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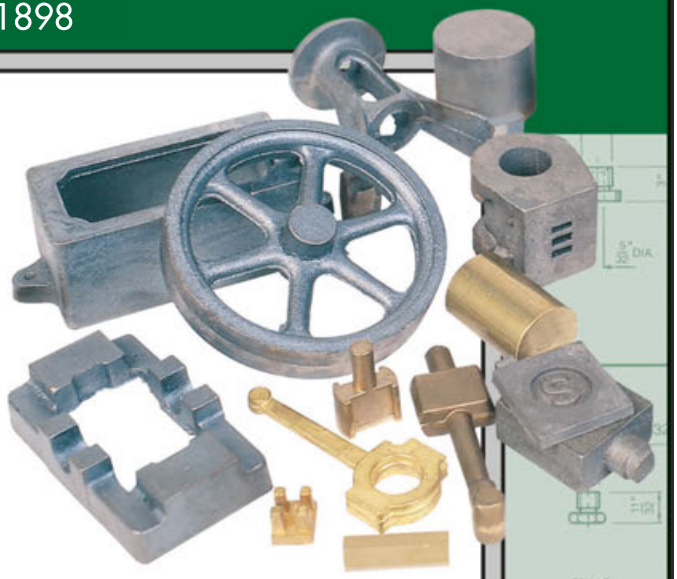

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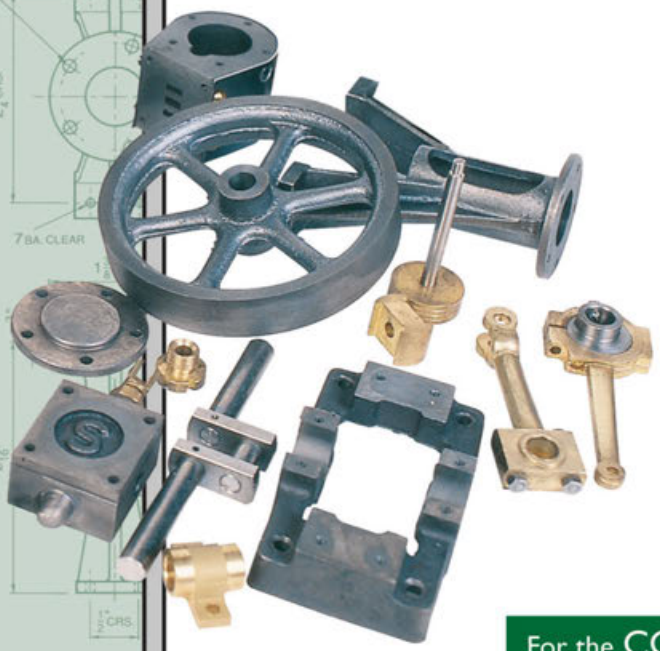

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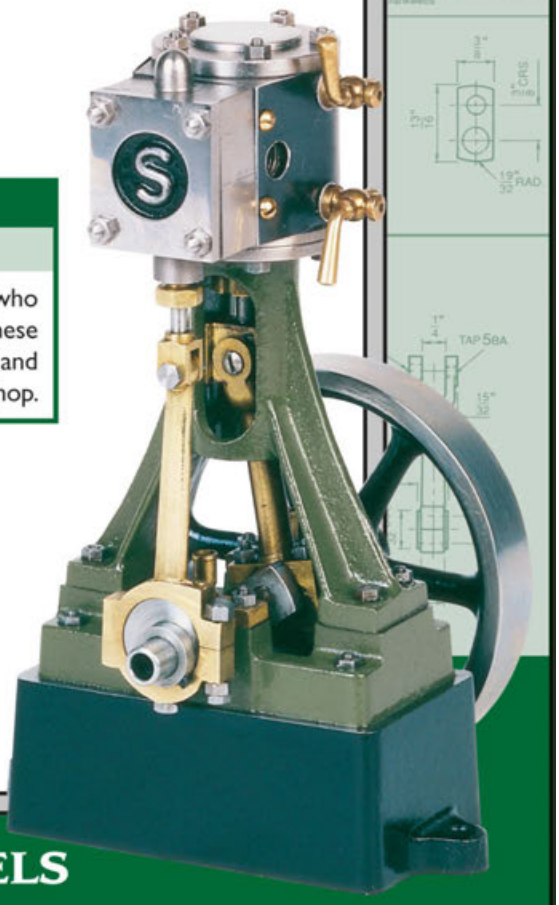

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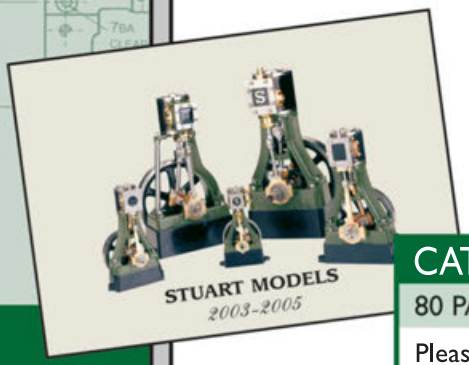

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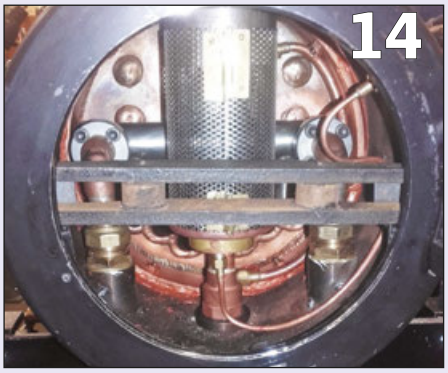
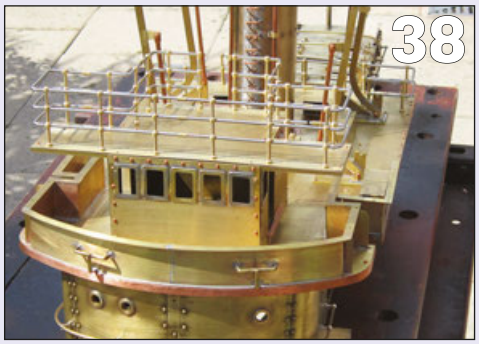
ENGINEERING in Miniature





FRONT COVER

Martin Johnson's impressive 7-inch scale Fowler steam lorry, the build of which we ahve been serialising as progress is made, has reached a milestone point with the boiler installed, as Martin describes this month.

Photo: Martin Johnson

EDITORIAL

The challenge of social distancing in miniature

Photo: Tim Abbott

Welcome to the July edition of EIM as we continue to navigate our way through the virus pandemic, and I again start by hoping that all our readers and your families have stayed safe during the outbreak.

We feel able to return to a normal editorial this month without the large panel reminding you of the various stay-at-home ways of obtaining your EIM – by the time you read these words 'non-essential' shops should be reopening in England at least, including newsagents who no doubt will welcome the return of customers seeking EIM! But the reopening is not country-wide – in Wales, where EIM Towers is located, there are indications that the Government is considering more relaxation of the stay-at-home rules but as I write we have no firm date yet. So if you still want to receive your issues at home you can obtain a printed version at www.world-of-railways.co.uk/Store/Latest-Issue/engineering-in-miniature. For digital versions turn to page 46.

We are delighted to present another varied issue for you this month, and I'd especially like to thank readers who responded to my request for more workshop features as we've had a good selection in – to the extent that I'd now like to see more features on readers' engines! Rail, road or stationary if you've produced something of interest why not write it up for the enjoyment of your fellow modellers?

A regular feature still missing from our pages is the Club Diary. As thoughts turn to a return to something of a new normal, the top phrase is of course 'social distancing'. When not editing this magazine the full-size heritage railway world occupies a lot of my time, and finding effective ways of restarting train services while still keeping visitors apart from each other is occupying the management of every line at present. On the narrow gauge it's harder, and of course on miniature lines operated by many a model engineering club it's a huge ask.

The clubs will want to start public running as soon as possible as these operations provide vital revenue, and they'll want to restart their meetings to bring members back together again, but they will also want to ensure the safety of all taking part. We are confident they will meet the challenge – maybe we will be able to present a much more upbeat picture next month?

Andrew Charman – Editor

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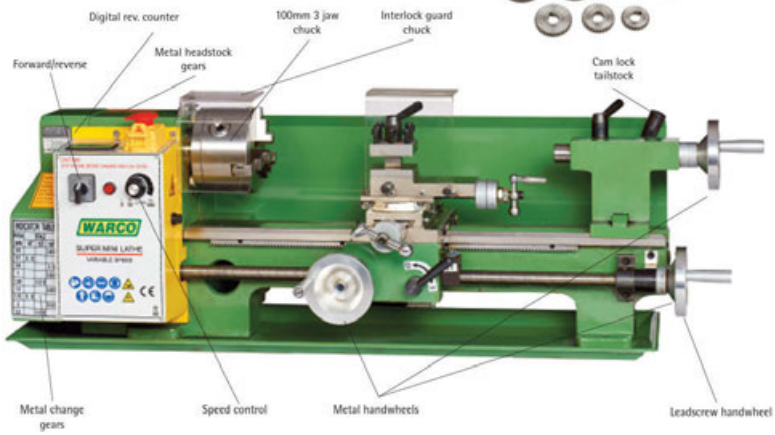

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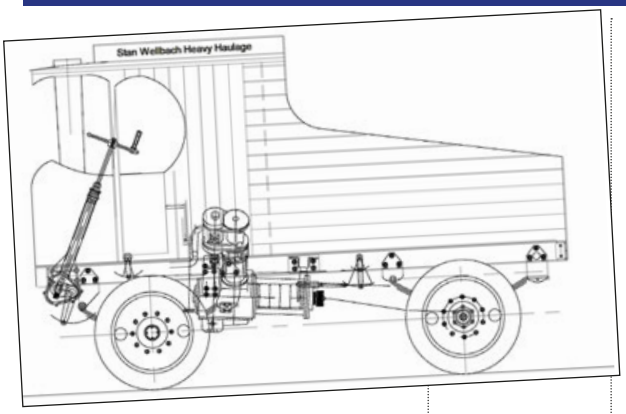
Building a large-scale Fowler Steam Lorry

Latest from Martin as he prepares to fit the boiler to his 7-inch scale road engine.

BY **MARTIN JOHNSON** Part Six of an occasional series



In the most recent episode of this build ,in the May 2019 issue of EIM, I described the design of the boiler for my 7-inch scale Fowler Steam Wagon. Well, to make a long story short the boiler arrived on a pallet at about the same time the article was published. We also had a very bare rolling chassis described in the April 2019 issue. So this article describes some of the work entailed in fitting out the chassis, while starting on the cab and bodywork and combining it all with the boiler.

The chassis

Much of the chassis work can be summed up in one word – brackets; there were brackets for supporting the cab, brake cylinder, pipes and pedals, towing eyes, mudguards and so on (Photo 52). There was nothing very complicated and all were welded fabrications, but they take time to design and make. A particular problem with the brake pedal and master cylinder brackets is that they are very close to the boiler and have only limited clearance to allow for assembly or maintenance without lifting the boiler. Photo 53 will give you the essence of this.

PHOTO 52: Chassis with brackets fixed.

PHOTO 53: Lever brackets need careful design due to cramped surroundings once boiler is in place.

PHOTO 54: Crossmember added for extra stiffness and support for various items.

Photos and diagrams in this feature by the author except where stated.

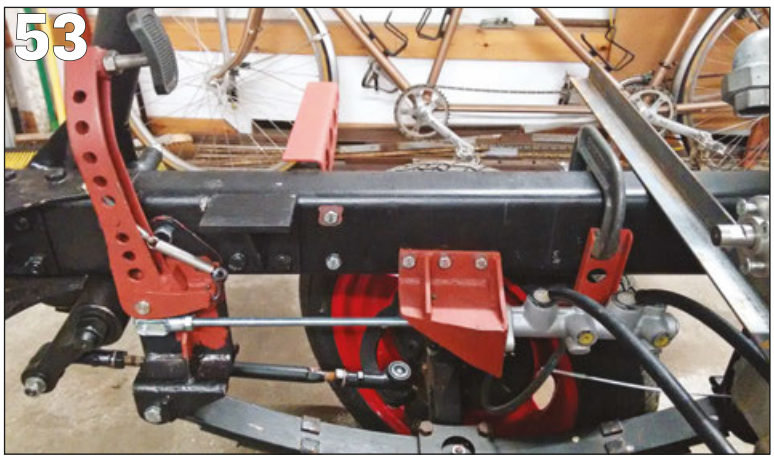
In addition to brackets, I put an extra cross-member into the chassis over the back axle. This has several functions. First, it provides torsional stiffness, secondly it keeps the chassis rails parallel over what would otherwise be a long span, it provides somewhere to hang brake pipes and it will be a fixing point to support a battery and a winch. Getting a lot of functionality out of each component helps to keep the vehicle weight down. Photo 54 shows a view of the cross-member and brake lines.

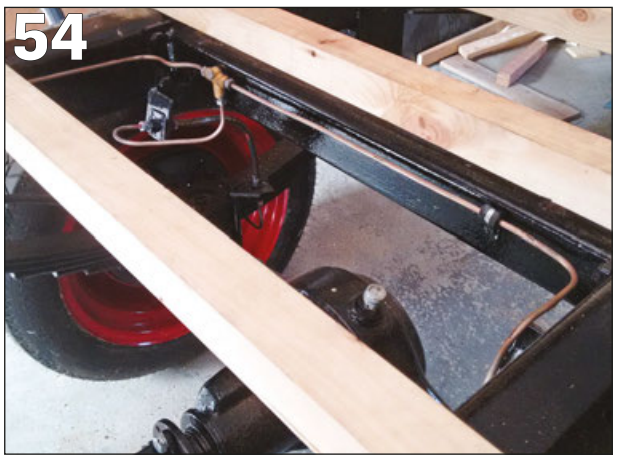
The controls

Controls have occupied quite a lot of my time. Following on from a bracket to hold the master cylinder, the brake pipes were all made up and fitted – a surprisingly long job considering they are all standard automotive parts. Control levers for the gear change, handbrake and engine reverser plus their associated parts were designed and made as a batch to speed up production. Photo 55 shows the early stage of manufacture of a whole range of levers for controls; all are milled out of 20mm x 40mm aluminium rectangular stock apart from the handbrake stand at the back which was cast from my pattern.

Photo 56 shows the engine reverse lever being fitted in its stand along with the linkage to the engine. The support sweeps are stainless-steel laser-cut blanks and are being marked out for the forward, mid-gear and reverse notches.

The cab floor provides a support





for several of the controls, so this had to be manufactured before the handbrake and gear change could be assembled. The floor was made from 5mm aluminium chequer plate and the hole for the boiler was created by routing with a wood router on a radius arm as shown in Photo 57. An ordinary 12mm wood router was used and the boiler opening took about 10 minutes to cut.

Photo 58 shows the cab controls assembled onto the cab floor. From left to right can be seen the handbrake lever, steering column, brake pedal, brake fluid reservoir (just to the left of the engine cylinder) and the engine reverser between the cylinders.

What Photo 58 does not show is how crowded the area below the cab floor is becoming. Photo 59, taken from 'inside' the boiler below the cab floor, shows from left the brake pedal and actuating rod to the master cylinder, above that the levers and rods for the gear change and handbrake which the brake pipes have been arranged to clear. Before completion there will be a lot more to squeeze into this space.

Cab and Bodywork

With the cab floor in place it was possible to start building further up with the main arch of the cab which includes the door pillars and supports the arch of the roof. This was a steel channel section on the original Fowler and I decided to follow that route. The scale size is approximately 30 x 30mm, so I started with 30mm square hollow section. I decided to saw one side of the box section out in the mill, but there is usually a lot of internal stress in such sections which will distort badly when sawn axially. To avoid this, the three lengths (top, left and right) were annealed; I made a crude tunnel furnace out of firebricks and fired the propane torch in one end while slowly feeding the section in at the other and keeping a short section at red heat.

The next problem was bending the top section to give the arc of the roofline. Photo 60 shows the formers I made to use in the large bench vice; they are a bit rough and ready as they were quickly made from scrap. However, the slots will stop the section buckling when bent.

Note also the regular chalk marks on the section showing me where to put the next small bend. Incremental bending is a good way of achieving these gentle bends with minimal equipment. The rest of the frame was welded up with the whole assembly laid flat on a template board.

The next logical step was to commence manufacture of the wooden cab and body parts. These involve quite a lot of mortise-and-tenon joints and so the first stage was to get tooled up for the job. A few jigs will make life much easier and more accurate. I already had a home-made router table which took care of the tenons and several other operations, ▶

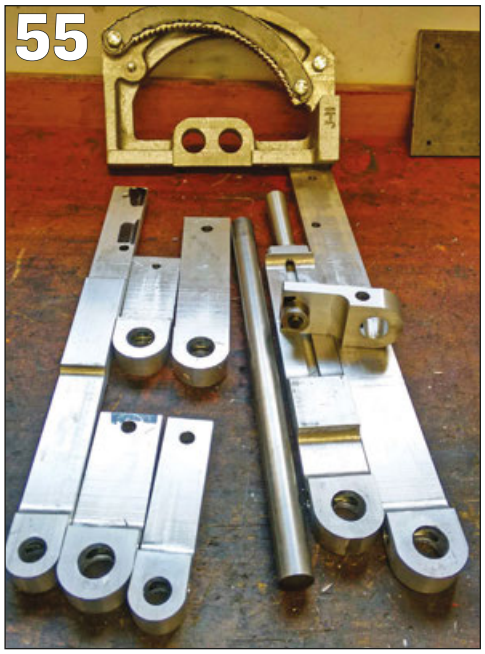


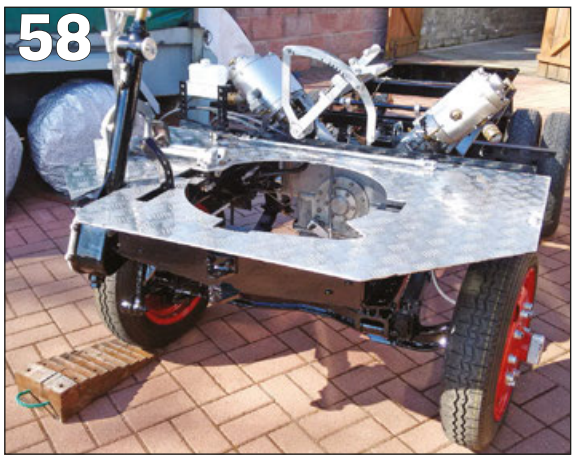
PHOTO 55: Various levers under build, milled from aluminium.

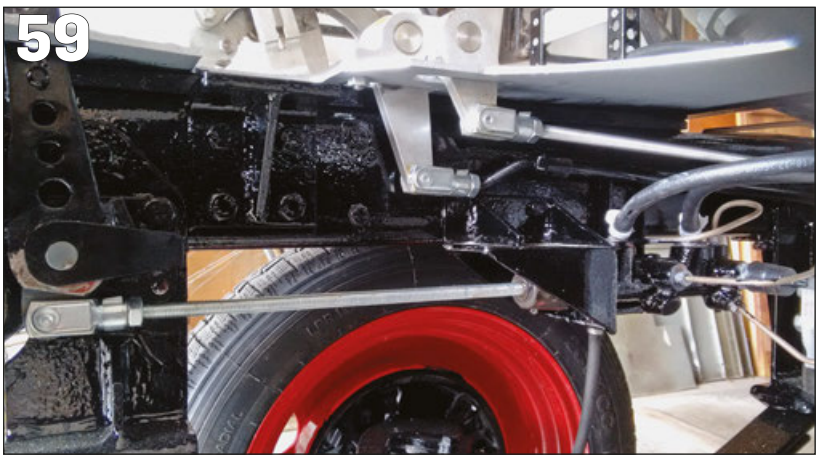
PHOTO 56: Reverse lever fitted in stand.

PHOTO 57: Wood router used to cut hole in cab plate for boiler.

PHOTO 58: Cab controls assembled onto floor.

PHOTO 59: View under the cab floor highlights a lack of space. *Photo: P J Johnson*





but I took the time to make a mortise cutting jig and a cut off saw jig. The mortise cutter is shown in Photo 61 and Photo 62.

The mortise jig is simply a way of holding the work and router in alignment and limiting the travel of the router. The two 'snails' seen in Photo 62 can be rotated to control the travel of the router and hence the length of the mortise. The router fence slides along the back of the jig and the fence setting determines the position of the mortise across the workpiece. The router plunge setting controls the mortise depth. There are many designs for mortise jigs on the internet; mine was made from scraps of MDF and plywood and is crude and cheap but effective – qualities I value in any temporary jigs.

You might be lucky enough to own a chop saw, but if not the jig shown in Photo 63 will suffice for the job in hand. I made the travel and height under the angles sufficient to cover all the expected work on the lorry.

"Sadly the first attempt resulted in porous castings, which I found out after a lot of machining"

PHOTO 60: Former made to bend cab roof line.

PHOTO 61: Mortise cutter used to make cab body parts.

PHOTO 62: Note 'snails' used to control travel of router.

PHOTO 63: Home-made jig helps greatly in cab body construction.

PHOTO 64: Assembly of frame for cab rear sheet underway.

The first job to be tackled was the rear of the cab which is closely based on the Fowler drawing, with a few subtle changes to ensure an out-of-scale crew can get in and to allow easy dismantling for maintenance. Photo 64 shows the frame for the cab rear sheet being assembled; you can see there are plenty of mortise-and-tenon joints there. The cab will be skinned with tongue-and-grooved planks running diagonally as on the original; luckily, internal spruce cladding obtained from one of our DIY stores is a good approximation to the scale size required.

The Fowler drawing for the firm's tractor version of the lorry is not specific about the method of construction for the rear body, showing zero thickness for the side sheets! As a one-time inhabitant of a drawing office, I know this sort of thing is shorthand for "we don't really know, but it will be something like this..." So the rear chariot body detail is based more on Scammell practice, but is appropriate for the period. Photo 65 shows the rear body in course of construction, it is built around U-shaped frames, mortise jointed at the corners. Next a series of infill pieces, held in place with angle brackets, are fitted along the sides to support the edge of the floor. Then the frames are clad over with scale size T & G planking, which was produced using my router table.

The floor will be plywood trailer decking, although pressure-treated planks might have been a better alternative. The rear body is split into a rear and forward section at the frame midway in the door opening; this will allow easy removal of the forward section, which in turn allows access to the engine and gearbox. The rear half of the chariot body houses the water tank, which sits slightly aft of the back axle. This holds nearly 200 litres and is made of MDPE (medium density polyethylene). The tank was purchased from a company making tanks for motorhomes. Photo 66 shows the rear body with the planking complete apart from the two doors; the Fowler drawing suggests side-hinged doors, so that is what I shall be fitting. The next major operation will be a lot of priming, filling, undercoating and rubbing down!

Boiler Fittings

So, after a lot of woodwork it was time to get on to some boiler fittings. I have used a steam pump as the main method of boiler feed. They are quite thirsty in their steam consumption, but I wanted something that could be

adjusted to match steam demand; mechanical pumps and injectors tend to be 'on/off' leading to wide fluctuations in boiler level. A variable water supply also means the feed water heater will be delivering consistently hot water.

Several months were taken up in building a Weir-type pump. My original plan was to simply build the set of Southworth castings and drawings supplied by Blackgates Engineering, but my design instinct was just too strong and I eventually completely re-designed it and in the end only used a few of the castings from the kit. This saga might form the basis for a standalone article, if there is any interest, but in the meantime Photo 67 shows my version of a Weir pump. Those who know the Southworth version can play 'spot the difference', but my version has been ruggedised to reduce leakage points and eliminate tiny bolts which would be a nightmare in the event of a 'field strip' occurring.

My design includes top-guided O-ring seated water valves, an easily detachable (six bolts) pump valve assembly, the correct Weir-type steam valve, packed glands throughout and piston rings on the steam cylinder. The extended valve yoke is for operating a mechanical lubricator and will also operate a metering pump to deliver boiler water treatment in proportion to the water feed.

The second boiler feed will be an injector and this was purchased complete. So next on the list were two clack valves. I made a pattern and got two clack valve bodies cast, but sadly the first attempt resulted in porous castings, which I found out after a lot of machining. To their credit, the foundry accepted my photographs of the porosity and produced a second batch of castings free of charge, which were fine – such is the nature of real engineering.

Photo 68 shows two castings, with one arranged to show how the clack valve cap, body and a locknut were all produced from the casting. The finished clack valves are shown in Photo 69, fully assembled on the left and an exploded view on the right. The valves are top guided with a Viton O-ring on the jumper, the valve seat is machined as a separate part as cutting the seat of a fairly deep bore would not be easy.

The valve jumper and O-ring are identical to those used in the Weir pump – they are all passing the same flow, so it was easier and quicker to make a standardised part. The clack valve is extended into the boiler and then flow discharges through four radial holes to keep the water from impinging directly on the tubes, which I have noticed causes premature failure of boiler tubes.

The water gauge is the smallest full-size unit available and was purchased as a finished item. However, fitting it was not so simple. Firstly, I found that the bushes on the boiler were a bit long (Drawing Office error – that's me!) so had to be machined back. The angle grinder and a thin cutting disc took care of most of the length, however the face of the bush needs to be flat and square for a locknut to seal against. This called for some in-situ machining, which required a special cutter. The teeth on the cutter are shown being machined in Photo 70, the bore is a close fit on ½-inch BSPG and the radial teeth were produced by winding a lathe tool mounted on its side across the face, with indexing by eye. It was made from EN8, which should be capable of hardening but wasn't, so an application of Kasenit saved the day. A hexagon was also machined on the other end so it could be spanner powered. A rummage in the scrap box produced a length of ½-inch BSP thread and a backing nut and machining commenced. It took a little while, but the final result is shown in ▶

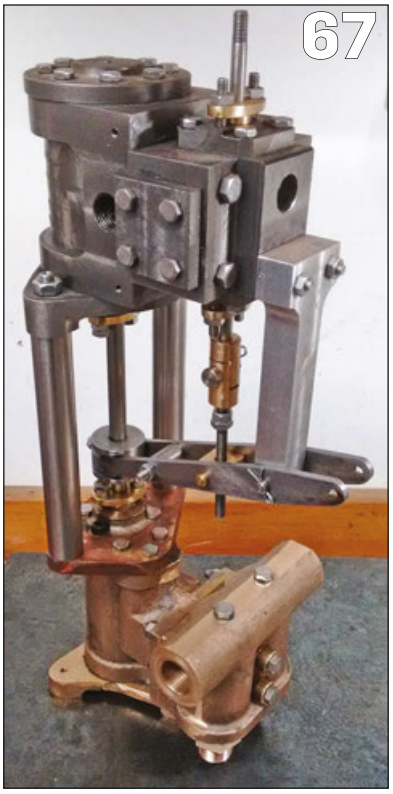
PHOTO 65: Rear body was built around U-shape frames jointed at corners.

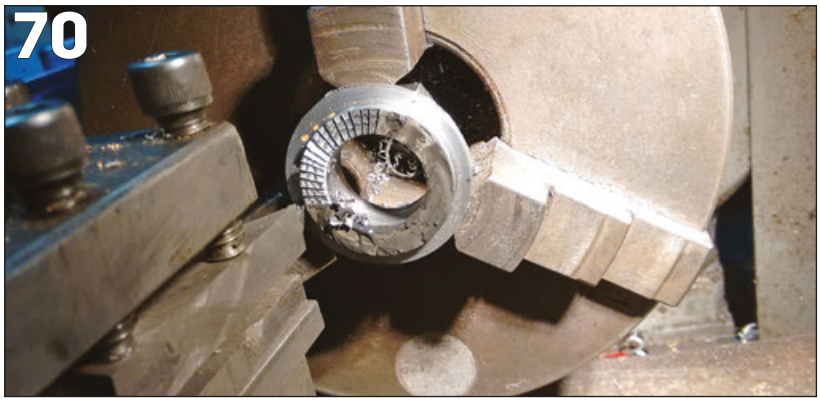
PHOTO 66: Rear body complete apart from the doors.

PHOTO 67: Weir-type pump started as simple job...

PHOTO 68: Two clack valves made from castings.

PHOTO 69: Finished valves assembled at left, the components at right.





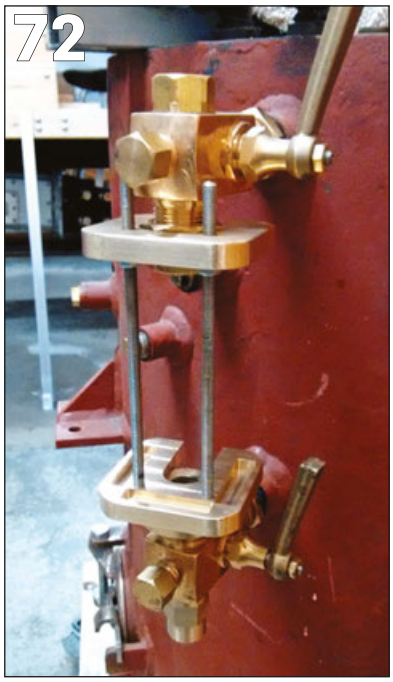


Photo 71, which speaks for itself.

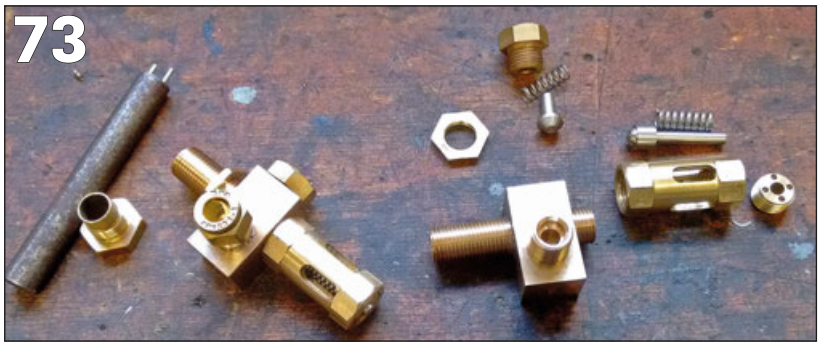
Photo 72 shows the water gauge in place on the boiler, along with the frame for a gauge-glass protector which was machined from a billet of brass bar. It also shows that the usual drain cock is missing and has been replaced by an adaptor. The drain cock position has to be extended downwards, since it would otherwise be just below the cab floor and surrounded by chassis. Once the boiler is in the chassis, an extension pipe will allow the drain cock to be fitted and operated by an extension rod.

Cylinder Drain Cocks

I had made a pattern to provide metal for the drain cocks and these were cast at the same time as the boiler clack valves – complete with the same porosity problem. So these were also made twice over! The clearance between the cylinder drain cocks and the chassis rail is very limited, so design was not easy. I adopted the poppet style of valve, used on Gresley's A4 locomotives and some GWR classes, which was then combined with a relief valve based mainly on Aveling & Porter practice, but using Gordon Smith's design rules for safety valves.

Photo 73 shows a completed valve and the relief valve adjusting tool on the left and an exploded view on the right. The drain pipe will be 8mm domestic copper pipe, and I found it was cheaper to buy 8mm couplers to get the union nuts and olives rather than make them from brass bar – a sign of our times, perhaps.

"On a rally field, engines spend a lot of time ticking over and hence not splashing much oil at all..."



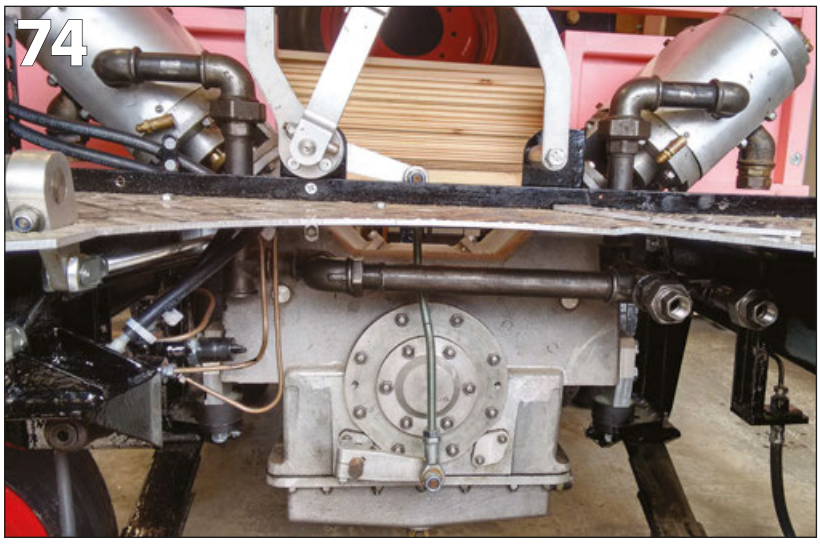


PHOTO 70: Special cutter needed to be machined up to reduce thickness of water gauge.

PHOTO 71: Bush for water gauge.

PHOTO 72: Completed gauge, fitted to boiler, frame for glass protector in place, machined from brass bar.

PHOTO 73: Drain cocks follow Gresley A4 practice.

PHOTO 74: Main steam pipe fitted, photo taken from position of the boiler.

Main Steam Pipe

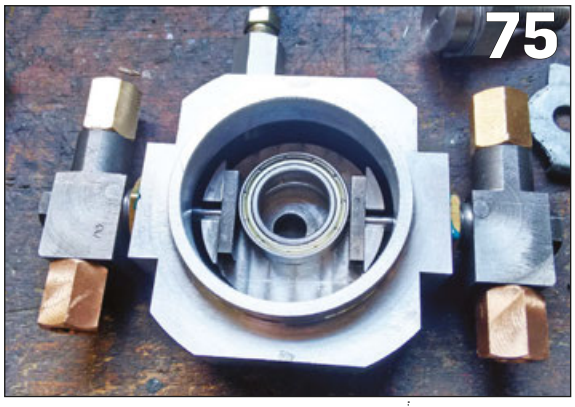
Before fitting the boiler, it was convenient to build up at least part of the main steam pipe. This is all made from commercial screwed pipe fittings and short lengths of pipe. This is shown in Photo 74 taken from inside where the boiler will be. There are two unions near the entrance to the cylinders, to allow the engine to be easily removed.

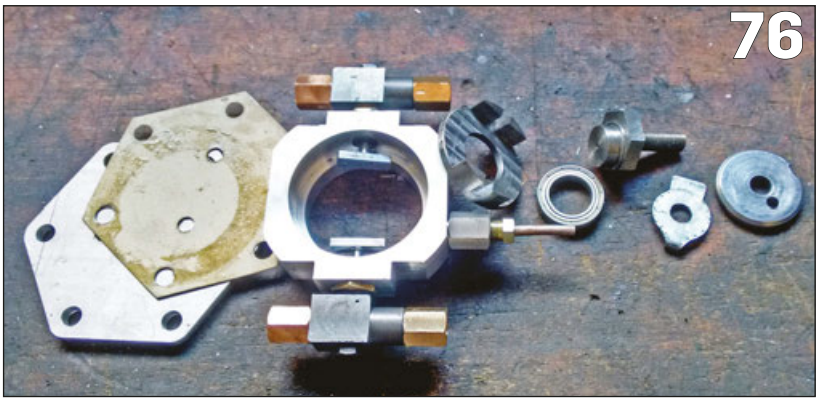
The pipework at the engine end is ¾-inch BSP to provide some reserve of steam to avoid choking what is a high-revving engine. There are two more unions at the bottom right of the picture to take two ⅜-inch BSP pipes from the twin superheater coils; I have used two relatively small pipes from the boiler to give some flexibility in the pipework as the chassis twists on uneven ground.

Lubrication

The original Fowler tractor relied on splash lubrication for everything inside the crankcase. I reasoned that on a rally field, engines spend a lot of time ticking over and hence not splashing much at all. I also realised that getting oil to the uppermost parts of the crankcase would not necessarily happen very effectively, so I wanted to incorporate a pump to deliver oil to the upper trunk guides and upper end of the valve gear.

I had puzzled over this design conundrum for well over a year before settling on a pump located on the free





end of the engine crankshaft. This would need to do the following:
1) Lift oil from a level a few inches below the pump
2) Deliver a reasonable quantity at minimum tickover speed
3) Not self-destruct at the maximum speed of 1000rpm.

Space is very limited at the free end of the engine, which further complicated the design process, but I came up with a twin-cylinder design which seemed to satisfy the objectives. The pump elements would be quite at home as axle feed-pumps on a Gauge 1 locomotive, being 5mm bore and stroke; the ball valves are rather oversized to cope with the maximum speed requirement.

Photo 75 shows a view of the pump bodies and housing looking at the engine side of the assembly. It will be seen that the two pump plungers are completely independent but are coupled by a separate yoke piece, a ball race actuates the two plungers as it moves eccentrically on a crankshaft extension. This was done mainly to cope with any misalignment between the left and right pump bores. Photo 76 shows the complete exploded view of all the parts, all of which are quite simple to manufacture.

I tested the pump assembly by mounting it on a dummy crankshaft end and running it in the lathe, drawing oil from a container on the lathe bed and returning it back again. I can confirm that it does self prime and that it is quite happy from 35rpm up to 960rpm.

The pump was assembled onto the engine in position in the chassis without incident. All the oil plumbing has been done using automotive brake line pipe and commercial brake line union nuts – it saves making 14 union nuts and olives. Oil is distributed to five oiling points through a sight glass system, so I should never need to deploy an oil can on this engine!

The Boiler

Well, at the start of this article I said the boiler had arrived. Fitting it had to wait until I had attended to what seemed an endless list of tasks in the area just behind the boiler – far easier to do without a pressure vessel in the way. However, the day for fitting finally came so I will leave Photos 77 and 78 to say a thousand words.

Finally Photo 79 shows overall progress in Spring 2020. EIM

■ The first five parts of this project appeared in the September and October 2018, and the March to May 2019 editions of EIM and we will carry further features as the build progresses. You can also follow construction online at: www.flickr.com/photos/140734312@N06/sets/72157669955074511. The author can also be contacted via the editor.

PHOTO 75: Oil pump and housing, from engine side.

PHOTO 76: Exploded view of oil pump.

PHOTO 77: The big day – fitting the boiler to the chassis.

PHOTO 78: Vertical boiler is a snug fit.

PHOTO 79: Progress so far – really beginning to look the part.

Keeping toolholders tidy

Peter and Matthew discover another use for their increasingly busy 3D printer...

BY **PETER and MATTHEW KENINGTON**

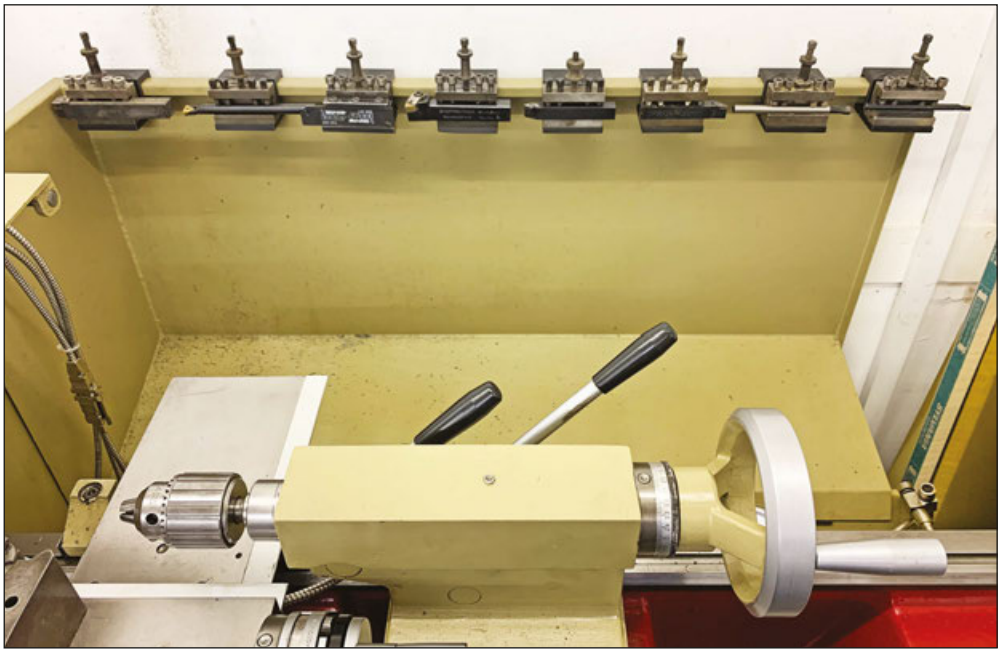
This is a simple idea for keeping lathe toolholders both accessible and yet out of the way (when not immediately required). It was driven from a need to free-up some bench space in our increasingly crowded workshop, to allow for yet another new toy (sorry, useful piece of workshop equipment).

Matthew, our 14-year old, internet-savvy Chief Researcher, had seen a few designs online for toolholder storage solutions, but none seemed to meet the requirements of being both simple to mount and simple to use in practice (defined as it being easy to remove and replace toolholders, whilst still having them close at hand and not occupying otherwise useful space, such as the aforementioned bench-top).

We have designed two variants of the toolholder receptacle: one is specifically for mounting on the rear splashback of a lathe (without needing to drill any holes in the splashback) and the other is intended for wall-mounting (or mounting on any similar vertical surface).

The designs shown here are specifically for a Dickson/Bison S1/T1 style of toolholder, although variants could easily be designed for similar toolholders, such as the S0/T0 typically found on Myford and other smaller lathes or the S2T/T2T, typically found on larger lathes, such as the Colchester Triumph 2000.

We have produced STL files for the receptacles – STL is actually a short form of 'stereolithography' but has subsequently been used as an acronym for 'Standard Triangle Language' or 'Standard Tessellation Language', both of which are descriptive of the 3D translation process involved and its result. Details of how to obtain the files are at the end of this feature.



ABOVE: The toolholder receptables in use on the lathe.

FIGURE 1: Dimensioned front and side view enabling readers to determine if the receptacle will sit nicely on their lathe splashback. All dimensions in mm.

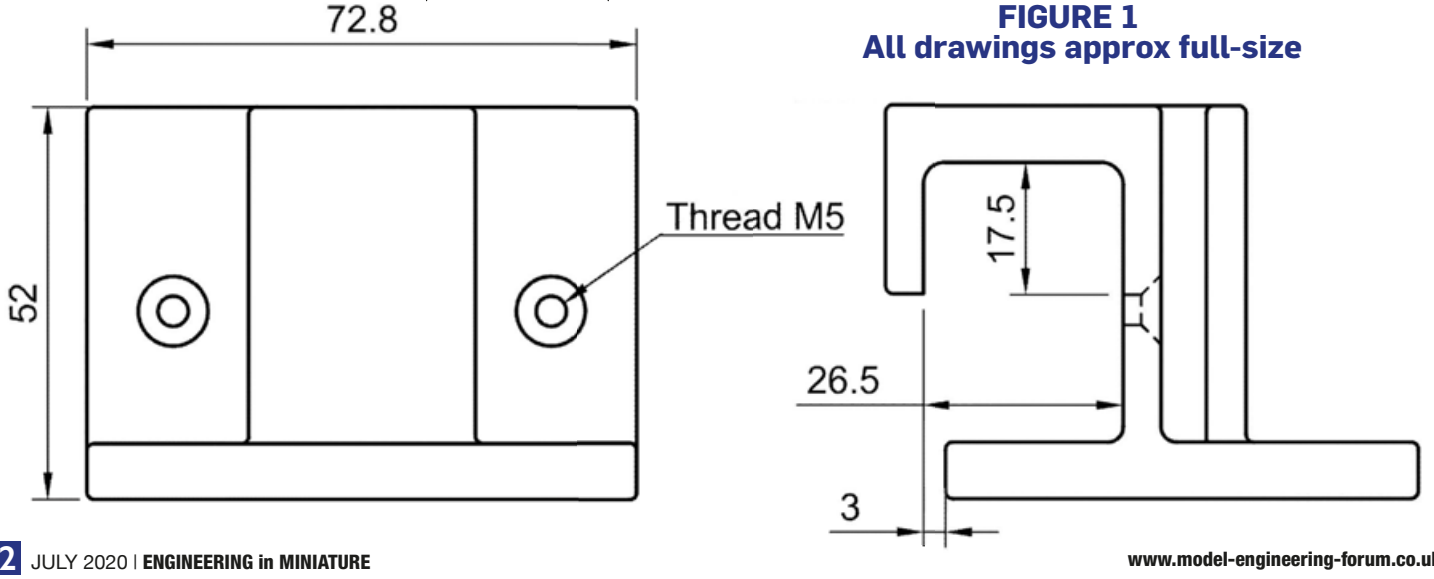
The receptacles can be printed in PLA and both require only a 15 per cent infill setting, so even the larger ('hanging') variant only uses 75 grams of filament, including the support material. This is a push-to-remove item and is discarded once removed – PLA is made from bio-degradable corn-starch, tapioca root or sugar cane and hence there is no need to feel guilty about this 'waste'!

Bargain cost

Based upon the above weight of material, including the discarded support material, the cost per receptacle was around £1 when using the mid-price filament we have. We used a wall thickness of 2mm, largely to ensure that the two mounting holes had adequate solid material to allow them to be threaded to M5 (as discussed below) whilst still retaining sufficient strength for their (minimal-stress) purpose. We also used only 'draft' print quality (0.2mm layer height) – neither a silky smooth appearance or dimensional precision is required in this simple application.

Figure 1 shows a dimensioned drawing of the 'hanging' variant of the toolholder. This fits snugly on the 25.5mm deep (approx) return on our splashback, the dimensions for which are provided in Figure 2. The lower

FIGURE 1
All drawings approx full-size



'buffer', located on the bottom-rear of the front-plate prevents the likely turning moment of the receptacle, which could result when mounting a toolholder, from trying to dislodge it from the splashback.

Figure 3 shows the first ('hanging') variant in its STL format and Photo 1 shows the outcome of this file when 3D printed.

In the case of the 'hanging' variant, two M5 countersunk machine screws are used to constrain the toolholder receptacle to prevent it from being dragged upward along with the toolholder, when the latter is being removed from the former. These machine screws are not used to clamp the toolholder in place (at least not on the splashback of our Harrison M300), and are merely used as insertable lugs or tabs, which slot in just underneath the return on the splashback, preventing the toolholder receptacle moving upwards in use (such as when a toolholder is removed).

Not critical

The length of these machine screws is not critical – they need to be long enough to protrude through the rear of the part sufficiently to engage with the underside of the return on the splashback, if the receptacle lifts when removing a toolholder, and short enough not to meet the main body of the splashback (and thus mark the paintwork!). For our M300, anything between about 15mm and 25mm is fine (including the countersunk head).

Once the machine screws have been installed, the receptacles will still freely slide along the top of the splashback, which allows positioning and re-positioning to be achieved with ease.

The hole sizes used in the STL file are designed to be a 'tapping' size for the M5 machine screws and will need threading once the part has been printed. The threads are only present to prevent the bolts from shaking loose and falling out – no real 'strength' is required from them. Whilst 3D printers are capable of printing threads, the small pitch and thread-depth required for M5 would be very unlikely to be reproduced well by the printer, hence the need for manual threading.

The 'hanging' part should be printed as oriented in Figure 3 and will therefore need to be printed with 'support material'. The printing orientation proposed means that the support material occupies the space to the rear of the front plate (in other words it fills the 'n'-shaped hanging bracket). This has the advantage that the material is easy to remove (it literally pulls or pushes out) and any remaining roughness on the part,

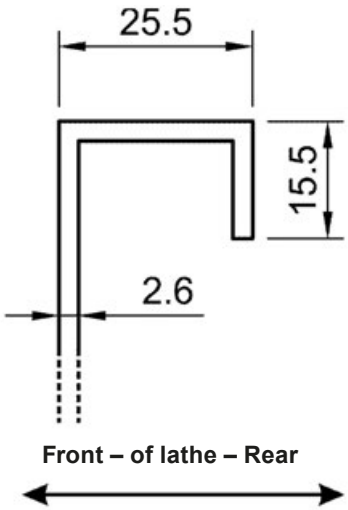


FIGURE 2

where the material is attached to it, is hidden in use. It can, of course, be removed if desired by light sanding or filing (although we didn't bother).

The wall-mounted variant should be printed 'lying on its back' (with the mounting holes pointing toward the print bed). This orientation will require little or no support material depending upon the printer and its slicing algorithms.

We printed the receptacles with a 'raft' (used to aid bed adhesion), as we had warping problems without. This may be printer-dependent, however.

The receptacles are very durable; astonishingly so, given the relative lack of material from which they are made (just to repeat: only 15 per cent infill!). Even if a toolholder is only just engaged with the receptacle and then dropped down, the receptacle copes happily, with no signs of distress.

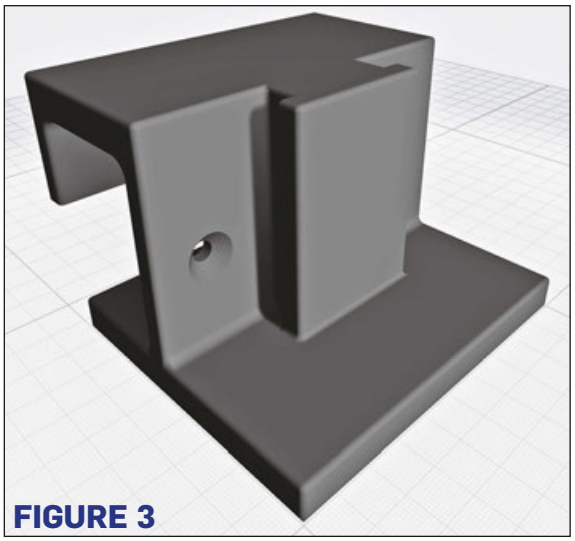
If one is somehow broken (which would be quite a challenge, even outside of 'normal' use), a replacement can be re-printed whilst you are asleep – it should take approximately seven hours or so, depending upon the speed of your 3D printer.

Now, time to order than new toy…

Essential information

The SLA files for the receptacles have been uploaded to Thingiverse and can be downloaded for free, for printing on your home 3D printer. You will need to go to: www.thingiverse.com/thing:4249941 (for the splashback-mount version) or www.thingiverse.com/thing:4249955 (for the wall-mount version) or search for 'Dickson Toolholder' on the site.

Note that Thingiverse is now called 'MakerBot Thingiverse' (presumably the founders sold out) and you will need to create a (free) account to join. You do not need to print the designs using a MakerBot 3D printer, however! EIM



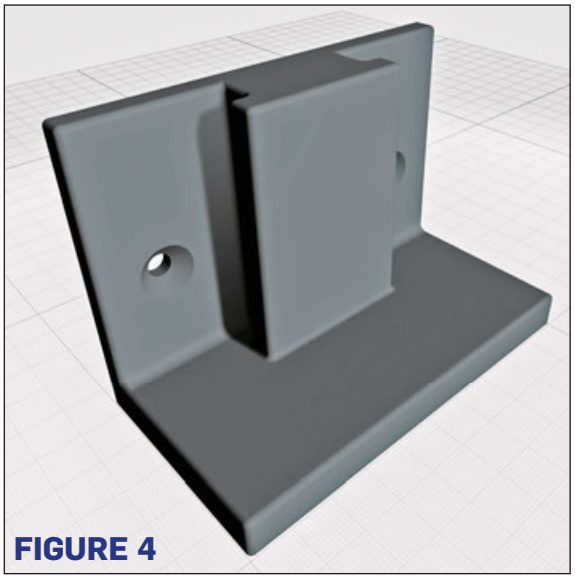
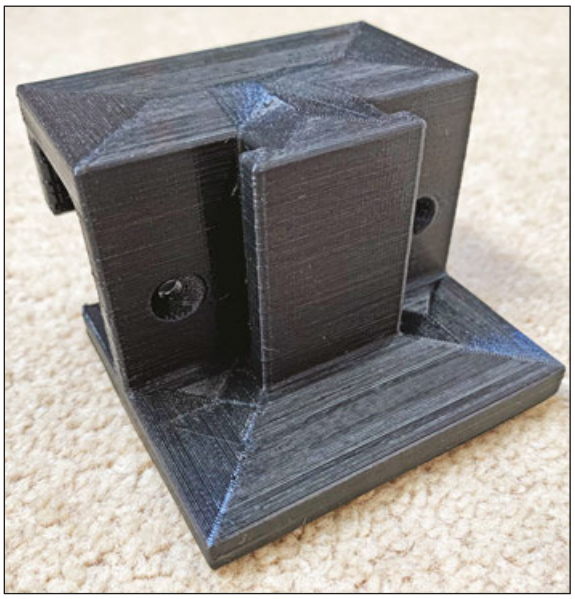


FIGURE 2: Dimensions (mm) of the top-return on the splashback of the Harrison M300.

FIGURE 3: View of the 'hanging' toolholder receptacle in STL format. The holes should be tapped to M5.

FIGURE 4: Wall-mounted variant as an STL file. The holes are suitable for No. 8 countersunk woodscrews.

BELOW: Hanging toolholder receptacle when 3D printed.



Black Knight rides again

Edward and his fellow Rugby ME members complete their major improvement of a Romulus locomotive after replacing the boiler.

BY **EDWARD PARROTT** Part Three of Three

The smokebox was previously part of the steel boiler, as on the original Roger Marsh design, but a few minutes work with an angle grinder separated it, and we could retain the original mounting points and chimney hole, making the job easier.

After cutting it off I set the tube up and bored out the back to suit the joining ring that was welded to the front of the boiler. It was further drilled all round front and back to allow the installation of dummy rivets to improve the appearance – it's the small things that count. Now it does look a little more realistic, a bit like the real E-class Barclay it's based on.

I set the smokebox tube up on the mill again and produced two holes in the bottom to take the main steam pipes from the superheaters to the cylinders (Photo 17). As I said before, the loco was built very much on the cheap, and these pipes along with the exhaust had been made from standard 15mm plumbing fittings. Luckily the threaded fittings for these

PHOTO 17: Holes in base of smokebox for pipes from superheaters to cylinders.

PHOTO 18: Making tubular fittings for pipes, to be welded in smokebox.

FIGURE 1: Drawing of tubular fitting.

All photos and diagrams by the author

are actually ½-inch BSP, which I could use to our advantage.

I made two steel tubular fittings to weld in to the holes in the smokebox, (Photo 18). I've included a drawing of the parts we made (Figure 1), but the lengths can easily be altered to suit any other engine. Yes there are some odd dimensions on it I know – plumbing fittings are metric, but I still think in imperial!

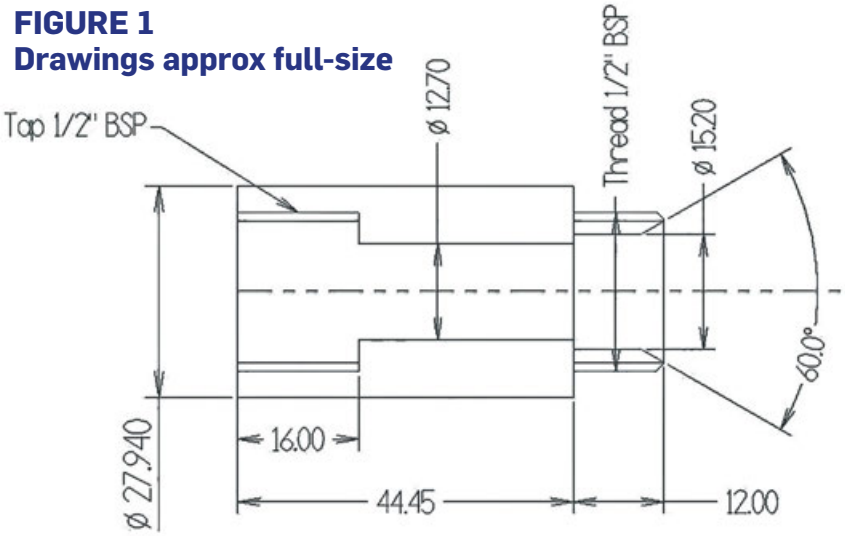
By employing a method such as this, there isn't the usual battle to seal the pipes to the tube. I've got one engine to work on at the moment, a large 7¼-inch example that has a hole big enough to allow a ¾-inch BSP union through, and had about a tube of bathroom silicone sealant applied around it to stop the air leaks. It was messy to say the least, and it won't be going back in! That will be getting similar treatment although to a larger size – I might send our Editor the information on that one for another article in the future (*yes please! Ed*).

Fabricated pipes

The outside main steam pipes are a fabrication of standard commercial 15mm plumbing fittings, silver soldered together. This is not my ideal choice, the bends are tight and don't flow nicely, and the fittings are bulky and ugly. I was hampered by the fact that this type of fitting had been used before, and the only way to remove the remains of the fittings was to remove the cylinders – not a job I was going to entertain! (Photo 19). As it was, I had to put the compression nuts up in the lathe and just take the corners off the hexagon to get it to fit through the existing holes in the frames.

The smokebox ends of the pipes fit into the two steel fittings I welded in,

FIGURE 1
Drawings approx full-size



on the end of which I had replicated the form of a standard brass compression fitting. Surprisingly simple when you look at it, it simply consists of a parallel ½-inch BSP thread, a hole bored to clearance for 15mm pipe, and a 60-degree inclusive taper (See Figure 1). The cylinder ends are just BSP to compression adaptors which have been screwed into the steam chests and can't be removed without dismantling the steam chests.

In the middle of the main steam pipes there is a threaded pipe stub to which the lubricators connect. These are fed by the two mechanical lubricators and drop the oil into the flow of steam to be carried into the cylinders. Quite how much it gets atomised I wouldn't like to guess, but dropping it into the steam flow undoubtedly does better than pumping it into one corner of the steam chest as it does on another engine I am working on.

The exhaust pipe was similarly built up. For this I made a length of ½-inch BSP studding, drilled through ½-inch, and machined a ½-inch hexagon into the top.(Figure 2 and

PHOTO 19: The main steam pipes are fabricated.

FIGURE 2: Design of exhaust fitting.

PHOTO 20: Hexagon machined in base of steam exhaust pipe.

FIGURE 3: Design of the blastpipe assembly with blower pipe.

FIGURE 2

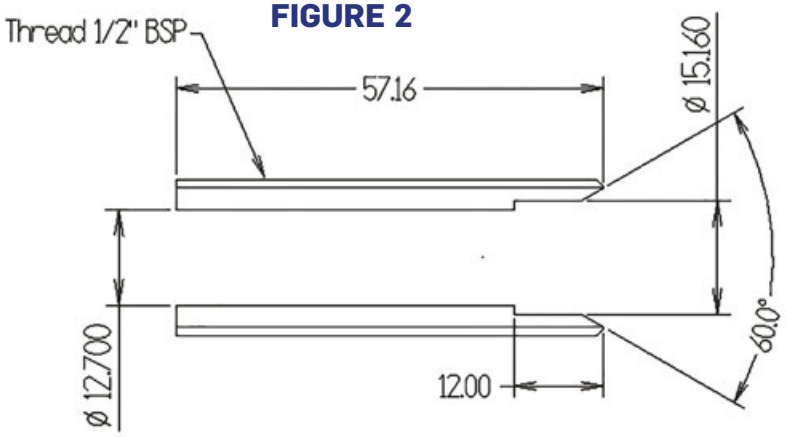


Photo 20). The bottom of this fitting replicates the compression fittings of 15mm pipe, so that we can connect direct. The easier route would undoubtedly have been to use another threaded 15mm compression fitting, but that to me is just messy, when the ability to copy and manufacture a custom part is well within the capability of a model engineer. Because of the way the loco is built, the assembly process requires the exhaust pipework below the smokebox to be assembled, then the length of studding is threaded down through the boss in the bottom of the smokebox to meet up with the exhaust pipe, and then an ordinary compression nut to fix it in place.

The smokebox side of the blastpipe assembly is made in such a way that it can be quickly and easily removed and replaced, and alignment with the chimney maintained. The theory was that should we have to tweak the angle of the pipe to match the chimney, that alignment wouldn't be lost if we removed it.

To achieve this, the length of threaded tube previously mentioned was designed to only poke into the smokebox side by ⅜-inch. We then soldered a piece of 15mm pipe into a standard plumbing fitting, and the base of the cap to the other end. This all screws down solidly onto the top of the boss we welded in. Every time it is removed, it goes back to the same place. In fact, we got the chimney alignment pretty much spot on and so we didn't have to tweak the pipe.

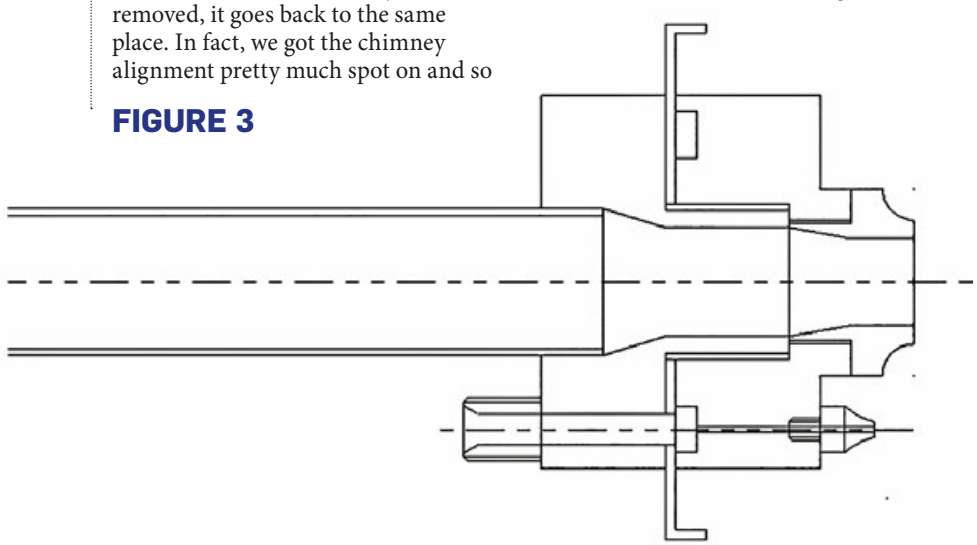
The blast cap is formed of two slices of brass, and incorporates a screw in blast nozzle that can be changed to suit different tracks or coal, and the blower ring. The lower piece is silver soldered to the top of the riser pipe. It has a connection for the blower feed pipe on the bottom, and the top is threaded ⅝-inch x 26mm.

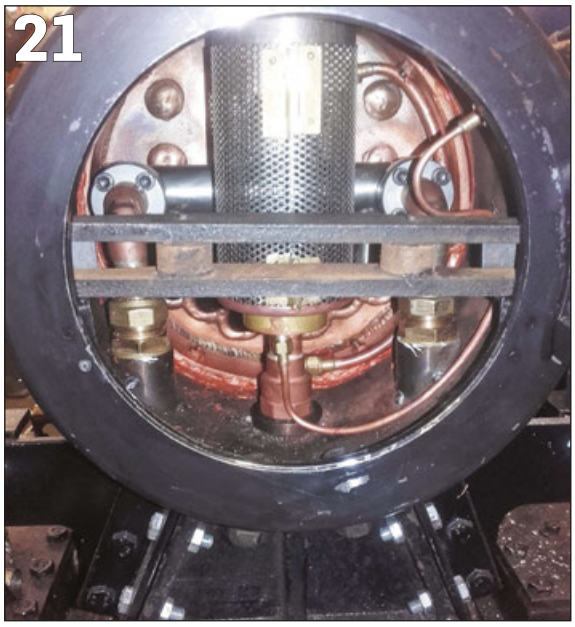
On top of this sits a thin copper tray which supports the spark arrestor – more on this later – and so the blower pipe connection just pokes through. The upper portion is a hollow blower ring in the usual format with four blower jets very slightly inclined inwards, and tapped through ⅝-inch x 26mm. The lower length screws down to trap the copper tray, and the blast nozzle screws into the top. Hopefully the drawing will make it all clear! (Figure 3).

Catching sparks

Spark arrestors are pretty much essential in today's litigious society, despite warning signs to members of the public that steam locomotives emit hot sparks which I'm sure every club displays, visitors are rarely impressed if they get a 'hot one'. Certainly there is no excuse for not making efforts to stop the escape of hot particles. We are not great fans of devices stuffed in chimney tops, if it's not railway-like we don't like to fit it to our engines. ▶

FIGURE 3





Instead one of our engineering team designed a tubular spark arrestor made from perforated stainless plate, which fits into the confined space of a Romulus smokebox quite well.

The photo shows the arrestor in position (Photo 21) and you can see how it is rolled from the mesh and has a couple of clips to hold it closed. The top is a close fit around the petticoat pipe, being a Romulus there is no special form employed, we simply set up the chimney casting in the Bridgeport milling machine (Photo 22) and bored out the bottom to fit a piece of 2¼-inch thin wall tube (Photo 23). In an ideal world a proper bell-mouthed petticoat would be employed, but Romulus doesn't fit the ideal world scenario with its tall, thin chimney and small smokebox anyway.

The bottom fits into the copper tray which is trapped in the blast cap, this was annealed and flanged in the same way as a front tubeplate. It's only 1/16-inch deep, but that is enough to stop it moving in service, it slides up the petticoat pipe to install, and drops down into the tray.

PHOTO 21: Spark arrestor fitted into smokebox.

PHOTO 22: The chimney casting being bored out for spark arrestor.

While I had the chimney off, the top was bored out round, and I also added a brass band to the chimney. Both exercises proved just how poor the chimney casting was on this engine. It appears as though the mould sagged when the casting was made, and instead of it being round it is more elliptical. Boring out both ends took some doing as the shape was so poor, and I imagine it's probably not doing much for the engine's ability to breathe. If you are building one I would check your casting very carefully and reject any that are supplied in poor shape.

At some point in the future I think we will probably revisit this and see about boring the chimney out to a proper shape, although with the outside being in the same poor shape, we'll have to be very careful or we'll end up with more than the usual two holes in the chimney!

Tackling a long and skinny boring job like this is no easy task, but luckily surface finish isn't something that matters to the Nth degree. When I added the brass ring, I fitted it to a steady band that I had already turned when boring out the top. We will need to set this up in the lathe again, and then use a specially made boring bar with a piece of high-speed steel clamped in the end.

One final little job was the making and fitting of a snifting valve. As a saturated engine our Romulus was never fitted with one, but now that it was superheated we needed one. This sits in the bottom of the smokebox in a boss I had to weld in to fill up the old hole where the main steam pipe exited. The connection point is on the side of the wet header so that cool air is drawn through the superheater when the loco is coasting, and a ¼-inch copper pipe wraps round the inside of the smokebox out of harm's way.

With all the work on the smokebox completed it was finally time to bolt the boiler to the frames permanently. Four of the dummy rivets around the back of the smokebox were left out, and we used 2BA slotted roundhead screws to fix it to the boiler, the front of which was supplied with a ring of copper welded in for this purpose. The nuts are a little awkward to get at, but they won't be coming out again any time soon. High temperature silicone sealant was again used to make sure there were no air leaks.

The rear of the boiler actually sits directly on the frame plates which are cut low behind the driving wheels, as per the original Romulus design. To stop the boiler lifting, there is an angle on the throatplate which sits on a stretcher across the frames. On a steel boiler, this is usually a piece of 2-inch by ¼-inch angle welded directly to the boiler, with a bolt hole drilled though. On the copper boiler the angle was replicated, but on reflection I wasn't sure about the wisdom of relying on a piece of copper, and for my own replacement boiler I specified doubling pads and blind holes to bolt steel angle on.

For this engine we instead chose to leave the angle sitting on the stretcher, but made a steel stepped clamp to sit above it and bolted that down. The copper angle is free to slide underneath as required by the expansion of the boiler while an occasional spot of oil makes sure it stays free but can't lift up.

Change of plan

The original intention was to employ the original cladding sheets on the new boiler and I had been quite careful to make sure that the bushes and the dome were all fitted in the right place. Unfortunately, this is where the position of the front tubeplate on the new boiler got me again! I've never checked against the old boiler, but the cladding must have stopped water side of the tubeplate. The new boiler had the position taken from the old, but when I held up the cladding sheets they were an inch short! No choice then, new ones it would have to be.

The firebox cladding sheet was fit to use again following a trip to my friendly local shotblasters, and then all the sheets were treated to a coat of paint. They were sprayed gloss black with Craftmaster synthetic coach enamel – this is the only paint I will use on my locos.

While the paint was resting to harden off, we made up new supports

to fit round the boiler. These are laser-cut steel rings, made in two halves, and hinged at the top (**Photo 24**). They are designed to only contact the boiler in a few places and not continuously, this allows for imperfections in the rolling of the barrel and has worked out very well. They are not physically attached to the boiler and can if necessary expand with the heat. Inbetween each support ring we used ceramic matting to create new insulation, available from the usual model engineering suppliers.

It had taken us quite some time to get to this point, working on the loco only two short mornings a week, so all of a sudden to have the boiler in the frames, with shiny new cladding sheets fitted, was quite a moment. It's fair to say by now we were eager to have the loco back in steam, but we'd committed to doing a good job with the rebuild and no short-cuts were going to happen, not on my watch!

The old plumbing was a bit of a mess, not well executed, and suffering from years of running and a previous rebuild that had been a bit more slap dash. We took the decision at the start to replace all the ratty bits of pipe, and luckily Noggin End Metals supplies 48-inch lengths of copper pipe in straight lengths, not the usual coil. I can never get a coiled length nice and straight again, and there's nothing worse in my eyes than a length of pipe that wobbles its way down the side of a boiler (*Ed's note – Tech Ed Harry showed us a clever way to uncoil copper pipe in the August 2019 issue!*).

While we were changing all the plumbing we adapted the blower line so that we could use a compressed air supply to raise steam. The connection is an 8mm 'push-fit' pneumatic fitting, with an isolating valve, and is tucked away behind the left-hand cab footstep, where the driver can reach and operate it while lighting up.

The 90-degree ball valve hasn't been that successful, being a bit 'all or nothing', so I will change this at some point for a needle valve which will offer more control. It works very well, as it utilises the blower jets that are built into the blast cap in the smokebox, but you do need to remember to close the isolating valve on the air connection, otherwise you get steam coming out where you don't want it!

The injectors are plumbed as you'd expect, water coming from the tender tank. The crosshead pump was the one exception to the rule of redoing the plumbing, however for a very good reason. The aim next winter is to build a saddle tank for the loco to increase its adhesive weight and its water capacity and endurance. Currently the pump draws water from the tender tank, and has a bypass valve located under the footplate feeding back to the tender tank.

The ejector plumbing has been changed from the past – it once exhausted into the smokebox and up the chimney. We had problems with another engine which struggled to create vacuum when steam pressure fell and its ejector was located in the cab and exhausted to the chimney, but we moved it up to the smokebox side and the problem was cured. We put it down to the long exhaust pipe condensing steam and creating too much back pressure, and the new short pipe cured that.

On the Romulus, because of the plan to fit a saddle tank later, we didn't want to fit the ejector in a place where we couldn't later access it. The decision was therefore to keep the ejector in the cab with a relatively short steam feed, but the question then was what to do with the exhaust. There is another engine at the club that is similarly built which exhausts into the ashpan, so we decided to follow suit, with the exhaust passing through the footplate and going through the side of the frame through an existing hole and into the ashpan.

Similar but different

For reasons we've not yet established, we have had problems with the loco steaming, so we've now removed the exhaust and it currently vents under the ashpan. We're not sure what the difference is between this and the other engine in the club, which steams very well, but the Romulus won't have it. After a station stop after the first lap, the fire was going very flat, and on the second trip it was failing in roughly the same place every time. We temporarily removed the exhaust pipe and the problem went away. We put it back, poor steaming again – mystery! My 3½-inch gauge Hunslet also vents its ejector into the ashpan and that certainly has no problems steaming, answers on a postcard please!

I'm pleased to say we've had a good year's running out of the engine now, relatively problem free. There's been a few little niggles that have had to be attended to during the course of the year, but it's generally been a success. The water consumption has dropped dramatically thanks to the higher boiler pressure and the superheater – we're now using only about 75 per cent of the water we were previously using. As my own Romulus is now almost finished it will be interesting to see how that has changed as it was an 80psi saturated boiler and one lap of our track emptied the well tank!

We now have 'Y Marthog Ddu' – renamed 'Dr John' in memory of the builder – back in the workshop to tackle outstanding maintenance issues that we left 'for now'. Currently that amounts to a complete rebush of the coupling and connecting rods which actually turned out to be a lot worse than we thought! We had planned to get the new saddle tank made ready for fitting by now, and the ballast weight running boards, but time has overtaken us!

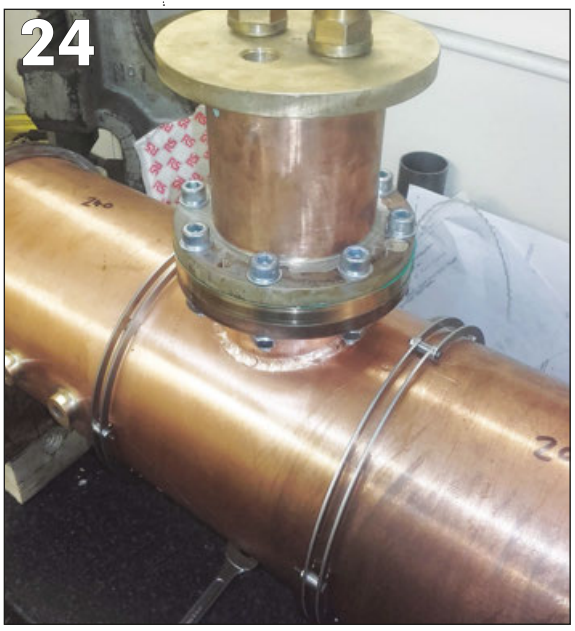
The loco is now a regular on our public running roster and can if necessary handle a four-carriage train instead of its previous two maybe three on a good day.

Once we are able to resume our running days at Rugby following the virus you will always find them published at http://rugbymes.co.uk and we welcome anyone who wants to know more to come along. EIM

■ Parts 1 ans 2 of this series appeared in the May and June issues of EIM – to obtain back numbers see page 35.

PHOTO 23: Thin-wall tube rises out of smokebox to fit in base of the chimney.

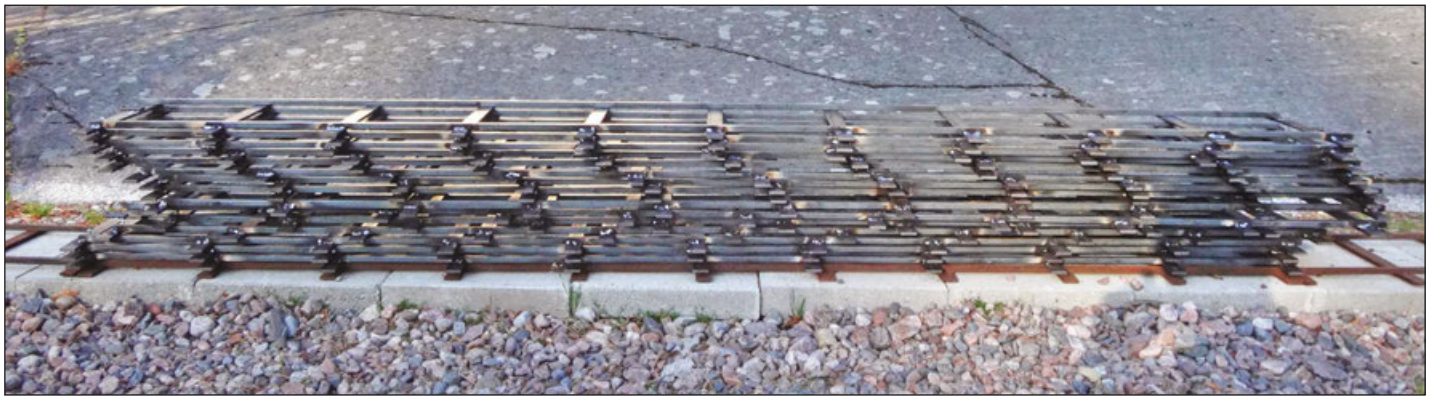
PHOTO 24: New supports made up for replacement boiler cladding.



Improving light track

Jan-Eric's bulk building session of portable track maintains family harmony...

BY **JAN-ERIC NYSTRÖM**



My 'portable' track (described in several earlier articles published in EIM) has become more and more permanent over the years, as the other family members have become used to it. Originally, they insisted on it being non-permanent, and in fact, I removed it completely over the first three winters!

All photos in this feature by the author

Over time, however, they have noticed how fascinated all our guests have been by a railroad circling our summer abode, with kids and adults alike enjoying a ride, or even driving the simple 'Quickie' battery locomotive themselves. So I was able to put in a foundation of concrete paving slabs, 1ft square, all the way under the track, which had shown a marked tendency of sinking into the soft lawn and the gravel walks... This slab foundation was described in detail in the September 2017 issue.

Portable permanence

The track is still portable, though, and I have disassembled parts of it several times to set up a simple oval in other locations, such as at a steam festival, at two different museums, in a friend's yard during a kid's birthday party and so on. Since it is always a hassle to break down the track (and especially to assemble it again, considering the several different non-standard lengths of track pieces I made to conform to my garden layout), I decided to make enough new sections to enable me to build an oval of about 15 by 30 metres anywhere, without using any sections from my now 'semi-permanent' track!

Having brought home some 100 kilograms of hot-rolled steel – 10mm square for rails, and 5 x 25mm for ties, the latter already cut to 280mm lengths by the stockist – I commenced the drilling and welding work (Photo 1). Since it was a nice and balmy, but mostly overcast day, I wanted to work outside – also good for avoiding inhaling too much welding smoke!

Setting up two collapsible work stands supporting two thick planks, I had a sturdy 'sacrificial' welding table to work on, (Photo 2). Note the original track with its slab foundation, seen under the table!

To ensure the correct gauge, I took the original piece of square 'key stock' I had cut to a length of 184mm when making the first track pieces almost 20 years ago, and kept it between the rails during welding (Photo 3).

I used my TIG-welding machine, but since the day was a bit windy, and the protective Argon gas would probably have blown away, I switched the machine to 'MMA' (Manual Metal Arc) in other words stick-welding mode, and wow, what a difference that was, comparing with the cheap 'buzz box' stick welder I used when originally building the track!

The arc started easily thanks to the high-frequency spark feature, and the rod only stuck a few times over the whole day — always due to my own clumsiness, of course. It never stuck badly, I could always simply wiggle it off – when using the old buzz box, starting the arc was sometimes very difficult and sticking happened regularly, so I had to release the rod from the holder and cut off the stuck rod with side cutters. No wonder it's called "stick welding"... But thanks to the better welding equipment, I could build twice as many track pieces in the same amount of time as before.

Note in Photo 3 that I only welded the rails to the ties on the outside; this ensures a free passage of the wheel flanges on the inside.

New connections

Photo 4 shows how I connect the track pieces with a simple tab-and-bolt method. Originally, I had tapped a threaded hole in the tie, and used a loose bolt through the tab. This, however, wore out the threads in both ties and bolts over several dis-assembly and re-assembly operations.

So I have instead spot-welded the head of a countersunk bolt to the

bottom of the tie, and use an ordinary Nylock nut to tighten the connection. Hopefully, this method will not cause as much wear on the threads as the previous strategy did. Renewing the bolt is also much easier than filling a worn threaded hole and drilling and re-tapping the thread.

The entire day's work is seen in the heading photo, altogether more than 30 metres of track, 15 sections of two-metre straights, plus four special pieces of varying length with a 9mm wider gauge at one end — they connect the straights to already existing curved sections having that amount of 'gauge spread', which is necessary in the very tight curves of 20ft radius.

Without the gauge spread, only my 0-4-0 Quickie would be able to negotiate the curves, all larger engines would either jam, or the flanges would climb over the rails, causing derailment!

This track has successfully been set up, without any further preparations, on a large asphalted field in a harbour, as well as on the floor in the loco storage building at our railway museum. EIM

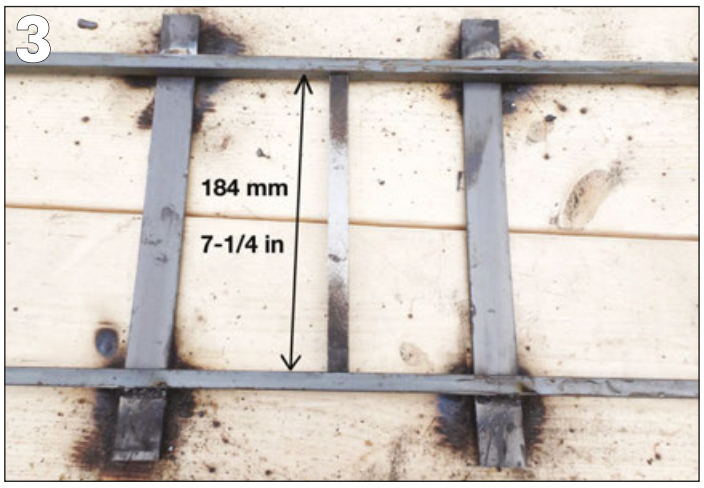
HEADING: A day's work, more than 30 metres of track resting on the old track and its paving-slab foundation.

PHOTO 1: Making more track!

PHOTO 2: Temporary welding station on top of older track Two thick planks form a sacrificial welding table.

PHOTO 3: A spacer, cut from key stock, for ensuring the correct track gauge.

PHOTO 4: Old and new method for connecting track sections.



Not to be snifted at...

Another of those phrases that might confuse model engineering newcomers...

BY **ANDREW CHARMAN**

The snifting valve – another of those locomotive components that experienced railwaymen know all about but newcomers might well say "eh?"

In fact the valve, also known as an 'anti-vacuum valve' has a simple purpose, to draw air into the cylinder when a locomotive is coasting, both to allow it to run freely and to avoid damage to the cylinders.

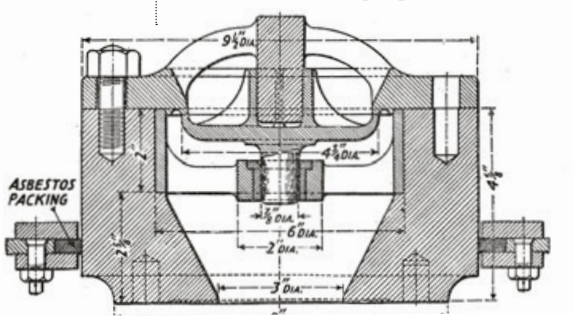
When the driver shuts off steam to the cylinders and the locomotive coasts, the resultant pumping action of the cylinders can create a vacuum. This can inhibit the free movement of the loco, but more seriously can draw soot and ash from the smokebox back down through the blastpipe and into the cylinder or valve chest, with the likelihood of damage resulting.

Multiple mounting

To prevent such issues the simple valve opens to admit air and destroy any vacuum. Sometimes the valve is mounted on the cylinders while on locomotives with superheaters it is mounted on the 'wet side', so the air is drawn through the superheater and warmed, preventing any likelihood of condensation in the cylinder once steam is admitted again.

Snifting valves were not universally accepted practice amongst railway companies – some locomotive designers argued that merely instructing the driver to keep the regulator slightly open when coasting fulfilled the same purpose. EIM

BELOW: An LNER-design snifting valve, of a type that was mounted in the superheater.



A rear parting tool

Rich comes up with a cutting-edge design to solve a workshop problem.

BY **RICH WIGHTMAN**

Quite a few years ago when I was new to this wonderful hobby I had been reading much about the virtues of parting off from the rear. I had a parting-off tool of course that fitted into the front quick-change tool post and worked okay for the most part but there were a few issues.

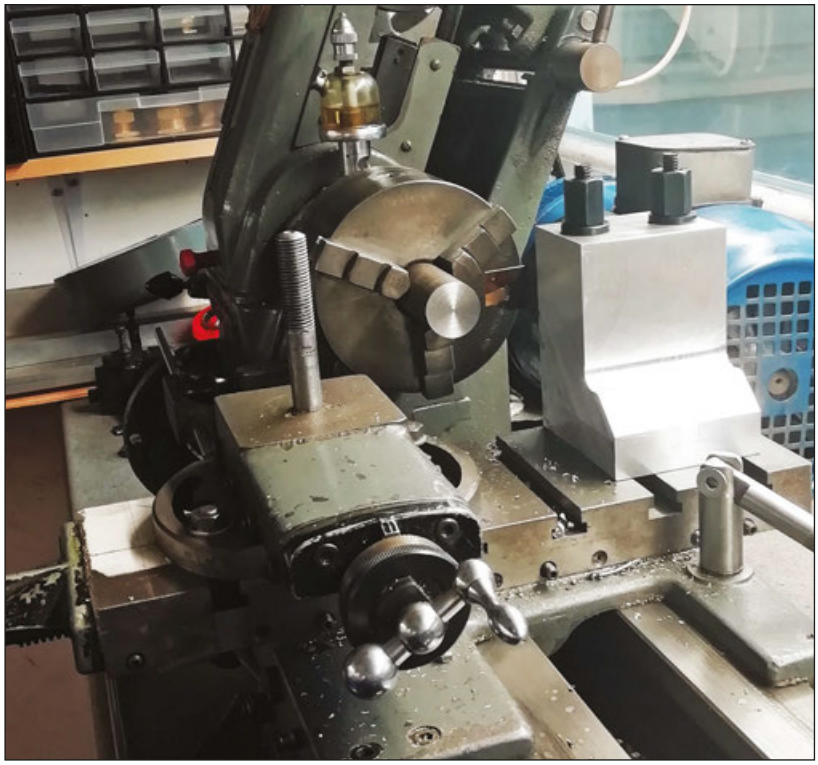
At the next model engineering exhibition we went to I took the plunge and bought a rear tool post and a parting tool and holder designed specifically for the Myford lathe (Photo 1). The cost at the time was about £75.00 for the two, a major investment for me then.

Back home I couldn't wait to try out my new purchase so duly went out to the workshop and fitted it to my Myford ML7 (Photo 2). I have to say that the expense was justified, parting off was a breeze, far better than using the front-mounted parting off tools.

The tool post is of the rocking boat design. The tool holder then clamps into the tool post. But unfortunately after a while the tool holder starts to work its way out of the tool post. This I believe is the weakness in the design.

I have tried all manner of things to stop it working out, shims of brass, steel aluminium, tightening the clamp bolts as far as possible and such like, all to no avail. The blade ends up not sitting square to the work and eventually grabs and jams often damaging the tungsten carbide tip. In Photo 3 you can see how the tool holder has started to work its way out and is now sitting at an angle. With the resultant overhang it seems to lose some rigidity.

The blade and tool holder then has to be refitted and set to centre height.



Adjustment is made by tightening or loosening the bolts to rock the boat which is awkward. On final tightening the blade can move by a fraction. If it does then setting process will have to be repeated.

One day while cutting a groove in an aluminium part I was making I didn't notice the blade had worked out and was at an angle. It suddenly grabbed and jammed the lathe. The tip embedded itself in the soft aluminium and ruined the part. This incident kick-started me into designing something that I think is a better solution.

This tool post is designed to fit my Myford ML7 but could easily be adapted to fit other lathes. Before I begin the description let me offer my usual apology. There will be a mixture of imperial and metric measurements. It doesn't bother me, I will happily use either and whatever material comes to hand. I will use mostly imperial measurements but use metric where fasteners are fitted.

I had two main thoughts while designing this tool. The cutting action of a rear-mounted parting tool is upwards so I decided that the blade should rest against a solid part of the tool holder and not be pushing against the clamp bolts. Secondly the tool

LEFT: The completed tool making a test cut on 30mm steel bar

PHOTO 1: Original rear tool post and its holder.

PHOTO 2: Tool post fitted to rear of Myford cross slide.

PHOTO 3: Angle tool holder moves evident here.

PHOTO 4: A new blade.

PHOTO 5: Facing the tool holder.

PHOTO 6: Boring recess for spigot.

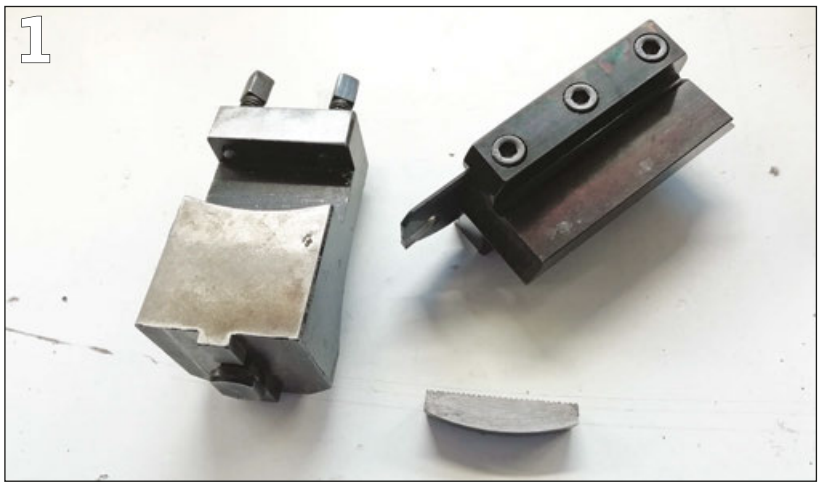
PHOTO 7: Testing fit of the spigot.

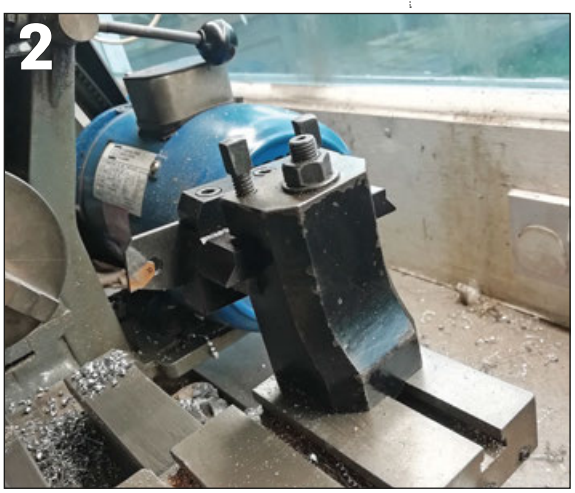
PHOTO 8: Drilling spigot.

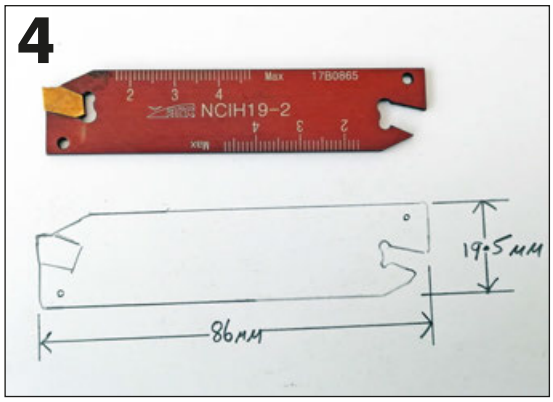
PHOTO 9: Drilling and tapping recess.

PHOTO 10: Machining the first shoulder.

PHOTO 11: Boring bar for cutting angle.







holder should be supported in the tool post and not rely solely on clamping/adjusting bolts.

Firstly I removed my existing blade – a 2mm that takes the GTN2 tip – and examined it carefully. It had a very slight twist in it, probably due to the above mentioned problems, so I discounted using it and bought a new one from arceurotrade. This blade also uses the GTN2 tips and is sized as per Photo 4. Further technical details of the blade can be found on the supplier's website (www.arceurotrade.co.uk). With the blade in hand I could sit down and rough out a few sketches until I was happy with the new design.

The tool holder

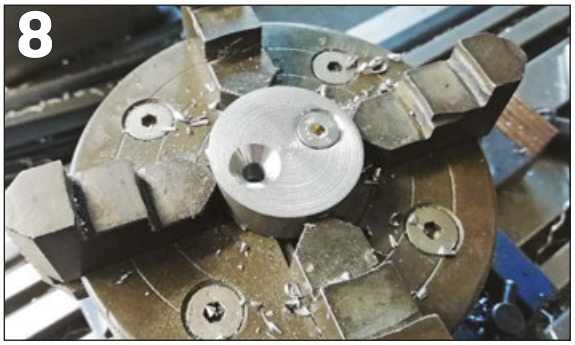
The drawings that are shown are the finished sizes that I ended up with so please check they are suitable for your lathe. The tool holder (Figure 1)is made from a piece of 2½-inch round steel and is faced both sides and finished to width (Photo 5). It then has the 1⅜-inch recess machined with a boring bar (Photo 6) aiming to get a good fit for the piece of 1⅜-inch round steel that is the spigot (Photo 7).

The spigot, (Figure 2) is a straightforward job that needs little explanation. It is made from a piece of 1⅜-inch round steel finished to a width. The spigot has two M5 holes drilled and countersunk (Photo 8). If you have a piece of steel wide enough you could machine the tool holder from the solid. Using the spigot as a drilling guide, drill and tap two M5 holes in the recess (Photo 9).

Back on the rotary table material is machined away to a depth of 0.145-inch to leave a square shoulder (Photo 10). It now has to have an angled undercut (if that's the right terminology) machined. The idea being that when the blade is pushed up by the clamp it is forced back into the face of the holder and rests solidly on the upper part of the holder. I don't think the angle is too important as long as there is one.

I looked through my cutting tools and came up with a boring bar (Photo 11), held in a boring head. I used the boring head because of the two flat sides the tool has – it was the best way for me to hold it. As near as I can say it's about 55 degrees when used this way.

The tool is lowered down to just above the face, then running at a fairly low speed, advanced into the workpiece by a few thou, by moving the Y axis and locking it. Then it is machined along by moving the X axis. Advance the tool a few thou at a time ▶



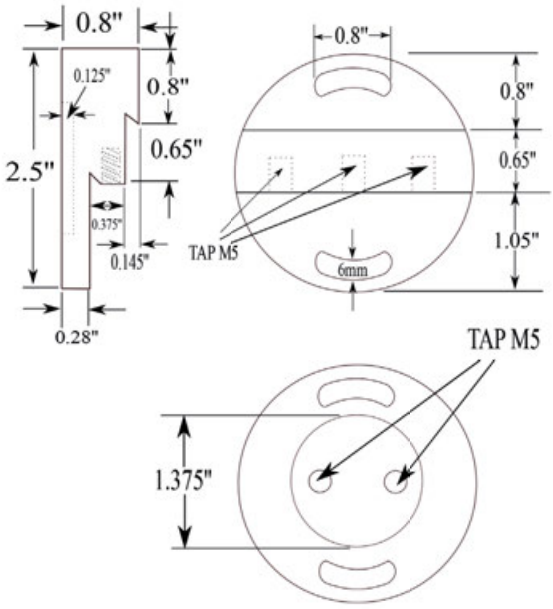


FIGURE 1 – TOOL HOLDER
approx half-size

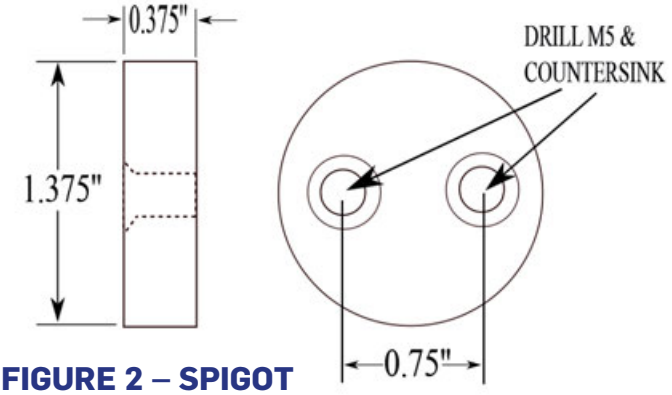


FIGURE 2 – SPIGOT
approx full-size

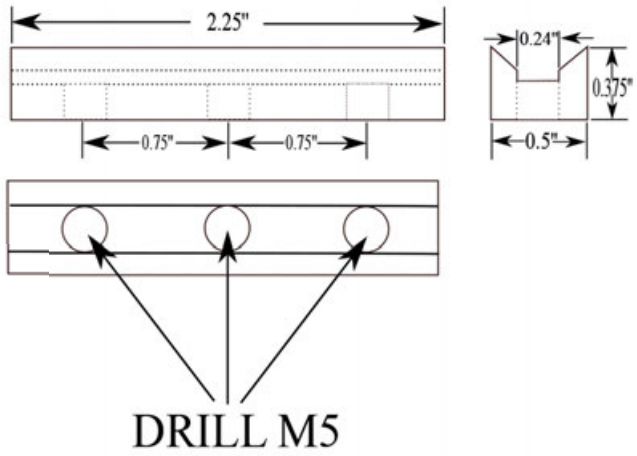


FIGURE 3 – BLADE CLAMP
approx full-size

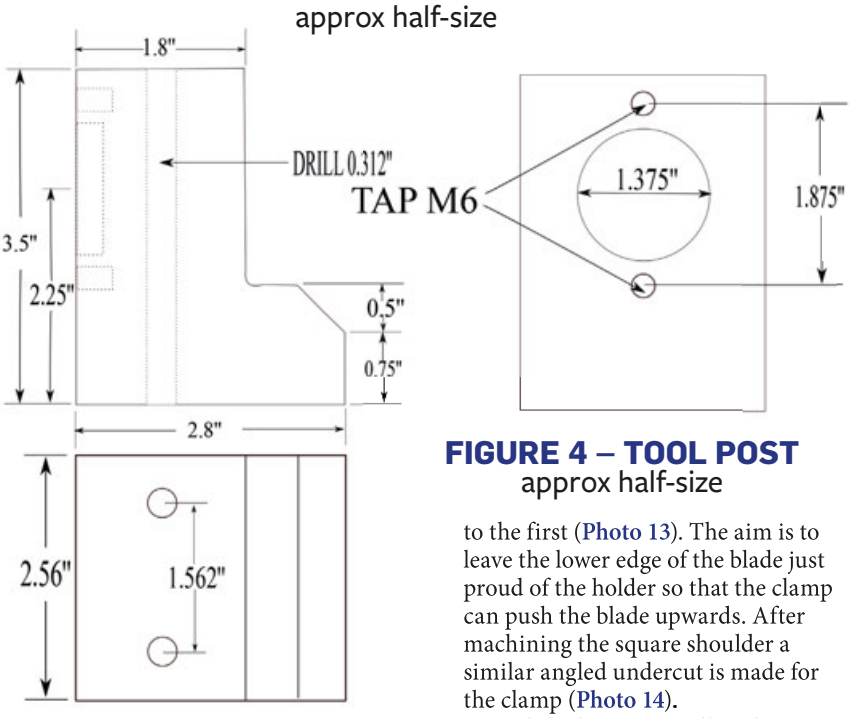


FIGURE 4 – TOOL POST
approx half-size

until the depth is reached (Photo 12). A dovetail cutter, if you have one, would achieve a similar result.

Now the second square shoulder can be machined in a similar fashion to the first (Photo 13). The aim is to leave the lower edge of the blade just proud of the holder so that the clamp can push the blade upwards. After machining the square shoulder a similar angled undercut is made for the clamp (Photo 14).

While the part is still in the rotary table machine the two slots by firstly drilling three 6mm holes for each slot (Photo 15), then joining them up with a 6mm cutter (Photo 16). With the holder now mounted in the milling machine vice drill and tap three M5 holes for the clamp (Photo 17).

That's it for the holder other than to say I like to run round all the sharp corners and edges with a small fine file to remove any accidents that are waiting to happen.

FIGURE 1: Tool holder.

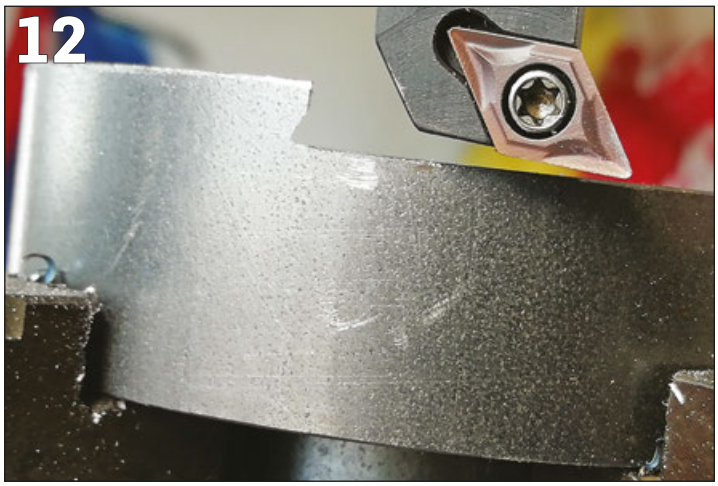
FIGURE 2: The spigot.

FIGURE 3: Blade clamp.

FIGURE 4: Tool post.

The blade clamp

The blade clamp (Figure 3) starts life as a piece of ½-inch x ⅜'-inch flat steel bar 2¼ inches long. Held in the milling machine vice it has a 6mm wide slot cut 0.170'-inch deep (Photo 18). To machine the angled sides I used a countersink, lowering the tool a few thou at a time and running the X axis back and forth (Photo 19). Finally drill three 5mm holes to match those



in the tool holder (Photo 20).

The eagle-eyed among you will notice that the angled undercut in the tool holder is 55 degrees and the blade clamp is angled at 45 degrees. Rest assured that in use it works perfectly and in actual fact does provide a little clearance. A trial assembly can be seen in Photo 21.

The tool post

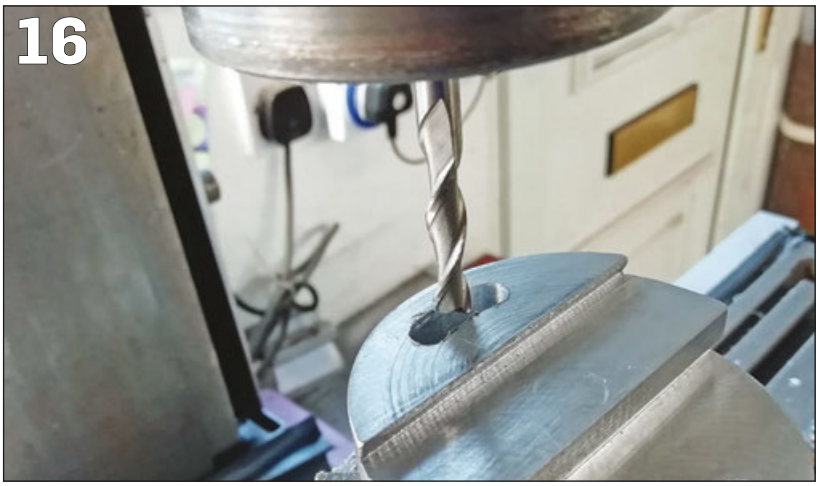
Moving onto the tool post (Figure 4), I used a block of aluminium that was in stock. Ideally I suppose steel or cast iron would be the preferred material but I didn't have anything that size to hand so aluminium it was.

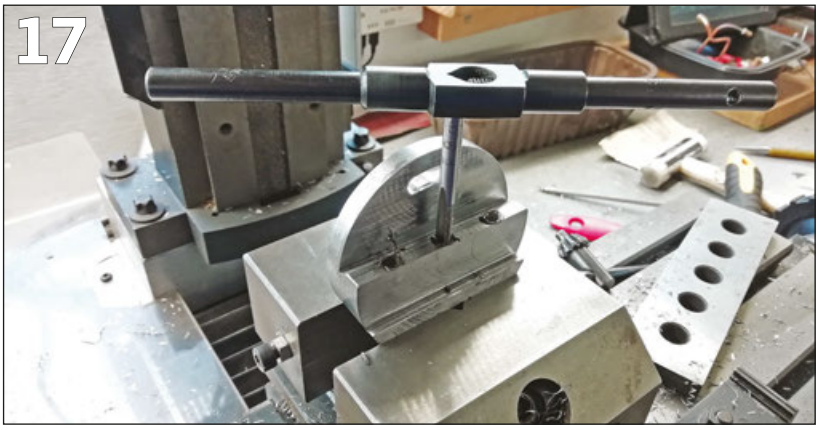
My initial plan was to use a single stud in one of the T-slots but this block of aluminium was wide enough to be able to use two studs in two T-slots. Firstly the block was fly cut to square it up a bit with attention paid to the bottom and front faces, making sure I got those two as square as possible. Some material was then cut away from the rear face to remove some of the bulk.

The block was then stood on the cross-slide with the tool holder clamped to it and the tip of the blade lined up with a centre in the headstock. From there I could work out where to machine the recess in the tool post. Do this for whatever lathe you have.

The recess is then machined slightly deeper than ¼-inch to give a little clearance, followed by two drilled and tapped M6 holes to match the slots in the tool holder (Photo 22). Vertically drill right through for two M8 studs to match the T-slots in the lathe cross slide (Photo 23).

Two 8mm studs 127mm long and two 8mm T-nuts were purchased from arceurotrade. Old Myfords of course don't use metric studs but I have found that with a small amount of fettling the 8mm T-nuts will fit and 8mm studs are near enough to 5/16-inch to not worry. Anyway at £2.62 for two studs and £2.62 for a pair of T-nuts its not really worth the ▶





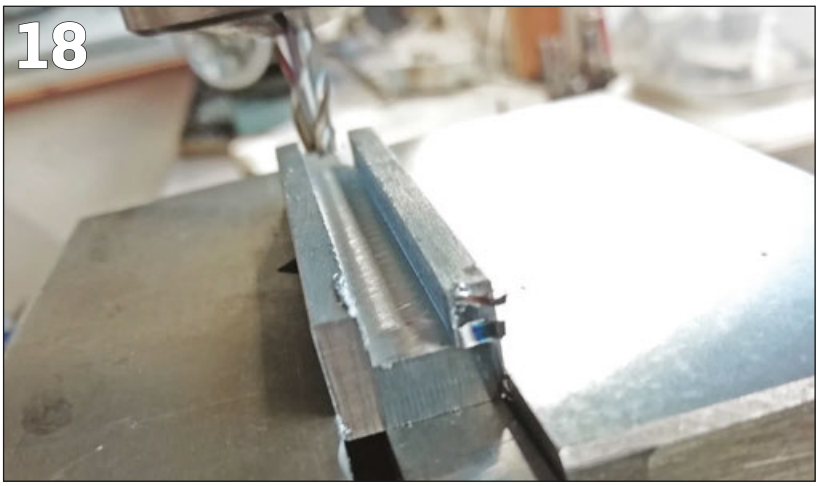


PHOTO 12: The angle cut.

PHOTO 13: The second shoulder is machined.

PHOTO 14: The second angle cut.

PHOTO 15: Drilling the slots.

PHOTO 16: Slots are then joined up.

PHOTO 17: Three M5 holes drilled and tapped.

PHOTO 18: 6mm slot machined in clamp bar.

PHOTO 19: Angle machined with countersink.

effort to make your own.

The two 8mm nuts and thick steel washers I did make myself. Once again all the sharp corners and edges were removed with a small file.

The last two pieces I made were a couple of thick brass washers to go on the two socket head cap screws that fit into the slots in the tool holder.

A complete set of parts is shown in Photo 24. All the steel parts were a given a dose of blackening which helps prevent corrosion and enhances the look – the duly treated parts can be seen in Photo 25.

With all the parts assembled the tool post could be mounted on the lathe cross slide and set to centre height. This can be done quite quickly by using a centre in the head stock or the tail stock as shown in Photo 26.

A test cut parting off some 30mm steel bar was a complete success, as shown in the heading photo to this feature. The blade sits at a perfect 90 degrees to the work and is perfectly vertical. It is extremely rigid, there are no signs of any stress while cutting and it is free from chatter.

A short video of the tool in action can be seen here;

https://youtu.be/zobcQF04uu8

After parting off the tool is rigid enough to skim the face of the previously parted-off material by advancing the saddle a couple of thou. A short video can be seen here;

https://youtu.be/iYMc1lLewvM

Overall I am very pleased with the way the tool works. EIM

PHOTO 20: Clamp has three 5mm holes drilled in it.

PHOTO 21: Trial assembly of holder.

PHOTO 22: Recess and tapped holes in tool post.

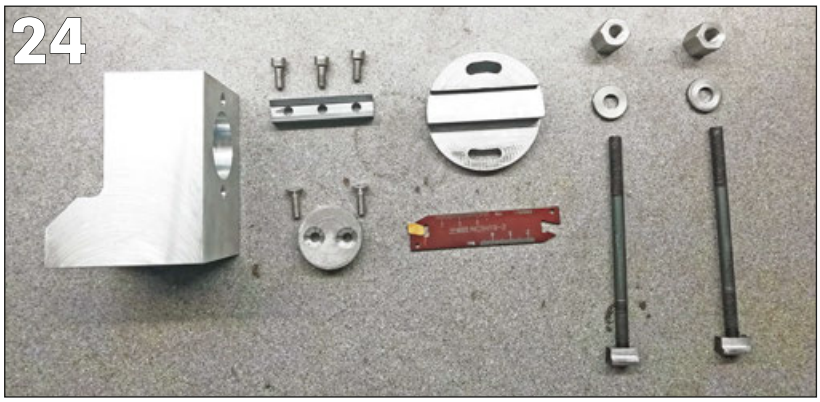
PHOTO 23: Two holes drilled in post for studs.

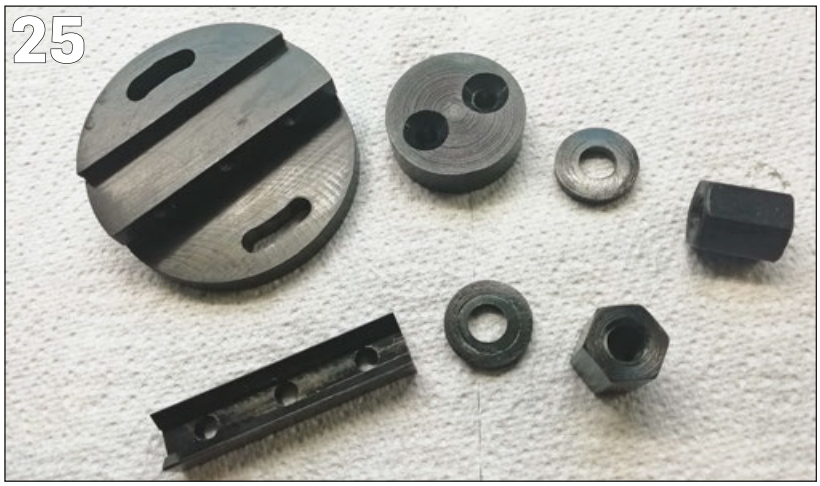
PHOTO 24: Complete set of parts.

PHOTO 25: Blackening applied to steel parts.

PHOTO 26: Completed project – the tool height being set.

All photos and daigrams in this feature by the author





The moment one snaps...

Snapped off a drill in a hole? As Cambrian ME member Bob describes, it doesn't have to be the end of the world...

BY **BOB CANNON**

One of my lockdown projects is to build the double-acting Muncaster engine described in the March and April 2020 editions of EIM, and rather than ask builder Geoff Walker for a cylinder casting I decided to fabricate my own. All was going well until I managed to snap a 1.8mm drill deep in the steam way of the cylinder.

The drill snatched as it broke through into the previously drilled cross hole. I have been drilling holes in sticky bronzes for long enough not to have been surprised at this outcome but when it happens it is always the cause of great consternation.

A quick trawl of the internet suggested dissolving the remains of the drill with boiling alum. Videos of the process in action convinced me it was worth giving it a go – I was able to buy some alum online and it was quickly delivered.

Three-way choice

Alums are double sulphates and the most common are potassium aluminium sulphate, ammonium aluminium sulphate and aluminium aluminium sulphate. These is also a chrome alum which is a beautiful violet colour.

I could not find which alum worked the best and decided that since the aluminium ion was common to all the successful outcomes described on the internet I would go for the aluminium aluminium sulphate.

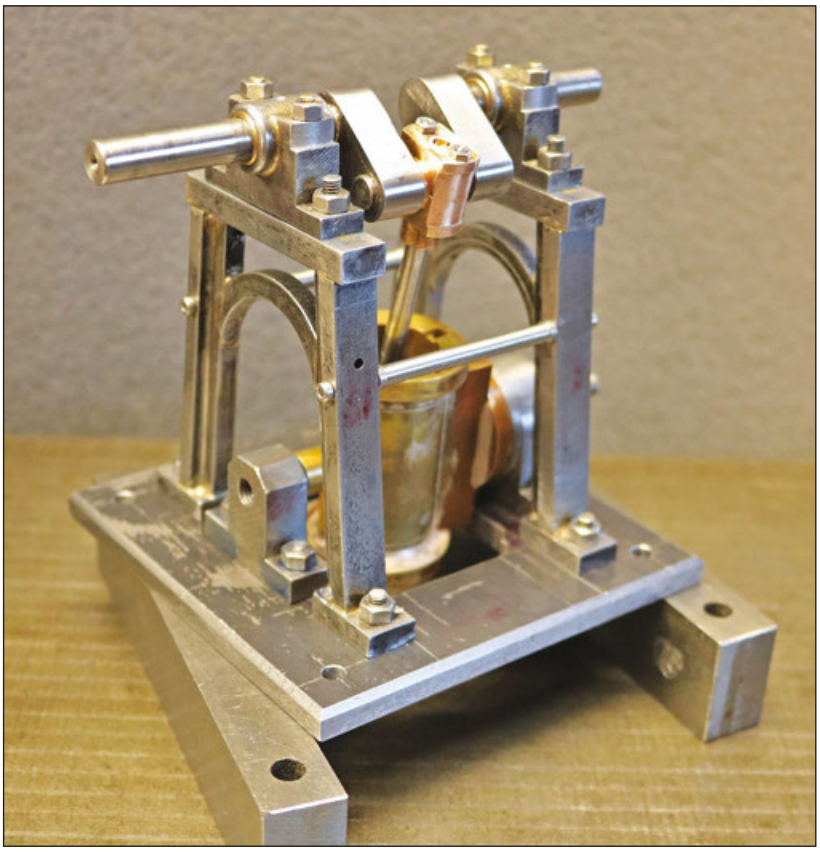
I dissolved three generous tablespoonsful in about 300ml of hot water heated in a Pyrex bowl in a saucepan of boiling water. The part was submerged in the hot solution and for good measure I dropped in the remains of the drill shank just to see what happened.

The chemical reaction was slow to start but after 15 minutes a steady stream of tiny bubbles appeared from the steam port. At the same time the broken drill shank was fizzing away quite vigorously – I took this to be a good sign.

There was no sign of any attack to the bronze parts, the silver solder or the stainless steel pivot that was Loctited in place at the stage.

I found it to be quite a hands-on process, with my needing to top up the water to replace that lost by evaporation and reheating the solution – it works much faster hot. I used a pipette to frequently renew the solution down the hole.

"The broken drill shank was fizzing away quite vigorously – I took this to be a good sign..."



ABOVE RIGHT: The broken drill has certainly not impeded Bob's progress on the build of his Muncaster engine which he began as a project during lockdown.

Do you have a dodge, a tip or a clever way of doing things that fellow EIM readers might benefit from? If so, send in details, and a picture if possible, to the address on page 3...

After about five hours the bubbling ceased and poking about with a fine scriber revealed no trace of the drill tip (or the broken drill shank). I washed everything in very hot water and cleaned up the kitchen.

The cylinder was given half an hour in the ultrasonic bath to make sure all traces of the alum were removed and then the part was dried.

The method had worked well and the part seemed to suffer no ill effects. The silver solder did dry to a matt silver colour but this easily buffed up. The stainless steel pivot was just as good a fit in the reamed hole in the pivot block so all was well. I was able to complete the drilling with no further problems.

Safety precautions

Before you use this method, however, I would add a safety rider –take care when using hot alum solution as I am sure you would not want to ingest it or get it in your eyes. Wear suitable safety glasses and PPE while you are working with alum.

Any splashes of the alum solution will dry to leave a white residue, so do keep your working area clean using a damp cloth.

If you are in any doubt about working with alum please check the safety sheets that your supplier should enclose with the chemical and follow the advice.

Remember too that aluminium sulphate was the chemical involved in the Camelford water pollution incident in 1988 and although the quantities used here are trivial by comparison to the 20 tonnes that entered the drinking water supply in Cornwall exercising caution in dealing with any chemical is sensible. You have been warned! EIM

■ Tech-ed Harry adds the following possibly useful chemical formulas for the various alums...

- Potassium alum, also called 'potash alum' or simply 'alum', $K(SO_4)_2Al(SO_4)_3{\cdot}24H_2O$
- Sodium alum, also called 'soda alum' or 'SAS', $NaAl(SO_4)_2{\cdot}12H_2O$
- Ammonium alum, $NH_4Al(SO_4)_2{\cdot}12H_2O$

Ravenglass Retrospective

Celebrating the genius of Sir Arthur Heywood with his 15-inch gauge locomotives that have survived, and those that have been recreated....

BY **MARK SMITHERS and ANDREW CHARMAN**

Editor's note: We don't go in for a lot of prototype material in EIM but we feel this is appropriate. Sir Arthur Heywood could be considered as the man behind the largest examples of miniature engineering, though he no doubt would have bristled at any such suggestion, considering his 15-inch gauge locomotives were very much 'minimum gauge'.

Certainly Heywood engines retain a fascination with many a model engineer today, stoked by the recent release of the first part of a major two-volume study of the subject by James Waterfield. This joins the extensive history of Heywood written by Mark Smithers and published in 1995 by the Plateway Press, and reprinted in 2010.

PHOTO 1: Heywood united – the inaugural 15-inch gauge train on April 11th 2019. 'Katie', effectively a new-build on the frames of the original 0-4-0T, and 'River Irt', which retains the chassis of the Heywood 0-8-0 loco 'Muriel'.

PHOTO 2: 'River Irt', complete with celebration headboard, basks in some welcome sunshine at the 'down' end of the 15-inch gauge line at Beamish.

Photos by Mark Smithers unless stated

The current coronavirus pandemic has sadly brought most of the heritage railway sector to a complete standstill but one of its few benefits is an opportunity to reflect upon past events that often did not receive their due amount of media coverage at the time they took place. Two classic examples were the Beamish Great North Steam Fair of April 2019 and the Ravenglass and Eskdale Railway's Big Birthday Gala of the following month.

Both events had a strong Heywood flavour: the former marked the opening of the new 15-inch gauge railway at Beamish, with visits from R&ER locos 'River Irt' and 'Katie', whilst the latter saw the official celebrations for the 125th Anniversary of the completion of Sir Arthur Heywood's 'Muriel', of which of course the chassis today survives under River Irt.

The Beamish event ran from 11th-14th April and saw the two R&ER locos working a single-carriage train facing outwards in 'book-end' fashion, with crew members including Ravenglass stalwart Peter Van Zeller and his two female colleagues Lisa Brathwaite and Anna Tilsley.

PHOTO 6: 'Katie' shunts empty stock into place prior to the morning run to Dalegarth, May 5th 2019. On its shuttle trains to Murthwaite the lack of a turntable ensured the loco ran 'back rail first', unusual on the Ravenglass line but a norm for Heywood who had firm views on the lack of need for a cab....

This was the reconstructed Katie's first visit away from Ravenglass since its re-dedication ceremony on April 28th 2018. The visit proved popular with the Beamish 'punters', although ideal photographic vantage points proved to be difficult to find, largely owing to the position of the sun and various 'obstructions'. Nonetheless, Katie was destined to make two further visits away from Cumbria during the course of 2019, the first to the locomotive's former 'stamping ground' at Fairbourne and the second to the Kirklees Light Railway.

Centre stage

The Ravenglass Gala, spread over the Bank Holiday of 4th-6th May 2019, was by way of contrast a solely 15-inch gauge affair and again Katie and River Irt were very much centre stage, although this time they were joined by the other R&ER locomotives and visiting Krauss 0-4-0T + T 'The Bug' from the Romney Hythe & Dymchurch Railway.

The highlight of this event took place on its first day, a celebration ceremony for Muriel's anniversary with an address given by R&ER chairman, Peter Hensman. In commemoration of the anniversary, River Irt carried an appropriate headboard for the occasion and cakes were provided.

The ceremony was followed by a locomotive cavalcade and intensive services followed throughout the weekend, including triple-header trains. Photographic opportunities were myriad and included the chance to inspect historic remains of Sir Arthur Heywood's locomotives 'Ella' and Muriel. A representative selection of photographs from the two events accompany this feature.

PHOTO 3: R&ER chairman Peter Hensman cuts the cake during the 'Muriel'/'River Irt' 125th Celebrations.

PHOTO 4: 'River Irt' leads the 'top and tail' train along the new 15-inch gauge line at Beamish museum.

PHOTO 5: There have been replicas built of Heywood's 'Katie' but this one is not really, as it was built upon the frames of the 1896 original. After the loco was dismantled at the Fairbourne Railway the frames survived, initially in use as a wagon before being dumped in the sand dunes, from where they were rescued many years later by members of the Narrow Gauge Railway Museum Trust at Tywyn.

The new locomotive was eventually built on these frames, with most of the work carried out by Station Road Steam and completed in 2018. Today the loco lives in the Ravenglass Railway Museum – it is pictured here taking part in the Locomotive Cavalcade at the R&ER's Gala on May 4th 2019, with Peter Van Zeller on the footplate.

PHOTO 7: Heywood 'holy relics' on display in Ravenglass Railway Museum – the left-hand side tank of Muriel and left-hand mainframe of 'Ella'.

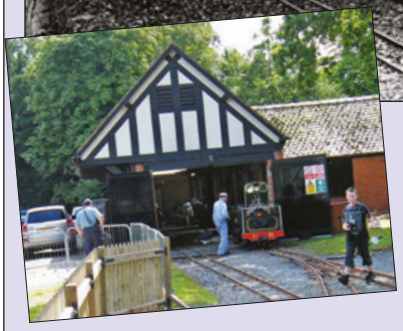
PHOTO 8: The right-hand mainframe of 'Ella' could be seen outside the locomotive works at Ravenglass on 5th May 2019. A replica of the locomotive is currently under construction at a private location, for which new mainframes have already been made.'

PHOTO 9: The side tanks of 'Ella', which once saw service on the rebuilt and re-gauged 'Bonnie Dundee', are now stored at Murthwaite and they are partially visible in this view on May 4th 2019. They are shallower than those of 'Muriel' and employ a circular, rather than rectangular profile tank filler. When 'Ella' was built, Heywood had yet to standardize a boiler diameter and tank height for his 'mature form' locomotives.

PHOTO 10: The unfortunate consequence of fitting 'River Irt' with the standard pattern of wide firebox R&ER locomotive boiler during the late 1970s was the loss of the upper rear portion of Muriel's side mainframes. This right-hand view shows the effect of the work undertaken in order to enable the new boiler to fit.

PHOTO 11: A study in elegance – 'River Irt' casts a shadow on the paint shop wall at Ravenglass in the mid-day sun on 6th May 2019.

PHOTO 12: Gala stars join the line-up of the Ravenglass fleet on 6th May 6th 2019. From left-to-right' are 'Katie', 'River Mite', 'Northern Rock', 'River Irt', interloper 'The Bug' visiting from the Romney, Hythe & Dymchurch Railway, newest Ravenglass arrival 'Whillan Beck' and 'River Esk'.



The Eaton Hall Railway was Sir Arthur's crowning achievement, and today survives in revived form (left). Heywood 0-4-0 'Katie' survives too, at least the chassis does in a mainly new-build loco.

Heywood – a Pioneer

Sir Arthur Heywood's principles of the 'minimum gauge' (*writes* ***Andrew Charman***) are today regarded as pioneering engineering but at the turn of the 19th and 20th centuries his 15-inch gauge estate railways, which he had visions of being used by the likes of agriculture and the War Office, failed to find widespread favour.

The two major lines built to the principle were around Sir Arthur's own estate at Duffield Bank in Derbyshire and for the Duke of Westminster at Eaton Hall in Cheshire. Following Sir Arthur's death in 1916 the Duffield Bank line was dismantled though much of its stock went to the Ravenglass & Eskdale Railway, while the Eaton Hall line was closed and lifted in 1947. Thankfully this has since been revived and in normal times stages an annual public open day.

Sir Arthur's legacy is alive and well today in many forms. His locomotive designs are popular with modellers and model engineers, despite their complex for the time technical innovations such as radiating axle systems, while several full-size replicas of the locos have been built. Many also regard the 15-inch gauge Perrygrove Railway in the Forest of Dean, with its stiff gradients and sharp curves, as a modern reincarnation of the Duffield Bank line.

Interest in the work of Heywood is also likely to be further boosted by a major new two-volume study by James Waterfield, who owns two full-size replicas of Sir Arthur's locos 'Effie' and 'Ursula' as well as several items of rolling stock. Volume 1 has already appeared and volume 2 on the Eaton Hall Railway is in production.

Open days at the modern-day Eaton Hall Railway have featured replicas of Heywood engines, here the version of 'Katie' built by FMB Engineering in 1996, and James Waterfield's 0-6-0T, then in the guise of 'Shelagh' but today presented as sister loco 'Ursula.'

The epitome of the estate railway, double-headed locos and Heywood rolling stock full of happy passengers at an Eaton Hall Railway open day in 2009.

Today's Eaton Hall Railway includes the sharp triangle leading out from the hall onto the cricket field.

All Eaton Hall open day photos by Dave Billmore, courtesy of Harry Billmore

Building a Ten-Wheeler

Jan-Eric sorts the input of water to the boiler of his 7¼-inch gauge loco project.

BY **JAN-ERIC NYSTRÖM** Part Six of a series

Continuing the build of my 7¼-inch gauge 4-6-0 locomotive, I wanted to add another way of getting water into the boiler – even with the loco standing. Since small injectors have a reputation of being finicky (both in construction and use), this meant a mechanical pump of some kind – either manually operated, or steam powered.

Because I often give train rides to the public at our railway museum, I decided against a hand pump – there's enough to do at the station already, checking passengers getting off and embarking, filling the tender, adjusting the fire and so on... A 1980s drawing of a 1½-inch scale model pump sparked my interest – even though it wouldn't be absolutely true to prototype, the design could be adapted to roughly simulate my prototype's three-cylinder, two-stage compressed air pump. In the model however, one cylinder would be for steam, and one each for compressed air and boiler water.

A caveat: don't expect to get a very high air pressure from a small steam-powered pump! The cylinder volume is small, and you cannot achieve a high-enough speed to produce a pressure high enough to compete with an ordinary electric workshop compressor – which generates up to 120psi after a few minutes of running.

For a miniature air pump like this, 20 or 30psi would be about the maximum you could expect. The speed of the pump will be something between 30 and 200 strokes per minute, depending on load – faster for air, slower for water.

Water more than air

As water pumps, small pumps can perform admirably. My first test with this design reached well over 220psi, which certainly is enough to get water into the boiler, against the steam pressure of some 100psi. Why doesn't it work well as an air pump, then? Simply because air is compressible, while water is not. As soon as the water piston starts to move, the water will be forced out through the valves and into the boiler – it has nowhere else to go – while the air will first have to be compressed inside the pump cylinder until its pressure is higher than the pressure in the air reservoir.

In order to achieve 30psi of air pressure (i.e. around 2 atmospheres), the air piston already has to move some two thirds of the stroke before the exit valve will even start to open. This means that only a very small volume of air can be supplied per stroke (in contrast, each stroke of the water piston will deliver the entire volume displaced by the piston stroke.) This is also the reason why the full-size prototype air pump is a two-stage design – better efficiency!

So why did I build the air pump section at all? Well, mostly since the third cylinder has to be there – after all, I want my miniature to look at least somewhat like the prototype! Very few additional parts are in fact needed, thanks to the 'flap valve' design. Besides, you could possibly use 20psi of air for some appliances on the locomotive...

Figuring that this design might interest at least some of the readers of this magazine, I prepared full drawings, and took many photos while building. All measurements are in millimetres, but they can be converted to imperial sizes very simply, by dividing each number by 25.4. For instance, the steam cylinder diameter is 28mm – dividing by 25.4, you get 1.102.

Using most pocket calculators, you can even input 25.4 as a 'constant': First press 1, then the divide button twice, input 25.4, and finally press '='. The result will be 0.03937, i.e. the inch equivalent of one mm. After this, all you have to do is enter a new measure in mm, and press '=', and you'll have your inch equivalent. This can immediately be repeated with a new metric dimension followed by '=', and so on.

Some measurements may have to be modified to fit imperial size reamers and O-rings, but that should be a trivial matter for most builders… So, let us not hang ourselves up on the 'old measurement controversy – let's start making a pump! As a consolation, I'll use imperial units for the discussion about pressures....

The valves

The pump actually has two D-valves; the first one is operated by the main pump piston, while the second is a 'shuttle valve' – it is actuated by the steam admitted by the first valve. The shuttle is really a piston in its own right, so theoretically speaking, the pump is comparable to a two-cylinder steam engine, where the motion of the piston of the first cylinder affects the valve of the second, and vice versa. The fact that the two cylinders are of very different size doesn't matter.

Looking at Figure 23 we see a section of the entire pump, as well as of the shuttle and other valves. Note Section A-A: On the left side is the mechanically actuated valve stem with its D-valve (the valve cavity is shown in dark orange), on the right, the shuttle valve, with an identical

FIGURE 23: Sections through the pump and its valve chests.

FIGURE 24-25: Component drawings for pump, refer to part numbers in text.

FIGURE 23

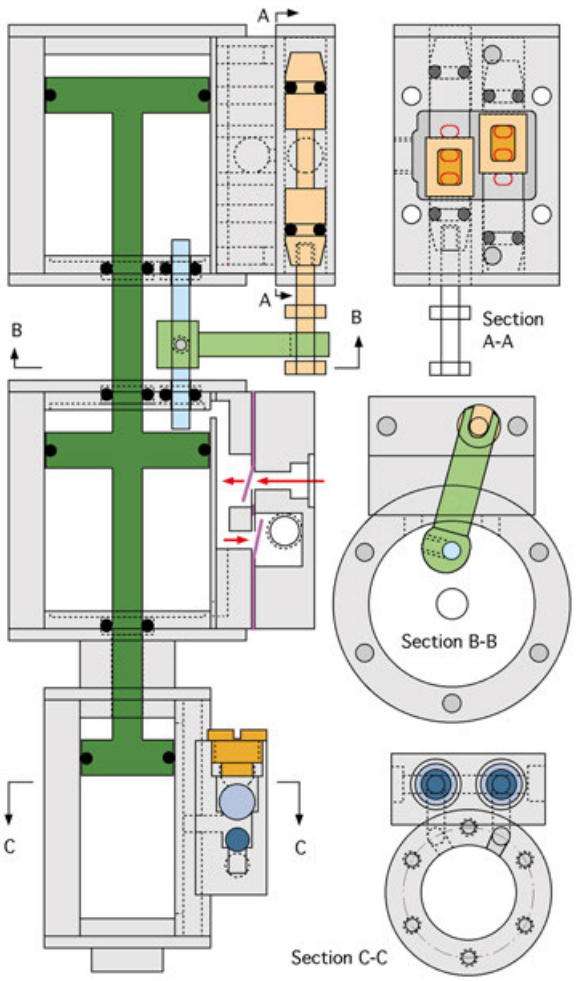


FIGURE 24-25 – Approx full-size

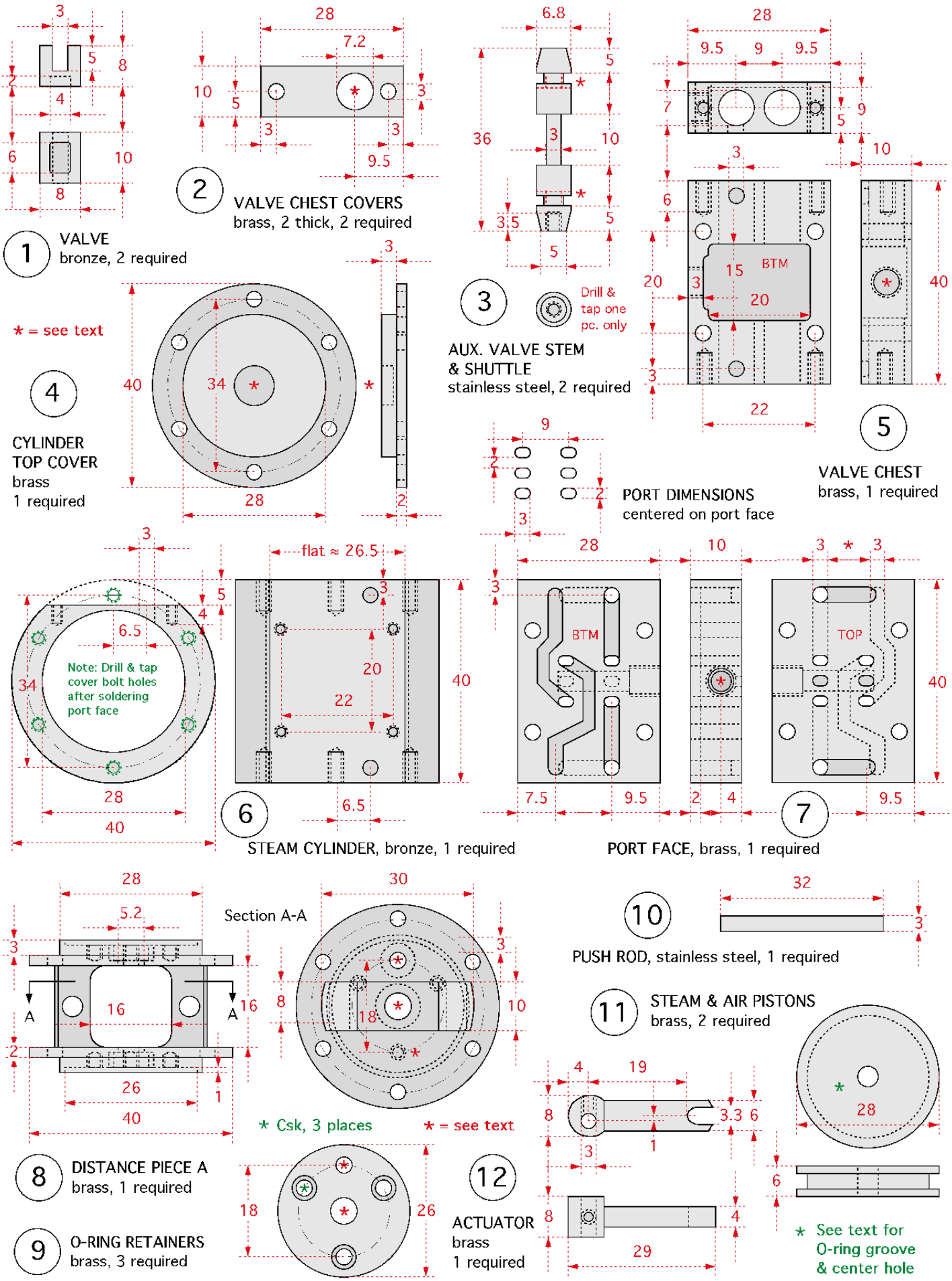
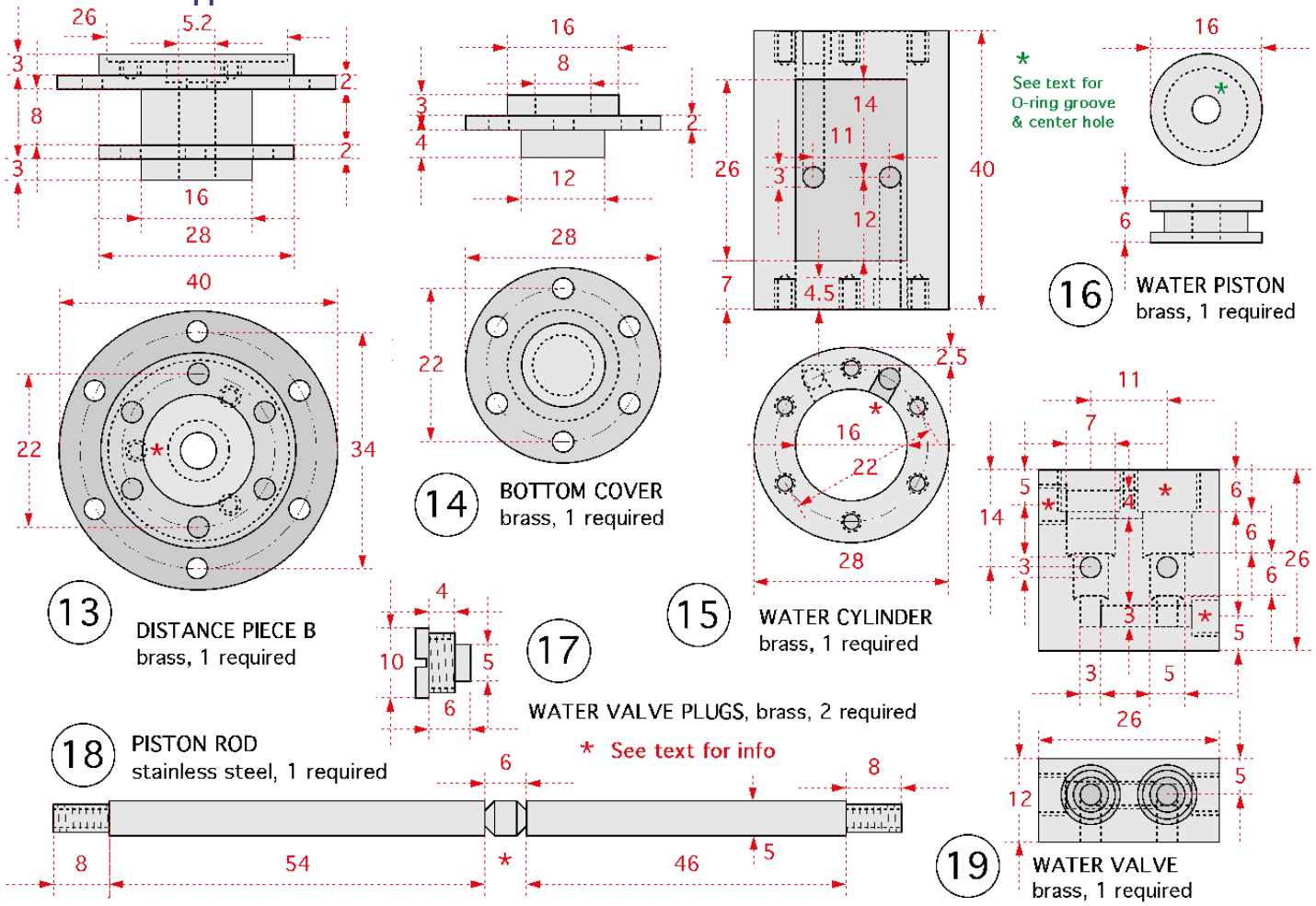


FIGURE 26 – Approx full-size



D-valve. Both valve stems are sealed with O-rings, and reside in a single valve chest cavity (darker grey). The position of the steam ports is outlined in red. We'll look into the function of all these parts a little later.

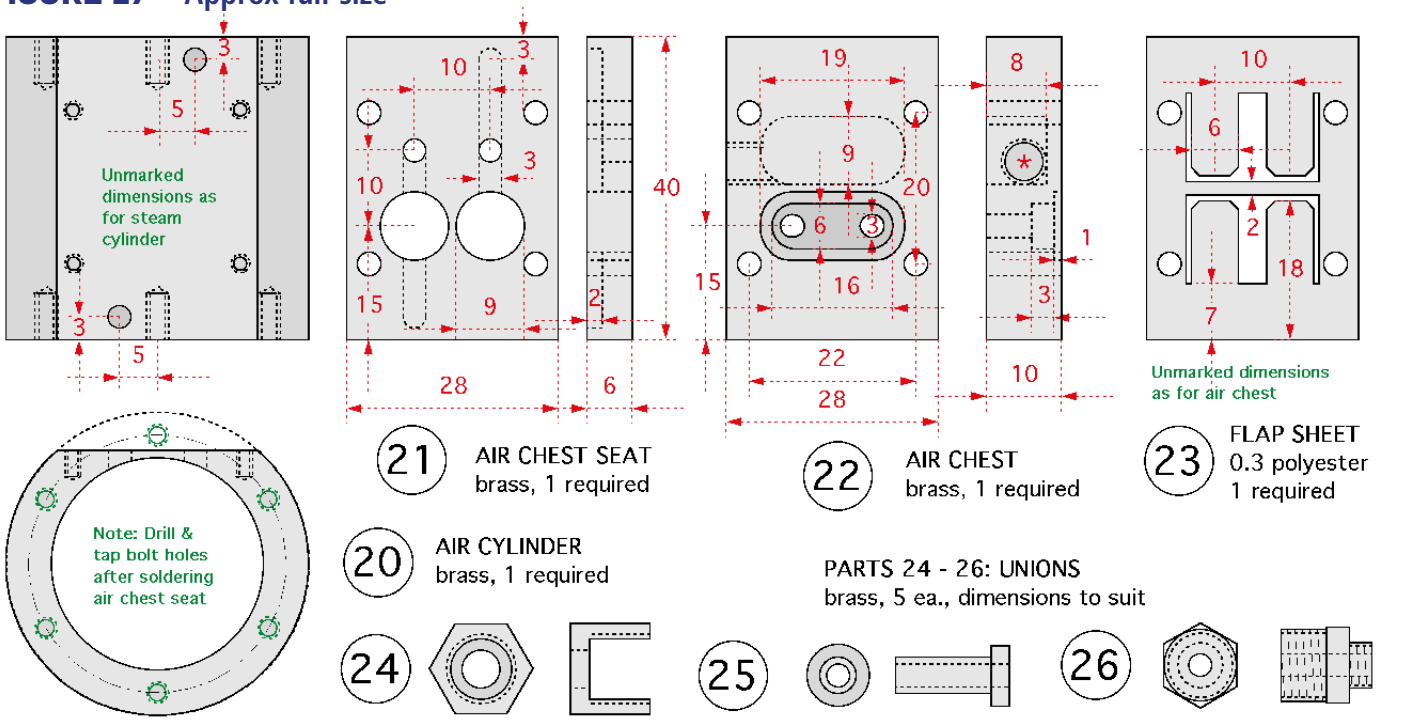
Section B-B in Figure 23 shows the actuator (light green) and its rod (light blue) – they are moved up and down by the pistons (dark green) in the steam and air cylinders. In order to prevent leaks, this rod has to be sealed by O-rings, just as the piston rod.

FIGURE 26-27: Component drawings for pump, refer to part numbers in text.

The middle cylinder is the air cylinder, and it has a very simple valve mechanism; 'flaps' made of thin rubber or another suitable material. The red arrows show the flow of air, and the purple lines indicate the flaps in operation.

Last, but not least – in fact, the reason I built this pump – is the water cylinder. It is smaller than the steam cylinder – this is necessary in order to achieve a water pressure higher than the steam pressure of the boiler. Say that we operate the pump on 100psi of steam; the area of the steam piston is a little less than 1 square inch, so disregarding friction and losses, we'll

FIGURE 27 – Approx full-size



get a force of more than 90 pounds on the piston. This is transferred to the water piston, but since its area is only 0.3 square inches, it can theoretically generate a water pressure of 270psi – and, as already mentioned, I did get 220psi on the gauge when testing with 100psi compressed air!

The water passes through stainless steel ball valves, shown in Section C-C of Figure 23. There are four balls in the valve chest, of two different sizes. In this way, the valves can be built in a small space and only need access from one end.

Building the pump

The construction drawings (Figures 24 to 27) are presented in actual size, and from this it can be noted that the two D-valves, Part 1, are indeed very tiny, just 8 by 10mm – this requires some precision in fabrication. Photo 53 shows how I used a tiny end mill to form the critical dimensions of the valves, using the X-Y feeds of the mill table. In Photo 54 the valves are finished on the steam port side, but still need to be separated and milled on the back side.

The D-valves will be moved by the valve stem and shuttle spindles, Part 3, and these, too, have to be made to tight tolerances; the middle part of the spindle must fit into the slot on the valve, but not so tightly that it will stick. For strength, the spindles should be made of free-cutting stainless steel. Brass will not be strong enough (don't ask me how I know...) The D-valve should be free to "float" on the spindle, but without slop.

Photo 55 shows the turning of one of the spindles – light cuts must be taken with a thin parting tool, and it is necessary to use a live centre in the tailstock, otherwise the thin spindle will flex. The ends of the spindles are tapered – this will make installing the O-rings a lot easier!

The valve chest, Part 5, is made from a solid piece of brass. The order of machining operations is important: first, the holes for the spindles should be drilled and reamed. This will ensure a smooth surface, necessary in order to avoid wear of the spindles' O-rings. The dimension of the grooves for the rings is not marked on Part 3 in the drawing, but the ring must be allowed to 'roll' a bit in the groove. Also, the depth of the groove should be adjusted so that there is only slight friction when the spindle is pushed in by hand – if the ring is compressed too much, friction and wear increases. A compression of 5 per cent of the material thickness is usual.

I've used 7mm outside diameter, 4mm inside, rings in my design, and so the groove is 1.4mm deep and 2mm wide. These rings were still easy to slip over the end of the shuttle and into the groove. If you use thicker rings, it's more difficult. Also, if you use thicker rings, make sure you extend the grooves inwards, as marked in red dotted lines on the drawing.

When the spindle holes are finished, you can mill and drill the other openings in the chest (Photo 56). Note that the chest is not milled through, so there is no separate top cover for it, only the end covers, Part 2. These covers must be sealed with a gasket, so that the shuttle valve is in a steam-tight space. The slight widening of the valve chest opening at left will better enable the steam to flow from the inlet to the other side.

The mounting holes are drilled through, the end holes are tapped to take the screws that hold the end covers in place. Note the two steam holes (darker grey) – they will coincide with corresponding holes on the port face, so their location has to be exact.

Photo 57 shows the finished valve chest block, and in Photo 58 the spindles and valves are in place. Make sure that the valves do not protrude over the surface of the chest – they ▶

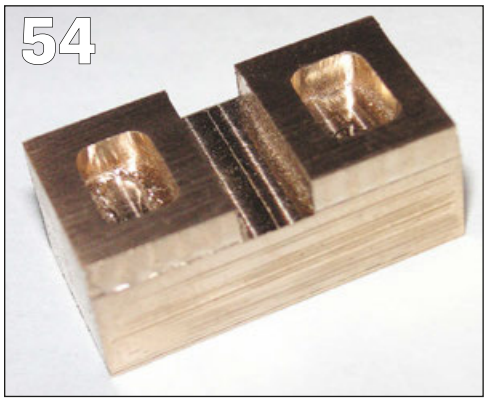


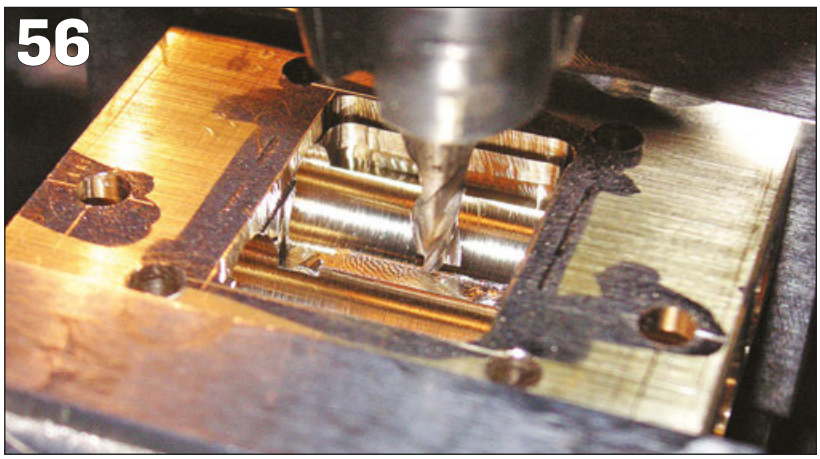
PHOTO 53: Milling the tiny D-valves using the X-Y feed of the mill.

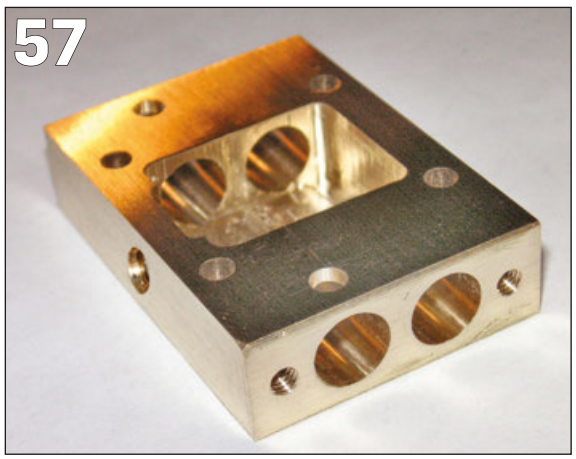
PHOTO 54: The valves must yet be separated, and machined on the other side.

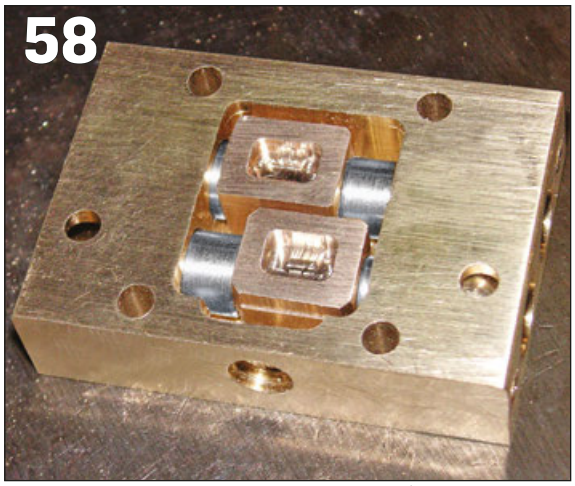
PHOTO 55: Turning and parting off the valve spindle.

PHOTO 56: Milling out the valve chest cavity.

PHOTO 57: The machining of the valve chest is completed.







should actually be slightly lower; in operation, the steam pressure will keep them tightly pressed against the port face.

Many faces

The cylinder, Part 6, is turned in a straightforward way, and is afterwards milled so that it has a flat face onto which the port face can be mounted. The cylinder top cover, Part 4, has a recess on the inside, so that the piston nut will not hit the cover. Dimension the recess according to the nut you use.

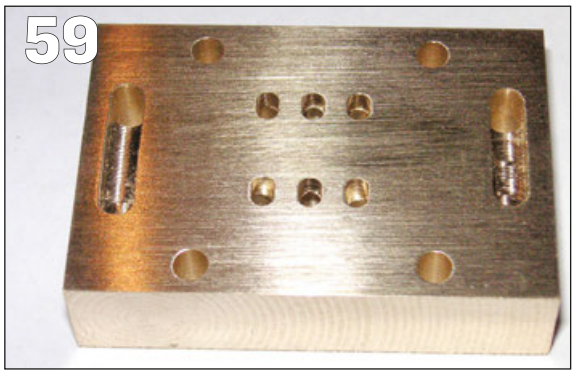
In order to get the steam from the valve chest both to the shuttle, and the cylinder proper, we need a port face with steam passages, Part 7. This part is pretty complicated, and needs to be made correctly. Study Photo 59 and 60, and you can see that on one side, the port face has two milled, straight channels in addition to the traditional three port openings for each valve, but on the other side, there are two more straight channels, and a couple of winding ones. These channels carry the steam to the correct ends of the main cylinder.

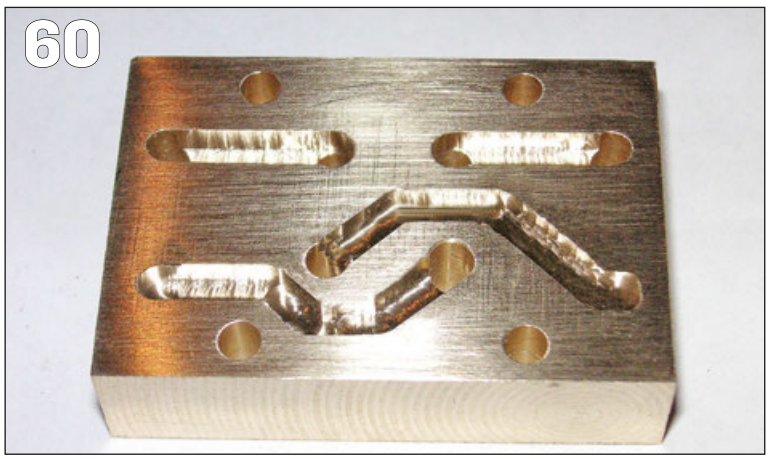
PHOTO 58: D-valves test fitted onto the spindles.

PHOTO 59: Note channels milled into port face, as well as usual triplets of port openings.

PHOTO 60: Reverse side port face block contains several milled channels.

FIGURE 28: Text describes passage of live steam through port face block.





The path of the steam is rather convoluted; in Figure 28, the round dots represent live steam (at boiler pressure) inside the valve chest, while the arrows indicate the winding path of the steam through the channels.

Let's take a closer look at what will happen: Start at the red dot (A) and follow the solid arrow. Assume that the first D-valve (on the actuator spindle, not shown here) has been moved to the left by the actuator lever, and has just opened so that the steam can pass through the rightmost hole in the port face. This hole leads downwards (B), to the straight channel (C) milled on the underside of the port face.

When it reaches the end of that channel, the steam goes upwards (D), through the hole, to the straight channel along the edge of the port face (E). The other end of that channel coincides with the hole in the bottom of the valve chest (F), and thus the steam enters on the right side of the shuttle spindle, and moves it to the left.

Now, the D-valve on the shuttle spindle has opened the port to the main cylinder, and the live steam, starting at the blue dot (G), follows the dotted arrow; first straight down (H), then along the winding passage (I) to the bottom rear end of the port face (J), where it enters the cylinder's left end.

Now, the main piston gets steam on its left side, and moves to the right. This will, at the end of the stroke, move the actuator rod and its lever to the right, thus moving the first D-valve back to the right.

This was the first half of a complete back-and-forth stroke of the pump – I have not described, nor drawn, the exhaust passages in the figure, but they are much simpler; the centre port holes lead down to the exhaust opening in the side of the port face. The next half stroke is similar to the first, but the passage of live steam is depicted by the dotted pink and solid green arrows in the figure.

As you can see, the whole trick of getting the steam from the valve chest into the right places is performed by all the passages milled into the port face block.

Soft solder

Okay, we now know how the steam is supposed to move, but how can we get these parts together, and steam-tight? Since the temperature of the steam will never exceed the melting point of soft solder (and, the parts are also secured with screws), there is no need to use silver solder. Additionally, a botched solder job is easier to correct if soft solder is used.

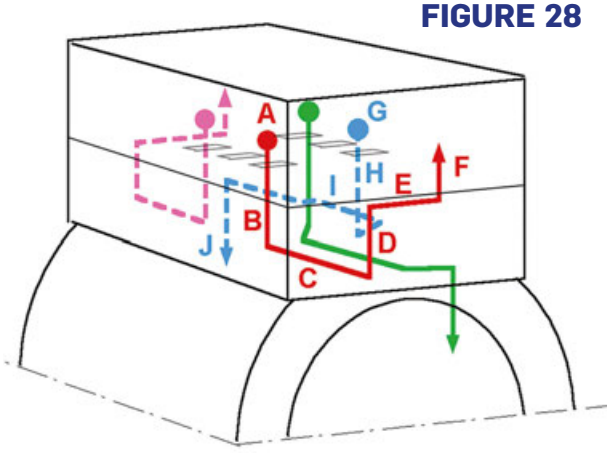
So, using a propane flame and electronics tin solder (containing multicore rosin flux), I gently heated the parts and tinned both the milled flat on the cylinder, and the bottom of the port face block, as seen in Photo 61. Note that the solder must flow freely over the entire surface to be tinned, in order to avoid any porosities or voids.

To seal the parts, it was only necessary to use four screws and washers to position the port face on the cylinder (note the asymmetry of the parts, the corresponding steam holes must match up correctly), then heat the assembly and tighten the screws while the solder was molten (Photo 62).

Drops of soft solder were extruded between the parts, and even into the steam channels. If the amount is large, you can use compressed air from a blowgun nozzle to remove extraneous solder – but don't blow too hard, or you might blow away the solder between the parts, necessary for the steam-tight union. Be sure to blow away from yourself, or any object you don't like to have spattered with molten solder drops!

The valve chest will be attached with bolts to the port face block, and

FIGURE 28



needs to be removable, so instead of solder you should use either a properly cut-out shape of oiled paper, or a small amount of silicon gasket paste to seal the assembly. Take care that none of the gasket will extrude into and block the steam passages or valve chest!

Keep your distance

Part 8, 'distance piece A', situated between the steam and air cylinders, needs both turning and milling operations. I started by turning the main outline, after which I milled away metal from the centre, to get the proper shape of the part. The square central hole is necessary, so that the actuator, Part 12, can be attached to the main piston rod, which holds both the steam and the air pistons, Part 11, as well as the water piston, Part 16.

The central holes in the pistons must fit the piston rod, thus the air piston will have a reamed hole the same diameter as the rod, while the steam and water pistons have threads corresponding to the rod end threads (I used M4).

The actuator rod, Part 10, passes through both ends of the distance piece. O-ring retainer plates, Part 9, are used on both sides of the piece, as well as on distance piece B, Part 13.

The bottom cover, Part 14, on the water cylinder, Part 15, finally completes the entire cylinder 'stack'. This water cylinder, which has passages drilled and milled in each end, also has a milled flat to take the water valve block, Part 19.

The block is soft soldered to the cylinder in the same way as the steam port face. No bolts are used here since only cold water will be pumped.

The water valves are classic stainless steel ball valves; I've used balls of 4mm and 6mm diameters, but suitable imperial-sized balls can also be used, if the bores and seats are modified accordingly.

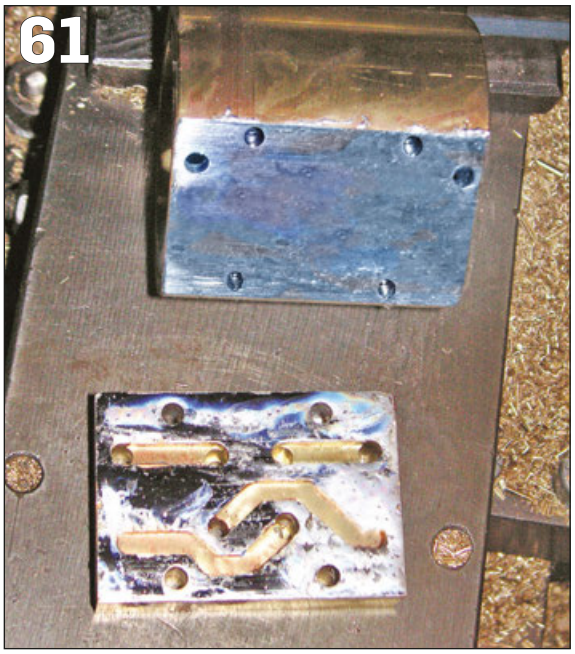
The seat for the 4mm ball is 3mm, while the 6mm ball seals a 5mm seat, as seen in the drawing of part 19. These seats should be finished to a sharp edge with a 10-degree D-bit, and 'punched' to shape in the usual way with a sacrificial ball.

The valve plugs, Part 17, close the top holes of the valves, which have a 9.8 mm diameter, R-⅛-inch thread (Yes, we do in fact use some imperial-sized pipe threads in Finland!). However, I used M6 threads for all the pipe connections to the different valve blocks, and will make unions to fit, Parts 24 to 26.

Sealing it tight

Note how the O-rings are recessed into both distance pieces. The holes for the piston and actuator rods are a little oversize, to prevent the rods touching the metal. The depressions for the O-rings are a little deeper than the thickness of the rings, and the covers are attached with three screws each. The tapped holes for the screws are of course not drilled through.

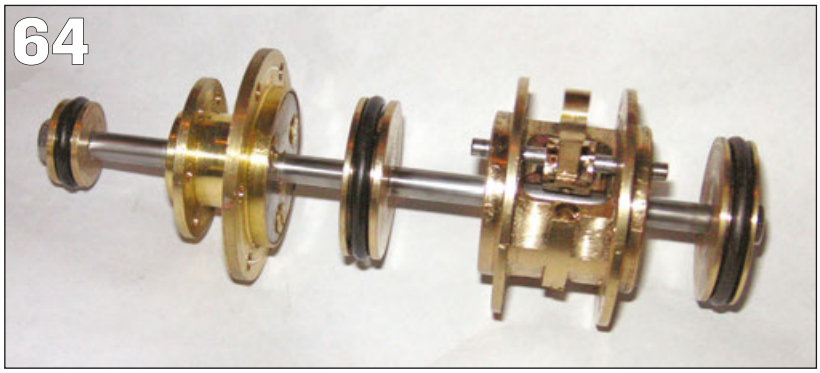
The distance pieces, as well as the top and bottom covers, each have six holes for retaining bolts – I used the M3 size, if you use something else, make sure that the screw or bolt heads fit in the rather tight space! All screws must of course be stainless.



"A botched solder job is easier to correct if soft solder is used..."

Photo 63 shows distance piece A and its two retainer plates, while Photo 64 shows the entire piston assembly – it will have to be disassembled again, in order to fit it into the air cylinder, Part 20. Note how the actuator rod and arm are protruding through distance piece A.

The air piston is silver soldered to the stainless piston rod, Part 18. The rod has two V-grooves in the middle, in order to retain enough silver solder ▶



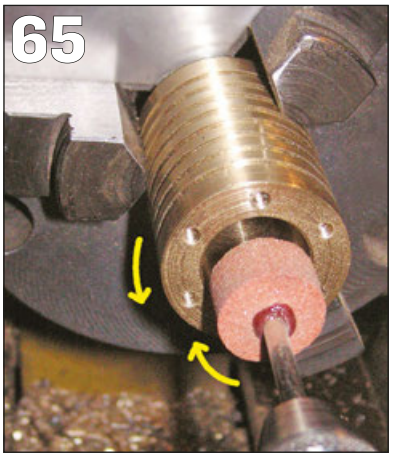


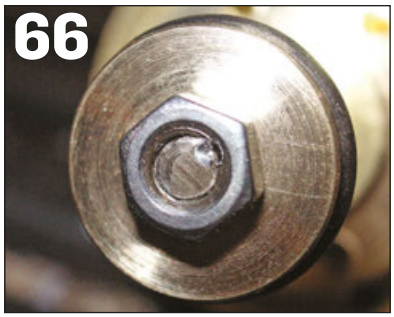
PHOTO 61: The cylinder and the port face block are tinned with soft solder.

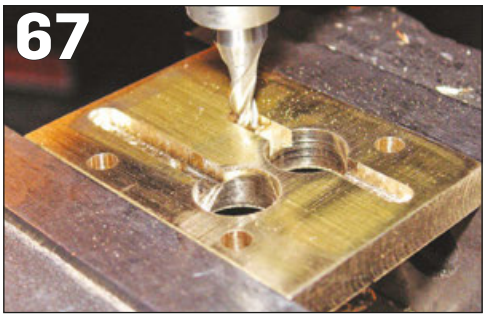
PHOTO 62: Screws are tightened while assembly is hot.

PHOTO 63: 'Distance piece A' and O-ring retainer plates.

PHOTO 64: The piston assembly and distance pieces.

PHOTO 65: Grinding the cylinders smooth.

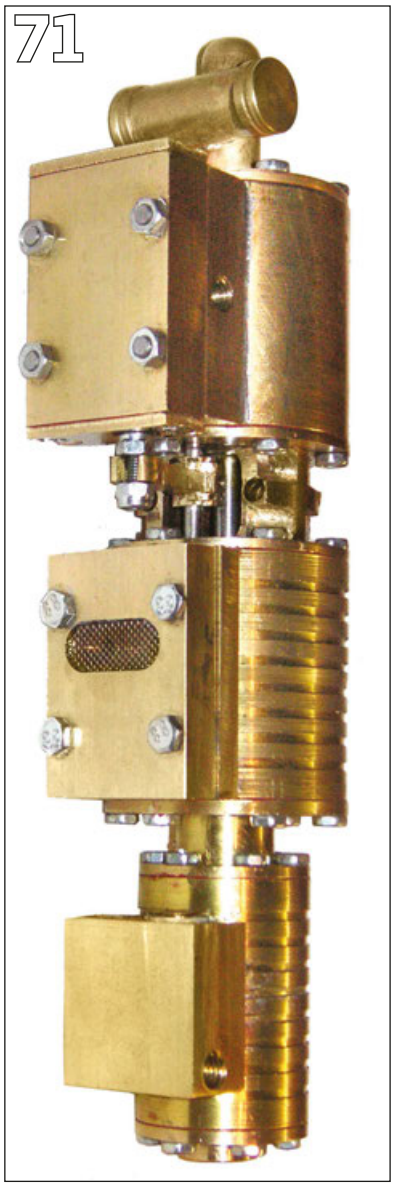




to hold the piston. Avoid silver solder flowing onto the part of the rod that passes through the O-rings in the covers! The other two pistons are held in place with stainless or brass nuts.

In order to get a very smooth surface on the inside of all cylinders, I used a very fine-grained stone in a small toolpost grinder, Photo 65. With the lathe chuck rotating in the opposite direction to the grinder, the bore of the cylinder was quickly smoothed out.

The steam and water piston nuts are secured with a punch mark, as seen in Photo 66 – this prevents the nuts from unscrewing in use.



"This pump project took me a couple of weeks of designing, and a month or so of evenings and weekends of building in the workshop..."

PHOTO 66: Punch mark secures the piston nut.

PHOTO 67: Milling of air chest channels.

PHOTO 68: Air chest and its cover.

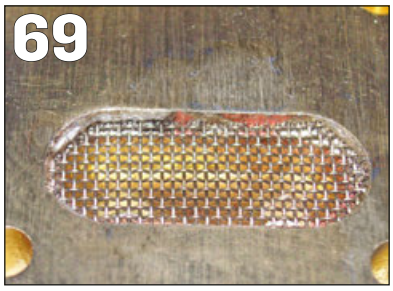
PHOTO 69: Wire mesh prevents any particles entering the air pump.

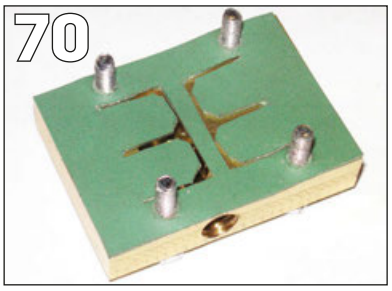
PHOTO 70: 'Flap sheet' being installed.

PHOTO 71: The finished pump, seen from its 'back' side.

PHOTO 72: The pump is attached to the boiler.

All photos and diagrams in this feature by the author





Flap valves for air

As already mentioned, the air pump has 'flap' valves, very simply constructed; the valve assembly is made in two parts, the air chest seat, Part 21, and the air chest itself, Part 22. In Photo 67, I'm milling the channels in the chest, while Photo 68 shows the completed parts.

The air chest seat is soft soldered to its cylinder, just as with the other two valve seats. The outside of the air chest has a small piece of fine stainless steel mesh soft-soldered in the opening, Photo 69, to avoid dust and other particles to be drawn in with the air.

A flap sheet, Part 23, completes the assembly. Thin polyester sheet, or some other tough plastic can be used for the flap sheet. Any other material flexible enough for the purpose can also be used – in my scrap box I found a very thin piece of fibre-reinforced rubber gasket material, and cut that to shape. In Photo 70 it is in position, and held in place by the bolts that will attach the air chest to the seat. The flap material also functions as a gasket, so nothing further is required for sealing.

In the water and air piping to and from this pump, there will be by-pass valves, so that the pump can be used alternately for air or water. It should be noted that, to deliver full air pressure the water by-pass valve must allow water to flow freely from outlet to inlet. Vice versa, to deliver the water pressure required to overcome the boiler pressure, the air by-pass must allow air to flow freely from outlet to inlet.

This pump project took me a couple of weeks of designing, and a month or so of evenings and weekends of building in the workshop. Photo 71 shows the completed pump, less unions for steam, air and water, but with a cosmetic, non-functional shuttle valve enclosure on top, according to prototype.

Photo 72 shows the pump attached to a brace which is TIG-welded to the boiler. The ridges in the air and water cylinders are purely cosmetic, imitating the full-size cooling fins. Their depth is not to scale. As mentioned, I slightly doubt this pump's performance as an air pump (I haven't even connected it as such), but it has been a very reliable back-up source for boiler water for over six years at this writing.

EIM

■ Parts 1 to 5 of this series were published in the February to June 2020 editions of EIM. Readers can download digital back issues or order printed versions from www.world-of-railways.co.uk/engineering-in-miniature/store/back-issues/ or by phoning 01778 392484.

What should my first build be?

I am a novice model engineer and I am enjoying reading EIM, and particularly appreciating the articles for newcomers to the hobby. I also greatly enjoyed Andrew Strongitharm's series on building 'Dougal' in 5-inch gauge.

I have access to a workshop and some more experienced friends willing to help me, and my question is, what should I build? I am leaning towards a simple railway locomotive but I must admit to being tempted by a traction engine!

The problem is, perusing the catalogues from the major suppliers, there seem to be a vast choice of engines, even those pitched at more novice builders.

So my question is, what should I choose? Is a traction engine beyond me? If so which rail engine would more experienced readers recommend? Or perhaps should I build up my skills with something like a stationary engine?

Russell Snowdon

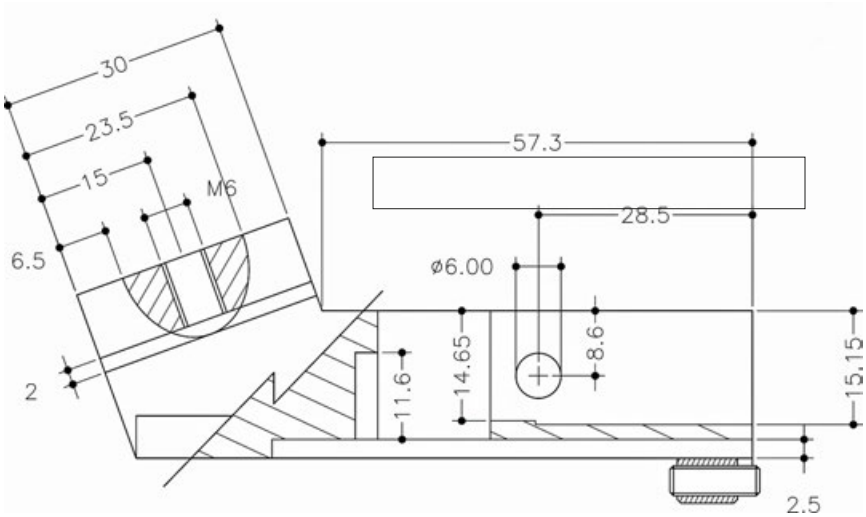
The editor replies: Wow what a question! In truth Russell, it's basically up to you. While there are indeed a vast variety of models for which castings and such like are available, the techniques to build them are basically the same and particularly if you have experienced help available, then it should be possible to construct whichever prototype you choose.

We would recommend choosing a fairly basic engine such as Dougal for your first project, for the simple reason that such an engine takes less time to build, and nothing encourages the recent recruit model engineer more than having a finished model on the shelf to admire!

For that reason it might also be worth buying an unmachined stationary engine kit such as those produced by Stuart Models, as they will provide useful practice and again be completed in a short period.

However, the world is basically your oyster, and if you are convinced you will complete a traction engine, and you have the means to build one, then go for it!

That's our view – what do our readers think? Write and tell us...



TOP LEFT: 'Dougal' is an excellent starter project, but not the only option... See the letter from Russell Snowdon.

That hole is not there...

After 49 articles it was bound to happen – in my article 'Modifications to a speed-up thread-cutting attachment' which you published in the June issue of EIM, I sent the mk1 drawing of Detail 1 to you. This drawing locates the lever 6mm diameter pivot hole at 6.45mm from the rear face.

In the mk2 block which the article is based on, this dimension should be 28.5mm. I have attached a corrected drawing showing the view concerned. Sack cloth and ashes for me, and my apologies for the error.

Graham Meek

New books support lines

Our hobby would be all the poorer without all the heritage and miniature railways around to visit, and most readers will be aware that with the current loss of revenue resulting from the enforced lockdown, most of the lines are facing serious financial difficulties.

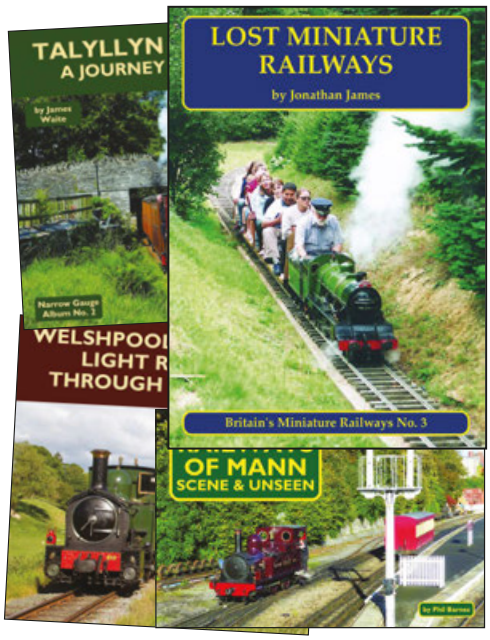
So we are more than happy to highlight an initiative by publisher Mainline & Maritime Ltd, which has approached various railways and offered to produce picture albums for them, a significant donation from each book sold being made to the fund-raising appeals that many lines have set up to try and ensure they are still here when the pandemic is behind us.

The titles announced so far include one of specific interest to miniature railway enthusiasts – *Lost Miniature Railways*, featuring the work of well-known photographer Jonathan James is going on sale at £12.95 with £4 from each copy being donated to support the 12¼-inch gauge Fairbourne Railway.

Other newly released titles include a pair of hardback albums focusing on the Talyllyn and Welshpool & Llanfair Light Railways. Costing £18.95 and £16.95 respectively, each copy sold generates a £5 donation to respectively the Talyllyn's 'Virtual Visit' and the Welshpool & Llanfair's 'Tracks to Recovery' appeals.

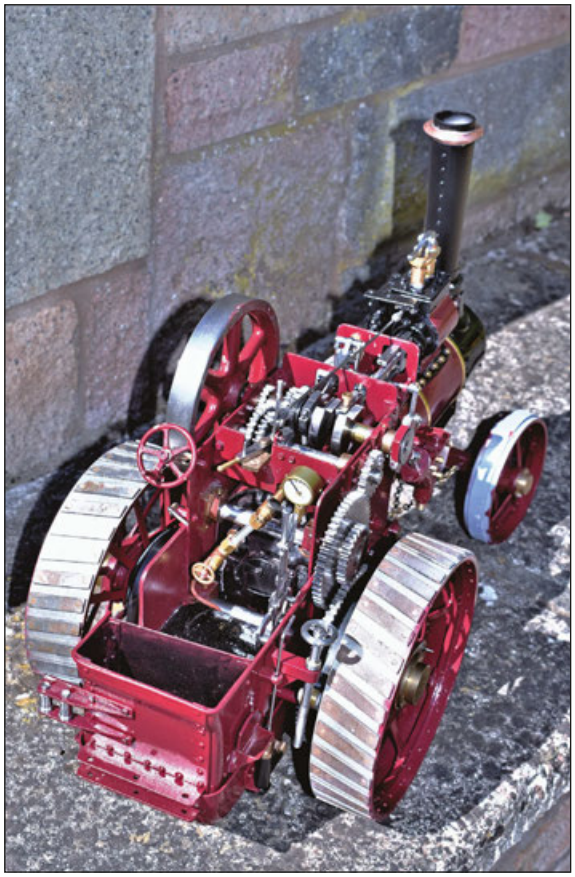
There are also two more softbacks – *Railways of Mann Scene & Unseen* and *Welsh Highland Railway 25 Years of Memorable Milestones* are both £9.95 each with £2 donations from each sale going to respectively the Groudle Glen and Welsh Highland railways.

This is an excellent effort by Mainline & Maritime and if you can we would encourage readers to support it. Details are at http://mainlineandmaritime.co.uk



No lockdown limbo...

EIM readers have been making the most of their enforced time at home...



Editor's note: A couple of issues ago in my page 3 editorial I suggested that the extended time we have been forced to spend at home thanks to the coronavirus pandemic could actually be beneficial to model engineers, as instead of whiling away the hours sitting on the sofa enduring abysmal daytime TV, they could make good use of the time in their workshops.

I also suggested those making progress on their lockdown projects should send them in for other readers to enjoy, and at last they are starting to come in! We have three excellent examples on these pages, and we would like to see some more, so if you have produced something you are proud of over the past few weeks, please drop us a line with some pictures and information!

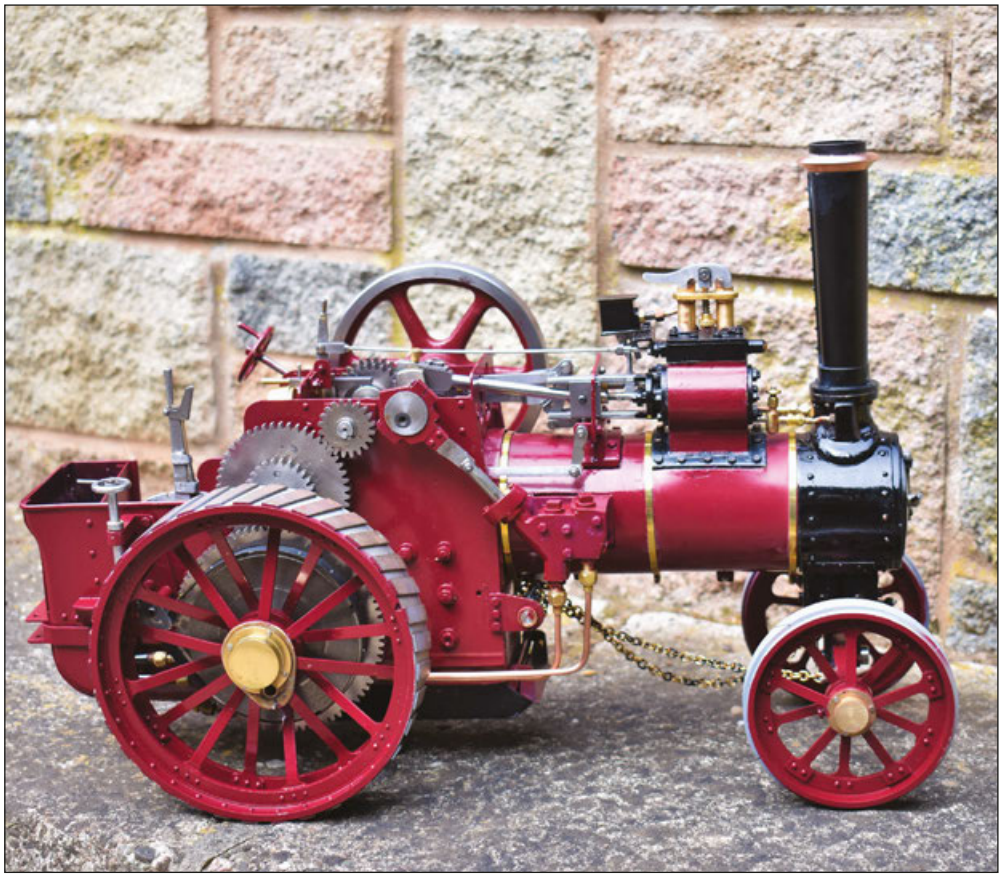
I thought you might like to see some pictures of a Minnie traction engine I have completed during lockdown (*writes* ***John Arrowsmith***) for a gentleman who had got so far but could not complete.

I was presented with a set of parts and the components to make and fit the remainder, followed by assembly – not as easy a task as it would appear.

Anyway the engine is finished now and I think it looks okay, while the owner who has only seen the photos thinks it's excellent.

The editor adds; For the benefit of newer recruits to the model engineering vocation some details of the Minnie may be useful. It was designed by L. C. Mason as an ideal design for those starting out in model engineering and favouring road engines. Leonard Mason described the construction of the engine in *Model Engineer* magazine through 1969-70, and later the entire build was published as the *book Scale Model Traction Engine Building.*

I have a very tatty copy of this book with a handwritten note on the inside cover stating that I started my first traction engine project on 30th September 1976! I was 15 at the time and attending evening classes – in due course other things got in the way and today somewhere in my garage workshop sits a part-machined boiler and a stack of part-machined castings. I will finish it one day...



Excellent starter

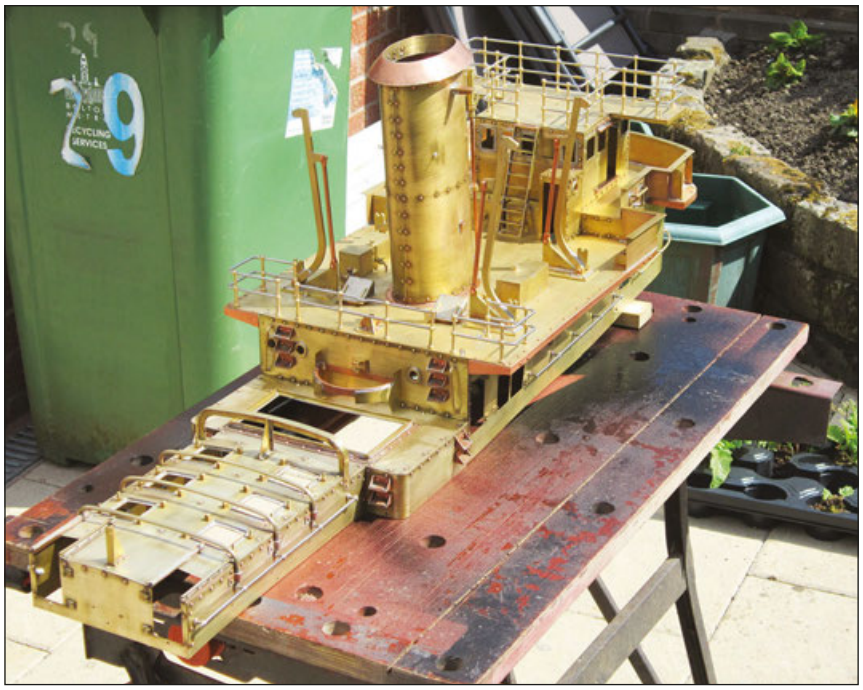
Minnie is an excellent project for the novice as while it is built with exactly the same components as any other traction engine, it is of a very manageable size, measuring just 18 inches long and 11¾ inches high.

The largest machining tasks are the rear wheel castings and these are of only 6¼ inches in diameter, so well within the capabilities of a 3½-inch lathe as found in many a model engineer's home workshop.

All of the castings required are available from both A J Reeves and Blackgates Engineering, and the latter also offers components for a double-sized 2-inch scale version.

A full set of castings for the engine will set the builder back less than £500 and aids to novice builders are evident in the availability of a full boiler kit, a fully-machined set of spur gears and stamped sets of wheel strakes so one does not have the laborious job of cutting them out.

The one missing element is the build book which will require a hunt on eBay or similar, but the drawings can still be purchased.



Marine master

The Lockdown has seen me return to the build of a live steam St Cruiser tug, which I started more than 30 years ago (*writes* ***Stuart Rothwell***).

It is built entirely from the original works drawings for the tug and all made in brass and copper to as near the original methods as modelling will allow.

The model was finished up to main deck level, powered by a Stuart Turner twin marine engine and fitted out with all the accessories to make it self-sufficient when steaming.

However I lost interest when the original boiler I made was not successful and moved my attention to railway locomotives. Since then I have completed three, a Rob Roy, a 3½-inch gauge Princess Royal and a gauge 1 locomotive.

I designed and fitted the tug out with a new boiler 12 months ago and so my lockdown project is to complete the superstructure with all the detail and then to paint it. The photos show the structure made up to the point where it is ready for painting.

The editor adds: We see very little from the marine side of model engineering in EIM (we'd like some more...) but Stuart's build is certainly a fine example – we look forward to further progress!

Another couple of photos sent in by ***John Arrowsmith***, who tells us that this little engine has been built by John's fellow Hereford SME member ***Phil Brown***.

"Phil was on a motorhome holiday in southern Spain when the virus problem broke," John tells us. "He had a major journey back to the Channel port at Caen and just managed to get on the last ferry before it was closed.

"He has built this engine and boiler since he returned home – not bad for such a short time."

Indeed, an impressive work rate!

What's been in YOUR workshop during lockdown? Why not send us in some information and pictures to the address on page 3?

Steam can still go to work...

This is a full-size story but has that 'smile to the face' appeal that we need in these troubled times. Demolition contractors knew what to do when they were faced with lifting decommissioned, and very heavy, infrastructure from the bottom of a deep quarry in Leicestershire – send for a ploughing engine!

Specialists AR Demolition deployed McLaren 12hp compound engine 'Avis', built in 1918, to remove sections of a conveyor belt from Croft Quarry.

There was a connection of course as Avis is owned by Robert Holt, father of Richard Holt, a fabricator with the demolition firm.

While admitting to a passion for heritage machinery, AR Demolition managing director Richard Dolman insisted there was a practical reason for employing steam on the job, which has seen the firm contracted by site owner Aggregates Industries to decommission the quarry.

"We looked into winch hire," he said, "but it was prohibitively expensive. And because of the nature of the site there was insufficient space to drag the pieces up the ramp from the bottom of the quarry using a long rope and demolition rig.

"I knew that Robert and Rich had Avis and it just occurred to me that she would be the perfect solution."

The job – undertaken before the coronavirus lockdown – involved the removal of approximately 100 metres of conveyor belt housing and was carried out over several hours, with the traction engine anchored at the top of the ramp.

The belt and housing was divided up using cutting torches to create sections – each weighing several tonnes – before being winched up the ramp and deconstructed using AR Demolition's specialist rigs.

Perfectly suited

Richard Holt operated the engine and said that Avis was perfectly suited to the task. "Quarries are actually a great setting to use this type of technology, due to space restrictions, and it you're working with competent people who are properly trained then it can all work really well."

Avis has quite a history, previous owners including the founder of the Courage Brewery and Sir William McAlpine, the son of Sir Robert who established the famed family construction firm in the 1860s.

While A&R Demolition is at the forefront of introducing new techniques and standards into the industry, Mr Dolman is open to looking backwards for new ideas, too.

"Thinking outside the box doesn't just mean adopting new innovative technologies," he said. "There are times when using a combination of the cutting-edge and the traditional can be just as effective.

"It's a matter of picking the right machine for the job, not having a vested interest in choosing one or the other. Ultimately, what our clients will want – and what makes business sense – is for work to be done as efficiently and, crucially, as safely as possible.

"It's been a delight to work with the Holt family and Avis on this job. Admittedly, it's been fun too. But I definitely won't rule out using her again, either at Croft Quarry or at any site where the methods are appropriate."

ABOVE: McLaren 'Avis' certainly stood out amongst current demolition machinery.

BELOW: Richard Holt, son of Avis's owner, operated the engine.

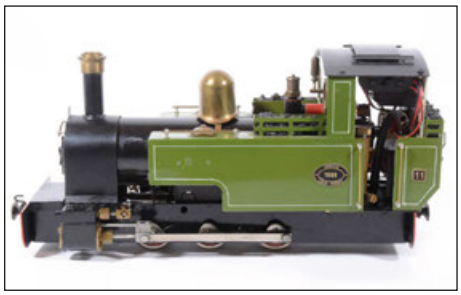
BOTTOM: The difficult location proved perfectly suited for the use of steam.

Photos courtesy AR Demolition

What is a ploughing engine?

Traction engine fans may scoff but not every model engineer will know the difference between types. Ploughing engines are easily distinguished by their large winches hung under the boiler – they were used in pairs, standing either side of a field and winching a plough between them.

Another distinguishing feature of a ploughing engine is the wide treaded front wheels, to avoid bogging down in the mud of a field.



Online auction of a 'lifetime loco collection'

Covid-19 restrictions will not prevent a Leicestershire-based auction house selling what is described as a 'lifetime collection' of Gauge 1 locomotives foremrly owned by one of the region's most prominent model railway enthusiasts.

Gildings auctioneers will be offering the large collection of more than 70 locomotives in its upcoming Live Steam auction, which will take place as a timed online-only event this summer.

The collection forms part of the estate of Kenneth Abbott and includes locos, carriages and freight stock, kit and pre-built. "Collections such as these rarely come up for sale, especially in this quantity and quality," said Gildings' Railway specialist, Andrew Smith. "Kenneth Abbott looked after each model scrupulously, keeping them in top condition."

The locomotive collection includes models from Accucraft, Bachmann, Aster, Locomotive Works and many others, the majority in handmade wooden cases and formerly used on an extensive garden line.

"Due to the current situation it will not be possible to view the collection in person, unless travel restrictions change and we can host private viewings safely and responsibly," Andrew added.

"However, condition reports will be available remotely and interested parties are very welcome to call me to discuss the condition of individual items in the sale.

"Obviously running an auction at this time involves unprecedented challenges but we are working hard to get this online sale live as soon as possible and aim to hold it some time between July and September."

Anyone interested can register for updates on the sale date at the auction house's website, www.gildings.co.uk. A sale catalogue will also be available on the site in due course.

No hasty decisions over Midlands show

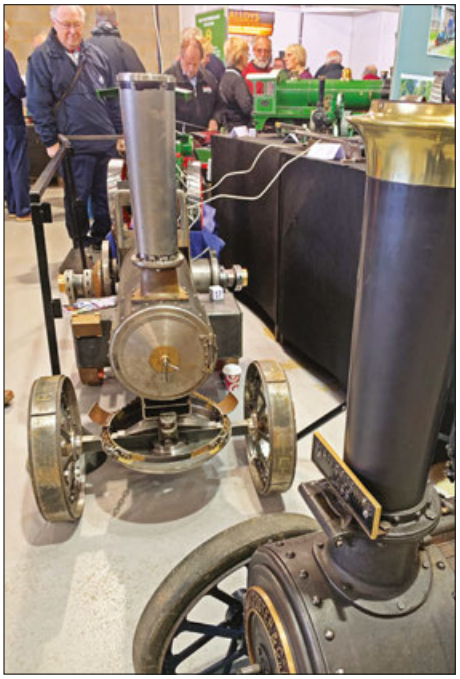
As we move towards the middle of the year our thoughts usually start turning to the big Autumn show, the Midlands Model Engineering Exhibition, this year due to take place on 15th-19th October. With some events in the sporting world and others in that period already cancelled, will the Midlands show go ahead?

Well the latest news from show organisers Meridienne Exhibitions is that they are monitoring the situation very closely. "Our number one priority is to ensure we protect the health and well-being of our visitors and exhibitors, and we will continue to follow government advice and recommendations with regard to Covid-19," says a statement on the show's website at www.meridienneexhibitions.co.uk.

The statement adds that the environment is rapidly changing, and so it is intended to review the ability to stage the show in August – this will be within the timescale set by the Government in its action plan regarding the hospitality industry and mass gatherings.

EIM thinks this is an eminently sensible route to take as come August the situation regarding the virus and how much life may return to normal could be very different to how it is now.

We will continue to bring you updated news on the Midland show as we get it, and in the meantime we will be crossing our fingers – having lost the Doncaster national this year already, we are in need of a good show to enjoy!



Twitter steam rally proves a big hit

The 'virtual steam rally' organised by young enthusiast Charlotte Coulls on 9th May proved a major success, the Facebook, Instagram and Twitter social media feeds being filled by a host of steam-themed posts on the day of all types, full-size and model.

As reported last month Charlotte, the 14-year-old daughter of National Railway Museum senior curator and traction engine enthusiast and author Anthony Coulls, came up with the idea to provide entertainment for enthusiasts stuck at home with no rallies or gatherings to attend.

To use social media terminology the concept quickly 'went viral' – the Facebook page alone gaining more than 8,000 members. The day's programme included parades in the 'virtual arena' while the posts were many and varied. The easiest way to demonstrate this is to encourage readers to have a look – as well as the very many posts on the day, posts have continued and are still on social media for all to enjoy.

Meanwhile a donation page on the website, together with a range of specially produced merchandise, has already raised more than £1500 for three health charities.

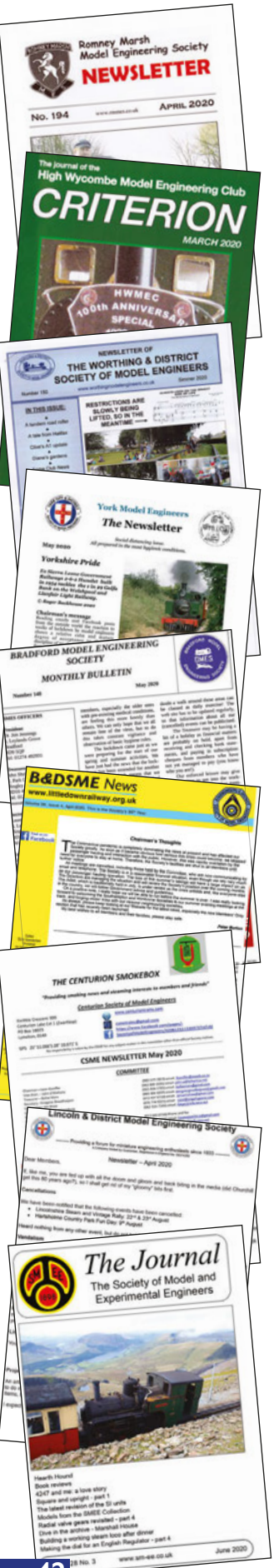
More details of where to find the many rally posts are on the website at http://twittersteamrally.co.uk. Well done Charlotte, and as we said last month, can it be an annual event?

BELOW: Those taking part in the Twitter Steam Rally could even order a plaque from the website – further boosting the funds that were raised for the three charities.

Vital efforts to keep in touch...

Club newsletters are proving an essential aid while members can't meet up in person.

COMPILED BY **ANDREW CHARMAN**



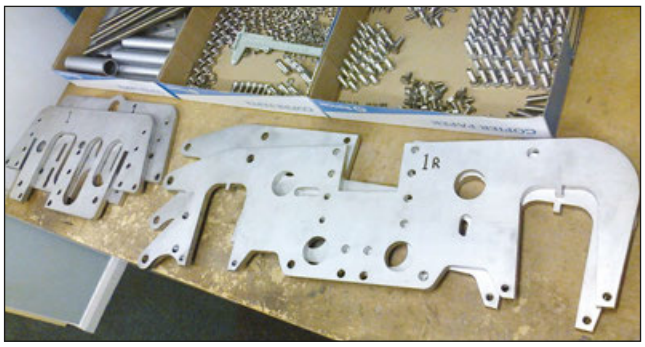
We open this month's *Club News* round-up by paying tribute to those who over the past couple of months have become the most important members of their clubs and societies – the newsletter editors.

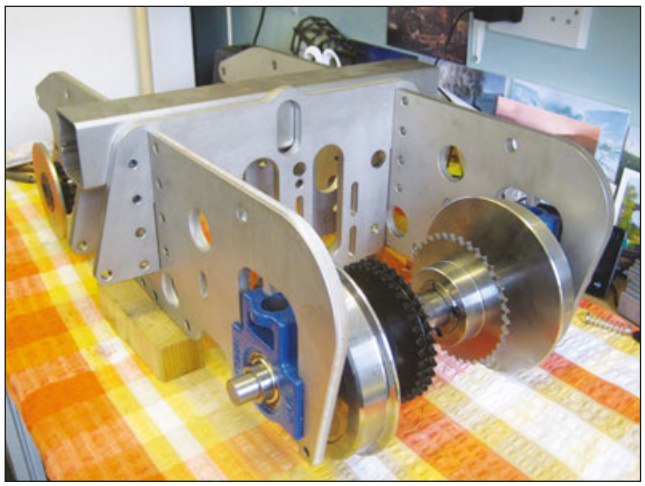
While club members have been locked down at home, unable to meet up and enjoy the hobby together, the newsletters have been maintaining a vital link, particularly for those in the vulnerable category, forced to self-isolate and completely cut off. Some clubs, such as the St Albans ME, have even doubled the frequency of their publications, which is particularly praiseworthy at a time when finding enough copy to fill a newsletter is more challenging than usual.

As our selection bordering these pages shows, we receive a highly varied but all equally interesting selection of newsletters at EIM Towers, and those illustrated here are by no means all of them – if you submit your newsletter to us and it's not here please accept our apologies as space doesn't permit us to show them all. And of course this doesn't include the purely email newsletters that some clubs employ.

Typical of the latter is the Rugby ME which always provides plenty of interest in its monthly round-up. With a current enforced lack of action at the Rugby track site the latest mailing focuses on members' lockdown projects, of which there are a wide variety. Ed Parrott has been making yet more improvements to the Romulus, the rebuild of which has been featured in the last few issues(so another article coming then Ed?), while the newsletter also includes an imposing LMS Black 5 and the piece of impressive engineering illustrated here, a power bogie for a freelance 7¼-inch battery powered bo-bo diesel being built by Rugby member Steve Bouchard. We look forward to seeing further progress on this one!

"Can you imagine having to write a chairman's report when nothing is happening?





BELOW: Rugby ME member Steve Bouchard is making good progress with his battery-powered 7¼-inch bo-bo diesel, the bogies being made up here.

Keep smiling through

The newsletter of the Worthing SME always presents a pleasingly light-hearted attitude and none more so than in the latest edition which reproduces a couple of sets of musical lyrics! Alongside the message "Restrictions are slowly being lifted, so in the meantime..." we get the lyrics to 'Always look on the bright side of life' and further down the message "It won't be long now..." is accompanied by 'Happy Days are here again'!

Inside the newsletter editor Dereck Langridge comments on one plus point of recent TV offerings, the BBC's *The Repair Shop* being moved from afternoons to a prime-time Wednesday night slot. We concur with this, the programme we reckon being one that many EIM readers find thoroughly enjoyable and inspiring – more please BBC!

One impressive model featuring in the Worthing pages is an unusual Aveling & Porter tandem roller, built in 2-inch scale by Glen Payne and almost completed.

Vectimod, the quarterly newsletter of the Isle of Wight ME, is yet another to feature 3D printing, member John Taylor using files offered by the Gauge 1 MRA to print out an attractive Terrier for his layout. A Terrier model in this scale costs around £700 to buy but adding up his entire costs John reckons he made his powered loco for a total of £42. "When you consider that you can buy a good quality printer for under £400 these days, the savings will soon mount up," John adds.

Many a club chairman will no doubt sympathise with Bradford SME's Peter Burton who opens the latest newsletter with the words; "Can you imagine having to write a chairman's report when nothing is happening? Anyway, it gives me a chance to practice my skills at waffling..."

Despite Peter's problems the newsletter includes much of interest including an update on the example of the Project Ellie simple 16mm gauge loco being built by member Dick Ganderton, who has decided to add some extra complexity by producing a twin-cylinder double-acting version of the loco – changing from the original's single-acting format required rather more head-scratching than Dick expected...

Fellow member Chris Bracey, who lives local to the Bradford's club track site, has been taking a walk around to check everything is

okay and discovered an issue that is currently exercising every heritage railway; "Network Rail would be proud of the weeds growing through the track..."

York SME newsletter editor Roger Backhouse makes a blatant effort to influence the EIM editor by putting a photo of my favourite Welshpool & Llanfair Light Railway loco on the cover, former Sierra Leone Railways Hunslet 2-6-2T No.85 – the green livery shows that is one old photo Roger, taken in the mid 1980s!

I admit to not being a fan of woodwork but I am impressed by a feature in the York newsletter on the highly attractive items, such as a light stand, produced on an ornamental lathe by member Eric Toolan – true craftsmanship.

Staying in Yorkshire and the latest newsletter from the Ryedale SME includes a natty rolling road constructed by Walter Rinaldi-Butcher as a lockdown project. We are glad to say that Walter has recognised the possible wider interest and written up the simple construction for EIM – we hope to run this piece next month.

Considering the St Albans ME is publishing its newsletter fortnightly editor Mike Collins is doing extremely well to offer an average of 18 pages per edition! Recent highlights include a feature on aircraft manufacturer Handley-Page, complete with evocative period photos, and a very interesting series on building a steam plant and engine for a hydroplaning boat.

Marine matters

Boats are a recurring theme amongst lockdown projects – the latest newsletter from Southampton SME includes pictures of a very nice boiler and compound engine made for a boat by member Mike Warren. Mike adds that members might like to see what he has been doing "over the last week or so" but we reckon it took him a bit longer than that – the boiler even has a superheater!

Giving Bradford ME members plenty to ponder in the club's newsletter is what is described as 'A short history of superheating' by member Ron Fitzgerald, but which crams a lot of information into its three pages.

The Bradford newsletter also reports on another aspect facing the management of many a society, holding committee meetings online! According to club president Jim Jennings the April meeting of the committee went so smoothly the secretary might suggest this becomes a permanent change. We think such views might be widespread, way beyond the world of model engineering.

Indicative of this trend is the Guildford ME, which having rescheduled its AGM from March to September has since decided, on the basis of the continuing uncertainty as to just when people will again be able to meet up completely freely, to hold a virtual AGM on 3rd June. Members have been distributed voting packs for the various decisions to be made with their newsletters, and can either vote by returning a paper slip, by a polling facility on the club's e-mail group, or by joining in the AGM on the night using the Zoom video conferencing facility that has become such a big part of the world's working life over the past couple of months. It's good to see a club making the best use of technology to ensure it can continue to function as normally as possible.

"The online April meeting of the committee went so smoothly the secretary might suggest this becomes a permanent change..."

Grant aid

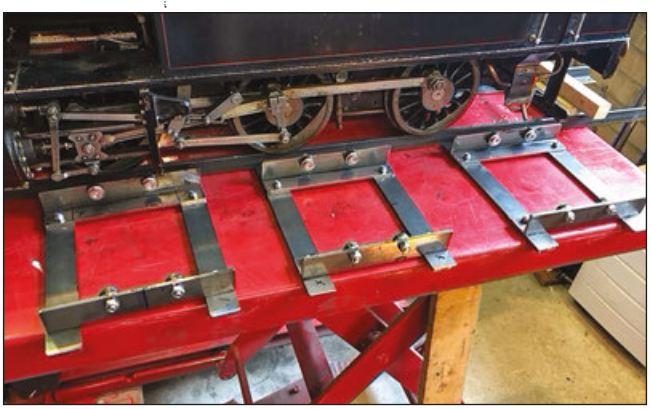
Other good news in the Guildford newsletter includes the fact that as the club is a business that has small business rate relief, it qualifies for a Government grant to mitigate the effects on revenue of the coronavirus. The club has received £10,000, which is a big help to its finances – we hope other clubs will also be able to take advantage of this scheme.

Of course not everything in model engineering, in fact not a lot, can be done online, acknowledged by SMEE chairman Alan Wragg in the latest *Journal* received just as these pages were closing for press. The SMEE council was already looking into the possibility of offering online courses before the pandemic broke, principally in the areas of CAD, CNC and 3D printing. But Alan adds that such programmes as the Society's basic model engineering course would not adapt well "as the main benefits are from the interaction of the students and tutors." And of course the more hands-on courses can certainly not be done online.

An excellent addition to the SMEE's forums offered to members is one entitled 'Work on the Table'. When work is displayed at the Society's Marshall House, London headquarters it is usually accompanied by detailed notes and the new forum seeks to make this information available at a time when members cannot get to Marshall House. While the result of a member's suggestion due to the lockdown, Alan believes the forum could have a longer-term function and your editor agrees – as an honorary SMEE member (which I greatly value) I can't take advantage of regular visits to Marshall House even in normal times but such innovations as this would allow me to enjoy the excellent model engineering too...

Your editor did smile when Alan stated that he had used the sudden free time to tidy up his workshop, quickly correcting it to "make a start on tidying up my workshop" and admitting he's come across "things I'd forgotten I had..." Yup, I know that feeling...

Oh look, we've run out of space again. Keeps those newsletters coming – they've never been more important... EIM



BELOW: At the Ryedale club Walter Rinaldi-Butcher has built this useful rolling road – he will tell us how next month.

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With half our workforce furloughed, we are currently working a reduced (if somewhat busy) service. With our couriers still working as normal, we continue to deliver engines worldwide and are still actively buying engines of all types. Collection with prompt payment can be arranged throughout the UK - if you're looking to sell an engine, get in touch!

5 INCH GAUGE LMS BLACK 5 4-6-0
A 5 inch gauge LMS Black, built from a ModelWorks kit by a retired gentleman for use on his garden railway. One could count the number of steamings on the fingers of one hand, the engine is in substantially as-new condition - boiler has had a hydraulic test and will be issued with paperwork for same. Somewhat asthmatic running, other than that the engine is complete bar one missing safety valve. **£6,500**

5 INCH GAUGE STIRLING 8 FOOT SINGLE
A 5 inch gauge Stirling 8 foot single, an older engine, it has had much recent work in the ownership of a highly experienced model engineer with many fine locomotives to his credit. Boiler has had a recent test with new certification issued; the engine runs well, notching up in either direction. **£4,750**

5 INCH GAUGE STEAM OUTLINE LNER B1
A 5 inch gauge steam outline battery electric B1 with Parkside controller, in running order with batteries. The batteries supplied by the previous owner are new, and stand proud of the tender—with some lower profile replacements, it would make for a handsome and easy to run model. Complete with remote handset controller. **£3,950**

7 1/4 INCH GAUGE CLASS 17 BATTERY ELECTRIC WITH DRIVING TRUCK
A 7 1/4 inch gauge Class 17 battery electric, complete with braked driving truck from 17D Ltd. I've no idea what they had in mind when they weaponised a pair of bogies with two huge batteries and a pair of 1hp motors, but it's the fastest accelerating locomotive we've had in any gauge. Ever. Overall build quality is what you'd expect from 17D: well thought out design; high quality engineering; all steel body. In excellent condition throughout. **£6,750**

5 INCH GAUGE GWR 14XX 0-4-2T
A 5 inch gauge GWR 14XX 0-4-2T, to Neville Evans' "Didcot" design. Run at the builder's club for steam test and to check valve setting earlier in the year, it's in excellent mechanical condition throughout. **£3,950**

5 INCH GAUGE RAIL MOTOR 0-6-0
An interesting variation on Don Young's "Rail Motor", executed as an 0-6-0 rather than an 0-4-0. Boiler has had a twice working pressure hydraulic test, the engine runs on air. **£1,350**

5 INCH GAUGE 17D CLASS 20 BATTERY ELECTRIC
A 5 inch gauge Class 20 battery electric by 17D Miniatures. In excellent condition having had little use from new. There is a soundcard fitted along with decent sized speaker under the removeable roof. Complete with custom built storage/transport crate. **£2,850**

We are always interested in acquiring engines of the type that we sell. If you know of a steam engine for sale, in absolutely any condition, please let us know. Engines bought outright, or we are happy to take them on a commission sale basis, or pay you a finder's fee if you put us in touch with an engine which we later purchase. All engines listed are on our premises, available for inspection by appointment. Please do contact us, even if all you have is a rumour of an engine being available!

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Harrison M250 5" x 20" £2750 each


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Boxford 125 TCL CNC less software £1500


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Colchester Mastiff 60" £12500


Startrite 14-S-5 bandsaw electronic brake added £1250


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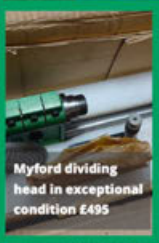
Myford dividing head in exceptional condition £495


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Boxford 260 VMC mill less software £1950


Harrison Graduate wood lathe 240V £1375


Startrite SD 12" Planer / Thicknesser £950


Neat cut and soluble cutting oils £10 each


Tipped tooling + 10 tips 6mm—20mm from £35—£50


Pultra 10mm lathe £650


RJH 8" bench grinder £345


Chester Mill 240 Volts £1750


Chevalier 50" x 10" 40INT mill £6250 Nice!


Myford Super 7B + stand (late model just in) £4450


Morgan Rushworth BP50 / 16 50" x 16G box and pan folder £1750


Ajax UP Universal Mill £1750


Super 7 ML7R Lever tail stocks £245 each


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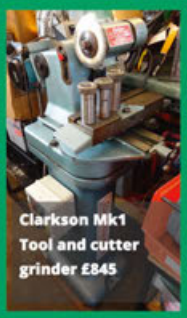
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