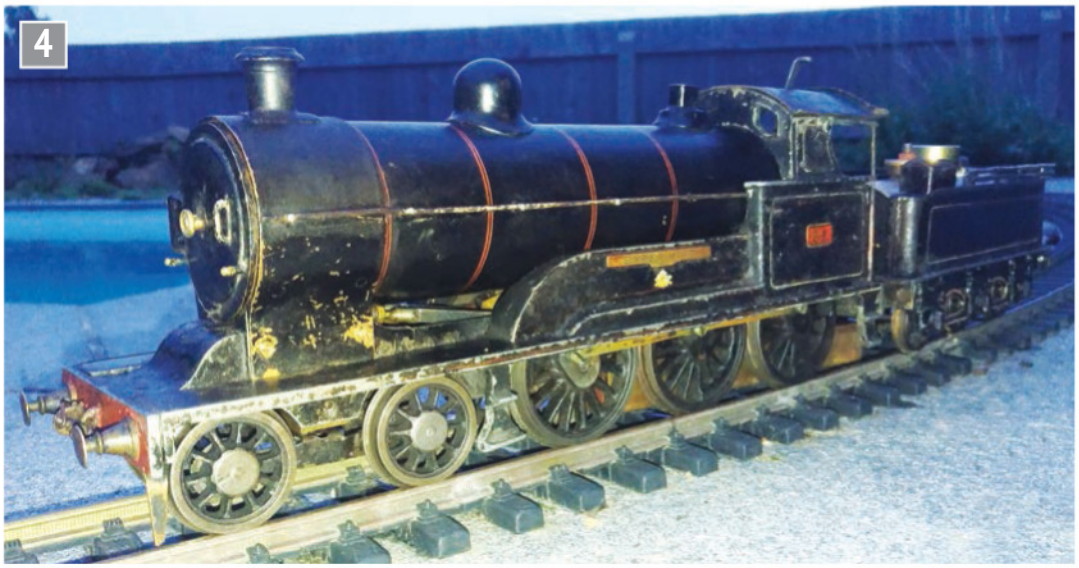
The January 5th Sheffield Auction Gallery model railway event offered a few live steam locomotives amongst the 'OO' stuff piled high. These were a Bing 0-4-0, a Märklin, an unfinished GWR King (£3-5000), a G1 (kit built?) 4-4-0, a 3½ inch gauge, a live steam 0-4-0 thought to be a 'Juliette', a 5 inch gauge rolling chassis, a Beck live steam locomotive, another (kit built?) Beck live steam, all 'O' gauge, and a 2½ inch gauge 4-6-0 rolling chassis.

Inside Motion, December, from **Tyneside Society of Model & Experimental Engineers** begins with Adrian Morley deciding that one of the finer moments of grass cutting is the spotting of mushrooms/toadstools. (There is no distinction in biological terms.) So far, he has spotted six areas around the track where they have been found. None of those discovered are edible. (Or, as Terry Pratchett said, all mushrooms are edible - once!) Dave Henderson would have liked to drive a steam locomotive, not on BR, but the R&ER. However, driver progression was as it is in the big railway. Gaining his 70th year, he tentatively asked a friend who volunteers at the South Tynedale Rly if he could get onto the footplate of one of theirs. Beginning in the workshop, he was quizzed on his abilities and put to work chopping the chimney (with an angle grinder…!) of Harrogate Gasworks *Barber*, about which, see numerous heated arguments in *Steam Railway* (other magazines are available). Ian Spencer joined TSMEE in 1961, when he was 15, and documents the activities at the time, and since.
W. www.tsmee.co.uk

Bournemouth & District Society of Model Engineers, *News*, December, has John Hoyle explaining how he caught the steam bug, Stephen Robson visited Pecorama and Chris Bracey visited the Watford Miniature Railway.
W. www.littledownrailway.org.uk

Chichester & District Society of Model Engineers also celebrate their 75th Anniversary. The *Newsletter* for November (slogan – *Perfectio in Parvo* – 'perfection in miniature')* asks us all to note that the festivities will be on June 24/25th 2023. Brendan Gill describes the Society's dynamometer car and how the magic pixies inside keep it going. A video on YouTube from the NRM shows it too (without the pixies… youtu.be/6x3TGPeImOc). Researching the subject, Brendan found that Power = Force times Velocity, and thought, 'We can do that!' What used to cost a lot to produce is now possible for under £100. A strain gauge and a rotary encoder plus a £6 Arduino, and some bits complete the ingredients. The encoder is driven from an axle and produces speed-proportionate pulses and which way it is turning. A bogie on which to mount this masterpiece would cost £200, so an existing coach bogie was modified. Watch this space!
W. www.cdsme.co.uk

Bristol Society of Model & Experimental Engineers' *The Bristol Model Engineer* opens with Santa on 'Treindeer' printed on the front page. This left your genuine 'Tyke' CN editor somewhat at a loss, Bristol being some way from Yorkshire. All became clear, or at least translucent, on finding a note within explaining that the bell on Santa's blue locomotive (not 'that' one!) came from Mangotsfield station and dates from 1845. Don't ask how he acquired it… Work is ongoing to produce a dynamometer car for IMLEC. Charles Baxter writes on the Wilton windmill, dating from 1821, and rescued from dereliction by the County Council. Restored at a cost of £25,000, it is being maintained in original condition and still works on occasion. (At the top of this 'street where I live….' is Windmill Lane and the mill, which was said to



Flash-boilered Experiment, of 1911 (photo courtesy of David Viewing).

be visible from most parts of Sheffield and appears in a few local pictures, it was built in about 1830 but I can find no evidence of when it was removed. Sheffield Libraries Local History department suggests it was removed before 1880, when photography became widespread.) Editor, Richard Lunn made two lamps from kits, for his 4 inch scale traction engine. (Geoff, he say, "Let there be light, and there was light, and you could see for ---- miles!") Chris Musty's 7¼ inch gauge BR Standard tank has been reboilered after a delay of 20 years and its first run was highly successful, so we look forward to its frequent use in years to come. David Giles writes on a new tether car track at Buckminster, but which is not quite flat enough, some cars flipping over and being damaged. He decided to build a car from the post-war years which could cope with the less sophisticated track of that time. It can achieve 75 mph and is big and loud, so is very popular… In 'The Tale of the Lost Mushroom' Richard Lunn also describes the CAD/3D manufacture of a part missing from a unique wooden puzzle of some vintage, with complete success.

Ralph's 'The Wonder Engine' (photo courtesy of Ralph Brades).

W. www.bristolmodelengineers.co.uk

Southampton Society of Model Engineers', December *Newsletter*, also has a Latin motto - *Pro Diligenti Palma* - which, according to Google Translate, means 'for the diligent, the palm'*.

A visit to Eastleigh Works was enjoyed by all but photography was not allowed as some of their work is of a sensitive nature. More 'leaves on the line' as a fallen tree obstructed the track, but was soon dealt with by Colin and Graham. As an aside, I found the appearance of the *Newsletter* interesting and unusual, with sections in text boxes and good use of colour.
W. www.southamptonsme.org

Malcolm High, editor of the **Gauge 1 MRA Yorkshire Group**, says his first newsletter as editor was well received, so he intends to enlarge it a little more by including dates for other events of a like nature, such as the 16mm AGM, Peterborough, the Sheffield Open Days, Gauge 1 North at Bakewell and the Elsecar 16mm show, which has been moved to Barrow Hill Roundhouse on this occasion as the Heritage Centre will be receiving a refit at that time.
W. www.g1north.org.uk

The *Gauge 3 Newsletter*, winter, from **The Gauge 3 Society**, again gladdens my heart, beginning with John Taylor, who produced frames and rods from a pantograph engraving machine, used in industry for die sinking before computer controlled milling machines were introduced. Mike Palmer suggests that suitable facilities should be set aside where members can make their own running engine. This may cost £5/600 and would not involve the use of power tools, but using laser cut parts. Ralph Brades informs us about the Wonder Engine, LMS 10800, built by Metropolitan Vickers in Manchester. It was a disaster. (Don't be shy, Ralph, tell us what you really think - Geoff) So far, he has built two (**photo 5**). Roger Marsh made this fine Cowan Sheldon crane (**photo 6**) and Dick Allan made a Crampton and period train, now owned by David White (in the next issue).
W. www.gauge3.org.uk

And finally, what do you get if you eat all the Christmas decorations? Tinsillitis! (Thank you, Bournemouth!)

* Doubt has been cast on the accuracy of Google Translate, as my request for a translation of the Arabic on the side of a wagon by the M1 (M.E.4706, 16th December 2022) was answered by Mike Joseph whose partner said it means, approximately, 'Prayer to Prophet Muhammed and to the people who follow him'.

Cowan Sheldon crane (photo courtesy of Roger Marsh).

CONTACT

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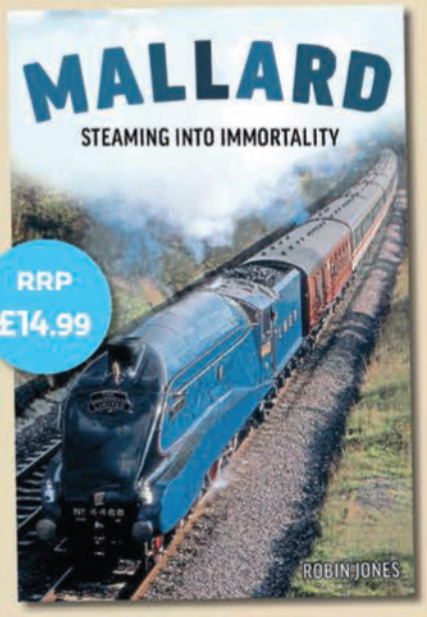

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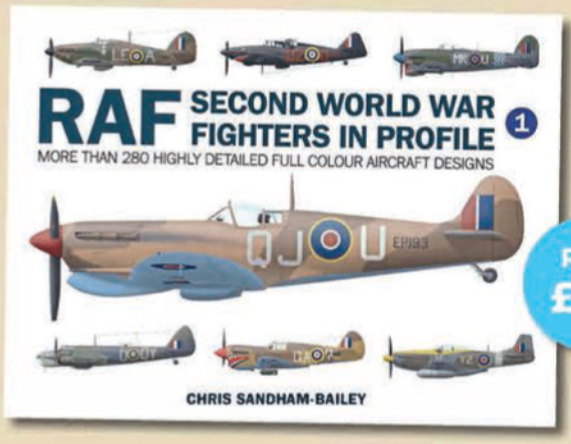

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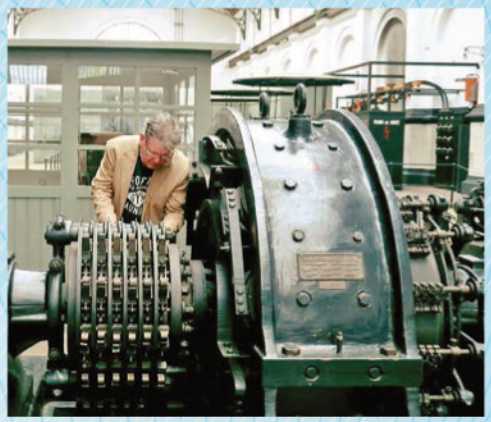

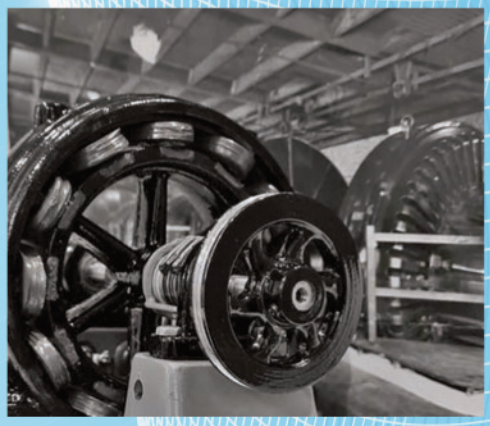

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