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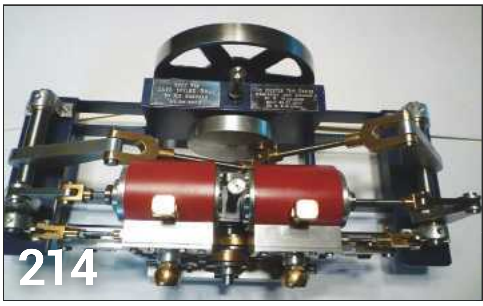

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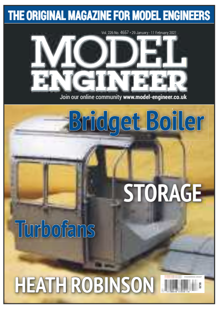

ON THE COVER...

Norm Norton's improved cab for his rebuilt Modelworks 5 inch gauge Britannia locomotive (photograph – Norm Norton).

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Lockdown III

Well – 'here we go again, my, my'! It's all getting a bit familiar, isn't it? Never mind, it's cold anyway, so who would want to be wandering about? Much better to retreat to the nice warm workshop, immerse oneself in something totally absorbing and ignore all the craziness currently surrounding us.

As I write though, there seem to be signs of better times to come. The vaccine roll-out is now well underway and covid-19 cases are at last on the wane. We can expect this to be reflected in the mortality figures in two or three weeks' time – indeed, by the time you read this, the rate may already be starting to fall. This will not come a moment too soon for our valiant, over-stretched NHS and should offer the promise of an imminent easing of the restrictions we are under.

I thought this might be a good time to revive our 'Lockdown Showcase'. Let's see what you have been up to while Boris has been keeping us out of the pubs. As before, send me a photo of what you have been working on – complete or not, it doesn't matter – and a few words (up to 100 or so) describing it. It will then appear in our magazine over the next few issues.

I will kick things off with a picture of my 5 inch gauge GWR pannier tank, now on the verge of completion. It's based on LBSC's Pansy design, with some borrowings from Doug Hewson and some modifications from myself. Many of the details are taken and scaled from photographs. The observant amongst you will notice that she has no wheels. I removed them in order to take out the motion work and modify it to Don Ashton's specification in order to improve the valve events. Doug's drawings include this modification. The recommended changes have been made and the wheels and motion will go back in as I carry out the final assembly. The tanks are currently off (since this photo was taken) in order to be tested for water tightness before painting. Apart from that, the main job now is to install gaskets etc. and complete the last pipe runs.

Robotic Dancing

Martin Gearing has sent me a very entertaining video, made by company Boston Dynamics, who manufacture robots, and it cheered me up no end so I thought it could do the same for you (if you need such a thing). Here it is: www.youtube.com/user/BostonDynamics Do watch it through to the end – it's only three minutes long. Cross one of these guys with 'Alexa' and we're not really very far from 'I, Robot', are we? In ten years' time I can see people going for a stroll and a chat with one of these. Scary thought!

Oh Dear...

I have been 'called out' for including Less Stiff's account of how his club managed their open days in a way that would satisfy 'social distancing' measures (M.E.4655, 1st January, p.80). I am told that it is bad advice to be giving during the current lockdown. Well, of course, so it is. However, the article was clearly not intended to apply during a period of lockdown. The difficulty we have with topical matters is that, typically, the contents of an issue are fixed about a month before publication. At the time we decided to include Les Stiff's article we were not in lockdown and, at that time, the article was in line with government guidelines. It's likely, too, that it will be again once we are out of our current lockdown. It remains good advice in the appropriate situation. This reminds me of the Suez crisis when Harold Macmillan famously remarked to a colleague that we are rather at the mercy of "events, dear boy, events".

Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
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Oliver Cromwell on the GCR, Loughborough in 2014.

Britannia Class 7 Locomotive in 5 Inch Gauge

PART 5 - CLEADING AND CAB

A Modelworks Rebuild

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

Continued from p.762
M.E. 4653, 4 December 2020

Progressing beyond the chassis

This article is the fifth in the series so far and there has been a short gap since the first four parts appeared in previous editions of *Model Engineer*. This publication gap is coincidental but appropriate since the tone of the content now changes. There will be fewer words and hopefully larger pictures that will appeal to a wider readership. It is my thought that those readers new to the model engineering hobby, and perhaps considering a locomotive to build or purchase, might find some of this future content more relevant to their interests.

The first four parts dealt with subjects that had to be addressed if this Modelworks Britannia was ever to steam and run again; the valve timing, proper sealing of the pistons and valves, correct springing for each axle and supporting an effective fire on a grate. These changes will equally apply to the earlier Winson Britannia kits and much will also be useful for correcting the 9F and Black 5 locomotive models. After fixing these faults I could have reassembled all the Modelworks parts, made a few improvements, and soon had a working engine. This was my initial plan. But the more I looked at those parts, the more it dawned on me that I would not be happy without major changes to almost everything that would be seen above the wheels. The 'detailing bug' had bitten.

I did explain in the first article that I am not an oil-soaked, experienced ex-engineer. I was involved in science and management and so looking at new things is an enjoyable pursuit. I started with a 5 inch gauge 0-6-0 tank engine that I purchased nearly ten years ago and I have learnt lessons as I have replaced and rebuilt many parts. I have also had great enjoyment steaming that engine at my club and travelling to other tracks. I already had a workshop with a lathe and milling machine and I started on the build of first one, and then a second large 5 inch gauge engine that I really admired and desired. Unfortunately, I have now been distracted by this Britannia rebuild. Clearly, I am incapable of following the 'one thing at a time' rule.

My suggestion to a newcomer is to consider doing something like I have done (but perhaps not have so many things on the go at once) and purchase a 5 inch 0-6-0, have fun steaming, maintaining and learning and meanwhile set up a useful workshop and start building an engine that you desire. This is different from the recommendations I have read that often guide the newcomer to build a small, beginner's engine. However, if the engine you desire is a Britannia like this one, and Winson/Modelworks unfinished or unused engines are surfacing at reasonable prices, then I have three warnings to offer:

1) It will be nearly impossible to maintain or repair any model locomotive without access to some machines and tooling. This might be at a club or friend's workshop where you can also get advice.
2) If you do acquire a Winson/ Modelworks engine then you will have to address the subjects I have discussed in parts 1 to 4 of these articles, unless these have already been fixed. Especially the pistons and valves and all the springing. To repair these you will need the workshop and you will need to gain the expertise.

The Modelworks upper 'throat piece' heavily reshaped to a better profile.

The lower part of the throat plate cleading formed from brass sheet using two wooden formers.

3) Although many very presentable kit engines have been a credit to their builders, a number of us poor souls have been struck by the desire to make them look much better - this leads down a long road of endeavour.

This is where this series of articles takes a new tack. I will describe and show the new parts I have made.

How detailed should a model be? The Hewson Effect

Doug Hewson wrote a series of articles in *Model Engineer* between August 2012 and July 2016 describing the improvements to some Winson kit models. I am very much following in his footsteps, adding new thoughts, but indebted to him for inspiration. He made available many small bronze castings and produced an outstanding set of drawings that can be purchased through The Steam Workshop. If anyone wants to improve the engine's appearance then Doug's drawings are the reference work to look at. I am sure there is an adjective 'Hewsonized' to describe a fully detailed Britannia.

If you are going to upgrade and improve one aspect of its finish, then it becomes difficult to know where to draw the line between keep or replace. I did receive most parts for a Hewson Britannia cab kit, certainly enough to get me interested once I had built a new floor and roof to replace parts that clearly, in previous hands, had not turned out a success. As the cab build progressed my thoughts settled and I decided that almost everything above the chassis that was previously attached to the bare Modelworks boiler would now be consigned to the bin.

Boiler cleading finished with added washout doors and plugs.

Boiler and firebox cleading

Cleading is a specific spelling for insulating material covering the boiler and firebox, in this case sheet metal with insulation underneath. It was a preferred term for the LMS but other railways do also use the term locomotive clothing. It is not cladding because that is found on buildings.

The Modelworks boiler cleading is a heavy gauge tube split at the bottom. Getting these tubes on and off a boiler is difficult if the smokebox is attached so I decide to split it down the top, soft solder a lap piece to make a joint and hold that together with a line of 10BA setscrews. The heavy gauge would make a good base for attaching hand rail stanchions and other fittings and a line of 12BA heads on the 10BA screws would add correct detail. Wherever a screw thread was tapped into the cleading tube a thick steel patch was soldered underneath to give depth to the thread. All soft soldering was performed with the newer 99% tin solder that has a higher melting point of 210-220 degrees C rather than the tin-lead conventional mixes that typically melt around 183-188 degrees C.

The Modelworks firebox wrapper and throat plate cleading under the boiler were crudely made and discarded. However, the upper section of throat plate cleading was a substantial piece of machined brass and it was kept as it offered a very rigid frame to properly hold all the other cleading pieces. The Perrier design does not have this but uses a more conventional beaten brass moulding. All that was needed was to spend a good time with a coarse file to bring it to the required shape (**photo 29**).

The lower throat plate cleading was conventionally made and required two wooden formers to achieve the profile (**photo 30**). Made from 0.5mm (26 gauge) CZ106 brass it required several annealing sessions between shapings. The curved section that lies over the boiler wrapper was soft soldered in place and the joint smoothed with a small amount of two-pack epoxy filler.

The firebox wrapper was made from three pieces of brass sheet: 0.8mm for the top and 0.5mm for the two lower side sheets. These are joined using 10BA setscrews and a lap joint to give a prototypical appearance. Dummy washout plugs were made from turned brass rod and small pieces of square section. The washout doors are purchased bronze castings. A backhead cleading piece was made, again over a wooden former, and this fixes securely to the Modelworks boiler by six M3 blind bushes.

Note that a proper cleading design would sit upon crinolines (metal under framework). I have not done this to keep things simple but achieved rigidity by using the brass top throat plate cleading and a firmly attached backhead cover made from thicker than 'scale' 0.8mm brass (**photo 31**).

The cab

Early in 2020 I visited Loughborough shed on the GCR and saw *Oliver Cromwell* being dismantled for its current rebuild (**photo 32**). It is very helpful to see the real thing when taken apart to gain an appreciation of the sizes of rivets used and how overlapping sheets look.

I admire people who build 'as near absolutely true to life as possible' scale models and thoroughly enjoy looking at the results. However, they all have to make some compromises to achieve scale and I am prepared to make more changes to ensure that the engine is a pleasure to operate and maintain. Yes, I will hope that it gives a visual effect of looking like 'the real thing' but I want to ensure that hands can get in to drive it and that controls are just slightly resized for our fingers and thumbs. This philosophy will appear in my design of the cab roof and in a modification to the gearbox reserver.

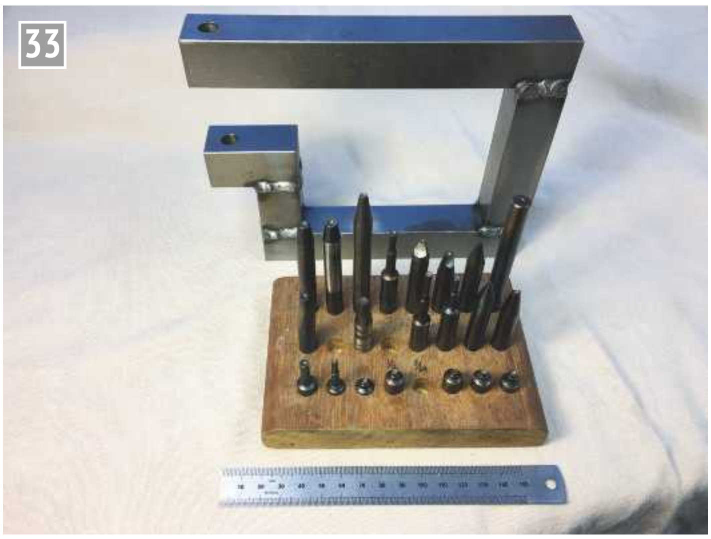
The model needs to have as many rivets, of the right size, as will be seen on the prototype. I am not a 'rivet counter' but their presence adds a great deal to the visual impression. I have made a riveting frame (**photo 33**) from welded 1 inch square bar with a deep throat to enable big and curved parts to be positioned. The $\frac{3}{8}$ inch reamed holes for the punches and dies (anvils) are finished after welding and need to be precisely concentric, the lower hole being half depth with a smaller drilling underneath. The punches and dies are made from $\frac{3}{8}$ inch silver steel, hardened and tempered, each having a variety of semi-circular impressions cut with small ball ended cutters. These punches and dies will accept a range of rivet heads and form the ball from the cut end of the rivet. The frame is mounted in a vice and its use greatly helps in alignment accuracy and ease of doing the job.

The cab parts were built up using $\frac{3}{64}$ inch round head copper rivets. The doors and framing have added half-round

Oliver Cromwell's cab seen at Loughborough in January 2020.

$\frac{1}{8}$ inch brass beading that is riveted in place (**photo 34**). The beading is also available in $\frac{3}{32}$ inch width and I have used this around the cab side windows but it has to be clamped and soldered in place as it is too narrow to rivet.

I took some time to think about access to the backhead controls through the cab roof and looked at many photographs of other Britannia models. It is helpful to have as much room for big hands as possible but still giving the impression of the real thing. All builders would agree that the roof side extensions over the rear door uprights have to be kept, but these do get in the way on the Perrier design as the removable opening is narrow being placed half way between the rain angle strip and the small roof panels (on the prototype these slide to enable lifting chains to be dropped through and secure to the frames under the floor). On Hewson's drawings the removable part opens wider to the width of the rain strips but only goes forward as far as the rearmost sliding roof panel. In my design I have also taken it full width to the rain strip but now gone forward to a point half way along the foremost roof panel. This risks weakening the roof as the design has lost two cross ribs so, to compensate, I have added an extra rib just in front of the small roof panel and built substantial rain strips with two longitudinal strips and an enlarged angle all riveted to the roof panel. **Photographs 35** and **36** show the cab components before and after assembly.

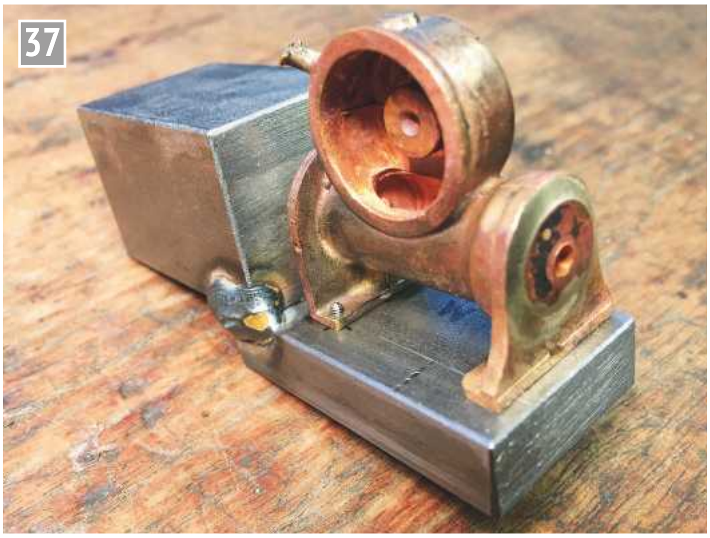


Riveting punches and dies (anvils) and frame used.

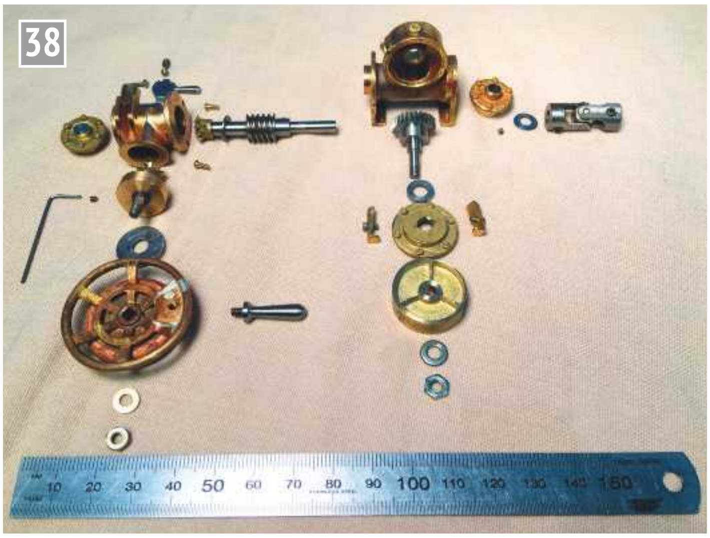
Cab doors being attached to frames and half-round brass beading affixed.

Cab sub-components assembled and primed, ready for joining.

The finished cab, ready for mounting on the firebox cleading.



Reverser gearbox indicator housing held on a fixture, or mandrel, for all machining operations.



Reverser gearbox components machined and ready for assembly.

Reverser gearbox

The Modelworks gearbox is a large 2¾ inch machined casting and the Perrier design is a similar, but slightly smaller, box fabrication; neither look vaguely like a prototypical item. Hewson made a kit true to the prototype and this is available from The Steam Workshop with ready cut gears and a simple drawing. I had been warned by a colleague that making one was not for the fainthearted.

I made new drawings from the ones obtained and started with a fixture (**photo 37**) to hold the indicator housing for all machining operations. I modified many parts and the whole job proved to be an exercise in fine scale lathe work (**photo 38**).

A major issue is the lack of clearance between the reverser handle and the driver's pedestal (**photo 39**). The Perrier design avoids the problem by having a much narrower pedestal that supports a brake control. In full size it did not matter as the driver reached forward to rotate the handle but we non-scale humans have big fat thumbs that will not go in the gap. My solution was to remove the latch housing that sat between the bevel housing and handwheel – this gave me ½ inch. I then designed another latch to sit on the bevel housing and now had room for a slightly oversized handle to suit my finger and thumb.

I saw a reverser built by Cro Fittings on a web forum and thought that the red painted handwheel and latch cover suited it. *Oliver Cromwell*'s is not red, but I have seen a picture of a full size 9F with a red one, so I am happy to exercise a bit of builder's discretion here (**photo 40**). Incidentally, you can see several nice items on their website **www.crofittings.co.uk**.

●To be continued.

The small gap between reverser handle and driver's pedestal.

Reverser gearbox finished, with latch set back in a non-prototypical position, and oversized handle.

Tee Making and Associated Issues PART 1

Another in the unpredictable writings of **Nigel Bennett** – this time mostly concerning Tee sections and a method of making them.

As some of you may have read in Club News (M.E.4640, 5th June 2020) I am building an Isle of Wight 'O2' 0-4-4T (No. 28 *Ashey*) to Don Young's *Fishbourne* design.

One particular component was exercising my brain as to how to make it – the Tee section edges to the tank tops and around the cab aperture. I needed three or four feet of the stuff, in lengths of about a foot.

The particular section I wanted was an offset steel Tee. Although a conventional Tee section of about the right size is available commercially in brass, it would just look plain wrong. The natural finish of steel is what I wanted. Here's Tiny, my beloved 3½ inch gauge 0-4-0ST (**photo 1**) made well before I appeared on this planet. I've always liked the appearance the builder achieved with the steel cab edging – true to real life, so I wasn't having brass on my 'O2'.

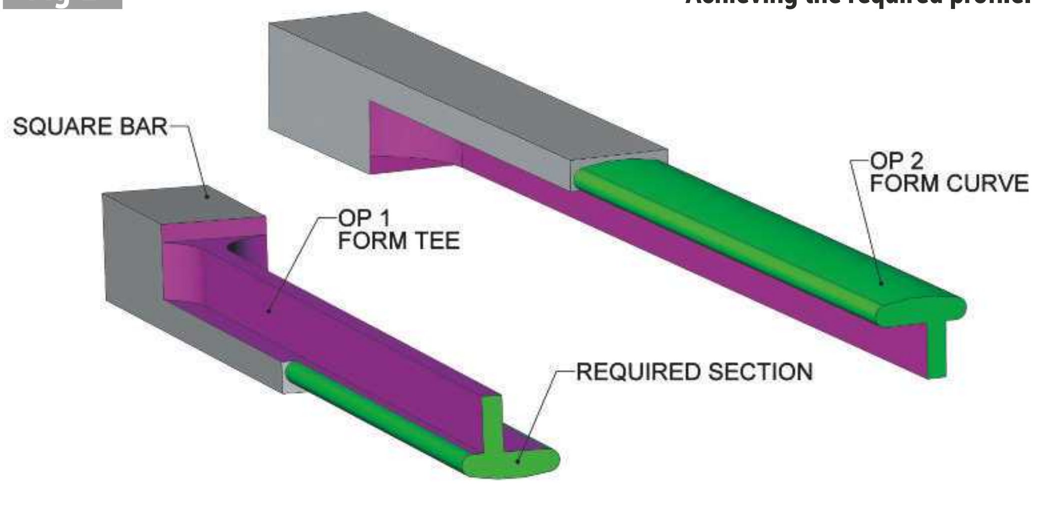
1

How I wanted it to appear.

I envisaged that it would have to be made from 3⁄16 inch square mild steel; the sketch (**fig 1**) shows the machining required to achieve the required section, shown in green. Fair enough - but how to hold it? You can't hold small sections a foot long in a 6 inch machine vice and attack it with cutters. Doing it a few inches at a time and then moving it along in the machine vice would result in visible steps no matter how carefully I worked. Machining had to be done in a continuous pass, the full length of the job, with it held rigidly. A fixture was called for!

Lots of model engineers seem to hate making jigs and fixtures when making models, seeing them as unproductive and a waste of good modelling time. However, I enjoy making fixtures; scheming something up and using it to produce something that would be difficult or impossible to hold in a chuck or vice is quite satisfying. John Smith, who produced a wonderful update of Martin Evans's *Dart* (7¼ inch gauge GWR 0-4-2T) back in 2013 seems to be similarly-

Fig 1



Achieving the required profile.

Zeroing against known length standard.

Zeroing against datum.

minded and illustrated his articles with some beautifully-made and well-thought-out fixtures. Builders of Bentley Rotary engines have a similar need for such things!

I dug around in my material stores and designed a fixture around what I had; a length of 1½ inch angle and a piece of ¾ inch square, both about a foot long. (The angle had been originally purchased by my firm for a test rig, which I had designed, made and taken down to Derby Carriage Works back in about 1990. It was to proof-test the passenger doors on the first of the then-new Class 158 DMU's. A whacking great air cylinder was mounted on bits of angle and pressurised to try to push the doors out of the vehicle. It passed. All good fun, and I later appropriated the angle for Hoapit Works for future use. Two pieces of it are now *Ashey's* buffer-beams, with various door-test holes brazed up.)

Now here is where (as has happened before) I get side-tracked in writing an article. During the manufacture of the fixture, I suddenly discovered that for the past several years, my milling machine DRO calibration had been miles out. Well - about one millimetre in 300, to be truthful. I only realised this when I was checking some long hole centres with a rule. It hadn't really mattered to me before, as most of my stuff is fairly small and if it's all made on the same machine with the same calibration error, it all goes together!

It seems that some while ago I had done a recalibration on it and I must have got it very wrong! Anyway, I now re-read the blurb in the manual and it explained that you need an accurate length-standard, the longer and more accurately-calibrated the better. You fit a clock gauge in a drill chuck and move the table to a suitable position, zeroing the clock gauge on a suitable well-secured datum (**photo 2**). The table is then moved the length of your length standard, with the other end of it located against the fixed datum and the clock gauge used to zero the position as shown. You read what the DRO says and then you can make adjustments on the console depending on the difference between the length standard and DRO indication (**photo 3**). (My length standards came from a jig-borer at Rolls-Royce and I've no idea how I got them!) I struggled with the DRO compensation adjustment for quite some time, getting it more and more wildly out, before the penny dropped. *You have to delete any previous adjustment figure first, setting the compensation value to zero*, **then** make the measurement comparison. Only then can you enter the new correction factor value. I hope that may help somebody out there.

So that was the DRO calibration sorted. However, another thing was bugging me. When I was drilling and reaming the dowel holes in the fixture, I found I had to raise the milling machine head in order to get the reamer in. It appeared that when I raised the head on the machine (a Chester Lux with dovetail column) the reamer didn't quite line up with the previously-drilled hole, and I hadn't moved the table. I'd sometimes wondered how accurately the dovetail was aligned with the machine table and this apparent anomaly nudged me into doing something about checking it. I had to measure it. But how? I didn't have a massive calibrated angle plate. Eventually I adopted the Baldrick Solution – I came up with a Cunning Plan.

To start with, I did a rough and ready check. Firstly, I trammed the head. It had been very slightly out, but I knew from previous machining marks left by milling cutters

Quick check of vertical alignment.

that it was not enough to matter much.

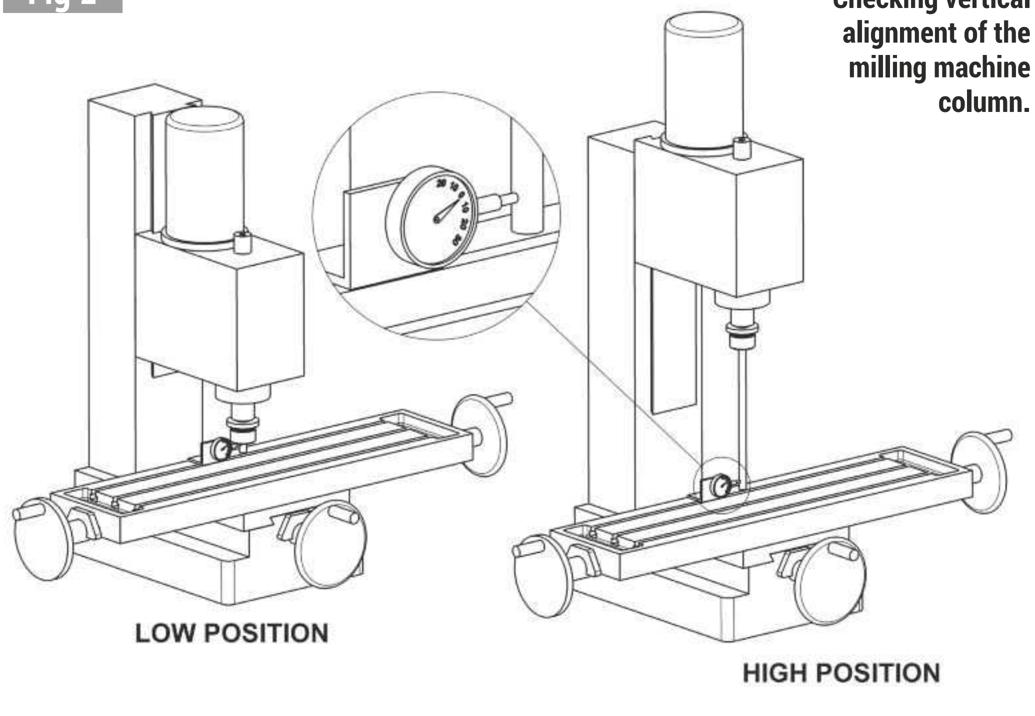
Some while ago I had purchased a 12 inch square from eBay. (The price was so ridiculous that, as I expected, it was what you might call a 'joke square'. It was way out! I attended to it so that it was something like.) Along with a length of 1 inch diameter ground bar and a piece of gauge plate, this was used to obtain a quick check of the machine dovetail relative to the table. I could just about manage to fit a 0.0015 inch feeler at one end (**photo 4**). This just took a couple of minutes but it told me that it wasn't far out, which was a relief. (The cross-stitch picture in the photo was made for me one Christmas by my late mother-in law. Unacquainted with the finer nuances of locomotive design history, she wasn't impressed when I told her it was 'Fairlie good'.)

However, I wanted a more precise measurement. I cut a short (about 50mm) length off a longer (400mm or so) length of 16mm diameter precision ground steel bar. The short length was mounted in a collet chuck and the milling machine head wound down until it nearly touched the table (**fig 2**). The head locking clamps were tightened. I firmly mounted a clock gauge on to the table, centred on the bar, and rotated the machine spindle by hand. I set the clock gauge to zero so as to give equal plus and minus readings of the slight eccentricity of the shaft. I zeroed the DRO X-axis. The head was then lifted 300mm and re-clamped and the remaining 350mm long bar fitted in the collet chuck. The test was then repeated but without touching the clock gauge; I moved the table so as to obtain the 'equal plus/minus to zero' position as before. (This gives a very reasonable comparison and eliminates errors due to collet chuck eccentricity or out-of-roundness of the test bar.) I then looked at the DRO - 0.025mm in 300mm; I thought that quite acceptable. I had half expected that I might need to shim one side of the column, in which case a more accurate measurement of the 300mm height movement would be needed to calculate the necessary shim thickness – and which side to fit it. However, in this case, needing shims of less than 0.02mm (0.001 inch) to give the necessary adjustment, I left well alone. I could imagine that I might very easily make it worse. So at least I now knew!

Incidentally, when I installed the machine some time ago, I found that the motor would hit the ceiling at maximum elevation. Accordingly, there is a 'power bulge' in the ceiling, employing a biscuit tin to finish off the cut edges and protect the roof insulation above (**photo 5**). If I ever need to have the head that high, but angled over, a bigger biscuit tin will be needed!

●To be continued.

Fig 2



Checking vertical alignment of the milling machine column.

5

Power bulge in the ceiling.

D.R. Oliver looks at Whittle's work on making his jet engine more efficient.

Frank Whittle's Turbofans

Many people, going on holiday, will have noticed the large fans on the front of the aircraft engines. Just a few may have wondered – what happened to the old-fashioned engines which powered early jetliners? The simple answer is that fanjets are both more fuel-efficient and quieter than turbojets. This has had the effect of making airliner design appear to be conservative and supersonic developments less likely.

Whittle called his first fanjet designs 'thrust augmentors' and from his well-written descriptions of four of them it is possible to sketch their designs.

Fanjets began entering service around 1960 and an early example was the Rolls-Royce Conway, which powered the 'whispering jet' – the VC10. The Americans joined in and the race for the really big fanjet was on, typified by the British RB211 in 1970, powering the Lockhead Tristar. But few people know that Frank Whittle had taken out a patent for the fanjet principle as early as 1936!

Fig 1

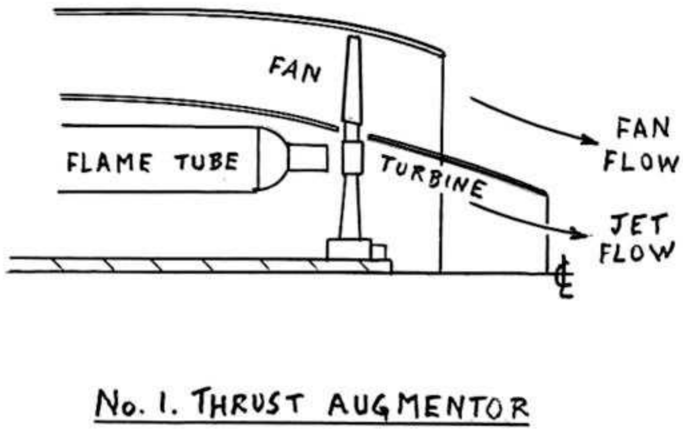
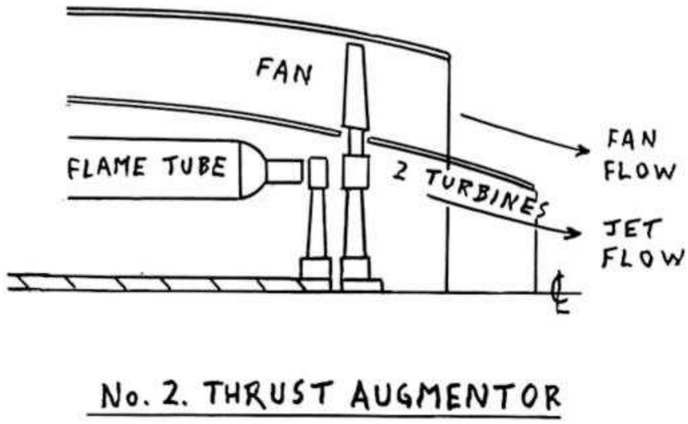


Fig 2



Whittle's pioneering designs

Whittle anticipated a fundamental problem with turbojets, because accelerating small amounts of gas to high speed is less efficient then accelerating large amounts of gas to low speed when producing thrust. This could be achieved by using an additional turbine to extract energy from the jet and use it to drive a large fan. Multiple blading and careful ducting of the fan would avoid sonic problems at the blade tips but aircraft cruising speeds would be slightly lower than for turbojet planes.

Whittle called his first fanjet designs 'thrust augmentors' and from his well-written descriptions of four of them it is possible to sketch their designs (see diagrams). The first thrust augmentor (**fig 1**) had fan blades acting as an outward extension of the turbine disc; the second (**fig**

Time was simply not available to develop a quiet, efficient engine. Whittle's early tests were thus based on the designs of existing engines and their components.

2) had an extra turbine disc, running independently, but with the fan blades again mounted further out. The third augmentor (**fig 3**) had the turbine blades mounted beyond the tips of the fan blades and was called a 'tip turbine' system. The fourth thrust augmentor, the LR1 (**fig 4**), had features more resembling those of modern fan engines. The front-mounted fan now boosted the flow into the compressor and it had two turbines and two shafts. Whittle's use of centrifugal flow compressors, however, differed from modern ones which are of the axial flow type.

Early problems

The turbofan concept was delayed by the urgent need to perfect a production turbojet engine in wartime. Time was simply not available to develop a quiet, efficient engine. Whittle's early tests were thus based on the designs of existing engines and their components.

Thrust augmentor one failed when preliminary designs showed that the required turbine and fan blade angles were not practicable. The drawings for augmentor two were sent to General Electric in the USA and developed in later years to power the Convair 990.

The 'tip turbine' idea of augmentor three has the advantage that the turbine blades, being further out, move faster than the fan blades and make the blade angles possible to design. When tested, the evident problem of disruption of inlet fan flow by the turbine ducting became apparent. The fan efficiency was too low and no time was available for further development work. The highly – promising augmentor LR1 was unfortunately cancelled.

General problems

Whittle first patented the turbojet engine in 1930 but his RAF career and time spent obtaining a first-class Cambridge degree delayed jet engine work. This was carried out in a cooperation with British Thomson Houston and later Rover and Rolls-Royce. He upset the former with his noisy test runs and by designing much better turbine blades than the established company. His own company, Power Jets, was formed in 1936. Finance was always a problem and only his relationship with Rolls-Royce really worked well. General Electric in the USA were also given access to his designs, a development of which powered the Bell Airacomet. In England, the De Havilland Vampire and the Gloster Meteor were the first jet fighters.

The conversion of Power jets into the National Gas Turbine Establishment had an unfortunate consequence. The LR1 had been intended to be the power plant of a four engined bomber for Pacific operations but the half-built engine was cancelled when it would have become the world's first turbofan! The original 1936 patent had been extended on the basis of 'exceptional merit' but it still expired just as turbofans were becoming popular.

Whittle's vision

Frank Whittle showed remarkable perception in recognising a basic weakness of the turbojet principle in the mid-thirties. Did Hans Von Ohain, who worked independently on jet engines in Germany at the same time, have similar understanding? It must be said, however, that early turbojet engines were highly successful in powering fighters, bombers and airliners like the Comet and the Boeing 707. Only the white heat of commercial airline competition was to highlight the need for fuel efficiency and vindicate Whittle's original ideas.

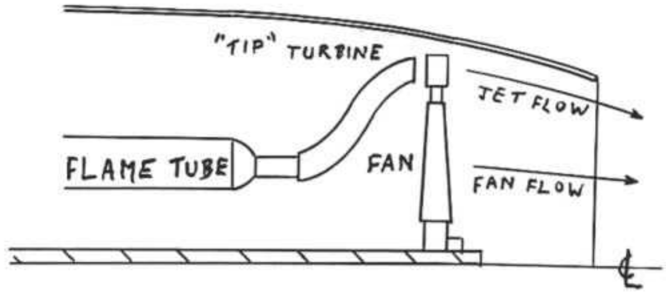
An obvious contrast is that between Concorde and modern twin-engined airliners. The wonderful supersonic plane was a real gas-guzzler and filled a specialised niche in the first-class market for over twenty-five years. The Boeing Dreamliner uses plastic laminate construction methods and fanjet engines – a model of efficient subsonic travel. Large twins tend to dominate the airline market these days.

Aircraft noise has always been a problem; London airport's projected third runway again illustrating the point. But people have become accustomed to the newer, quieter engines and they can still hear them! The position of the airport, just west of the city, and the serious disruption of established communities remain the biggest problem in expanding Heathrow airport.

In conclusion, we can say that over eighty years later, we can still marvel at the foresight and engineering perception of Sir Frank Whittle. His turbofan ideas have been more successful than he can ever have dreamed!

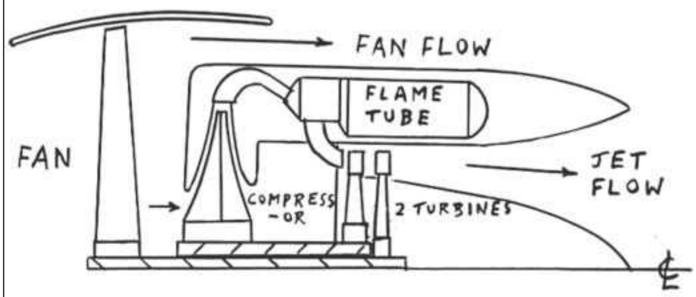
ME

Fig 3



No. 3. THRUST AUGMENTOR

Fig 4



No. LR1 THRUST AUGMENTOR

Mick Baker reckons that a big problem deserves a big solution.

Arrival on site at 8.00 am, 1 March 2018. It snowed all day. (Photo John Hoyle.)

An Answer to your Storage Problem

It is in the nature of the human being to be a hoarder and model engineers are masters of the art. 'It might come in useful one day' is our mantra!

To some extent this policy can be justified; small quantities of metals are difficult to source and, moreover, can be very expensive. The heartbreak at the moment of realisation that you recently discarded the very piece that you now need has to be experienced to be appreciated. The problem is that we want to keep everything, just in case ….

The dilemma of 'keep it or throw it' is unfortunately not confined to our own workshops but spreads to our society premises as well - but here, thank Goodness, it is ameliorated by the fact that we have some younger members who were not brought up in the age of austerity after the war. Their motto is 'If it has no present use it is rubbish.' To clarify the position, in a model engineering society a 'younger member' is one who has not reached the age of retirement. That said, societies need to store a considerable amount of equipment needed for every day running and the club building becomes more and more cluttered.

At the club of which I am a member it was decided to run courses in basic machine operation for new entrants; in short, a proper workshop was required. You can't learn to operate a lathe sitting on a lawn mower.

A new building purely for storage was necessary and thoughts turned towards a container.

Our track is, like many others, situated in a public park and we hold our site on lease, so the first step was to contact the landlord. After some discussion permission was given and it was agreed that the container would be dark green in colour and situated behind the society's building, under the trees and shielded from view by a hedge and some trellis. In other words, it would not be an eyesore.

A chat with the local planning authority should

2

The prepared site showing the concrete pads to take the load. (Photo John Hoyle.)

3

We have lift off - easy when you have the right tackle. (Photo John Hoyle.)

4

Container in place, now the work begins. (Photo John Hoyle.)

be considered although it is unlikely that planning permission is required.

Thoughts then turned to what to buy. Used containers are readily available in both the standard sizes, either twenty feet or forty feet long, in all states of repair from almost new to almost ready for the scrapheap. A firm on the south coast was contacted to find out what was available in our price bracket to suit our needs. A twenty foot container which had been used only once, almost new condition, was available for just over two thousand pounds. Price to include delivery to site. This seemed reasonable but the box would be in its 'raw' state. For about twice this figure, just over four thousand pounds, the firm would supply a similar container fully lined and insulated, in other words a complete room ready to use. The committee decided that the latter option should be taken up so an order was placed and a delivery date was agreed (**photo 1**).

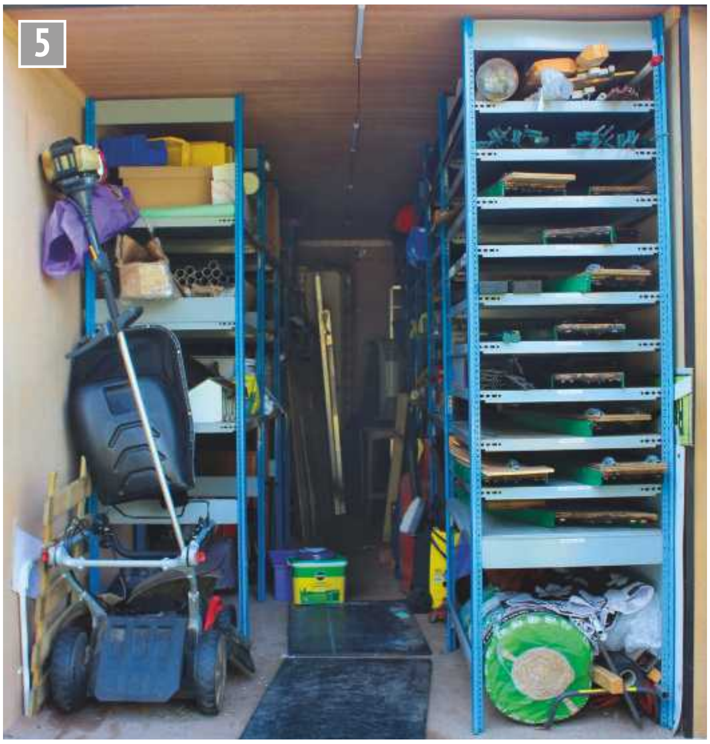
The site behind the club house was cleared and levelled and two concrete pads were laid twenty feet apart, each pad being eight feet four inches long and one foot eight inches wide to support the four feet of the container (**photo 2**).

On the day appointed, the container arrived on site and it was expertly manœuvred into position by the driver of the lorry (**photo 3**). We were now the proud owners of a large space in need of shelving (**photo 4**). Fortunately, a local firm was changing its storage facility at the time and we were offered, free of charge, sufficient industrial quality racking to fit out our new store (**photo 5**). Careful consideration was given to the layout of the shelving; for instance, a space was left clear just inside the door for the rotary mower and large strimmer (we are responsible for cutting the grass around the track) and a section has shelves very close together vertically to accommodate the many sections of the 16mm narrow gauge track which have to be stored away after each running session. Electric lighting was installed by a member who is a qualified electrician and all was ready.

We have had the container for some eighteen months (**photo 6**) and it has proved to be a boon. The club building is now completely clear of things being stored and in their place is a kitchen, a workshop and a very comfortable seating area.

If your society is in need of storage space and you have room for a container then, if funds permit, consider taking the course that we followed. You will not be disappointed.

ME



5

Container fitted out with racking.

6

Well shielded from the road, eventually we will have some climbing plants to cover the trellis.

A Frame Saw in Model Form

PART 1

Peter Evans builds a miniature of a German frame saw seen at a steam fair.


1

Model frame saw.

I first saw a full size German Frame saw working at a steam fair and thought then that it would be great in model form. I did take plenty of photographs but I lost them all later, due to a virus on my computer. I later found a couple of photographs in a steam magazine and that started the process going again. My version certainly cannot be called a scale copy as there were no drawings - it just evolved from those pictures that I had found, along with my memory. In general, it works like the original but that is about as far as it goes.

The original basic design was just a reciprocating blade that could be adjusted for height for cutting through a tree trunk to make planks. The height adjustment allows the plank size to be set accurately. Then a winch slowly pulls the trolley which is running on its track and holding the tree trunk. This drives the log against the moving blade. All speeds are comparatively slow, which to me is quite a large factor in its favour.

There are still quite a few frame saws of varying designs in preservation. My version (**photo 1**) has now had to become more of a freelance one, as I know that a direct copy would not work in model form. This is because in the full-sized version it relies a great deal on weight for most of its operation. In model form, of course, that is not present. With this in mind I have used the original basic features, just so that it looks like an original, but modified it as necessary, just to make it functional in this smaller scale.

These are a few general notes on the construction of my frame saw which may be of interest to some. I chose this particular implement for many reasons, the main one being that I wanted something to drive, at shows, that was uncomplicated and would be able to run for long periods without constant attention. It would also not need to have vast quantities of wood to keep it working. Last, but not least, it is quite health and safety friendly (a major consideration nowadays). This is mainly because it is slow moving, so the blade is not that dangerous, certainly not like a high-speed circular one.

As you can well imagine there were many problems that came into being as the build started. With no proper drawings most of the problems I had were probably 50% self-inflicted.

There were also few criteria that I needed to absorb into this project for my own benefit. The major one was the size and weight of the finished article. I needed to have something that could be lifted and it had to fit in a car, so that meant it had to be made in sections. There was also a major problem with the different speeds required. The wood log had to be winched through the saw very slowly, so a massive speed reduction from the main drive train was called for.

This project all started a few years ago but, after some months of work, it just got shelved as other projects took priority. It has now come to the front once again. This time I intend to carry on, hopefully until the end.

This project all started a few years ago but, after some months of work, it just got shelved as other projects took priority. It has now come to the front once again. This time I intend to carry on, hopefully until the end.

With any saw the base has got to be very strong and stable. The original was a massive casting. In model form with weight at a premium this makes it more difficult. I started with a small length of RSJ and built the rest off that. My saw is also on wheels which again was a departure from the original. The uprights also have to be very strong as they take the load of the whole saw unit and are subject to a huge amount of vibration. For these again I used parts of another

The saw drive.

RSJ suitably cut to the shape required. These are bolted on, not welded, so that they can be shimmed to get them perfectly square and parallel.

The actual saw blade cuts both ways and was quite wide. The blade had to have the teeth pointing one way from the middle to one end then from the middle to the opposite end pointing the other way. This I achieved by utilising the blade off a hand wood saw. This was cut in half, reversed one end, and then welded back together again. It was then cut to the length and width to fit what was needed along with suitable holes drilled each end. For hard material like this, I use a masonry drill in the drilling machine, suitably sharpened and using plenty of oil.

The wheels were made using a piece of tube for the rim with the spokes just made from strip. The centre hub was firstly machined and drilled. Then a suitable jig made from ply wood with a central steel pivot to take the hub. This was just to make welding easier. After welding together, each wheel was held by the hub in the lathe chuck with a rear centre in place. The outer rim was skimmed to make sure it was reasonably square. If at this stage it happens to run miles out due to welding distortion, then usually a smack with a hammer at the right place on the rim will ensure you do not have to skim too much off to get it reasonably true. I made the rims pretty wide just to allow for the massive vibration and to stop it digging into the ground when running.

The blade carriage must slide with ease and has to have strength with no sideways movement at all. Oil for the main saw slide comes from a ratchet lubricator driven off an eccentric on the main shaft.

The drive off the main shaft to the bed drive is provided via a large, flat belt and this runs free until the adjuster roller tightens the drive. I have included a close-up picture of this saw drive, to give those reading this a better idea (**photo 2**). Pictures are often better than words.

The chassis, as already stated, has to be a very strong item. It has to be rigid; there must be no movement in any of the basic structure at all. There are two columns fastened to the base which must be upright and parallel to achieve perfect alignment. The whole blade unit slides up and down these columns via long feed screws - that is the reason that everything has to be perfectly square and parallel. The actual saw unit works in a similar way to the old fashioned hacksaw machine except that the blade is running horizontal, not vertical. The trolley on the full size original, which held the tree trunk, ran on a long railway type track as it was slowly winched against the moving blade.

On the model there have to be one or two major modifications made to accommodate this smaller scale. The railway type track which was on the original would be no use in this smaller scale as the trolley would just derail against the blade movement. Both the trolley and trunk weight would not be enough to keep it on the track against the vibration. With this in mind I made my track of channel, with the trolley wheels close fitting up the inside. This made sure that the truck could not move up and down, only forward and back along the channel. I made spring loaded buffers on the trolley sides which run inside the channel to remove, or at least cut down, any side play, if present.

> As you can well imagine there were many problems that came into being as the build started. With no proper drawings most of the problems I had were probably 50% self-inflicted.

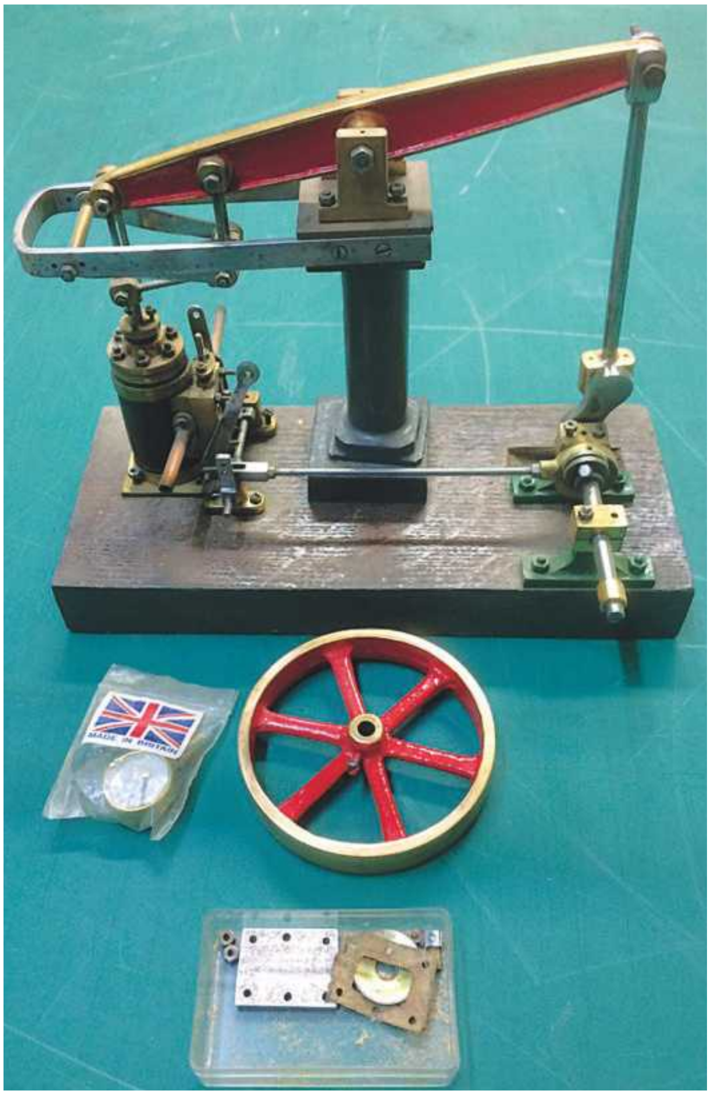
One of the big headaches was making this track. This was made using box section and just cutting, leaving the 'U' section. However, when you do this, the whole thing then tries to emulate an aeroplane propeller. The challenge is then to get it straight again. I was told the way to get over this problem was that you should clamp it to a stronger piece of material before cutting it. I tried this method and, as soon as you unclamp it, bingo! Another propeller! I have, in fact, tried quite a few different methods but in the end you just have to be patient and straighten what you have got. Holding it in the vice and using a big adjustable spanner to slowly twist it straight did this. After a bit of a struggle you get there in the end.

The trolley drive that I have used is also different. Instead of cable I have used bicycle chain with small sprockets both ends and underneath. One of these sprocket ends is spring loaded to keep the chain tight. There is a slip clutch in the shaft as well (**photo 3**). On the trolley there is a clamping device to attach the trolley to the chain. This device enables the operator to disconnect the trolley just by moving a lever at any point. My reasoning on this is as follows: firstly, it would be a positive drive with no slip and, secondly, I could attach the trolley at any point on the continuous drive chain. It would also give a fast return for the next cut by just uncoupling the trolley and pushing the trolley back by hand. Another good point was that I could also incorporate an auto uncoupling device to automatically stop the trolley at the end of the travel. The winch chain drive and the blade would still be working but, with the trolley unclipped, nothing then would be moving forward.

●To be continued.

Slipping clutch.

Restoring an Old Model Beam Engine PART 2



Tony Bird turns a pile of nondescript bits into a working engine.

Continued from p.154
M.E. 4656, 15 January 2021

Crank and Connecting rod assembly

With the beam being able to move up and down and the parallel motion working, the second plastic bag containing the flywheel, crank shaft, eccentric, valve and connecting rods, along with their bearings, was opened (**photo 18**).

The idea of doing as little re-engineering as possible was quickly going down the pan; quite a lot had been done to the column and beam assembly and it was then found that the crankshaft bearing brackets need to be almost completely re-machined. The bearings weren't the same height, they wobbled on their bases, their securing screws screwed down onto a slope and where there were threads to hold the split bearings, they are either stripped or different sizes! The bearing brackets had to be machined and the split bearing screw holes were plugged for drilling. It was now looking as though, when finished, there would be more holes plugged and drilled than were original (**photos 19, 20, 21** and **22**). Oddly, the model had split bearings on both the crank shaft and the big end though none were needed as it was possible to assemble the model without taking the bearings apart!

The eccentric sheaf originally was kept on the eccentric by the end of the valve rod screwing into a slot that was in the eccentric.

The contents of the second plastic bag.

Initial state of the bearing brackets.

Bearing brackets after tidying up.

Restored bearing brackets.

This didn't seem a good idea so the eccentric sheaf was drilled and tapped for a screw to run in the slot (**photo 23**). With the crankshaft bearing brackets drilled and tapped and fitted to the wooden base, along with the other parts assembled, the model was starting to look like a beam engine.

Before continuing working on other parts of the model, those that had already been worked on were tidied up: the flywheel was skimmed true, the crankshaft bearing pedestals along with the column were painted, the wooden base of the column was varnished and all the temporary screws were replaced and a new bolt to hold the small end of the connecting rod to the beam was made (**photo 24**).

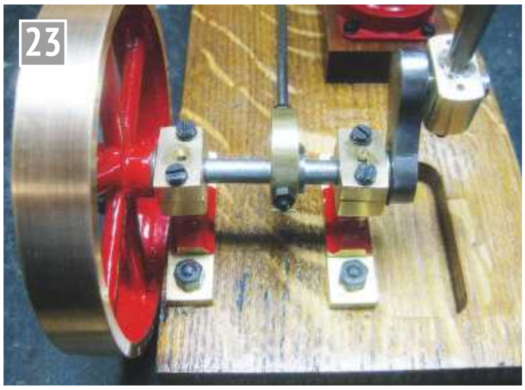
While visiting a model show, a suitable size cast resin figure of an engineer was bought and painted by Mrs. B. This figure was christened 'Owen the Oil' (**photo 25**).

The flywheel of the beam engine is a little too small so it was decided to check how well the beam balanced: the connecting rod and crank being on one side and the parallel motion and piston on the other. Well, by accident or design it was pretty well balanced, the crank and connecting rod being possibly a little heavier. Anyway, it was close enough so it was not worth weighting the flywheel to compensate until it had run - and then it might still be found not to be necessary. With such a small and light flywheel, the engine was likely to run fast for a beam engine (**photo 26**).

The piston and its rod are interesting as the piston is screwed off the piston rod and not the big end (which is soldered to the rod) to remove the cylinder cover. At this point in the project the engine was first turned over with help of an electric drill.

●To be continued.

Crankshaft and flywheel reassembled.



Eccentric added.

Paint added.

'Owen the Oil'.

Owen casts a critical eye over the work so far.

POSTBAG

Springing

Dear Martin,
I have been reading Norm Norton's articles on his Modelworks Britannia with great interest, not least because his observations so closely mirror my own experience, recently described in *Model Engineer*, of building my A4 starting with a Winson kit. My approach was, perhaps, a little less investigative than Mr Norton's but many of the same problems were encountered and our solutions appear to be similar. I would like to comment, in particular, on the article on springing in M.E.4652.

Mr Norton has shown that, for coupled wheels at least, it is possible to make leaf springs with acceptable load deflection characteristics entirely with spring steel and without recourse to the tiresome business of slotting out the lower leaves. I am sure that other builders have come to the same conclusion and it accords with my own experience with the coupled wheel springs for my A4. Like Mr Norton, I had found the original Tufnol leaf springs to be absolutely hopeless and made and fitted unslotted spring steel replacements and it is interesting to note that the calculated stiffness of my springs is very similar to that reported by Mr Norton for his Britannia. Regarding his finding that the slotted spring had higher than expected stiffness compared with the unslotted equivalent, I suspect that the reason is the holes for the securing screw through the buckle. This is the point of maximum bending moment and the stresses, which are easy to calculate, will be the same in both types of spring at this location. Unfortunately, the deflections (which are a function of the stresses along the full length of the spring) taking account of the holes and slots, are not so easy to calculate, which is why Mr Norton's tests are so valuable.

I am sceptical about Mr Norton's concluding comments that an inch or so of movement each way at steam dome level is desirable. Does he mean a total of one inch or one inch each side of the mid position? Either way I cannot agree. For example, my Stirling 8 foot single locomotive has very restricted clearances, less than ⅛ inch, on both sides of the driving wheels within the splashers so such movement cannot be accommodated or even approached. Nevertheless, it holds the track perfectly

Good With Your Hands

Dear Martin,
I found your recent editorial (*Smoke Rings*, M.E.4646, 28th August 2020) quite thought provoking in a good way.

I feel that all too often these days we seem to overlook the manual skills whether it be using hand tools or machines. Maybe we older readers seem to have a knack of being able to look at a thing and think with a little bit of work I can mend that.

A typical example is that I work in a local branch of the Marie Curie charity shop as a volunteer. Among other things I help keep the shop tidy as well as serving customers. The other week we had a camera tripod which we put in the window and after a couple of days it went. I was rummaging through what was going to be put out in the rubbish and found another tripod which had a partly broken Mazak casting which held the three legs so I said I can take that home and fix it and then we can put it out for sale. I don't have a lathe but I do have a collection of hand tools and a small bench drilling machine, so at the moment my repair piece is almost finished – just needs a bit of fettling and it will be good to go.

The comment "Ah, you're so good with your head" is so true. I remember when I was the workshop technician in my local secondary school. One of the things I liked to do was to find a chunk of timber and set it up on the wood turning lathe and carve it away with the wood turning tools and make a bowl etc. out of it. Funnily enough, I found that more satisfying than using the metal turning lathe where you know how much depth of cut you are taking by the dial on the cross slide etc.

With the wood turning lathe you rely very much on the co-ordination of your brain and eyes and also of course your strength and manipulation of the wood turning tools to get the result you want. I feel that there is probably more skill involved in turning something on the wood lathe, as each thing you make is a one-off.

As you rightly say the skill is very often in our heads as well as in our hands, often gained through years of experience. I started out at the age of 15 (now 73) and now I can look at a thing like the broken camera tripod for instance and say that it can be fixed. OK, it will take a little bit of work but being able to visualise in your mind as to what is needed and to be able to do it, I feel is quite an important skill.

As I used to say to the students who took technology, you never stop learning till the day you pass on from this world and these skills are always handy especially if you need to do something round the house.

Hopefully it won't be too long before we can get back to our clubs and societies when this covid thing gets beaten. I don't doubt that many of our clubs rely on being able to have open days and exhibitions which raise badly needed funds to keep going.

Yours sincerely, J. E. Kirby (London)

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Responses to published letters are forwarded as appropriate.

satisfactorily with no undue rolling.

Incidentally, it is very easy to determine the position of the centre of gravity (COG) of the locomotive using nothing more sophisticated than bathroom scales and a means of lifting, sequentially, the front and rear ends. Taking as reference points the bogie centre pin and the trailing axle, I set my A4 up so that it was supported only at these locations which are spaced at 876mm. I then raised the front end sufficiently to insert the bathroom scales and lowered the locomotive down onto the scales (after packing the top of the trailing axleboxes against the frames to prevent overloading the springs). The reading was 51kg. I then repeated the exercise at the rear end and noted the reading of 42kg. The total weight of the locomotive, with empty boiler, is therefore 93kg. The position of the COG, relative to the bogie centre pin could now be calculated as 42 x 876/93 = 396mm. This is just 28mm ahead of the centre driving axle. I doubt whether the exclusion of the unsprung weight of the wheelsets or the inclusion of the weight of water in the boiler would have a significant effect on the calculated position.

The bathroom scales could be pressed into service again to check individual axle, but not wheel, loads with the locomotive back on the rails. There needs to be a gap between the rails of the elevated track and sufficient clearance under the axle of the smallest wheels to accommodate a jack with the scales on the ground or other solid surface. A suitable strut should provide a load path from the jack to the axle under test. The jack should be pumped until both wheels are just lifted from the rails at which point the reading on the scales will indicate the axle loading.

However, I would not waste any time trying to equalise the coupled wheel loads to take account of the actual position of the COG. I would only adjust as necessary to correct the trim. As is evident from figure 5 in Mr Norton's article in M.E.4652, even small track irregularities will cause large variations of individual wheel loads when the locomotive is in traffic. The important thing is that in traffic wheel loading shed by any coupled wheel is, as far as possible, redistributed to an adjacent coupled wheel with minimal increase in loading on the bogie and trailing wheels. My experience has been that this is easier to achieve on a Pacific than on a Stirling 8 foot single.

Best Regards, Jeremy Buck

Tube Expanders

Dear Martin,

I noticed last night a mention of tube expanders on page 568 of M.E.4650 (23rd October 2020). I spent my working life in the marine industry. Tube expanders are used in engine rooms in various sizes, the smaller ones being generally used on coolers, often for lubricating oil. I think contacting a manufacturer of coolers or marine auxiliary equipment would be worthwhile for finding out more. Ruston Diesel's for example built a large number of Diesel generators for the marine market and probably still do and would be worth a try. Another contact would be a ship repair company, preferably one that tended to work more on the smaller types of vessels.

These smaller tube expanders generally came with a new vessel along with spares. I would think that the supplier would have gone 'out' for purchasing these. They are a simply smaller version of those used for boiler tubes.

Best regards, Mike Casey (Isle of Man)

Blowers

Dear Martin,

As a little fill-in project I decided to make one of the variable voltage output devices to power my steam raising fan, as described back in March/April 2020 by Peter Kenington in M.E.4635 and M.E.4636. To make things easy, and so I could just follow his instructions, I managed to purchase an identical DC-DC converter board to the one he used, though I had to obtain it direct from China (eBay). The rest of the parts came from CPC as he suggested except that I decided to use a flylead on the input side and a GX12 connecter (eBay) on the output. I normally run my blower off a 2.2AH battery and connect using crocodile clips, as many of us do. My requirement was slightly different to his as I wanted a variable output fan to optimise the starting conditions over the wide range of locomotive sizes I run and so I used a linear potentiometer.

All did not go to plan and as a result I have a couple of improvements to suggest.

Firstly, it didn't take long to discover that the converter board had no protection against reverse polarity connection, which is too easily done with croc-clips. Oops! No great loss as it only cost £3.95 but of course this caused a delay. To prevent a recurrence (and embarrassment at the track) I fitted a 30V 5A SB530 diode to the input. Other types would do but getting as close as possible to the voltage requirement should minimise power losses.

Secondly, this event caused me to look more closely at the board specification. It may be unwise to trust any information for an unbranded Chinese product but there's no real alternative. This board is rated at 1.5A output, presumably continuous. A quick check showed my fan motor draws 600mA when running at 12V - fine - but when stalled or starting this goes up to around 5A which is way beyond the board's capabilities. The board does seem able to cope with the starting transient, but having suffered a stalled motor more than once (all that soot and grit) I've played safe and fitted a 1.5A mini fuse to give some protection.

Finally, and no fault of the design, my ancient battery was not up to it. All went well for a while and the fan ran well at anything above about 5V. But after about 15 minutes the whole affair slowed to a crawl. Re-charge and it's back to normal again. I surmise that by demanding an input power to provide a continuous output the board is drawing more and more amps to compensate for the declining voltage in the battery and so hastens its demise. When the fan is connected directly to the battery this does not occur as the current will decline as the voltage goes down so the motor slows over a longer period. This may not even be noticed over the time for one or two locomotive starts. New battery on order!

Best wishes, Gerald Martyn

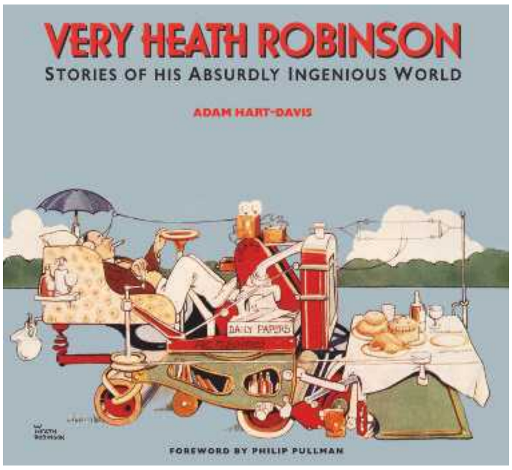
Captain Stirling

Dear Martin,

Just a small correction to the letter by Paul Collyer (M.E.4653 4th December 2020). David Stirling did not set up the Long Range Desert Group, he set up the SAS in 1941. The LRDG was set up by Major Ralph Bagnold in 1940. The LRDG provided transport for the SAS on raids but the two groups remained separate, both being disbanded in 1945. The LRDG did not become the SAS.

Regards, David Hall (Warwick)

Book Review



Very Heath Robinson: stories of his absurdly ingenious world

Adam Hart-Davis

Few artists and illustrators created English phrases but Willam Heath Robinson (1872-1944) managed that remarkable feat. His humourous drawings of incredibly complex mechanisms, often designed to do the simplest jobs, made him one of the best known illustrators of the 20th century and gave rise to the expression 'Heath Robinson' to describe any complex object or contraption.

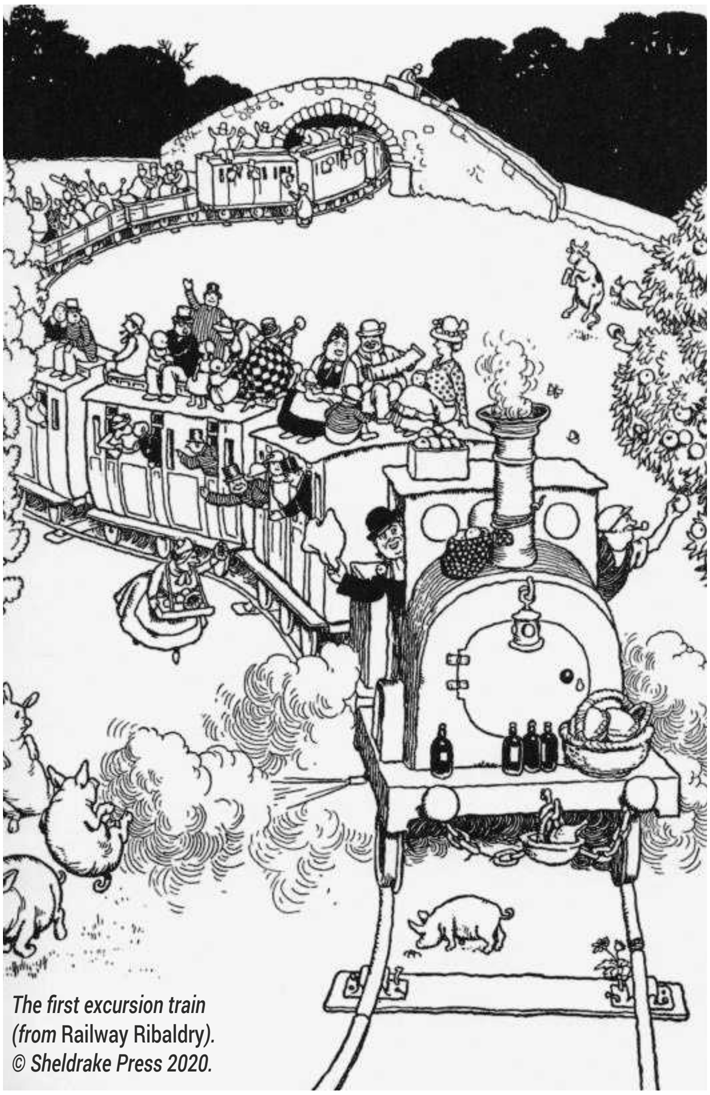
During the Second World War codebreakers at Bletchley Park designed a machine to break Lorenz teleprinter ciphers. Of remarkable complexity, it was nicknamed 'Heath Robinson' and carried out valuable work before being superseded by the *Colossus* computer.

His father was a professional illustrator and William studied at an Islington Art School. Unsuccessful at selling landscape pictures, he turned to book illustration, even collaborating with Rudyard Kipling. He gradually introduced humour into his pictures and was recruited to draw propaganda cartoons for newspapers during the First World War. Postwar, he did a strip cartoon featuring 'Mr Spodnoodle' and his complex machines, leading to commissions for drawings from various companies.

Commissions included Ransome's lawn mowers, Moss Bros. menswear, Hovis, Yorkshire Relish (made by Goodall, Backhouse and Co. in Leeds), Sandy Macdonald Scotch Whisky, Connolly leather and many others, even carrying out work for continental firms. Heath Robinson visited factories to make sketches and gain ideas. At the cement works of G & T Earle near Hull he drew all the processes for making cement but gave them his own light hearted interpretation. The resulting book was highly popular and was reprinted.

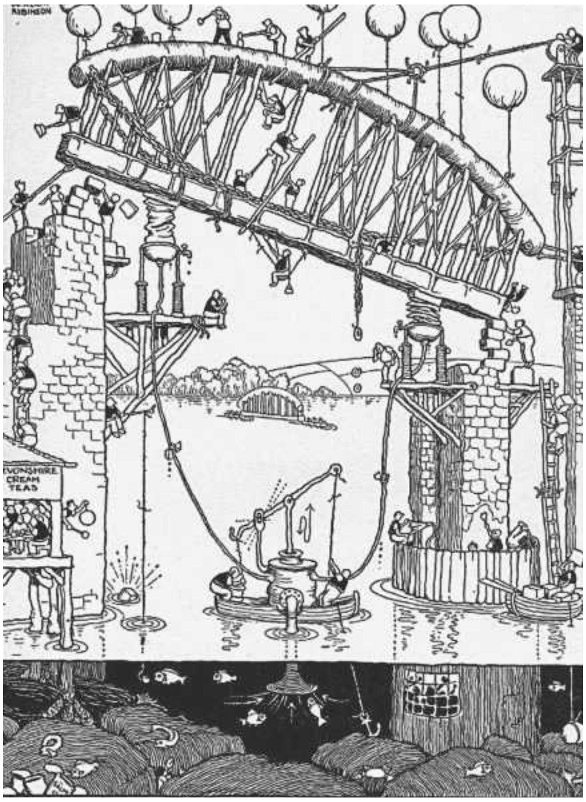
He later said "My designs for machinery were certainly considered efficient" and his drawings show machines and gadgets with a base in reality so they could have worked! They mostly featured hand operations by apron clad and rather serious operatives but there is never any malice in his pictures.

His ideas were put into reality with an exhibit at the 1934 Ideal Home Exhibition featuring ¾ size dummies, the Glowmutton family in a large model house. Within it was an array of gadgets - the alarm clock made the family a cup of tea and a breakfast gong operated two pulleys lowering Mr and Mrs Glowmutton on



The first excursion train (from Railway Ribaldry*). © Sheldrake Press 2020.*

Published by Sheldrake Press, 2017
ISBN 978-1-873329-48-1
£40. 240pp, hardback



Building Saltash bridge (From Railway Ribaldry). © Sheldrake Press 2020

their chairs through the floor down to breakfast where they switched on the radiogram, squirted milk for the cat and lifted lids off breakfast dishes! Not to be outdone, the cook beat eggs by bicycle power. This was a highly popular exhibit though sadly it doesn't appear to have survived.

Many of his drawings featured domestic life but he also enjoyed making pictures of sports, motoring, walking and photography. For one commission he decorated the cocktail bar and other rooms for the steamship *Empress of Britain* in the days when shipping companies liked to decorate vessels distinctively.

Perhaps his best known work is *Railway Ribaldry*, produced for the centenary of the Great Western Railway in 1935. Incidents from the early GWR are given the Heath Robinson spin - parachutists help install the electric telegraph and hand operated bellows power atmospheric railway trains! Growing up in the 1930's, my mother described this as one of the books her family most enjoyed.

For those who know little of Heath Robinson, Adam Hart-Davis has created a readable volume showing just what a remarkable artist he was. A book to be recommended for those enjoying the lighter side of engineering, leisure and domestic life.

Heath Robinson Museum
Pinner Memorial Park
50 West End Lane
Pinner HA5 1AE
0208-866-8420
www.heathrobinson museum.org

Roger Backhouse

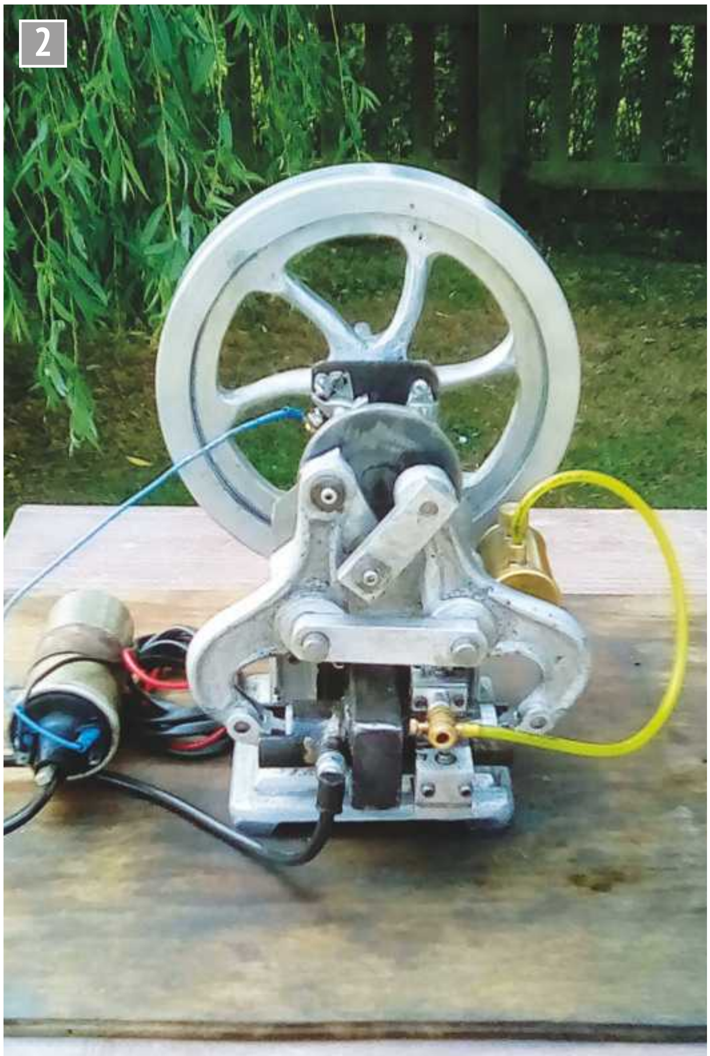
SHOWCASE

A Pair of Atkinson Engines

The first (**photo 1**) is an Atkinson Differential Engine. It's based on a home made set of castings in aluminium and built entirely from scratch over a period of four months. It is shown being bedded in by coupling to an electric motor.

The second (**photo 2**) is another Atkinson cycle internal combustion engine. Both engines complete all four of their strokes in one revolution of the crankshaft so they are a bit unique! The originals were built in 1886.

Malcolm Smith



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Machines and Tools Offered

■ Contactor assembly and main switch and also the 3 phase suds pump from a MK2 Colchester Student. Free to a good home for postage.
T. 07900 400364. Newbury.

■ Reamers: Adjustable reamers, 2 in. nominal, $1\frac{13}{16}$ - $2\frac{7}{32}$ and $1\frac{15}{16}$ - 2 1/4 in. David Brown adjustable Reamer 4MT, approx $1\frac{7}{8}$ - $2\frac{7}{16}$ in.(needs carbide cutters grinding). Just the job for largeish cylinders. Also Standard reamers (2 MT) 7/8 and 13/16 in. All UK made.
T. 01205 290312. Nr. Boston, Lincs.

■ Unimat SL Lathe. 3 Jaw Chuck. Drill chuck. Face plate. £250.
T. 01283 733109. Etwall, Derbyshire.

■ Murad Cadet lathe £475,
T. 01938 552817. Welshpool.

Parts and Materials

■ Maid of Kent inside cylinder, complete rolling chassis, £1600 ONO. Also Maid of Kent castings, £200, ONO.
T.01460 419969. Crewkerne.

■ A part built 5" Maid of Kent o/s cylinder, chassis largely complete motion made but not fitted cylinders are fitted, some drawings,.Western Steam boiler (round top) with cert, tender 90% complete £2,500. **T. 01732 462665 Sevenoaks Kent.**

Wanted

■ A copy of Model Engineer Vol. 224, No. 4635, 27 March 2020. Will pay £6 plus P&P.
T. 01432 350902. Hereford.

■ Three jaw chuck for Cowells ME lathe, also other accessories. Also complete Cowells Lathe in good condition.
T. 01986 835776. Norwich/Ipswich.

■ Josie "0" gauge loco. I'm looking for construction details published in ME 1933, Vol. 69. Any information that could be useful, thank you.
T. 01159 469229. Derby.

■ Full set of drawings wanted for 3.5 inch Schools Roedean Locomotive.
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Old girl all dressed up posing for the camera.

PART 10 - BOILER FITTINGS AND VALVES

WAHYA A 5 Inch American Type Locomotive

Luker builds an American 4-4-0.

Continued from p.93
M.E. 4655, 1 January 2021

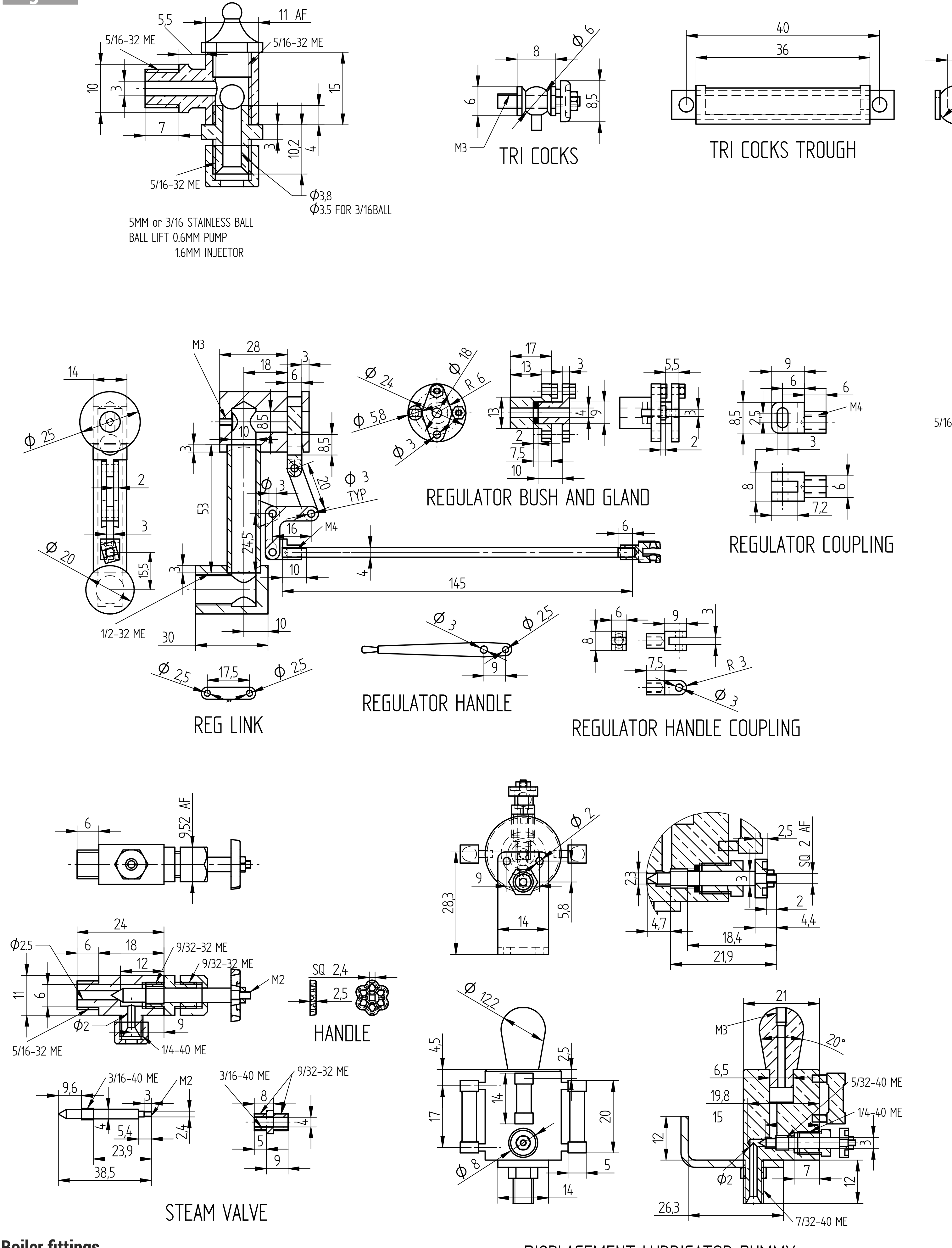
The steam valves and turret

The steam valves for the injectors and blower (**fig 12**) are my standard design with the captured spindle to prevent it from being screwed out completely while in steam. These valves are different to the large scale, being longer and slightly larger. This was done to make the model an easier drive on the track. The real locomotives had these valves all over the place above the boiler, either on a common steam line or sometimes just screwed to the boiler barrel in the cab or on an upright turret. The 'scale' access would have been an issue, being hidden for a giant driver and very finicky. The described valves are on a common turret and extend slightly forward allowing for easier access with gloves and a hand full of thumbs. I doubt this configuration would offend the enginemen or master mechanics of the day, being the logical souls they were, and the model cab (I think) looks like a homely and neat place to work for any miniature engineman (**photo 65**).

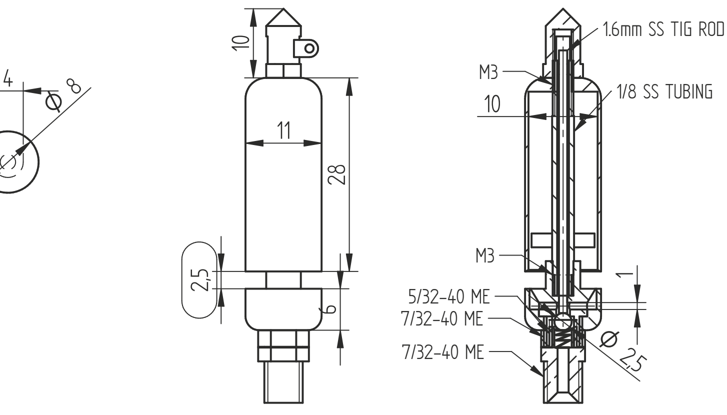
One trick I would like to mention with making any steam valves is the making of the spindle seat. I gave up a long time ago drilling perfectly round holes; you will always get a clover, with only the extent of the 'leaves' improving with practice. For valves, I pre-drill the holes undersize and open them up with a toolmaker's reamer or a D-bit cutter, fashioned from some silver steel the normal way or by grinding the back end of a drill bit that made me angry at some point. This drastically improves the seating surface and I don't get valves that don't seat properly. For clacks I use a slightly different approach, even more deliberate to get a round hole, but I'll get to that in a bit...

Wahya *backhead fittings.*

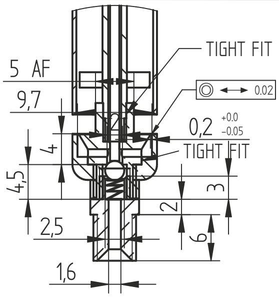
Fig 12

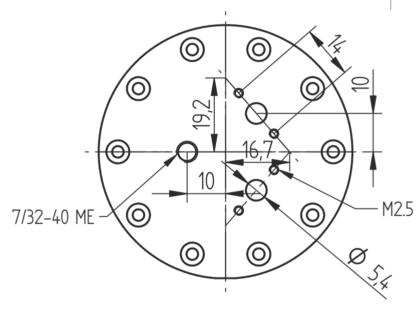


Boiler fittings.

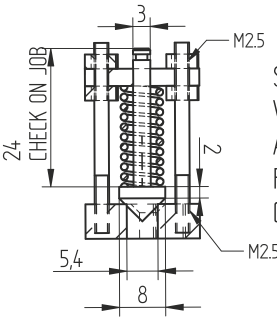


STEAM WHISTLE



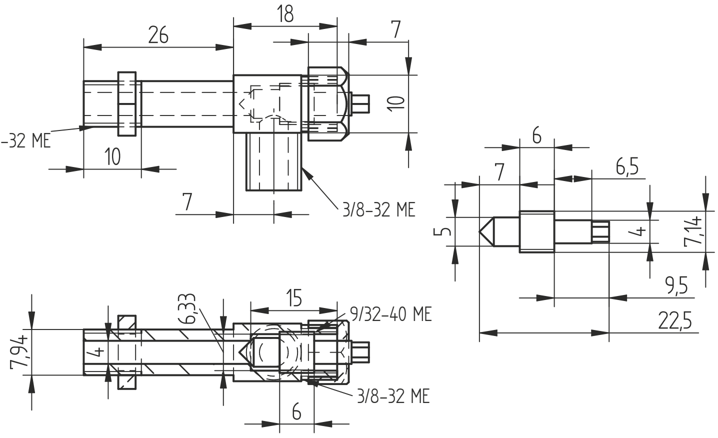


REGULATOR FLANGE

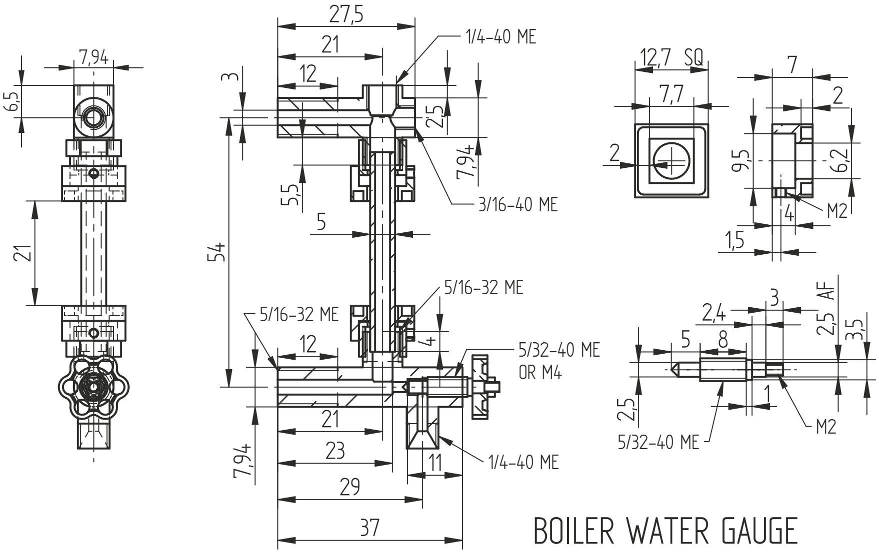


SAFETY VALVE SPRINGS
WIRE DIAMETER 1mm
ACTIVE COILS 11
FREE LENGTH 23mm
COMPRESSED LENGTH 17.5mm

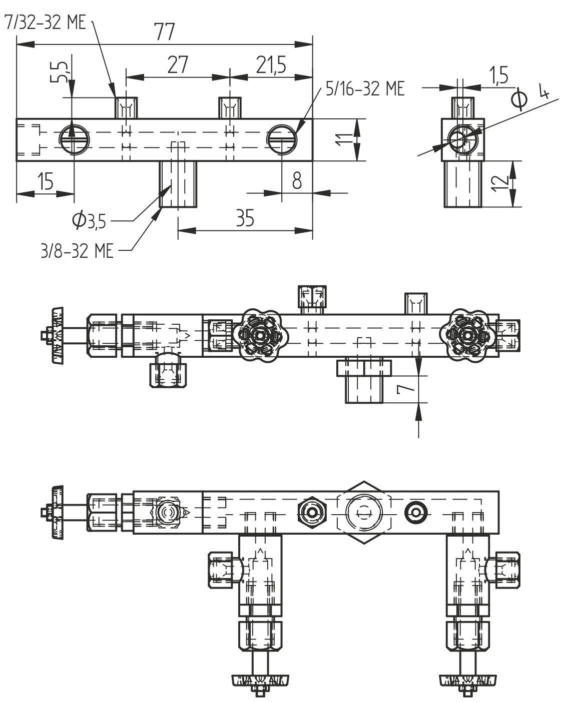
NAKED SAFETY VALVES



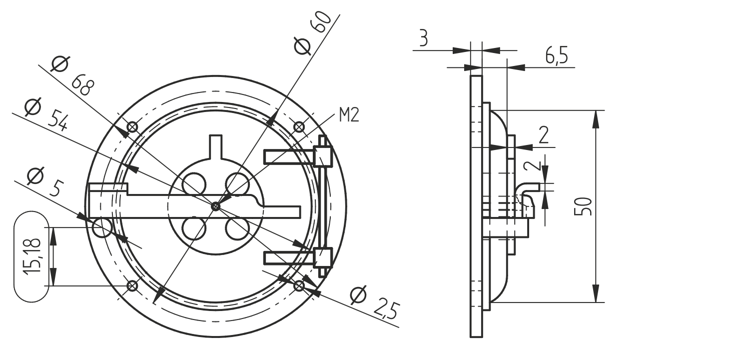
BLOWDOWN VALVE



BOILER WATER GAUGE



TURRET



FIREDOOR

The steam valve for the displacement lubricator needed to come off the main turret because of the super heaters. The valve is made to look like a scale sight glass lubricator, but it is really just a simple small steam valve, with a graphite gland to prevent leaking.

The turret is made from some brass square bar with the spigot that screws into the boiler made from some bronze and silver soldered into place (**photo 66**). The top union connections are for the displacement valve line and the pressure gauge. This is mounted behind the turret on the back of the wooden cab with the normal pipe looped around the gauge to prevent the heat from the boiler affecting the reading.

Boiler water gauge

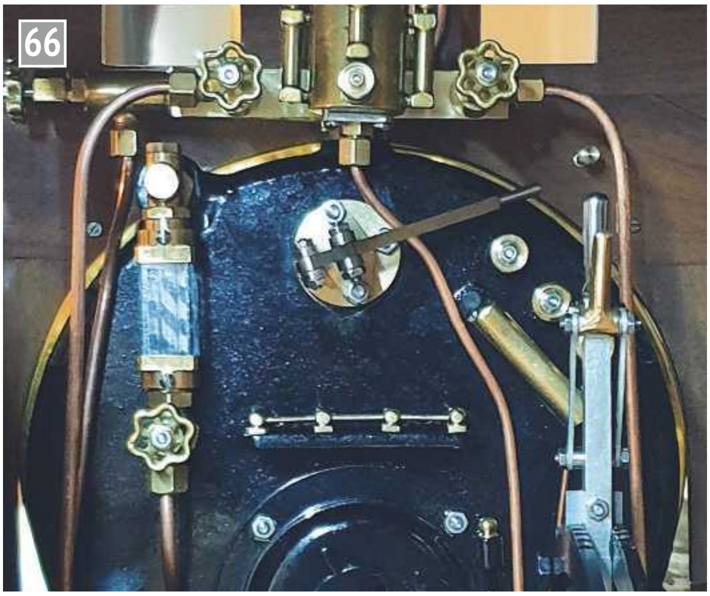
The water gauge design and position are critical depending on the position of the top of the firebox, and need to match the boiler design. This gauge is of a simple design but the glass cover and backing zebra stripes add a little something and bring the model closer to what the larger locomotives would have looked like. Incidentally, the boiler gauges fitted to most of the working examples today are of the new clamped tempered glass type and are a much later design.

The slot for the cover glass is 2mm. I used 1.8mm glass from a broken picture frame. I doubt 2mm will fit properly top and bottom, all sides, so a little play is necessary. The back was made from 1.6mm steel plate and painted to the zebra style shown in the pictures. A small 2mm hole is necessary at the bottom of the back plate as a pressure release should the glass tube on the inside break.

Regulator valve

The regulator valve (**photo 67**) is a simple sliding valve and is a stainless steel welded assembly. All the pivots are solid stainless steel centre drilled and mushroomed to make sure they stay put during steaming. The bottom fitting was made from a good quality bronze to prevent any chance of cold welding or seizing with the main steam pipe (this would be a disaster!), which is machined from the same pipes as the boiler tubes. I tried my hand at dissimilar Ni-TIG welding but silver soldering this connection will also work. Just don't braze it!

The main steam pipe that connects to the regulator valve (**photo 68**) is measured on the job and should just extend past the wet header bush. I welded a 3mm cross bar 50mm from the end and flush ground the ends. This, with a simple tool (a 10mm rod with a groove cut at the end and a torque bar on the other), makes assembling and tightening the main steam line an easy job. The other end of the regulator is connected to the 4mm bar that in turn connects to the handle. The 4mm bar should pick up the coupling at the bottom of the link relatively easily provided the end of the thread is liberally chamfered. The top of the regulator is held in place with a M3 countersunk screw to the side of the steam dome.



66

Water gauge and steam valves.

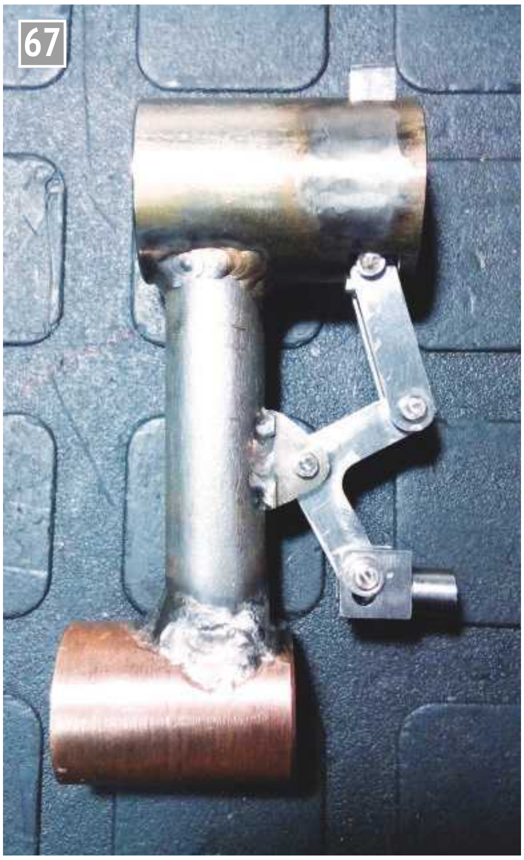
Before tightening everything up I suggest checking the valve movement with the regulator handle using a small mirror to make sure the valve opens and closes completely.

Blowdown valve

The blowdown is a convenient point to test the locomotive on air and fill the boiler with water before steaming up. All my blowdowns have a common ⅜ inch fitting so I only need to make up one line and I never bring the wrong line on a steam day. The tube at the front end of the blowdown is to clear the back axle and to improve access from the back end of the locomotive.

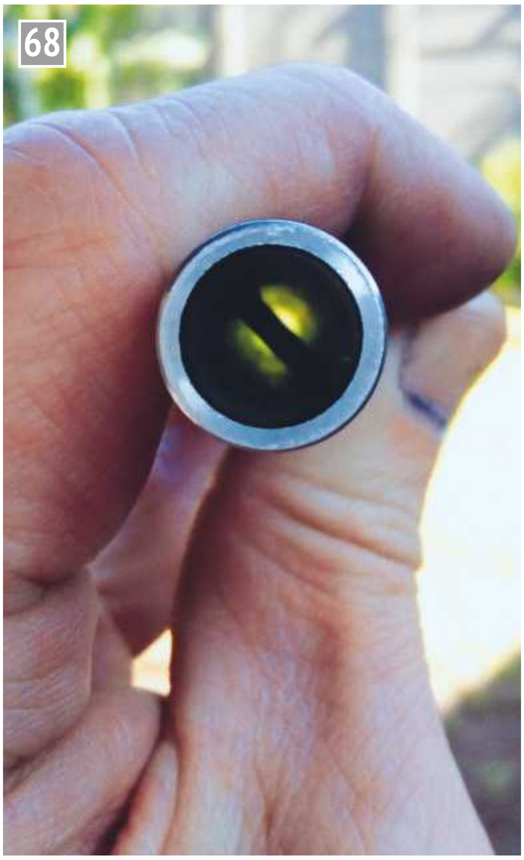
Boiler clacks

Many builders battle with getting boiler clacks to seal properly and most of the



67

Regulator valve.



68

Main regulator steam pipe.

problems can be traced back to a poorly seated ball on a non-round hole. The same principle applies to the steam valves; with a normal drill you will most certainly get a clover hole. For all my clacks I machine the ball side of the clack first, centre drill and drill with a smaller drill through to the other side. I then flip the component around and machine the other side to drawing with the threaded part held in a tapped mandrel. Concentricity won't be perfect but this isn't an issue on the pipe coupling side. I then run a toolmaker's reamer from the back end through to the seating surface. Most of my toolmaker's reamers are just the back end of a drill that has been ground at 60 degrees to the midpoint of the drill and polished with a little 600 grit sandpaper. Because the shank will be completely in the hole before it gets to the seating surface the shank will make sure it is perfectly round and any concentricity issues will be taken up by the flexibility of the drill and the tailstock.

The part is then removed from the threaded mandrel and the seated surface is very lightly de-burred with some steel wool (outside the workshop away from any machines!). Nine out of ten times the ball seats perfectly and this is tested by the normal, very scientific, method of suck and seal using your tongue and see if it sticks. If it doesn't then a light tap with a piece of brass on a scrap ball normally fixes the problem.

Steam whistle

The steam whistle for *Wahya* was deliberately made shorter than the large scale locomotives. The full scale locomotives had the whistles extending almost as high as the chimney and for a working scale model this is going to get in the way and likely break if knocked by mistake. The whistle still extends past the roof of the cab so on the display stand it looks like a good fit. This whistle design was developed for my previous locomotive and has a pitch that isn't too high like most bell type miniature steam whistles. It's a bit of a tricky thing to make but if the bell and base are concentric with all the tight fits keeping the assembly lined up, the results will be very satisfactory. All the whistles on my locomotives work really well and are easily tapped from a comfortable sitting position to warn people on the track.

The tiny spring holding the ball against the seat to prevent leaking when heating up the boiler is made from stainless steel fishing tracer wire wound around a suitable drill.

Safety valves and regulator flange

The safety valves are the open type with a number of the larger locomotives employing these types of safety valves. It's an appealing type of safety valve because the spring and inner components are visible unlike the standard type of safety valve. On that note, please excuse my naming of the safety valves in the drawings; I couldn't resist! It is a little more difficult to set up and needs to be done with the boiler assembled and on compressed air.

I made the springs using stainless steel wire but, because these valves are open, normal spring (music) wire can be used and oiled after each steam day to prevent any rust.

The regulator dome cover can either be made from stainless or a good quality gunmetal or bronze. If stainless is used (which is the route I followed) the seats for the safety valves should be changed to a ⅜ inch bronze screwed in from the underside of the cover to improve the sealing surface for the safety valves. A 12AF hex on the underside seals nicely, with the screw machined flush to the top of the dome cover. The same methods used for the clacks were employed to machine my seats, forcing the seating surface to be perfectly round.

The firedoor

The firedoor is made up from a combination of laser cut pieces with the actual door machined from a piece of cast iron. The backing flange has four bolts that are bolted to the boiler backhead with the hinges fitted to this flange. The holes and cover plate are used for low load running conditions to prevent the safety valves from continuously blowing off. Added to that, slots can be cut into the lever resting bar to allow the door to be left slightly open on the run.

Finishing off the backhead

I added the tri-cocks and trough to the backhead. They have no functional use in the model and are purely for show, but they were very quick to make and only added a few small holes to the backhead. In the end, they were well worth the effort.

Most builders won't make their own pressure gauges but, generally, my builds are done on budget with the trade prices for these gauges prohibitive for me. I circumvent that minor financial constraint by modifying standard cheap 1 inch gauges. This allows me to change the pointer and the gauge face to match the period and type of the locomotive being built. They're also generally more accurate, with a wider range than the model engineer gauges supplied with a simple lever arm system.

Most builders won't make their own pressure gauges but, generally, my builds are done on budget with the trade prices for these gauges prohibitive for me.

Boiler insulation.

The cab will also benefit from a working clock and repurposing a small quartz watch into a suitably machined casing bolted to the cab will add some interesting detail for any members of the public that want to have a closer look.

Boiler cladding and strapping

Finally, to finish off the boiler it can be insulated with 1.6mm cork and clad with 1mm steel plate (**photo 69**). The cladding and insulation stops level with the running boards for the entire section of the larger diameter of the boiler with the taper and parallel section cladded all round. The thicker cladding keeps its shape much better than thinner cladding. It's also easier to bolt all the fittings directly to the cladding through suitably tapped holes. The straps were made from 0.5mm brass strips with brass angles riveted to the ends to close the loop. The last strap extends into the cab and is folded around the back end of the cladding, neatening the inside of the cab substantially with very little extra effort.

●To be continued.

Rodney Oldfield constructs another of Bob Middleton's small but interesting engines.

Continued from p.169
M.E. 4656, 15 January 2021

The Middleton 'Monitor' Type Engine

PART 2

Flywheel

The designer says it will run perfectly well without a flywheel and the original did not have one. I included one because in my opinion I thought it looked more in keeping and better with one. Also, it makes it a lot easier to play with and much easier to help with the setting up.

Once again, I didn't have a big enough diameter piece of material to make one but I did have five old gear wheels, one of which would do (**photo 10**) but I had to bush the bore down to size. I machined it all down to size and finished it off being careful to get it all running true with the bore. There are no sizes for the fly wheel – use what materials you have. The only thing that matters is the ⅜ inch bore.

Having made this, I had to make four feet 1⅛ inches long (**photo 11**). I made mine fancy only because I happened to have some hexagon bar. Drill and tap 2BA and insert some studs. Once the frame is all built up make sure the shaft turns freely. It is a lot easier to do now with a fly wheel on (**photo 12**).

Do not move on until you are happy with it.

The cylinders

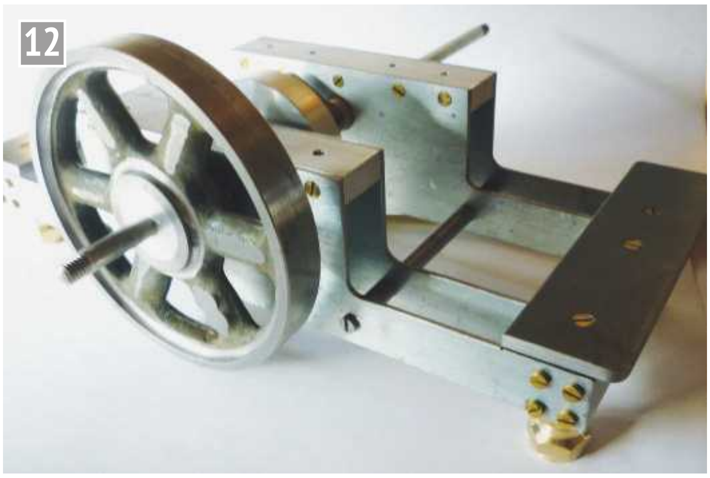
These were the most expensive pieces of material

10

My flywheel is a repurposed gear wheel.

11

Four feet.



Frame standing on its feet.

I have had to buy in a long time - £15 each for two bits of brass 2¼ inches diameter x 2⅜ inches long. Place in a chuck, face off and bore out to 1 inch diameter, getting as good a finish as possible. Do this to both pieces and then face off to 2 3/16 inches exactly. Place in a vice on the miller table, level with the front of the vice **for all operations.** Mill or fly cut down to ½ inch from the bore. Do this on both cylinders. Next fasten into the vice with the flat face to the fast jaw and cut down to ⅜ inch from the bore (**photo 13**). Take out and mark off very carefully with the aid of digital callipers the positions of the ports then fasten as before. Line up the 3/32 inch cutter on the centre line over the 3/32 inch port, taking small cuts, and machine over to the ⅜ inch slot length, ¼ inch deep. Take out and repeat with the other cylinder. Next move over to the other 3/32 inch slot and mill out. Take out and repeat with the other cylinder. Change the cutter to 3/16 inch, move over to the centre of the cylinder and cut the exhaust slot (**photo 14**). Remember you will not have to move as far on the X-axis to get a ⅜ inch slot.

Next place the cylinder upright as in **photo 15**. Mill out a ¼ inch slot x ⅛ inch deep, centre drill then drill down with a 4mm or 5/32 inch drill until you meet the top slot (**photo 16**). Turn over and repeat on both cylinders.

After making at least 20 models over the years using slide valves I finally managed to mill both the cylinder steam passages into the wrong face NOT into the bore. However, I managed to mill into the bore and solder a bridge into place - WHAT A PLONKER.

Place in the vice on the 1 inch flat with the other flat level with the front edge of the vice. Centre a ½ inch slot cutter in the centre of the cylinder and ½ inch in from the face. Mill down to approximately 0.030 inch above the line of the flat. Drill and tap as in the drawing (**photo 17**).

Cylinder inner cover

I used a 2 inch diameter piece of aluminium for this. Take a light skim over the top and turn down the inner spigot to 1 inch diameter x 1/16 inch deep, to be a good fit in the bore. At this stage it is a good idea to place the parting off tool onto the spigot and zero off on the cross slide dial. Next, in order to mark out the positions for the holes in the cylinder bolts, place a pointed lathe tool in and scribe a circle 1⅜ inches diameter, place the No.1 jaw to the top and scribe a short line across both sides of the circle, next place the No.2 jaw to the top and repeat, and then jaw No.3 and repeat (**photo 18**). This is for the hole centres.

Move over ⅛ inch and plunge in with the parting off tool to zero. Move over and repeat until you have a 1/16 inch wide boss. It is possible to nip lightly on the spigot boss to clean up the parted off face.

Outer cylinder covers

Turn a 1 inch diameter ¼ inch deep, centre, drill and ream 3/16 inch through and then drill tapping size as drawing.Now

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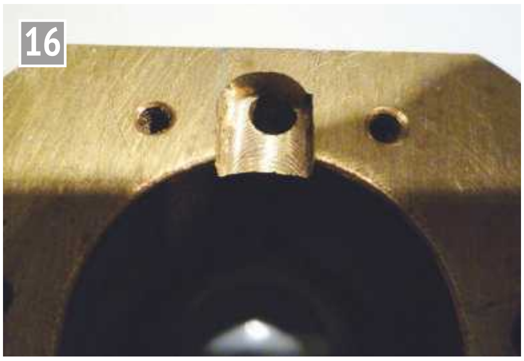
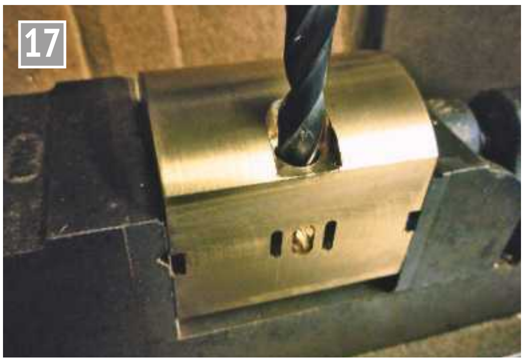
Flycutting the portface.

Milling out the exhaust port.

Drilling a steam passage.



More or less on target!



Drilling through for the exhaust.

Marking out a cylinder cover.

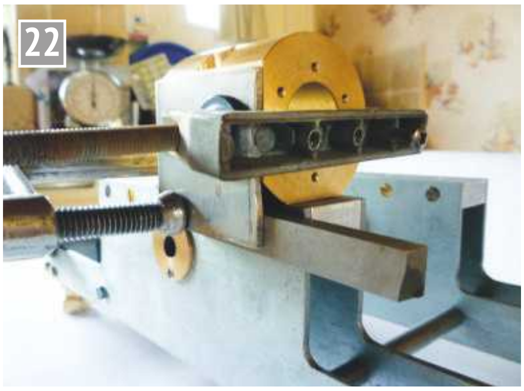
This may sound a simple job but take your time and do it right.

mark off for the bolt holes as inner cylinder cover. Next, move over 3⁄16 inch plus width of parting off tool leaving a 3⁄16 inch thick flange. Now plunge into zero on the top slide which will leave you with a 1 inch diameter which should be a very good fit in the bore. Move over with parting off tool until you get a 1⁄16 inch boss to fit into the bore of the cylinder and part off. Centre punch the six holes on the crosses and drill out using a 6BA clearance drill. Place the cover onto the cylinders, which must be stamped L and R or 1 and 2 because from now on they are HANDED. Line up and spot through one hole, drill and tap out. If you are happy with it, do the same with the other five holes. Stamp the cover to the cylinder and repeat on all four covers (**photo 19**).

Cylinder, piston and covers.

Cutting grooves for 'O' rings.

Putting spanner flats onto the valve rod gland.



Lining up cylinder on the frame.

Piston rod

Saw off a piece of 3⁄16 inch stainless steel rod 3½ inches long and die down 2BA in the lathe to make sure it is square.

Piston

Machine out from cast iron 0.010 inch above 1 inch diameter and grove it out ⅛ inch wide and ⅛ inch deep for packing or an 'O' ring (**photo 20**). (I do not use anything because I do not need power - all I demand of my engines is that they run on compressed air, preferably slowly and about 15 psi or under.) Drill and tap out 2BA keeping everything square. Tighten the piston rod into the tail stock chuck and screw it into the piston making sure it is tight. Take off all sharp edges and part off. **DO NOT REMOVE PISTON FROM ROD AFTER THIS.**

Nipping a ¼ inch piece of brass into the chuck, centre, drill and ream 3⁄16 inch then slip the piston rod with piston on up to the chuck (all this does is to get it running true - if you have some collets use them). Tighten it up so that it will turn, now skim the piston down to 1 inch diameter to be a good fit in the cylinder bore.

Valve rod gland

I turned mine out of ⅝ inch round stainless steel (I use a lot of stainless steel on my models for the small bits because I can get a good highly polished finish which will not tarnish). Turn it down to ⅛ inch BSP diameter x 5⁄16 inch long. I threaded it down making sure everything was square and drilled a 3⁄16 inch hole through, ⅝ inch deep. Next put No.1 jaw to the top and file a flat on then, turning the jaw to the bottom, file another flat on to fit a 14mm spanner (**photo 21**). Part off a strong ⅛ inch. Using a piece of brass which I have tapped out ⅛ inch BSP I fastened this in the chuck, screwed the gland in and slightly domed the face, taking all sharp corners off, and gave it all a good polish.

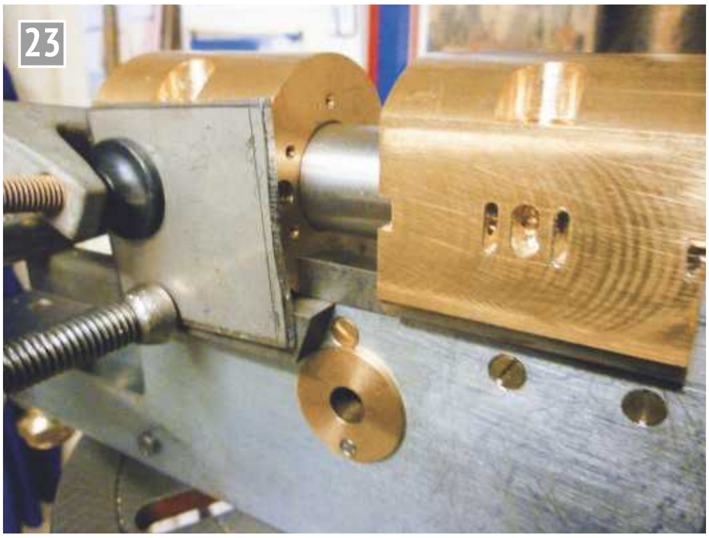
Fastening cylinders onto the frame

This may sound a simple job but take your time and do it right. Just glance at **photos 22** and **23** for a few minutes - it may help.

Using a flat piece of metal I clamped it onto the cylinder porting face and then with a ⅜ inch distance piece between the flat clamped on plate and the frame I clamped it onto the frame making sure it was ½" from the centre to the cylinder face. Next I spotted through one hole of the holding down screws, dismantled, drilled and tapped the hole. (I use ¼ inch Whitworth Allen cap screws because they are easier to get to and tighten up.) Screw the cylinder onto the frame and do the same with the other cylinder placing a 1 inch diameter bar through both bores. Spot through all three holes, dismantle, drill and tap holes.

DO NOT FORGET TO MARK CYLINDERS TO FRAME.

●To be continued.



Ensuring the cylinders are truly coaxial.

Wenford

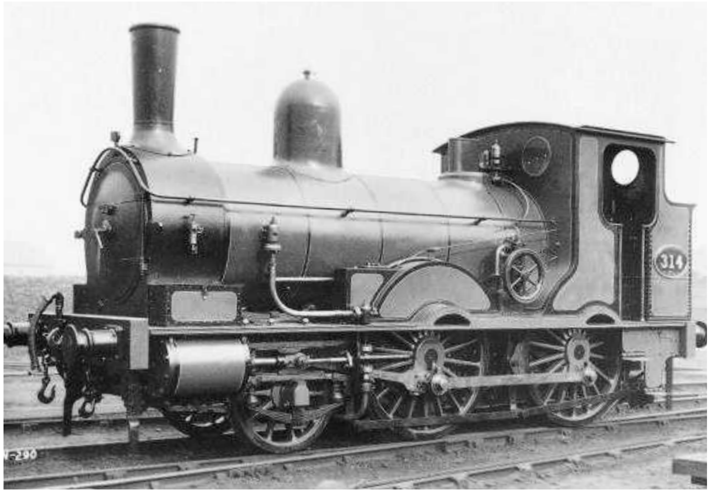
PART 16

A 7¼ Inch Gauge 2-4-0 Beattie Well Tank

Hotspur catches up on the description of his Beattie well tank.

Continued from p.107
M.E. 4655, 1 January 2021

Forward well tank vent pipe fitting



Looking through my various reference books on the early Beattie 2-4-0 tank locomotives, the pictures show that they all have air vent pipes that come up from the front right hand end of the water supply tank under the boiler and wrap around at the rear of the smokebox before poking up behind the chimney! They have to be this long to cope with the bunker being full of water but, when the access to the front tank is examined, it is not a simple matter to attach this pipe after all the painting and other assembly operations have been done. The immediate area is cluttered by the front axle leaf spring and hangers so that adding the fixing bolts for a flange on the tank side could be very awkward. The pipe has an interesting flared top and for some builds of the locomotive, the pipe was held by a bracket close to the chimney.

My first consideration was what to make the pipe from? Copper would be very easy but vulnerable to being bent and brass would also be feasible and a little more rigid. Lastly, I considered that probably stainless steel would be best if it could be shown to be malleable enough to be both swaged into the top flare and bent through a fairly tight radius. I consulted M-Machine in Darlington and Andy Myers did a bend test to assure me that one of the features at least was achievable. I am only a satisfied customer of this company and ordered some of their 5/32 inch diameter grade 316 stainless tube and set about making the top portion to my drawing set out in **fig 16**. As the front well tank vent hole is close to the smokebox, I found a 12 inch length was ample.

Start by forming the flare and, to do this, first drill a hole 5/32 inch diameter in a steel block at least 5/16 inch thick to easily take the stainless pipe (a No. 22 drill is suggested) then chamfer the hole to at first 60 degrees and then 90 degrees followed by some internal filing to form a radius to produce a female trumpet shape. **Photograph 126** shows my set-up and the swaging was done cold with the end of the tube just protruding above the steel block and the pipe held carefully in protective jaws underneath in a vice. A short length of rod, around 3/32 inch diameter, was rotated in the end of the pipe to start the flare and then a standard centre punch was used to ease the material out to the final diameter. The operation cannot be carried out too energetically or I suspect the pipe wall will be split but I found that the material was sufficiently malleable to be worked without any heat.

The next operation requires a pipe forming ring and mine was machined on a short piece of alloy bar with a parting off tool ground down to be a radius to suit the tube, plus a few

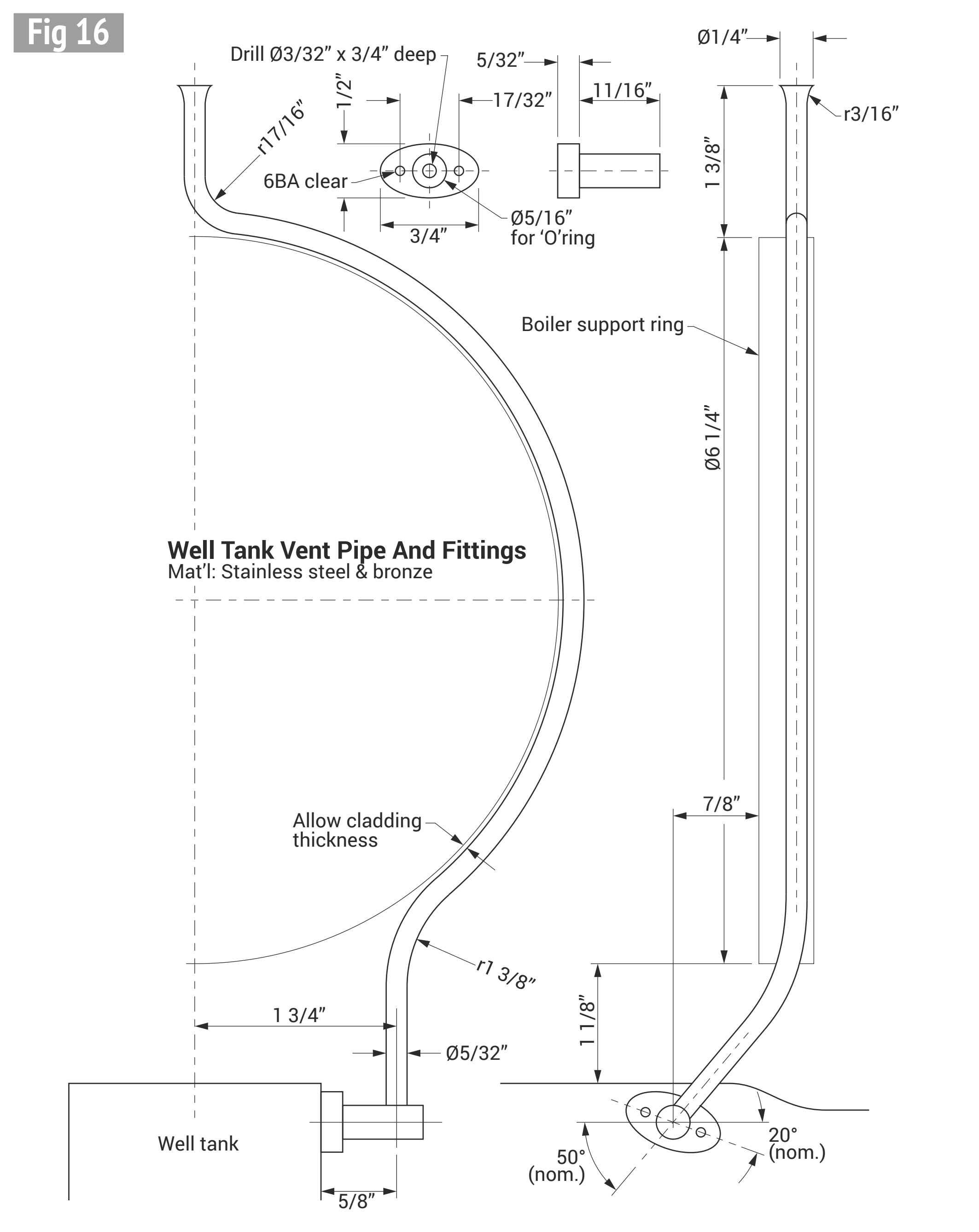
126

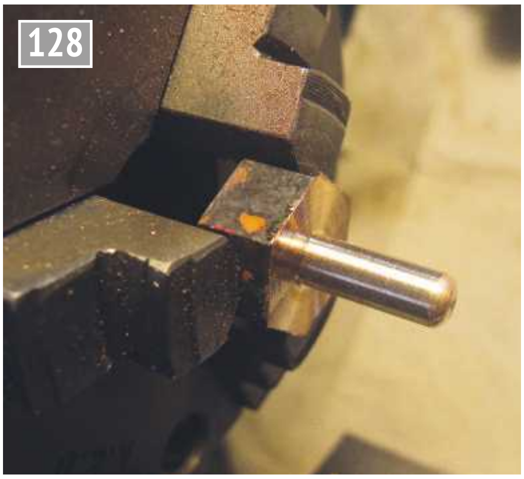
This view shows the forming block being used to add the flare to the top end of the vent pipe. The swaging operation has to be carried out while the pipe is straight otherwise the block cannot be removed.

127

The first part of the tube forming exercise is complete and is shown with the tools used.

Fig 16





Odds and ends from the scrap box were used to make the pipe adaptor for the forward well tank; here the two parts were hard soldered together ready for machining.

The pipe adaptor for the forward well tank connection. For convenience the joint onto the tank is made with a small 'O' ring rather than a conventional gasket.

thou! The forming operation was very soon completed and then a 6 inch diameter lathe chuck held horizontally in the bench vice allowed the pipe to be formed by hand around its circumference with a small allowance for the radius required outside the boiler support ring and the eventual cladding sheet. The tools and the resulting pipe shape are shown in **photo 127**.

The next task was to make the pipe adaptor to fit the well tank vent hole. I had drilled this hole to be $\frac{3}{16}$ inch diameter when the tank was made originally, and for an air vent this is much too large, but fortunately I had some $\frac{5}{16}$ inch diameter black Viton 'O' rings of $\frac{1}{16}$ inch section left over from the construction of the donkey pump that would effect a seal. Rummaging in the scrap box I found two pieces of bronze material to make the pipe adaptor that fits onto the tank. I used a length of cast bronze with a cob end of phosphor bronze hexagon bar that would enable the correct length of flange to be profiled. The two parts were machined to be able to silver solder them together with a high melting point solder as this fabrication would subsequently be soldered to the air vent pipe with the usual 'Easiflow' grade.

Photograph 128 shows the fabrication at the first machining stage. Reversing this item in the chuck allowed the part to be turned down to the necessary flange thickness and the drawing shows the dimensions. I added a recess for the small 'O' ring for the joint with a slot drill and made the depth 0.062/.065 inch. Holes were drilled for mounting it on two 6BA stainless steel studs and the outside profile was generated by hand. **Photograph 129** shows the part. I decided that offering nuts onto the studs would be simpler than trying to engage the bolt threads into the tank but builders may have a preference for the latter. The tapped holes for the studs were made on a centreline to angle down by about 20 degrees towards the front of the tank as this would offer improved access for the tube spanner. **Photograph 130** shows the end result that is ready for the installation and the judging of the correct angle for drilling the pipe junction.

With the adaptor in place, the air pipe can be curved backwards from the smokebox boiler ring and the angle sighted for the drilling of the second silver soldered joint. I cut the stainless pipe at an angle to ensure the air way from the tank remained clear and to discourage any solder from entering the internal drilling. Setting up the pipe and its fitting for silver soldering was quite straightforward using support bricks and clamps and, once the joint had been cleaned up, the assembly could be mounted on the studs. Any further 'tweaking' of the air pipe was easy enough and **photo 131** shows the installation on the chassis.

Modifications to the front springs

During the assembly of the locomotive it has been increasingly clear that the front of the well tank droops down and that the inner front springs in particular need more stiffness. This was only to be expected as there is a significant forward overhang on the front axle and the bulk of the spring is made up from quite a few Tufnol leaves and these lose any stiffness with time. So, they need to be replaced with spring steel ones and for those who may not have seen my original description of spring leaf preparation I will repeat it now. My original drawing No. 8 back in 2000 showed the spring details and I have included **photo 132** in which one of the assemblies is held in the bench vice by the support hangers with its pushrod upside down. Note how the spring pack can be dismantled by undoing the pushrod and the clamping nut for the leaves which is inside a dummy shackle.

There are five Tufnol leaves in a group which are ideal for the substitution of two interstitial replacement parts at 2¾ inches and 3⅜ inches long which will neatly fit at positions two and four amongst the five shown. The spring material required is 7⁄16 inch wide by 28 SWG thick and my strip was purchased as semi-hard steel which is not convenient for spring making without some heat treatment to anneal it first. Two strips of 6¼ inches long overall were cut off by creasing the material in the vice with a hammer and then annealed by heating them to red heat and allowing them to cool without any quenching; **photo 133** shows the annealing has taken place.

The next task was to cut the material with a small hacksaw and trim the leaves to the lengths given above with a file whilst also adding the angled corners that leaf springs require. The centre was drilled with a No. 33 drill for 6BA clear. The parts can also be formed into the shape required ready for the heat treatment to restore the springiness. **Photograph 134** shows a pair of the new leaves ready for the torch.

There are two parts to the heat treatment; the first is to place a leaf on its side on a firebrick above a dish of quenching oil and bring each up to red heat by playing the torch along its length, so all the leaf is at the same temperature, and then tip it into the dish. I use cutting oil as it is not wasted as a machining aid. At this stage the leaves should be quite hard and would snap across the hole if a bending load was applied. So, the next operation is to carefully clean the outside curved surface of each leaf to create a shine; then the leaf can be placed on the back of a firebrick with its outside curved surface uppermost. The secondary heating operation is to temper the material and, using a gentle flame and starting at one end, wait until the end of the leaf has turned blue and work the heat along the leaf until this condition has been seen on all of it before again tipping the leaf into the oil.

With all the new leaves at the same state, the original spring pack can be dismantled and the new parts substituted. It was noted that the previously curved Tufnol leaves had straightened out proving how it is only useful as a filler added for appearance's sake. **Photograph 135** shows the result and the two front springs are now capable of taking the load.

130

The adaptor has been fitted to the well tank ready for installation into the chassis to judge the angle of the pipe drilling.

131

The final soldered assembly and the pipe in place on the locomotive chassis. Note that the engine has been dismantled to add the forgotten extras and undertake some painting.

132

A front inside leaf spring assembly held upside down to show the method of clamping the leaves.

133

The two annealed strips of steel ready to be cut, drilled and shaped for heat treatment.

134

ABOVE: Two of the curved leaves ready for the two-part process of hardening and tempering. RIGHT: The revised spring assembly with its new leaves that provided the increased stiffness required.

135

●To be continued.

The Stationary Steam Engine

PART 17 - THE DEVIL OF THE ROTATIONS IS AFOOT

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

Continued from p.109
M.E. 4655, 1 January 2021

If Watt's pursuit of greater thermal efficiency virtually ceased in the early seventeen-eighties, the evolution of the engine's mechanical design acquired new energy. Watt remained the mainspring of progress but much was owed to an influx of fresh young talent into the Soho concern. A key figure was John Southern. Although trained in medicine, he was a talented draughtsman and mathematician who became the head of the drawing office. Southern was responsible for translating Watt's innovations into workshop drawings but he was also independently responsible for much of the detail improvement in the construction of the engine. He joined Boulton and Watt in 1781. The decade that followed was to see the transformation of the steam engine from a mine pump into the machine that powered the factory revolution for the next century and a half.

It had long been realised that the steam engine builder who succeeded in producing a machine capable of providing rotary motion without using the engine as a pump to send water over a waterwheel held the key to a huge market. Boulton was convinced that Watt could produce an effective solution to the problems of converting an engine to produce rotary motion but Watt, preoccupied by the pressures of meeting existing demand for pumping engines, tended to be dismissive. Probably the event that precipitated matters was near-success of the partners James Pickard and Matthew Wasborough in building a direct-acting rotative engine. The engine was used to drive Pickard's metal rolling mill at Snow Hill in Birmingham, hardly more than a mile from Soho, which must have added vinegar to the wound.

Without the aggravation of Pickard and Wasborough it is arguable that Watt's patent taken out on 25 October 25 1781 would not have seen the light of day. The patent was purely concerned with: *Certain new methods of applying the vibrating or reciprocating motion of a steam engine… to produce a continued rotative or circular motion … and thereby give motion to the wheels of mills….*

The specification and drawings describe five different methods of attaining continuous rotary output and two include what is indisputably a crank. In spite of this the legend has persisted that Pickard held a prior patent on the crank which debarred Watt from making use of the device. In reality the dispute between Watt and Pickard was not directed at the crank. Pickard's patent of 23 August 1780 certainly included reference to the use of a crank but was more specifically intended to cover a gear and revolving weight system which was intended to give uniform rotational motion. It was this aspect of the Pickard patent that incensed Watt who maintained it had been copied from work undertaken earlier at Soho (**ref 102**). Although Pickard subsequently claimed that the crank was covered by the patent he could not have defended his claim as it was an anciently familiar device and was already in use for steam engines.

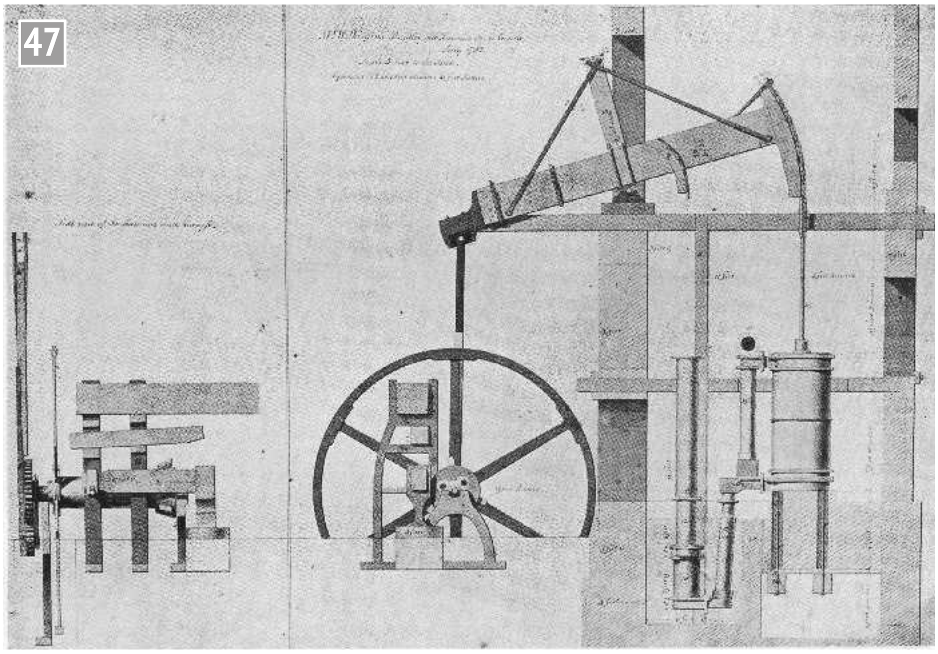
Watt was also prejudiced against the use of the crank as he felt that that it would prove unable to cope with a situation where the piston failed to complete its stroke or more disastrously, over-ran. Should this happen he argued, the crank would simply break, opening the way to a catastrophic smash. Taken in isolation this was a legitimate objection but Pickard dealt with the problem by incorporating a flywheel with the crank. By its rotational inertia the flywheel carried the crankshaft over any fluctuations in cylinder output and acted to prevent both under-running and over-running of the piston. Pickard only adopted this course of action following the failure of the balanced gear wheels to give satisfactory results and ironically the flywheel was fitted to the Snow Hill engine after the weighted gear had to be abandoned. Again, the use of a flywheel in combination with a crank was an established mechanical device. The domestic spinning wheel could not have been more familiar. Pickard's achievement was his faith in an enlarged version with a heavier flywheel able to overcome any possible aberrations in the stroke. As the 1780 patent had been enrolled before the flywheel was applied to the engine it was not protected by it.

Watt's alternative solution was the sun and planet motion, a system of epicyclic gears included in his 1781 patent as the fifth item in the specification. Both the internal planet wheel and the external planet wheel were covered. Where the former simply rolled around the toothed inner circumference of the sun wheel, in the external version the planet wheel was constrained into an orbital path by a circular wheel with a grooved rim which guided the axis of the planet wheel as it revolved. In the external planet wheel version, with equal-sized gear wheels it also offered the additional advantage that the rotational speed of the shaft was doubled compared to the crank, particularly an attraction where factory shafting was being driven. Again, the novelty lay not in the epicycle itself which was as ancient as celestial mechanics. Watt would have undoubtedly been familiar with its use in gears from his days as an instrument maker. It was the application to the steam engine that justified the patent.

Years later Watt admitted he had failed to appreciate the value of the crank when combined with a flywheel (**ref 103**) and it is notable that nothing in the 1781 patent suggests that he had associated the need for a flywheel with any of the devices included.

Experiments with the various options for producing rotary motion contained in the patent were carried out at Soho and the final choice of the sun-and-planet gear took place probably shortly after the patent passed into law. An attempt was made to apply a sun-and-planet engine to a hammer in the works. The engine which formed the basis for the experimental work was a two cylinder semi-compound based upon a proposal for a continuous-expansion engine which Watt was pursuing in late 1781. After some unsatisfactory investigations the expansion experiments were abandoned, the two cylinders were separated; one unit was fitted with a sun-and-planet gear to drive a hammer. This engine may have had some kind of flywheel but the references are ambiguous and it is likely that the cam drum which lifted the hammers served the purpose. The motion proved to be unsteady.

This experience at the Soho works was followed by the first sun-and-planet engine to be supplied to a commercial customer, a machine for that ever ready apostle of Boulton and Watt innovation, John Wilkinson. Wilkinson had been producing coke-furnace iron suitable for making wrought iron at least since 1770 when Bradley Ironworks had supplied the Knight family's Wolverley Forge with iron (**ref 104**). This success encouraged Wilkinson to venture into the production of wrought iron on his own account and in 1770 he made an addition of 26 acres to the Bradley Ironworks site with the intention of developing the forge as a wrought iron producer. The same circumstances that had induced him to adopt the first Boulton and Watt condensing engine at the Broseley works prompted him to look for an alternative to water power at Bradley.



Wilkinson's Bradley Forge Sun-and-Planet Engine.

The engine (**photo 47**) began work in the first quarter of 1783. The cylinder was identical to the pumping engines of this period, working on a single-acting, non-expansive cycle and using an arch head at the cylinder end of the beam from which a chain descended to the piston rod. At the hammer end the drive train was powered through a sun-and-planet motion and connecting rod. The problem of cyclical irregularity remained with the single-acting steam cycle and to counter this, two measures were adopted. The first was to weight the outer end of the beam over the sun-and-planet gear with a substantial casting which served to anchor the connecting rod to the end of the beam. How original the idea of weighting the end of the beam to raise the piston was, is uncertain.

The second innovation was to incorporate a flywheel into the camshaft drum. The use of a flywheel was an obvious response to the problems that the Soho experimental engine had encountered but it should also be borne in mind that the traditional tilt hammer, when driven by a water wheel, had an integral flywheel in the waterwheel itself. This was clearly recognised at the time and waterwheels driving machinery that employed intermittent cam action often carried rim weights in order to add to the rotational inertia. As cast-iron was introduced for waterwheel construction the practice of making the rim, spokes and hub as a single massive casting was adopted with the same objective.

●To be continued.

NEXT TIME

The advent of the double acting steam engine.

REFERENCES

102. This issue is discussed fully in *James Watt and the Steam Engine*, H.W. Dickinson and R. Jenkins, 1927, republished Encore Editions, 1981. p. 149 - 157.

103. Dickinson and Jenkins. ibid. p. 154.

104. *The Knight Family and the British Iron Industry*. Laurence Ince. Pub. Ferric Publications1991. p. 21.

A Boiler for *Bridget* PART 1

Jon Edney builds a boiler for his 7¼ inch gauge Bridget locomotive.

Introduction

Over the past few years, I have been building a Bridget, the popular Ken Swan designed 7¼ inch gauge locomotive. Starting in 2016, by May 2018 I had a complete chassis with smokebox running on compressed air. This appeared in an article published by *Model Engineer* during 2019 (M.E.4619, 16 August 2019 *et seq.*). I had been thinking ahead to the boiler and discovered that the lead time for having a boiler professionally built was over a year. Being impatient and inexperienced, I decided I did not want to wait that long. So, optimistically, in 2017 I purchased a boiler kit from Western Steam Ltd. This was an expensive purchase that committed me to building the boiler myself - no turning back.

But a year after receiving the kit, I had not even started! So, in May 2018, I knew the time had come to dive in – and what a deep dive it turned out to be. It was very difficult and stressful and took another year to complete. Ultimately it was successful but I can say that I am now happy to tick the box 'done that' and next time wait for a professional to put in the sweat (literally) and toil.

Kit of material for a Bridget boiler.

So here I was with a boiler kit. It comprised several flanged and pre-drilled end plates, a large copper tube and many smaller ones, sheets of thick copper plate and various lumps of phosphor bronze and copper rods (**photo 1**). There were also a large number of copper rivets. It came with no information about what the various bits were for, so I had to do a bit of guessing based on Ken Swan's plans. I did ask the supplier for some information but did not get any help. Although it was good that the ends were already flanged, the pre-drilling of the pilot holes was a mixed blessing because the accuracy was not great and in two cases I had to plug holes and re-drill.

Bridget has a simple boiler shape with a tube at the front (barrel), the round top of which then extends all the way to the back over the firebox. There are no complicated changes in diameter or tapering or any of those sorts of difficulties. The outer shell is made from the barrel at the front and the firebox section at the back, joined together with an internal strap in the middle.

The construction is essentially two assemblies – the inner part which includes the firebox and fire tubes and the outer shell which includes the backplate and front plate and the throat plate at the front of the firebox section. Of course, in between these will sit a lot of boiling water. In the firebox area there is a 10mm water jacket all around the sides of the firebox held strong using thick rivets (stays)between the inner and outer part. The top of the firebox is held in place by girders attached to the top of the outer shell to prevent the pressure from collapsing the roof of the firebox (crown). As designed, this turned out not to be very satisfactory as was discovered at the end during the pressure testing.

To help visualise all this I have included **photo 2** taken during the construction which shows the two parts of the boiler from the rear. The girders supporting the top of the firebox are clearly visible.

Partially completed boiler.

Preparation

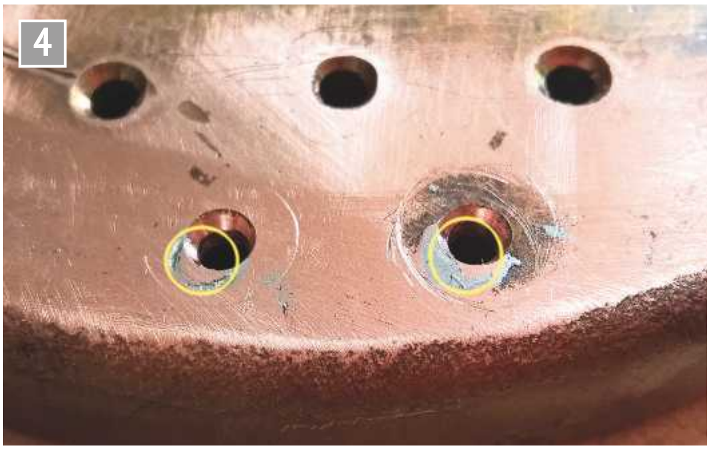
The first thing was to obtain the seminal book of model boiler making by Alec F. Farmer (*Model Locomotive Boilermaking*, Alec F. Farmer, TEE Publishing Ltd. 2011). Everyone should start with this book. It was originally published in 1964 and is still in print although I don't think the content has changed much. Through no fewer than 302 photographs (mainly black and white), Farmer starts from scratch and covers every detail of every stage in building a boiler which, while smaller than *Bridget*, has a much more complicated shape. Of course, he makes it all look much easier than it actually is but, at least, he gave me confidence that, step by step, this task was possible - and I was encouraged and learned a lot.

The next thing to consider was which tools would be necessary. Regarding machine and hand tools there was really nothing needed that I did not already have in my workshop, with the exception of a set of metal rollers capable of rolling the 3mm copper which forms the rear part of the boiler shell. For this, I made my own rollers based on a simple plan that I bought online. It was pretty beefy and took some time to make but I knew I would eventually need rollers to make the locomotive boiler cleading so I decided to make the tool now and use it for both.

Some serious fire breathing equipment was obviously going to be needed. Until then I had made do with a pretty simple and rather low-quality propane torch but I splashed out to get a top-quality torch (mine was Sievert) with a moderate size nozzle. The torch arrived – and was very nice but obviously way too small for this job. In the end I purchased a nozzle with a 86kW output. Think about that for moment – imagine, in your hands, the size of a blue flame producing 86kW! But I would need every bit of it before I was done.


3

Oxy-propane set.


4

Repositioned holes on tube plate.

It was clear from Farmer's book that a focussed high temperature torch would be needed too. The obvious approach, which he used, was an oxy-acetylene torch which could heat small areas – when silver soldering individual rivets for example. I wanted to avoid oxy-acetylene if possible because of the cost of getting the gas, which often involves renting the bottles. Since I knew it would take me a long time to complete the boiler, I did not want anything rented in the workshop. In the end I opted for oxy-propane which, while not hot enough for welding, would be hot enough for brazing and silver soldering. I already had a large tank of propane and was able to purchase a 10L bottle of oxygen, paying a deposit of the bottle which could be exchanged when empty or, ultimately refunded (**photo 3**). I had never used an oxy torch before and finding the right sized nozzle and learning how to get the correct flame took some time and practice.


5

Drills need to be ground flatter for copper.

Making a start

The end plates of the boiler had been flanged and spot drilled to locate the various holes that had to be drilled. The flanging saved quite a bit of time and avoided having to make moulds against which to bend the copper. However, the accuracy of the spot holes was not great and, in two cases, I had to solder plugs into the holes and re-drill otherwise the boiler tubes would have been too close to the edge of the flange. This can be seen in **photo 4** where the original holes are marked in yellow.

The *Bridget* boiler has 13 small fire tubes 7⁄16 inch in diameter and three large tubes of 1 inch diameter, the latter being used for the superheaters.

Holes had to be drilled in the copper plates and they had to be right to ensure a good silver solder joint. The holes must not be tight, or the solder will not penetrate and must not be loose or the joint might be defective. I decided to drill some test holes in a piece of 3mm copper sheet before


6

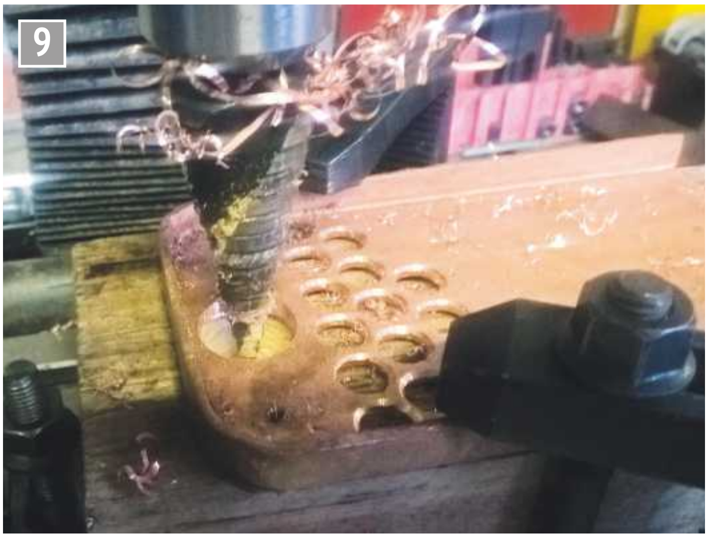
Drilling firebox holes.


7

Chamfering the holes.

>>

Drilling support with clearance holes.



Using a cone drill for the regulator bush hole.

launching into the flanged plates. I also ground a 7/16 inch drill to have a flatter cutting angle to avoid the danger of the drill grabbing the copper and tearing through. The drill is shown in **photo 5** compared to a conventional drill angle. After drilling several holes in the test sheet, I felt confident enough to make a start on the end plates and, going steadily and carefully, managed all the smaller holes without incident.

After drilling, the holes need to be chamfered as shown in **photos 6** and **7** to encourage formation of a good solder filet. The holes were quite tight on the tubes and needed to be dressed with a round file to ensure the smooth fit required. Having drilled the 26 smaller holes, I now had to drill the six large 1 inch holes. For this task I used a conical stepped drill with plenty of lubrication. The one I had would take me up to 24mm from whence I could finish the job with a boring tool.

I find this conical drill very good for large holes and the way it works means that it is not prone to bite or wander. The only thing you need is a suitable hole in the supporting base for the drill to descend into. I made a support from a piece of old timber as shown in **photo 8** and the actual drilling is shown progressing in **photo 9**.

●To be continued.

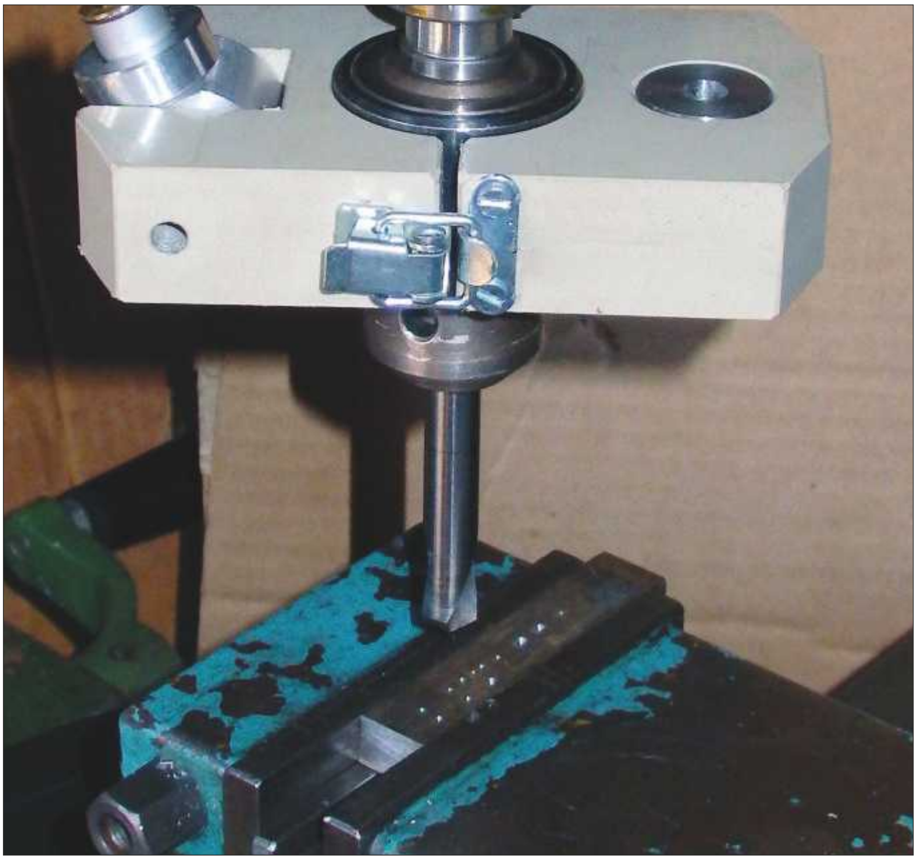
NEXT ISSUE

Laser Centre
Jacques Maurel demonstrates an ingenious laser centre finder.

Gauge Hack
Luker shows how you can save money on pressure gauges by modifying standard industrial 1 inch gauges.

Phoenix Engine
Daco builds the Edgar Westbury Phoenix internal combustion engine.

We Visit North Wilts
John Arrowsmith takes a trip to Swindon to visit the North Wilts Model Engineering Society.



Content may be subject to change.

ON SALE 12 FEBRUARY 2021

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

Continued from p.151
M.E. 4656, 51 January 2021

Painting by Diane Carney.

PART 3 - TENDER SOLEPLATE AND INTERNALS

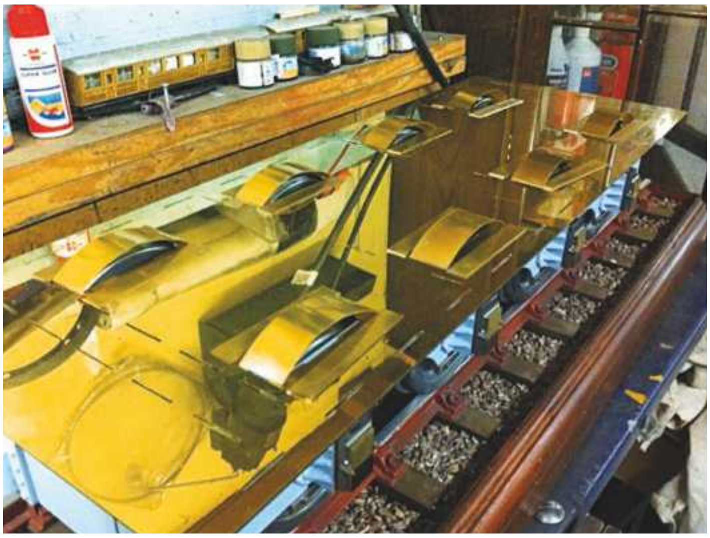
Flying Scotsman in 5 Inch Gauge

The body will be super detailed, as will the entire model. I chose to use one of Malcolm High's M.E.L. (Model Engineers Laser) brass laser cut kits which saved me an awful lot of sawing/ filing - there's plenty of that in this build as it is!

For those not familiar with M.E.L. I can highly recommend Malcolm and his laser cut range (now under new management – see Smoke Rings, *M.E.* 4656, 15 January). Malcolm already had a number of bits available for *Doncaster* when I began building this model but there are now many more parts in the range. A substantial number were drawn up for me by John Baguley; some may recognise his name from the 2½ inch Gauge Association. I am very much indebted to John for his superb drawings which have proved to be extremely accurate.

There are a lot of internal sections in the tender which add greatly to its strength. Don states that the tender design is capable of supporting a driver sitting astride it for ground level operation. You would, of course, need to take this into consideration when making the springs and perhaps it may be wise to modify the axleboxes for roller bearings. You'd also need to consider how best to attach foot stirrups to the tender chassis.

●To be continued.



Tender soleplate.

I started with the belly tank; this picture shows the two end plates for the tank, not much to see but included as part of the process, these are 3mm thick. I had to machine a small amount off the top edge to gain clearance between the bottom of the soleplate and the intermediate stays.

I have no rollers so had to use some steel bar to shape the tank. Some panel beating hammers helped with this.

After the parts had been brazed (silver soldered) together the tank was clamped securely to the mill bed and the rolled sides were machined down to match ends.

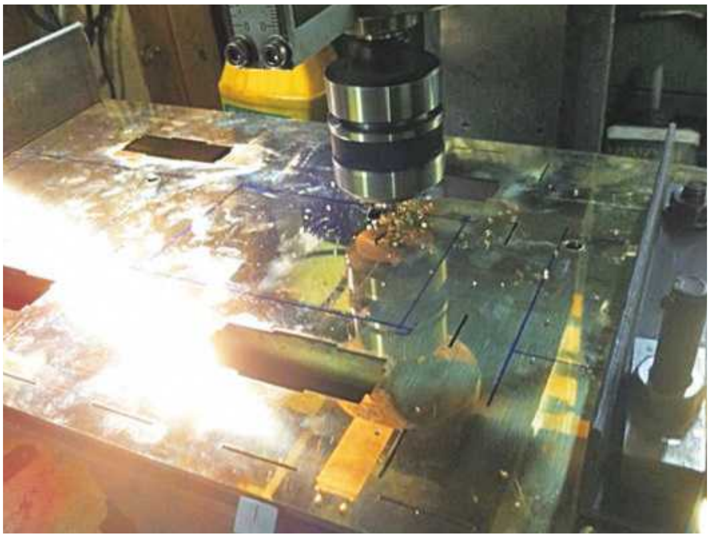
The finished belly tank being checked for the top edge being flat ready for brazing to the soleplate.

Belly tank held in place ready for brazing to soleplate. Brazing is the right word here as I was going to silver solder these parts together. Bad move - and I reverted to using soft solder in the end.

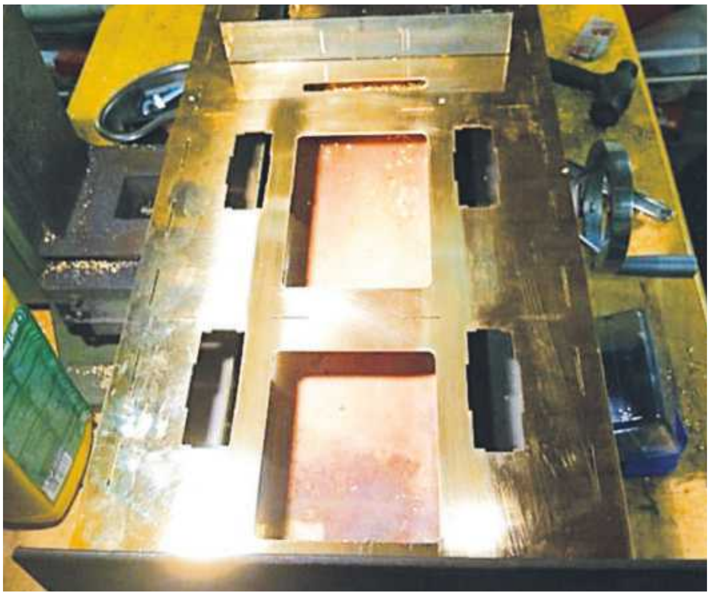
With the tank soft soldered to the soleplate it was time to construct the wheel splashers. The kit has parts that basically make up into rectangular boxes, I didn't like these as they are not correct so made up my own. Yes, I know once built you'll never see them but I felt happier doing them as they should be. Here you can see the components shaped ready for brazing.

A simple jig was used to hold the parts for brazing. The sides will be profiled to shape after. Before that each arch will be turned upside down and filled with water to check for leaks which is very easy to do while the sides are still rectangular and level.

First arch complete and dry fitted, next was to get the other seven to this stage and then fixed to the soleplate.



Oh! Before soldering the wheel splashers on, I had to machine the large water tank access holes into the soleplate.



Tank access holes completed.

With the soleplate finished I moved on to the water scoop dome and the top deck it attaches to. Here the dome has already been soft soldered together and fixed to the deck. Using some clamps as heat soaks and bars clamped to the deck keeping it flat, I proceeded to fix the small right angle around the dome.

The tender has now been moved to the brazing area. Having had trouble with the first soleplate (basically I got it too hot trying to silver solder it instead of the usual method using soft solder and it distorted) I managed to get most of it flat but wasn't happy with it and knew I could do better so ditched it for a replacement. If I remember correctly, the first of only three items to date (over 11 years so far ...) that I felt it best to replace.

To help keep the replacement soleplate flat, I attached it to the chassis. This worked very well as when the body was later removed from the chassis after completing the internal structure it remained true. Live and learn as they say...

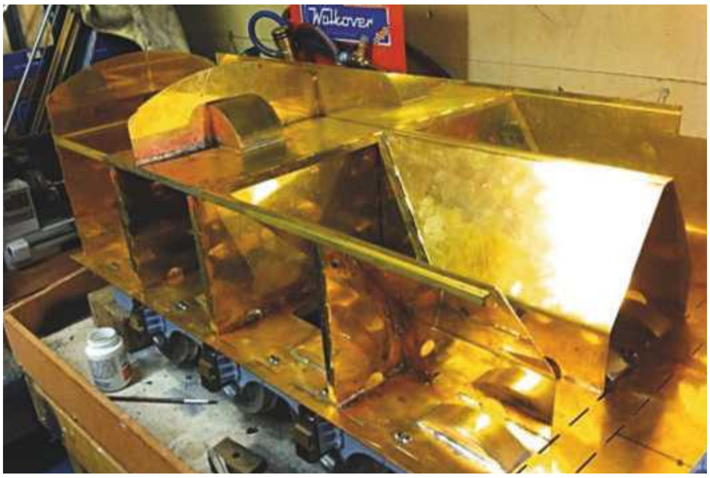
The picture above shows the three baffles dry fitted to the soleplate ready for brazing. The dome top deck has already been brazed to the top of the rear two baffles. During this and proceeding set-ups the squareness of the parts was constantly checked.

Here I have folded the coal chute sides to the correct angle and these slide into slots in the front baffle. The front panel has been temporarily put in place to help keep things square while the sides are fixed. It's important to think these things through. Use as many parts to keep things square as possible; thin brass and heat are not good bed fellows. Take your time and all will go to plan.

Rear coal wall with right angle supports riveted in place. The right angle sections are $\frac{1}{4}$ x $\frac{1}{4}$ x $\frac{1}{16}$ inch.

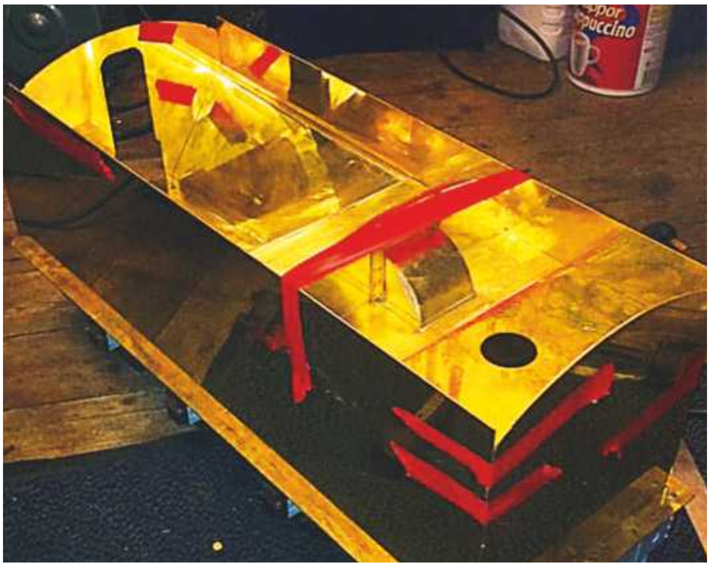
Front baffle held in place for brazing. The top right angle strips are also in place helping to keep the baffle square. Malcolm's kit is very well thought out; the right angle support sections fit neatly into slots already cut to accept them.

With the right angle now brazed to the baffles it was time to attach the rear section. The 45 degree angles on the right angle have been measured and cut in preparation for assembly.



This picture is just to show progress of the body at this stage. One side panel and the end panel have been dry fitted to check all is well.

The next important step, which I include as an 'internal' part, is the fitting of the coal chute. In this picture the section has been folded to shape and soldered in place.



Once the coal chute was fixed, I dry assembled all of the exterior panels to check that all was fitting as it should. There are a number of rolling sessions required before these panels can be permanently attached. Before I could do this, there were a number of other smaller details that I need to attend to first.

CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.

A right collection of old xxx befalls us this time, a mongrel, or Heinz 57 varieties. Now then, I have instituted a personal land speed record award, for unqualified participants using a vehicle of their own design and construction. There is one candidate, Me! It is divided into 11 speed categories, ranging from 'Lewis' to 'HD'. After several false starts, I hope to reach my first milestone, that of actual movement, exceeding 0 mph. The machine has propelled itself along the garage floor but not with a payload. Again, me! It may also be capable of winning the award in two categories, Road and Rail, with the same vehicle. With this in mind, I recommend several YouTube videos under the heading of Ridiculous Rides. Mine was constructed from *objets trouvé*, scrap, my spares box and only a few new items, basically the chassis frame and the wheels. I call it Brian (not Monty Python, more Serge Danot) because it moves at a snail's pace. Attempts will take place at Firth Park Raceway, for the timing of which I have obtained a Bulova-style chronometer. There's nothing quite so comforting as a well-worn old Bulova. (Later) a moment I've long been waiting for. Galileo was right! In 1633 (or just after half past four) when he had been forced to say that the Sun moved round a stationary Earth, he allegedly said, "E pur si muove" (and yet it moves). On Friday, the 4th of December, at 12.30pm, my Bolide ran the length of my garage under its own power, with me aboard. Huzzah! Chocolate biscuits all round! Now to finish it all off, which may take another 4 years. 'In BrianSpace no one can see you move'. See the next gripping episode, courtesy of Loctite. Sheffield SMEE is planning a Fun Run on 12th December - if so, my latest enhancements to Brian may be given the acid test.

A correspondent writes from the USA regarding my 10-years' service for Club News and offers his congratulations. He is also a radio amateur, and 'tinkerer', and a senior member of the American Radio Relay League, noting its origins in passing messages long distance before telephones became widespread. So, I have the ear of a senior member of the ARRL. It's getting rather shrivelled now but I think it can still hear me.

Another US correspondent liked my Aladdin joke and reports that the fast rug was stolen from the Sultan's bedchamber a couple of weeks before… (cometh the Houri, cometh the man – Geoff).

In this issue: Speed, a baboon, coaxial switches, light in the firebox, self-taught engineers, light in the tunnel and a Chinese bus.

Very shortly after confessing that I had no more newsletters to review, this November missive dropped onto my metaphorical doormat. **Stamford Model Engineering Society**'s editor, Joe Dobson, is still in France, although mercifully still writing *en Anglais*. Joe confesses to be a good engineer, for an electrician, and not necessarily up to the mark with mechanical devices. He inadvertently created a wedge shaped 'parallelogram' in the mill and took a while to ascertain the cause. By way of recompense he motorised the cross slide on his lathe, which worked very well. Keith has completed his nautical model, and is wisely leaving the 'where to display it?' question to his wife. (I am allowed a model Aston Martin, a 3½ gauge *Tich* and the contents of Firth Park loco shed to display in our living room but only if my CDs are neatly stored and no wires to the Hi-Fi are obvious – Geoff.) The chairman (anonymously) thanks Joe for his sterling work and relates his own liking for speed, beginning with 4 mph in a pedal car, to passing a Triumph 110 at 100 mph, *then changing into top gear* on his Vincent Black Shadow, and ultimately reaching 146 mph (7000 rpm) on test at Bristol's

1

Brian's steam launch at TSMEE (photo courtesy of Linda Nicholls).

Sheffield concourse after derailment on 12th December.

'Brabazon' two and a half mile runway at Filton, before deciding to call it a day.

Inside Motion, December, from **Tyneside Society of Model & Experimental Engineers,** has an item by Peter Angus on Robey of Lincoln and says that they also built locomotives. In 1904 they claimed that 21,000 of their products were then at work. Photographs from the time, and of Peter Angus's 16 mm models, show the type of engine commonly produced for the narrow gauge. Gordon Bullard has designed and made six locomotives over the years, whilst Ian Spencer's new project is an LNER V3. Dave Nesbitt makes chequer plate (if readers only need a little, Dave's idea solves a pressing problem - Geoff) and Brian Nicholls a steam launch which, despite Brian's claims of incompetence, actually turned out very well (**photo 1**). Hugh Janus points out that, originally, the massive radio telescope at Jodrell Bank rotated on front bogie wheels from a GWR 'Castle' and co-inventor of the miners' safety lamp, George Stephenson (the very same…), had it verified by two independent witnesses and a canary called Trevor.

W. www.tsmee.co.uk

Welling & District Model Engineering Society's December/January 36 page *Magazine* features Tony DeWynter writing on the Abbey Pumping Station at Leicester, which still houses the four beam engines it was built for. It also houses the Leicester Museum of Technology and has a resident ghost… A fascinating item concerns the Plymouth Breakwater, built to shelter the harbour from the weather and containing a fort to defend the town. (A group with a similar interest is the Fortress Study Group, which I find very absorbing – Geoff.) A section on railway cats by editor, Tony Riley, is delightful since, unlike dogs, cats are too sophisticated to be guard animals and actually train us to look after them. Following this is another item on a Railway Baboon… To round all this off, there is a photo of the plaque commemorating the Tonbridge station cats, which can be found on the 'down' platform.

W. www.wdmes.co.uk

Bradford Model Engineers' December *Monthly Bulletin* begins with Dominic Scholes writing on propulsion and steering for small boats. President, Jim Jennings, tells of his experiences with blowers (also see M.E. 4648) starting from when he joined his local club, where he has been a thorn in their flesh ever since. (Jim said that, not me! – Geoff.)

W. www.bradfordmes.uk

Saffron Walden & District Society of Model Engineers has a new home at the private, 7¼ inch gauge Great Easton Railway, Essex (that's very good news – *Ed.*). They had to close when their previous host died and their previous site (Audley End) became unavailable. They wish to reinstate the workshop and lay a track for 5 inch gauge locomotives. Anyone interested please e-mail **swdsme@westonstar.org.uk**

On Track, December, from **Richmond Hill Live Steamers** has little to say this time but draws our attention to the Holt caterpillar tractors and bulldozers which made civil engineering so much easier. (No mention that the 'caterpillar' track was a British invention – boo hiss! – Geoff.) www.youtube.com/watch?v=lJnvE9DGzrE

W. www.richmond-hill-live-steamers.tripod.com

A severe shortage of suitable photos compels me to offer the results of a trawl through the archives. Here is Sheffield railway station concourse on the morning of 12 December, after the derailment (**photo 2**).

Blast Pipe, December/January, the joint newsletter from **Hutt Valley & Maidstone Model Engineering Society,** contains Phil Drummond's article which tells of Ian Welch's new railway, running around his house, including a fine view of the house, with a train on the adjacent track. (The picture requested was not available at the time of submission to the editor – Geoff.)

W. www.hvmes.com

The December issue of *The Journal*, from the **Society of Model & Experimental Engineers,** in its 56 pages, begins by noting that several talks are to be presented via Zoom, which means that not only can visitors see them from home but the presenters can speak from their own home too. Mike Tilby asks for advice on soldering tinplate whilst Neil Wyatt, *Model Engineer's Workshop* editor, describes his award winning camera and astrophotography. John Spokes writes a seasonal story. Gareth Hughes then explains that machinery should not be operated whilst in an angry or annoyed state, and why. 'Work on the virtual table' includes an amateur radio coaxial switch* from Gareth Evans who 3D printed a control knob for it, including a pointer design taken from a 'dingbats' collection. Neil Read writes on the humorous aspects of writing for public consumption and how, sometimes, an enquiry will appear regarding some aspect of your published work to which you had given no attention whatsoever... Graham Astbury has a useful article on using the internet for research. (I have printed this for my future reference – Geoff.)

W. www.sm-ee.co.uk

>>

Timing! Ecclesshall Woods Light Railway, Sheffield.

Chingford Society of Model Engineers has a tip from Geoff Williams, in that he advises that, if readers are not allowed to keep locomotives in the bedroom, a small, fridge type incandescent light bulb in the firebox will combat any deleterious effects caused by cold and moisture. In another extract from *Model Engineer* of 1956, H. J. Turpin, (Not W. A. as I originally thought, and see M.E.4653 'Postbag') describes a utility locomotive designed specifically for club use in hauling passengers. Ted Joliffe writes on protecting the leadscrew from swarf and contamination.

W. www.cdmec.co.uk

The Prospectus, December, from the 'other' RSME, **Reading Society of Model Engineers**, begins with John Spokes discussing white metal casting, together with the fact that the self-taught process has taught him some new expletives. This process was the experience of Josiah Wedgewood and Abraham Darby 1, in their respective businesses. However, John is not holding his breath and still buying lottery tickets. Mark Kirton has completed his Gemeinder locomotive and has taken it to four different tracks, and joined two societies, running 200 miles in the process. He advised the museum where he had measured and pictured their example and they sent him a 1937 GA drawing by way of thanks. If only they had done that at the beginning…!

W. www.prospectpark railway.co.uk

A Fun Run for Sheffield SMEE enabled me to exercise my camera, in particular this shot of trains crossing my viewfinder at just the right moment (**photo 3**).

Time now for a break because 1) I'm tired, 2) I'm dry, and 3) I have used up all my newsletter resources, so a change of scenery, polarisation or somnolence will give an opportunity for AmaBay to deliver something, the Royal Mail to bring me a present, or I receive an offer I cannot refuse.

GMES News, November, from **Guildford Model Engineering Society,** begins with Roger Curtis discussing his Chinese 'woven timber' bridge with a friend, who asked if he was aware of a somewhat similar bridge by Leonardo da Vinci. It appears that, though similar in appearance, they are completely different and use different principles. Paul Horth investigates traction engine efficiency measurements. Driving a generator, this calculates as about 1%, in line with most steam locomotives. He used a motor from a mobility scooter, driven by the TE, as a dynamometer load. Ten years ago, Ivan Hurst built his first 5 inch gauge wagon, an SECR well wagon, intended to carry Aveling & Porter products. This year, he began building a load for it – a pair of boilers ('Minnie' design). An article by Matthew Clark covers Peter Maddison's recent talk on gas turbine prime movers and the 'Leader' locomotive.

W. www.gmes.org.uk

Stockholes Farm Miniature Railway *Newsheet* for December, has Ivan Smith feeling that wishing us a Merry Christmas and a Happy New Year is somehow inappropriate. He says Stay Safe, and 'Putting the current situation into railway terms it is as though we are on a long journey and currently travelling through a long tunnel. The grade is against us, the load is heavy and we are travelling very slowly. There is a glimmer of light in the far distance but it is to be hoped that we all make it through the tunnel before we are asphyxiated by the locomotive fumes.'

W. www.sfmr.co.uk

And at last, the money shot! Me, on my Bolide, entrusting my precious self to my engineering skills. I'm still in one piece though (**photo 4**).

B&DSME News, from **Bournemouth & District Society of Model Engineers,** October/November, also refers to the Light at the End of the Tunnel and Chris Bracey gives details of the third set of London Underground trains bought for service on the Isle of Wight. The first was of 1920s stock, then the 1938 types and now some 1978 vehicles. Bournemouth's bus operator is independent and does not carry a stock of 'spares'. They therefore hire in as required. One which caused some amusement was from China, a demonstrator, made by YouTong - needless to say, this was swiftly and universally known as 'YingTong'.

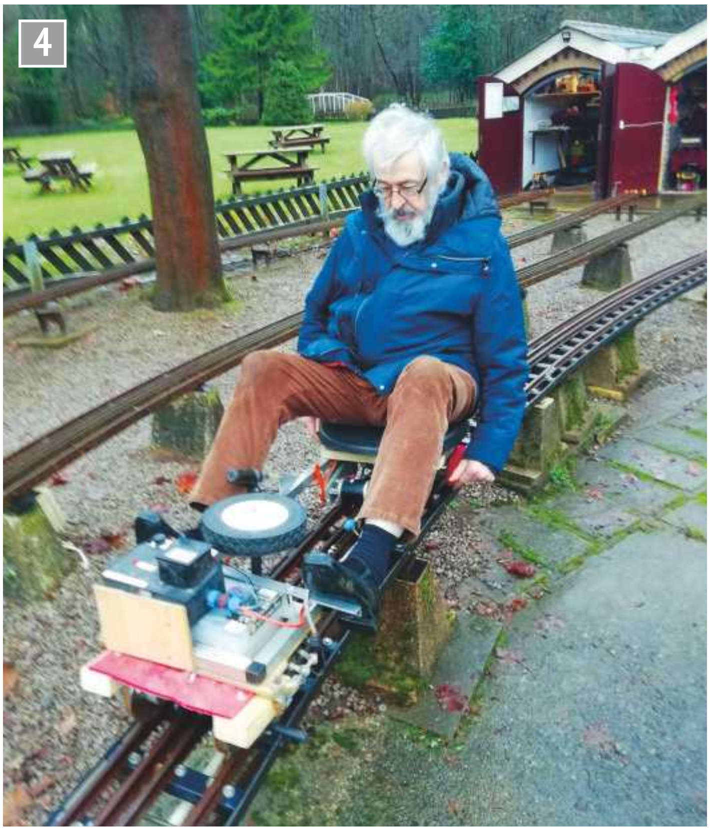
W. www.littledown railway.co.uk

And finally, from Chingford MES - Karl Marx is a historically famous figure but no-one ever mentions his sister Onya, who invented the starting pistol.

* Switches designed to lose as little energy as possible when used in a radio system. It also helps if they are of 'constant impedance' but that is a matter above my pay grade…

CONTACT

geofftheasby@gmail.com



Risking life and limb (photo courtesy of Deborah Theasby).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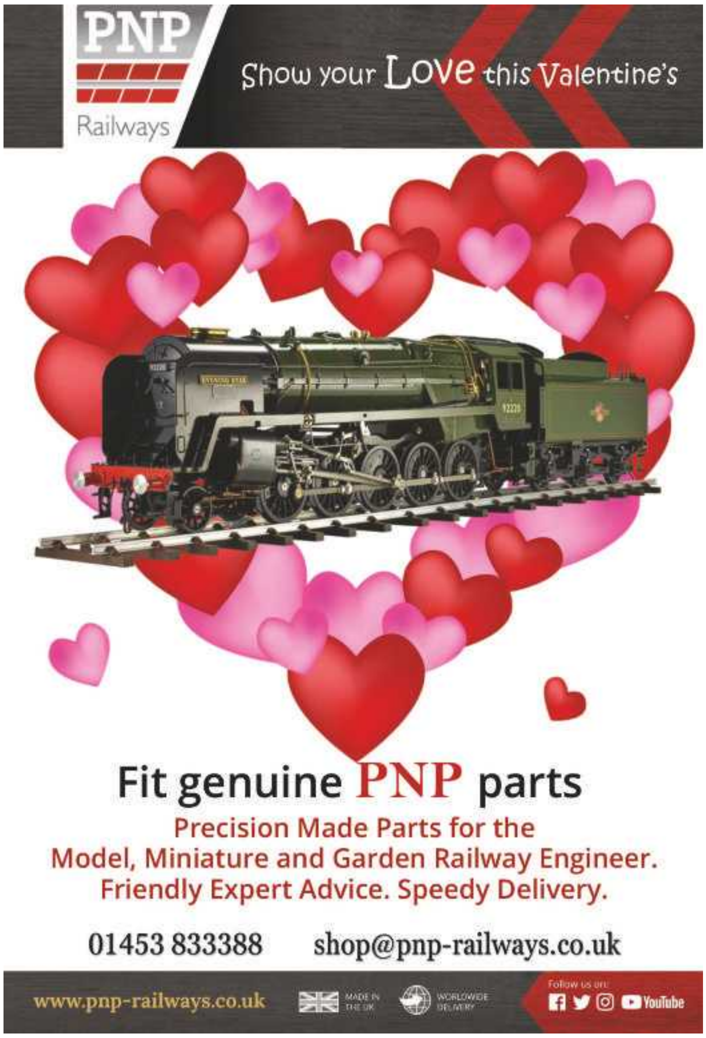
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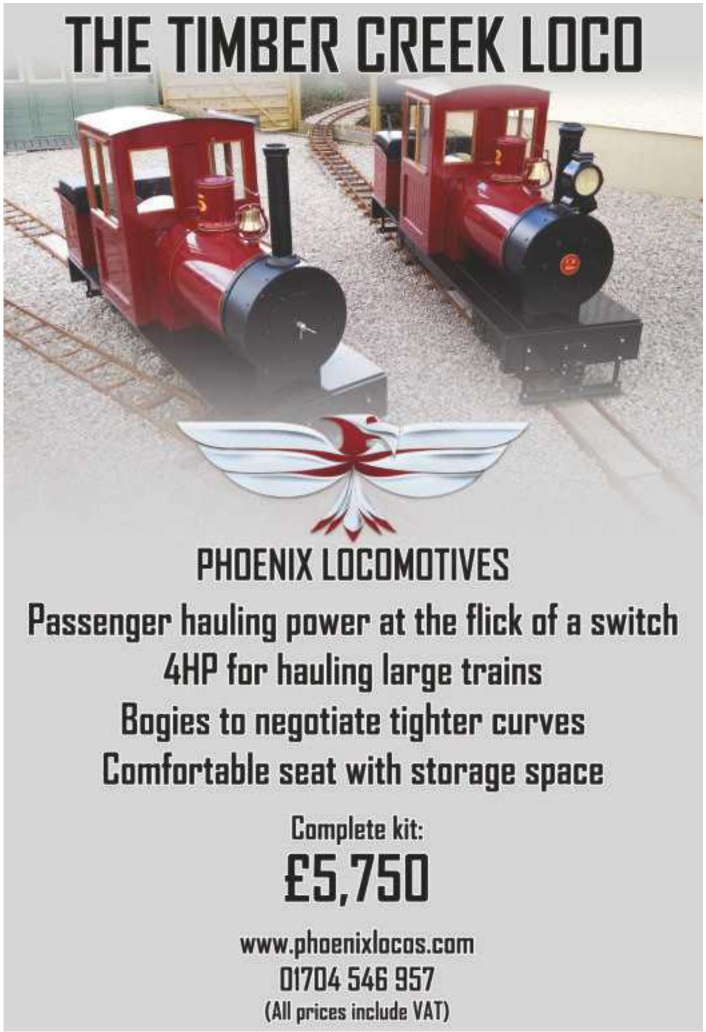
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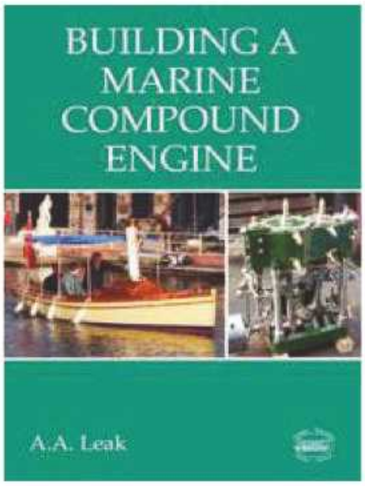


Leak Compound Marine Engine

3" & 5" x 3" Compound

Now back in print A A Leak's book on how to build this very classic design of compound marine engine. Castings and drawings are available for home machining. The book includes basic drawing info.

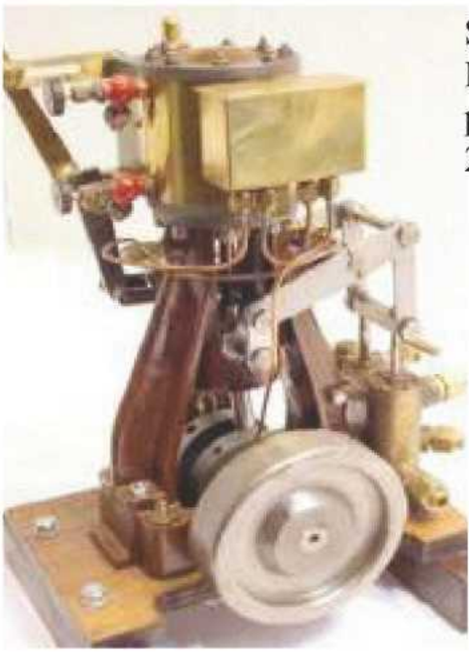
Offer :- book inc UK post £39.50

The designs of Antony Bever

These well thought through engines were designed (and built) by a practical and experienced engineer with many being built and installed in steam boats over many years. They can be built using modest size machine tools. A excellent way to enter the world of steam boating or for stationary use.

The drawings are printed in book form with one page per part with parts lists and exploded diagrams to help with construction. The drawings and castings are available as a set of parts (excluding raw material and fixings)

Bever single



Slide valve Stevenson's link reverse. Large bore trunk guide. Marine type connecting rod. Combined boiler feed & vacuum pump Est 1.5 HP .
$2\frac{1}{4}$" bore, 2" stroke, $14\frac{1}{2}$" tall.

Bever compound

A compound version of the single launch engine, rated at approx 3HP. The cast iron cylinder is supported on four cast columns, reversing is via Stevenson's linkage. A combined bronze boiler feed & condensate pump are driven from the cross head.

*Contents may vary

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HOME AND WORKSHOP MACHINERY