THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 228 No. 4680 • 17 - 30 December 2021

MODEL ENGINEER

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COVER FEATURE

Pride of Edwin

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We Visit Rugby

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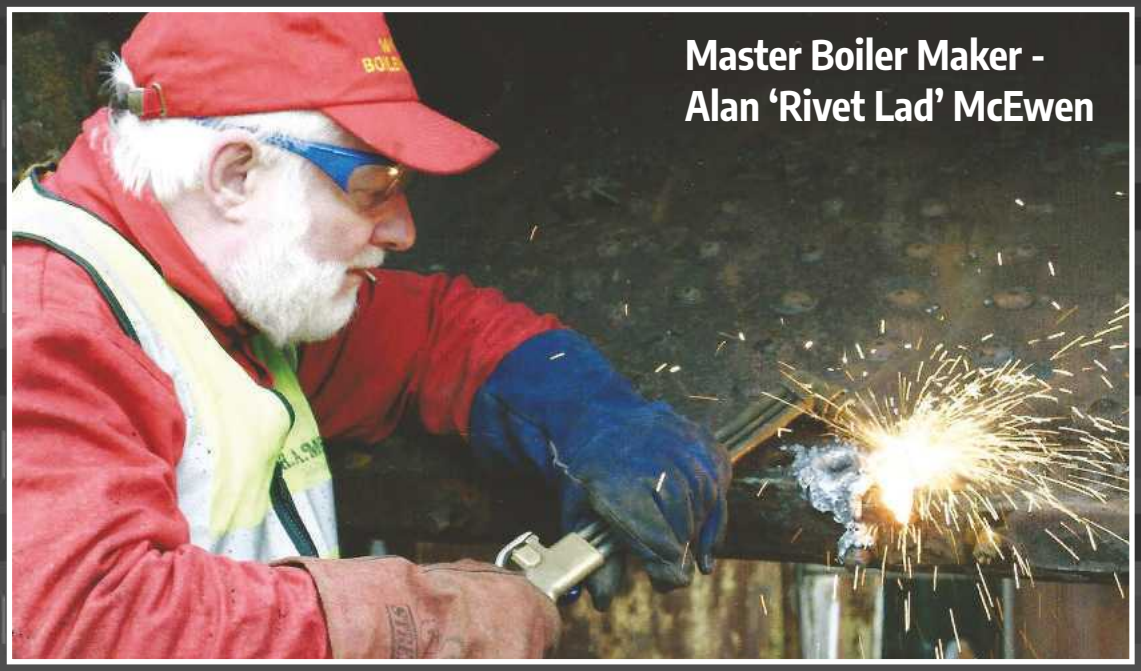
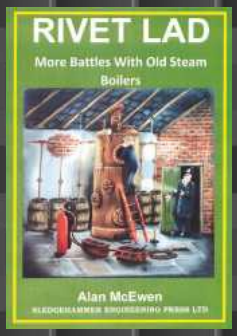
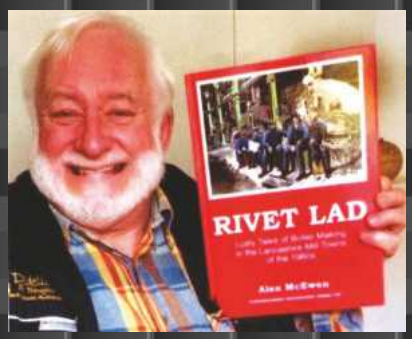
Bringing British industrial history to life



Master Boiler Maker -
Alan 'Rivet Lad' McEwen





When Master Boiler Maker and author, Alan McEwen was a young sprog, he loved banging and hammering on rusty old boilers; now that he is an old hog, he just prefers others to bang and hammer!
Alan McEwen's Boiler Making adventures and also 'potted histories' of several Lancashire and Yorkshire Boiler Making firms, can be read in RIVET LAD - *Lusty Tales of Boiler Making in the Lancashire Mill Towns of the 1960s.* The book is crammed with 'hands on' technical information of how Lancashire, Locomotive, Economic, and Cochran Vertical boilers were repaired over 50 years ago. The book's larger-than-life characters, the hard as nails, ale-supping, chain-smoking Boiler Makers: Carrot Crampthorn, Reuben 'Iron Man' Ramsbottom, Teddy Tulip, genial Irishman Paddy O'Boyle, and not least Alan himself, are, to a man, throw-backs to times gone by when British industry was the envy of the world.

Alan McEwen's first RIVET LAD book: *RIVET LAD – Lusty Tales of Boiler Making in the Lancashire Mill Towns of the Sixties* published September 2017 is now priced at £25 plus £3.00 postage and packing to UK addresses.

Alan's second RIVET LAD book: *RIVET LAD – More Battles With Old Steam Boilers* was published in September 2018. **Now priced** at £25 including postage and packing to UK addresses.

BOOK BUNDLE SPECIAL OFFER

Both RIVET LAD books can be purchased together for £40 plus £5 postage and packing to UK addresses.
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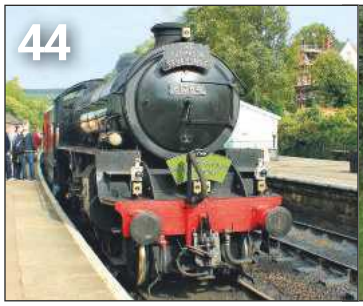

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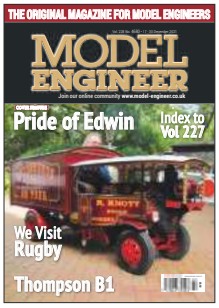

ON THE COVER...

Richard Knott is in control of his 4½ inch Foden Showman's steam lorry. (photo: Paul Ritchie).

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Merry Christmas

All of us at *Model Engineer* would like to wish everyone a very Merry Christmas – or at least as merry a Christmas as the 'powers that be' and the Omicron variant of the coronavirus will permit. My own view is that the pandemic will before very long be little more than a bad memory although we shall probably have to live with this virus for a long time, although chiefly as a seasonal nuisance, like 'flu, rather than a lethal disease. In this spirit of optimism, I am looking forward to a brighter 2022, with a return of our exhibitions, all of the usual events and a return to full programmes of events for all of our model engineering clubs and societies.

This is a good opportunity for me to urge club secretaries – again! – to let me have their programmes of events for next year so that we can reinstate the Club Diary. What better way to signal a return to normality, at least in the model engineering world?

Bradford Cup

The existing trophies and awards presented at the Model Engineering Exhibition at Doncaster are awarded for the excellence of actually making models. However, there is little acknowledgement of the creative side of producing designs and writing them up for the enjoyment and benefit of others to make models or use the advice and writings of authors in the hobby. Therefore, it has been proposed by the committee of Bradford Model Engineering Society that they donate a trophy to the Society of Model and Experimental Engineers so that the efforts of authors in writing their articles for the *Model Engineer* magazine are recognised and rewarded.
It is obvious that the hobby of model engineering, and the magazines supporting it, would simply not exist without the authors spending their time creating the articles, so this award is to recognise that talent.

The organisers invite nominations for the award of the trophy, to be submitted to the editor of *Model Engineer* by the end of January 2022, and should relate to articles published during the year 2021. Submissions should include the following:

The author's name;
The title of the article;
The issue number in which it starts;
Contact details for the person nominating the article.

You may not, of course, nominate your own work!

The full rules of the competition will be published in the next issue.

All the above of course is dependent on the Model Engineering Exhibition being held. It would normally be expected to run in May 2022 but there is currently a degree of uncertainty, because of covid, as to whether this will happen. We will of course let you know as soon as we know.

An Editor's Day Out

Jeremy Dunn with Black Five 45163.

I live not far from the Colne Valley Railway, near Sible Hedingham in Essex. Just before sitting down to write this I was privileged to spend a morning there to witness progress on a Black Five locomotive being restored by a team led by Jeremy Dunn.

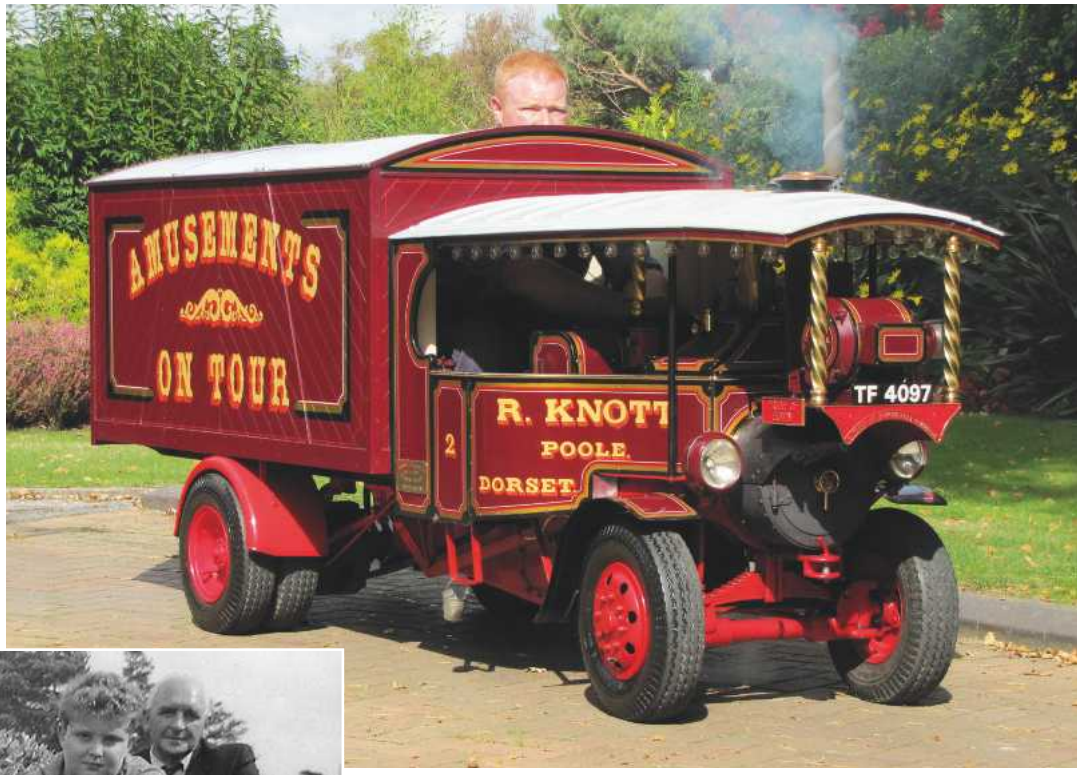
The locomotive was bought from the Barry scrapyard and work started 30 years ago. The frames required a lot of work, including welding in new metal at the front end, extensive repairs to the saddle and new drag boxes. A new smokebox has been made and the boiler awaits retubing and some (fortunately) minor repairs to the firebox. The axleboxes are about to be remetalled and it is hoped that the locomotive will be back on its wheels in the summer. While I was there a new cab was under construction and the slide bars were being aligned in the traditional way with a length of piano wire stretched from cylinder to axle centre.

I had no idea this was going on so near to where I live. Now that I do know, Jeremy and his team will have to tolerate further visits from time to time!

Terence Holland

It is with great regret that I have to report the death of Terence Holland. Terry died on November 17th after a fairly short illness. He was a regular contributor to *Model Engineer*, most recently with his series on the Barclay well tanks, which remains unfinished. Established readers of *Model Engineer* will remember his series on making injectors and boiler making and, notably, his articles revisiting LBSC's steam calliope.

Paul Ritchie makes the acquaintance of a Foden steam lorry built for speed.



The unique Foden canopy curvature.

Richard aged 12 driving his beloved Maisie.

Pride of Edwin

When people say to Richard Knott that they have a 4½ inch Foden, his cheeky reply is always to say "Not like mine you haven't!".

For Richard is the proud owner, of amongst many other things, a rather fine 'bespoke' 4½ inch Showman's Foden, built neither from John Rex castings nor the now very popular Steam Traction World kits. It was in built by prolific model engineer Ian Tressler at his home in Hampshire with only the water pump being sourced 'off the shelf' (in fact from John Rex) and everything else being made by Ian.

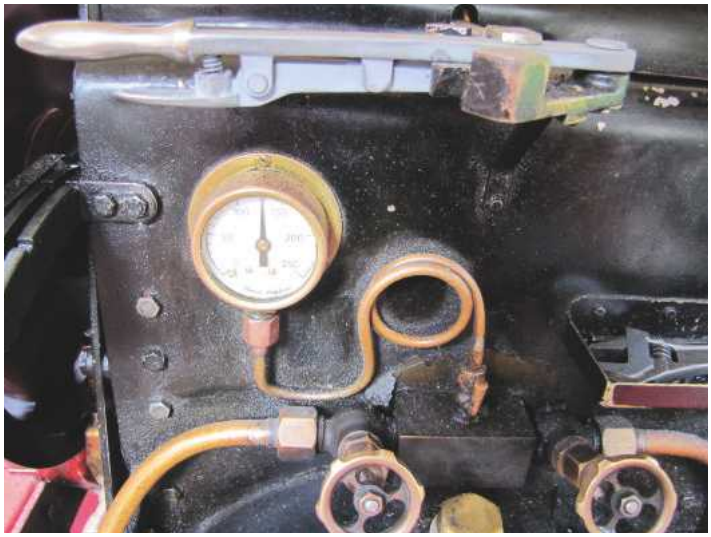
The engine was one of six built from some suitable metal that was found to be sufficient to make six 4½ inch scale boilers for a Foden wagon. In fact, only five of these ever got built and the whereabouts of the other four is not currently known (perhaps *Model Engineer* readers can help out with this question?), although there was a rally at Breamore House near Fordingbridge many years ago that saw three of them brought together. Each one was built by a different engineer and Ian personalised his build by the unique registration he gave it, TF4097. The 'T' stands for Tressler, the 'F' for 'Foden', the '40' for the age he was when he completed the build and finally the '97' for 1997, the year of completion. The engine is of course road registered and carriers a valid DVLC registration number.

This one was the only one built as a Showman's (the others included a drop back lift and tilt, and at least two flatbeds) and took Ian six years to complete. For work, Ian was a retained fireman at Overton fire station and after a day's work, and having had his tea, he would retire to his garage and work into the evening on his model engineering. Ian in fact retired from the Hampshire Fire and Rescue service in March 2016 having completed over 40 years in the service.

Richard Knott's heritage, and interest in transport and travel, owes much to his late father, Bill Knott, who was the renowned individual that started the Bluebird caravan business, building as many as 350 caravans a week from their Parkstone works in Dorset, at the time the world's largest caravan works. Bill was very much a 'hands-on' engineer ≫

The tube expander made overnight to allow Richard to continue to steam up.

The silencer baffle is visible inside the smokebox above the tubes.



The regulator and drop-down spring setting to utilise the high pressure.

Richard Knott at the controls of Pride of Edwin *passing the entrance to the Luscombe Valley Railway.*

and entrepreneur bringing the joys of caravanning holidaying to post war Britain.

Bill's personal interest in transport was predominantly cars, and he had a fine collection of no fewer than seven classic cars, but his interests rubbed off on Richard and he gave his young son a 3½ inch gauge *Maisie* steam locomotive – which he loved! British Pathé films featured Bill in their 1958 'Caravan Man' colour pictorial film roll, including his impressive car collection – which is well worth a look at.

Richard would take his *Maisie* and give rides to the public at the track of the Bournemouth club at Kinson, now buried under tennis courts. Since 1988 Richard has become the proprietor of the Luscombe Valley Railway – a private 5 inch gauge railway at his home in Poole, Dorset, which in 'non-coronavirus' times he opens to the public for public running days to raise money for his favoured charities. His collection also features amongst other items a full size 1907 Stanley Model R steam car called *Alice*, restored by his great friend the late Steve Baldock of Steam Traction World, a Lykamobile, a steam launch, and a 4 inch Foster traction engine. Richard acquired the Foster in 1994 two years after it had been built and in 2000 he oversaw the modification of the addition of a crane and a re-paint to its current black livery.

Something Richard also had in common with his father was his middle name – Edwin. He decided to use this as part of the inspiration of the name he gave his Foden – *Pride of Edwin*. Furthermore, of course, the great Foden company, which produced its first steam wagon in 1901, was founded by one Edwin Foden in Sandbach, who had completed an apprenticeship at Crewe railway works. So, it certainly is the 'Pride of Edwin' across many levels.

There a number of features about Richard's Foden that make it so different from the others that are seen on the rally fields. Immediately visually noticeable is the canopy, which has been constructed with the correct curvatures to replicate the full-size version with the downwards sloping angles. Other features included the pre-heater by the water pump for water entering the boiler. Rather than pumping cold water straight from the tank into the boiler, the Foden pre-heats the water using steam to then add warmed water, rather than cold, allowing it to create steam quickly without the usual noticeable loss of pressure.

It also sounds very different to most miniature Fodens because, like the full-size version, it has an exhaust baffle silencer in the smokebox and it almost sounds like an internal combustion engine if you didn't see the steam exhaust! The regulator throttle control has an interesting setting in that the lever drops down to pick up the double high and creates a surge of steam which causes the engine to speed up very quickly – and this has caught a few drivers out in the past.

With the elevated driving position, the driver sees over

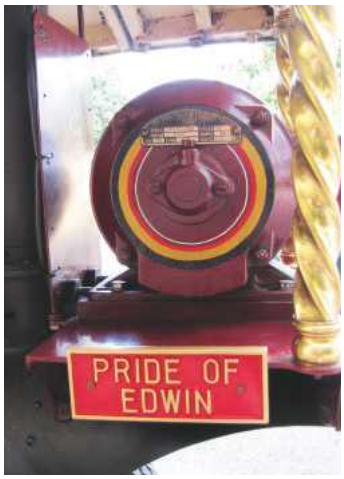
the roof and therefore the controls are operated by a combination of feel and knowledge of where things are situated. It also features the Ackermann steering geometry system, allowing the wheels on the inside and outside of a turn to trace out circles of different radii. At 10 feet long and with a working pressure of 200psi this chain driven engine is a fine piece of model engineering.

Richard has rallied his Foden frequently since owning it, both locally and further afield into the South West. He has very fond memories of the rallies he attended in Cornwall especially the West of England Steam Engine Society's rallies at the Stithians Showground in Truro. He recalls taking the engine up Engine Hill at St Agnes the first time, where his combined enthusiasm and still learning about the engine resulted in a tube leaking through low water level in the boiler. The camaraderie of the rally field and the usual support and friendship resulted in a fellow exhibitor arriving the very next day with a tube expander made overnight to allow for repairs so Richard could steam up the next day.

Whilst only two speed it really enjoys the road surface and with speeds up to 20mph it is very capable of outrunning the full-size versions. Richard recalls an occasion when he overtook Nick Baker on his Burrell road engine *Duke of Kent*, much to Nick's surprise!

Generating at a Christmas event at the Moors Valley Railway.

TF4097.



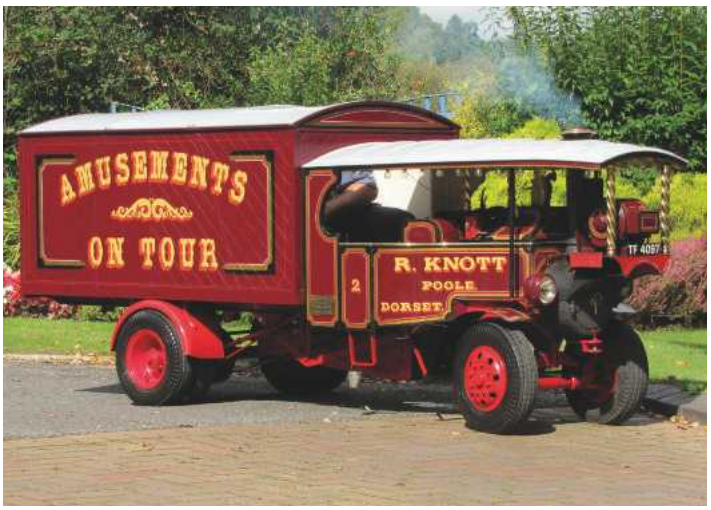
Pride of Edwin *and the generator.*

Richard at the controls.

Very often Richard shows the Foden with his scale 48 key organ. This was built in 1999 by Paul McCarthy of Basingstoke, a teacher by profession, and it carries over eight hours of music, and Richard shows it in the same livery as the Foden. With the 240-volt English Electric generator providing 3 phase electricity to power the lights on the Foden it makes for a magnificent and popular exhibit.

Richard last exhibited the Foden at the Moors Valley Steam Gala in 2019 and it attended the 50th anniversary of the Great Dorset Steam Fair in 2018. He looks forward to rallying it as soon as he can in the future but it does have to take its turn with his other engines! ME

Foden maker's plate.



Simmering in the sunlight in the grounds of Luscombe Valley Railway.

An Astronomical Bracket Clock PART 18

Adrian Garner makes a bracket clock showing both mean and sidereal time.

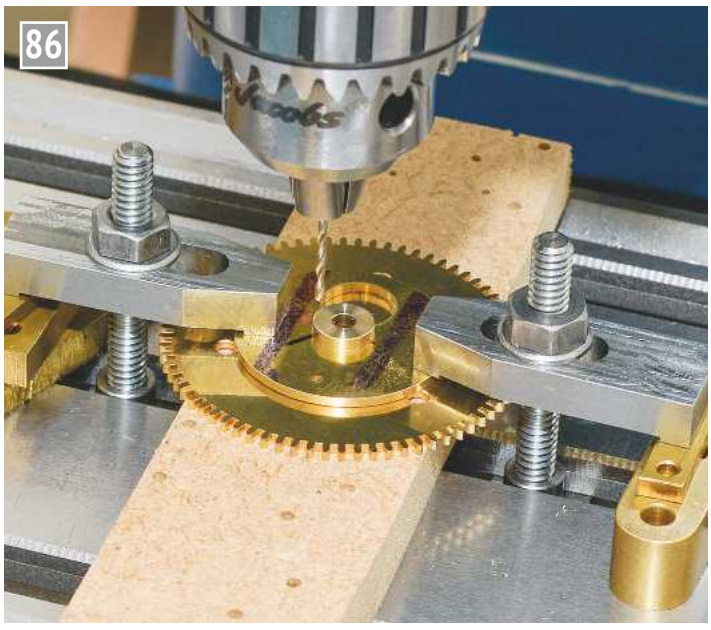
Continued from p.734
M.E. 4679, 3 December 2021

Motion work

In addition to the usual slip washer allowing the minute hand to be turned to set the correct time I have opted to include an additional slip washer on the hour hand so that this can be set separately. This is very convenient when the hour changes.

I cut the hour hand washer from a piece of 1/16 inch brass plate, centre drilled, opened up the hole and then reamed 3/8 inch. The larger offset hole was then centre drilled, opened up to 3/16 inch to fit the pin in a 7/16 inch pin drill and then drilled accordingly. Pin drills have the enormous advantage that they are happy to drill overlapping holes provided the pin hole is complete. At the same setting I made a small centre where the No.32 hole for the 10BA screw is to be secured.

Do not file the holes to shape at this stage. Mount the slip washer on a mandrel and turn to diameter and use a file to remove the inevitable edge burrs. Now turn up a small bush, 7/16 inch one end with a shoulder of 3/8 inch diameter at the other. This is used to register the washer with the hour wheel to allow the 10BA tapping hole to be drilled through both (**photo 86**). Tap the hole in the wheel, open the hole in the washer to No.32 so that the head of the screw is a slightly loose fit. The keyhole can now be filed to shape. Take it slowly as not much metal needs to be removed.

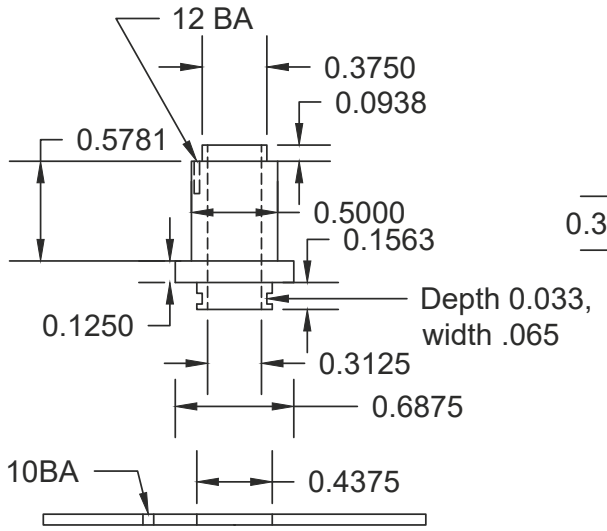


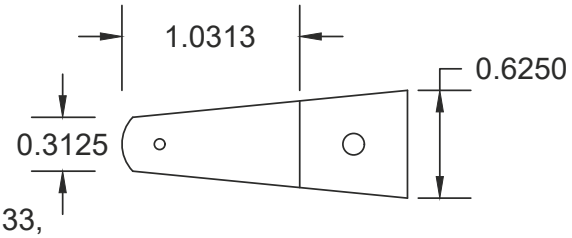
Drilling through the washer and hour wheel.

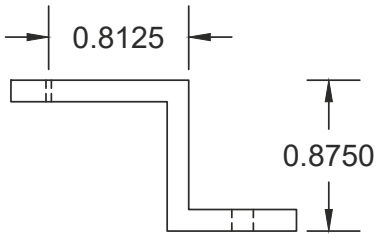
Due to its central position on the large front plate it is again difficult to hold the hour bridge in position for drilling the 4BA securing holes. I used the DRO to position the 4BA holes in both the bridge and on the front plates. If you do not have a DRO, use the dials on the hand wheels to measure out the positions – this is just as accurate provided you remember to take up any backlash by always ensuring dimensions are set and measured with the

Fig 33

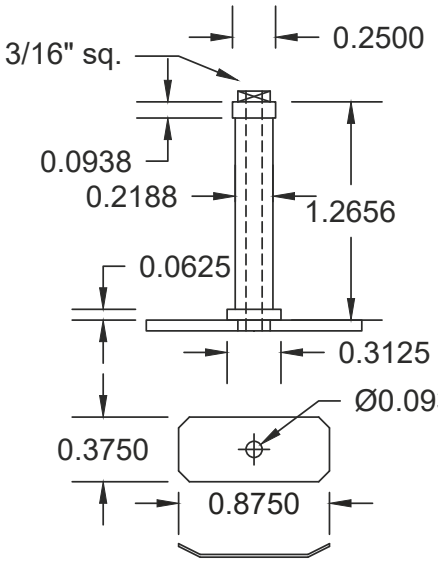
Motion Work

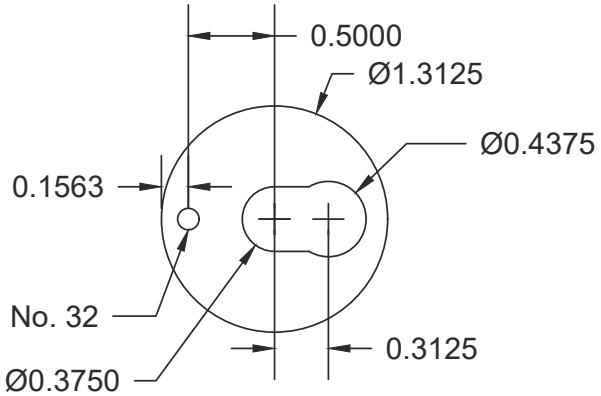


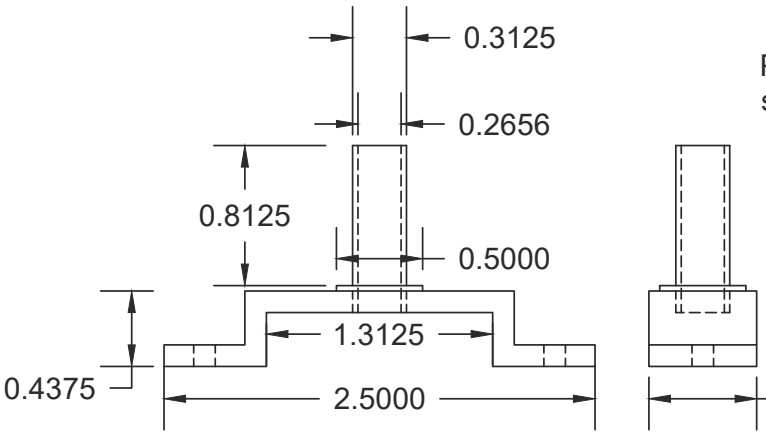


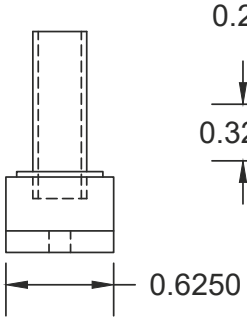


Hour wheel 72t, 0.75 module,
O.D. 2.2075, 1/16th thick









Minute wheels 39t, 0.75 module, O.D.1.233, 1/16" thick
Pinion 6t, 0.75 module, O.D. 0.228

lead screw being turned in the same direction.

With the bridge secured with screws the holes for the taper pins can be drilled. They can either both be on the same side of the bridge to ensure the bridge is always mounted the same way, or in opposite diagonal corners (which looks slightly prettier). In the latter case an 'X' must be marked under the bridge and on the front plate to show which direction the bridge needs to be mounted.

Once in position, the central hole in the bridge can be drilled and reamed with the hole aligned with the centre arbor hole. I used a microscope to centre the front plate under the mill and then mounted the bridge. Place a small slip of brass under the hole to be drilled to avoid marking the front plate by accident when the drill exits the bridge.

At this stage the central hole in the matted face needs opening up to about 9/16 inch diameter. Do not try and drill as it may well distort the face. I mounted the face on the mill aligning with a 3/16 inch silver steel peg in a chuck. I then opened up the hole with a 3/8 inch slot drill and bored the hole to size (**photo 87**).

A few notes on the hour hand collet which is turned from ¾ inch diameter brass may help. With about 1¼ inches projecting from the chuck turn the outer 11/16 inch to precisely ½ inch diameter so that it can be held by a collet. Face the end and turn to fit the hour hand. Part off over length. Rest on the parted off end to drill the 12BA tapping hole and tap. Return it to the lathe and hold in a ½ inch collet. The other hour wheel end can now be machined. If the groove you cut for the slip washer leaves the wheel loose do not worry – the slip washer can be slightly domed on a doming block until it allows the wheel to turn but not slip freely.

To judge the length of the minute hand pipe take a length of ¼ inch brass, face each end and drill though ⅛ inch. Place a length of 3/32 inch steel into the hole at the end of the minute arbor, drop on the slip washer and a 39t wheel and mount the hour bridge, pipe and hour wheel collet. The brass tube can then be lowered over the arbor until it rests on the 39t wheel. Reduce in length until it is flush with the top of the hour hand collet. Measure and make the minute hand collet accordingly. The 39t wheel can be soft soldered onto its collet. Use a small amount of solder paste in the joint and heat with a small flame.

Opening up the centre hole in the front face.

The reverse minute wheel arbor I made from 1/16 inch mild steel with blue steel inserts 0.035 inch diameter. The 39t wheel was again soft soldered to its collet which was secured to the arbor with Loctite. This was also used to secure the 6t pinion. I cut the latter from silver steel - a totally unnecessary waste of effort as the wear will be minimal. More typically these were made from brass.

The minute hand collet is turned from ½ inch diameter brass rod. About ¼ inch is turned down to 3/16 inch diameter and the curve formed with files. Start with a No.2 cut and finish with a No.6 cut and then polish the surface. I used 600 grit, then 1500 grit followed by 4000 and 8000 grit, cleaning between each stage. This is an item which is far easier to polish at this stage.

Part off from the bar overlength, reverse and, holding in a collet, take small cuts (0.002 inch) on the rear face to ensure it does not slip in the collet and thus mark the surface. Now centre drill, drill No.43 and ream to 3/16 inch. Make a small undercut across the centre of the rear face before cutting off the excess 3/16 inch section. The rear face can now be Superglued to a faced bar to allow the 3/16 inch diameter end to be brought to length to obtain the correct compression. Again, take small cuts. As before, heat will release the minute collet from the bar without damage.

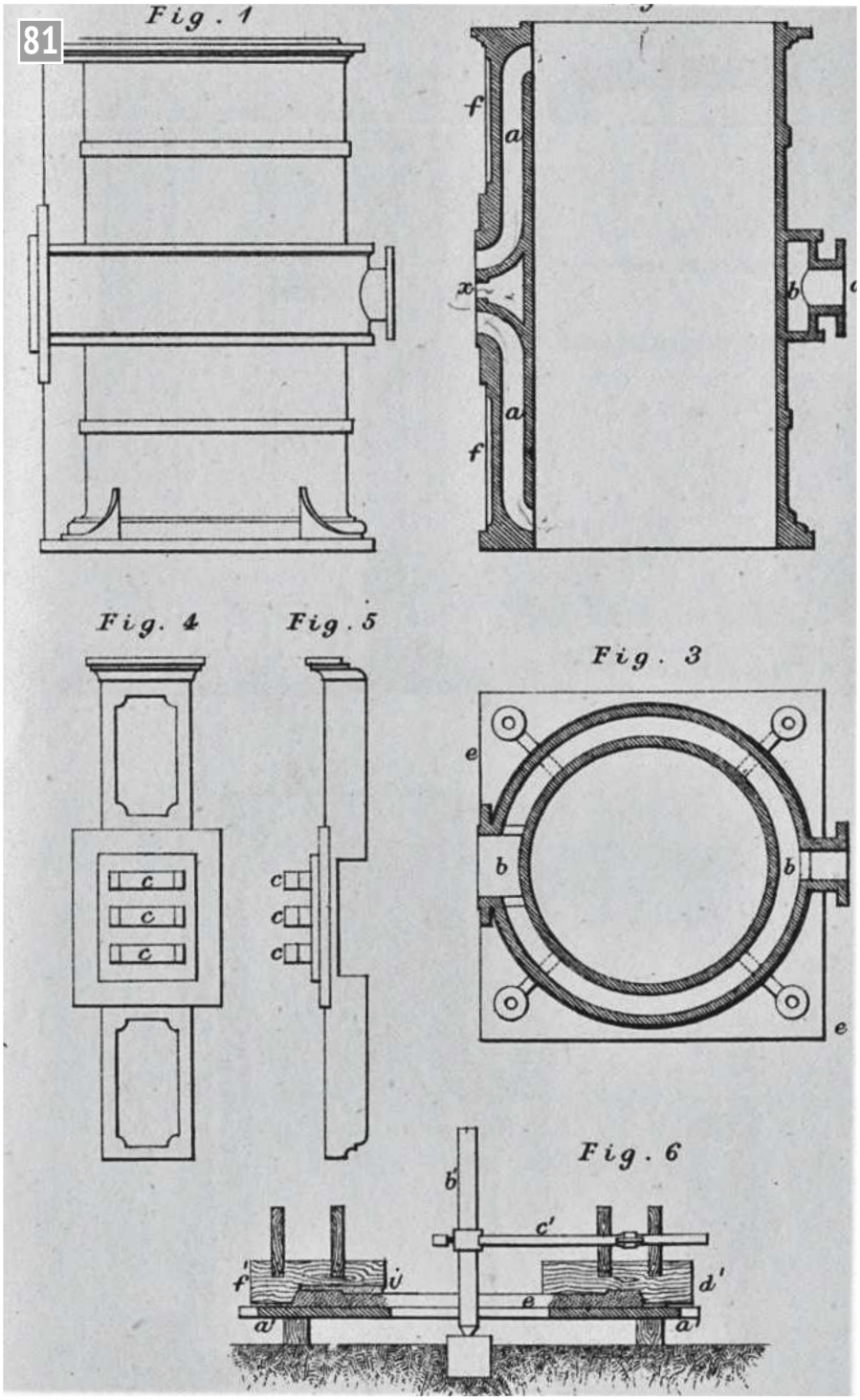
●To be continued.

Ron Fitzgerald takes a look at the history and development of the stationary steam engine.

Continued from p.703
M.E. 4678, 19 November 2021

The Stationary Steam Engine

PART 28 – THE FOUNDRY FLOOR – LOAM MOULDING



A beam engine cylinder with steam chest pattern.

Beyond melting the metal, the main activity of the foundry floor was the preparation of moulds into which the molten iron could be run. At the end of the eighteenth-century the three branches of foundry floor moulding work, loam moulding, greensand moulding and drysand moulding, had emerged as separate skills. Of these loam moulding, dating back to bell and then cannon founding, was the origin of all modern heavy foundry work. It was uniquely differentiated from the other two branches of foundry moulding in that it did not use wooden patterns but built up the moulded form using a mixture of clay and sand strengthened by straw, horse hair and dung. Ideal for regularly shaped castings such as pipes and large cylinders, loam moulding was the most important contribution that the foundry made to the steam engine.

The example of a mid-nineteenth-century beam engine cylinder, shown in **fig 81**, illustrates the loam moulding process. The complete cylinder is shown in elevation, vertical section and horizontal cross-section. It will be noted that the steam entry takes place on one side of the cylinder and the exhaust is carried round the cylinder in an exhaust belt to an outlet on the other side. The drawings annotated 'Fig. 4' and 'Fig. 5' in fig 81 show the wooden pattern for the valve box (f-f on the cross section). The cylinder will be cast in its

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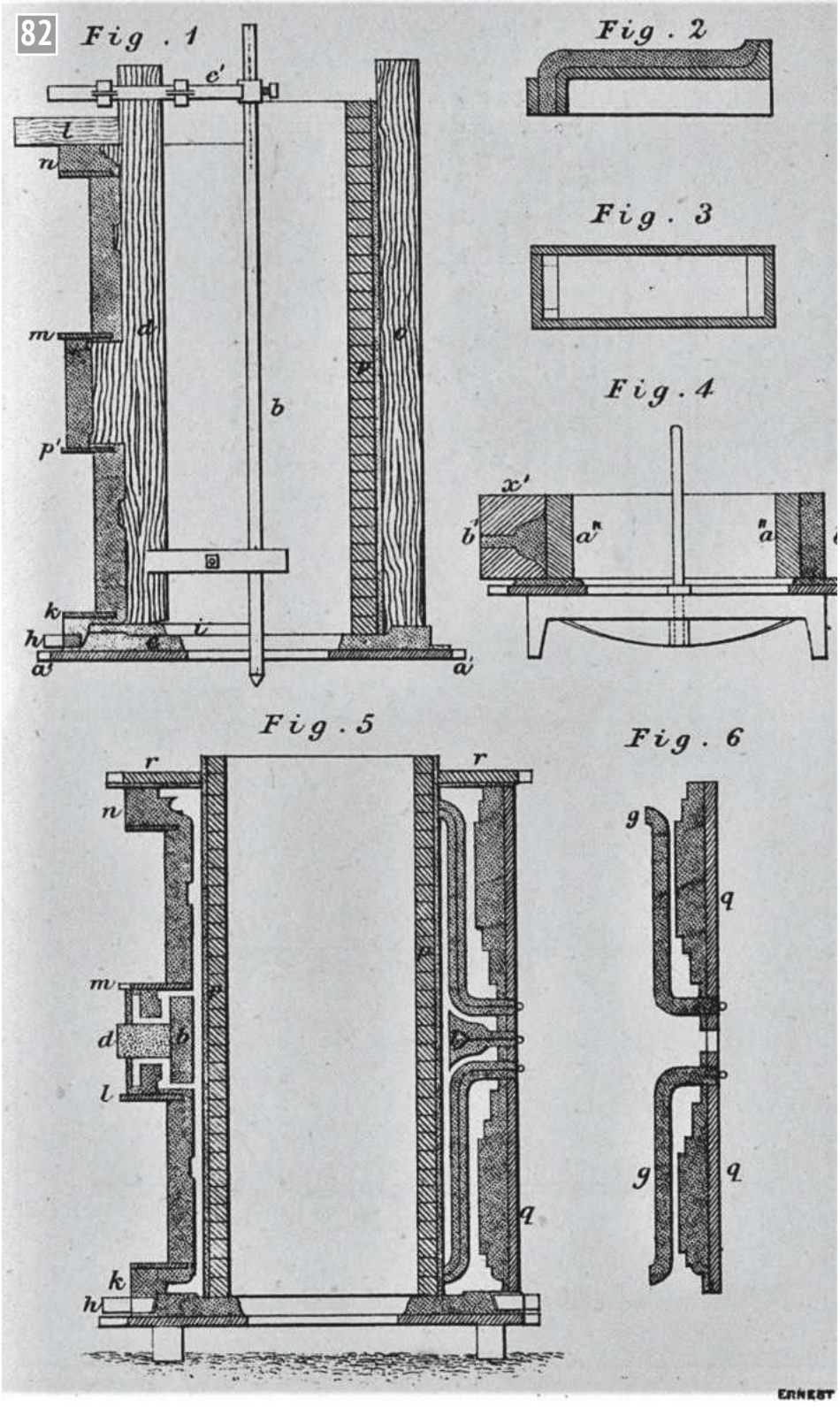
inverted state to ensure that the flange for the top cover contains sound, dense metal.

The floor of the foundry was invariably made up of pit sand which might have an average depth of ten feet or more with localized pits deeper still. The first step in preparing a mould for a cylinder involved digging a large hole in the foundry floor sand, referred to as forming the casting pit. A smooth base was formed at the bottom of the pit and an iron plate with a central hole was set level on blocks (a-a on the view marked 'Fig. 6' in fig 81). The iron plate had lugs projecting from its edge which enable it to be lifted evenly by a crane. In the centre of the plate a footstep was placed and this formed the lower bearing for a vertical iron spindle which was externally stayed at its upper end.The spindle carried a radial arm that could be freely rotated and moved up and down through the height of the spindle. Variously profiled wooden sweeps attached to this radial bar would be used to form the contoured surfaces of the mould.

In the illustration fig 81 (view marked 'Fig. 6'), the right-hand profile is sweeping out the base plate for the mould in foundry sand. A small projecting tapered shoulder and lip in the moulded sand (d') will form the locating device for all subsequent operations. The left-hand sweep (f') is forming a separate sand mould which will be removed when the metal is poured to create the void into which the metal will run to make the bottom flange of the cylinder at (i). The lower ring serves as a substantial support for the more fragile cylinder flange ring above it which would otherwise have an unsupported overhang. A separating medium is applied between the two rings to ensure that they do not adhere. When completed, both rings will be lifted away from the iron base plate as a single unit and taken to a core stove to be baked hard. After it has dried sufficiently, still



Formation of the loam moulded pattern for a steam cylinder.

mounted on the iron plate, the core will replaced in position in the casting pit to act as the foundation for further moulding operations.

The loam mould for the cylinder body (**fig 82**) is built up over the foundation ring. As the loam is raised into a cylindrical form metal bands and loops of wire are buried in its depth to provide additional strength as it will be free-standing when complete. After the roughly formed moulded loam has reached its finished height, a wooden profile (left-hand side of (d) in the view marked 'Fig. 1' in fig 82) is swept over the surface to shave the excess away, leaving a smooth, reflected image which will form the outer face of the cylinder casting.

The sweep incorporates a projecting square at mid-height which, when rotated, cuts the circumferential channel of the central exhaust steam belt. Support for the overhanging loam at this point is provided by metal plates (m and l in fig 82) and similar plates carry

the loam which will bear the impression of features that project beyond the main wall of the mould such as cavetto and torus of the cylinder base (n). Once the profile of the moulded cylinder has been completed the surfaces that will be in contact with the molten iron are painted with a wash of charcoal and loam. During the casting process the molten iron will gasify the charcoal producing a pressurized buffer between the iron and the mould surface to give the finished casting a smooth surface.

S-shaped steam ports are made as separately moulded cores (fig 82 – view marked 'Fig. 2') using compacted sand, moulded around bent wire or rod armatures. When completed, the core will be heated to a high temperature in a core stove from which it emerges as a brick-like solid that will withstand handling. With additional cores to form the outer parts of the steam chest the port cores are attached to iron plate which is then located on the loam cylinder of the main moulding (view marked 'Fig. 6'). Other, smaller, cores are attached as required. After completion this exterior shell of the mould (the cope) was slung by lifting loops from a crane using the lugs on the iron baseplate and conveyed to a drying stove where the loam was baked hard.

Building the mould for the internal surface of the cylinder was a simpler process as it was a plain cylinder of loam and brick. The formation is shown on the right-hand side of fig 82 (view marked 'Fig. 1'). On the sand moulded base vacated by the removal of the cope, a cylinder of brick is built up within the path of the external sweep board (o). (In the illustration, for clarity, the sweep is not shown attached to the arm of the spindle.) A gap of about an inch is left between the sweep and the brickwork. The gap will subsequently be plastered with loam and shaped to the profile of the cylinder bore by the sweep board. After completion this mould is also transferred by the crane to the drying stove. When both moulds have been thoroughly dried and hardened the cope is replaced in the casting pit and the inner mould lowered inside it. Between the two is a space which represents the void into which the molten metal will flow.

Floor sand is used to fill the area between the exterior of the cope and the walls of the casting pit. This is tamped to produce a compacted fill around the mould, a process requiring considerable skill as the sand must be sufficiently well-packed to resist the pressure of the molten iron acting upon the loam mould but porous enough to allow steam and gas to escape. The interior is similarly packed with floor sand. **Figure 83** shows a perspective view of a completed mould with a metal box at floor level containing the sand moulded runner channel and its feeding gates which conduct the metal into the mould.

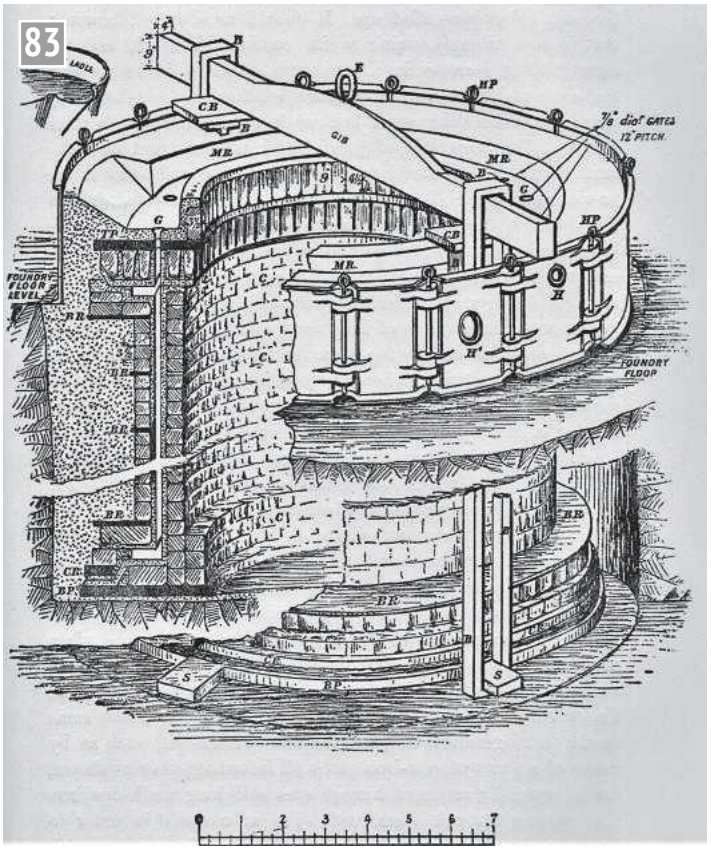
After casting has taken place and the metal has solidified the packing sand is dug out to release the loam mould. The internal and external moulds are then broken up and removed from the casting pit leaving the casting alone, ready to be craned away for fettling. Much of the moulding material is recovered, the bricks cleaned for re-use and the hard loam ground up and returned to the foundry floor.

The sequence of operations described above represents mature nineteenth and twentieth-century practice but John Farey's description of the foundry in Rees' 1819 *Cyclopedia* shows that loam moulding a hundred years earlier differed in detail rather than substance:

The casting floor is made up of loamy sand about ten feet deep and into this a pit is dug. Within the pit a hollow core is built up from bricks with clay and wet loam bound together with iron hoops or wire. A fire is then lighted within the core to dry it out. The final contour is superimposed upon the dried core using a thick layer of loam shaped by a profiled sweep. This forms the interior shape of the item to be cast. The outer shell of the mould is then made up in a similar way again using loam bound with hoops. It is covered with a charcoal wash and a thin coating of loam is then laid on top of the wash. Four hooks are set in it and the exterior is finished with a thick coating of loam and hair. After the mould had dried out fully a man entered the cylinder and removed the interior brick work. The excess loam is cut away, the charcoal wash preventing the two layers adhering and leaving a smooth surface. The outer mould is lifted by a crane and let down upon the inner mould in the pit leaving a void between the two which forms the shape of the final casting. The space between the outer mould and the walls of the pit is then packed with sand to give support. The molten metal is conveyed to the mould by channels cut in the floor sand.

The use of stoves to dry the moulds was not mentioned by Farey but instead fires were lighted within the moulds to dry them out whilst they were *in situ* in the casting pit.

●To be continued.



The completed mould. Sand which would fill the interior is not shown for clarity.

NEXT TIME

We examine the development of green sand moulding.

Robert Hobbs ventures into unfamiliar territory.

Continued from p.765
M.E. 4679, 3 December 2021

PART 5

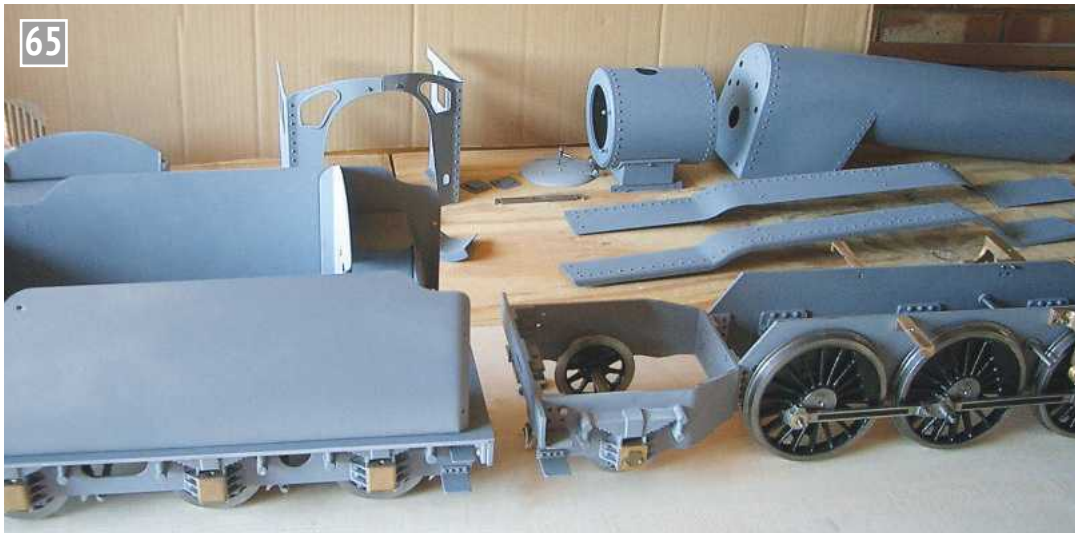
Recycling a 3½ Inch LNER Prairie

This part of my description will cover preparation and painting before covering final assembly in the concluding part next time.

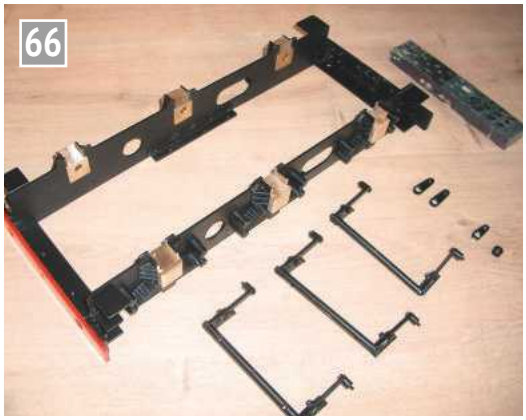
Most of the items were cleaned up and sprayed with etch primer as they were completed and one or two were painted with Humbrol enamel. Unfortunately some of these, especially the coupled wheels, needed rubbing down and repainting due to the wear and tear of repeated handling. **Photograph 65** shows the main components once they had been cleaned and spray painted with grey primer/undercoat.

The tender chassis was checked over, rubbed down where necessary and then sprayed matt black, then the brake components were tackled in a similar manner and these are shown in **photo 66.** The six tender wheels were touched up with gloss black Humbrol enamel. The bearing blocks were polished up with fine emery cloth and the chassis was assembled with springs, keeper bars, pull rods and the brake column assembly. The assembled chassis is shown in **photo 67**.

The leading bogie frame was spray painted matt black and the wheels brush painted with gloss enamel. **Photograph 68** shows the painted bogie.



The major components are all primed.



Tender chassis paint job is complete.

Assembled tender chassis.

Complete front bogie.

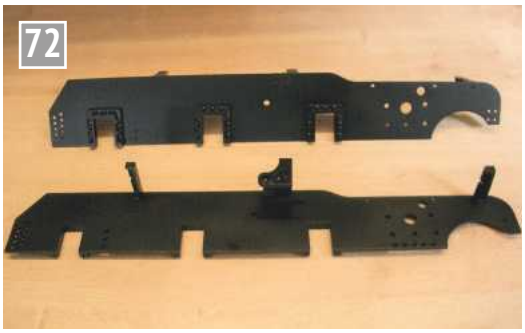
Whilst the matt black spray was active the running boards, the smoke box and its door were finished off and are shown in **photos 69, 70 and 71** respectively. The main frames, rear extension and the stretchers were also sprayed matt black and are shown in **photos 72** and **73.**

When assembling my locomotives new nuts, bolts and screws are used wherever possible and in this instance they were left unpainted to highlight the construction methods. These rescue projects are old and mainly assembled with BA threads so continuing with BA is costly compared with modern metric fixings but I think it is worthwhile. My BA stock comes from EKP Supplies at Barnstaple, North Devon; they offer a very quick usually next day delivery and, more importantly, offer fixings with 'one size less heads' which improves the overall appearance/finish on the locomotive. Other than as a satisfied repeat customer I have no connection with any of the suppliers mentioned in this series of articles.

Finished running boards.

Finished smoke box.

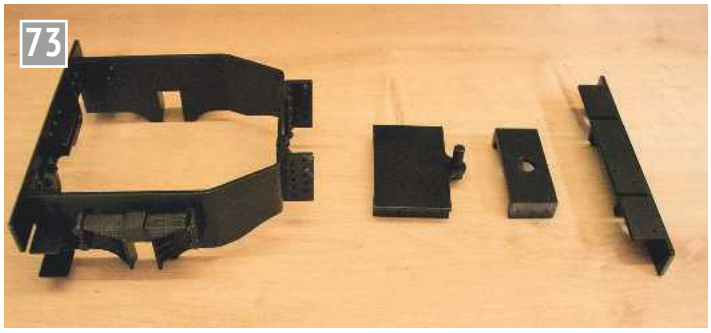
Smokebox saddle and door.



Main frames.

Photograph 74 shows the assembled main frame and the untreated fixings. The black spray paint was put to one side and the tool boxes, steam dome, cylinder trims, cab sides and tender body were rubbed down and carefully sprayed with Oxford green paint and are shown in **photos 75, 76** and **77.**

The cylinders were fitted with the valve chests, slide valves and top covers together with their front and rear covers,



Rear extension, stretchers and buffer beam.

A complete set of frames.

A few odds'n'ends.

Finished cab.

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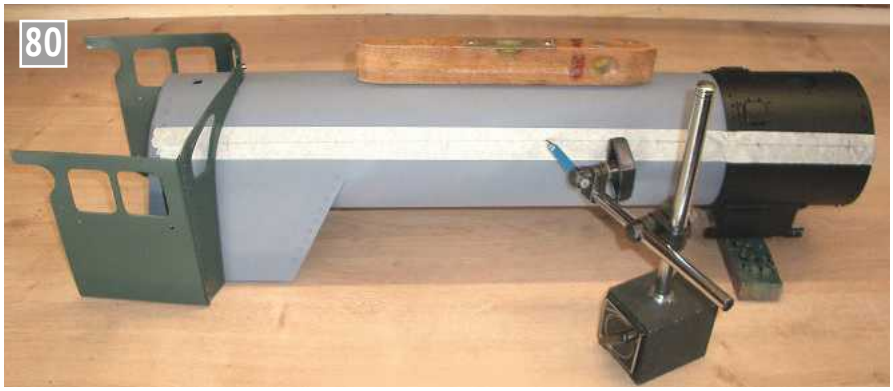
Finished tender.

Finished cylinders – note packing plates.

Cylinder sub-assemblies.



Marking out for the handrail stanchions.

again using new fixings with one size smaller heads. This assembly is shown in **photo 78** and clearly shows the additional packing plates necessary to allow the coupling rods to clear the slide bars. The cylinder sub-assemblies with piston, slide bars and cross heads in position are shown in **photo 79.**

Before painting the boiler body the positions for the locomotive hand rail stanchions were determined by leveling up the boiler and marking the horizontal line with a height gauge for the fixing holes. The stanchion spacing was calculated to suit the brass boiler banding and the smoke box, with the holes being drilled and tapped accordingly. The set up to achieve this is shown in **photo 80**.

●To be continued.

NEXT ISSUE

LittleLEC 2021
Stephen Harrison reports from this year's LittleLEC competition at Birmingham.

Ransomes Elevator
Ian Couchman constructs the raising gear for his Ransomes straw elevator.

Flying Scotsman
Peter Seymour-Howell makes the crank axle and assembles the wheelsets for his 5 inch gauge *Flying Scotsman.*

Bolton Tram
Ashley Best glazes the windows to complete Bolton tram No. 140.

Content may be subject to change.

ON SALE 31 DECEMBER 2021

Bolton Corporation No. 140 in 1:16 Scale

PART 5

Ashley Best builds a model of the first of the fully enclosed Bolton trams.

Continued from p.769
M.E. 4679, 3 December 2021

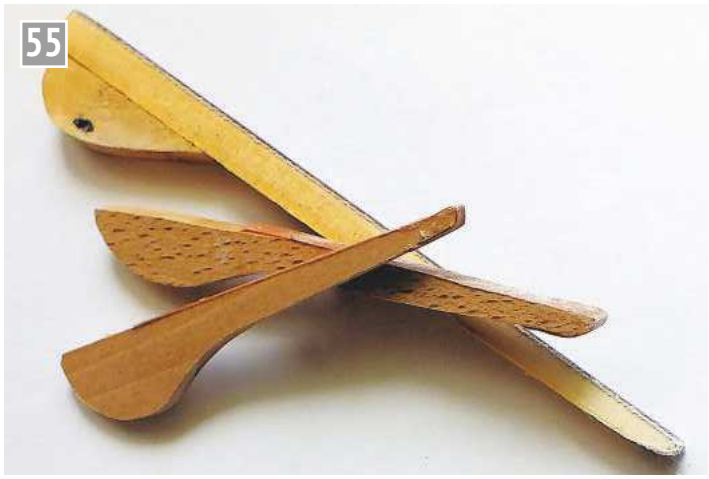
*In 1927, Bolton Corporation Tramways took delivery of twelve new large bogie tramcars. These were built by the English Electric Company and were of interest in more ways than one. They were Bolton's first totally enclosed tramcars and the last trams in England to use the Brill designed 22E trucks and were almost the very last traditional style tramcars to be built by English Electric. One of these trams, number 140, forms the subject of this article (**photo 1**).*

Bolton Corporation No. 140.

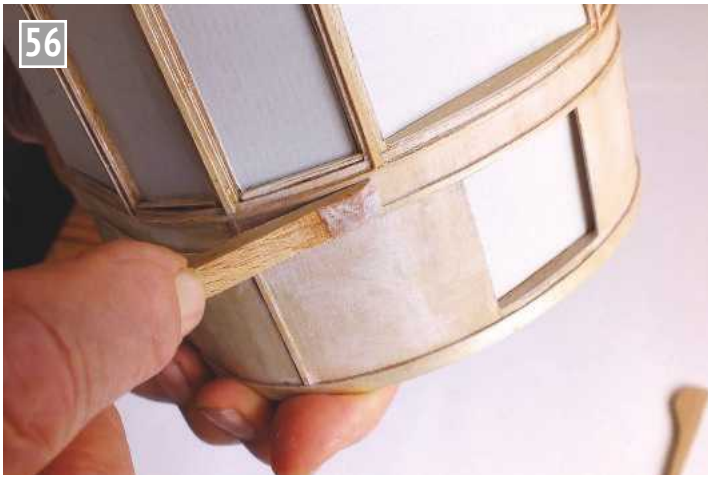
Painting

Painting and lining often cause problems and indeed are difficult. A model made to perfection can be ruined if the painting falls short. It can be a nerve–wracking business when the time comes for paint to be applied and even more so for the lining.

The first essential is preparation. Metal, especially brass, needs etch primer after the surface is made as smooth as possible. This can only be avoided when the metal has absolutely no chance of being knocked. I learnt this the hard way years ago when, after carefully painting a metal dash, I applied masking tape to aid lining and when the tape was removed it brought some of the paint with it. Lesson learnt! Wooden parts need to be sanded as smooth as possible and it helps to make some tools to aid this, especially where moulding has been applied. These tools can be made easily from wood and different grades of abrasive paper; some wet and dry types can be fixed to them. Some such tools are shown in **photo 55**. The same tools can be used on finishing the final paint application (**photo 56**). After getting the wood really



Sanding tools.



Rubbing down.

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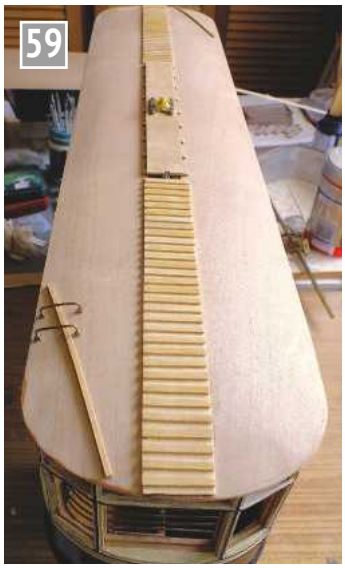
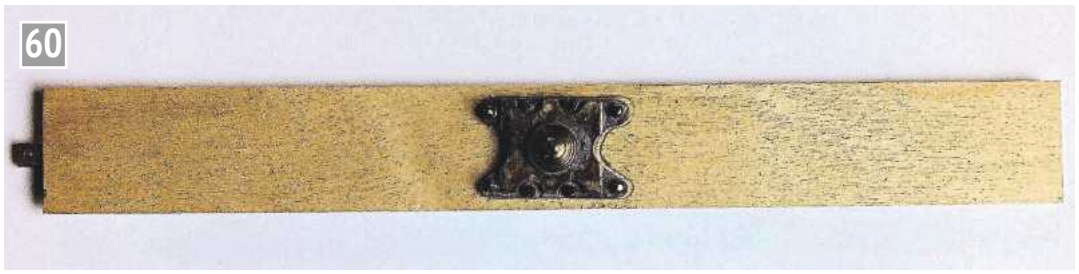
Set-up lettering.

Finished lettering.



Catwalk.



Trolley base.

Trolley mechanism.

smooth, I apply a couple of coats of sanding-sealer, rub down again and then apply primer – rub down yet again before the top coats.

Now, the primer and all the other coats can be sprayed or brushed. Each has its advantages and disadvantages. There is no doubt that a sprayed finish can be very accurate and generally lacks drips and runs, which are difficult to avoid with brush work. However, the use of sprayers requires a lot of careful preparation to mask out the parts not needing paint. This masking takes a very long time. Brushwork avoids much of this but a little bit of masking is often needed as well. Sometimes both methods can be used. On this model, I masked out just enough to spray prime the side panels of the lower saloon.

I use automotive aerosol spray paint which is excellent. Allowed to dry, it was then rubbed down with grades of wet and dry paper. For the next stage, I used approximately coloured automotive spray paint as undercoat – it was impossible to find a match for the finishing colour. Again, a lot of rubbing down, including a session with very fine wet and dry abrasive paper mounted on one of the home-made tools which was necessary for the corners of the mouldings. The top coat was applied by brush and needed at least two coats rubbed down vigorously between.

Colour mixing

Obtaining the right colour took time and involved three Humbrol paints – black, red and a touch of brown. I found that, actually, it was possible to get the final colour more or less right from different combinations. The mixing was done on a palette and then an empty paint bottle which had been thoroughly cleaned was used to contain enough paint to do all the top coat work and have a bit spare. This was important, as should insufficient be mixed, I would have needed to prepare more with identical proportions to ensure a colour match. The window frames and smaller areas of cream were all painted by brush and were hand-primed as well. When all the main final painting was finished, it was allowed ten days minimum to dry as the lining was to be applied with a draughtsman's pen and this needed a hard surface. The top deck side panels were kept ready to be fixed to the framework after completion including the lining.

I prepared a panel of sufficient size to provide a test surface and this was prepared in exactly the same way as for the model. This panel was of particular use when the lining came to be done. I made a smaller cream panel at the same time. These panels were essential as getting the right consistency for the lining colour to ensure they flowed without sudden drips takes a lot of time. The lining is maroon on cream parts and deep chrome yellow on the maroon.

Some parts presented a problem. The top deck above the windows and round just below the roof at the car ends is a narrow section too small to paint *in situ*. This problem was overcome by cutting a strip to size and painting it, sticking it down to hold it in place on a flat surface and applying the lining aided by a straight edge. It was then ready to be glued in position. A similar method was employed for the cant rail above the lower saloon windows.

Lettering

After the lining, it only remained to paint the coat of arms on the waist panel and the lettering of the corporation on the rocker panel. The coat of arms required a 000 fine brush and I had to use magnifying lenses. The lettering on the rocker

...the bus was fast becoming dominant and a policy of tramway abandonment had already been adopted.

panel is a scale four inches high with ¾ inch shading, so the layout was first applied with two parallel strips of fine masking tape ¼ inch apart down the length of the saloon – the top and bottom of the letters. A strip of paper with the spacing established and drawn was placed below the tapes, so the painted letters could be spaced correctly. **Photograph 57,** which is actually of a four-wheel car, shows how this was done.

After the lettering was completed, the bottom tape was removed to be replaced with another tape a scale ¾ inch below. This was to provide a guide for the base of the shading. I used acrylic gold as the oil-based gold cannot be used if varnish is to be applied as it then bleeds into surrounding paint. The shading was all done with standard oil-based colours which remain fixed when dry.

I did the lettering slowly as it required much concentration, one side at a time; lettering on one day and then shading the next so four days in all spread out over a week (**photo 58**). The numerals on the dash were done in the same way, but are larger (5 inch + 1 inch - scale ⅜ inch).

The livery of these trams as delivered in 1927 was to last for a fairly brief time. Early in the Thirties, it was simplified with a reduction of the cream panelling and the rocker panel lettering reduced to leave out the word 'Tramways'. This was more logical as, by then, the bus was fast becoming dominant and a policy of tramway abandonment had already been adopted. The twelve cars delivered in 1927 were joined in 1928 by another three almost identical vehicles but with re-designed platform screens with a difference so slight that it was not immediately obvious that the later cars were not quite identical to the 1927 batch.

Roof

The roof was first covered by 5/16 by 1/16 inch planking (scale 5 inches) and the centre section was a scale 18 inches wide plank down the length of the car. On this, in the centre, was the trolley plank with power cable leading to the wiring down through the bulkhead to the switch gear. These trams had an 18 inch wide slatted catwalk reaching right to the ends of the roof (**photo 59**). The trolley base was bolted to the trolley plank (**photo 60**) with 12BA bolts. The trolley mechanism fitted with a small roller bearing was the last thing to be fitted (**photo 61**). It has a swivel head trolley wheel (**photo 62**). Late in the war, the wheel was replaced with a skid like those used on trolley buses.

In 1940, all Bolton trams had their fleet numbers increased by 300 to distinguish them from the bus fleet. Thus No. 140 became No. 440 and as such was Bolton's last tram on 29th March 1947. It had therefore lasted 20 years and had been allowed to decline to become scruffy and run down with a life shorter than it could have been. Subsequent developments with the re-introduction of tramways in parts of Britain show how short sighted was the almost universal desire to be rid of tramways. The model of number 140 shows the tramcar as it was at the optimistic peak of operation with its splendid and distinctive livery indicating well-justified civic pride (**photo 63**).

●To be continued.

Swivel head trolley.

NEXT TIME

We complete the tram by glazing the windows.

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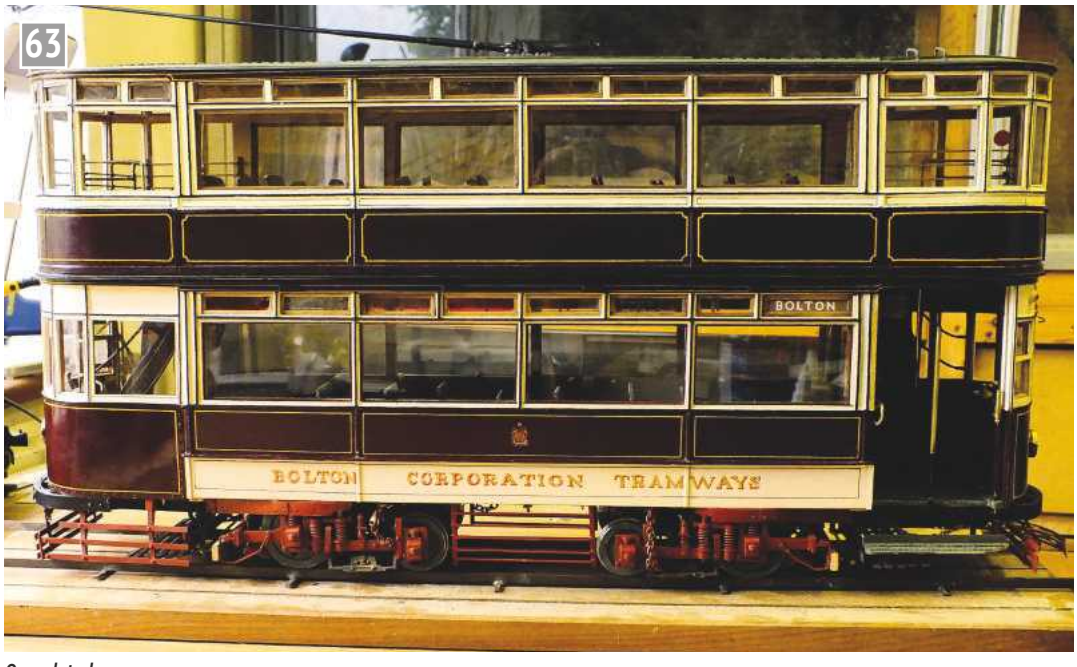
Bolton Corporation, Harry Postlethwaite.
Tramways in Bolton, Tony Young and Derek Shepherd.



Completed car.

Many hands make light work; the busy scene on Sunday morning.

Husband and wife team, Steve and Alex Bouchard working on the track fixing sleepers.

We Visit the Rugby Model Engineering Society

John Arrowsmith visited the Rugby club to see how they were getting on with their track and signalling system renewal.

It is three years since I visited the Rugby Society. The occasion was a Sweet Pea rally and it was during my visit that I heard about their plans for a large extension to both the ground level and elevated tracks. Little did I think such an ambitious layout was possible in a period of about three years! The Sunday morning of my latest visit coincided with one of their regular working and maintenance days, so there was a buzz of activity on the site (**photo 1**).

The club was founded in 1949 and operated from the Community Centre in Hillmorton Road. They were here until they moved, in 1991, to their present site in Onley Lane where the members constructed a 7¼ inch gauge ground level track about 1km long and a raised track of 3½ and 5 inch gauges which totalled about 335 metres in length over the 4½ acre site. In 2014 a new 50 year lease was negotiated with the local authority which gave the club the confidence to embark on this large project to extend both the ground level track and the raised track. This is now well under way, to be completed probably by the end of 2020 or certainly by the spring of 2021. They are very fortunate in having such a good group of working members - on average 25 to 30 or so - who turn up regularly, twice a week to get the various tasks completed. It was also good to see that wives of members are involved, with Steve and Alex Bouchard busily working away (**photo 2**). When you have resources like this the work programme can be maintained. The work has been overseen and assisted by Chairman, Aubyn Mee who, in addition to dealing with all the other club duties, still gets involved with work on the ground. On the older part of the track adjacent to the clubhouse, for example, Aubyn has been heavily involved in building the new heavy duty hydraulic lifting platform for the unloading of locomotives from cars and trailers. The novel detail about this installation is that it is built on a traverser so that everything can be lined up both vertically and horizontally with whatever vehicle is presented to it. This guarantees safety when large, heavy machines are involved. It has been calibrated and certified to take up to 2 tons and it is longer and a much sturdier machine than the previous one (**photo 3**).

During my visit Aubyn was busy working on fixing the rail on the raised track extension. When this new section is connected to the older raised track it will be a considerable and interesting run for drivers. For those of you who know the site, the connection from the old to the new will be at

The newly installed 2 ton Hydraulic lifting table.

the top bend, furthest away from the clubhouse (**photo 4**). It will include quite a substantial bridge between the two sections. The new track is mounted on concrete posts with timber stretchers between each post securely bolted to the post (**photo 5**). These stretchers also act as anti-tipping guides for the passenger carriages. New Iroko wooden sleepers are then screwed directly to these stretchers. All the sleepers are pre-machined at the club to take the three gauges of track (2½, 3½ and 5 inch) so that it is just a question of lining everything up and tapping the track into the sleepers to create each section (**photo 6**). Part of the ground level track route is quite damp so the members are experimenting with concrete sleepers they make themselves having found that even well treated wooden sleepers rot away quite quickly. The new concrete sleepers are cast to suit the location, with gauge widening of up to 0.090 inch for some curves (**photo 7**). The old main station area will also be subject to a makeover once the new project is complete. The track work here has served its time and will be replaced as time and funds allow. As this is one of the damp areas of the circuit it is probable that concrete sleepers will be used if they pass their testing on the new track (**photo 8**).

The 7¼ inch gauge ground level circuit is almost complete and has been laid with 6lb per yard rail. A section across the site is waiting for the completion of the access road into the middle of the raised track circuit. When this is all connected the club will have about one mile of continuous track.

There is an impressive three platform station with generously wide areas for passengers. As the new station is a considerable distance from the original water and power supplies, they have devised a way of providing a good water supply to the station. The original supply did not have sufficient pressure to fill a tank or tender in a locomotive while it was in operation so a header tank and booster pump has been installed alongside No. 1 platform to service all three, which means there is an ample water supply at the new station. It is all housed in an

The connection point for the raised track, with the new track at the top and the existing on the right of the photo.

Well constructed raised track panels.

Chairman, Aubyn Mee hard at work fixing sleepers.

One of the new concrete sleepers with the gauge widening dimension clearly shown.

The old station and track work which is due for refurbishment.

The main water pumping shed on platform 1.

The station coal bunker.

An impressive three platform station.

Alain Foote with his 7¼ inch gauge Kerr Stewart, Hampton.

Passengers' view from the ground level track over the surrounding countryside.

inconspicuous timber building which is easily accessible for station staff (**photo 9**). A large coal bunker is also available between Platforms 1 and 2 which, again, is easily accessible (**photo 10**). A lovely feature of the space between the platforms is a beautiful flower garden which adds to the overall atmosphere of the railway (**photo 11**). The whole area is robustly fenced off to provide a good, safe access for passengers.

A new simplified signalling system designed by Chris Hall has also been installed. It uses the track as the main conductors and is divided up into track blocks, each with its own failsafe system built in. This method does away with the need for a central control panel and of course lots of complex wiring. Howard Brewer, the club Secretary, demonstrated it to me and then, having been given a drive round the track behind Alain Foote's 7¼ inch gauge 0-4-2 Kerr Stewart, *Hampton* (**photo 12**), demonstrated how well it all works. This locomotive built by Alain is a model of one of the three locomotives owned by the Metropolitan Water Board which ran on the railway between Hampton and Kempton Park Water Works. It was built using original Kerr Stewart drawings so it is a fairly accurate scale model of the original. It was completed in 2012 and was first run in 2013; since when it has covered about 800 miles on this track.

The laid track work provides an excellent journey for passengers with changes of scenery to enjoy, from big views over the countryside in one place (**photo 13**) to an avenue of trees in another and then open grassland at the station area. One section of the track used to have a flooding problem during periods of heavy rain but a new drainage system installed during the rebuild has alleviated that problem. The building of the new track has also seen two new shipping containers moved onto the site to provide extra storage (**photo 14**) and working space for the members. They have been positioned alongside the existing engine shed and have been spaced and

Plenty of stock ready for fitting.

The useful storage space between the containers.

The dead load tester ready for testing pressure gauges.

The impressive front end on Mount Kilimanjaro.

Part of the workshop with the overhead crane.

roofed over, such that a very useful storage space for the club tractor and other ground working equipment now exists (**photo 15**). In the workshop is a good selection of machines and tools to help with all the maintenance needed (**photo 16**). The workshop is fitted out with a fully certified overhead hoist which can traverse the length of the shop. It also has a very good safety feature which retains the crane trolley on the overhead side rail to prevent it twisting off. Another very useful piece of kit was the dead weight gauge tester. This will be extremely useful now that the regulations require all steam pressure gauges be tested annually for accuracy before the locomotive's annual steam test (**photo 17**).

Among the locomotives currently residing at the railway is the 7¼ inch gauge Garratt, *Mount Kilimanjaro*. Based on the original East African Railway locomotive it is a massive piece of engineering in this gauge and is currently undergoing some repairs to both wheels and smokebox (**photos 18** and **19**). Another large locomotive under construction, *Criccieth Castle* (**photo 20**) was one that ≫

The massive blast pipe on the Garrett.

Criccieth Castle ***under construction.***

The club-built disability carriage demonstrating the swivel action of the platform.

The weed killing tank wagon and its dedicated engine.

was displayed at the Midlands Exhibition in 2019 where it was shown as a wooden mockup. Here, in the shed, the wooden superstructure is slowly being replaced with the finished metal bodywork parts so that the manufacture closely follows the mockup. Outside the shed was a small works train with a weed killer tank wagon (**photo 21**) and their own version of a carriage for disabled people. This carriage has quite a novel aspect to it in that the main wheelchair platform can swivel out from the chassis to assist in embarkation; a seat for a carer and for a club member are also parts of the carriage (**photo 22**). There is also a vacuum brake lever available for use in the event of an emergency. This carriage will have its own dedicated locomotive when in operation, rather than forming part of a normal service train.

In concluding my notes, I would like to congratulate the members of Rugby MES for the superb effort they have made in completing very extensive new layouts for both ground level and elevated tracks. You have done a tremendous job in just about three years; it is a credit to you all and will be for many years to come!

I would also like to thank Secretary, Howard Brewer and Chairman, Aubyn Mee together with all the members on site during my time at Rugby MES for their help and hospitality. It was a pleasure to meet you all and I look forward to my next visit, hopefully in the not-too-distant future.

ME

MODEL ENGINEER

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

Continued from p.739
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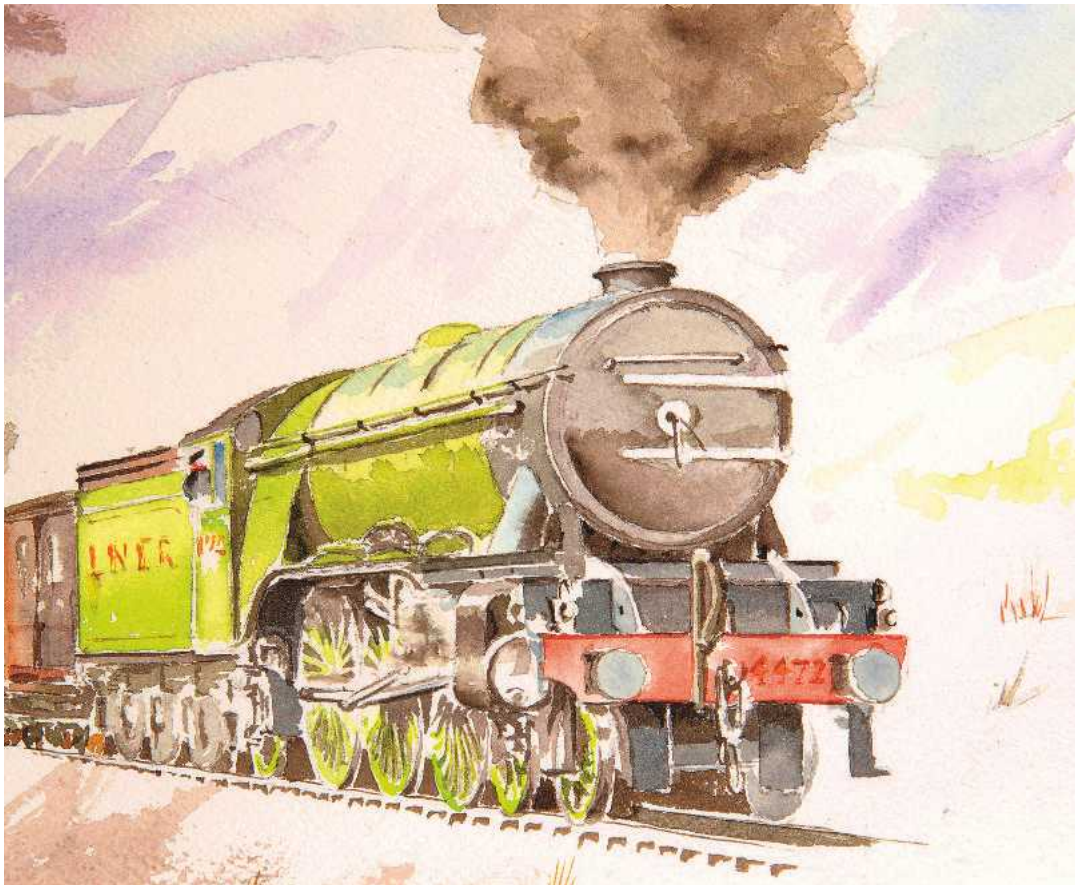


Painting by Diane Carney.

PART 24 - DRIVING WHEELS

Flying Scotsman in 5 Inch Gauge

1. I decided to first get rid of the excess metal in the flash and stubs - a hacksaw sorted this out as seen in this first picture.

Don's castings are very good, very little flash and pretty concentric which is a good start. As those of you with

2. To help setup in the four-jaw chuck I used a scribe in the height gauge fixed to the topslide to get the wheel central and also eye-balled the front face to see if the casting looked concentric, which it did. The back face, outside diameter and rear bub were then faced. Here the wheel has been set to run true and a start made on the bore with the first stepped drill. I used four steps up to ½ inch and then took about 20 thou off with each pass of the boring tool - just over 20 passes. Final cuts were at slow feed and fine cut. I checked the size a number of times during this exercise.

≫

experience in this field will know, there's are a lot of things to take into account when machining wheels, more so with main drivers. I studied the drawings and photographs to get a good understanding of what I needed to do and what sequence suited me best. I decided to start with the wheel held 'backwards' in the four-jaw chuck and to carefully machine the rear of the tyre keeping an eye on what I needed for material thickness for the front. I decided to take only a small amount off the back, the reason being that on the prototype the spokes are very close in width to the rims, closer than it seems they will be on the model, which makes sense as 5 inch gauge wheels are a little thicker than scale, as I discovered on the front bogie. So, I'm thinking of machining the fronts close to scale in as far as spoke edges being close to the rim recess and leaving the excess thickness at the rear which is not seen. I'm probably over thinking this and will make a final decision when I do the fronts. The wheel treads and hub bosses will of course, be correct no matter which I decide – I hope that all makes sense.

Machining the front

Having finished the machining of the backplate and spigot, I set up the first wheel to skim the front face ensuring it was parallel to rear and square to axis. The spigot is a good close fit to bore and a live centre is used for added concentricity. The wheel is set ½ inch off the backplate (to clear the back of the hub) using bar stock cut to length to bridge between two mounting points of which there are four. Everything was checked for being securely held before machining began - you don't want a piece of steel bar flying out - a little dangerous to say the least.

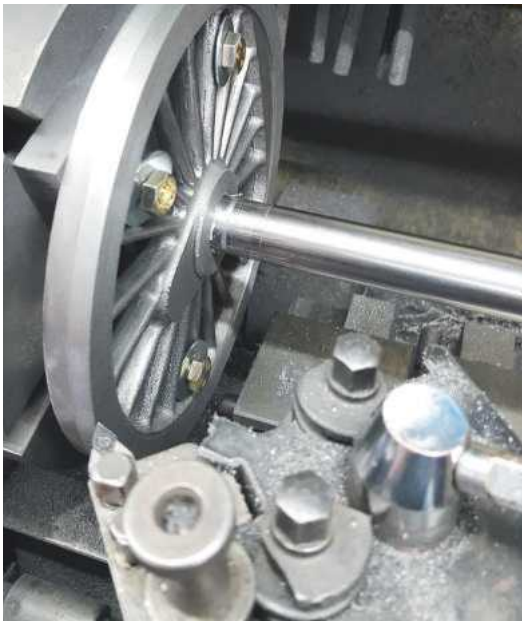
●To be continued.

FAR LEFT: 3. Here is the last wheel with the final cut on its second pass. I took great care with this, with constant bore size checks, a few longitudinal cuts for Loctite 638 and 1 thou undersize for a drift fit. Having done the first wheel, it was easy and quick to use the same final setting for the rest.

LEFT: 4. Even though all wheels were machined on the same final setting I still checked each one a number of times before making the final cut. Once machined, each wheel bore was checked by drifting in the axle a short distance - this was really just for my peace of mind.

5. The picture shows the first wheel (main driver) after having the tread face machined until it was flat so that when I return to final machining of the rear face I have two datums to line up with - the front face and bore axis. Note that the balance weight sticks proud of the wheel tread - final size will be 1/16 inch proud. None of this can I do yet, needing to finish the rear first - but also the fact that the securing bolts are in the way.

6. The next step was to machine the centre boss to size. Like most of the measurements on these wheels, this needs to be accurate to ensure no problems when motion mates with cylinders. With the spigot removed (it just slides out) it was a straight forward job to machine away the protruding bush and then the boss down to a step of 0.94 inch. The drawing states 30/32 inch which as you guys know is 0.9375 inch. My gauge doesn't go to that resolution so I decided on 0.94 inch. A word on the gauge - it's a very cheap affair but pretty accurate with a small modification employed. I've seen this done elsewhere before but can't remember who did it, so my apologies for not giving credit where due. Anyway, the modification just involves a short length of flat steel Loctited to the plastic base, which gives a nice solid flat face to measure from. I did a small test on a known step to check that the gauge measured the same from either side, which it did.



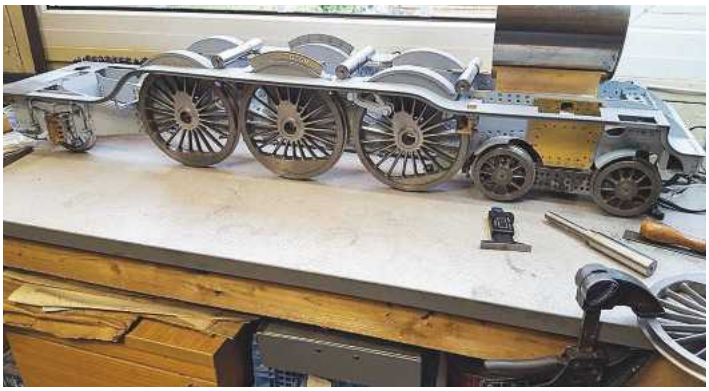
7. With the spigot re-positioned between centres I then tackled the flange diameter. I machined each flange to 7.412 inches leaving a single cut of 6 thou to achieve the final size of 7.406 inches. This will be done between centres after the wheels have been pressed onto their respective axles.

8. And so we are at this stage - this is the sixth wheel left on the faceplate ready for the final two operations on the rear which is the inner rim step and rear radius of flange. I may need to grind up some tool steel for this.

9. Next, I moved on to the tread diameter. Here I used a profile tool for the flange and machined to +50 thou for now - no taper yet and the root radius is slightly oversize. I'll get in closer when doing the taper, again leaving final machining for when fitted to the axle.

10. Here is the first wheel placed in position (well it had to be done..) on a suitably sized piece of BMS bar just to get a feel of how things are progressing. I have weighed the chassis down a little (about 60lb) for this picture but it's presently riding a good bit higher than it will be when fully loaded. The good news is when pushing further down on the chassis to approximately running height the wheel turns freely without binding on anything such as the splasher.

LEFT: 11. Now after doing all that, I decided to make a start on the filing which would leave just the final machining of the tread taper and rear radius to do before moving on to the crank pins. This picture shows one of the coupling wheels having been filed around the spokes. I spent half a day on this as I wanted it to look good – I think the natural casting finish is too heavy scale wise to be left as cast. I was going to put the wheel on the spigot (as usual) that I turned up to fit but some fool left it out in direct sunlight all day with obvious results...so here the wheel is just propped up for the photograph. RIGHT: 12. For filing, I simply held each wheel to the bench via a quick release clamp working my way around spoke by spoke. Here, I still need to clean up the outer parts but that won't take long, just a simple matter of using some 3M sanding pads. This picture shows one of the main drivers close to being finished to this stage - just the four spokes along the bottom edge left to file down. I haven't scraped the balance weight lip yet either - I will tackle that job next once all wheels are filed.



13. I have filed three wheels so far - couldn't resist lining them up with the chassis. She's actually starting to look like a locomotive now. The plan is that before I tackle the crank pin bores I'll machine the keyways into the axles (113, 127, 120 degrees, once, that is, I have it clear in my head exactly what goes where) and then do the wheels and crank webs all together using a jig (yet to make) to ensure wheels and crank webs are all identical. I have to say that I'm looking forward to getting these wheels done, if for no other reason than that they are the last big cast iron components that I have to work on so no more dirty metal to deal with - the lathe will certainly have to be stripped down for a good clean once completed.

14. Final jobs now done to finish all of the turning operations for the main drivers which involve taper, chamfer and radius of flange. This picture shows the 30 degree chamfer which ends 1/16 inch in from the front face. This actually was the second operation of the day - I have already machined the taper in this picture, which follows the GL5 profile of 3 degrees. Both operations were done in one pass ensuring that all six are identical.

15. With the front face completed each wheel was turned around, packed out to clear balance weight and had the rear radius filed down by hand to its final size of 0.93 inch radius.

16. Finally, here we have all six wheels ready for the next stage which will be drilling/reaming of the crank pin bores - 5/16 inch for the main drivers and ½ inch for the coupled wheels with the last job to do (other than general clean up before painting) being broaching for the keys.

Ian Couchman constructs an elevator to keep his Ransomes threshing drum company.

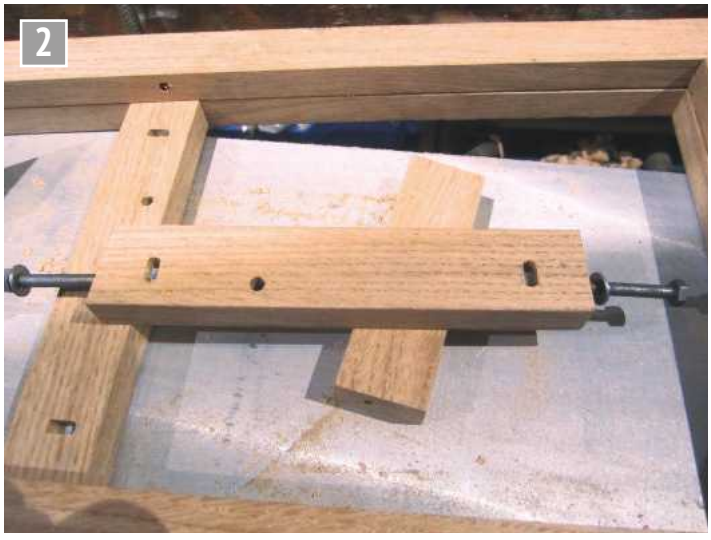
PART 1

A Ransomes Elevator

After a few seasons threshing with my Ransomes threshing drum, serialised in *Model Engineer* from issue 4540 a few years ago, I felt I wanted more kit to run. First thought was a baler. Trouble is, these need a second person to thread the wires and a second person is not always available. Next thought, an elevator (**photo 1**). This could be set up, belts (or straps, as they are known) fitted and it could be left to its own devices. Sounds good. Elevators were often used with threshing drums, catching the straw from the drum and lifting it to the top of a stack, from where the farm hands would build the straw stack.

Most elevators made 'in the day', for use with threshing drums, were Hayes Pattern, invented and patented by one James Hayes, with each manufacturer having his own minor variation. It would be good to build a Ransomes version, so the search for details started. I bought a set of drawings for a 2 inch version of a Ransomes elevator but they suffer from the same problem that so many model drawings have - inaccurate or missing detail. Unfortunately, Ransomes elevators are not common. The best I've found to base my model on is an engraving from the excellent book, *Steam Threshing* by G.F.A. Gilbert but, although much can be figured out from this picture, much of the smaller detail is missing.

After extensive searching for the details, I've found nothing but I wanted to move on with the elevator. I had planned to scour the rally fields that year but this rotten virus put paid to that! This leaves me with two choices: use the



Joining method for frame segments.

Squaring off the ends.

Drilling the bolt holes.

Haining drawings or guess, so, I decided to take the details from various other makes of elevator and the Haining drawings and try to come up with an average. So here goes.

The frame

Let's start with the frame. This is made from oak. Needless to say, this is not available in the sizes I need, so it's over to the band saw and thicknesser to produce a stock of the required sizes.

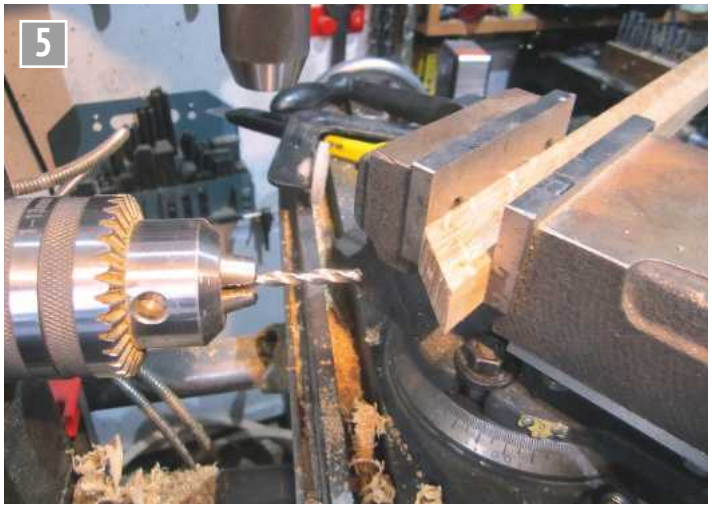
The method I used to join the frame segments is the same as used on the drum. **Photograph 2** shows the method. A slot is milled in the side of a vertical timber, a hole drilled from the end to meet the slot and a nut fitted. The joint can then be bolted together. This is basically the method used in full-size, except that they also had stub tenons at the joint. By leaving these out, I achieve two advantages: it's less work and any section can be unbolted and removed if required. Experience shows these joints to be both strong and stable. I've had no joint problems in the four seasons I've been threshing with the drum.

I start by squaring the ends of the sections in the mill (**photo 3** - note the sacrificial piece preventing the edge splitting as the cutter leaves the edge). Then bolt holes are added (**photo 4**) with some at an angle (**photo 5**) and slots milled (**photo 6**).

Diagonal braces are held in place with stub tenons (**photo 7**) with **photo 8** showing a joint about to be tightened.

Photograph 9 shows the complete frame, ready for the next components. At this stage, I don't know the positions or sizes of holes for fittings, so the bolted construction allows me to remove one part at a time for drilling.

●To be continued.



Angled bolt hole.

Milling the slot.

Stub tenon.

Joint ready to be tightened.

The completed frame.

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An Engineer's Day Out

The Yorkshire Dales National Park

Roger Backhouse spends a day in the Yorkshire Dales.

Beautiful upper Swaledale seen from near Muker. Stone built field barns are characteristic of the Yorkshire Dales National Park. Yet the Dales have an engineering heritage too.

Yorkshire's Dales attract thousands of tourists every year attracted by fine scenery and excellent walking (**photo 1**). Yet if you can tear yourself away from beautiful views and attractive stone-built villages you are not far from a varied engineering heritage.

Killhope Wheel in County Durham gives the best idea of how Dales lead mines appeared when working.

Lead mining

This wasn't always an unsullied rural landscape. It had rich lead deposits exploited by the monks of Fountains Abbey and was once the richest lead mining area in Britain. In the 18th century London and Bristol merchants of the London Quaker Lead Company saw potential and expanded the industry, with mines, crushing plants and furnaces extracting lead from galena ore.

Lead is usually found in near vertical lodes. Most mining involved tunnelling into a hillside and then excavating upwards and downward along the 'stope' or vein of lead ore. This was then taken to surface for crushing and processing to concentrate it ready for shipment or smelting. Much mining took place above Wensleydale and in Swaledale, where substantial remains of lead extraction scar the landscape of Gunnerside Gill.

The best example of a preserved lead mine is outside the National Park at Killhope, in Weardale, County Durham. **Photograph 2** gives an idea of how working lead mines in Yorkshire once appeared.

Transporting coal for steam drainage was difficult and expensive so at Killhope the mining company erected the

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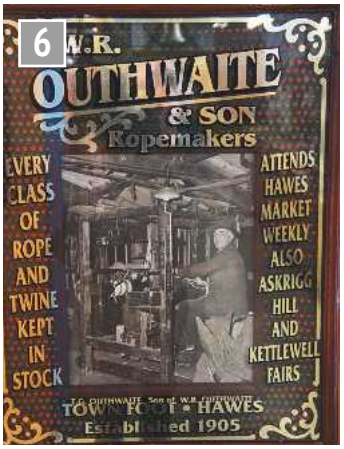
Boys once washed lead ore. More recently children enjoyed doing the same at Killhope. Check before visiting to see if these activities are still possible.

Miner's tools in the Dales Countryside Museum. Many still lie abandoned underground.

Recreated tinsmith's workshop in the Museum. Once every town of any size had a tinsmith to make the products farmers and local businesses needed.



Sign for W.R. Outhwaite ropemakers - still functioning in Hawes.

Twine making machine in Outhwaite's ropeworks.

largest diameter water wheel still working in England. This pumped water from the nearby mine via a series of rods. The mine itself is a narrow tunnel into the hillside serving also as a drainage adit. Visitors are suitably equipped with helmets and boots entering the mine to see recreations of old lead mining techniques. Inside the mine is another smaller water wheel helping pump water from the mine. Such underground water wheels were once common.

At the surface the principal activity was ore dressing, crushing ore using stamps and then subjecting remains to a flotation process. Much of this cold and wet work was once carried out by boys but now children enjoy washing lead ore in rocks extracted from the mine (**photo 3**). Ore was then smelted nearby. Miners built long flues up hillsides and vapours from roasted ores condensed on the chimney walls to be scraped off later. Both lead and silver could be extracted in this way. There are the remains of one nearly a mile long at Rookhope. Some fluorspar extraction continued in the area until 1999 when Pennine mining ended.

At Hawes the Dales Countryside Museum at the former station has displays about the lead industry with a recreated mine though rather antiseptic compared to the dark cold wetness of a real mine. Examples of miner's tools are displayed (**photo 4**). The museum also shows the wide range of local crafts encouraged by mining with one curiosity being the recreated tinsmith and wheelwright workshops (**photo 5**). Local farmers and other industries also needed a wide range of tools and equipment once all made locally by skilled craftsmen.

Ropeworks

Outhwaite Ropemakers near the Dales Countryside Museum (**photo 6**) is one of the last surviving small ropemaking firms open to the public. (Chatham Dockyard has another working ropeworks.) Once almost every small town had a ropeworks (**photo 7**) with more in coastal towns like Bridport. This ropeworks now makes various twines and specialises in bellropes and decorative ropework - a good place to buy your dog lead (**photo 8**).

Water power evolves

Apart from small coal deposits once mined around Tan Hill Inn (highest pub in England) and a few other places, wood and water power were the only local energy sources. Coal for mining machinery was carried by packhorse or cart.

However, the area is rarely short of water and Hardraw Force in Wensleydale is the highest waterfall in England. Near Pateley Bridge in Nidderdale, Foster Beck Mill was built around 1800 to process flax. A 36 foot diameter water wheel remains behind the Bridge Inn (**photo 9**). There is a former corn mill nearby at Wath occasionally open to the public. At beautiful

Examples of bell ropes made at the ropeworks. Your local church might have some.

Aysgarth Falls another mill took water from the River Ure.

Just above Hawes, Gayle Mill was built in 1784 using water power and is claimed to be the oldest structurally unaltered cotton mill (**photo 10**). Unlike most mills drawing water from weirs across streams this takes water directly from the Gayle stream via a leat. As steam powered mills developed elsewhere local cotton spinning became less competitive so the mill was used for spinning local flax and wool before becoming a sawmill in 1879 and operating until 1988.

The 22 foot (7 metre) overshot waterwheel was replaced by a Thomson double vortex turbine made by Gilkes and Gordon of Kendal, probably the only remaining example. It drove woodworking machinery and from 1919-1948 supplied electricity to Hawes. After closure in 1988 it was restored and reopened in 2008 featuring in the 2012 TV programme *How Britain Worked*.

Unfortunately, the mill suffered a dispute between the owners and the operating group. Press reports suggest it may reopen and some works are currently ongoing. If so, it will offer an interesting example of a small water mill adapting to changing conditions.

Although the Dales have several reservoirs, such as Gouthwaite in Nidderdale, these aren't used for hydro-electric power, built instead to supply clean water to the growing conurbations of the West Riding. Wool processing needed soft water from these dales.

Near Sedburgh, Farfield Mill is open to the public with an art gallery, craft workshops, plus hand and power looms which can often be seen working (**photo 11**). Originally built in 1836 as a cotton mill powered by a water wheel a vortex turbine was installed in 1896. It has been restored more recently with the help of consultants from Gilkes and Gordon who built the original turbine.

Wensleydale Creamery

Nothing appears further from engineering than cows grazing in green fields. Visit the Hawes creamery for the 'Yorkshire Wensleydale Cheese Experience' to find that dairying is in fact a highly mechanized process. This dairy making authentic Wensleydale cheese has an interesting history. It was twice threatened with closure to be rescued the first time by the remarkable Dalesman Kit Calvert. While *Model Engineer* is not usually the place for gastronomy the cheese named after him is far superior to supermarket Wensleydale.

There are cheese making demonstrations and glimpses into the dairy plus a small museum with examples of milking machines, coolers and milk separators. Such devices transformed dairying (**photos 12** to **14**). They needed power, usually from small portable oil engines. Firms like Rustons and Petters built a large market supplying engines to farmers.

Railways

A railway once linked Northallerton with Garsdale (formerly Hawes Junction) through Wensleydale. Hawes has a train in the former station, now the museum, but it is not typical of those that once served this line nor is it connected to the network (**photo 15**).

Though the line closed to passengers in 1959 and to goods in 1964 the Wensleydale Railway aims to bring services back to the Dale. It has partially succeeded now running mostly Diesel trains between Leeming Bar and Scruton though the route continues to Leyburn and Redmire. Scruton Station, just outside the National Park, has been beautifully restored.

Seen on an icy day, Fosters Beck mill near Pateley Bridge in Nidderdale was built around 1800 to process flax.

Gayle Mill above Hawes was built as a cotton mill using water fed by a leat from the Gayle stream. Renovation works are ongoing and it may reopen in 2022.

Power loom in Farfield Mill near Sedburgh, one of several in this fascinating craft centre and art gallery.

Milking machines like this mechanised dairying from a highly labour intensive industry.

INFORMATION

Outhwaites Ropemakers Hawes
www.ropemakers.com Tel 01969 667487
Open Monday to Friday (not Bank Holidays or two weeks around Christmas). Free admission.

Killhope - The North of England Lead Mining Museum
Near Cowshill, Upper Weardale, County Durham DL13 1AR
www.killhope.org.uk Tel 01388 537505

Dales Countryside Museum
Station Yard, Burtersett Road, Hawes, North Yorkshire DL8 3NT
www. dalescountrysidemuseum.com Tel 01969 666210

Wensleydale Creamery
Gayle Lane, Hawes, Wensleydale DL8 3RN
www.wesleydale.co.uk Tel 01969 667664

Farfield Mill
Garsdale Road, Sedburgh, Cumbria LA10 5LW
www.farfieldmill.org Tel 01539 621958

Dent Village Heritage Centre
Dent, Nr. Sedbergh LA10 5QJ UK
www.dentvillageheritagecentre.com Tel: 01539 625800

Little White Bus Company
Serves Upper Wensleydale and Swaledale
www.littlewhitebus.co.uk Service line 01969 422050

Although it seems unlikely that their trains will run through Wensleydale, another group hopes to connect Hawes station to Garsdale on the Settle and Carlisle line. Most of the trackbed is still in place.

Railwaymen in the Dales could be characters. David Joy is a rail historian and former editor of *The Dalesman.* He tells the story of a Hawes stationmaster who also dealt in coal. One day a well-spoken lady telephoned her request for a coal delivery, adding "s'il vous plait". French did not discourage the stationmaster. After a pregnant pause he replied "Certainly Madam, would you like it 'cul de sac' or 'a la carte'?"

The most scenic stretches of the Settle and Carlisle Railway lie in the Yorkshire Dales National Park. Noted for the steam specials using the line the scenery can also be enjoyed from the regular Diesel services travelling between Leeds and Carlisle or from the summer only Staycation Expresses.

Milk coolers reduced risk of spoilage in transport to markets.

To make butter high fat cream is separated out using similar machines. It was difficult to make a machine that ran at the steady speed required.

Sedburgh and Dentdale

Sedburgh's St Andrew's Church houses a unique change ringing machine. English bell ringing uses changes rung on a peal of bells so that no combination of bells is repeated. A science teacher at Sedburgh School devised and made this machine to demonstrate the principles.

It is beautifully engineered and could perhaps be described as an early analogue computer, albeit one designed for a highly specific task. The machine was restored by Bill Purvis and is occasionally demonstrated. Church ringers are led by the Tower Captain Susan Sharrocks. It is hoped to feature the workings in a future article.

Even if needlework isn't your thing the Sedburgh Tapestry in the church is definitely well above the standard of many church embroideries. Well worth a look.

Not far away Dentdale is lovely and of particular geological interest. Dent Village has an idiosyncratic Heritage Centre in an attractive building with various classic tractors outside (**photo 16**). Farming here was always hard.

Getting around

Unfortunately getting around the upper Dales is not easy without a car. However, the Little White Bus Company is locally owned and runs services to some out of the way parts with connections to Settle and Carlisle line stations. There's much to be said for being chauffeured in this scenery.

ME

Locomotive in Hawes station stands on isolated track. Built by Robert Stephenson and Hawthorn in 1955 this locomotive worked at power stations and not in the Dales. However, it carries the number of the last locomotive to haul a passenger train from Hawes in 1959.

American made tractors were important in British farming and this Allis-Chalmers is now displayed at Dent. The Centre has an eclectic collection of interesting Dales bygones and has recently opened a wool centre.

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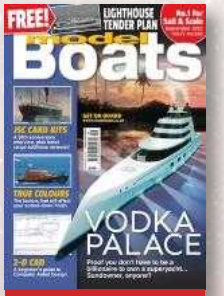

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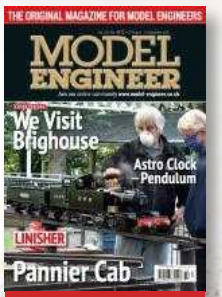

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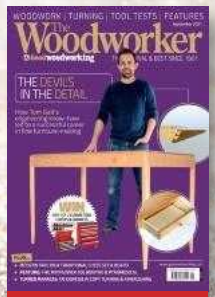

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Doug Hewson presents an authentic 5 inch gauge version of Thompson's most successful locomotive.

B1 61264 photographed at Grosmont. (Photo by Doug's granddaughter.)

LNER B1 Locomotive

PART 1 – INTRODUCTION

I am from a solid B1 area; Scunthorpe. I worked in the Structural Drawing office at the United Steel Structural Company and at end of our car park was the line to Cleethorpes and Immingham. In summertime I used to take my sandwiches down by the lineside and sit on a pile of steel beams to watch the B1s come by with the lunch time Up and Down trains. I thought the B1s were very handsome engines but there is no way that a 5 inch gauge Springbok lives up to that accolade.

Some readers may know that I have already designed the BR 2-6-4 Tank, a 4-6-0 Class 4, the Britannia and I am well on with the BR Class 4 2-6-0, all in 5 inch gauge. I have also redesigned the GWR 5700/8750 Class Pannier Tanks, mostly to the works drawings. The next target just had to be the B1.

There are thirteen drawings (A0 size) for the locomotive and tender and four more (A1 size) for the tender. If you are going to build the locomotive, you need these drawings. For the tender there is the General Arrangement drawing, the tank drawing and the underframe details which are available now through G & S Supplies. The drawings show all five different types of tender (excluding the self-weighing variety, of which ten were built and circulated amongst the other engines). Very fortunately most of the 410 B1s lived with their own tenders throughout their lives. There are notes on the drawings to say which tender belonged which engine. There are some which had snap head rivets to fix the top plates to the sides; some were flush riveted ones; there were ones with the coal plate positioned over the water dome and there's a drawing showing the position of the coal plate later in life (the 1950s). At the front end of the tender there are drawings to show the differences between the Darlington built and the contractor built ones. The Darlington built ones had inclined shafts to the water valves and others, including the North British ones, were vertical.

There are two sets of frames for the B1s – for both the locomotive and tender - and they changed at 61340. This information is all on the drawings. On numbers 61400 to 61409 the drag beams were cropped off. The tenders on 61000 to 61039 did not have intermediate buffers and the coal plates on all the tenders were altered to suit the cab profile during the 1950s. As mentioned, tenders for the engines numbered 61352 to 61354 and 61357 had snap head rivets to join the upper side plates to the tender sides and 61355/6 and 61400 to 09 had these plates joined with countersunk rivets so, apart from the step, they were flush sided. The remainder were all completely flush sided.

None of the B1s ever had the K3 tender as Martin Evans had drawn to go with

B1 61264 ready for the ball!

Here she is again at Pickering.

his Springbok. I think that Martin must have thought that as they were paired with an LNER Group Standard Tender, any of them would do - but he just happens to have picked the wrong one. The K3 tenders were only 3,500 gallon capacity but the B1s all had the 4,200 gallon LNER Group Standard tender which is obviously a much larger tender. All of the tenders had steam brakes and a through vacuum pipe.

For the locomotive, I have been concentrating on drawing all the differences such as six different driving and coupled wheels, four or five different smokebox fronts and five different front bogies.

I did not have any proper details for the valve gear so I contacted Don Ashton and he sent me all of the full size details - and they are all dimensioned in 64ths on the full size!

The Steam Workshop already have the proper castings in stock for the buffers, tender horns and all the suspension details, including the spring hangers and brackets, spring helpers, Spencer blocks, axle box covers and all the usual finishing details such as steam heating and vacuum pipes etc.

I have set out the details of all six driving and coupled wheels, some of which had additional plates riveted to the balance weights. The first ten B1s and the next batch were built with V2 wheels. The driving wheels had the balance weights 5 degrees in advance of the crank. The coupled wheels had the balance weights 4 degrees in advance. The details of all these locomotives - which ones had which plates - are given on my drawings. Note the difference in the driving wheels between the two preserved B1s 61306 (which is wrongly named *Mayflower*) and 61264. (*Mayflower* was an Immingham engine, number 61379, which I used to see regularly so this naming of a different engine is very annoying for me!)

Anyway, **photo 1** is a photo which my granddaughter (aged six!) took for me at Grosmont and it shows the engine off very nicely. Note that this engine has wind shields to the front and rear of the cab windows, but these were only added for when it is working tender first and is not a feature to be copied.

Photograph 2 is a lovely photo of the B1, 61264 after it had emerged from Crewe Works following a major overhaul and shows the other side of the engine. I am not sure who took the photo. **Photograph 3** shows the front end of the B1, this time at Pickering (taken on the occasion of a courtesy trip for my support for the LNER Coach Association). Note that by this stage the step on the smokebox door has been removed.

I have drawn out the front views of all five of the different bogies and noted on the drawing which locomotives had which bogies. Can I suggest that when building a locomotive to my drawings, choose a number and build your engine to suit so you will not be disappointed, as there are *many* differences. I have only drawn out one of the front bogies fully but there were two types; one had leaf springs and one had coil springs … but it seems that 61264 has both!

I have drawn up the cylinders and all that goes with them on Drawing No. 7 but I have included a rear cover which the B1s did not have. They were blind bored, similar to the A1s, A2s, A3s, A4s and the V2s. I thought that it would make sense to do it this way so that the bores could go straight through; they are then fitted with a mild steel cover which can easily be disguised.

Smokeboxes next: these are all on Drawing No. 8 and I have shown the smokebox barrel drawn as a flat plate. There is quite a variety of front views to the B1s; the first ten B1s had smokebox doors which were (when dimensioned for the model) $4\frac{25}{32}$ inches outside diameter and were $11\frac{11}{16}$ inches radius so were very flat. This applied to 8301 to 8310. They also had the door hinges at $2\frac{1}{8}$ inches centres; the handrails were bent inwards and then exactly followed the radius of the door. The later doors, which were $5\frac{1}{16}$ inches diameter had a much more pronounced curve at $10\frac{27}{32}$ inches radius. The hinges on these smokeboxes were very narrowly spaced at $1\frac{5}{16}$ inch centres. The number plates then had to be placed above the top hinge. The final type of door was the same diameter

B1 backhead, Fireman's side…

...and the Driver's side.

(5 1/16 inch) and they were 6 7/8 inches diameter and the hinges then reverted to the 2 1/8 inches centres which gives them a much more bulbous effect. The handrails from now on were radiused from the outside handrails to the knob in the top centre.

Locomotives from 61190 were fitted with a step on the door but these were dispensed with later.

Photographs 4 and **5** show as much of the boiler backhead as I could get in and on the mid right is the clack and input for the right hand injector. Attached to the right of that is the train heat valve. There are also the two gauge frames and in the middle there is, of course, the regulator. On the extreme right is the steam brake valve with a cross shaft to the other side of the engine so that the driver can also use this. The valve is identical to those on the BR Standard locomotives. These photos were taken by John Tomlinson who built a wonderful B1, despite the drawings! Photograph 5 is the left side of the backplate and on the left of this photo is the left-hand injector steam valve and clack and just to the left of that is the blower valve. Below is the very hefty reverser and attached to the right-hand side of it is the forward and reverse sanding gear. Just above the reverser is part of the vacuum brake ejector and right at the bottom of the picture is, of course, the fire hole door which I hope I have faithfully copied! Just above the fire hole door is the shaft coming across with a similar ratchet on it for the steam brake valve.

From 61350 onwards the smokebox doors changed again and although the diameter remained the same at 5 1/16, this time the radius of the door changed to 6 7/8 giving them a much more pronounced domed effect. The door hinges reverted to the 2 1/8 centres so the number plates in this case were placed below the top hinge. I have shown the superheaters on this drawing, and they are a departure from the usual single row as I never think that we have enough superheat on our 5 inch gauge locomotives. I first tried this on my BR 2-6-4 T, the 4MT, with great success as it performs very economically.

The superheater elements are only 5/32 in diameter and with a double bend in them they will fit down a ¾ inch x 18 swg tube and one can still get a flue brush down the tubes to keep them clean (**photos 6** and **7**). There are no obstructions in the smokebox to interfere with the cleaning operation as the main steam pipes go straight down the insides of the smokebox and into the steam chests. The header for the superheaters is tucked right in the top of the smokebox, just as on the full size engine. The upper set of elements is radiant and the lower set ends at the fire box tubeplate. There are ferrules on some of the side stays in case you want to fit a brick arch inside the firebox. There are 58 feet of elements in my smokebox.

There is the conventional LNER anti-vacuum valve on top of the smokebox just behind the chimney. I have drawn the engine with the correct LNER 100A boiler with its sloping backhead; Drawing No. 10 refers. I have also drawn most of the various fittings, including the manifold, fire hole doors, regulator handle and the blower valve. At present I am just working on a suitable design for the 'SJ' vacuum brake ejector so that it looks correct, although I have not found the correct drawing for the internals of the ejector. I am missing the works drawing for that so if anyone can lay their hands on one I would love a copy of it - but hopefully you will not be needing this immediately!

The Drawing No. 11 is all of the side platforms and, would you believe, they consist of 23 pieces! I have, of course, detailed them all off the joints in the engine as, once again, I could not obtain a works drawing for these. I have, however, measured them myself.

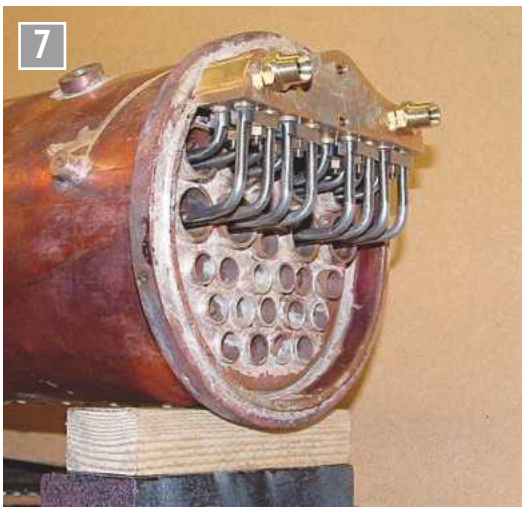
On Drawing No. 9 there is the view of all the cab fittings, details of the front cab window frames, the cab side windows, the vacuum brake reservoir, steps - including the left hand one which has been modified to accommodate the AWS box behind the cab step - and the grab rail to fit on the front platform. Also on there is all of the cab details including all of the separate plates.

I am intending to make a start on the tender drawings next month so if you have not started on the tender for your Springbok yet, you can at least fit the correct tender on your engine.

(I will include a general arrangement next time as it deserves the centre spread and that is not available this time! – Ed)

I cannot build the locomotive myself but hopefully the description which I will give will allow you to do so. If you have any photographs of your builds of my engine I would be more than delighted to see them.

●To be continued.



FAR LEFT: The superheater header on my BR Standard 2-6-4 4 MT and the superheater elements.

LEFT: The arrangement of the smokebox header and, as you can see, there are no obstructions to the tubes.

A K.N. Harris Oscillating Engine PART 2

Geoff Walker builds a simple oscillating engine designed and described by K.N. Harris 75 years ago.

Continued from p.761
M.E. 4679, 3 December 2021

The cylinder and associated parts

The cylinder assembly is in two parts, comprising what is the cylinder itself and the cylinder port face and trunnion. The two parts can be seen assembled in **photo 6**. They are located together by an 8mm stub register and bonded with JBW. The sectional view in in fig 1 shows the two parts together and fig 2 has details of the cylinder port face and trunnion (figures are in part 1).

The latter can be made in much the same way as the port block. It has the same profile and will need to be gripped by the register boss in a rotary table chuck, like the arrangement in photo 5 (part 1). There are three port holes to drill, with the auxiliary port drilled to a depth of 2.5mm. Drill the horizontal hole to link both ends of the auxiliary port and then Loctite a 3mm plug in place as shown. The stub trunnion is extended for the spring and nuts using 3mm mild steel rod.

The auxiliary port arrangement as shown in fig 1 and 2 is an alternative suggested by KNH in issue 2381 and is the one I decided to use in preference to the much simpler exhaust shown in photo 2 (part 1). As can be seen, in the latter the exhaust(s) is two holes drilled at a mid-point through the sides of the cylinder.

The cylinder is machined from cast iron, the following is a brief suggested procedure:

1 Prepare a block of cast iron 32mm long and 23mm square, centre it in a four jaw chuck and then drill, bore and ream a 12.7mm hole. At this setting turn one of the cylinder flanges 23mm diameter and 2.5mm long.
2 Now prepare a mandrel, 12.7mm diameter and shouldered at the end for a 10mm nut and washer. Slide the cylinder on to the mandrel, secure in place and turn the other cylinder flange. This mandrel will be used again to support the cylinder for machining the semi-circular waist (**photo 7**).
3 Select an inner port face, drill the three port holes and mill the recess for the register. Mill the two port channels top and bottom and then drill link holes from the channels to the port holes. The latter process can be seen in **photo 8**. In between the two flanges, mill the two flat sides of the cylinder, removing 3mm from each side of the block to leave a face width of 17mm for the inner port face.
4 Using the rotary table set up as shown in photo 7, machine the semi-circular waist at the front of the cylinder.

≫

Front view of the complete engine.

The dismantled engine.

5 The fixing holes in the flanges are for an 8BA thread, on a 19mm pitch circle diameter and can be positioned by jig drilling from the cylinder caps or using coordinates on the milling machine.

The cylinder caps

The top cap contains the gland, the plug is made from 6mm A/F brass and the thread is 2BA. The four bolt clearance holes are on a 19mm pitch circle diameter are for 8BA screws or studs and can be positioned for drilling using the rotary table.

The big end guide

I chose to make the big end guide in a similar fashion to the cylinder. Using 25mm round cast iron stock, prepare to length and then drill and ream 8mm for the big end. At the same setting turn the register diameter to match the outer gland diameter on the top cylinder cap. The outside diameters can be turned on a mandrel like the one used for the cylinder. To machine the crankpin slot I used the rotary table setup shown in **photo 9**. The part machined cylinder block, the top cap and the guide are all attached. The upper surface of the block will be the inner port face. This is set level with a D.T.I. and then the table is locked in place before machining the slot. I drilled a ⅛ inch hole at each end of the slot and the remainder was removed with a ⅛ inch end mill.

The piston and big end

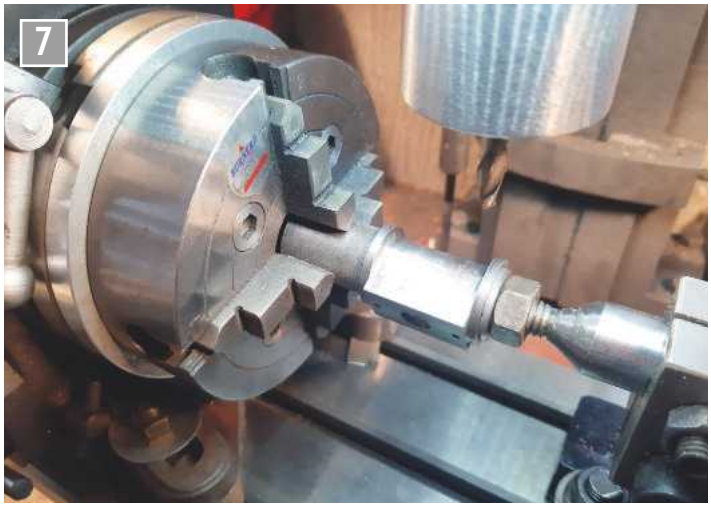
The piston and big end are both made from brass and can be seen in photo 6. Note the two shallow 'V' shaped oil grooves in the piston which are an aid to compression as well as lubrication. The connecting rod is made from 3mm silver steel. There is no adjustment/lock nut on the big end but this could be added if so desired. My choice was to adjust the length of the rod until the length between the crankpin hole centre and the end of the piston was 46.5mm.

The piston is turned a little oversize on diameter and 13mm long, then attached to the piston rod as shown with the addition of Loctite if found necessary. Grip by the rod in a collet chuck or a small chuck which grips truly concentric and turn the piston to a close sliding fit in the cylinder. Screw the big end on to the other end of the piston rod and turn the big end to size, repeating the same procedure so it is close sliding fit in the big end guide. If using a small three jaw chuck the turned piston could fit inside the chuck body and if the jaws are not too long they will still close on the piston rod. The big end can then be turned to size leaving both piston and big end diameters concentric. The big end will have to be removed to replace the cylinder cap but it should be possible to reset it in the turned position.

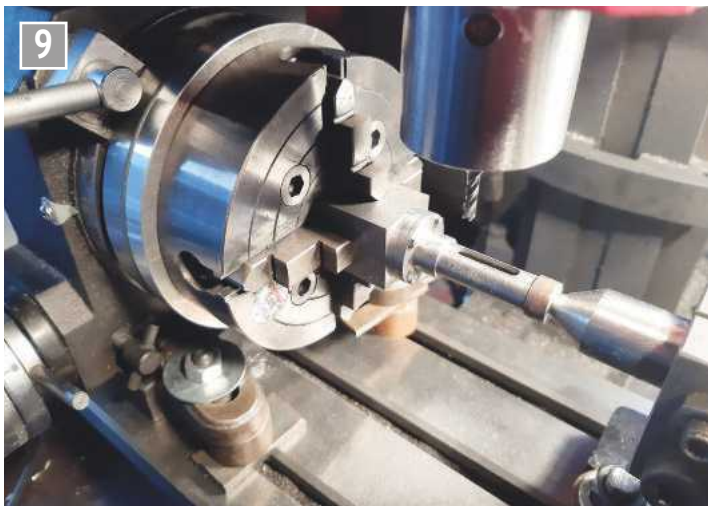
The flywheel/crank

I chose to make a combined flywheel and crank; the space was there so it seemed like a good idea. What you see in fig 3 (part 1) and the photographs is my attempt to provide a balanced crank whilst still maintaining the inertia of a flywheel.

After some initial turning and drill/reaming the crankshaft hole the flywheel/crank can be held as shown in **photo 10** to drill the crankpin hole, the balance holes and mill the



Machining the front of the cylinder.



Milling the slot in the big end guide.

Drilling the port holes.

Milling/drilling the flywheel/crank.

Rear view of the engine.

semi-circular grooves. The crankshaft can be secured with Loctite.

Summary/conclusion

On completion of all the parts it is probably a good idea to assemble the engine without any gaskets/seals and run the engine using compressed air.

On final assembly, for the cylinder cap gaskets I used P.T.F.E. sheet 0.1mm thick and for the seal in the gland, plumber's P.T.F.E. tape rolled into string and wrapped around the piston rod.

A rear view of the engine (**photo 11**) shows the position of the base fixing screws. The base is mahogany, stained and then clear varnished. The painting is a brush finish using Humbrol grey primer and colour. If you like the colour, it is number 23, duck egg blue.

A steam run, with gaskets fitted, was done using the small boiler shown in **photo 12**. I do not know at what pressure this boiler operates but I would estimate around 5-10 p.s.i. The boiler was bought on the internet and uses bio-ethanol burners. It has been modified by adding an adaptor, a globe valve and a homemade displacement oiler. It is more than adequate for all my miniature oscillators but because of its small size the engines only have a short running time.

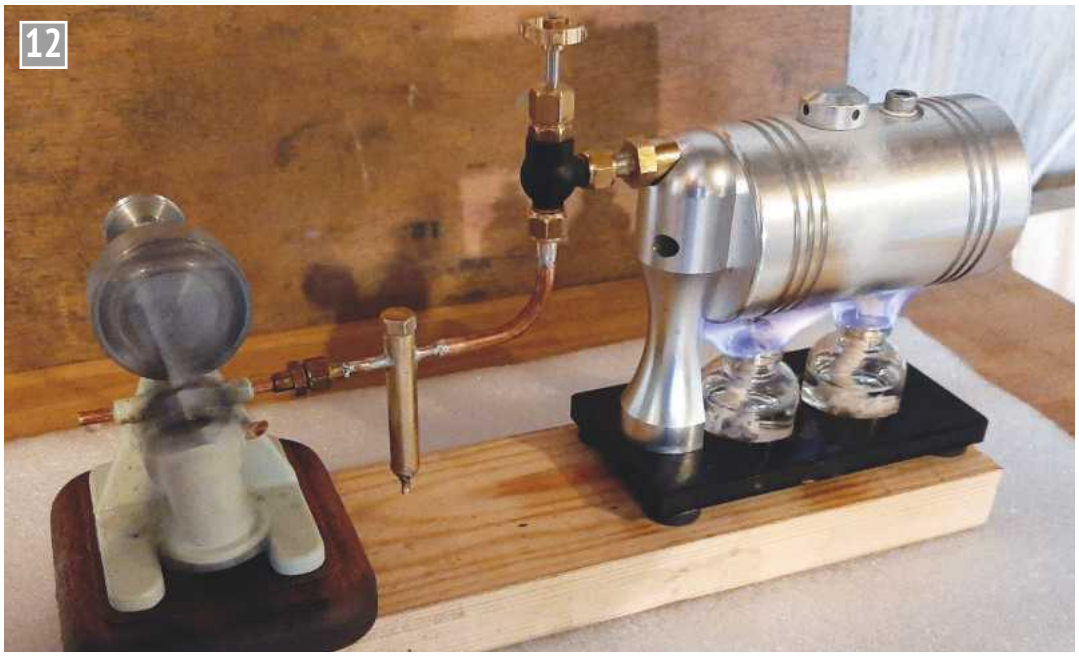
I found the engine ran well on air and steam, at both high and low speed. The big end guide seems like a worthy addition as does the combined flywheel/crank.

I am not so sure about the additional auxiliary exhaust port. At low speed it appeared to make no difference to the engine performance whether it was open or closed (blocked off). It was only with the engine running at high speed that I could sense a marginal performance improvement with the port open. The jury is out on this one. In my opinion the engine runs fine without it but really it is a maker's choice whether to leave out or include and judge for themselves. If the port is left out the relief area in the port block can be enlarged to make it symmetrical.

The spring for the engine has a free length of 20mm, has a 6mm outside diameter and has a wire thickness of 1mm. I tried a few different springs, including the much lighter one shown in the photographs but this one gave the best result.

This model has now been added to and is on display with my small collection of miniature oscillators. It presented some design, machining and assembly challenges which I found most enjoyable. If you decide to make this oscillating engine I do hope you enjoy the process as much as I did.

ME



The engine running on steam.

CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.

Bon thingy, *an autre billet pour la plume de mon oncle Geoff*. Oops! *Pardonnez moi.*

I am taking up my recumbency after a brief interregnum since I sent off CN 4679 to the editors, during which time I have restored a vhf radio transceiver to working order and begun work on a power supply for a broken oscilloscope. It will supply 2 x 6.3 volts, 30 volts, 200 volts and minus 1.5kV.

This will be treated with utter respect, as you may imagine. They say things come in threes. Hmmm. Just after hanging new curtains, the microwave oven expired, loudly and spectacularly. So, its curtains for that as well. Twee, pink and decorative or plain, 'keep the daylight out' new ones?

I visited Doncaster spotting a tamping machine parked briefly in a bay platform. I was wandering tamper-wards with picturesque intent when it hauled in the anchors and left. This one, mayhap? https://www.youtube.com/watch?v=QHCLGMdEVQo

In this issue, a *coup de grace*, leaky tanks, a hand-powered lathe, molehills, a winnerless competition and brakes.

This is the great model by John Regan, mentioned in *M.E.* 4679 (**photo 1**).

Ryedale Society of Model Engineers' August *Newsletter* reveals much activity over the period; nothing really to remark on, what with ongoing maintenance, school visits, good weather, etc. Unfortunately, no cameras were available when three drivers fell off during the proceedings, causing the signalman to put his signals to danger: 'Obstruction on line'. I suppose the Earth moved for them, dizziness from overuse of the turntable, tea too strong, a 'Y' in the day perhaps. Is there an acronym for this event, as there is SPADs, for running a red signal? 'Fell off near Club House, FOCH? *Hmmm*. Foot caught under k...? No, No, No! One of the regular signallers was away being married, two others were with him for moral support. Nevertheless, preparations for the first 5 inch gauge mainline rally in two years went ahead apace. Some seemed not to leave their 'box' for four days, or so it seemed. A view of the turntable revealed an impressive collection of motive power, whilst the goods yard was full to overflowing. Tinsley was never like this (**photo 2**)!

John Regan's cardboard locomotive from Hutt Valley & Maidstone MES. (Photo courtesy of John Regan.)

The last item in the *Newsletter* is a brief explanation of the signalling system at Gilling. No longer is it switches and manual points, but computerised and power driven. Consequently, the S&T dept has members who might be said to live in a state of 'Linuxorious'-ness with respect to their activities... Moving swiftly on, Signalman Sam and Kate were married in Dorset and emerged from the church under an arch of firemens' shovels.

W. www.rsme.org.uk

B&DSME News, September, from **Bournemouth & District Society of Model Engineers** has a good picture of Kevin Hunt's newly built A4, 60021 *Wild Swan*. I have driven Roger Holland's version of this locomotive at the Sheffield track, although it was all stoked up, so I needed only the regulator and brakes for a couple of laps. Ron Barson warns against water being left in locomotive tanks for a period as they may develop corrosion and leaks from the salty washout water, also, a biological contamination may occur, blocking the injectors or filters.

W. www.littlledown railway.org.uk

RSME Mainline rally. (Photo courtesy of Bill Putman.)

Maritzburg Matters, September, from **Pietermaritzburg Model Engineering Society**, contains a handful of pictures of disasters in the steam world: a traction engine in two separate halves - not a boiler explosion, looking carefully; a locomotive being removed from the building it demolished and a pair of TEs crossing a river. One assumes that they had checked the depth of water before risking extinguishing of the boiler fires. Another photograph depicts the one man-power hand wheel used to drive the lathe (in five-minute shifts) on which George Stephenson made his first engine.
W. www.pmes.co.za

Due to circumstances entirely within my control but not activated (I couldn't find it) the picture of my most favourite locomotive - a 4F at K&WVR - is unavailable. Instead you have the never-to-be-forgotten picture of me being entrusted with a live steam locomotive (**photo 3**).

Grimsby & Cleethorpes Model Engineering Society's *The Blower,* September, contains an item regarding 10% ethanol in petrol and its use in mowers, generators etc. YouTube and other sites offer ways of removing or neutralising the chemical. (Reminds me of making diesel fuel from common substances – Geoff.) August's *Railway Magazine* describes a project to convert Class 08 08649 shunter to hybrid power. The result is twice as powerful and is more precisely controlled. A Stage 5, John Deere 6.8 litre engine drives a generator for recharging the batteries. (Stage 5 is the latest standard in emissions control, reducing still further particles of soot and nitrous oxides in the exhaust – Geoff.)
W. www.gcmes.com

A sequel to Barry Goldings' book, *The Company of Men,* on the history of the Men's Shed movement, has been produced; amounting to 400 pages, it is entitled *Shoulder To Shoulder, Broadening the Men's Sheds Movement.* One Immanual Doss has invented a tool which helps people to saw wood in a safe manner, relevant especially to children learning to saw. It is very simple, suits the left- and right-handed and will fit wood up to two inches thick.

A friend and I were talking about our gardens. He said he spends much time on keeping his tidy, whereas I regard ours as a space in which to erect radio aerials. Debs is not a gardener either. Currently, it has an array of molehills, some looking like pyramids - so we may have Pharoahs at the bottom of our garden….

CoSME Link, autumn, from **City of Oxford Society of Model Engineers** informs us that a replacement mower, *Gladys 3* has been obtained, as *Gladys 2* has been declared uncooperative and sold. Coincidentally, in early November, the chairman of the Old Lawnmower Club will give a talk. The Dreaming Spires rally went well, despite worries over the Covid virus. Brian Remnant and Mrs. R. brought along a 'gravity' motorised slate wagon. John Bentley reports the celebrations on the occasion of the opening of the Newton Abbot and Moreton Hampstead Railway, as they appeared in a contemporary local newspaper. The language is quite flowery, as was the fashion, but writers were paid by the word. If a lady's crinoline was crushed in the crowds then it could be the occasion for an attack of the vapours and the administration of pungent smelling salts, but eventually taken with good grace. A novel way to service a locomotive shows the front end hoisted aloft to enable servicing to be performed. No doubt this is to keep the firebox crown covered, or to avoid rusty water dripping on the poor unfortunate below…
W. www.cosme.org.uk

John Bryant reports on the state of the **Ottawa Valley Live Steam & Model Engineers'** elevated track and the attention given to the engine shed bridge, illustrated by photographs. This corrects major problems, as we can see, or would have, had they been included with his e-mail. Fortunately, this senior moment was rectified shortly afterwards, so its wasn't all a figment of his imagination….
W. www.ovlsme.x10host.com

The Theasby express gets under way.

Durban Society of Model Engineers, newsletter, sent by Jon Shaw, who sends me almost all the South African model engineering newsletters, has little to report, but sent with it was the June *Wheeltapper*, from Western Province Live Steamers. Sadly, the Nessling family are emigrating to the UK, to live in a safer environment. Such problems are only occasionally hinted at in newsletters but we do understand in our reflective moments. With the easing of restrictions, KykNET's *Leif Jou Reis* asked to visit. Presented by Gerrie Pretorius, it appears to be a magazine travel programme of DSTV, a sort of 'Sky TV' organisation. I had some difficulty finding out more because there appear to be few concessions to English on its website, being written almost entirely in Afrikaans. Not to despair, this is an opportunity to learn more about SA. There are lots of photographs of activity at the club site but there are few active members.
W. www.dsme.co.za and www.wpls.co.za

York City & District Society of Model Engineers, *Newsletter*, September, begins with details of the only surviving beam engine by Bradley & Craven of Wakefield. It was acquired in order to drain land near Tattersall, Lincs. It is unusual for its scoop buckets rather than centrifugal pumps which were just being introduced when it was installed in 1855. See www.dogdyke.com Allan Denton has built a 3½ inch gauge Class B Darleeling & Himalayan locomotive, designed by Ray McMahon, whose series on his build was published in *M.E.* Volume 204 to 210. David Joy's book on *Piercing the Pennines* is reviewed by editor, Roger Backhouse. It describes the railway tunnels through the hills between West Yorkshire and Lancashire, although that range of hills was not so identified until the 19th Century. The new workshop has been planned, built and kitted out by members working under Covid restrictions. Well done to all concerned! A challenge by vice-chairman, Richard Gibbon, to launch a tennis ball using a trebuchet built for the purpose, led to a fun afternoon although we are not privy to the identity of the winning team. Perhaps we should be grateful that there were no fisticuffs nor was the law invited to contribute. Bob Lovatt, also locked down, built a whimsical diorama of Fred Dibnah in his workshop. Kevin Dick made a model of *Bismark* from a kit. "Its not as easy as it looks" he

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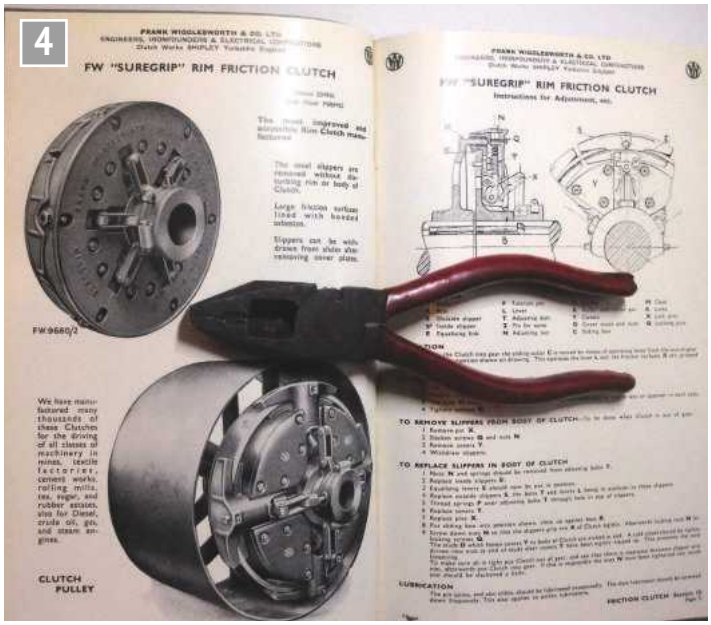

Frank Wigglesworth clutches, from 1950s catalogue.

says, and it doesn't look easy! Phil E. Stein received two art books to review. Since BMES claim to be the only model engineering publication with an Arts Correspondent, he did so. All is not lost, however, as both books are concerned with paintings of railway matters. A further review is of Arthur Peppercorn's contribution to railways and industry during and after WWII. The reviewer also firmly scotches the tales of the supposed vendetta by Edward Thompson towards Sir Nigel Gresley. A generous gift by Peter Bentley to the Society, of an H. A. Taylor half-completed beam engine provides the opportunity to create a good model involving the members, juniors and beginners, finishing with an asset to the Society. Finally, Roger asks for contributions from members regarding their early engineering experiences. *Hmmm.* My third job after leaving Stalag Heer 13 (KBGS) was at Frank Wigglesworth & Co. in Shipley. I was Chief Cost Clerk, responsible for the introduction of a computer and the associated paperwork. I therefore got to know all about engineering, from the point of view of an unqualified and untrained observer. I discovered, in a dusty cupboard, a catalogue in mint condition, from the company's heyday in the 1940s and 1950s, which I still have. It boasts of the latest and most up-to-date plant, private railway sidings, etc. but it had fallen on hard times by the time I arrived (**photo 4**). Mr. W. founded the company in 1903 and had a new factory built in 1913. He studied mechanical power transmission deeply and the business grew to having a worldwide presence, with offices or agents in 14 locations. He worked closely with Prof. G. F. Charnock in the power transmission field.* The new (mid-1960s) company logo 'Fw' was designed by a young lady in the office, winning a competition open to all employees (**photo 5**).

W. www.yorkmodelengineers.co.uk

Deborah was a little startled recently when the microwave oven departed this earth, reminiscent of Tommy Steele's photography experience in *Half a Sixpence*. For its sins, it has been disembowelled and the useful bits, microswitches, electric motors etc. now reside in my spares box whilst the transformer, now suspect, provided a suitable mounting for the intermediate shaft of my diesel-outline, chain-driven locomotive as well as contributing to the tractive effort by its mass.

The *Bristol Model Engineer,* summer edition (although the front page claims it is autumn) is from **Bristol Society of Model & Experimental Engineers,** with whom I would query my MIDI instrument problems. Despite being named after that illustrious city, its claimed ability to join up a MIDI keyboard with any number of music synthesiser programs is false. I followed the instructions to the letter, yet they all failed at the last hurdle. They can't all be wrong, so it must be me. *Hmmm.* Anyhow, back at the ranch, Bob Lilley discusses Galloway non-dead centre engines, one of which survives at Bolton Steam Museum. Bob made a fine model of such an engine, doing much original research because information is sparse. Alan Bartlett updates progress on the 16mm railway. Tim Hims has a fine three-coach model of a modern train (Azuma?). Bert Roberts has made some cheap disc brake systems using brakes from Mini-Moto bike components. Bert explains the operation, modifications and fitting to carriage bogies. Go-kart brakes cost about £100 per corner but these are only about £12 each and strong enough to do a good job. Kevin Slater adds power to his hydraulic press.

W. www.bristolmodelengineers.co.uk

Intrepid motoring correspondent, Gerald Cann, spotted a sticker on a car; 'My ex-husband is in the boot.' I like it…

And finally, "And God said,

$$\nabla \cdot \mathbf{D} = \rho$$
$$\nabla \cdot \mathbf{B} = 0$$
$$\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t$$
$$\nabla \times \mathbf{H} = \partial \mathbf{D}/\partial t + \mathbf{J}$$

and THEN there was light."

*I also encountered this 73-page document when researching Prof. Charnock. Yorkshire is the IMechE's oldest region…

https://nearyou.imeche.org/docs/default-source/Yorkshire/imeche-yorkshire-centenary-book.pdf?sfvrsn=2

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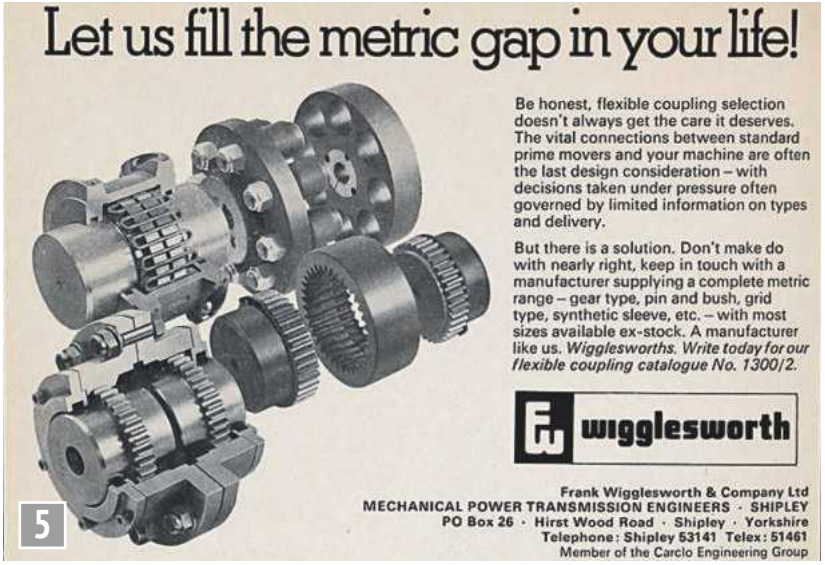

FW advertisement and logo, 1960s from Grace's Guide to British Industrial History.

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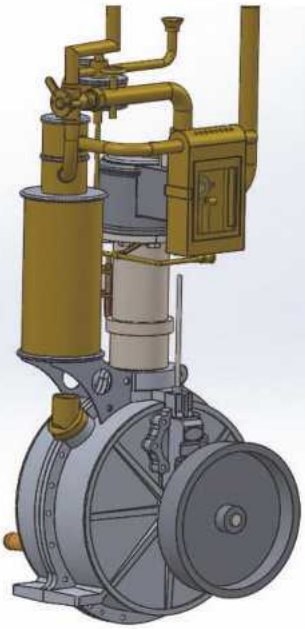

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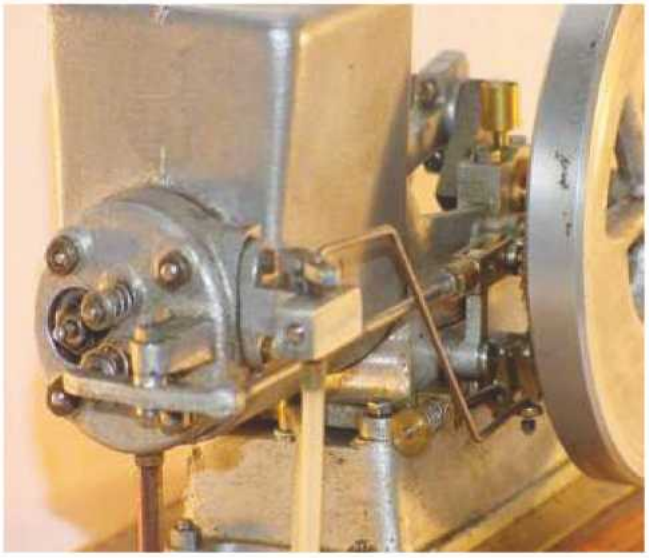

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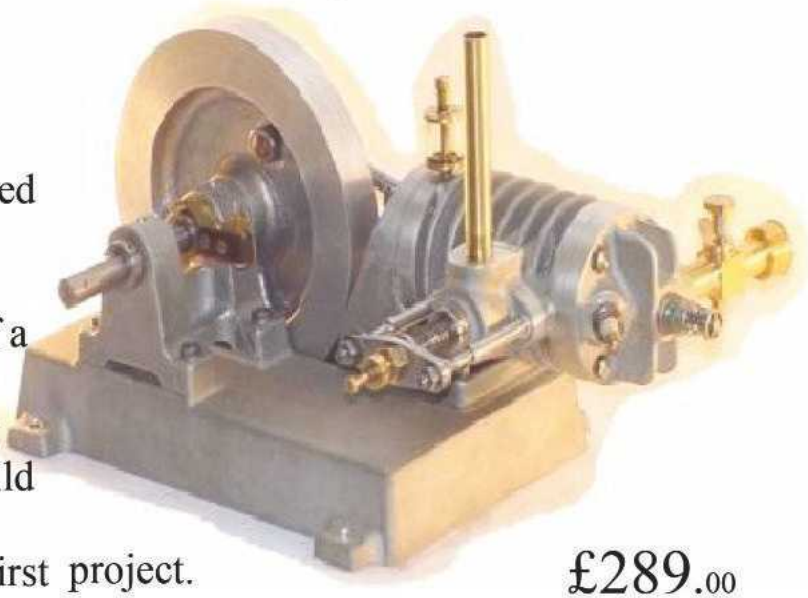

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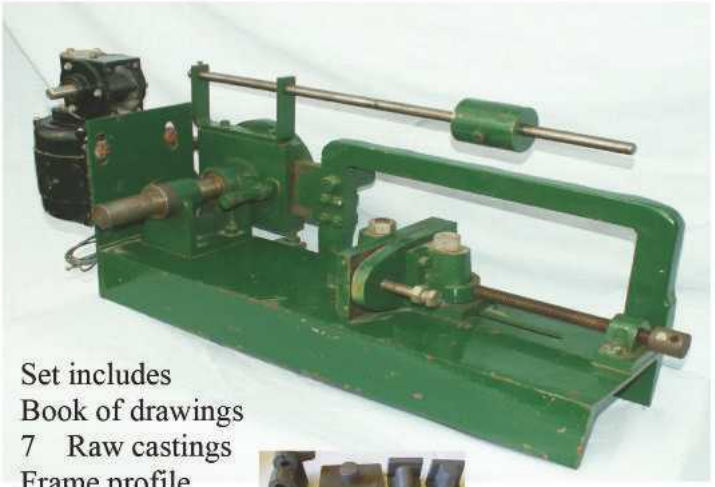

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