THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 226 No. 4658 • 12 - 25 February 2021

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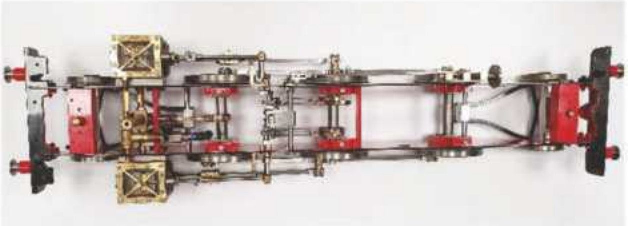

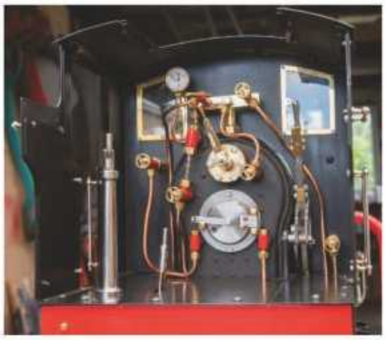

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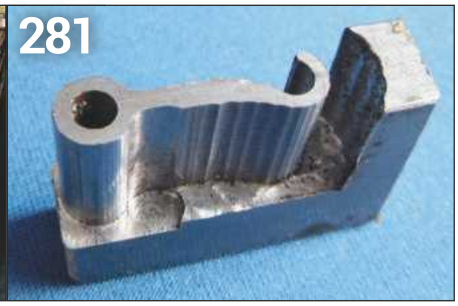

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ON THE COVER...

Daco's *three cylinder version of Edgar Westbury's* Phoenix *two stroke internal combustion engine (photograph – Daco).*

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SMOKE RINGS

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IMLEC 2021

The International Model Locomotive Efficiency Competition (IMLEC) was of course cancelled last year but I am pleased to say that it is planned to run it this year, assuming that no further lockdowns disrupt plans.

Tom Parham, from the Maidstone club, writes to say:

'We would like once again to extend an invitation for our fellow model engineers to enter IMLEC at Maidstone.

'We have decided as a club, bearing in mind the current pandemic situation, and in order to give the best possible chance of the event going ahead, to move the date to later in the year than usual. We intend to run the competition over the weekend of 21st and 22nd August. This will be extended to the 20th as well should there be enough entrants.

'By delaying the competition it gives us an extra 6 weeks or so to ensure that we are in a position safely to host the event this year.

'There are details of the track in a previous edition of *Model Engineer* (M.E.4633, 28th February 2020). We would invite all to apply for entry by the end of June. If you would like any more information or an application form, please contact me at tom_parham@hotmail.co.uk or call 07754281280.

'In the event that we are oversubscribed, all that entered last year for the event that was cancelled will be given priority for entry and preferred running day.'

Mystery Object

Here is another mystery object to ponder as you while away the hours (perhaps conferrin' with the flowers) during our long lockdown evenings. Robin Luxmore sent me the photograph and reports that it was recently handed in at a charity shop where his wife works. It is made of brass and it is just less than two inches overall length. If any *individdle* can unravel this little riddle Robin and I would be pleased to hear from them.

Innovation

John Arrowsmith sends an aerial photograph of the Hereford club track, showing the customary annual flooding. This is a nice reminder of the UK's position as the world leader in the field of innovation and that our model engineering societies are always doing their best to uphold that tradition. Yes! The country that brought you the world's first underground railway now brings you the world's first underwater railway.

Model engineers – always ahead of the curve.

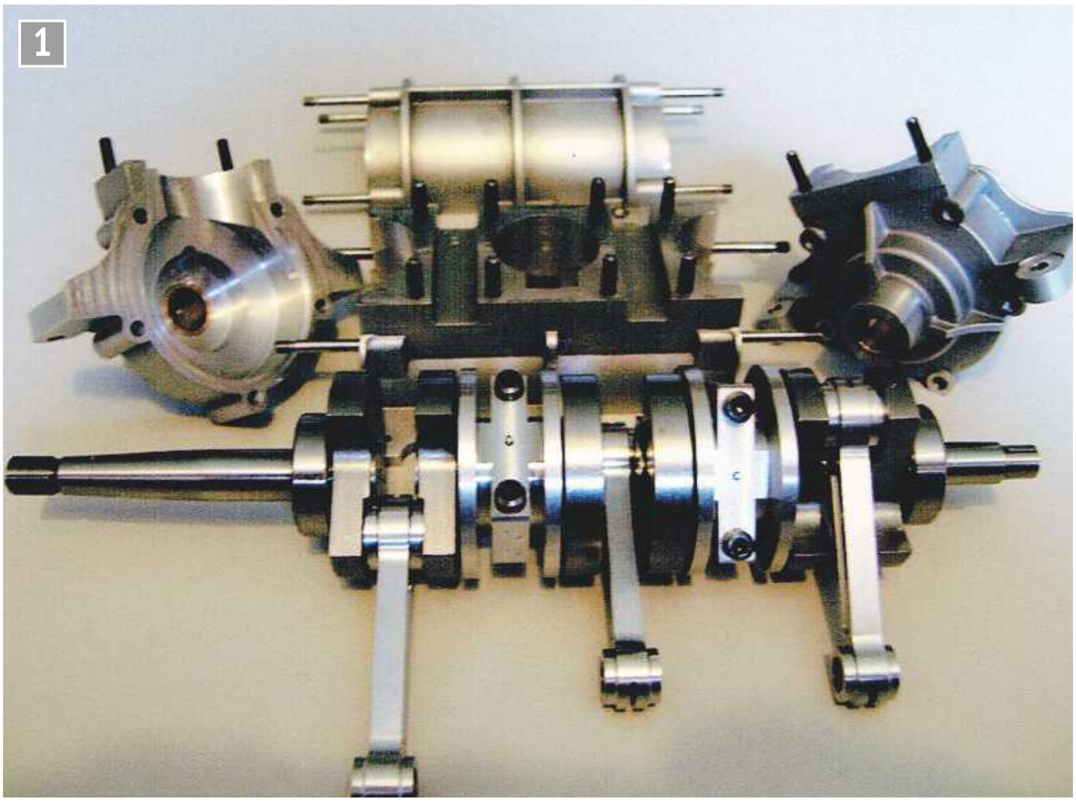
Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
07710-192953
mrevans@cantab.net

Valentine's Day

What will you give your Valentine this year?

Something romantic? Pah! Forget chocolates or flowers – they're 'old hat'. How about a MIG welder, a set of BSF spanners or a wire brush? Can't decide? How about a Valentine's Gift Card then? These, and e-Vouchers, are available from Machine Mart, to any value between £20 and £500. To find out more call 08448-801265 or visit www.machinemart.co.uk

Daco constructs his own three cylinder version of Edgar Westury's two stroke single cylinder engine.



Internal components of the three cylinder engine.

A Three Cylinder Westbury Phoenix Engine

Following a lifetime interest in model internal combustion engines of all types, and having made various four stroke engines, I decided to have a go at building a few two strokes.

The Edgar Westbury Phoenix design seemed to be a good starting point for my project. Published in 1950 the design is for a basic but reliable 15cc engine of robust and sound design. The drawings and a prototype engine, designed during World War II, were lost in a raid on the then offices of *Model Engineer* but Westbury resurrected the design in 1949/50 and named it Phoenix – history tells us why.

First, I produced metal patterns and, using methods described by the late Gerald Smith in *Engineering in Miniature*, I set up a small 'backyard foundry'. A deep study into casting aluminium alloys was needed in order for me to produce the accurate and sound castings I required.

Tooling was also made so that the various parts could be machined to fine limits and be fully interchangeable.

Five engines were produced to the ETW design but I employed pressed up crankshafts with hardened shafts and crank pins in alloy steel. Also, I improved the cylinder porting and used square ports. The cylinder head volume was reduced in order to provide higher compression.

The carburettors follow ETW's Dolphin design and these work very well once set up.

Two air cooled engines and three water cooled versions were built. Two of the water cooled engines were donated to Model Power Boat Association members to try out in power boats.

After a long break, and the building of a half-sized Lister 'D' engine (see M.E. 4653, 4 December 2020), I thought I would have a go at building some improved Phoenix two stroke singles with ball bearing supported crankshafts and then, to follow up, a few three cylinder versions.

The three cylinder engines were all air cooled. Two drive 22 or 24 inch diameter airscrews and the other is fan cooled and has a flywheel. »

I have made many engines with crankshafts like these and there have never been any failures. To do this kind of work, many years ago I built a high precision universal grinding machine, which was well worth the effort involved.

The three cylinder engine ready to test.

The most interesting part of the project was making the crankshafts and crankcases. These share the same castings as the single cylinder version with ball and plain bearings fitted. Centre sections are in two parts and carry inter-cylinder main bearings, which take the form of split thin wall bobbins, each housing a split bronze bush with oiling provisions.

The crankshafts for the three cylinder engine design are made up from thirteen parts press fitted in assembly jigs. End shafts are of EN24T steel and the centre or inter-cylinder main journals and crank pins are in hardened alloy steel. All areas that form bearing surfaces are finish ground to a very high degree of accuracy, TIR being less than 0.0002 inch – the connecting rods are fitted before the main journals are finished. I have made many engines with crankshafts like these and there have never been any failures. To do this kind of work, many years ago I built a high precision universal grinding machine, which was well worth the effort involved.

The cranks in the three cylinder engines are phased at 120 degrees and each is balanced to a factor of around 65%.

The modified cylinder castings each accept a Dolphin style carburettor fed from a common fuel rail, this being supplied by two float chambers, with my own made plastic floats to control fuel levels.

Coil ignition is employed controlled by my own designed and produced electronic system. A distributor of the usual type feeds HT to the three spark plugs. In fact I have made a few of these using Macor machinable glass ceramic as the insulator material. These also employ nichrome wire for electrodes and work okay. The engines shown have NGK or Denso plugs fitted.

The engines are shown mounted on self contained running stands made of anodised aluminium plate etc. Fuel tanks etc. are of brass, these being nickel plated, and all cast work is glass bead blasted for a nice effect.

I always make my own fixings from stainless steel, studs and screws being screw cut with a pitch controlled die in the lathe.

The single cylinder 15cc engines drive 20 inch diameter by 8 inch pitch Menz wooden airscrews at 3000 rpm and produce 0.36 hp. Three cylinder versions drive 22 inch by 10 inch or 24 inch by 10 inch airscrews at 4200 or 3800 rpm. Fuel is unleaded petrol with the addition of two stroke oil in the ratio of 25:1. The exhaust sound of the triples is 'magic'.

All the engines start easily by hand but I use a power starter on the three cylinder engines when starting up from cold. Very great care has to be taken in view of the large propellors used.

All in all, a very interesting project. The present job is to finish off my Anzani engines.

ME

We Visit the North Wilts Model Engineering Society

John Arrowsmith takes a day out to Coate Water Park in Swindon.

My visit to this club, located in the Coate Water Park near Swindon in Wiltshire was, again, one of those fine, early autumn days when the sun was shining and there was a busy atmosphere prevailing. I was met by chairman, Les Stiff who provided an excellent mug of coffee and some very nice chocolate cake which was much appreciated. A walk round the complete track showed what a tremendous amount of work has been carried out by the members here, work which is still continuing. The current membership stands at about 75 including a small number of younger members which always helps to reduce the overall average age. Having the benefit of a secure lease arrangement with the local authority they have built a first class miniature railway which will be the envy of many.

The origin of the North Wilts MES goes back to the early sixties when a small, multi-gauge (3½ and 5 inch) track was built on this same site, but at that time it was just a 200 foot oval. There were no facilities of any kind so when members wanted to run their locomotives they had to bring everything with them including water. The late sixties saw the first ground level track being constructed which was built on a gravel base. The club continued with this arrangement until 1980 when the 3½ inch gauge track was removed and a new 7¼ inch gauge line added. A further addition to the club facilities was the new club house built in 1983. This greatly enhanced the site and was enjoyed by the membership up until the 1990s when a major new track extension was undertaken together with lots of help and support from the local authority.

Richard Jeffries Halt is a request stop on the railway. The two water bottles under the cover are for the engines, if needed, or for extinguishing any sleeper fire.

Adjacent to their land was one of Swindon's oldest properties; the original home of John Richard Jefferies, a Victorian writer and novelist who had a great interest in the English countryside and folklore. This house has become a well known museum dedicated to his life and has enabled the model engineering club to add an additional request stop (**photo 1**) for their trains so that passengers can alight and pay a visit before rejoining a train back to the main station. Yet another extension was completed in 2016 and this has given the club a superb railway, full of interest and providing drivers with a very testing circuit of approximately 1 mile.

Many clubs lay their track in the traditional way with a base level and perhaps a membrane covered with ballast on which the track is laid. At Swindon, however, the entire track has had a concrete base laid (**photo 2**) on which the track is fixed, making a very stable structure and an excellent ride for passengers. The club decided to use plastic sleepers on the new extension

The concrete track base and the plastic sleepers which are slowly being replaced.

and to relay the old wooden sleeper sections with plastic as well. They discovered, however, that plastic sleepers are not the answer to every rail problem. The first batch of plastic sleepers were fitted and performed as expected, but it was then found that they would ignite if hot coals were dropped on them. This was after being assured by the supplier that they would not do so! In addition they also found that after a comparatively short time they also became quite brittle which resulted in failure around the fixing bolts (**photo 3**). These sleepers are in the process of being replaced with a new supply of more resilient plastic which is proving to be a much easier material to work with and provides excellent running qualities (**photo 4**). The club buys the basic material in strip form and then cuts it to suit. As they were using a heavier weight rail the width was made similar to the wooden ones they were replacing.

I mentioned the latest track extension. This is certainly now a very extensive and interesting layout. It contains no fewer than three tunnels, which are all new, corrugated steel to the club's own design. They resemble something like the old Anderson shelters but are of a much bigger corrugation and thickness. The members themselves positioned and then joined all the sections together. Unfortunately, there were a couple of fixing issues, not design issues, which needed rectification by the suppliers.

When this was completed the club members began the outside landscaping work. Each tunnel will be covered with soil and blended into the surrounding land area, which is naturally undulating, so that when complete the tunnels will look to be part of the ground scene, not just lumps incorporated into the circuit. While I was there the members were filling in the gaps between the back of the portals and the steel sections before the back filling takes place (**photo 5**). I was surprised at the cost of these installations; the steel sections are in the order of £30,000 and the portal work, which was also contracted out, came in at around £18,000. There are two more portals to be completed which the club are also contracting out. I have to say the overall impression of the work is superb and really enhances the visual aspect of the railway (**photo 6**).

Unlike the majority of model engineering societies, the North Wilts had recently been running every Sunday for the public. I was interested to hear how they have done it. They started on 4 July and assembled four sets of socially distanced trains, which means they can take a maximum of six passengers per train. There are no tickets issued and all payments are by card reader. The entrance to the station and platform was also socially distanced to ensure the public could not all crowd onto the platforms at the same time.


One of the replaced plastic sleepers showing the brittle cracking and the burn damage.


One of the simple point control boxes showing the new plastic sleepers.


Members putting the finishing touches to the back of the tunnel portal before it is covered in soil.


The double tunnel portal on the one short and one long tunnel.


A well planed and built steaming bay.


One of the trains ready for its 'socially distanced' passengers in the station.

Chairman, Les Stiff steam tests his L&B 2-4-2 locomotive, Lyn.

Many of the club members were very concerned about this but having completed a full risk assessment to operate the trains they went ahead and started running. The local authority had asked for their risk assessment which was duly submitted and approved and they haven't looked back. It has been a great success (**photo 7**).

As it is now, since its extension, a complex circuit it was decided, during the building of the extension, that an escape route for passengers should be incorporated. A substantial flight of steps was built from the lower level to the upper level in the middle of the track to ensure that passengers and club members could easily evacuate in the event of a serious problem.

The usual operating facilities are first class with a substantial steaming bay area that has a large turn table to access all the bays and a good hydraulic lift table for unloading purposes (**photo 8**). A well built, five road stock shed is adjacent which provides easy access to the main line. The chairman's 7¼ inch gauge Lynton & Barstaple 2-4-2 *Lyn* was on the bay having its annual steam test (**photo 9**). The interesting layout includes a good sized turntable in the station approach area (**photo 10**) together with a full signalling and CCTV system in place. This is all controlled from the Lakeside Signal Box (**photo 11**). There are five CCTV cameras strategically positioned around the site, one permanently and the others demountable to help the signalman keep track of train movements; this is for both safety reasons and to minimise any train stoppages 'out in the country' (**photo 12**). The point control boxes also have micro switch blade detectors (**photo 13**) which show up on the extensive control panel in the box (**photo 14**). A novel idea is the small loudspeaker located within the panel wiring which picks up the point motor operations so again giving the signalman confidence that the movement has been successful. All this complex wiring and relay installation together with the control panel was built by member, Derek Sawyer.

A small but useful workshop provides facilities for repair and maintenance to keep the busy railway running smoothly. As they are involved with local charities they have purchased one of the versatile commercial invalid carriages which are now available. They have added its own locomotive so this self contained unit can operate on running days and enable wheelchair passengers and a carer to enjoy a journey on the railway. This little train also has its own storage shed so that it is always available at short notice should the need arise (**photo 15**).

In concluding my notes I would, as usual, like to thank all the members who were on site during my visit, for their hospitality and good humour, particularly the chairman, Les Stiff along with Derek Sawyer and Ken Parker and to Hilary Foley for making the arrangements. You have a railway to be proud of and for me it was a most enjoyable day out.

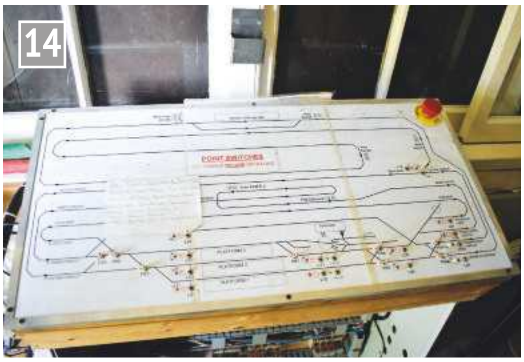
ME


The station turntable opposite the signal box.


A driver's eye view approaching the station with Lakeside signal box on the left.


Just the permanent camera is in action; the other screen will have signals from the other four cameras on running days.


Inside one of the point motor control boxes showing the micro switches for blade detection.



Lakeside Signal Box Control panel.

The invalid coach and its locomotive.

Peter Seymour-Howell

builds a fine, fully detailed model of Gresley's iconic locomotive.

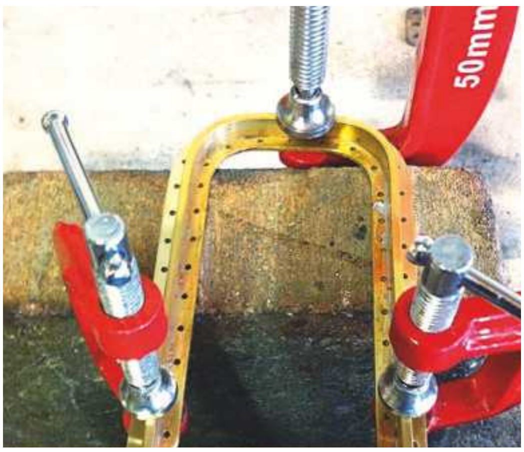
Continued from p.229
M.E. 4657, 29 January 2021

Painting by Diane Carney.

Flying Scotsman in 5 Inch Gauge

PART 4 - TENDER BODY

The two formed sections ready for being soldered together.



I drilled the rivet holes after soldering the parts together. I did it this way around to be sure that all of the holes would be clear for riveting, i.e. there was enough clearance for me to get a snaphead tool close enough to form the rivet head. I did grind down one edge of said tool to allow me to get closer.

Coal door

The door way is basically a 'U' shaped Tee-section held onto the coal wall with rivets. This could have been made


Here the door frame has been fixed in place.

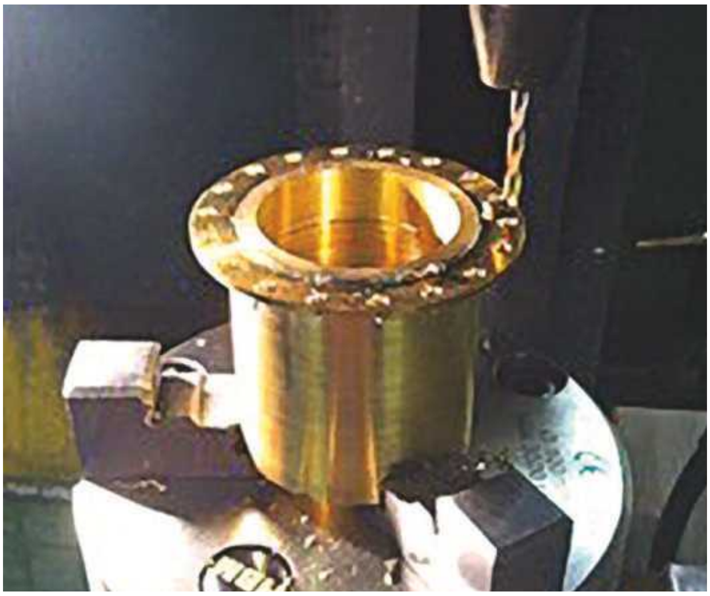
using some brass Tee-section shaped around a former. In fact, much later in the build I have done this for the running board supports. In this case I chose to fabricate the doorway instead.

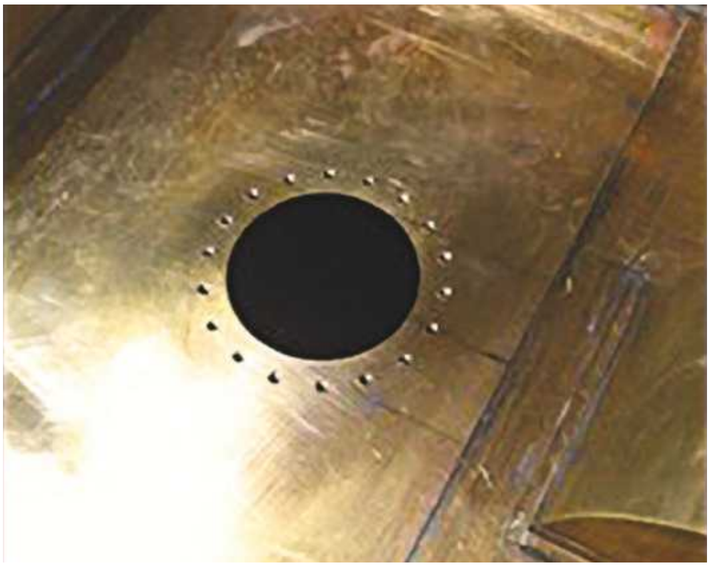
Water filler

Here is something that I later changed. I had planned to have the water filler top plate removable as can be seen by the temporary hex-head bolts put in place (these would have been changed to countersunk screws later). Of course, once I had rolled the sides I could see a panel this size would never be able to slide out and I didn't want a non-prototypical joint here. I had originally planned to have this removable in case I fitted a hand pump. However, taking Don at his word when he says - to quote – 'a hand pump on a locomotive this size is undignified and with two injectors fitted, if they both pack up, then maybe so should the builder.'

Taking note of Don's words I decided to permanently fix the top to the body. There's no real need to get inside anyway; the filters for the pipes leading to the injectors will be attached inline under the body for easy maintenance.


With the ring securely fitted to the tube it was mounted in the three jaw chuck and the outside radius was machined to size.


I decided to attach the tank filler neck with hex-heads rather than sweating it on as Don suggests. This gave me good reason to play with the rotary table. Here the holes have been drilled. This is not necessarily prototypical as some pictures that I've seen have this ring whereas others do not. Well, mine has and it's held in with bolts.


The holes were then transferred to the tank top and drilled/tapped 8BA.


We then had the filler neck firmly attached to the tender top plate.

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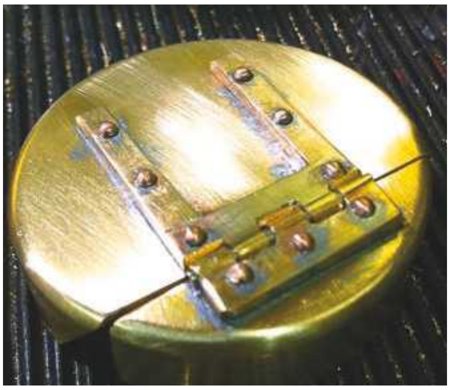
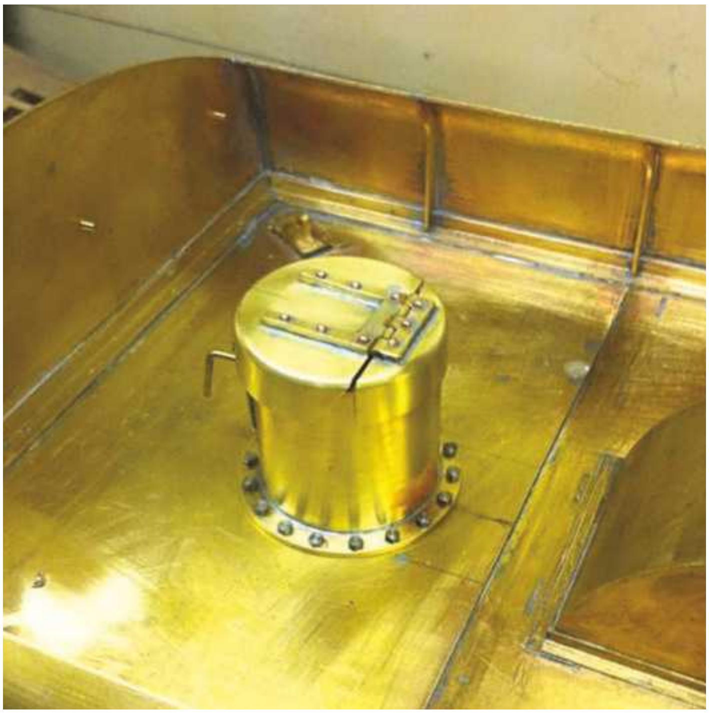
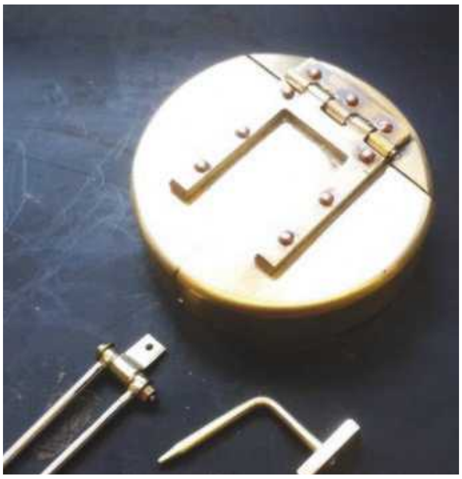


This is the filler hinge, the part attached to the lid was placed so that the pin section was overhanging the edge. The part fixed to the smaller section that will later be brazed to the filler neck was set further in with only a small amount of the pin hanging over the edge. In doing this I could control how the lid will actually open and sit when closed.



The finished lid was then sweated onto the filler neck and the catch bracket soldered on to stop the lid from flying open if too much water is taken on when using the scoop - not that this would happen on the model as the scoop is one of the very few parts that won't be functional on this model. I took on board Don's wise words when it came to the scoop; 'being a possible cause of derailment, it is not worth the risk of fitting a scoop.'

Next up was to make the coupling clasp. This is made from stainless steel with brass rings silver soldered to complete. The brass was first drilled, as with the hinges, and then brazed across the top of the U-shaped stainless steel. This was then cut and filed to finish with a 12BA screw. The hinge part was as before and riveted to the hatch lid, the final part being the catch bracket that attaches to the filler neck.



Don suggested fabricating the water filler tube using copper tube. I had none of the correct size but I did, however, have some brass billet; a bit wasteful perhaps but at least I could get on with it.

With the billet held in the three jaw I faced off and then turned down to size. The billet wasn't large enough to include the mounting flange so this was added after.

To help line it up I machined a spigot on one end to make life easier when mounting to the top plate and then spot drilled, ready for drilling and boring the filler neck to size.

Bored out, this was undersize as I wanted the step (spigot) for easy locating. As drawn the filler hole was the same size as the hole in the tank top so I machined the bore slightly smaller to give me enough metal to allow for the spigot.

The job was then parted and reversed in the jaws so the top can be machined. I also opened out the top of the bore down to about to about ¾ inch depth, remembering to leave enough material at the bottom for the spigot.

Next job was the bottom ring. This was first cut roughly to size, fixed in the three jaw with packing, centre drilled and then bored out to fit the filler tube. The ring was then soft soldered to the filler neck.

Filler lid

I did a little research on the tank filler lid. Don's drawing is different from the photos that I have which show a much smaller diameter lid. Also the drawings show a straight cut to separate the two parts of the lid whereas the photos show the lid itself having an angle to it. This makes sense as with a smaller diameter lid it would be impossible to open with vertical sides, thus confirming that *Flying Scotsman's* current lid is indeed smaller. I also found a picture showing the older Great Northern tender with the larger lid, so I'm guessing that it was changed on the later tenders. I could find no information as to when this change occurred. It may well have been after my chosen era of 1938, so my smaller lid following F.S. as she is today could be wrong. (Well … who's going to know? I mean, it's not as if I've mentioned the differences ...)

Onto the work, then. A piece of brass billet was turned down to size, faced, corners rounded and then parted off. The lid was then reversed in jaws to machine the recess. To stop the lid from getting damaged I wrapped it in some brass shim to protect it. With the lid pushed flat against the jaws and held firm, but not too tight, this worked well. It was then a simple task to mark out and cut the lid using the bandsaw (its blade being narrower than my slitting saw). I then set the sanding table at the correct angle and sanded the lid cover to give enough room to be able to open the lid.

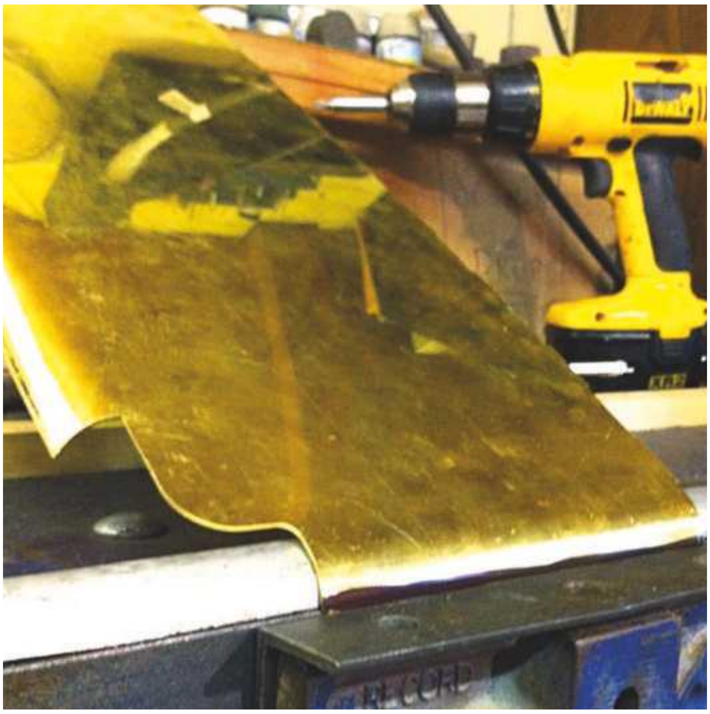
Tender sides

These are large pieces of brass and care needs to be taken when forming them as any buckle or deformation will show up very easily on a flat panel of this size. The time consuming part of sawing/filing, I don't need to worry about as they are already laser cut, but they still need to be formed and being nearly two feet long and with no rollers in my arsenal, this required a little thought/planning.

The original plan was to clamp the top edge of the tender side between two right angle pieces of steel with one of these having a piece of alloy of the correct diameter, which had been cut lengthwise, bolted to it. The two right angles where clamped together with the one without the alloy bar being positioned higher than the other. The reason for this was to reduce the possibility of the brass sheet slipping out when forced around the former. Now this worked perfectly for lengths of brass 1mm thick and 300mm long, which I used for testing whilst working out how much material was needed to be held between the right angle to give me the correct shape, remembering that these tenders have a radius close to the top edge which then flattens out for a short distance.

Unfortunately, when it came to forming the sides themselves, it wouldn't work. Well … not so much it *wouldn't*

The picture shows the former/jig that I used. I might add that this length of alloy was first cut down the middle using my small band saw. It's a good job I had a very good blade made for it some time ago.



Once the tops of the large side panels had been rolled, it was an easy task to do the front curves using the former jig as originally intended.

With the sides rolled I could now make a start on assembling the panels. The rear was done first, followed by the front after I had first turned up a short length of brass which was drilled, tapped, stepped and brazed into a matching hole for the step in the front panel. This can just be seen bottom right. This is for the working water gauge once it's fabricated; the drawings weren't very clear here as they only show the hole for the gauge on the locker panel, which, yes, has to be done too (I did both at the same time while clamped together) but since it's a locker and not part of the water tank I can only assume that there is some sort of connection pipe running through the locker from the tank to the gauge. Anyway, I've tackled it with my brass tube which the gauge will screw into later. Finally the side panels were soldered on and I finally had something that looked like a streamlined non corridor tender.

And now we have the locker panel and its shelf soldered in place. The hole, bottom right, is where the water gauge fits.

work - more that I didn't have enough strength to form the brass which is double the test piece length and thicker too. I didn't want to go anywhere near these panels with heat, so annealing was ruled out early on.

Plan B; leaving the former in the vice I laid the tender side on it. (As you look at the picture, imagine the brass lying on top with the section to be curved over the alloy bar.) I then calculated exactly where the brass needed to be and screwed a length of timber along the bottom edge into the top of the bench. Next was to clamp another piece of right angle along the top of the brass, trapping it at the correct position over the alloy former. This allowed me to then beat the brass around the former using panel beating hammers. I hope I explained that well enough. Once I had decided to do it this way, each panel only took a few minutes.

●To be continued.

A Frame Saw in Model Form

PART 2

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

Continued from p.201
M.E. 4657, 29 January 2021

The list of materials consists mostly of metal, ex-stock or off the scrap heap. The sprockets were all home-made, just marked out on a steel disc, drilled, then the outer machined off to leave the tooth pattern required. They were not hardened as they are really very slow moving so I did not think that would be required.

Everything on this model had to be prefabricated, as there were no castings available. Most of the superstructure is welded together and then fibreglass resin used in the corners and joints just to make it look more like a casting.

The drive gearing needs to be a large reduction because on the original saw there was lots of pulleys and flat belts to achieve this. The winch drive reduction is made using a completely separate gear box to get it really slow - about 56:1.

All bearings are bronze bushed and fitted with oilers.

SAFETY NOTICE

Please be aware that this saw will cut fingers much easier than wood.
Please keep well out of the way.
That way we all live to fight another day

Model frame saw.

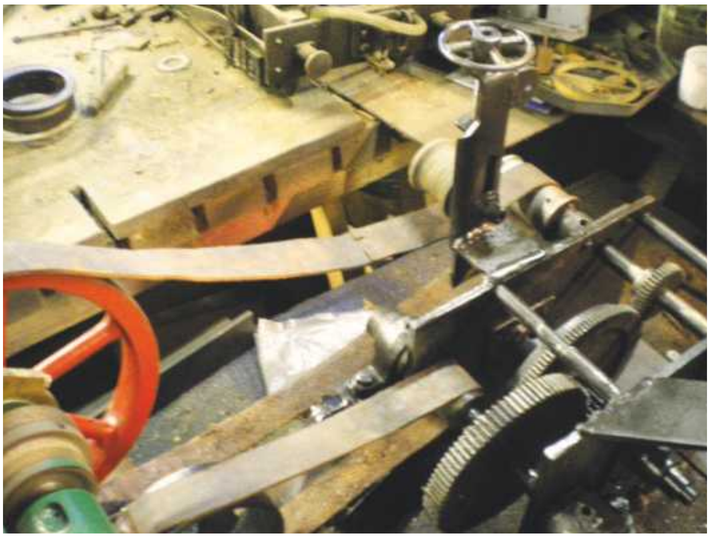
The reason for this is that ball races would make the bearing blocks, which are numerous, hopelessly out of scale. On the main input shaft and the secondary shaft these are all bronze bushed. The pulleys are mostly prefabricated and so are the four wheels that the whole thing sits on. The front axle is a swivel axle with a drawbar attached so it can be towed if required. The saw controls are mostly grouped together. One puts the saw in motion via a flat belt fast and loose system. Another puts the winch gearing into drive. Then another unclips the trolley and this one has to have the auto override as well. The first two levers will have a ratchet type lever to keep them in place when either in or out of drive. The other one needs to be an over centre type so it will knock out on the auto system.

After visiting a slate museum in Wales I found another frame saw there which was made by T. Robinson & Sons of Rochdale. This one gave me plenty of fresh ideas for the model. One of these was most interesting as they had a roller running on top of the log to make sure it stayed in position on the trolley. The amount of pressure for this was governed by how much weight they had added extra to the arm which carried this roller. This was just scrap lumps of metal in a sort of bucket suspended on a chain off the arm. All very simple, but it most certainly worked. I will incorporate this in my system as it looks the part - really a bit of a novelty.

The main blade slide on this model is made from a piece of solid one inch square steel and the female slide is an angle iron fabrication. I did put some bronze slippers in this but I think they are probably not required. As it runs quite slow, although it is metal to metal, if it is well lubricated it would be okay without. The only fast-moving part is the jockey pulley to tighten the drive. This is a rubber roller in which I put some small sealed ball race bearings.

The drive from the power source is a flat leather belt. The material for this came off the back of a leather sofa that I was given some time ago now. It was going to the tip. I needed a lot of belts when I made my threshing drum and this leather is left over from that. This was thick old-fashioned leather - really great material and no doubt would be a job to find now.

I have found this whole project fascinating to make and on the plus side it actually works well. I have to admit that quite a few of the parts have been made at least twice but that is probably normal when there are no drawings and the whole thing is been made off photographs, with many of the ideas changing all the time. The power source



The reduction gearbox.

Carriage and track passing under the blade.

The track folds away when not in use.

Weighted rollers keep the wood on the carriage.

Crank driving the saw blade.

has changed as well. This is now a small engine sitting on a unit containing a massive array of gears just to get the speed reduction required. This is all a separate unit on three wheels that just hooks to the saw by screw adjusters. This method keeps the flat belts tight. I have made the engine to be removed so with a pulley flywheel on the shaft instead I could use my traction engine as the power source if needed.

I must admit that there has been a vast number of modifications as this project progressed. This is mainly because there were no drawings, just sketches, ideas and some photographs. Using this method is both wasteful and time consuming. You make a part then find it will fowl up something else. It then follows that it becomes scrap and a new idea has to be sought. A classic example of this was the winch drive. I think this was altered five times.

Trying to get the speed down was a challenge. I knew that the drive sprocket wanted to go at less than 1rpm. I have now got the reduction but most of it is a separate item on its own wheels just coupled to the saw by screw adjusters. These screw adjusters are there so that the flat belts can be tightened. As a further safety measure, in case the speed is still too fast, I have incorporated a slip clutch in the last drive shaft just in case the load is too much, then the clutch would slip until the load decreased.

The main power source also changed as I was given a small strimmer engine which had a centrifugal clutch. I thought that that would be an added asset. When I think back, I would imagine that worm drives would probably have been a better option to get the speed down better than the mass of gears that I have used.

As each of the model parts were finished, I made sketches with measurements and took plenty of photographs as the build progressed, so if ever I was daft enough to start again it would be easier. It all started in August and some work was done then. That was until it got pushed to one side after just a few weeks and shunted to the back of the queue priority wise. It did not restart with any enthusiasm until 2017 when it continued, off and on, with loads more ideas coming forward until the finish at the end of 2017.

Was it worth the effort that I put in? Yes of course it was. It is now a working model and probably unique as well. It is always the same with any model - when you see it working you forget all the frustration and trouble that had ensued to get it to that stage.

ME

GENERAL DATA

Chassis overall length: 34 inches less drawbar
Chassis width: 12 inches
Chassis height from ground: 2 inches
Table track input section: 23 inches
Table track output section: 13 inches
(Both these sections fold up but can also be detached.)
Rear wheels: 3 inches diameter
Front wheels: 2 inches diameter
Trucks: 12 inches wide x 9½ inches long
(There are two of these and the two trucks are joined with a solid bar when in use.)

A Model Engineering Gauge Hack

Luker avoids expensive gauges from model engineering suppliers by adapting standard cheaply available gauges.

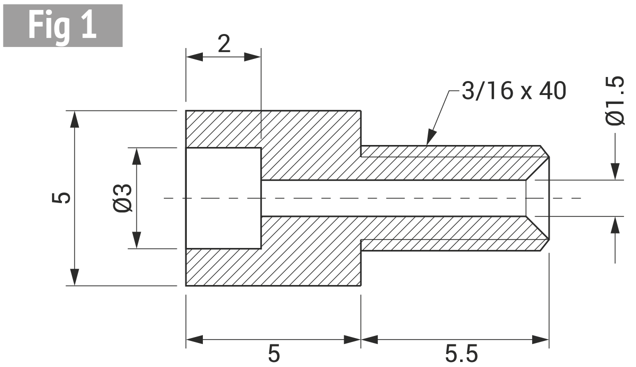
The model pressure gauge

There was a brilliant article written in *Model Engineer* by Roy Amsbury (*Making Small Vacuum Gauges*, M.E. 3825, 20th May 1988) describing his method for making small model gauges using watch spares for the sector and pinion and Sifbronze rod for the Bourdon tube. I have also heard of numerous other articles using brass shim stock to make the tube and I'm sure there are a number of other methods builders have come up with over the years.

Without going into the detail of how gauges work and are manufactured (there is loads of literature on the web), there are a number of aspects of industrial gauges that are different from model engineering gauges, especially the homemade ones described in these articles. Firstly, the tube is commonly made from a very specific beryllium copper alloy giving it incredible life cycle fatigue strength, which I doubt can be matched with brass shim stock. You could of course argue that the cycles of a model steam train are relatively low and if you're not planning on leaving your work of art to your great grandchildren you'll be fine.

Industrial standard gauges from roughly 1 inch also have a much wider scale than commercially available model engineering gauges of similar size. This is because they have a geared mechanism inside and not a simple lever arm connected to the Bourdon tube. In terms of size, the most common model engineering gauge found on the tracks here in South Africa is the standard ¾ inch gauge (with an outside diameter closer to 20mm than 19mm) and generally they're not flange mounted, whereas the gauge described here has an outside diameter of 23mm.

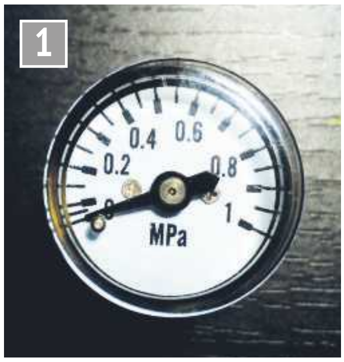
Personally, I'm always saddened to see a fine model where the builder and designer has put loads of effort into the detail only to see the same old model engineering gauge face. The prototypes which we try to scale had a large variety of gauge faces and designs. At the very least, using the methods described in this article, anyone can take any gauge and make any face needed to fit their fine model.



³⁄₁₆ inch socket.

The standard gauge as a base

All my gauges are made from a standard (cheap) 1MPa 1 inch gauge (**photo 1**). With some minor modifications, the mechanism is fitted into a shiny brass casing with a new dial and pointer that will make any model proud. The casing is typically changed to suit the style of locomotive and of course the face is period specific, matching the railway line and type of locomotive.



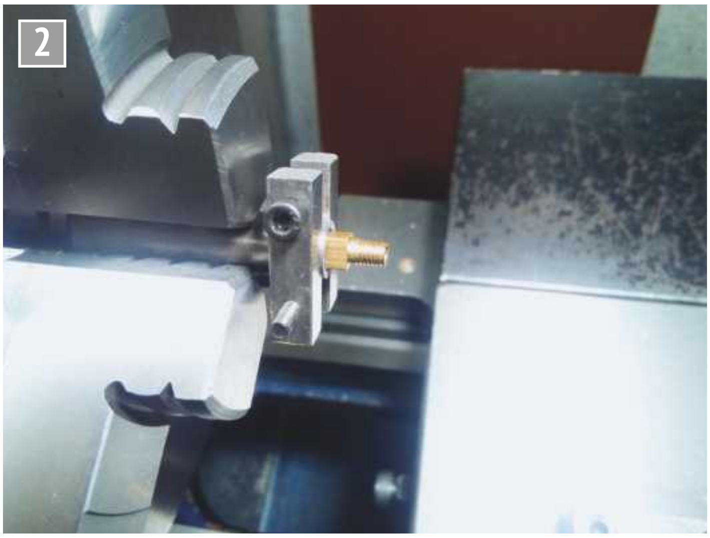
Standard 1MPa gauge.

By standardising on a specific gauge a number of jigs can be made, speeding up the process considerably. The last gauge I made was for my 5 inch gauge American type locomotive *Wahya* (currently serialised in these pages) and was completed before tea on a fine Saturday morning - which is about the time my lovely wife is ready to do some retail therapy.

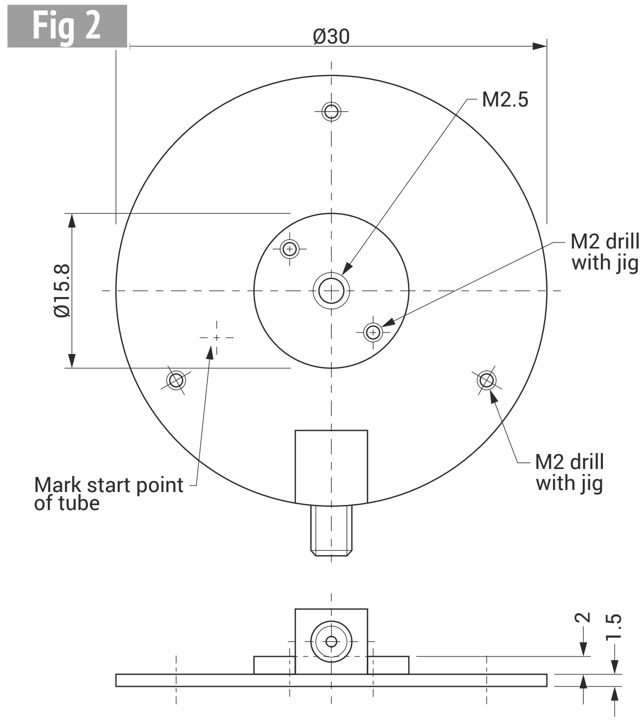
Base plate assembly

All the gauges I've needed were back mounted, so the drawings are to suit. The fittings for the copper lines are also generally small so the socket is made to ³⁄₁₆ inch x 40 tpi which will work for ⅛ inch thin walled copper lines and below. One important thing to understand with fitting gauges is that the pressure in the tube is what causes it to deflect, moving the pointer. The exact same thing will happen if the Bourdon tube is heated and expands. The addition of a syphon tube helps by increasing the conduction resistance to the gauge. If the model has a steel cab you won't do any harm by adding wooden backing to stop conduction to the gauge from the cab - just like the large locomotives.

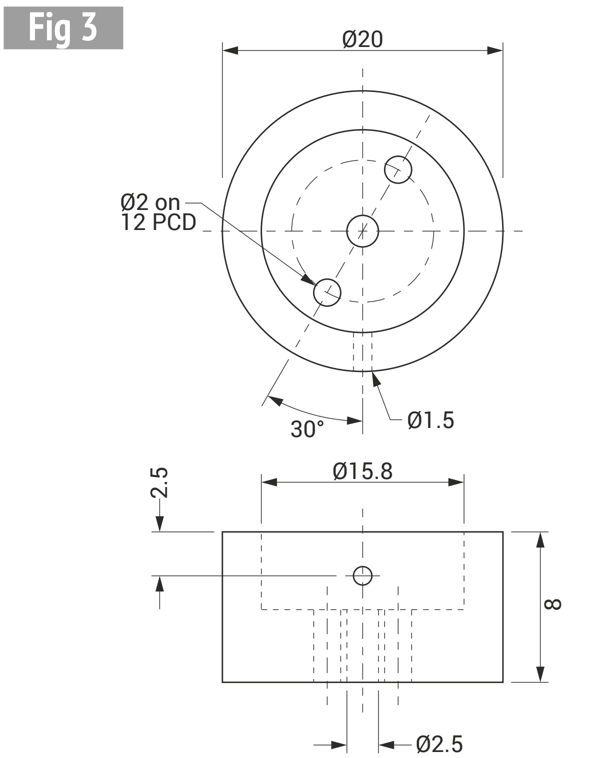
The socket is machined from 5mm square brass (**fig 1** and **photo 2**). I don't bother



3⁄16 inch socket in collet.



Back plate.



Backing plate mechanism hole jig.

Backing plate drilled and ready for soldering.

Marking start of tube.

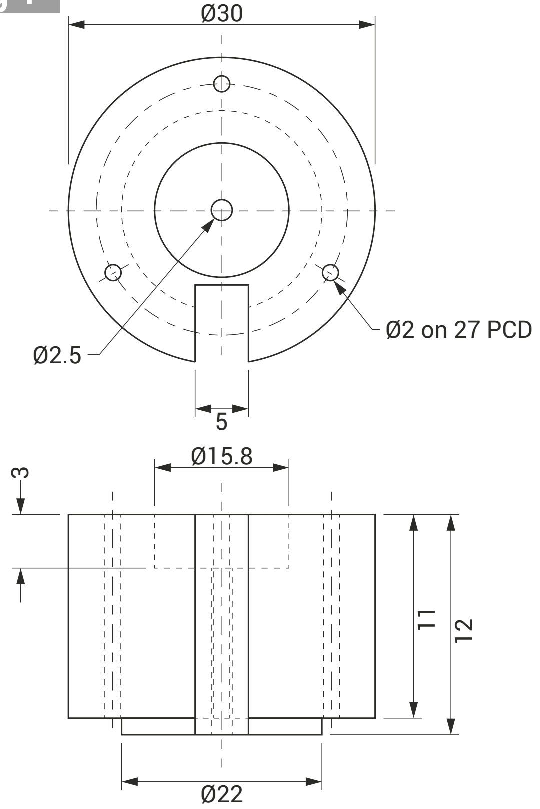
with my four-jaw chuck for this because the accuracy is not that important. A simple collet can be made by drilling a piece of round bar to the across corner dimensions of the bar (I'm not giving that dimension because the specific bar needs to be checked; sometimes the corners are rounded). The end of the collet is then slit with a hacksaw and clamped with a simple 'V'-clamp. Before you know it, you've machined ten sockets, far more than you'll need!

The backing pate is machined from 30mm brass bar or it can be soldered together from pieces of brass lying around (**fig 2**). Personally, I machine mine from solid bar; I normally have a few pieces I've cast, lying around for just these types of jobs. Because the price of buying a piece of 30mm bar can be prohibitive I'll describe the latter method, which is just as satisfactory. Cut a rough 30+mm circle out of any brass plate thicker than the drawing. Drill a 3mm hole in the middle. Chuck a 16mm brass bar; face, drill and tap a M3 hole in the centre. Remove the bar from the chuck and dimple the machined surface in three locations with a small centre punch; this will give the required gap for proper solder penetration. Screw the plate onto the bar using a brass screw, flux and solder the three parts together. The soldered assembly can then be returned to the chuck and the job machined to the outside dimensions required and the M2.5 hole drilled and tapped in the centre. All other holes are drilled using jigs.

The first jig (**fig 3**) is used to align the socket relative to the mechanism mounting holes, at the correct distance from the centre boss. This also ensures the dial face clamping screws and the needle stop are in the correct location.

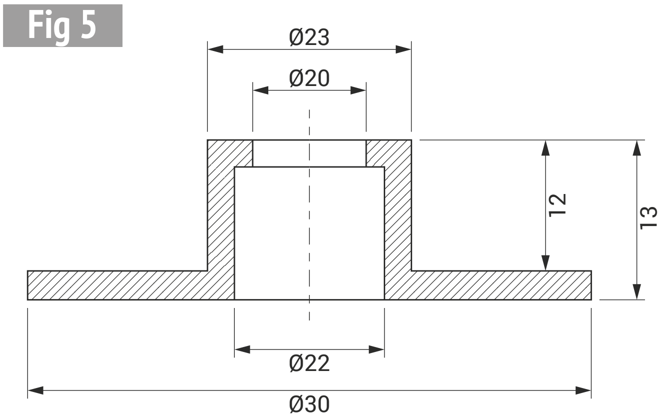
The jig is held in place with a M2.5 screw and the M2 holes are spotted with a 2mm drill then drilled using the normal 1.6mm drill and tapped M2. A 2mm hole is also drilled in line with the socket half way between the jig and edge of the backing plate. Solder is applied through this hole to prevent fillets which would clash with the cover. The whole job is soldered with the jig in place to make sure nothing moves, with a 1.5mm drill aligning the socket. I made this jig from cast iron which doesn't tend to solder well, making it a perfect holding jig (**photo** »

Fig 4



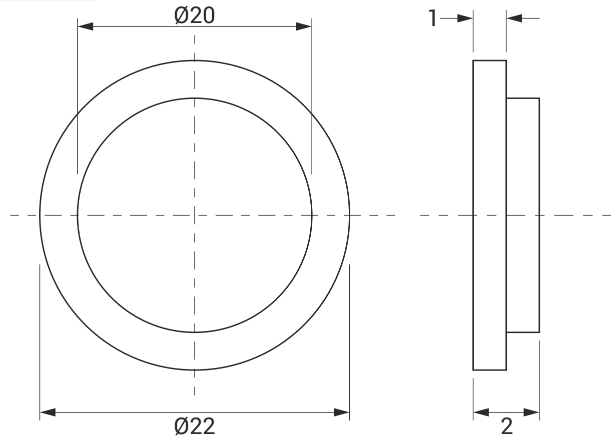
Mounting hole drilling jig.

Fig 5

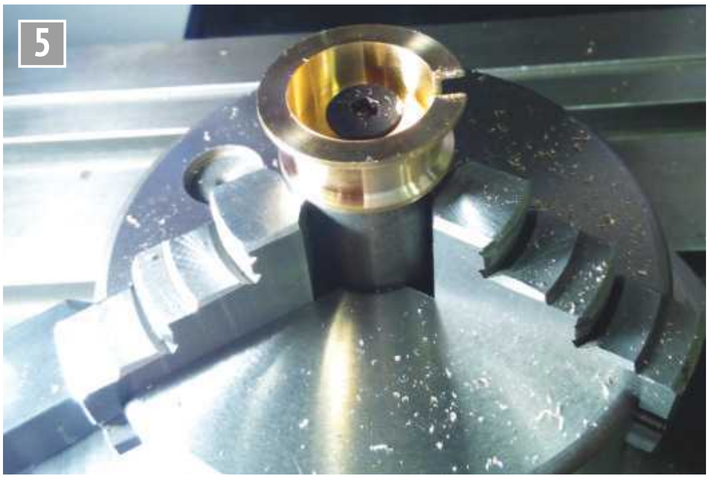


Cover plate.

Fig 6



'Glass'
(Machined from original cover)



Milling the cover slot.

3). Nevertheless, I still Tippex areas where I don't want solder to run and spoil the job.

Most gauges have a mark or a hole to show the assembly line where the beginning of the tube needs to be. The original backing plate of the gauge makes a nice jig for spot punching this start position (**photo 4**). Incidentally, this hole also acts as a gas escape should the tube fail and somewhere on our gauges we should do the same. Typically, I leave a little clearance at the top of the socket square.

The final three holes holding the cover plate are drilled and tapped using a drilling jig (**fig 4**) making sure all the gauges I make are interchangeable. Generally, the cover plate will change according to the type of locomotive being built but the backing plate will be standard.

The cover plate

Changing the size and look of the outside of the gauge should happen with the cover plate (**fig 5**). I've given my standard dimensions but the last locomotive I built was the American type locomotive and they weren't shy to use large gauges with a pronounced rim on the glass side. This can be machined from one piece or built up in a similar fashion as the base plate.

The only trick with machining the cover plate is the slot for the socket. I machined a 22mm disk that fits easy into the cover with a M6 countersunk bolt clamping this to a mandrel that can be held in a three-jaw chuck. The chuck is then aligned to the spindle of the milling machine by clamping a 12mm rod in the collet and closing the chuck around this rod; you then know the chuck is centred. Then it's a simple milling operation with the mandrel clamped in the chuck and the chuck clamped to the table (**photo 5**).

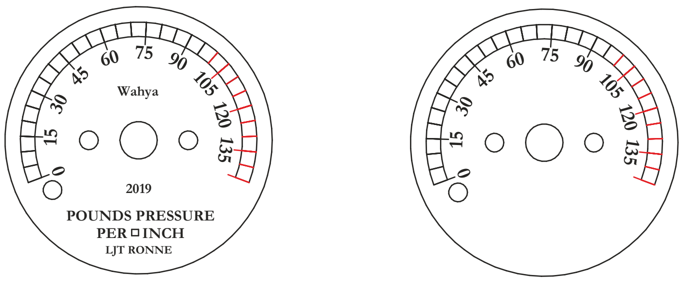
I use 22mm diameter 1mm thick watch glasses for the glass; they're cheap and can be found relatively easily. For my first gauges I machined the original plastic casing to make the 'glass', on a mandrel (**fig 6**). Both options worked really well with the plastic casing press fitted into the cover and the glass option sealed using two-part epoxy.

The dial

This is the easiest and most fun of the entire process. Roy Amsbury actually said in his article that the dials are the most difficult part of making the gauges but I've found a few hacks that make life much easier.

Firstly, because a standard gauge is used the increments are fixed as well as the range;

Fig 7

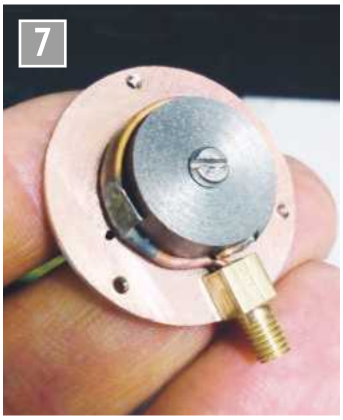


Dial prints..

6

The Bourdon tube.

7

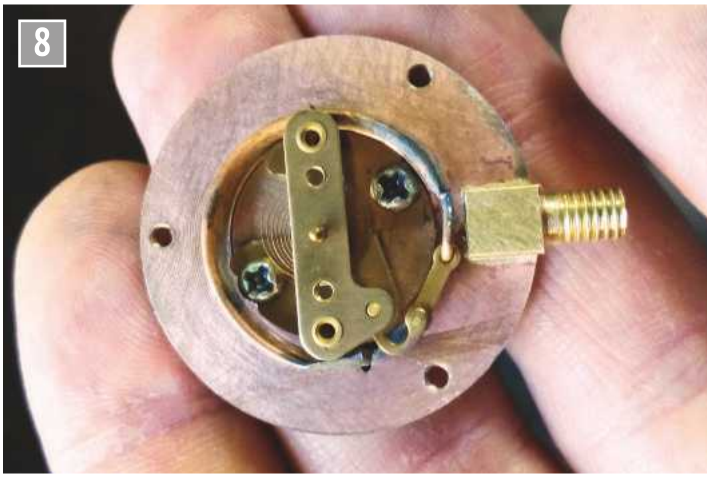


Fitting the Bourdon tube.

this is half the work done. If a different gauge is used the dial needs to be adjusted.

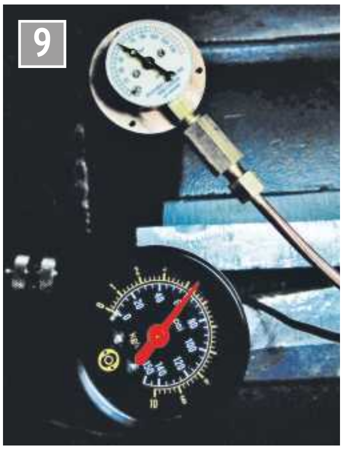
If a 1MPa gauge is used the clear dial (with only the pressure in PSI and increments) can be brought into any drawing program and any logo or lettering added as an overlay (**fig 7**). Even a program like MS Word can be used to get the dial looking like the original. The size of the dial should be between 21.5mm and 22mm. The dial can be printed on a decent piece of cardboard; 240gsm has worked very well for me. You can even use bronze board from the arts and crafts store for gauges with a brass dial face. The holes for the pointer (3mm), mounting screws (1.5mm) and stopping pin (1.5mm) are punched (on a piece of plastic) using the back end of an appropriate drill ground flat. The dial face can then be sealed by spraying two coats of clear lacquer front and back, and glued onto the original dial face using 2 part epoxy glue - easy peasy.

8



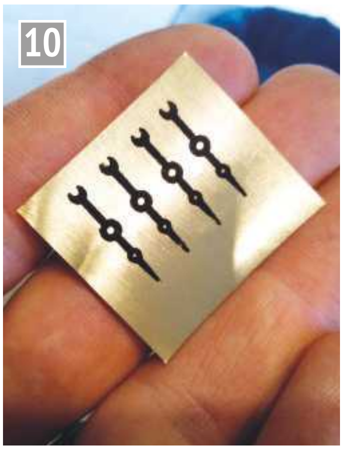
Mechanism assembled.

9



Calibrating the gauge.

10



Toner printed pointers on brass shim stock.

Assembling the gauge

The Bourdon tube of the standard gauge is potted with glue into the NTP fitting. Using a lighter, this glue can be melted and the tube extracted but make sure the tube itself doesn't get hot or the solder will melt (**photo 6**). I normally remove the pointer with my fingers but a simple pointer extractor tool can be made; there are a few examples on the net.

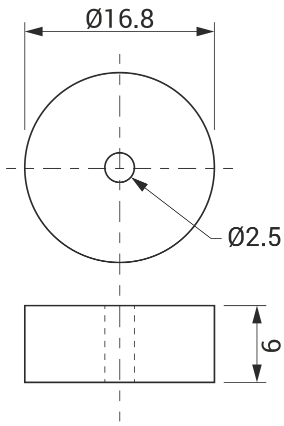
The Bourdon tube is assembled to the backing plate around the Bourdon tube fitting jig (**fig 8** and **photo 7**). The small tube needs to be bent and inserted into the square socket lining up the mark that was made for the start of the tube. (Note: the small tube needs to fit **inside** the 1.5mm hole to prevent the potting glue from sealing the tube.) The end of this tube also needs to be cleaned with a solvent to make sure the epoxy takes properly, with no chance of leakage. Once all is in place a two-part epoxy can be mixed and, using a syringe and needle, can be injected into the 3mm cavity and allowed to set overnight. The next day the assembly can be pressurised in a glass of water to check for leaks.

Now the whole shebang can be assembled for calibration (**photo 8**).

Calibrating the gauge

With the dial face fitted the gauge can be tested on the

Fig 8



Bourdon tube fitting jig.

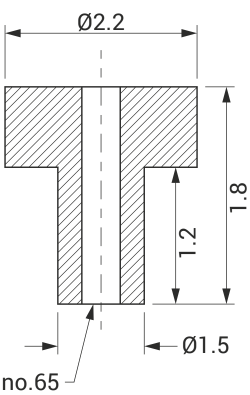
calibration jig, which is made up from used compressor components and an accurate industrial gauge (**photo 9**). I normally set my gauges at 60% design pressure for my boilers. The pointer should go back to zero if everything is fitted correctly and there is no interference inside the casing. The pointer is pushed onto the spindle, on pressure, at 60psi. It is not necessary to use excessive force; it will stay put and if it doesn't after a little shaking push a little harder! The cover can then be assembled and the gauge rechecked to make sure the movement is still happy.

Some pointers on pointers

The pointer that comes with the gauge is perfectly satisfactory and easy to see when steaming… but it is of course possible to make your own pointers perfectly scaled from the specific

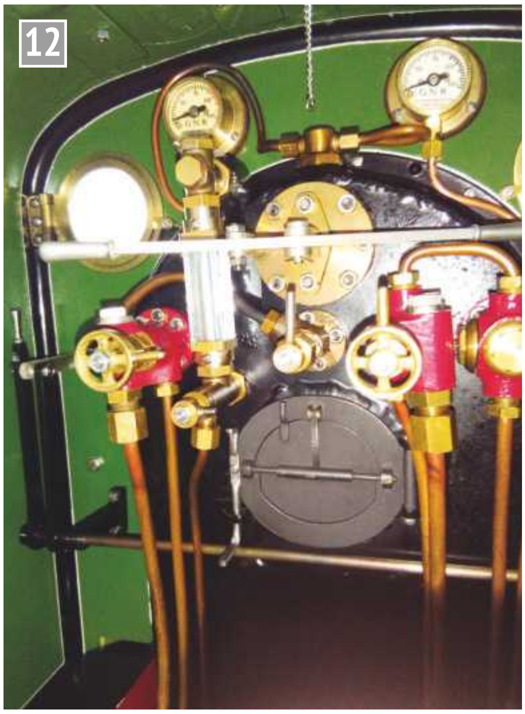
>>

Fig 9



Pointer base.


11
Wahya gauges.


12
Stirling gauges.

locomotive of interest. I failed dismally at cutting along lines at preschool so I use an electro stripping process to cut printed pointers from brass shim stock, typically 0.2-0.3mm (**photo 10**). The principle and setup are identical to that described in my article *Making Loco Name Plates* (M.E. 4650, 23rd October 2020). After etching, it is relatively easy to break the pointers along the etch line, and then they would only require the lightest dressing with a very fine nail file. The pointer is then either glued or soft soldered to the pointer base (**fig 9**).

Finally, some example gauges

Two examples from both sides of the pond are shown in the pictures. The Americans seemed to like the bold gauges with a rim around the face (5 inch gauge American type 4-4-0 – **photo 11**). The GNR had smaller gauges mounted with backing wood above the backhead (7¼ inch gauge Stirling single 2-2-2 – **photo 12**). The lettering is printed very small but if you look very closely on the model the detail is clear for those who are interested.

The clock on the American type locomotive (wooden cab) is a fully functional quartz watch, made using similar methods as the gauges with the same internal diameter to standardise on the glass. The cover is a finger press fit onto the backing plate.

ME

A New GWR Pannier PART 28

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

Continued from p.139
M.E.4656, 15 January 2021

Before we cut any metal, I will just say a few words about the fire hole doors. I have had the pleasure of riding shotgun on quite a lot of GWR engines and done quite a lot of firing on them too - great fun. I also had a little drive on *Foxcote Manor* on the Llangollen railway, including running round the train at Llangollen, and the one thing which struck me was that all of the GWR fire hole doors looked identical to me (**photo 210**).

Hopefully I am not mistaken with this and I am sure that someone will let me know if they are not! In fact, I started to make a set of patterns to have them cast but sadly I never got them completed. Looking at the photographs I can't think what there is to do on them. I don't know what type of fire hole door was on the original Pansy but if it was just a hinged flap then I am not really that bothered so hopefully you will get going on these.

One other thing is that the fire is much easier to control with these types of doors than any other type. You should be watching the fire and water all the time - it only takes a glance - and as soon as you see the pressure approaching the red line you can either pop the injector on for a few minutes or, if you already have enough water in the boiler, you can open the doors a little way to blow some top air across the fire. Either should do the trick but if not then you shouldn't have put all the coal on in the first place!

Foxcote Manor's *fire hole doors.*

To make a start on them I would suggest that you tackle the runners first. You could make them from a piece of $\frac{1}{4}$ x $\frac{3}{16}$ inch BMS bar but I found it just as easy to make mine from three laminations, two of 18swg steel and one in the middle of 16swg steel. The thing is that it is much easier to add the necessary piece on the lower runner as that can be made from the outer piece of 18swg steel. The other three pieces can be flush riveted together and then if you like you can file them to look like one piece of steel and no one will ever know the difference! Making the centre piece from 16swg steel will just give the doors that little bit of clearance if you make them from 18swg steel.

To make the door handle you will need a section which is $\frac{5}{32}$ x 16swg steel about 3 inches long. To this you then need to fit a little pad $\frac{3}{16}$ x $\frac{1}{4}$ inch long x 16swg and round the ends off, then you can silver solder it on. You then need to make a slotted hole in it $\frac{3}{32}$ wide and about $\frac{3}{16}$ long. This will make a nice little reinforcing plate over the slotted hole. **Photograph 211** shows the patterns which I made for the handle, links and runners, and the doors.

The bottom end of the handle needs to be narrowed down a little to $\frac{1}{8}$ inch width and then you will also need to drill a No. 50 hole through it $\frac{15}{16}$ inch further down and then another hole $\frac{11}{32}$ inch below that No. 41 and round the bottom off. At the top end you can turn a nice little handle $\frac{7}{16}$ inch long as I have shown. You also need to fit a little piece of 18swg plate into the top of the handle on the outside to hang the chain on for the flap, which should just nicely fit inside the fire hole, when we get there.

You can now make the other arm to the dimensions which I have shown. These dimensions are quite important as, if you don't follow those, your doors may not work evenly. The only thing left to do now is to make the connecting link and I would build it up again from the same three pieces, as the top and bottom runners, with the arm being 16swg steel. >>

Parts for the fire hole doors.

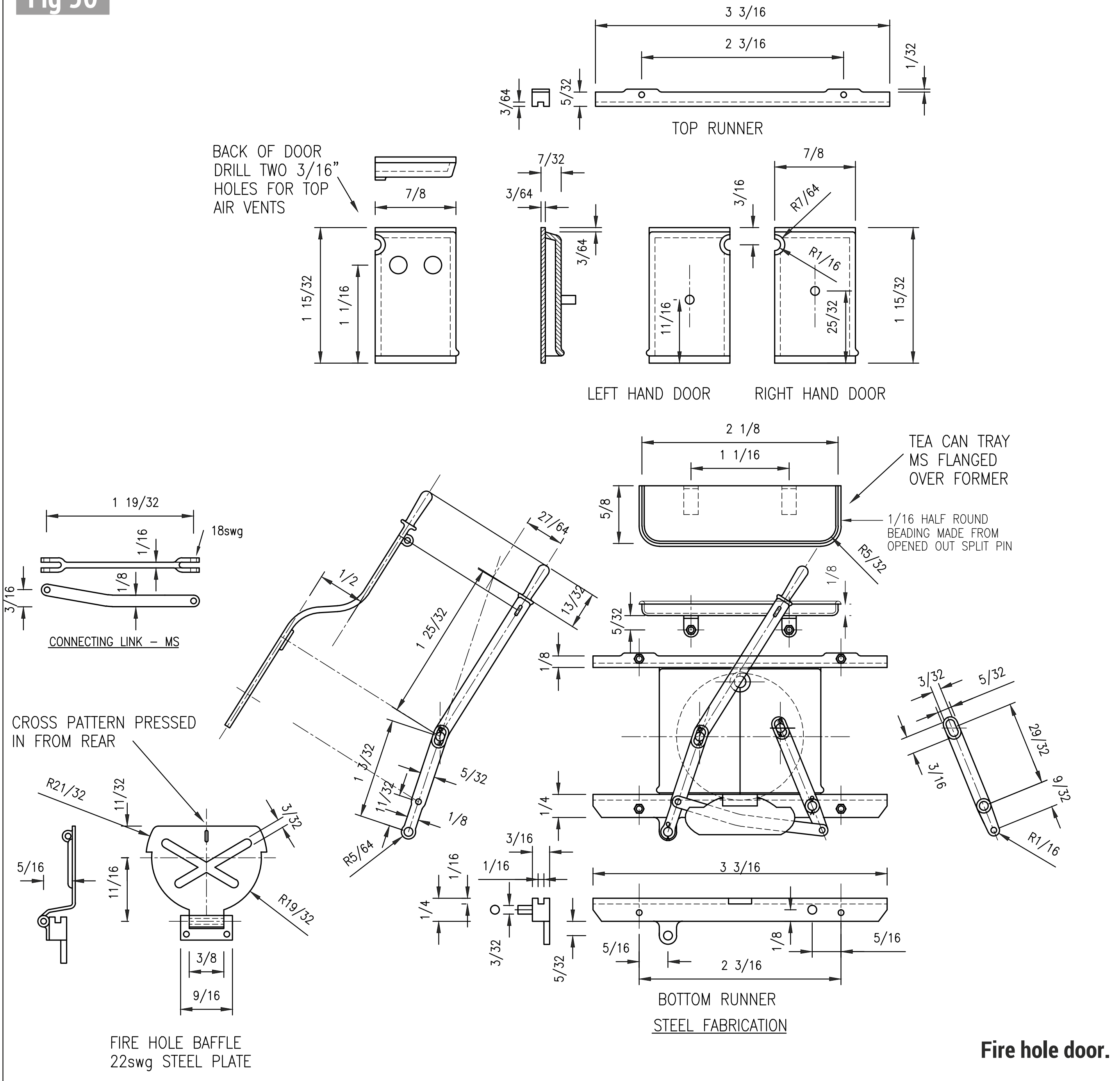
Preparing to silver solder the connecting link.

Alternatively, you could also make two U-shaped pieces and silver solder them onto the ends of a piece of ⅛ inch x 16swg strip. Whatever you are going to do they are going to be painted black anyway. The connecting strip needs a bend forming in it so that one end looks up by 3⁄16 inch. **Photograph 212** shows my method making the connecting link all fluxed up ready for silver soldering.

The bottom runner needs to have a slot filed in it, down to the bottom of the groove, so that any trapped coal can be brushed out of it to enable the doors to close properly.

To make the pair of fire hole doors you will need two pieces of 18swg mild steel plate ⅞ inch wide and 1 15⁄32 inches deep. First of all, they need to be made to 'just' fit into the sliding runners. In fact, it would be a good idea to silver

Fig 50



Fire hole door.

Stays establishing the separation of the runners.

Top air holes in the doors (viewed from inside).

Y4 fire hole doors (cack-handed!).

Fire hole doors on Andrew Fiderkiewicz's pannier tank.

solder a couple of $\frac{3}{16}$ inch x 18swg strips in between the runners to hold them together first. **Photograph 213** shows the two stays which I added to hold the runners apart (or should that be together?!)

The next thing you need to do is make the outer plates for the doors. These can also be made from pieces of 18swg mild steel. They will need a little bit of blacksmithing to bend the top down and the sides bending, and also the bottom of the doors need bending outward slightly. I noticed that I have used brass beading around the bottom of the door and down the sides but then it occurred to me you can use an opened up split pin just as well. This needs to be $\frac{3}{64}$ inch wide. (You can find this by opening a split pin up and laying it round!) You can silver solder this beading on without fear of melting anything else. The only reason I used brass was that when having the doors lost wax cast the colour didn't really matter! You need to drill two or three holes in the back plates No. 12 or $\frac{3}{16}$ inch diameter to give some top air to the fire.

It has suddenly occurred to me that I have some pictures of some very similar fire hole doors which I used for illustrating my Y4. I fitted this type of fire door to all my Y4s for exactly the reasons I have just given above. **Photograph 214** shows the fire hole doors which I made for the Y4 (except that I then found I had made them the wrong hand, so I had to do a little remaking!). **Photograph 215** shows the three holes which I drilled in the back plate of the doors to give some top air to the fire.

Once you have silver soldered these pieces together you need to use a piece of ¼ inch round bar bored out with a No. 20 drill and silver solder one piece into each of the two doors. These need to be long enough to go through both plates. Once you have got those silver soldered in, they will need machining off flush - and make sure that they match when you close the doors!

The last thing to do is to make the tray to put your tea cans on! For this I made a little former and flanged it over that. I used a piece of 20swg steel plate for this. The one thing which I didn't do on the Y4 one was to add the beading around the edge. That can also be made with an opened up split pin.

Photograph 216 shows the lovely fire hole doors made by Andrew Fiderkiewicz for his pannier tank. I can see that he has also had a proper boiler made for his engine, judging by the curve on the firebox wrapper. Apparently, he used the levers and doors from a kit supplied by The Steam Workshop although the runners were supplied by Model Engineers' Laser, but he had to machine the groove into them himself. Anyway, if he carries on like this it looks like being a lovely engine.

●To be continued.

NEXT TIME

For a change, we shall turn our attention to the platforms.

A Convenient Laser Centre Finder PART 1

Jacques Maurel demonstrates a simply made but very effective laser centre finder.

This laser centre is inspired by the one described by Mr. Dan Gelbart in his video : **www.youtube.com/watch?v=otSjut1iGGk** (after the 2m 25s mark).

A prototype was quickly rigged up (**photo 1**) using a low price laser pointer, the one used to play with cats (**photo 2**). A second-hand polyamid flange was used and the laser pointer set in a 20 degree inclined hole. Friction was sufficient to hold it in place but allowed some axial movement to operate the on/off button on the side of the pointer.

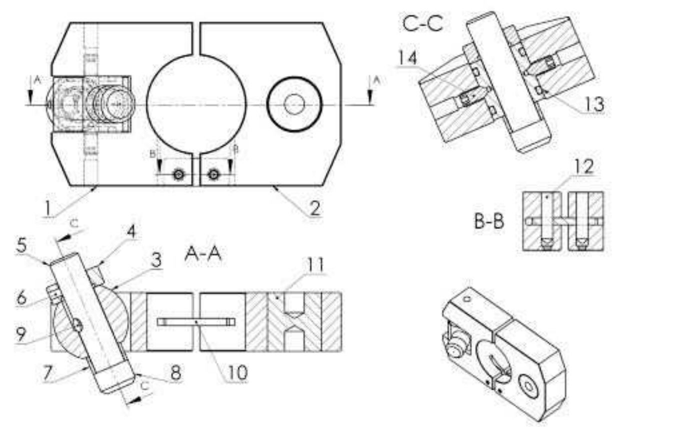
When the drilling spindle is running, the laser beam produces a conical surface, the intersection of this surface with the target plane surface being a circle. The diameter of this circle is adjustable by moving the spindle vertically. A small diameter, near the cone apex, is ideal for centring the spindle on a cross line mark and bigger diameters are convenient for centring the spindle on an already made hole.

All these applications and more can be seen on the video.

The centre finder attached to a Jacobs chuck.

The laser pointer.

Fig 1 **Construction of the centre finder.**



Experimental issues

The experiment revealed the following problems:

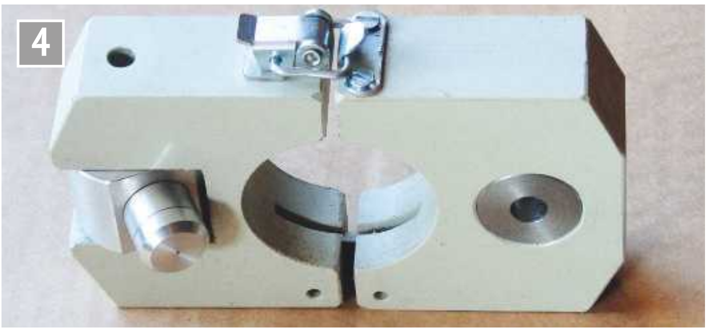
- It was not possible for the light circle to go to a point. This was because the light beam didn't cut the drill axis. The flange was quite narrow relative to its diameter, the fit was not good on the knurled drill chuck surface and the locking as achieved by a single knurled set screw, so it was difficult to aim the laser sufficiently precisely.
- The laser spot was too large.
- The fixed angle of the laser pointer limited the drill length and the size of a target circle.
- The distance between the drill end and the workpiece had to be more than the flange thickness for removing the attachment.
- The attachment could only be used with a dedicated chuck.
- Balancing was necessary to avoid vibrations and the chuck falling down (because of the Morse taper coming loose).

Design features

As a result of the prototype tests the following design principles were established (**figs 1** and **2**):

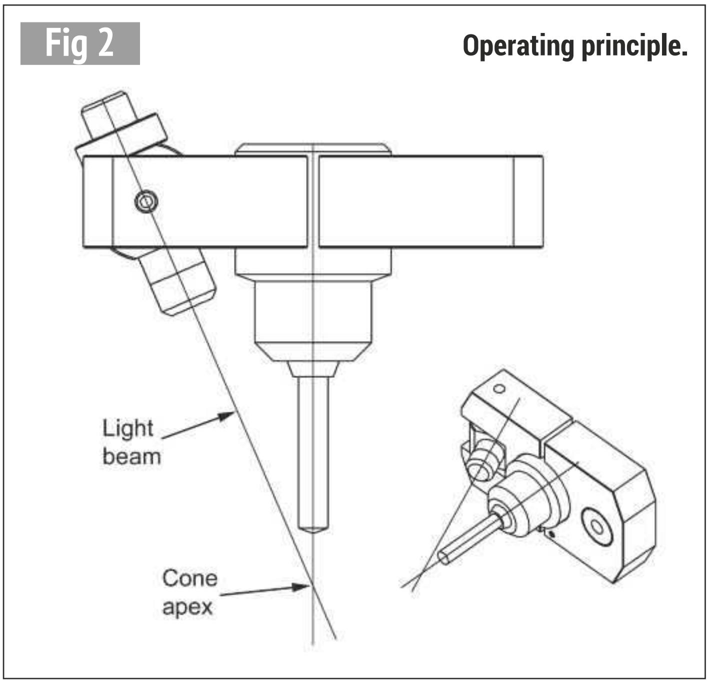
- The chuck used should have a smooth cylindrical surface (no knurls) - **photo 3**.
- The attachment is made with two halves closed by an instant lock, so the end of the drill can be set very close to the workpiece (**photo 4**).

Ideally a smooth bodied chuck should be used.



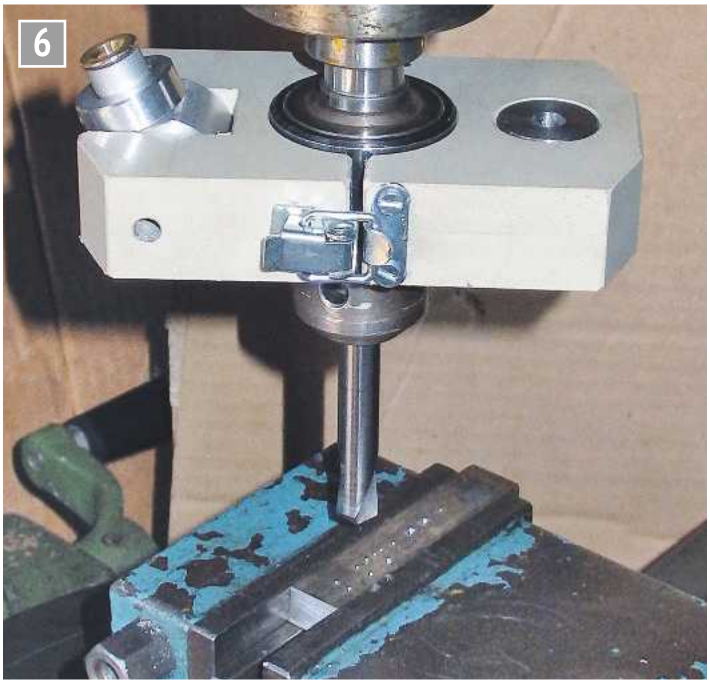
The body of the centre finder.

Tang plug for using the centre finder without a chuck.



- A special cap (**8**) was made for the laser pointer with a small 0.5mm diameter hole to get a small light spot and the battery housing plug was machined to make it lighter.
- The laser pointer is set in a laser holder (**3**) and turns about the axis of two screws (**14**); two O-rings (**13**) keep it in position.
- The lighting ring (**4**) turns the pointer, moving the lighting button (**9**) in and out of a groove in the laser holder (**3**), turning the pointer on and off.
- A balancing weight (**11**) is included to avoid the vibration problem.
- An adaptor allows the use of the pointer without a chuck (**photo 5**) but of course this is less convenient as, after centring, you'll have to remove the adaptor from the chuck to set the drill in place.

Photographs 6 and **7** show the laser centre finder in use.

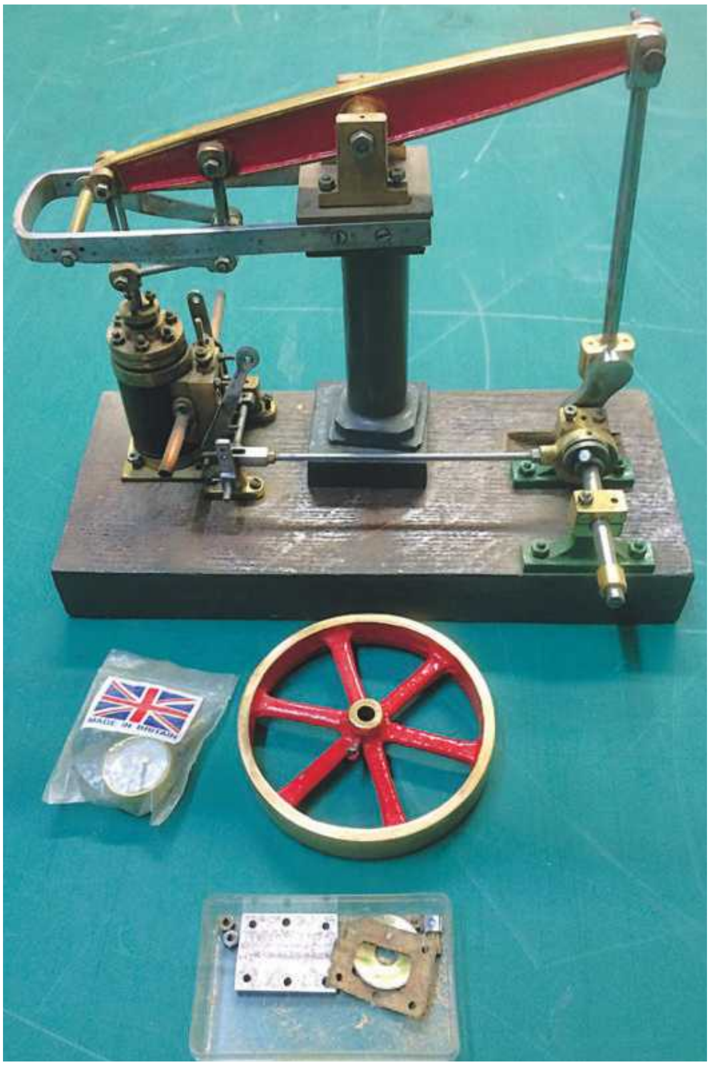


The centre finder mounted ready to centre a drill.

The centre finder in action.

●To be continued.

Restoring an Old Model Beam Engine PART 3



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

Continued from p.203
M.E. 4657, 29 January 2021

Cylinder and assembly

With a little trepidation, given previous problems, the last plastic bag containing the cylinder and the valve gear parts was opened (**photo 27**). Like all the other parts of the beam engine, they were not particularly well made.

First the parts of the valve gear which had been pinned together were taken apart - they would just need cleaning and reassembling.

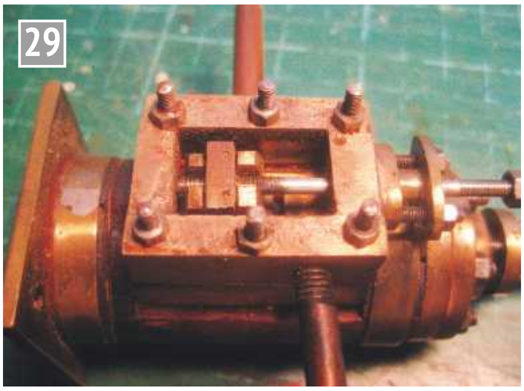
The piston had already been removed from its cylinder to check the balance of the beam. Like the beam, the cylinder is a fabrication and, also like all the other parts, uses BA threads so the model was probably made in the UK any time after 1903 (probably a lot later) when the British Association adopted the thread (**photos 28** and **29**). Instead of using gaskets a lot of the sealant Red Hermetite had been used which had blocked one of the cylinder's steam passageways; the engine could not have run in this state. After taking the cylinder apart there was still no evidence that the model had ever worked (**photo 30**).

All the brass/bronze parts where cleaned by first scraping off most of the Hermetite with a knife, then washing with lighter fuel before boiling in washing soda. The now clean metal was brightened up using fine wire wool (**photo 31**). As mentioned before, the cylinder is fabricated like the beam; the steam port block looks as if it was cast with the steam ports in it. It is hard soldered to the

27

The contents of the third bag.

29

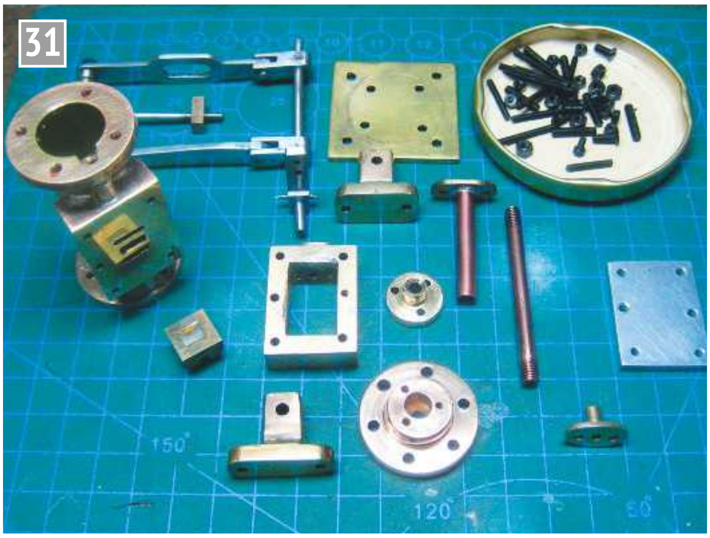


The steam chest.

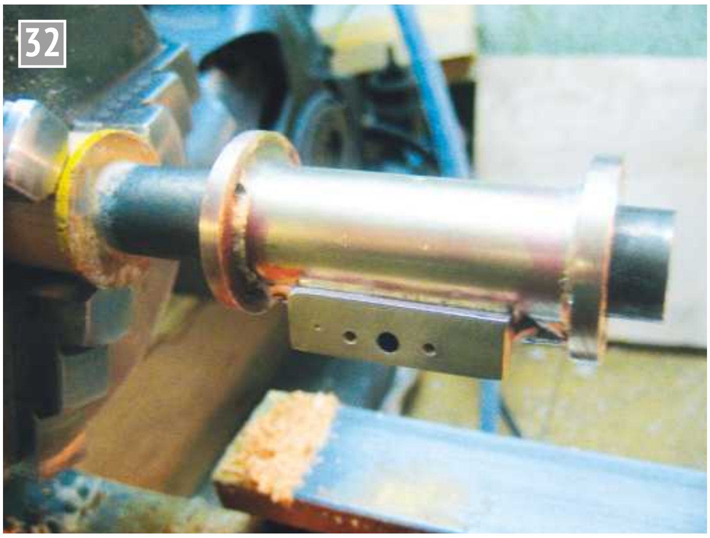
28

The cylinder, showing the port face.

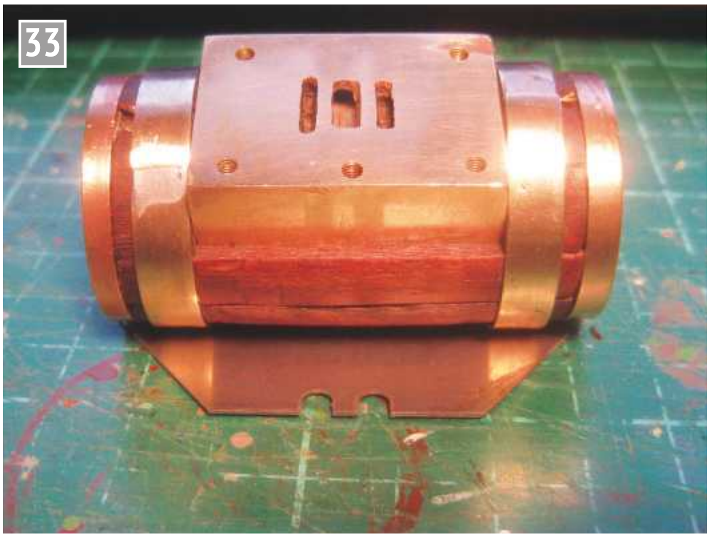
The piston, freed from its rod.



Cylinder parts restored to respectability.



Rejuvenated cylinder.



Cylinder newly lagged.

cylinder barrel which has a very smooth bore, possibly having had a previous use (another recycle?). The cylinder ends are soldered to the barrel and connected to the steam port block by pipes which are also hard soldered in place. The cylinder was lapped and the cylinder port and valve faces were polished (**photo 32**). Out of interest - the engine has a stroke of 1¾ inches and bore of ⅝ inch (46 x 16 mm) -ish.

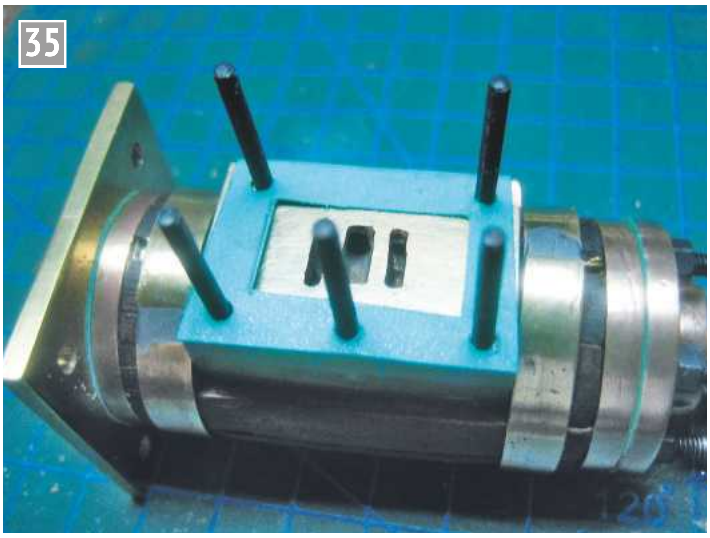
The steel studs and nuts were put into caustic soda to be cleaned and to remove any rust and Hermetite; they were then oil blackened.

Surprisingly the mahogany lagging went back on over the cardboard packing on the cylinder and was held in place by brass hoops rather like a wine or beer barrel (**photo 33**). The position of the piston on its rod was checked (**photo 34**) and gaskets (**photo 35**) for the cylinder and steam chest were made before the engine was assembled.

All the parts of the engine went back together quite well; the positioning of the cylinder and valve gear on the oak base took some time. They were first held by wood screws to check alignment and when correctly lined up these wood screws were replaced by nuts and bolts. This took time as the beam had to be removed and replaced several times to allow the oak base to be drilled (**photo 36**). The author is not keen on wooden rather than metal engine bases as the drills tend to wander if drilling jigs aren't used and the wood can contract allowing the parts to become loose at a later date.

Checking the piston position.

>>



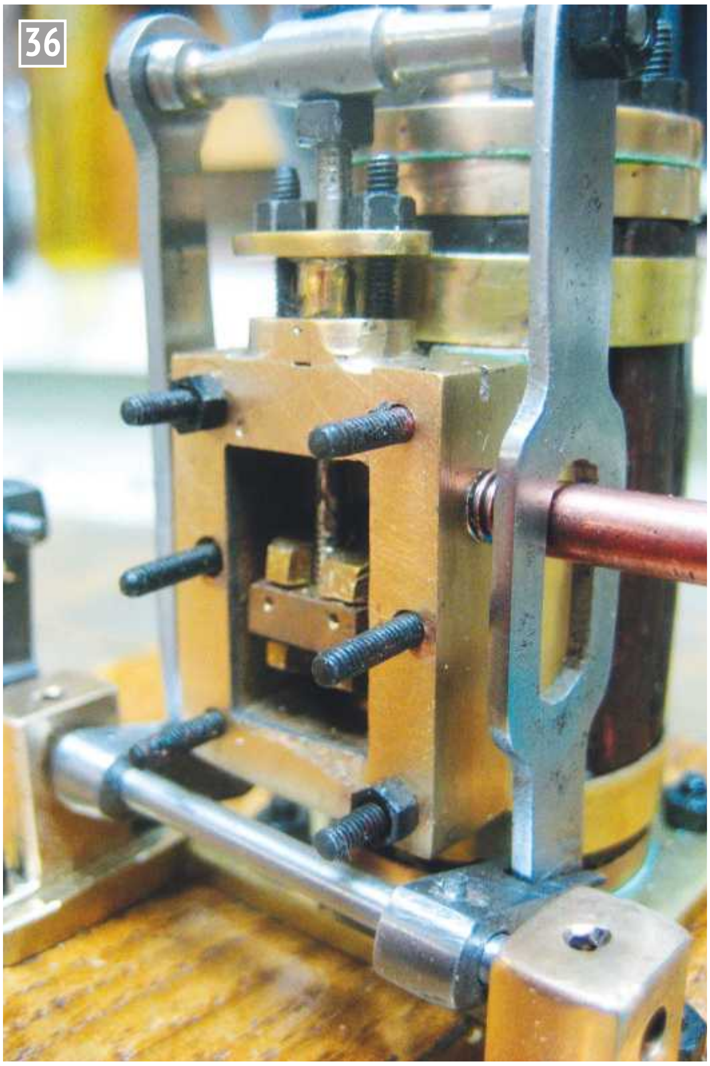
New gaskets all round.

With all the valve gear connected, again using an electric drill the engine was turned over for a second time. There was no major binding but there was a bit of a knock - the big end bearing being a bit oversize was probably causing it.

As the steam enters the steam chest at its side it was possible to make a plastic steam chest cover to replace the aluminium one to see the valve operating. The engine's timing could then be easily set by eye (**photo 37**).

Moment of truth

So, at approximately 15.00 GMT on the 1st February 2020, under the supervision of Owen the Oil, the beam engine ran for possibly the first time ever or most certainly the first time in many years (**photo 38**). When connected to an air supply the model ran on quite a low pressure; initially quite fast but after some minutes of running the pressure could be reduced further so slowing the speed of the engine quite a bit. It is still very fast for a beam engine but then the flywheel is very small and light so perhaps fitted with a larger flywheel it might run quite slowly. There are a few knocks, probably caused by the crankshaft bearings and the big end being a bit over size - this might or might not be attended to. It was quite an interesting project. Given the quality of the brass castings, having a lot of holes apparent, they might have been cast in a home foundry - we will never know.

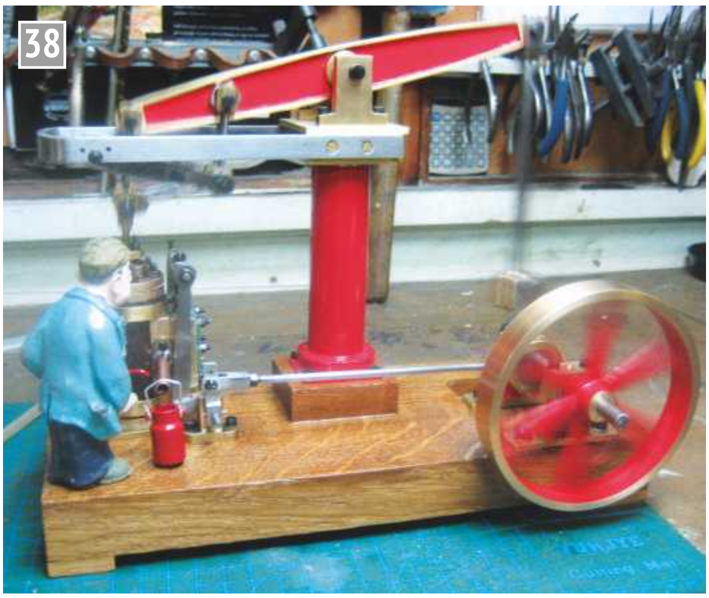


Cylinder repositioned on the base.

For those interested, videos of the beam engine's restoration can be seen at:
Phase 1 - **youtu.be/XVxtcx8DvE0**
Phase 2 - youtu.be/jkGxGVEZVJI
Phases 1 and 2 - youtu.be/wuT0G16fSzo

ME

Owen checks the timing.



Beam engine restored to working order.

POSTBAG

Boiler Design

Dear Martin,
Following on from the various articles in recent issues of *Model Engineer*, as someone who has spent most of my time working in the industrial boiler industry, I would offer the following comments.

It is accepted that the various components in an internally fired shell boiler, of which the locomotive type is one, operate at different temperatures. As a result, differential expansion occurs between the various internal items (furnace and tubes) and the outer shell/wrapper. This differential expansion is transmitted to the boiler endplates and these must be capable of absorbing this.

During operation, the boiler is said to 'breathe' and thus 'breathing spaces' are taken into consideration in the design. So there has to be a space on the endplates between the inside of the shell/wrapper and the adjacent stays to accommodate the bending stresses and movement created by the differential expansion.

Before welding became the norm, rivetted boiler endplates were flanged as a matter of course and this design offered a degree of flexibility which proved satisfactory. As welding became the norm, early designs still incorporated flanged ends, sometimes with the shell butt-welded to the flange. However, with the cost of press work, inset endplates became the preferred option with the so called 'T-butt' welded joint with the shell/wrapper.

This method of construction is still the industry standard, and experience has shown this to be perfectly acceptable, preferably with a full penetration weld. However, flanged endplates are frequently selected for shell boilers working at high pressures (> 300 psi).

As for materials, these must be ductile to provide the required flexibility.

A copper boiler with flanged ends is ideal and corrosion is not a problem. Steel units are available, but corrosion must be monitored.

Stainless steel is not an allowable material for industrial boilers as it does not have the required ductility.

Looking at the *Wahya* boiler design, I'm sure it is quite adequate for a working pressure of 100psi because the use of relatively thick plate will result in stresses of a very low order. Forget Finite Element Analysis - it's not a super critical utility boiler or nuclear vessel, and stress corrosion cracking due to chlorides is not a consideration unless it's running on swimming pool water. Rainwater is the simpler choice.

Boilers are designed for stresses way below the material yield point and taking into consideration the difference in room and elevated temperature properties. Yielding is not a consideration for the hydraulic test pressure; the industry standard is 1.5 x max. allowable pressure (safety valve set-point).

So yes, you can design a boiler that is far too rigid and over designed, or stick to the traditional tried and tested copper flanged designs that should demonstrate the skills of a true model engineer.

Very best regards for a better 2021, Mike Willerton

Crank Axle

Dear Martin,
Following the request from Clive Barton in M.E.4655 (1st January) and rereading the section on the crank axle design on the P2 website (www.p2steam.com/design-study), the following comments may be of interest.

Rolling a fillet radius puts the surface layer of the metal into a state of compression. Metal fatigue normally only occurs when the metal is in tension, hence for metal fatigue to commence the tensile stress must be greater than the compressive stress from the fillet rolling. Fillet rolling without a groove is very difficult to control.

The bearing size has been increased from 9.625 to 10 inches; this does not sound much but it is an approximate 8% increase in cross sectional area of the axle.

The original steel is said to be EN8 but that is a temporary WW2 standard (that is still with us), so I assume that it's an EN8 equivalent. Also, EN8 does have a wide chemical tolerance - 0.35 to 0.45% carbon for example - therefore its properties can vary. The above website implies that a more fatigue resistant steel has been specified along with a number of detailed changes that should reduce stress concentrations but the details have not been published.

I hope this clarifies some of the questions about crank axles.

Yours sincerely, Robert Walker

Dear Martin,
I feel that Joseph-Jean Pâques has missed the whole point of boiler safe construction and operation.

Over-pressurisation is not an issue. You have a safety valve, one or more, to prevent this. The biggest cause of failure of steam boilers is lack of water. When the furnace crown is uncovered it overheats and fails due to a loss of strength of the plate. The failure looks like a tongue in the mouth giving a huge area compared to the safety valve size.

The designs for boilers are for amateur construction using silver solder in a home workshop environment and usually give positive results. When you use arc welding or bronze welding methods, these should only be carried out by a qualified (coded) welder.

Ultimately the design of the boiler depends on insurance company approval.

Regards, P. W. Collyer (Tunbridge Wells)

Write to us

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Responses to published letters are forwarded as appropriate.

PART 2

A Boiler for *Bridget*

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

Continued from p.224
M.E. 4657, 29 January 2021

Starting the soldering

Eventually I had the tube holes drilled in both the firebox and the smokebox plates and all the tubes fitted nicely. The smokebox plate has other holes, not least of which is the hole for the steam supply bush, but I had not yet drilled these. However, the time had come to solder the tubes into the firebox plate.

The way to do this, as recommended by Farmer, is best described by looking at **photo 10**, taken immediately prior to the soldering event. I had made a stand with a clamp to hold the firebox plate at just the right height so that the tubes could stand vertically, each in their allotted hole. At the bottom is the smokebox plate which will not be soldered at this stage but is used to locate the other ends of the tubes. Note the temporary hearth because the hot gasses from the burner will travel down the tubes and out at the bottom. Of course, it was important to ensure that the plate was at right angles to the tubes!

Prior to inserting the tubes each hole has three small 'V' section grooves filed, spaced at 120 degrees. These allow the solder to flow between the two sides ensuring an even fillet of solder. Each tube extends a little past the plate and around each tube I placed a carefully crafted ring of silver solder, as can be seen in **photo 11**. The whole area was well coated in flux and then the big flame applied. This was a bit of a leap into the unknown for me as I had never soldered anything this big before. I can tell you that it took a lot of heat to get the assembly up to temperature and watch the solder flow. I kept turning up the torch! Those lovely blue clamps in photo 11 did not have a scrap of paint left at the end – it all burned off even though they were not directly in the flame!

When it was done and cooled down, I was delighted to see that all the preparations had paid off. The joints were well filleted and looked pretty good to me, as shown in **photo 12**.

Pickling catastrophe

In 2017 there had been a number of horrific stories of acid attacks in the news. I said to my wife that I thought it would not be long before the sale of highly corrosive acids was banned. So, although I had not started the boiler, I purchased two litre bottles of 100% concentrated sulphuric acid and put them at the back of the workshop cupboard. Sure enough, my prediction came true and the product can no longer be obtained without a licence – but I smugly remembered my bottles. The recommended dilution for pickling is 10% acid to 90% water. However, to submerge a boiler of this size you need a pretty large container and a lot of pickling solution. In fact, I concluded I needed nearly 20 litres. So I mixed up the solution using all of my precious stock and placed it into a large (5 gallon) glass demijohn which I had left over from my wine making days.

And so the day came to pickle my first assembly and I fetched out my large plastic dunking box and big demijohn of pickle. I was worried about spillage and splashing so I set up the box on my tarmac drive and started carefully to pour the pickle in. Sixteen litres of water is heavy and glass is smooth and quite slippery when wet. As I was pouring, to my unmitigated horror, the demijohn slipped in my hands. It hit the ground quite gently but glass is glass and the whole thing shattered

Silver soldering the tubes into the firebox tubeplate.

Rings of silver solder in place.

Neat fillets.

immediately, depositing about 16 litres of dilute acid and a pile of broken glass fragments on the ground around my feet. ARRGHHH!

My first response was to rush to the tap and flush off my feet and shoes. Then I grabbed a garden hose and returned to the scene. Thank goodness I had been on the driveway and not in the workshop! But by now the liquid was spreading across the driveway and starting to foam as it ate up the detritus in the tarmac. It was heading towards the car and I feared what it might do to the tyres, so my first action was to use the hose to direct the slick away from the car. I spent about an hour hosing down the drive and, to this day, I have not seen any lasting damage. But the bulk of my pickle was gone.

Now I had about 4 litres of pickle left, which was what I had poured before the catastrophe, and no means to purchase any more. There was not even enough to submerge the tube assembly I had just made and I had to partly submerge it and keep turning it over and basting it like a joint of meat! It was enough for now.

In the end a club member recommended an alternative pickling solution in the form of citric acid. This is easily available on-line as a concentrated powder and pretty inexpensive. I kept my few litres of sulphuric acid pickle to use for smaller items – and am still using it to this day. But I filled the 20 litre box with citric acid solution and found this worked very well – although it is rather slow, needing many hours to do a job that would take twenty minutes in sulphuric acid.

The main boiler barrel

The outer shell of the boiler comprises two sections: the rear section surrounding the fire-box and the boiler barrel which surrounds the firetubes and supports the steam dome. The boiler kit included a large section of copper tube, 3mm thick, 5 inches in diameter and 11 inches long. I can't imagine where you would get such a tube or what its other applications might be! This tube is ready to use, subject to having the steam dome attached and a couple of holes drilled for bushes. The outline of the steam dome is shown in **fig 1** which is an extract from Ken Swan's plan. The steam dome is made from copper tube of 1¾ inches diameter and is in two parts – one attached to the boiler barrel and the other, removable, to get access to the regulator. There is a split flange about one third up between the two parts. This flange is held together by twelve through bolts. The kit included a suitable piece of copper tube and a slab of phosphor bronze bar for the flange.

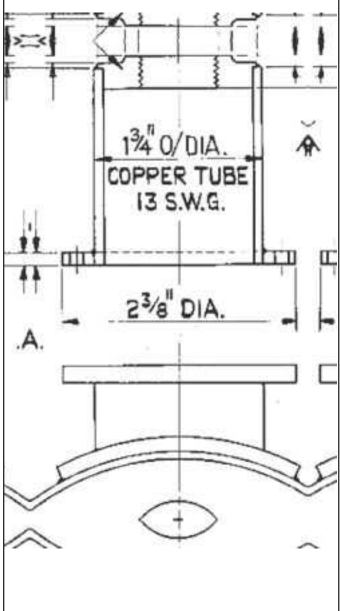
There are several fabrication challenges here:

1) Making a 1¾ inch hole in the boiler barrel.
2) Making the 3mm thick circular plate shown at the bottom of the dome which joins the dome tube to the boiler tube.
3) Making the two parts of the flange. The upper part just has a hole matching the copper tube but the lower part has a complicated shaped hole where the regulator is mounted.

Making the hole in the barrel was reasonably straightforward using a boring table on my Harrison lathe. However, before starting any operations Farmer, in his book, recommended scoring four lines down the length of the tube, exactly parallel to the tube and spaced at 90 degrees around the end. This will be an important reference and is much easier to do while the tube is bare. I marked off the end of the tube with four points at 90 degrees simply by computing the circumference and using a calliper (see **photo 13**). Then I put the tube on to my milling table and carefully adjusted it to be parallel to the table so that I could scribe down the length. Finally, I added the same four points at the other end of the tube so that I could scribe the remaining three lines.

I was now ready to mount the tube onto the boring table for the large hole, choosing one of the scribed lines to be the top of the boiler. In itself, the task was not a problem for the lathe but, as with so many jobs of this nature, the problem was to ensure that the tube was held firmly and stable. I did my best using a cast right angle support at the back and top clamps. However, even then I found I needed a large clamp to ensure that the tube was not drawn forward into the cutter (**photo 14**).

Fig 1



Steam dome (from Ken Swan's drawings).

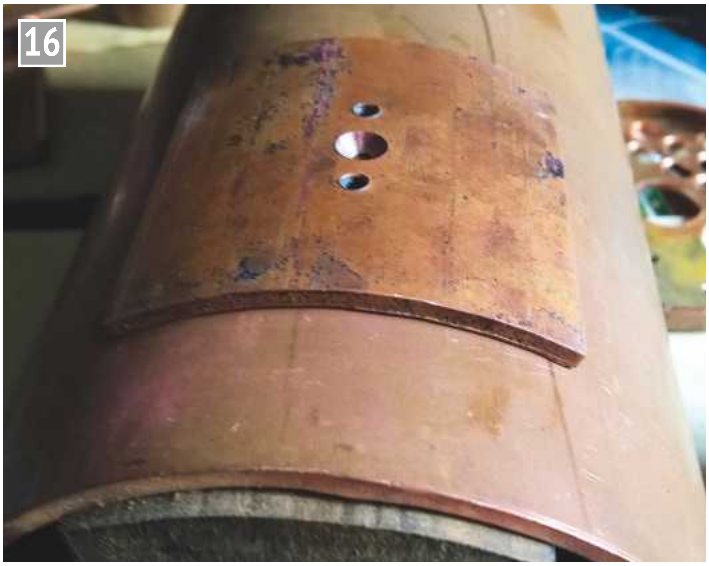
Marking off quarters around the boiler barrel.

Boring the steam dome hole.

Curving the steam dome flange to fit.

Steam dome

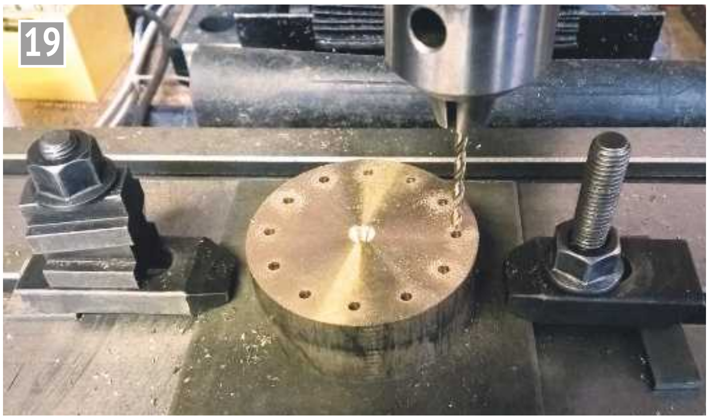
The next task was to make the round seat of the steam dome which would be soldered onto



Steam dome flange nicely fitted.

Rounding off the steam dome flange.

Mounting the phosphor bronze disc before cutting slices off it.



Drilling the dome fixing holes.

the top of the barrel and join the steam dome tube. This can be seen in **fig 1** between the boiler tube and the steam dome. I had a nice 3mm thick square piece of copper in the kit but what I needed was a round piece bent into a saddle that would exactly fit the top of the boiler. This apparently simple operation was actually quite a challenge. The piece had to perfectly match the top of the boiler or it would not solder satisfactorily so I could not just bend it manually. Also how was I to machine it to a circular profile after bending it to shape? It was no good making it into a circle beforehand as it would not then have a circular profile after bending.

I decided the best thing to do was to use the boiler barrel itself as a former against which to bend the square piece. Being annealed copper, I could bend the plate over the tube and it would not spring back. However, I was concerned about distorting the boiler barrel in the process, so I made a tight fitting wooden insert to ensure the tube was supported and then pressed the copper square down using a special jig in my fly-press. This can be seen in **photos 15** and **16**. Yes, I know it is not quite square but since it is going to be machined to a circle that doesn't matter so long as the pilot hole is in the middle!

At this point I mounted the, now bent, square piece into the four-jaw chuck, lining up the centre hole, and proceeded to drill and bore the large hole in the middle to fit the 1¾ inch copper tube of the dome body. Once this was done, I was able to solder the tube into the base. I used high temperature solder to ensure it would not come to pieces later when soldered onto the boiler barrel. However, attaching the tube at this stage enabled me to mount the whole assembly into the three jaw chuck and machine the square base into a circular base – thus solving the final construction conundrum for this piece (**photo 17**).

I now turned my attention to the flange joining the upper and lower part of the dome. The kit included a big piece of phosphor bronze bar – I'd say about 1 inch long and 2½ inches diameter. Out of this I had to make both parts of the centre flange and also the top of the dome. This would have been an expensive piece of metal to replace so I was keen not to mess it up.

Being wide and not very deep I was concerned about how to get all the three pieces out of the bar while having enough left to hold in the outside jaws of the lathe chuck. In fact, I concluded this would not be possible. As a solution I cut a good deep centre into the face of the bar segment and then mounted it onto a steel plate using short countersunk crews that I computed would not be too deep to prevent me cutting off the three slices needed. This plate is shown in **photo 18**.

This was a good move as it allowed me to mount the slab on either the milling table or the faceplate of the lathe, using the deep centre to line it up in each case.

First, I brought the bar down to the correct diameter in the lathe and transferred to the milling table. Here I drilled the twelve holes, going deep enough to go through the first two slices which would form the central flange but not so deep as to disturb the metal that would become the top of the dome. This is shown in **photo 19**. My milling machine has a DRO which makes accurate drilling of circles like this very easy.

The top section of the central flange just has a hole in it matching the internal diameter of the copper tube. However, the lower part has quite a complicated cut out on which the regulator is mounted. To make the first piece I transferred back to the lathe and bored the required hole – but only to the depth required for the top flange. Thus, when I parted off this slice, the parted piece had a nice hole in it and the remaining part did not.

Now I transferred the remainder back to the milling table and used the DRO to map out the corners of the required shape and a small milling bit to cut out an appropriate groove between them using a combination of linear table movement and the rotary table (**photo 20**). Thus, when I then parted off the second slice, the centre part fell away and left the correctly shaped hole as shown in **photo 21**.

The final stage was to solder it all together and attach to the main boiler tube. This was the first time I experienced the prodigious heat required to bring the boiler barrel up to that dull red glow to enable the solder to flow. It took ages with the biggest flame due to the wide surface area of the tube. My daughter had given me a pair of heat resistant gloves as a gift – something I had never thought about. These were really helpful because when the tube reaches working temperature any bare skin within about eight inches of the surface will be burned by radiation and, even with leather gloves, the leather starts to smoke and then begins to scald the hands inside. I had placed a ring of solder under the steam dome base so that it settled by gravity and self-filled with solder when it finally reached the right temperature.

The completed steam dome (including the top with a very large threaded plug) is shown in **photo 22**.

●To be continued.

Forming the base of the steam dome.

The base parted off from the disc.

The completed steam dome.

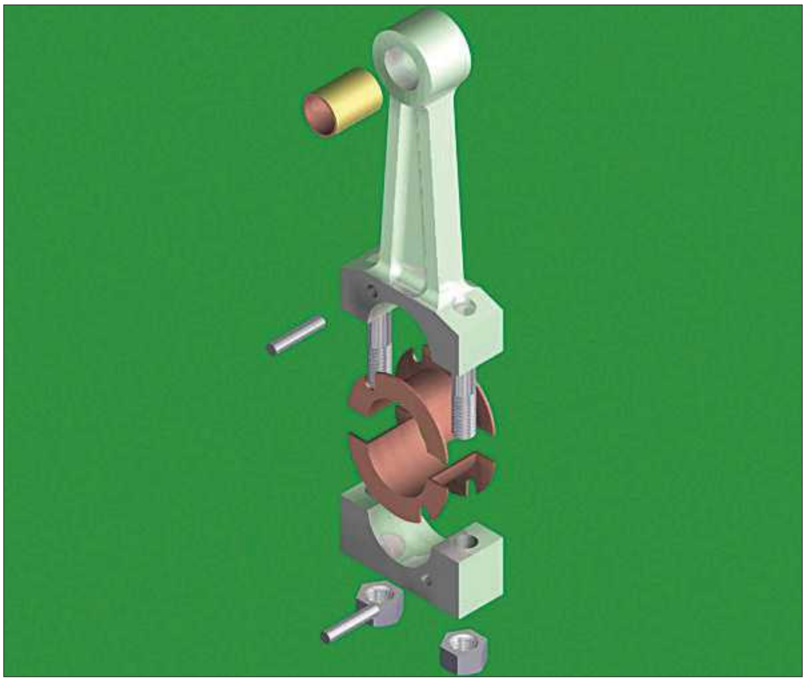
NEXT ISSUE

FOCAS Conrods
Peter Worden describes the connecting rods for his FOCAS internal combustion engine.

Backgear Repair
Noel Shelley finds a way or repairing the broken backgear on his Myford Super 7 lathe.

Brienz RB
John Olsen visits the Brienz Rothorn Bahn.

Boring Attachment
Bob Bramson devises an alternative boring attachment for his Myford Super 7 lathe.



Content may be subject to change.

ON SALE 26 FEBRUARY 2021

2020 The Christmas That Never Was

Terence Holland draws a veil over the recent festivities and looks forward to the next.

The lonely, little engine

Yet more unnecessary work was thrust upon me recently (see *Back to Basics*, M.E.4655, 1st January) due to the lockdown here in Spain (where the *Guardia* carry guns and one replies "guilty yer honour" before they ask the question). 'Er-indoors (she hates being called 'the wife'), on one of those rare days when she was allowed out, bought me another 'train' (**photo 1**). "It's a bit seasonal" you might say but there's no reason why, if you were to make one, the Christmas stuff couldn't be left off and it could be finished off as a 'pull-along' for the grandchildren!

She brought it in and plonked it on the patio table and, as it is with us model engineers, I found it difficult to leave it alone – "it's perfectly good enough as it is, so stop interfering…". A bit of cotton wool on the chimney, the safety valve and under the cylinders helped a bit with realism, but it still lacked that *je ne sais quoi* – I have to note here that 'oven-ready' is not the only one who can come out with fancy, foreign phrases.

She bought me another train.

The Yule log

Minutes later I realised what was needed – split the locomotive from the 'parcels van' and add another wagon. My first thought was to fit wheels to our big, old Yuletide log but that idea didn't go down too well with management and, in any case, it would have been grossly overscale. The boss then came up with an alternative – I could 'mutilate if you have to' another, smaller Yule log that she had. It was given to her by our sister-in-law in England when we left for Spain. And, as doesn't happen very often, it was perfectly proportioned for the job (**photo 2**).

Four wheels on my wagon

All I needed to do was to make a set of wheels but sadly, on inspection, I had no wood in stock of a suitable size. After a thorough search of my 'hoard' I remembered that I had several Moore and Wright tool chests, each with lids that could be

Perfectly proportioned for the job.

...and the damage was done.

stored by sliding into the base. Now I've had these chests for more years than I care to remember and, as yet, have never closed one. So there was the answer and half an hour later the damage was done - there was no stopping me now (**photo 3**)! Needs must when the Covid drives...

The goose, sorry caboose

Later I decided that a train is not a train unless it has a guard's van. So more work was acquired! "Why caboose?" I hear you say. Well, not because it rhymes with goose but because it seems to me to conjure up certain Americana – such as the thought of giant logs being dragged out of the forest by strange little engines with oddly placed cylinders.

Another deep sweep of my collection of raw materials came up with an old potato seed tray – perfect for the job – well it was until I tried taking out the staples! With the dismantled seed tray, a few bits of old floorboard for the base, a set of 'Moore and Wright wheels' along with a pair of simple wooden beams, the kit of parts was ready. I knew that the old seed tray would come in handy someday. A few wood screws and a quick paint job was all that was now required and bingo – instant caboose – well almost (**photo 4**)!

Let there be photons

To finish off the job, a dusting of snow can be applied from a spray can and, of course, cotton wool added to the relevant parts, including the guard's chimney. But the icing on the cake is the fairy lighting. I added separate sets to the locomotive and the van – each powered by three AA batteries. Modern LED lights, cheap as chips and multi coloured, are energy efficient and available in an endless variety of shapes and sizes – the two sets I bought cost me less than a fiver, each with 50 lights. These are inserted through small holes next to the battery boxes, which are screwed to the rear ends of the locomotive and van. The battery box looks part of the cab structure if given a lick of white paint. A click of the switches and the locomotive and van light up from the inside (**photo 5**).

Gone are those 'good old days' when the only Christmas

Certain American features.

lighting available was achieved by burning candles on a fir tree, 'rustled' from the local woods on a dark and stormy night. I well remember the day when I was deemed old enough to join the lumberjacks on their annual, nocturnal outing – preceded of course by a swift half down the local. I don't think Xmas trees were available for purchase in those hard days just after the war but everyone managed to 'acquire' one! Goodness knows what 'elf and safety would have made of it all!

The locomotive and van light up.

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One of the first presents I bought for my mother after I started work in the late '50s was a set of lights for our tree. Sets then were quite expensive and there were only twelve lights to a string. Each light was an individual bulb of various shapes: Santa Claus, fir tree, snowman etc. And if one bulb packed up (as they invariably did), all the others went out and dad started shouting and screaming. I remember that one of the pre-Xmas jobs was checking that the bulbs were securely screwed into their sockets. It was a 'eureka' moment when they all came on!

You can do it - diy it

It's a bit late now, of course, but plenty of time is available to make something before the next Christmas, which, God willing, plenty of vaccine and a fair wind, will be 'back to normal'.

The difference between a 'model' and a 'toy' such as this lies in the proportions. In general, the toy tends to be a caricature of the real thing. They are generally narrower but I don't mean narrow gauge as there is no track for it to run on! Maybe the 'loading gauge' is the key, i.e. the toy tends to be tall and thin compared with 'normal' proportions. However, the precise dimensions are not important, as long as they present an impressive display, so a few suggestions for size are given in the drawing of the caboose (**fig 1**). It should be easy to apply these generic dimensions to the locomotive and other wagons. This is one occasion when the rules can be broken – so feel free to 'scale' the drawing!

Starting to look like a caboose.

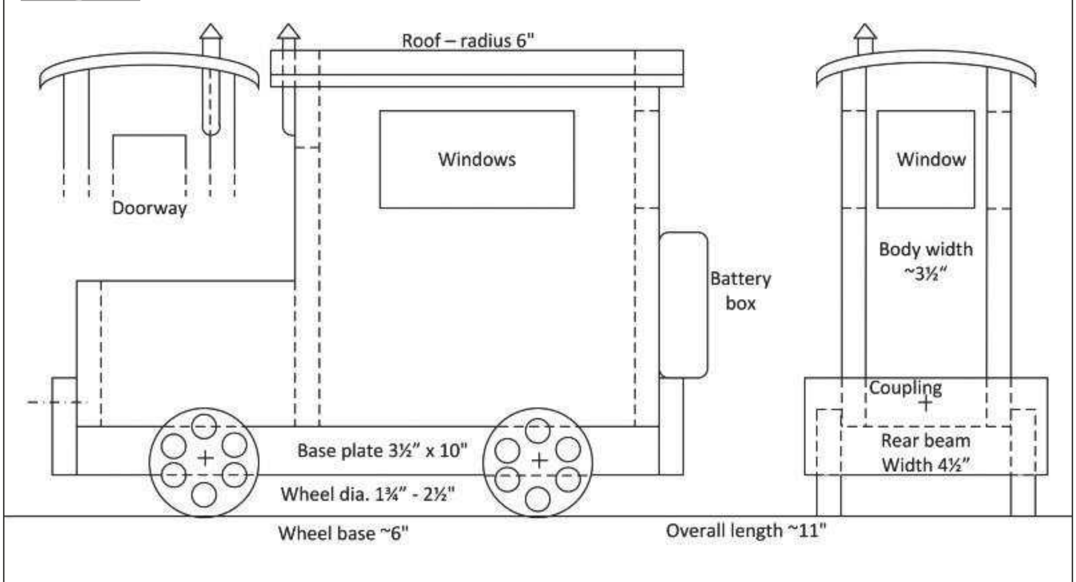
The wheels are easily made using a hole saw. This will cut wood without a centre drill – so the drill can be set back so that it makes a shallow centre in the blank. Drill this 5mm diameter for a wood screw, which will act as the axle. If you have a rotary device for the mill, the 'spoke holes' (for want of a better phrase) can be centred and drilled through on one blank and this then used as a pattern for the others. Without a rotary device a pattern will need to be marked out by hand. Once the door and window panels are fitted to the base plate it starts to look like a caboose (**photo 6**).

The battery box for the lights is easily fitted; just drill a couple of 4mm holes in the back of the holder and screw it with small wood screws to the rear of the vehicle and next to the quarter inch diameter hole for the string of lights. Poke the lights through, fit some batteries and the job is complete. If the lights seem a bit bright just replace one of the batteries with a shorting wire or metal rod, which will reduce the voltage from 4.5 to 3 volts. This will have the added advantage of making the LEDs, and maybe the batteries, last longer.

As I said before, this doesn't have to be a Christmas ornament. Just leave out the fancy balls, Xmas tree etc., don't dust it with the snow spray, make sure that the wheels are free on their woodscrew axles and it becomes a child's toy train; fit to grace any nursery.

Fig 1

GA, with a few suggestions for size.



A mantelpiece-sized ornament.

A happy little train

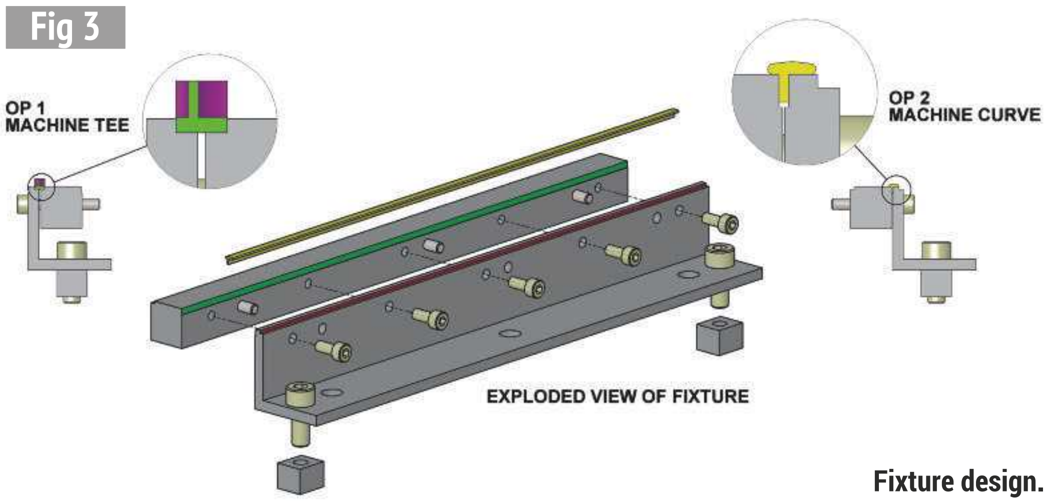
After all that graft, you'll end up with a nice, mantlepiece-sized Christmas ornament just under four feet long and fit for a palace (**photo 7**), plus a sizable number of brownie points from the boss! As I have said in the past, it is a token of gratitude for all those long hours she lets you spend down that cold, draughty shed!

ME

Tee Making and Associated Issues PART 2

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

Continued from p.195
M.E. 4657, 29 January 2021



Fixture design.

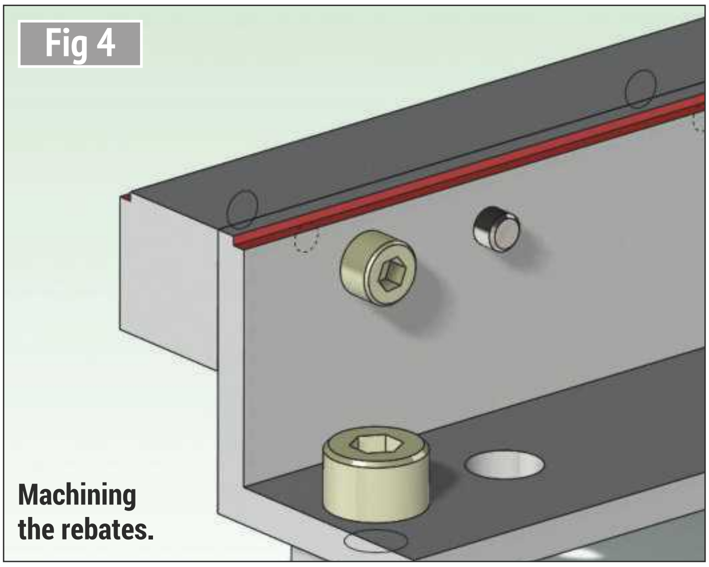
Time to move on – back to the manufacture of the fixture for the Tee section.

I clamped the length of 1½ inch steel angle for the fixture in the machine vice and co-ordinate drilled all the screw holes and undersize dowel holes (accurately positioned, now!). The length of ¾ inch square bar was given similar treatment, making sure the bar was truly horizontal in the vice so the M5 tapped holes were true.

Both pieces were assembled and reamed together for the locating 5mm dowel holes.

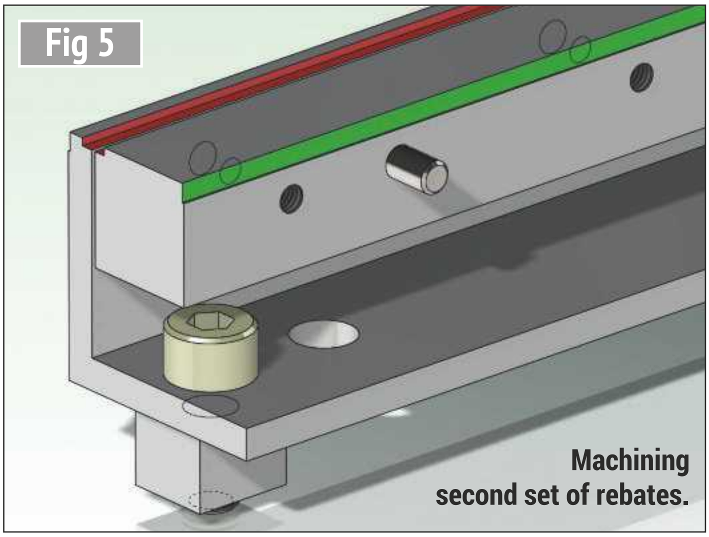
The assembly was then mounted directly to the machine table with three tee nuts and the face of the angle clocked up. With an eye to future use, I had also included a couple of tenons, one at each end, to fit accurately in the Tee slot for instant re-alignment in the future (**fig 3**).

With the fixture now in position, and the clamping screws tight, I took a light skim off the entire top surface of the fixture to level it up. Then I machined rebates each side (the red surfaces – **fig 4**) for the bare square bar material to the maximum depth I could get away with so as to maximise the gripping area of the fixture on the workpiece. The width of the slot was such that when the ¾ inch square bar was mounted on the *other* face of the angle (as shown in **fig 5**), the slot width would be about 0.2mm less than the smallest AF size of the square bar I had in stock, i.e. it would actually clamp any of my 3⁄16 inch square bar for conversion into Tee section.



Machining the rebates.

The fixture was then reassembled to machine the other gripping surfaces for the machined web (fig 5). If I had wanted just a simple Tee section, then this part of the business would not have been necessary (unless I



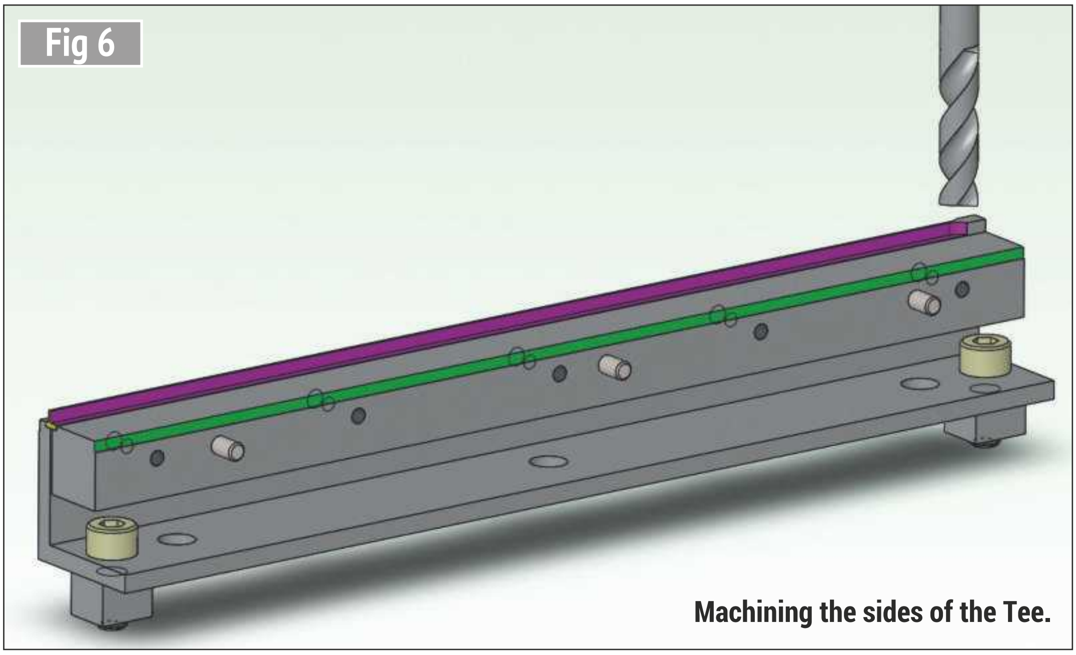
Machining second set of rebates.

had wished to thin down the thickness of the top of the Tee) but I needed to reproduce the curved section as per the prototype. I didn't fancy my chances of filing it and getting a couple of metres of the stuff to look more or less the same! So, the green rebates were now machined for gripping the newly-machined leg of the Tee.

The fixture was now ready for the first stage of component machining.

First of all, I annealed all the lengths of 3⁄16 inch square bar I was going to machine; just a dull red heat and slow cooling. I imagine they'd have gone banana-shaped during machining if I hadn't. A length of annealed 3⁄16 inch square steel was clamped up in the fixture (in the 'red' area in fig 5) and tapped down.

Ah, yes – another aside. Previously, when bopping stuff down on to parallels in the vice (or a fixture), I belaboured the workpiece with the copper side of my mallet. Despite the striking face being copper, I sometimes still managed to distort the component with over-enthusiastic bopping, usually trying to get a component to trap both parallels in the machine vice. I was watching a chap in the toolroom at work some while ago and he used a normal hammer but he interposed a piece of hardened, ground tool steel in a form similar to a somewhat overgrown Tee nut between hammer and job. The Tee bit protected his fingers. Since then, I've always done the same, and found it a much better method, as the tool steel can be aligned level on the workpiece, spreading the load and avoiding damage.



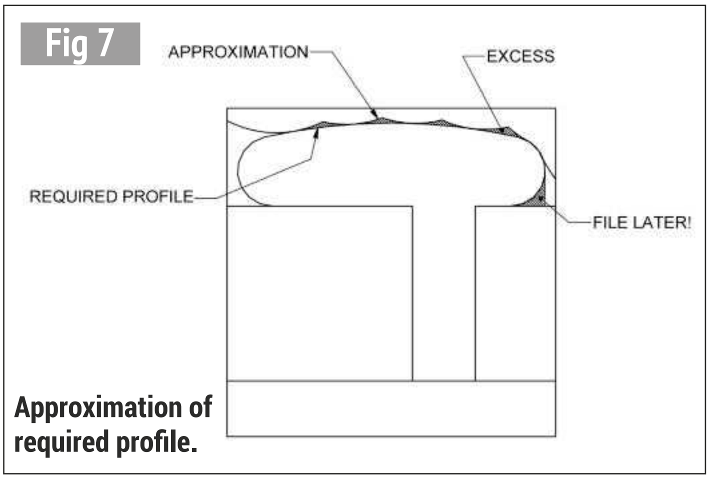
Machining the sides of the Tee.

Back to the Tee section...

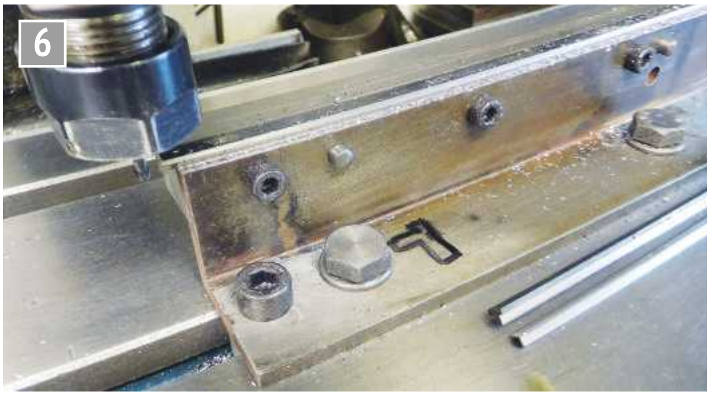
After taking a skim off the top face of the raw bar, each side of the job was machined to full depth at one pass using a 12mm carbide cutter (**fig 6**). I forgot to take a photograph and I've run out of bar now... It worked beautifully and I was delighted it had worked so well.

The next stage was susceptible of at least two methods of machining; I could make a form cutter or I could use a ball-nose slot drill and form the radius in a series of cuts as might be done on a CNC machine, for example. If I'd been using brass Tee section, I may well have gone the form tool way but there was quite a bit of length involved and I doubted my toolmaking skills would be up to making a form tool that would last on steel and give a good surface finish.

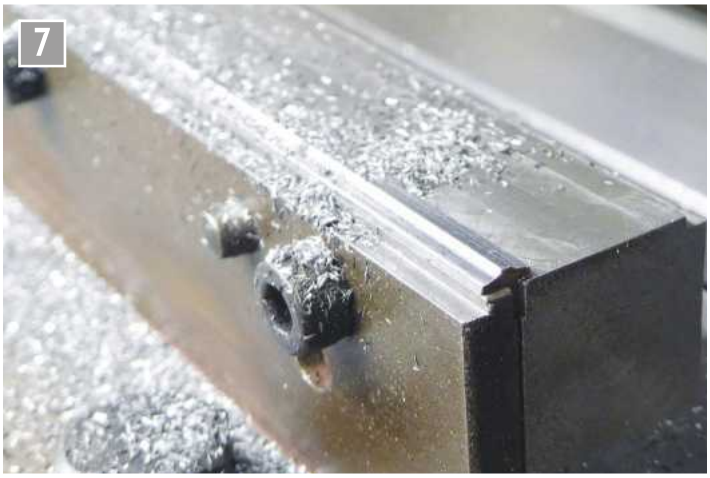
I went for the 'series of cuts' method which, in the absence of CNC, I have sometimes adopted to plunge cut around a complex profile, using X-Y coordinates kindly generated by my little friend in the PC – see later.



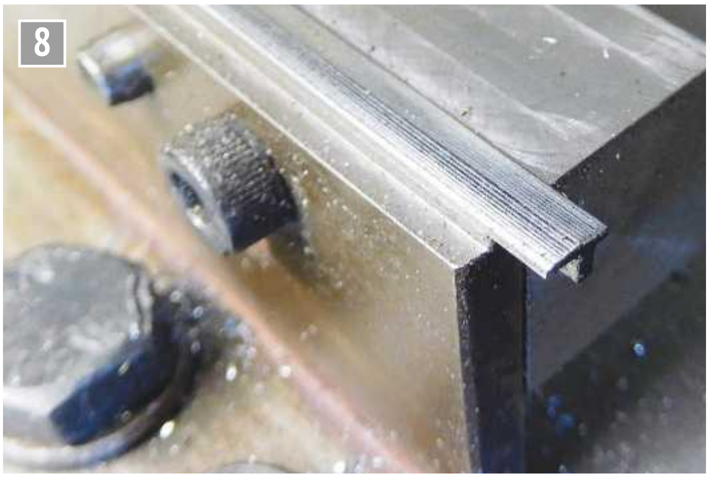
Approximation of required profile.



First cuts on a new component. One finished and one plain tee are also shown. Note also the sketch of the profile on the fixture in black felt-tip pen to remind me which way round the job fits!

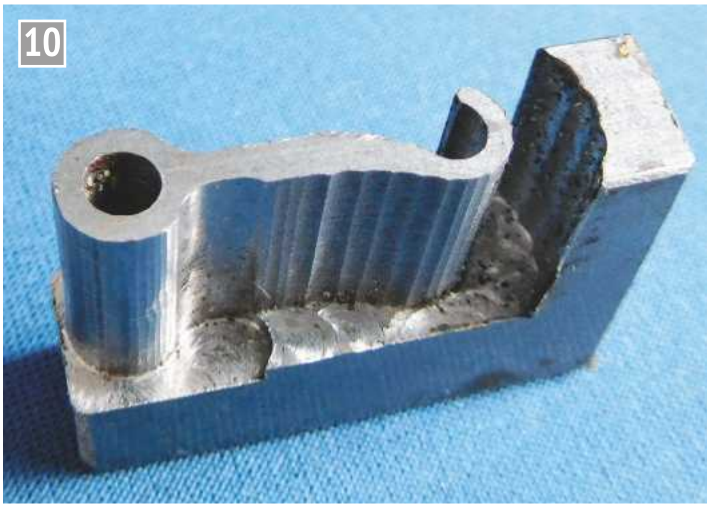


Part-way through generating the profile – still 11 more passes to do!



Finished result – 3mm cutter, 0.25mm steps.

3mm cutter, 0.5mm steps.



Spring hanger.

Shown below (**fig 7**) is the general idea; the nice smooth profile wanted is obvious but the operation achieves a number of grooves as shown by the jaggedy profile (**photos 6** and **7**). I've exaggerated the distance between steps in order to illustrate the effect.

By reducing the distance between steps to about 0.25mm, and using a 3mm ball-nosed cutter, I found that the maximum deviation from the true profile was 5 microns. Even the peaks of the exaggerated jaggedy edges above are only 0.07mm proud of the true profile (that's less than 3 thou for the dinosaurs). The actual result I obtained with a 3mm cutter and 0.25mm increments is shown in **photo 8**.

I had worked out my coordinates equally from the centre of the curve so that I could set the Z depth of cut and machine two passes at the same depth, one from each side so as to (eventually) meet up in the middle. Just for a change I machined one where I started in the middle and worked outwards... one has to get one's excitement where one can in a job like this. It didn't seem to make a lot of difference to the finish. As an experiment to reduce machining time I increased the steps to 0.5mm and it rather resembled a ploughed field - or a corrugated roof for a 2mm gauge railway vehicle - (**photo 9**) so I went over it again.

Ball-nosed cutters removing tiny amounts of material are generally sub-optimal as cutting tools, as the actual cutting speed is very low – zero at the point – so although larger cutters would have given a better theoretical result, in practice I went for 3mm because the cutting geometry at the point was likely to be better and there would be less rubbing. Or, more to the point, because the only new cutter I had was that size. I did try a slightly-worn 6mm one but the surface finish I got was poor and I couldn't get as far round the profile with it before it hit the fixture. In any event, the best speed I could manage was 1600rpm, so I would have been glad of a speed-increaser to perhaps ten times that!

It took a while to traverse all the cuts – each foot length of bar took about an hour; I wished I'd had a power feed! As each cut took about four minutes at the feed rate I was using, I found I could let my mind wander whilst twiddling the handle. In fact, I scribbled down quite a few notes about this article with my free hand during machining! However, it is important that you wake up and concentrate properly when applying the next cut to ensure you've got the readings correct before proceeding. At least with long bits like these, which need to be cut to length later, there's a chance to stop and get it right without doing too much damage! In the end I was very happy with the result, and a few minutes of attention with a needle file and some emery paper soon brought things into line with what I wanted. I couldn't really get to the complete edge corner radii to machine them but a deburring tool and a file quickly produced an acceptable approximation.

Returning to the theme of using X-Y (or in this case Z-Y) coordinates, it's worth mentioning that the incrementation of each step will depend on the geometry of the part. As you profile around a circle, for instance, when you get to the 45° point around it, you need to change from incrementing (say) Y to incrementing Z. This is because as you get a fair way round the circle, a small

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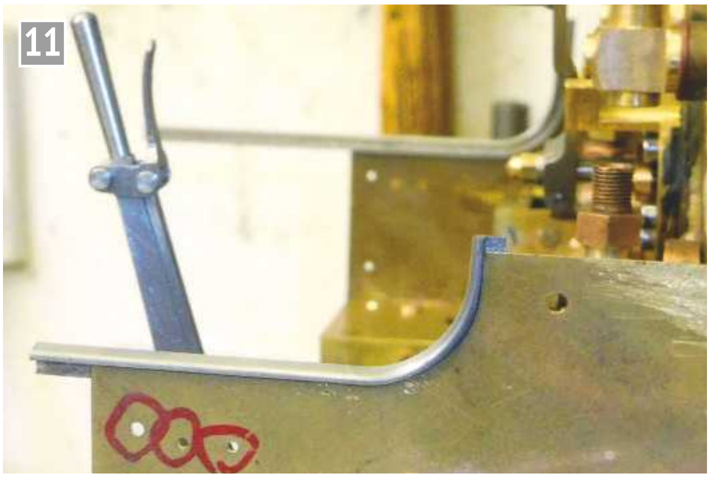
Table 1. Z-Y coordinates for the Tee section (extract)	
Z	Y
1.19	0.00
1.19	-0.25
1.18	-0.50
1.16	-0.75
1.14	-1.00
1.11	-1.25
1.07	-1.50
1.03	-1.75
0.98	-2.00
0.92	-2.25
0.83	-2.50
0.70	-2.75
0.52	-3.00
0.26	-3.25
0.00	-3.43
-0.25	-3.55
-0.50	-3.64
-0.75	-3.68
-1.00	-3.70

increase in Y will give a huge increase in Z (see **table 1**).

The first row of coordinates (1.19, 0.00) will position the cutter in the middle of the curved profile and at the correct depth. As the Y value is incremented by 0.25mm, the Z value doesn't change very much as the curve is still very flat here. However, when the profile really starts to dive round the outside corner (last three rows), I have chosen to increment the *Z* value by 0.25mm, and it is now the Y value that changes only a little.

Profiling using X-Y coordinates is something I tried a while ago when I needed to make some spring hangers. I used the CAD to work out all the coordinates I needed to plunge cut around a blank, slightly deeper than the finished part so that I ended up with a shaped part that I could simply saw off to thickness. The one in **photo 10** is the early (scrap) attempt, where I made a blunder, but it shows the principle. It also established that I needed to make the increments a bit smaller!



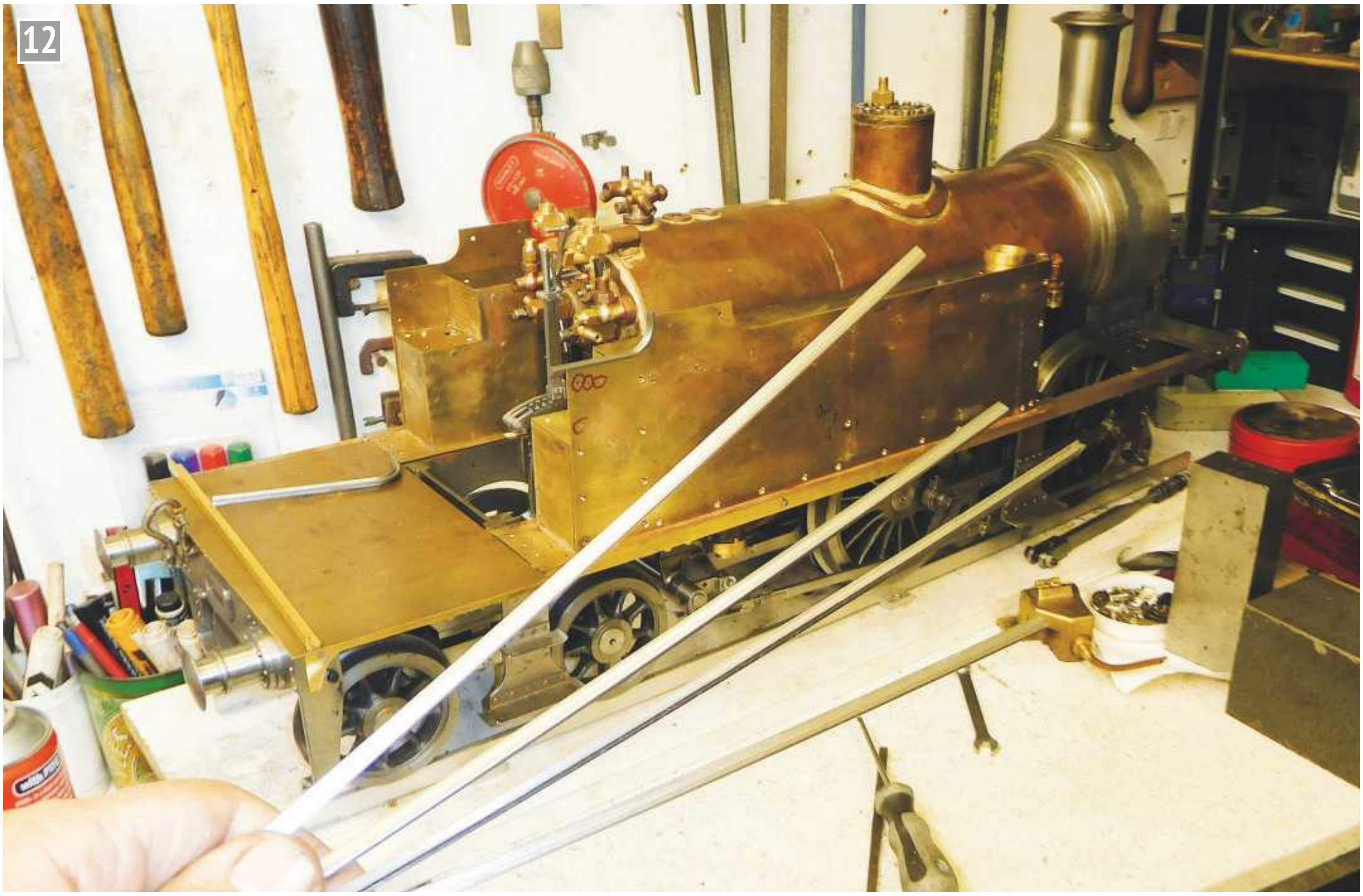
Tried in place.

Back to the steel Tee sections again. I found that the finished section bent quite readily (another reason for annealing) around the cab profile (**photo 11**). Next step is to solder it in place, aided by a few strategically-placed tiny rivets.

The fixture was then pressed into service to turn some more square bar – 4mm brass this time – into some angle for the cab roof. I had to move the ¾ inch square bar round to present another face and take off another skim to suit the new material. I was very happy with the result (**photo 12**).

I will wait until I've made the cab before I start doing any fitting of the Tee section – so as I haven't done that yet, there are no photographs of it. Watch this space!

ME



All machined – and awaiting bending and fitting.

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

Continued from p216
M.E. 4657, 29 January 2021

The Middleton 'Monitor' Type Engine

PART 3

Steam chest

Having a large piece of plate ¾ inch thick, I managed to saw and mill it down to size 2 3/16 x 1 3/8 x 5/8 inches (**photo 24**). Use what you have! Then place it in a four-jaw chuck, end on, centre it and get it running true. Centre and drill tapping size as in the drawing (I used 1/8 inch BSP). Next drill and ream 1/8 inch, by 1 inch plus deep. Tap it out whilst it is still in the lathe chuck using the tail stock to hold the tap square then turning the chuck by hand to tap out (**photo 25**).

Next, place it in the miller and mill out the centre all the way through to 1¼ x ¾ inch as in the drawing. Do not worry about the square corners.

Steam chest cover

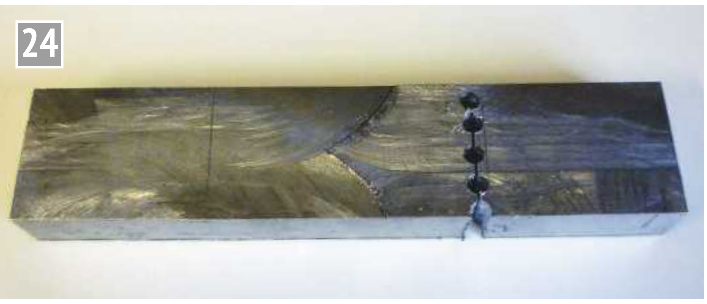
Using ½ inch thick aluminium, machine it down to size 2 3/16 x 1 3/8 inches. Then place it in a four-jaw chuck getting everything square, central and running true, nipping it on the edge (**photo 26**). Turn the boss down to 5/8 inch diameter x 5/16 inch long, centre, drill 5/32 inch through and then drill tapping size (I used 1/8 inch BSP) x 5/16 inch deep.

Repeat (two required).

Then place each in a three-jaw chuck and face off to approximately 1/8 inch thick.

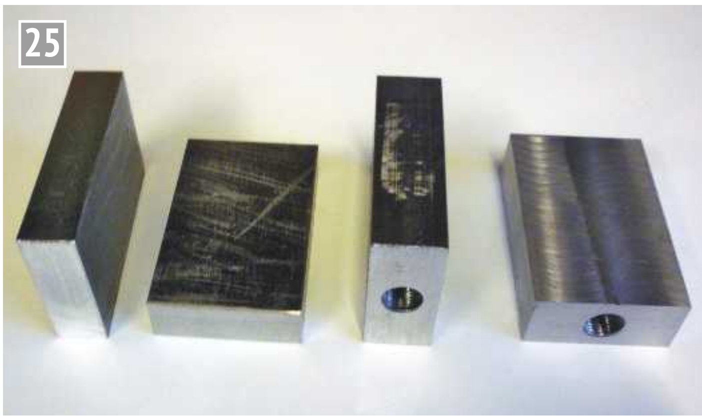
Next, mark out the eight clamping holes and drill out

24



Preparing the blank for the steam chest.

25



Drilling and tapping for the valve rod gland.

>>

6BA clearance. Using this as a jig, clamp it onto the steam chest, spot though and drill out (**photo 27**). Remember the steam chest is now handed.

MARK WHICH FACE YOU DRILLED FROM and WHICH WAY ROUND.

Clamp the cover onto the cylinder and spot through one hole. Drill and tap 6BA (mark the cylinder). Bolt the cover onto the cylinder and check all is lined up and the right way round. When all is okay drill and tap the other seven holes 6BA (**photo 28**).

Do not be afraid to open any hole out slightly if they do not line up - it is only a distance piece.

Slide valve

Part off a piece of brass 9/16 inch square in the lathe, or mill a piece down to 21/32 x 9/16 x 9/16 inch. Whilst it is square and easy to nip in the vice, mill out the 3/8 x 3/8 x 1/16 inch cavity. Do not worry about the round edges. Next place it in the steam chest with a flat piece of metal in the base where the cylinder will fit and pack the sides equally (**photo 29**). Clamp it down on the top and drill through the 1/8 inch hole in the steam chest and straight through the slide valve (make sure the slide valve is the right way round - the 21/32 inch dimension is top to bottom). Mark each valve to its own steam chest. Take each back to the miller and mill out a 1/8 inch slot across the hole and 1/8 inch deeper than the hole (**photo 30**).

With a 1/8 inch thick bit of brass make a nut with a round bottom, clamp it into the valve and spot through with a 1/8 inch drill, drill and tap the nut 5BA. Clamp the nut in the valve with a bolt and mill down the sides flush to the sides and then approximately 0.150 inch from the base face.

Slide valve rod

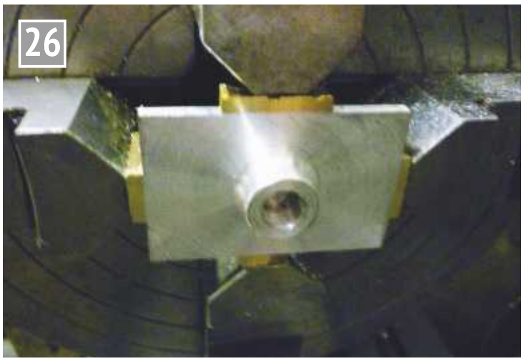
This is made out of 1/8 inch stainless steel rod 2 7/8 inch long, threaded down to 5BA 3/8 inch at one end and 1/2 inch at the other end (to be adjusted on the job).

Slide valve gland

This is made out of 7/16 inch hexagon brass bar, turned down to 1/8 inch BSP, or whatever you have tapped your steam chest. Turn it down to tapping size 3/8 inch long and thread then, leaving a 1/8 inch flange on the hexagon, plunge in with parting off tool to approximately 5/16 inch diameter. Keep repeating this until you have a length of 3/16 inch, then centre and drill 1/8 inch. Part off at 11/16 inch long. Fasten the steam chest to the cylinder and build up all as a unit complete with 'O' rings in the gland for stability, making sure it all slides well (**photos 31** and **32**).

Steam chest outrigger

Using a rather large plate of aluminium I cut two pieces out by my usual method and then milled them oblong 5/8 x 1/2 x 4 1/4 inches long (**photo 33**). Whilst it is in this oblong state mill out the 1/8 inch slot 1 1/4 inches then mill down to 1/4 inch thick by 2 3/16 inch long. Mark out the 1/4 inch hole and the two 5BA



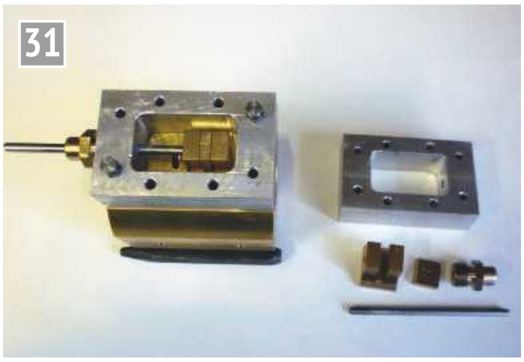
Turning the boss on the steam chest cover.

Spotting the fixing holes through the steam chest.

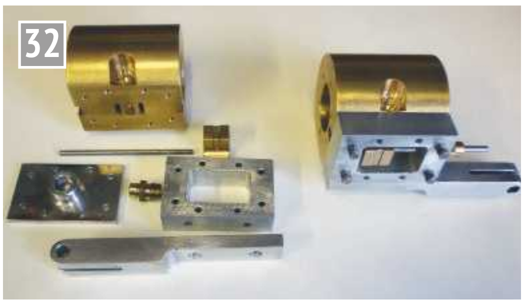
Spotting the fixing holes through to the cylinder.

Preparing to drill through the slide valve.

Finished slide valves.



Built up steam chest and cylinder.



Cylinder and steam chest parts.

Cutting strips for the steam chest outriggers.

clearance holes, centre, drill and ream (**photos 34** and **35**).

Fasten onto the steam chest.

Valve rocker

This is made out of ⅛ inch material. Mark out and cut as accurately as possible according to the drawing. Clamp this first one onto another piece of material, mark it out and cut the other one (**photo 36**), then mark the hole centres using a drill just under ⅛ inch and drill a pilot hole through. Drill and ream the ¼ inch hole and mill the ⅛ inch slot (**photo 37**).

Valve rod end

Take a ⅜ inch square piece of brass 1¼ inches long, place it in the miller and mill out a ⅛ inch slot x ¾ inch deep (**photo 38**). I find it easier to put my small four-jaw chuck into my three-jaw chuck then, using packing pieces so as not to damage it, get it running true. Centre the valve rod end and turn it down to 5⁄16 inch diameter x ⅜ inch long. Centre, drill and tap 5BA then mark it out for the ⅛ inch reamed hole (**photo 39**). (I only drilled one flange and drilled and tapped the other flange 5BA on mine - but DO YOUR OWN THING).

Valve rocker pin

Machine to the drawing but file two flats on the big flange. When you have got so far, deburr and polish all components and assemble them onto the cylinder as shown in **photo 40**. Make sure everything slides smoothly. If it is tight you may need to take a small amount off the bottom of the slide valve.

Remember you only need to uncover one porting slot and cover the other one, both ways.

Do not move on until you are happy.

Rocker shaft bearings

There are four of these.

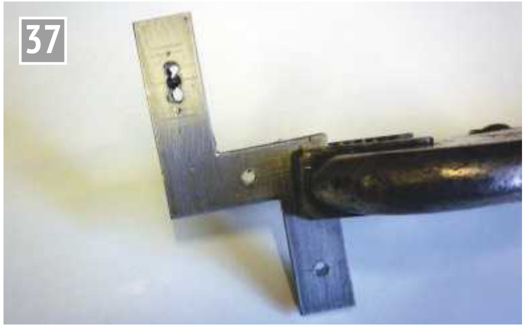
Machine two pieces of aluminium 1⅝ x 1¼ x ½ inch and two at 1⅝ x 1¼ x ⅝ inch (**photo 41**). Drill and ream a ⅝ inch hole ¾ inch up from the base - all four bearing centres from the base line must be as accurate as possible.

Next, mill the sides in to leave 15⁄16 inch in the centre. Drill the holding down bolts 5BA clearance at 1¼ inch centres. Turn down the four brass bushes to be a good, tight fit in the ⅝ inch hole and press them in. Round off the tops of the bearings, deburr and polish, or leave for painting (**photo 42**). Next, part off two pieces of ⅜ inch diameter bar 5¾ inches long with a good chamfer on the ends for the rocker shafts.

Shaping an outrigger.

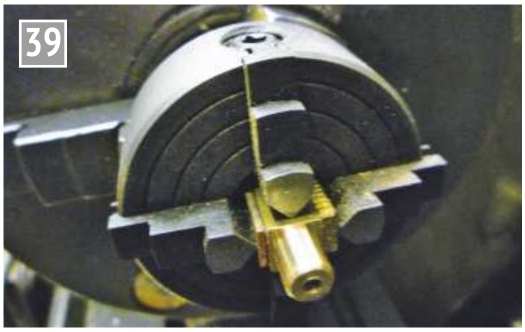
Completed outrigger.

Marking out the second rocker from the first.

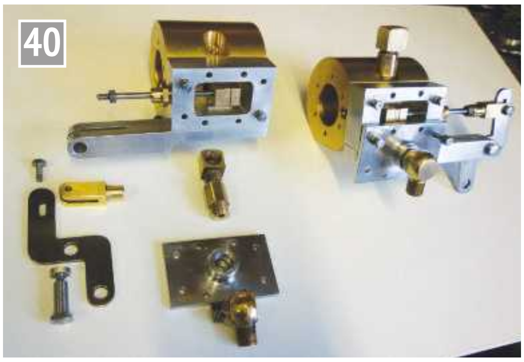


Almost complete rocker.

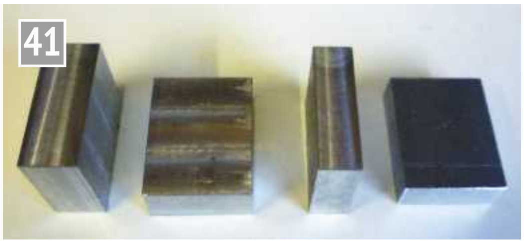
Slots formed in valve rod ends.



Turning the boss on the valve rod end.



A pair of complete cylinder assemblies.



Blanks for the rocker shaft bearings.

Rocker shaft bearings.

●To be continued.

The Barclay Well Tanks of the Great War

PART 71

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

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

Continued from p.161
M.E. 4656, 15 January 2021

Springing

The springing arrangements are similar to those on the 0-4-0 except that an extra pair of springs is required for the middle wheel set (**fig 232,** opposite). As mentioned earlier, this extra set of springs, along with a beefed-up transverse spring and somewhat lighter superstructure, means that underhung springs, as fitted to the 0-4-0, will not be needed and neither will a modified figure – just don't tap the 2BA holes for the underhung springs shown in fig 36 (M.E.4523, December 2015).

Centre spring pillar

The centre pillar is shown in fig 232, which also shows the guide blocks fitted to the 0-6-0s, which, for some unknown reason, were not fitted to the 0-4-0s. These could be left off, as they don't seem to fulfil any particular function.

Transverse spring

Figure 232 also details the modified transverse spring originally shown in fig 26 (M.E.4521, November 2015).

Clearance between the transverse spring and the ashpan is similar to the 0-4-0 and therefore the design of the spring is more or less the same. See fig 27 (M.E.4521, November 2015). The main difference is that the spring hanger is shorter, the spring contains two extra leaves and it is fitted to the rear stretcher, rather than on the back of a well tank plate.

Note that short lengths of ⅜ x ⅜ inch mild steel are bolted to each side of the axlebox openings using 4mm countersunk head screws. These provide the horns where cross stays are not available. The thickness of the frames eliminates the need for cross pieces forming tops to the horns, as would be used in conventional fabricated horns. With removal of the underhung springs no extra means of axlebox location is necessary – my 0-4-0 ran for some 30 years without underhung springs.

Centre wheel set.

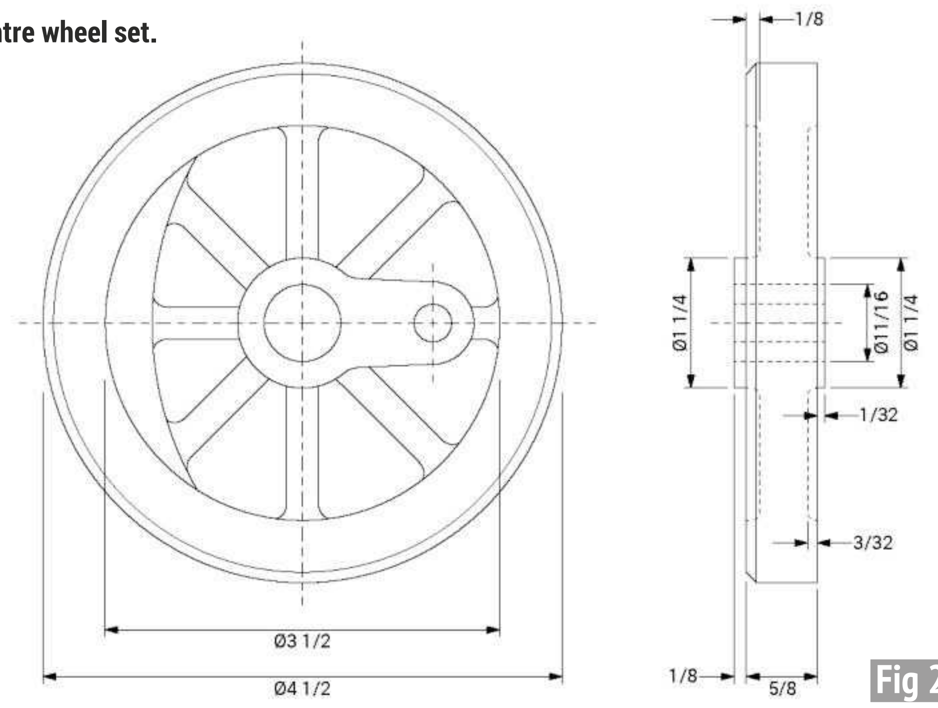


Fig 233

Wheels

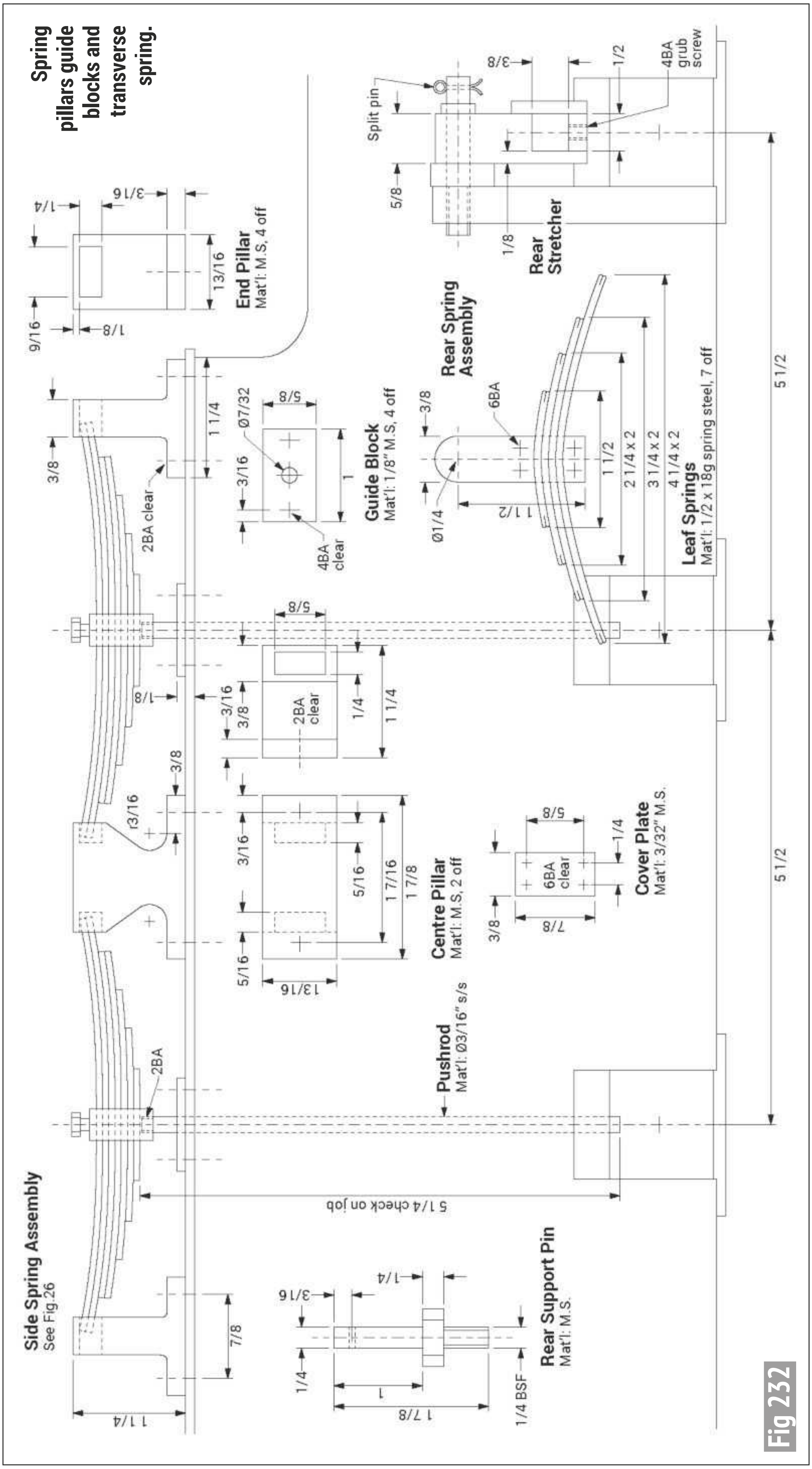
The wheels are as detailed in fig 30 (M.E.4523, December 2015) and the same procedure should be used for fabricating the four wheels that have flanges as well as the centre pair. The centre, flangeless wheel set is shown in **fig 233** (left). Using flangeless wheels on the centre wheel set was fairly common practice on six-coupled, narrow gauge engines and enabled the engines to work around tighter curves than would otherwise be the case. Note, however, that the tread depth is ⅝ inch in fig 233 as opposed to ½ inch for the wheels with flanges.

Axles

The axles are detailed in fig 35 (M.E. 4523, December 2015).

Axleboxes

The bearings are the same as those shown in figs 36 and 37 (M.E.4523 and M.E.4525, December 2015 and January 2016) but without the 2BA



Spring pillars guide blocks and transverse spring.

tapped holes for fitting the underhung springs fitted to the 0-4-0.

On my engine I intend to save some money by using cast iron boxes – a suitable stick of gunmetal costs almost 200 notes! It is quite acceptable for mild steel axles to run in cast iron and with the oil boxes proposed there should be plenty of lubrication and no problems.

The cast iron brackets I have came from an old olive press and will provide boxes that are ⅞ inch deep – I will screw on 3⁄32 inch thick plates to form the part that contacts the wheel. The bearings will not be so deep as the specified 1¼ inch depth shown in the original figures but with six bearings and not four the bearing surfaces will be slightly increased. However, for a Rolls-Royce version the cast iron blocks could be bored out to take phosphor bronze bushes – and these could be made the full 1¼ inch length. This would be similar to full-sized practice, which utilised cast iron boxes with gunmetal bearings. If bushes are fitted they should not be pressed in, as this is likely to fracture the cast iron block. Instead fit them in with Loctite or similar and lock them in place with 2BA grub screws, threaded partially into the bearing.

Brake gear

As with *Airservice Constructional Corps No.1*, only one pair of blocks is required because the front set of wheels is the only set that is provided with brakes. Figures 43 and 44 (M.E.4531, April 2016) provide the details. The position of the pillars for attaching the brake hangers and blocks was shown in fig 222 (M.E.4656, 15th January).

Details of the pull rod and operating gear are the same as that on *ACC No.1*, except that the rod needs to be longer and the length is best determined 'on the job'. The actuating mechanism is the same as that for *ACC No.1* (M.E.4634, figures 191 to 193, March 2020).

●To be continued.

CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.

There are thousands of tales in my portfolio. This is not one of them. **Sheffield Society of Model & Experimental Engineers** held a Fun Run under Covid Tier 3 rules so I took my *Bolide* to test it on a real track. This juggernaut has been built in accordance with the 7¼ Inch Gauge Society recommendations but although tested on a flat piece of track in my garage, the acid test would be on a real track with inclines and curves. I pushed it round the circuit to ensure nothing fouled the track and the front wheels derailed a couple of times. Sitting on it and applying power initiated movement but it almost immediately derailed. Investigation showed it was wide to gauge at the front and VERY wide at the rear. Valuable information! I'm looking forward to the next opportunity.

Deborah, my 5 inch gauge electric locomotive, has been given an upgrade. Instead of the original motor I have fitted a motorbike starter motor (£14). The first test, with normal test bench clip leads and a 14 volt DC supply, revealed only 7 volts on load and by the motor terminals was down to 0.6 volts. No movement; it just hummed at me, whilst I hummed and 'aargh'-ed as well. Rebuilt with heavy duty cables, it almost leapt off the bench with the torque reaction. In Test 2 the on-load voltage exceeded 10 at the motor terminals, whilst running at 8 amps. It kept throwing off the chain but better alignment of sprockets cured that. Unfortunately, the chain contained two links from a different assembly, forming a stiff section and it kept stopping, so I have ordered a new one. I built a millivolt meter using a £7 kit bought online (1 mV is 1/1000 of a volt) and it will measure down to 1 mV. I know it isn't a laboratory instrument, nor have I calibrated it except by comparison with a digital test meter. It is therefore, only used as a comparison. However, I found that in Test 1, losses amounted to tens of millivolts PER CONNECTOR! Test 2 revealed that the entire

Marcus Cordran's trolley built at Elvington.

Derailed tank wagons at Sheffield on 11 November.

control box losses were 14 mV. Bingo! The control box is very simple, using a 555 timer and a MOSFET rated at 110 amps.

To conclude my meanderings through the byways of engineering, I repaired a cheap Chinese panel meter. It wasn't economically worth it; I spent over an hour on it and a replacement would only be about £5. It was also reminiscent of mending a Rolex watch whilst wearing boxing gloves. However, the feeling of satisfaction on rescuing something from oblivion is immeasurable.

In this issue: Gin - 'Just like Mother used to drink', a flightless autogyro, non-castings, cranes, a nomogram, special tape and prostate cancer tests.

Before we dive in, I must apologise for the dearth of club pictures in this episode. In order to avoid having acres of text, rivetting though it may be, I have raided the archives at Theasby Publications, beginning with a handy little trolley built by Marcus Cordran, where he is helping to restore a Blackburn Buccaneer. Various parts are detachable so it will fit in a car. The aircraft ID is XN979 and it is now at Aeroventure, Doncaster (**photo 1**). Here is another view of the Sheffield derailment on 11 November. Observe the interlocked buffers and marks on the wheel of the left hand tanker; it has clearly been dragged through the ballast for some distance (**photo 2**). The official report blames several broken rail fastenings.

CoSME Link, winter, from **City of Oxford Society of Model Engineers**, has a picture of *Welsh Pony* adorning the cover. Not the ungulate quadruped, common to the west of the UK, but an 0-4-0 steam locomotive of the Porthmadog variety. Editor, Joy Brown reflects on the past year, wishes everyone a safe Christmas and mentions an article on the Oxford Artisan Distillery. A present for me was a bottle of *Mary Jane,* an artisan beer (honest, M'Lud!) from the Ilkley Brewery. Need I elaborate further on its name? Those born within the sight of harebells will know. (Yorkshire's Official Flower, according to Plantlife.) Where was I? Oh yes, the Society! A full internet service is offered, which is manifold. The society website (below) is complemented by a Members' Area, also accessible through the said website. A 'public' Facebook page similarly offers an attached, Members' Only page. *Tandem* (that's your actual Latin), a weekly (-ish) e-mail list to members handles immediate matters and contains the digital *link* when required. David Price writes on the Teesdale railway, its history and decline. Ron Head, on filing buttons, is followed by Tony Pearsall on the Oxford Artisan Distillery. They have some steam-related items on display but the copper boiler is new, made at the South Devon Railway (**photo 3**). Richard Brown made some substantial labels for a cemetery, whilst Grahame Toplis and party went to George Borrow's Wild Wales.
W. www.cosme.org.uk


3

Oxford gin still from CoSME Link. (Photo courtesy of Tony Pearsall.)

Bristol Society of Model & Experimental Engineers sends the *Bristol Model Engineer,* winter edition, in which editor, Richard Lunn gave a fact that I had not realised; if valve events are set when cold, they change as the boiler warms up and expands, lengthways and in girth. Alan Church decided on a change from making steam locomotives to building a r/c boat. (I see the Royal Navy is trialling a rather larger one – Geoff.) Now finished, he returned to 'Plan A'. Trevor Chambers describes making a wooden propeller and found the *Simple Guide to Propeller Making,* by Ken Fern. Trevor also tracked down details of the correct design for his type of machine. (I remember that in the 1950s a neighbour built an autogyro, I think from a kit. This aroused much local interest but I was only a kid at the time. I since learned that he spent many hours being towed at speed along the runway of an airfield, fruitlessly in the end, as it resolutely declined to leave *terra firma* – Geoff.) Trevor goes into some detail on this interesting subject. Lynne Leak writes on building her first item of rolling stock and Roger Davis on making a diffuser for a Wren MW54 turbine. Roger also made a r/c milling machine probe, fascinating! More aeronautical interest was provided by Paul Canning, who repaired a seized, one-third scale Pegasus engine.
W. www.bristolmodelengineers.co.uk

PEEMS, November/December, the newsletter from **Pickering Experimental Engineering and Model Society**, reports on their virtual AGM held via Zoom. A suggestion was made that a full Zoom licence be obtained in order to accommodate more members. The secretary, David Proctor, replied by saying the time limit on such free meetings served to concentrate minds on the matter in hand. John Heeley had a new model, a development of the Bentley BR2 radial aero engine but having nine cylinders. No drawings were made for this 1/5 scale item and John worked directly 'in the metal'. See the Bentley BR2 on the Vintage Aviator website. Mike Sayers spoke on machining 'castings' without a foundry, using a component from his model 3 litre Bentley engine. It incorporates the drive for a water pump, two magnetos and the camshaft, driving shafts on three axes and is machined from solid. Mike's article occupies 13 pages and is heavily illustrated. Fine engineering indeed! Ted Fletcher fixed a faulty angle grinder motor, in a process which would be applicable to any small brushed motor. Maybe something to 'cut out and keep'?

In *The Centurion Smokebox* from **Centurion Society of Model Engineers,** chairman, Leon Kamffer referred to 2020 as the most challenging year

John Pickering's Tich from Steam Chest. (Photo courtesy of John Pickering.)

due to Covid restrictions. However, an event on 17 December was planned, to include a sheep on a spit, so one hopes that the attendees do it justice. I like the 'inspirational poster' at the end, which claims that a man will always do what he promises, so there is no need to remind him every six months...
W. www.centuriontrains.com

Maritzburg Matters, December, from **Pietermaritzburg Model Engineering Society**, has an item on *Rocket* replicas, of which there are now many worldwide. The same piece also claims, interestingly, that the word 'tram' is derived from the Welsh dialect word, *dram*.
W. www.pmes.co.za

Durban Society of Model Engineers' *Workbench*, the newsletter for December/ January says that Editor, Errol Koch admits there is little to report but one positive achievement is Neal Roberts' Gauge 1 spirit-fired locomotive, from *Building Small Steam Locomotives*, by Peter Jones. Neal points out that much depends on the wicks and the amount of alcohol in the fuel, methylated spirits. Also, a chuck speed nomogram from 'some magazine of years ago', shows ideal turning speeds for various materials. This is definitely one to 'cut out and keep'.
W. www.dsme.co.za

The above three publications were all sent from South Africa by Jon Shaw, to whom I am very grateful, as that country seems rather isolated from the model world.

Steam Chest, January, from the **National 2 ½ inch gauge Society** opens with a good picture of John Pickering's 2½ inch gauge Tich, discussed on page 47 of that periodical (**photo 4**). Des Adeley sent in an article by K. L. Mayer, from *Model Engineer* of August 1935, on an 'experimental' locomotive utilising one large firetube in a flash boiler design. Will Powell writes of his interesting boiler cradle, which enables most 2½ inch gauge locomotives to be held safely upside down for inspection and maintenance without damaging the cab or boiler top fittings. Cedric Norman writes on the Lynton & Barnstaple locomotives, whilst Michael Holden discusses the current L&B decision to build two new locomotives, *Yeo* and *Exe*. The L&BR Trust now owns the name 'Manning Wardle' but these two machines will be new, not replicas of previous engines. A chimney from the original *Yeo* has been donated and a genuine, restored, Manning Wardle pressure gauge is ready to be fitted. An obituary of Peter Shaw by son, Jeremy, mentioned his interest in yachting, organising for several years a 'launch weekend', where boats laid up for the winter were returned to the water for the year's events. One such weekend managed to release 94 boats, a record never to be surpassed. This unprecedented event involved an articulated lorry, three cranes and 300 helpers, sustained by 500 bacon sandwiches cooked on-site. It even featured in the journal *Crane News.*
W. www.n25ga.org

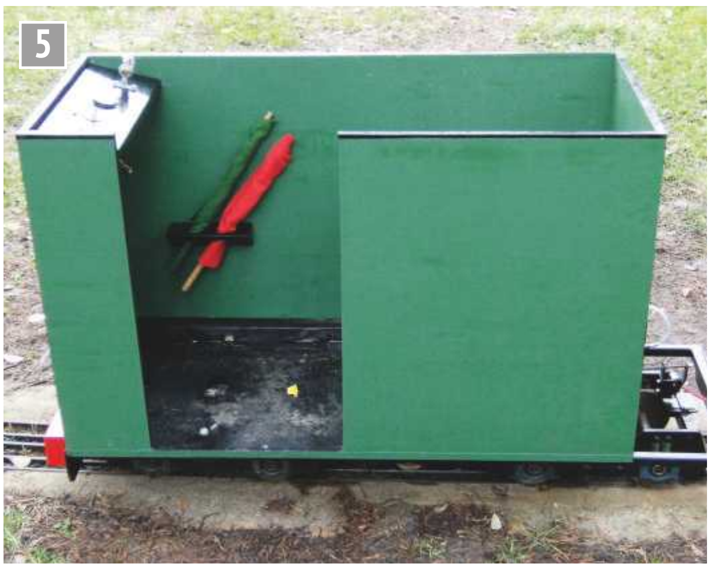
MEEA Newsletter, from **Model & Experimental Engineers, Auckland**, starts with Mike Jack, who is building a massive Stanier press brake. A device which required identification turned out to be a George Thomas Versatile dividing head, which editor, Murray bought with a view to improvement, as there were some features on this particular item which could be bettered. He also bought a sheepskin armchair cover which did not quite fit his furniture but could be adapted with a little thought and some 60 year old, wide industrial tape which was saved for just such an occasion as this. The snap fasteners Murray used had to be crimped in place and he devised a tool to do this, from information found on the internet.

Norwich & District Society of Model Engineers' winter *e-Bulletin* opens with David Beekens' *March Hare,* a V2 in 1/32 scale, made principally because he had never before built a locomotive with Walschaerts valve gear. The name comes from an unofficial name bestowed at March locomotive shed in Lincolnshire. A guide to machining hard phosphor bronze can be found on YouTube: https://www.youtube.com/watch?v=HPEL_kQXihw. Roger Backhouse's recent *Model Engineer* piece about prostate cancer is reprinted here. Required reading, I think, for us older men. (I have had the D.R.E. test, which is painless, if extremely undignified but quickly over – Geoff.) Member, Brian Reading has published a book on East Anglia and the East Coast railways, from the late 1940s to the late 1960s, illustrated by his own photographs. Three more such books are planned. Two new guards' vehicles have been built (**photo 5**) offering improved facilities for the mostly unsung volunteers, which (If I may be so bold in the pantomime season) provokes the cry - *"He's behind You!"*
W. www.ndsme.org

And finally, If Phil Collins goes back to work, will there be repercussions?

CONTACT

geofftheasby@gmail.com



One of the new guard's trolleys at Norwich SME. (Photo courtesy of Mike Fordham.)

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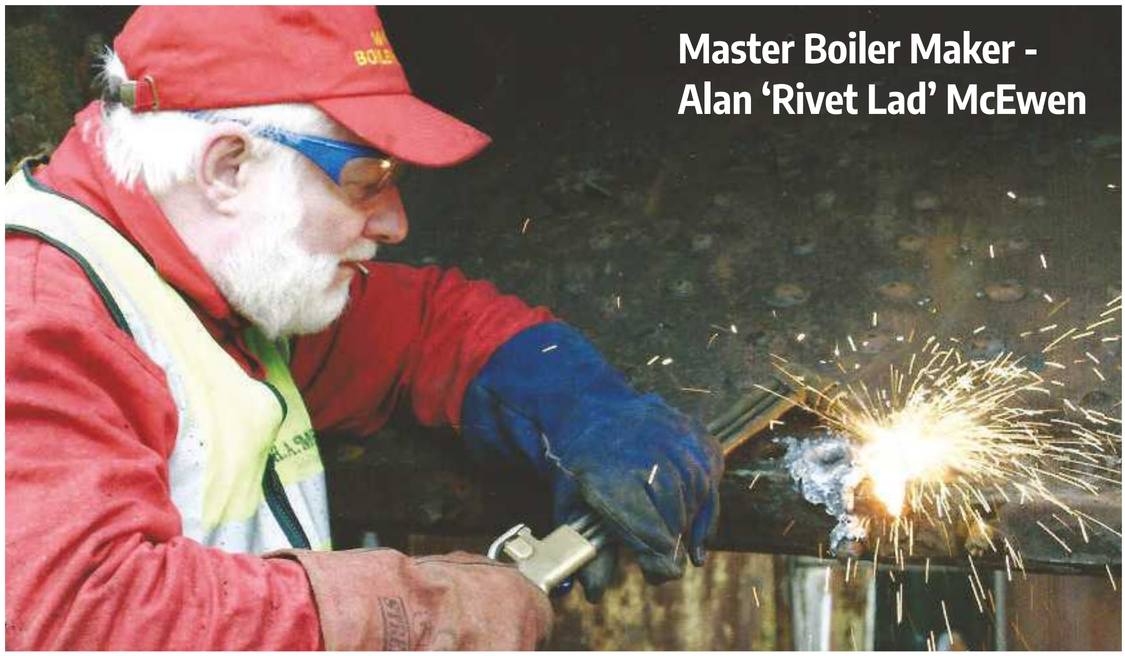
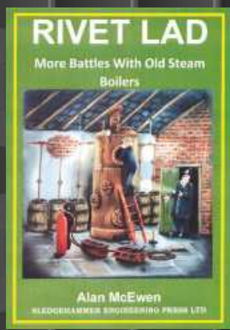
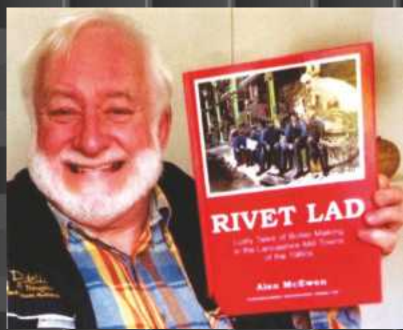


Master Boiler Maker -
Alan ‘Rivet Lad’ McEwen





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

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

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

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