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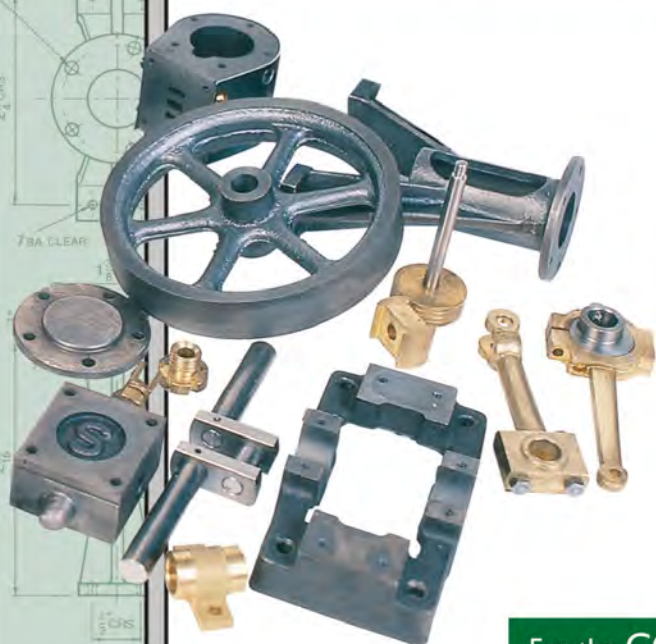
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FRONT COVER

Our front cover shows Bill Hatton with his 4" scale McLaren road locomotive.

Photograph: John Arrowsmith

EDITORIAL

As this is the December issue I suppose I should wish everyone a Merry Christmas! No matter that, for most of you, the pre-Christmas season of Advent has not even started. The high street shops, however, tell a different story and, for them, the Christmas season started many weeks ago. If it's good enough for them then it's good enough for us, so – Merry Christmas everyone!

CHRISTMAS CARDS

If your Christmas preparations are as advanced as mine and you are still looking for Christmas cards perhaps I could draw your attention to a card offered for sale by the Welshpool and Llanfair Light Railway. This bears a picture of their Beyer Peacock 0-6-0T No. 822 'The Earl' in a suitably seasonal setting. You can find more details on their website at wllr.org.uk.

While we're in the Christmas mood perhaps you might like also to consider Christopher Vine's latest books, which would make ideal presents for youngsters with an interest in steam. These are 'Rain, Steam and Speed' (with hints of JMW Turner) and 'Grandpa goes Bananas' (guaranteed Turner-free). More details are to be found in the advertisement later in this issue or at petersrailway.com.

MIDLANDS EXHIBITION

I hope all of you who managed to get to The Fosse in October enjoyed the show. I certainly did, and it was good to meet so many of you there. Although our magazine is now published by Warners, rather than TEE Publishing, our links with the Midlands and London exhibitions are as strong as ever. I will look forward to seeing many of you again in January, which is not so far away now.

BOILER STANDARDS

Doug Hewson's remarks about boiler testing in his recent Y4 articles have prompted a couple of letters, one each from the Secretary of the Southern Federation of Model Engineering Societies and from a member of the boiler sub-committee of the Northern Association of Model Engineers. Both letters point out that the responsibility for maintaining the boiler test code for model engineers rests with the Model Engineering Liaison Group, not just with the Southern Federation. I think this is a useful clarification and further details may be found in Peter Squire's letter which is printed on the readers' letters page.

On the subject of boilers, it has become apparent that there are some forged boiler certificates in circulation. The club involved is investigating this but you should exercise some care before accepting a certificate. Fortunately the forged ones are quite easy to spot as I am told that the serial number, which is printed on a genuine certificate, is hand written on the forgeries.

Martin Evans
Editor

The January issue will be on sale on December 15th

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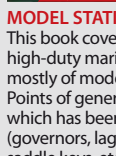
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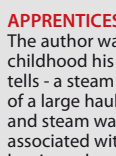
STIRLING & HOT AIR ENGINES by Roy Darlington & Keith Strong
Provides an essential reference to engineers, teachers, students and hobbyists and aims to provide a thorough insight into designing and building Stirling and other hot air engines. Describes the design ethos and principles used and looks at the machining, workshop techniques and processes that go to build such engines. Roy Darlington is one of the world's foremost authorities on small stirling engines and this book will keep any potential Stirling engineer fascinated for hours.



MODEL STATIONARY & MARINE STEAM ENGINES by K.N. Harris
This book covers a range of engines from the simplest oscillating engine to high-duty marine and small power enclosed engines. The illustrations are mostly of model stationary and marine steam engines built by the author. Points of general interest include reversing gears, lubrication - a subject which has been largely neglected - and a number of miscellaneous items (governors, lagging, splash guards, drain cocks, feed pumps, stop valves, saddle keys, etc.). First published in 1958 and now reprinted.



EXPERIMENTAL FLASH STEAM by J. H. Benson & A. A. Rayman
The authors cover the application of flash steam to transport and describe a home built steam car. They also cover other applications such as the model locomotive and Sentinel Railcar, however, they have concentrated on the use of flash steam in model boats and hydroplanes. They have approached the subject in a scholarly and lively fashion, and their work will go a long way to meet the demands of those who are responsible for the current revival of interest in the subject. First published in 1973 and now reprinted.



APPRENTICESHIP IN STEAM by Jack Hampshire
The author was born in Cowes, Isle of Wight, in 1898. During his childhood his father acquired - almost by accident, as this book tells - a steam engine and sawbench which led to the growth of a large haulage business employing steam traction engines and steam wagons. The author, in spite of his youth, was actively associated with the early years of the family business and, on leaving school entered into an apprenticeship in steam engineering in order to provide his father with some expert assistance. His formal employment with the firm was interrupted by a spell in the Navy as a steam engineer from 1917 to 1919, but then he worked with his father and brother until 1922. This book recounts his early years as an apprentice in the family business.



I WORKED WITH A TRACTION ENGINE by Jack Hampshire
The late Jack Hampshire was one of the small number of men, alas all now departed, who really had worked with road steam. Jack was driving engines for the family company when barely in his teens, and was to work with steam all his life, latterly the marine variety. The book vividly illustrates what was like hauling and threshing with steam during the first 30 years of the twentieth century, and make for a tremendous read. 168 pages.

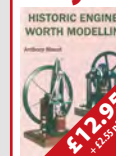


GEARS FOR SMALL MECHANISMS by W. O. Davis
Covers the theory and practice of the design of very small gears, friction and efficiency of tooth action, design of tools for cutting and generating gear tooth forms and production and testing of gears used in clocks and other machinery. Required reading for some study courses.

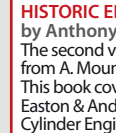


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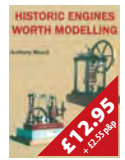
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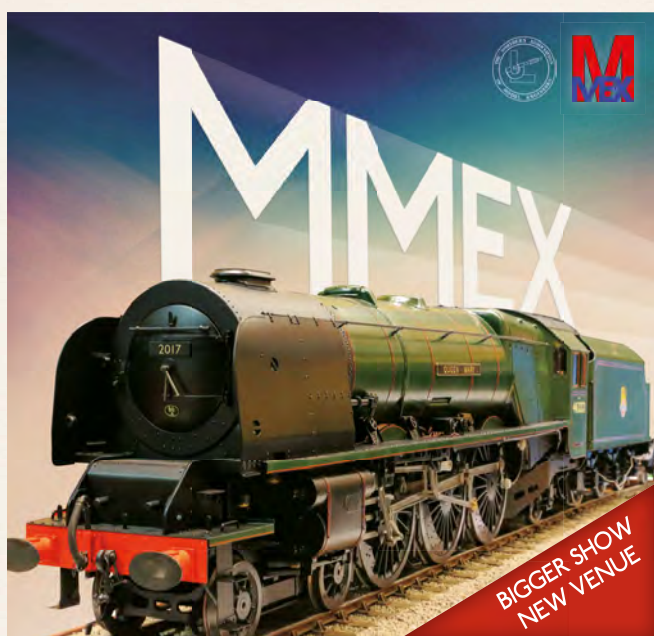
HISTORIC ENGINES WORTH MODELLING VOL. 2
by Anthony Mount
The second volume of fascinating models of unusual historic engines from A. Mount, one of the UK's best known builders of model engines. This book covers four more popular engines: Benson's Vertical Engine, Easton & Anderson Grasshopper Beam Engine, Bodmer's Sliding Cylinder Engine and Simpson & Shipton's Short Stroke Engine of 1851.



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Building the LNER/BR Y4 in 5" Gauge



Doug Hewson makes the chimney, blast pipe and blower for the Y4

BY **DOUG HEWSON** CONTINUED FROM PAGE 164 NOVEMBER 2016

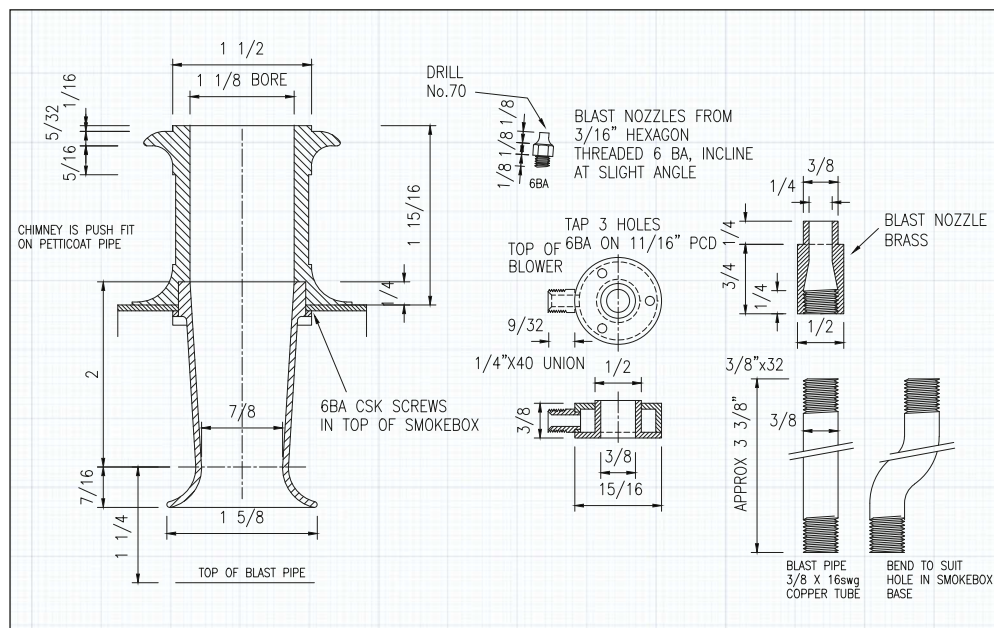
CHIMNEY

At long last I have received my chimney casting (they should be available to you shortly) so I thought I would describe this now. There were several types of chimney fitted to the Y4s at different times so you have a good choice. I decided to build this one with the later type of chimney as I have some good photographs of it. I have found three photographs showing Y4s with some of the other chimneys but the one which I do not have is the intermediate one. This has a slightly narrower section between top and bottom but I do not know when that type was fitted. If you wish to keep matters simple you can merely turn a very simple petticoat from brass or copper tube and silver solder a piece on the bottom to make the flare. Anyway, the one shown on the drawing was designed by Sam Ell of the GWR, so nothing to do with the Y4, but I have used this design on my other Y4 and it certainly makes the boiler steam, even at low pressure. We still have not got a casting yet so if you happen to see a piece of brass bar $1\frac{1}{8}$ " diameter it will be just the job. I

did just happen to have one in my stock box so I used that. I first of all turned the top to size so that I had something to grip whilst I was turning the lower part and the bell mouth. However, one little mistake I found I had made was that I

ABOVE

I thought I would start with a few Y4 photographs and this first one is one which Ivor White sent me. It is 7227 brand new. It is in the dark blue GER livery and has the tall earlier chimney, before the cab was cut down to go down to Mile End Road.



didn't quite turn the top spigot long enough; I did not find out until I was trying to fit the top flange and there just was not enough of it, which made life a bit awkward. We will come to that later.

Once the top was turned I reversed the bar in the chuck and held it by the newly turned section and then centred the end to give a bit better support. This gave me a nice firm base to turn the taper, taking decent cuts to save time. I set the top slide over by 3° (towards me) and then turned the taper down until the choke was 1" diameter. At this setting I also turned the outside of the bell mouth by juggling the hand wheels around to achieve a nice curve. If you are pedantic you can of course work out all the co-ordinates and turn in steps and then blend the steps into a curve. Well I suppose that is what I did really but I did it all by eye which is good enough. There are other things you can better spend your time on like watching paint dry! I then bored the petticoat out in stages until I used the largest drill I had which I think was $\frac{5}{8}$ ". With a small boring bar, I then bored about 1" deep to $\frac{7}{8}$ " bore to give me the choke diameter. With the top slide now set 3° in the other direction I used the small boring tool to create the taper inside the petticoat until it met my previously bored $\frac{7}{8}$ " diameter when it was $\frac{7}{16}$ " from the bottom. Of course, you can't do this with the centre in place, so, you need to take light cuts otherwise the whole thing might fly out of the chuck. The flare was again made by juggling the hand wheels on the top slide and cross slide and at the same time trying to eye it up to keep the inside as near as possible parallel to the outside.

The chimney I used is not the official casting but is a lost wax cast one made specially as I wanted to be getting on but the castings should be available any time, hopefully before this is in print. I had it cast with a chucking spigot on so that I could grip that first and turn the inside at the bottom to a nice press fit in the petticoat. It does not need to be too nice a press fit but just nice enough that it will not pop off if you happen to catch it by mistake. In fact, the one on my original Y4 is so good a fit that I cannot get it off at the moment and any time I need to pay attention to the superheaters I need to remove the chimney and petticoat to get at them. Whilst I still had the chimney in the chuck I decided to take a very light skim off the outside to remove the striation marks from the casting. Of course, you cannot machine the base so this had to be done with a bit of coarse emery cloth and then finished with some fine emery so that the join is not visible.



ABOVE

The next is one you may have seen before but it is 8126 showing the later chimney, cut down cab and the chimney bolted on with eight set screws.

BLAST PIPE

I then went on to making the blast pipe, blast nozzle and blower. I found that I could not bend the brass blast pipe I had made so I resorted to copper, but I made the mistake of using $\frac{3}{8}$ " x 18swg tube. This will just take a 32tpi thread but annealing it and trying to bend it was a dismal failure as I could not grip it to thread it. Not a good day all round really. I went to the Midlands Exhibition expecting to find some 16swg copper tube but no-one had any. Anyway, I mentioned it to my travelling companion, Malc, on the way home and he said he had made a special little bending tool for $\frac{3}{8}$ " tube so I borrowed that and it was magic. I could bend the tube

without any annealing and then thread it. However, it did take plenty of cutting oil and I kept reversing the die to break the swarf. I was then able to screw the blast pipe into the tee and eye up the double bend so that it lined up with the centre of the petticoat. To fix the blast pipe into the tee I made a thin lock nut from $\frac{1}{2}$ " brass hexagon about $\frac{1}{8}$ " thick. I also made another one whilst I was at it to fix the nozzle on top when I got to that stage.

BLAST PIPE NOZZLE

The next job was to make the nozzle. This was made from $\frac{1}{2}$ " brass bar so I drilled $\frac{1}{32}$ " to a depth of $\frac{1}{4}$ " and tapped that $\frac{3}{8}$ " x 32. I then

BELOW

Finally, we see 68129, now in departmental use as Shed Pilot at Stratford and now numbered 33. It has six set screws holding its chimney down but it also has the N7 chimney now.



**LEFT**

The first thing I did was to turn the outside from a piece of 1½" brass bar and a revolving centre to support the long overhang. The top slide was set over 3°.

RIGHT

The flange on the petticoat ready for silver soldering.

**LEFT**

Boring the chimney after drilling out with the largest drill I had to hand but taking light cuts as it now has no additional support.

RIGHT

Parting off the chimney from the spigot after boring it to fit the petticoat. I also took a light skim off the inside with the top slide again set over 3°.

**LEFT**

The chimney now in place with the six 8BA small headed set screws as dummies. They were cut off flush under the skirt.

RIGHT

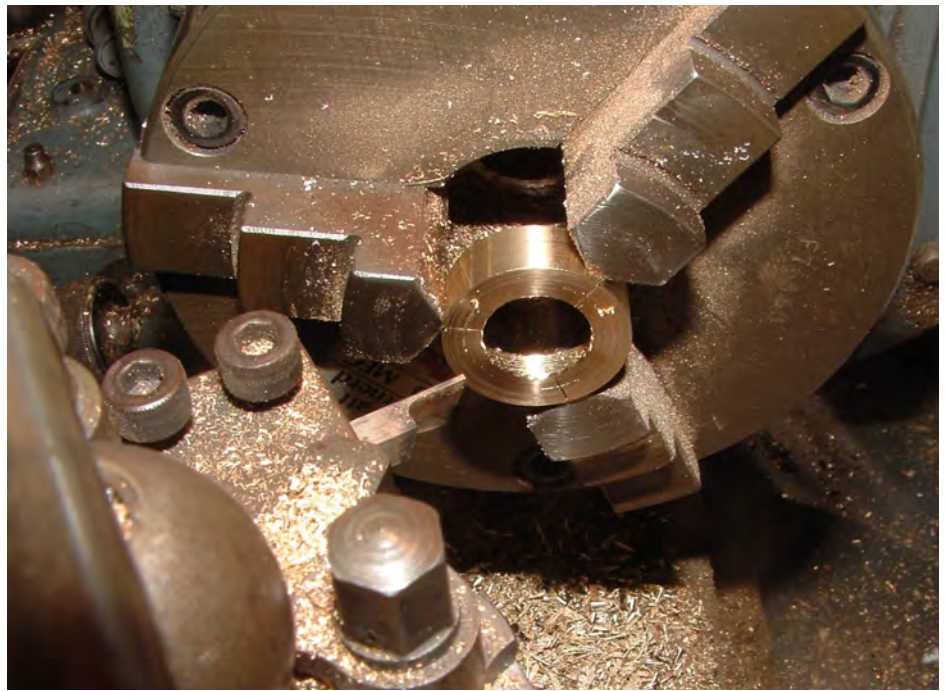
The front end with chimney in place. I can assure you that it doesn't look as cock-eyed as this in real life.



drilled to just over 1" deep with a ¼" drill to form the actual nozzle. On the drawing I have shown a nice taper from the thread into the nozzle but that would need a special tool making and I really do not think it is worth the effort. The bar was parted off at 1" long and then I reversed this in the chuck and turned down the step for the blower ring to sit on. I have to say that the blower on my own Y4 is very effective and, if you happen to have a brain lapse and forget to put coal on, it is amazing how quickly these blowers with the three nozzles bring the fire back up. I did that on one occasion when shunting at Gilling and I had let the fire down a bit low. The next job was to fetch 25 loaded coal wagons back out of the long siding down at the apple tree. I had just filled up with water and had the blower on so I turned the blower up, filled the boiler whilst I was at the water column and shovelled coal. By the time I had got down to the apple tree the fire was burning very nicely so I took my time going down there and as I hooked up the engine blew off so I knew I was alright. I put the engine into full reverse and set off back gathering the couplings one at a time and then the Y4 dug its heels in and the bystanders were amazed as the Y4 was chopping very loud beats off one at a time and sending incandescent sparks and red hot fragments of coal into the sky. Very satisfying, and it was just on the point of slipping all the time, but with a judicious move of the regulator I just kept it going to the top of the 1 in 100 gradient.

BLOWER

For the blower I began with a chunk of 1" brass bar, turned a good length down to 15/16" diameter and then turned a further ¼" down to ½" diameter. At this stage I also drilled about ⅝" deep with a ⅜" drill. This was parted off to leave a flange 1/16" thick. I made the top from the same piece of bar, which meant drilling down about ½" deep with a ½" drill. This was then bored out with my little boring tool to ¼" deep to leave a wall 1/16" thick and then parted off at 5/16" long. I reversed this in the chuck and gave a quick face across and then used the same tool and the three jaw chuck jaws to mark out the positions of the blower nozzles. I also used another sharp tool to mark the pitch circle diameter. If you have a rotary table you can use that as it will be good practice but it is not really necessary as accuracy does not matter too much with this and marking with the jaws will be near enough for a blower. To drill the No. 43 tapping holes inclined inwards I made a small mounting block from wood inclined at about one in ten and then held the top on this to drill the holes. Simple. The ¼" union is the same as the one you made for the steam brake cylinder and this just needs making a press fit in the body for silver soldering.



ABOVE

Marking the holes for the blower nozzles using the three jaws as a guide.

BLOWER NOZZLES

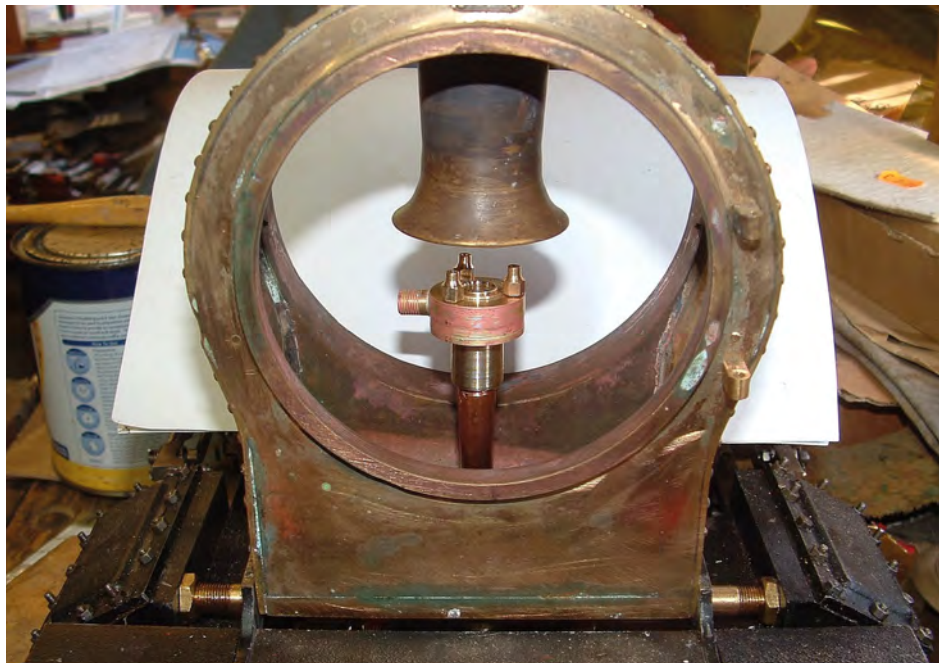
For the nozzles I used 3/16" brass bar, turned down ⅛" to 0.011 diameter and threaded it 6BA. With things like this I use the die the correct way round and then run it off, reverse it and run it on again as you can usually get another thread or two. The bar was centred and drilled No.50 to ⅛" deep and then using a No.70 drill (or 0.7mm) drilled a further 5/32" or so. When drilling a small hole and then a larger one it is always best to drill the larger hole first and then the larger drill will not break though and ruin the job. These were parted off at ⅛" long. They were then reversed and held in a tapped bush to tidy the outside

up. I used a round nosed tool and took fine cuts to prevent the nozzle breaking off at the thread and turned this down to about ⅛" diameter for ⅛" depth. To finish off I made a very slight countersink in the No.70 hole and ran a very fine file over the top of the nozzle. A tool maker friend of mine said that when he was an apprentice he had just made something and showed it to the boss. The boss took it off him and drew it across the back of his hand drawing blood. The boss then said "there, you will remember to remove the burrs next time, won't you!"

« TO BE CONTINUED »

BELOW

All complete and ready for some steam. We are getting there.



The Atkinson Steam Wagon

Graham completes the cylinders by adding front and rear covers and inlet and outlet manifolds

BY **GRAHAM SADLER** CONTINUED FROM PAGE 152 NOVEMBER 2016

REAR COVER

The rear cover needs lots of care to ensure concentricity and correct alignment and should be made first.

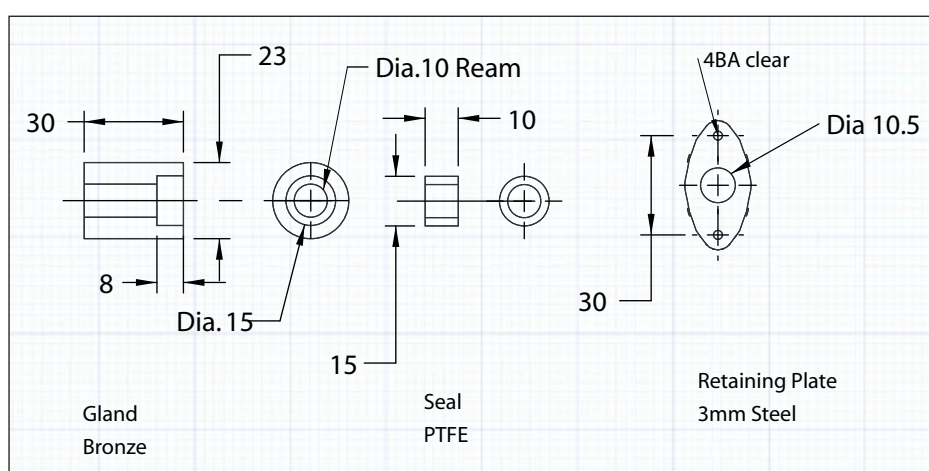
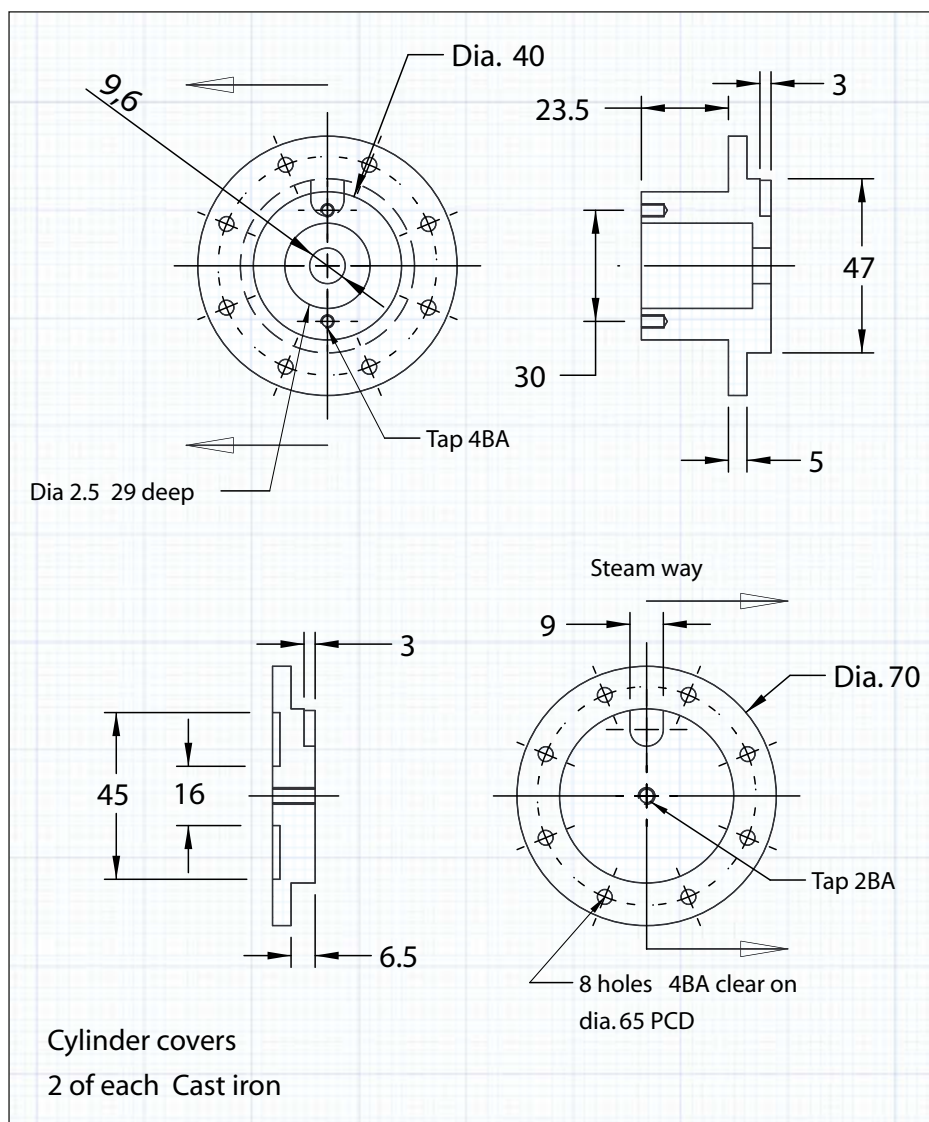
Turn the stuffing box end first. Rough down first then finish to 40mm diameter, or to match the register, achieving a good fit on the crosshead tube. Although not shown on the drawing it is a good idea to reduce all but the last 7mm to act as a relief as this will make assembly easier. Now bring the outside diameter to size at 70mm diameter and bore for the floating PTFE seal to a diameter of 24mm and 29mm deep.

Now grip by the relief section in the 4-jaw, clocked true to the outside diameter, and turn the register to the cylinder. The hole for the piston rod can be produced at this stage but do not ream this hole as it must have a small clearance. The piston rod is guided by the piston, its rings and by the crosshead. If alignment is not absolutely perfect the rod will be bent by the combined action of the three bearing surfaces and will wear itself until the binding has been removed. I just cannot understand the common advice, which is to ream here and try to get a close fit. Perhaps I'm wrong, but it's the gland which seals, not the hole in the cylinder end. That is my belief and I can anticipate a lot of letters on this topic!

The cylinder does not wear much. Our club Romulus locomotive, which sees a lot of hard work, mainly at Papplewick waterworks (a magnificent example of Victorian water pumping engine engineering in situ), is being overhauled. I was testing the bores for roundness and parallelism; they were true along their length and only one thou. out of circular. Nothing at all (and the engine had done a lot of work hauling passengers) – but the rings were well worn! Don't cut the steam way yet.

FITTING THE COVERS

Without removing from the chuck, use the dividing head to produce the ring of holes on a 65mm PCD at 3.1mm for 4BA tapping size (see photograph 1). Note the position of the top two holes on the drawing, which are positioned to clear the steam ways. Transfer these holes to the cylinder which can then be tapped. Open three of the holes in the cover to 3.6mm. Don't forget to mark the top of the cover for orientation.



Turn 6 stubs of steel to 3.6mm, thread 4BA and part off. The parallel portion should be just less than 5mm long. Add a screwdriver slot and screw tightly into the cylinder to match the positions of the three enlarged cover holes and drop the cover on. The screws must not protrude above the plane of the face of the mounting flange.

We need to be sure to get the top valve face of the cylinders true to the crosshead assembly. This is most important but straightforward to achieve. Use a long M6 stud through the crosshead assembly and the cover (but not the cylinder) to lightly clamp the cover in place. With the assembly vertical, both of the embryo cylinders and covers are dropped onto the mating bore in the crosshead flange and both are rotated along with the covers, which will rotate as well due to the 3 pins, until a rule across the machined faces of the cylinder is showing no gaps. The alignment is now done. Tighten the M6 studs from the crankcase end of the crosshead assembly, re-check for straightness and adjust if required. Get this right! Remove the cylinders and drill through the cover and mounting flange to 3.7mm, but do mark the covers so you know which of the mounting holes is at the top! See photograph 2.

It may be necessary to file a short flat where the covers join – they should touch if all has been made correctly but tiny differences from designed size mount up!

This may seem long winded but I couldn't think of a quicker way to ensure the accuracy of this critical assembly. The cylinders will be fitted with 4BA studs screwed into the cylinders.

FRONT COVERS

The front covers are simple turning tasks compared to the rear ones. See photograph 3. The recess in the front is only for appearance but it does make them look better (not that anybody will ever see them). The 2BA hole is to enable front dead centre to be found easily. Fit a stainless or brass screw.

MANIFOLD ASSEMBLIES

These are best made from end feed plumbing fittings (10mm for inlet and 15mm for exhaust) – they look a lot better than the pre-soldered type and this is another brazed assembly. The flange plates are made as a single piece then cut up after brazing.

It's strange how a small change can make a big difference. I have enlarged the size of the top pads on the valve housings. The 7BA fixings I used seemed OK in the drawing stage, but when made were obviously tight so I've increased these for you to 5BA. Consequently the housings had to be made bigger but then the bolt holes for fixing down to the cylinder were too close, so the valve housing had to be widened and also a lot of other minor details changed!

So to start the manifolds. Firstly bolt the cylinders on to the crosshead tube assembly and fit the valve plates onto the cylinders. Now it is possible to get an exact measurement of the total length of each manifold across the width of the cylinder unit, which should, in theory, be 95mm. Two brass plates are now made, one for the inlet and one for the exhaust, from 3mm brass. Mark out the positions of all the holes. Check the dimensions on the cylinder assembly and drill the holes to match the diameter of the elbows, and use files to get them to fit the holes. For the exhaust try to get the elbows to sit high on the plate to give a little more clearance for fitting the nuts onto the studs. This has to be done under the engine when it is in the chassis and, to say the least, is fiddly so any extra you can gain here is a bonus. In mine the manifold exhaust and drain valve assembly are a single piece attached to the water heater.

With the elbows in place it will be possible to mark out for the fixing holes – put these close to the corners to make fitting easier. Mount the cylinder crosshead assembly on the miller with the exhaust up and with the valve housings removed and skim across the cylinder blocks in the area where the exhaust bosses will be, just enough to make it flat, but make it over width. Only do this cut if there is any discrepancy when a straight edge shows the exhaust faces are not in line, which there shouldn't be. There may have been small errors creeping into the machining of the cylinders and the valve housings. We want both inlet and exhaust flanges to be in the same plane.

Carefully position the spindle over the exact centre of the cylinder to drill the exhaust port. Arrange clamps to hold the plate in position and drill through them into the cylinder boss to tapping size for the studs, remove and open up clearance in the flange plate. Turn the assembly over, fit the valve housings (which by now will have

RIGHT PHOTOGRAPH 1
Drilling the rear cover mounting holes.

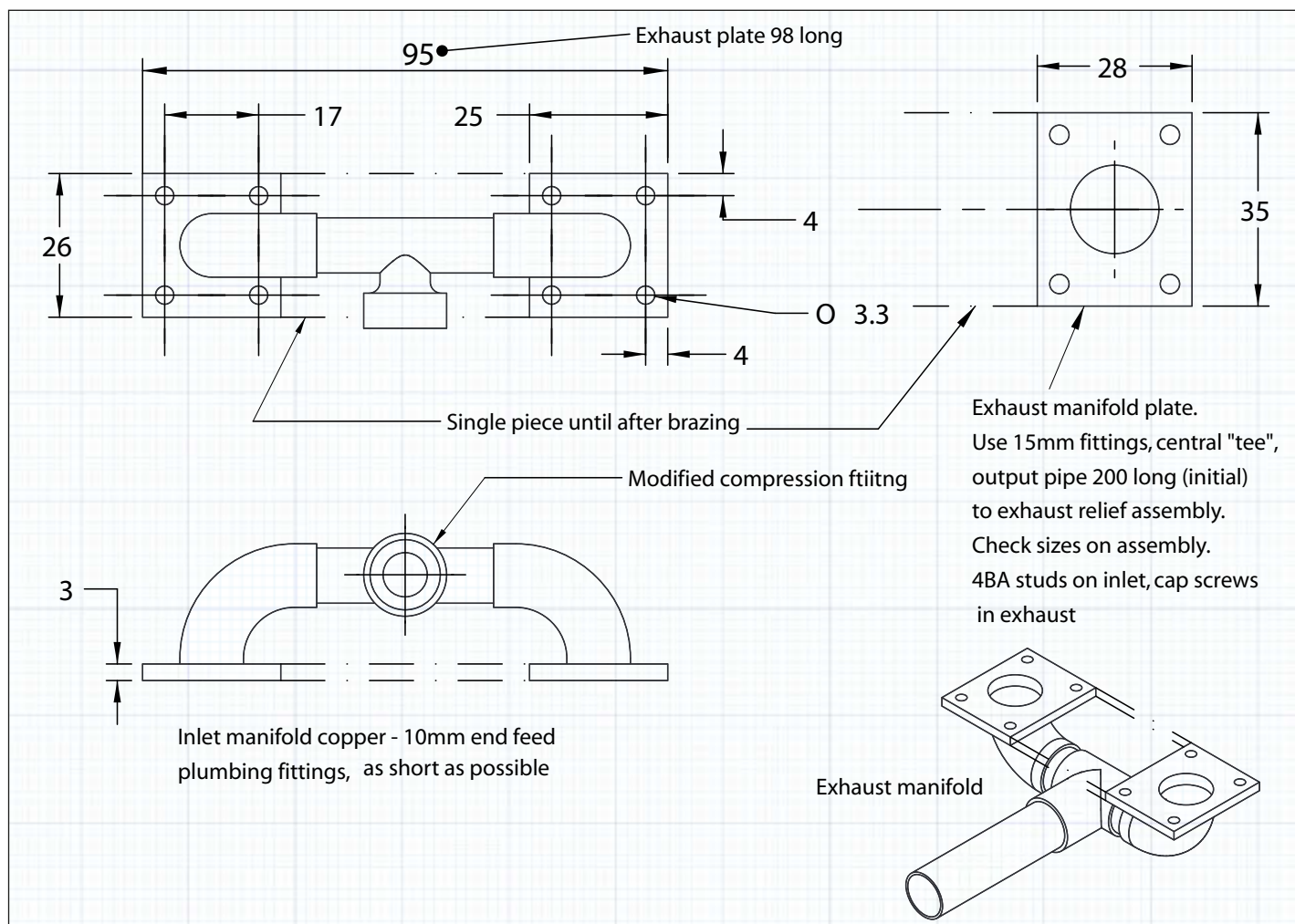


RIGHT PHOTOGRAPH 2
Drilling the cylinder mounting holes.



RIGHT PHOTOGRAPH 3
Roughing out the front cover.





been brazed) and get the tops of the valve housings level by skimming the tops of the valve housings to dimension, which in theory is 50.5mm from the cylinder plate, but just clean it up. It's time to drill the hole for the steam inlet on the top of the valve housing so turn two short stubs to the size you just drilled the plate with. Put into the miller chuck and use this to centre the hole in the inlet plate, twiddling with the table handles until satisfied. Drill now in stages – we need care here especially when the drills break through. Perhaps a suitably sized end mill or even boring (with a boring head) could be used to stop the possibility of the drill snatching but we will have the confidence that the holes will match perfectly. For the second hole, leave the locating stub in place in the first hole to teach the plate some manners and keep it aligned.

Insert the elbows and now it is easy to determine the length of the cross pipe for the inlet, and the two for the exhaust into the “tee”. The inlet also needs a modified compression fitting. Make sure you get one which is small as they do vary in size a lot. Try to get the type without spanner flats on the nut –

BELOW PHOTOGRAPH 4
The exhaust pipe.

it's circular with ridges on it and smaller in external size. We need a crescent shape on the end of the fitting to match the inlet cross tube. Fit the nut but without the olive and grip by this in the miller vice. Cross drill with a 10mm slot drill, getting

the edge of the drill about 5mm from the end of the screw thread. Remove from the vice and saw off the remainder. For the exhaust, the outlet is a simple straight pipe about 200mm long (or, as above, fit a compression fitting here as well)



which will later be finished to length to fit into the exhaust relief assembly. It is possible here to use another compression joint. Perhaps it could be fixed directly to the relief valve? This is another of the great things of modelling prototypes of this nature – the scope for personal design work and variations to get your teeth into without the rivet counters getting annoyed...

With this joint in the exhaust, when the engine needs to be removed from the chassis it will be an easy task to remove this section of the exhaust pipe, support the engine on a cradle fixed onto a 1m long plank, undo the fixing bolts and just slide the engine out. Access to the 8 fixings on the exhaust manifold under the finished wagon is not easy, and I have to remove the entire exhaust pipe and relief valve and then try to unthread it round the wheels, steering gear springs etc. Photograph 4 shows the contorted route for the exhaust, and this is only to the water heater, (which really does work) with an additional three 90° bends and a curve round the front of the boiler from water heater to blast nozzle! No wonder the blast is so quiet! Incidentally, my original fixing for the exhaust manifold was with studs and nuts but, when working under the chassis to remove and refit the engine, they were a devil to put in place, taking an age as there wasn't enough clearance for a box spanner for

the nuts, the washers being impossible. So these have been replaced now with 4BA cap screws which take only a couple of minutes to fit as they sit nicely on the hex key.

Wire both assemblies and braze together, pickle, check to correct any distortion and then cut out the centre – job done! I wish I had done it like this – I made separate pads and it was a real effort to get them all lined up and flat and the correct distance apart even using a jig.

Referring back to the time line on page 129 of the October issue, we have completed tasks 1-7 so now it's time to make all that swarf and give the cylinders some real shape!

THE CYLINDER CLADDING

This is cut from 22g or 24g sheet, brass if painted, but I used stainless. Do not use any thicker material, as there is only a 2mm gap between the cylinders. Make them initially a trace too long, then they can be marked to length by scribing from the cylinder end faces on the inside and filed to give minimal clearance.

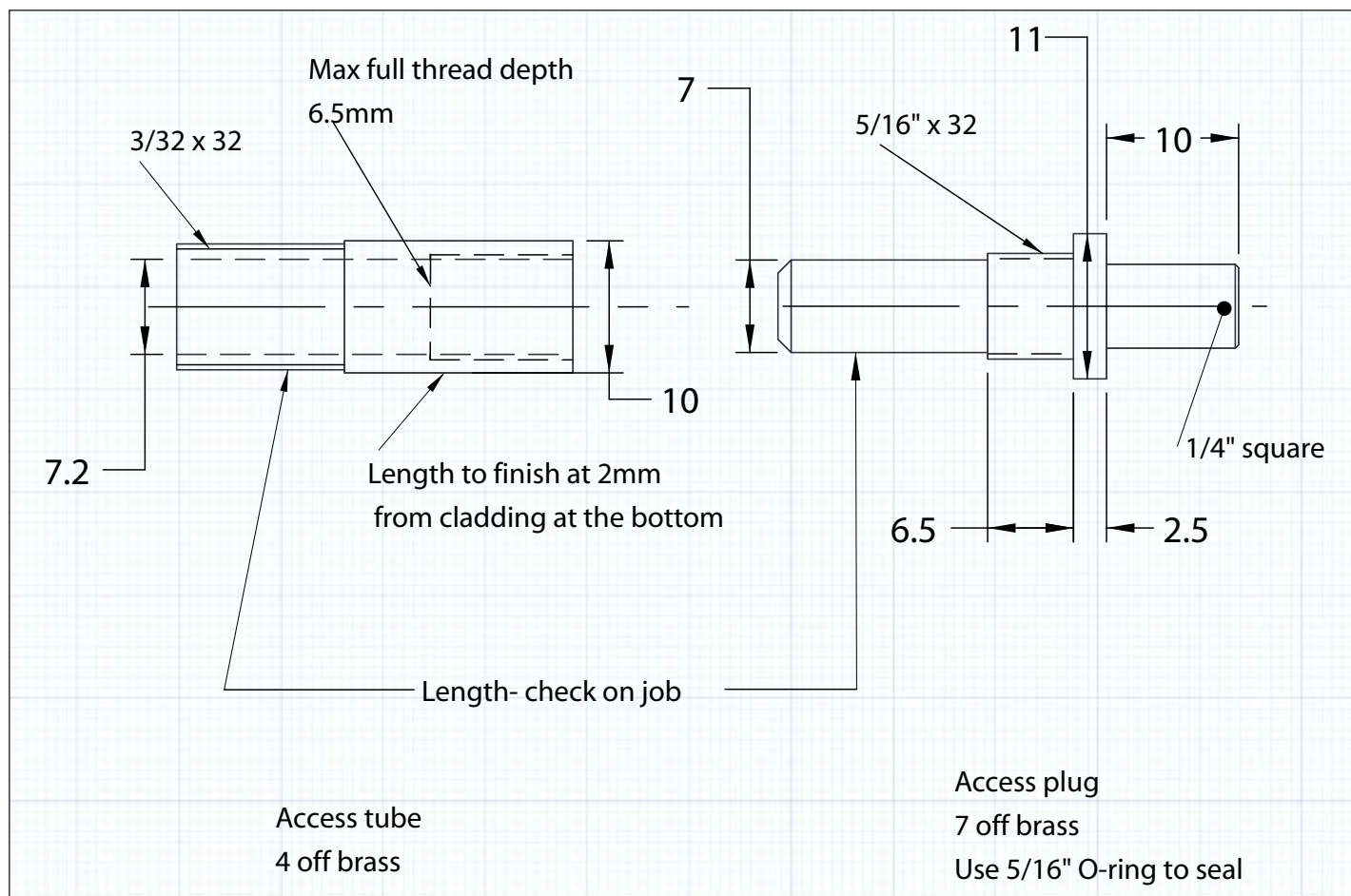
They fit inside the end covers and have a small flange bent up at the top so 3 x 8BA brass round-head screws can be used to fix them to the edge of the top of the cylinder and overlap the valve housing base. Cut the hole for the exhaust boss first then use bending rollers to get to the 69mm diameter, and at the same time toll

a thin strip about 10mm wide to use as a test piece to determine the position of the bends. Use 6mm balsa wood glued on and sanded smooth to keep the cylinders nice and warm.

CYLINDER PLUGS

On the outside of the cylinders are two brass tubes tapped into holes close to the top. These in turn are internally tapped to take plugs. The problem is simple. I used cast iron for all the components – cylinders, pistons, end caps etc. – and the worry of rust is always present. The plugs allow easy access into the cylinders for spraying a good dose of WD40 or similar at the end of each steaming session when the engine won't be used for a while. It is easy to see when all the water has been dispelled by watching the outflow from the exhaust valve. The plugs can be left out to help dry out the inside. Sealing is so easy with a simple O-ring – used as a washer surprisingly little twist is needed for a complete seal with extended fingers. I suggest making a couple of spares as losing one on the rally field would finish a steaming session! So we will need 7 in total, of which one will be for the drain in the crosshead stuffing box.

To drill the holes, which are positioned 18.5mm from the top face of the valve mounting plate, fit the cylinder cladding then clamp the cylinder to an angle plate on the top face. I added the plugs after





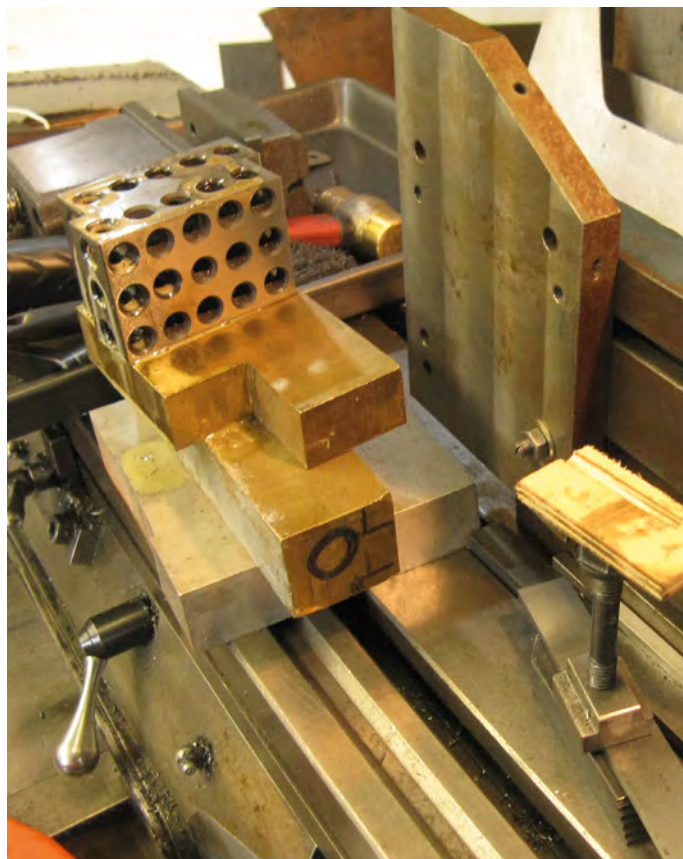
**ABOVE LEFT
PHOTOGRAPH 5**
Drilling for the
plugs the hard
way!

**ABOVE RIGHT
PHOTOGRAPH 6**
The packing
arrangement.

finishing the engine – photographs 5 and 6 show how difficult it was to support the complete engine. Use a slot drill to very gently cut through the cladding and onto the cylinder, just deep enough to give enough of a flat for a centre drill. Go easy with this. If you go too deep then there's a real danger of breaking into the bore. Now drill a small pilot, and slowly increase the size to the tapping size drill (we will be cutting with only one lip of the drill). Use a taper tap first which must be guided positively so it cannot tilt when tapping.

Turn the brass tubes and make the internal tube diameter just less than the tapping size for the $\frac{3}{16}$ " x 32 thread at 7.3mm. Make the cylinder bore end too long at first then, after screwing in tight, the shape of the cylinder wall can be scribed in situ. At the same time mark the point where the tube emerges from the cladding at the bottom. This will later be finished to project by 2mm. Remove and file the internal contour but make sure there is good clearance for our unmade piston. This will make each tube specific to a location. The object of the exercise is to reduce the volume of empty space as much as possible. Part off and mount in a threaded mandrel or collet to produce the internal thread. This should be 6.5mm deep at full thread depth (the tube is thin and weak). Use with thread lock to seal.

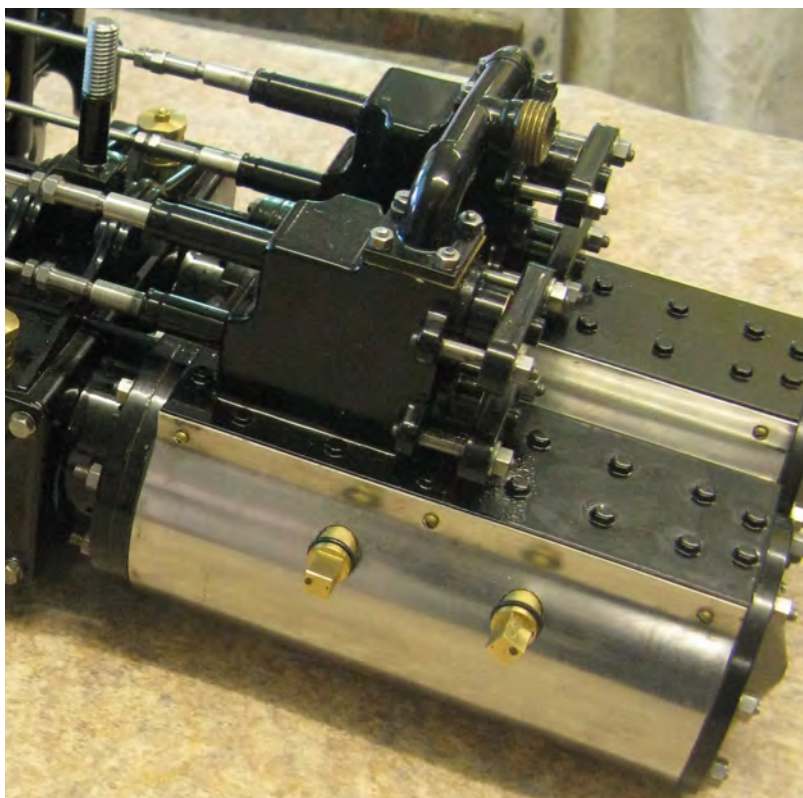
**RIGHT
PHOTOGRAPH 7**
Cladding, access
plugs and inlet
manifold.



The plugs are turned from 12mm square bar and threaded. The the end is then turned away to just below the root diameter leaving the thread 6.5mm long. Make it too long at first, put the O-ring on then test each plug in all 4 plug tubes making the extension as long as possible without fouling the piston – these must be

interchangeable! When satisfied mill the flats $\frac{1}{4}$ " square. Finally, part off. The plugs don't show much but the square does look a lot better than a knurl. Photograph 7 gives a good view of most of the items in this section.

« TO BE CONTINUED »



'YORKIE' – A Yorkshire Engine Company 0-6-0 Locomotive in 16mm

Malcolm and Derek discuss the pipework and detail the clack valves and the connection to the hand pump.

BY MALCOLM HIGH AND DEREK CROOKES CONTINUED FROM PAGE 169 NOVEMBER 2016

PIPEWORK

There is very little pipework on Yorkie compared to a five inch gauge locomotive. Water is stored in the left hand tank which feeds the inlet on the pump. The pump then delivers water to the bypass valve. If this is closed the water goes into the boiler, otherwise it just returns to the tank.

Start by making the bypass valve itself – the drawing was in part 12 of this series. The body is turned from a piece of $\frac{1}{4}$ " diameter brass. The only really tricky operation is drilling the $\frac{1}{16}$ " diameter hole as this is nearly two inches long. Using the correct speed and cleaning out the hole regularly will ensure this goes smoothly.

The various pipes are silver soldered into the valve as shown on the drawing. The gland is from hexagonal bar and again should not be a problem in turning. Note that the handle is from stainless steel and has a cone on the end to make a seat in the end of the bored section of the upstand. The unit is housed in the bunker area of the left tank. Feed the valve up from underneath through the elongated hole. The top pipe fits into the tank and is held in place with the locknut.

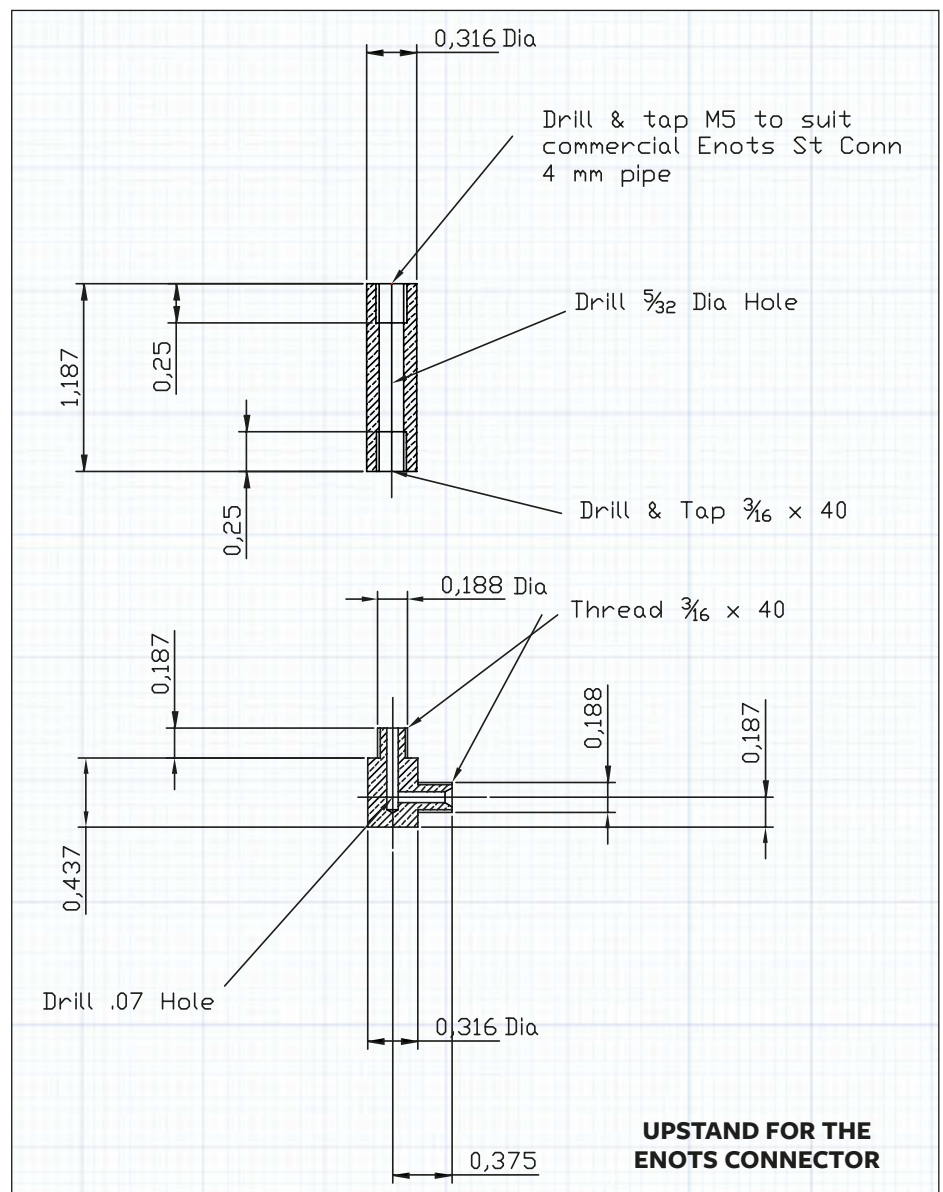
Two clack valves are required. These fit on either side of the boiler at the front. The right hand one is for the manual feed whilst the right hand one is fed by the axle pump. They are straightforward to make. It is recommended that Viton balls are used as these make a better seal than stainless steel. The latter is still required to make the seat though.

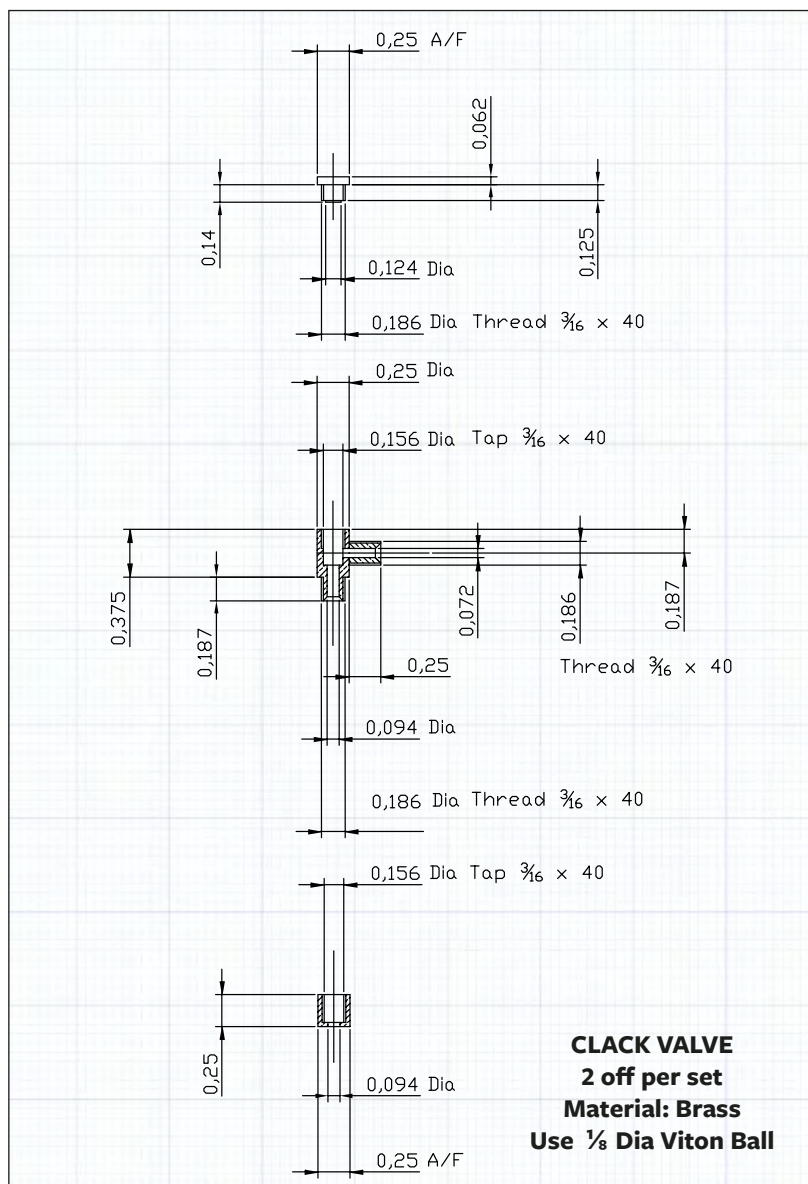
The pipe end arrangement is shown on the bypass drawing. This is a typical pipe fitting and can be used on all the pipes. You will need a number of these. Start by turning down some brass to the correct diameter, drill it $\frac{3}{32}$ " and then part off $\frac{1}{16}$ " slivers. Soft solder these onto the pipe end, then put the pipe into the lathe and turn the sixty degree cone. Note that the nuts have to be fitted before soldering on the second ring if the pipe is double ended.

Start by making the pipe that runs from the bypass valve to the front left hand clack valve as this is the longest and

runs inside the frames. Cut a piece of $\frac{3}{32}$ " O/D copper pipe to approximate length, fit a cone and pipe nut on one end. Couple this to the front screwed connection on the bypass valve. The pipe threads its way along the top of the frames behind the dummy springs to the clack valve. The end then has to be turned through ninety degrees

and marked for length. To make the bends neatly a small jig can be made from a piece of 20mm diameter bar. Using a parting tool turn a slot in the bar $\frac{3}{32}$ " wide to a depth of $\frac{1}{8}$ ". The tube can then be annealed and formed in this slot. Solder the other pipe end on, not forgetting to put two nuts (back to back) on the pipe first and make the cone.





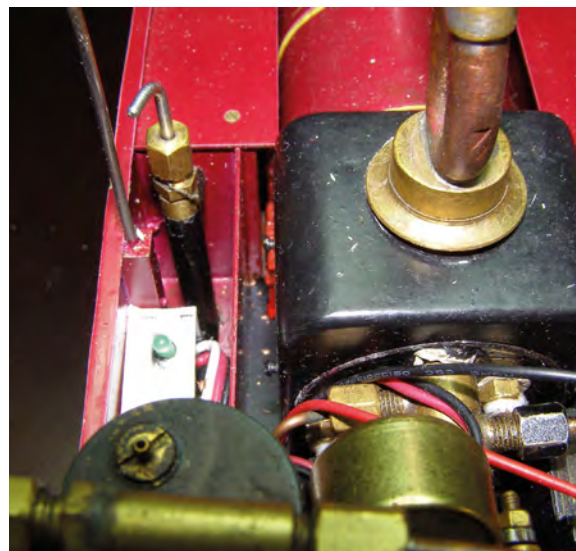
One of the problems in tightening up the pipe nuts is the spanner slipping off the nut and rounding the edges of the hexagon. Many years ago I remember making up a special brake pipe spanner, which was basically a ring spanner with a piece cut out. This I lost a long time ago but with the advances in laser cutting I managed to design a set for Imperial hexagon. I have found these really useful, especially in getting to the bottom sight glass nut on my Gauge 1 locomotives.

To hide the ENOTS connector for the hand pump it is mounted in the bunker area of the right hand tank. Turning the parts should not present any problems. The connector itself can be troublesome to obtain in small quantities so Model Engineers Laser has obtained a number for prospective builders. Fit the upstand through the tank base and the footplate, attach the ninety degree bend underneath and tighten up ensuring the outlet faces forward. Make the pipe in the same

manner as for the left hand side and fit. Note that the pipe goes through the frames.

The only pipes left now are the feed to and from the pump. It is not essential which order these are done and with the experience of making the longest two pipes they should not cause any problems. To make life easier a piece of neoprene tubing can be used between the outlet from the tank and the inlet to the pump as shown in the image. This is under no pressure.

To test the pipework couple your hand pump to the ENOTS connector, power up the level indicator and put water into the boiler. Depending on the quantity of water in the boiler already the red light will go out and shortly after the green light will illuminate, indicating the boiler is full. Light the boiler and with the locomotive on a rolling road clear the cylinders of condensate and let it run. With the bypass valve open there should be a steady stream of water entering the left hand tank.



ABOVE

The bypass valve and electronic level indicator in the left hand bunker.



ABOVE

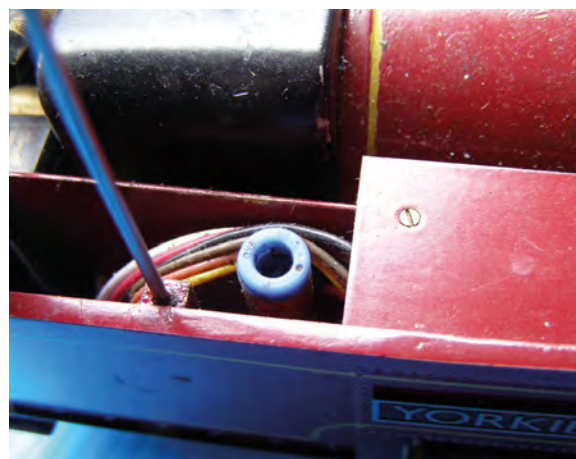
The feed to the pump is under no pressure so neoprene is fine, note the pipe nut spanner.

BELOW

The ENOTS connector in the right hand bunker.

Close the valve and this water will be fed to the boiler. It will now be under pressure from the pump to the clack valve so check all your joints for leaks. In practice the pump easily keeps up with the water requirements of the boiler so the valve will need to be opened occasionally otherwise the boiler will overfill and will prime.

« TO BE CONTINUED »





The Shrewsbury Steam Rally 2016

John Arrowsmith recalls the summer and shares his memories of the Shrewsbury Steam Rally

BY JOHN ARROWSMITH

This popular and well known steam rally has been running for a considerable time and this year's was the 54th, organised by the County of Salop Steam Engine Society. All arranged by volunteers, the show had over 1000 exhibits of both working and stationary machines on display. As well as the full-size traction engines and steam lorries there was also a good mixture of miniatures to be admired. Add onto this the steam cars plus a number of interesting steam-powered working areas and the large display of assorted working stationary engines combined with a great display of working horses, and you really did have a show that had something for everybody.

For my report I will concentrate on the miniatures which included some superb examples in steam and working round the different areas of the rally fields.

Among the miniature engines on show I noted a very nice 4" scale McLaren Road Locomotive owned by Bill Hatton. It was a scale replica of the full-size engine 'Gigantic' and was beautifully turned out and ticking over very nicely. Brian Harris from Shropshire brought along his newly acquired half-size Fowler T3 engine complete with a pair of ornate front lamps – again this engine was immaculately presented and Brian, accompanied by his faithful footplate companion, his dog, gave me a demonstration of the engine's capabilities. The engine was built by David Benyon and was his 20th. Brian had only had it for a week so this was its first public outing. Going well and really looking like it was

ABOVE

The start of the Grand Parade, led into the ring by two Burrell Showman's engines.



RIGHT

Brian Davies with his newly acquired Fowler T3 traction engine.

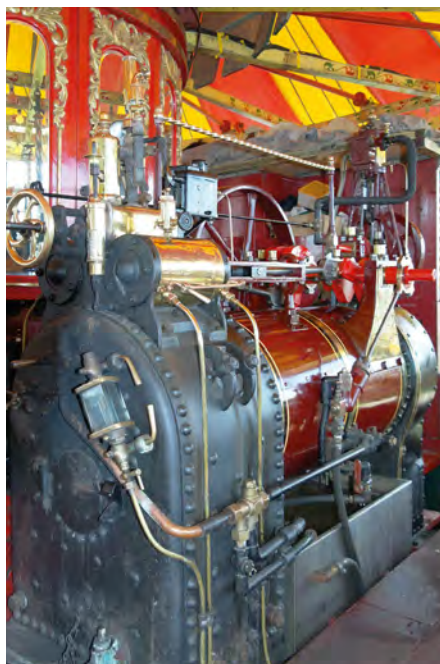


RIGHT

This little Bregazzi Steam Buggy was an interesting combination of components.

**ABOVE**

Bill Hutton with his 4" scale McLaren Road Locomotive.

**ABOVE**

The Savage Centre Engine powering the Gallopers.

**ABOVE**

This Stanley Steam Car circa 1910 looked in excellent condition.

ready for a days work, the 4" scale freelance 'Charlie Monarch of the Glen' had come all the way from Scotland and owner Mike was certainly enjoying his trip around the site. In the Grand Parade of models, one engine caught my eye and that was the 4" Fowler 'Big Dad' presented in traditional black livery with Alex Kirk at the controls. It looked an excellent example of the prototype. One vehicle that did make me smile was the vertical boilered and Stuart Swan steam engine powered Milk Float. It has appeared in EIM before but this was the first time I had seen it close up.

In the large group of Stationary Engines I came across a group of very well made miniature i/c engines all constructed by Wyn Rees from Carmarthen in South Wales. There was some very fine workmanship here and they were all scratch built and a real tribute to the builder. He also had an example of the first gasoline engine designed and built by Henry Ford in 1893 working on his display.

Another exhibitor from South Wales was Teifin Thomas who showed off his fine 4" scale Scammell Tractor unit which is powered by a 10hp Briggs lawnmower engine. Adjacent to the Scammell was a pair of well-made Field Marshall tractors which were originally built by Vic Hodges in 1990. Powered by Villiers 1½hp engines they compared very well with the full-size versions on show elsewhere in the rally. All of these rallies always include a fairground so that visitors can enjoy having an exciting ride or two. The Gallopers are a traditional and popular attraction and the set working here included an original Savage Centre Engine to provide power. Beautifully maintained and presented it was a real treat for stationary steam

enthusiasts to see this engine operating. I was able to access the engine during a pause in the rides and, talking to the operator, I was told it was the original engine from 1887 which had been carefully maintained and had recently been fully refurbished and fitted with a new boiler. It is a Duplex engine and the valves are in full gear at all times to ensure continuous power so that there is no uneven running. Among the many full-size steam vehicles on show the Robey Tandem Steam Roller is not a common machine and the example on show was built in 1924. It was bought by its present owner in 2011 since when it has had a complete major overhaul and been fitted with a new firebox. This is its first season on the rally circuit. There was a good selection of steam cars on display and I thought the Stanley Steam car Model 85 circa 1910 was a good example of the cars there. The Wolverhampton Society of Model Engineers were running a dual track miniature railway on which visitors could enjoy a short train ride.

The Grand Parade of Steam Vehicles really lived up to its name. I don't think I have ever seen so many steam powered machines in a parade ring at one time at a local Steam Engine Society event. It was a tremendous spectacle with the entry into the ring led by two giant showman's engines accompanied by the music of Elgars Pomp and Circumstance march played at full volume over the PA system. The way the engines all entered the ring was beautifully choreographed – most impressive and dramatic and a real show of steam power.

That just about sums up my visit to Shrewsbury. It was a good day out with plenty of action and interest for everyone – and thoroughly to be recommended for 2017. ■

**ABOVE**

A rare Robey Tandem Roller circa 1924 on its first rally after refurbishment.

BELOW

The 4" scale Scammell tractor unit built by Teifin Thomas.





Dual Purpose Coaches

In this article **Jan-Eric** describes the construction of two 7¼" gauge passenger coaches that serve a dual purpose – they can be used in a ‘display configuration’, looking like prototype coaches, or as riding cars in a ‘passenger configuration’. The conversion from one to the other takes only seconds. Since you would probably prefer to model a different prototype yourself no measurements are given. Instead, the article describes the general methods used to build these coaches, concentrating mainly on the woodwork and its detailing.

BY **JAN-ERIC NYSTRÖM**

The six, very quickly constructed, down-to-earth, extremely simple riding cars I had built for my trains (April 2016 issue of EIM) soon started to look very modest and more than a bit simplistic, especially since some of my live steam friends were building very detailed models with every rivet in the right place!

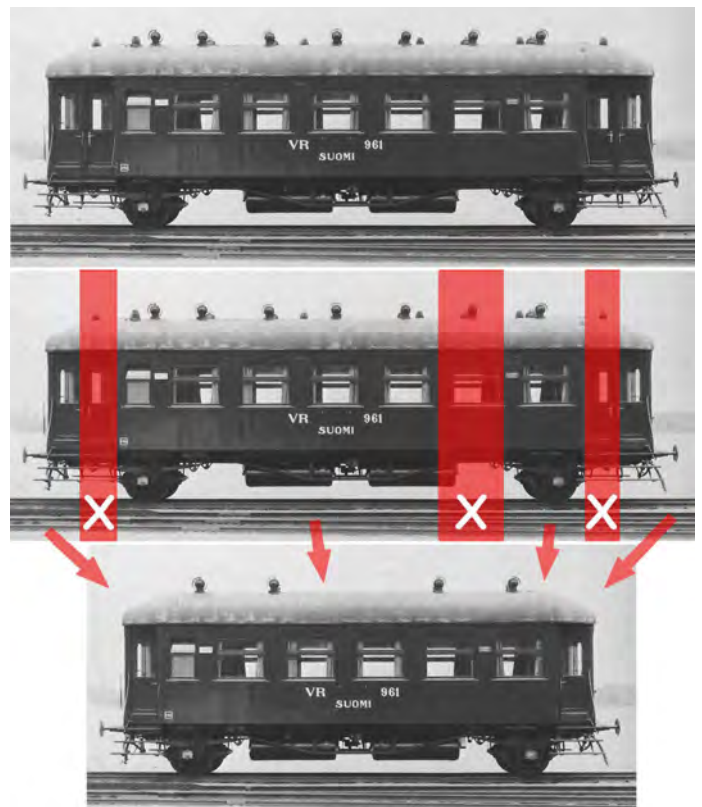
Therefore I decided to try my hand at something between these two extremes – coaches that look like the prototype (at least when viewed from a few feet away, as in photograph 1) but which could also be used for passenger hauling. Why make two sets of coaches if the two uses can be combined?

PROTOTYPE AND PLANNING

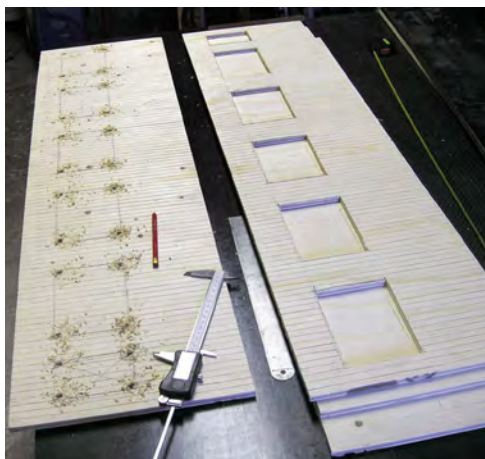
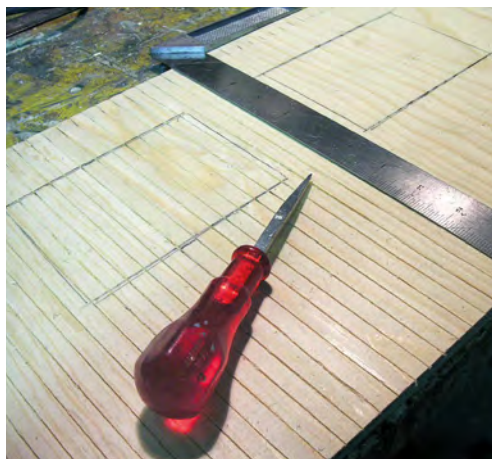
As the prototype I chose a wooden coach that I rode innumerable times in the 1950s to 1970s, indulging my ever-present railroad nostalgia. Photograph 2 shows an old picture of the Finnish State Railroad's "Ek"-type coach, of which 190 units were built from 1925 to 1946. In order to make coaches that would be easily transportable I did, however, modify the design somewhat.

Scaling down the original to one-eighth size, the total length over buffers would be around six feet, which I felt was a bit too long for comfort. A somewhat shorter length would enable me to

ABOVE PHOTOGRAPH 1
The author's two dual purpose coaches in their display configuration.



RIGHT PHOTOGRAPH 2
An old Finnish State Railways photograph of the prototype and how it was converted to a shorter version for construction in 1.5" scale.



carry the coaches in my vehicle, by removing the rear seats in my compact minivan. As shown in the figure, I shortened the coach by about fifteen inches, eliminating one window plus a door at each end. These modifications resulted in a coach that was a little under five feet long and still visually appealing in its proportions. In fact it is now very close to another prototype passenger coach from the same time period.

Scanning the old photograph, and also a rail fan's drawing of the prototype, into my computer it was a simple task to shorten the original design making the new proportions immediately evident. This gave me the confidence needed to embark on the construction project.

PLYWOOD, SOFT AND HARD

In order to keep costs down, and the workload as small as possible, I decided to make the coach tops of inexpensive, $\frac{3}{8}$ " three-ply softwood plywood, typically used for construction and industrial purposes. Painting would provide the surface finish so no fancy, expensive veneer was needed. The lumber yard cut a whole sheet into 11" wide strips, conforming to the scale height of the coach sides. I then cut these long strips to suitable lengths myself using a power sabre saw incorporating a laser line pointer. Thanks to the built-in laser I could make the cuts just as straight as with a table saw. Next, I used an awl to score the plywood and simulate the prototype's walls (photograph 3). Marking the plywood strip at the top, a layout square helped to evenly space the scoring. To make the windows I first marked them out then drilled holes in the corners to start the sabre saw cuts. This made quick work of sawing out the openings (photograph 4).

The coach bench has to be sturdy enough for several adults to sit on so here I used $\frac{5}{8}$ " resin-coated, nine-ply hardwood plywood (sometimes called "marine plywood"), as seen in photograph 5. The bench top (shown upside down) is attached to the sides with lengths of $\frac{3}{4}$ " hardwood in the corners. One of the benches, less the



ABOVE LEFT PHOTOGRAPH 3

Scoring the softwood plywood with a bradawl to imitate the paneling of the prototype.

ABOVE CENTRE PHOTOGRAPH 4

Marking, drilling and sawing out the windows.

ABOVE RIGHT PHOTOGRAPH 5

Assembling a bench from pieces of nine-ply marine plywood.

LEFT PHOTOGRAPH 6

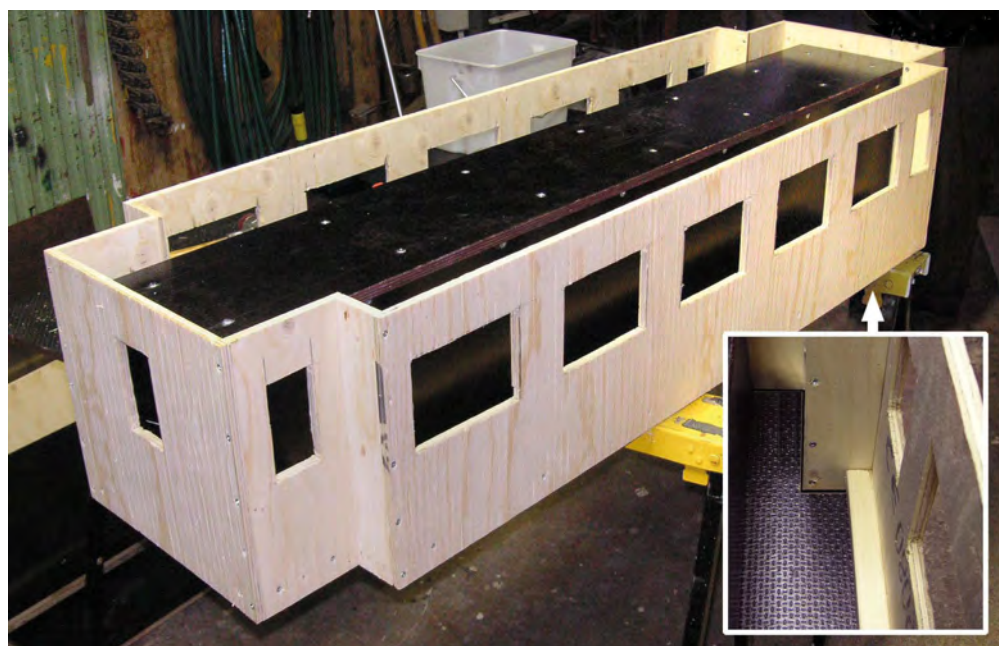
The bench is attached to the floor of the coach.

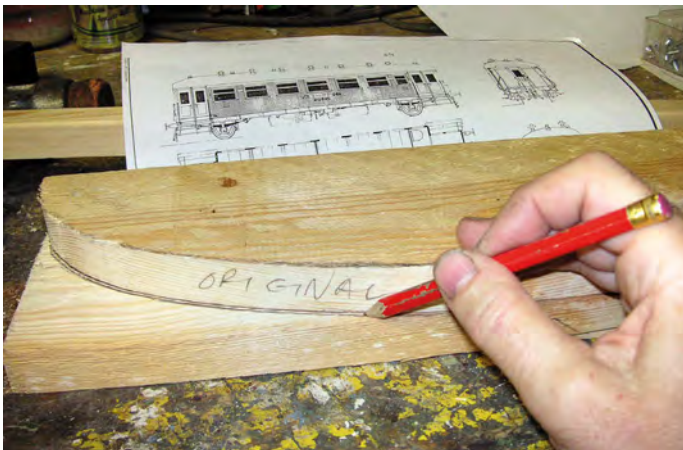
BELOW PHOTOGRAPH 7

The contour of the coach is taking shape. The inset shows a wooden strip on the inside of the wall, to hold the coach top in place on the floor.

end covers which were added later, is shown in photograph 6. The sides are held to the floor with woodscrews passing through the floor. Since the bench top needs to be removed occasionally, to provide access to the bolts that will hold the floor to the frame, it is held in place with the wooden strips and not screwed directly to the bench sides. Also note the cutouts in the corners of the floor – they conform to the narrower vestibules of the coach, thus allowing the coach top to be lowered into place.

In photograph 7 the sides of the coach are assembled around the bench and floor. Here I had to ensure there was enough clearance for easy removal of the top – about $\frac{1}{16}$ " on all sides. The inset shows the wooden strip on the inside wall, used to keep the coach top aligned to the floor. Since the plywood for the coach walls is $\frac{3}{8}$ " thick I could use small wood screws in the corners to hold the parts together – the structure will soon be reinforced with ribs and planks.



**PHOTOGRAPH 8**

The first rib for the roofing is used as a template for all the others.

**PHOTOGRAPH 9**

Five ribs to support the sheet metal roof.

A SIMULATED ROOF

The original coaches had canvas roofs covered with tar and sand to make them waterproof. My plan was to visually simulate this without worrying about the mechanical details of the prototype. Since the coach tops would be handled, maybe even somewhat roughly, every time the coaches were converted from one configuration to the other I also needed something that would hold the rather flimsy walls together. Planks to the rescue!

Copying the curved shape of the roof from the rail fan's drawing onto a $\frac{3}{4}$ " x 4" plank, I sawed and formed one rib to the exact contour and used that as a template to cut all the others – five for each coach, ten in all, to the final shape (photograph 8).

Splitting a plank lengthwise in two, I had suitable slats to reinforce the top edge of the coach by attaching the slats to the coach sides and to the underside of the ribs. This stabilized the structure so that it wouldn't flex. Photograph 9 shows a coach at this stage. A rechargeable hand drill with a 4" long screwdriver bit was of immense help in getting the Pozidrive-headed screws into the wood – ordinary slot-head screws and an old-fashioned screwdriver would certainly have meant slow progress and aching wrists!

In order to get a properly curved roof cover I cut a piece of 0.5mm thick steel plate to size and clamped it between a plank and a steel tube of suitable diameter in the bench vice. Almost by itself (ie by its own weight) the plate formed the required curve on the roof edge (photograph 10). This was done on both edges, of course.

Now it was an easy task to attach the sheet metal to one edge of the coach and form the rooftop curve (photograph 11). A few wood screws through the metal sheet on top into the ribs, and some more on the other



**LEFT
PHOTOGRAPH 10**
Bending the edge of the thin sheet metal to shape.

**RIGHT
PHOTOGRAPH 11**
Attached to one side of the coach, the metal sheet will conform to the shape of the ribs when stretched over them.

**BELOW
PHOTOGRAPH 12**
The roofing is in place. Note the round-edged plywood ceiling piece over the vestibule.



side, and I had the main part of the roof in place. At this stage I also attached properly formed pieces of plywood to form the ceilings of the vestibules (photograph 12).

« TO BE CONTINUED »



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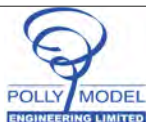
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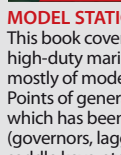
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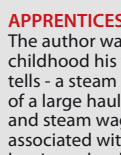
STIRLING & HOT AIR ENGINES by Roy Darlington & Keith Strong
Provides an essential reference to engineers, teachers, students and hobbyists and aims to provide a thorough insight into designing and building Stirling and other hot air engines. Describes the design ethos and principles used and looks at the machining, workshop techniques and processes that go to build such engines. Roy Darlington is one of the world's foremost authorities on small stirling engines and this book will keep any potential Stirling engineer fascinated for hours.



MODEL STATIONARY & MARINE STEAM ENGINES by K.N. Harris
This book covers a range of engines from the simplest oscillating engine to high-duty marine and small power enclosed engines. The illustrations are mostly of model stationary and marine steam engines built by the author. Points of general interest include reversing gears, lubrication - a subject which has been largely neglected - and a number of miscellaneous items (governors, lagging, splash guards, drain cocks, feed pumps, stop valves, saddle keys, etc.). First published in 1958 and now reprinted.



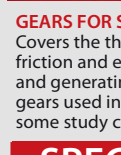
EXPERIMENTAL FLASH STEAM by J. H. Benson & A. A. Rayman
The authors cover the application of flash steam to transport and describe a home built steam car. They also cover other applications such as the model locomotive and Sentinel Railcar, however, they have concentrated on the use of flash steam in model boats and hydroplanes. They have approached the subject in a scholarly and lively fashion, and their work will go a long way to meet the demands of those who are responsible for the current revival of interest in the subject. First published in 1973 and now reprinted.



APPRENTICESHIP IN STEAM by Jack Hampshire
The author was born in Cowes, Isle of Wight, in 1898. During his childhood his father acquired - almost by accident, as this book tells - a steam engine and sawbench which led to the growth of a large haulage business employing steam traction engines and steam wagons. The author, in spite of his youth, was actively associated with the early years of the family business and, on leaving school entered into an apprenticeship in steam engineering in order to provide his father with some expert assistance. His formal employment with the firm was interrupted by a spell in the Navy as a steam engineer from 1917 to 1919, but then he worked with his father and brother until 1922. This book recounts his early years as an apprentice in the family business.



I WORKED WITH A TRACTION ENGINE by Jack Hampshire
The late Jack Hampshire was one of the small number of men, alas all now departed, who really had worked with road steam. Jack was driving engines for the family company when barely in his teens, and was to work with steam all his life, latterly the marine variety. The book vividly illustrates what was like hauling and threshing with steam during the first 30 years of the twentieth century, and make for a tremendous read. 168 pages.



GEARS FOR SMALL MECHANISMS by W. O. Davis
Covers the theory and practice of the design of very small gears, friction and efficiency of tooth action, design of tools for cutting and generating gear tooth forms and production and testing of gears used in clocks and other machinery. Required reading for some study courses.

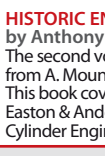


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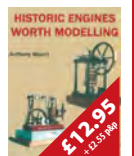
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HISTORIC ENGINES WORTH MODELLING VOL. 2
by Anthony Mount
The second volume of fascinating models of unusual historic engines from A. Mount, one of the UK's best known builders of model engines. This book covers four more popular engines; Benson's Vertical Engine, Easton & Anderson Grasshopper Beam Engine, Bodmer's Sliding Cylinder Engine and Simpson & Shipton's Short Stroke Engine of 1851.



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Building the LNWR Coal Engine in 5" Gauge

Hotspur details the oil boxes that provide lubrication to the rear coupled axleboxes

PART 10 – CONTINUED FROM PAGE 176 NOVEMBER 2016

MAKING THE OIL BOXES

These assemblies are a bit fiddly but they are a very worthwhile addition to the cab fittings, especially as I think the oil box in particular should be functional and give a direct feed to the rear coupled axle bearings. Fitting them will require the two oil pipes to be carefully positioned around the rear spring beam so that the oil can drip down onto the feed holes for the bearings and hornblock guides.

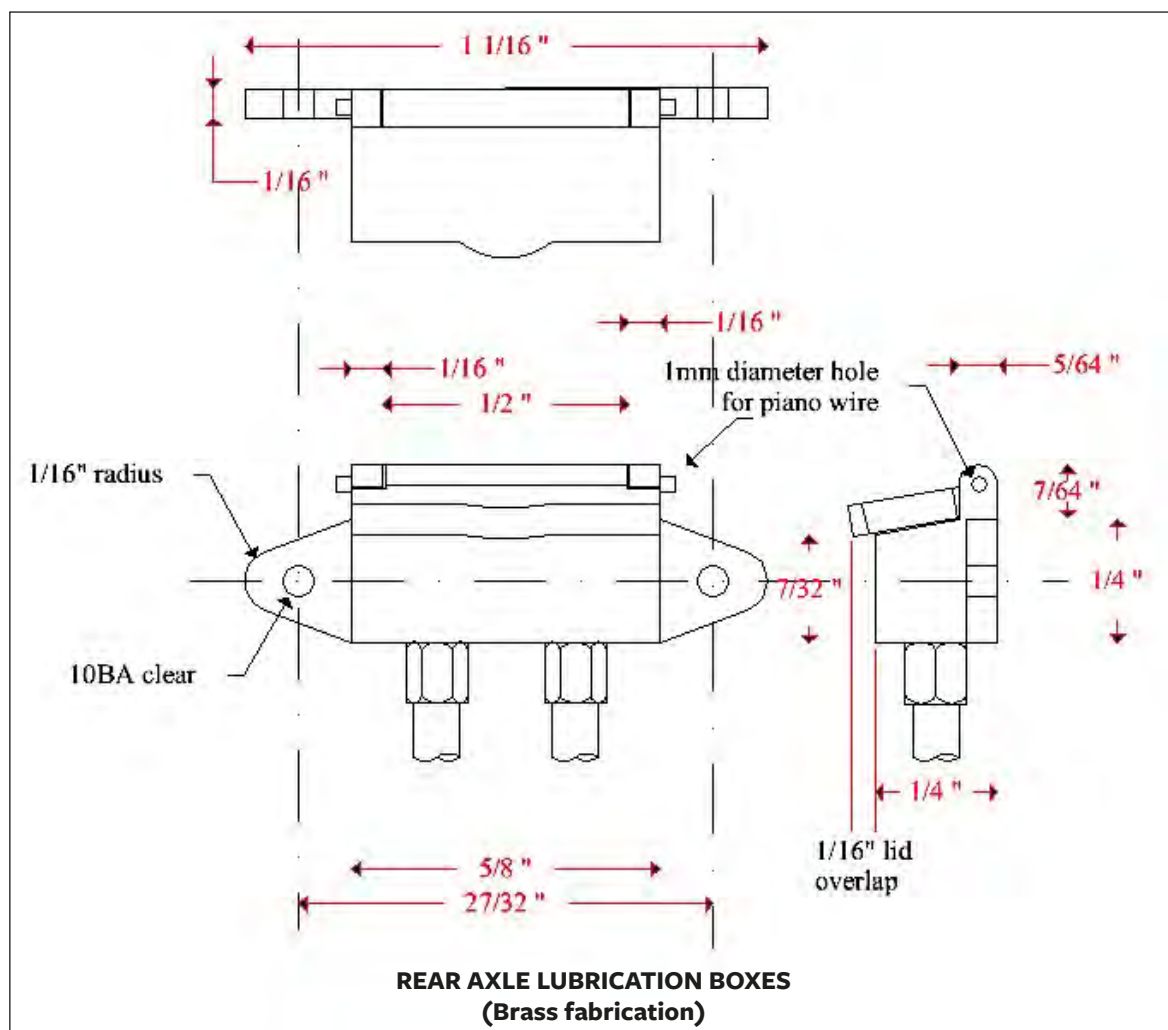
The materials consist of a short length of $\frac{1}{4}$ " square brass rod and scraps of $\frac{3}{8}$ " x $\frac{3}{8}$ " x $\frac{1}{16}$ " brass angle. I have included a sketch with my drawings to show the orientation of the parts and the order of

assembly. Cut off two lengths of brass rod to finish squarely at not less than $\frac{1}{2}$ " long and add a $\frac{1}{32}$ " slope down on the intended top face. Also, mark out and drill two pilot holes right through on the centre line and $\frac{3}{32}$ " apart about 1mm diameter for the oil sockets as these will remind you which way up the body should be. Next, square the end of the brass angle and cut off 4 pieces not less than $\frac{3}{8}$ " long to be the extensions to the body and the attachment brackets. These short lengths need their bases to be square to sit correctly against the block for assembly. One of my photographs shows how these are positioned each side of the main



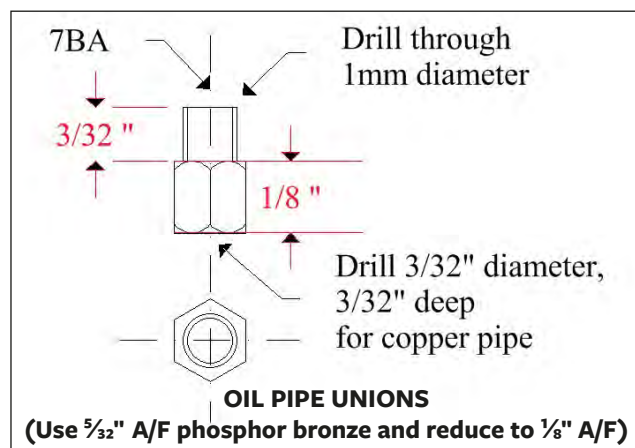
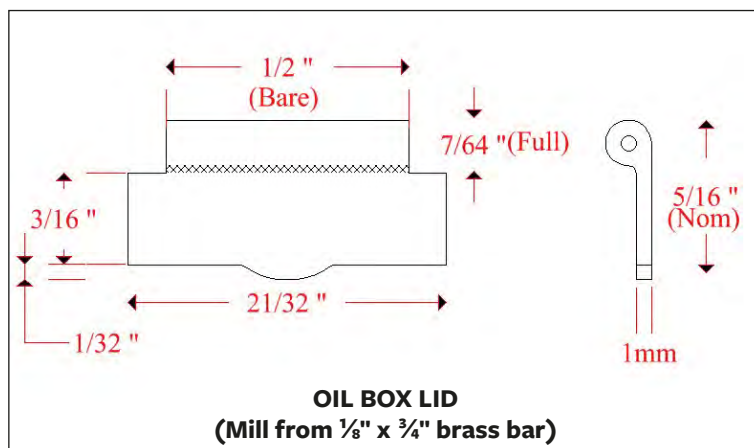
PHOTOGRAPH 1

The central block prepared for assembly and drilled for the oil pockets.



1mm diameter p
holes on centre

1/4" square brass ba
with 1/32" taper
on top face



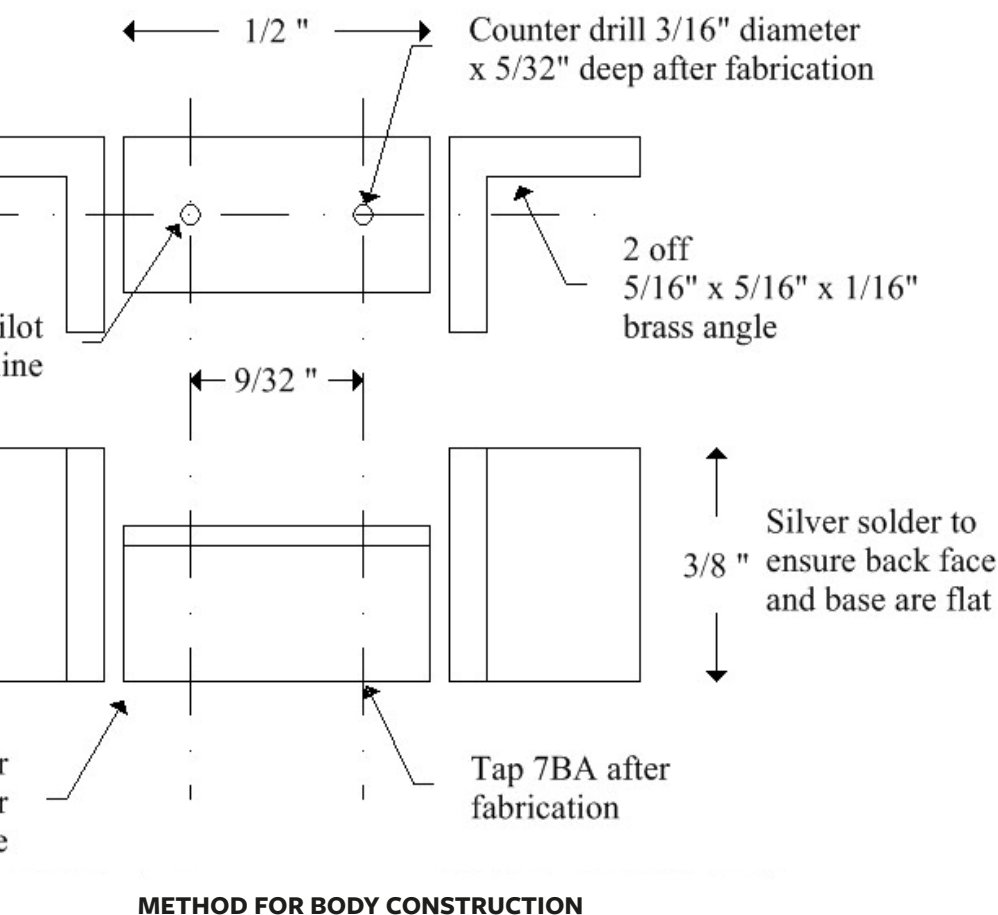
LEFT PHOTOGRAPH 2

The three parts for the box assembly placed together on a flat fire brick for silver soldering.

body block on a flat firebrick for silver soldering them together. Make sure the fabrication gives an assembly that is as flat as possible on the base and the back faces.

The next task is to clean up the assembly and carefully file away the unwanted material to leave the two lugs standing up for the lid pivot holes; the two outer ends can be shaped to provide the mounting brackets. The only two faces that are flat enough to be used for holding the assembly are the back and the front but with care and ingenuity the surfaces can be filed to size. Radius the pivot lugs and very carefully mark out the centres for the two 1mm holes; I have used a length of stainless steel wire for the pivot shaft. At this stage it is also necessary to drill out the oil pots themselves and I have specified using a $\frac{3}{16}$ " drill zeroed on the top face and drilled down just 4mm in total. From underneath the two pilot holes need to be opened up to 7BA tapping size and then threaded for the pipe unions.

Make the lid for the oil box from a piece of $\frac{1}{8}$ " thick brass bar about $\frac{3}{4}$ " wide. I held mine on my lathe topslide to reduce the lid material to thickness; a milling cutter with very slightly radiused corners is ideal here as it provides the start of the sweep up to the hinge section that then just needs to be radiused off to give a profile that matches the lugs on the body. Fitting the lid can be awkward but I put the two shoulders on each corner and held the part onto the body to spot through for the centres of the pivot rod. I set the part up vertically in my machine vice and very carefully drilled the 1mm hole through from each end. It met in the middle without any difficulty and then a trial fit of the hinge rod only required some minor metal removal around the lid to enable it to seat fully and open properly. The final width of this lid needs to be very slightly wider than the body all round and should have a convenient lifting tab in the centre. This detail should be clear from my drawing and photographs.



Make the oil pipe unions from the smallest phosphor bronze hexagon section you can obtain. My stock is the smallest available at $\frac{3}{32}$ " A/F but with care I filed down the faces to get it nearer to $\frac{1}{8}$ " A/F. This can be done by holding the material with one face level in your vice and using a sharp 6" file to remove $\frac{1}{64}$ " from one side while keeping the face parallel and checking with a micrometer that an even amount has been removed. Turning the stock bar round and repeating the operation for the other four faces should give a passable approximation for the parts required. I produced a reduced section just over 2" long which was sufficient for the 4 pipe unions. Face one end then shoulder the bar to add the 7BA thread using the oilbox body as a gauge. When the thread size is correct, make a centre to drill a 1mm diameter hole a full $\frac{1}{4}$ " deep for the oil feed. I feel this order of manufacture is best as once the bronze bar has been drilled it is not very strong. Part-off the union and do the same for the other end with a counter-drilling to take the $\frac{3}{32}$ " copper feed pipe that will be silver soldered in place.



Next time I will describe the complete assembly and include the modifications I made to the rear suspension spring beam and the drillings in the axleboxes for the oil feed pipe positions.

« TO BE CONTINUED »



**ABOVE LEFT
PHOTOGRAPH 3**

The fabrication filed and drilled to complete the oil box body.

**ABOVE RIGHT
PHOTOGRAPH 4**

The lid shaped and held for drilling for the pivot wire.



**LEFT
PHOTOGRAPH 5**

The lid assembled to the body; the pivot wire should be left long and carefully ground on the ends to create a burr to prevent it working loose.

**RIGHT
PHOTOGRAPH 6**

Another view of the completed oil box.



**LEFT
PHOTOGRAPH 7**

Filing down the hexagon phosphor bronze; to keep the length stiff the end is jacked up on a support across the vice jaws.

**BELOW
PHOTOGRAPH 8**

The oil box with its pipe unions ready for fitting.



The EIM Steam Plant – The Engine – Part 1

Martin Gearing begins the manufacture of the double-acting oscillating engine for the EIM steam plant by tackling a simple task – bringing the base of the engine to the correct dimensions.

BY MARTIN GEARING

The order in which the items are presented in the following notes has been chosen as far as possible to present the techniques needed in a logical order, beginning with a simple example first and gradually becoming more complex as necessary to make up the parts required to make a complete steam plant.

PREPARING THE BLANKS

The larger main parts of the engine consist of three stationary parts and the pivoting oscillating cylinder block, to which are secured three covers. The base has secured to it the main bearing block and port block, onto which is pivoted the cylinder block. It makes sense to prepare the blanks for these seven items together as the cutting tools, accessories and setting techniques are the same for each one.

BASE – ITEM E1

Brass – 6.35 x 48 x 100.

Refer to – Drawing E1 and again to Fig 2 – DATUM Locations (EIM, October 2016).

Because the material is supplied in the thickness required we only need to concern ourselves with bringing it to width and length.

Take the blank supplied and remove any burrs produced in the cutting process with a fine file.

Wipe the blank and fixed jaw clean. Use a permanent marker to mark the best face, which is now your DATUM FACE, and position it against the fixed jaw with the length running left-to-right.

If necessary use a parallel between the bed of the vice and the base edge to raise the top edge at least 5 -10mm above the top of the closed vice jaws.

Tighten the vice and tap the edge down with a soft faced hammer to ensure full contact with the vice bed and move the blank on the Y axis so that its edge lies on the centre of the cutter.

Using an end mill around 12mm diameter running at about 250rpm, feed the work on the Y axis at a slow steady rate past the cutter, raising the Z axis until the cutter just takes a continuous skim off the protruding edge. Stop the cutter. See photograph E3.

Release the work and remove any burrs with a fine file. Mark the surface with a permanent marker and measure the width. This is now your DATUM EDGE.

Clean away any swarf particles from the work, vice and parallel. Return the

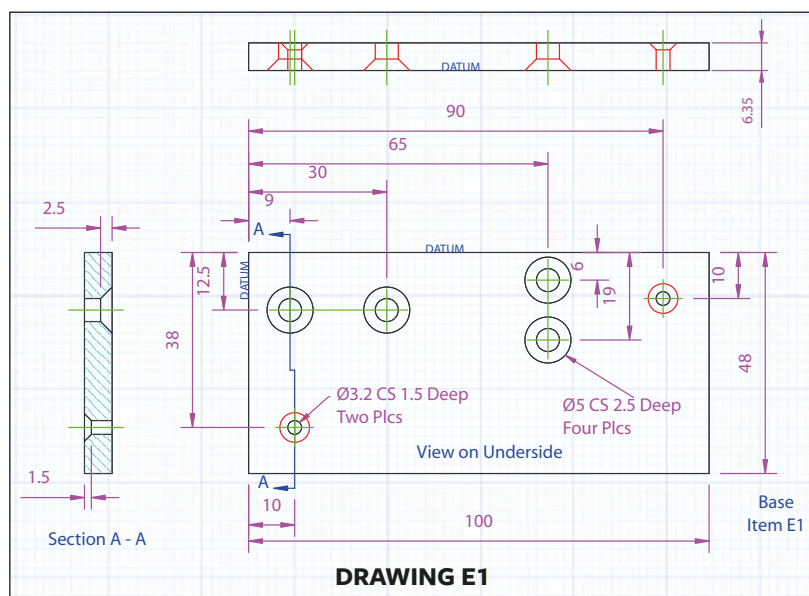
work back to the vice keeping the marked DATUM FACE against the fixed jaw and the marked DATUM EDGE surface now positioned against the vice bed (on the parallel if used). Tap the edge down with a soft faced hammer as before.

Feed the work on the Y axis at a slow steady rate past the cutter, raising the Z axis until the cutter just takes a continuous skim off the protruding edge, as before. Stop the cutter. Zero the Z axis dial.

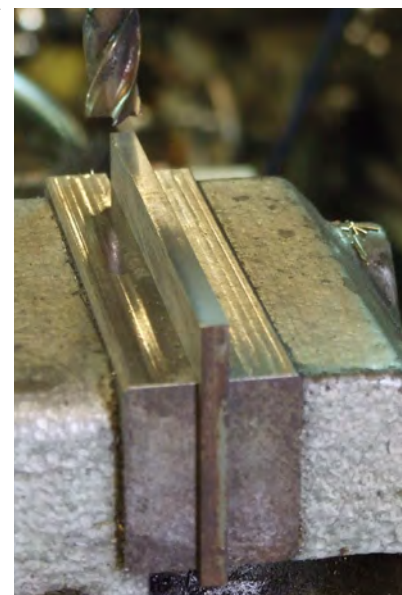
Release the work and remove any burrs with a fine file. Measure the width, subtract the required dimension of 48mm from this figure, and note the result.

Clean away any swarf particles from the work, vice and parallel. Return the work back to the vice keeping the marked FACE against the fixed jaw and the marked EDGE surface against the vice bed (on the parallel if used). Tap the edge down with a soft faced hammer as before.

Raise the work on the Z axis the amount calculated, less 0.2mm and machine that amount away from the protruding edge. Finally move the work the remaining 0.2mm on the Z axis, and feeding on the Y axis slowly, take a finishing cut.



RIGHT PHOTOGRAPH E3
Machining the datum EDGE.



Remove the work and measure the width which should be $48 \pm 0.1\text{mm}$ which means any figure between 47.9 to 48.1mm is acceptable. Take off any burrs with a fine file. See photograph E4.

Because the work piece is thin and the vice jaw opening would be correspondingly small if holding its thickness, it is difficult to ensure the blank is vertical when machining the first of the ends, which has to be square to the two DATUM surfaces produced so far.

One of the safest ways to produce the DATUM END square to both these datums, after cleaning the vice parallels and work of any swarf, is to set the DATUM FACE down onto parallels (to bring the work near to the upper part of the vice jaws for ease of access) and position it to protrude about 5mm from the right hand end of the vice jaws. The DATUM EDGE is placed against the fixed jaw. This is when the care you took setting the fixed vice jaw parallel to the X axis pays dividends!

To prevent the cutter grabbing the work as it rotates (called 'climb milling') the cutting forces must push against the work. Therefore the clockwise rotating cutter must be to the right of the surface being milled and the cut started from the front of the vice and move back towards the fixed jaw.

Make sure the parallels do not protrude beyond the right-hand side of the vice jaws and tap the face carefully down with a soft faced hammer to ensure the parallels are held.

Position the cutter vertically so that it goes past the lower surface edge of the blank by about 5mm and with the cutter running, move the vice on the X axis until the cutter JUST touches the protruding end. Zero the X axis dial.

Move the blank back on the Y axis, so the cutter is clear of the work and to the front of the vice, put a 0.2mm cut on the X axis and apply the table lock.

Machine the end face past the rotating cutter by feeding the work on the Y axis away from the machine frame slowly so as to produce a fine finish. Stop the mill. See photograph E5.

Remove the blank from the vice, take off any burrs with a fine file, and check that it's square to the FACE and EDGE, marking the end face with a permanent marker. This is the final DATUM END. Clean away any swarf from the vice, parallels and work before replacing the blank in the vice with the FACE down and EDGE against the fixed jaw. However, this time position it with 5mm protruding

RIGHT PHOTOGRAPH E4

Checking the WIDTH is in Tolerance.



RIGHT PHOTOGRAPH E5

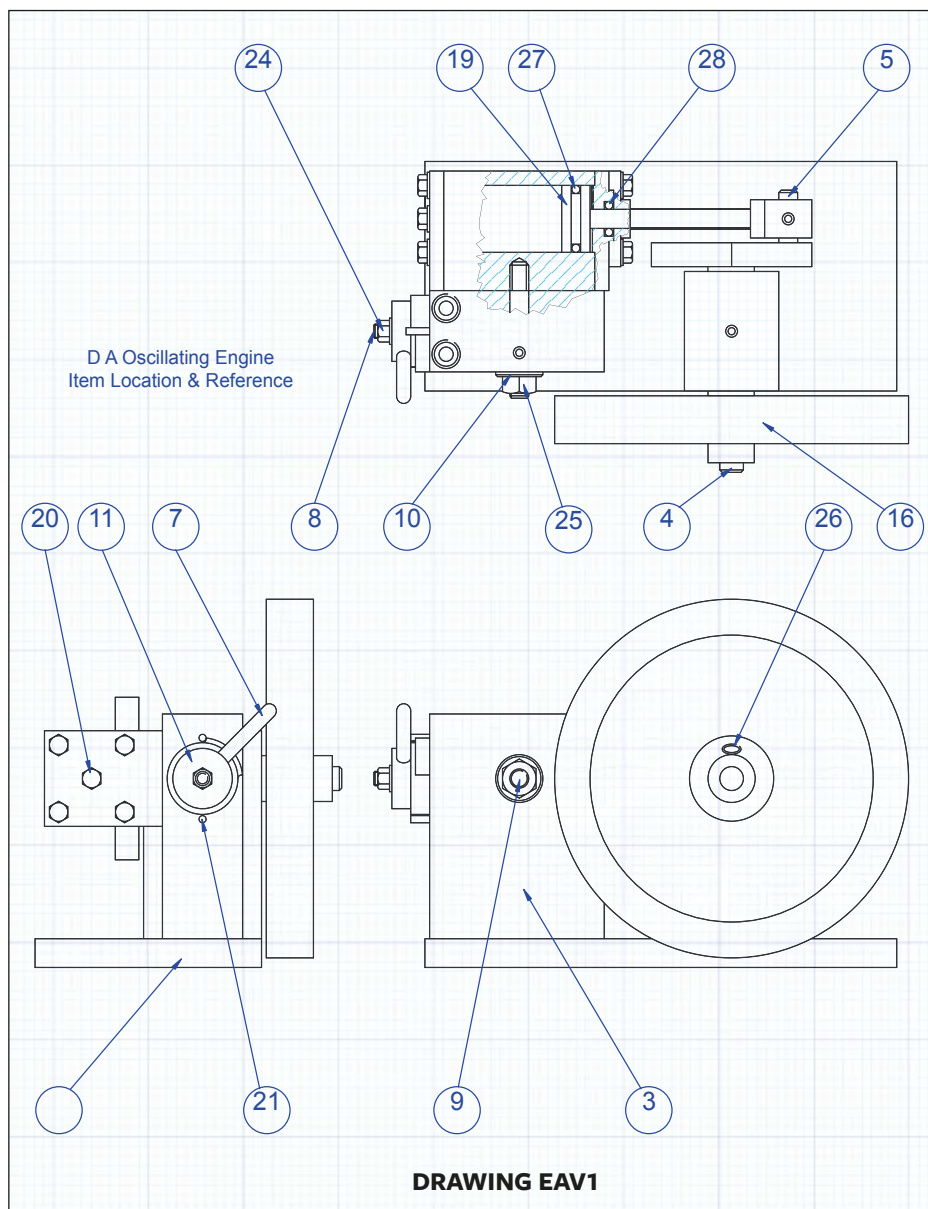
Machining the Datum END.



RIGHT PHOTOGRAPH E6

Checking the LENGTH is in tolerance.





from the left-hand side of the vice and, after checking that the parallels beneath do not go past the vice jaws, tap the face carefully down with a soft faced hammer to ensure both the parallels are held.

Move the cutter to the left of the vice and to the rear alongside the fixed jaw. This is to ensure that the cutting forces will be against the work and 'climb milling' will not take place. With the cutter running, move the vice on the X axis until the cutter JUST touches the protruding end. Zero the X axis dial. Move the vice back on the Y axis to clear the cutter and put on a 0.2mm cut on the X axis – lock the table. Feed the work past the cutter towards the machine column and when the cut has finished return the cutter back to the start position to the rear alongside the vice fixed jaw. Stop the cutter, and zero the X axis dial.

Because of how the blank is held in the vice the distance between the two end faces may easily be measured; subtract 100 mm from this figure and note the result. Move the work on the X axis the amount calculated less 0.2mm and machine that amount away from the protruding edge. When the cut has finished return the cutter back to the start position to the rear alongside the vice fixed jaw and put on the remaining 0.2mm on the X axis. Feeding on the Y axis slowly, take a finishing cut.

Stop the cutter and measure the length which should be 100 ± 0.1 mm, meaning any figure between 99.9 and 100.1mm is acceptable. See photograph E6.

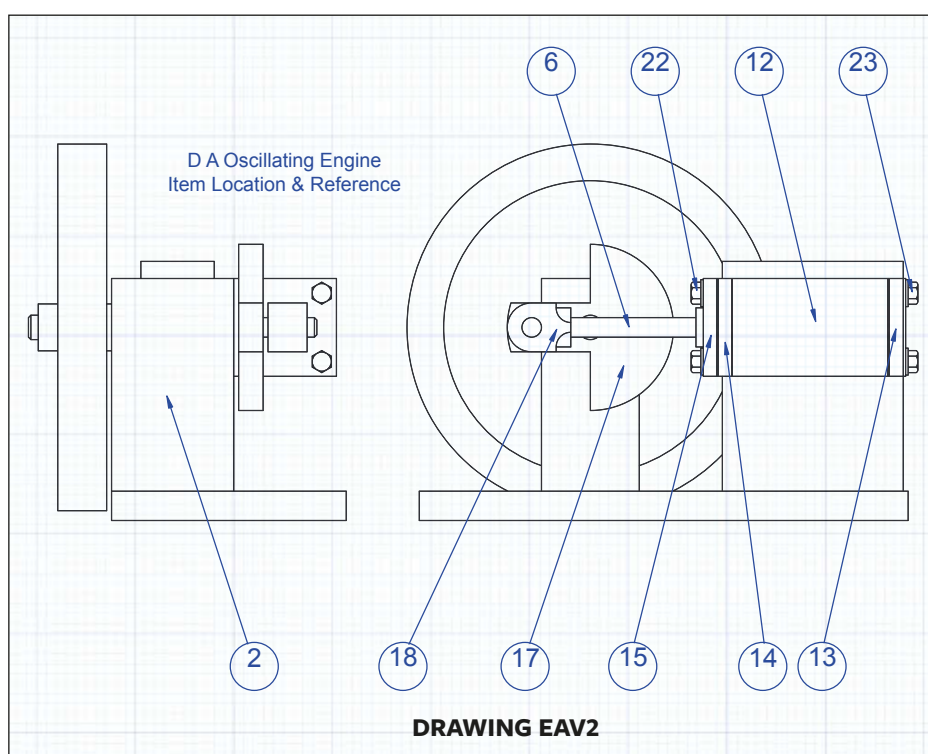
Remove the base blank from the vice and double check that all of the surfaces are square to one another.

The same process is repeated for the other six main components with some variations made necessary because of:

- 1) The need to machine all six surfaces,
- 2) The different proportions of width to thickness to length and
- 3) The material specified for some of the parts being cheapest in round section so two flat dimensions have to be created from a diameter.

We will start to deal with these in the next instalment, which will include a reference list of all the engine parts.

« TO BE CONTINUED »



BUILD NOTES

Tolerances for all parts in the article – unless stated otherwise:

- Non-functional (ie parts not a fit or a match): ± 0.1 mm
- Functional (ie parts having to match): ± 0.02 mm

All drawing labels start with the reference letter E.

A Millstone Made of Araldite

David relates how he learned a hard lesson that will 'resinate' with many of us

BY DAVID HARTLAND

We model engineers are all scroungers and hoarders – you are, I am, he is. Admit it or lie. Sometimes this obsession with hoarding can be our undoing,...

My last company used a large quantity of Araldite in the production processes. This Araldite arrived in 5 litre cans, just like paint cans, with press fit caps and a metal handle. You all know the stuff – one can for the white Araldite resin and one can for the brown, treacle-like hardener. Occasionally the rate of delivery did not match the rate of usage and stock of these cans would build up in the stores. Each can was marked with a 'use before' date and once the date had passed the cans were thrown out with the scrap. It was one fine day in 1992, therefore, that I noticed two cans in the scrap pile, each marked 'USE BEFORE 20 JUNE 92'. A quick word with the responsible person and these two cans were on the way home to my workshop. Needless to say, Araldite does not deteriorate very quickly. If the raw materials are kept cool there is every chance that the constituents will have a shelf life of decades with only a slight reduction in cured strength of the glue. The USE BEFORE date is very conservative.

When the cans reached my workshop I immediately decanted a small amount of the white resin and the brown hardener into two screw-top coffee jars. This is not an easy process – the white resin is quite viscous and needs spooning out while the brown resin is tacky and has a pungent smell. Any spillage in the decanting process was dealt with by wiping with paper towels – again not easy because of the viscosity of the materials. Anyway, the two jars were each half-filled and over the last 24 years they have formed my supplies of Araldite for all manner of jobs in the

house as well as projects in the workshop. A ready source of good glue tends to focus the mind into using the stuff. Several years ago the two coffee jars approached empty and I took the opportunity to top up the level by decanting more from the two large cans.

In the 24 years I have moved my house and workshop three times. Each time all the machinery, workbenches, raw material, tools and finished and unfinished projects have moved with me – and with the hoarder instinct as time has gone on the volume of each of these categories has steadily increased. Each time, all my paint pots have been moved carefully, keeping them upright in boxes, and amongst this have travelled the two cans of Araldite and hardener, each time packed up and unpacked. Each time, the cans look a little more rusty on the outside, the label USE BEFORE 20 JUN 92 a little more faded.

Recently we have moved back to Taunton. The move of the workshop this time has not been straightforward, owing to the fact that the building did not exist at the time of the move. This is a long story best left untold but suffice it to say that for some time I have had boxes stacked up in the old garage awaiting sorting. Heavy boxes, mixed contents, not entirely uncrushable boxes. More things have been added as the weeks have gone by. The new building has been taking shape around it. As is so often the case, recently I had to dash off on business for a few days and on my return a look into the workshop revealed that a few boxes had collapsed, crushing the contents. After cursing loudly, I set about the process of sorting through the pile, opening boxes, recovering parts. One box had two rather

rusty tins, one of which had been tipped over and the lid squeezed out. Yes, you've guessed it, the Araldite hardener, all that brown, sticky, treacle-like liquid had flowed out onto the box underneath, and over the intervening days had passed onto the concrete floor and flowed in a devious and loathsome manner under a plastic mat, around a fly press, into a stack of wood and among numerous other items on the floor. A happy hour or two followed while I attempted to clean up. Large globules of the hardener I scraped up and ladled into plastic bags, but the remaining smears and drips were more tricky. Rubbing with white spirit failed, so did petrol, so eventually the remaining sticky patches were liberally coated with cement powder and rubbed vigorously before dumping the gooey mess into more plastic bags. The tin of hardener was tossed into the trailer ready for the tip. The psychology of dealing with this sort of spill is interesting – a sort of phobia develops where some hours after finishing the job everything touched seems sticky even if it is actually perfectly clean. I passed through the initial rage – rage at losing the tin – but consoled myself with the fact that Araldite was not actually that expensive to buy! At that moment, however, the hoarder instinct clicked back in. I remembered that the burst tin of hardener was actually not quite empty. Back I went to the trailer and fished out the plastic bag with the tin, (more sticky fingers and gloves) and carefully decanted the remaining clean hardener in the bottom of the tin into a clean coffee jar. (More cleaning with petrol, white spirit and cement powder to remove stickiness). At least I would save some for future use. The next job was to decant an equal amount of the white resin from the other (undamaged) tin to keep for future use. I searched out the white resin tin and prised open the lid.

I suppose there comes a time in life when one realises that time is precious and wasted time is a tragedy. Small amounts of wasted time over many years are even more frustrating. So, for me, it was on that day, just a few weeks ago, that I realised my own folly – a millstone of my own making. The white Araldite resin – that which has accompanied me through 24 years of model engineering and has helped with endless small jobs – but that which has involved so much effort in moving, packing and unpacking and recently caused so much upset and effort in cleaning – the resin had solidified in the tin. ■



Notes of a Beam Engine Builder

How a part-built Stuart Beam Engine lay forgotten for over half a century before finally being brought to life

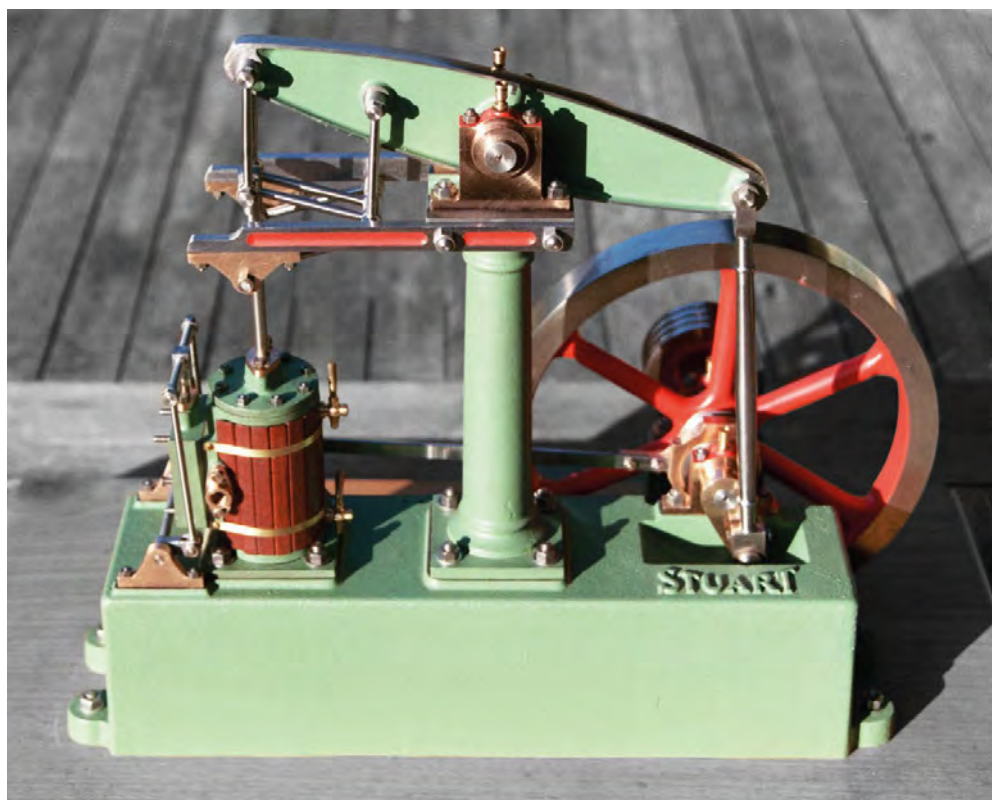
BY PATRICK CARNEGIE

Some projects take longer than others, but the protracted completion of this one bids fair to set some kind of record.

Much of my happiest time at school was spent in the workshops. By the time I left at the age of 17 my finished work included a Stuart 10V together with a complete steam-plant for a 5' model boat, and a $\frac{3}{8}$ " sensitive drill from an excellent kit of castings, sadly, I think, no longer available. But left unfinished at my departure (one had to steal some time for A levels) was a Stuart Beam Engine. I'd managed to tackle only the flywheel and the top and bottom of the column.

Real life intervened until a few years ago when, on holiday in Tobago, I stumbled upon the remains of a sugar-crushing plant. When the rains fell it had been powered by a Fairbairn-type overshot waterwheel and in the dry season by a mid nineteenth century galleried beam engine. I photographed the magnificent machinery and wrote it up for an article published in *Model Engineer* (14-27 September 2007). Just as well, for the whole site, already tragically neglected, has been catastrophically devastated by a fire.

This reminded me that back at home, languishing under my workbench, were the neglected embryonic bits and pieces of my own beam engine. As described in a previous piece for *Engineering in Miniature* (August 2016), this was the cue for realizing my dream of a dedicated 'engineerium', complete with Boxford lathe and Raglan mill. It has taken me some four or five years to complete the Stuart beam engine and given me great pleasure to do so (photograph 1). In the process I've learnt much and I'm writing these notes in the hope they may interest other builders of this justly popular model. The basics are well covered in Andrew Smith's booklet



Building the Stuart Beam Engine (1977 and subsequent reprints). What follows covers only a few of what I found to be the trickier corners.

Never imagine that cast iron stays still. Abandoned for some 50 years my dust-encrusted flywheel failed to run true. The solution was to clock it up on a faceplate, open up the bore, loctite in a brass bush and rebore. Finally, mounted on a mandrel, the rim was skimmed and polished. No better way to advertise incompetence than a wonky flywheel!

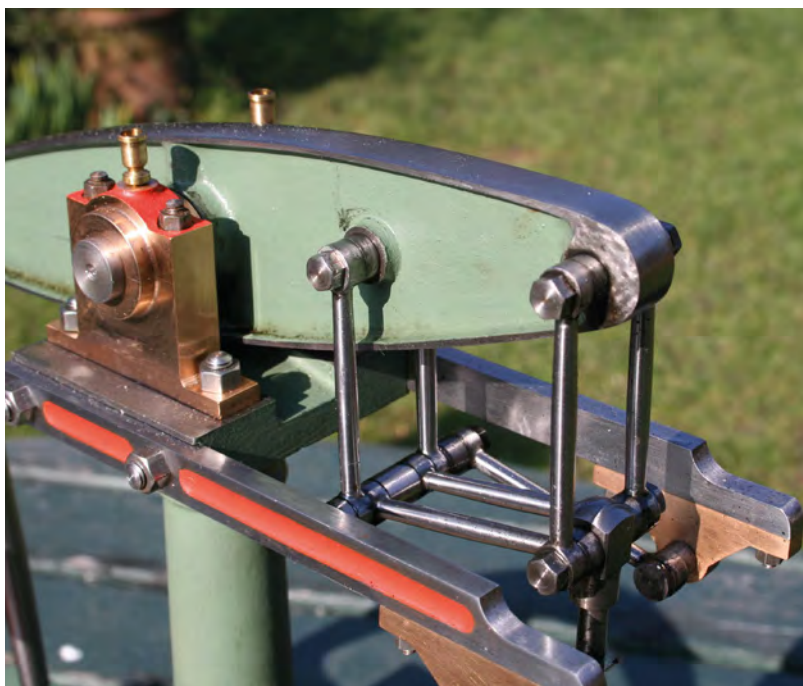
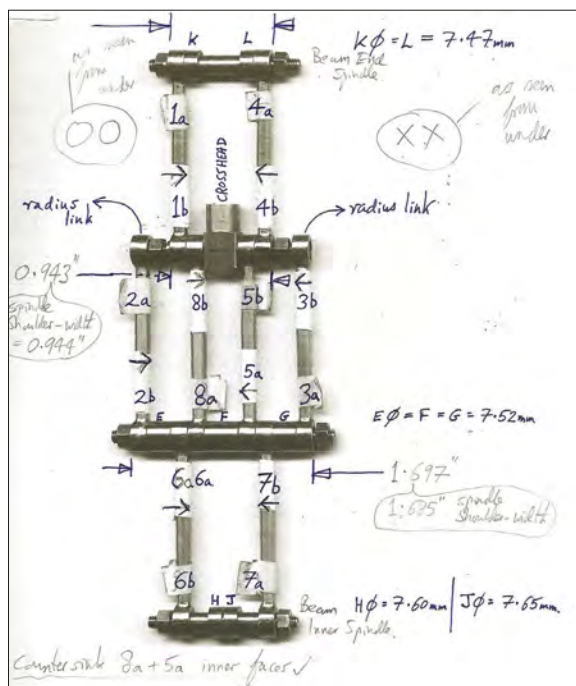
Much of the model's attraction lies in the operation of the Watt parallel motion. But, although a simplified version of full-size design, this needs eight fiddly little links. Stuart gives the option of leaving these 'in the flat' but they look

ABOVE PHOTOGRAPH 1

The Stuart Beam Engine, begun 1957 and approaching completion after being abandoned for half-a-century. The valve-chest cover is missing and the governor is still to come.

infinitely better if the centre sections are turned to 'fish-belly' shape. In ski-parlance, this is something of a black run. It's not too hard to devise a way of holding the little pre-drilled flat strips in the lathe and turning the centre sections. The difficult bit is shaping the rounded ends.

This plainly calls for filing buttons (one on each side, with a screw holding them together) and top quality needle files like the Vallorbe ones I used. It also calls for much patience and a steady hand. It's alarmingly easy for the file to slip and score your beautifully finished fish-bellied spindle. Timing myself, out of curiosity, I found it took 6½ hours to make each link. There are two similar links for the activation of the slide-valve – even more difficult as they're longer and thinner!



A little further down the line lies the trial assembly of the links with the other much easier components of the parallel motion. Although each link is supposedly identical, I never trust myself in such matters and, as you can see in photograph 2, each one was labelled to ensure it would retain its exact place in the assembly. This was just as well for, as all builders will discover, the clearances here, as elsewhere in the model, are uncomfortably tight. When the parallel motion is finally fitted, as it moves up and down the clearance between the crosshead nuts and ends of the radius links is less than $\frac{1}{16}$ " on either side.

For this reason, and for all others, the alignment of the column and its attached entablature (the two arms from which the parallel motion pivots) with, at the one end, the crankshaft and, at the other, the cylinder has to be spot on. I found it was best to determine and fix the column quite precisely (tight rather than 'clearance' holes for the studs securing the base). Then drill much easier 2BA clearance holes for the retention of the bottom cover of the cylinder, enabling the whole cylinder assembly to settle into its own optimum position before bolting it down. To help with this I turned a hardwood disc to the 2" diameter of the distance between the inside faces of the entablature arms, drilling it for the $\frac{3}{16}$ " piston rod. In effect, this was making a giant wooden 'piston', fitting snugly between the entablature and ensuring that when the cylinder was correctly positioned below, the fully extended piston rod

ABOVE LEFT PHOTOGRAPH 2

The parallel motion in spatchcocked trial assembly, each link labelled to preserve its particular place.

ABOVE RIGHT PHOTOGRAPH 3

Parallel motion in place on the model. Note the sculpted ends and milled channels in the arms of the entablature.

RIGHT PHOTOGRAPH 4

The cylinder head, with eight studs and nuts securing the top cover. The lagging strips are mahogany with brass cleading bands. The glands are as yet 'unstuffed', their set-screws waiting to be replaced by the correct studs and nuts.

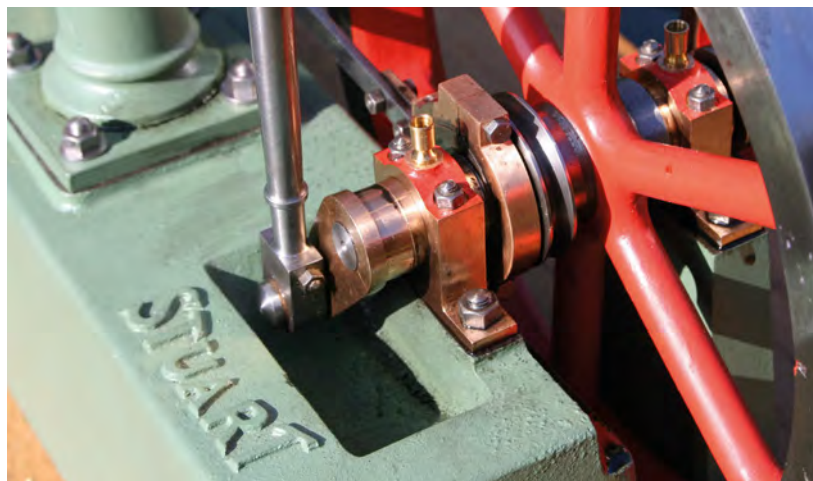


would fit perfectly into the wooden 'piston'. Hopefully you'll find this, or some variant thereof, much easier to do than it is for me to describe!

I couldn't resist some embellishments to the functional severity of Stuart's 'off-the-plan' design. You'll see (photograph 3) that I've profiled the otherwise blunt ends of the entablature arms, and used a bull-nosed endmill to give interest to the otherwise flat sides. I also thought it a good idea, following full-size practice, to increase the number of bolts securing the top cylinder cover from four to eight (photograph 4). Here,

as elsewhere, I replaced set-screws with the more prototypical studs and nuts. Discovering that you can get 2BA nuts 'one size down' for a 3BA spanner I used these wherever I could as the smaller nuts certainly look better. And it was very worthwhile making mahogany lagging strips for the cylinder.

With the engine approaching completion I thought it would be good to add a governor, for which Stuart can supply a kit that I duly bought. But governors are intrinsically problematic, especially as the Stuart governor, a relatively late addition to their range, has



been designed on a 'one size fits many different models' basis. To accommodate it to the beam engine you need to make modifications to the eccentric sheave and to the valve chest (photograph 5). These are detailed in the drawings and were easily managed. But a trial fitting of the governor to its appointed position on the cast-iron base of the engine revealed a problem unmentioned in the Stuart instructions. The spring belt running between the extra pulley on the crankshaft and the governor's small pulley was seriously fouling

the rim of the flywheel (by as much as $\frac{7}{16}$ "). I checked and re-checked the drawings but I'd followed them faithfully and there remained this horrible little problem, as you can see in photographs 6, 7 and 8.

So I got in touch with Stuart's but without being given any plausible explanation, only the suggestion that perhaps I should move the flywheel further out. Certainly this would be do-able, but only by also moving out the pedestal carrying the outer bearing of the crankshaft. To attempt this would have risked disturbing the sensitive

LEFT PHOTOGRAPH 5

The in-board end of the crankshaft. The boss of the eccentric strap has been removed to allow room for the steel pulley which, with the help of a spring belt, will drive the governor.

alignment of both crankshaft bearings – they had been carefully reamed in-line in situ.

After much time exploring possible solutions, which included re-designing the governor's drive system for the bevel gears that would be typical of full-size practice, I decided simply to move the governor's cylindrical base further in-board. The only snag was that this brought the base smack into the line of the eccentric rod. So this meant making a new eccentric rod, cranked to give it clearance around the governor base. Even so, the run of the spring belt brought it painfully close to the motion of the eccentric strap and necessitated filing off the corner of the lug attaching it to the rod. A few other small changes needed to be made and the eagle-eyed will spot these in photographs 10.

As you can imagine this was all rather tiresome. So beam-engine builders beware, and I do think Stuart should give due warning.

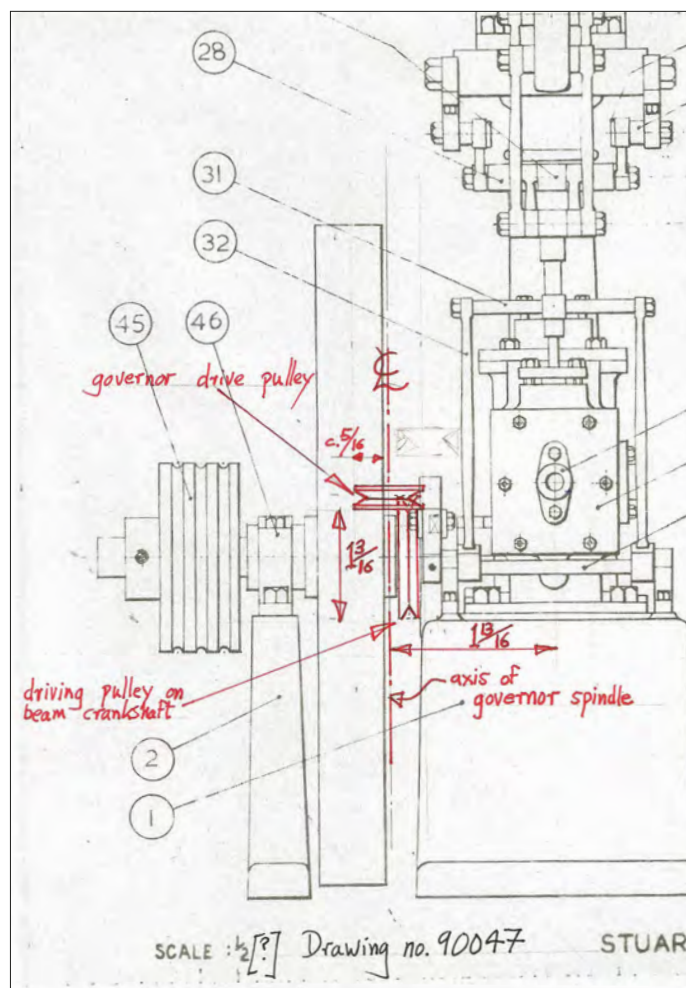
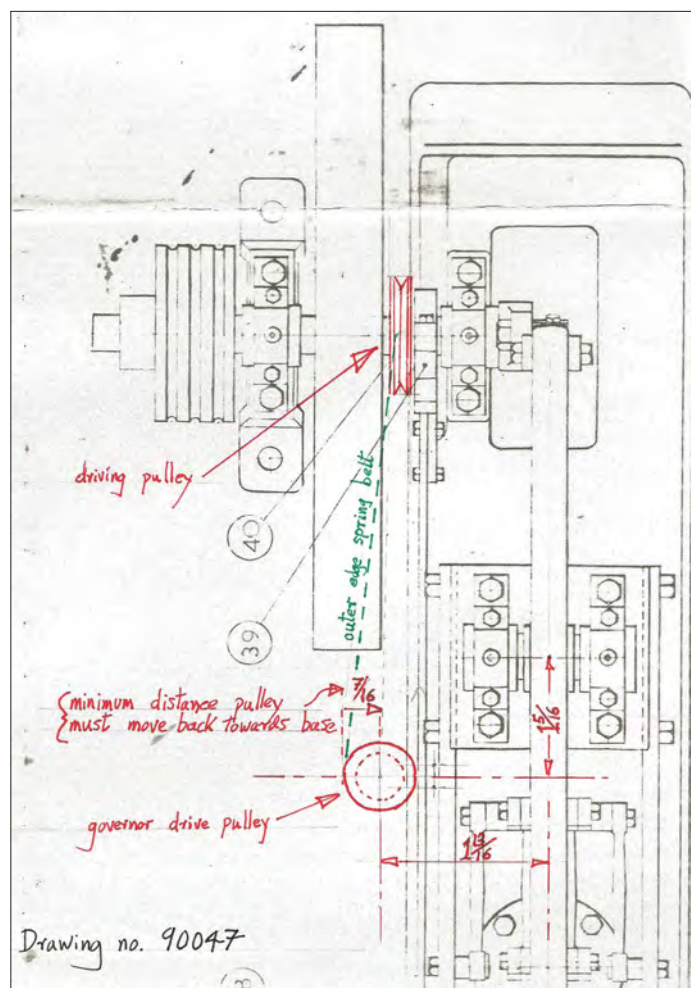
Their suggestion of moving the flywheel further out is good but you need to know this before you fix the position of the pedestal. And if you do so you could move it far enough to allow you to retain the boss of the eccentric sheave, making the

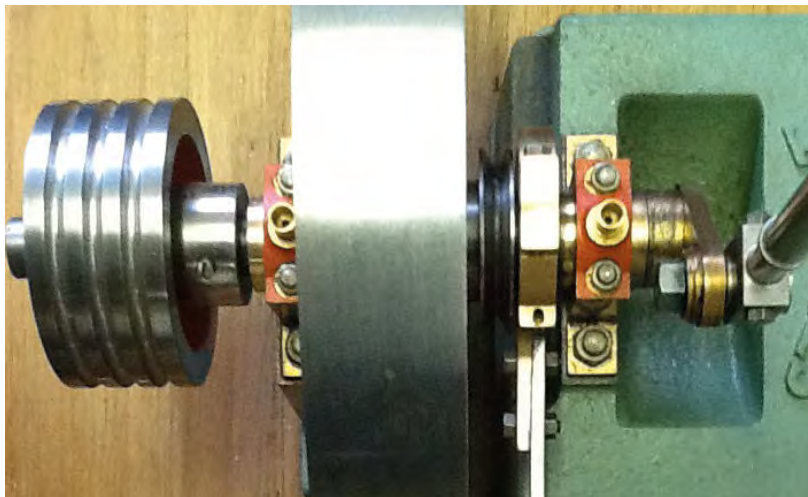
BELOW LEFT PHOTOGRAPH 6

Drawing showing how, if Stuart Turner's governor design were strictly followed, the belt drive to the governor pulley would foul the flywheel rim by some $\frac{7}{16}$ ".

BELOW RIGHT PHOTOGRAPH 7

End elevation drawing showing the positions of the governor drive pulleys as designed.





LEFT PHOTOGRAPH 8

A mock-up of the governor pulley's position, as designed: the belt-run between it and the crankshaft pulley would plainly foul the rim of the flywheel. The pulley with rope-grooves on the free end of the crankshaft is the wrong way round; the boss should face outwards.



LEFT PHOTOGRAPH 9

Bird's eye view with the superstructure removed, showing how the problem was solved. The governor assembly has been relocated north, allowing the drive belt to clear the rim of the flywheel. A new eccentric rod is cranked to clear the support base of the governor.

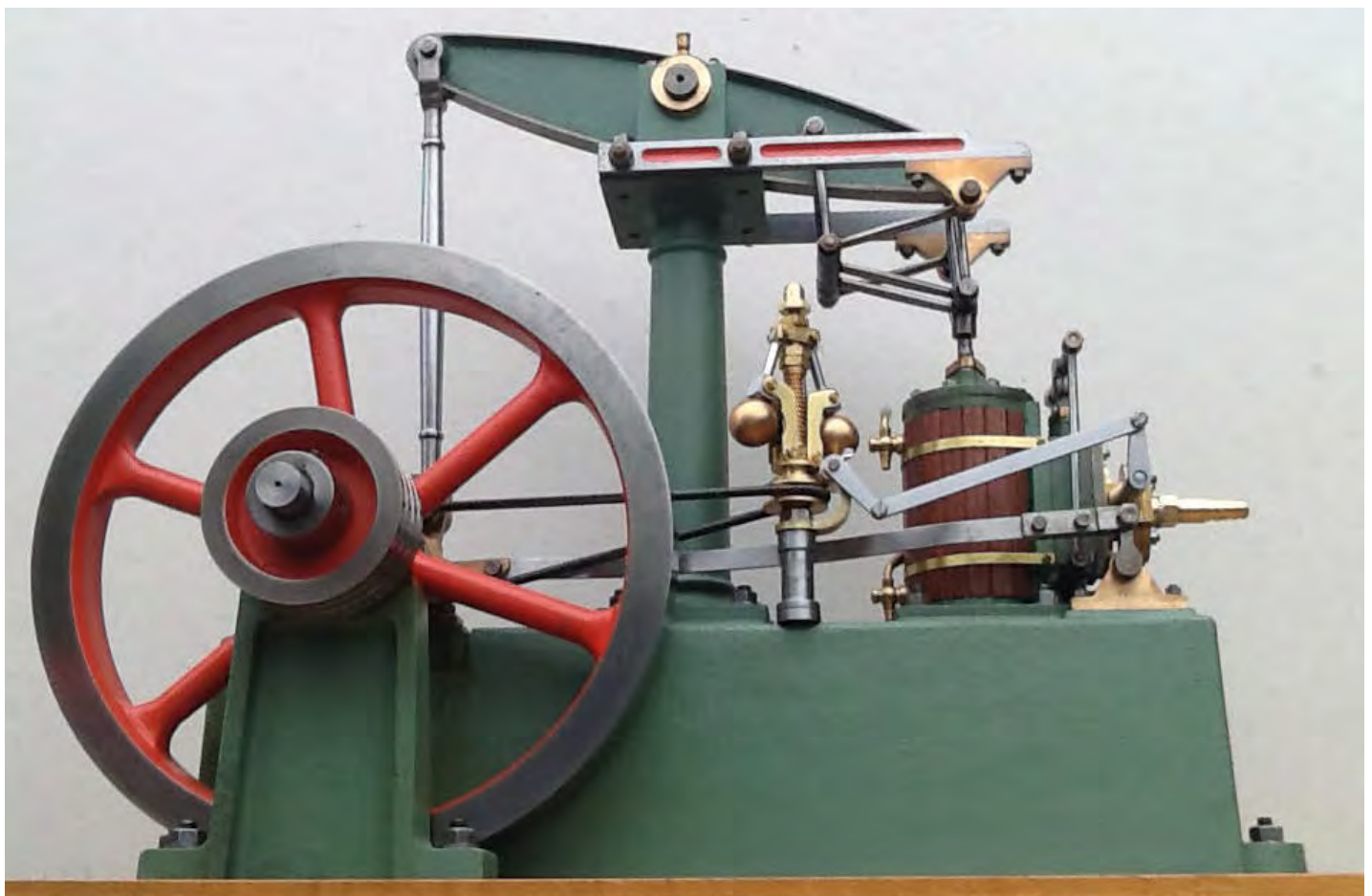
BELOW PHOTOGRAPH 10

The completed engine.

eventual setting of the valve gear that much easier. Stuart's 'modifications to accommodate governor' require the removal of the boss and a new set-screw buried in the sheave itself and therefore inconveniently accessed only by removal of the eccentric strap. Welcome to hours and hours of lovely trial and error in setting the valve-timing!

One final thought. Although my completed governor now runs sweetly enough, with all moving parts as frictionless as I can manage, I'm resigned to accepting it will never activate the throttle valve as it would do in a full-size engine. This is simply because of the notorious 'scale effect', meaning that the model governor would need to be turning so very much faster than its full-size equivalent. This, and much more, is brilliantly explained by Tubal Cain in his articles for *Model Engineer*, 'Governors: Their Operation and Construction' (21 September, 19 October, 16 November, 21 December 1979).

A model beam engine is all the more impressive when running under minimal pressure as a slow-toiler. It's gratifying to watch those bronze balls spin round, but even if you whack up the pressure don't expect too much corrective response from that tiny little throttle valve. ■



READERS' LETTERS

Dear Editor,

In the September edition of your excellent and informative publication, Doug Hewson mentions the need for a hydraulic test for the boiler of the Y4, and refers to "The current regulations (Southern Federation)".

I am sure that many readers of your publication will know that the "current regulations" to which he refers are set out in the 2012 Boiler Test Code but there may be some newer readers who are not aware of the Boiler Test Code and its use by model engineers across the UK. I would like to suggest that a brief note on the origins of the test code in a future edition of your magazine may avoid unnecessary misunderstanding for these readers.

The 2012 Boiler Test Code has been produced and published by the Model Engineering Liaison Group (MELG) in consultation with representatives from the Southern Federation of Model Engineering Societies, Northern Association of Model Engineers, Midland Federation of Model Engineers, 7¼" Gauge Society, HSE, Royal & Sun Alliance Engineering, Footman James and Walker Midgley Insurance Brokers.

It is therefore not only endorsed by the Southern Federation, as mentioned in the article, but by all the national bodies that represent the model engineering clubs and societies across the country and, most importantly, by the main provider of public liability insurance to the hobby.

If any reader wishes to know more about the 2012 Boiler Test Code I would first encourage them to speak to their club or society boiler inspector or seek to attend a Boiler Inspectors' Seminar, which are jointly promoted and organised by SFMES and NAME. Information on the venue and dates for these seminars is available from the Secretary of either organisation.

Regards,

PETER SQUIRE

Secretary

Southern Federation of Model Engineering Societies

The Editor writes:

I have also received a similar letter from Nigel Thompson, who is a member of the boiler sub-committee of the Northern Association of Model Engineers.

Dear Editor,

I just received the latest issue of Engineering in Miniature. In your editorial you mentioned that the trial run of the new layout did not cause any adverse reactions. This does not surprise me, since at least I am very pleased with the new layout. Maybe I would prefer to have the image captions directly under the corresponding image but that is just a minor gripe.

Thanks a lot for producing such a high-quality magazine!

Best regards

JARMO SCHRADER

Dear Editor,

A few years ago I believe your magazine ran an article on making a gas burner to run a 7¼" gauge engine.

However from my recollection I can not recall it containing any details about calculating the heating requirements for a particular model. Do you know anyone who could write such an article? I am drawing up plans to construct a Kerr Stuart Tattoo class narrow gauge engine in the above gauge but the pivot point for the trailing bogie is extremely close to the ash pan so I am wondering about gas firing.

Regards,

PHIL WISEMAN

May I try to answer Mr Wiseman's query about sizing of boilers in particular for gas firing.

I did publish the bones of a method in chapter 3 of my book on injectors (published by TEE Publishing and still a bargain at £14.95!).

Taking a loco with two cylinders 2¼" bore x 3¼" stroke, running at 35% cut-off at 10mph, the steam consumption is 5.21ft³/min. This equates to 17.7oz/min and represents the engine working pretty hard. In Napoleonic units this is 548.7g/min.

From the steam tables the enthalpy of this steam is derived as follows:

17.7oz/min = 548.7g/min steam consumption.

Total enthalpy @ 0.653 MPa (80 psig) pressure

= 2760 kJ/kg x 0.5487 = 1614kJ/min

(Less the enthalpy in feed water @ 20°C

= 84kJ/kg x 0.5487 = 46kJ/min)

So the boiler is producing (1614 - 46) = 1568kJ/min of useful energy at say 65% efficiency.

This means that the fuel input to the boiler must be 1568/0.65 = 2412kJ/min.

The calorific value (net) of propane (bottled gas) is 86,000kJ/kg so working hard the loco would be likely to use fuel at the rate of 28g/min or 1.7kg/h.

I trust that this helps him on his way - please interpret the figures liberally!

Regards,

D A G BROWN

Dear Editor,

I like the new look! The Times font is much more readable than the previous Gill Sans (although the latter was so very typically British). You might also consider using a slightly larger type for the photo captions - not all readers have 20/20 vision...

The layout of my own "Quickie" article is just perfect, thanks!

Best regards,

JAN-ERIC NYSTRÖM

The Editor writes:

I have had several emails along similar lines and I am relieved that the new look has met with general approval! There have also been a number of useful suggestions for further improvements which we have taken on board.

Midlands Model Engineering Exhibition 2016 – Highlights

John Arrowsmith shares his first impressions of the Midlands show

BY JOHN ARROWSMITH

The 39th Midland Model Engineering Exhibition was held at the Warwickshire Exhibition Centre from the 13th to 16th October 2016. Large numbers of visitors crowded through the doors on all days so that the organisers, participants and traders all had a busy time. In terms of the Competition section of the show it was disappointing to see that this year there were no entries in either Class 3 for Locomotives of 5" and 7¼" gauge or in Class 4 for Rolling Stock. Nevertheless there were good numbers in most other classes.

A number of large locomotives however put on an admirable show at their various locations, with an impressive array of quality workmanship. One exhibit in Class 9 stood out as an exceptional piece of work and thoroughly deserved its 1st Prize. The English Regulator Clock built by Jake Sutton was to me an outstanding example of the clockmaker's skill.

Another encouraging sign was that in Class 14 for Young Engineers there was a good entry which provided a well deserved 1st prize for Angus French with a self-designed 3D printer. There was as usual a splendid response from the clubs, who provided a wide range of exhibits covering every engineering discipline you could imagine. It was nice to see that an old form of modelling material, Meccano, could form the basis of an outstanding display that richly deserved the prize for the Best Club Stand at the exhibition.

Outside, the good weather enabled the Fossey Steamers to be fully occupied with various demonstrations of working traction engines and machinery as well as giving the visitors a chance to get up close and experience live steam activity.

A comprehensive lecture programme gave an insight into some of the more problematical and sophisticated aspects of model engineering, and was well attended. All of these aspects of the show will be fully covered in my main reports in subsequent issues of EIM. ■



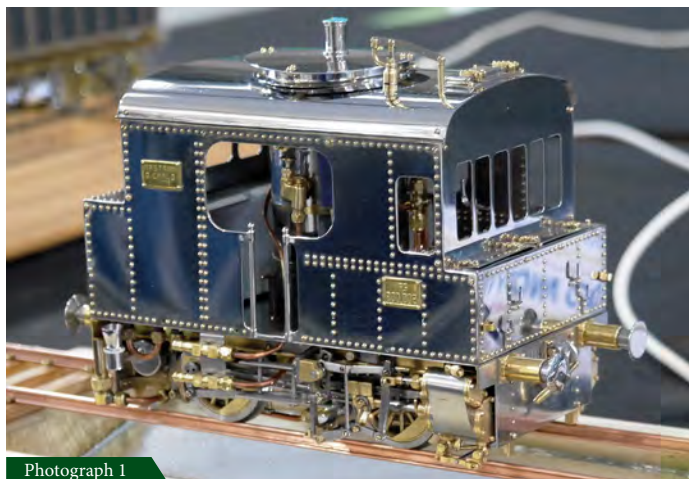
ABOVE

The magnificent 47XX 2-8-0 GWR Freight Locomotive built by Dave Bull.

BELOW

This beautiful Merryweather Fire Engine gained a First prize in Class 7.





Photograph 1



Photograph 2

PHOTOGRAPH 1: In Gauge 1 this example of a CUBO 0-4-0 800-001 locomotive showed exceptional skill by Giancarlo Mastrini.

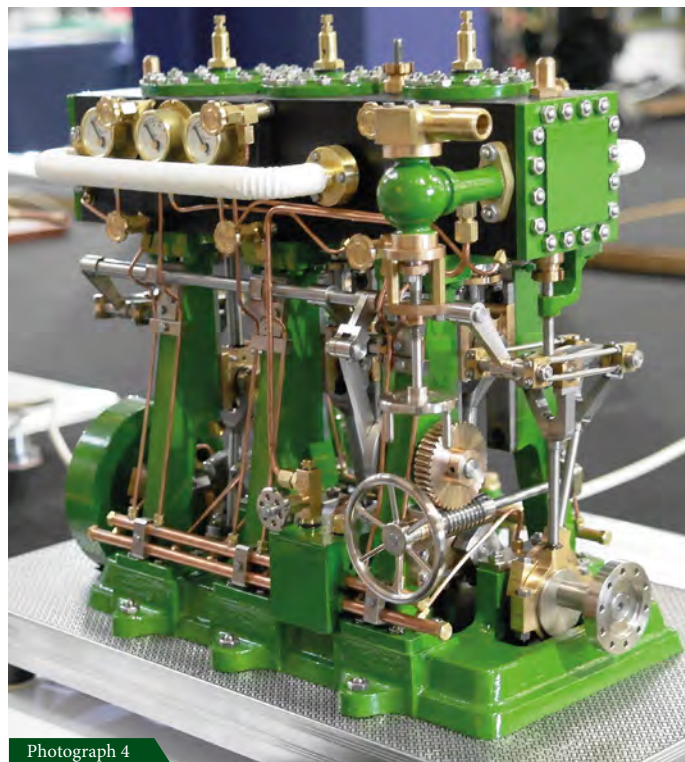
PHOTOGRAPH 2: A wonderful display of Meccano models won the Best Club Stand award.

PHOTOGRAPH 3: The nine cylinder Rotary engine was part of an Avro 504K Biplane.

PHOTOGRAPH 4: A Triple Expansion Marine Engine showed off some fine workmanship.

PHOTOGRAPH 5: A fine example of an Oliver Steering Plough on the Birmingham Society display.

PHOTOGRAPH 6: This 7¼" gauge Lima "Shay" really attracted attention.



Photograph 4



Photograph 5



Photograph 3



Photograph 6

YOUNG ENGINEERS

BY JOHN ARROWSMITH

I would like to wish all young engineers, wherever they may be, a Happy Christmas and hope that 2017 will be a good productive year for everyone. During the last 12 months there have been many young people involved in many different ways with engineering and model engineering in particular. Every club in the UK and abroad is hopeful of attracting as many younger members as they can. As I have said many times in these pages it can only be done with hard work and commitment by the membership to attract the younger generation to the club and when they do attend to make them welcome and feel that they are not a nuisance. You all know yourselves how an indifferent and grudging first meeting makes you feel, no matter what the occasion, so just imagine how a potential member feels if they are treated casually and no interest is taken in them. They will not bother so your club has lost another potential member. So let's all make the effort in 2017 to change attitudes and make it a good year for model engineering. The youngsters are out there – you just have to find them.

If you have a potentially good young person in your club encourage them to enter the Southern Federation Trophy and Polly Model Engineering Prize for young engineers. They will be warmly welcomed by both organisations and it will give your youngsters a target to aim for. You have until the 19th January 2017 to get the applications in which can all be downloaded from the net. Better still get them to do it for you and help them fill in the details and show them that the club really is interested in them.

Attending various rallies over the year I have found once again that the traction engine world takes much more interest in young people than traditional model engineering clubs do. The rallies have lots of youngsters involved in many aspects of the event and not just the operation and maintenance of steam vehicles. One mum I spoke to thought it was because traction engine rallies include, in most cases, all the family whereas at ME clubs it is just dad who is there on his own without anyone else. They are involved in the organisation as well as selling programs, acting as guides or working in the assorted information areas etc. – all the sort of things that help to keep their interest. I know some ME clubs do the same but they are as rare as hen's teeth. For example, one of the Urmston MES youngsters was very much involved in the organisation of this year's IMLEC rally event, and look how successful that was. This is just the type of thing where, given the confidence of the club, they can really get involved. It is not difficult and the only cost to the club is the time spent advising and training them to do it.



ABOVE
Billy Stock from the Urmston MES poses with 5" gauge Britannia 'William Shakespeare'.



RIGHT
Catch them young – 7-year-old Joseph Walker and his 6-year-old friend with dad's original motorcycle which they both ride.

We oldies did it the same way – we have all made mistakes – but with a bit more thought it may have been avoided so when young people make mistakes, as they will, show them where they went wrong and what they should have done. Don't reprimand or embarrass them in front of others just because they messed up, tell them in the right way why they messed up and let them learn by their mistakes. Obviously if it is a serious breach of health and safety then that is a different matter but they should not have been doing whatever it was on their own in the first place. I hope my photographs remind you of the good summer we had and the fun some young people had during their time at various events are welcome and will be given all the help they need to get involved. BCLS are obviously demonstrating this because they say in their current report that they have had a "dramatic increase in members" their words not mine so they must be doing something right. We should all learn from this sort of experience. Nothing puts people off more than a "couldn't care less" attitude and "we cannot be bothered to make the effort" sort of reception – the answer once again lies in your own hands.

I have already mentioned the generous donation of a Myford Super 7 Lathe, complete with gearbox and tooling, to be given to the most deserving Young Engineer. A good number of entries were received and, having appraised the details, the representatives of the Northern Association, the Midland Federation and the Southern Federation plus the editor of EIM with Chris Deith as Chairman, decided that Jack Colby from the Pimlico Light Railway should be the fortunate recipient of the machine. This was duly presented to him at the Midlands Model Engineering Exhibition during the awards ceremony that always completes this event. Jack was warmly congratulated by many of the assembled model engineers present some of whom I suspect were wishing they were young enough to have been considered. ■

RIGHT

Eight-year-old Alfie Daws really enjoyed himself driving round the rally field at Shrewsbury.

**RIGHT**

Enjoying the Cardiff Rally was Ewan Wilcocks from the Hereford SME.

**BELOW**

The opening of the track extension at Swindon featured a very busy station.



CLUB NEWSROUND



BY JOHN ARROWSMITH

First of all I would like to wish all our readers and fellow model engineers the compliments of the festive season which I hope will be enjoyable for you all. Despite the problems the world seems to have at the moment model engineering is a great relief from it all.

I have to say that I was disappointed by the response to the Myford Lathe Award made at the Midlands Exhibition. There was not one entry from any northern club which I could not quite get my head round as there is a number of good young people involved in their activities but despite this the quality of the young people who did enter was excellent. The clubs they represented should be very proud of their contributions and the young man Jack Colby from the **Pimlico Light Railway** who was the recipient of this fine machine will no doubt continue to be a major influence on the club. I hope his involvement will encourage more young people to realise that model engineering can be a great addition to any CV.

I would also like to let you know that EIM now has a new forum web page www.model-engineering-forum.co.uk where topics on any related model engineering subject can be discussed. So if you have a good idea or workshop tip, or wish to raise a question about anything in EIM or model engineering in general, try it out – I am sure it will be a good experience for you. Garden Rail enthusiasts also have a new forum web page for their use at www.garden-rail-forum.co.uk so try that out as well and use it to cross reference between the model engineering scene and the garden rail activities – there is a lot of common interest between the two.

Traction engine enthusiasts in the Midlands area are well catered for with the **Black Country Live Steamers**. This group of like-minded model engineers formed in 1993. A lot of local model engineers were disillusioned with what was on offer at traditional model engineering clubs, where locomotives, trackwork, signalling and all the associated club work left no time for traction engines. This led to the formation of the BCLS and one of the founder members is still actively involved as their treasurer. With the membership now standing at around 60 they have become a well recognised group who are bucking the trend of model engineering

RIGHT

One of the superb tram models on the Tramway & Light Railway Society layout at Brooklands.



clubs by attracting quite a few younger members, which suggests they are doing something right. The range of activities spans a number of other disciplines including stationary engines, hot air engines and narrow boats as well as the full-size road steam and classic vehicles, but there are no railway locomotives. Their long term President, Len Crane, died recently and Les Bromley has taken over as the new President. Regular meetings take place at the Dudley Canal Trust in Dudley which, as they say, lends a tremendous ambience to the proceedings. The group regularly attends steam events throughout the area so no doubt if you are out and about at steam rallies in 2017 you will probably come across some of these members with their traction engines. I must say that when I have met them there is always a good reception and plenty of friendly banter.

The **Bournemouth SME** have a new club secretary with Ron Barson taking over the reins from George Wheatley, so I wish him good luck in his work at the club. It has been a busy summer for the Littledown Park railway with lots

of visitors enjoying the passenger rides but, as at many clubs, the regulars could do with some more help from other members to help spread the work load. The Society has been given three bus shelters by Queensbury Shelters which they will be able to erect on their station platform to provide a canopy for both passengers and staff. A good summer season has also been experienced by the 16mm group within the club with increased attendances on running days. They are considering adding a passing loop on their main line in order to provide a facility for the increasing number of coal fired locomotives in this gauge. Members are also being asked for their ideas about how the existing steaming bays and marshalling yards can be improved. Member William Powell won the 'Curly Bowl' competition at the Stockport Society back in August with his 2½" gauge locomotive Freya, which is based on the LBSC design for Ayesha. William's engine has some modern features including a rosebud grate and radiant stainless steel steam dryers, along with aluminium pistons.

A good Open Day at the **Bradford MES** included 10 visiting locomotives running on the track so, with two of their own club locomotives adding to the fleet, it was a busy day which was enjoyed by all. On their Diesel Day in July they had another good turnout with around a dozen visitors providing plenty of interest for everyone. Following a fire at the Bradford Moor Park the Marine section members have had to move their sailing days to a new venue to enable them to continue. The local council have been very helpful in this by allowing a move to Wilsey Park and the club members are very grateful to them and the other users for allowing them access.

The **Frimley & Ascot Locomotive Club** report on a busy year with plenty of activity at the track, including their 25th Anniversary day in July. Like many clubs, they are keen to attract new members and have asked their existing members to try and be as positive as possible in making the club a welcoming and interesting place. The new Steaming Bay Awning is now complete and will no doubt be a great benefit to both members and visitors when raising steam. They are also pushing ahead with a number of other projects including costing out an extension to the carriage shed. When this has been completed the club house will receive some attention. In the future an extension to the clubhouse is being considered as well as a permanent ticket office and tunnel on the curve leading to Frimley Junction. On the track itself three new points have been built and fitted; two provide access to the storage extension siding while the third replaces the existing yard point with a larger radius making for easier access. They also have a new rake of red and cream coaches ready for service while a refurbishment on the chocolate and cream set is about to begin. This all sounds like members there have been putting in a great deal of work which augers well for the future.



ABOVE

James Cole waits with his Class 66 as Dave Smith thunders through the junction with his LNER P2.

BELOW

The triple header led by Nick Kane's 'Blowfly' at a running day at the SLSLS.

At the August meeting of the **Grimsby & Cleethorpes MES** Chairman John Rea announced that he was stepping down from his post as his other commitments limit the amount of time he can devote to club business. Geoff Morgan has taken on the job of acting Chairman. The club's Gala Weekend was a great success with a number of visiting locomotives, traction engines and steam lorries as well as full-size versions for visitors to appreciate. A number of members who had not been to the club for some time for various reasons turned up for the day which made it all the more enjoyable for the organisers.

In the summer edition of Vectimod, the newsletter from the **Isle of Wight Society**, they report on their 2016 Rally which was a successful event for them with a number of visiting clubs from the mainland enjoying the facilities at Broadfields. It seems that by holding it on just one day the response to invitations has improved so that it is probable it will now be held on a Sunday in future. Work has continued on the ground level track refurbishment and the tunnel has also been relined. The society is actively considering changing to a Company Limited by Guarantee, as many clubs have, but no decisions have yet been



made. It was pleasing to note that the club rules have now been changed which allows younger members over 16 to drive fare-paying passengers, provided of course that they are competent to do so.

Some tremendous attendance figures from the **Sidney Live Steam Locomotive Society** show that they had almost 32,000 visitors to their track in the 12 months up to the end of April. The current winter period seems to be just as popular with well-filled trains operating on their running days. Nick Kane, who described the rebuilding of his Blowfly locomotive in these pages in September, steamed the engine for the family of the original builder, which was much appreciated by them. In an interesting triple header train

the locomotive was lead engine with an Australian Class 27 behind and then a Hunslet, which was the train engine.

Talk about a mix of prototypes!!

Membership at the club has been increasing and they are hoping this trend will continue as they move towards their 70th Anniversary in two years' time. A large number of new boilers are also being built of which quite a few are in the smaller gauges which means their smaller gauge railway system will see much more use. How about this for a record? Their newsletter has been produced by John Lyons for the last 40 years. Well done John – that is some record.

I caught up with the **Tramway & Light Railway Society** at the Model

Engineer exhibition at Brooklands in September where they presented a very nice operational tram layout based on 3½" gauge track. This group work in a variety of popular scales from the ¾" scale right down to N gauge and I didn't know that there is a National Model Tramway Collection which is located in the Heaton Park Tramway Museum in Manchester. If model trams are your interest then a visit here might be very rewarding. There are a number of area groups which cover most of the UK where regular meetings are held and there is also a group in Germany. A nice 40 page A5 size magazine provides members with the latest information on both models and meetings. ■

DECEMBER DIARY

2 Bournemouth SME. Public running, Littledown Park 11:00 – 15:00.	4 Woking MRS Santa Specials Mizens Railway 10:30 – 15:30 ticket only.	10-11 Fenland Light Railway. Santa Specials 10:00 – 17:00 booking required.	17 Fenland Light Railway. Santa Specials 10:00 – 17:00 booking required.
3 Grimsby & Cleethorpes MES. Santa at the Mill, Waltham Mill 10:00 – 14:00.	4 Guildford MES. Christmas Special Public Open Day 11:00 – 15:00 Stoke Park.	10 Bridgend MES. Santa Specials, Parc Slip noon – 16:00.	18 Barton House Railway. Santa Specials noon – 15:00 pre-booked tickets.
3 Ickenham & District SME. Public running noon – dusk.	4 Pinewood (Wokingham) MR Santa Specials 11:00 – 15:30 booking only.	10 Eastleigh Lakeside Railway. Santa Specials from 11:00.	18 Harlington LS. Mince Pie & Santa run 11:00 – dusk High Street.
3/4 Bedford SME. Santa Specials Summerfields Railway 10:30 – 16:00 pre-booked tickets.	4 Pietermaritzburg MES. Public running Day at Haley Park Bisley Valley from noon.	10 Nottingham SME. Winter Steam Up & Visitors Rally from 11:00.	18 Rochdale SME. Christmas running Springfield Park from 11:00.
3/4 Echills Wood Railway. Christmas running 10:00 – 15:30 pre-booked tickets only.	4 Reading SME. Public running 13:30 – 16:00 Prospect Park.	10 Urmston MES. Public running at Abbottsfield Park 10:00 – 16:00.	18 Rugby MES. Public running Rainsbrook Valley Railway 14:00 – 17:00.
3/4 South Downs Light Railway. Santa Specials from 11:00 pre-booked tickets only.	4 Sale Area MES. Public running noon – 16:00 Walton Park.	11 Chelmsford MES. Santa Specials 14:00 – 16:30.	18 Taunton SME. Santa Specials Creech St Michael noon – 15:00.
4 Basingstoke MES. Christmas running at Viabes Craft Centre 11:00 – 16:00.	4 Sheffield SME. Santa Specials 11:00 – 15:30.	11 Frimley Lodge Miniature Railway. Santa Specials 11:30 – 14:30 tickets only.	18 Gravesend MES. Santa Specials 13:00 – 16:00 Cascades Leisure Centre.
4 Bristol SME. Santa Specials, Ashton Park from noon. Tickets only.	4 Tyneside SME. Santa Specials 11:00 – 15:00 Exhibition Park.	11 Harrow & Wembley SME. Father Christmas Run 13:00 – dusk.	18 Woking MRS. Santa Specials Mizens Railway 10:30 – 15:30 ticket only.
4 Cardiff MES. Santa Specials, 11:30 – 16:00 ticket only.	4 Wigan MES. Public running at Haigh Hall 11:30 – 16:30.	11 Langford & Beeliegh MR. Christmas Fayre 10:00 – 17:00.	21 Bristol SME. Members Night at Begbrook from 19:30.
4 Chesterfield SME. Santa Specials 11:00 and 13:00 pre-booked tickets only.	10-11 South Durham MES. Santa at the Station, Head of Steam Darlington 10:00 – 16:00.	11 Taunton SME. Santa Specials Vivary Park noon – 15:00.	26 Leyland SME. Boxing Day Mince Pie and Steam Up.
4 Fenland Light Railway. Santa Specials 10:00 – 17:00 booking required.	10-11 Surrey SME. Santa Specials 11:00 – 16:00 booked tickets only.	11 Worthing MES. Santa rides 14:00 – 17:00 Field Place Worthing.	26 Leeds SME. Boxing Day Steam Up at Eggborough 10:00 – 16:30.
4 Gravesend MES. Santa Specials 13:00 – 16:00 Cascades Leisure Centre.	10-11 Sutton Coldfield SME. Santa Specials at Little Hay, tickets only from 11:00.	11 Gravesend MES. Santa Specials 13:00 – 16:00 Cascades Leisure Centre.	26 Maidstone MES. Boxing Day public running 11:00 – 15:00 Mote Park.
	10-11 Wirral MES. Santa Specials 11:00 – 16:00 booking at the Royden Park only.	11 Woking MRS. Santa Specials Mizens Railway 10:30 – 15:30 ticket only.	27 Rugely Power Station SME. Christmas Steam Up.
	10-11 Echills Wood Railway. Christmas running 10:00 – 15:30 pre-booked tickets only.	11 Pinewood (Wokingham) MR. Santa Specials 11:00 – 15:30 booking only.	

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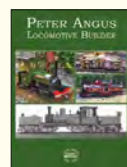
Quite simply, this book is brilliant, showing you how to build a 16mm gauge live steam locomotive, plus some passenger and freight rolling stock. If you have always dreamed of building a real steam locomotive, have a lathe (which needn't be big) and some patience, then you can build your dream from this book. The locomotive on which the design here is based is a 2' gauge John Fowler 0-4-0 shipped to Australia in 1923, but as is admirably shown in this book, the basic design can be modified to Hunslet, Peckett, even Decauville outline. And it can be built for gas or coal firing. 189 beautifully produced pages with full drawings, sketches of set-ups and loads of colour photos. Welcome to the world of live steam! Hardbound.



Peter Angus Locomotive Builder

Angus • £38.45

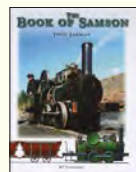
Peter Angus and colleague Mike Lax have built over 300 16mm NG locomotives. All look like the real thing, are very reliable and having good handling characteristics. The vast majority are illustrated, but there is more, including historical and technical details of the prototypes, how the models have been built, the ways Peter ensures their realistic performance, the different methods of firing, how he often fits unobtrusive radio controls etc., all whilst keeping a near scale appearance; this book will be a source of inspiration to anyone building their own smaller-scale live steam locomotive. The prototypes range from well known narrow gauge locomotives, through Garratts, Kitson-Meyers, Sentinels, Shays and Avonside locomotives to the very unusual. 221 pages, including archive B&W photos of prototypes and colour photos of models in various stages of assembly, plus some drawings. Hardbound.



NEW! The Book of Samson

Jarman • £24.45

Recounts the construction of the replica 'Samson', at Beamish Museum, after much research into the 1874 original. It also includes a history of its manufacturer, Stephen Lewin of Poole, the contemporary narrow gauge industrial locomotive scene, a chapter on other narrow gauge locos and tramways in Weardale plus an extensive collection of photographs, most in colour. The 14 drawings of 'Samson' here would certainly be enough to start a builder on a live steam version. As well as the drawings, this 144 page hardbound book contains 255 photographs, 2 paintings, 3 engravings and 2 maps. A really stunning book.



NEW! Model Power-Boats: Steam, Petrol, Electric. • Hobbs • 19.05

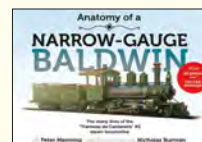
First published by Percival Marshall, probably in 1914, this is 'A Complete Manual on the Designing, Building and Running of all kinds of Model Self-propelled Boats, Steam, Petrol, and Electric'. What attracted us to reprint this book was the sheer spread of its coverage - amongst the 15 chapters are 'Types of Models', 'Theoretical Consideration', 'Resistance and Propulsion', 'How to Design a Model Boat', 'Construction of Hulls', 'Steam Machinery explained' followed by 4 chapters on propulsion, including flash steam, 'Deck Fittings' etc., etc., all from a time when you built very largely from scratch. There really is a huge amount of information in this book's 338 pages, some of which may well be of use to full-size steam launch builders. Around 380 illustrations, split between B&W photos and line drawings. Paperback



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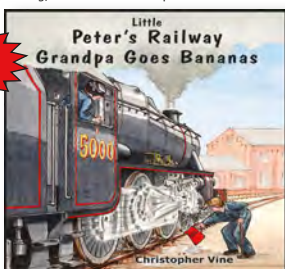
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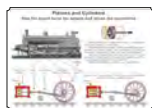
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