

THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 229 No. 4693 • 17 - 30 June 2022

MODEL ENGINEER

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Riverside Museum

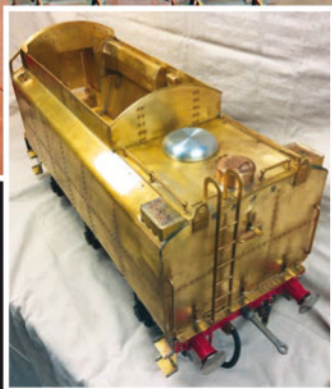
We are reminded of Glasgow's rich industrial past

MATTHEW MURRAY

The rise of Boulton and Watt's competitor

We Visit Leyland

A trip to a thriving club in the North West



BRITANNIA Part 12

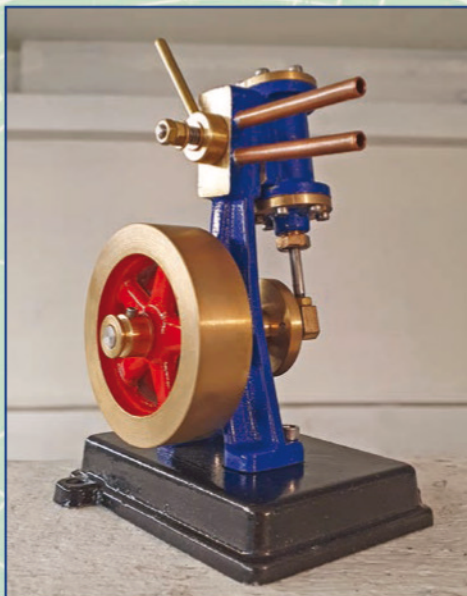
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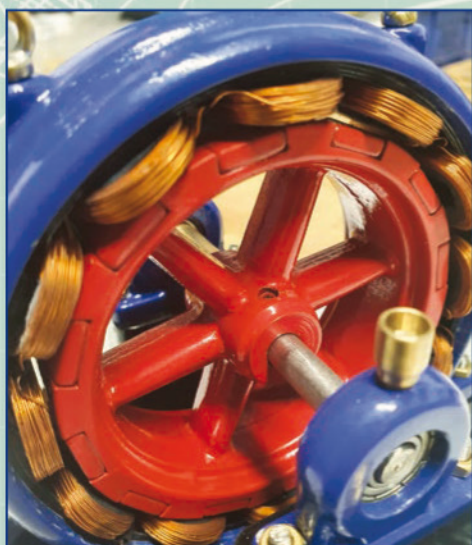


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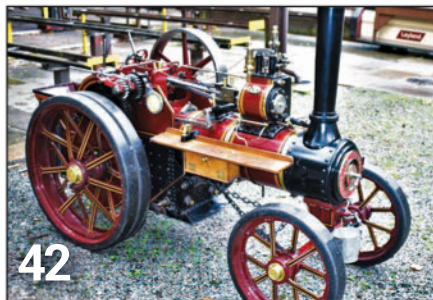


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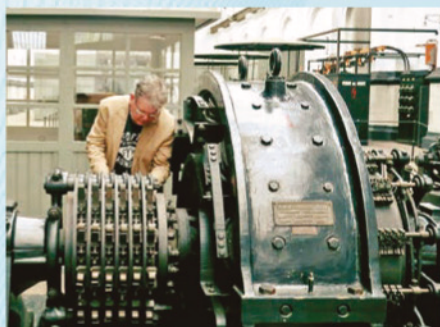
Cake break at a Gauge 3 get-together (photo: Ted Sadler).

This issue was published on June 17, 2022.
The next will be on sale on July 1, 2022.



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Mike Pavie



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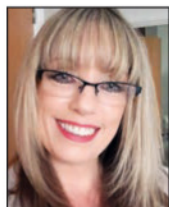
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Gloucestershire Extravaganza

If you are into extravaganzas then it may be well worth while taking a trip over to Gloucestershire.

After a two-year hiatus due to the pandemic, the 46th Gloucestershire Vintage & Country Extravaganza will make a welcome return to South Cerney Airfield, Cirencester on the 5th – 7th August 2022.

Rally chairman Martyn Slater said 'The show will be packed full of exhibits, displays, entertainment and stalls to keep the whole family entertained. We pride ourselves on being one of the best value days out for all – and we've frozen our prices for the 11th year. What's more, the event helps local and national charities with up to 30 represented on site raising money and awareness of their respective causes. The Club (Stroud Vintage Transport and Engine Club) has donated over £200,000 for charity in recent years. So, whether you are an exhibitor, visitor, trade stand, entertainer or volunteer, we can't wait to welcome you back to the show and let the good times roll ...'

Live Action Arena - the Steam Section is at the heart of the show and will be packed with nearly 70 full-size steam engines of all descriptions. The infamous 'Demonstration Arena' puts these mighty machines to the test and there's the opportunity to drive one. Don't miss the grand parade of miniature steam in the Alec Tanner arena or watch The Royal British Legion Poppy Parachute Display Team daily descent.

The Countryside Arena - promotes animal conservation and features fun and educational displays from bird of prey flying demonstrations, ferret racing, rare breeds, shire horses, horse logging, reptiles to beehive making. The popular Dog Show will make its return with all money raised going to a local animal shelter.

West Riding Rally

The West Riding Small Locomotive Society will be holding its annual Rally/Open Weekend on the 13th and 14th of August. All are welcome to these all-day events with or without a locomotive. As this is a public event hauling passengers, priority running will be given to locomotives capable of performing that duty on the ground or raised level tracks. Please bring boiler certificates, club insurance and spark arrestors. In addition, we are in the process of building a garden railway which consists of two loops approximately 200 feet in length using 45mm (Gauge 1) and 32mm (0 Gauge) track with additional sidings and passing loops. This will also be available for visitors to run their locomotives/trains on.

Refreshments will be available throughout the day and parking is available on site. Further information can be had by visiting our web site, Facebook page (search for WRSLS) or by contacting Stuart Merton - email wrssec@gmail.com or by phone on 01132 523258.



Kids will love it too – there's so much to keep them entertained from the vintage fairground organs, 'electric yachts', waltzers, big wheel, steam-driven 'gallopers', traditional penny arcade games, to passenger rides on board a 10¼ inch scale steam locomotive or 'Chuffy the train' to Professor Colliwobble with his traditional Punch and Judy Show.

Massive Trade Stand zone - featuring 180 trade stands, autojumble and craft marquees where you can have a rummage to find a hidden gem or bargain along the way.

Food and Drink - there's plenty of food and drink 'pit stops' across the showground - a firm favourite is the vintage tea room with the 1940s radio broadcasting a great selection of tunes, Lindy Hop dancers plus regular sets by vintage singer Miss Franny Delight. Miss Franny will delight you with songs from the 1920s

through to modern day with a vintage twist.

FREE vintage bus rides - operating around the perimeter of the show site, and to and from Cirencester Town Centre and Kemble railway station to the show ground connecting with selected First Great Western Trains including Stroud, Gloucester and Cheltenham.

What better way to spend a summer Saturday? More details can be found at www.glosvintageextravaganza.co.uk



Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
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Midlands Show

Meridienne Exhibitions wish to assure readers that the Midlands Model Engineering Exhibition in October will go ahead exactly as planned, as Chris Deith would have wished.

Soft Soldering PART 4

Graham Astbury and Mike Tilby delve into the background behind fluxes and soft solders.



Continued from p.743
M.E. 4692, 3 June 2022

Having reviewed in Part 3 (M.E.4692, 3 June) the various parameters that can affect a soldered joint, we conclude by discussing the practicalities of soldering and summarise the best options for various tasks.

Choosing the right method

The easiest way of deciding which is the best method is to summarise the data as in **table 2**. This starts with the first line, showing the simplest materials to join, going down the table with increasing difficulty of making a joint. Where a metal is not easy to tin, such as when soldering mild steel items together, the

best method is to use an active flux (such as Baker's Soldering Fluid) to tin the mating surfaces and then thoroughly wash off the active flux residues. The two items are then assembled and reheated to 'sweat' the two items together, with a little non-corrosive flux such as a resin-based flux, and applying a little solder as necessary to ensure a good joint. The same method can be applied to the joining of dissimilar metals, such as joining steel to brass. Where traditional soldering of wires to solder tags or terminals is undertaken, the usual pre-heating with the soldering bit followed by application of the flux-cored solder to the

joint is the best method. This also applies to the soldering of easy-to-tin metals such as brass or copper which can be heated by a flame. The cleaning of the mating surfaces and the application of the flux is followed by heating and the application of the solder to the joint when the parent metals are hot enough. It is also possible to add a pre-form of solder around a joint, such as where a tube or rod penetrates a plate. Here a ring of solder is placed around the rod adjacent to the plate, fluxed and then heated until the solder runs. This is similar to the typical 'solder ring' copper pipe fittings. In the interests

Table 2. Choice of solder and flux for various parent metals.

Metals to be joined	Flux	Solder	Comments
Tinned wires/electrical	Resin cored	99.3 Sn/0.7 Cu †	
Copper or brass	Resin	99.3 Sn/0.7 Cu †	
Tinned steel	Resin	99.3 Sn/0.7 Cu †	
Plain steel	Aqueous zinc chloride ‡	99.3 Sn/0.7 Cu §	If corrosion is a problem, pre-tin the steel, clean off the flux and sweat together using resin flux if necessary, or use phosphoric acid based flux #.
Zinc or zinc-plated steel	Aqueous zinc chloride ‡	99.3 Sn/0.7 Cu §	Can use cored electrical grade instead †. Do not use Tinman's or Plumbers' solder as they have antimony in them. Also can use phosphoric acid based flux #.
Stainless steel	Aqueous zinc chloride ‡	96 Sn/4 Ag	Also can use phosphoric acid based flux #.
Aluminium	Special flux in cored solder	80.1 Pb / 18 Sn / 1.9 Ag (Alu-sol™)	(ref 31)
Lead	Tallow and scraping	38 Sn/68 Pb/2 Sb	'Wiped' joints are not easy to do!
High service temperature	Various*	5 Sn/93.5 Pb/1.5 Ag	Max service temperature is 150 degrees C
White metal castings	Various*	Fusible Alloy	Depends on the base metal and the fusible alloy.

† Can also use electrical grade solders - 60 Sn/40 Pb or 50.2 Sn/47.9 Pb/1.9 Cu instead.

‡ This flux may also contain ammonium chloride, depending on the manufacturer.

§ Best not to use resin cored solder at the same time as an aqueous zinc chloride flux.

See section below on stainless steel fluxes.

* Use the flux appropriate to the solder and the metals being joined, as guided by the supplier.

of the environment, the use of lead-bearing solders should be minimised and the lead-free varieties used instead wherever possible. It is important that cleaning of the metal is not undertaken using emery cloth as this can leave a deposit which interferes with the action of the flux and can inhibit the tinning of the metal. Wire wool, filing or sandpaper are the best methods of cleaning the surfaces to be soldered.

Stainless steel fluxes

As stainless steels all contain chromium they require a quite aggressive flux to remove the chromium oxides that readily form on the surface. Whilst the standard zinc chloride flux (Baker's Soldering Fluid) will usually be adequate for soldering stainless steels, there may be times when a more aggressive flux is required. One such flux was originally developed by Firth-Vickers Stainless Steels Limited for their 'Staybrite' steels (ref 32) and the method of preparing it and its properties are given as follows:

For 2 litres dissolve 520g. of zinc chloride, 180g. of ammonium chloride and 40g. of ferrous sulphate in a mixture consisting of 800ml. of hydrochloric acid (sp. gr. 1.16), 460 ml. of water and 40ml. of ethylene glycol. The addition of 2% ethylene glycol and 2% ferrous sulphate to this flux imparts distributive and wetting properties which are quite exceptional and this improved flux will be found particularly useful in cases of difficult or awkwardly situated joints. This flux is highly corrosive and all traces of it should be removed after soldering by thorough washing with clean water.

However, the information from Firth-Vickers was simply titled 'Soft Soldering of Staybrite and Stainless Steels'. At the time the information was written in 1954, a majority of Firth-Vickers grades were of the austenitic grades which were equivalent to the present AISI 300 series. Consequently, it is

probable that this flux was designed for the 300 series stainless steels and not the more modern duplex and martensitic grades, so may not be as suitable for non-300 series grades. Also, it would be reasonable to assume that this was for a typical 50/50 Sn/Pb Tinman's solder, 60/40 Sn/Pb solder or the 63/37 Sn/Pb eutectic solder.

In correspondence in *The Journal*, published by the Society of Model and Experimental Engineers, Barry Taylor (ref 33) advises of his own experience of using the Firth-Vickers flux by saying '*...I have used this flux on small stainless steel items and it works. However, some words of caution. It is extremely corrosive. I always applied the flux using a glass pipette fitted with a rubber bulb. Always keep it in a sealed glass bottle and when not being used locked away. I always kept it in a cupboard with the pickle bath acid. If it's left open, even just overnight, near anything steel you will very soon find rust patches appearing. It also eats away soldering iron bits so be prepared to replace them sooner than you would normally. Try not to be put off by the nature of this flux. There are times when it can be really useful...*'. All the ingredients for making this flux seem to be readily available in small quantities within the UK but, of course, great care is required when making up the flux due to the very corrosive nature of the hydrochloric acid. Note that hydrochloric acid with a specific gravity of 1.16 corresponds to 32% w/w (ref 34). Before purchasing any of the chemicals required for this flux, it would be prudent to read the Material Safety Data Sheet (MSDS) for it, which lists all the known hazards of the material. These are usually available for free download from the Internet.

If you are somewhat concerned by the potential

hazards of this flux, the Firth-Vickers Information Letter describing it (ref 32) also mentions another potential flux for stainless steels, which is clearly less corrosive and Firth-Vickers attach some importance on its effectiveness to the inclusion of ethylene glycol and ferrous sulphate:

In cases where complete washing free from flux cannot be assured, a 50% solution of phosphoric acid is frequently used on Staybrite and stainless steels. The effectiveness of this flux also is much improved by the addition of 2% ethylene glycol and 2% ferrous sulphate.

It would seem also that 50% phosphoric acid (assumed to be orthophosphoric acid H₃PO₄) is also readily available in small quantities but due to the corrosive nature of the acid, it can only be delivered by specialised courier services within the UK. We have no idea what the supply situation and regulations apply in non-UK territories.

Other fluxes for stainless steel are currently available commercially, such as the phosphoric acid-based S26 flux (ref 35). Phosphoric acid is considerably less corrosive than the zinc chloride/hydrochloric acid-based fluxes and so is less likely to leave corrosive deposits. It appears that phosphoric acid is an effective flux as, according to Beatson (ref 36),

...a solution of phosphoric acid is very effective on steel, nickel, copper or brass and has been effectively used on stainless steel. The residue on steel, while it cannot be classified as truly non-corrosive, does appear to serve as a partially protective coating, so it can be considered as a possible alternative where non-corrosive fluxes are not sufficiently active...

Phosphoric acid fluxes find favour with small-scale railway modellers who use a 12-14% solution of phosphoric acid as a flux when soldering steel and brass (ref 37).

Health and Safety

It is a necessary part of soldering to pay attention to the health hazards of using solders. The use of lead in solder is being phased out (with certain exceptions) so the tin-based solders are becoming more common. There was guidance in the form of a Health and Safety Executive Guidance Note WL17 (ref 38) about using resin-cored soft solders. The main consideration is that the fumes from the resin-based flux are irritating to the nose and lungs and can contribute to asthma, so breathing in the fumes should be avoided by soldering in a well-ventilated place (leave the workshop door open?). Also lead and cadmium are cumulative poisons, so ideally any lead- or cadmium-containing solders should not be touched with the bare hands - use suitable disposable gloves when handling lead-based products and wash your hands thoroughly afterwards. Similarly, some of the fluxes suggested in this article are corrosive and give off toxic, irritating and corrosive fumes, so they should only be used in a well-ventilated environment.

Conclusion

In answer to Mike's original question, it would appear that he could use pretty well any solder or flux he chooses. However, it would probably best to use a resin-based flux and the more environmentally-friendly 99.3 Sn/0.7 Cu eutectic alloy, unless he has a large quantity of Tinman's or 60 Sn/40 Pb solder, either of which would be suitable. The flux residues can be removed with white spirit when the job has cooled down. He could, of course, also use a cored electrical grade of 60 Sn/40 Pb or 50.2 Sn/47.9 Pb/1.9 Cu instead and dispense with the separate flux but this might present some problems of having inadequate flux for the job if the joints are large. If he has difficulty tinning his steel for any joint, he could use a

phosphoric acid flux as the residues are far less corrosive than the zinc chloride-based fluxes. The joint design and the area of the joint has a greater bearing on the overall strength of the joint than the solder used.

Summary

- * Soft solders are defined as alloys which have a liquidus below 450 degrees C and a solidus above 180 degrees C.
- * Solders which have a liquidus below 180 degrees C are more correctly termed 'fusible alloys'.
- * There is a large range of soft solders and fluxes commercially available.
- * Metals that are difficult to 'wet' with molten solder require more aggressive fluxes which leave corrosive deposits which need to be washed off thoroughly.
- * Solders have been developed, usually containing silver, which have improved 'wetting' properties.
- * Formation of an intermetallic layer in the joint is essential to the formation of a satisfactory joint.
- * Resin fluxes can be incorporated within the

solder and are best for electrical and electronic work.

- * Activated resin fluxes are less corrosive than aqueous zinc chloride fluxes and can be removed with white spirit or methylated spirits.
- * Some metals require special fluxes to allow the surface oxides to be dissolved whilst soldering.
- * Antimony is added to Plumbers' solder and Tinmans' solder to add increased strength.
- * Plumbers' solder is best avoided where there is the possibility of capillary action occurring.
- * The ultimate strength of the joint is governed more by the geometry of it than by the choice of solder.
- * There is little difference in strength between any of the solders with a liquidus above 180 degrees C listed in Table 1 (see Part 2, M.E.4691, 20th May).
- * All solders form a eutectic which has a lower melting point than either of the constituents.
- * Where a solder composition is far from the eutectic composition, the solder

exhibits a 'pasty' range before freezing fully.

- * For easy-to-solder metals, the choice of flux and solder is not at all critical.

Acknowledgments

We would like to thank Professor Norman Billingham of the Chemistry Department at Sussex University for his helpful comments in the

preparation of this article and also thanks to Barry Taylor of the Society of Model and Experimental Engineers for providing an image of the letter from Firth-Vickers Stainless Steels Limited (ref 32).

This article has previously appeared in *The Journal of the Society of Model and Experimental Engineers*.

ME

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No.316

Look out for the June issue:

MODEL ENGINEERS' WORKSHOP



Tony Jeffree recounts the challenges involved in making a free pendulum clock.



Glenn Bunt looks at an exciting new topic for MEW – electroplating 3D printed objects.



Bob Reeve starts a short series looking at making better bevel gears.

On Sale 20th June

Peter Seymour-Howell

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



Continued from p.772
M.E. 4692, 3 June 2022

PART 37 – OUTSIDE CYLINDERS



Painting by Diane Carney.

Flying Scotsman in 5 Inch Gauge

LEFT: 1. Having fixed the casting to an angle plate, I machined the top 'T' shaped face flat, keeping an eye on the distances to both bores as these are what is important.

RIGHT: 2. I used the vernier with a rule clamped to it to check the distances.



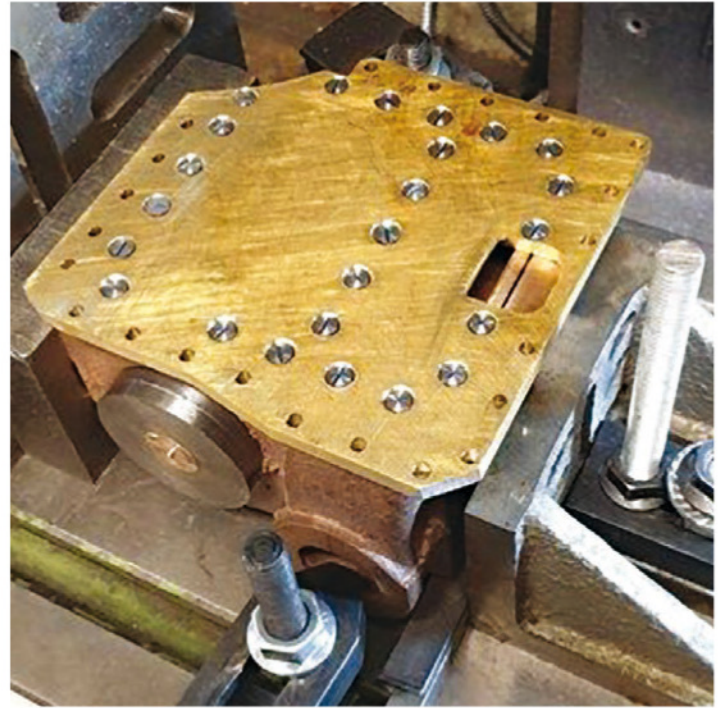
The outside cylinders are dealt with in much the same way as the inside cylinder (see part 33, M.E.4689 22nd April) but with some differences so I will provide a brief description here.

Squaring up the outside

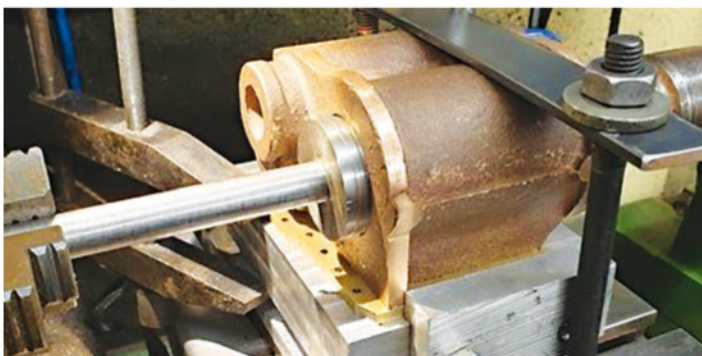
Firstly, the cylinder castings must be squared up to provide reference faces for the subsequent machining operations. I started by squaring up the top and bottom and then facing off the back face at right angles to these, checking that the distances to the centres of the bores from all faces corresponded to the drawing.



LEFT: 3. Once happy with the top, I then moved on to the bottom. This was easier as I now had a machined datum on the top so it was so much easier to clamp to the angle squarely. RIGHT: 4. I used 2 angles and sandwiched the cylinder in between them and used clamps to hold the casting down to the mill bed. Again, I measured the distance from back face to the bore centre. I have used the same bung as was used for the middle cylinder but turned up another centrepiece to measure from.



5. Once happy with both cylinders having all of their external dimensions completed I decided to take a look at the mounting flanges as I plan to fit these to aid in holding/setting the cylinders for doing the boring. Here we have the first cylinder with its mounting flange fitted. As you can see there were yet more copious numbers of holes (6BA) to drill/tap which took time but we got there in the end.



6. Here is the boring bar being used to line up the cylinder. The boring bar is the same as used for the middle cylinder. Once set up, I made two passes to ensure all was concentric - as before the return cut is done in reverse which buffs the bore giving a lovely finish. I did this throughout even though it's not really required until the final cut.

Bores

My setting up approach was more or less the same as with the middle cylinder and I was able to use the same raising block, with some modifications. Once happy with the height I double checked it was correct by sitting a cylinder on the block but not bolted down. I held the boring bar in the three-jaw chuck with its bung slid along it. I then advanced the cross slide towards the chuck adjusting the 'Y' axis until the



7. As things progressed I needed an easy way of checking the bore size. A normal plug gauge couldn't be used as it would require me removing the bar for each check. I had a rummage through my tools and found the pair of dividers seen hanging on the bar in the picture. It dawned on me that if I set the outside curve of these to size and hung it over the boring bar I could use these to easily check the bore. Better still, they would spring in as I pushed them into the bore giving me some idea of how close I was - in effect they were doing the job of a tapered plug gauge.



8. An extended centre drill was used to spot the hole at the end of the blind bore and the hole drilled out. Then a reamer was used to finish off. As the taper began to show at the other end I engaged the tailstock live centre with the reamer and completed the pass to achieve a parallel bore, ready for the boring bar to slide through.



9. Here is the front face being machined, again using the boring bar. The next job is to remove a quarter inch off the bottom of the alloy jig to give me the correct height for boring the steam chests.



10. This is what I used to hone the bores - it's a small brake/clutch cylinder honing tool. I have covered up the pads with some tough paper towel and soaked them in the solution and as you can see I have already used the tool in this picture.

bung would slide into the bore without binding or moving the cylinder, once happy with that I could tighten everything down.

End covers

I now move on to the cylinder covers, which come as cast discs including a spigot with the cylinders. First job was to true up the spigots, for this, I used the outside jaws and held the cast in the most concentric position. I then refitted the internal jaws and machined the front face. I do each casting in turn for each operation, as this makes things much quicker.

Ports

We need to locate and drill the holes for the main steam pipes and also drill the holes from the steam chest to the main bore. The front ports, as with the middle cylinder, are cast in. The first job was to put in place the running boards and plot the exact position for the main steam pipes into the cylinders. As the boards with their holes for said pipes were already finished this job didn't take too long.

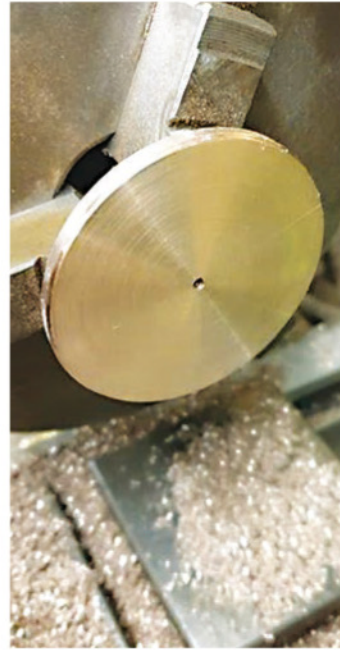
The way I did the ports was a little different to the middle cylinder. I marked out their



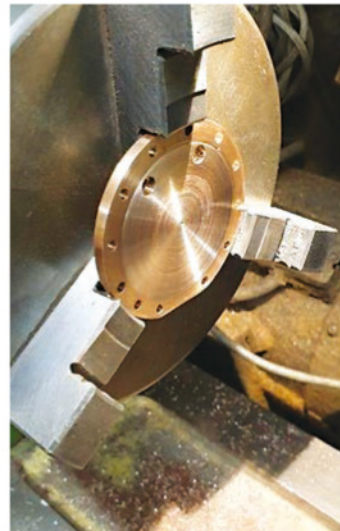
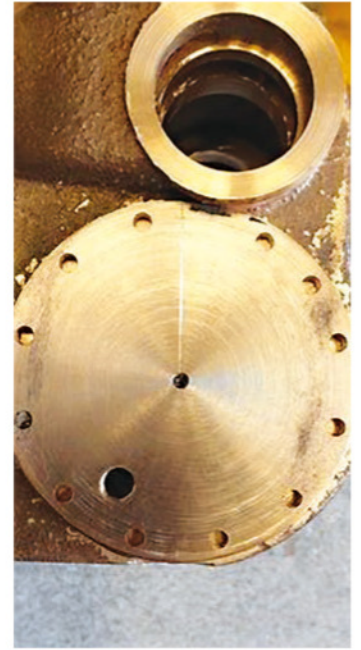
11. I started with the rear face of the front cover. I have added an internal register to fit the bore to help locate the cover for when transferring the mounting holes. This will be removed once the cover has had its holes drilled and been mounted to the cylinder. The cover here is still oversize so I wasn't worried about marking it in the jaws.



14. The next job was to transfer all of the cover holes to their respective cylinders and tap 6BA. I won't show pictures of that as it's the same as the middle cylinder. Here we see two holes for the relief valves. This was an error. They were initially drilled 'inboard' and, as you can see, inboard they would foul the front mudguard. So, I needed to drill new relief valve holes and the original holes will need to be plugged.

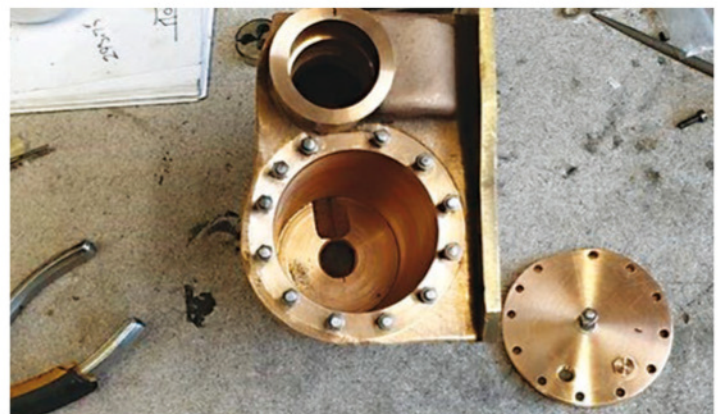


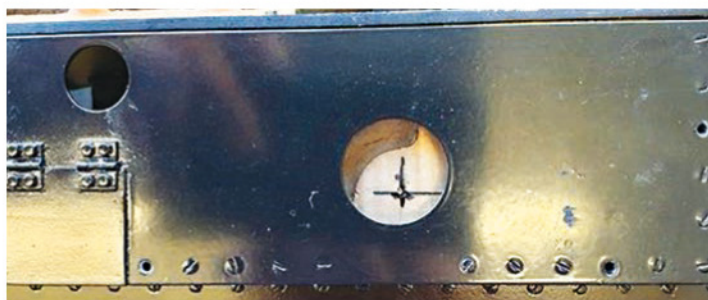
LEFT: 12. Now to the front and here I have deviated from how the middle is as I want them to look like the prototype including the cosmetic covers that sit over the studs. I have reduced its thickness down to nearly half and I have also added a small step around the outer edge. The idea for this was to give a register for the shield but, on further investigation, this may not be required. The third difference is I have added a central blind hole tapped 6BA to secure the shield, as in the prototype. RIGHT: 13. And here we have the cover put roughly in place. I need to make two mirrored covers as they are handed to fit the cylinders. The scored line is to give me a vertical register for placing the holes. The first hole to the right will be on a 15 degree arc, the first hole to the left will be on a 30 degree arc and all others will also be on 30 degree spacings.



15. Now that I had transferred all of the mounting holes I needed to remove the spigots on the rear of the covers. The small diameter spigot was cut off with a hacksaw and the larger diameter spigot (used to help align the cover with the bore) was machined off using the outside jaws.

16. Here's the right-hand cylinder with the cover off and showing the relief valve plug fitted. There is also the long stud in the middle which will be shortened once I have made the shields. From pictures, there is very little thread showing once the nut is fitted to hold the shield, which I will try to emulate.



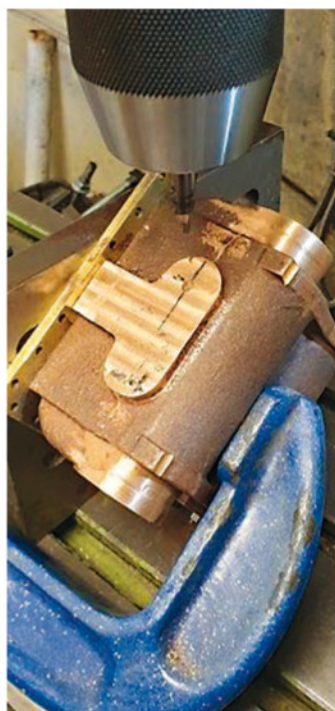


17. First up, was the outside cylinder steam entry holes. I marked the position on the cylinder and then I placed the running boards, both lower and upper, in place. At first, when I looked at this I wondered if something was wrong but on checking the drawings I could see that the steam pipe isn't central to the running board hole. Here's the picture to show the lie of the land so to speak.

position for width, placed the endmill further inside the bore by about 1 mm than it needed to be and just let it kiss the bore. Since the cylinder is placed at a 35% angle I could engage one edge of the cutter working my way down slowly until just half of the blade cut a flat edge. I then brought the cutter out towards the front to its final position. I then removed the endmill and, using

a drill, much smaller than No. 22 but large enough not to impede the 'no cut' area of the endmill, drilled right through into the chest below. I refitted the endmill into the chuck and plunge cut approximately 30 thou, moving carefully either side to the start and finish points. I continued doing this until I broke through to the steam chest below.

●To be continued.



LEFT: 18. Don shows a 30 degree angle for the steam entry into the cylinder, angled towards the front. I held each cylinder against the angle bracket and using a digital angle gauge set each in turn for 30 degrees. Here the first cylinder is having its opening hole drilled. RIGHT: 19. Here is the milling cutter (in its hex bar extension) having just broken through.



An Engineer's Day Out

Riverside Museum

Glasgow

Roger Backhouse visits a museum that preserves Glasgow's rich industrial past.



Glasgow has a fine engineering heritage developed during the 19th Century when it became known as the Second City of the Empire. Sadly, most of its industry has vanished and shipyards have closed, although the city centre retains many impressive buildings from that era.

Older readers may recall the Transport Museum in Glasgow's Coplawhill Works at Pollokshields, later relocated to Kelvin Hall. Riverside Museum is a worthy successor with a distinctive building designed by architect, Zaha Hadid. Preserving much of Glasgow and Scotland's transport heritage with a large range of objects and innovative displays, it is easily spotted from paddle steamer trips down the Clyde on the *Waverley* as the Tall Ship,



The modern architecture of the Riverside Museum contrasts with the 19th Century Clyde built tall ship *Glenlee* and the paddle steamer *Waverley*, built in 1947 at A. & J. Inglis' Pointhouse yard nearby.

Glenlee is moored in front (photo 1). Further articles about the Tall Ship and a Clyde journey on the paddle steamer *Waverley* are planned.

Museum contents range from skateboards and prams to bicycles - including one claimed as being the world's first - prehistoric wood trunk boats and ship models. Reflecting the city's railway heritage it has

steam locomotives, Glasgow trams and many cars and motorcycles.

The Clyde - birthplace of the successful steamboat?

William Symington tested his steamboat *Charlotte Dundas* on the Forth and Clyde canal in 1803. Though the boat was a success, his backers disagreed and withdrew funding; a short-



Helensburgh hotelier Henry Bell had *Comet* built in 1812 to bring visitors from Glasgow. Though not the first steamship it was arguably the first to offer a regular passenger service.



Built soon after *Comet* the *Industry* worked until a collision in 1862. This side lever engine was built by Caird and Co. of Greenock and installed in 1828. It was nicknamed the coffee grinder because of the noise it made

sighted decision if ever there was one! Henry Bell's *Comet* was a pioneering steamboat, first operated in 1812 from Glasgow to Helensburgh (**photo 2**). Bell is commemorated with a monument at Helensburgh, a replica of the *Comet* at Port Glasgow and a display at Riverside.

The side lever engine from the 1814 steam boat *Industry* may be similar to that of the *Comet* (**photo 3**). This geared engine was built in 1828 by Caird and Co. of Greenock and was nicknamed the coffee grinder because of the noise it made. Like many Clyde products it was built to last and worked for more than fifty years.

Glasgow shipping grew during the 19th Century. Anchor Line was a Glasgow based firm and its ships sailed to the USA and Canada (**photo 4**). Docks near the centre have now been infilled and trade has gone downriver to Clydeport.

Shipbuilding

Shipyards once lined the Clyde from near the City Centre to the sea. Notable yards included the Pointhouse Yard of A. & J. Inglis, Fairfields at Govan, John Brown at Clydebank, birthplace of the famous *Queens* and Dennys of Dumbarton, pioneers in ship model testing. (See *Model Engineer* No. 4584, 13 April 2018.) The Pointhouse shipyard near the museum site



Glasgow was base for Anchor Line operating services to the USA and Canada. (Courtesy CSG CIC Glasgow Museums Collections.)

was birthplace of the paddle steamer *Waverley*.

Shipbuilding exhibits include a slipway trigger. Yards generally used slipway construction with spectacular launches, but dry dock construction is now preferred worldwide. Lower labour costs in the Far East caused a rapid decline in UK shipbuilding. Now even Korean yards are being undercut by Chinese fabricators. Relics on the river include four giant cantilever cranes used for fitting out ships and loading cargo. Finnieston crane features on BBC Scotland News bulletins (**photo 5**). The John Brown 'Titan' crane now has a lift and



Well known Glasgow landmark, the Stobcross or Finnieston crane was used for loading cargo including locomotives from Springburn. Built by Cowans, Sheldon of Carlisle and Cleveland Bridge of Darlington it is 53m high (175 feet) and could hoist 175 tons. Unusually it has an auxiliary hoist for lighter loads. An entrance to a former Clyde tunnel is just behind the crane.

is occasionally open to the public.

Ship models

Glasgow museums have hundreds of ship models, far too many to display, but there are bookable tours to view the stored collection and learn about techniques used to make them. Riverside has an ingenious conveyor system to show the range of Clyde-built ships (**photo 6**) with a model of the largest Clyde built ship, the *Queen Mary*, displayed near the Clyde entrance.

The Clyde once had several busy ferry crossings but the Clyde tunnel and later, the Erskine Bridge killed off traffic

with the Renfrew passenger ferry being the only survivor. The model of a movable deck ferry shows how loading and unloading at all states of the tide were possible (**photo 7**).

Locomotives

The biggest beasts here are locomotives, mirrored by model engines including one of the first to run on a Scottish railway (**photo 8**). Oldest in the collection is the Caledonian Railway single driver number 123 built in 1886. The Highland Railway Jones Goods 4-6-0, built in 1894 was the first of that wheel arrangement on any British railway and was highly successful (**photo 9**). There is



Glasgow museums have a large collection of ship models. Some are ingeniously displayed on a conveyor system but others can sometimes be seen in store.



Model of a movable deck ferry used at several places to cross the Clyde allowing for vehicles to load and unload at all states of the tide.



Model of locomotive built by Robert Stephenson and Co. to run on the Glasgow and Garnkirk Railway.



The Highland Railway Jones Goods of 1894 was the first 4-6-0 to run on a British railway and was the most powerful locomotive in Britain at the time. A Glasgow and South Western Railway 0-6-0 tank engine of 1917 is above.



Cab of North British Railway 4-4-0 inside cylinder Glen Douglas built in 1913.



South African Railways 4-8-2 built in Glasgow by North British and now repatriated. Built with massive proportions for the Cape gauge of 3 foot 6 inches.

a North British Railway Glen class 4-4-0 (**photo 10**) - a classic locomotive with inside cylinders - and a 1917 built 0-6-0 tank engine from the Glasgow and South Western Railway.

North British Loco Co. of Springburn exported many locomotives. Their diamond shaped workplate was familiar worldwide, carried by many engines sent to India and South Africa. A huge 4-8-2 locomotive, built for the Cape gauge of 3 foot 6 inches, dominates the museum (**photo 11**).

Unfortunately, locomotives here feel cramped and are difficult to photograph. Perhaps financial constraints limited the building but museum designers seem unable to appreciate that large objects need space around.

Rails in the road

Glasgow had one of Britain's largest tramway networks, lasting until 1962. This was late enough for many 'caurs' to be rescued for preservation and several are displayed here. The city began with horse drawn trams and then electrified in 1898. Single deck tramcar No. 672 was one of the earliest electric cars before being converted to a maintenance vehicle in 1907 (**photo 12**).

A standard tramcar design was introduced in 1900, double deck with an open top and then roofed in 1904 - although luckless motormen weren't given a windshield until 1910! (My great uncle Eddie drove Halifax trams to Hebden Bridge. In icy weather he'd set the tram going slowly and run alongside to get warm! Perhaps Glasgow's



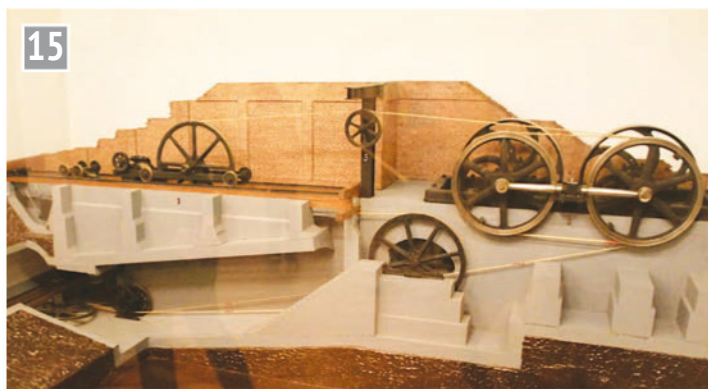
In 1898 this was one of the first electric tramcars in Glasgow; it was then converted to a maintenance vehicle before being restored to original appearance.



Glasgow standard tramcar 779; this type were introduced in 1900 and roofed in 1904. Withdrawn in 1959 it was then converted back to pre First World War condition.



Glasgow subway car from 1896, elegantly decorated with stained glass in the end windows.



Model of tensioning device for Glasgow cable subway.

motormen did the same.) Car 779 was withdrawn in 1959 and converted back to pre-First World War condition (photo 13).

Glasgow's subway

Enterprising Glasgow became the world's third city to have a subway. It was cable operated on a circular route to the west of the city centre and has some distinctive stations. Originally steam powered it had to cope with the 10.5km (6.5 miles) cables inevitably stretching in use. There is a classic car displayed (photo 14) with a gripper used on each train plus a model of the cable haulage system (photo 15).

The system was taken over by the Corporation in 1923 and converted to electricity in 1935 using 600 volt DC third rail. Uniquely in Britain it is 4 foot gauge (1219mm). Though never extended, the subway was upgraded in 1977-80 and again in 2010. New trains will be introduced from 2022.

Horse drawn vehicles

The collection has several examples of horse drawn vehicles, some displayed in a replica Edwardian street housing an example of a classic Glasgow-Italian ice cream parlour (though not, alas, now serving ices).

Steam on the road

A certain unprepossessing object in the museum is one of the most historically significant. Sir Goldsworthy Gurney was a pioneer of steam road carriages (there are models in Bude Museum). His steam drag was tried in Scotland in 1831 but was destroyed in an explosion. The chassis and frames are all that remain (photo 16).

The Sentinel steam lorry was built in Shrewsbury in 1916 and operated by Brown Bayley Steels as one of a fleet of nine. It ran for many years and was restored fifty years later (photo 17). A transport museum isn't



The remains of Sir Goldsworthy Gurney's steam carriage. This was destroyed in an explosion.



Cab view of a Sentinel steam lorry built in Shrewsbury but operated by Brown Bayley's steel works from 1916.

complete without a traction engine and the Ruston and Hornsby *Pride of Endrick*, built in 1920, operated on farms in the south of Scotland. It's

surprising that Scotland did not have its own traction engine builders but perhaps the market was not big enough (photo 18).



Ruston and Hornsby traction engine Pride of Endrick came to work on southern Scotland farms in 1920.

Cars and commercial vehicles

Scotland once had its own car industry with several examples shown. The Argyll 'Voiturette' $\frac{3}{4}$ hp was made in Bridgeton, Glasgow in 1900 (photo 19). Argyll later built a distinctive factory in Alexandria (now a shopping centre) but the company's success was short lived and it closed in 1932.

Showing the rapid evolution of car designs an Albion A3 16 hp tourer was built at Scotstoun, Glasgow, in 1910 (photo 20). The Galloway car was created by the pioneering woman engineer, Dorothée

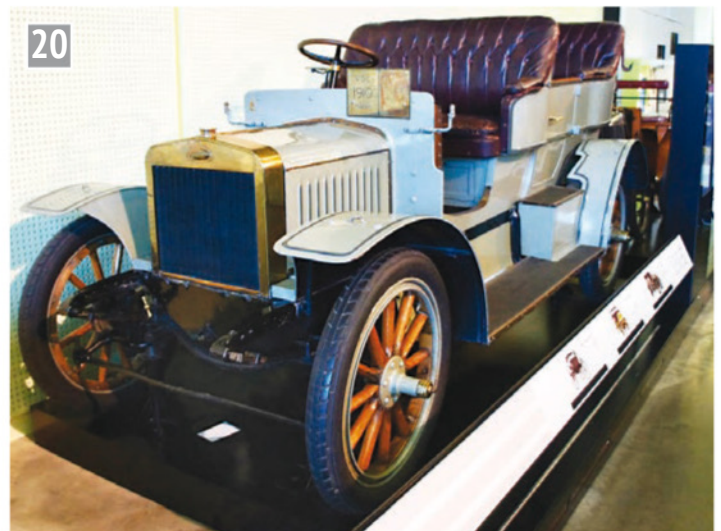
Pullinger who designed the car for women and had it largely built by women engineers (photo 21). Her work will feature in a future article.

Production cars displayed include the 1960s Linwood built Hillman Imp in a 'notable good cars' collection. Vehicles include the third Rolls Royce to be built and one of the replica 'Chitty Chitty Bang Bang' cars used in the film.

Among several commercial vehicles the Merryweather fire engine was obtained from Galway (photo 22). A Glasgow fire service engine with extending ladder helped



Argyll was a pioneering Scottish motor company. This $\frac{3}{4}$ hp Voiturette was built in 1900.



This Albion A3 tourer was built in Scotstoun, Glasgow in 1910; a luxury car for the time.

for fight fires in the city's many tenement blocks.

Bicycles and motorbikes

The Dumfries blacksmith Kirkpatrick Macmillan is claimed as the inventor of the

world's first bicycle and this is one of several displayed (photo 23). (Dumfries museum has similar bicycles.)

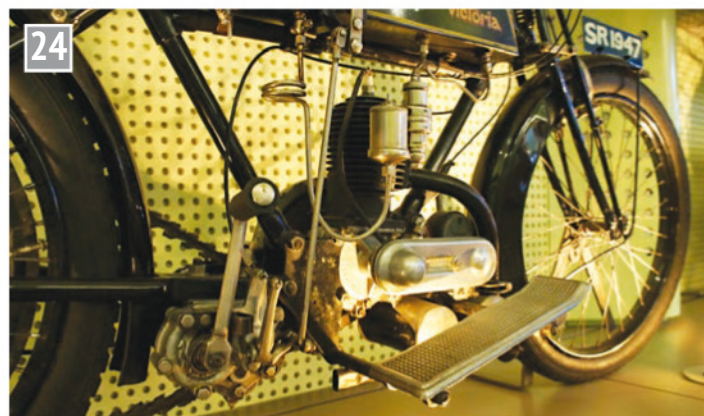
Some of the many motorcycles displayed include the 2.5hp Victoria



A Galloway car designed in 1924 by a pioneering woman engineer Dorothée Pullinger.



1920s Merryweather fire engine used in Galway but built in Greenwich. The firm claimed they were 'sustained by extinction'



This 1920 Victoria motorcycle was Scottish built in 1920.

Dumfries and Galloway blacksmith Kirkpatrick Macmillan is often claimed to have built the world's first bicycle powered by pedals in 1839. This claim is much disputed.



The 248cc Gerrard motorcycle was built around 1923 to a design by J. A. Porter.



Replica of one of Percy Pilcher's early gliders. Sadly he died in 1899 when one crashed.

built in Scotland in 1920 (photo 24) and the 248 cc Gerrard designed by J. A. Parker around 1925 (photo 25). Several later models are displayed on walls, unfortunately not permitting close inspection.

drawing office and built gliders in his spare time, flying his first in 1895. Sadly he suffered a fatal crash aged just 32 whilst testing his last design, the Hawk, in 1899. There is a replica on show, memorial to a brave pioneer (photo 26). **ME**

Aviation

There is a Scottish Aviation museum near Haddington, East Lothian but Riverside features the early Scottish glider designer, Percy Pilcher. He worked in a shipyard

THANKS

Thanks to Suzanne Rough (Glasgow Museum Service) for help with illustrations for this article.

THE MUSEUM

Definitely a museum to visit. Amenities include a restaurant and shop. Opening hours are 10.00am - 5.00pm Monday to Thursday and Saturday; 11.00am - 5.00pm Friday and Sunday. Admission is free. Pointhouse Place, Glasgow, G3 8RS
W. www.glasgowlife.org.uk
Tel. 0141 287 2720

REACHING THE MUSEUM

For a museum of movement Riverside is not well served by public transport. The nearest railway station is at Partick Interchange, also with subway and bus stations, around 0.6 miles away.

Railway lines for interchange run through the Low-Level platforms at Glasgow Central (GLC) and Glasgow Queen Street (GLQ).

The only direct bus route is the hop on - hop off City Sightseeing bus with a commentary which is itself worth considering if staying just a short time in Glasgow. The two-day tickets are better value if staying and exploring the city - there is plenty to see.

There are signposted walking routes to the museum and a walk/cycle way along most of the riverbank from central Glasgow. Glasgow is now a tourist destination with plenty to see, both in the city centre and its surroundings.

SOME OTHER ATTRACTIONS

The Tall Ship *Glenlee* is moored outside the museum. Steel built on the Clyde, it had a varied history and will feature in a future article.

W. www.thetallship.com
Tel. 0141 357 3699

Clydeside Distillery is located in a former dock pumphouse, a short distance from the museum.

100 Stobcross Road, G3 8QQ
W. www.theclydeside.com
Tel. 0141 212 1401

Kelvingrove Art Gallery and Museum is vast and absorbing. One of several excellent Glasgow museums and galleries.

Argyle Street, G3 8AG
W. www.glasgowlife.org.uk
Tel 0141 276 9599

Glasgow Science Centre* (includes the Glasgow Tower, reopening Summer 2022) 50 Pacific Quay, G51 1EA
W. www.glasgowsciencecentre.org
Tel. 0141 420 5000

*The Science Centre is closed at the time of writing. Please check before travelling.

Denny Ship Model Experimental Tank (part of the Scottish Maritime Museum - the other branch is at Irvine) (See also *Model Engineer* No. 4584, 13 April 2018.) Castle Street, Dumbarton, G82 1QS

Club Diary 18 June - 9 July 2022

June

18/19 Cardiff Model Engineering Society

Welsh Rally, evening hog roast, Heath Park - see www.cardiffmes.co.uk Contact: secretary@cardiffmes.co.uk

18/19 Fareham and District SME

Sweet Pea Rally, Club Track 10:00 - 16:00. Contact: sweet-pea-2022@fdsme.org.uk

18/19 Melton Mowbray MES

Steam Show, Whissendine Sports Ground - see mmdmes.wixsite.com/home Contact: jacced@hotmail.co.uk

18/19 Reading SME

LittleLEC 2022, Prospect

Park, Reading. Contact: littlelec@gmes.org.uk

18/19 Southport MEC

Open Weekend, Victoria Park 10:00 - 16:00.

Contact: Gwen Baguley, gwenandderrick@yahoo.co.uk

19 Bradford MES

Running Day, Northcliff Railway 13:30 - 16:00. Contact:

Russ Coppin, 07815 048999

19 North Wilts MES

Public Running, Coate Water Country Park, Swindon 11:00 - 17:00. Contact:

Ken Parker, 07710 515507

20 Bristol SMEE

Talk : 'Fusion360 Review', on Zoom, 19:30.

Contact: secretary@bristolmodelengineers.co.uk

25 Cardiff Model Engineering Society

Steam-up and Family Day, Heath Park, Cardiff. See www.cardiffmes.co.uk

26 North Wilts MES

Public Running, Coate Water Country Park, Swindon 11:00 - 17:00. Contact:

Ken Parker, 07710 515507

26 York Model Engineers

Open Day. Contact: Bob Polley, 01653 618324

July

3 Bradford MES

Rae Gala 2022, Northcliff

Railway 14:00 - 16:30.

Contact: Russ Coppin, 07815 048999

2/3 North Wilts MES

Charity Weekend, Coate Water Country Park, Swindon 11:00 - 17:00. Contact:

Ken Parker, 07710 515507

6 Bradford MES

Boating Competition and Social Evening 2022, Wisbey Park 19:30. Contact: Russ Coppin, 07815 048999

9 York Model Engineers

Evening Talk - 19:00.

Contact: Bob Polley:

01653 618324

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Silver Soldering

Dear Martin,
Having read the Smoke Rings editorial in issue 4687 (March 25th) of *Model Engineer*, I was interested to read at the bottom of the page the article on Silver Soldering in which Martin Gearing wishes to correct a small error in his article in issue 4668 of 2nd July 2021, about certain grades of silver solder not being allowed to be used in boiler making under the Australian boiler codes ie having phosphorus and less than 15% silver. Why would this be?

I remember many years ago that the use of silver solder containing cadmium in its make-up was banned in Britain due to the alleged toxicity of fumes coming from the cadmium and that now the silver solder that we use either as model engineers or indeed in industry now has a different composition.

One job that we used to do on a regular basis at the firm I worked for both in Clerkenwell and later in Southwark, in Long Lane near the borough in London SE1, was for the Post Office engineering department and was for heating element tubes. These tubes were made from either $\frac{5}{8}$ inch diameter or $\frac{3}{4}$ inch diameter stainless steel tube. One end was plug welded and the other open end was threaded either $\frac{5}{8}$ inch or $\frac{3}{4}$ inch British Cycle thread for approximately $\frac{3}{4}$ inch or so in length. As our older readers will probably know the BS Cycle thread was a shallower depth of thread

Soft Soldering

Dear Martin,
I read the article about soft soldering in issue 4690 (6th May) with great interest and I feel that some additional information would be helpful to other readers. The main reason for not using zinc chloride (or any similar flux) is that it conducts electricity. If the flux is not scrupulously cleaned from the joint area (somewhat difficult) then, in a worst-case scenario, a short-circuit could result or, almost certainly, a reduced insulation resistance (leaky connection). Electrical joints should always be made using organic non-conducting fluxes.
Regards, Chris Baker

compared to the normal BSF or BSW threads of the same sizes to allow for the thickness of the gauge of the tube wall.

Part of the job involved silver soldering a hexagonal brass collar onto and below the threaded portion, which was to allow the completed element to be attached to whatever the element was being used for. This collar was also threaded either $\frac{3}{4}$ inch or 1 inch BSF or BSW - it could have even been the appropriate BSB (British Standard Brass) thread. What we did use was Johnson Matthey Easyflo flux and silver solder, which did the job well, but in those days (1960s/70s) we were not aware of the problems of the cadmium content.

I am interested as to why a silver content of say 15% or less and no phosphorus is allowable or not under the Australian boiler codes. Would this be a problem if a model boiler is being made from the traditional metals i.e. copper or possibly brass? I know that in all cases when a person makes a model boiler it obviously has to be tested and certified by a nominated club boiler inspector to ensure its safety, i.e. hydraulically tested to twice its working pressure and steam tested to working pressure - and if not to an accepted design, that calculations as to strength and sizes etc. have to be provided. After all, although our boilers for either a model boat, locomotive or indeed a traction engine are obviously not as big as the full-sized version

they can still be a potential bomb if not built properly and maintained. So obviously both the materials and the methods of joining them i.e. silver soldering or, if of steel, being welded or rivetted, have to be of the best construction for obvious reasons. It would be interesting to know what the problems if any would be if one used a silver solder containing phosphorus and a low content of silver and how it would affect the construction and use of such a boiler. I have also used in my time sifbronze welding rod and flux with the oxy-acetylene welding torch and this gives a really strong joint as it melts at a higher temperature than brazing alloy, almost but not quite as hot as joining steel by welding with steel filler rods.

**Yours sincerely,
J.E. Kirby (London)**

Write to us

Views and opinions expressed in letters published in *Postbag* should not be assumed to be in accordance with those of the Editor, other contributors, or Mortons Media Group Ltd. Correspondence for *Postbag* should be sent to:

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Responses to published letters are forwarded as appropriate.

LBSC

Dear Martin,
First of all, many thanks to Nick Feast for pointing us to the document *The Steam Locomotive: A Machine of Precision* in his letter in issue 4691 (20th May).

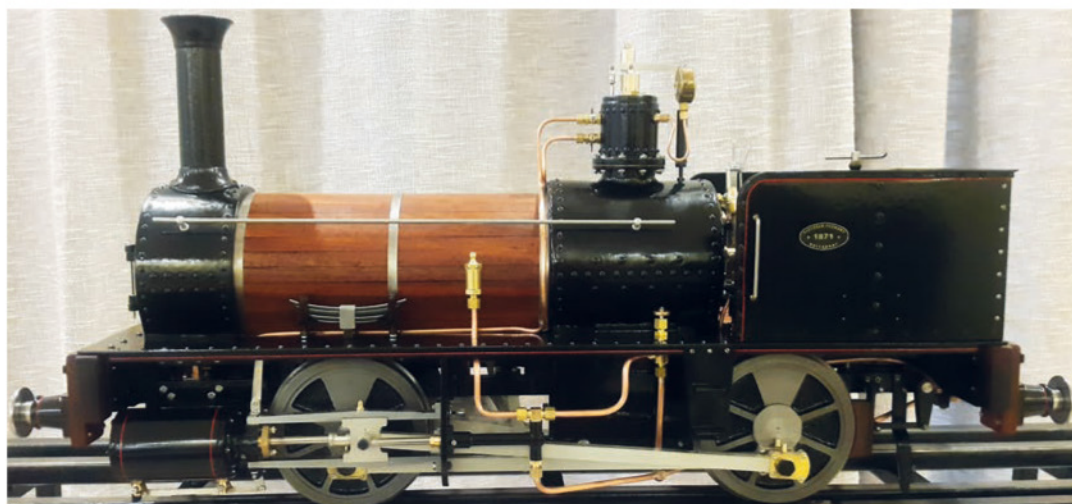
Secondly, in issue 4690, in his article *LBSC's Years with the London Brighton and South Coast Railway* Ron Fitzgerald seems to be unaware of the book *LBSC Footplate Experiences: Reminiscences at New Cross* (Curly Lawrence, Oakwood Press, 1996) in which LBSC gives an account of his time on the railway.

All the best, Rhys Owen

Luker
describes
a simple
but authentic small
locomotive.



Continued from p.679
M.E. 4691, 20 May 2022



Ballarat

PART 13

A 5 Inch Gauge 0-4-0 Aussie Locomotive

The running boards

The running boards (fig 25) were laser cut but all the cut-outs are best left until the final assembly. For example, the hole for the clack piping can only be positioned after the clacks have been fitted to the boiler. I've found the easiest way to mark them out is by dropping a pointed bar through the clack body (square to the running boards), to make a mark on the running boards.

The edges of the running boards can be finished off

neatly with a piece of 6mm square bar, the same used for a number of components during the build (photo 102). The square is riveted with 2mm rivets at 20mm intervals along the length, with neat rounds on the top of the running boards, until you get to the cab sides where you'll need to switch to countersunk.

The crosshead pump bypass valve hole position can be marked and drilled in the meantime. The final position is not that critical as long as the

valve handle misses the boiler and the pipes miss the wheel and coupling rods.

The steps are a simple riveting operation, with some 1.5mm panel pins serving as more than adequate rivets if you don't have fancy trade produced examples. This part of the build was the first real riveting exercise for the young lad, and you'll notice I'm very light with the description of how to go about riveting. This is because I passed on a few very good articles on how to make the setting, and forming punches with a fantastic description of how to tackle riveting. There are loads of articles on the subject so I'll stay clear of boring you all during this series. Back to the steps: the final mounting position on the running boards is not shown, simply because it should align with the outside panels so that a mini-driver can get to the handle when getting onto the locomotive.

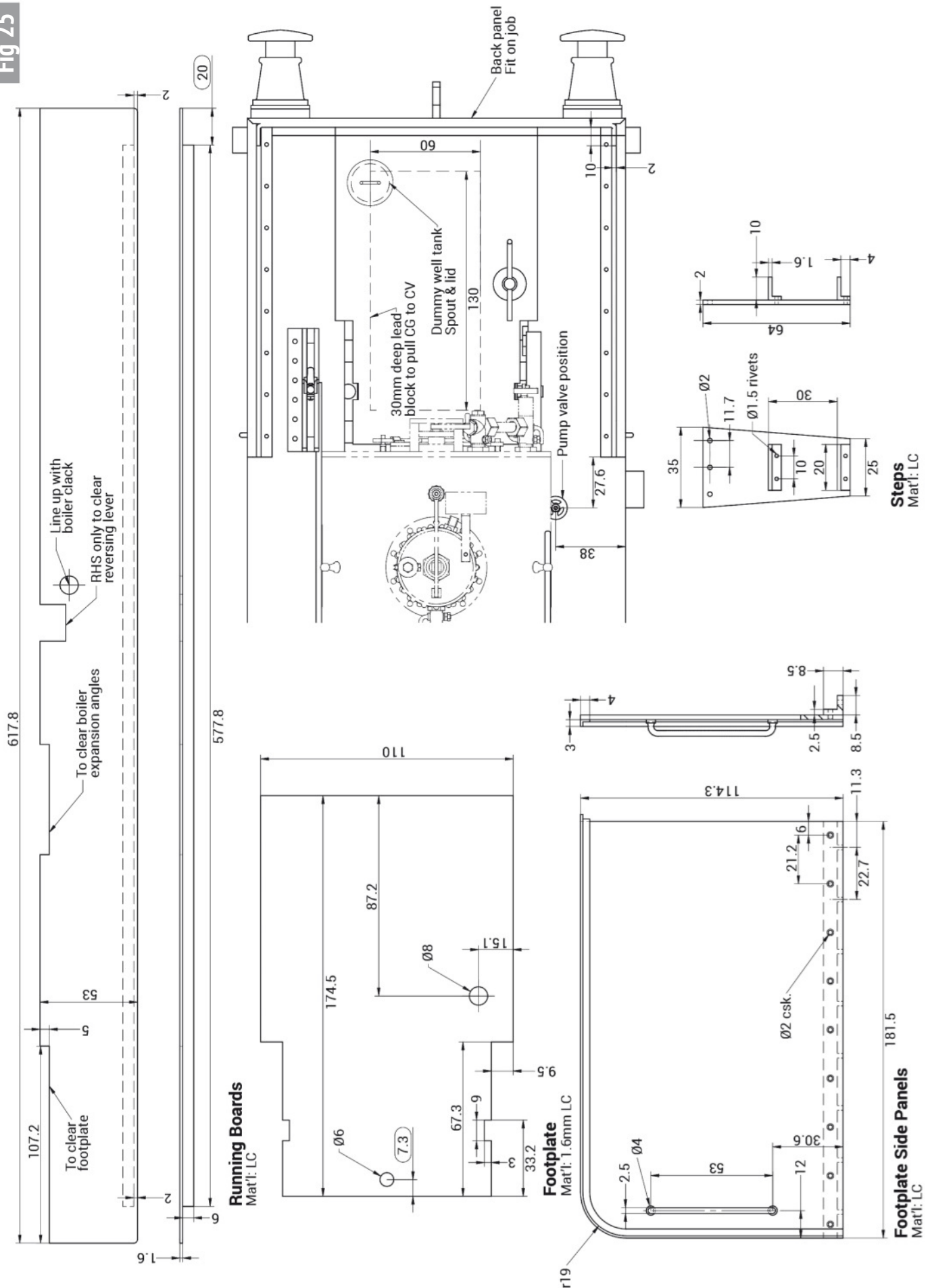
The footplate

The footplate was again laser cut. Provided the boiler is made reasonably well, it will fit with very few problems. The large prototype had a bunker



Running boards showing rivets and cut-outs for clack etc.

Fig 25





Bunker lead tank box with lead anchors.



Bunker lead tank.

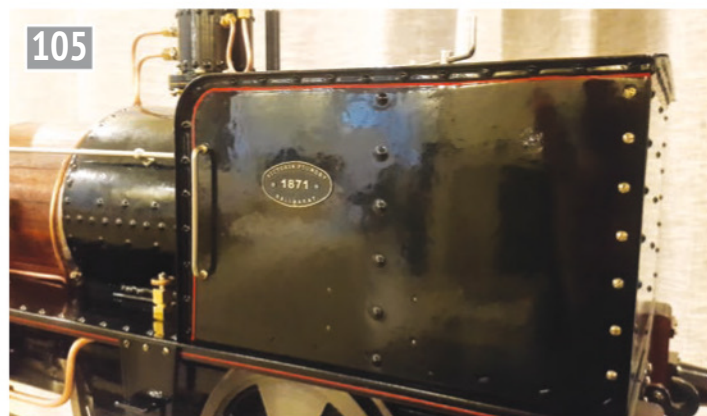
tank for the first part of its working life but was quickly upgraded to include a tender tank. It's likely the capacity was a little light. A quick tank volume check and estimation of steam usage for the model showed that a small tank under the footplate would be pointless. Even if the tank were extended further down to the wheel axles it would only go around our track twice before a refill was required. I also didn't fancy the idea of filling over the wooden floorboards. Yes, every locomotive should have beautiful wooden floorboards! If this area is used to add weight to the locomotive the benefits for running will be far more obvious. Including a 'lead tank' to the design moves the centre of gravity to almost perfectly between the wheels, effectively offsetting the cylinder overhang at the front of the locomotive.

The tank itself doesn't need to be water tight; I just tacked the corners together. The screws holding the tank to the footplate need to be extended, and large washers screwed onto the ends to act as anchors for the lead (photo 103). If the assembly is placed in a box of dry sand then leaking is not a problem and any spills are contained (photo 104). Working with lead is of course dangerous with it being poisonous (and hot), so be careful (well-ventilated area

and all that) and even though the temptation is there to scoff down some of that tasty lead, I'm sure you can resist and rather have a bag of chips and some tea later!

The side panels

During the first bit of its working life *Ballaarat* had very simple side panels with access to the footplate from the sides of the locomotive. The coal was piled at the back of the footplate. This changed when the locomotive had to traverse longer distances and the bunker tank and coal reserves fell short. For the model the original configuration and design was used with the side panels neatly boxed (photo 105). The plating for the panels is made from slightly thicker material which will hold up well during a rough day of steaming. The outside of the plate is neatly finished off with an angled strip, made by forming some 1mm plate in the vice (photo 106). This is riveted to the side panels with 1.5mm rivets (panel pins or nails). To get the bend around the corner a couple of notches are cut with a hacksaw and these are filled in with a little automotive body putty before painting. Make sure you extend the angle a little over the edge of the plate, to be trimmed neatly right at the end (the back panel corner join should be mitred). The back panel is



Cab box assembled.



Completed side panel ready for painting.

not specifically dimensioned in the drawings because this should be fitted on the job. A simple plate with the edges folded and the bottom cut out to miss the side angles will work well. A row of pan-head screws, neatly rounded to look like rivets, will finish the back end off neatly. These can be oil blackened to blend in with the paint while being far more resistant to assembly abuse than normal paint.

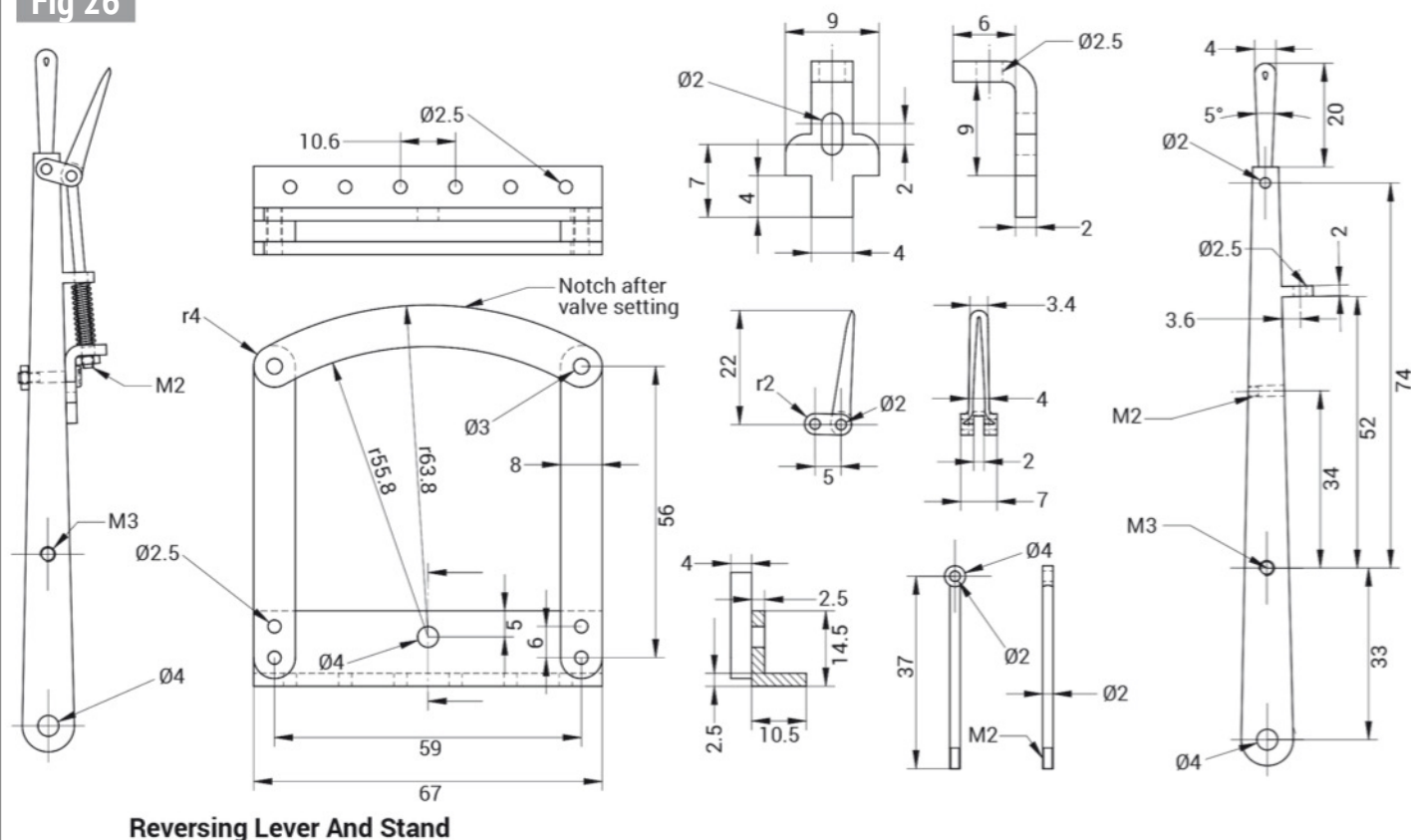
I made the hand rails from two M2 screws and a bent piece of 2.5mm stainless rod brazed together in a jig. TIG welding filler rod comes in 2.4mm which will work just as well, but there was a culinary stand in the kitchen that was looking for a promotion, so I made it disappear, never to be seen again! The M2 screws are held in a piece of scrap bar in the three-jaw chuck (drilled and tapped) and a 2.5mm hole is drilled into the head of the screw to just before you break through to the thread. After bending the stainless rod over a suitably sized former in the vice, the lot can be held with

a toolmaker's clamp in a jig for brazing the M2 heads to the rod. A little Tipp-ex under the M2 heads will make sure any solder mishaps won't permanently fix the lot to the jig (photo 107). The solder should make a nice fillet, finishing off the hand rails to look like the prototype.



Setup for soldering the hand railing.

Fig 26



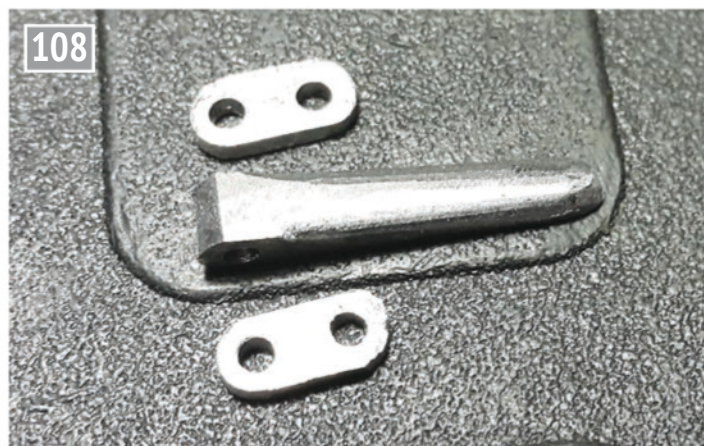
The reversing lever and stand

The reversing lever stand (**fig 26**) was mostly laser cut with only the mounting holes requiring drilling. The base angle was made from a scrap piece of angle iron machined to size. This is one of the few cases where I would suggest skimming the bottom and sides of the angle to ensure the reversing handle and stand is perpendicular to the running boards. Most stock-bought angles (in Africa) are skew and will make the footplate look very untidy if the reversing lever is skew.

The reversing lever required a few drilling operations. The easiest way to hold a tapered laser cut component is between two pieces of soft wood, clamped in the vice so that it digs in a little. This will hold it firm enough for the drilling. The end of the lever is a turned taper, machined in the same manner as described for the smokebox door handles, with a small spigot at the end. This is

brazed into a hole drilled at the top of the lever. To get a clean, neat soldered joint, place a small piece of silver solder in the drilled hole with a little flux. Hold the assembly upside down with a pair of pliers and heat until the solder melts, and the end slips into the hole, fixing the two components. Then finally for the lever: the M2 cross-drilled hole for the latch slider doesn't need to be tapped right through; 3mm tapping depth is more than adequate.

The handle is a brazed assembly with lots of hand filing (**photo 108**). The two chain-link-type pieces are drilled and filed to drawing, with the centre piece also drilled and filed to form a neat handle. After brazing, the lot can be cleaned with a file. A 2mm slot is needed through the centre for the pull rod; this can either be done using a circular slitting saw in the milling machine, if available, or a thin file. Because the pull rod can be made to suit, the accuracy here is not that critical.



Reversing handle bits.

The catch is filed in the vice; hardly worth machining this in the milling machine, you're only going to break cutters. Even the 2mm hole can be filed between two holes with a standard round needle file with the sides ground to 2mm using the bench grinder. This needs to be done slowly with lots of dipping in water to prevent the file from getting too hot and softening. After filing the flat pattern the top can be bent in the vice and the top hole drilled.

The pull rod is again a brazed assembly, with a shallow hole drilled to locate the rod for soldering. I suggest making the round cylinder slightly oversize (this is of course machined on the lathe) so that it can be filed down to suit the slot in the handle.

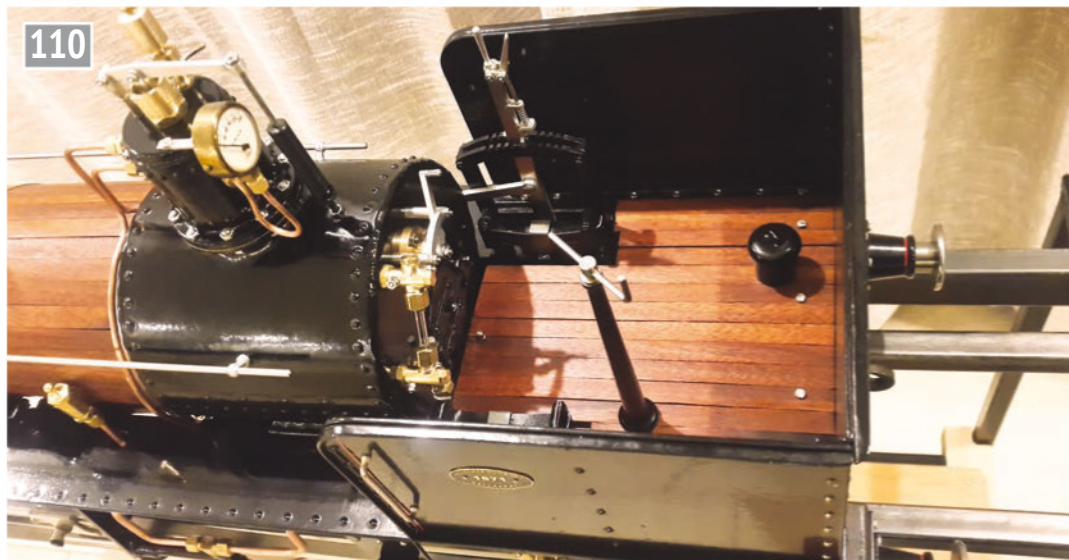
On final assembly the pull rod end nut will need to be locked with a little thread locker to make sure it stays put during steaming. This is after the slots have been cut and the handle position looks



109
Checking for correct sizing on the reversing lever.

good. Incidentally, the final handle position should be such that a miniature driver can comfortably grab the handle to move the lever (**photo 109**).

With the reverser bolted to the running boards and



110
Completed and fitted reversing lever.

connected to the reversing arm, the slots can be marked for best running (**photo 110**). You can open the valve covers and recheck the timing or if you're lazy like me just put a little air on the cylinders and

move the lever to where you get the best running. This is how I decided my notch positions. Just make sure you look out for clashes with the valve spindle coupling and eccentrics and the expansion

link and lifting links. You would need to rotate the mechanism one full revolution to check for clashes. If you find that the linkages clash you've moved the lever too far.

●To be continued.

NEXT ISSUE

HIPP Clock

Carl Wilson describes the operation of his Hipp clock, based on John Wilding's large balance wheel clock.

William Spence

Cliff Almond resumes the story of the Guinness brewery's narrow gauge tram engine.

We Visit Urmston

John Arrowsmith takes a trip to Trafford to visit the Urmston club.

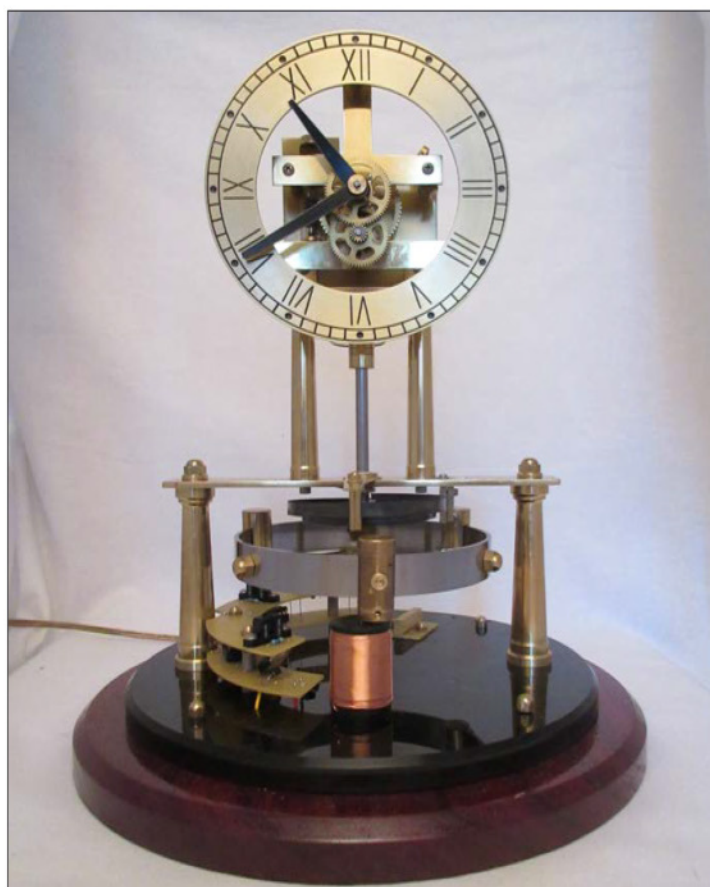
Oscillating Engine

Hotspur fits the water pump to his three-cylinder oscillating engine and makes the reversing gear assembly.

Local Hero

Roger Backhouse looks at the life of businessman and industrialist Henry Schneider, of Barrow in Furness.

Content may be subject to change.

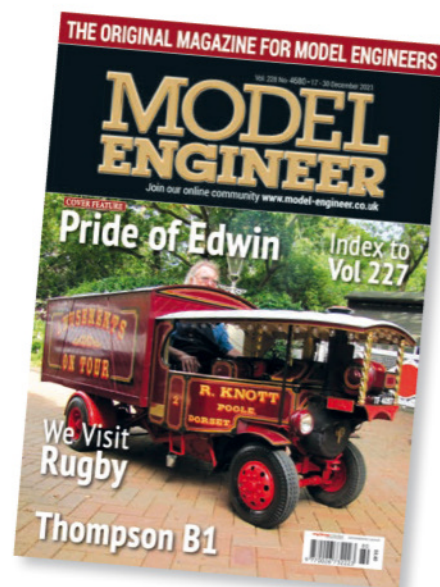


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Britannia Class 7 Locomotive in 5 Inch Gauge A Modelworks Rebuild

PART 12 - THE TENDER

Norm Norton takes a renewed look at this popular, kit-built BR Standard Pacific.



Continued from p.252
M.E. 4671, 13 August 2021



Oliver Cromwell on the GCR, Loughborough in 2014.

Progress to date

This series of articles describes the rebuilding of a 2006 Modelworks 5 inch gauge Britannia and the last Part was in *Model Engineer* 4671, published 13 August 2021. That largely took us to the completion of the main locomotive. So why has it

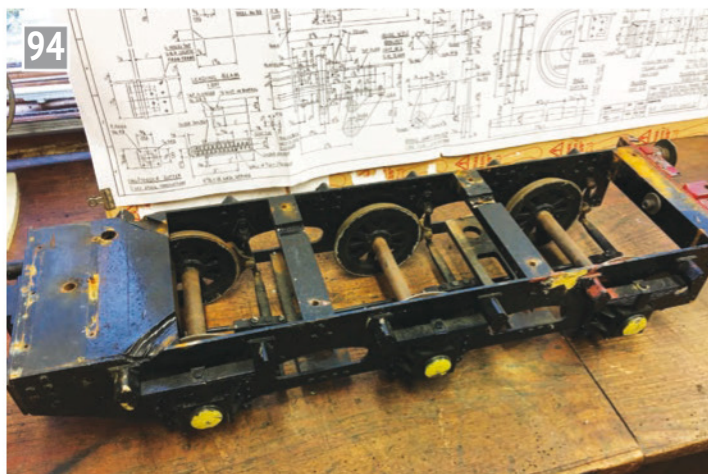
taken me so long to continue the series? Well, my fault obviously. I did take a few months off from the workshop in the summer of 2021 but it has since been pretty solid work through the past winter. The reason for the slow-down is that this 'rebuild' has turned into a 'new-build' for much of the engine. For the locomotive it is just the frames, wheelsets, bare cylinder blocks, motion and boiler that are largely original; almost everything else has been replaced. This is my warning to any potential Modelworks 'rebuilder' – beware of setting your personal targets too high!

It has been the same story with the tender. I have recycled the frames and the wheelsets with axle boxes were quite useable but the brass tender body is all new – and that means quite a lot of work if you want it to be detailed.

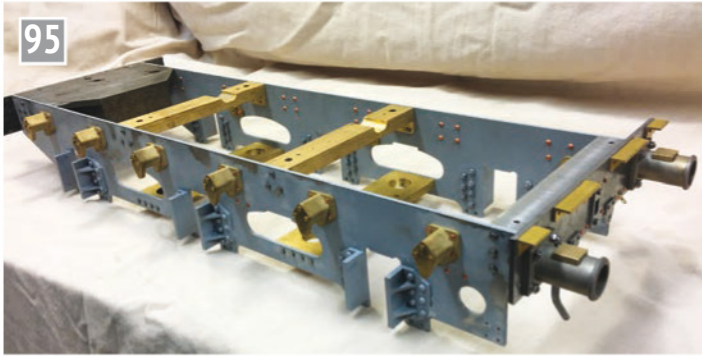
Tender chassis

I started with a very tired and worn-looking Modelworks chassis to improve (**photo 94**). I wanted to reduce the size of the large, metric hex headed screws that fixed the frame plates to the stretchers. The stretchers were solid bars of brass or iron and not prototypical fabrications, but I was happy to reuse these as they are largely hidden. The Warnett tender drawings were very helpful and Winson, then Modelworks, had copied most all the dimensions, although not the screws (!)

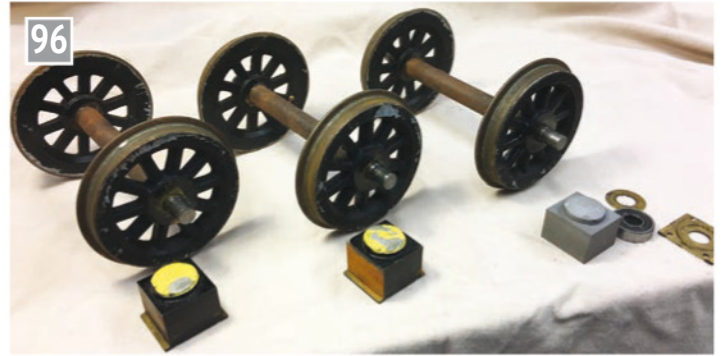
It was fully dismantled, paint stripped and then all the holes in the frames for the stretcher attachment screws were welded up. New holes were drilled, offset by $\frac{5}{32}$ inch in many cases so that the original stretcher could be re-drilled and tapped. 7BA hex setscrews with 8BA heads were generally



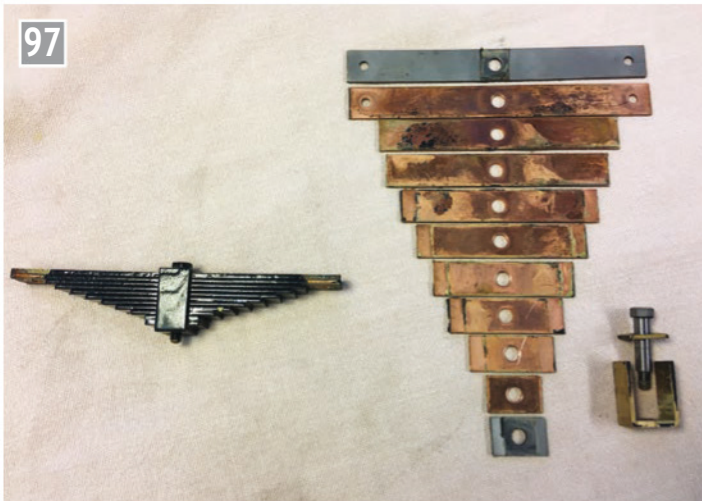
The Modelworks tender chassis was based closely on the Les Warnett drawings.



95
The frames have now had all the metric screws removed, the holes welded and re-drilled for 7BA setscrews with small heads.



96
The wheelsets locate in ball bearings fitted within the cast iron axleboxes.



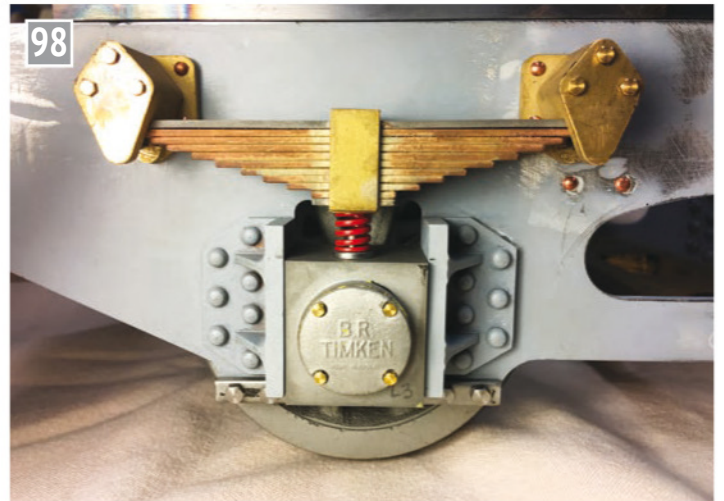
97
Separate leaves made up the leaf springs, but allowed no spring movement whatsoever.

used to rebuild. Spring hangers were riveted on and new buffer and drag beams made.

It is possible to add a lot more lovely detailing to a Britannia tender chassis, but this is supposed to be a

Modelworks rebuild and I am trying to limit just how much gets changed (**photos 95 and 96**).

An odd feature was what Modelworks, or a previous builder, had done with



98
The leaves have been silver soldered together and drilled to accept the die spring that now controls the movement of the axle box.

the springing, or should I say complete absence of springing. The leaf springs were strips of bronze with a steel top leaf and a securing screw passing down and through to press directly on the axle box (**photo 97**). The problem was that these leaves did not give at all - solid suspension. Warnett shows a coil spring sitting inside a dummy leaf spring casting. I decide to copy this for simplicity and so silver soldered the leaves together (otherwise the coil spring will bear on the top leaf only), then drilled for the coil spring (**photo 98**).

I could not find commercial wire-wound small springs of sufficient force and not even as high as Warnett suggested so the red ones shown in **photo 99** are described as commercial die springs and are wound from square section wire. I wanted the tender to cope with my weight from tender-mounted footrests.

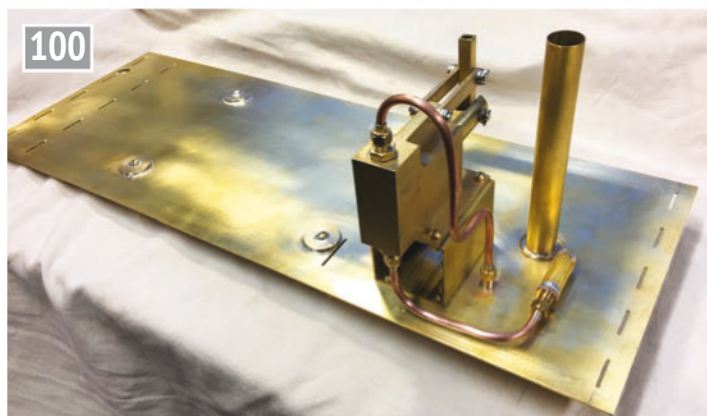
In addition to the 26kg of a finished tender, you need to allow for half your bodyweight, so plus another 40kg on top of that.

Tender tank assembly

The tender chassis was fairly straightforward to sort out. The making of the brass tank was quite a different matter. The Modelworks tank was beyond saving as it had been subjected to several modifications in its past and so I purchased a BR1 kit from Malcolm High (under new ownership now) at Model Engineers Laser (MEL). The kits are very well done and I was interested to see whether the 'tab' together design would make it an easy job to assemble. The first issue was getting my head around how it all went together. Les Warnett's drawings are of limited use but Malcolm's notes gave a sequence of assembly and he had sent notes from another builder which were actually quite useful.



99
The red die spring on the left is wound from square section wire and offers a higher spring rate than the conventional black coil spring.



Tender body construction starts with the components trial fitted to the soleplate.



The double-skinned bulkhead was soldered first to the coal chute, then the two sides added and finally to the soleplate.

First was the soleplate (photo 100). I just added four big 2BA studs for fixing to the chassis and there will be no small bolts at the ends of the soleplate as the Warnett drawing shows. The hand pump is the modified Modelworks original, the bore seemed about right but I made new levers to utilise the full stroke. The overflow tube I have added fits into an inch deep socket in the sole plate and has two O-rings to seal it. A quick pull out will drain the tank after running.

The MEL suggested assembly scheme is to first make the double-walled bulkhead, then bend up the coal chute and solder this to the bulkhead (using the soleplate and sides to check it is square). Now solder on the sides as you are able to work a torch from underneath. Finally solder on the soleplate ... but here was the problem. Malcolm says in his notes that getting a solder seal between the rear plate of the bulkhead and the soleplate might be awkward – well he is absolutely right, it is nigh on impossible. **Photograph 101** is before the soleplate was fitted. You are not going to send enough heat through the soleplate to get the inner bulkhead plate hot, even with a few tabs showing.

I therefore stood it on end, on the floor, filled the joint area which was two feet down the internal tunnel with flux and



In front is the dummy water level indicator and behind, at the top of the tender side, is the dummy inspection hatch used by shed staff to maintain the water level indicating apparatus. These are not standard kit parts and present a mini-project of their own.

Attaching the soleplate was tricky. To reach the solder joint between the bulkhead rear plate and the soleplate a long-necked burner and metal pipe on the vacuum had to be used to remove CO₂.

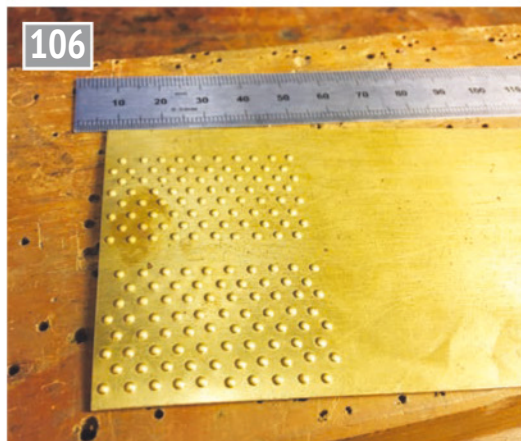
solder pieces and used a long neck Sievert torch and a metal pipe on the Henry vacuum to pull out the CO₂ from the flame. If you don't extract the spent gasses it will all go out in ten seconds! The joint all ran and looked okay, but I was left with one gap that is now epoxy sealed. I tried not to melt poor old Henry. There was quite a big air flow, enough to 'suck out' the big Sievert flame and it had three feet of metal pipe to go up first. I don't think I checked the pipe for temperature, I was too stressed trying to get the solder to run and not too much more.



The tender rear plate is attached last and here all seams can be easily heated to achieve a seal.



105
The jig frame holds a small round-nosed punch above a recessed die. The punch and die were turned from $\frac{3}{8}$ inch silver steel, then hardened and tempered. When a brass plate is held between and the punch tapped with a hammer, a small dimple is produced.



106
Dimples produced using the tool shown in photo 105. This is 0.8mm thick brass sheet for the tender top rear steps. The dimple pitch is 3mm vertically and 2mm horizontally to produce the hexagon effect. The same principle was used for 0.5mm brass inlay pieces on the lower steps.



107
To make the sliding door bolts a press tool was made to form the circular channel. The formed plate was then soft soldered to a flat base and the assembly then cut to make the bolt catch and slider.

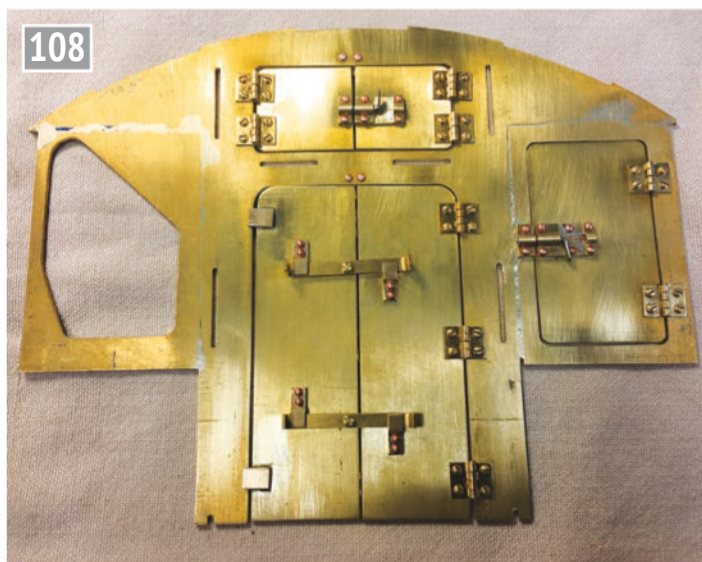
It was also suggested that you could probably put the tank together over a weekend. Well ... no comment. To give MEL full credit, it is a very well-made kit and I fully recommend it, but I wonder if perhaps the assembly and thus tabbing sequence is wrong. The kit should be built up with just the inner plate of the bulkhead used. Then you can see and access all the seams to make it water tight. The outer plate with its windows and water gauge, etc. should then be added last. But, this would require a re-design of the tab system.

Photographs 102 to 109 show some of the key features of the build.

Tender design modifications

The MEL kit contains parts for four of the inner side reinforcing brackets and I had made and fitted them as you will have seen in photo 101. But there should not be any on the right-hand side because that is where the tool tunnel goes! Yes, my fault, I perhaps should have planned ahead better. The kit does not have a tool tunnel so that was an interesting piece of fabrication relying partly on the drawings of Doug Hewson and those of Les Warnett.

If you built a BR1A tender exactly as the prototype you would have severe difficulty firing or driving the engine. This is because the high front to the prototype's tender has



108
Door furniture seen on the front part of my enlarged bulkhead insert. The long, coal-access doors also have three sets of hinges on the reverse of the centre seam, but at this stage the rivets have not been drilled through.

cupboards that sit close to the rear of the cab roof. Many builders, therefore, have a 'lift-out' centre bulkhead insert and the MEL kit copies this. I have, however, considerably modified its outline by including the tool tunnel opening and the lower cupboard on the removable insert part. This removes two sharp corners from hands and wrists when driving. However, I have affixed the actual tool tunnel to the tender as this presents a nice visual feature.

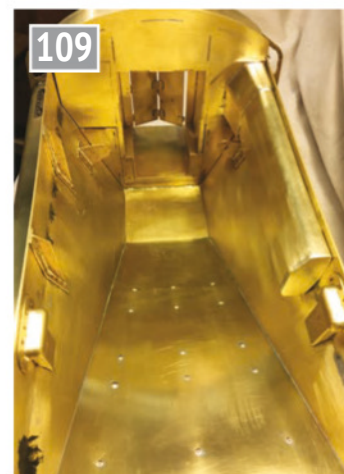
The coal shovel plate is a separate piece that will slide out. Above that sits the enlarged bulkhead insert. The tricky bit at the start was working out what the insert slid between to ensure a

secure fore and aft fixing. The tool tunnel opening comes out with the insert, but the tunnel will stay fixed in the tender.

Water filter boxes

Building the basic tender tank was one thing but it was the amount of time spent on all the detail additions that dragged it out.

The BR Standard tender water filter boxes are an attractive feature and perhaps need to be modelled in some good way. I thought of fabricating them, but life is so much easier starting with a pair of castings. (Funny how many things in life become easier if you use money to get someone else to make bits).



109
The coal chute upper sides have the two dummy water space ventilators at the rear. On the right is the long tool tunnel and on the left the two inner side reinforcing brackets, that obviously cannot be repeated on the right. The bulkhead removable insert has been positioned to show its location.

Steam Workshop were very helpful in coming up with two Hewson castings. Problem was they were both right-hand side items and after I had sent one back they found they had no left-hand ones. I spoke to Adam at Cro Designs, who previously had none and was waiting for new castings to be made. He went through his box of 'rejects' and they were all right-hand! However, I had already devised a plan to convert a 'right hander' to left hand so I gratefully took a 'reject', which was actually fine.

Photograph 110 shows the Cro right hand casting on the left and the Hewson casting,

with the triangular water pipe outlet cut and moved, still in its post-silver soldering state. On the reverse are the square bosses for the water valves, but I did not bother moving the Hewson one as they are so near the centre line. I did beef-up the top of the Hewson casting with a plate to match Cro's design.

I doubled the thickness of the pair of lids I had, to try and make them more capable for the job of sealing on the faces. The lids and tops and bottoms of the bodies were milled flat. Filter sieves were made to slide into the bodies (slightly different sizes for the two castings) and these look like they will make a reasonable seal for filtration purposes.

Photographs 111 to 113 show some of the work on the filter boxes.

I wanted water from the tender to flow into the box, through the filter and out of the pipe flange in prototypical manner. I did not bother with the water valves and fitted dummy heads. I cannot see the point of having a valve there; if you really want to keep a tender full of water (perhaps overnight if away for a weekend?) then maybe screw little PTFE nipples into the ends of the rubber tender connectors?

Mounting plates, with a single water hole into the tank, were screwed and epoxy sealed to the bottom of the sole plate and 10BA studs screwed and set into these with hard Loctite. The boxes are affixed on to gaskets by 10BA nuts. The result is immensely strong, but a ridiculous amount of work. The 10BA nuts will never be seen unless someone puts their chin hard on the gravel of a ground level track!

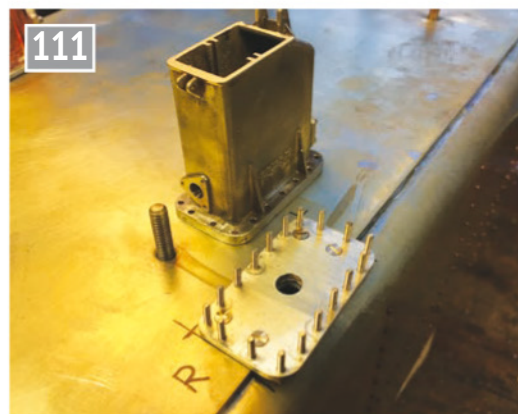
The lids seal to the body with a thin neoprene rubber gasket. Well, I say 'seal' but you cannot get much force from that tiny scale thread and lever, it needs to be bigger. I am left with tiny water droplets that grow so a wipe-on soft sealant might be the answer between filter cleans.

Photographs 114 and 115 show the completed tender.

●To be continued.



110 A 'Cro' water filter box on the left and a modified 'Hewson' filter box with silver solder evidence, the triangular water pipe outlet having been repositioned.



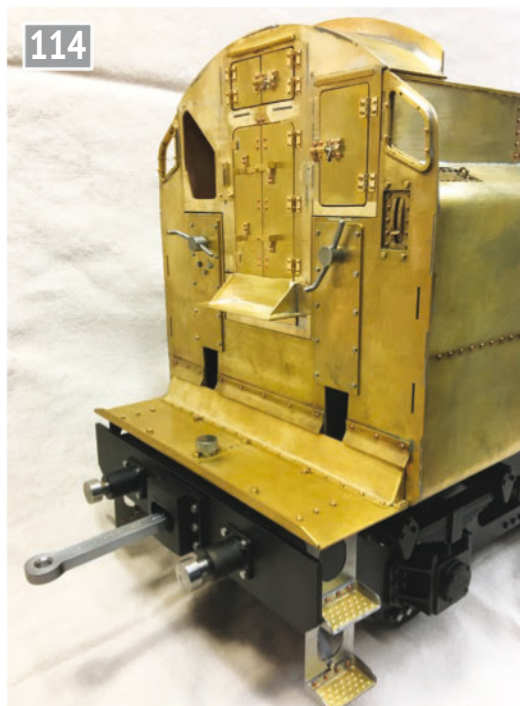
111 The filter boxes locate on sturdy plates screwed and epoxy sealed to the soleplate. The plates carry 10BA studs and nuts pull the filter box down onto gaskets. A single water passage is drilled through into the water tank.



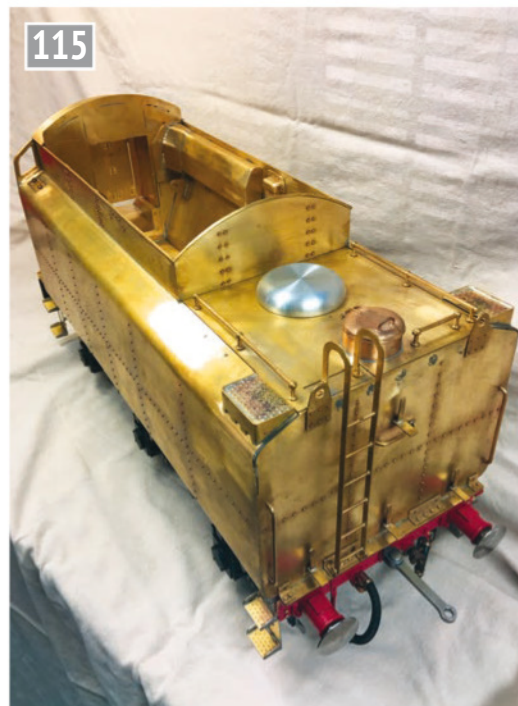
112 The filter boxes have lids that are pulled down onto thin neoprene gaskets. Inside are brass-framed, brass gauze filter panels that sit between the drilled water passage and the triangular outlet flange. The shut-off valves are dummies.



113 The filter boxes look just like the real thing and are very solidly mounted on all those 10BA studs, but whether it was worth all the effort and whether anyone will ever look under the tender is questionable.



114 The brass tender tank trial mounted on the painted chassis. The platform on a BR1A tender should meet a higher buffer beam plate. Also the slots on the very edge of the front body side are to be filled. These errors arise from the fact that the Warnett drawing is for a later tender.



115 The rear top plate infill rests on four ledges screwed to the chute, sides and rear. The plate lifts out for access to the drain pipe and pump. The hand pump can be operated by lifting the water scoop dome that has been made from aluminium. The upper steps are a copy of 70013's actual steps with three cut-outs below; normally there is one longer cut-out.

The *Little Demon* Supercharged V8

PART 7

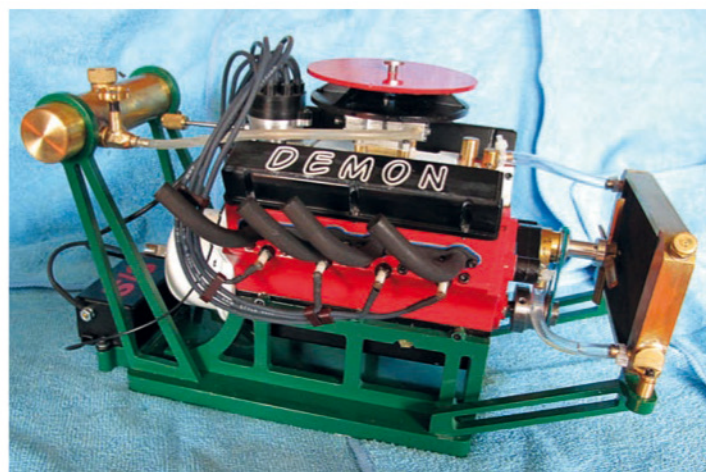
Mick Knights describes the construction of a supercharged V8 internal combustion engine.



Continued from p.746
M.E. 4692, 3 June 2022

There are many examples of this particular engine on various media outlets but all that I have seen so far show the engine running with a single carburettor and air filter. I can only conclude that the twin carburettor supercharged version may be a bit trickier to set up and get running, so I set out to produce two manifolds; one for the single carburettor that hopefully will run and another for the supercharged twin carburettors, that would also require a different cam shaft and so quite possibly will only be for show.

The side faces of both manifolds that mate against the cylinder heads not only have to be as close to 45 degrees as you can get them, but they also need to be completely parallel as even the slightest taper along the length will create gas and fluid sealing problems with the heads. I couldn't really rely on the tilting vice to hold the manifold stock true enough to produce completely parallel faces, as it's not a super



precision vice and the body is quite likely to slip when tightened on the incline, so a milling fixture was required. I'm very fond of saying that simple is best, mainly because it's true - complicated fixtures have more things to go wrong. Sorting through the accumulated bits and pieces in the workshop an old angle plate looked the most promising bit of kit. The angle plate is ground all over, which means that when it's inverted on the machine table it will

present the billet at exactly 45 degrees - all that was needed was a couple of pieces of angle screwed to the sides to allow it to be clamped to the machine table. To ensure the billet is set in a parallel plane a steel locating strip was screwed to the clamping face and clocked completely true before finally tightening down (**photo 44**).

It's essential that the flat central face of the manifold is in the exact centre of the block. To ensure this is so



Manifold milling fixture.



Milling side faces central to the block.



Fly cutting to final close fit to the engine block.



Machining the outside faces.



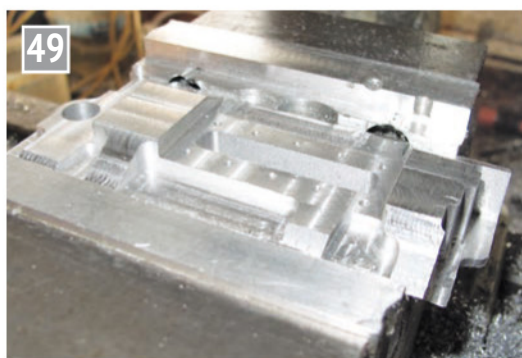
Generating the rear detail and distributor bore.

the side faces are machined at the same depth settings until, when presented in its final position between the two heads, there's about a millimetre gap between the manifold and the engine block (**photo 45**). It's then a gradual process of machining the same depth setting a few thou at a time from both faces until a snug fit is obtained between the manifold faces and the assembled engine block. Again, fly cutting is used to achieve the desired result (**photo 46**).

Two 0.020 inch thick Teflon gaskets will be fitted between the heads and the cylinder block on final assembly and two 0.010 inch thick gaskets fitted between the inlet manifold and the heads. This may result in all the components not fitting as snugly as before when everything is fully tightened down, which means a small amount of adjustment might be necessary.

The next couple of angled faces, being in fresh air, are not quite so critical and can be milled without a fly cut finish. Both faces are again finish machined at the same depth setting (**photo 47**). The rear end detail and distributor bore were generated on the CNC mill (**photo 48**). The detailing of the top faces is quite intricate and was carried out with a combination of conventional and CNC machining. All the straight milling of pockets and cut outs was conventionally machined, while all the corner radii were generated on the CNC machine. **Photograph 49** shows the detail of the supercharger manifold, while **photo 50** is the single carburettor version.

Next, the manifold securing bolt clearance holes along with the inlet ports have to be produced on the 45 degree angled faces. The positions of these bores on the drawings is again a liner dimension from the corner edge of the two angled faces, which need to be



The supercharger manifold.



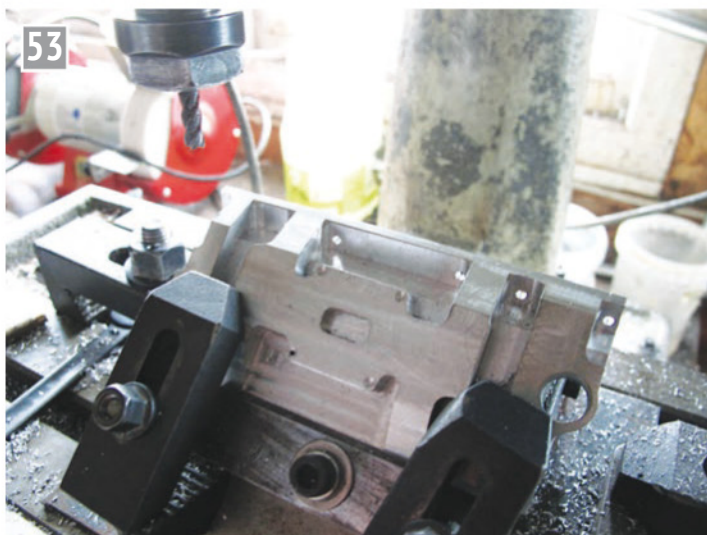
Single carburettor version.



Establishing centre line of securing bolt holes.



Drilled holes and counterbores.



53 45 degree clearance pockets in the single carburettor manifold.



54 Clearance pockets in the supercharger manifold.



55 Picking up the counter bore using a $\frac{3}{16}$ inch rod.



56 Drilling $\frac{3}{16}$ inch diameter feed bore at 5 degrees.

I'm very fond of saying that simple is best, mainly because it's true - complicated fixtures have more things to go wrong.

established with the forty five degree face set horizontally (**photo 51**). With the centre line established the securing bolt holes are produced along with two counterbores for the air/fuel mixture delivery ports, which are drilled at a future set-up (**photo 52**). The 45 degree clearance pockets are then machined with the manifolds mounted in the milling fixture (**photos 53 and 54**).

The quarter inch diameter counterbores that were produced at the same time as the securing bolt holes now need to be picked up using a piece of $\frac{3}{16}$ inch diameter rod in order to drill the cross feed

bores. These are drilled $\frac{3}{16}$ inch diameter on a 5 degree centre line so the manifold in photo 52 is inclined at five degrees (**photos 55 and 56**). These cross bores now need to be connected by another feed bore drilled $\frac{3}{16}$ inch diameter on a 22 degree inclined centre line starting from the central manifold fuel/air intake pocket (**photo 57**). The cooling water return ports also need to be drilled from one face to the centre line of the manifold where they join the brass water neck for the water to be returned to the radiator. The single carburettor manifold has a simple parallel



57 Connecting the cross-feed bores to the fuel/air intake pocket.

drilled hole, while the blower manifold's cooling water return port is inclined at ten degrees as the water neck is positioned vertically on the front face of the manifold.

●To be continued.

NEXT TIME

This is as far as we go with the manifolds for the time being and we'll now concentrate on other aspects of the air/fuel intake.

Obituaries

FRANK COOPER

Frank Cooper, chairman of the 7¼ Inch Gauge Society, died suddenly at home on the 3rd May 2022.

Frank was a great asset not only for our Society but for model engineering interests in a variety of fields. He worked extremely hard on behalf of our Society and his contribution was so wide that it is difficult to know where to start in trying to record all that he has achieved.

Frank had a professional background in insurance and his knowledge in this area was often put to good use in regard to model engineering activities.

Frank was appointed as Society chairman at the 2014 AGM, having already served on the committee as membership secretary since 2010. It was typical of Frank's ability and his willingness to cover a range of responsibilities that on his appointment as chairman he was happy to continue as membership secretary.

We must not forget that Frank was also chairman of the Northern Association of Model Engineers and on occasions, such as model engineering exhibitions, was able to juggle the two (or more) hats with conspicuous ease.

Frank was a great ambassador for the Society and firmly believed that whenever possible the Society should have a presence at model engineering functions. In this respect he certainly practised what he preached and travelled widely all over the country to ensure that the Society stand was present. Along with other members I spent many happy and rewarding hours stewarding at these occasions and enjoyed Frank's company.

Over the years Frank had wide interests with regard to our love of railways. He was for a number of years involved with the management and operation of the Welshpool and Llanfair Narrow Gauge Railway. He was also a keen volunteer



member of York Railway Museum and involved with the operation of the 7¼ inch gauge railway at this site.

Frank was a tireless worker for our hobby generally – for example he took over from me as the Society representative serving on the body that compiles and publishes the Boiler Testing Code and Guidance for the Safe Operation of Miniature Railways.

The width of his interests stretched beyond the UK – for example it may not be generally known that he assisted from time to time in the development and operation of narrow-gauge railways in European countries including Ukraine and Romania, making several visits to these and other neighbouring countries. Further interests were dramatically different from the model engineering activities – Frank loved music and was a member of the local choir and was often responsible for arranging local music events.

Frank had a strong personality with strongly held views, a style that tended to mask somebody who had a deep sense of humour, also a good conversationalist and always pleasant and enjoyable company.

7¼ Inch Gauge Society

CHRIS DEITH

It is with deep, deep sadness that we announce that Chris Deith passed away suddenly on 12th May at the age of 76 whilst enjoying a holiday in Italy with his wife, Bridget.

Chris will be remembered by many in the model engineering and hobby world as a true mastermind and entrepreneur.

Born in London in 1945, Chris developed a passion for steam in his early teenage years, becoming well known in the specialist modelling world and steam preservation movement, and this continued throughout his life.

In his early years he founded the well-known specialist book sales and publishing company TEE Publishing in London in 1961.

In the early 1970's following a family move from London to Hinckley, Leicestershire, Chris founded the magazine *Engineering in Miniature* quickly followed by the annual *Steam Heritage Guide* and *Clockmaker Magazine*.

The magazines became the catalyst for the formation of a new company Meridienne Exhibitions followed by the development of a number of specialist hobby exhibitions including the Midlands Model Engineering Exhibition started in 1978 and the London Model Engineering Exhibition started in 1997.

In 1990 Chris and Bridget purchased 'The Fosse' near Leamington Spa, providing a permanent home for the family and business. This was quickly followed by the creation of the Warwickshire Event Centre, the jewel in his crown. For the past 30+ years Chris continued to develop a full portfolio of hobby exhibitions at the venue and also to host a wide range of client events.

In addition to model engineering and associated hobbies, Chris enjoyed numerous other hobbies throughout his life including classic cars and Roman history. Chris was a real family man and involved his family in every aspect of his life including business and hobbies.

He is survived by his wife Bridget, daughter Avril, daughter in law Heather and three grandchildren. Sadly, his son Adrian, who many will also have known, passed away in December 2021.

Chris achieved so many things during his lifetime and now with his sad passing his daughter Avril, who has worked alongside him for many years, will continue his legacy in his honour, with the full support of family and the team.

Meridienne Exhibitions



We Visit the Leyland Society of Model Engineers

John Arrowsmith ventures up to the North West to visit an active club near Preston.



Following on from my visit to the West Country, I journeyed up to Lancashire at the end of September (just as the petrol problem began to emerge) to visit a number of model engineering clubs in that county. My first visit was to the Leyland Society of Model Engineers. Located in Worden Park in Leyland, the society has developed a first class model engineering club and miniature railway over the last 60 years. I have been couple of times in the past but these have been when other events like the 7¼ Inch Gauge Society AGM was taking place. This time I was able to take my time, talk to members, enjoy their extensive facilities and find out a bit more about the club.

Being located in Worden Park they have developed an excellent working relationship with the South Ribble Borough Council, their landlords, who appreciate their work and

commitment to the local community. It all began, of course, way back in the 1930s when the Preston Society of Model Engineers was formed. This society was active until the onset of WWII and, like many societies of the day, it did not survive due to lack of interest and members. At the end of the war, however, about eight members started it up again. It continued to grow such that in 1952 the club was able to stage an exhibition of models to coincide with the Preston Guild.

As the Society grew, the pressure to have their own track increased and an approach was made to the local authority, Preston Corporation. Again, as with many other clubs, this request was refused so the members continued looking for a suitable site on their own. Eventually some land at Towngate in Leyland became available. Although no security of tenure was forthcoming, members decided that they could build a track on this ground and operate for at least a few years. Having thus proved themselves, an approach was made to the then named Leyland Urban District Council and this was met with a totally different response from that of Preston. They offered a site in Worden Park at a peppercorn rent with the only requirement being that Leyland was included in the title. Very quickly the club

name was changed to the Leyland, Preston and District Society of Model Engineers and the members then set to and built a new 300 foot 2½, 3½ and 5 inch gauge track which was opened at Easter 1955 by the chairman of Leyland UDC, Mrs. Kelly.

The increase in membership and locomotive ownership resulted in this track being extended in 1968 and again in 1972 and 1978 to 851 feet. Yet another rebuild in 1983 resulted in a track length of 1617 feet and this is as it is today. The ground level 7¼ and 5 inch gauge track came in 1995 and was further developed in 2005 when they built a circuit out into the park, increasing it to around 1 km long. This is how I found it on my visit.

Of course a railway like this needs lots of additional facilities to operate efficiently so a splendid club house with all the usual domestic facilities and comfortable members' area has been built (**photo 1**). When I arrived it was quite a wet morning but the welcoming fire in the club room was burning brightly and really lifted the damp atmosphere. Chairman John Barr met me and introduced me to a number of the other members who were starting their endeavours that morning. On display in the clubhouse was a very nice looking tender built by Roger Locock for his 5 inch gauge Johnson Single



The inside of the comfortable club house.



The tender from a Johnson Single in 5 inch gauge being built by Roger Locock.



The smart outside area showing the traverser control section and the hydraulic lifting table.



View of the covered steaming bay area with the club house in the background.



Preparations in hand for a steam test on the 'Lanky'.



The departure end of the raised track station, Worden Halt.



The substantial footbridge over the raised track.

(photo 2). Outside the main entrance to the club building is a block paved area covered with a traditional station awning and valance (photo 3). This provides some welcome cover on wet mornings like this. Between the club house and the new workshop is the main steaming bay. This area is configured as a round house

and is fully covered with a hexagonal roof (photo 4). This morning one of the Leyland members, Alan Crossfield, was busy getting his 5 inch gauge Lancashire and Yorkshire 2-4-2 tank engine ready for a steam test (photo 5). Alan, as many people know, is a builder of superb locomotives and this 'Lanky' was no exception. It

passed its steam test without any problem so it was then ready for a test run on the track. Alan offered me a run so I set off behind him and the 'Lanky' for an exhilarating trip round the excellent 5 inch gauge raised track.

It is an interesting layout with some good long straights and well fitted, super elevated

curves. The main station has a good passenger layout with a substantial footbridge allowing access to the centre of the track (photos 6 and 7). Alan's engine performed faultlessly and finished the run with plenty of steam and water (photo 8).

The 7¼ inch gauge ground level track winds its way



A satisfied Alan Crossfield after his test run.



Vic Whittaker at the controls of club engine Merlin.



One of the club's steam locomotives on shed is a basic Romulus design.



The club's 5 inch gauge battery powered raised track workhorse.



The departure layout on the ground level track.



The arrival side of the ground level track showing the three sidings and moving sector plate.

through the park with no fencing or other restrictions so that a journey round the 1km length really feels like a train ride to somewhere else, albeit on a smaller railway. One of the club locomotives, *Merlin* was brought out of the shed for me to see. This powerful engine was built by club members led by Vic Whittaker who gave me the low down on its engine and

construction (**photo 9**). Vic designed the bogies with an hydraulic motor on each bogie; these are driven by a Kyboto diesel engine driving an hydraulic pump, which is very effective. The way it is set up means that there is no wheel spin. It is a very powerful machine and will pull all the club's passenger carriages fully loaded, which equates to about 50 people.

Inside the shed was another club locomotive (**photo 10**) and the club electric locomotive was parked in the steaming bays (**photo 11**).

Photograph 12 shows the departure track from the main station and this clearly shows what I mean about the ride out into the country. The track coming in from the left is from the club area to join the main line at this point. In the

distance you can just make out the line from the sheds to the main line avoiding the station. Using this line Vic kindly took me for a spin around the park and back to the ground level station. Here they have another innovative idea in use with three storage sidings but only one moving sector plate to enable each siding to be used without the need for complicated point work (**photo 13**).

The club does have around 20 members who are traction engine owners and builders and Mike Whalley explained that they are very keen to support this section, allowing, as it does, different aspects of steam and model engineering to be demonstrated at the club (**photo 14**).

While I was busy having rides on both the tracks, another member, Paul Speakman had arrived and



Paul Speakman steaming his 5 inch gauge 'Heilan Coronation' Pacific.

Mike Whalley's 4 inch scale Burrell traction engine.



Paul Speakman leaves the station for a run with his 3½ inch gauge Pacific.



The very impressive club workshop.

was busy preparing a 3½ inch gauge locomotive which he described as a 'Heilan Coronation Pacific' (photo 15). It apparently started life as an LBSC Heilan Lassie and when he bought the chassis it was decided that it could be turned into a locomotive that looked like an LMS Coronation - and this was how it was on the steaming bay. Having got it steamed up it performed admirably on the track (photo 16).

I mentioned above the new workshop and here again the club have a very impressive set-up. Housed in a smart brick building there is a comprehensive selection of machinery, equipment and tools that would enable any member to carry out a wide range of engineering operations. I also have to compliment the members for the tidy condition of the

workshop, as it is not easy to maintain spaces like this when it is regularly used (photos 17 and 18). One of the ground maintenance sheds includes quite a good sized sand blasting machine as well, so they really are well kitted out (photo 19).

By this time the rain had all but disappeared and the sun

was shining which brought a different atmosphere to the club. I continued my visit by talking to other members and having lunch in the club house. It was also good to see some of the lady members enjoying some tea outside in the brief sunny interlude while no doubt putting the world to rights.

I think that just about sums up my very enjoyable visit to a well established and progressive model engineering club and I offer my sincere thanks to John Barr, and all the members I met, for their hospitality and enthusiasm. It was a real pleasure to be at your club.

ME



These members were keeping a beady eye on me!!



One of the ground maintenance sheds.

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

Continued from p.706
M.E. 4691, 20 May 2022

The Stationary Steam Engine

PART 34 – MATTHEW MURRAY AND THE ROUND FOUNDRY Buying the land

As Boulton and Watt stumbled through the five years that would ultimately result in the engineering works known as the Soho Foundry they could not know that theirs was a single building block in a process that would lead to the revolutionary new industry of engineering. Within the space of twenty years the millwright's dominant role in creating machines was to be usurped by a rising generation of specialised engineers working almost exclusively in metal and using new tools within a factory environment. The protean engineering works that made the industrial revolution possible had its origins in a handful of firms that seized the opportunity offered by the end of Watt's patents. This emancipation of the steam engine was largely responsible for creating modern engineering and once the system of manufacturing had begun to evolve it could be extended beyond steam engines to other engineering products.

It was Boulton and Watt's accumulated experience of engine building that had led them to concentrate the hitherto separate trades involved onto a single site as the most effective shield against the changed conditions that the end of their patents threatened. Acknowledged as their most formidable competitor, Matthew Murray had also appreciated that the

factoryisation of engineering was the key to imitating Watt's principles, his clear intention. Unfortunately there is nothing comparable to the Boulton and Watt Archive for Matthew Murray and as a consequence his story is less coherent but the scattered historical record of his career has recently been drawn together in Paul Murray Thompson's *Matthew Murray, 1765-1826 and The Firm of Fenton, Murray and Co., 1795- 1844* (ref 184). An extensive historic building and archaeological record was also made of the remains of Murray's Round Foundry site before it was adapted to new uses in the period between 2000 and 2005 (ref 185). The account that follows draws mainly on these two sources.

Earlier parts of this series of articles outlined the beginning of Matthew Murray's career with John Marshall. Working initially at Scotland Mill, north of Leeds and then at the new mill in Holbeck, close to the centre of Leeds, Murray played a central part in developing Marshall's flax spinning machinery. On that first acre of land in Water Lane where Marshall had erected the A Mill, a small smith's shop and a joiner's shop were built, presumably for craftsmen working with Murray including David Wood, a blacksmith and Joseph Drabble, pattern maker, millwright and machine fitter (ref 186). Murray himself appears to have had his own facilities as in May 1794 Marshall's accounts recorded

a valuation of £11*For a lathe in Matthew's room....* (ref 187).

Following the dissolution of his first flax spinning partnership, Marshall formed his new association with the Benyon brothers and after this agreement was formalised, in mid-December 1793, a further four acres of land was purchased from David Rider. Two of these acres adjoined the A Mill site to the west, and the remainder lay directly opposite, on the south side of Water Lane and the mill stream which was becoming known as the Hol Beck. B Mill was to be built on the land adjacent to A Mill and was over twice the size. In June 1794, Marshall ordered the B Mill engine from Boulton and Watt for delivery in January 1795 but it was four months late in completing and the mill did not start spinning until September.

This very substantial increase in demand for machinery and millwork must have severely tested the limited facilities available to Murray and it was around this time Matthew Murray and David Wood first emerge as an independent partnership. As partners, at the beginning of January 1795, they were owed £285/14/7½ by Marshall although he had evidently previously advanced money to the pair for by the same entry they were stated to be indebted to him for the sum of £90/3/6. It is not clear whether Murray and Wood were still occupying Marshall's premises when these financial dealings were recorded as

unverified evidence indicates that at some point they had moved from the flax mill site to another location in Mill Green, Wortley, half-a-mile away (**ref 188**). An advertisement in the *Leeds Mercury* for 15 August 1795 announcing that Murray and Wood, machine-makers, required mechanics, white-smiths, joiners, wood-turners and iron-turners is, unhelpfully, simply addressed from Holbeck but the absence of any mention of Marshall's Mills may imply that they had their own workshop facilities. It is unlikely that such an influx of non-flax manufacturing employees would have been welcomed on Marshall's site and the range of trades which Murray and Wood wished to attract supports the view that the partnership had attained something more than token independence by the summer of 1795.

Murray and Wood's occupancy at Mill Green was short-lived. On 12 February 1796, they purchased half of a close of ground known as the Leckkeys, located about 200 yards downstream on the watercourse from Marshall's Mills. The other half was purchased by John Marshall. Prior to its division, the main body of Leckkeys extended over 13,068 square yards but the recent construction of Water Lane and the former mill stream separated the ground from a detached portion amounting to a further 786½ square yards on the north side of the water. For the purpose of the sale the owner, Jeremiah Barstow, divided the close into two exactly equal parts and in consecutive transactions Murray and Wood purchased one half and Marshall and his partners, the Benyon brothers, purchased the other (**ref 189**).

There has been considerable speculation about the role that John Marshall played in Murray and Wood's acquisition of their half of the Leckkeys. It has been claimed that Marshall was responsible for the entire purchase and that he subsequently resold the moiety of the property to Murray and Wood. This idea is

not supported by the evidence of the legal documents which clearly show two parallel but distinctly separate conveyances by which each half of the site was acquired as an independent unit. Although the price paid by Murray and Wood is not known it can be anticipated to have been in the region of £500 to £600 per acre and it has alternatively been suggested that Marshall loaned the purchase money to the partners. The surviving Marshall financial accounts contain nothing that would give substance to this contention and it is probable that by this time the engineers were generating sufficient profit on the basis of Marshall's custom alone to be able to support the expenditure without assistance.

Nevertheless, Marshall's support for his former employees as they moved towards independence must have been critical. He remained by far their largest customer and as a counterpoint, Matthew Murray was in possession of the strategic patents and the machine making expertise upon which Marshall's prosperity depended. Clearly, there must have been a significant, if apparently unwritten, agreement that a mutual first loyalty should continue to exist between them. The argument has also been advanced in previous articles that Marshall, in addition to his continuing need for textile machinery and millwork, saw Murray as a means of breaking Boulton and Watt's stranglehold on steam engine production which would require more extended facilities than those offered by either his own mill site or Mill Green.

These considerations partially explain the cooperation in the ground purchase but Marshall's actions may have been influenced by additional motives. With Murray's aid he had been highly successful in spinning the coarser grades of flax and in the space of four years demand

for his yarn justified building both his original Water Lane mill and then another mill of over double the size of the first. There was no reason to expect that this burgeoning demand would cease and Marshall must also have been confident that ultimately mechanisation would extend to finer yarns with corresponding call for even more factory space. Although two acres of the 1794 Rider purchase, south of Water Lane, remained unbuilt on it may be that the Leckkeys purchase was also seen as a possible new mill site. That the later availability of land adjacent to the Rider purchase, on the other side of what became Marshall Street, opened the way to very extensive developments by Marshall between 1806 and 1830 was possibly not foreseen in 1796.

In fact, part of the Leckkeys ground was offered for sale by Marshall and Benyon even before the sale was registered. It appeared in the *Leeds Intelligencer* as suitable for building cottages and was subsequently sold to the bricklayers and builders Longley and Cave. Apart from a school erected by Marshall, the remainder of the flax spinner's portion of the Leckkeys remained open ground with the exception of

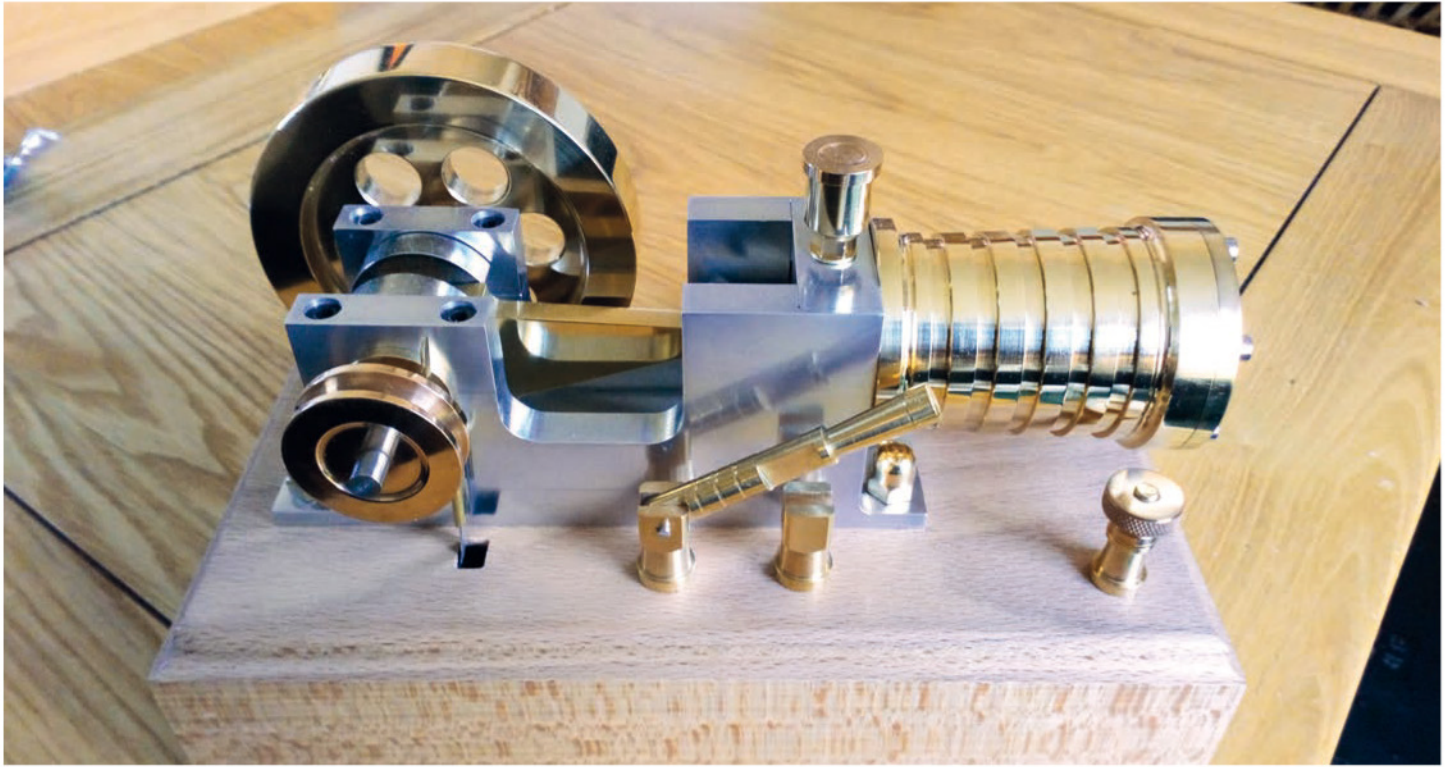
two-thirds of an acre sold to Murray and Wood in December 1801 (**ref 190**). It is interesting to note that W. G. Rimmer in his history *Marshall's of Leeds* records all of the other land transactions that Marshall was involved in but fails to mention the Leckkeys and the associated purchase with Murray (**ref 191**).

Murray and Wood's share of the Leckkeys was marginally reshaped by a further purchase of 216¾ square yards (14 yards x 14 yards?) on the east side, Kays Close, in October 1797. The ground was purchased from Peter Garforth, partner in the Skipton cotton spinning firm of Garforth and Sedgewick and a close friend of John Marshall. After a further twelve months Murray and Wood sold to John Kirby, a maltster, a strip of land on the west side, 16 yards wide and 98½ long. The conveyance was between the partners and John Kirby's assigns and the ground was already occupied by a house, a maltkiln and a stable all recently built. After these changes the Leckkeys with its additions was destined to become the site of what might legitimately be claimed to be the world's first great engineering works.

●To be continued.

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184. *Matthew Murray 1765-1826 and The Firm of Fenton, Murray and Co., 1795- 1844*. Paul Murray Thompson. Pub. paulmurray@btinternet.com, 2015. Paul and the author of this series have long been collaborators in the study of Murray and his works. I am greatly indebted to him for sharing his monumental research.
185. Reports by *Structural Perspectives* now lodged at the West Yorkshire Archives, Morley.
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187. Murray Thompson op cit. p. 51.
188. *Matthew Murray, A Centenary Appreciation*. G. F. Tyas. p. 9 of *Matthew Murray, Pioneer Engineer* Ed. E. Kilburn Scott.
189. W.Y.A. Volume DS page 614 no.684 Barstow to Clough (Murray and Wood's agent), 11 and 12 February 1796. Regd. 19 February 1796 at twelve noon and W.Y.A. Volume DS page 614-5 no.685 Barstow to Hutton (Marshall's agent), 11 and 12 February 1796. Regd. 19 February 1796 at twelve noon.
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The coil engine.

Making a Solenoid Engine PART 3

Tony Swinfield constructs an electrically driven horizontal engine.



Continued from p.741
M.E. 4692, 3 June 2022

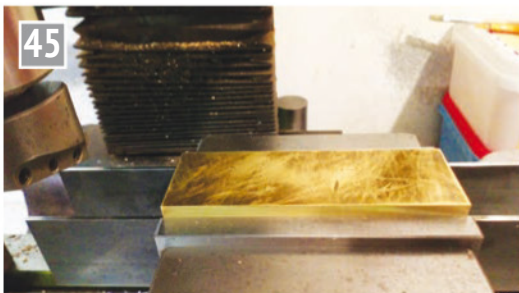
The connecting rod

This is 83mm long x 32mm wide x 6mm thick (**fig 8**) and I used brass because I had some. This was cut a few mm oversize and a fly cutter was used in the mill vice to square it up and bring the width to final size but it was left over long for the moment. The surface was also badly marked and again this was cleaned up with the fly cutter (**photos 45 and 46**). Most of my materials came from a scrap metal dealer, who I used to do electrical work for, so it's not in the best condition. I never

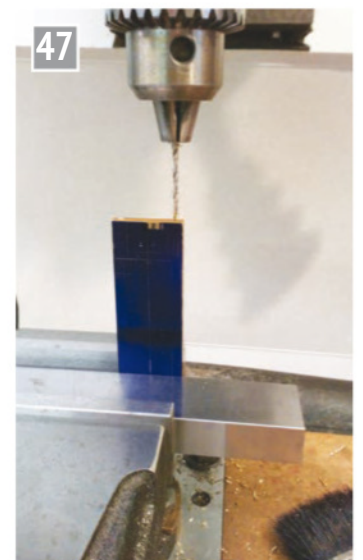
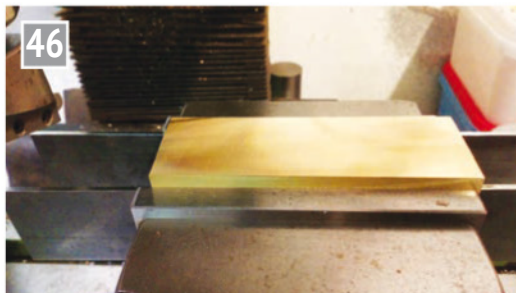
made any money working for him but always came away with lots of metal.

The end of the part was marked out for M3 cap head screws and was positioned in the mill vice, again lining up the edge of the part against the edge of the vice. A 2.5mm drill was used to drill 3.5mm in from the edge and 24mm deep (**photo 47**). This was repeated at the other end then the cap and body were marked with a centre punch, for reassembly. The cap was sawn off, the main body was fitted back in the mill vice, aligned with the

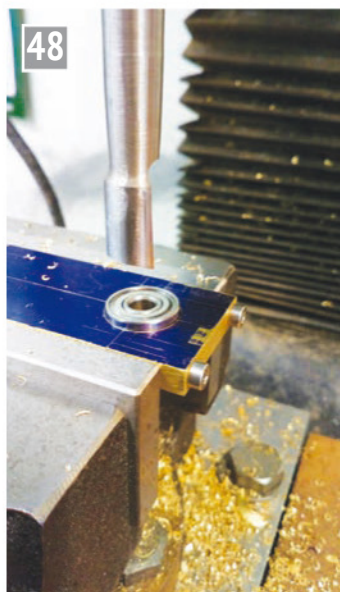
edge of the vice, and tapped M3. The cap was then fitted in the mill vice and the 2.5mm holes opened out to 3mm. The fly cutter was used to clean up the sawn ends. The cap was brought to final size of 16.5mm long and the two parts were screwed together.



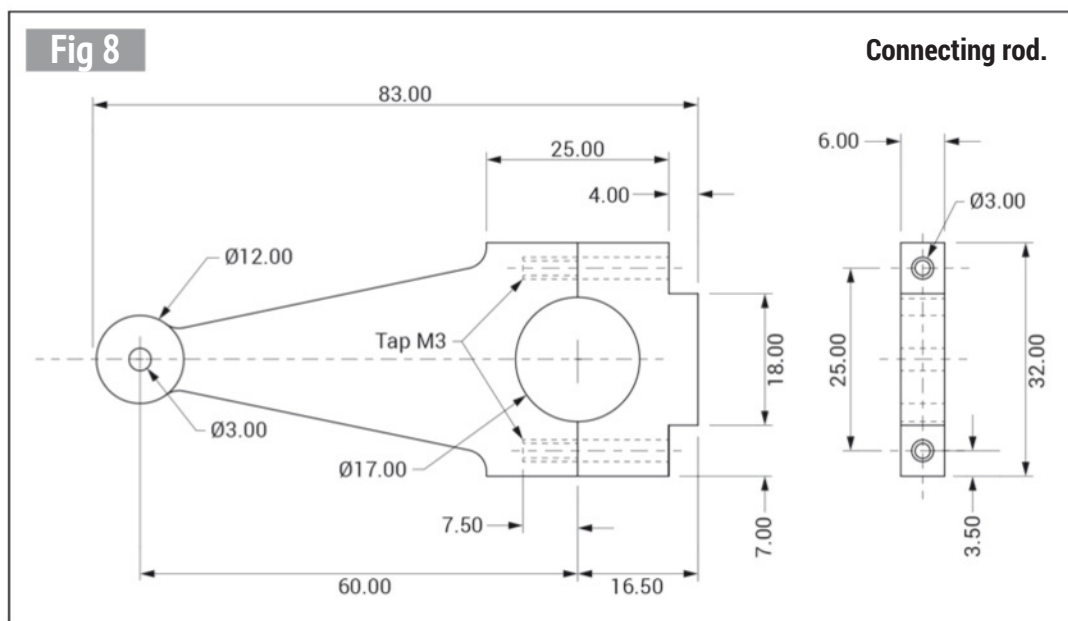
Scrap brass can be cleaned up quite nicely with a fly cutter.



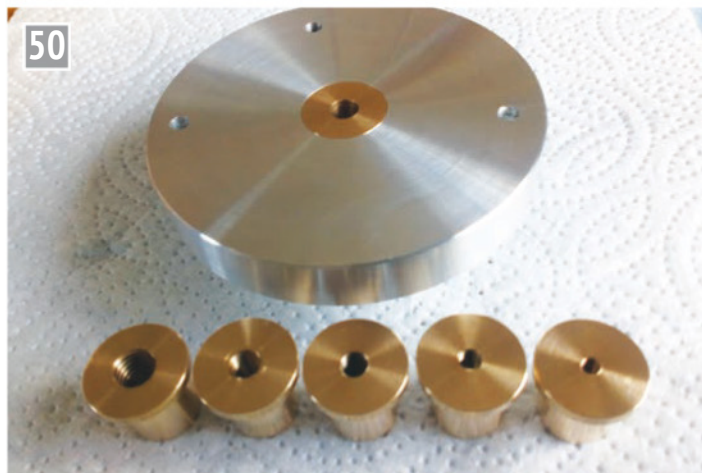
Drilling holes for the big end screws.



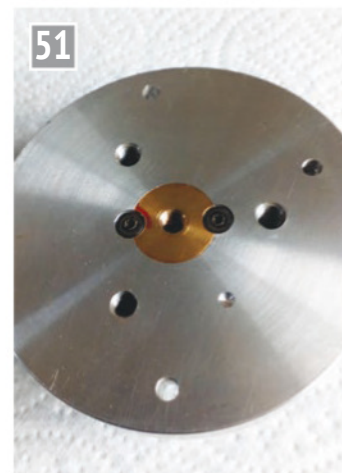
The big end is bored out for the bearing.



Mini face plate with central tapped hole.



A set of bushes made for the faceplate.



Holding a bush in the faceplate.

A centre line was marked along the length, then centre punched on the joint and from this mark the little end was marked 60mm centre to centre. It was placed back in the mill vice on parallels, the little end was centre drilled then drilled and reamed 3mm and the big end was then centre drilled, drilled and bored out to 17mm diameter (**photo 48**). So that the bearing would be held

tight, the cap had a few thou skimmed off the joint face.

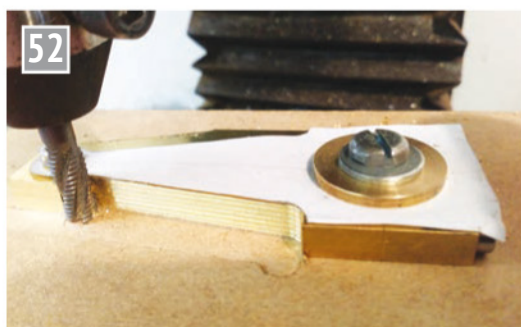
The shape of the connecting rod was drawn on paper, cut out and fixed to the brass bar. I have a small face plate made from aluminium which is used to machine parts on the milling machine. It had a 5mm tapped hole at the centre, to make it more versatile. I decided to bore this out and make a set of bushes. I had some 18mm

brass bar, which was used for this. The centre of the mini face plate (MFP) was drilled out 13mm and a recess 18mm diameter x 2.5mm deep was machined into the face. The bushes' finished length is 17mm, tapped M2, M3, M4, M5, M6 and M8. A plain 6mm diameter bush was also made to centralise it on the milling machine. These bushes are held in the MFP with two M3

countersink screws (**photos 49 to 51**).

Back to making the connecting rod - the rotary table was fitted on the mill and the MFP was fitted in the table, which was centralised under the spindle using the plain bush. The mill table and rotary table dials were then set to zero.

To enable the connecting rod to be held on the MFP by the big end, another bush was made. I had some 20mm diameter brass bar, so I turned it down to 17mm diameter x 3mm long. It was centre drilled then drilled 6mm and parted off 5mm long. A wooden spacer 80mm wide x 120mm long x 10mm thick was used in between the connecting rod and the MFP, so as not to mark the MFP. The connecting rod was also bolted to the wooden



Profiling the sides of the connecting rod.



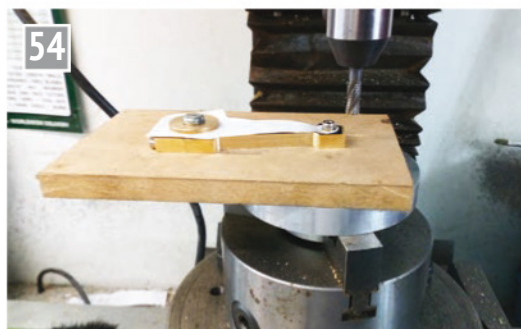
Profiled connecting rod.

spacer at the little end using a M3 bolt.

Using the lines on the paper template as a guide, the mill table and rotary table were adjusted by eye, then the waste was milled away from the sides. This was not very easy to do but it worked (photos 52 and 53). The connecting rod was then remounted on the MFP, using the 3mm bush in the centre of the MFP and re-aligning with the spindle. The table was offset by 9mm to form the radius around the 3.0mm hole (photo 54 and 55). All that was then left to do was to use a milling cutter to form the recesses for the heads of the M3 cap head screws, 4mm deep x 7mm long. The finished connecting rod is shown in photo 56.

The piston

This is 75mm long x 12.80mm diameter (fig 9) and this must be made of iron. It was turned down from 16mm diameter bar to 12.80mm diameter x 80mm long. It was centre drilled then drilled 5mm to a depth of 13mm and parted off to length. It was then fitted in a square collet block (this was bought from Arc Euro Trade and is used often - well worth buying) and mounted in the mill vice with the 5mm hole uppermost. A 5mm diameter dowel was fitted in the mill chuck to align the piston centrally with the mill and a 6mm milling cutter used to form the slot 13mm deep for the connecting rod (photo 57). The block was then laid down with the slot horizontal, drilled 2.5mm and



Setting up for profiling the little end.



Profiling the little end.



The finished connecting rod.



Cutting a slot into the piston.

tapped M3, after which one half was opened out to 3mm for the 3mm diameter screw (photo 58).

The crank bearing bushes

These are 22mm diameter x 13mm long (fig 10) and made to house the 13mm outside diameter x 6mm inside diameter x 5mm deep bearings. On the first engine I made I used bronze, reamed to 6mm diameter. On this engine I chose to use bearings because of the low friction so you could use brass instead. Not wanting to mount the bearings in the frame, as bought, because they are only 5mm thick, I made the bushes to house the bearings. The 25mm diameter

bar was held in the three-jaw chuck on the lathe. This was faced square then the outside was turned down to 22mm diameter x 16mm long and again turned down to 16.7mm diameter x 10mm long. It was centre drilled then drilled 6.2mm to a depth of 16mm. I then used a boring bar to finish the recess 13mm diameter x 5mm deep. It was parted off 15mm long then reversed in the chuck and brought to the final length of 13mm. Making the brass bushes was more work but I consider it well worth the time and material - two bushes are needed. The bearings for the brass bushes

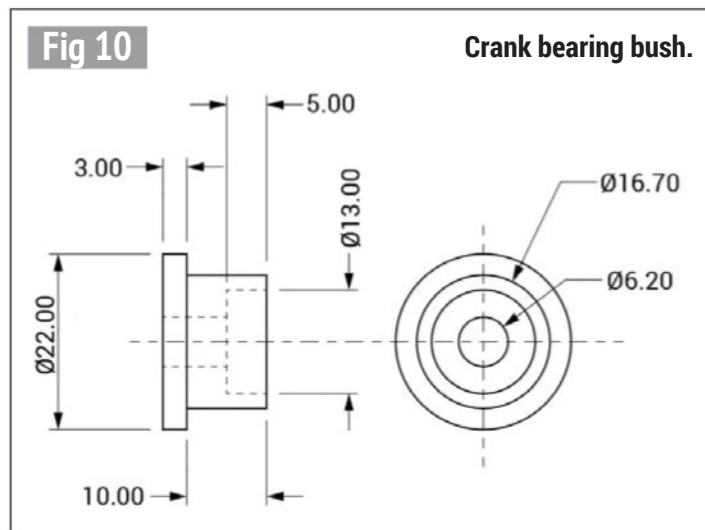
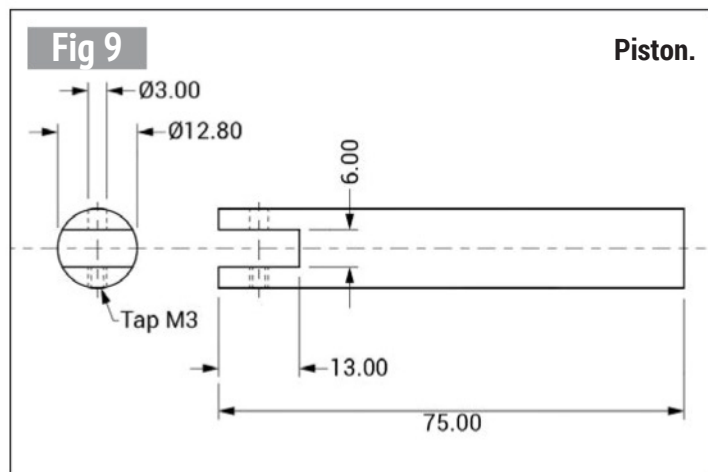


The finished slot.

had the shields removed and all the grease washed out. Do not fit the bearings in the bushes yet (photo 59).

The crank

This is made from stainless steel. The two sides are 32mm diameter x 8mm thick (fig



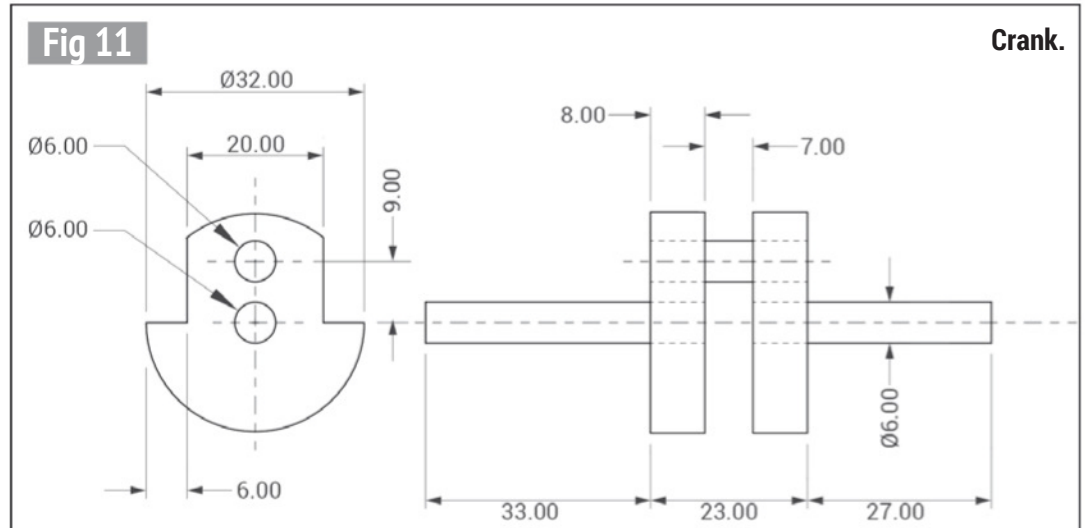
11) and the shafts are 6mm diameter x 41mm, 35mm and 23mm long. Two blanks were cut from 32mm diameter bar x 9mm thick. They were faced both sides and brought to finished thickness, then they were centre drilled, drilled 5.8mm and reamed 6mm diameter (**photo 60**).

They were bolted together on a block of nylon, mounted in the mill vice, centred under the spindle, then the dials were set to zero. The mill table was moved 9mm, the table locked, and the blanks centre drilled, drilled and reamed 6mm (**photo 61**). The two discs had two 6mm dowels fitted and held in the mill vice, with the dowels resting on top of the vice. I then used a 6mm cutter to remove the 6mm deep waste from both sides (**photo 62**). The milling marks were removed with emery paper (**photo 63**).

The connecting rod bearing, 17mm outside diameter x 6mm inside diameter, was pressed onto the middle of the 23mm long dowel, which was then pressed into the sides of the crank using a 0.50mm thickness gauge, to give clearance for the connecting rod. The two milled flats on the sides are used to make sure that everything lines up. I would normally use a 6mm dowel in the centre hole when assembling the crank but this was not possible because of the 17mm diameter bearing being in the way.

The two smaller bearings (13mm outside diameter x 6mm inside diameter) are pressed onto the dowels, one 41mm long, the other 35mm long, to leave an 8.5mm length of dowel at one end (**photo 64**).

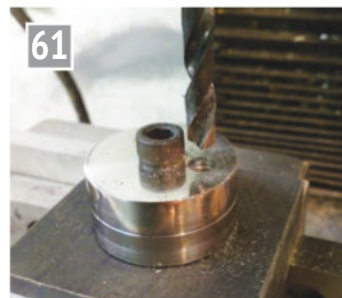
To assemble the crank a spacer was made 7mm thick



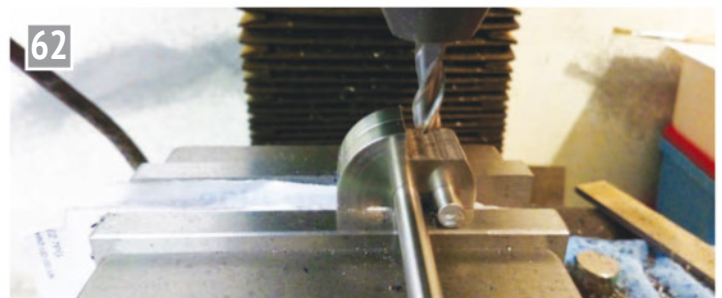
Crank bearing bushes and bearings.



Reaming one side of the crank.



Drilling for the crank pin.



Shaping the crank.

to fit between the inside faces of the crank and the two dowels pressed home using a 0.5mm gauge as before, to give clearance between the crank and the inside of the side frames. To check that all was square and true, a straight edge was clamped to the work top and two 'V' blocks aligned with this (**photo 65**). The bearing bushes were then

fitted onto the bearings using Loctite, being very careful not to get any in the bearings 'or it won't work'.

When I came to fit the crank into the body I found that it did not fit, because the outside measurement of the frame was 44mm but the inside measurement of the bearing bush flanges was 43.7mm – *damn*. because the crank

was all glued up, the easy way to solve the problem was to mount the body in the mill vice and machine 0.15mm off both sides. Note - before you glue the bushes onto the bearings, fit it all together and measure the inside of the bush flanges. That way, if it is too small you can machine the bushes to correct the problem.

●To be continued.



The finished parts for the crank.



Assembling the crank.



Checking the squareness of the crank.

Geoff Theasby reports on the latest news from the Clubs.



Harken ye! 'tis the sound of more inconsequential dross from the undersigned, Brigadier The Reverend Geoff T. Loudermic, CDM, and Bar, (Mrs), having now acquired an amplifier for his radios.

My locomotive, *Deborah*, is approaching a milestone. The electronics are tested, the motor/layshaft is ready and securely mounted, and I have reassembled the primary chain drive and tested it on the bench, running for 15 minutes continuously but with no load. It is now in the garage almost ready to run on my temporary track, as my driving trolley has been completed. Perhaps I should paint a tunnel mouth on the garage door?

In this issue, Cadets, flat packets (not Swedish), a record, small cattle?, a nameless cat, variable pitch and blue buses.

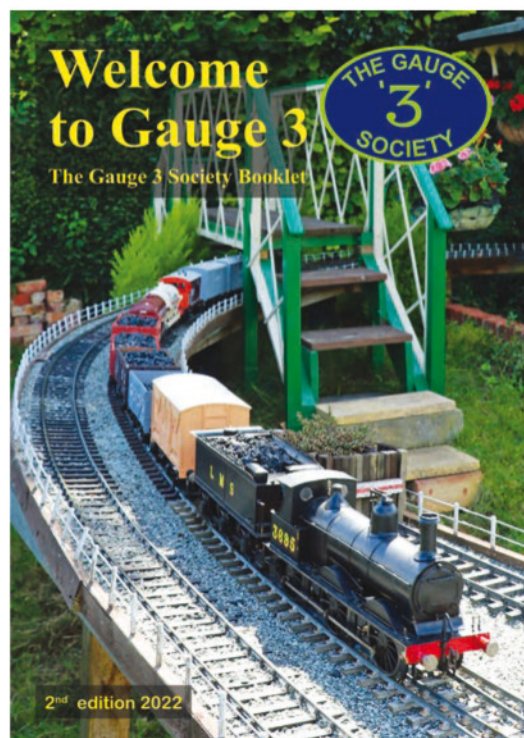
I start with a Mother Hubbard of an 'IN' pile, i.e. nothing, nada, zilch. I'm thinking 'The Lord will provide', and lo! She did! Through my virtual letterbox comes *PEEMS Newsletter*, March/April, from **Pickering Experimental Engineering**

& **Models Society**, to begin gnawing away at the visibly empty slush pile. (Er, ...) It is full of optimism and a great read (it says here...). John Heeley has built a new turbine stream launch, first trialled in his bath, where he then learned about 'metacentric height', which governs stability. Having added ballast, it now sits well on the water. The Stumpf turbine has performed reliably and well, if noisy. (See next item.) Mel Doran gave a talk on gear cutting and tooth shape/reasons for same. Mike Sayers explains his choice of involute gears on his new engine (do I sense a theme developing here?). William Burrell writes on Life in the Merchant Navy, and his promotion up the career ladder from Cadet (who thinks he knows everything) to Chief Engineer (who realises he knows nothing but has a Cadet to help him...). The rest of the newsletter is taken up with a detailed coverage of the ships on which he served and the events which befell him. Paul Windross went to Elvington for Top Speed Day, which featured some interesting machinery.

Stamford Model Engineering Society's April Newsletter reports that recent meetings

were taken up with old films, such as *History of the Lathe*, and *Making Hex Nuts, Indian Style*. (In one of my first jobs I worked for textile engineers, Prince, Smith & Stell, in the cost office. This required frequent forays onto the factory floor, to clarify some query, and I was most impressed by the automatic lathes making large nuts. These were fed by a rotary magazine not unlike a Gatling gun, each tube holding a length of steel bar – Geoff.) Member Keith has built a twin oscillating engine with three and a half inch diameter flywheels, in only three weeks; he must have an understanding wife... Pete also built a three cylinder oscillating engine from J. de Waal, via the internet, and says it self starts 'most of the time' with 10/15 psi. He also built a flame gulper, which has never run.

A sizeable stiff envelope wafted onto my doormat (A calendar? *Cowpat World?* *Road Roller of the Month?* *Frisbee Fun?* *Pizza?*) which proved to contain (the envelope, not the doormat) the **Gauge 3 Society Booklet**, rivalling if not outshining the **G1 N&J** in its use of large format glossy photos and all aspects



Gauge 3 book. Do judge it by its cover (photo courtesy of Ted Sadler).



G3 - a small garden railway (photo courtesy of Ted Sadler).



G3 - prairie tank on viaduct (photo courtesy of Roger Salisbury).



G3 - what a backdrop (it's real) (photo courtesy of Ted Sadler).



G3 - another high flier... (photo courtesy of Ted Sadler).



G3 - tea break! (photo courtesy of Ted Sadler).

of Gauge 3 as it is lived. (I have taken an executive decision and all the photographs in this Club News are taken from this book – Geoff.) After enjoying it for a few days I decided, for the very first time in the 12 years of writing this column, to place it on my bookshelves, it's that good. (Everything normally goes into the paper recycling bin after 3 months, in a fruitless attempt to keep my editorial eyrie/computer workstation/hovel in a state whereby I can at least see the floor.) Succinctly, Ian Turner explains, 'What is Gauge 3?'. Roger Salisbury gives guidelines for setting up a GTG (get together) or an eyeball meeting, running your own trains on another track and consuming lashings of ginger beer/gallons of tea. Visitors should clearly mark and keep secure containers of methylated spirits (to burn) and tea (to drink). Tea is brown and meths is purple - get it wrong

and you're a twerp - you'll be carried off 'ere illness spoil the perfect day for which you toiled. Track standards are defined and, less publicised, track clearance standards. Roger also sets out the civil engineering required for a garden railway, whilst Geoff Nicholls does the same for indoor layouts. Ashley Wattam writes on buying an engine and Alan Headech covers live steam safety and also coal firing, which is unusual in this gauge, as most use gas. Tim Gleed-Owen deals with electric propulsion. This is followed by Steve Foster who deals with the intricacies of radio control. John Tomlinson converts 'troublesome trucks' to G3 (as Mrs Beeton might have said, "First, find your trucks and with a fine-toothed saw..."). Paul Ash gives advice on lettering private-owner wagons. Numerous other articles cover various aspects



G3 - OcCre tram (photo courtesy of Ted Sadler).

of G3 modelling but not much on lineside infrastructure, like signals, platelayers' huts and stations.

W. www.gauge3.org.uk

Halesworth & District Model Engineering Society's spring *Newsletter* opens with a good picture of Lyall Stockman with his BR Class 2 'Mogul', 78007, built jointly by Tony S. and his Dad upon the latter's retirement. This machine holds the Hale record for the most circuits of the track without

refuelling – 29! Planning, and entries for LowMex, to be held in late October, are proceeding well. In recent years this exhibition had been becoming better in every way, so hopes are high for a good event (see Emile Coue). If you can get there, do so (I'll be there – Ed.). Vic Scott brought his London General bus model for its first try-out. Andy Belcher suggests a YouTube video asking 'Are electric cars really that green?' - www.youtube.com.

com/watch?v=lOyzLSBCBWo (For me, removing the internal combustion tailpipe gases to the power station is beneficial as, there, they can be dealt with, 'en masse' far more efficiently than in each individual car – Geoff.)

W. www.hdmes.co.uk

From **Sheffield Society of Model & Experimental Engineers** comes *Steam Whistle*, April, bearing on the cover a mixed freight hauled by Standard Class 4 Tank 80080 at the GCR in March. As photographer, Henry McDonald says, it is unusual at this location to be entirely without trainspotters! Mike Peart describes the only GWR Pacific, 111, *The Great Bear*. It was often referred to as 'Lord Nelson', because of its number – 'one eye, one arm and one leg'. Murray has been speculating on why the human race is so uniformly sized. How would we cope with life if we were only, say, two feet tall? My first thought is that we have manageably-sized crops, cattle and machinery because we bred or designed them to be that way over the past centuries. Dogs' natural appearance is wolf-like, cattle have been bred to be docile, sheep allow themselves to be herded (except Soay, don't know why) and, look up *homo floresiensis*.

W. www.sheffieldmodelengineers.com

Martin Gearing writes regarding my comment on the cost of Spirawrap and recommended CPC (cpc.farnell.com). My other fan, Mike Joseph, says, in the matter of the half-constructed belt sander, 'I have an elderly Picador sander, only motorised about 15 years ago, and I would not now be without it. It is such a time saver for removing ragged edges on freshly cut items, steel/brass/wood, providing a decent thread-able end on screw threads, reducing thicknesses/widths, providing an acceptable finish across the flats of some otherwise grotty steel strip and so on'. Yes, I'm sure it would but I have a 'to-

do' list of about 15 items, the priority of which varies from day-to-day as circumstances change. All this has to take their turn AFTER I write this column...

AND, the next newsletter is *Stephenson Link*, second quarter, from **Chesterfield & District Model Engineering Society**, which has an unusual picture on the cover - a modern train! Well, -ish, Vaughn's HST set. New chairman, Adrian Lloyd, introduces himself (and cat, currently anonymous - he's the one with a blob of grease on his nose, acquired when curiosity got the better of him). Adrian is rebuilding a Stanier 2-6-4T, and the total rebuild of a 1971 Series 2 Land Rover, modified for electric drive, using parts from a Nissan *Leaf*. A picture of John Cottam with his Bulleid Pacific in Royal blue catches the glint in the winter sun. A collection of mystery photos, all taken at the track, invites your solution. No prizes, save only being mentioned in SL. Ivan Turner is building a three-cylinder engine, following that described in *Model Engineer* in 1967. A question about the lack of ethnic diversity was raised in a SL of 20 years ago. Yes, I wondered the same. Go to a preserved railway or a model exhibition and dark skins are not evident. I'm sure this is not intentional but the hobby, worldwide, seems to be restricted to English-speaking countries with origins in Western Europe.

W. www.cdmes.co.uk

The May Newsletter from **York Model Engineers** opens with York's very own Holgate

windmill, built in 1770 and still operational. It incorporates a 'sail feathering' system operated through the central boss, much like a modern variable-pitch aircraft propeller does. The blade of a modern wind turbine was exhibited in Hull for their City of Culture event. Whilst the artist who created the display was celebrated, there was no mention of the engineers who designed and built it. David Hampshire built an OcCre tram kit whilst editor, Roger B, built a Hemingway kit of bending rolls, keeping a detailed record of its progress and the pits he fell into. (I find that the first 90% of the work takes up about 10% of the time, and, QED – Geoff.) There are three entries for the Clangers Competition - come on, it's all in the cause of making us better engineers! A visiting locomotive to York track was a 7¼ inch gauge Fairlie, built by Peter Beevers of Sidcup. Richard Gibbon tried descaling his 'Wren' boiler, using Fernox GS3 as recommended by a member. It worked beautifully, releasing enormous amounts of thick brown sludge, not to be confused with G3 tea (see above). There has been good coverage of the club in the Yorkshire Post of late, and also see: www.yorkshirepost.co.uk/heritage-and-retro/heritage/inside-the-york-club-of-tinkers-dreams-where-model-engineers-make-tiny-trains-from-scratch-3656803. Bob Lovett thought of putting a locomotive in a bottle (well, why not?). He found that Jack Daniels bottles were a good container, pestering

his friends for empties (he couldn't afford full ones...) but eventually settling on Tiptree ketchup bottles for their wide necks (57 other varieties may be available). As usual with 'vitrified' models, the question is always, 'How?'. Well, I can say that the brake van and locomotive chassis will just push gently through the neck whilst attached to the track. The 08 shunter body will follow, assisted by tweezers, and followed by superglue. The book review is of 'Ledgard of Leeds', by Stuart Emmett. Ledgard was a bus operator in West Yorkshire, which lasted until 1967, when it was taken over by the West Yorkshire Road Car Company. WYRCC was a descendant of the Thomas Tilling group. (I well remember seeing Ledgard buses on the streets of Bradford during my first job at the Central Library. The company operated a wide variety of second-hand vehicles, which, to me, always looked a bit tatty – Geoff.) The 'very old railway joke' about Dent Station was heard by me in relation to Levisham station on the NYMR which is similarly remote and difficult of access.

W. www.yorkmodelengineers.co.uk

And, finally, how many consulting engineers do you need to change a light bulb? One, but you'll be charged £250!

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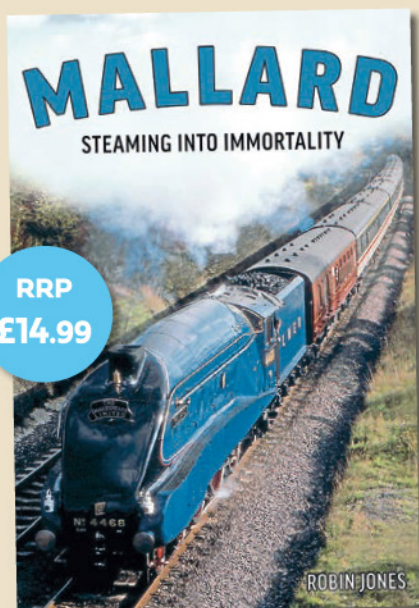
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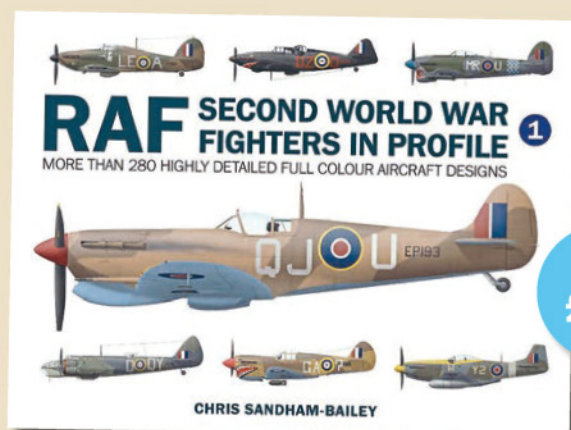
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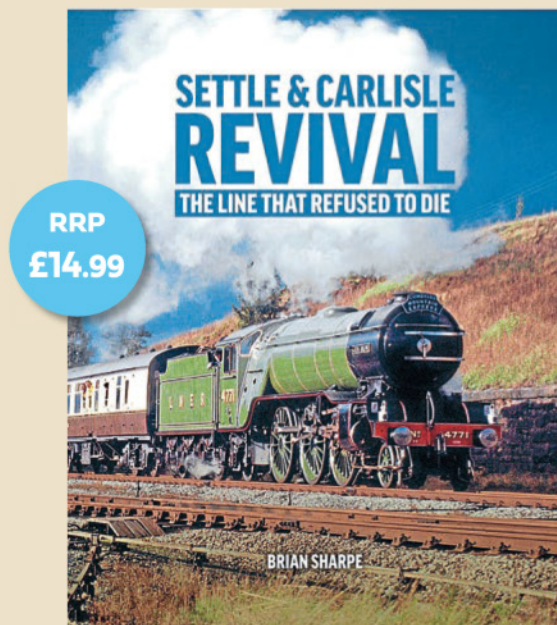


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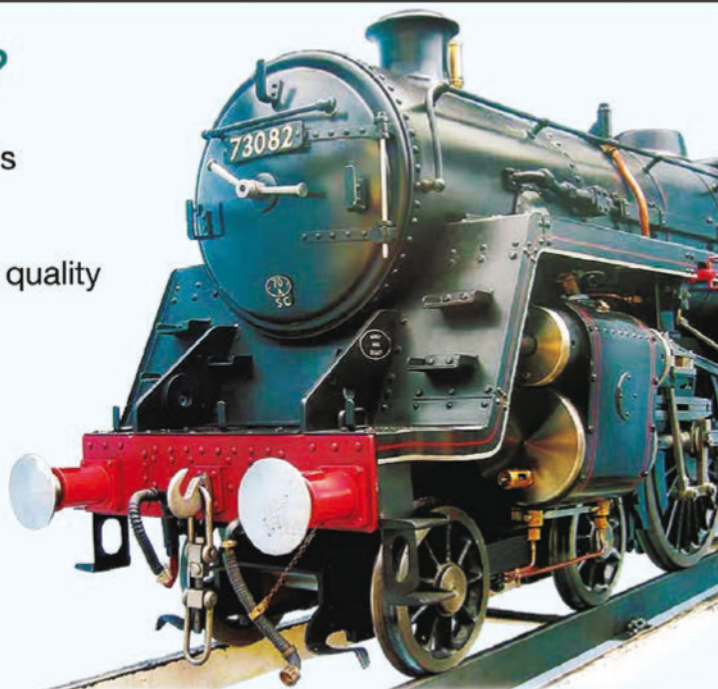
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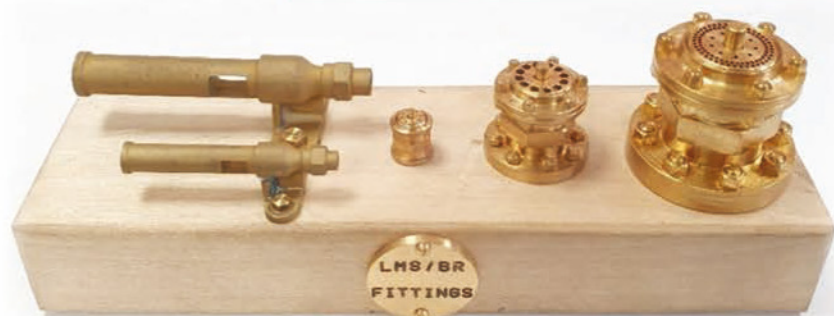
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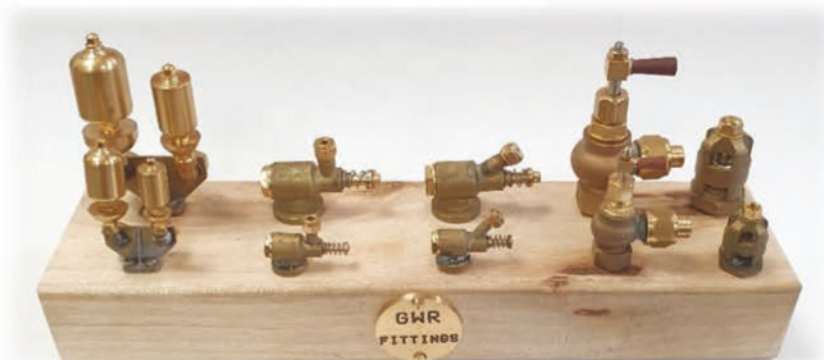


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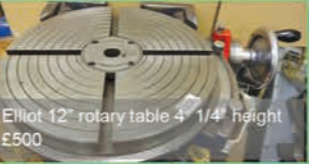
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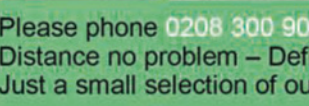
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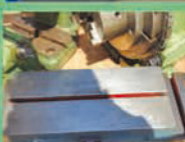
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