THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 226 No. 4662 • 9 - 22 April 2021

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Thompstone Engine

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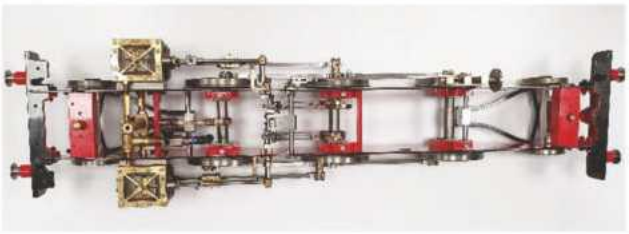

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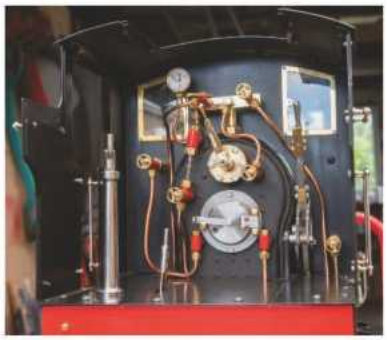

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MODEL ENGINEER

Published by **MyTimeMedia Ltd**.
Suite 25S, Eden House, Enterprise Way,
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EDITORIAL
Editor: Martin R Evans
Tel: +44 (0)7710 192953
Email: mrevans@cantab.net
Assistant Editor: Diane Carney
Club News Editor: Geoff Theasby

PRODUCTION
Designer: Yvette Green
Illustrator: Grahame Chambers
Retouching Manager: Brian Vickers
Ad Production: Andy Tompkins

ADVERTISING
Advertising Sales Executive: Angela Price
Email: angela.price@mytimemedia.com

MARKETING & SUBSCRIPTIONS
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Group Advertising Manager: Rhona Bolger
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Model Engineer, ISSN 0026 - 7325 (USPS 24828) is published fortnightly by MyTime Media Ltd, Suite 25S, Eden House, Enterprise Way, Edenbridge, Kent, TN8 6HF, UK. The US annual subscription price is 136USD. Airfreight and mailing in the USA by agent named World Container Inc, 150-15, 183rd Street, Jamaica, NY 11413, USA. Periodicals postage paid at Brooklyn, NY 11256. US Postmaster: Send address changes to Model Engineer, World Container Inc, 150-15, 183rd Street, Jamaica, NY 11413, USA. Subscription records are maintained at DSB.net Ltd, 3 Queensbridge, The Lakes, Northampton, NN4 5DT, UK. Air Business Ltd is acting as our mailing agent.

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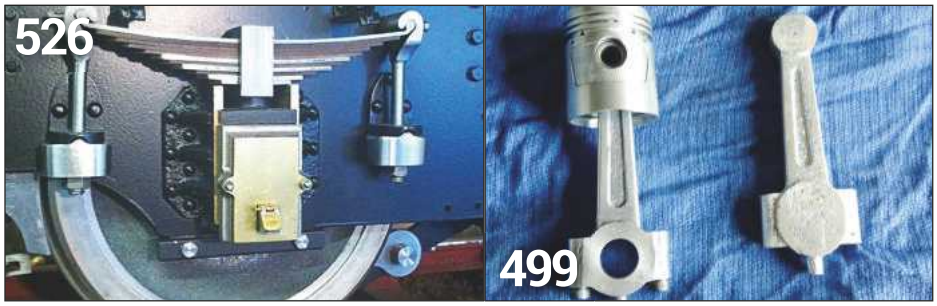

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ON THE COVER...

Jason Ballamy's Thompstone horizontal mill engine (photograph – Jason Ballamy).

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Metric Rules

I read recently that only three nations in the world still officially use the Imperial system of measurements. These are the USA, Liberia and Myanmar. Every other country in the world uses the metric system. The UK, characteristically, sits on the fence and uses the metric system for most things but keeps miles and pints for the roads and the pubs. The British, of course, spread the Imperial system around the world, which had the beneficial effect of standardising the measurement of things virtually globally, which made sense, provided you ignored the total illogicality of the system, which requires the use of about half a dozen different number bases for any calculations made using it. Feet and inches, pounds and stones, yards and miles, rods and perches – none of it really makes much sense. The main benefit, speaking personally, is that I (and most of my peers) became quite adept at multi-radix mental arithmetic by the age of ten.

It took the French to come up with a logical system, which requires calculations to be made using only one number base – ten. Whereas the English had based their units of length on the dimensions of one of their monarchs, the French decided to base theirs (mainly because they had no monarch at the time, having removed his head) on the size of the earth, a metre being defined as one ten millionth of the distance from the north pole to the equator down the line of latitude passing (naturally enough) through Paris. As time was based on a line passing through (or near) London, I suppose that was fair. And all this while they were busy with the revolution.

Science and engineering, of course, being logical pursuits, use the metric system, refined and formulated as the *Système International* of units, or SI. This can cause difficulties in a technologically advanced nation that nevertheless still uses Imperial. A famous example is the NASA Mars Climate Orbiter. The spacecraft engineers used the Imperial system but the navigation engineers used the metric system and, as a result of the ensuing confusion between units, the spacecraft burned up in the Martian atmosphere instead of elegantly entering the planned orbit. This sounds like one of those urban myths but it is actually true (en.wikipedia.org/wiki/Mars_Climate_Orbiter).

Anyway, enough of that. To our short list of 'Imperialists' we must add model engineers who, in most cases, use the Imperial system. This is not surprising as the majority of the most popular designs were drawn years ago, using Imperial units. Many of the most recent designs, though, have switched to metric and many model engineers are now moving over to metric fasteners because they are easily available and cheaper. Most suppliers, though, continue to supply small section metal stock only in Imperial sizes. No doubt that will change in time but it can present current difficulties. Jason Ballamy has supplied me with some information about metric suppliers, which I can share with you.

'EKP Supplies and Noggin End do a very limited amount of metric sections and Macc Models keep a bit more. One of the most extensive ranges of materials with a high proportion of metric size is that of M-Machine Metal who price by the 300mm or 25mm length depending on cost. Another supplier that I use is Ringwood Metals who have a good range of the more commonly used materials such as round, square and Hex in Steel, brass and aluminium.'

www.ekpsupplies.com

www.nogginend.com
maccmodels.co.uk

www.m-machine-metals.co.uk/metals_menu.html
ringwoodmetal.com/shop

Greenwood Tools

Peter Cook, managing director, writes to me to say:

'With great regret I have to inform you that after 35 successful years, Greenwood Tools has had to cease trading due to twelve months of heavy losses caused by the coronavirus pandemic.

'The mainstay of the business, our account customers in the local engineering industry, have been working at much reduced capacity due to workers being furloughed or self-isolating and this has reduced our turnover by almost a third.

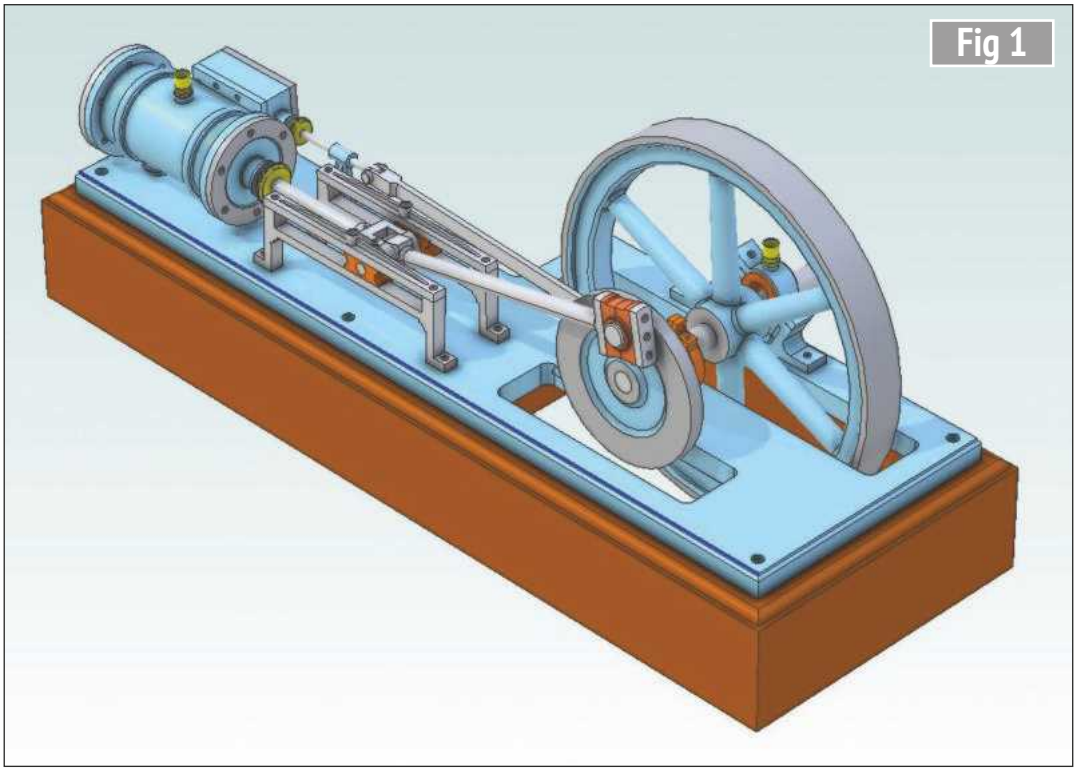
'As I reached state pension age in December 2020, I have decided to retire from the industry I joined from school 50 years ago.

'I have, however, bought the Greenwood Tools stock and will be selling it at 'closing down sale' prices. If there are any items you are interested in you can email me at greenwtool@aol.com or call me on 07973 165437. I will also, in the coming weeks, be listing items on eBay where my user name is green-483.

'I thank you sincerely for any business you have placed with us in the past and I wish you all the very best for the future.'

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

Jason Ballamy builds a mill engine first described in *Model Engineer* 120 years ago.



Thompstone Engine

PART 1

Background

I first became aware of this old engine design when part of the article was published in *Best of Model Engineer Volume III* where, unfortunately, part of the text had not been copied due to the habit of the magazine at the time to detach the odd half page of text and print it elsewhere in the magazine rather than at the end of the article. However, some time later I got hold of a copy of the original magazine which was No. 49 of Vol. 4 dated 15 May 1901, where the model engine is described by S. L. Thompstone after whom I have named my rendition.

As well as a detailed description, the article included a plan and elevation of the assembled engine with a good number of dimensions so it was not too difficult to work out the rest from those.

The model

Like my previous Muncaster Entablature Engine I chose to stay with the 24mm bore, however in this instance that results in a slightly smaller engine as Thompstone's was 1 3/16 inch and the stroke works out at 46mm compared to 2 5/16 inch of the original. All my dimensions are in metric and materials sized to suit available metric stock sizes where possible, though for those with a preference for Imperial it should not be too hard to make suitable adjustments and BA & ME threads could also be used. **Figure 1** shows the 3D image drawn, using Alibre, of the assembled engine.

It is worth mentioning here that the engine, like my others, has been built with 'small hex' metric nuts as these look more in keeping with nuts of the period. Standard ones could be used in most cases but there may be the odd issue with sufficient room to fit them in.

Once again, I will be running a thread on the Model Engineers Forum (**ref 1**) which will include some additional photos, bill of materials and possibly an alternative cylinder construction method (if there is enough interest) for those that don't feel up to the fabricated method that I have used here. This is, without doubt, the most complex part of the project. It will also serve as a place to ask any questions you may have about the model, different construction methods if you don't have the same tooling as me, etc.. It would also be nice to see others' builds posted there or even to see others start their own build threads.

Base plate

This (**fig 2**) can be sawn from some 8mm thick 6082 aluminium plate though the thickness is not critical and you could even sandwich two layers of say 6mm and 2mm together to form a moulding around the top rather than mill it. Start with the plate clamped to the mill table with some

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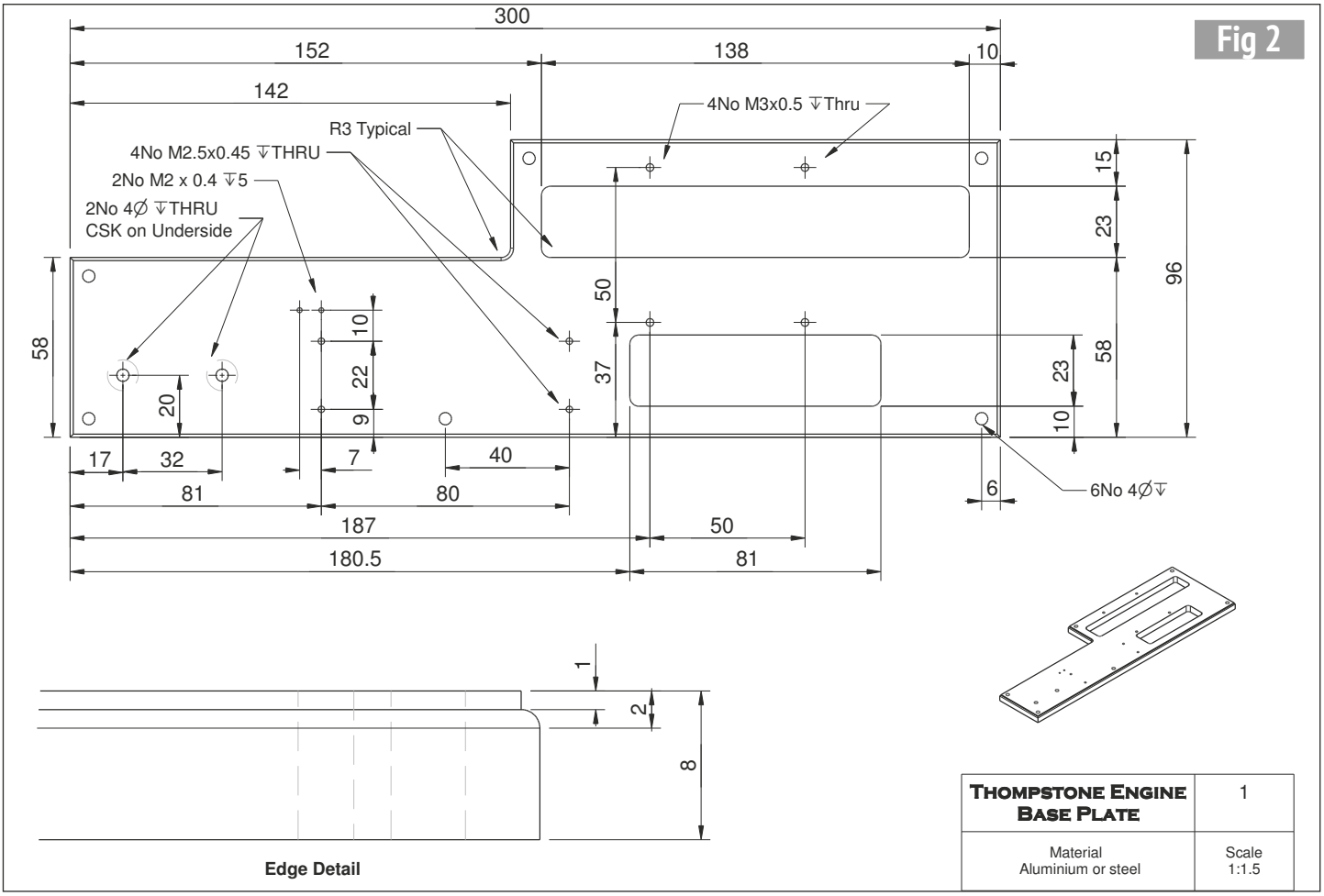


sacrificial packing between, such as MDF or ply, and square up the edges.

The notch that forms the L-shape is optional but if you do decide to include it use a cutter with a diameter equal to the small diameter of the round over cutter being used for the moulded edge. The clamps are likely to have to be repositioned a few times to allow access all round as the plate is squared up and then the moulded detail milled. I used an old, blunt two-flute cutter and ground the quarter circle form into each tooth with a Dremel cutting disc rather than buy in a commercial cutter. The shape does not have to be exact as we are trying to replicate a casting after all (**photo 1**).

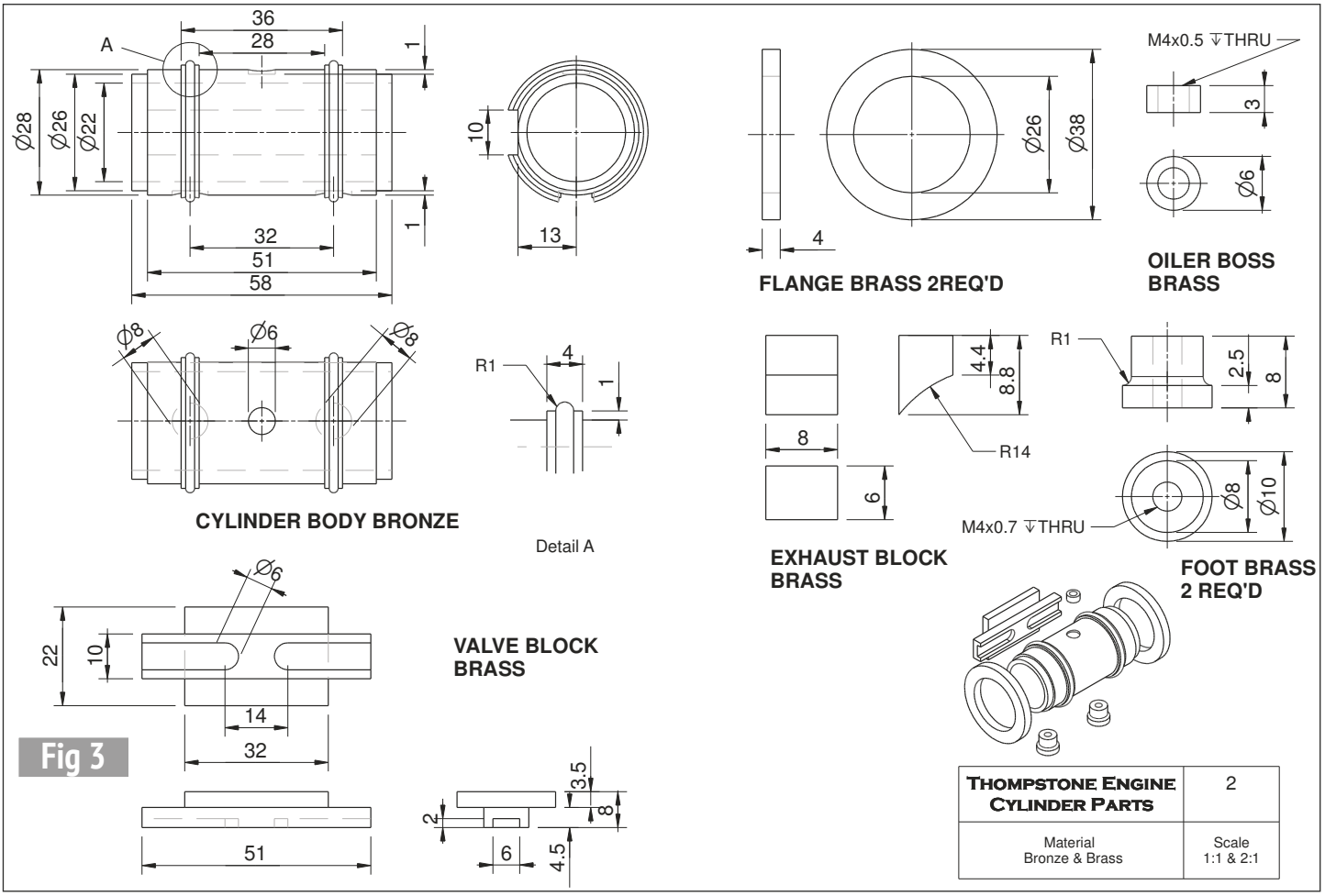
The two cut-outs can now be machined either just by milling or the waste can be stitch drilled out and the edges then tidied up with a 6mm diameter cutter (**photo 2**). Follow this by drilling and tapping the various holes, not forgetting to countersink the two 4mm holes for the screws that hold the cylinder on the underside.

Cylinder fabrication

The aim with this part of the build (**fig 3**) is to produce a 'casting' that has machining allowances so that if there is any movement or distortion during soldering then these can be machined true at the next stage. An alternative to silver soldering, if you don't have the equipment or feel able, is to bond the parts together with JB Weld (original formula, not rapid or marine) which will work for both air and steam running or you could soft solder the parts together but that would really limit the engine to operation on air.

Machining the quarter round decorative moulding around the base.

Forming cut-outs for flywheel and crank disc clearance.



Cylinder body

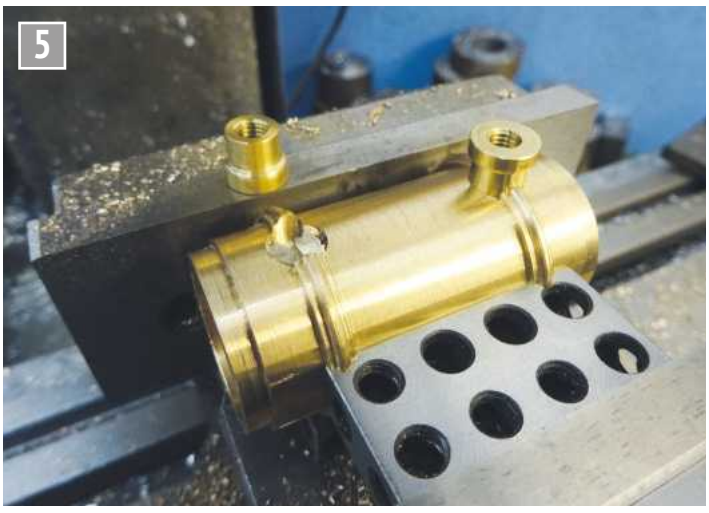
A length of hollow bronze is the most economic material to use for this. Start by boring to 22mm diameter and face the end and then turn the OD to 32mm for a length of approximately 60mm, then form the 26mm diameter spigot of the outer end. A combination of left and right hand tools or a parting tool can now be used to turn the three 28mm sections and the decorative bands. The radius of the bands can be done by cutting with a suitable form tool or - with great care - using a file.

Finally, use a parting tool to cut the 26mm spigot at the chuck end before parting off (**photo 3**).

Moving over to the mill, hold the cylinder body in the mill vice and locate its centreline then mill a 10mm wide slot along its length, setting the depth to just leave a witness mark on the 26mm spigots (**photo 4**). A packer in this slot will help to set the cylinder at 90 degrees to the slot so that two recesses can be plunge cut for the feet (**photo 5**) and a smaller one on the opposite side for the oiler boss.

Turned external profile of cylinder complete.

Milling a 10mm wide flat for the valve chest.



Plunge cutting pockets for feet.

●To be continued.

REFERENCE

1. Follow the discussion thread on this build: www.model-engineer.co.uk/forums/postings.asp?th=170608

The Barclay Well Tanks of the Great War

PART 73

This constructional series addresses Andrew Barclay 0-4-0 and 0-6-0 narrow gauge locomotives supplied for use in the First World War. Built without the use of castings, the 0-4-0 design is described as two versions; as-built for the British Admiralty in 1918 and as rebuilt and currently running on the Talyllyn Railway as their locomotive No.6, *Douglas*. The 0-6-0 engines described were built in 1917 and operated on 60 centimetre gauge track at the Western Front in France. These were small, spartan machines of which only 25 were supplied and none have survived into preservation.

Terence Holland describes and constructs two appealing, century old locomotives.

Continued from p.380
M.E. 4660, 12 March 2021

Lubricator check valves

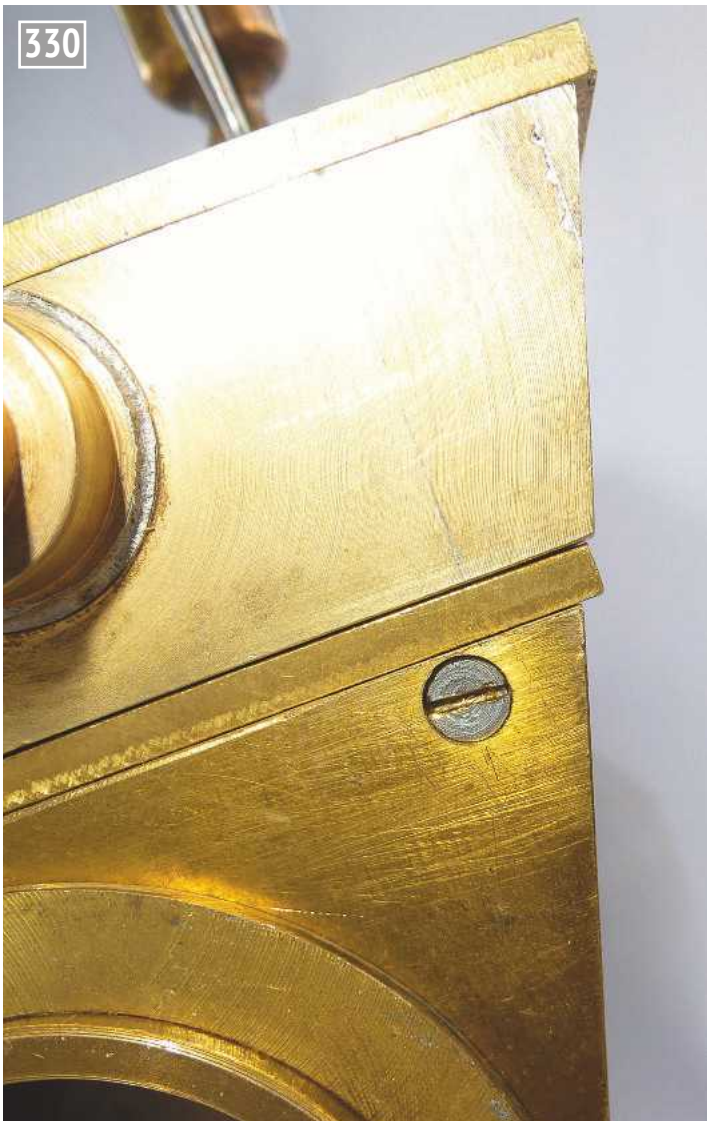
These check valves are exactly the same as those on the 0-4-0 – see fig 81 (M.E.4567, August 2017).

The valve plates

These, again, are identical to those shown in fig 53 (M.E.4539, July 2016). Note that if the dummy centre drains, detailed recently (fig 216, M.E.4652, November 2020), are to be fitted, chest drain holes will not be needed at the front of the plates or in the cylinder block. Also note that, although the steam ports are shown with square corners, 'as drilled', round port ends are adequate.

When I designed the separate valve plates, there I was thinking I'd invented a new way of providing steam cylinders with ports - ha-ha! (see M.E.4539, August 2016). Then, recently, I discovered that the replica Beamish engine *Samson* has a separate valve plate for its single cylinder engine unit. Furthermore, the book identifies W.J. Hughes as the inspiration and refers to his book *Traction Engines Worth Modelling*. No doubt Bill Hughes was merely following earlier work. There's nothing new about steam engine practice!

The original *Samson* was built by Steven Lewin in Poole Foundry and when I left school in 1959 and started work at British Drug Houses, Poole as a laboratory technician, the foundry, not far from where I worked, still existed and was in regular operation. Sadly, as is the case with many of these old industrial locations, the foundry is long gone and the brown field site is now occupied by ubiquitous blocks of flats.



Close-up of the steam chest.

Photograph 330 is a close-up shot which shows the small overlap of the cylinder cover to allow flush fitting of the cylinder lagging. Note that the valve plate will require a small, angled milling cut on the exposed front edge.

The steam chest will need three 1/32 inch thick gaskets; one under the valve plate which will need cut-outs to match the ports milled into

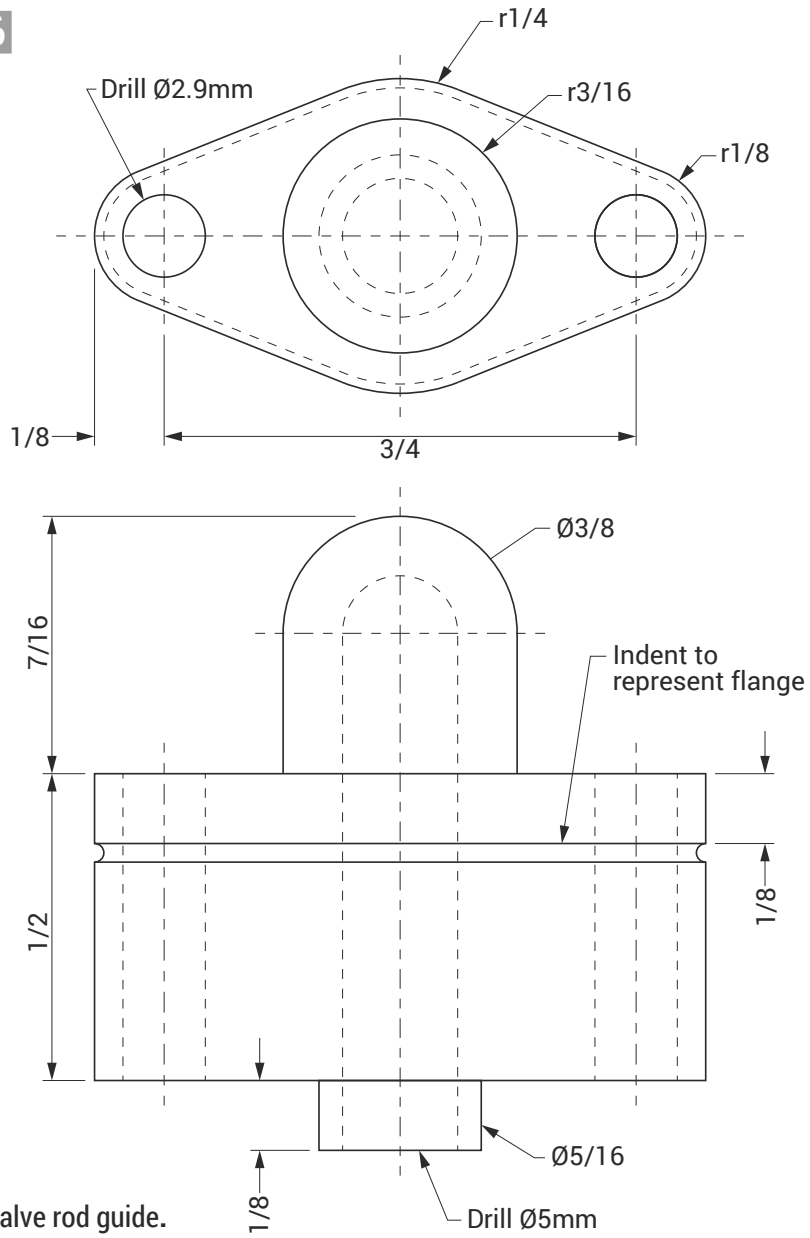
the cylinder block. The other two gaskets are conventional; steam chest to valve plate and steam chest cover. Fit the two, lower gaskets each side with gasket cement, as they should be more-or-less permanent.

Valve rod guide

My original drawing (fig 75, M.E.4565, July 2017) shows a very plain valve rod guide. However, if you would prefer the original design (see photo 327, M.E.4660, 12 March) of a flanged, removable guide see **fig 236**. Fit the ends of the chests with 6BA studs and screw the guides in place with suitable nuts and 1/32 inch thick gaskets.

I note that the piston rod glands and the valve rod gland on the rear of the cylinders are fitted with oval flanges, each with two bolts. I have not attempted to reproduce these and have shown typical hexagon glands with PTFE inserts. It's a difficult part of the locomotive to access in 5 inch gauge for adjustment and the rod glands are not so obvious on the engine as the front valve rod guides - that's my excuse anyway! Modification to original specification would not be difficult for the valve rod gland and I will provide a drawing later when dealing with the valve gear.

Fig 236



Flanged valve rod guide.

Curved filler piece

Not essential this item but, as can be seen in photo 327, the original cylinder/steam chest was cast in one piece, with a neat curve between the back of the steam chest and the extension of the main body to the backplate. This can be reproduced using two small filler pieces, ¼ inch thick, silver soldered to the base of each steam chest. I don't want to teach my grandmother to suck eggs (whatever that means!) but I will simply file them up from a piece of ¼ inch square brass, although I'm sure there must be fancy ways to mill 'em.

As for my grandmother, she has been gone now for some 50-odd years but, as they say, 'gone but not forgotten' and sadly missed. She was, to use her words, 'a dear old soul'. She was brought up in Devon but spent most of her long years in Dorset. The family, including my mother, moved up between the wars to work at the Admiralty cordite factory at Holton Heath. As a teenager I would call round to see her after work on a Saturday lunchtime – those were happy days even though we worked a 5½ day week. I was, however, quite familiar with Saturday working as my school had also operated a 5½ day week – Saturday morning made up for time spent on the Wednesday in uniform, as part of a Combined Cadet Force.

Her first words when I arrived on a Saturday were 'would you like a fry-up?' and the answer, of course, was always 'yes please'. And, after partaking of one of her puddings, I would spend time 'yarning' with her as we both relaxed and smoked her Woodbines.

My transport at the time was an old, 1937 ex-WD 500cc Norton - ridden on 'L' plates as I hadn't passed the test; crash helmets were optional but not as far as mother was concerned! I bought the 16H for a fiver from a colleague where I worked in West Quay Road, Poole and rode it back from Bournemouth to Wareham after a five minute lesson on how to drive it! Some things were a lot easier in those days. Eventually my crash helmet, a 'Centurion' (the company are still going today), was stolen so I rode it without one anyway. The Norton was literally falling apart (well it had survived a world war!) and it handled like a wet lettuce leaf – but it got me initiated as a 'biker'. However, I digress – enough of these ramblings, this isn't *Motor Cycle News*, and so, on with the job.

●To be continued.

NEXT TIME

We move on to the motion work.

Machining Locomotive Cylinders from Solid Material

PART 2

David Earnshaw suggests

an alternative approach to machining cylinders using the milling machine.

Continued from p.469

M.E. 4661, 26 March 2021

Boring tools

The tools used for the actual boring were all home-made. The between centres boring bars were made many years ago to the George Thomas design, having a screw adjustment to the cutting bit. These boring bars have been entirely satisfactory and used for many jobs over the years. For this job the actual cutting bit in each bar was a small piece of tungsten carbide. In the larger bar the cutter was ground up from the shank of a worn-out solid carbide burr and the bit in the smaller bar came from a similar source. The fly cutter was made with an integral 30 INT shank and the cutting bit in this tool was a piece of High Speed Steel **(photo 12)**.

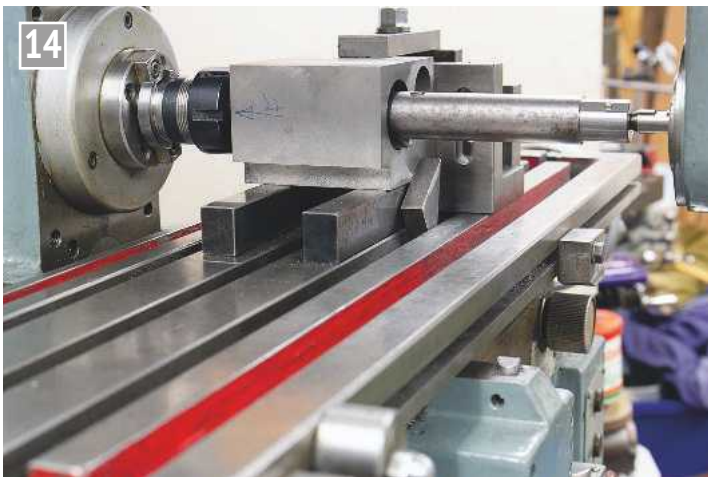
Boring and facing tools.

Setting the blocks and castings for boring

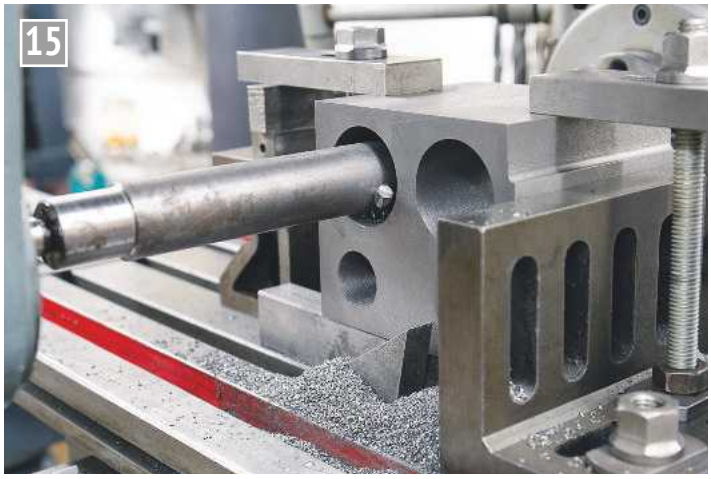
An angle plate was bolted to the milling machine table and set true to the Y-axis **(photo 13)**. The cylinder block was placed on a pair of parallels in order to lift the block/casting off the table and two stout clamps were used to hold the casting down to the mill table, at the same time keeping the block in close contact with the angle plate. **Photograph 14** shows one of the outside cylinder blocks set using this method. Note - the photograph was taken with only one clamp in place to allow clear access for the camera.

The triangular piece of steel in the tee slot appears in many of the photographs and it is there simply as an additional stop; a close fit in the tee slot prevents any possible inadvertent movement of the job. To position the cylinder block for boring the DRO proved invaluable. Using a probe and using the 'centre' feature of the DRO the centre of the block was found along the X-axis; this was then recorded as zero on X. The underside of the casting (which is actually the top surface of the inside cylinder block) was taken as zero on the Z-axis and from these datums it was quite easy to position the centres of the cylinder bores. Firstly, the Z-axis was lowered to give the correct position of the cylinder centres from the top surface of the block/casting and then moving the X-axis to give the distance of

Setting the angle plate true to the Y-axis on the milling machine.



One clamp omitted to allow access for camera - block on parallels to lift it clear of machine table ready for facing later.



Inside cylinder block - boring bar just completed a cut on main bore, cutter bit is clearly seen, one bore completed, the lower two piston valve bores are still in as drilled condition and await treatment by a smaller boring bar.

Boring through one of the outside cylinder blocks, this time viewed from the opposite side of the milling machine.

the cylinder center from the centre of the block. The Z- and X-axes were then locked so that boring could commence.

Power feed to the Y-axis?

Throughout the time that the modifications were being made to the arbor bearing bracket I was giving considerable thought to how I could provide power feed to the Y-axis. I had a motor with worm gearbox attached and this seemed a good starting point. However, mounting such a motor would need some substantial bracketry and quite a lot of drilling and tapping of the machine knee which, although possible, I was not really happy to do. Ideas of driving the existing Y-axis feed screw with this motor using a toothed belt and pulleys looked promising but space for a pulley on the feedscrew shaft was limited. I toyed with the idea of sacrificing the graduated collar and making it into a toothed pulley but I still needed to be able to engage/disengage the drive to use manual operation. I got around to thinking of using something like a synchromesh collar from a car gearbox to engage or disengage the feed but I couldn't remember the last time I had access to surplus gearbox parts! In the end I decided that motorizing the feed to the Y-axis would take up far too much time and went ahead on a trial basis to see what quality of finish could be achieved using manual feed to the Y-axis.

Boring operations

The larger cylinder bore was tackled first. The between–centres boring bar was gripped in the ER32 collet chuck and supported at the opposite end on the dead centre which was adjusted carefully to provide support without excess pressure – just as one would do on a lathe tailstock and not forgetting the lubrication.

A fairly low spindle speed was initially selected but it quickly became clear that, because of the tungsten carbide cutting bit, the speed could be increased and most of the work was done at either 430 or 600 rpm, depending on how the boring bar was cutting. The G.H. Thomas design of boring bar incorporates a fine screw adjustment to the cutter bit and it is quite easy to adjust the amount of cut to a fine degree. The cutter bit is held at 45 degrees to the boring bar and the adjusting screw is 40 TPI so one turn of the adjuster increases the projection of the cutter in the radial direction by about 0.017 inch. Careful observance of the screwdriver as the adjusting screw is turned makes it easy to judge how much cut is being put on; it is relatively easy to turn the screw one half, or one quarter, or even one twelfth of a turn, using the clock face as an analogy.

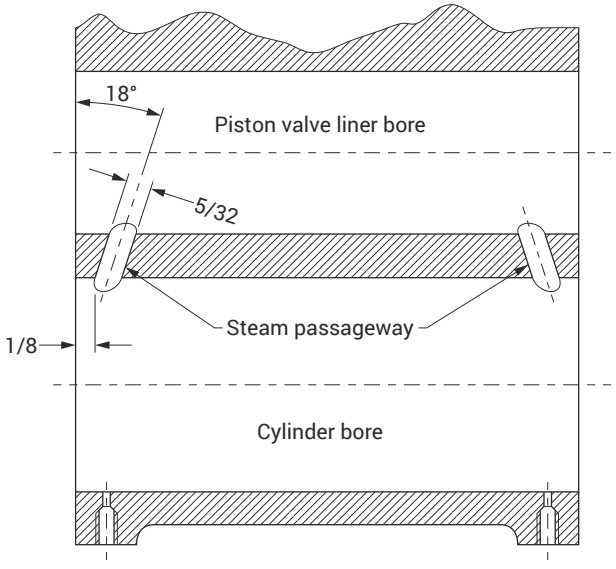
Hand feeding the cylinder block along the Y-axis was not such a problem as was expected. The carbide cutting bit cut cleanly through the cast iron and it was not too difficult to achieve a good finish in the bore. Each pass of the boring bar did not take too long and it was not a particularly tedious operation. In order to measure the bore after a cut it was necessary to slacken off and remove the overarm bearing bracket to allow access for the telescopic gauge but this became a fairly simple routine.

Photograph 15 illustrates boring through one of the bores of an inside cylinder block and the cut has just been completed. The clamping arrangements can be seen and the cutter bit can be clearly seen as it has emerged from the bore. **Photograph 16** shows a similar operation on one of the outside cylinder blocks and viewed from the opposite end of the milling machine.

Finishing the bores to size

With due care, I am sure that it would be possible to bore all cylinders to the same size within quite close limits. However, with a total of eight cylinders to machine it would be an advantage to have a means of ensuring that they all came out as near to the same size as possible. Some time ago I purchased a number of shell reamers along with a No.3 Morse taper shank to mount them on.

Fig 3

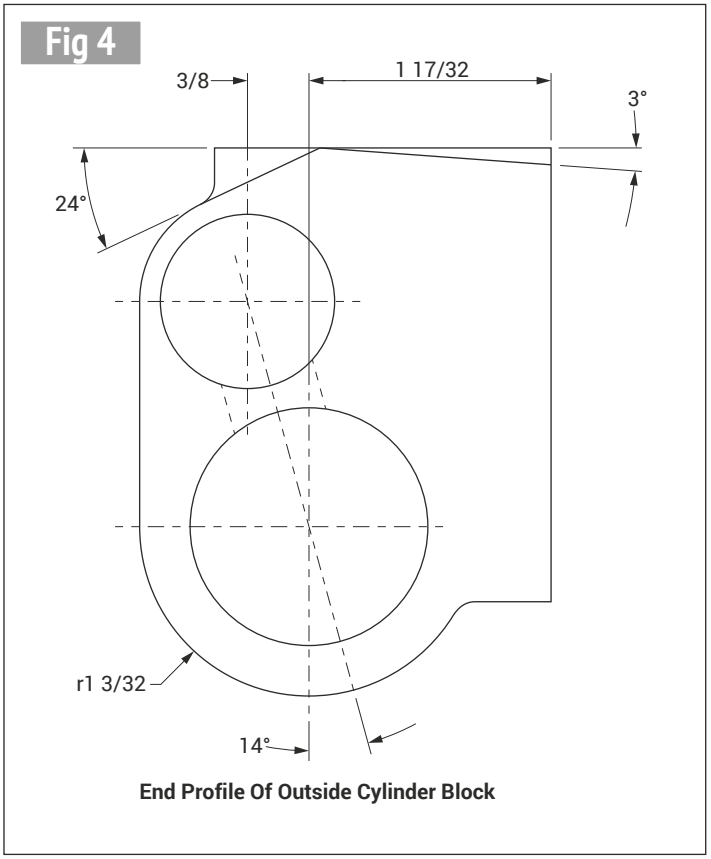


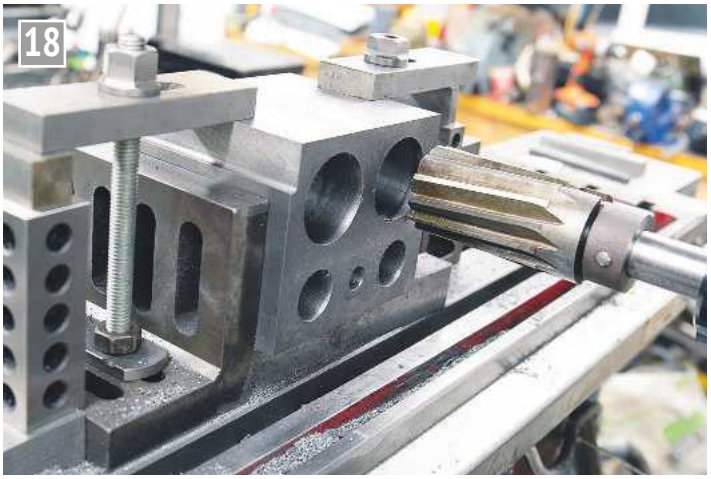
Section To Show Steam Passageways

Shell end mills mounted on home-made shanks, the original MT3 shank being on the left. Also shown is the face mill used for much of the early machining to square up blocks and bring them to size.

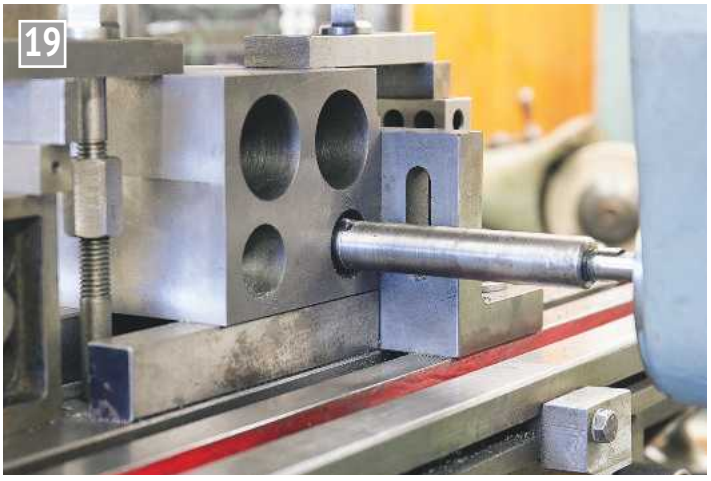
These tools came from one of the surplus stands at an exhibition and looked a little tired when I bought them. Closer inspection, however, had found that they had seen little, if any, use and the scruffy appearance was quite superficial. Checking on the sizes of these reamers, I was pleased to see that I had one of 1½ inch diameter for the main cylinder bores and also one of 1⅛ inch diameter for the piston valve chambers. What luck! A 30 INT to No.3 MT sleeve was available so that meant they could be mounted in the spindle of the Harrison mill. My ego was soon deflated when I fitted the 1½ inch shell reamer on the shank and then began to assemble it via the 30 INT sleeve into the machine. It was all too long and there was no way I could get the tool into the spindle and move the cylinder casting back far enough (using the Y-axis) to enter the bore. Not to be outdone, I made up a new, shorter shank without the No.3 Morse taper and turned the end down to fit in the ER32 collet chuck. These shell reamers have a very slight taper in their bore and are held onto the shank in much the same way as a Morse taper holds in a machine spindle but have the additional security of a collar on the reamer shank which has two small twin dogs machined on it which engage with twin slots in the back of the reamer. The collar is fixed to the reamer shank by a shear pin. This arrangement prevents any possibility of the reamer slipping on the shank**. Photograph 17** shows two reamers mounted on home-made parallel shanks. The twin dogs cannot be seen in this photograph but the shear pin is clear on each of the shanks. The shank on the very left is the original No.3 MT shank and the red item in the foreground is the carbide tipped face cutter used earlier for machining the blocks to size. Why are there two home-made shanks? Well the 1⅛ inch reamer has a smaller internal taper so could not be fitted to the same shank as the larger reamer! The 1⅛ inch diameter reamer was required for the size of the piston valve chambers.

The bores were machined to slightly undersize with the boring bar, leaving about 0.008 inch to 0.010 inch for the reamer to remove. The new shank size for the reamers had been chosen as 20mm diameter, the largest size that could be gripped in the ER32 chuck. Spindle speed was dropped to about 150 RPM and the reamer and the cylinder bores liberally anointed with lubricating oil. A steady feed of the Y-axis was all that was required to run the reamer through. Occasionally the reamer was withdrawn to remove the cast iron swarf that built up in the reamer flutes, relubricate and continue with the process. Although the reamers cut to exact size the finish on the reamed hole was a little disappointing but was





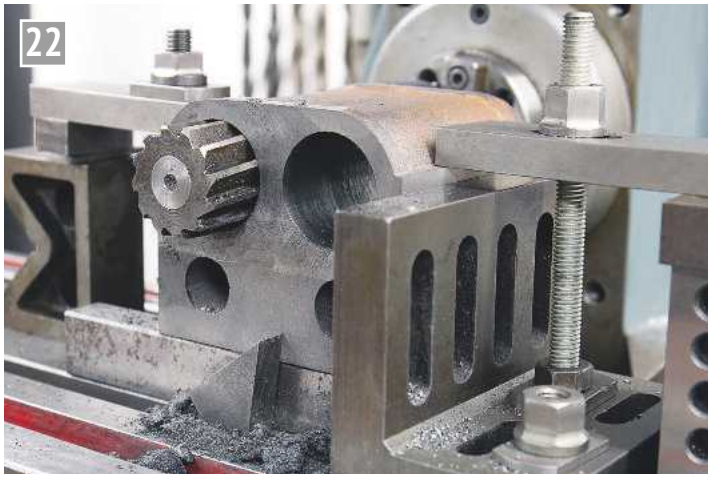
Shell reamer used for the main bores, viewed from spindle side of machine.



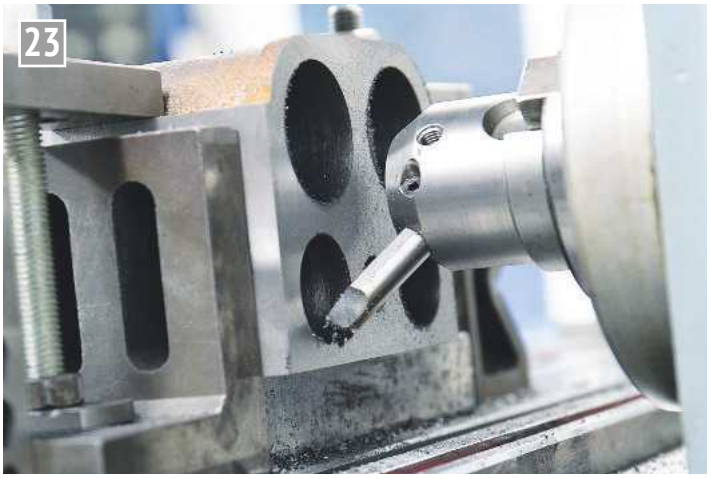
DRO used to reposition block and small boring bar in use machining the smaller piston valve bores.

Smaller shell reamer emerging from one of piston valve bores.

Work on one of the castings, showing slightly different clamping arrangements.



Large shell mill emerging from one of the castings, cleaned of swarf for the photo!



Flycutting the face of a casting using the home-made flycutter, with HSS cutting bit, which was shown in photo 12.

easily improved by light honing afterwards.

The finish in the 1⅛ inch diameter piston valve chambers was not as important as this is for a press fit for the actual piston valve liners. **Photographs 18** to **22** show various views of the boring and reaming processes.

Before unclamping the cylinder block from the milling machine table, the end face nearest to the machine spindle nose was faced using a fly cutter. The reason why each casting was packed up on parallels at the setting up stage was to allow room for the flycutter to operate without damaging the machine table. **Photograph 23** shows the flycutting operation.

The final operation on the internal cylinder blocks was to drill a 9⁄16 inch diameter hole right through the block for the exhaust steam passage. This was a simple drilling operation after using the DRO to relocate the casting so that the centre of the hole was positioned centrally between the two piston valve chambers. The hole was then first started with a centre drill and drilled through with a 9⁄16 inch diameter Morse taper shank drill. As **photo 24** shows, it was just possible to get this size of drill in between the spindle and casting.

●To be continued.

Drilling 9⁄16 inch for the exhaust steam passage through the block.

Bending Rolls

Dear Martin,

With regard to the very many faults with the 'old' Martin Evans designs I have another that should be on the list, namely that of rolling sheet metal to make a tube/cylinder. The 'Evans' design was to put together two rolls with a third roller centrally above the two and adjust its height to give the required result. Unfortunately, with this 'design' one ends up with two flat ends, so that a true cylinder cannot be made.

There was an article in the *Model Engineer* in the issue dated 1st October 1976 which clearly shows how the rolls should be provisioned to give a true cylinder. Naturally it is necessary to roll the metal both ways to give a true circle, which means removing the sheet metal from the rolls and turning it around. I first built the 'Evans' design and found the problem so I then built the design from 1976 and all is well. After all these years it would be an idea if someone again wrote such an article as I am sure that the youngsters of today would appreciate it.

Apart from building the 1976 model I also built another set of rolls about twice the size in all dimensions, the problem being that it needs two healthy persons to move it to a usable position - I realise that I am also getting older!

Kind regards, Philip Bellamy (Switzerland)

Stainless Steel Boilers

Dear Martin,

I'd like to thank Anthony Mount for his kind words (Postbag, M.E.4659, 26th February).

I've been enjoying writing the articles immensely and as long as the readers find them interesting (and with our editor's permission) I'll keep them coming. The age-old complaint that the hobby doesn't attract younger engineers is a little superfluous if the clubs and associations insist on copper boilers. You'll be hard pressed to find a young chap willing to invest in a copper boiler before a car or motorbike! The Australian boiler code is very good but unfortunately it's geared more for the larger boilers. The code calls for a rather onerous welding qualification typically used in large industry and I personally think this needs to be revised for the smaller model boilers.

TIG welding is not very forgiving (with incorrect setup) and if the boiler inspector knows what to look for he'll pick up problems very quickly just by visual inspection. The code doesn't offer much guidance when it comes to actually making the boiler and working with stainless. The most popular excuse for not using stainless (SCC and CCC) is managed in the design phase so a builder shouldn't worry too much about these failure modes - and this is where Finite Element Analysis as a design tool is very handy. This is assuming of course the welds are good, which is easy with a little patience and a lot of practice. A modest TIG welding setup should cost the same as a good gas torch setup anyway.

***Luker* (South Africa)**

Insurance

Dear Martin,

Dave Moore's letter (Postbox, M.E.4659, 26th February) struck a chord as our treasurer and committee have expressed similar views in recent weeks as we await the insurance renewal request. I am sure that other clubs within the hobby feel as we do that the public liability element of our premium should be adjusted to account for the closure of our miniature railways over the past season and, what looks likely to be, a considerable chunk of this coming season.

Another organisation (not model engineering related), of which I am a member, has similar concerns and has received an advisory leaflet from the brokers prior to the renewal date which details 'Special Considerations for Insurance Renewal in 2021.' On the matter of public liability insurance, the leaflet states *'Even if your activities have reduced, your risk of a significant claim remains, even with remote and/or online services.'*

Am I being cynical or is this a way of saying that the public liability element of the premium remains, without adjustment!?

Could we persuade our insurance experts to give us their views on this matter. Our annual insurance premiums take a large chunk of our annual income and I have no doubt there will be some of our smaller societies who will be struggling to cope with having lost at least a year's income.

Fortunately, my own society had sufficient reserves to make up for our loss of income due to Covid but the prospect of another full premium charge before we are able to (hopefully) re-start public running operations will make a big hole in what remains.

Best regards, Mick Funnell, Chairman,
Brighton & Hove Society of Miniature Loco Engineers.

Write to us

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Martin Evans, The Editor,
Model Engineer, MyTimeMedia Ltd,
Suite 25S, Eden House,
Enterprise Way, Edenbridge,
Kent, TN8 6HF
F. 01689 869 874
E. mrevans@cantab.net

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PART 2

A Queensland DH Class Diesel Locomotive in 5 Inch Gauge

George Punter builds a 5 inch gauge version of a locomotive that evokes old memories.

Continued from p.435
M.E. 4661, 26 March 2021

The wheels are plain, simple discs - no fancy spokes here - and were cast in iron by a local foundry using my patterns. When machined up these were pressed onto the machined axles and held in place by Woodruff keys and Loctite. As there was no 'quartering' to be done this presented no problem. The bevel gears were pinned and held in place by Loctite to the axles. All the axles would later be connected by ball jointed shafts to allow for the individual movement of the spring suspension. The brake system now uses cable operation and is fully compensated but early on I did consider both air and hydraulic systems, but lack of space was a deciding factor. With the brake cylinders and other small parts now made and fitted the bogies were beginning to look more business-like (**photos 5** and **6**) and it was time to think about the superstructure.

The DH class locomotive.

Bogie end view.

The superstructure is in three parts and is removable from the chassis. I wanted this model to look realistic inside the cab (**photo 7**) and to have the engine where the engine should be. Some models I have seen have a Briggs and Stratton or a Honda engine in the cab as with an engine of this size, that is about the only place they can be accommodated. The next stage for me was to design an engine to power the locomotive. The limitation of physical size of the engine was dictated by the height and width of the bonnet. You must remember that all this

The bogie mounted in the chassis.

A close view of the cab.

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process took place many years ago; hindsight is all very well, and perhaps the choice of engine design could have been better, but just put it down to experience!

The design would be an 80cc single overhead cam water cooled four-stroke, four-cylinder, petrol unit (**photo 8**). The drawings and patterns were made and it was time to go casting. All castings were in aluminium and the engine would have cast iron liners pressed in. The camshaft was driven by a combination of gears and small chain and would have the points and distributor at one end and a governor at the other. I used a variety of techniques to make the castings including a commercial oil bound sand - a sand with a binder and hardener added - and the CO_2 process (for some of the cores). I enjoyed this part of the process and the earthy smells that it produces, but soon it was time to move on, to start to machine up the efforts of the last few weeks.

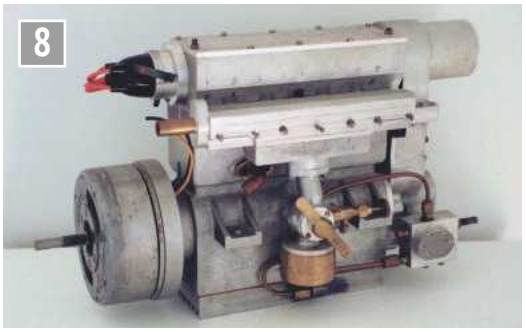
The crankshaft was made from a 4140-steel billet and took quite some time and effort. Making the camshaft is always an interesting process but as I had made myself a camshaft grinder this did not present as a problem. Silver steel was used and after grinding to shape and polishing, the individual cams were heat treated. The engine has points/coil ignition and a small oil pump to circulate the oil to the big ends and main bearings. The cylinder head has a pent roof combustion chamber with the inlet and exhaust valves at an angle on one side and the spark plugs on the other. The water for the cooling system was to be circulated by a remote pump which was driven by the main power drive shaft and housed at the front of the locomotive (**photo 9**). The large commercial flywheel on the engine was to be used to generate electrical power to drive the electrical systems. Having designed, made and assembled the engine it was time for the great day – would it work? Yes!! It did and it ran successfully after a short time of fiddling. I will return to this engine later as it is now time to look at the method of transmission to the wheels.

I had considered using a fluid flywheel from an old washing machine but, again, lack of space was the enemy. The answer was quite conventional; I used a centrifugal clutch and a gearbox that contained two forward and one reverse gear. A spreadsheet was designed to speed up the process of calculating the revs in and speed out – all based on 1,000 rpm of the engine. Any time the engine is running the drive shaft to the water pump and fan at the front of the locomotive must also be running to prevent overheating. This shaft runs through the gearbox and under the cab. As the engine speed increases and the clutch picks up the drive, a concentric shaft returns the power back into the gearbox to the individual gears. The output is then fed then down through another gearbox to the two shafts to the bogies. As I said earlier, this gave me plenty of experience at cutting spur gears!

The answer again is quite simple;
you just design and make another engine!

At this stage of the proceedings it was time to make a start on the parts I really enjoy making and that was the cab details. When a completed model is displayed the first impression is of the overall model, but it is the details that capture the imagination. I had taken many photographs of the inside of the cab and had a booklet that had been produced by the manufacturer of the full-size locomotive (Walkers D.H. Class Operating Manual Model G.H.500) for use by the crew and found this to be very useful. Fortunately, the dials had not been removed from the locomotive that I was studying and I was able to take close up photographs that would be later scaled photographically down to a 5 inch gauge scale.

The years were now ticking by and in the numerous breaks I also completed other projects including a model tractor and a Lister Diesel engine. In the early part of 2017 I rekindled my interest in the DH locomotive; after all, it had been sitting there, staring me in the face all those years and was crying out to be finished. The engine I had designed and made, many years ago now, came up for review. This engine was quite sporty and would rev freely but the full-size Diesel engine should have modest revs and a sound that related to it … and the two did not correspond. So much for hindsight! So, what does one do in this situation? The answer again is quite simple; you just design and make another engine! The four-cylinder unit is now on display in my office - along with the other 29 engines - and the new one was designed. The new engine would be a three-cylinder cross flow side valve



OHC 80cc engine, exhaust side.

The water pump.

One of the pistons and a connecting rod casting.

Crankcase sand moulds.

Pattern and core box for the sump.

Cast crankcase top.

The crankshaft is machined from the solid.

water cooled petrol engine, with a capacity of 150cc. The choice of cross flow (exhaust on one side and inlet on the other) stems from the design of the engine used in my Saunderson and Mills tractor and it also complied with the design limitations of the available size under the bonnet. The engine only needs to produce enough power to pull me along as it is not intended to pull a mass of passengers but does need to make a realistic sound. I now have a CAD system which I did not have early on and this is a joy to use as it brings the drawings to life with its 3D visual effects and ability to produce good quality drawings and 3D prints.

The pistons used (**photo 10**) came from a swap meet I attended in Cheltenham many years ago when on holiday in the UK. They were being offered at five pounds each or I could buy all four for fifteen pounds. How could I resist this bargain? They came with rings and gudgeon pins, all new and unused. At that stage I did not know what I would use them for, but they were too good to be left behind. Three of these pistons were later to form part of the design criteria for the new engine. The design was drawn up and patterns and core boxes made (**photos 11** and **12**). Back to the foundry section I go, and it is all action. Some of the set-ups take a day to prepare but it is extremely rewarding when the finished casting appears from out of the sand (**photo 13**). Professional foundry men may question the way I produce my castings but the system works for me with the equipment I have at hand.

Machining the castings is then undertaken, followed by trial assembly just to check that the parts are aligning satisfactorily. The crankshaft (**photo 14**) starts with a billet of 4140 steel and is machined on the miller using the rotary table to rotate the work under the cutter. This is a laborious task as the rotary table has a 90-1 reduction and so there are many turns of the handle to complete the operation – about 15,000! The engine has two cam shafts and the ends of these are used to drive the oil and petrol pumps and the distributor and Hall effect ignition. The oil pump is of the gear type, but the petrol pump is a small piston pump with check valves. The fuel tank is situated below the chassis and fuel is pumped up to a weir with the excess draining back to the tank. Only one fuel tank is used for the fuel as the other contains all the electrical parts and a battery. I had thought of adding an electric start system but at this stage starting is by a remote power unit such as an electric drill.

The ignition system parts were designed on the computer and then made using a 3D printer. This tool has also proved particularly useful for producing small patterns for casting and are just magic to watch in action.

The locomotive was now on the home straight and the end not too far away – well that is what you think at the time. It was now time to detail the buffer beams, add the working lights and all the trimmings that add just that little bit extra to a model. In the end these small jobs do take some time to complete. I did order some

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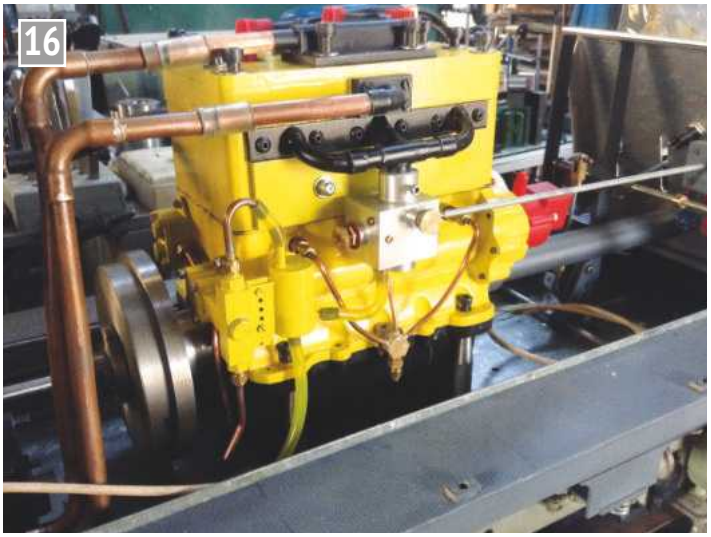
The engine installed in the chassis.



A view of the engine, showing the carburettor.

small thin walled silicone tubing for the pipe work at both ends of the locomotive (decorative not functional) but promptly lost it in the workshop and had to order some more. All the lettering and small numbers were made in vinyl and added after the painting. Painting is not always easy at the best of times but here in Bundaberg the humidity can be a real pain and as I don't have any special paint rooms with controlled atmosphere I have to wait until the humidity is down before action can take place. Also, the local insect population seem to enjoy a visit when parts have been painted green and yellow.

The model has now been finished and the engine installed (**photo 15**). A test run of the engine revealed that I do need to modify the carburettor as it can suck fuel at a rapid rate due to the choke area being too small. The present carburettor cannot be modified (**photo 16**) and I will need to design a new one that fits in the available space. Electrical power for the lighting system is provided by a 12-volt battery. Two circuits are used, 12 volts for the ignition and 5 volts for the lights and instruments. The gauges for water temperature and engine revs were made by a good friend and add interest to the backhead as well as being useful (**photo 17**).

It is good to have completed the model (**photo 18**), even if it has taken far too long to finish but most of the time was spent in thinking or working on other projects. When I look at the model it brings back many happy memories of that day when my son and I made this most enjoyable journey. In these days when we must avoid the dreaded virus, the shed and the projects we make are a very worthwhile distraction and allow us to live in our own little world of being creative. I am now on the next model and yes, it is another tractor to the same scale as the Saunderson and Mills, only this time it is an Australian make.

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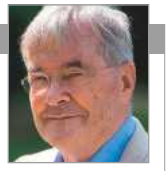
The backhead.

The finished engine.

PART 3 - STRESSES AND DISTORTIONS DURING HYDROSTATIC PRESSURE TESTING

Stress Analysis of a Model Steam Boiler



Wim Merks, Chairman and Safety Coordinator of the Dutch Model Steam Society, shows how Finite Element Analysis can be used to analyse stresses in model boilers.

Continued from p.441
M.E. 4661, 26 March 2021

This article was first published in 2020 in *Onder Stoom*, the magazine of the Dutch Model Steam Society.

Boiler deformations due to pressure testing at 12 bar (1.2 MPa) and 20 degrees C

The deformations are limited to a maximum of 0.1 mm. The highest values occur in the longitudinal stay, blower pipe, regulator tube and in the flat top section of the firebox (**fig 19**).

Note that the copper will harden during hydrostatic testing due to the stresses and (minor) deformations which, as can be seen from the picture, take place. The Deutsches Kupferinstitut writes about the mechanical properties: soft copper has a tensile strength of approximately 200 MPa and a yield strength of 40 - 80 MPa as well as an elongation of more than 40%. After a cold deformation, the tensile strength increases to at least 350 MPa and the yield strength to 320 MPa but the elongation is then reduced to below 5%.

Material stresses in the outer wall of the firebox

As a result of brazing at a high temperature (approximately 620 degrees C), the copper material of the boiler will soften and lose much of its strength (**fig 20**). The material can be work hardened by increasing the pressure in 1 bar steps and releasing after each step. It is not known whether it will reach the above-mentioned value of 320 MPa.

Material stresses in the inner wall of the firebox

Naturally, as in the operating state, the maximum stresses occur at the same positions. Because the boiler is pressurised at 2x the working pressure, the stresses in the material are also twice as high (**fig 21**).

The firebox crown stays are clearly heavily loaded.

Material stresses in the firebox tube plate

It can be observed that the ligament between the top two fire tubes and the ligament between the fire tubes and the superheater flue have a high stress. See the red dots at these positions (**fig 22**). This is also the case with the top row of stays.

Material stresses in the smokebox tube plate

This is obviously identical to the situation when the boiler is operated at the working pressure. In this part the highest stresses occur around the solder connection between

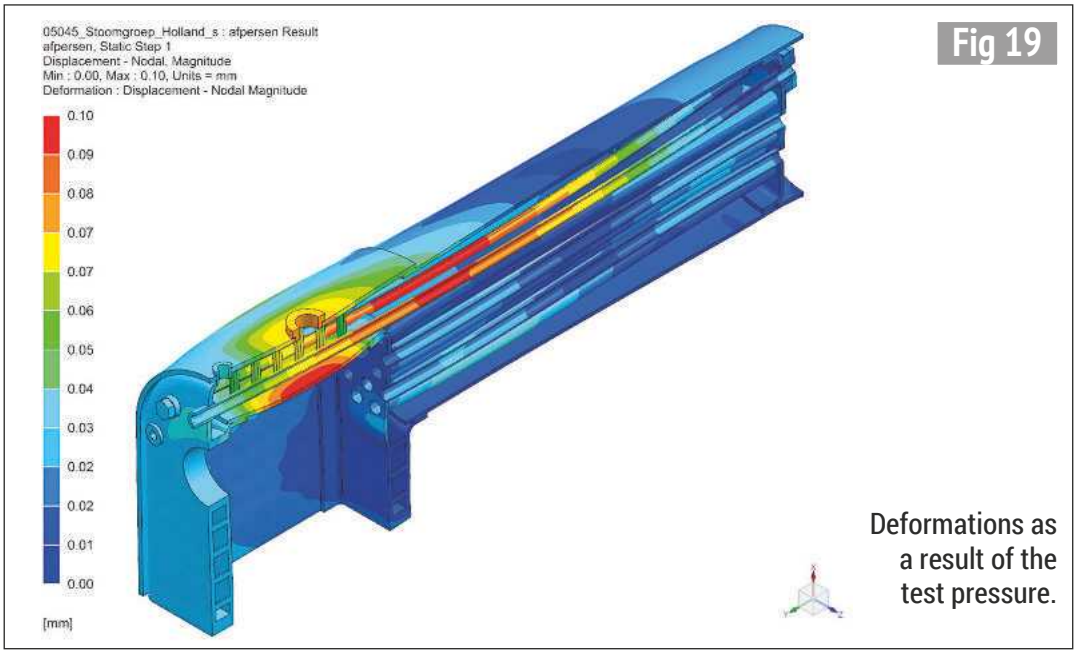


Fig 19

Deformations as a result of the test pressure.

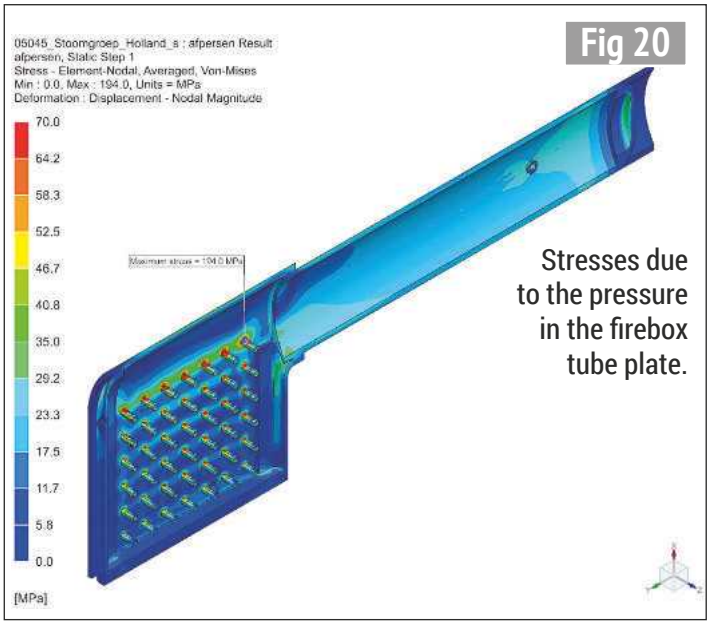


Fig 20

Stresses due to the pressure in the firebox tube plate.

the boiler barrel and the smokebox tubeplate (**fig 23**).

Deformation of the longitudinal stays and the regulator tube

Although they are supposed to be under a tensile stress, fig 13 (part 2) and fig 19 (this part) show a deformation of the longitudinal stays and the regulator tube while the boiler is under pressure. The question is: will these tubes add strength to the tube plate at the smoke box side and the part of the vertical wall above the firebox? They will indeed and the clarification is as follows.

As a result of the internal pressure in the boiler the firebox plate and the tube plate will show a deformation and as the longitudinal stays and the regulator tube are brazed into these plates, they will be subject to bending. **Figure 24** shows the maximum deformations during the pressure test of 12 bar and are for clarity 200 times magnified. The real maximum deformation is only 0.1 mm! On YouTube, see link https://www.youtube.com/watch?v=Jr_oQQPhLUM where an animation is available of the deformations of the boiler assembly during pressure testing.

The animation shows 20 frames, each representing a cumulative step of 0.6 bar pressure rise. The deformations of both plates are shown clearly and also the deflection of the tubes.

As an example, the stresses in the regulator tube are investigated.

In **fig 25** the stresses are shown in the tube and on the basis of this figure we can estimate the ratio of tensile stress in relation to bending.

At the scale of the figure it is difficult to read the right stresses in the pipe but the computer specifies the stress at the lowest point of the tube as 10.2 MPa. This is a tensile stress due to bending of the tube. At the same position, but at the top

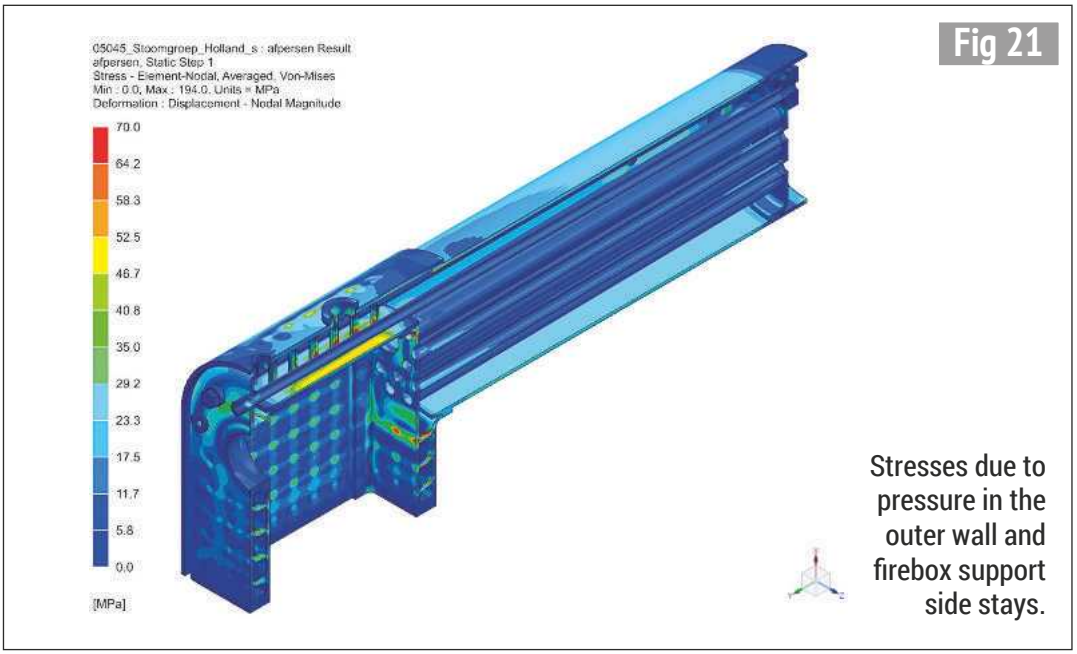


Fig 21

Stresses due to pressure in the outer wall and firebox support side stays.

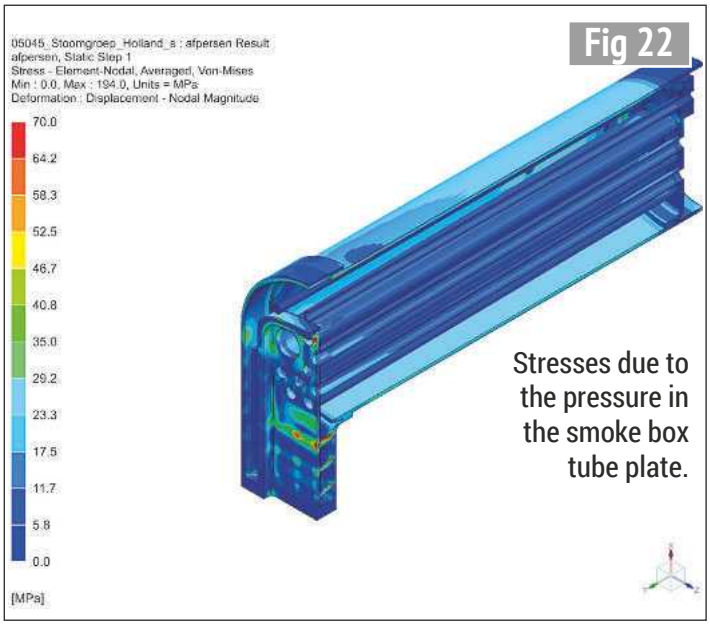


Fig 22

Stresses due to the pressure in the smoke box tube plate.

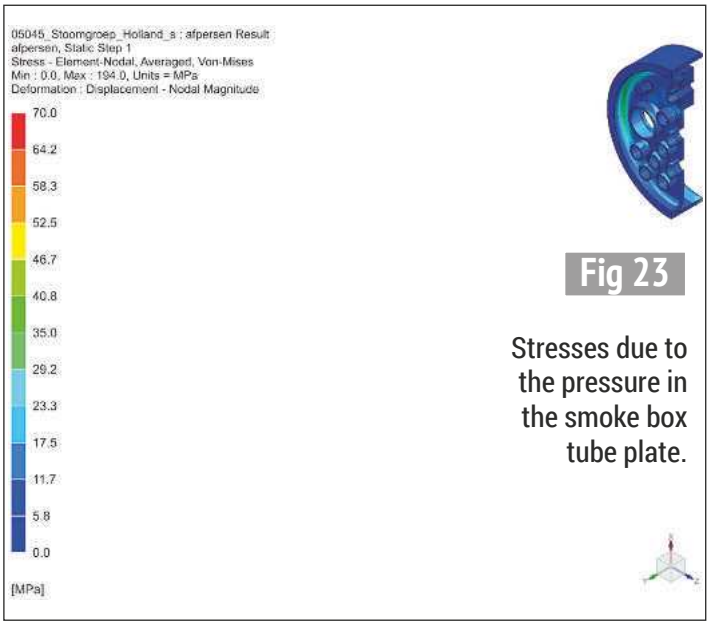


Fig 23

Stresses due to the pressure in the smoke box tube plate.

of the tube, the stress is 6.4 MPa. However, for the same reason as mentioned before, here it is a pressure stress. In the neutral axis of the bent tube, so in the centerline, the computer specifies a stress of 8.2 MPa. At this line stress is not influenced by bending of the tube. So here we only have a tensile stress. This proves that the tensile stress is dominant and that bending causes an additional stress of plus or minus 1.9 MPa. We can therefore conclude that the regulator tube adds additional strength to both plates to which the tube is brazed, and hence to the boiler. An identical analysis can be executed for the stays. An analysis under operating conditions is more complex as thermal influences have to be taken into account as well.

Conclusions

As we have seen in the past three articles, the Finite Element Method (FEM) offers a perfect opportunity to analyze the strength of the whole model steam boiler and to identify the weaknesses in the construction, allowing adjustment to the design and/or material thicknesses during design if necessary.

The Femto report mentions the following points:

- The firebox side stays, crown stays and longitudinal stays are subjected to a relatively heavy load relative to the walls due to the pressure (working or test pressure) in the boiler.
- The temperature differences in the steam boiler result in uneven expansion of the copper. A number of curved plates therefore show high stresses because the edges want to 'fold'.
- The lower the convection coefficient of water/steam and the higher the convection coefficient of the flue gases, the greater the temperature differences. Other thermal properties can therefore quickly lead to higher or lower thermal stresses.

Fig 24 Maximum deformations during pressure testing 200x magnified.

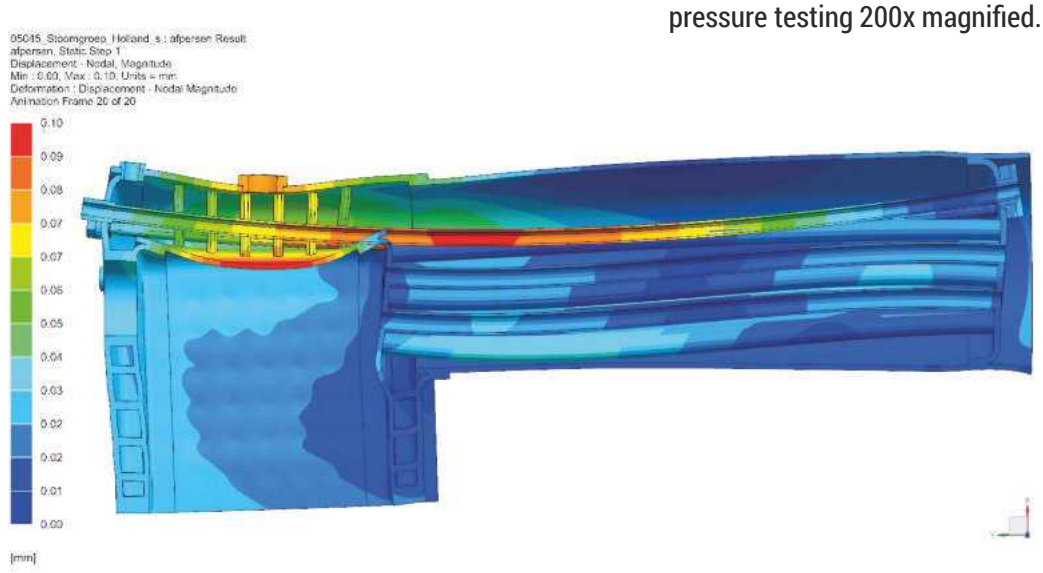
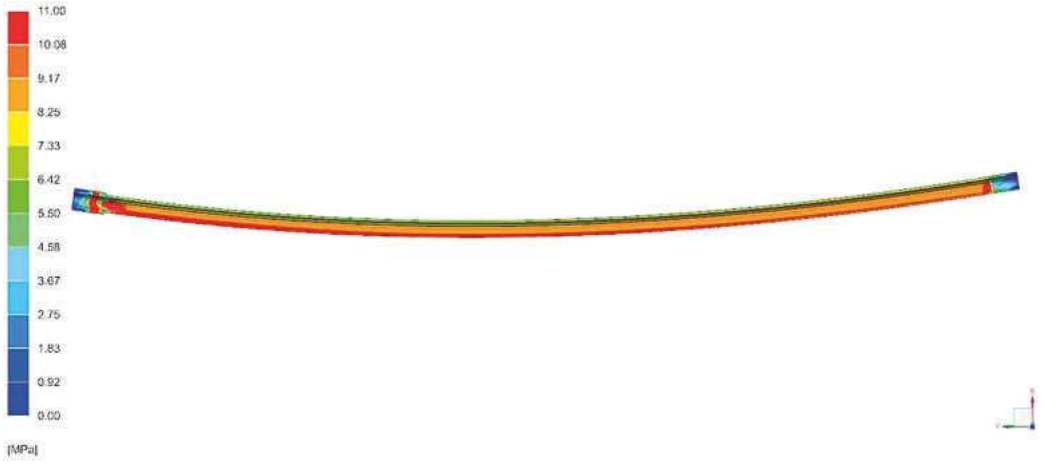


Fig 25 Stresses in the regulator tube.



It should also be mentioned that it is difficult to make a qualitative statement about the strength of the boiler because values for the yield strength of copper are lacking at higher temperatures.

Given the complexity of a boiler, advanced software is required to perform such an analysis. Setting up a FEM calculation and assessing the results requires fundamental knowledge, as available at Femto Engineering. Assistance by specialists is therefore indispensable. The standard calculation methods according to the *Rules for Pressure Vessels* (former Dutch Rules) and ASME Section I are sufficient in practice but knowing where high load concentrations take place is of course very useful. Design verification methods will not have to change on the basis of these articles. The aim of this series was therefore only to show how a steam boiler behaves under operating and test pressure conditions. In my opinion, this approach has reached its goal. The 3D drawing programs such as Solid Edge and Solidworks, which are increasingly used by the model builder, also contain simulation programs in the University Editions with which FEM analyses can be applied. The author uses the Solid Edge University Edition from Siemens and has now applied a few simple load cases as an exercise. It is important that the loads must be entered correctly and that also requires the necessary practice. And, as mentioned above, interpretation of the results is difficult. Nevertheless, it is instructive to try it out. However, the analysis of a complete model steam boiler would be too complex and would require a powerful computer with high grade graphics card and a lot of detailed knowledge.

ME

PART 3

Focas Connecting Rod

Peter Worden continues his occasional series describing the building of his FOCAS engine.

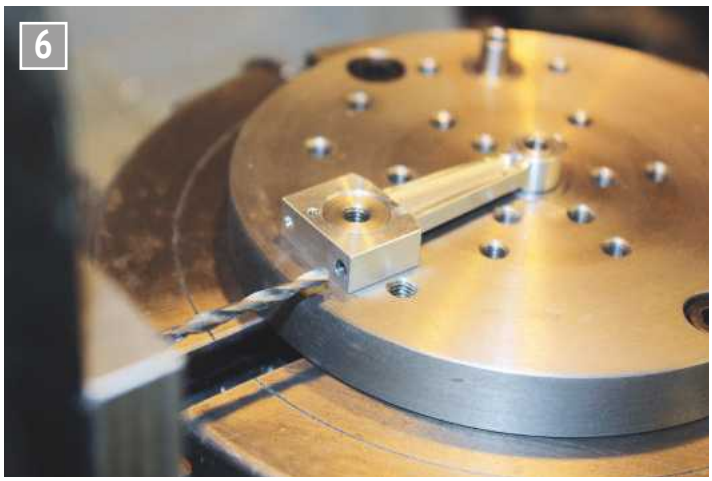
Continued from p.453
M.E. 4661, 26 March 2021

Last time we ended up with the machined conrod separated from the parent stock (**photo 5**). A couple of operations remain to complete the machining of the rod itself. The first drills the holes for securing the bearing cap to the big end and the second splits the cap from the big end.

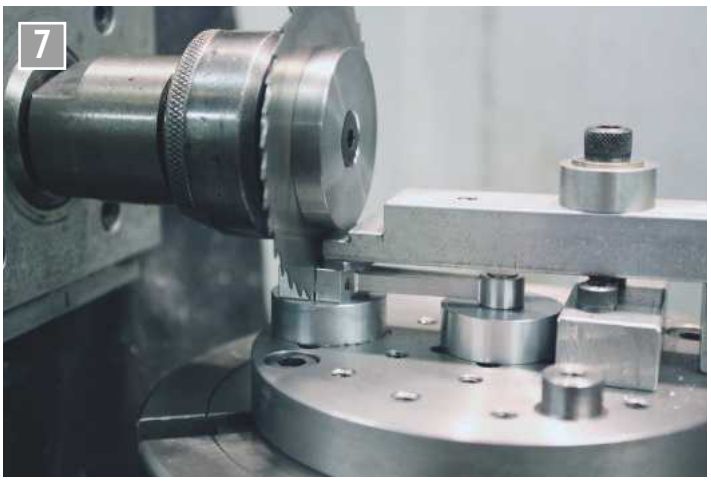
Stage 16

The centre 0.406 inch diameter spigot was removed and replaced with the 0.250 inch diameter spigot. The part was then located on the two spigots. The fixture was rotated 120 degrees clockwise. The conrod big end was clamped with a screw and washer. Two holes No.43 were drilled through to dimensions in the main conrod drawing using the horizontal spindle of the machine. These holes were opened to 0.110 inch diameter to the centreline of the big end, to provide clearance for the fixing stud, and tapped 6BA (**photo 6**).

Conrod separated from the parent stock.

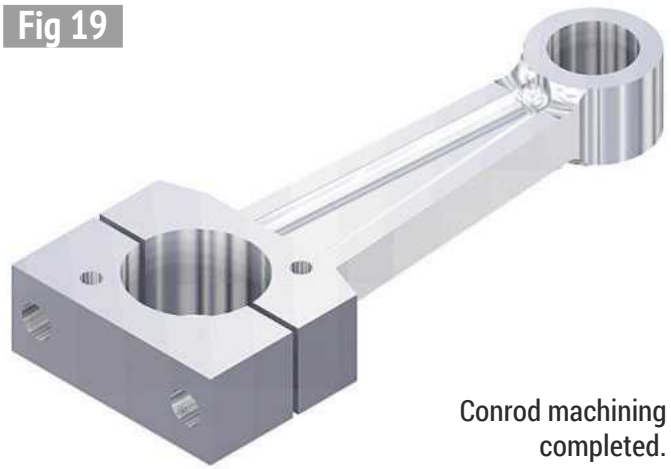


Drilling for the bearing cap screws.



Separating the bearing cap.

Fig 19



Conrod machining completed.

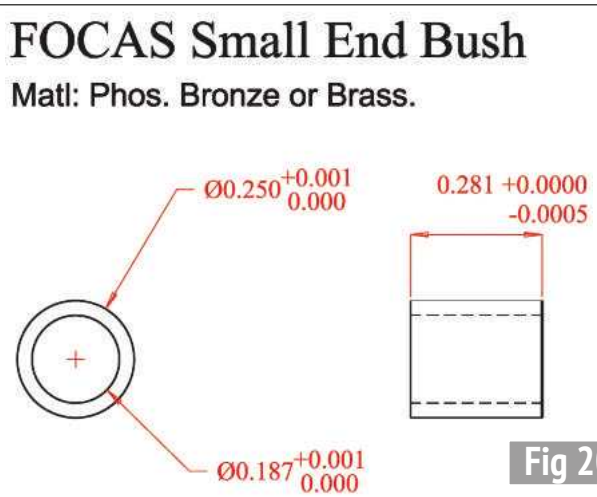


Fig 20

Stage 17

A 0.020 inch slitting saw was set up on the horizontal spindle and a cut was made right through to the dimensions in the main conrod drawing (**photo 7**). This separated the bearing cap from the conrod (**fig 19**).

Small end bush

The small end bush is a simple phosphor bronze tube as shown in **fig 20**. This is longer than the width of the small end of the conrod to allow for a clearance between the conrod and the inside face of the piston.

Unsplit big end bearing shells.

Big end bearing shells

These items should ideally be made from phosphor bronze but as this project is being made from materials that I have available I made them from brass instead as I didn't have the right stuff. The ¾ inch diameter bar was faced, drilled ¼ inch and rough bored to 0.312 diameter. The outside groove was rough formed to 0.437 inch diameter x 0.230 inch wide with a parting tool, leaving the thickness of the 0.031 inch flange oversize at 0.045 inch and the outside diameter was turned.

The groove was then finish turned with two special tools to machine the inside faces of the groove to 0.250 inch and to 0.406 inch diameter, to the limits as per the drawing (**fig 21**). The front face was then finished to produce the 0.031 inch flange. The bore was finished to 0.375 inch diameter and the part was deburred and parted off plus 0.010 inch. The part was then mounted on a 0.375 inch diameter split mandrel and faced to length.

At this stage the part could be regarded as a bobbin **(photo 8)**. I originally thought of making the flanges 0.015 inch thick but this would have made them rather flimsy and could cause a problem when milling the slots.

The bearing shell fixture (**fig 22**) consisted of a disc 2 inches in diameter x 0.656 inch wide with a boss on one side of 1 inch diameter x 0.532 inch long and a boss on the other side of 0.375 inch diameter x 0.312 inch long.

The fixture was mounted on the rotary table located by the 1 inch diameter and clamped. A bearing shell was loaded to the fixture and the toggle clamp was secured to the rotary table in a position to clamp the shell to the 0.375 inch diameter of the fixture.

A slot was cut, with a 1/16 inch diameter slot drill, in the flange on one side to the dimensions ≫

Fig 21

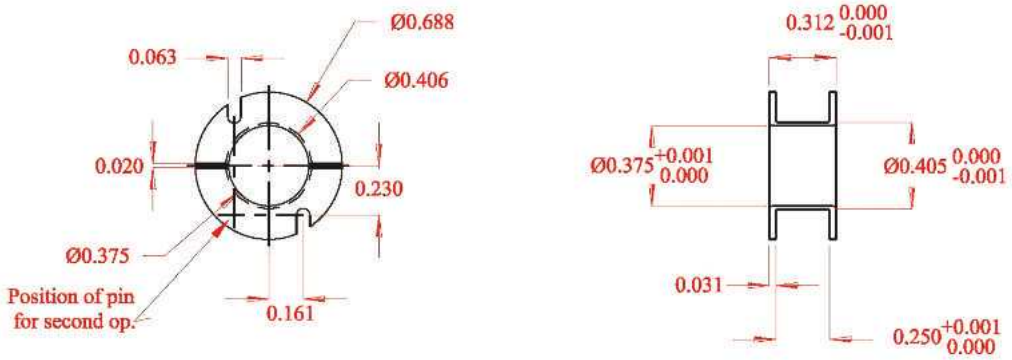
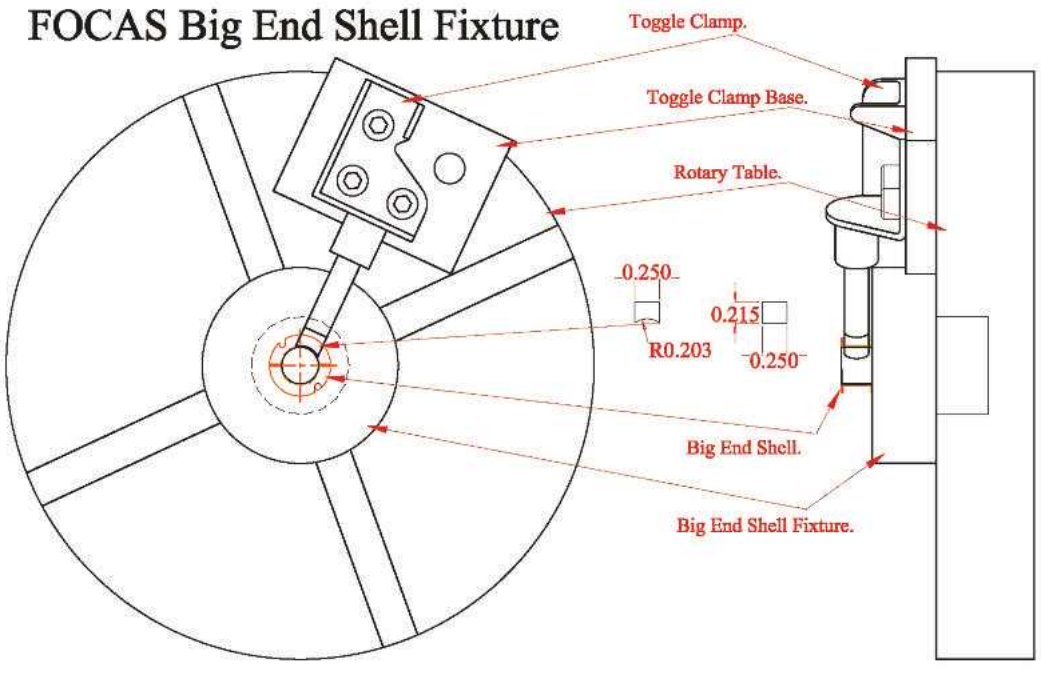


Fig 22



shown (fig 21) using the X-axis of the machine. The rotary table was rotated 180 degrees and a second slot was cut as before. As this slot drill is a rather delicate item, I decided to play safe and perform these operations in cuts of 0.005 inch at a time so as not to break the one and only tool I had.

A hole 0.062 inch diameter was drilled in the fixture in the position indicated (fig 21). A pin 0.062 inch diameter was pressed into this hole. The part was flipped on the Y-axis and located on the pin and clamped. Two slots were cut as before on the X-axis (**photo 9**).

A 0.020 inch wide slitting saw was set up in the horizontal spindle and lined up central with the fixture. The rotary table was rotated 90 degrees clockwise. A part was loaded to the fixture, ensuring that the slots were at 90 degrees to the saw, and cut in half to make the upper and lower bearing shells (**photo 10**).

Big end bearing shells with slots.

Finally, the big end bearing shells are split.

Studs and restraining pins

Eight studs were made 0.110 inch diameter x 0.688 inch long with a 6BA thread 0.250 inch long on one end and a 6BA thread 0.125 inch long on the other end (**fig 23**).

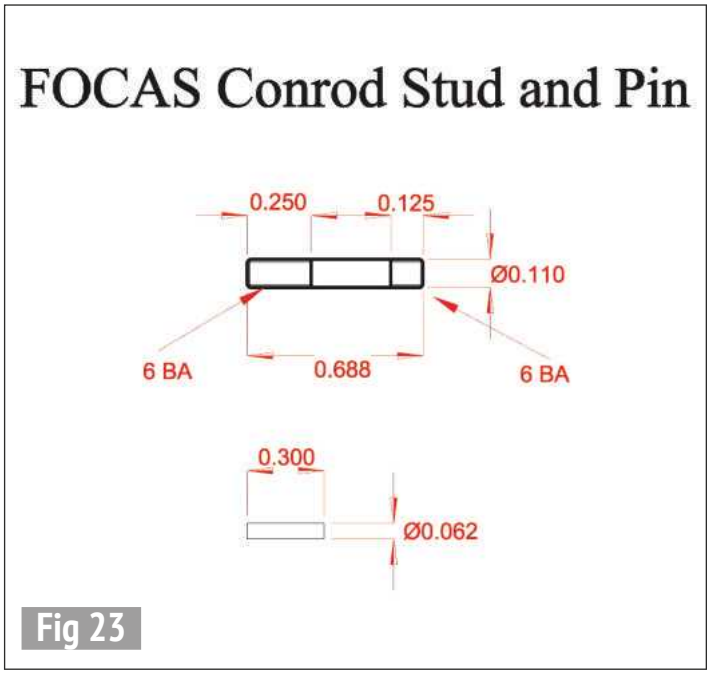
Eight pins were made 0.062 inch diameter x 0.300 inch long (fig 23). The length of these pins was less than the width of the bearing shell to save them fouling on the face of the crankshaft.

The studs were screwed into the conrods, long thread first, and the pins were pushed into the conrods and bearing caps. The pins might need a little adhesive to hold them in place on final assembly.

The small end bushes were pressed into the conrods so that an equal amount protruded each side. This was, as said above, to keep the conrod from fouling on the inside face of the piston.

And there you have it, how I machined a conrod using one fixture.

ME



A New GWR Pannier PART 30

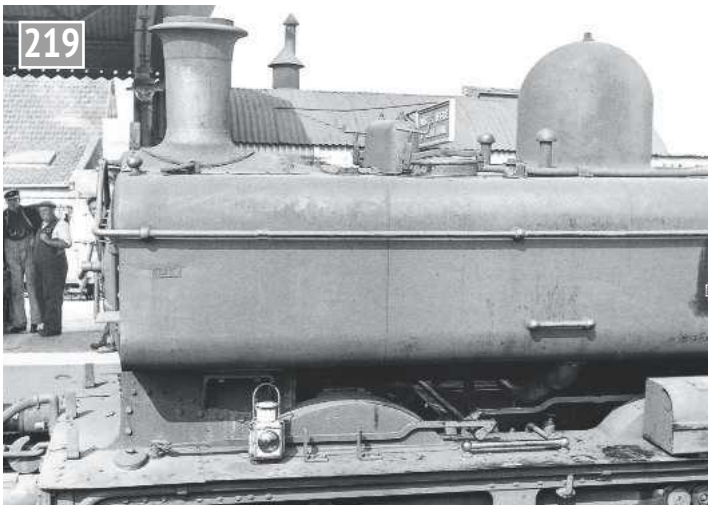
Doug Hewson decides that LBSC's well-known GWR pannier tank design needs a make-over.

Continued from p.403
M.E.4660, 12 March 2021

I think it is about time that we made a start on some of the platework now and this will make the engine. I have called these the side platforms as that is how they are called on the works drawings. The 'footplate' is only the part of it which appears in the cab. We do a complete set of the side platforms in laser cut form and I have also included a special set for the for *Pansy* which is 1/16 inch longer than the scale version, to fit over the overscale thickness buffer beams.

I think it would be a good idea if you were to fit the valances on to the side platforms for a start.

We need to use 1/16 inch rivets here.

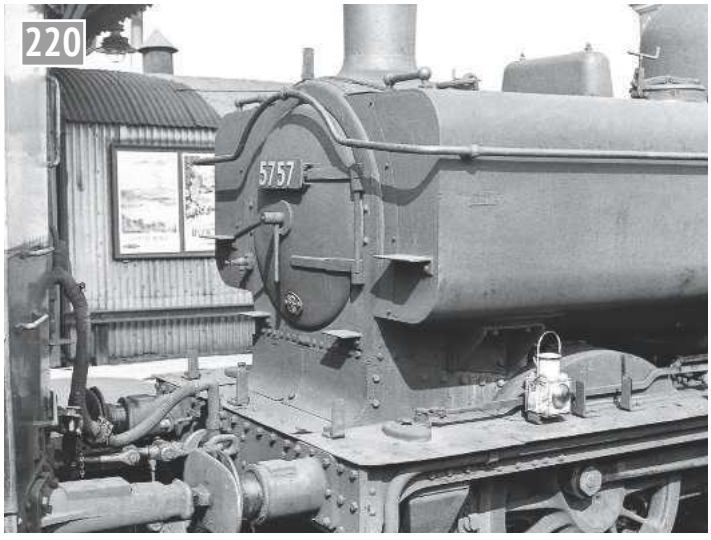


Note the centre lamp iron is ahead of the others.

I have made the platforms in three pieces as on the full size engine, which is what I didn't do on my original Y4 and regretted later. I had to cut through the footplate just in front of the tanks later in life as the valve gear had moved just enough to give it an odd beat. I am not saying that this is the case here, but it must have been done on the full-size engine for some good reason.

I have shown a photograph (**photo 218**) of the rivets along the platform together with a 2p piece for comparison and I think that these equate to 1/16 inch rivets but certainly not 3/32 inch ones as on the original *Pansy*. Behind are the rivets around the splashers which are much smaller so I would suggest you use 3/64 inch ones for these. The platforms should be made in 20swg steel plate and definitely not brass as it does not take paint very well. Nothing looks worse than bits chipped off brass plate. There is no reason for making platforms of brass anyway.

I have shown **photo 219** to show you how the front centre lamp iron is forward of the other two. This is to clear the lift up lid over the front draw hook. The photograph also shows the spare lamp on its bracket. **Photograph 220** is of course the same loco 5757 and it shows the notch out of said lid to miss the lamp iron. Note also the old type steps on the tank front. **Photograph 221** is one of mine and shows



The notch in the lid misses the lamp iron.

Joint in the platform, extending across the cab.

»

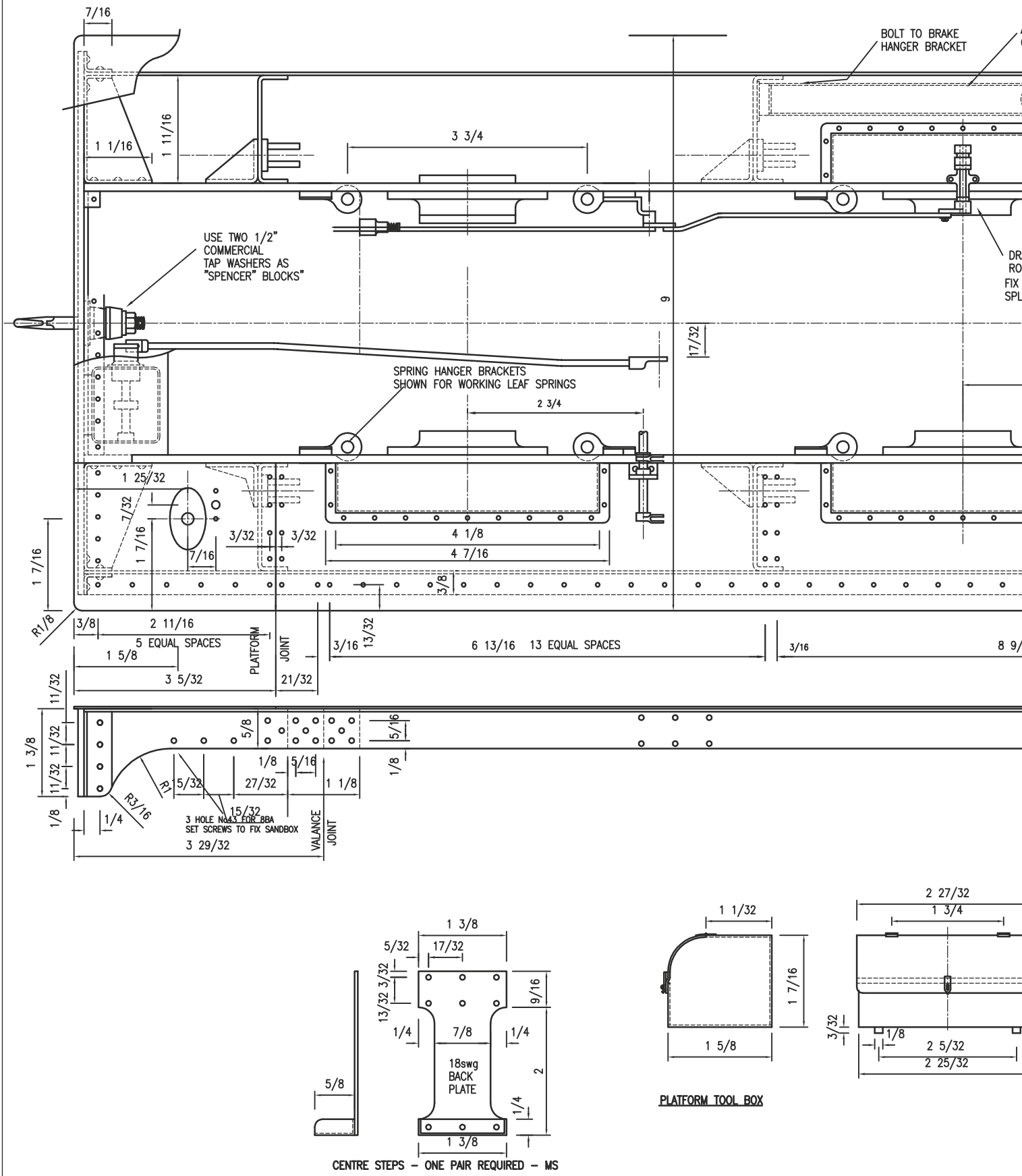
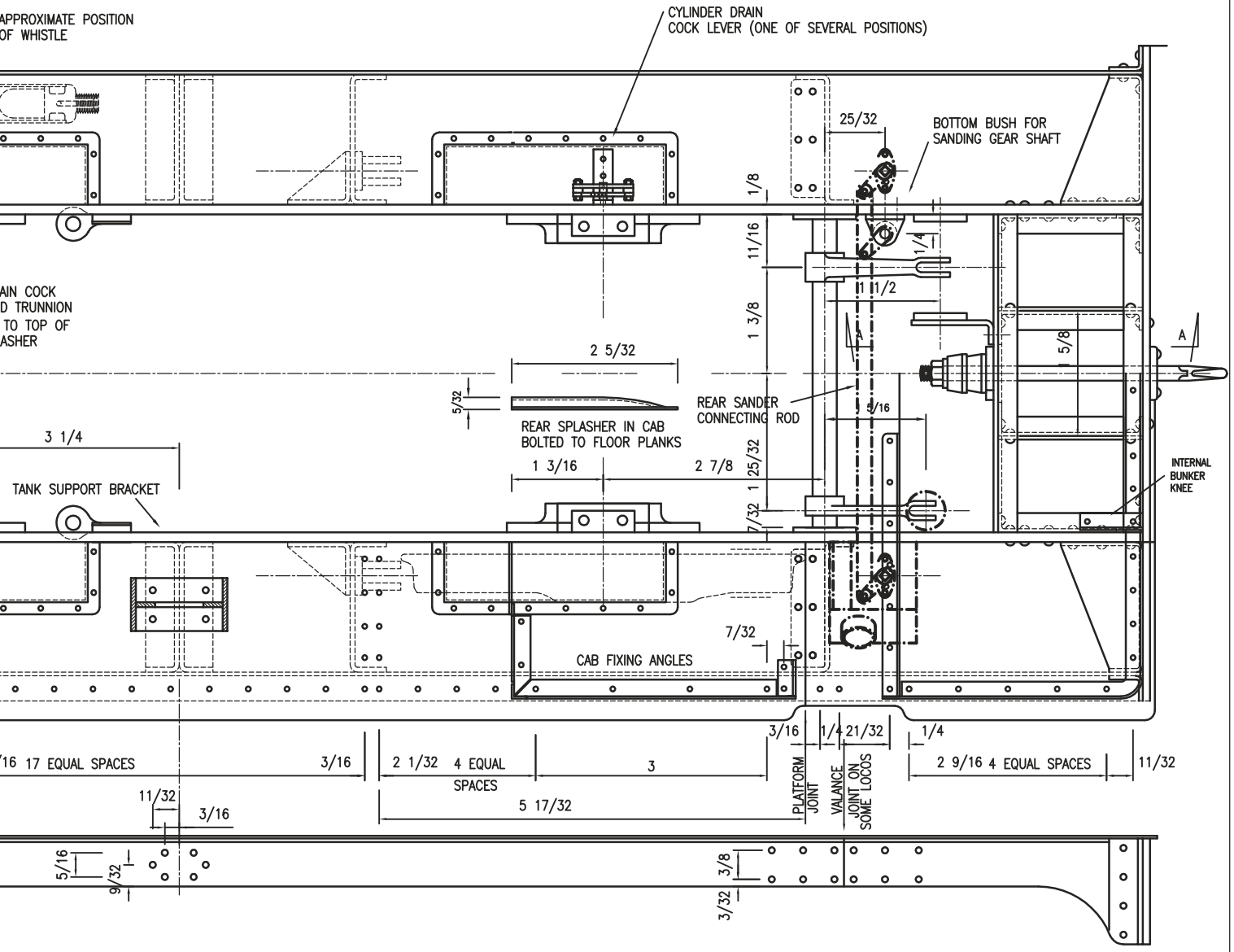
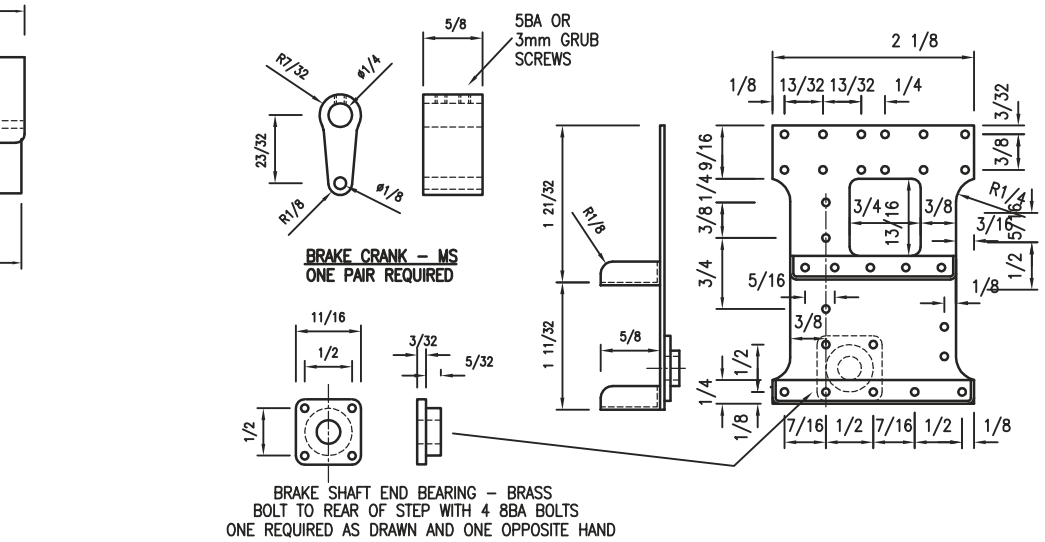

7/16
BOLT TO BRAKE HANGER BRACKET
1 1/16
1 11/16
3 3/4
USE TWO 1/2" COMMERCIAL TAP WASHERS AS "SPENCER" BLOCKS
SPRING HANGER BRACKETS SHOWN FOR WORKING LEAF SPRINGS
2 3/4
17/32
1 25/32
7/32
1 7/16
7/16
3/32
3/32
4 1/8
4 7/16
1 7/16
3/8
R1/8
3/8
2 11/16
5 EQUAL SPACES
1 5/8
3 5/32
PLATFORM JOINT
21/32
3/16
13/32
6 13/16 13 EQUAL SPACES
3/16
1 3/8
11/32
11/32
11/32
5/8
5/16
1/8
1/8
5/16
R1
5/32
27/32
1 1/8
R3/16
15/32
1/8
1/4
3 HOLE No43 FOR 8BA SET SCREWS TO FIX SANDBOX
3 29/32
VALANCE JOINT
1 3/8
5/32
17/32
13/32 3/32
9/16
1/4
7/8
1/4
18swg BACK PLATE
2
5/8
1/4
1 3/8
CENTRE STEPS – ONE PAIR REQUIRED – MS
1 1/32
1 7/16
1 5/8
PLATFORM TOOL BOX
2 27/32
1 3/4
3/32
1/8
2 5/32
2 25/32

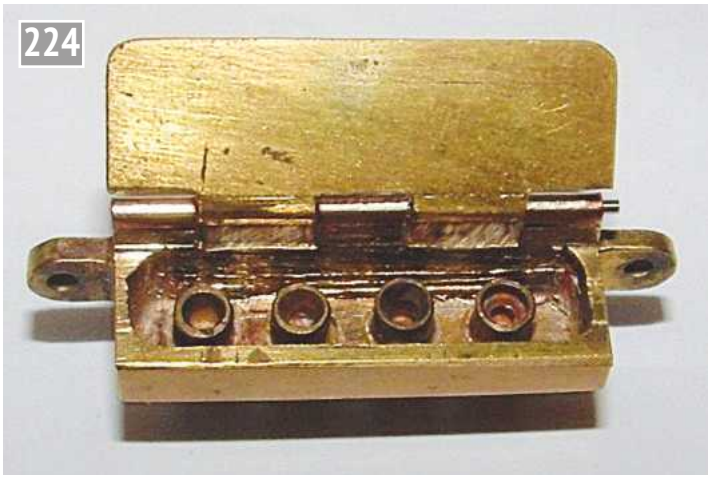
Fig 52


APPROXIMATE POSITION
OF WHISTLE
CYLINDER DRAIN
COCK LEVER (ONE OF SEVERAL POSITIONS)
AIN COCK
D TRUNNION
TO TOP OF
ASHER
25/32
BOTTOM BUSH FOR
SANDING GEAR SHAFT
1/8
11/16
1/4
1 1/2
1 3/8
5/8
A
2 5/32
5/32
REAR SPLASHER IN CAB
BOLTED TO FLOOR PLANKS
REAR SANDER
CONNECTING ROD
5/16
3 1/4
1 3/16
2 7/8
1 25/32
7/32
INTERNAL
BUNKER
KNEE
TANK SUPPORT BRACKET
7/32
CAB FIXING ANGLES
3/16
1/4
21/32
1/4
/16 17 EQUAL SPACES
3/16
2 1/32 4 EQUAL
SPACES
3
2 9/16 4 EQUAL SPACES
11/32
PLATFORM
JOINT
VALANCE
JOINT ON
SOME LOCOS
11/32
3/16
5 17/32
5/16
9/32
3/8
3/32


5/8
5BA OR
3mm GRUB
SCREWS
R1/32
ø1/4
23/32
ø1/8
R1/8
BRAKE CRANK – MS
ONE PAIR REQUIRED
2 1/8
1/8
13/32 13/32
1/4
3/32
3/8
9/16
1/4
3/8
3/4
3/4 16
3/8
R1/4
3/16
5/16
1/2
5/16
1/8
3/8
1/2
1/4
1/8
7/16
1/2
7/16
1/2
1/8
1 21/32
R1/8
1 11/32
5/8
11/16
1/2
3/32
5/32
1/2
BRAKE SHAFT END BEARING – BRASS
BOLT TO REAR OF STEP WITH 4 8BA BOLTS
ONE REQUIRED AS DRAWN AND ONE OPPOSITE HAND

Another joint, towards the front of the locomotive.

Splasher and oil box.



Inside of the oil box.

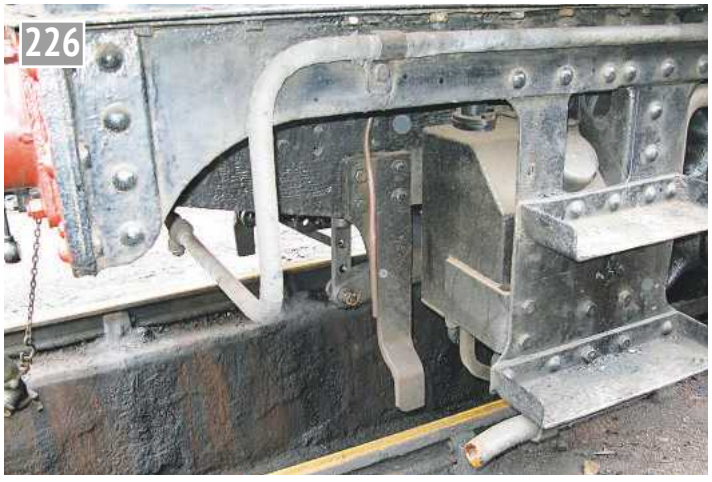
Splasher and maker's plate.

the platform joint in the cab step recess and this goes the full width of the locomotive. This is on 7754. The next photograph (**photo 222**) is the joint 3 5/32 inches from the front of the engine. The joint is over the brake hanger bracket. This is on L99 and the photograph was kindly sent to me by Guy Harding. I have detailed the joints in the plates so now you have four nice little pairs of rows of rivets to finish the job off properly.

Starting at the front end there are a pair of 7/16 x 21/64 inch angles which hold the valance on. They are riveted on to the valances but are bolted on to the buffer beams. These are included in the laser cut set. It also has two sets of five rivets, domino like, on the face of the valance and two more to the front which also go into the first brake hanger bracket. I would, however, use some 10BA bolts on the plate to the rear with the heads filled in so that they can easily be removed. Similarly, with the rivets on the face of the valance. The rivets on the face of the valance look more like 5/64 inch ones to me so that is what I have allowed for. They are certainly quite a lot larger than the ones on top of the platform.

The next photo (**photo 223**) shows the middle splasher on the left-hand side of the engine with a stay across holding a quadruple oil box. The box is a lost wax casting for which I made the pattern, and they are available now from one of our usual suppliers. **Photograph 224** shows the inside of this oil box. I have made the splashers so that the laser cut kit can be assembled by rolling the curved piece and then hopefully it should just slot into the front plate. Silver solder that up, clean the tabs up and then you can fit the bottom flange. There is a good photograph (**photo 225**) of the front splasher which I took at Llangollen and it also shows the works plate and the photo also shows a lot of the hand rails laid on the platform which are also worth noting.

Making the steps is another good little job to do and the rear step needs a little bit of thinking about. Again, I have provided the step plates in the laser cut set but quite frankly they do not take a lot of making. The back plates should be made from 18swg steel plate - some nice bright



Rear steps.

A view of the rear steps bracket.

Middle step.

CR4 steel plate will do for these. You should be able to buy this from any sheet metal workshop for next to nothing as it generally goes in the scrap bin.

The step treads are made from 20swg but I could not make my mind up whether they had dimples in or not. I have looked at numerous photographs of panniers and they didn't help much. **Photograph 226** was not a lot of help either as I am sure that these step treads were without any dimples. Anyway, I would cut them out in one piece and then they can be just folded up and riveted on with what looks like 5/64 inch rivets.

At the back of the rear steps is a bearing for the ends of the brake shaft, which has four 8BA bolts, so you need to miss out these four rivets. There is also a bracket which supports the rear sand box. There are also a couple of rivets which support the front of the sand box. **Photograph 227** might show these brackets a little better.

Photograph 228 shows the middle (or front) steps but there is a set of four holes in the middle which have no bolts in them. Don't worry about these as they were something to do with the brake gear trip cock for working on the London Underground but the mainstream panniers did not have those. When I first looked at Guy's photographs, I had to scratch my head a little as I could not work out what they were for. Just to the right on Guy's photograph is a pipe which goes through the valance and this is where the vacuum pipe emerges and, in our case, from the ejector inside the smokebox.

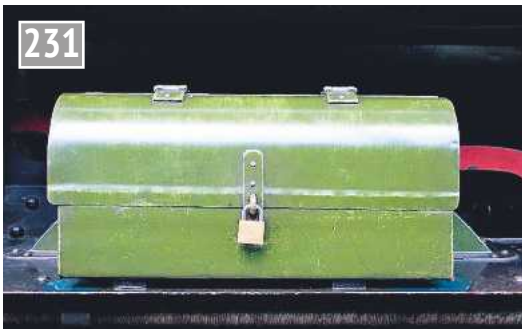
I have also included a photograph of the lamp irons for the spare lamps, which sit on the left hand platform to carry the spare lamps, and the position of these varies. **Photograph 229** shows the lamp irons in one position and photos 219 and 220 show them in another. The other thing is that 3702 and 6725 have the lamp irons in the forward position but there are only two of them on each of these engines. Not part of this instalment but I just thought it was appropriate to show you **photo 230** which shows the vacuum pipe tucked neatly beneath the side valance on the left-hand side of the engine and on the right-hand side in a similar position is the steam heat piping.

Now, I also thought that it would be a nice idea to make a couple of toolboxes to adorn your platforms. These can be made from pieces of 20swg CR4 steel plate, one for the box and another for the lid. I would use a piercing saw to cut them out so that there will be no distortion to the plate. If you cut them out to the shape shown on my drawing you should be able to fold them up by the use of a good pair of very square edged folding bars and a piece of ½ inch plate machined to a size of the inside of the box. They have a couple of hinges on them and a lock. I hope you can make the lock but I am afraid I do not have a drawing of such a thing! Anyway, I can at least supply a photograph or two (**photos 231** and **232**).

●To be continued.

Irons for spare lamps.

Vacuum pipe neatly tucked away under the platform.



Tool box – front view.

Tool box – side view.

Edwardian elegance on the Isle of Wight Steam Railway; Calbourne *with vintage carriages. Note the Westinghouse brake pump.*

An Engineer's Day Out

The Isle of Wight Steam Railway

Roger Backhouse marks the railway's fifty years in preservation.

Thousands of rail enthusiasts visited the Isle of Wight during the early 1960s to see a working railway museum. All carriages were over forty years old and the newest locomotive was built in 1896! This all ended in 1966 with line closures and the cessation of steam operation.

In 1971 volunteers set up the Isle of Wight Steam Railway (IOWSR) to preserve this history using stock with island links offering an authentic heritage experience. The whole line of 10.5 miles is an accredited museum.

At the time of writing 12 April 2021 is the probable reopening day but this is subject to Covid-19 restrictions.

History

This attractive island once had 55 miles of railway run by four companies. The Isle of Wight Central line from Cowes to Newport was first, later extending to Smallbrook Junction, with the Isle of Wight Railway running from Ryde to Ventnor East. More branches and extensions followed.

The Southern takeover in 1923 saw the oldest equipment replaced by more ex-mainland rolling stock. Following other closures, lines to Newport and Cowes and Shanklin to Ventnor East shut in 1965. Ryde to Shanklin, now known as the Island Line, carried heavy summer traffic. As larger vehicles could not fit through Ryde tunnel it was electrified using ex London Underground 1920s stock (**photo 2**). This was later withdrawn and replaced by 1938 vehicles but a 438 unit is preserved at Haven Street. An Island Line major upgrade is underway with ex

This 1920s ex-London Underground stock took over from steam in 1966. Now replaced with a system overhaul and 'new' stock due in early 2021. (Photo, Roger Backhouse 1978.)

Terrier Freshwater *was built by the London, Brighton and South Coast Railway and worked on the island until 1949. After operating the Hayling Island branch it became a pub sign! Currently being overhauled ready for the 150th Anniversary of the class in 2022.*

Ivatt 2-6-2 tank engines and Class 2 2-6-0 locomotive. (Now on the East Somerset Railway.)

Metropolitan line trains to be introduced.

Preservation

Haven Street Station is the IOWSR base on the former Ryde to Newport line. From Smallbrook Junction, where it connects with Ryde to Shanklin electrics, the line runs through pleasant countryside to Ashey and descends to Haven Street, terminating at the beautifully restored Wootton Edwardian station.

Locomotives

W24 *Calbourne* is the only surviving 1960s era locomotive. Built in 1891 for the London and South Western Railway to an Adams O2 design, this class came to the island in 1923, little altered except for larger bunkers and the fitting of Westinghouse brakes used by the Isle of Wight Railway. *Calbourne* was recently restored with a striking malachite green livery and is now back in service.

The London, Brighton and South Coast Railway A1X class (Terriers) were built from 1876 to William Stroudley's design. No. 8 *Freshwater* worked on the island until 1949, then on the Hayling Island branch. It is being overhauled ready for the 150th Anniversary of the class in 2022 (**photo 3**).

W11 *Newport* won a Gold Medal at the 1878 Paris Exhibition. The Isle of Wight Central Railway bought it in 1902. After a 1946 return to the mainland and later sale to Sir Billy Butlin, it was restored to regular island service in 2014.

Treasured veterans are supplemented by more modern locomotives. Two Ivatt Class 2 2-6-2 tanks were rescued from Barry and donated by the Ivatt Trust. This class never worked on the island but there were plans to bring over similar engines with cut down cabs. These two operate many services (**photo 4**).

Austerity 0-6-0 saddle tanks are a mainstay of many preserved railways. WD198 *Royal Engineer* was donated by the National Army Museum (**photo 5**) along with WD192 *Waggoner,* due back into traffic in summer 2021.

Hunslet saddle tank *Juno* built in 1958 worked at ironstone quarries and is currently on loan to *Locomotion* at Shildon. Saddle tank 0-4-0 *Invincible* was built by Hawthorne Leslie in 1915 and worked at Woolwich Arsenal before moving to the Royal Aircraft Establishment railway at Farnborough. It is currently dismantled awaiting restoration.

Austerity saddle tank, Waggoner *in the workshops. Railway staff and volunteers have carried out amazing restoration work.*

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A Barclay 0-6-0 tank engine *Ajax* is displayed in the Train Story Discovery Centre. Built in 1918 it was sent to Persia, later working at an oil refinery and an iron works, then in quarries. Moved to the island in 2005 it has been out of service since 2014.

Three Diesel shunters are now important relics. The oldest is a Barclay shunter built in 1945, donated by the National Army Museum. There are British Railways 03 and 05 class shunters with the latter brought over to help electrification trains in the 1960s.

The railway has ambitions to obtain the 1879 built Robert Stephenson 0-6-0 tank engine *Haydock*, currently at Penrhyn Castle museum. It is a sister locomotive to one used to build the Freshwater line.

Calbourne *with a fine set of LBSCR era compartment stock. These carriages were already veterans when they came to the island in the 1920s. Manager Steven Backhouse says the line has 'the finest heritage coaching stock in the country'.*

Carriages and wagons

This railway has magnificently restored original coaches surviving from the London, Brighton and South Coast Railway, London, Chatham and Dover Railway and the South Eastern and Chatham Railway. The newest wagon was built at Ashford to a Southern Railway design in 1949. This is a true museum collection.

Among highlights are six SECR and LBSCR bogie coaches running until 1966 and now used on most trains (**photo 6**). They are compartment stock (good for 'social distancing') and superbly restored.

Railway volunteers acquired several four wheel coaches and rebuilt them to a very high standard, including an original Isle of Wight Railway coach built by the Oldbury Carriage and Wagon Company in 1864 (**photo 6**), rescued from use as a garden chalet. (For details of restoration see *Steam Railway* No. 506 May 29th - June 6th 2020 pp72-79.) LCDR six wheelers were converted by the Southern Railway to a four wheeled push-pull set. After use as bungalows they are back on the island and in frequent use. A former LCDR four compartment six wheeled coach was built for boat trains in 1866. It became a four wheeler under the Southern and became a garden chalet before rescue and restoration. Much maintenance and overhauling are done in the line's own workshop with dedicated professional staff and volunteers.

Once several hundred wagons ran on the island, mostly transporting coal from Medina Wharf (**photo 8**). All preserved wagons have a Wight connection and include a goods van, a 10 ton 'road' van (used for parcels and smaller goods), bolster wagons and an LBSCR cattle wagon, one of six from the island and donated by the National Railway Museum. There are two brake vans including the unusual 15ton 'pillbox' type designed for low axle load lines transferred to the island for electrification engineers' trains.

The railway's six wheel crane was built by the Midland Railway and acquired by the Isle of Wight Central Railway in 1912. Capable of lifting 5 tons it is now in the Train Story exhibition (**photo 9**).

Beautifully restored original coach from the Isle of Wight Central Railway. Built in 1864 this was sold off and used as a garden chalet.

Heritage goods train hauled by a Terrier. Once the island had several hundred goods wagons including cattle trucks.

Ex-Midland Railway 5 ton crane in the Train Story Museum with a tank wagon and vans.

Amenities and events

The Train Story Discovery Centre is excellent and features historic rolling stock, a cafe and shop. Railway plans are to improve the museum facilities for smaller exhibits and provide extra storage for large items. The Edwardian ambience makes this line highly suitable for filming.

Special events include real ale festivals, a 1940s gala and the Isle of Wight Steam Festival currently planned for 4 - 6 June 2021 where *Calbourne* will star. Another Terrier, *Bembridge,* is understood to be visiting. PLEASE NOTE: opening times and events are subject to change in the light of Covid restrictions. Please check before travelling.

Declaration of interest and thanks

This article was written with the help of my nephew, Steven Backhouse, General Manager, IOWSR. Thanks to John Faulkener for use of his excellent photographs – all photographs are his unless otherwise stated. A donation will be made to the IOWSR for their use.

ME

REACHING THE RAILWAY

By public transport:

There are normally good public transport connections and bus services around the island so don't forget your Freedom Pass and Railcard if you have one.

Wightlink catamaran ferry operates from Portsmouth Harbour station to Ryde Pier Head.

Hovercraft operates from Portsmouth to Ryde Esplanade. Island Line train from Pier Head or Esplanade station to Smallbrook Junction, with a cross-platform connection to the IOWSR. Pre-booking from Smallbrook Junction on the IOWSR may be required (via website) .

Wootton station has regular buses (No. 9 every 20 mins from Ryde to Newport), with connections to other ferry terminals at Cowes and Yarmouth. (Pre-booking from Wootton on the IOWSR may be required.)

The island is popular with coach companies with over three hundred tours already booked for 2021. Many coach tours include a trip on the railway.

By car or coach:

Travel to Havenstreet station with a large car and coach park.

NOTE: All services may be affected by Covid 19 restrictions.

Contact:

Isle of Wight Steam Railway, The Railway Station, Havenstreet, Isle of Wight PO33 4DS
W. www.iwsteamrailway.co.uk
Tel. 01983 882204

The railway welcomes volunteers for different roles on the line and in workshops.

Original Ryde pier tramcar now in Hull's Streetscene Transport Museum. (Photo, Roger Backhouse 2017.)

OTHER LOCAL ENGINEERING AND MODEL INTEREST

Ryde has the world's oldest pier dating back to 1814. Another was built in 1864 with a horse drawn tramway, later replaced by a petrol car and trailer now being restored. An earlier car survives in Hull's Streetscene Museum (**photo 10**). The present railway pier was built by the LSWR and LBSCR as a joint line.

Paddle Steamer *Ryde* was built for the Southern Railway by William Denny of Dumbarton in 1937. It operated until 1969, latterly the world's last sea going coal fired paddle steamer. Now beyond repair at Binfield Marina it is likely to be scrapped.

Needles Battery (National Trust) was one of 'Palmerston's Follies' to defend Portsmouth Dockyard. Britain's *Black Arrow* rocket was tested at the nearby High Down Rocket Test site with launch pads a relic of Britain's attempt to enter the space race.
Tel. 01983 754772
W. www.nationaltrust.org.uk/the-needles-old-battery-and-new-battery

Calbourne Water Mill still grinds corn. Exhibits include old farm equipment, a portable steam engine and an unusual small producer gas plant.
Tel 01983 531227.
W. www.calbourne watermill.co.uk

Bembridge has the island's only working windmill, run by the National Trust.
Tel. 01983 873945
W. www.nationaltrust.org.uk

For lovers of model villages, Godshill has one of the finest in Britain.
Tel. 01983 840270
W. www.modelvillage godshill.co.uk

Across the Solent

Portsmouth has Eastney Pumping engines (opening restricted) and branches of the National Museum of the Royal Navy with *HMS Warrior* and monitor *HMS M33*.

Gosport has the Submarine Museum with *HMS Alliance* and the Museum of Naval Firepower.
W. www.nmrn.org.uk

National Artillery Park at Fort Nelson, Portchester.
Tel. 01329 233734
W. www.royalarmouries.org.uk

Saunders Roe of Cowes built flying boats. SolentSky museum in Southampton has examples plus a Shorts Sandringham flying boat.
Tel. 023 8063 5830
W. www.solentsky.org

Saunders Roe also developed the first practical hovercraft design by Sir Christopher Cockerell. The Hovercraft Museum is at Lee-on Solent, Gosport.
Tel. 02392 552090
W. www.hovercraft-museum.org

The Southsea to Ryde hovercraft still operates daily and may be the worlds last regular service.
W. www.hovertravel.co.uk

Britannia Class 7 Locomotive in 5 Inch Gauge
A Modelworks Rebuild

PART 7 - PLATFORMS AND PLATEWORK

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

Continued from p.399
M.E. 4660, 12 March 2021

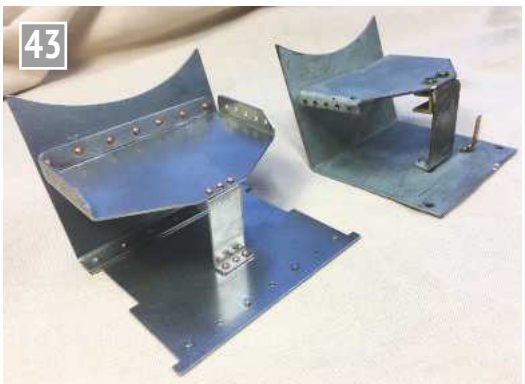
Oliver Cromwell *on the GCR, Loughborough in 2014.*

The front and side platforms

I said in a previous article that the 'detail bug' had bitten and so most of the Modelworks platework has gone in the bin. **Photograph 43** shows an example of the difference between what was found on the engine and the replacement item I made (excuse the photo perspective that makes them look different sizes). I used Doug Hewson's drawings (that are a joy to look at) to get rivet detail right but the Perrier version is very similar for this platework.

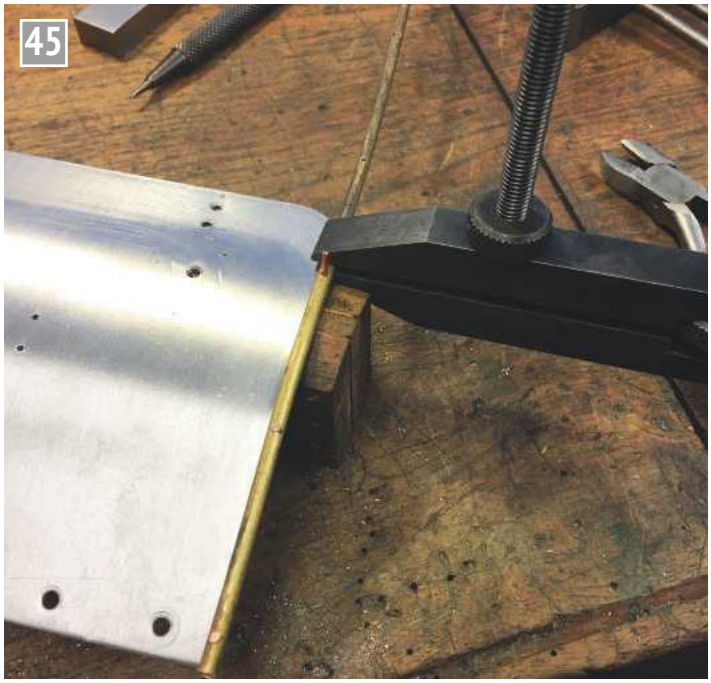
Note that these are 'plates' and are made from steel. If they were made from wood they would be called 'boards'. This is why I have a dislike for the term 'running boards' to describe the platforms set at the side of the boiler. Running plates - yes - and we agree that the driver stands on the footplate, not the footboard. Unfortunately, a few famous model designers and some who worked in railway sheds, have used the term running boards so I cannot fairly criticize a newer generation of writers for using vintage sports car terminology. I wonder if the phrase comes from very early in railway manufacture when the primitive locomotives had wooden boards hung along the side of the boiler for the driver to run forward and attend to the valve gear. The incorrect term perhaps stuck through following generations.

I have made the side platforms in sections, bolted together to make a full length, just like the prototype; it adds detail (**photo 44**). It was tricky to get the right position



Modelworks front centre platform (right) and newly built replacement.

Locomotive side platforms (running plates) fitted close to the boiler cleading.



Smoke deflectors fixed to front platforms.

Riveting ⅛ inch brass beading to the smoke deflectors. Soft solder was added to seal all gaps.

to align with both the cab and buffer beam and still sit horizontal and close to the boiler. It just takes a lot of time with a spirit level, several rules and constantly looking at drawings to try and work out where things should be. I have made it difficult for myself by trying to fuse together three different designs: the Perrier (N. Spink) original drawings, the Modelworks actual result (in which the boiler is slightly larger) and Hewson's design that is true to the prototype. It is the latter that I am trying to achieve, but fitting it over too big a boiler. I'll just say this, as a warning to anyone else who wants to fit a Hewson design cab on a Modelworks boiler – you will have a bit of redesigning to do.

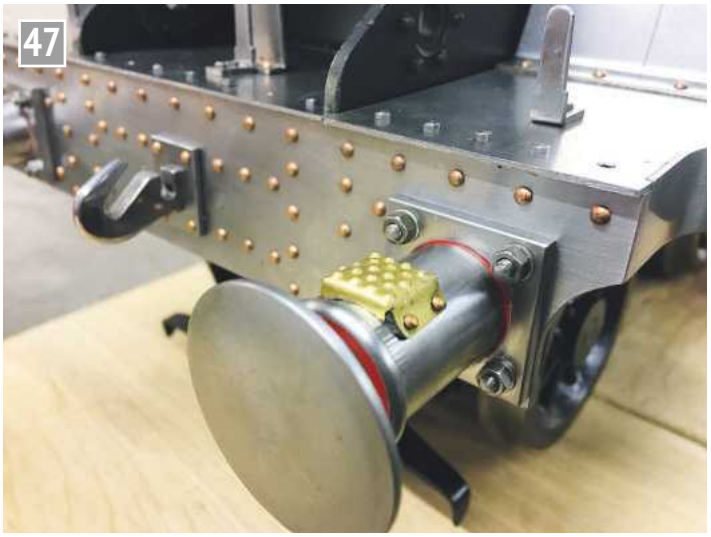
Standard wire gauge

The side platforms were cut out from CR4 sheet steel and in a thicker gauge than others might use. I will go through the subject of the choice of thickness of sheet metal here as I think this topic can be confusing for a newcomer. I personally find the old Standard Wire Gauge (SWG) cumbersome to use and therefore choose to label my stock in millimetre thickness; it gives a better sense of the material to be selected and is convenient to find with a digital calliper in hand. The SWG system originated in Birmingham, England and eventually became standardised in 1855. The sequence of number sizes relates to the number of times a piece of wire was 'drawn' to reduce its diameter – the bigger the number the thinner it is. There is, apparently, a constant ratio of 0.89 (approximately) between each successive gauge number. The gauge system for sheet metal however was based on its weight per unit area and although the numbers were deliberately very similar to those for wire it was a different standard as far as the manufacturers were concerned. The gauge system is historic and not a part of newer international standards, but we will find it in older articles relating to model engineering and it still appears as a wall thickness printed on some new copper tubing, so it is helpful to understand what is going on. You can find conversion tables in engineering reference books and on the Internet.

On the firebox cleading I used 0.5mm (25swg) brass for the side sheets and 0.8mm (21swg) brass for the top – 0.8mm is thicker than you would normally see specified for a model but I chose it to give strength for a cab support. For the long side platforms Perrier specified 0.9mm (20swg) but Modelworks chose to use 1.5mm (16swg). Hewson specifies 1/32 inch, or 0.8mm (21swg) as being nearer to prototype. If you do chose an over-thick gauge the additional weight is not a problem (it can be a help with traction) and the job is stronger but sharp bends look poor and visible ends will look over-thick. I chose 1.2mm (18swg) for the main sections and 1.4mm (17swg) for the joint pieces that lie under each main section join. I wanted the finished job to be stronger. I say all this only to illustrate that you either use a drawing specification or copy what was there before - or think about the job to do and select what you think will work best.

Smoke deflectors

The smoke deflectors are the original Modelworks parts. They are over-thick at 1.7mm (approximately 16swg or 1/16 inch) but that helps make the whole assembly rigid. The excess thickness does not show because the edges carry a brass half-beading (**photo 45**). I welded up all the old (large metric) screw holes and standardised assembly with 10BA setscrews with 12BA heads and 1/16 inch rivets. The deflectors now look much better with the beading (which



Buffers affixed with nuts on studs and new step detail.

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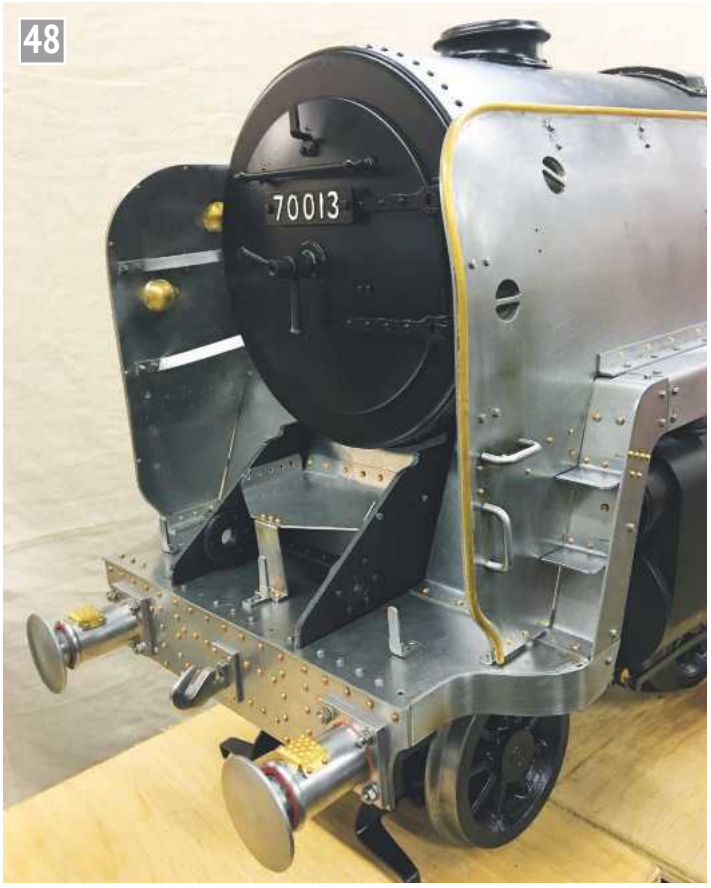
Modelworks did not fit), all the long smokebox straps and a strip of exterior angle to affix to the front platforms. It is a relatively quick job to attach or take the whole assembly off the engine (**photo 46**).

Keeping the Modelworks smoke deflectors meant I already had the two handholds on each side. These are prototypical for around half of the Britannia group that was running post-1955, including 70000 *Britannia* and 70013 *Oliver Cromwell* that we can see in preservation today. All Britannias were originally made with a hand rail that ran along the top and the front of the smoke deflector. An accident in 1955 led to a thought that the hand rail may have obscured forward visibility and so all the London Midland Region engines had the two hand grips fitted in place of the hand rail and Western Region engines had a set of six, square hand holds in place of the hand rail. A group of engines, however, including 70004 *William Shakespeare* and 70014 *Iron Duke*, retained the hand rails until withdrawn.

Buffer beam

I made a new buffer beam with 1/16 inch rivet detail but this item is largely decorative as the buffer studs and drawhook pass through a substantial, heavy stretcher behind. The drawhook affixes behind this stretcher with a rubber washer, thick steel washer, nut and lockpin. When another locomotive attaches to your front and you have a heavy train behind, it is best not to have the buffer beam ripped off! Also, if the engine derails, the buffer stocks are about the only substantial item that you can grab at the front, so it is best to ensure that they can cope with a 50kg force!

The drawhook (reprofiled) and buffers are the Modelworks parts but the buffer stocks now have step detail added and are attached with nuts on studs as per full size practice, rather than bolts (**photo 47**). These studs and nuts are overlarge at 6BA (for the reason given above!) but the size does not look unreasonable. There should be an additional small oval plate secured with two studs behind the step. In full size this secures a pin to stop the buffer head rotating. At this point the thought occurred to me: will the detailing notion ever stop (**photo 48**)?



Front end of the engine looking more like the real thing.

●To be continued.

NEXT ISSUE

Astronomical Clock
Adrian Garner describes his astronomical clock, which shows both mean time and sidereal time.

Nene Valley
John Arrowsmith takes a trip to Wansford station near Peterborough to find a 5 inch gauge miniature railway being built alongside the full-sized Nene Valley line.

Information
Graham Astbury looks at several ways to track down that piece of elusive but vital information.

Cylinders
Graham Langer follows the design of the cylinders for the A1 Steam Locomotive Trust's new-build Gresley Class P2 *Prince of Wales*.

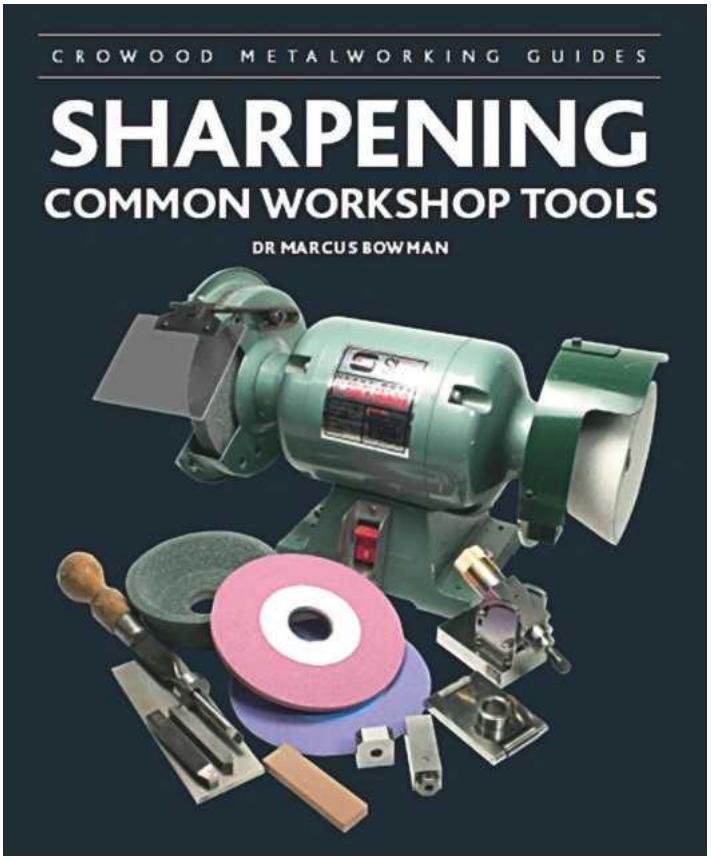
Content may be subject to change.

ON SALE 23 APRIL 2021

Book Review

Sharpening Common Workshop Tools

Dr Marcus Bowman



This book deals with the problem of sharpening many of the common tools that are in use today. The use of high quality photographs enables the message to be put over in a way that is both understandable and succinct; so, for example the various abrasives and grades of material are put into context, which must help any novice, as well as making a useful reference for the more experienced model engineer. The importance of getting the various tool angles right is brought home, along with illustrations of the way these can be achieved.

The reader is encouraged to study and to take seriously the various angles of a tool to get the best results. Many different types of tool are mentioned, encouraging everyone to treat them appropriately, in accordance with their designed purpose. Good quality photographs in colour make the text very readable. The different tool types are considered individually, which exposes the reasons for choosing a particular type of sharpening method or device.

First consideration is given to some of the most common tools which can be regarded as domestic; knives and scissors, often disregarded and lost within the catering department, have pride of place and are taken seriously, alongside screwdrivers, the implication being that they are important items but easily taken for granted or forgotten. Each of these items has its own description for bringing it back to new condition. Scissors are a case in point, since they require serious attention to their cutting edge angles to keep them in first class condition.

A wide range of different abrasives is described, the accent being on grinding wheels, with different formulations for cutting the different types of metal. Alongside the various types of abrasive is the grit size of the wheel material. The wheel specification is therefore shown to include a number of variables with which the beginner can soon become acquainted. The reader is led gently along the correct path which leads to the specification required for understanding the definition of almost any grinding device.

The subject of drill sharpening is aired, with fair coverage of several of the published methods, whetting the appetite for the reader to take the plunge and try one of them. Here again pictures rather than drawings make the point that precision operations are called for. Some of the available proprietary items of kit are illustrated. So the topic of drills takes up a significant part of the second half of the book.

What comes as a welcome topic is that of punches, which again are broadly covered. What might otherwise have been skated over or largely left to the imagination is a subject that stimulates the mind. A punch is not just a centre-punch but one of a wide family of tools found in the workshop for all sorts of purposes.

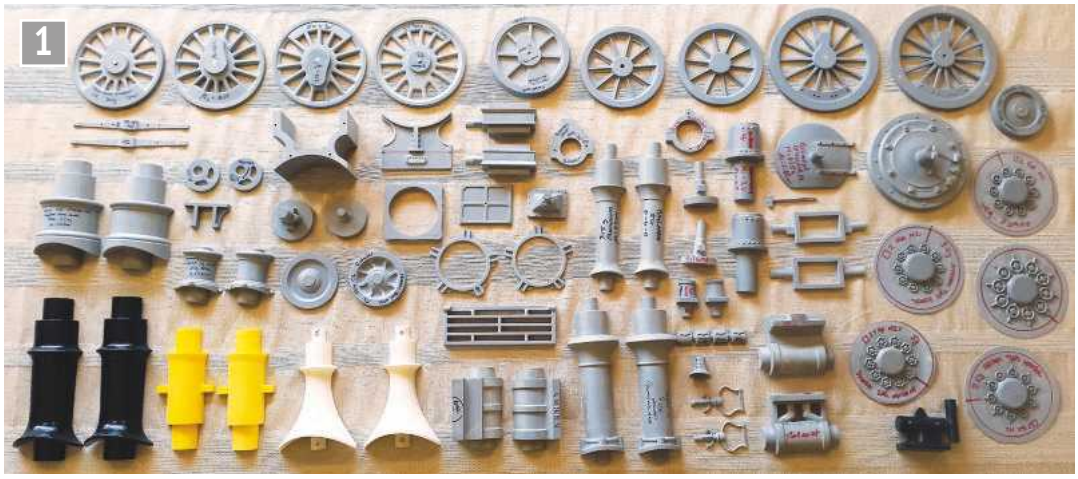
The common devices for sharpening drills are well covered for the clear instruction of the newcomer in particular and the seasoned model engineer will find the book a useful tome of reference with good quality photographs avoiding any possible misunderstanding of the contents.

Bound between board covers the book is well presented and should be regarded as one for the workshop where it makes a useful reference source for many of the sharp tools found not only there but also about the house. In the final section marked *further information* there is an informative list of common abrasives to tickle the memory.

D.A.G. Brown

Published by The Crowood Press, 2020
ISBN 978-1-785006678
£16.99. 144pp, hardback

Luker shows how a 3D printer may be used to make patterns for casting.



3D printed patterns.

PART 1

Backyard Foundry Techniques

Pattern Making Using 3D Printing

Introduction

If you take a 3D printed pattern to a jobbing foundry or a backyard foundry enthusiast he is likely to chase you away. That old foundryman, I can assure you, has tried to mould printed patterns and has no time for young whippersnappers with their evil technology desecrating the art of patternmaking.

But in fairness he has a point; anyone who has tried to mould a 3D printed pattern will know it is very difficult to get it out of the sand, no matter how much rapping you do. Being a soul that was born in a technology era with a love for the manufacturing techniques used to make the great iron horses of old, I came up with ways to marry the past with the present. The methods described are focused primarily on using 3D printing in foundry applications, either for conventional sand casting methods or, if you're unable, or not particularly interested in setting up a home foundry, pattern making for investment casting. To a certain degree the article continues from the previous series *Backyard Foundry Techniques* (M.E.4626, *22* November 2019).

The 3D printer

The fundamentals of 3D printing are actually very simple: a nozzle extrudes a very fine line of plastic onto a flat bed, one on top of the other, building a 3D image of a part that has been modelled on a computer. The finer the line and layers and the more accurate this line is laid down the better the final 3D print.

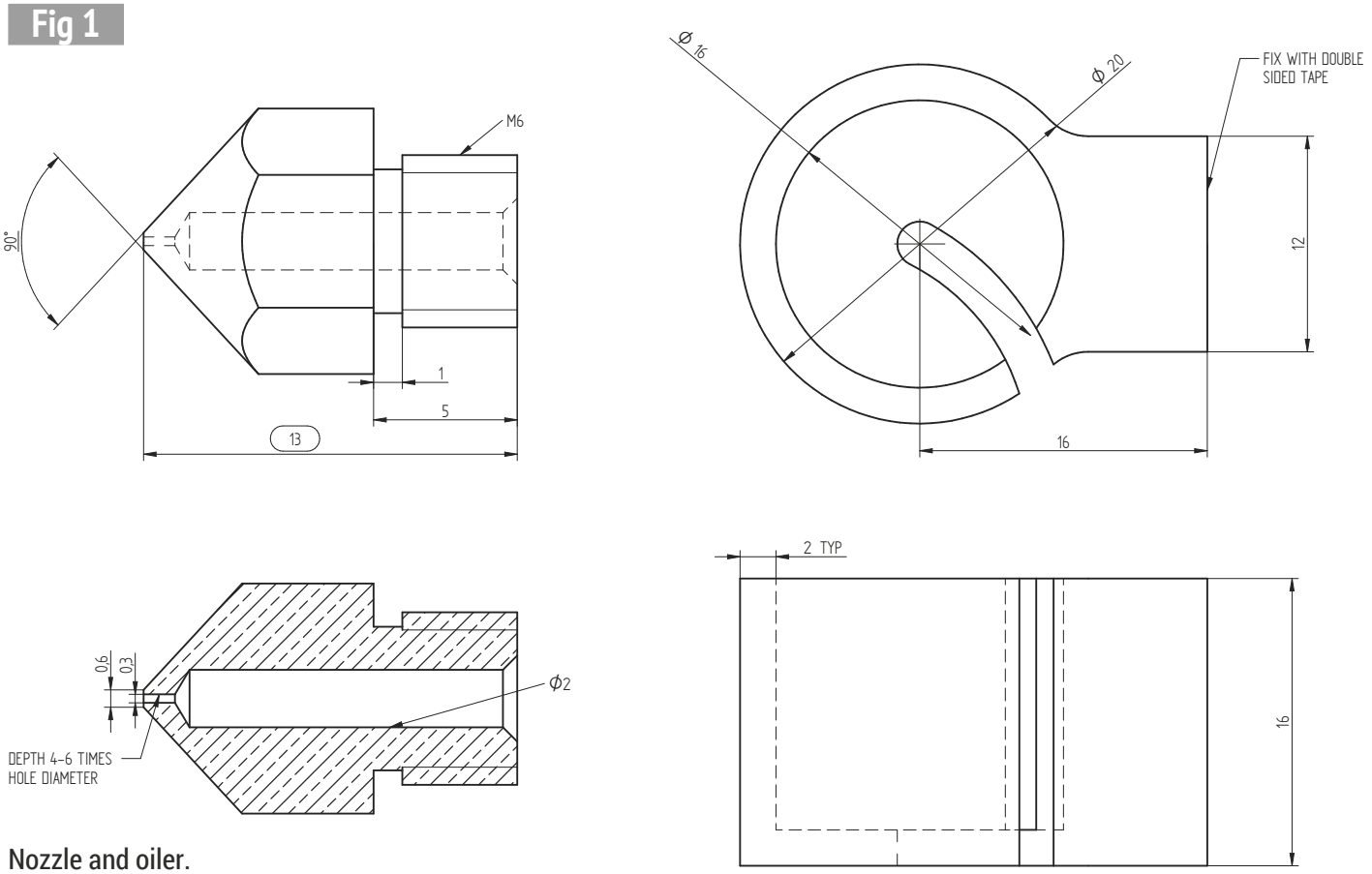
I am by no means an expert on 3D printers but you don't need a fancy printer to make casting patterns so I can at least point you in the right direction.

Firstly, the printer needs to have an on-board USB or card slot and should not need to have the computer connected to the printer for the duration of the print. Some of these prints take hours and the buffering between the computer and the printer can cause print issues. Most printers will print PLA but I have found this is not the best material for sand patterns. If you're planning on making patterns for sand casting then a printer that can print ABS is preferential.

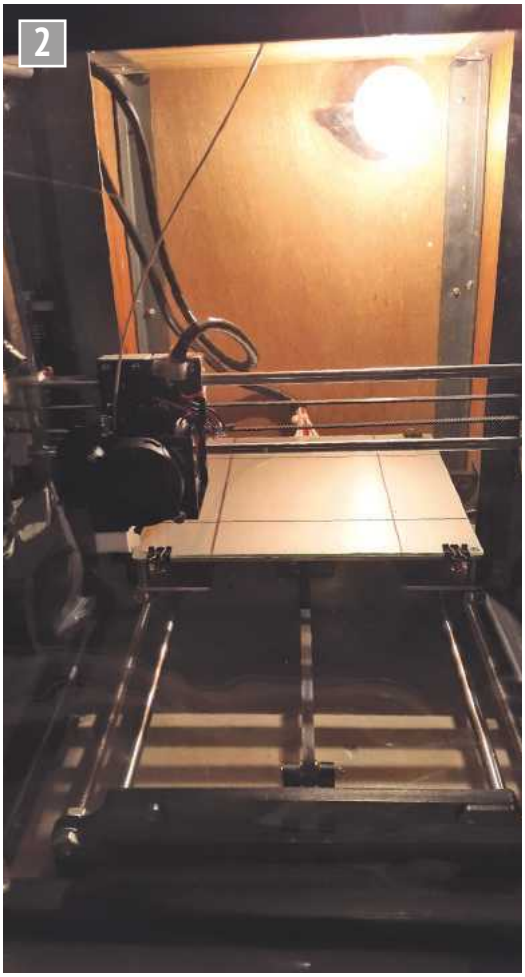
For ABS a heated bed is needed and an enclosure, but don't worry about the enclosure; that can be circumvented easily enough. The bed size will obviously limit the size of pattern that can be printed. When I was doing my research I found the 220mm square heated bed was a common size and the printers were relatively inexpensive. The next size up resulted in a rather large price jump that I thought was not worth it. I've managed to print most of my patterns on this bed and the odd pattern that didn't fit was easy enough to break up and join after printing.

In the end I bought the cheapest printer I could find knowing that it required some assembly and redesign. Out of the box, and assembled according to the instructions, it would never have printed patterns of sufficient quality for casting and in all likelihood it would have only lasted one roll of filament. I make a point of reading the reviews of a product and in this case all complaints related to the frame and structure with no complaints about the electronics, the heated bed or

Fig 1



Nozzle and oiler.



3D printer inside enclosure for ABS.

3D printer enclosure for ABS.

the servo motors which are the key elements and expensive to fix later.

Set-up and worthwhile modifications to a printer

Some modifications to an entry level printer are mandatory for successful ABS printing, while others just make life a little easier in the long run. For colder areas the addition of an enclosure will drastically improve any ABS prints and most of the more expensive printers come standard with some sort of enclosure. If you're lazy you can fit the printer in a cupboard and provided there is no draught it will work just fine. If, on the other hand, the winters are cold it is unlikely the heated bed will get to the required temperature; then a smaller, more controlled enclosure around the print area is worthwhile with a filament type bulb (60W) to keep the enclosure warm (**photo 2**). Electronics don't like heat, so they need to be kept outside the 'hot zone'. With

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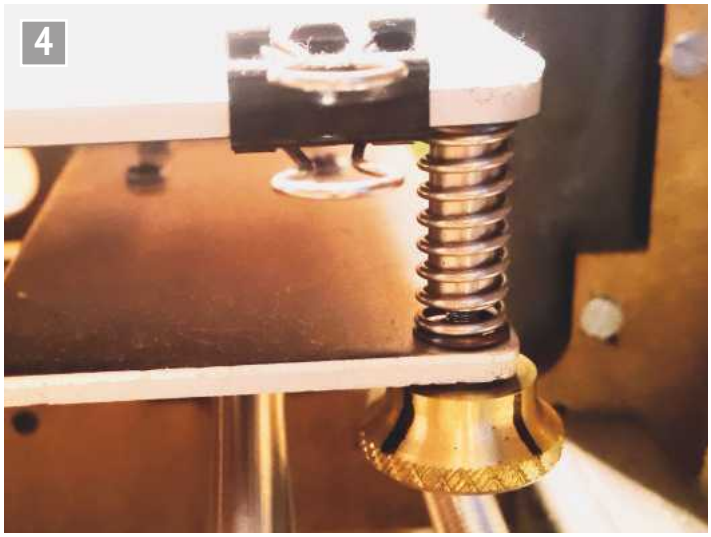
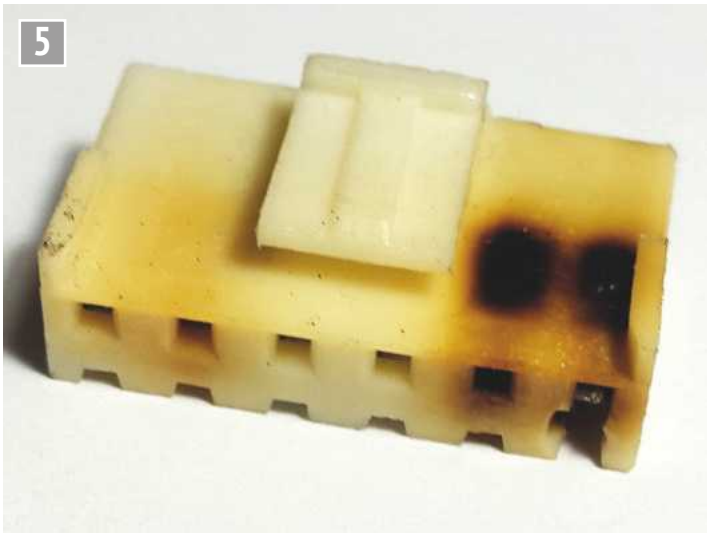
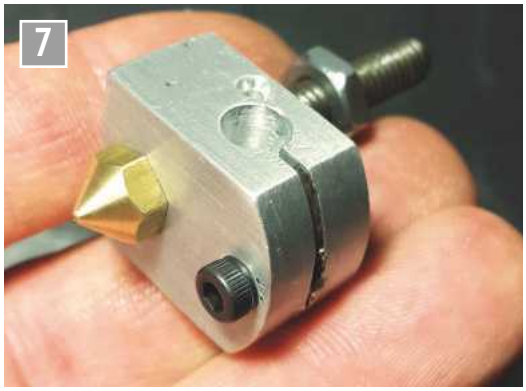


Heated bed adjustment screw.

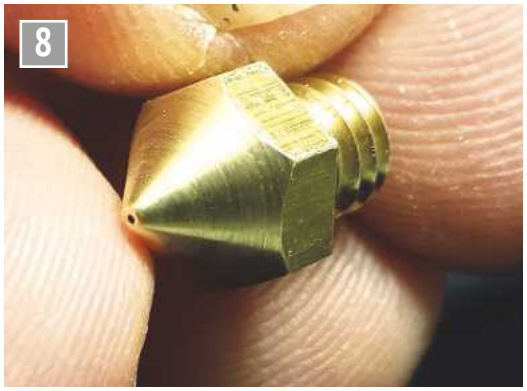


The heated bed plug failed early on.

Failed PET tube and new stainless feeding tube.



Assembled 3D printer head.



Completed printer nozzle.

my printer the enclosure is on the inside of the frame and all the electronics are fitted to the sides (**photo 3**).

The set-up of the printer largely depends on the specific product bought; even if the English is poor the pictures are very helpful. Allow some time to go through the assembly and set-up slowly and carefully. The distance between the print nozzle and printing surface is incredibly important. Too close and the nozzle will choke causing the stepper motor to jump or the feed gear to strip the printer filament; too far and the ejected plastic won't stick to the bed, making a bird's nest around the nozzle. I cover the heated bed with a pane of framing glass which is 2mm thick, held at the corners with crocodile clamps. The glass adds strength to the somewhat flimsy aluminium heated bed and is far more even making the initial bed setup far simpler; it's also easier to clean. Make sure the glass does not hang over the bed or it will crack when heated. To set up the distance between the nozzle and bed a piece of standard paper should slide between the nozzle and bed with only the slightest resistance felt (like setting automotive valves, this is done cold).

The wing-nuts that came with my printer were useless and were very quickly changed out for properly machined adjustment knobs that can easily be accessed by the tip of the finger from the side of the bed (**photo 4**). The bed was also marked under the glass ⅓ of the way from the edge, with the four cross hairs the set points for the nozzle gap adjustment.

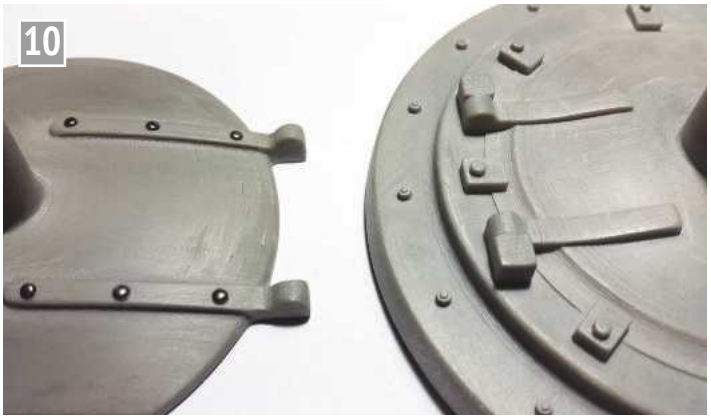
One of the biggest complaints with heated beds is the electric plug at the back. With all the movement of the bed the connections work themselves loose creating a poor electrical connection resulting in overheating and oxidization, and the bed fails (**photo 5**). One of the first things I did was cut the plug off and solder the wires directly to the bed. This was then covered with heat shrink. The cables leading to the bed need to move freely with no undue forces that will cause issues.

Most of the entry level printers feed the filament through a PTFE tube. This only lasts about a roll before the prints become progressively poorer and needs to be replaced. I wanted a more consistent quality of print so I machined a solid stainless tube by drilling through some stainless steel threaded bar and polishing the inside with Brasso and string. It took a few minutes to make and has proved to be well worth it (**photo 6**).

While I was at it I redesigned the heating block and made another smaller and more accurate nozzle (**photo 7**). The printer came standard with a 0.4mm nozzle but I was never particularly happy with the quality. When feeding the filament through the (heated) nozzle using the stepper motor it tended to curl up and make a mess. With the home-made nozzle the plastic leaves the nozzle straight without curling. I did actually order a replacement nozzle but it was liberated by someone that clearly needed a printing nozzle desperately. No matter; this is not a difficult component to make and I had the material (**photo 8**).

There is only one trick to make a nozzle like this; the tiny hole needs to be drilled first otherwise you're likely to break the drill when it punches through the inner hole. Start by facing the front and centre drill with the smallest centre drill you have (I used 1mm). The tiny hole can then be drilled by feeding by hand from the tailstock (**photo 9**). I mount my

Drilling the 0.3mm nozzle hole.



Detail added to the pattern after printing and as printed.

pin drill chuck in a collet that is not completely tightened. With the lathe turning as fast as it can, the small drill is lightly advanced and retracted to the desired depth. The centre drill hole is then faced off. You're likely to close the small hole with the facing operation but don't stress; the hole can be opened up by hand from the other side right at the end. The rest of the operations are simple lathe turning operations so I won't bore you any further!

Because I changed the extruder tube and made the smaller nozzle I added an oiler and filament cleaner to prevent blockages and improve feeding. The oiler was 3D printed and fixed to the front of the printer in line with the filament role using double sided tape. A piece of sponge with a slit to the centre fits in the oiler with the slit turned opposite the oiler slot. A single drop of used lathe oil (because you shouldn't throw away treasures like used oil) every 20 hours or so seems to do the job.

The 3D modelling software and printing software

For the most part CAD companies offer 3D modelling software free and you can write the required STL files for the 3D printing program from the free version. It's only when you want to produce manufacturing drawings you need to mortgage your home for the licence and then your car each year after that for them moving around icons and changing the front-end. And for the record, tech support shouldn't include fixing what adolescent teens broke by hacking into the background code! But I digress…

Learning to use the 3D modelling software can be painful and the best advice I can give here is to do the tutorials and keep the models simple. Try to use as few commands as possible, for example, when modelling a wheel you would only draw one spoke and pattern the rest. For symmetrical components the mirror command comes in handy. If you make a habit of modelling like this you're less likely to miss mistakes and the mistakes you do make tend to jump out at you because they have been duplicated. I once had one of my students in my design lecture tell me that was the best piece of advice I gave them; doesn't say much about the rest of my course!

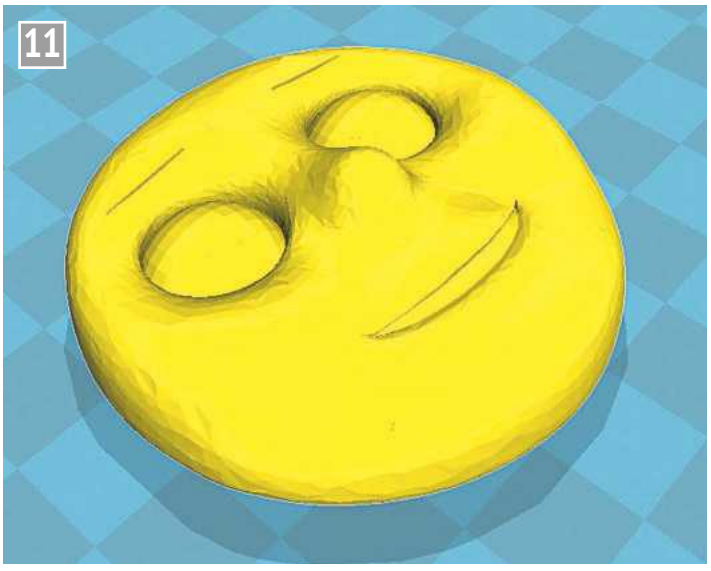
When doing the detailing remember there is a limit to what can be printed and moulded. As a rule I tend not to add detail that is smaller than the nozzle diameter or layer height. Sometimes it's just not worth modelling a specific feature; a good example is a bolt or rivet on a non-flat surface (like the rivets on the smokebox door hinges). Trying to get a reference plane to draw the geometry takes ages and it's unlikely it will pattern properly. Detail like this can be added to the pattern after it has been printed (**photo 10**).

The single most important thing to remember when designing 3D printed patterns is to add a draft angle of 3 - 5 degrees. For double sided patterns the location holes and hold points to remove the pattern from the sand need to be included in the model (a little more on this later), as well as any additional material for machined surfaces; I typically add 1mm for the machined surfaces. All corners need to be broken by a radius otherwise the printing is likely to result in a sharp edge that will need to be sanded later. All concave corners also need a radius but this is more to prevent hot tears or corner draws. If all corners around the circumference of a print are rounded by at least twice the printer nozzle diameter it helps improve the print quality by preventing the printer head from making a sharp directional change. You really do want the head to print in a smooth uniform speed for excellent prints.

Luckily the actual printing software is open source (for the most part) and is free. The STL file which is the printing program input is a mesh-based file, which just means it breaks up the geometry into discrete points. When writing the STL file you need to check that the tolerance is set as low as your computer can handle - at least 0.01 times the smallest feature you want to print. If the tolerance is set too high the printer will miss features and you'll notice the geometry in the printing program looks like a faceted geometry and not smooth (**photo 11**).

Finally, for PLA or ABS a shrinkage factor of 2% needs to be added to the model, over and above the metal casting shrinkage allowance. With a heated bed this can be drastically reduced but, as always, this should be checked for the specific set-up in use.

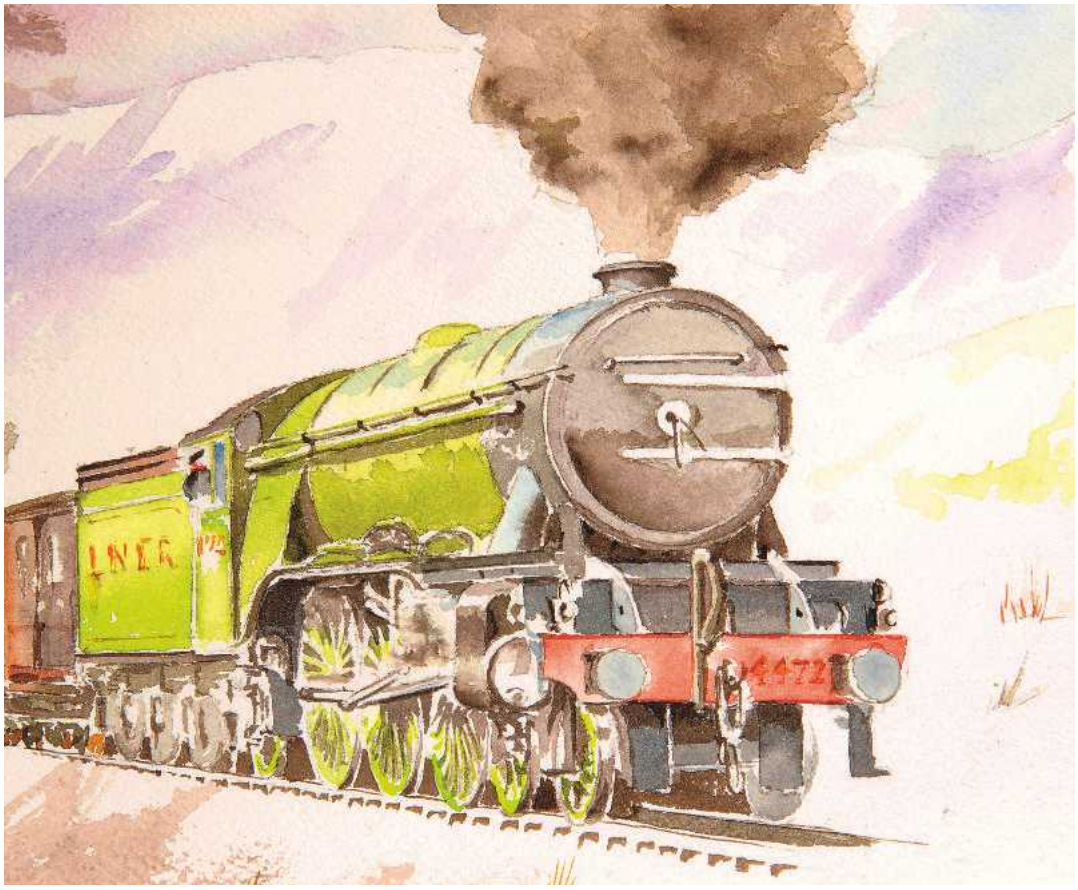
●To be continued.



A faceted geometry - STL tolerance set too high.

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

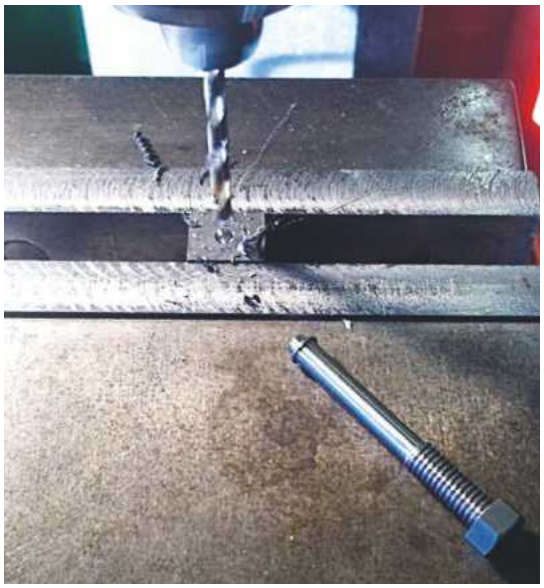
Continued from p.447
M.E. 4661, 26 March 2021



Painting by Diane Carney.

Flying Scotsman in 5 Inch Gauge

PART 8 - TENDER SUSPENSION



1. Here we see the finished hanger end and also the grip end being drilled with a No.30 hole for the top leaf spring to fit into. This block also had a 3mm hole drilled to a depth of 2mm for the 3.1mm spigot to be drifted into, with the collar acting as a stop to ensure correct overall length for the bracket.

Spring hangers

Ahh.. bless the little beggars - these take a fair bit of work, resulting in sore fingers. You'll probably hear me say this a lot as the build progresses.

Don suggested machining the hangers from ½ x ⅜ inch BMS bar as one piece but I decided to build them in two parts to save on material and time. The hanger end starts life as 3/16 inch bar threaded 2BA for 9/16 inch and then turned down to 5/32 inch for another ⅞ inch. I left a small collar here and then turned a 3.1mm spigot that would be a drift fit into the next part, that being the hanger grip itself.

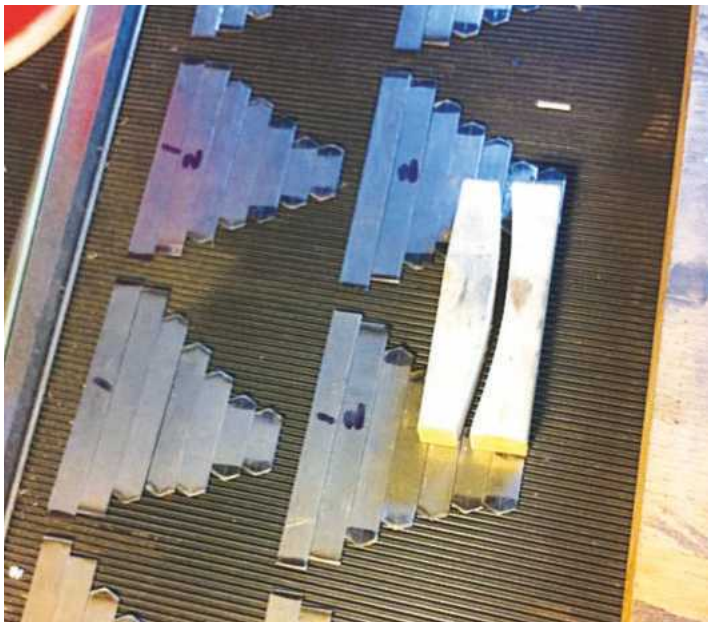
2. With the parts fitted together they were then silver soldered and so two parts became one, ensuring a good fillet was achieved around the collar.

Suspension leaf springs and buckles

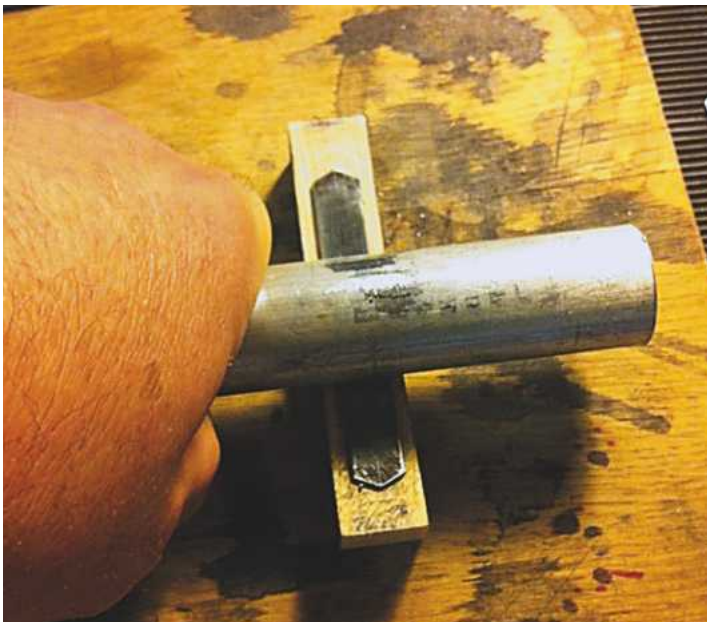
Now comes the fabrication of the leaf springs and I'd like to start by pointing out that the thickness for the springs as given by Don is incorrect. This is something that I didn't discover until after making all of the leaves to the thickness as drawn. Let's just say that I wasn't a happy bunny once I discovered the error. As drawn it's 0.028 inch but it needs to be thicker - I don't have the details to hand but it will be covered when I discuss the locomotive springs.

3. After retrieving the parts from the acid dip (note to self, don't leave things with fine threads in acid for too long as they get eaten away - although the threads are slightly damaged, on doing a small stress test the threads are still capable of doing their job - live and learn) I cut a small template for the gripper and scribed around it for each hanger. I used the small casting of a grip for reference but I just can't recall where it came from after 10 years.

4. Now Don mentions about adding a touch of class by drilling a small hole in the gripper and tapping it 10BA for a bolt to be able to lock up against the top leaf to stop the spring from sliding out, as on the prototype. On checking Mallard's tender it was obvious that 10BA would be too small and that 8BA was the correct size to use so a 1.8mm hole was cross drilled to the No.30 hole drilled previously and then tapped 8BA. The picture shows a finished spring hanger, which involved an awful lot of hard work sawing, filing, sanding and polishing.



5. Seen in the picture are the various steel components cut to size ready for bending to shape. They are, of course, in the annealed state. The piece of wood seen is a piece of 2 x 1 that I have cut to the profile needed for the 1/4 inch camber as drawn - this will be used to shape the steel so that all leaves are correct.



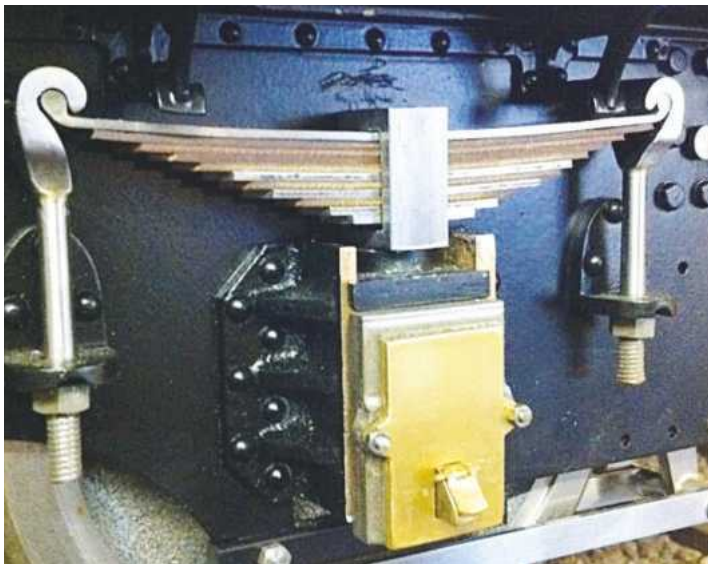
6. This picture shows me using the bottom profile piece, and rubbing a suitable piece of alloy bar across each leaf to form its shape. For the large leaves I used this method (using both hands of course) but for the small ones I used a small hammer to rapidly tap the alloy while moving it along the length of steel.

7. The leaves hardened ready for tempering. I was going to take a picture during the tempering stage but found I was a bit busy. I used the old trick with tallow in a tray to temper the leaves. I coated each leaf first with tallow and then put all of the leaves into a tin tray with some more tallow and lit it. Sounds easy, eh? Yeah right, it takes a fair bit of heat to ignite the tallow although I was forewarned about this. I used a different method for later leaf spring construction, having learned a lot from these, which were my first introduction to making leaf springs.

8. Next job was to braze on the ⅛ inch rods to the top leaf, that are held by the hanger grips. Don suggested using a potato with just enough sticking out for brazing the rods on. I tried this but found it difficult keeping the rods square as naturally the potato moves when heated. So I settled for laying the leaf on a magnetic bar with a piece of steel either side, the leaf was ascribed 1/16 inch from its end and the scribed line was used to keep the leaf square by lining it up with the two pieces of steel. It was easy then to paste the rod and spring and then lay the rod in place. Since the leaf was lying on a magnet everything was held together for brazing. All this metal acted as a heat sink so helped keep the rest cool. By the way, the leaf hadn't been cleaned yet which is why it's black in the middle.

9. A finished set of leaves at last. The picture shows both the steel and tufnol leafs that make up the spring. The others were also completed at this stage except for polishing. The hangers fit nicely and cannot be pulled out - they have to be slipped in so I guess I built the gripper correctly...

10. Spring buckles next. Here a length of 9/16 x ⅜ inch BMS bar has been set in the four-jaw chuck, faced and then one end turned down to 5/16 inch radius over a length of ⅛ inch. After centre drilling, a No.34 drill is used to a depth of 5/16 inch which is later tapped 4BA. Last job here was to part the job at ¾ inch along the bar not including the turned spigot. After all lathe work had been completed the buckles were chain drilled in the machine vice as a first step to the leaf spring slot. Next an end-mill was used to machine out to the scribed lines and then finished with files. Finally, the spigot that fits into the spring plate was tapped 4BA.



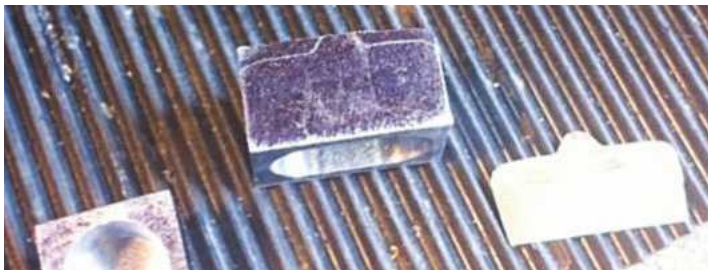
11. Here is an assembled spring. Once the leaves had been fed into the slot and centred they are held in place with the 4BA grub screw. Now at this point, I decided that the springs would be too strong as originally drawn and so I replaced another two steel leaves with tufnol. I didn't at the time know if this was enough until all springs were assembled and the chassis was fully loaded but it looked good. Today, now that the tender is finished, I can report that the springs are working correctly. This was one of the milestone events - there have been a number since - but it was a big step in the tender's construction.

Shock absorbers

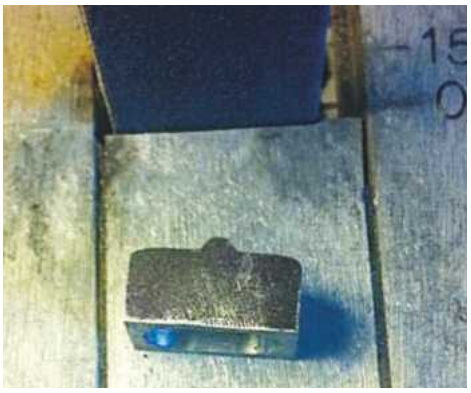
There are in fact 32 shock absorbers on Gresley's Pacific and I guess I should have built them all at once. However, on further reading it's come to light that the locomotive shocks (except the trailing bogie) have a different shape to the tender, basically rectangular rather than oval, so I left those until later. There's also the fact that I just didn't have the energy to do 32 at the same time - my poor fingers are getting very sore.

12. Here are the 16 rectangles cut and machined ready for shaping - size is ¾ x ½ x 13/32 inch BMS. With the shocks marked out (easier to do before drilling the hole) they were drilled in the centre of the ¾ x ½ inch face using a No.10 drill.

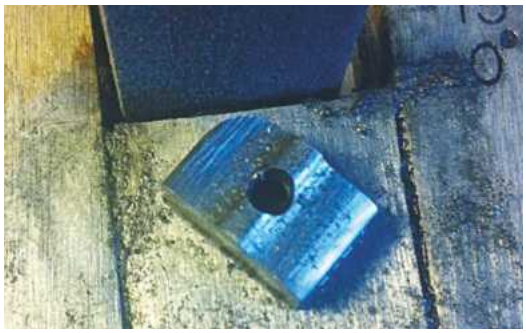
13. Next job was to mill out the recess for the rubber to sit into. This needed a 11/32 inch end mill, which I don't have, so I used a smaller one first (I only had a plain shank of the required size hence why I'm using a drill chuck) and then finished with the correct sized slot drill using a proper Clarkson auto-lock chuck.



14. It was then time to tackle the shape. Here you can see the top template cut from brass sheet and the shock having already had the required shape scribed on to its side. The top has to be done first as I need a flat surface for each stage and wouldn't have had this due to the 5 degree taper on the sides and ends.

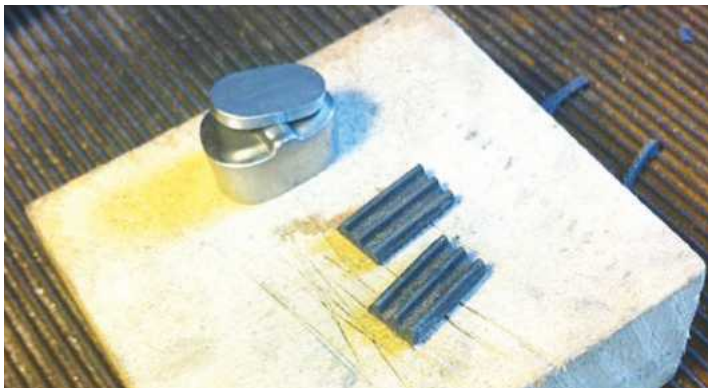


15. The top now roughly shaped using the band sander. This was later finished off using files and sanding pads.



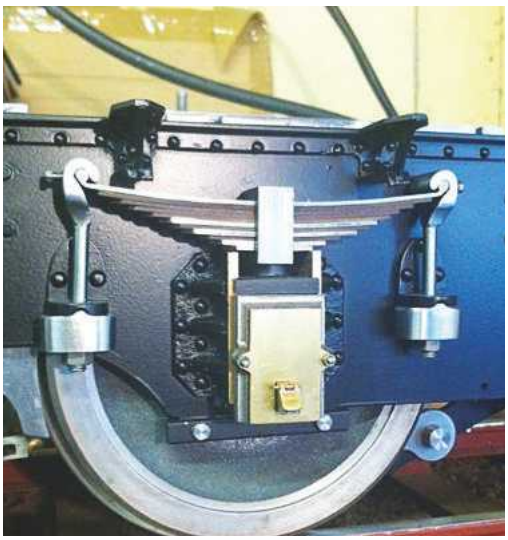
16. As mentioned before, the ends and sides have a 5 degree taper so the sander table is set at the correct angle for this and shaping begins.

17. Since the top isn't flat a template couldn't be used but here the earlier recess comes in handy as it was a simple task to keep checking underneath to ensure the correct shape was being made, as shown here.



18. Next was the retaining plates - again these were shaped using the sander first and filed to finish. Don says to use 3/16 inch rubber sheet or smaller if not available, but all I have is the ribbed matting that I use on the bench, as you can see in this picture, so I cut some of this up and put the ribbed faces together. That is then close to 3/16 inch - worked a treat.

19. Now the rubber and retaining plates needed the No.10 hole drilled for the spring hanger and to me the easiest way of doing this was to assemble the parts first and then drill using the existing hole as a guide for position. The picture shows the shock absorber so far - you can just see the rubber inside the recess.



20. The parts were then assembled and fitted to the chassis, I only fitted them loosely in this picture as everything needed taking apart later for painting.

●To be continued.

CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.

Bill Hall on patrol, PC37999 (photo courtesy of Martin Burgess).

There were a handful of live steam models in the Sheffield Auction Galleries sale of 11 February - a Merlin Locoworks 0-6-2T to 16mm scale went for £440, a Bowman 'O' gauge 4-4-0 £150, a 2½ inch gauge Flying Scotsman £1000, a 3½ inch gauge 2-6-0 £1600 and two Mamod stationary engines for £25 each.

I debated with myself on the advisability of rising from the pit one morning, as it was so very cold outside. I won the debate, since these columns don't write themselves and I have some research to do. Is it not said that to steal from one writer is plagiarism but to steal from many is research? Yes, it is not said. (But it was once...)

During video conferencing meetings with my amateur radio club, some comment was made on the workshop behind me. Whilst I have nothing (on view!) I would be embarrassed to admit owning, I have been investigating suitable 'virtual backgrounds' to give entirely the wrong impression... Rather like the vinyl overlays you can get for the garage door, with images of jet fighters or expensive cars within, these have fish tank videos, expansive countryside or racks of electronics/transmitting towers/serried ranks of house elves making up circuit boards for me to write about, as is your wont.

I was proceeding on the 'Up' line through the station... (photo courtesy of Martin Burgess).

In this issue: technical? What, us?, y plismon, the hot seat, granddaughters, reckless auction bidding, seabed litter and a flower.

Whistlestop, January, from **Hereford Society of Model Engineers** is first out of the trap today. Editor Martin Burgess apologises for the technical nature of some of the contents. Surely, Martin, technical items are what we are about? As the T-shirt says, 'Engineers are people who solve problems you didn't know you had with methods you don't understand'. A steam-up in September was held during a lull in the lockdowns. Amongst those present was new member, Nick Williams, who ran his early Bassett-Lowke locomotive. I don't often hear about such engines still being steamed and run and I am pleased to see it ran faultlessly all afternoon. The proceedings were attended by HM Constabulary, or 'Heddlu', in the shape of Bill Hall's (The Old Bill? - Geoff) Class 37 outline locomotive in 'Jam Sandwich' livery, ensuring everyone kept a civilised distance apart (**photos 1** and **2**). Also, lots of pictures of the activities including the Gauge 1 fraternity. A comment was made that some people

like to use methylated spirits to clean their windows, or glasses. Some like to drink it but here they burn it, hauling trains. Richard Donovan spent lockdown being antisocial, making a G1 LNWR coal tank begun by his father, the wheels having been maturing nicely under his bench for the last 20 years. It will be a single cylinder version but geared down 2:1 to sound right. Richard has also built a Gloucester Railway Carriage & Wagon Co., 1898 style, in Gauge 1 (**photo 3**). Bill Hall tells how F1 driver seats are made. They are individual to each driver, who has to sit in a box over a strong plastic bag, which is then filled with expanding foam until the driver reaches the right height. This much I knew. What I didn't is that the process is exothermic, generating lots of heat. LOTS! The fitting takes several minutes, during which the driver must sit and suffer. Their suits are fireproof… Lastly, John Townsend continues on vacuum brakes for miniature railways.

W. www.hsme.co.uk

Shoulder to Shoulder, February, from **UK Mens Sheds Association**, reports that in addition to providing support for each other, as originally intended, it functions as an aid to comradeship and to combat loneliness in the community. Sheds have been helping the greater community in vaccination centres and food banks, where possible within the lockdowns. As the founder of MS in the UK, Mike Jenn said, "We are adding years to life and life to years". Themselves in need of help, West Wight MS says that their van became unserviceble last year and, with assistance from local businesses, a new van is now on the road. (Should it have been an estate car?* - Geoff)

W. newsletter@ukmsa.org.uk

Inside Motion, February, from **Tyneside Society of Model & Experimental Engineers**, has commemorated the life of chairman, Jim Stephenson, who died in November, by naming the signal box *Stephenson's Halt.* Jim spent much of his time there and a blue plaque has accordingly been installed to record the matter. Michael Mee, in *Trial by Injector*, discusses his tribulations in making injectors. Much reference to D.A.G. Brown's book and accurate work, with some care, and anybody can do it! (It says here.) Martin Ashley joins the Old Men's Link, as the time has arrived when the drive to and from his club is becoming tedious and his locomotive too heavy to manhandle. As a member of the GL5 Society, he took a leaf from their book and took up shunting. He laid several sidings and built wagons, and can now have many a steam-up in the comfort of his own garden. Jim Scott has been investigating sex. Of poplar trees I hasten to add! There are several on the club site and Jim informs us how to differentiate between them.

W. www.tsmee.co.uk

The Prospectus, February, from **Reading Society of Model Engineers,** begins with Terry Wood writing on the genesis of a locomotive, starting with a discarded invalid buggy found in the street. (Another one! That's very similar to how I began my scratch-built Bolide - Geoff) Mike Manners made a John Wilding electric clock,

Richard Donovan's GC&W carriage (photo courtesy of Richard Donovan).

which didn't run too well, but he modified part of it and it is now accurate to 1 minute per month, or 1 in 43,000.
W. www.prospectpark railway.co.uk

Tim Coles sends the latest, action-packed newsletter, *The Cam* for 'Theasbyfurcation' (what, twice? - Geoff) covering events, or not, at **Cambridge & District Model Engineering Society.** Chas Salmon has almost finished (another – see above) Simplex, *Julia Lily*, named after his granddaughter, who, he says, is 10 going on 23 but at least she has got over her pink phase! Co-editor Tim, in referring to my remarks in M.E.4656, asks, "Was Geoff referring to the newsletter's name when calling it 'eccentric' or was he taking a Punt?". "*Au Contraire,* Tim," says Geoff, contrapuntally, "it was about the name".
W. www.cdmes.co.uk

Chingford & District Model Engineers Club, *Newsletter*, tells that two members have unearthed a Pathé News film from 1951 regarding a miniature motor bike and sidecar, built by a member from scratch. This clip, lasting less than 2 minutes, does not appear to have made it to the club archives, and editor, Chris Manning, wonders what else might be 'out there' www.youtube.com/watch?v=iJA7lSx4E2M Elsewhere in the archives, in April 1952 an auction was held in which reckless bidding jumped from 3d. to the giddy heights of 4d. for items in demand, says the then newsletter, *Echo*. A coachload of members visited the Kodak Model Engineering Society Exhibition, followed in their car by Stan and Pop Joyce, 'until the string broke'. More seriously, the continuing paper shortage forced a cut in the number of newsletter pages, and still no paper delivery dates promised. The then editor of *Mechanics* magazine visited and brought with him one Walt Disney, a personal friend. Mr Disney showed great interest in the track, as he is an enthusiast himself, with a private 7¼ inch gauge track 5600 feet long.
W. www.chingford-model-engineering.com

Welling & District Model Engineering Society *Magazine*, Feb/March, greets us with the news that the Sword of Damocles has finally fallen, after holding them in suspense for 12 years, and they have been given notice to quit their current site. A new site has been found, the lease is being scrutinised, the track is being lifted and the station dismantled. In the days before IMLEC, locomotive trials were held at WDMES. The second of these was reported in *Model Engineer* on 11 December 1958. They tested the driver's skill rather than the combination of contributions as now. In the 1990s shunting competitions were held. On one occasion, a slow driving contest, the competitors were so skilled that the examiner had to leave for a previously-booked appointment and the event went on 'til 9pm. In response to the previous article on Plymouth breakwater, Joe Budd, who is a diver, described the underwater finds around that location. Bob Underwood writes on a complete set of *Great Western Echo*, which has been given to the Society, and in the copies from 2001 he read of four schoolboys who were destined for railway preservation fame! They were incensed at BR preserving only 10 GWR locomotives and resolved to save a 46xx, which they did, followed by an Autotrailer, then a King, Castle, Prairie Tank etc, and the rest is history. Could four schoolboys do the same today, with a Class 66, for instance? Frank Stears, originally writing in the *Railway Magazine* of February 1974, describes his life as an engine cleaner at Southall and Old Oak Common sheds between 1923 and 1928.
W. www.wdmes.co.uk

Ryedale Society of Model Engineers' *Newsletter*, January, was sent, as usual, by Walter Rinaldi-Butcher, who fires the

Walter's Easingwold *at Ryedale SME (photo courtesy of Walter Rinaldi-Butcher).*

starting gun with a piece about repainting his Simplex. He took as his inspiration the livery of the Easingwold Railway, since he lives there, and at 2½ miles, it was easily the shortest main line railway in Britain. Running from 1891 to 1957, it made a profit in every year of its existence! Walter retained the number, and the name *Easingwold* (plates by Diane Carney), and after reading Christopher Vine's book on how not to paint your wagon locomotive, here it is (**photo 4**). Sings, "Easingwold, Easingwold, every morning you greet me…"
W. www.rsme.org.uk

The Blower, February, from **Grimsby & Cleethorpes Model Engineering Society**, begins with Geoff Hoad deciding to build a new locomotive. For divers reasons it will be a lookalike General Motors GP40-2, being a switching locomotive with main line capabilities.
W. www.gcmes.com

The Workbench, February, from **Durban Society of Model Engineers,** opens with editor, Errol Koch, requesting contributions with a slightly different variation on a theme – 'If it is worth doing, it is better to do it, even badly, as you will learn how to do it better from your mistakes.'
W. www.dsme.co.za

Paul Ohannesian of **British Columbia Society of Model Engineers,** informs us of certain Natural Laws, such as 'When a body is fully immersed in water, the telephone rings', or, 'The probability of meeting someone you know dramatically increases when you are accompanied by someone you don't want to be seen with.'

Needing to brace the bonnet of my Diesel outline locomotive *Deborah* against parallelogram distortion, I determined to mill an angle in a piece of square brass bar, with one at the base of the left-hand side and the other at the top of the right-hand side, connected by M4 threaded rod. With two such assemblies forward and two at the rear, it is quite rigid. I could swing the mill head over to get the right angle but setting it back at 90 degrees afterwards is a pain, so I used the angle vice instead. **

And finally, from **Chingford & DMEC**, 'My neighbour tells me that his son is dating two girls. One makes fine Yorkshire puddings and the other writes beautiful poetry. He doesn't know whether to marry for batter or verse. His Dad told him to weigh up the prose and scones.'

* Colloquially known as a 'shed' in the 'banger' community…)

** 'Angle vice, angle vice…' (Sorry!)

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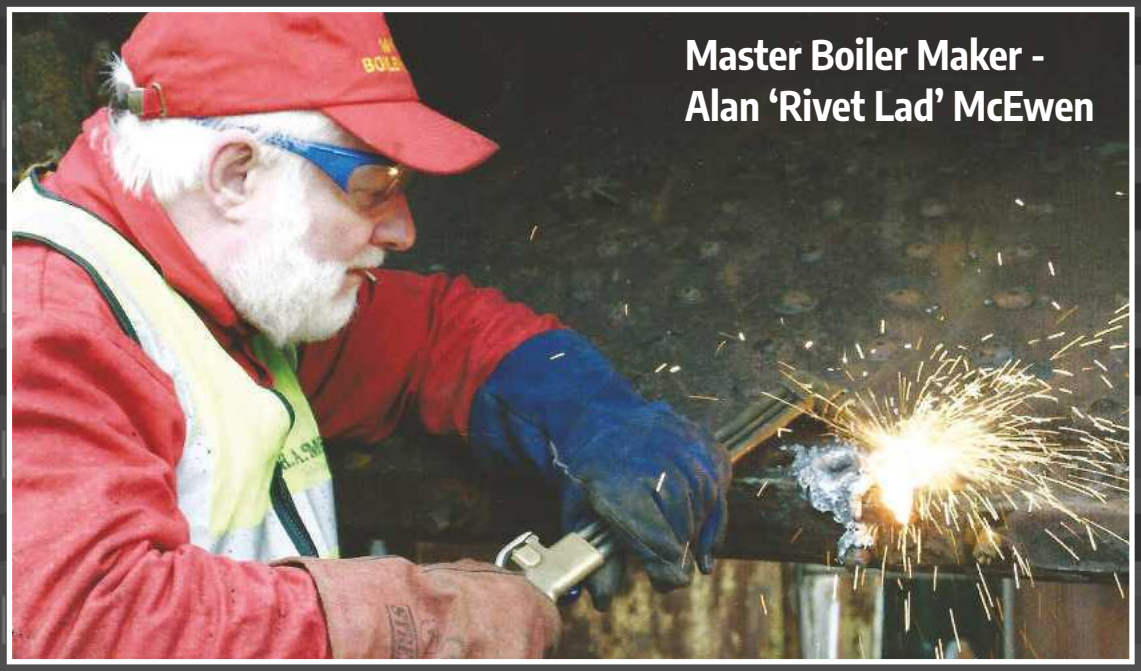
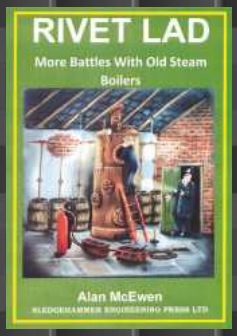
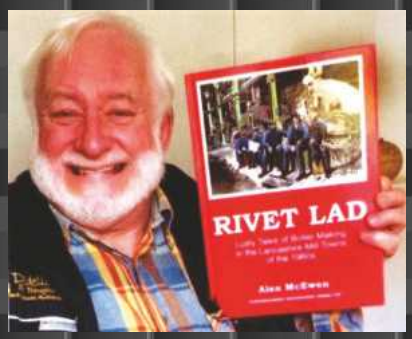


Master Boiler Maker -
Alan 'Rivet Lad' McEwen





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