THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 219 No. 4566 • 4 - 17 August 2017

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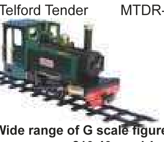

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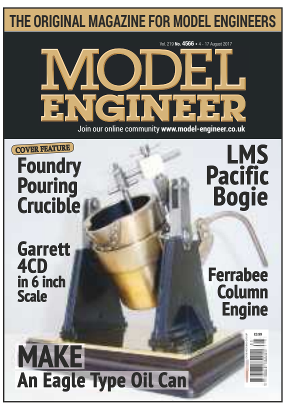
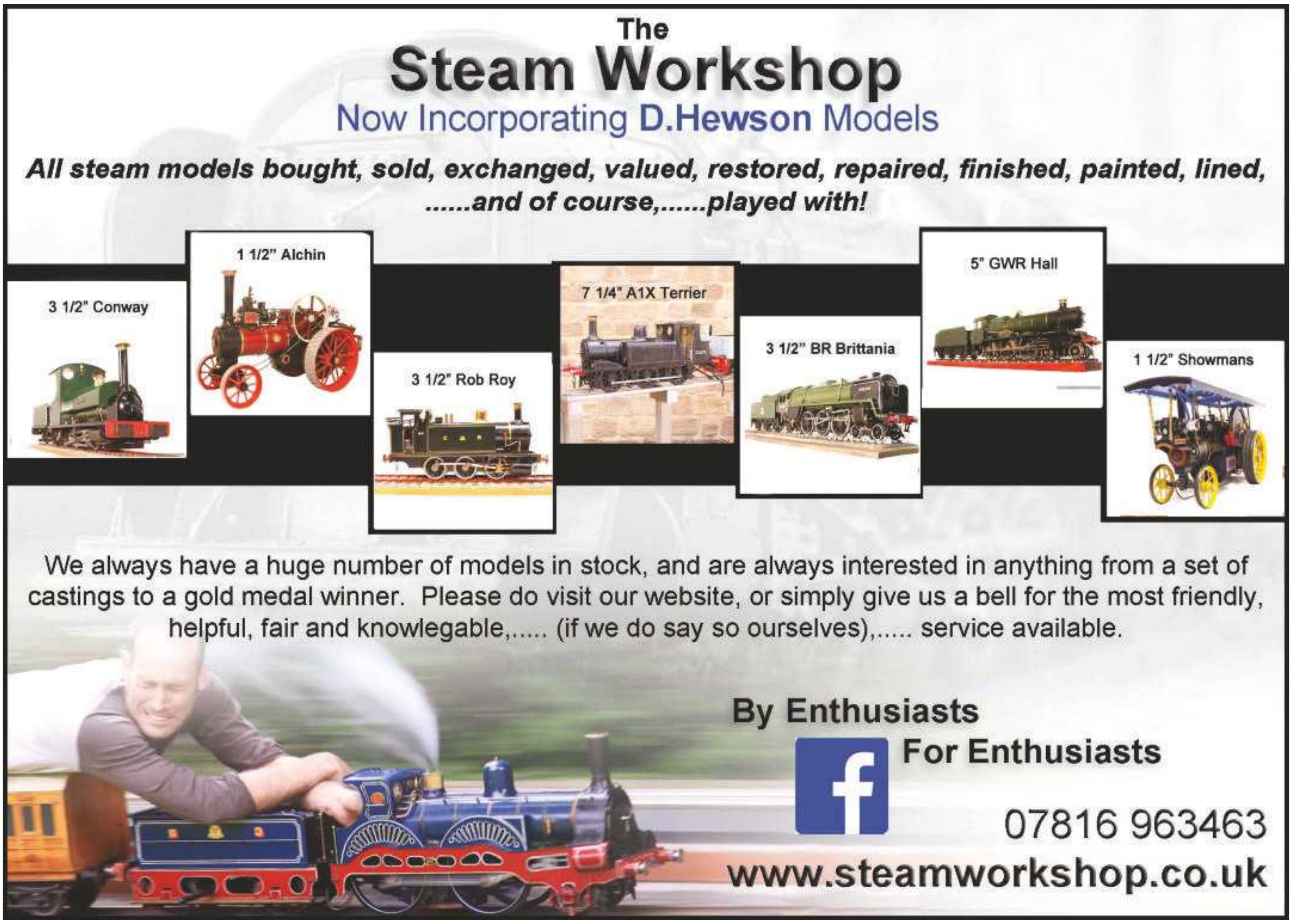
See page 215 for our latest offer.



ON THE COVER...

Alan Pickering hopes to inspire model engineers to consider something a little out of the ordinary for their next project. This model features on page 230. Photo, Alan Pickering.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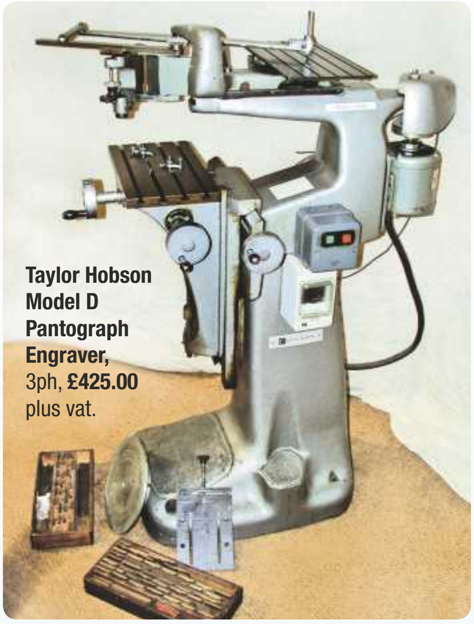

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SMOKE RINGS

DIANE CARNEY
Editor

Junior winner - Alex Loadman of Grimsby

In my review of the various competition winners' models on display at the recent National Model Engineering and Modelling Show at Doncaster, I mentioned that I had no information about the winner of the Junior Prize, Alex Loadman, but that I would be glad to be enlightened.

I am happy to report that I have had an email from Garry Crossland of the Grimsby & Cleethorpes Model Engineering Society who tells a heart-warming tale about this young man. Gary says:

'Alex is a member of the GCMES which he joined at the age of eleven and now, at the age of seventeen, he plays an active part. He started building his first 5 inch gauge battery powered locomotive at the age of fourteen, then progressed to a Class 20 of the same gauge, which he regularly runs on the Society's track located at the Waltham windmill site, to the south of Grimsby.

For the past two years he has been constructing two 08 shunters, one of which has been completed and was entered into this year's exhibition at Doncaster (**photos 1** and **2**). Whilst he has demonstrated a high level of enthusiasm and dedication, his primary asset has been his skill in engineering which has been supported by society members, John Britten, Greg Marsden and Andy Hammond who have drawn upon their own wealth of experience to provide Alex with invaluable mentoring when required.

In addition to his engineering attributes, he has also shown a level of maturity beyond his years by organising, with Andy Hammond, two Gala Weekends for the society. These events have attracted hundreds of visitors and raised vital funds, mainly through an increase in the number of those riding on the Society's miniature railway.'

GCMES Gala Weekend

Following on from the above, this year's GCMES Gala Weekend will take place over the Bank Holiday weekend, 26 - 28 August, open from 10am each day. This year a Dakota fly-past has been organised and a full size steamroller has been secured to attend the three-day event. The railway will be running, there will be stalls and an exhibition. The track is located in the village of Waltham, four miles south west of Grimsby, adjacent to Waltham Windmill (DN37 0JZ).

Attracting youngsters

The Southern Federation of Model Engineering Societies is considering the possibility of holding a seminar in the near future on the subject of attracting younger members to the hobby and also into the clubs. This is a subject that is on the minds of almost every M.E. club in the land so the SFMES wish to take the very positive step of organising a gathering of representatives from all clubs, in particular those where there is a thriving, younger membership. In their *Newsletter*, the SF say: *Some clubs do have thriving junior membership, and it would be useful to pool expertise in an attempt to identify the key features which lead to this happy situation. Once the germ is planted, it may become a life-long interest, with the benefits of a relaxing hobby and/ or a worthwhile profession in the engineering industry in its widest sense*.

Your club may have as few as one or two teenagers, for example, but the idea is to find out what those clubs are doing to make them successful and attractive to younger people and to share that with those who are keen (in some cases, desperate) to attract junior/ youth members. The SF would like to hear from anybody who would be interested in taking part in the initial meeting as soon as possible, with a view to holding that meeting sometime in the autumn/winter. They would also welcome hearing from any society that would be willing to host such a meeting. Please contact Ivan Hurst on 01252 510340.
Email: ivanhurst@sfmes.co.uk

Bristol Model Engineering Exhibition

There's just time to remind readers that the annual 'Bristol Show' opens on Friday 18th August at Thornbury Leisure Centre (within easy reach of the M4/M5 interchange). The displays run to three large halls and there will be live steam outside. This show is always a highlight of the summer season and definitely worth a trip.

1


2


Ferrabee Pillar Engine, 1862

PART 4

Anthony Mount continues his new construction series; an unusual stationary steam engine.

Continued from p.859
M.E. 4562, 9 June 2017

I was looking through some old technical books and came across an engine exhibited at the International Exhibition of 1862 (not to be confused with the Great Exhibition of 1851); I rather liked the look of it, thinking it would make an attractive model.

Steam Chest

For the steam chest (**part 04** and **fig 10**), a block of cast iron can be used or you might prefer to use gunmetal or even mild steel. Machine the block all over to bring to the finished overall size.

I have shown a slot in the wall thickness of the steam chest to take the steam from the annular ring to the top of the steam chest. The cavity for the slide valve has been kept central; thus, the slot leaves quite thin walls either side. However, you could off-set the cavity by making the wall thickness opposite the slot 1.5mm and increasing the wall thickness for the slot to be cut into to 4.5mm.

If you do this, then while the valve rod can stay central, the port slots and the slide valve will need to be off-set to compensate.

With the block squared up I used co-ordinates to set out and drill all the stud holes as it's easier to do it now than later on.

Clamp the steam chest block in the machine vice of the milling machine to start machining the flanges. I have 3mm rebates in the top of the vice jaws which nicely takes the block, but it does not give a great deal of material for the vice jaws to grip on, so I also used a heavy clamp bearing down on the top of the block.

The bottom and sides of the block were now available for machining in the rebates to form the flanges. With these complete the clamp was removed and the top of the steam chest reduced in thickness.

The block was then turned over, clamping on the sides for machining the cavity. Set the table stops to cut undersize and then reset them to take off the last 0.5mm to give a nice, clean finish removing the steps or ripples caused by the repeated cuts.

There are two photos (**photos 24** and **25**) showing the completed steam chests.

NOTE: The two drawings on the following pages, figs 9a and 9b complete the set for the cylinder (see *M.E.* issue 4562, 9 June 2017).

24

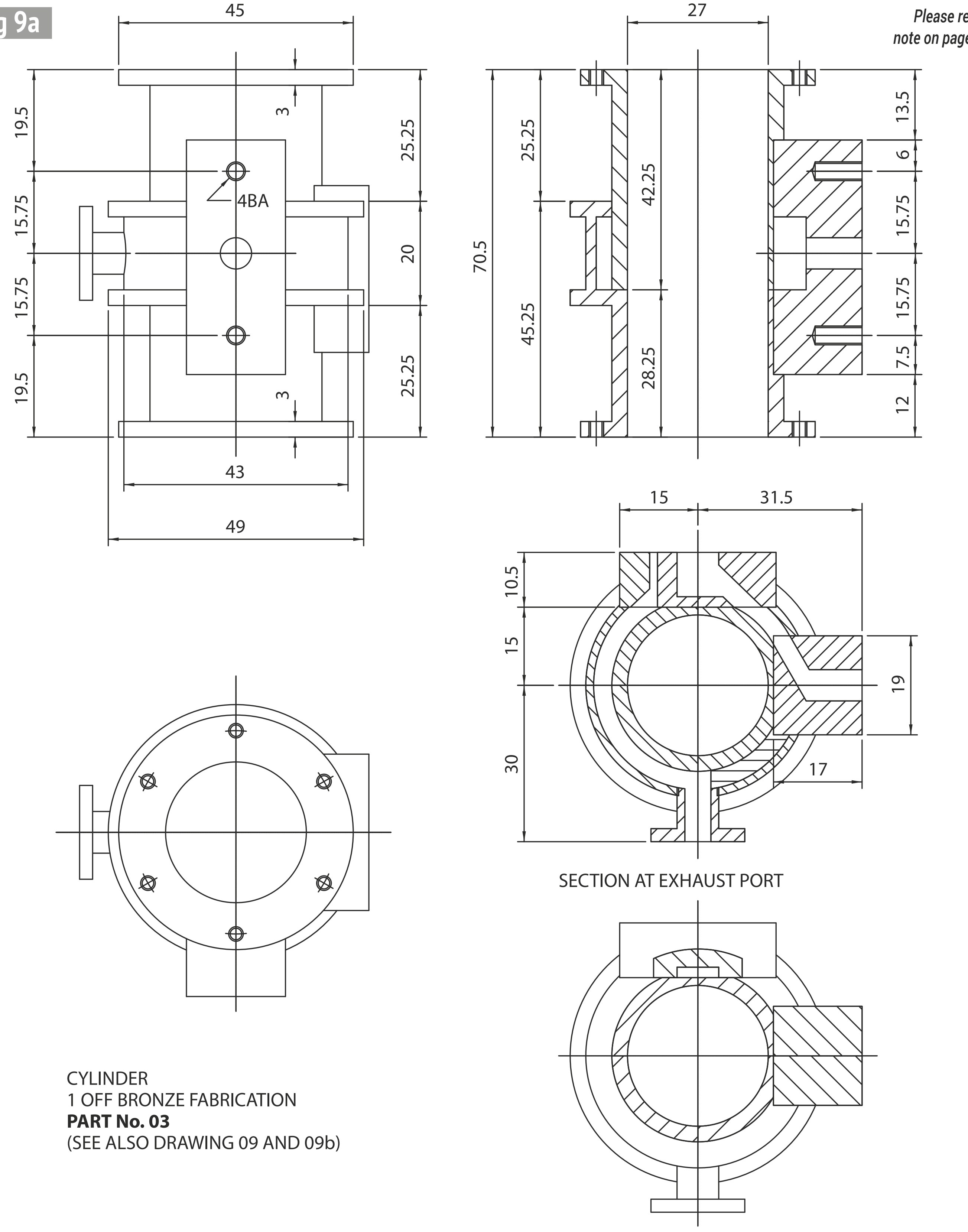
The completed steam chest.

25

Inside the steam chest.

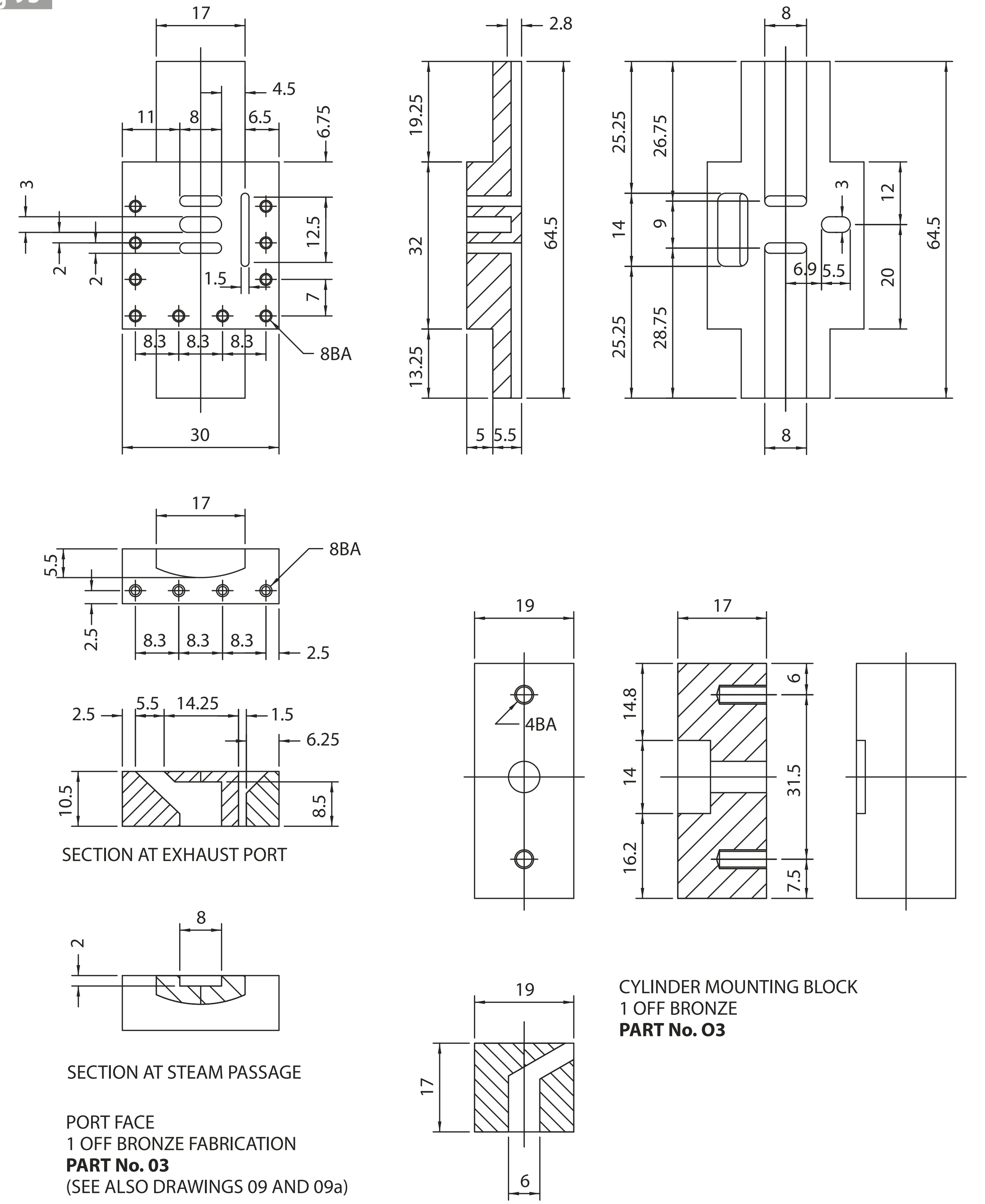
Fig 9a

Please refer to note on page 217.



FERRABEE'S COLUMN ENGINE 1862	FIRST ANGLE PROJECTION	Historic Engines South West
CYLINDER	DRG NO 09a / REV'	
	SCALE 1:1 / DATE 22-06-13	

Fig 9b



FERRABEE'S COLUMN ENGINE 1862	FIRST ANGLE PROJECTION	Historic Engines South West
CYLINDER	DRG NO 09b / REV'	
	SCALE 1:1 / DATE 22-06-13	
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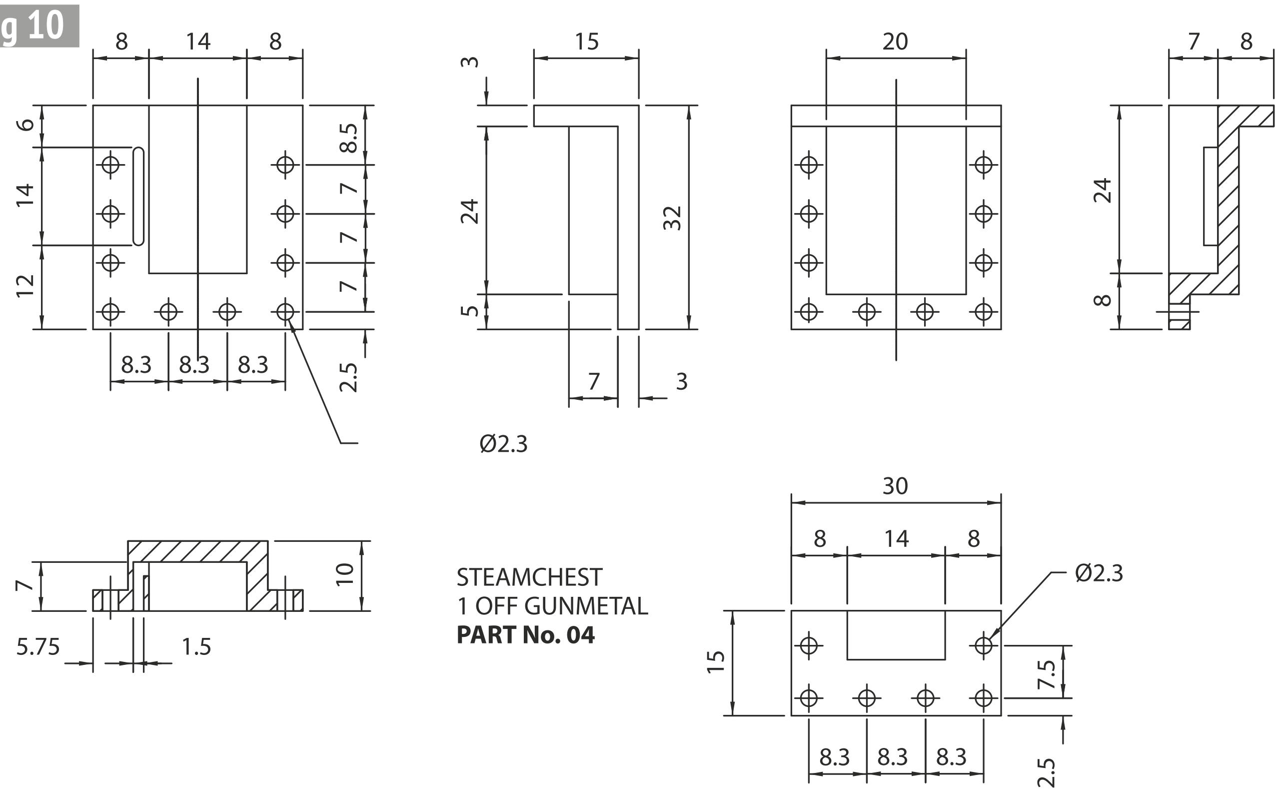
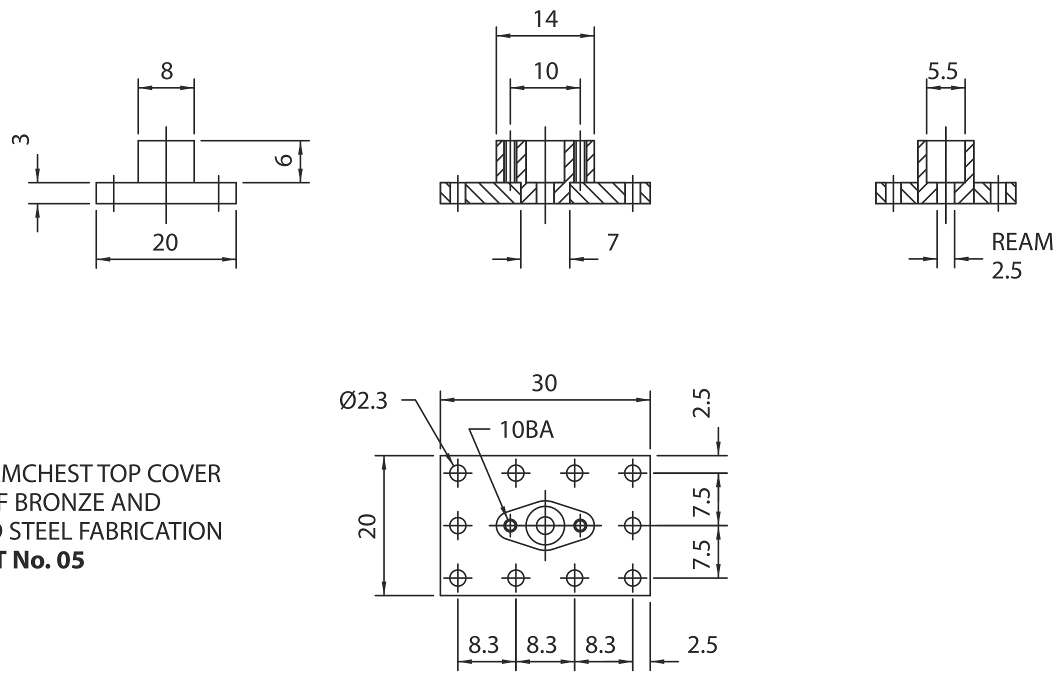
Fig 10



STEAMCHEST
1 OFF GUNMETAL
PART No. 04



STEAMCHEST TOP COVER
1 OFF BRONZE AND
MILD STEEL FABRICATION
PART No. 05

FERRABEE'S COLUMN ENGINE 1862	FIRST ANGLE PROJECTION	Historic Engines South West
STEAMCHEST	DRG NO 10 / REV'	
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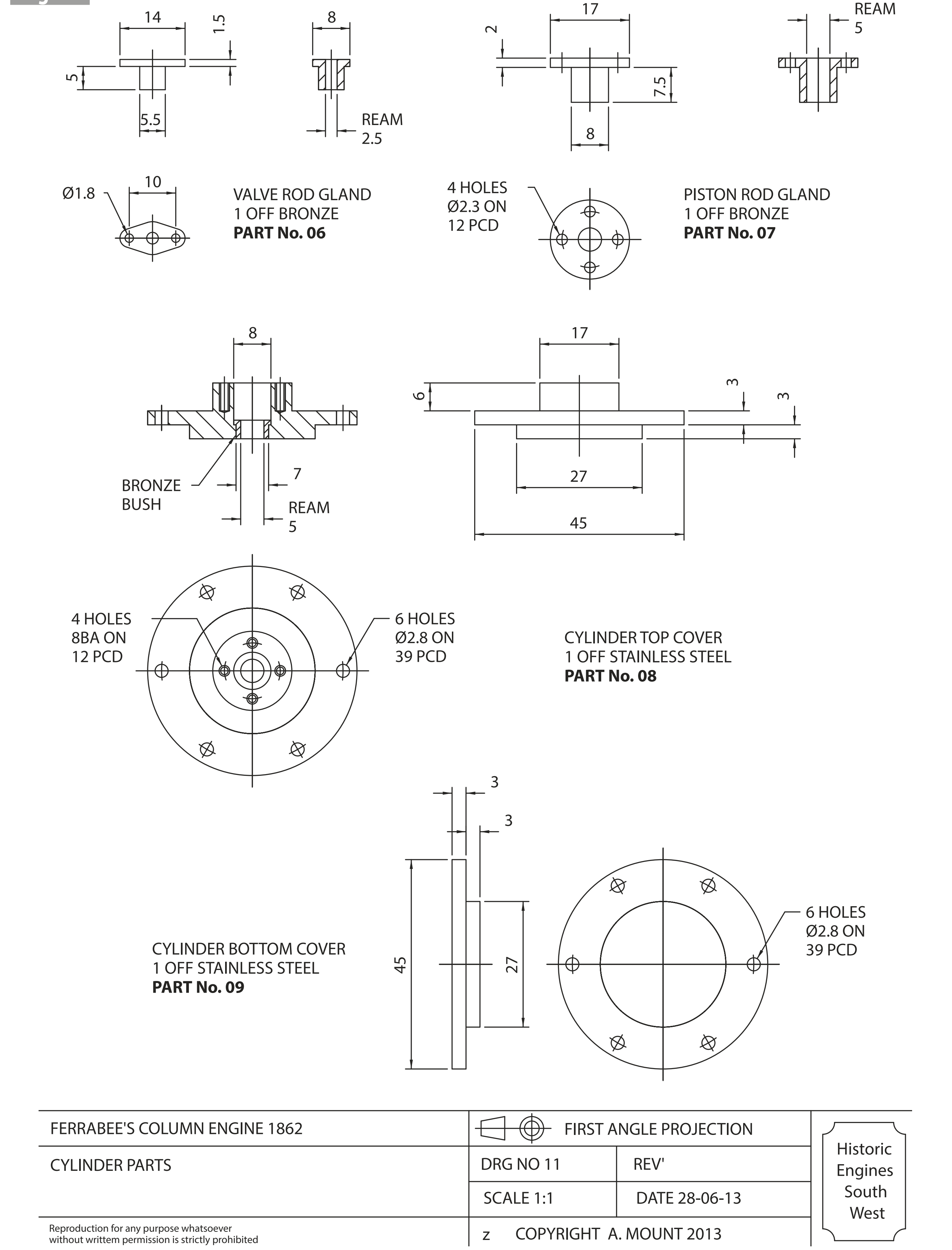
Fig 11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8
REAM
2.5
Ø1.8
10
VALVE ROD GLAND
1 OFF BRONZE
PART No. 06
17
2
7.5
8
REAM
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4 HOLES
Ø2.3 ON
12 PCD
PISTON ROD GLAND
1 OFF BRONZE
PART No. 07
8
BRONZE
BUSH
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REAM
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17
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27
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4 HOLES
8BA ON
12 PCD
6 HOLES
Ø2.8 ON
39 PCD
CYLINDER TOP COVER
1 OFF STAINLESS STEEL
PART No. 08
3
3
45
27
CYLINDER BOTTOM COVER
1 OFF STAINLESS STEEL
PART No. 09
6 HOLES
Ø2.8 ON
39 PCD
FERRABEE'S COLUMN ENGINE 1862
FIRST ANGLE PROJECTION
CYLINDER PARTS
DRG NO 11
REV'
SCALE 1:1
DATE 28-06-13
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West
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Steam chest top cover

To make the steam chest top cover (**Part 05** and fig 10), machine up a rectangle of 3mm thick mild steel, drill for the stud holes and the central hole for the gland block.

The gland block is a piece of bronze rod, 14mm diameter. Turn down a register a press fit in the cover, drill and ream 2.5mm for the valve rod and part off. Reverse in the chuck and counterbore for the gland.

Use a dividing head to drill and tap the two stud holes. Saw off the waste material and file to shape.

The two parts can be pressed together and ideally silver-soldered as well. Another additional way for a secure fixing would be to continue the stud holes through the cover and then countersink underneath for countersunk head screws to be used as studs inserted from underneath. The completed cover is shown in **photo 26**.

Valve rod gland

The little valve rod gland (**part 06** and **fig 11**) is also from 14mm diameter bronze. Turn a register a close fit in the steam chest cover counterbored hole, then drill through and ream for the valve rod. Part off and reverse to face off the top.

Hold in the dividing head to drill the two stud holes, then saw and file the flange to finished shape.

Piston rod gland

The piston rod gland (**part 07** and fig 11) is from 17mm diameter bronze and follows the same procedure as for the valve rod gland.

Cylinder top cover

I like to use stainless steel for cylinder covers (**part 08** and fig 11) as they look nice when machined bright and if other materials are used that tarnish or rust it is very difficult to clean up the surface without taking the engine apart. Stainless steel, however, does require a bronze bush where the piston rod passes through as you cannot run stainless steel together, which would be the case as both the cover and piston rod are of the same material.

The steam chest cover.

Saw off a piece of suitable material a little over length, hold in the chuck and face off one end. Change to soft jaws and bore them out to take the faced off end then put in a centre with a centre drill. Give tailstock support and face off, bringing to finished length. Follow on and machine the boss.

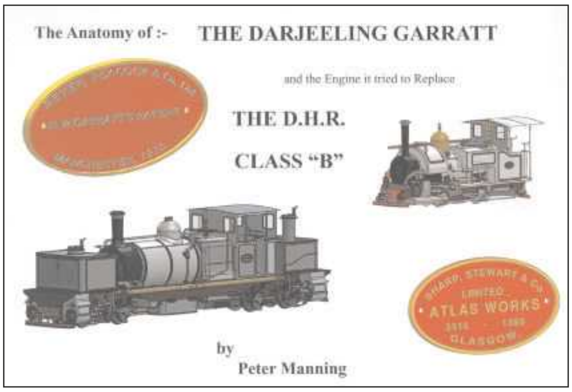
Reverse in the chuck and, again using tailstock support, turn down the register a close fit in the cylinder bore. Then, drill through; reverse in the chuck again and counterbore. Make up the stepped bush and press in.

Set up the dividing head on the lathe saddle; index around and drill the stud holes. At the same set-up, reposition the drill and drill for the gland studs, tapping them 8BA. As you are using stainless steel, use a good cutting compound on your tap.

Cylinder bottom cover

The bottom cylinder cover (**part 09** and fig 11) follows a similar procedure as the top cover but, being plain without a gland, is somewhat easier to make.

●To be continued.



Book Review

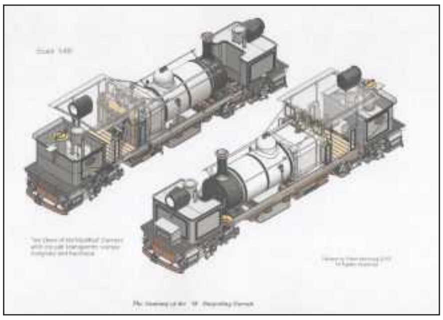
The Darjeeling Garratt and the engine it tried to replace

By Peter Manning

Another excellent model maker's book from Peter Manning. Containing a wealth of information in the form of detailed dimensioned drawings, historic photos, CAD diagrams and illustrations, it is a complete anatomy of the second Garrattt locomotive built - the D class for the Darjeeling Himalayan Railway. This section is followed by similar descriptions of 'the engine it tried to replace' - Sharp Stewart's Class B.

The Garratt is now available for 16mm narrow gauge, and drawings and castings are available for the 'B' class in the larger steam gauges so this would be a very useful book for modellers but, in addition, it is a fascinating read, beautifully presented, for anyone interested in Garratts in general.

Printed on high quality, heavy paper and spiral bound, the book is 'workshop friendly' and to be recommended.



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Quick-Change 16mm Turning Tools on a Myford 7 Lathe

The finished toolpost.

Another outburst from the infrequent pen of **Nigel Bennett**.

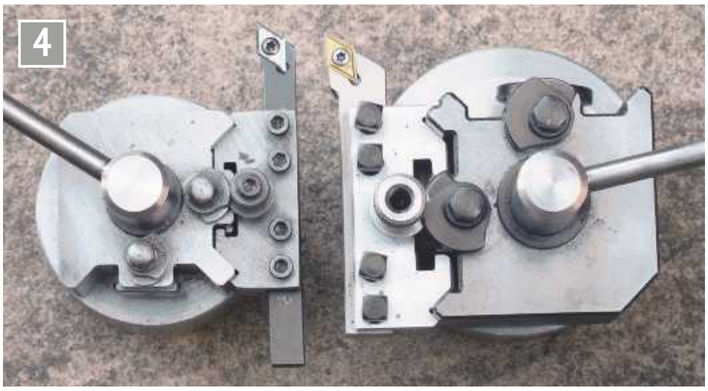
A few years ago (*M.E.* 4366, 4 Dec 2009), I described how I made a new mounting for the Dickson QC toolpost for the Myford Series 7 lathes. This replaced the topslide assembly. (The original idea originated from Tom Walshaw, the late lamented *Tubal Cain*, with his 'Gibraltar' toolpost.) It was made slightly lower in overall height than the topslide and it enabled the fitting of the Dickson Quick Change toolpost at a slightly lower height to permit the use of 12mm tooling. (Although the Myford size Dickson toolholders will accommodate 12mm tools, it is not generally possible to position them at centre height on Series 7 lathes.) In dispensing with the topslide, it increased the rigidity of the tool by eliminating the clearances present in the topslide assembly. I have used it extensively over the years and it is almost always in place on my lathe; I only fit the topslide on the rare occasions that I need it for taper-turning.

16mm boring bars are more rigid.

I recently acquired a larger lathe - a Boxford 280. The intention was to sell the Myford and so fund the purchase of the Boxford and the tooling needed to enable me to use it. However, an unexpected windfall meant that I could afford to keep both lathes. (The ideal number of lathes to have is one more than you currently own...) There was a certain amount of head-scratching required to accommodate both machines in my workshop without it bursting, but it was achieved at the expense of a slight increase in bruised elbows.

The only tooling with the Boxford was a QC toolpost (with no toolholders) and a three jaw chuck. The Myford toolholders are T0 size; the Boxford ones are T1 (**photo 2**), significantly larger to accommodate 16mm tooling and hence more rigid (**photos 3** and **4**). I didn't want to use the T0 size on the Boxford. When I tried to purchase some T1 toolholders, I discovered that genuine Boxford items are the type of thing that would cause the governor of the Bank of England to suck his teeth before he bought

T0 and T1.



Top view of the two types.

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one, whereas RDG sell a very reasonably-priced equivalent made by HBM. These don't fit the Boxford toolpost properly, however! Luckily the chaps at RDG could tell me this before I found out for myself so I bought a new HBM T1 QC toolpost and a number of toolholders to match from RDG. I had to modify the existing Boxford stud to enable the HBM QC toolpost to fit. The Boxford toolpost was put away in a cupboard.

I did try to fit the new HBM holders to the Boxford toolpost and I discovered why they wouldn't. The HBM toolholders have small differences in the thickness and relative position of the toolpost clamping flanges. (The Vee location arrangement is nominally the same.) Using a carbide tool, I machined away a small amount of material from the clamping flange on the Boxford QC toolpost and I was then able to fit an HBM toolholder to it. I tried another toolholder – it didn't fit! I removed some more material to enable it to fit - but then discovered that the first one I'd got to fit couldn't now be clamped up properly. *Bah!* I'd spoilt it! I chucked it back in the cupboard and forgot about it.

Recently I dug out the Boxford QC toolpost. I used a putting-on tool to restore the clamping flange. Further investigation showed that the HBM and Boxford QC toolpost locking cam spindles were different; the HBM ones are a little bit more eccentric (about 1mm vs about 0.5mm) and so provide a bit more movement at the expense of a slight reduction in clamping force for a given tightening torque of the cam spindle. This allows HBM to be a little less fussy about tolerances. The Boxford system is a much higher grade, but the need to hold much tighter tolerances on the toolholder slots explains why they are more expensive.

I attacked the (hardened) Boxford cam screws with a carbide milling cutter and a diamond file and was able to remove 0.5mm to increase their 'throw' to accommodate all my RDG toolholders. But what was the use of two QC toolposts? I'd already made a rear toolpost for parting tools! My gaze fell on the Super 7. How would it be, I wondered, if I were to fit a new mounting to the Super 7 cross-slide, and fit the Boxford QC toolpost? I'd get a much more rigid tool and I could even use 16mm square tools! Increasing the tool from 10mm to 16mm square gives an increase in rigidity of 650%. Now I am not proposing to use the Myford for peeling off great, thick, smoking chunks of swarf, because it's not designed for that. What I do want to achieve is consistency and accuracy and anything that reduces deflection and bending of the tool is all to the good. Also, I reasoned, if I took some very careful measurements, I could manufacture a new toolpost mounting so that toolholders could be fitted to either lathe at the correct centre height without having to adjust them each time. Also, I wouldn't need as many tools. (Briefly, refer back to the ideal number of lathes one should have; it also applies to lathe tools.)

Like Baldrick, I had a Cunning Plan. All I had to do was execute it. I chucked a piece of ground bar in the Boxford, making sure it was held truly. With a height gauge, I measured the height from the top of the bar to the top surface of the HBM toolpost cam shoulder – where the flange on the toolholder height-adjuster locates vertically (**fig 1**). I then transferred the piece of ground bar and did the same thing on the Super 7 but with the Boxford QC toolpost sitting firmly on the upper face of a carefully-cleaned cross-slide. The difference between the two dimensions would be the necessary thickness of the new mounting for the toolpost.

Fig 1

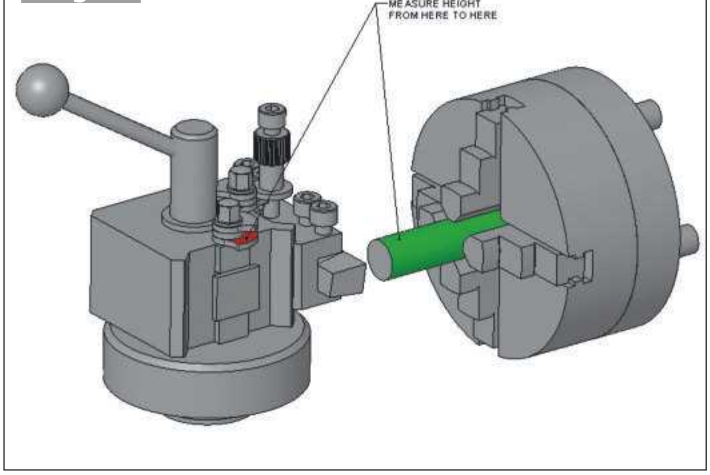
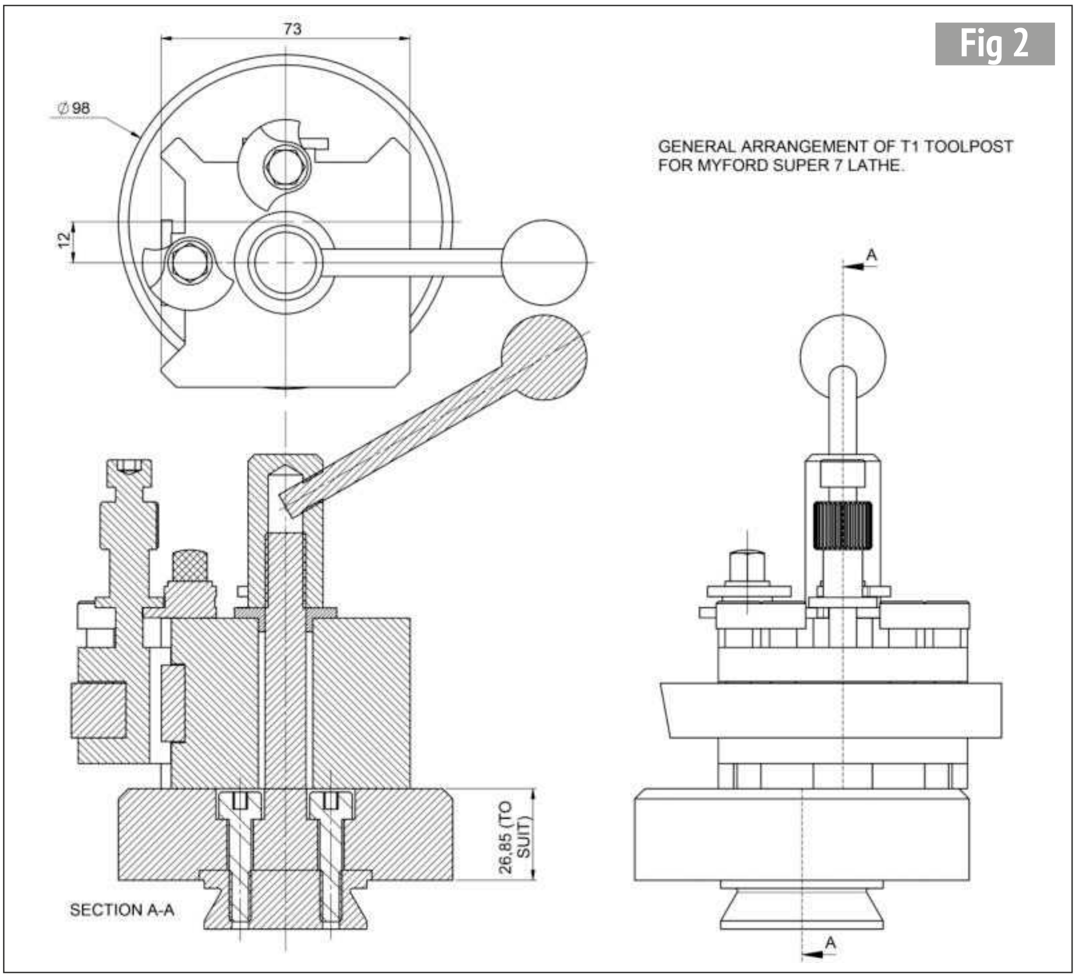
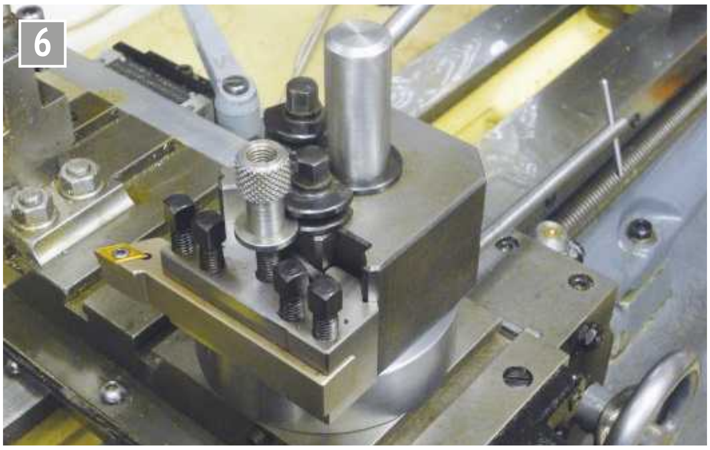


Fig 2



How would it be, I wondered, if I were to fit a new mounting to the Super 7 cross-slide, and fit the Boxford QC toolpost? I'd get a much more rigid tool and I could even use 16mm square tools!

Mounted on the Super 7 with 16mm tool.



Top view with a 16mm tool holder in use.

The new mounting needed to be larger than the one I'd described in 2009, to provide a decent surface on which to mount the larger QC toolpost (**figs 2** and **3**). I happened to have a chunk of steel of an appropriate size but it wasn't long enough for the job to make the mounting spigot for the Myford an integral part of it. I therefore made it in two parts, using three M8 cap-head screws, as shown, and some Loctite 603. It's perhaps a good way, anyway, as the amount of swarf produced making it in one piece (not to mention wear and tear on the lathe and its tools) would be enormous.

Machining the spigot was straightforward; I made it about 0.0005 inch/0.01mm larger than my Myford topslide spigot, which was a relatively free fit. I used the top slide set over at 30 degrees to get the angle, taking it carefully until I had it looking like the Myford original. Other than the angle, the actual dimensions of the tapered feature are not too critical.

Due to its size, I made it all on the Boxford but there's no reason why the Myford couldn't have handled it; I just thought it unkind! However, if using a Myford, it's important that you achieve the correct height of the block *before* machining the spigot and the angled undercut. You can't easily adjust it afterwards (if it's too thick) without making up a split collet (or using soft jaws) to grip on the spigot, and taking very small cuts.

You will notice that the M12 stud in the mounting is off-set, not central (**photos 5** and **6**). This is to ensure that the QC toolpost is fitted a little further away from the rear toolpost so that there is still the same sort of gap between them as previously with the smaller one. (All very well increasing tool rigidity, but if the biggest bar you can fit between the parting tool and turning tool is 3⁄16 inch diameter...)

I just used a length of M12 studding for the stud. I suppose to be posh I should have used a piece of En24 and screw cut the end but it's only to stop the toolpost rotating, as normal cutting forces aren't too brutal to it. It was Loctited into the main body. The handle needs to clamp up the toolpost in a suitable position; you don't want it battering into the chuck jaws! When it's made, clamp it up and see where it ends up. M12 is 1.75mm pitch, so measure how far you need to rotate the clamp handle to get it right and machine a little off the bottom of the handle boss. The figure is obtained from: (Desired Angle)/360 x 1.75.

For example, for 30 degrees, remove about 0.15mm.

So there it is; it's an idea that could save you having to duplicate turning tools and toolholders, if you are in the fortunate position of having two lathes of different sizes. I have no doubt that it would extend to fitting a T2 sized toolpost on a Myford, if you were so equipped.

ME

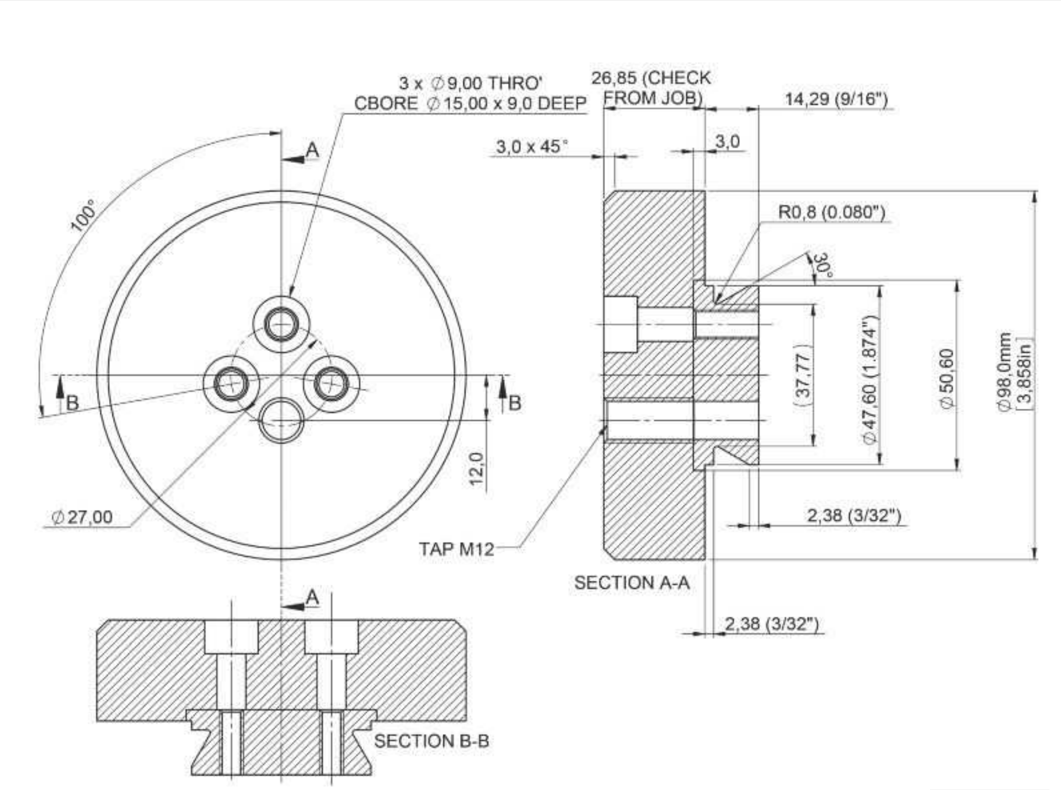


Fig 3

Ashley Best's illustrated description of an award winning, scratch built model in 1:16 scale.

Continued from p.83
M.E. 4564, 7 July 2017

When Number 46 was withdrawn for scrapping in 1937, it was just another typical British four wheel, double deck balcony tram. There was nothing to indicate that it was, in fact, a significant tramcar. This article explains the significance and describes the making of the model.

PART 4

Bolton Corporation No. 46

Axleboxes

I have tried several ways of making axleboxes; milling, fabricating or casting in white metal from prototype patterns. No. 46 uses cast white metal boxes but, in this article, I shall describe my latest design which is, I think, superior because it provides a much better solution to the problem of lubrication. A finished box is shown in **photo 32**.

The stages of making the axleboxes follow a logical progression. The parts of the box are assembled from brass sheet, bar and rod. The wing parts were first cut from brass sheet with a piercing saw and carefully filed true (**photo 33**). A central block was soldered in place then drilled through ¼ inch diameter (**photo 34**). The second wing, held in place by a sacrificial 10BA nut and bolt, was soldered in place. The first drilled hole provided the correct alignment for a clearance hole to be drilled right through (**photo 35**). A pre-drilled backing spacer piece was then added; this is not always necessary.

The next stage was the making of the cover. This required a jig to achieve the right profile (**photo 36**). Sides were soldered on and filed to ensure the correct shape and depth (**photo 37**). The box was then cleaned up and put aside while the spring cups were soldered in position on the ends of the wing pieces. These cups have to be fixed exactly at scale 20 inch centres. To achieve this, I made a jig (**photo 38**) which can be seen in use (**photo 39**). It is made of steel and uses a square firebrick block as a height rest. A ¼ inch diameter rod is run through to ensure the box is accurately

32

An axlebox.

33

Starting the axleboxes.

positioned. The rod is removed before heat is applied. In **photo 40**, a drill bit is being used as an alignment rod and in **photo 41**, the box is seen from above with notched spring cups and splayed wing plates.

The spring cups needed to be notched and the wings slightly expanded before being set up on the jig. Once placed accurately in position silver-soldering took place. I have found no problem with parts moving during soldering as heat can be directed to where it is needed and removed as soon as the solder runs. In any event I have found in almost any soldering exercises joints remain fixed after re-heating and careful use of solders with different melting points makes the task easier. Once the cups were in place there was the essential task of running a reamer through the drilled part of the box and making sure an axle would rotate freely. After the hollow box part was soldered in place it required an end mill or D-bit to gain clearance right to full extent. The hollow box, being the last part to be applied, used low melting point silver solder. At a pinch, it could be done with soft solder but avoid this if possible.

Final cleaning up and small adjustments for all my axleboxes was achieved with needle files. The reason for making the axleboxes with hollow end covers is that it allows a small oil soaked wad of cloth or cotton waste to be inserted to provide long lasting lubrication.

Brakes

The brakes on a four wheel truck are very simple. They have to be operated from either end of the car and compensated so that balanced force is applied to all the wheels. This is effected by a most elegant mechanical solution as shown in **fig 5**. When the brakes are applied, one set of wheels will be the first to receive the force and this wheel-set then acts as a fulcrum for the brake blocks on the wheels at the other end of the car. The parts were

Drilled for alignment.

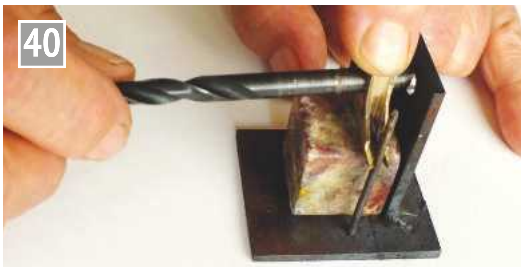
All the parts.

Forming the cover.

Completed cover.

Solder jig.

Set-up for soldering.



Checking alignment.

Ready to be set up.

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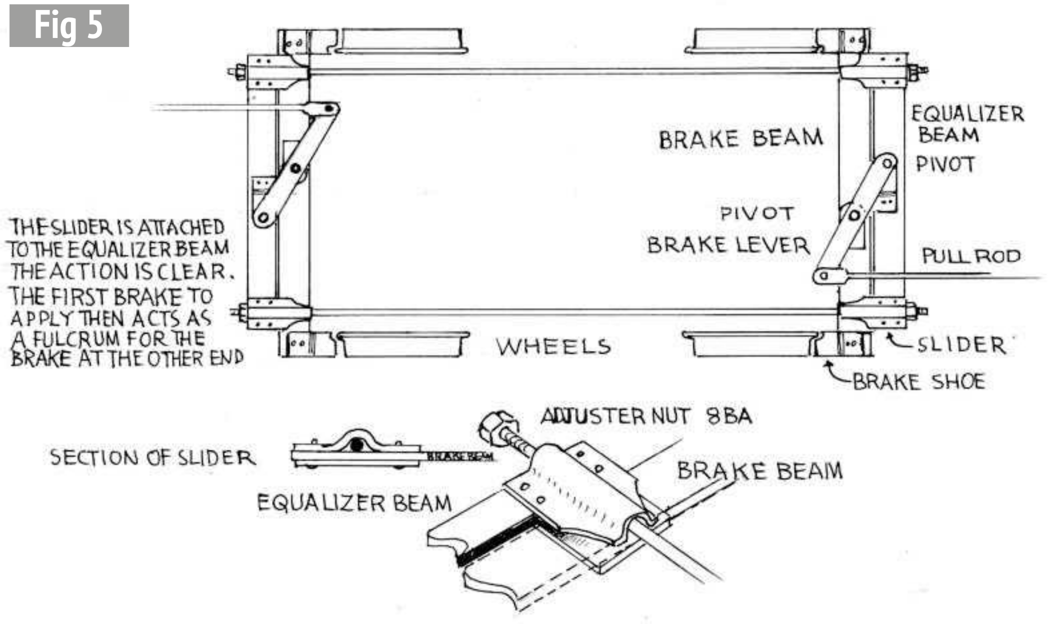
easily made with the only really rather tricky bit being the shackle pins. Space on the truck is confined and parts are small. The best solution to the problem does require careful use of a very small drill and either an accurate drill stand or - my own method - a steady hand and a mini-drill with a 1⁄32 inch or 0.8mm drill. I first turned a number of pins to 1⁄16 inch diameter shaft and filed a hex head on the end as seen in **photo 42**. The shaft was then nipped in the vice and given a very careful tap with a hammer and a fine pointed punch. It was then possible to drill a 1⁄32 inch hole through the end.

Next, after a full set of these pins had been made, it was time to make split pins. These were easier to make than I first thought. A length of wire, 1⁄32 inch diameter is filed into half round section and carefully bent to form a tiny split pin. This then makes possible fixing pins for the brake shackles. These are 1⁄16 inch diameter wires with ends hammered flat and drilled 1⁄16 inch diameter or, as I eventually found more successfully, cut to exact size and given a small piece of 3⁄32 inch diameter tube or bar, silver soldered to each end and drilled 1⁄16 inch diameter (**fig 6**). I found I needed to make a few extras as even with the greatest care there were some slight inaccuracies. The assembly of the truck was a time-consuming and fiddly process, especially the fitting of the brakes.

In **photo 43** can be seen all of the main parts of the brake mechanism at one end of the truck. At the top are shackle pins, just below is the truck end cross brace beam; below that are the double compensating brake beams with the end slide brackets through which the brake rods run. The main brake pull lever is obvious in the centre and at each end of the brake beams can be seen the brake block holders and the shackles.

Photograph 44 is a pair of brake blocks. These were fitted eventually to the brake holders by epoxy glue. They are separate items exactly as on a real tram and can be seen, as fitted, in the underside view (**photo 45**). When the truck frame and parts are painted, the brake blocks should be a different colour, simulating cast iron.

Fig 5



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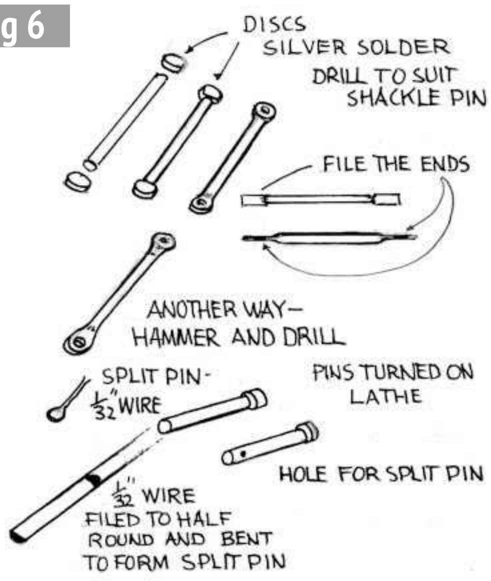
Clevis pins.

43

Brake beam.

Fig 6



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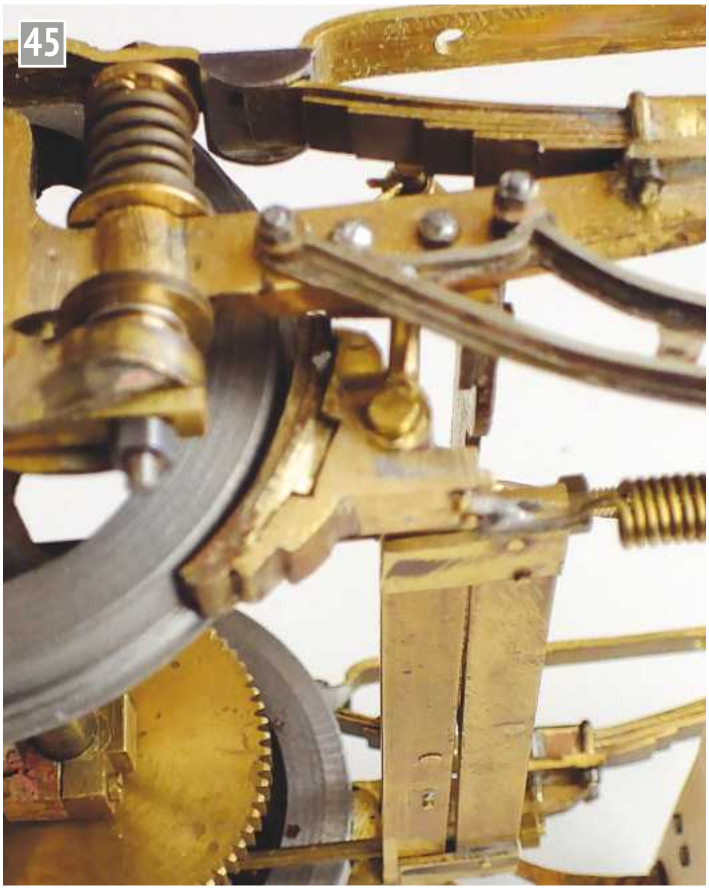
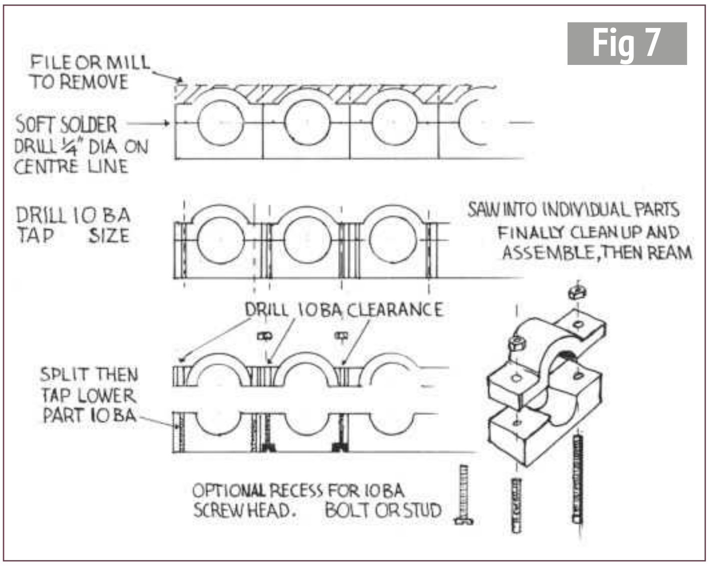
Brake blocks.



Brake mechanism.



A motor.

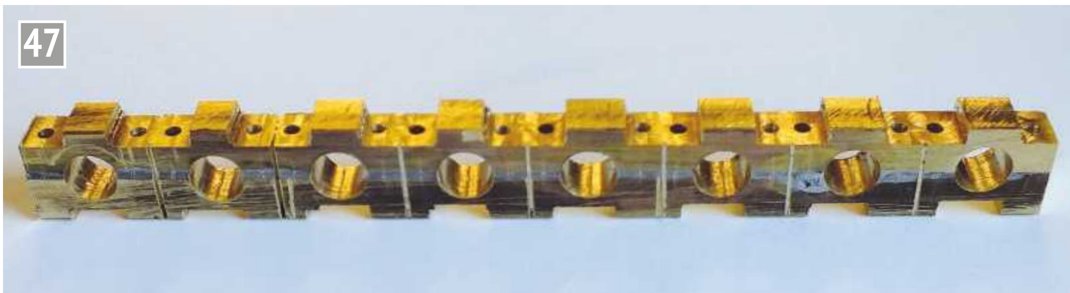
If two motors are used, it is very important to make sure that the polarity is checked early as it is easy to end up with the motors turning in opposite directions!

Motors and gears

The electric motors used by most tramcar modellers on this scale are ex-government 24 volt 5U Type (**photo 46**). They are slow rev motors best employed geared down 7:1. These motors, obtainable from the Tramway and Light Railway Society, are $1\frac{9}{32}$ inch diameter and $2\frac{1}{16}$ inches long with a half inch long, 3mm diameter shaft. They are very close to scale prototype motors and can be incorporated realistically in a model tramcar. Gears with 80 or 84 teeth, 48 DP are mounted on the tram axles which are ¼ inch diameter steel. Wheels are turned to a scale diameter 30-32 inches tread diameter. I always fit the motors with split bearings on the car axle and have never simply used a tube on the axle as is sometimes recommended. The split bearing is by far the best method and allows the motor to be removed easily if necessary. An axle hung motor is supported on the axle at one end and by a motor beam at the other. The motor beam is sprung to take up the shock of the power being applied, but in a model this is but slight and the mounting is there to look correct. Split bearings are made by soft soldering two bars together and drilling axle holes exactly on the joint line (**photo 47**). Before separating the bars, they are drilled and tapped as shown in **fig 7**, then cleaned and bolted together. It is then necessary to run a reamer through because after separating and cleaning up to remove all the soft solder; the hole is, of course, reduced in diameter and is also no longer a true circle.

The motors require a robust casing which supports the split bearings on the car axles and a bar opposite, which is threaded to accept fixing bolts from the motor support beam. I have tried many ways of making this item, finally arriving at a satisfactory design in which the cylindrical motor is slid into close fitting rings onto which I have soldered the bearings and support bar. A lock screw is fitted to prevent the motor moving and a gap is provided for the electrical connections to the motor. If two motors are used, it is very important to make sure that the polarity is checked early as it is easy to get this wrong and end up with the motors turning in opposite directions! A complete motor carriage showing all the main features is in **photos 48** and **49**.

●To be continued.



Split bearings.

Motor carriage.

A Foundry Pouring Crucible

Alan Pickering gets to grips with an industrial model … and finally completes it.

The completed model crucible.

This is a rather unusual model to say the least and is far from typical of the sort of model I would build. My preference, usually, is to sit behind something that steams around a rally field or to, at least, watch it function.

This project (**photo 1**) took approximately one light year to finish but, like most models, was very easy to start. I came across some pictures that fascinated me; they were of a Polish steel works - in Huta Pokój, in fact. I have since been told that this was the only foundry in the world that was capable of casting the hub of the London Eye but I cannot verify this claim. Molten steel ladles are lined with firebrick and fire cement (otherwise the gantry crane would have nothing to lift!). As the prototype that this model is based upon has a bottom pouring facility, it must have been used for the lower melting point alloys; the slag is left floating on the surface and only the pure metal pours from the bottom. The vessel lip is used to empty the slag leaving the crucible ready for the next firework display. There is no such thing as an old foundry worker.

I am always looking for something easy or different so this appealed to me and I had no more sense than to start it. My endless searching in scrapyards has produced a lovely box of good things, amongst which was found a piece of bronzy looking brass, a little bit bucket-like and totally useless for anything other than a foundry pouring ladle. It was a ¼ inch thick tube, possibly originating in a water pump. Anyway, that was the catalyst that started me off, probably because it was free. Naturally that piece of material dictated

Slotting the lifting arms of the crucible.

all future dimensions. Once again, fools rush in where angels fear to tread.

My biggest headache came in the form of a total surprise; it was the difficulty of holding things to mark out and then to machine. There is hardly a straight line to be found, it's all just a silly shape. Against my natural instincts this was actually going to require some sort of plan of attack … like what to make first? Essentially, most stock material is either round or square - the secret is to keep it that way as long as possible, especially the drilling, machining and the precision bits. Only after these processes are finished should one start tapering, shaping and making pretty. A very useful tool is a machine vice, machined square on all sides and that can be flipped about at will on the surface plate to hold and mark out silly shapes. Such a vice can be seen in the photo of the horizontal milling set-up being held in a large Abwood milling vice for slotting the lifting arms of the crucible (**photo 2**). The trunnions were threaded M5 to screw directly into the crucible with the side plates and dummy rivets fitted later.

I soon realised, however, that this was probably destined to be one of the 80% of models started and never finished. It soon found its way into the box of bad ideas where it stayed forgotten and unloved for about five years. Occasionally it was rescued, dusted down and quickly put back. After my latest model was finished (an undertype hot air engine that was feature in *Model Engineer*, issues 4539/41/43/51), a long overdue workshop clean, rearrangment, room making exercise began. All the long lost tools that had been missing for years were found and, along with them, this half built model. Having no project on and a lovely clean workshop galvanised me into action. It was soon finished with lots of filing and handwork plus I had the help of the 2 inch belt Vanco linishing machine and polishing spindle. If I were Prime Minister I would make these machines compulsory.

One problem that needed sorting out soon became apparent, however. Upon lifting the model, it fell apart; the dovetails at the base of the lifting arms stopped it rocking but not slipping off sideways and looking like a rag doll. Drilling two 0.125 inch internal holes for two ¾ inch pins solved everything. It required four 6BA grub screws to lock the pins so that assembly/dismantling could be possible. A drop of Loctite on the trunnions stopped the cradle from rocking, enabling it to stay in a tilted position for display.

During its construction, no photographs were taken as this model pre-dates digital photography. The intention here is to inspire a builder looking for an unusual project. This project was altogether very satisfying and maintained my reputation for always finishing a model. The photos (**photos 3, 4, 5** and **6**) show the finished model from various angles. In the end, it has become a pleasant talking point, built to exhibition standards, that exceeded all my expectations. **ME**

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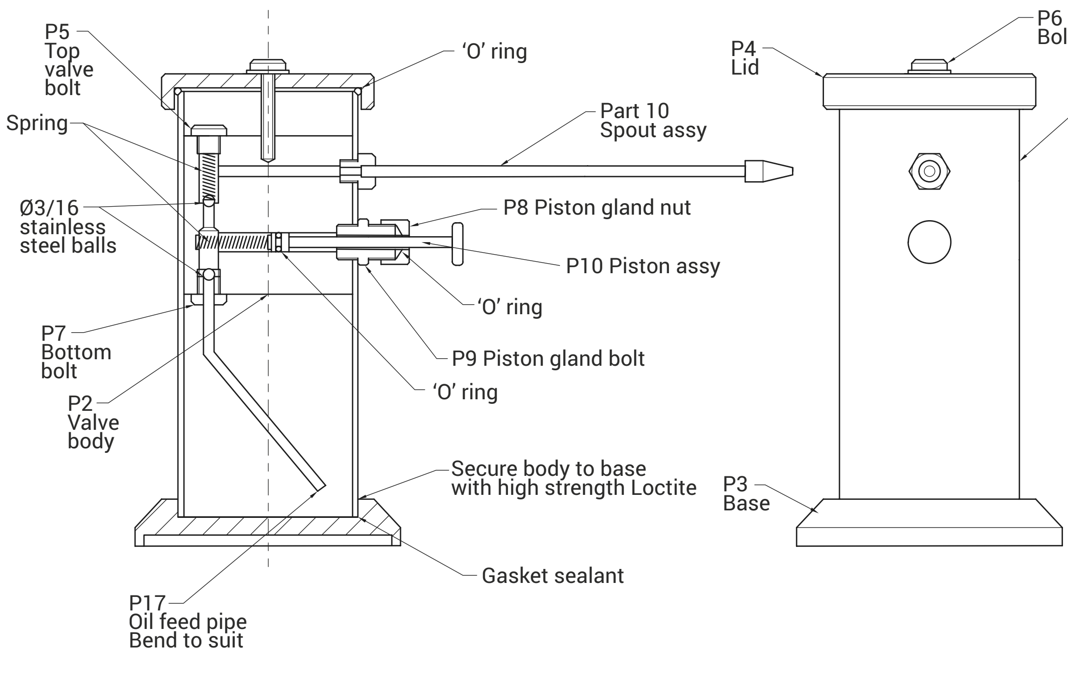
Stewart Hart takes a break from his projects to make a useful workshop companion.

Completed oil can.

Eagle Type Oil Can

Fig 1



General Assembly
Design based on the Eagle 66 oil can

Assembly notes:

1. Make valve body part2 a tight fit in body part1, squeezing tube lightly in a vice will allow you to assemble valve body, & the tube will spring back making a good oil seal.

2. Seal tube into base using a gasket sealant & high strength Loctite. Apply gasket sealant to the corner of the base & then Loctite to the tube, the assembly direction will push any surplus material away from each other.

3. Seat Ø3/16" balls onto their seating with a light tap via a brass drift from a hammer.

Material used.

Cutting the bar into slices for the lid and base.

Boring out using soft jaw extensions.

Diameter turned to size.

Over time I've became increasingly frustrated with the performance of the commercially available oil cans; they either leak, are annoyingly difficult to prime or are lacking in pressure. I even bought one of those expensive Swizz cans but I ended up bending the flimsy pump handle. I decided, therefore, to have ago making my own. An online search came up with a staggering array of different types of cans from the simple to the intricate. I was attracted to a can produced by the American Eagle Company in the early 1900s; it had a simple shape that would lend itself to manufacture in a home workshop. It has a robust, direct pumping action and further research came up with a number of home builds of this type of oil can so I wasn't the first to be attracted to its simple, no nonsense design.

Figure 1 shows the general assembly. For the body, base and lid I used aluminium but alternatively brass or steel could be used. The original Eagle cans were made from brass. I made the body (**part 1**) from a piece of 2 inch diameter by 1/16 inch wall thickness aluminium tube that was simply cut off to length and the position of the 6.4mm and 10mm holes were marked and drilled through on the centreline. The base (**part 3**) and the lid (**part 4**) are similar and are dealt with in the same manner. I had a piece 80mm diameter aluminium in my material stash that was suitable for these parts, the first job was to cut off two discs using the band saw (**photos 1** and **2**).

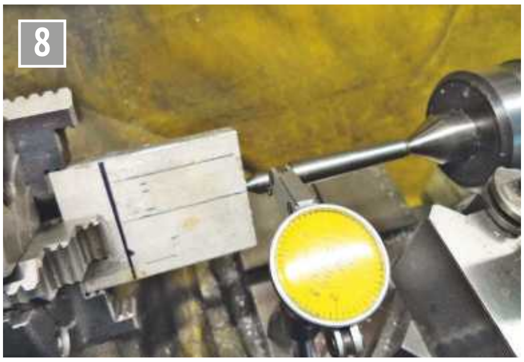
You will need to reverse the chuck jaws in order to grip this diameter but I made thing easy for myself as I have a set of soft jaws to which I've added extensions; this not only increases the life of the jaws, it also gives me a little extra range and by boring out the jaws to suit, they chuck up dead true and square. I first bored out the part (**photo 3**), then skimmed up the outside diameter (**photo 4**), then reversed the part in the chuck and finished off the other face and diameter (**photos 5** and **6**).

Finishing the reverse side.

Trial assembly of body, base and lid.

>>

Centre drilling the valve body.



Clock the valve body true in the four jaw chuck.

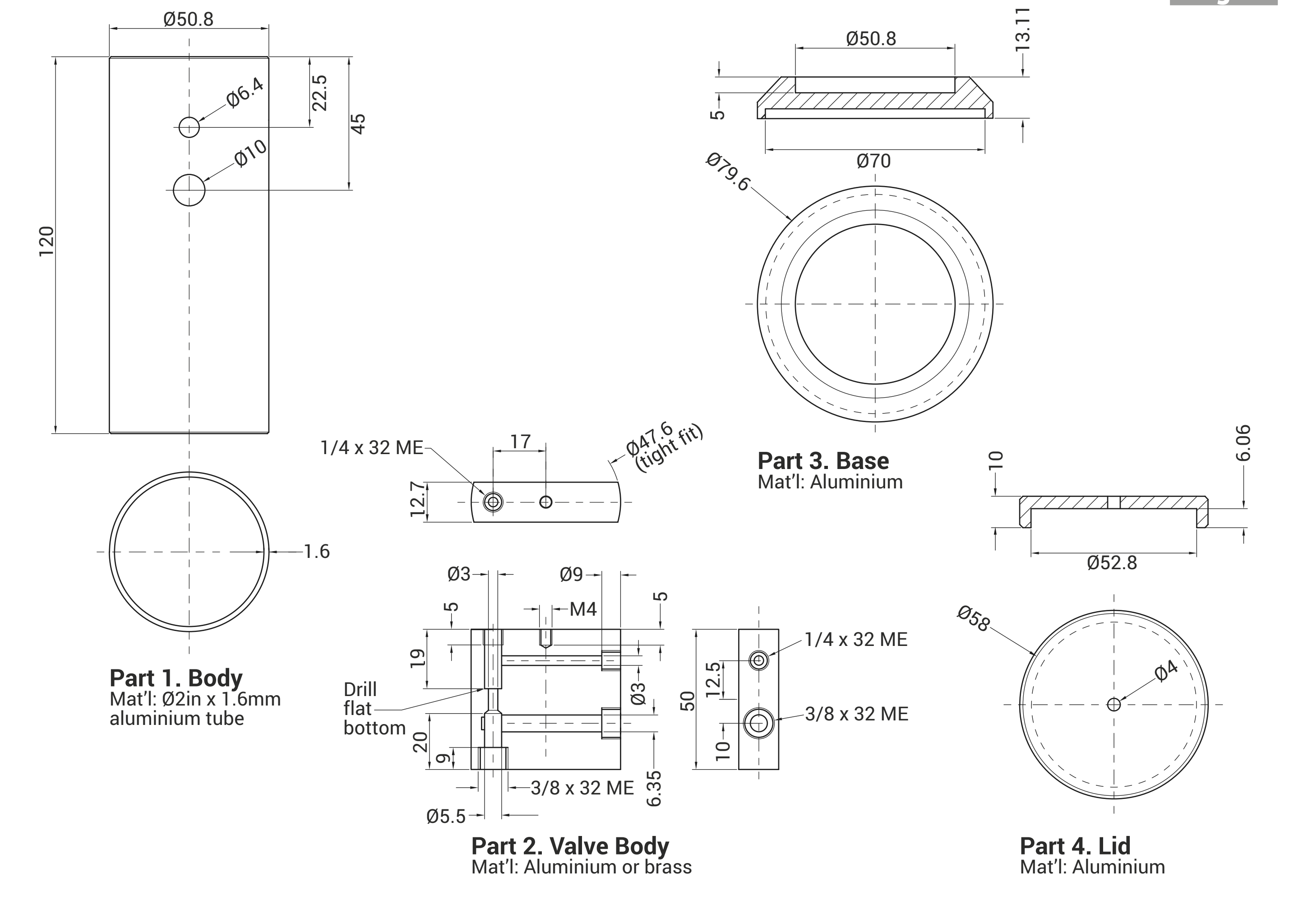
Turn the valve body to a tight fit in the tube.

Drilling the oil ways.

Valve body

The valve body (**part 2**) is made from a piece of ½ inch aluminium jig plate (**photo 7**). After squaring up the piece in the mill with a fly cutter, put a nice, deep centre drill into its middle then, using the four jaw and a wobble bar, clock it up so that it runs true (**photo 8**). With the part supported with a running centre (**photo 9**) turn the valve body down so that it's a very tight fit in the tube (this is all part of a cunning plan). Remove from the chuck, cut to length and square up this newly cut face. Drill and tap the oil chambers (**photo 10**). Note: use a flat bottom drill to finish off the valve seats. Flat bottom drills are easily ground up from old jobber drills. Over the years I've accumulated a collection of flat bottom drills (**photo 11**).

Fig 2

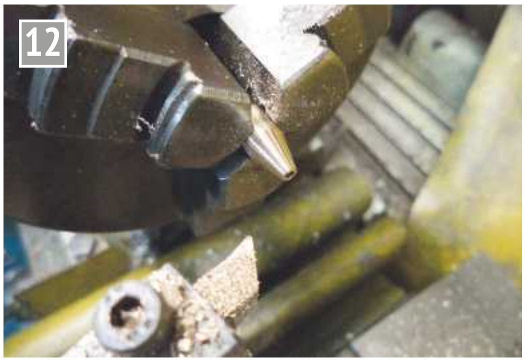


Spout

The spout assembly (**part 10**), consists of an oil tube (**part 11**) made from 5mm diameter thin wall brass tube, a nozzle nut (**part 12**) and nozzle (**part 13**). These are all simple enough parts to make (**photos 12** and **13**) that are soldered together with soft solder (**photo 14**). For this I used a gas torch. The flame need only be applied for a few seconds to get the solder flowing.

The remainder of the parts are, again, straightforward turning jobs and don't need much explanation. Turn the piston to a nice slide fit in its bore and turn the oil groove to suit the particular O-ring you are using if you don't have any O-rings then use graphite packing or a twist of PTFE tape will do just as well. Fix the piston to its rod (**part 15**) with some Threadloc, as well

Collection of flat bottom drills.



Turning the nozzle to shape.

Spout parts.

Spout soft soldered together.

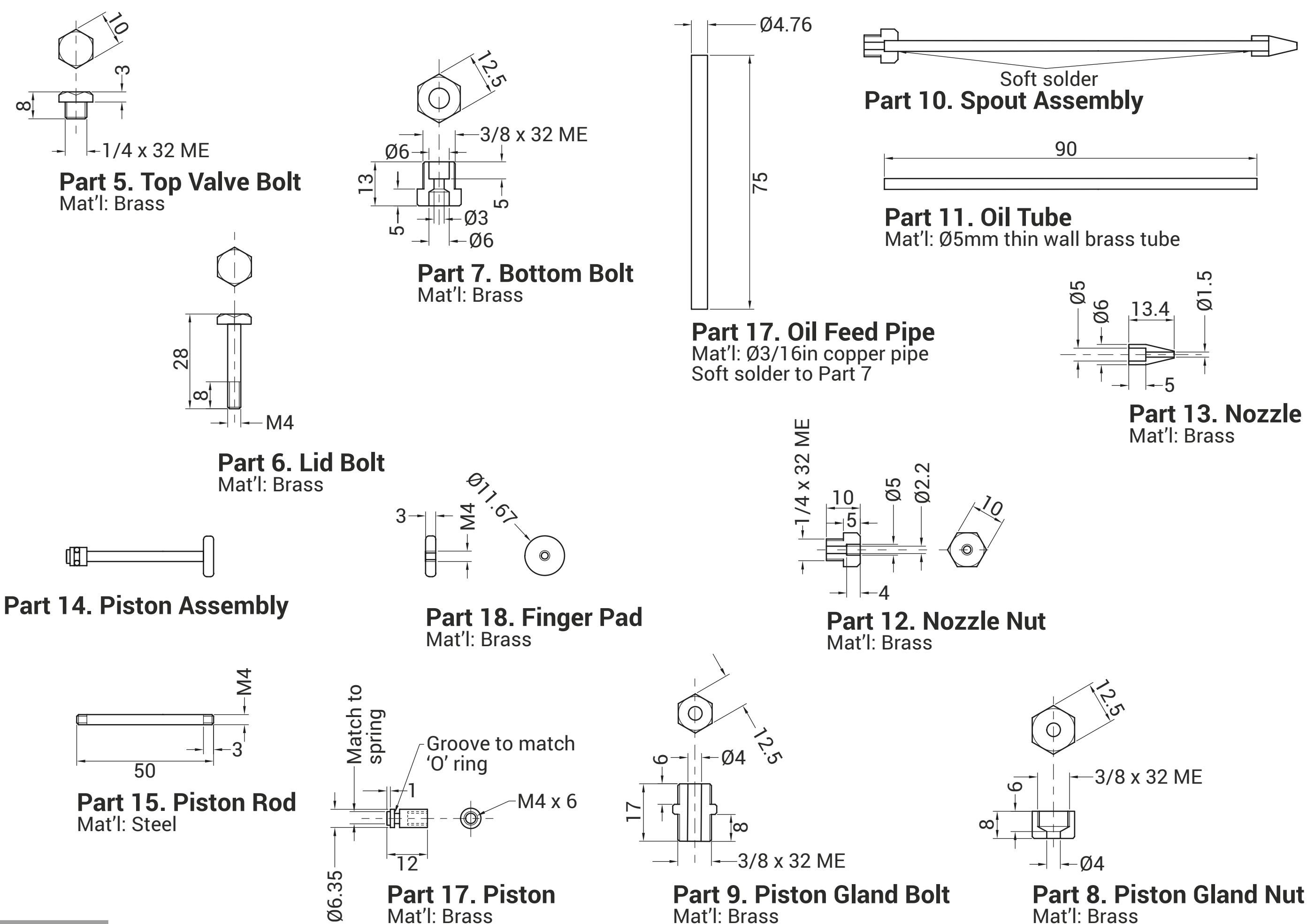
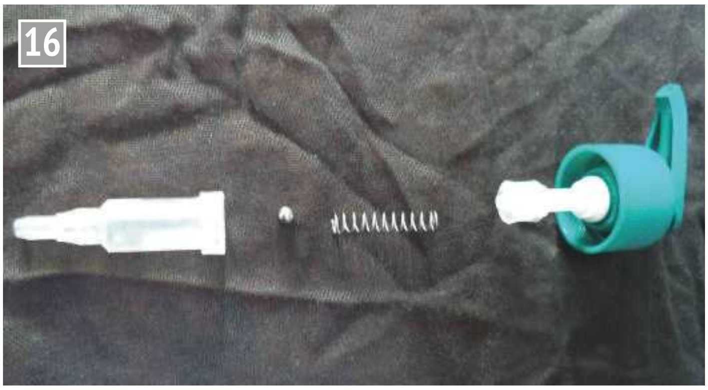


Fig 3

Pump parts ready for assembly.



Salvaged parts.

I found making the oil cans an enjoyable diversion from my long term workshop project and, so far, they have worked perfectly; there's hardly any leak and they deliver oil first time and with a good pressure.

as the finger pad (**part 16**), but not until you have checked everything is working, as you may have to strip things down. **Photograph 15** shows all the parts ready for assembly.

Springs and $\frac{3}{16}$ inch balls can be salvaged from liquid dispensers - if you can drop on one (**photo 16**). (I'm always on the lookout for salvage opportunities and have amassed a useful collection of screws, springs and other bits and bobs over the years.)

Body

The body is sealed to the base using a gasket sealant and high strength Loctite. Apply the gasket sealant into the corners of the base and apply the Loctite to the tube; that way the direction of assembly will move the surplus material in opposite directions. Give the $\frac{3}{16}$inch stainless balls a light tap with a hammer using a brass drift to seat them in properly. You may have to search around for a suitable spring. For the piston I used a 5.75mm diameter spring, 27mm long made from 0.55mm wire and for the top valve I used a 4.3mm diameter spring 18mm long made from 0.25mm wire.

The oil feed pipe (**part 17**) is soft soldered to the bottom bolt and bent so that it takes oil from the front of the can.

To assemble the valve body into the tube, lightly squeeze the can in the vice firstly. It will go slightly oval allowing you to slide the valve body in place. The tube will spring back when released from the vice and tightly grip the valve body, giving an oil tight seal. (Remember, I said there was a cunning plan!) The threads can be sealed with Threadloc and O-rings.

That's it - job done! Fill up with oil and prime the system by operating the piston and the oil should start to come out of the spout. If you wish, you can tailor the nozzle to suit your requirements.

I found making the oil cans an enjoyable diversion from my long term workshop project and, so far, they have worked perfectly; there's hardly any leak and they deliver oil first time and with a good pressure.
ME

Sealing the body to the base.

Drawing List		
Sheet Number	**Part Number**	**Description**
1		Oil Can General Assembly
2	Part 1	Body
	Part 2	Valve Body
	Part 3	Base
	Part 4	Lid
3	Part 5	Top valve bolt
	Part 6	Lid bolt
	Part 7	Bottom bolt
	Part 8	Piston gland nut
	Part 9	Piston gland bolt
	Part 10	Spout assembly
	Part 11	Oil tube
	Part 12	Nozzle nut
	Part 13	Nozzle
	Part 14	Piston assembly
	Part 15	Piston rod
	Part 16	Piston
	Part 17	Oil feed pipe
	Part 18	Finger pad

Champion 20VS Mill from Chester Machine Tools

PART 4

John Smith compares the requirements of the model engineer with the offerings of this milling machine.

Continued from p.53
M.E. 4563, 23 June 2017

In this article, the author proposes some mandatory and desirable requirements for a vertical mill for the model engineer. He then assesses the Champion 20VS mill against these evaluation criteria, showing how to measure the accuracy of the basic geometry of any vertical milling machine. The objective: to help you choose a mill that will enable you to do good work. Finally, he puts the mill to work to assess its flexibility, usability and performance.

Ruggedness and usability

To assess this, I made some brackets which call for a variety of milling operations (**fig 1**). These are part of a mounting kit for a GWR nameplate. I've made these on both the Myford VM-B and the Bridgeport, so they should be a good test. They don't call for extreme accuracy, but I'm going to ignore that and make them as if they do. **Please note:** the safety guard was removed for the photographs.

I started by cutting three pieces of 1¼ x 5⁄16 inch BMS slightly longer than 3 inches and one piece of 1½ x ½ inch BMS slightly longer than 4 inches (allowing three brackets to be milled, providing ⅛ inch between each pair for sawing). All four surfaces of the blanks were rubbed down on a piece of emery paper sitting on a surface plate (the model engineer's surface grinder!) to remove any lumps and bumps. The blanks were then milled to lengths of 3.000 and 4.000 inches respectively using the set-up shown in **photo 9**. The vice was first positioned with respect to the front face of the table using a square and clamped lightly in position. Then, using a DTI running along a parallel gripped in the vice, the vice jaws were positioned precisely parallel to the X-axis of the mill. The blanks were mounted on parallels, gripped lightly, then tapped hard with a copper-faced hammer to force them down against the tendency of the vice jaws to lift. Then the vice was fully tightened. A ⅜ inch diameter end mill in a Clarkson-type collet chuck was used and ten thou cuts were

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Milling the blanks.

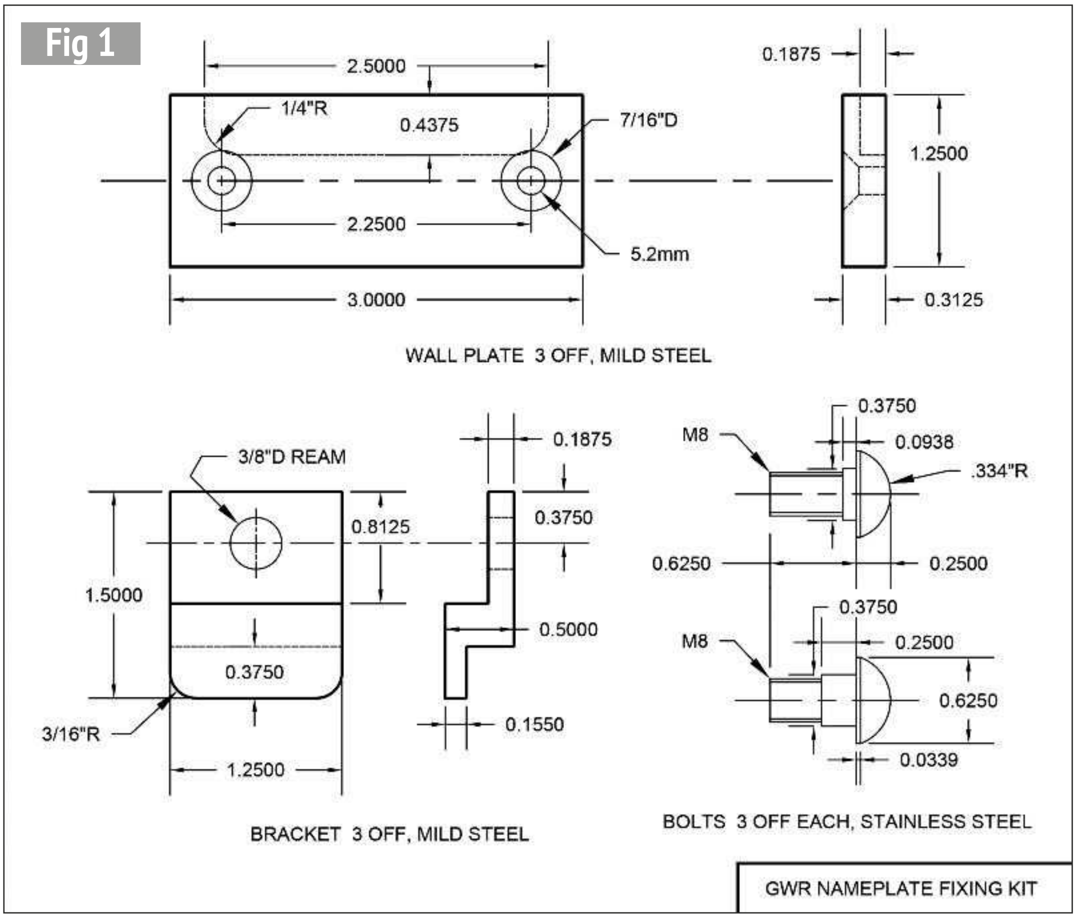
taken, first feeding against the direction of rotation of the tool and then returning (climb milling). I clamped the X-axis for each cut. The X-axis clamping levers proved a real pain and were quickly swapped for M6 Allen screws. If I bought this mill, I would change all seven clamps for tommy bar screws from WDS Component Parts Limited. The mill produced a nice finish and I managed to get all workpieces to within half a thou of the desired length. Checking with a square showed that the milled ends were *very* square (as we knew they would be).

The next task was to drill and countersink the wall plates. One plate was mounted in the vice on tall parallels, the milled end flush with the side of the jaws. A centre finder was used to set the X and Y axis handwheels to zero (**photo 10**) and then the parallels were replaced with lower ones. Then the handwheels were advanced to the position of the first hole and the table was clamped. The hole was drilled, starting with a centre drill and progressing to 5.2mm via 4mm and 5mm drills. The countersinking was done at slowest speed (**photo 11**). The process was repeated for the other two workpieces, without needing to re-set the handwheels, and then the table was moved along the X-axis to the position of the second hole and three more holes were drilled and countersunk. It took no time at all to change speed and very little time to wind the head up and down. The quill handwheel has just the right gearing and the countersink cut beautifully.

Then, the recess was milled, using the set-up shown in **photo 12**. After setting both X-axis dials and the Y-axis dial using the centre finder and advancing the quill to the very end of its travel and clamping it, a ½ inch diameter end mill was mounted and the recess was milled 10 thou all round smaller than required, lowering the head by 12.5 thou for each pass using the Z-axis handwheel. Then the final cut was made. When an end mill advances into a corner, cutting takes place over a full quadrant of the end mill. This increases the cutting resistance and most vertical mills will complain (you will notice a change in the tone of the motor). As soon as you hear the change in tone you slacken the quill clamp, lift the tool up using the quill feed handle, advance the table to its final position and then pull the quill down to the end of its travel and clamp it. The end mill bores a beautiful quadrant and you are ready for the next leg of the recess. Using the end of the quill travel as a quill stop was not totally convincing and the graduations on the Z-axis dial were very confusing. Much use was made of a depth micrometer, but a satisfactory result was obtained.

The remaining two wall plates were milled in a different way, which worked much better.

Fig 1

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X- and Y-axis handwheels were set to zero.

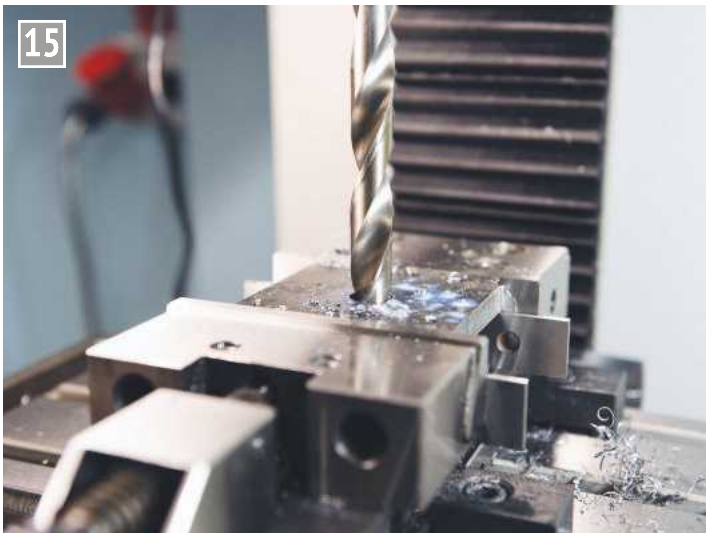

11

Countersinking at low speed.

Milling the recess.

Rounding the bracket lugs.

The finished brackets.



The large hole drilling test.

With the quill withdrawn but not clamped, the end mill was positioned over the workpiece, the fine feed clutch was engaged (by means of a thumb screw on the quill handwheel), the fine feed was advanced until the end mill just grazed the surface and the fine feed dial was set to zero. Ten thou cuts were taken by advancing the fine feed dial and then clamping the quill. This was a very effective and precise process; the quill return spring preventing any backlash. The fine feed dial advances the quill by 0.080 inch per revolution (a bit odd!), but I became used to this very quickly and it was easy to obtain precisely the correct depth of milling. I did notice that when the table is moved in towards its maximum travel, the Y-axis leadscrew is exposed to swarf and care must be taken to cover the hole.

The larger of the two flats on the brackets (fig 1) was milled using the same set-up as in photo 12. There was a lot of metal to remove and, as the mill is not continuously-rated, I gave it 15 minutes rest every half an hour (I probably needed it more than the mill!). It took longer than normal as I was only taking ten thou cuts. Five hours into the project one of the Y-axis clamps failed and had to be replaced with one of the ones removed from the X-axis. Taking the clamp apart showed that there is approximately ¹⁄₁₆ inch length of cast-in hexagon in the white-metal handle and this had worn away. Get the tommy bar screws; they will last a lifetime!

After milling the other flat in the vice and sawing the workpiece into individual brackets, these were milled using the set-up shown in photo 9. The bores were drilled and machine-reamed using the mill as a jig borer.

There are two ways to accurately machine the radii on the lugs. A corner-rounding cutter will do the job nicely but mounting a large rotary table on this little mill is more fun. The bracket lugs were rounded off using the set-up shown in **photo 13**. I have a dodge which works very well for this type of work. Both my rotary tables are fitted with Morse taper inserts which have been bored ½ inch diameter. A range of ½ inch diameter inserts has been made with different sized holes drilled in them. A dowel of the desired radius is inserted and a plain square (no base) or a small V-block is clamped against the dowel. The dowel is then removed and the workpiece positioned against the square or Vee-block and clamped. The square or Vee-block is removed, allowing the radius to be milled very accurately. Radii larger than ¼ inch are accommodated by turning a ½ inch diameter spigot on a short length of rod of the required radius.

Photograph 14 shows the finished brackets. The mill performed all the operations needed to produce the brackets very competently and with a fine finish.

The next task was to test the drilling capacity of the mill by drilling some large holes in a piece of black steel (**photo 15**). Working up from 4mm to 17mm in 1mm increments

Boring up to 1 inch diameter.

Finally a fly-cutter test.

The Champion 20VS is a nicely-made and very accurate machine which represents excellent value for money. It is easy to use and will enable you to produce very good work. I can strongly recommend it and would happily find space for one in my workshop.

took very little time. The drills cut nicely and there was no shortage of torque from the motor. Swapping the drill chuck for an Arrand boring head with a carbide tool, I proceeded to bore the hole to 1.000 inch diameter (**photo 16**), taking 0.010 inch cuts. I used all three methods of advancing the tool (the quill handwheel, the fine feed dial and the Z-axis handwheel). The latter gave the best control and finish.

Finally, a fly-cutter was mounted, set to a radius of 1½ inch (**photo 17**) and put to work taking 0.005 inch cuts on a piece of brass flat. The job was no problem for the mill and it produced a fine finish which, upon inspection, proved to be free from any 'dishing'. To fly-cut a workpiece clamped down directly onto the table will require the removal of the swarf guards.

Conclusions

The Champion 20VS is a nicely-made and very accurate machine which represents excellent value for money. It is easy to use and will enable you to produce very good work. I can strongly recommend it and would happily find space for one in my workshop. I judge that the mill could handle all of the milling requirements of a 3½ inch gauge locomotive. Whilst it is perfectly usable in its current configuration, perhaps when the machine is due for an upgrade the following shopping list of nice-to-have enhancements could be considered:

1. Larger X-axis and Y-axis dials with 0.001 inch graduations and dial locking screws;
2. A 10TPI Z-axis leadscrew and a dial with 0.002 inch graduations and with larger graduations *increasing* as the head is moved towards the workpiece;
3. A quill stop;
4. A non-captive drawbar;
5. An extra keyway in one of the X-axis handwheels so that they can be mounted such that the handles counterbalance each other;
6. Tommy bar screws to clamp the table, head and quill;

I feel that it is important for me to state that, in my opinion, the cabinet stand offered for this machine has too small a footprint to provide a stable base for the mill and is not sufficiently sturdy to support a mill of this weight. Other mill suppliers provide similar stands for similar machines, so I think this is an industry issue. However, Chester can provide a stand with a larger footprint, designed for a heavier mill (you might have to make some raising blocks). I would opt for one of these, or shop around for a sturdy stand (*not* a flat-packed one).

ME

I hope that the evaluation criteria and measurement techniques presented in this article will be of value to any model engineer looking to purchase a new vertical mill. It's a big investment and we want to get it right. We must assume that the accuracy of the geometry will vary between machine models and also between machines of the same model due to normal manufacturing tolerances. My advice would therefore be to visit the retailer of your favoured machine and ask them if they would:

1. Allow you to measure the accuracy of the geometry of a specific machine in the showroom - after all, the measurements are not intrusive. The verticality of the spindle to the table and the error from 90 degrees between the X and Y axes are the key measurements, which take very little time to do,

2. Deliver that specific machine to your workshop, if you are happy with its accuracy.

Knowing the suppliers with whom we work, I believe that many would agree to this.

PART 2

Grampian Transport Museum

Roger Backhouse visits Aberdeenshire's flagship museum of historic vehicles.

Continued from p.163
M.E. 45065, 21 July 2017

West Aberdeenshire is better known for farming, forestry and fishing but engineering interest is rarely far away. The small town of Alford boasts two fascinating museum collections.

Halley's Industrial Motors were major Scottish commercial vehicle makers from 1906 to 1919 though the company declined, closing in 1927. Though well made, few vehicles have survived. This example was rescued from near Heathrow and largely reconstructed. The B35 engine has four cylinders in two rows with chain drive but is not operational (**photo 28**).

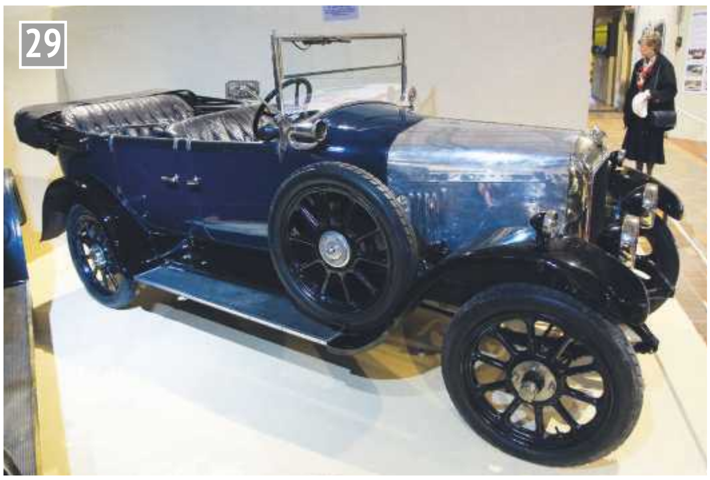
Many Scottish engineering firms developed cars. One of the largest was Beardmore, constructing locomotives, ships and the R34 airship

Grampian Transport Museum entrance.

among other achievements, even building the Bennie Railplane (see *Model Engineer* issue 4435). The firm began building cars from 1919, later making a successful taxi cab in Paisley using the starter engine designed for airship motors. The car on loan to the museum is a 12/30 of 1925 with a lighter 12 HP engine (**photo 29**).

The final attempt at Scottish mass car manufacture came with the opening of the Rootes Group's Linwood plant to make the Hillman Imp. Its aluminium engine was the first fitted to a mass produced car but the factory was remote from Midlands parts suppliers where the engines were machined. With a skills shortage and industrial relations difficulties, production never reached expected levels and the factory closed in 1981 after just 18 years. Even so, the Imp retains an enthusiastic

Halley lorries were well made but few have survived. This was rescued from near Heathrow and rebuilt.



A 1929 Beardmore 12/30 of 1925 with a 12 HP engine. The firm had many engineering branches and later developed a successful taxi cab.

The last attempt at mass car production in Scotland. A Hillman Imp recreated in Dumbarton Police livery. The aluminium engine was innovatory but sales did not match expectations.

Argyll super car developed by Bob Henderson and Andrew Smith with a Rover 3.5 engine. Alas, competition from other super cars defeated sales.

American Mack truck of 1940 used to haul tank recovery trailers, then showmans vans, and was converted to a snowplough by Aberdeenshire County Council in 1960. It had 45 years' service.

A very early 1912 Rudge TT Combination with a 498cc engine and a Sturmey Archer three speed gear.

Enthusiasts dreamed of a Scottish super car and, resurrecting an old name, the privately funded Argyll Turbo GT prototype of 1976 was launched in 1983 with a 3.5 litre Rover engine.

following, one even recreating a Dumbartonshire Police Car (**photo 30**).

Enthusiasts dreamed of a Scottish super car and, resurrecting an old name, the privately funded Argyll Turbo GT prototype of 1976 was launched in 1983 with a 3.5 litre Rover engine. Developed by Bob Henderson and Andrew Smith using Bob's knowledge of turbocharging, it was soundly engineered. Unfortunately, it was just too expensive in a market dominated by Porsche and Lamborghini (**photo 31**).

The US Army once made use of Mack trucks to haul tank recovery trailers. Built in 1940, the museum's example hauled fairground rides after the war. It was rebuilt in the 1960's by Aberdeenshire County Council as a snowplough, much needed and used during local winters as it could cope with 10 - 15 foot drifts and hard packed snow. The Council fitted an AEC engine and added a Leyland cab with power steering retaining left hand drive. It lasted in service until 1985; a remarkable record. As with many other exhibits, the cab is accessible for photographs (**photo 32**).

An Ariel 2.5hp of 1923.

Motorcycles

Perhaps a motorcycle enthusiast could do justice to the excellent range of bikes on display, though most are here on loan. A very early 1912 Rudge TT Combination has a 498cc engine and a Sturmey Archer three speed gear (**photo 33**). Another is an Ariel 2.5HP of 1923 (**photo 34**). Of the later machines, the DKW Hercules built in 1979 has an unusual

The DKW Hercules built in 1979 had an unusual rotary engine, but did not sell well.

Guy Martin's Suzuki 1000 K3 of 2003 on which Guy thinks he's won more races than on any other machine.

rotary engine, though they did not sell well (**photo 35**).

Guy Martin, a well known motorcycle racer and collector of motorcycles, has generously loaned several machines. They include the Suzuki 1000 K3 of 2003 on which Guy thinks he won more races than any other machine (**photo 36**). He also loaned the Rolls Royce Merlin engine of a type once used in Spitfires, Lancaster bombers and Mustang fighters (**photo 37**). Comedian Billy Connolly has also loaned his Boom three-wheeler.

Visiting the Grampian Transport Museum

CONTACT DETAILS:
Grampian Transport Museum,
Alford, Aberdeenshire
AB33 8AE
Tel. 01975 562292
www.gtm.org.uk
Contact email:
info@gtm.org.uk
Amenities include the Traveller's Rest Tea Room, shop and tourist information.
Opening: 1st April to 23rd October, 10am - 5pm, but 10am - 4pm in October. Admission charges apply.

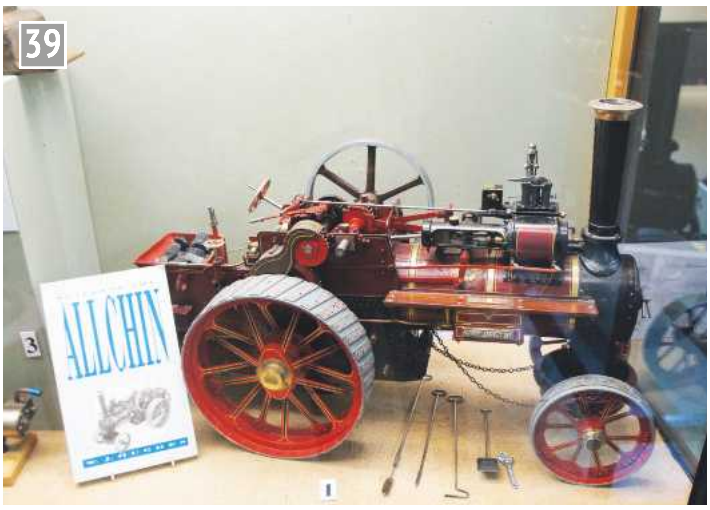
PUBLIC TRANSPORT:
The X18 and X20 bus routes link to Aberdeen and the 421 to Inverurie. Both have rail stations. Car parking is available at the museum.

SPECIAL EXHIBITS AND EVENTS:
There are two nicely made Tich locomotives plus a disassembled miniature locomotive, showing how one is built up (**photo 38**). Besides model buses, stationery engines, a miniature saw bench and traction engines (**photos 39, 40, 41** and **42**) there's even a miniature pistol believed to have been made in Austria. The centrepiece is currently two fine 4 inch scale Fowler BB1 ploughing engines with reversible plough and water carrier on loan to the Museum (**photos 43** and **44**).

An enhanced 'Tribute to Triumph' display is matched by one devoted to the 'Swinging Sixties' and additional items from the Guy Martin collection.

Rolls Royce Merlin engine of a type once used in Spitfires, Lancaster bombers and Mustang fighters.

Disassembled Tich model locomotive.



An Allchin traction engine model.

Aberdeen's historic transport in model form.

Various miniature stationary engines.

Pultra lathe.

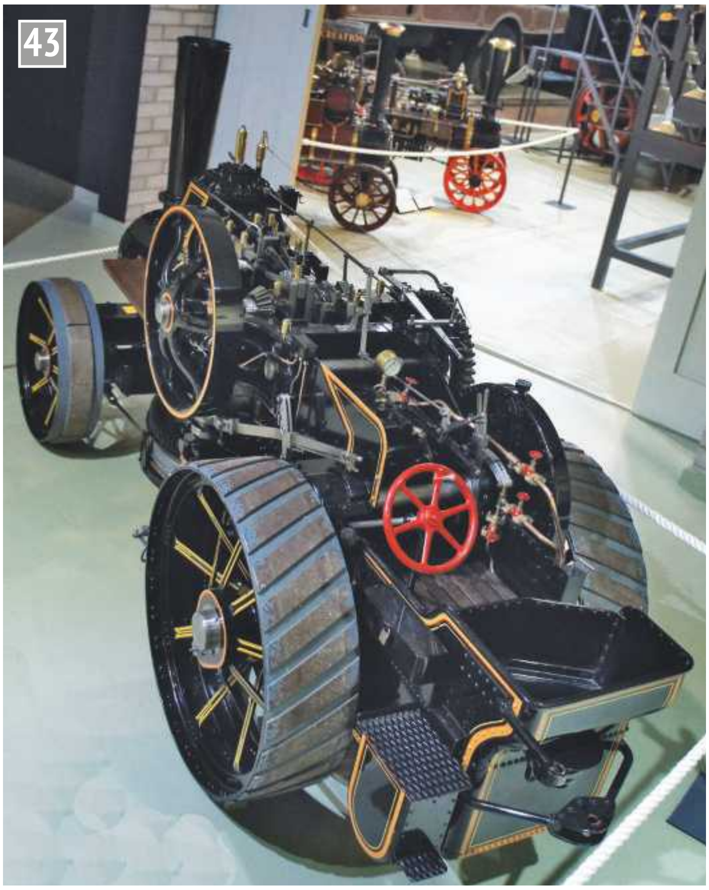
AllFord, a day for all Ford fans to enjoy with vehicles from 1908 to the present, takes place on Sunday 27th August.

Grampian Motorcycle Convention will be held on Sunday 3rd September 2017.

Steam@Alford with engine parades, demonstrations and rides is on Sunday 8th October 2017.

Other Local Attractions

Alford Heritage Centre
Housed in a former auction mart, the style contrasts with the Transport Museum. It holds many bygones, thematically arranged with most unrestored, a large collection of agricultural tools and machinery, even a collection of chainsaws. If in



Fowler BB1 ploughing enines in 4 inch scale.

These models are simply superb. They are currently on loan.

Alford Heritage Centre is housed in a former auction mart and houses a fascinating collection of local bygones.

the area it's well worth a visit (**photos 45** and **46**).

Alford Valley Railway

A 2 foot gauge line operated from the old station site nearby on summer weekends.

Other attractions with engineering interest

Most are some distance away, but worth the journey.

Pitmedden Garden and Agricultural Museum (National Trust for Scotland)

One of Britain's finest gardens with an agricultural museum in the grounds. Even if you aren't a keen gardener this precision horticulture is fascinating.

Museum of Scottish Lighthouses

At Fraserburgh; including the Kinnaird Head lighthouse and a specially built museum.

Aberdeen Maritime Museum

A fine display with much about the modern North Sea oil and gas industry. To be subject of a future article.

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Vintage tractors in the Alford Heritage Centre. It even has a loaned collection of chainsaws!

Where to stay

'Bydand' is a quiet and comfortable small bed and breakfast in Alford.
Tel. 01975 563613

18 Balfour Road,
Alford, Aberdeenshire
AB33 8NF.

ME

Thanks to:
Mark Jeffery, former Marketing & Events Organiser, GTM and Oliver Edwards, currently Marketing Manager, for help with this article.

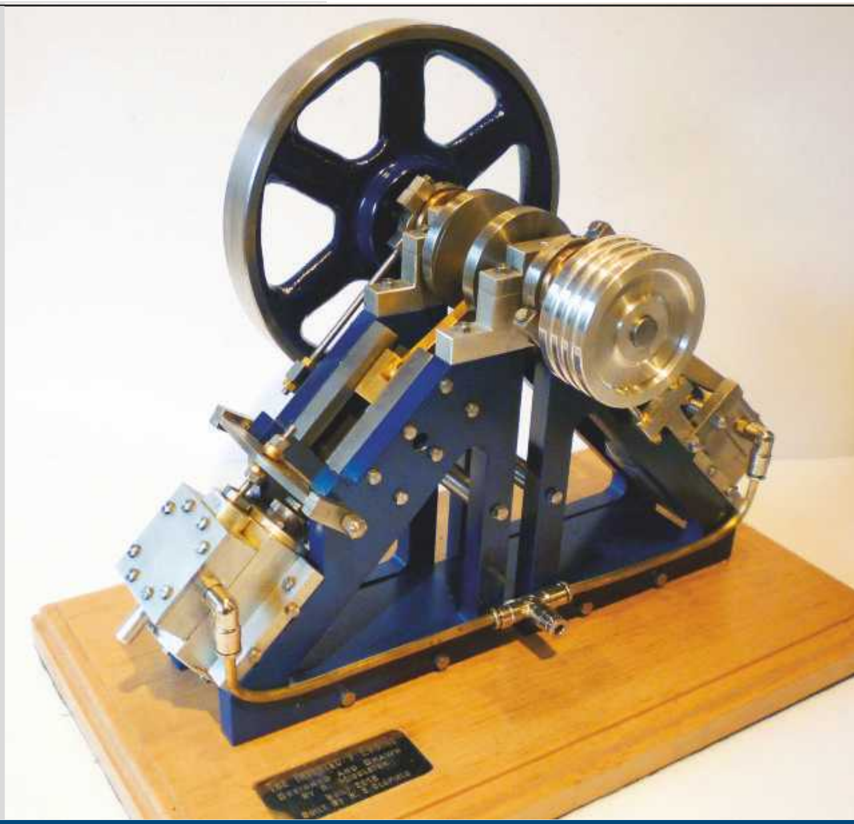
NEXT ISSUE

NEW SERIES:

- Middleton Inverted Vee Engine
- Using Coventry Dieheads

- IMLEC - First Report and Results Tables
- Observations of a Displacerless Hot Air Engine
- Barclay Well Tanks of the Great War

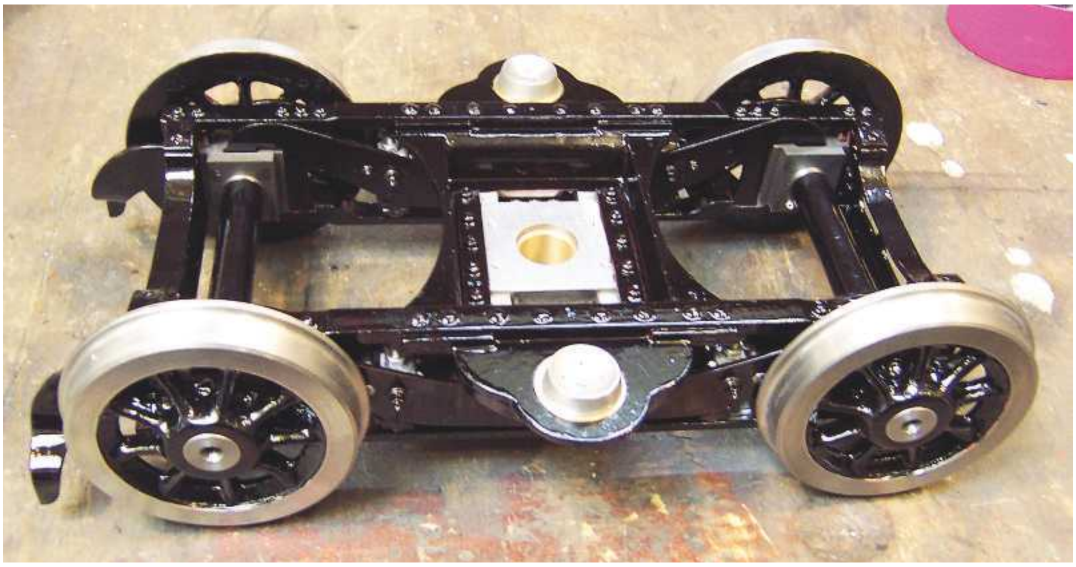
Content may be subject to change.



ON SALE 18 AUGUST 2017

LMS Pacific Bogie in 5 inch gauge

Clive Fenn fabricates a distinctive part of the Stanier locomotive.



The bogie completed.

When William Arthur Stanier (later to be Sir William) arrived at the London Midland and Scottish Railway on the 1st of January 1932 to take up his new post as Chief Mechanical Engineer, things on the motive power front were in a bit of a mess to say the least. The Midland Railway held sway with its small engine policy and firm belief in 'no cruelty to small engines'. Trains were getting longer and heavier and double heading was the normal practice. Things had to change and larger motive power was needed. Sir Josiah Stamp, who was at that time the President of the Executive and Chairman of the LMS, began to look outside of the company for a new CME and Stanier was approached and later appointed to the position.

Stanier's first express passenger locomotives were 6200 and 6201 of the Princess Royal class Pacifics. At first these two engines were not a straightforward success and required several modifications to get them right, the main one being to do away with the GWR policy of low superheat and to increase it. Once this had been corrected things improved markedly and the production batch of 6203-6212 began to appear in 1935. Later, in 1937 the first of the streamline Princess Coronation Pacifics appeared and these were an even greater success. What these two classes of locomotives had in common, though, was the bogie, which was based on the De Glehn type and was known on the LMS as a 'French' bogie. In 2008 I set about building a Princess Royal pacific and what follows is a description of making one of these bogies.

Firstly a drawing had to be produced. I was lucky enough, many years ago, to acquire from the National Railway Museum several drawings appertaining to the LMS Princess Coronation pacific. In amongst these was a General Arrangement for the bogie.

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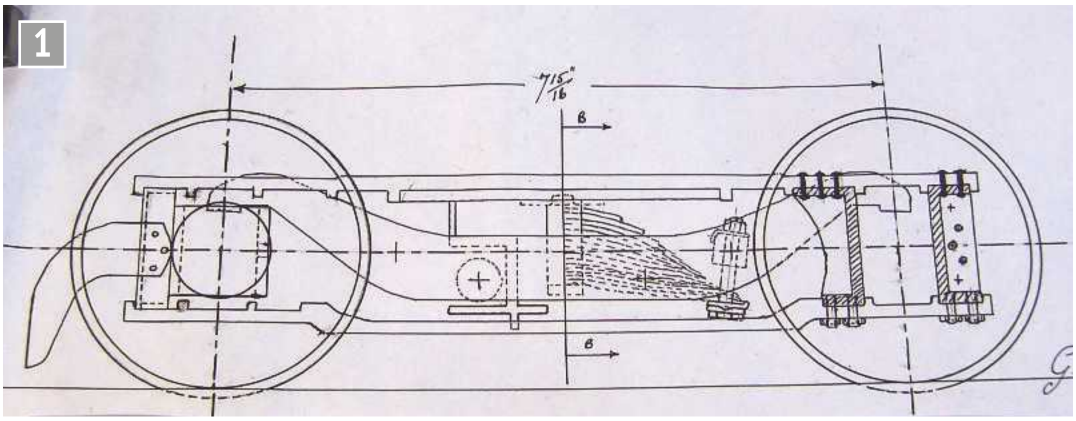


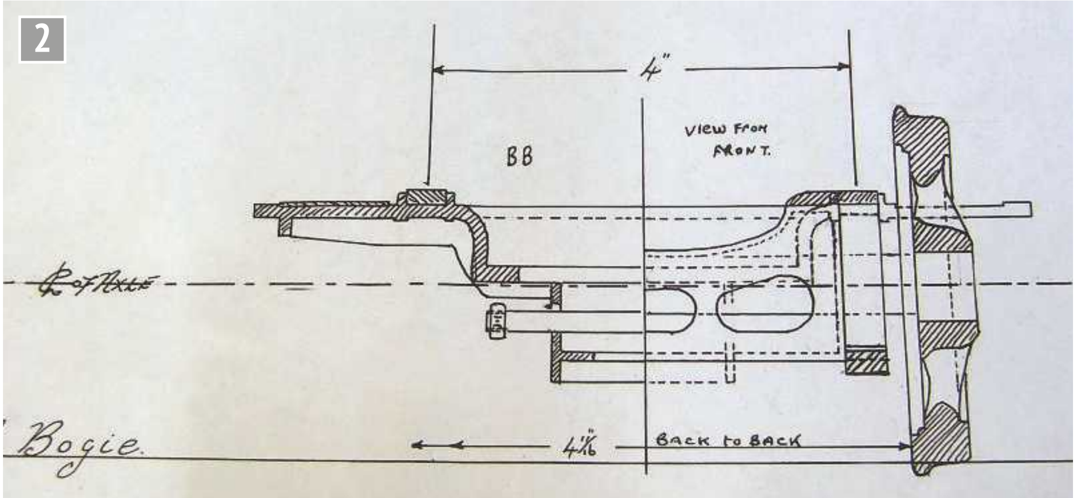
Bogie GA scaled to 1 1/16 inch : foot.

The next step was to scale down the full size drawing to 1 1/16 inch: 1 foot scale - i.e. for 5 inch gauge. This took several days to achieve as I wanted to get as close a copy of the full size as was possible (**photos 1** and **2**).

Bolster

My bogie bolster was to be a mild steel/ silver solder fabrication, unlike the full size which was a steel casting. The first step in the construction stage was to mark and cut out the bogie bolster top plate from ⅛ inch plate. **Photograph 3** shows the plate marked out and the outline chain drilled and **photo 4** shows the plate having the ¾ inch radius being profiled in the milling machine. **Photograph 5** shows the bolster plate with the radius cut and the centre removed ready to build in the lower part which will house the side control mechanism and spigot bearing. Note that I have not removed the front and rear chain drilling; this is to give strength to the plate whilst the downward 1/16 inch plates are silver soldered on. **Photograph 6** shows the top plate now set up for silver-soldering the 1/16 inch plates. Note also the use of magnets to keep the plates *in situ* and at 90 degrees whilst this operation is carried out. Although I refer to front and rear, the bogie does not technically have a front and rear as it is identical at both ends, save for the life guard irons which, of course, were placed leading.

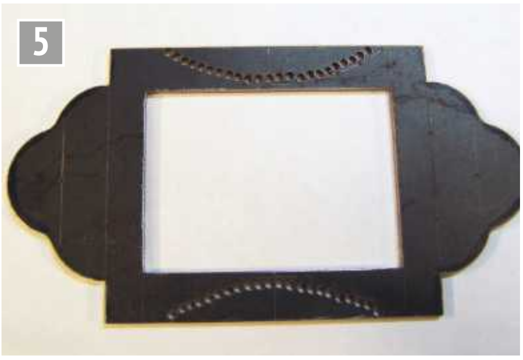
The next task was to form what could be called the 'curved shoulders' leading down from the sides of the bolster top plate. These two pieces were made from ⅛ inch plate and required heating to red hot to form the 3/16 inch inner radius. They were then cut to size and machined in the mill to get the curved section at 90 degrees. With the aid of G-clamps, magnets and set square, these two shoulder plates were then placed in position and silver-soldered (**photos 7** and **8**).



Section detail.


Marked out for chain drilling.


Profiling the ¾ inch radius.


Embryo bolster plate.


Using magnets to hold the 1/16 inch plates for soldering.


Forming the 'shoulder plates'.


The shoulder plates in position.

Now the downward sides were in place it was time to fill in the lower part to form a box which will have the centre removed so that the side control bearing can slide to and fro. **Photograph 9** shows the centre being removed in the mill using a two flute cutter. Note the finished dimensions written in thou's so I do not forget!

Two more plates of ⅛ inch thickness were now brazed on. These will form the sides to the side control bearing housing. Note once more the use of the magnets and a piece of 1¼ inch O/D stainless steel tube to keep things in place whilst silver-soldering (**photo 10**).

The four side control spring housing plates were to be made next from 1/16 inch plate. These will eventually have slots in with a 5/32 inch radius at the root but, for now, to keep things square I have left it with a 5/16 inch hole. A simple jig was made to keep the two pairs of plates at the correct distance and clamped *in situ* whilst silver soldering took place (**photos 11** and **12**). The photos show the jig partially removed after brazing and **photo 13** the job after being cleaned. The base plate was next to be put in place and **photo 14** shows the job held in the vice with a G-clamp ready for silver-soldering.

Having got this far, I decided to check for any deflections across the top of the bolster before I silver-soldered the strengthening gussets to the underside. Lo and behold there was a slight deflection of about 1/32 inch from one side to the other. This needed to be corrected before I went any further. By placing two pieces of 1/16 x ¼ inch flat under the bolster and using two G-clamps I corrected this fault (**photo 15**). I could now silver-solder in the gussets that give strength to the underside of the bolster.

With the gussets in place, I turned my attention to the spring pad recesses underneath and the positioning slots for the two upper bars. These were just pieces of flat plate positioned and silver-soldered in place and will be machined later.

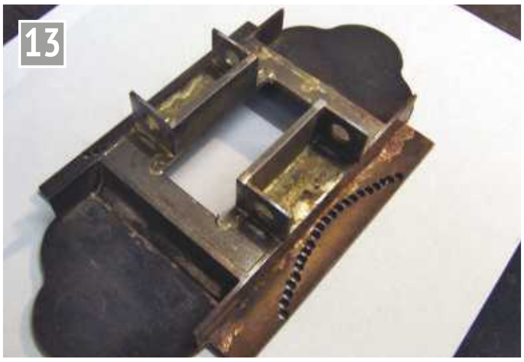
The bolster was now placed in the pickle and then thoroughly cleaned ready for final machining. **Photograph 16** shows the underside having the gussets and spring pad recesses being attended to. **Photograph 17** shows the slot for the bogie pivot being machined using a two flute and **photo 18** shows the

A two flute cutter removes the centre section.

Magnets in use again to assist with the silver-soldering.

A simple jig supports a side control spring housing plate.

Spring housing plates brazed in position.



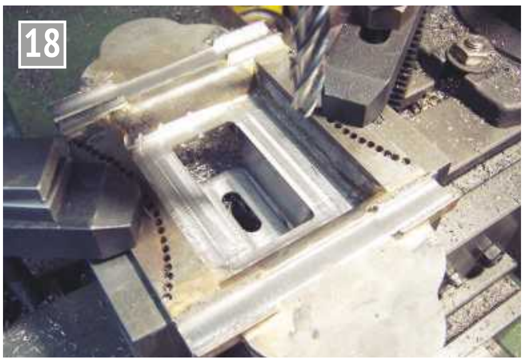
The part after cleaning.

The housing's base plate held in position.

Correcting a slight misalignment with G-clamps.

Forming the spring pad recess - an underside view.

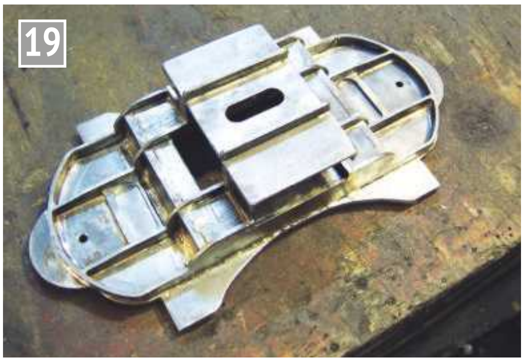
Machining the bogie pivot slot.



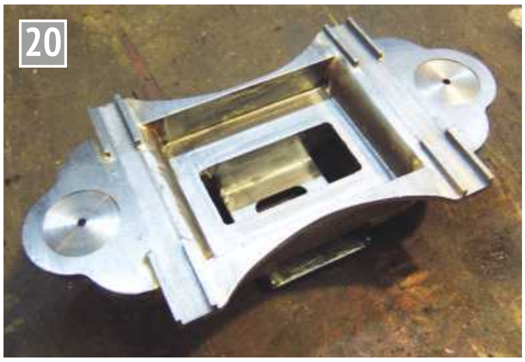
Machining the side control.

>>

side control housing being machined. **Photograph 19** shows the underside view of the bolster whilst **photo 20** is the top view. Note the machined slots for the top bars and the circular recesses for the spittoon pads were made from 1 inch O/D brass bar and are $\frac{1}{32}$ inch thick.



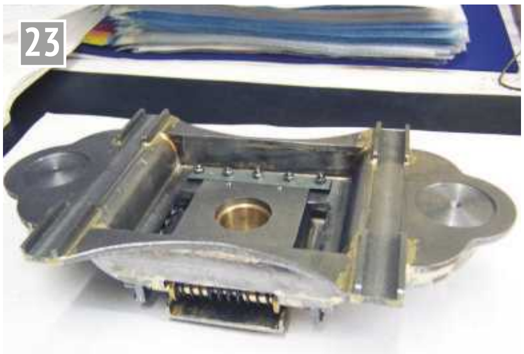
Underside view of the bolster.



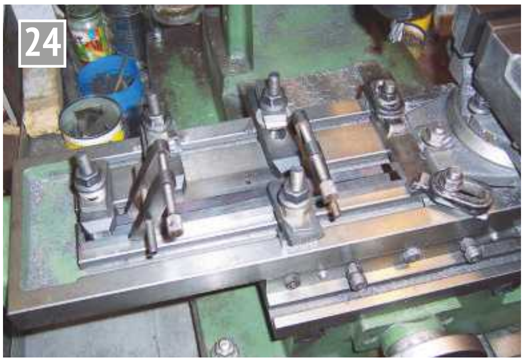
Bolster top view.

Gunmetal pivot bearing within the machined block.

Two spring arms attached.



The complete pivot bearing unit inside the bolster.



The set-up for machining the four longitudinal bars.

Machining one of the various slots.

Components of the horns ready for soldering. Magnets in use again!

Side control

The next task was to make the side control mechanism and pivot bearing. This was machined from a block of cast iron $2\frac{11}{16}$ x $1\frac{11}{16}$ x $\frac{13}{16}$ inch thick. I am not going to bore the reader with the machining process as it was fairly straightforward but time consuming milling. **Photograph 21** shows the finished article complete with gunmetal spigot bearing. The two spring arms are, again, straightforward work but also time consuming (**photo 22**). The photo shows the complete unit and **photo 23** shows it *in situ* inside the bolster.

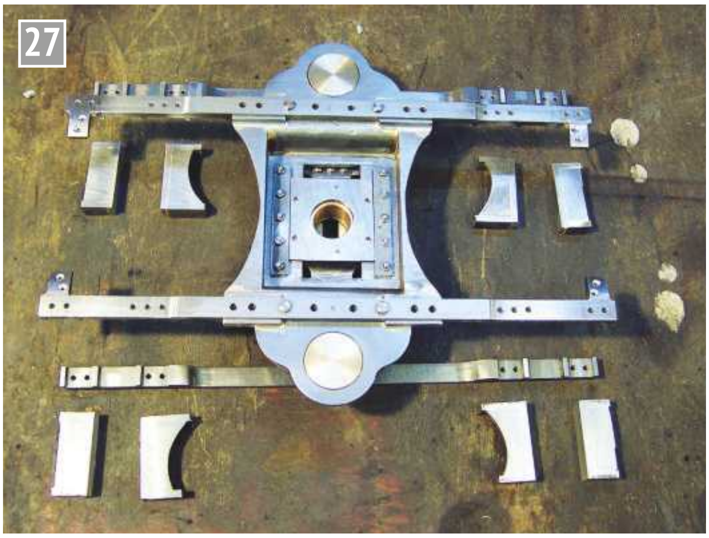
It was now time to make the four longitudinal bars which support the axleboxes and wheels.

Four sections of BMS bar were required, $10\frac{1}{16}$ x $\frac{3}{8}$ x $\frac{3}{8}$ inches. I now always anneal all bar section before machining, the reason being that I have, in the past, found it to distort. All four bars were machined to length. The milling table now had a simple set-up positioned so I could place the bars, two at a time, in the same spot for machining. This consisted of a piece of metal clamped at 90 degrees to the table, then another piece clamped longitudinally, having checked it with the DTI to see it was parallel to the table (**photo 24**). The photo shows the set-up. All four now had the various slots cut out that would later take the two end stretchers and the eight horn blocks, not forgetting the positioning long slot on the top two bars which stride the bolster. I was very pleased, at the end of this job, to find that on placing the two top bars in place, all was nice and square with no slop (**photo 25**). In the photo a bar is being machined - note the 'Jurassic' measuring tape stuck to the table side.

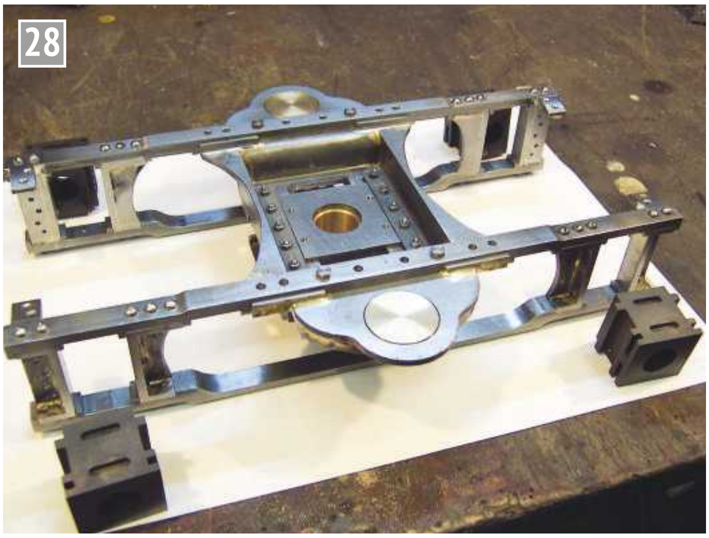
Horn blocks

The eight horn blocks were now made and for these I used $\frac{1}{8}$ inch mild steel plate. I did consider machining them from the solid but when I checked my bar stock, I found that the $\frac{3}{8}$ x $\frac{1}{2}$ inch that I was going to use was 5 thou under on both dimensions, so fabrication had to be the answer.

Each horn consisted of four sections, all cut nice and square with the addition of a $\frac{1}{32}$ inch machining allowance. The square section helps because at the end of the silver-soldering operation very little machining is necessary, just a rub on a piece of emery paper placed on a surface plate to get the business side nice and square. The ends



The bolster and associated components; two bars and eight horns.



Progress so far - a temporary assembly.

Now with the stretchers, wheels and axleboxes in place.

Everything, thankfully, seems well.

and the width would then true up in the milling machine.
The silver-soldering operation was again done with the aid of magnets. You will see from the photographs that these operations are all carried out on steel plate. This helps to keep things in place and nice and square, therefore I think oxy/acetylene is a must in these circumstances, where fine detail fabrication is required. **Photograph 26** shows one of the horns set ready for silver-soldering and **photo 27** shows the bolster complete with bars and the eight horns now ready for final machining.

With the horns machined it was time to fit them to the bars. One at a time, each horn was placed in position on the top bar - with the aid of my surface plate - clamped, drilled and tapped 7BA. I elected to use round head slotted screws for this job, filling in the slots with filler before painting. I think this gives a much neater finish than riveting. I sometimes think model engineers should have been made with three hands; one for holding the job, one for holding the rivet snap and the other for holding the hammer!

With all the horns in place on the top bar, it was time to fit the bottom bar. Again, the surface plate was used to square things up. The bar was clamped, the horns drilled and tapped 7BA. This time studs would be fitted to the bottom of the horn blocks. On the full size, square bar was used for these studs but, as I have no 3⁄32 inch square in stock I used round instead.

Photograph 28 shows the bogie so far with the bars temporarily in place and the horns fitted. Note the axleboxes; I made these several months ago whilst turning all the wheels. Cast iron is wonderful to machine but it does make one hell of a mess. Not only that, but it gets in the eyes and on the chest so I always wear goggles and a mask.

Just getting back to the axleboxes - they are of the split type and will have a felt pad in the bottom. When making split axle boxes I find Loctite high strength comes in useful to hold the lower part in place whilst doing the machining. Then, when all is finished, simply warm it up and the lower part will fall away.

End stretchers, beams and springs

The next job was to make the two end stretchers. These are identical and are fabricated from 1⁄16 mild steel plate, with the exception of the side pieces which were of 3⁄32 inch plate to allow for machining to size. My normal silver soldering process was again used and **photo 29** shows the stretchers in place, together with wheels and axleboxes.
The equalizing beams and leaf springs were next to be made.
The beams - four of them, two each side - were made from 3⁄32 inch mild steel plate and this was quite a time consuming task. I could not think of any easy way of machining these so they were all done using my bandsaw and hand files.

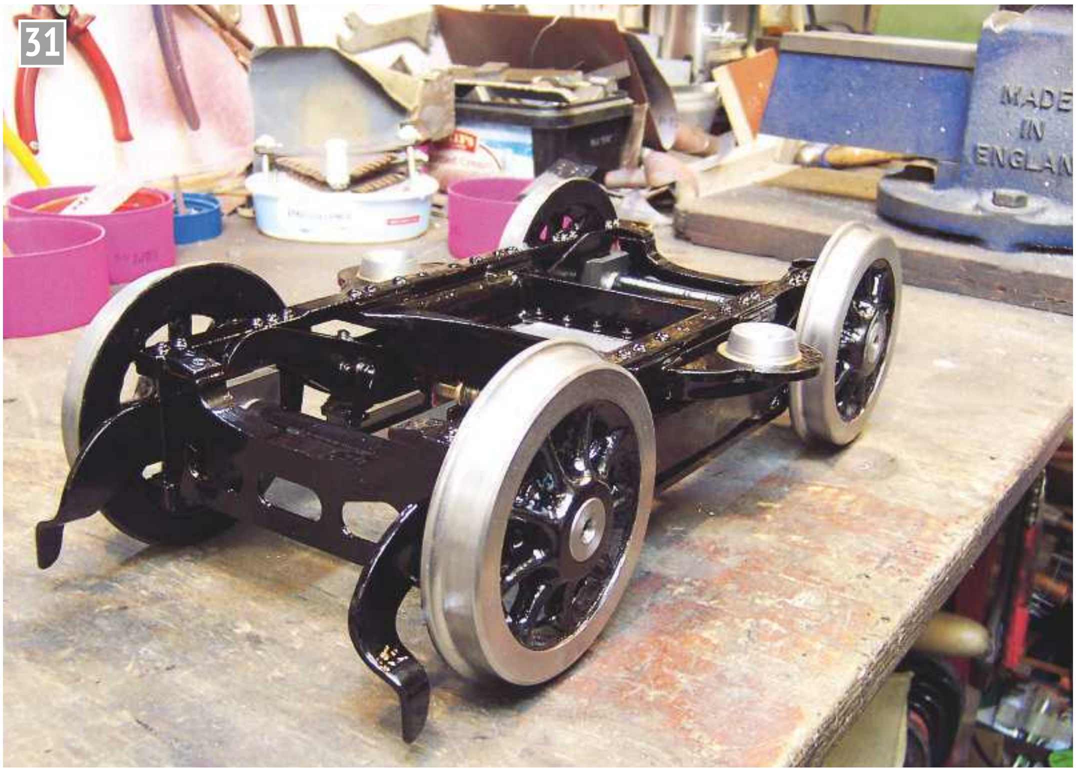
Once the beams were complete, I had a trial fit (**photo 30**) and all seemed well.

Now for the springs. These were made from a combination of annealed spring steel 7⁄16 inch x 20 thou for the major leaves and Tufnell strip 7⁄16 x 1⁄32 inch for the remainder. The steel leaves were hardened by warming them up to red and quenching in cold water then, one at a time, placed in molten lead for about 30 seconds, then quenched in vegetable oil to give them the right amount of tempering. This method was given to me by my good friend Mike Butler and works very well.

The two steel buckles came next and for these I followed Alan Crossfield's very neat method of fabrication (described in *M.E.*, issue 4498, 24 December 2014). The process is to partly machine the buckles, then to silver-solder a piece on the open end to produce a rectangular hole. This leaves the inside of the buckle nice and square to take the leaf springs. Unfortunately, I did not take any photos of this operation but it certainly beats chomping them out of the solid!

The making of the four hanger pins, nuts and washers followed, together with the two spring bearer plates which fit under the bolster.

31



The Bogie looking well in gloss black.

The life guards came next and for these I again used 3⁄32 inch plate. The last task was to make the two cast iron spittoons. These were simple turning procedures but the cup in the spittoon was produced by using a form tool specially made for the job. **Photograph 31** shows the finished bogie, painted and ready to fit to the chassis.

Now on to the trailing pony truck. When finished this will give me a complete chassis ready to take the boiler, which was described in volume 214 No. 4501 and 4503 of the *Model Engineer*.

Special thanks to my wife Vicki for processing this article and her comprehension of modern technology.

ME

PART 35

Garrett 4CD Tractor in 6 inch scale

Chris Gunn machines the castings associated with the belly tank.

Continued from p.855 M.E. 4562, 9 June 2017

This article has been written to guide the builder through the construction of the 6 inch scale Garrett 4CD tractor designed by Chris d'Alquen. The writer has previously built a 4 inch scale Garrett and a 6 inch scale Foden wagon so has the benefit of considerable experience in larger scale modelling. Most machining can be done in the average home workshop but the supplier from whom the castings and drawings are currently available is able to provide a machining service for the largest items if required.

Water filler casting

It was time to put the sheet metal work to one side for a while and machine the rest of the parts that had to be fitted to the tank. I started with the water filler, which came as a casting. I needed to skim the mounting face and drill the holes to mount it and the lid. I popped it in the vice to skim the bolting face, but as soon as I tried to face it, I could see the casting was chilled and I could not mill or drill it.

I have a heater that I built from an old spin drier drum, which I take to rallies to provide some heat when we sit outside. The drum sits on an old mesh fan guard and has a section of 100mm ducting as a chimney. I stoked that up with some logs, got it burning hot, dropped the casting in and left it until the logs had burnt down. I tossed in some more, then some coal, which would keep it going through the night. **Photograph 308** shows the casting the following morning.

I was able to mill the bolting face and drill the holes after this and once drilled, I spotted the holes through onto the front of the tank and drilled the holes to let the water through into the tank.

The steering shaft brackets were next to receive attention and these came as a pair of castings. The first step was to machine the mounting faces and drill the three mounting holes. I was able to hold these in the vice on the Bridgeport, with a jacking screw to stop them tilting (**photo 309**).

Normalised water filler casting.

Steering shaft castings.

Drawings, castings and machining services are available from A. N. Engineering: Email: **a.nutting@hotmail.co.uk**

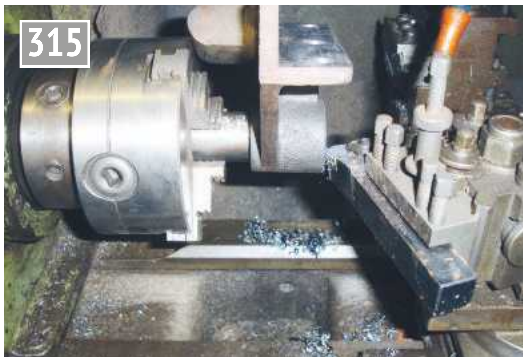

310 Drilling steering bracket.


311 The set-up.


312 Drilling steering brackets.


313 Reaming the steering brackets.


314 Milling the lower steering bracket.


315 Facing off in the Bantam.

In order to drill the holes in line, I used an angle plate that started life as a mounting bracket in a machine that was scrapped. I had previously drilled holes on one face to match the table slots in the Bridgeport. I held the bracket in the vice with the opposite face uppermost (**photo 310**) and drilled two sets of holes which would hold the two brackets in line.

Once the holes were drilled, I mounted the angle plate on the bed of the Bridgeport, bolted the brackets in place and then milled the top face, as shown **photo 311**.

Once I had a flat face, I centre drilled the top casting and then drilled through the pair in one hit, as shown in **photo 312**.

I did not have a machine reamer of the right size - 1 inch - but I did have a hand reamer so I used this, supporting the free end with a centre held in a collet (**photo 313**). This was hard work, but I had no other way to do with the kit I had at the time.

Once the holes were reamed and they were of, course, dead in line, I took the top bracket off and faced the lower one (**photo 314**).

The second bracket was removed from the angle plate and then I made a tapered mandrel in the Bantam and tapped the castings onto the taper in turn, then carefully positioned the lathe tool to miss the flange and faced off the other ends of the bosses (**photo 315**).

Once the brackets were turned, a ¼ inch BSP hole was drilled in each one for the fitting which would accept the lubrication pipe. That finished the two castings; I then made the axle from a length of 1 inch steel and had a trial assembly of the shaft and brackets on the bottom of the belly tank (**photo 316**). Once I was happy, I spotted through the holes in the brackets and tapped the angles for M8 screws.

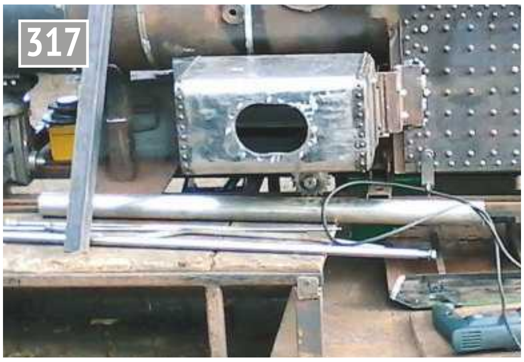
At this stage, I did not drill the hole for the steering wheel shaft through the boss provided as I wanted to check this when I had moved further on with the assembly.

Now I was happy with everything, the angles were welded to the bottom of the tank and the tunnel for the steering wheel shaft was also welded in place and the welds cleaned up. I then removed the steering brackets and replaced the base plate with a few screws, then spotted through the steering bracket holes and opened them out to M8 clear. Next, I replaced the platework, fitting the top curved section and then the base plate, bolting them in position with my temporary screws and adding the steering brackets as well. This made the assembly pretty rigid, so I cut out the three stay tubes on one side, fitted the side wrapper


316 Steering shaft in position on the belly tank.

and then repeated this for the other end so that all the temporary tubes were now out and the cladding and the base angles were holding everything together.

The curved top was removed once again, giving good access to the interior of the tank and it was time to start 'riveting' the tank. I decided to treat this the same as the tender and insert the rivets, hold them in with a clamp and then weld them on the inside. I went along the bottom first, which was reasonably straightforward, and then I did the two side sections. This was a bit fiddly but would have been even worse had I tried to set the rivets. Once all the rivets were done, I cleaned the welds up as best I could and cut the end and base of the tank for the steering shaft tunnel and also cut the holes for the mud hole doors in the sides, using an angle grinder with a thin disc to take the bulk of the material out, finally finishing off with a sanding disc and files as well. Now I had holes in the sides of the tank, I could use these to secure the curved tank top, using temporary bolts and nuts on the inside. I would need to take the top off again when adding the final details, such as the breathers, oilers and oil pipe clamps.



Belly tank refitted.

Right hand bracket

Left hand bracket

Front bracket.

Belly tank brackets

The tank was almost complete now, so I decided to bite the bullet and make the brackets to support the belly tank from the boiler and get them welded in position by a competent welder. In preparation for this, I set the belly tank in position under the boiler, supporting it with ply packing. When it was in the correct position, I made some strips that would space the curved top of the belly tank the correct distance away from the boiler. Thus, I was able to secure the belly tank to the boiler with a couple of ratchet straps. Then I could mark out the positions of the side mounting angles and drill the holes that unite the rear supports. I also made the saddle, which would finish up supporting the tank at the front. I now had the tank set up in the right position, but I had to break down the set-up in order to slide the boiler off my trolley and into the back of my van. I took the boiler to the factory premises of a friend where we were able to slide the boiler out onto the forks of a forklift. After strapping the boiler to the forks, the boiler was withdrawn from the van and I was able to set the belly tank up again, using my spacers and marked bracket positions to get it in the right place. About 5 minutes later all the brackets were welded with a MIG welder, despite the welds being ‘uphill’. Not long after that, the belly tank had been dismounted from the boiler and everything was back in the van. Once I was home again, the boiler was slid from the van, back onto my trolley and I refitted the belly tank (**photo 317**). The photo shows the belly tank in position with the boiler back on my trolley.

Having just re-read this again some months after writing it, I do wonder why I did not turn the boiler upside down to weld the brackets in position, apart from the fact that I had already set it the right way up.

Photographs 318, 319 and **320** show the three brackets that hold the belly tank in position.

The remainder of the steering gear parts which fit to the horn plates will be dealt with in a future episode but in the meantime, I could finish off the belly tank. I made the two hand hole covers and drilled the holes, then spotted through them into the belly tank and tapped M6 holes just to allow the studs to stay in place in the tank. I made some studs from M6 bolts and locked them in place with locknuts on the inside of the tank. The water filler casting was skimmed across the mounting face and the holes marked out in the bolting flange; the filler was then used to spot these holes through onto the end of the tank. A series of holes was then drilled to allow the water to flow through into the tank. I made a hinged lid to fit and I also used a scrap of perforated aluminium, salvaged from an old speaker fascia, to make a filter for the top of the filler. I cut out a D-shape, a bit bigger than the filler, and turned a small flange over so the filter could sit just below the lid.

Lifter hose bracket

There is a bracket on the top of the right hand side of the belly tank that holds the water lifter hose and I had seen some sheet metal fabricated brackets on some engines but these did not look right compared to the cast bracket fitted to the full size engines (**photo 321**).

Water lifter hose bracket.

I decided I could fabricate a bracket and eventually worked out that I could make it from five items; the back could be hacked out of a piece of angle, the three 'spokes' from sections cut from RHS tube and the front from a piece of flat bar. I did a rough sketch working from the only dimension I knew which was the pitch of the two mounting holes, together with a print of photo 321, which I scaled down to try and get the proportions right. Once I felt my sketch was right, I started cutting metal and bending it too. I finished up with the fabrication shown in **photo 322** - taken just prior to the last welding operation - and **photo 323** which shows the fabrication after fettling it up a bit.

Fabricating a water hose carrier.

Hose carrier welded and partially cleaned up.

In order to make it look a bit more like the real thing I needed to make some beading to fit around the edges and, as this was supposed to be a casting, I searched around for some split round edging I had salvaged from a job 40 years ago - we had used it to put a safe edge on sheet metal - but I could not find it so I made some from some off-cuts of copper tube, sanding a flat on it with my disc grinder, being very careful. This was then wrapped around the fabrication and soft soldered in place (**photo 324**). **Photograph 325** shows the beading completed.

Applying the half round beading.

Half round beading fitted.

Once the beading was soldered it was time to fill all the holes in the 'casting' with Isopon (**photo 326**).

Filler applied to hose carrier.

Finished hose bracket.

Once the filler was hard, I spent a couple of happy hours cleaning up the whole thing. Once clean, I stuck on some white metal letters to replicate the casting numbers which can be seen on the original. The white metal letters can be obtained in small quantities from pattern makers' suppliers and I stuck them on with Araldite. I waited for the Araldite to dry and then gave it a coat of primer and, in due course, it was hand painted with Garrett chocolate brown; **photo 327** shows the finished 'casting' in position. This bracket did take a few hours to make, but does not need to be a precision job and is well worth the effort.

Apart from some lubricators, the belly tank and its associated parts were now complete and it was time to seal it. Once again, I took the curved top plate off, and the steering brackets, and took it over to my local sandblaster who did the inside and outside. As soon as it was ready I collected it and sprayed it with primer inside and out. The sandblaster told me that it would start to rust again within a couple of hours once it was really clean and advised me to get a coat of paint on as soon as possible. **Photograph 328** is a shot taken of the inside of the primed belly tank.

●To be continued.

A view inside the completed tank.

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■ Anzani 'Y' 3-cylinder radial engine nearing completion. Discontinued due to ill health. Les Chenery drawings, castings etc. All required components, most materials, also machining fixtures. Phone for details, offers invited.
T. 0121 4768903. Birmingham.

■ 5 inch GW Grange, part finished, frames laser cut, wheel complete, weights, crankpins fitted, cylinders line bored, faces machined, buffers and couplings ready to fit. Other castings. Main boxes complete. Tender boxes with needle rollers. Drawings, materials, £250 O.N.O. **T. 01494 758478. Berkhampstead.**

Magazines, Books and Plans

■ Model Engineer magazines from 1991 to date. All copies filed in date order. Buyer collects. Sensible Cash Offers.
T. 01748 812841. Richmond, N.Yorkshire.

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T. 01579 350343. Tavistock.

■ Part built 5" or 7 ¼" loco including boiler. Too old to start from scratch!
T. 01895 613919. Ruislip.

■ Boiler for a 5" gauge Simplex. Any condition as it is for display purposes only. **T. 01984 631054. Minehead**.

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CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.

I have a Titanium bolt chez Theasby, found in a Skipton surplus dealers, which he claimed came from the Concorde programme. It is very light and the hex head is drilled across the angles of the head for a security wire and coated in Molyslip as Titanium galls easily and squeaks on being tightened down. I often wonder how the holes are drilled, unless they are produced before the hex head is formed. I also have a blade from an RB199 jet engine, covered in melted sand, as replaced in a Tornado from the Gulf War. Maybe I should start a Cabinet of Curiosities? My pet rocks could live in there too...

In this issue, a little Jumbo, jets and turbines, twice stolen? Lifeboats, floppy disc, George Adamski, a long gestation and pretty passengers. First, though, a photo: 7¼ inch gauge *Fire Queen* at West Riding SLS (see *M.E.* 4564) (**photo 1**).

Fire Queen from WRSLS Branch Lines. *(Photo courtesy of Stuart Merton)*

Worthing and District Society of Model Engineers' *Newsletter,* Spring, reports that the new toilet block is under way. In motion, perhaps... Barry Partridge just happened to have an excavator in his garden, as you do, and it was inveigled onto the club site with millimetres to spare. In Part 2 of his Stuart Turner series, Peter Guy deals with the models produced over the last 115 years. Mike Wheelwright is making a 5 inch gauge L&NWR Small Jumbo and describes the Webb originals. The valve gear was changed from the usual Stephenson's to Allan's, which meant the reverser worked in the opposite way. Rather than redesign the reverser thread, the enginemen just had to lump it. As Victor Borge once said, 'That's the way the Management wants it and **that's the way it's gonna be**!' Diana Lewins remembers the midget coaches fom Brighton seafront in Coronation year, 1953. Carrying four children, they were powered by a two-stroke engine, were road-legal and could reach 26 mph.

W. www.worthingmodelengineers.co.uk

The News Sheet, June, from **North London Society of Model Engineers** prints a photo from the '00' group, in which a pair of LMS Garratts, 47995 and 47996, almost squeeze a Wickham trolley whilst 'on shed'. A model of the crane currently working in London at Earls Court was photographed by Paul Godwin. He claims it is the largest land crane in the world, with a 2000 ton capacity. (Search online for 'AL.SK190'.)

W. www.nlsme.co.uk

The Frimley Flier, June, from **Frimley and Ascot Locomotive Club**, appears to show Chairman, Paul Naylor manhandling their new 20 foot container into position, on his own. Nick Moore writes on miniature jet engines. The first in the UK was made in 1983 and flown at Greenham Common in a 1/6th scale BAE Hawk. Paul also describes a weathercock he made from some scrap copper sheet, an old water cistern float and 'bits'. A major cost was £5 for the 'gold leaf' which looks better than paint. It is mounted on his garage.

W. www.flmr.org

The Link, June, from **Model Engineers' Society (NI)** reports that the Railway Preservation Society of Ireland's new £3m Whitehead museum is now open after five years' work. It looks well worth a visit.

W. www.mesni.co.uk

Another *The Link,* this time the June issue from **Ottawa Valley Live Steamers and Model Engineers**, revealing the horrendous landslip suffered under the GL track, destroying 400 feet of 1% incline, which was so useful for giving locomotives a good workout (**photo 2**). The cause was abnormally heavy rainfall on top of snow meltwater. A local dam overflow recorded five times the average Spring peak; a record. Restoration of the track may have to wait a while, if it is possible at all. For other reasons, on 9 June 9, the English Channel was recorded as having increased in volume, due to all those EU officials laughing fit to bust at our election results... Editor, Graham Copley and Louise visited the UK, including Hampton Court, family in Chesterfield, Saltaire, Peak Rail and NYMR and Whitby. Graham was most complimentary regarding our meeting in Chesterfield, initially by George Stephenson's statue outside the railway station, then to lunch. Coincident with meeting Graham and Louise, a

OVLSME's 'Hole'. (Photo courtesy of John Bryant)

Network Rail track measuring train pulled into Platform 3, powered by Europhoenix Class 37s *Andromeda* and *Pegasus* (**photo 3**).

W. www.trainweb.org/ovlsme

East Somerset Society of Model and Experimental Engineers Open Weekend will be held on October 7/8th at the Showground, Shepton Mallet, from 10am each day. Overnight camping or caravan spaces by prior arrangement, Live Steamers bring your boiler certificate. 5 inch and 7¼ inch gauge tracks, plus running area for traction engines. Contact Michael Malleson, 01747 860719.

W. www.essmee.org.uk

Gauge 1 Model Railway Association, North West Group, May newsletter, says that the BIG BIG show at The Fosse was shaping up well, with four G1, a Gauge 3 and a 16mm layouts and a Bassett-Lowke display. MOSI (Museum of Science and Industry, Manchester) have made contact, with a view to accommodating a track but parking and access might be a problem. Maurice Rushby has devised a test rig for coal evaluation (a pierced tin can and blower) called a Fossilised Fuel Primary Combustion Unit. Terry Passmore is building a GWR railcar, using bendy ply or Flexiply to achieve the complex curves. Often used in shopfitting, this sounds interesting material. (I'm just trying out Plastikard, wonderful stuff! - Geoff)

W. www.G1MRA.com

Norwich and District Society of Model Engineers' *eBulletin* opens with this picture of a locomotive, using a container for the local product. Hot dog! It formed part of a talk on powder coating and is made of steel, brass, copper, plastic and glass **(photo 4).**

W. www.ndsme.org

Welling and District Model Engineering Society, *Magazine,* June/July, begins with a photo of a radial-engined Peugeot motor bike. Built in the 1920s for board racing, it still works. Editor, Tony Riley found details of how the Gauge 1 MRA began. A Captain Worrall proposed it in 1946 with a letter to Model Railway Constructor. A book by an academic from Sheffield University, published in 1961 claims that the steam engine was invented by a Russian in 1766. Although Russia makes many such claims, this appears to be correct. I.I. Polzunov, does appear to have invented a unique two-cylinder atmospheric engine. Andy Houston discusses batteries, whilst Tony continues his story of *The General.* Found languishing in sidings in 1892, the locomotive was refurbished and exhibited several times in later years. In 1939, it was requested for the film, *Gone with the Wind* but the transport costs to LA were prohibitive so wooden mockups were used. In 1960, further restoration was planned but due to rival plans, it was removed in great secrecy, leading to claims of being 'stolen' for a second time! The Great Chase was re-enacted in 1962 and the train crew were paid in Confederate money. A further contribution from Tony covers the new footbridge at Dawlish, which is entirely plastic, or fibreglass, even unto the structure.

W. www.wdmes.co.uk

Bradford Model Engineering Society's *Monthly Bulletin*, June begins with an article by Martin Chappellow on the RNLI. In the 19th Century many old tea clippers were converted to transport wool from the Antipodes, the tea trade having been superceded by steamships. One such old clipper was the *Royal Charter*, lost off Anglesey in 1859. As most of the wool was intended for Bradford, Titus Salt launched an appeal to buy a lifeboat. The sum required was raised in 1 hour! (Today's equivalent, £2m.) To date there have been 11 Bradford lifeboats, the current one is stationed at Spurn Point on the Humber. The largest lifeboat, the Severn class, has a crew of six and room for 185 survivors. Previously launched by slipway, it now uses a tractor, which makes recovery and turnaround times much faster. Closely inspecting one in Wales, the tractor appears to be made of stainless steel and has a snorkel for use underwater. (I recall once seeing the slipway launch of the Flamborough lifeboat at North Landing - very spectacular!) The Society visit to Bolton Steam Museum on 30 April, was cleverly timed to avoid the Tour de Yorkshire. (Well done, chaps! Have you joined the 'I hate sport' website? - Geoff)

W. www.bradfordmes.co.uk

The Whistle, June, from **British Columbia Society of Model Engineers,** describes Jim MacKie's 7½ inch gauge Holmside, to the Martin Evans design, finished in 2008. Bill Mellors visited the Adobe and Western Railroad, as a passenger this time! This is another system operating to a timetable, dropping off and collecting loads at waypoints around the track, a round trip of which takes two hours. Take food and coffee...

W. www.bcsme.org

On Track, June, from **Richmond Hill Live Steamers,** has a cure for ecstasy and high spirits, (www.smartrailworld.com/abandoned-steam-locomotives-in-train-graveyards) should readers

3

Europhoenix Class 37s and NR Track Recording Train at Chesterfield.

4

Norwich DSME powder coated locomotive. (Photo courtesy of Mike Fordham.)

>>

Lion's 'gab' valve gear on the OLCO stand at Doncaster.

feel excessively full of the joys of Spring...

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

The Journal, June, from the **Society of Model and Experimental Engineers** contains much official business, with which I shall not detain you, having delighted members once already. However, revised Articles of Association need the originals for reference but these were only thought to exist on paper. OCR was being investigated, until it appeared that an electronic copy does exist, on a floppy disk... Now, can this still be read? David Coney discusses drilling and tapping blind holes, whilst Mitch Barnes made a 'UFO' (a photographic prop). If the shape looks familiar, the name of George Adamski may also ring a bell. Mike Tilby covers energy losses in model turbines. As fewer hobbyists have practical experience of turbines, there is less accumulated knowledge than of reciprocating engines. He refers to shock waves in the steam nozzle - exacerbated if the gas flow is supersonic, as this has the effect of reducing the energy of the steam. In addition, surface roughness of the nozzle interior has a greater effect, since the irregularities are proportionally greater relative to its diameter, than in full-size nozzles, which are easier to machine to a good internal finish. Stuart Walker found details of a file guide in a 1945 copy of *M.E.*, No 2314 and made one. Peter Haycock describes the Merryweather Hatfield pump model at SMEE, together with a brief history of Merryweather and its fire pumps.

W. www.sm-ee.co.uk

Modelling Ways, June, from **Fareham and District Society of Model Engineers**, has a contender for the longest gestation of a model, in that Mike Burridge's father bought a Stuart No 10V set of castings presumably intended for the young Mike. Unfortunately, real life conspired against him and the bits were put away. Mike is certain that his discovery of Sex, Drugs and Rock and Roll had little to do with it... (that would have caused little Ian Dury - Geoff). Mike grew up in a household, and at a time, when practical skills were considered normal so it didn't take long for the old interests to be rekindled, after a chance visit to the Society's Open Day in 2011. A wooden oscillating engine, followed by a hot air engine, a Polly V and a diesel outline electric shunter were made. Now for the 10V! In April this year, it was finished and ran smoothly on 4 psi air, over 60 years since it was first bought! An extract from Christopher Booker's column in the *Sunday Telegraph* on the subject of 'green energy' was as prejudiced and unreasonable as usual. (This subject is one with which I am familiar and no doubt Mr. B would have been chagrined to learn that energy from renewable and non-polluting sources generated more than half of the UK's midday electricity demand on 7 June - Geoff.) Clem's tramway column returns with details of systems in Edinburgh, Blackpool, Sheffield and Birmingham being extended, with the Sheffield Tram-Trains currently (!) being tested in the city centre. The Isle of Man's horse tramway service was suspended for 10 days in May, due to pony disease. (Feeling a little hoarse, spotty hooves, twisted ears, or The Clop?) The Newcomen Society's *Links* publication awards Book of the Year to *Rails in the Road*, by Oliver Green, which the reviewer claims is an excellent one-volume work on the history of tramways. I have ordered it.

The 'gab' valve gear on Lion is shown in **photo 5 - s**ee *M.E.* 4565.

York Model Engineers' *Newsletter,* May, reports on 'Loco le Mans', a 24 hour non-stop fundraising effort for Martin House Childrens' Hospice, which raised about £3,500! Well done indeed to Richard Gibbon and his team, driving Richard's Wren! (**photo 6**).

W. www.yorksme.org.uk

Ryedale Society of Model Engineers noted that as the Labour Party announced its plans to renationalise the railways, a large GWR locomotive failed out on the track, to be rescued by a Class 37, whilst some signals came out in sympathy. A wedding party was entertained, white ribbons decorating the engine, a Just Married headboard and tin cans clattering behind the brake van. John Cook drove a trainful of bridesmaids, plus Bride - lucky him. The bride and groom were so pleased with their day that they paid RSME a bonus. On another day, signalman Chris Heslop remembered his arm signals when he was unsure of a driver's intentions.

W. www.rsme.org.uk

And finally, from Richmond Hill Live Steamers; '*A private railroad car is not an acquired taste. One takes to it immediately.'* Eleanor Robson Belmont (1879-1979).

Contact:
gefftheasby@gmail.com

Richard Gibbon's York secret! (Photo courtesy of Paul Howard.)

DIARY

AUGUST

1 South Cheshire MES. Stwart Hart: Potty Pot Pouri. Contact Stuart Daw: 01782 767587.

1-3 Vale of Rheidol Railway. Driver for a Fiver. Footplate experience days. Contact: 01970 625819.

2 Bedford MES. Public running. Contact 07498 869902.

2 Bradford MES. Evening steam up and Social from 7.30pm. Contact: Russ Coppin, 07815 048999.

2 Bristol SMEE. Mike Ackerman: Early Years in the Nuclear Industry. Contact Dave Gray: 01275 857746.

2 Chesterfield & District MES. Club running day. Contact Ian Blackbourn: 01909 562458.

2 Grimsby & Cleethorpes MES. Summer Holiday running, noon - 4pm. Waltham Windmill site. Contact Dave Smith: 01507 605901.

2 Vale of Rheidol Railway. Summer evening train. Contact: 01970 625819.

3 Sutton MEC. Bits & Pieces night. Contact Jo Milan: 01737 352686.

6 Ellenroad Engine House, Elizabethan Way, Milnrow, Rochdale. Engines in Steam, 11am - 4pm. Enquiries: 01706 881952.

6 Grimsby & Cleethorpes MES. Public running, noon - 4pm. Waltham Windmill site. Contact Dave Smith: 01507 605901.

4 Chesterfield & District MES. Summer Holidays Public Running, 12 noon - 3pm. Contact Ian Blackbourn: 01909 562458.

4 North London SME. BBQ at Colney Heath. Contact: Ian Johnston on 0208 449 0693.

4 Rochdale SMEE. Tony Finn: The History of the Lathe. Castleton Community Centre, 7pm. Contact Len Uff: 0161 928 5012.

4 Stockport DSME. Bits & pieces. Contact Dave Waggett: 0161 430 8963.

5 Tiverton & District MES. Running Day at Rackenford track. Contact Bob Evenett: 01884 252691.

5 Vale of Rheidol Railway. Summer evening train. Contact: 01970 625819.

6 Basingstoke DMES. Public running at the Viables Craft Centre. 11am - 4pm. Contact: Austin Lewis: 01256 764765.

6 Frimley & Ascot LC. Public running, 11am - 5pm. Contact John Evans: 01276 34970.

6 NW Leicestershire SME. Members and visitors steam up. Contact Den Swain: 01530 412048.

6 Plymouth MSLS. Public running at Goodwin Park. Contact Malcolm Preen: 01752 778083.

7 Lancaster & Morecambe MES. Informal meeting. (Public running every Sunday.) Contact Mike Glegg: 01995 606767.

7-10 Vale of Rheidol Railway. Driver for a Fiver. Footplate experience days. Contact: 01970 625819.

8 Peterborough SME. Bits & Pieces. Contact Terry Midgley: 01733 348385.

8 Wolverhampton DMES. Public running at Baggeridge Min. Rly. 1 - 5pm. Contact Ian Priest: 01384 287571.

9 Bedford MES. Public running. Contact 07498 869902.

9 Frimley & Ascot LC. Public Running – free rides for children with Teddy Bears! 11am - 4pm. Contact John Evans: 01276 34970.

9 Grimsby & Cleethorpes MES. Summer Holiday running, noon - 4pm. Waltham Windmill site. Contact Dave Smith: 01507 605901.

9 Vale of Rheidol Railway. Summer evening train. Contact: 01970 625819.

11 Chesterfield & District MES. Summer Holidays Public Running, 12 noon - 3pm. Contact Ian Blackbourn: 01909 562458.

12 Cardiff MES. Steam up and open day (no public running). Contact Rob Matthews: 02920 255000.

12/13 Leeds SMEE. August Rally. Contact Geoff Shackleton: 01977 798138.

12 Vale of Rheidol Railway. Summer evening train. Contact: 01970 625819.

12 Westland & Yeovil DMES. Track running day, 11am - 4.30pm. Contact Bob Perkins: 07984 931 993.

13 Grimsby & Cleethorpes MES. Public running, noon - 4pm. Waltham Windmill site. Contact Dave Smith: 01507 605901.

13 Sutton MEC. Afternoon running from noon. Contact Jo Milan: 01737 352686.

13 Welling DMES. Public Running 2 - 5pm. (Behind Falconwood Elec Sub stn.) Contact Martin Thompson: 01689 851413.

13 Wolverhampton DMES. Public running at Baggeridge Min. Rly. 1 - 5pm. Contact Ian Priest: 01384 287571.

14-17 Vale of Rheidol Railway. Driver for a Fiver. Footplate experience days. Contact: 01970 625819.

15 Chesterfield & District MES. Mick Melbourne: Train chasing and riding in the USA. Contact Ian Blackbourn: 01909 562458.

15 Grimsby & Cleethorpes MES. Monthly meeting, 7.30 at Hartley Lodge. Contact Dave Smith: 01507 605901.

15 Nottingham SMEE. Brian Parker: Powder coating - talk and demo. Contact Pete Towle: 0115 987 9865.

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