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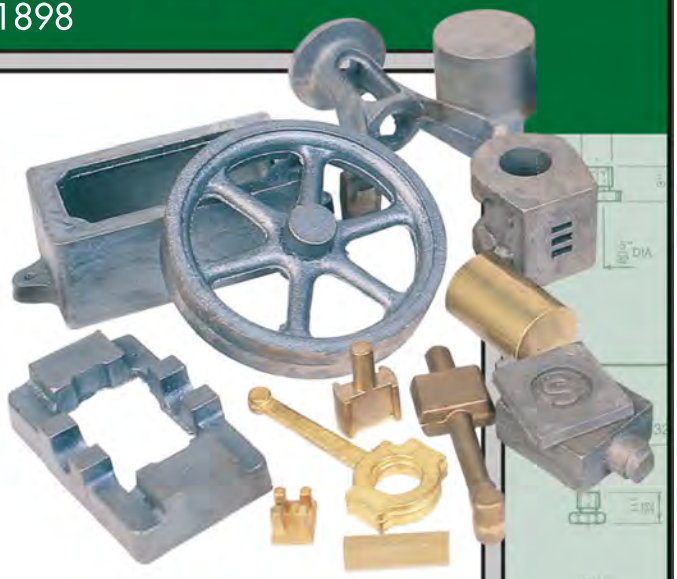

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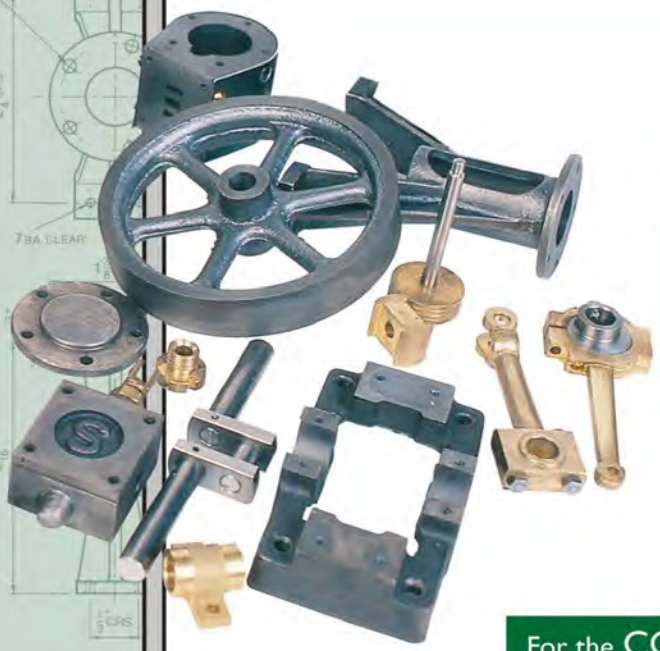

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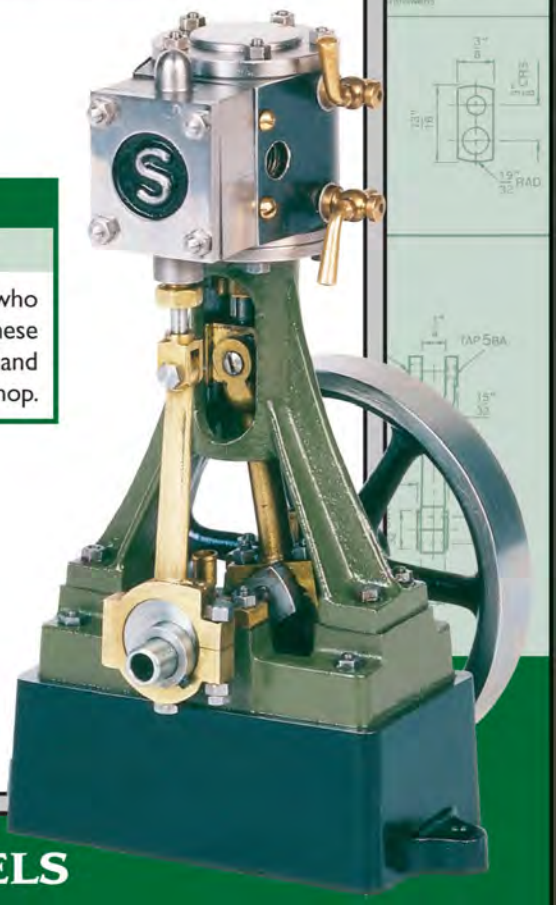

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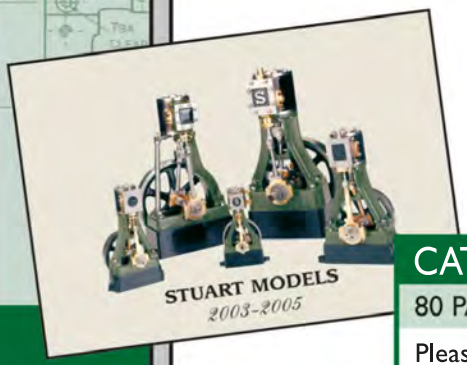

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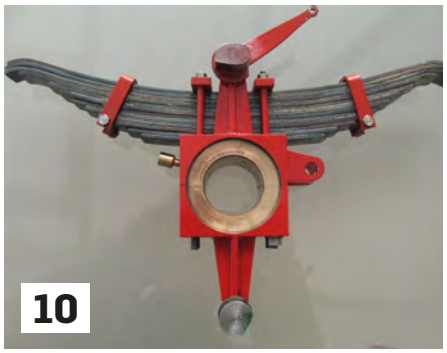

FRONT COVER

Our front cover shows John Matthews driving his 7¼" gauge 0-6-0 *Romulus*, which was brought all the way from Cornwall to help celebrate the opening of the Newport MES turntable.
Photograph: John Arrowsmith

EDITORIAL

WARCO

Warco have launched a new website which includes an ever expanding range of machinery and associated tooling. Of special interest are the 21st century versions of their iconic VMC and Super Major milling machines, which are now offered with inverter drive through an AC induction motor. The speed range is infinite. Warco will continue to offer the original VMC and Super Major.

The Warco website has always been informative and user friendly and the new site is even better. Warco appreciate the importance of an easy to negotiate website so no expense has been spared to make the buying experience stress free. For those who prefer direct telephone communication customers will find the Warco sales team to be knowledgeable, friendly and informative.

A paper alternative to the website is offered in the form of a newly-produced 128 page brochure, packed with machinery and a huge range of associated tooling. On the opposite page to each machine suggested accessories are displayed to help with the decision making process. This brochure is free of charge on request.

Warco will continue to organise three Open Days throughout the year and attend both the London and Midlands Model Engineering exhibitions. The showroom is open from Monday to Friday for visitors and an appointment is not necessary.

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CARFEST

If you fancy a grand day out why not head over to Chris Evans's *CarFest North*, being held at Bolesworth Castle in Cheshire on July 28th to July 30th? More details on page 26. For those of us in the south there will be a *CarFest South* in August.

ERRATUM

The caption on the picture of the points in the Club Newsround last month was incorrect, wrongly crediting the Kings Lynn society with their construction. The caption should have read: 'Reconnecting the point work from Erimus yard at the Gilling track of the Ryedale Society'. My apologies are due both to the Kings Lynn Society and to the Ryedale Society for any confusion caused.

Martin Evans
Editor

The August issue will be on sale on July 20th

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The Doncaster Model Engineering and Modelling Exhibition

John presents an account of his visit to the show at Doncaster Racecourse

BY **JOHN ARROWSMITH**

The 24th National Model engineering and Modelling Exhibition held at Doncaster Racecourse again attracted large crowds on the opening day. Inside, visitors were treated to an excellent display of model engineering in all its different guises together with a fine selection of model boats, aircraft and road vehicles. Outside there was a fine display of traction engines and steam lorries all in steam and creating that lovely atmosphere of steam, hot oil and smoke that all model engineers enjoy being around.

To me the only disappointment was the lack of entries in the competition classes. I suppose it is a sign of the times with scratch built models not being as popular as they were in the past. However, the quantity lacking in these classes was more than made up by the quality of models generally in the exhibition, some of which were superb. Add to this a wide range of popular traders and you had all the ingredients for a great show.

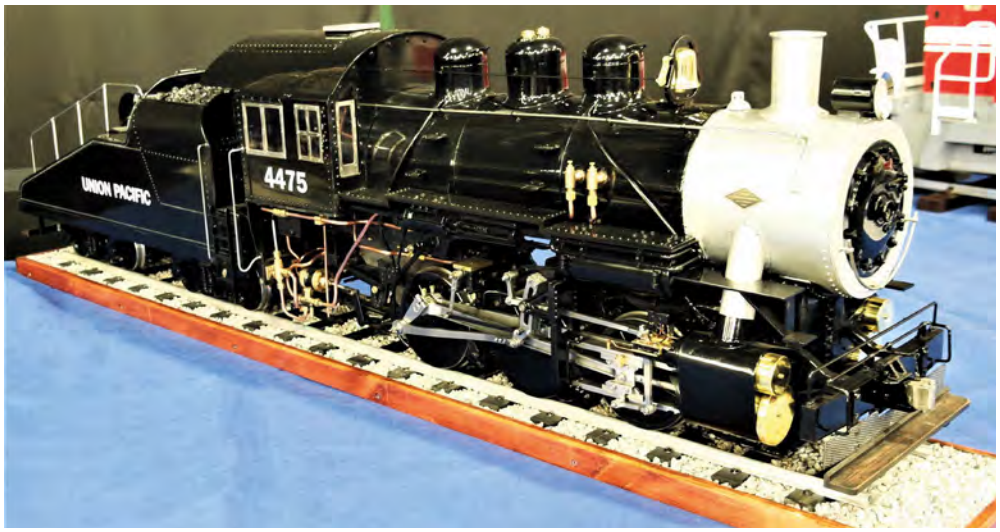
Starting with the competition entries there was just four locomotives entered in the three classes. In Class 39 there were two entries, both in 5" gauge. First Prize and the Myford Trophy were awarded to Keith Taylor-Nobbs for his fine example of a GWR Manor 4-6-0 locomotive. Finished in BR Green it had some excellent detailing and rivet work and captured the profile of these popular locomotives exactly. Second Prize was awarded to a completely different prototype in the shape of an 0-6-0 Union Pacific switcher. Built and entered by R Holland it was an imposing model that again was well built with lots of attention to the fine details that always featured on these engines.

ABOVE
This fine GWR Manor locomotive won the Myford trophy and First Prize for Keith Taylor-Nobbs.

BELOW
This highly detailed Union Pacific switcher won a Second Prize for R Holland.

In the class for diesel outline locomotives a well made example of a Hunslet DH6OC Shunter in 7¼" gauge gained a Second Prize for A West. Finished in a striking red livery it really caught the eye. The fourth locomotive entered was in the Junior section. Alex Loadman presented a Class 08 Shunter in 5" gauge and gained a Highly Commended certificate.

In the class for Road Vehicles there was a superb example in 2" scale of a Fowler Showman's Road Locomotive built by L Davies. It was full of excellent detail and finished in the typical red livery. This was a worthy winner which also collected the Barry Jordan trophy for Best in Show and the Precision Paints trophy for the Best Finished Model. Second Prize in this class went to a regular contributor at this show, John Eva, for his selection of Road Vehicles in 1/12 scale. As usual John had lots of interesting details on his models which always invite plenty of comment. A Highly Commended certificate was awarded to Mrs J Stephen for her example of a Open Top Preston Tram.



The Stationary Engines Class had a small but high quality selection of models for the judges to ponder over. First Prize and the Warco trophy went to Tom Pasco for his 42cc twin cylinder opposed piston two stroke engine. Beautifully presented and constructed it just oozed quality. It must have been a close competition in this class as the Second Prize awarded to Brain Muggleton was another high quality model with lots of good pipework and details. An additional Second Prize was awarded to P McQueen for his version of a wall mounted steam engine. A Highly Commended certificate was gained by J Brittain.

A colourful display with a great deal of interest was presented by the Guild of Model Wheelwrights Association. Three models were entered into competition Class 44 with the American sheep herder's wagon in 1/8th scale taking First Prize and the Guild of Model Wheelwrights trophy for Brian Simpson. Two Third Prizes were awarded to Brian Young for his 1/12 scale Gunson's gun carriage and his 1/12 scale American horse drawn dump wagon.

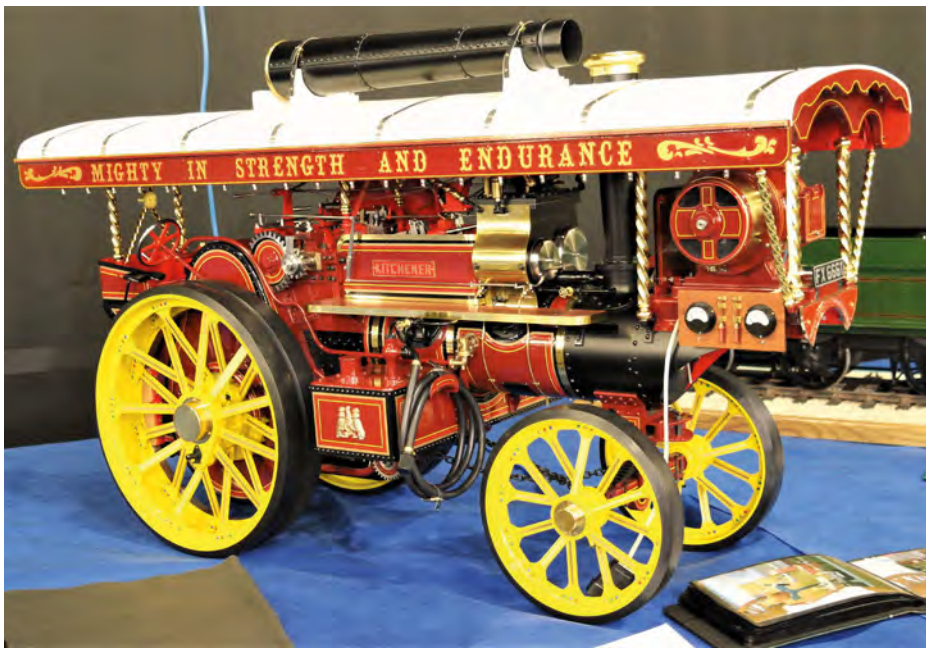
The award and winners of the NAME Shield for the Best Club Stand went to the Hull & District SMEE. A wide variety of well presented and finished models showing off the excellent workmanship of members achieved the high standard needed to achieve this award.

Outside on the hard paved area there was an excellent selection of traction engines, rollers and steam lorries in steam with drivers showing off their driving skills for the enjoyment of the spectators. There was a great deal of good natured banter and conversations which also added to the display. The winner of the of the Raymond McMahon trophy for the Best Road Locomotive in Steam went to Graham Sadler for his 3" scale Atkinson Uniflow steam tractor. Included in the outside activities were regular demonstrations of model R/C helicopter flying which attracted some good crowds.

« TO BE CONTINUED »

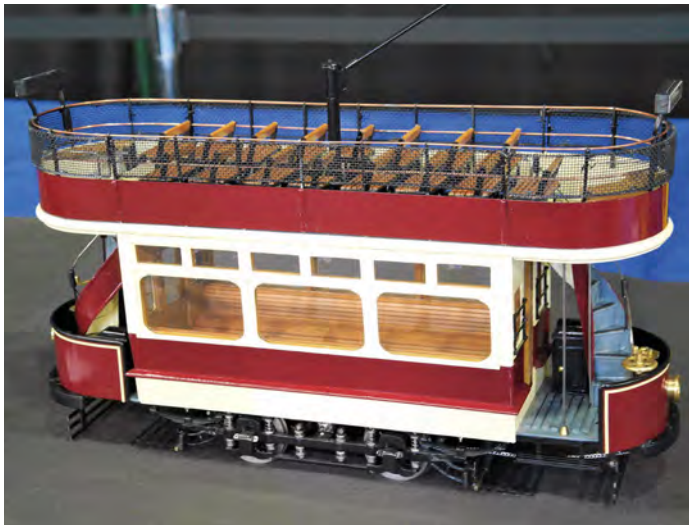
ABOVE
This 7¼" gauge example of a Hunslet DH60C shunter won Second Prize for A West in Class 39.

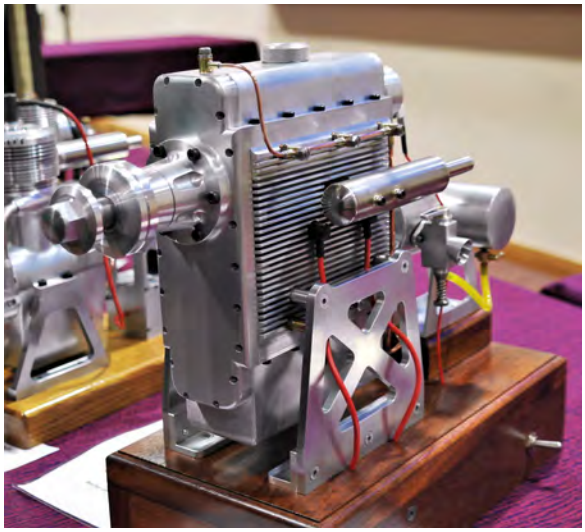
BELOW
Best in Show and First Prize were awarded for this 2" scale Fowler Showman's Road Locomotive built by L Davies.



BELOW – Part of John Eva's selection of lorries and road vehicles which won Second Prize in Class 40.

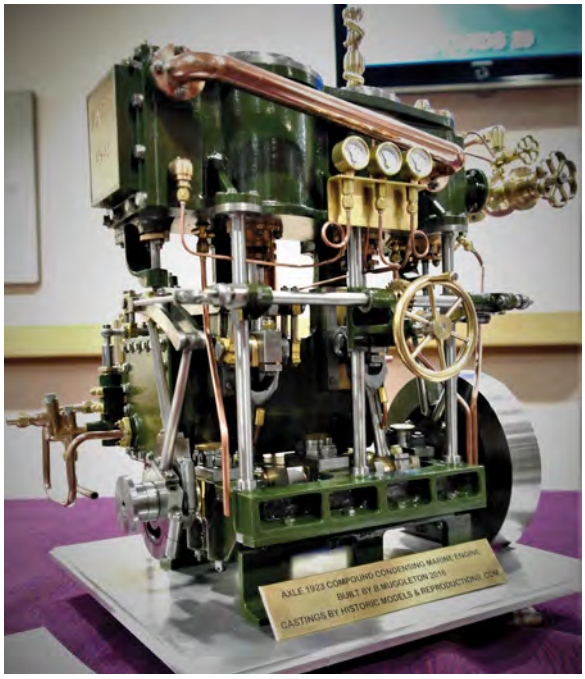
BELOW – A Highly Commended certificate was presented to Mrs J Stephen for her example of a Preston open top tram.



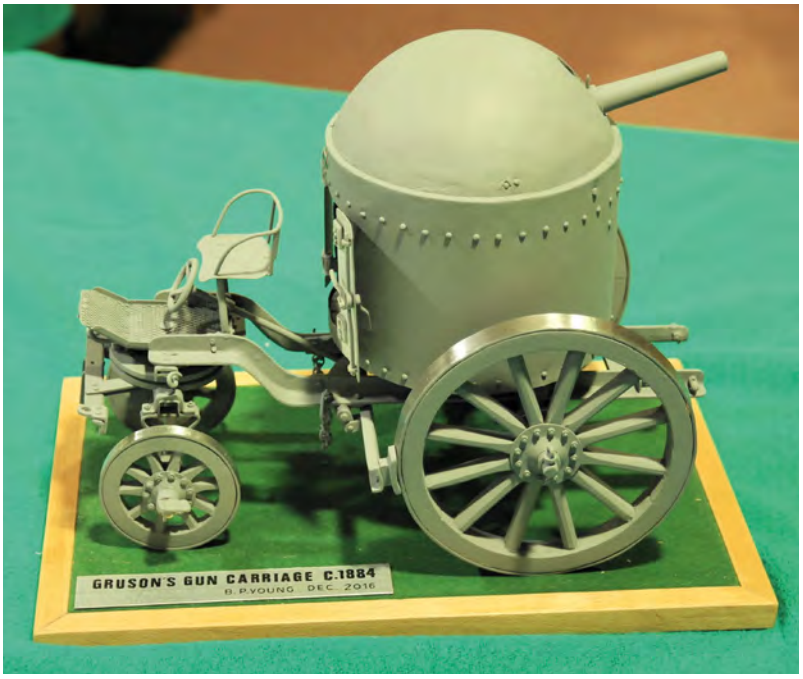


ABOVE – Tom Pasco's First Prize winning 42cc twin cylinder opposed two stroke engine.

ABOVE – This 1/8 scale American sheepherder's wagon won First Prize in Class 44 for Brian Simpson.



ABOVE – Brian Muggleton won Second Prize in Class 42 for this ¼ scale compound condensing steam engine.



ABOVE – A 1/12 scale version of Gruson's gun carriage by Brian Young was awarded a Third Prize in Class 44.

BELOW – This wall mounted steam engine won a Second Prize for P McQueen.

BELOW – Graham Sadler won the Ray McMahon trophy for his 3" scale Atkinson Uniflow steam tractor.

The Atkinson Steam Wagon

Graham describes the rear hubs and an effective brake design for his Atkinson wagon

BY **GRAHAM SADLER** – CONTINUED FROM PAGE 21 JUNE 2017

REAR HUBS

In my early research into the Atkinson, I came across a cross section of the back axle showing the braking system found within the rear wheels. From talking to owners, it was clear the band brake as designed and fitted to Prime's version was ineffective except for use as a parking brake. In addition, I heard comments about the quantity of muck which found its way into the rear hubs, and that the best way to stop this was to fit grease nipples and force the muck out after a run. I did however think a simple modification to the bearings might improve matters.

In order to fit the brakes, vertical extensions are needed to carry the brake shoe mounting pins and this needed wider axle boxes. It also occurred to me that, if there was only a small clearance on the large flanges on the rear axle, it would be possible to form a simple semi labyrinth type seal and thus the muck would not sit on the axle flange and it would be more difficult for it to get into the hubs. The brakes are extremely useful when unloading and when close to excited children, not to mention the parents…

I obtained sawn bronze blocks for the hubs and brazed a number of pieces onto them to form the mounting points. I am not giving full instructions for this component group, just the general method of construction. The CAD package from the millennium period used for the design has now been lost, and I have only a few exported .dxf files to use. Note the CAD assembly image (figure 1) does not show the retaining collars or the actuating arm. In addition, it was an early design test and the end of the brake shoe is clearly too long and intersects with the cam. The drawings have been altered to resolve this. The photographs will show the methods used. However, the designs are relatively simple compared with the engine and, if you have got this far, they will be easy to sort out.

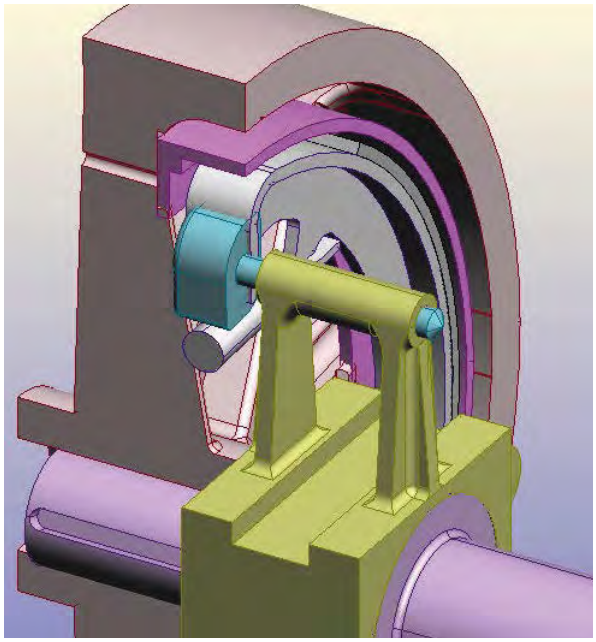
The first stage is to square up the blocks and bolt them together with 2BA studs and nuts. Then it's into the 4 jaw and, after centering, boring the bearing and forming the flange recess to match the axle, with a small clearance fit on the flange and a normal running fit on the diameter of your measured axle. Turn a stub mandrel to a close fit in the bore, but just a trace oversize and, after slackening the studs, fix it in place onto the stub mandrel and finish the other side true and complete the recess (photograph 1).

Now prepare the top and bottom pin bearings in bronze. I turned simulated casting flanges on mine and left a shoulder for the side cheeks. Do not add the holes at this stage. The cheeks are made from 3mm brass strip and are first bored to match the ends of the bearing pins. A central 3mm groove is milled on one side to provide location for the flange piece. The pieces can then be cut into the tapered shape, leaving the top hole as a crescent shaped cut out. They are left overlong at first so that after brazing the web in place with high melting point silver solder they can be machined to the correct height knowing that all dimensions are the same.

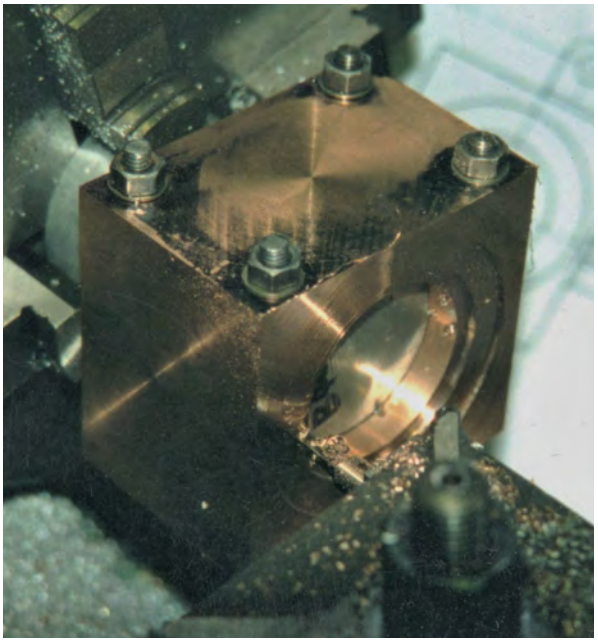
Prepare the small pieces of brass which will form the anchor points for the chain tensioning radial arms. These are at ⅝" spacing and are clamped in place for brazing with a ⅜" diameter stub of steel drilled 4BA clear for a bolt tapped into the front end of the top piece of the bearing block.

The embryo top bearing and side cheek pieces are clamped onto the top using the holes which will eventually hold the studs for clamping the leaf springs in place. The whole lot is then brazed with low temperature silver solder. Make sure you cut the clearance for the lower fixing for the pin going through the centre hole in the springs. Make this an elongated hole on one side or you won't be able to get the springs in – I had to mount the finished hubs at an angle in the miller vice and use a long series end mill to enable assembly – just another thing which caught me out!

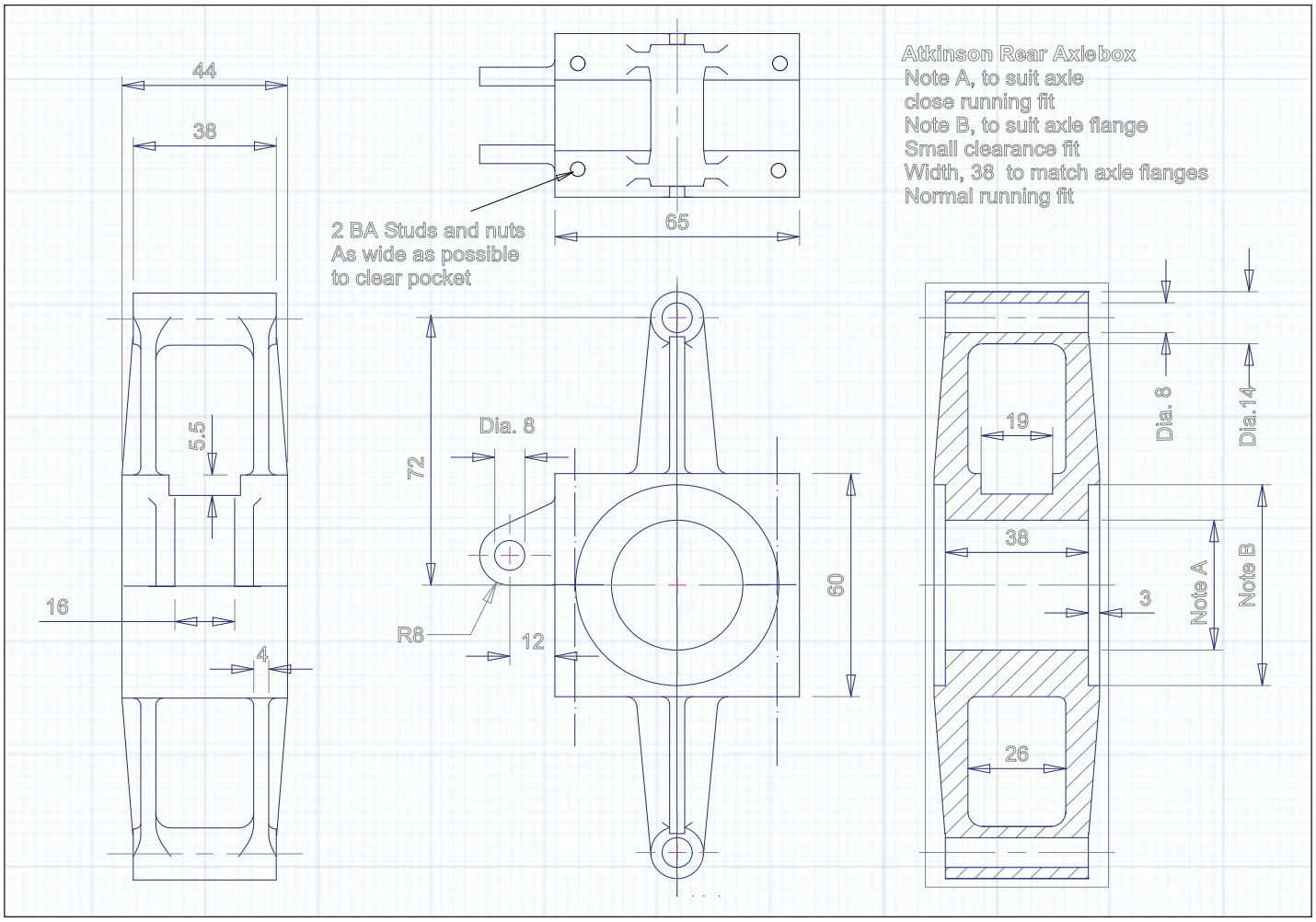
Once the top and bottom assemblies are completed, file the brake mounting pin bearings to remove the top part of the dummy flanges. Mount them on the rotary table, which is centered under the miller spindle, and clock the bore true. The holes for the brake shoe pins can then be drilled and reamed with the assurance that they will be the same distance from the centre.



LEFT FIGURE 1 – An early CAD assembly; the shoe is over sized at the top and intersects with the cam - this is corrected in the drawings.

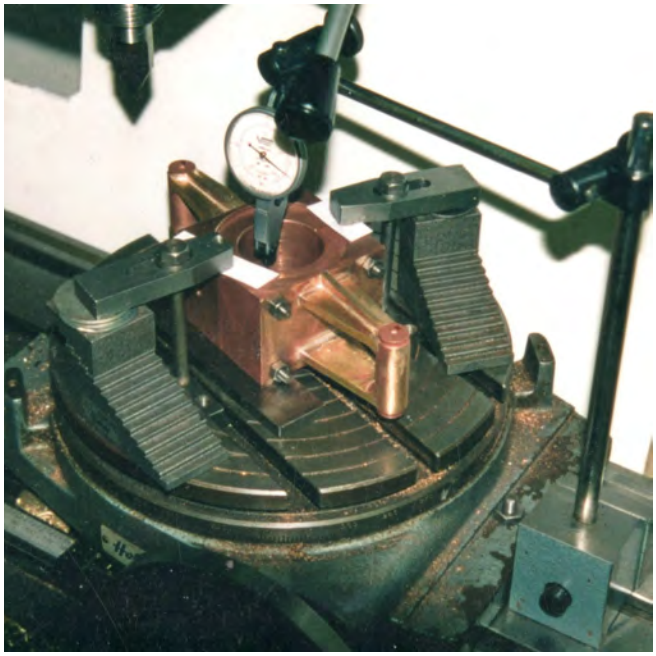


RIGHT PHOTOGRAPH 1 – Finishing the second pocket.

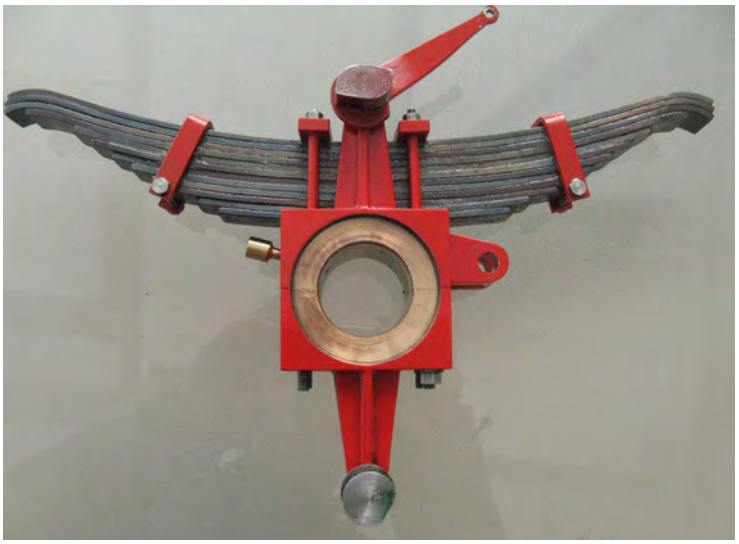


RIGHT
PHOTOGRAPH 2
Different stages of assembly.

BELOW
PHOTOGRAPH 3
Preparing to drill the brake pin pivot holes.



BELOW RIGHT
PHOTOGRAPH 4
Finished axlebox assembly.



BRAKING SYSTEM

Don't be a slave to my drawings here as they are for guidance only; final dimensions will be determined by your component as all are interdependent. All the dimensions were correct for me but cannot necessarily be relied on in your situation, and you will need to modify as and where required.

Before any work is started you need to gather the three key components for this assembly:

- friction material,
- brake drum material and
- return springs.

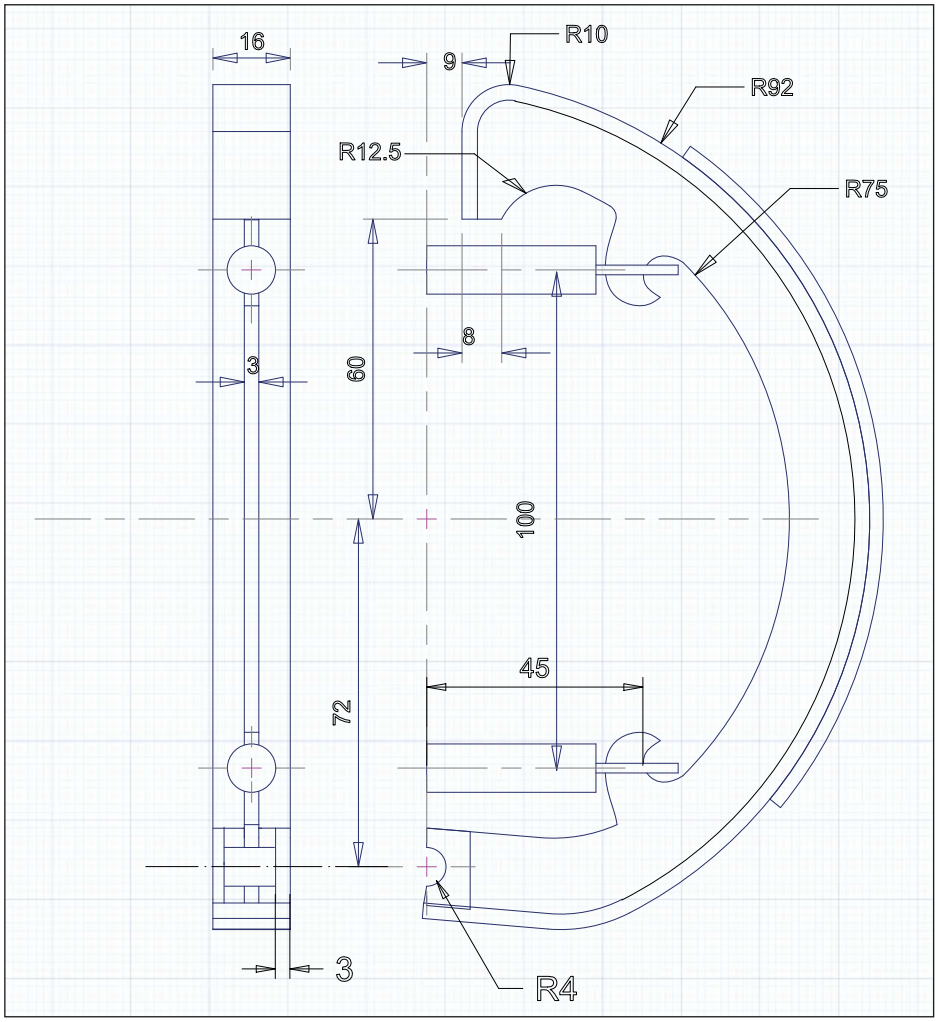
BRAKE DRUM AND WHEEL MODIFICATION

In the prototype, the drum was either cast with the wheel or the brakes worked on the actual wheel rim itself. I have seen several Sentinel rear wheels which have bosses built into the spokes and I considered adding these and either aluminium soldering or glueing them in place. In the end they were not needed and in any case the cost of the wheel castings makes the soldering too scary to contemplate! As the standard castings are aluminium I considered that they would be easily damaged by stones or grit being trapped between shoe and braking surface if they worked directly on the inside of the wheels. The only real option was for separate brake drums. Machined steel rings were considered, but eventually I found a very cheap solution. (Note that it is important to start with the brake drum as its final dimensions will determine the sizes of the other components. My drum is like a piece of angle iron bent into a circle – outside diameter 200mm, wall thickness 3mm.)

A visit to the local scrapyard with a tape measure and an open mind yielded a pair of Fiat Uno brake drums. Mr Scrappy couldn't understand that I wasn't interested in a pair from a specific vehicle but was just interested in size, with a flat face and uninterested in overall condition! Back at home, after a lot of machining, there wasn't much left of the original drum.

Firstly, the inside was gripped and the outside skimmed to remove the rust and to get it to diameter. Following this the centre was trepanned out leaving a flanged tube which was parted off to width. Gripping gently on the outside, the inside was bored to size. If your lathe does not have the capacity for this it will be a saw job to mount the reduced width drum on a plywood blank on the faceplate.

Now the wheel casting has to be modified to suit the drum. Mount it however you can – I just gripped it in the 4-jaw of my Colchester Student (this very useful machine was really obtained just to machine the wheels!) then, with an assortment of tools, some left hand, some right hand, a flat was produced for the drum to sit on. As an alternative, it could be done by rotary milling. The important thing is to be sure the depth is correct and the diameter of the counterbore on the wheel webs closely matches the outside diameter of the drum. The outer edge of the brake drum should be flush with the face of the wheel. To fix the drum in place, centre the wheel onto the rotary table and clamp the drum in place. Check again and again that things are properly concentric. Drill through the drum into the centre of each web. I used a combination of 5BA countersunk cap screws alternating with 3mm dowels to take the thrust into the centre of each spoke.



BRAKE SHOES

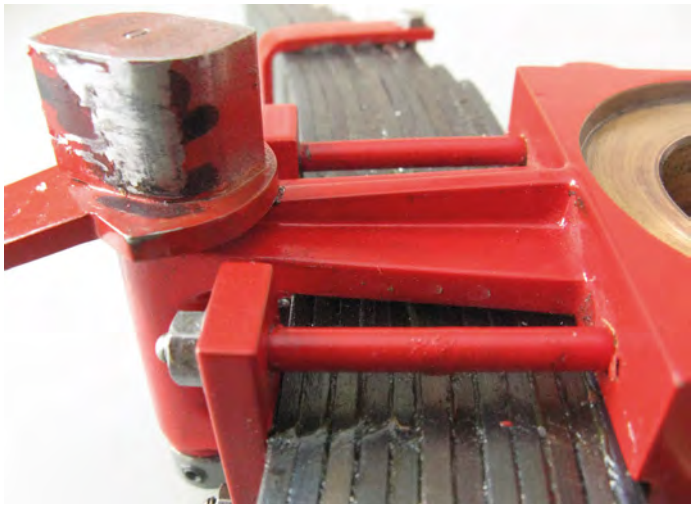
The first thing to establish is the position of the spring hooks to give a reasonable tension. I have not given the position of these, only their shape. If the tension is too small, it won't pull the shoes and actuating gear back; if too much, the shoes will be difficult to assemble. For the shoes, once you have the springs in place the exact position of the hooks for them can be determined. In addition, the outside diameter will depend on the brake drum and the thickness of the chosen friction linings, which need to be determined before anything is started.

I made my shoes from brass but steel would be fine, except that the bending at the top would be more difficult. A separate piece could be used at the top instead of the bend but location during brazing will be trickier. For the friction linings I was lucky, finding ancient scooter brake linings at an auto-jumble which were by an amazing fluke the exact radius, thickness and width needed! I understand cork glued on with contact adhesive works very well. Mine were fixed in place with modified 3⁄32" rivets into the existing counterbored holes (tedious).

Adjustment for wear and manufacture discrepancies are catered for by the actual thrust being on a thin piece of carbon steel cut from an old saw, after annealing, then the countersunk holes drilled and re-hardened. It is secured with 4 8BA countersunk screws with shims for adjustment. The cam itself can be sized to suit. The web portion of the shoe is made from a disc and most of it goes to waste.

Start by putting a 3mm wide groove 1mm deep along the centre of the 16mm wide rim bar to locate onto the disc. Once you have established the radius, this is the drum internal diameter divided by 2, minus the lining thickness, minus the shoe flange (rim) material minus clearance of 1mm (on diameter). Drill the disc centrally, then it is best milled to size on the rotary table which has been centred under the miller spindle. The hole positions for the spring hooks can be drilled relative to the size of your springs by co-ordinate methods. A notch is cut at

ABOVE – PHOTOGRAPH 5 – An early trial assembly with weak springs for ease. Note tapered clearance on spokes for the springs.



ABOVE – PHOTOGRAPH 6
Photograph 6 - Cam and lever details.

the top to accommodate either the brass flange or a straight piece of steel, for the pressure face. The outer flange is bent to fit the central disc by using bending rolls. At the bottom of the central web, thickening pieces to within 3mm of the edge of the rim are added to provide a stable platform for the lower mounting pin.

Once all the pieces are formed it is a simple matter to wire them all together, with a few extra holes drilled for the wire in the area which will be cut away, and silver solder them all in one go. Then it's back onto the rotary table to skim the inner faces of the thrust pad at the top of the thrust faces to get them true and equidistant from the centreline. At the same time the bottom pivot hole is drilled and reamed to match the distance from the hub centres to the pivot holes. Most of the central waste can be cut out by milling followed by filing to shape. The bottom pivot is a flanged pin (which will need a flat on the flange to clear the inner edge of the shoe flange) on the outside with a sized thickness washer on the inside secured with a nut on the inside of the hub arm. This flange should be as big as possible to stop the shoes from twisting out of place.

ACTUATING CAM

Lay the wheel flat on the bench then fit the hub and axle assembly, the lower support pin and the brake shoe complete with wear pad but without any shims or return springs. Clamp the shoe tight onto the drum with packing to give the clearance so the size of the cam can be determined. Machine this to width and drill the central hole (it must be really central). Pin the block to an overlong 8mm diameter shaft which can be gripped with a mole wrench to test the action. File the curved end to shape, attending to one shoe at a time, checking and when satisfied going to the other side. Polish nice and smooth then get the angle correct for the actuating lever (65mm between centres, 20mm wide tapering to 7mm) which can be located in position with a 1.5mm pin into the cam block. Note in photograph 6 the flange round the cam which is needed to locate the inner edge of the brake shoe and to keep it in position. When satisfied braze the lot together and cut the extension off. A simple collar with a grubscrew secures the shaft in place on the axle box arm on the inside. Finally, ensure both shoes are working correctly, adding shims as required.

ACTUATING RODS

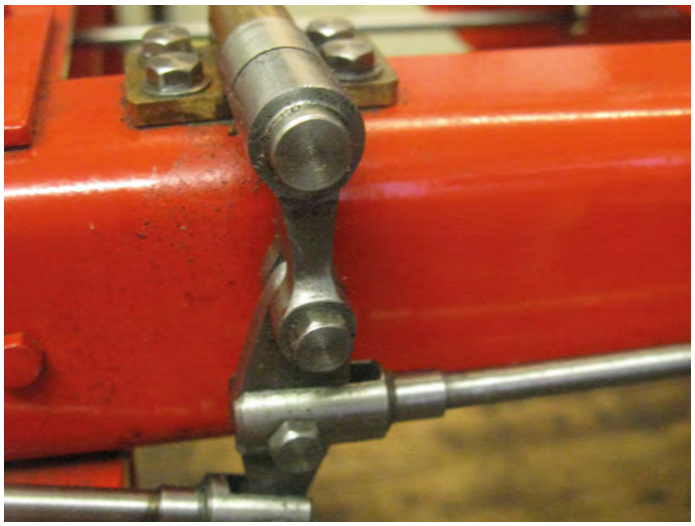
The photographs show these components clearly and no drawings are needed. The brakes need a compensation arrangement, the layout for which came from a line drawing in the Atkinson advertising material. The components are mainly made from stainless.

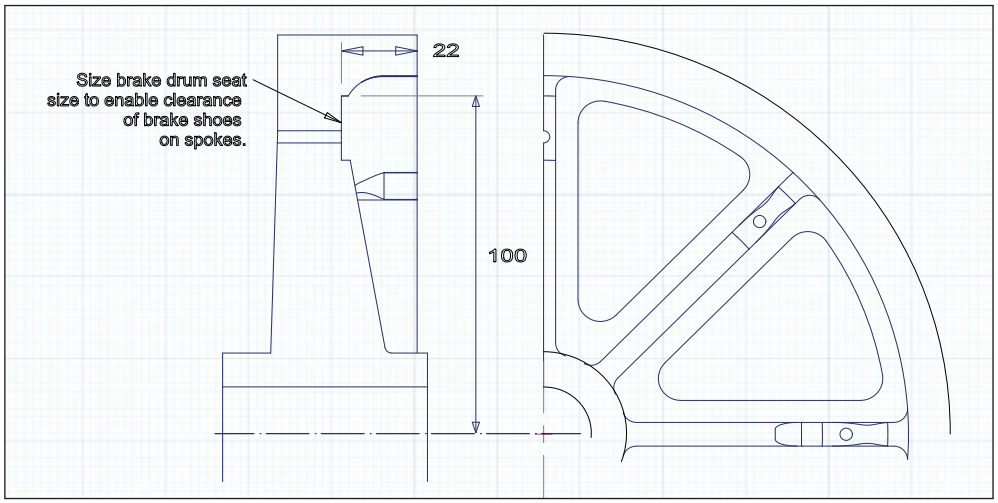
A shaft across the top of the chassis is made from 5mm material supported by a pair of brass bearings, 25mm square and 10mm high in all, fixed to the chassis with 5BA bolts. The shaft has forked arms brazed on each end and these need to be in line with each other. They have 26mm centres and are 10mm thick to give sufficient material for the 3mm slot. The offside brake arm is fitted into the bottom of the compensation bar (25mm centres, 10mm wide and 3mm thick) and the top directly into the cross arm to the nearside brake, thus providing the support for it.

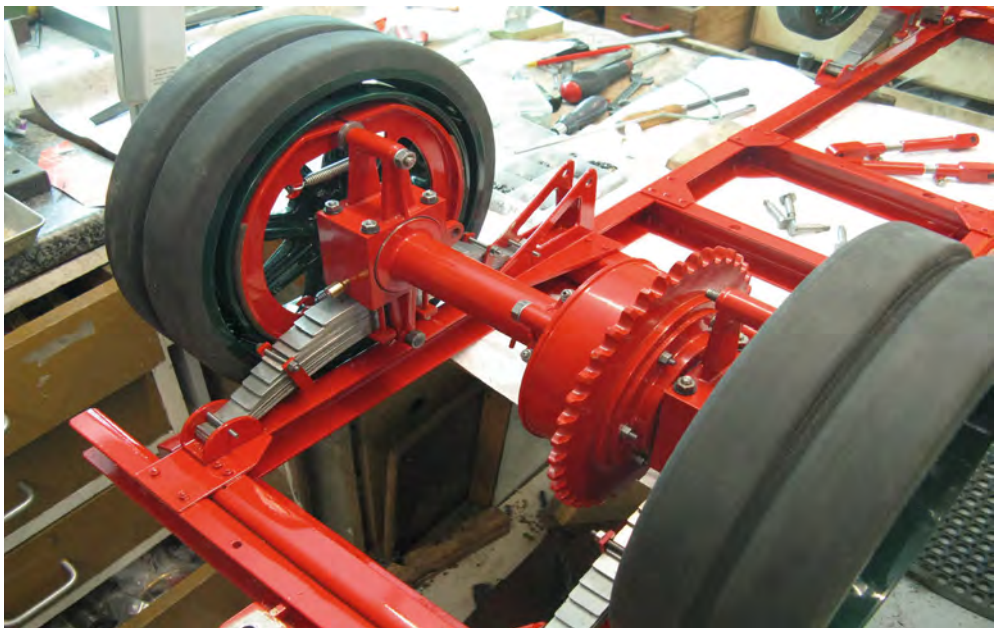
The centre hole is then connected by a long rod to the lever on the control lever stand covered in the March 2017 issue of EIM. For the rod end fixings, you will need 6 slotted (female) clevis ends secured with 5BA bolts, tapped one side, clearance on the outside. Although

BELOW – PHOTOGRAPH 7
Final assembly.

BELOW – PHOTOGRAPH 8
Compensation system on the offside just forward of the spring hanger.







I used strong springs within the shoes I had to add an extra pair from the chassis end onto the brake arms to ensure a complete return.

The actual actuating rods are 5/32" diameter threaded 4BA or 5/32"x40 for the adjusting barrels, which are made from 6mm diameter stock and, finally, a locknut is needed. Keen observation of photograph 9 will reveal the second braking system located inside the winding drum. The details for this came from a very poor view of the chassis from the Commercial Motor magazine from the 1920's. It was interesting to make (one of my favourite pieces) but it is only used as a parking brake, is completely hidden from view and was not really worth the effort so I'm not detailing it but I could send drawings on an individual basis (please apply to the editor).

All that remains now is the new camshaft design which we will cover next.

« TO BE CONTINUED »

LEFT
PHOTOGRAPH 9
The finished rear axle assembly.

PRODUCT REVIEW

EXPO TUBE BENDER

Code 751-20
£14.95 RRP

At some point in all steam modellers' careers, small bore tubing will need to be shaped and fitted and can make or break the appearance of a model. There have been many designs for tube benders published. Some are very complicated – one, I estimated, would take at least 100 hours to make...

Not so with this simple example from Expo. This small hand held version can be used on 1/8", 3/16" and 1/4" tube or rod which will give a bend radius of 12-15mm. It produces neat bends with great ease and without complication, is made of alloy and has a thick coating of smooth paint to avoid damaging the tube.

The tube is placed under the hook and the start of the bend is aligned with the 0° mark. Squeezing the handle produces the bend; the former has graduations at 45° and 90° to give good control of the angle. Being portable, it's easy to get right up to your model, although at times I found it convenient to put one handle in the vice especially when forming more complex bends so one hand could hold the tube while the other manipulates the bender. The bends are not flattened at all and the tube does not appear to be stretched at the start and end of the bend. A highly effective solution to the problem. The benders are 'suitable for bending brass, aluminium and copper and rods up to 6mm diameter'.

Graham Sadler

The full range of Expo tools can be seen at www.expotools.com or by calling on 01834-845150

The EIM Steam Plant – The Engine

Martin Gearing machines the flywheel

BY **MARTIN GEARING – PART 8 –** CONTINUED FROM PAGE 24 JUNE 2017

FLYWHEEL – ITEM E17

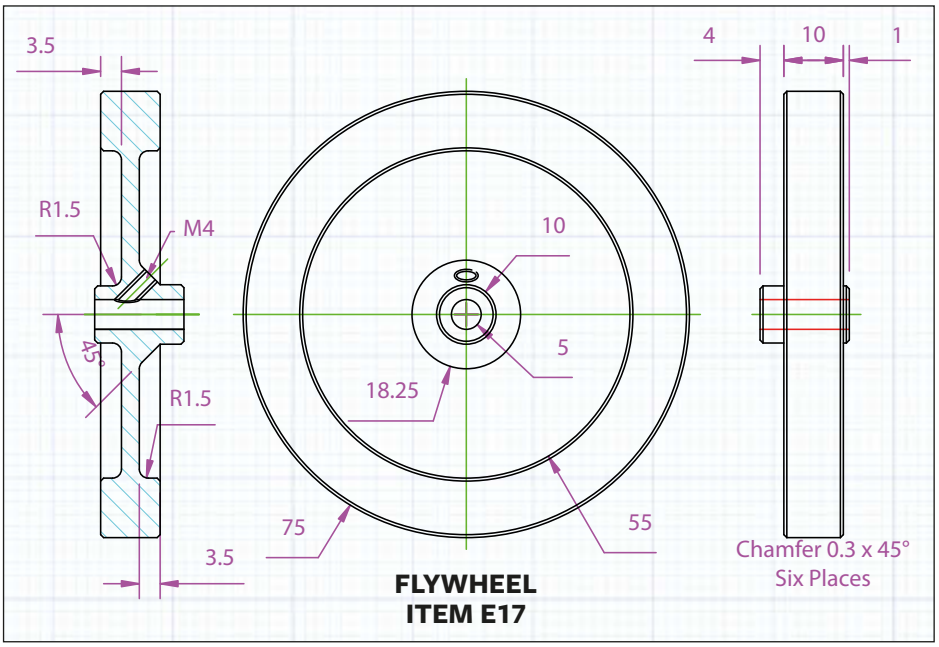
Cast Iron Ø75 x 1"
Refer to – Drawing E17 – Flywheel

FOR COMPLETE SAFETY.
Setting up should be done with the machine electrically isolated.

Setting the blank to run true in a 4-jaw chuck with 15mm protruding is best done using the 'loose tool method', mainly because the outside diameter is not smooth enough to use a dial indicator. This method involves putting a tool blank into the tool holder with the unground end facing the work and not tightening the clamp screws in any way. If you are lucky enough to have a quick change tool post, set it so that the middle of the tool is approximately on centre.

Set the work by eye to run roughly true radially – using the rings on the chuck body as a guide – and pulling the blank against the largest diameter that you can mount in the tailstock (which inevitably is the drill chuck) in an effort to bring the sawn face reasonably square to the axis.

The trueing process will be speeded up if you resist the temptation to tighten the jaws too much initially. It really is a case of 'Gently – Gently – Catchee – Monkey'! Push the tool so that the end touches the blank and pull the chuck around one turn. The high point will push the tool back into the tool holder and enable you to find, by continuing to pull the chuck, grounds where the greatest gap between the blank and the tool is located. At this point the work needs to be brought back towards the tool half of the distance observed. Depending on your luck, it may be very close to a chuck jaw, in which case slacken the jaw nearest the gap and tighten (gently) the one opposite. Should you be faced with the gap being between two chuck jaws consider one of the jaws at a time. Keep repeating the process until the minimum run out is achieved, gradually increasing the pressure evenly on each of the jaws the nearer the work comes to running. Because the material suggested is continuous cast, you may find that there is more than one high point, in which case it's a case of the best average. A word of caution! Get into the habit that before actually beginning to machine work in a four jaw chuck after setting up, go around each of the four jaws individually one final time, checking that they are all tightened to the same amount, as it is quite possible to arrive at a situation where the work is running true but only held by two opposing jaws. Don't ask me how I know that! See photograph E42.



BELOW – PHOTOGRAPH E42
An aid to setting the flywheel blank face to run true.

Face off, centre drill, and drill Ø4.8mm using a well sharpened drill (ideally new) feeding gently and removing frequently to clear any swarf, before reaming Ø5mm.

Skim the outside diameter removing only sufficient to obtain a continuous surface; the actual diameter achieved is not critical. Using a sharp right-hand knife tool produce the Ø10 x 1mm stub. Chamfer this and the outside diameter 0.3mm x 45°.

Before the recess can be machined a tool needs to be ground to produce the profile. This is best described as being similar to a tapered parting tool – approximately 5mm wide tapering to 3mm, the cutting end of which has been ground to a semicircle of 1.5mm radius. The suggested tapered form is to make it easier to grind and more robust. Additional clearance has to be provided to one side to allow it to operate freely when producing a circular radius of about 12mm to a depth of no less than 8mm. See photographs E43 and E44.

The production of the recess on both sides of the flywheel using this tool is a two stage process.

Note: The diameter of the centre boss differs from one side to the other.

ABOVE – PHOTOGRAPH E43
Top view of tool profile used to machine flywheel recess.

BELOW – PHOTOGRAPH E44
End view of profile - showing clearance to enable machining recess inside diameter.

FIRST SIDE – STAGE ONE

- Start by positioning the tool to provide side clearance on the outside tool edge, so as to allow machining the inside bore of the Ø55mm recess that forms the inside of the rim.
- Begin machining the 3.5mm deep recess with the profile tool after clamping the saddle and touching the radiused tip at the centre of where the recess is to be formed, and zeroing the top slide feed dial.
- Feed in 0.5mm on the top slide and then, using the cross slide, feed the tool out towards the rim checking continuously the visible edge of the cut and stopping when this edge is at Ø54.5mm.
- Using the cross slide return the tool to the midway starting position and feed in a further 0.5mm and repeat. Repeat this process a further five times, resulting in a recess depth of 3.5mm.
- Finally, withdraw the tool clear of the recess on the top slide, before bringing the tool to touch the Ø54.5mm. Take cuts of 0 .1mm depth with the cross slide and hand feeding the top slide, stopping at 3.5mm, before withdrawing the top slide and adding another cut of 0.1mm on the cross slide. Repeat until the Ø55mm x 3.5 recess is achieved.
- On the last cut, after feeding in to the full depth of 3.5mm slowly feed in on the cross slide to 'blend' the 1.5 radius into the flat surface of the recess. See photograph 45.

ABOVE – PHOTOGRAPH E45
Flywheel machining – 1st stage. Inside diameter recess.

FIRST SIDE – STAGE TWO

- Start by positioning the tool so as to provide clearance on the inside edge of the tool to ultimately allow machining the Ø10 x 4.5mm boss at the centre. Move the tool using the cross slide to the recess area previously machined, and very carefully advance the tool in using the top slide, until it takes the faintest of 'witness' cuts at the base of the recess. Clamp the saddle and zero the top slide feed dial.
- Retract the tool with the top slide until it is 3mm away from the previously machined recess. When doing this, remember to account for backlash in the feed screw, by coming back ¼ – ½ a turn more before returning in, until 3mm on the top slide dial is reached, which equates to a 0.5mm depth of cut.
- Using the cross slide, move in towards the centre Ø10mm boss previously formed, checking continuously the visible edge of the cut, stopping when the visible edge is at Ø10.5mm. DO NOT pass this point.
- Return the tool to the starting position and feed in a further 0.5mm using the top slide. Repeat this process a further five times, resulting in a recess depth of 3.5mm.
- Finally, withdraw the tool clear of the recess on the top slide and bring the tool to touch the Ø10.5mm on the cross slide. Take a cut of 0.1mm depth with the cross slide and hand feed on the top slide, taking care to always stop at zero on the top slide dial, before taking the tool back clear of the work.
- Repeat until the faintest witness is taken from the original Ø10 x 1mm boss resulting in the production of the Ø10 x 4.5mm boss as drawn.
- On the last cut after feeding in to the full depth, slowly feed out on the cross slide to 'blend' the 1.5mm radius into the flat surface of the recess at the rim. See photograph E46.

ABOVE – PHOTOGRAPH E46
Flywheel machining – 2nd stage. 1st Recess completed.

SECOND SIDE

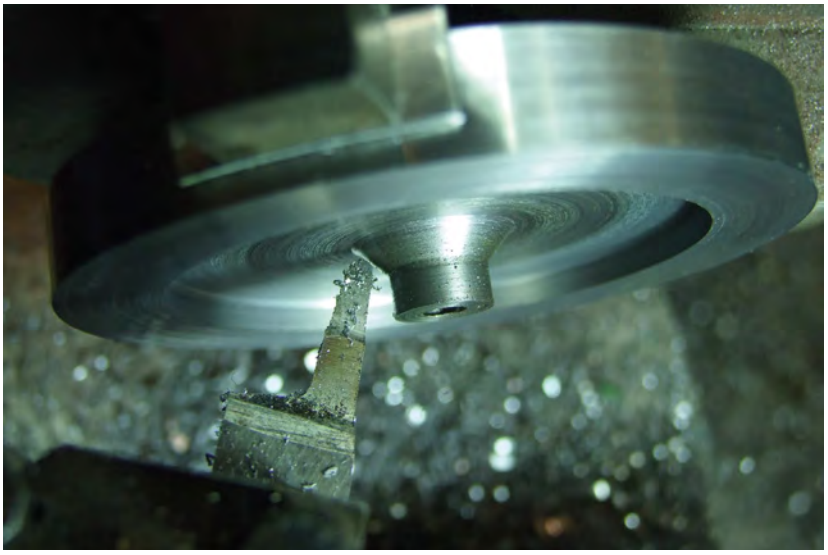
Using a self-centering chuck with cleaned outside jaws installed, fit soft uniform thickness packing between the jaws and machined surface (Aluminium from drinks cans is a good source), then hold the blank making sure that the machined face is hard against the ground surface at the front of the chuck jaws. Face off to produce a measurement of 14mm between the back face of the rim and the front face being machined.

Using a sharp right-hand knife tool, produce the Ø10 x 4mm stub. Chamfer this and the outside diameter 0.3mm x 45°. See photograph E47.

Using the profile tool repeat the two-stage process for producing the 3.5mm deep recess, the outer Ø55mm recess as before, but with an inner Ø18.25mm. See photograph E48.

BELOW
PHOTOGRAPH E47
Flywheel machining – 3rd stage. Stub machined.

ABOVE – PHOTOGRAPH E48
Flywheel machining – 4th stage. 2nd Recess completed.



ABOVE – PHOTOGRAPH E49
Flywheel machining – 5th stage. Tapered hub detail completed.

SECOND SIDE – TAPERED HUB DETAIL

Set the top slide round to 45˚ and adjust the profile tool to lie midway between the recess flat surface and the Ø10 x 4mm stub. Clamp the saddle. Pass the tool held in the top slide back and forth past the corner of the Ø18.25 boss until it just touches.

Slowly hand feed the tool past the corner, using the cross slide to add 0.2mm depth cuts until you achieve a smooth transition between the recess base and end of the Ø10 x 4mm stub. See photograph E49.

Remove from the chuck.

DRILLING AND TAPPING FOR THE GRUB SCREW

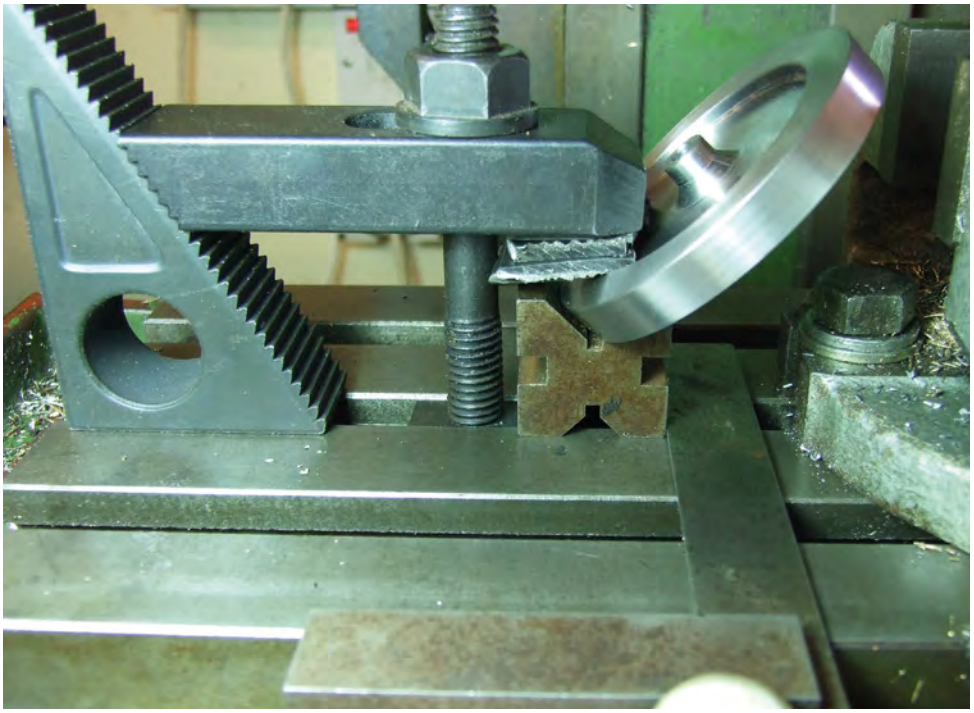
Transfer to the milling machine setting the flywheel rim in a Vee block with the 45° boss facing upwards. Place some soft packing between the inside of the rim and the underside of the clamp so as not to damage the edge of the rim. Tighten the clamp, checking with a square to make sure that the base of the Vee block is at 90˚ to the machine table before tightening the clamp fully. See photograph E50.

Centre the machine spindle on the Y-axis to the upward protruding Ø10mm boss. With the aid of a short length of rod that has a 60˚ point held in the chuck align the spindle to the centre of the 45˚ boss. Clamp the machine slides. See photograph E51.

Taking care that the drill chuck doesn't contact any part of the flywheel, centre drill, drill Ø3.3mm and tap M4 taking care not to run into the other side of the Ø5mm reamed hole.

All that is left now is to make the crank disc, big end and piston, which I will describe next time. After that we can proceed to the assembly of the engine.

« TO BE CONTINUED »



ABOVE – PHOTOGRAPH E50
Flywheel machining – 6th stage. Setting hub axis true to table.

LEFT – PHOTOGRAPH E51
Flywheel machining – 7th stage. Setting spindle true to tapered hub.

BUILD NOTES

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

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

All drawing labels start with the reference letter E.

Building the LNWR Coal Engine in 5" Gauge

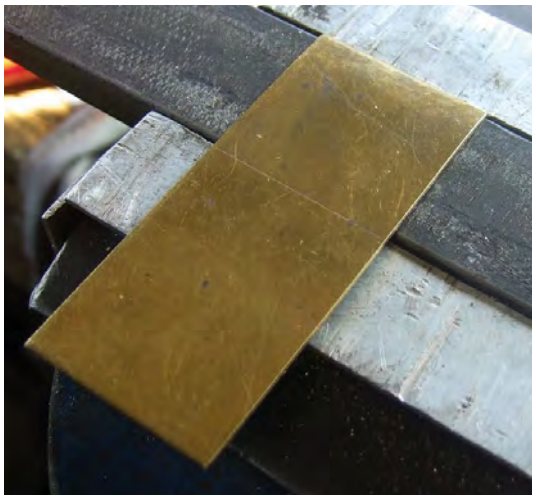
Hotspur describes the lubricating oil tank and the assembly of the pump

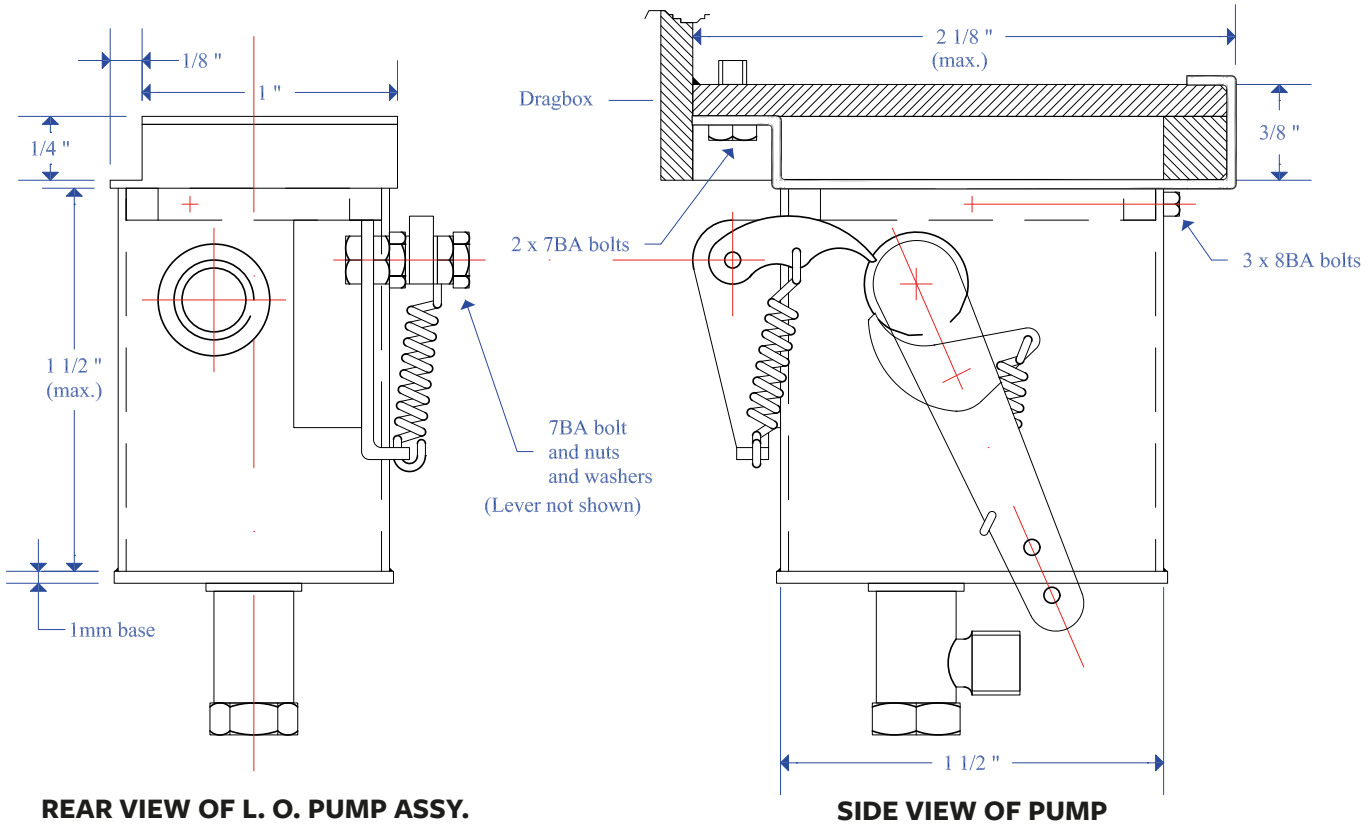
PART 17 – CONTINUED FROM PAGE 12 JUNE 2017

MAKING THE TANK

It is extraordinary when faced with a new component how flashbacks occur to help the process along. Many years ago I had wanted a specific lubricating oil tank size for a model and made up a fabricated assembly but found it would not do. I knew where I had put it and wondered whether it would be of use for this locomotive. Remarkably it was on the back corner of the bench where I had put it and after a clean, it was used to judge the new requirement. Unfortunately, the old tank again was not suitable, but the exercise was sufficient for me to decide on what the new sizes should be.

Making the first two bends in the brass plate that will form the lid of the lubricator. The steel bar is ⅜" thick to give the end channel section. Note how the plate is cutaway at the corner so the side will overlap the chassis frame.



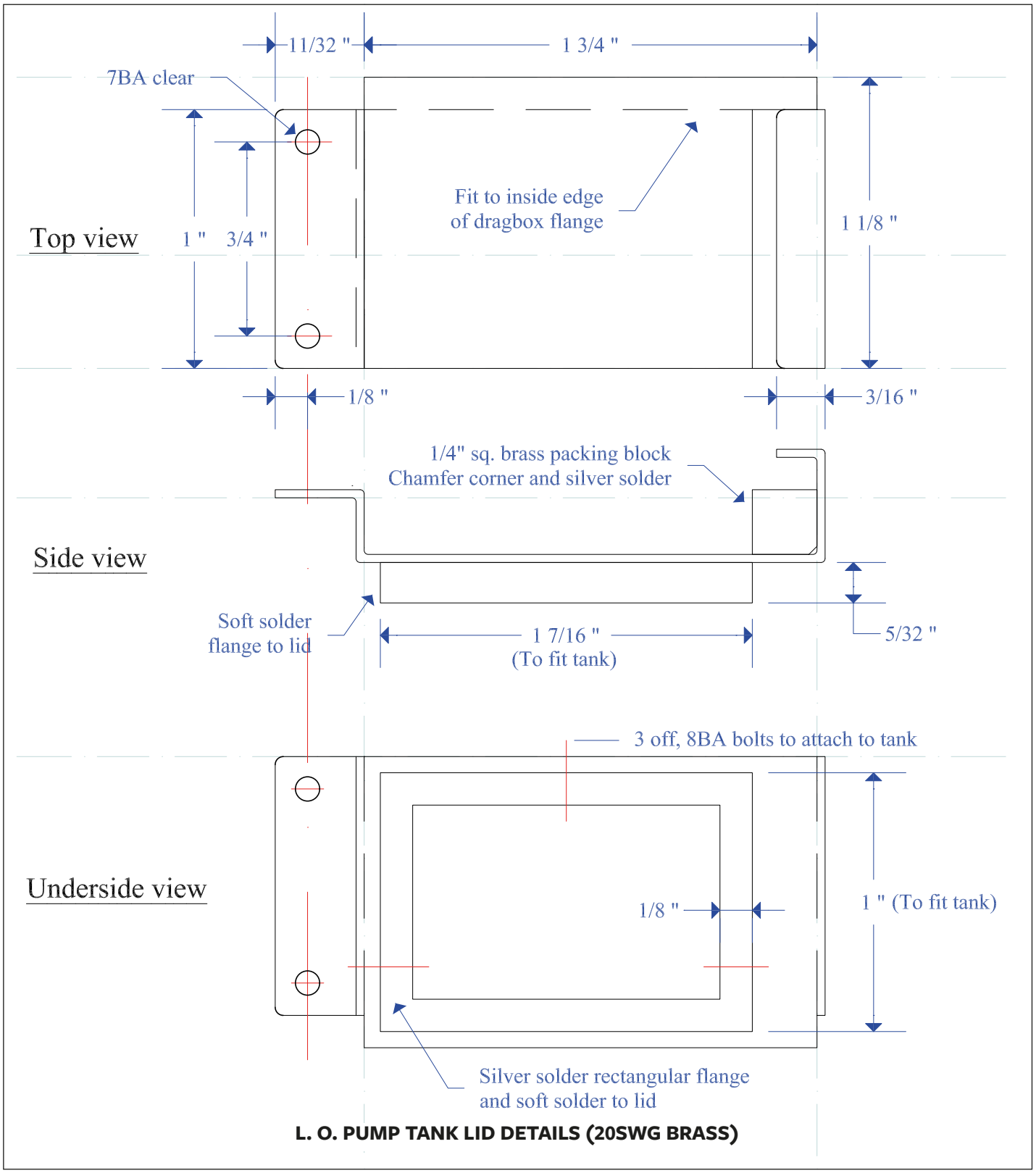


REAR VIEW OF L. O. PUMP ASSY.

SIDE VIEW OF PUMP

LEFT
The third bend in the brass plate to form the rear step.

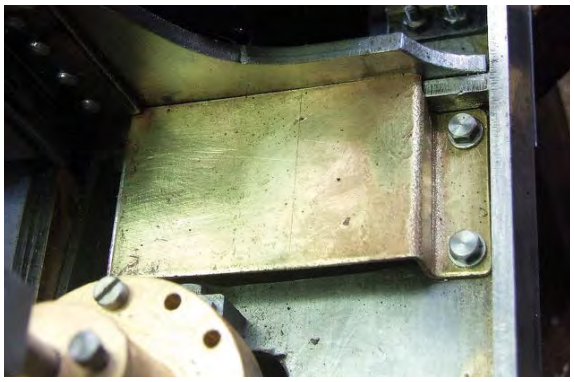
RIGHT
The completed lid with the spacer bar being silver soldered in place.



L. O. PUMP TANK LID DETAILS (20SWG BRASS)

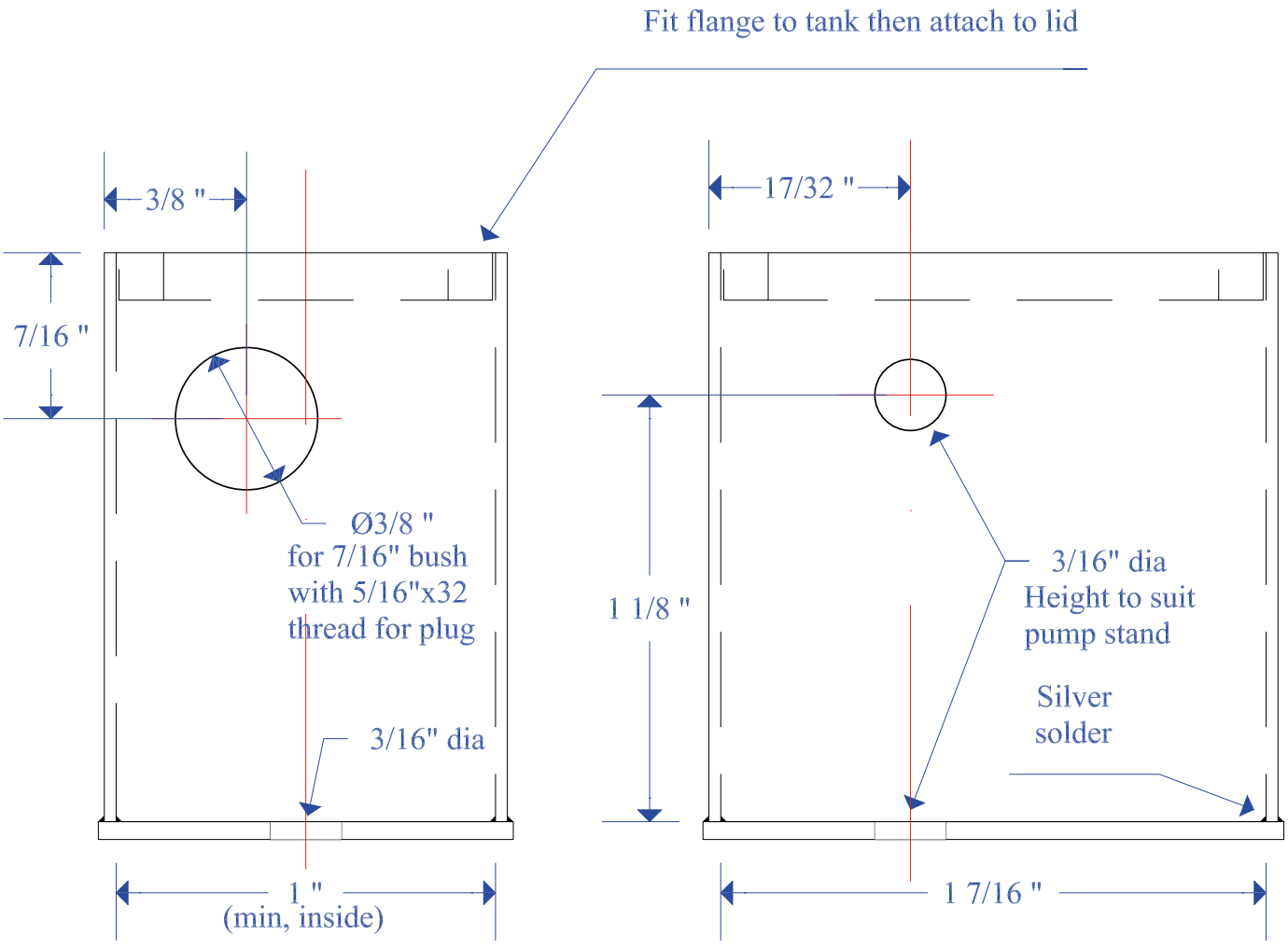
One of the challenges of building a new model is deciding where the constituent assemblies should be sited and, as noted previously, there is very little room under the drag box to mount a lubrication pump; instead of a flat surface to fix it to, I was faced with attaching it by its lid! My outline for the basic tank is given here and the pump itself is a standard LBSC type oscillating unit bought separately from Blackgates Engineering (no commercial relationship) and slightly modified to suit the layout required. The most important restraint was the internal width of the tank. It meant the pump mechanism needed a shorter operating spindle, achieved by extending the 7BA thread by 5/32" so the shaft could be reduced in length by this amount. Then the threaded carrier that supports the stand was also shortened by the same amount and the drive pin on the crank was cut back to be only 1/8" long. These changes meant the assembly could fit into a tank just over 1" wide internally.

To satisfy myself that the tank could be fixed by its lid, this part was made first to wrap under the front edge of the drag box plate and attach to the rear using two short 7BA bolts. With the constraints of width I arranged for the 'lid' to overlap the lower side edge of the drag box flange on the left side and the results are seen in my first pictures. The 18swg brass is 1 1/8" wide by 2 15/16" long initially and after notching the left side corners front and rear, it can be formed over a piece of 3/8" bar at the front and joggled to give a 1/4" step at the rear where the bolts go. Make sure you take great care with the bends as it is all too easy to form this type of component the wrong way round. It will be seen that internally at the front is a piece of 1/4" square brass bar that has been chamfered on one corner and silver soldered in place to compensate for the height.

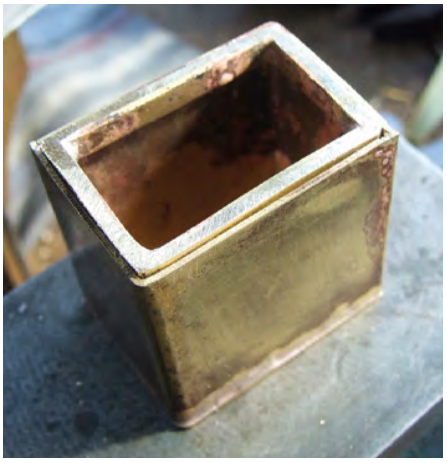


LEFT
The lid shown fitted to the dragbox.

RIGHT
The two pieces of right angled brass plate being silver soldered to form the lubricating oil tank.

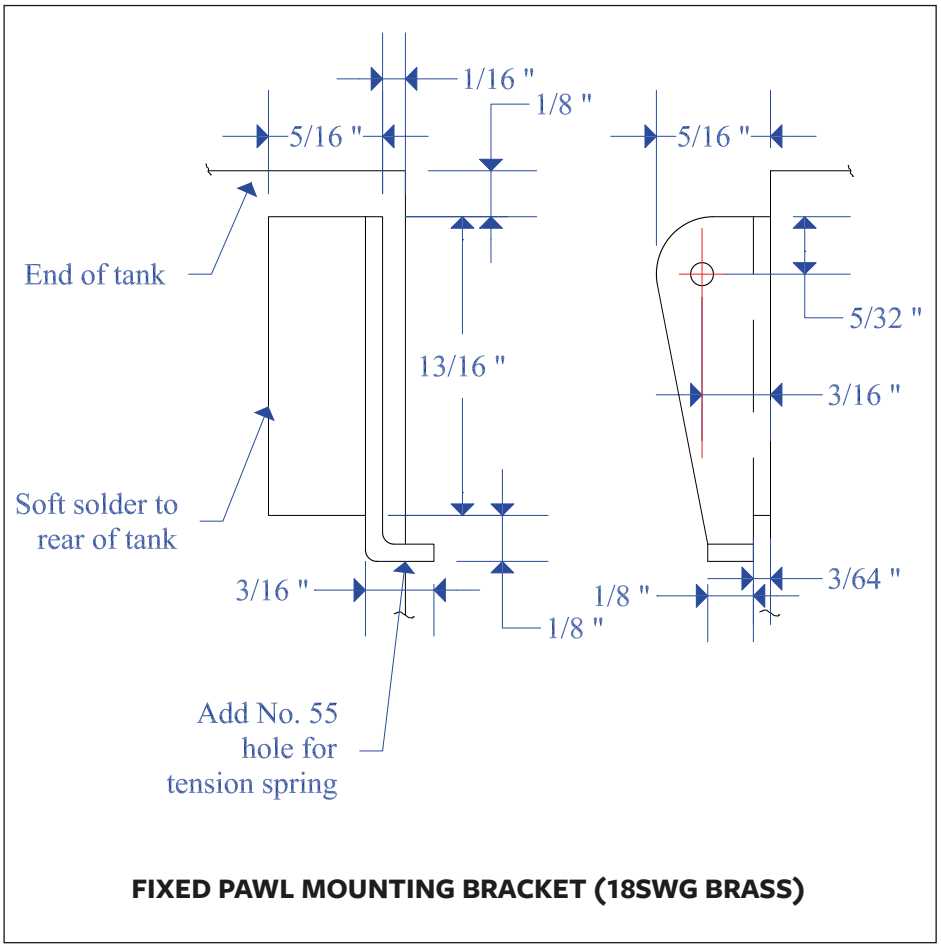


L. O. PUMP TANK DETAILS (1MM AND 20SWG BRASS)



ABOVE
The finished tank having the rectangular joint flange fitted.

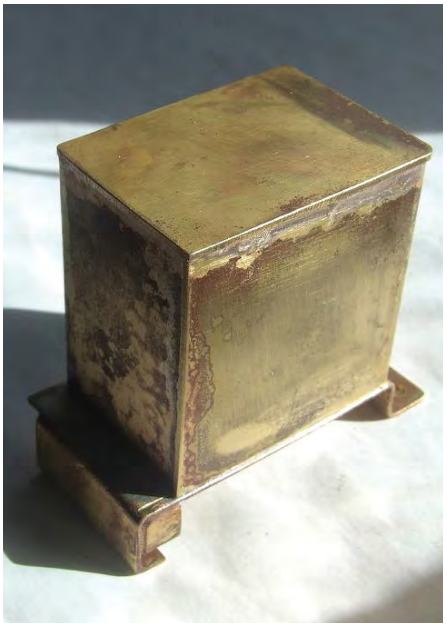
BELOW
The flange soft soldered to the tank lid.



FIXED PAWL MOUNTING BRACKET (18SWG BRASS)

Then I made the tank body by first squaring off two pieces of 18swg brass 1½" high (maximum) by 2¾" long and forming a 90 degree bend at 11/16" from one end. They were placed together on a flat firebrick to make the two joints by silver soldering down each opposite seam to form a rectangular box and I used a small weight to keep them in contact.

BELOW
The tank assembly ready to have the three attachment screws added.



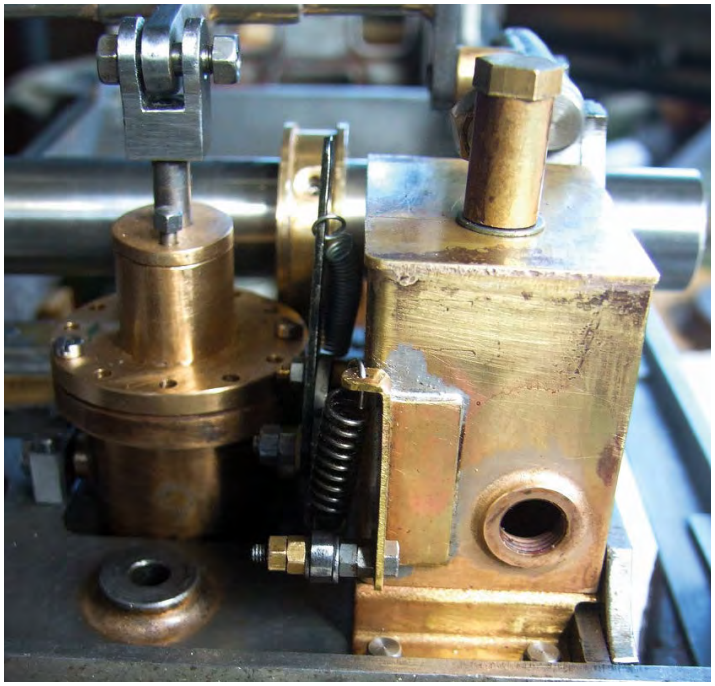
Again I hope my picture will give any guidance needed. To complete the tank base, a slightly thicker plate was added but initially I made it oversize to assist the silver soldering operation and trimmed it back afterwards. The last high temperature soldering task on the tank body is to add a phosphor bronze bush fairly high up on the left of the rear face which will be the level plug and filler so it needs to be flanged to fit a ⅜" hole and then threaded 5/16" x 32TPI to be durable in service.

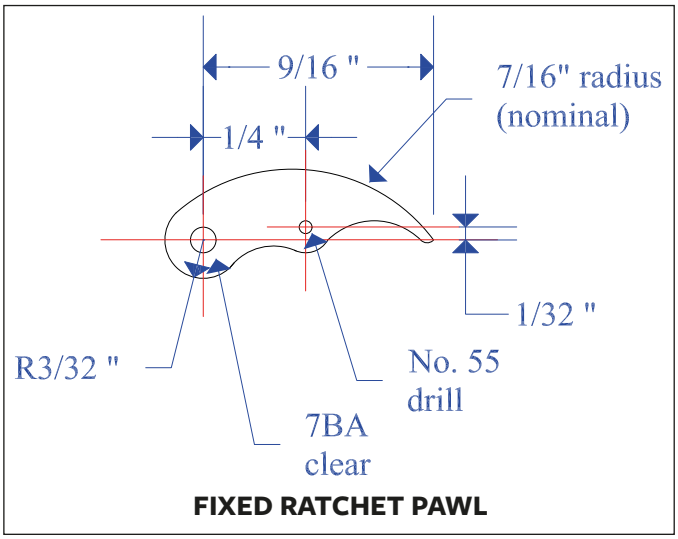
The next item to be made is the rectangular flanging strip that will fit inside the top edge of the tank and be soldered to the lid to act as a dust shield and provide the means of attaching it with some small screws. Again, I made the strip in two parts to follow the tank construction with a mixture of two rounded corners and two jointed ones. By using 2.5mm by 5mm material it meant that if the result was slightly oversize it could be filed down to fit without losing thickness for the screw threads. You may find as I did that the tank is not a perfect rectangle so note which way round it has to be attached to the lid. The rectangle was then soft soldered to the tank lid and the tank fitted to the chassis. At this point I noted that unless the tank body was attached close to the rear and the inside edges of the lid, that the tank would foul the rear horn cheek and hinder assembly. Again, I have included a picture to illustrate what I mean.

FITTING THE PUMP MECHANISM

Once the modifications have been made to the pump assembly, the two holes for fitting the stand to the tank can be carefully marked out. The stand is actually on the centre line just ½" in from the rear end. Next, measure the height from the base of the stand to the centre of the threaded carrier support and drill the hole to suit; again ½" in from the end on the side next to the brake cylinder. Clean off any burrs and make sure the pump mechanism is not in contact with any swarf as you do a trial assembly. A small 'tickle' around the offending hole with a half round needle file should line-up the parts if they do not quite fit together squarely. Re-assemble the drive shaft with its ratchet and operating lever to make sure it operates correctly and then there is one more part to add to the tank body.

This is the external bracket to be soft soldered to the rear of the tank and which supports the second ratchet pawl. This bracket has a bent lug at the bottom where a small hole is needed to hold a spring to apply a light load on the pawl and keep it in contact with the main ratchet wheel. I suggest you source the spring to use at this stage because the bracket could be made shorter for a smaller spring. Now make the bracket and bending it to shape should not be too difficult. Drill the 7BA clearance hole for the pawl pivot and soft solder the bracket in place.





FIXED RATCHET PAWL

LEFT
A rear view of the tank in place on the dragbox showing the oil filler/level plug bush and the soft soldered bracket holding the second ratchet pawl and spring.

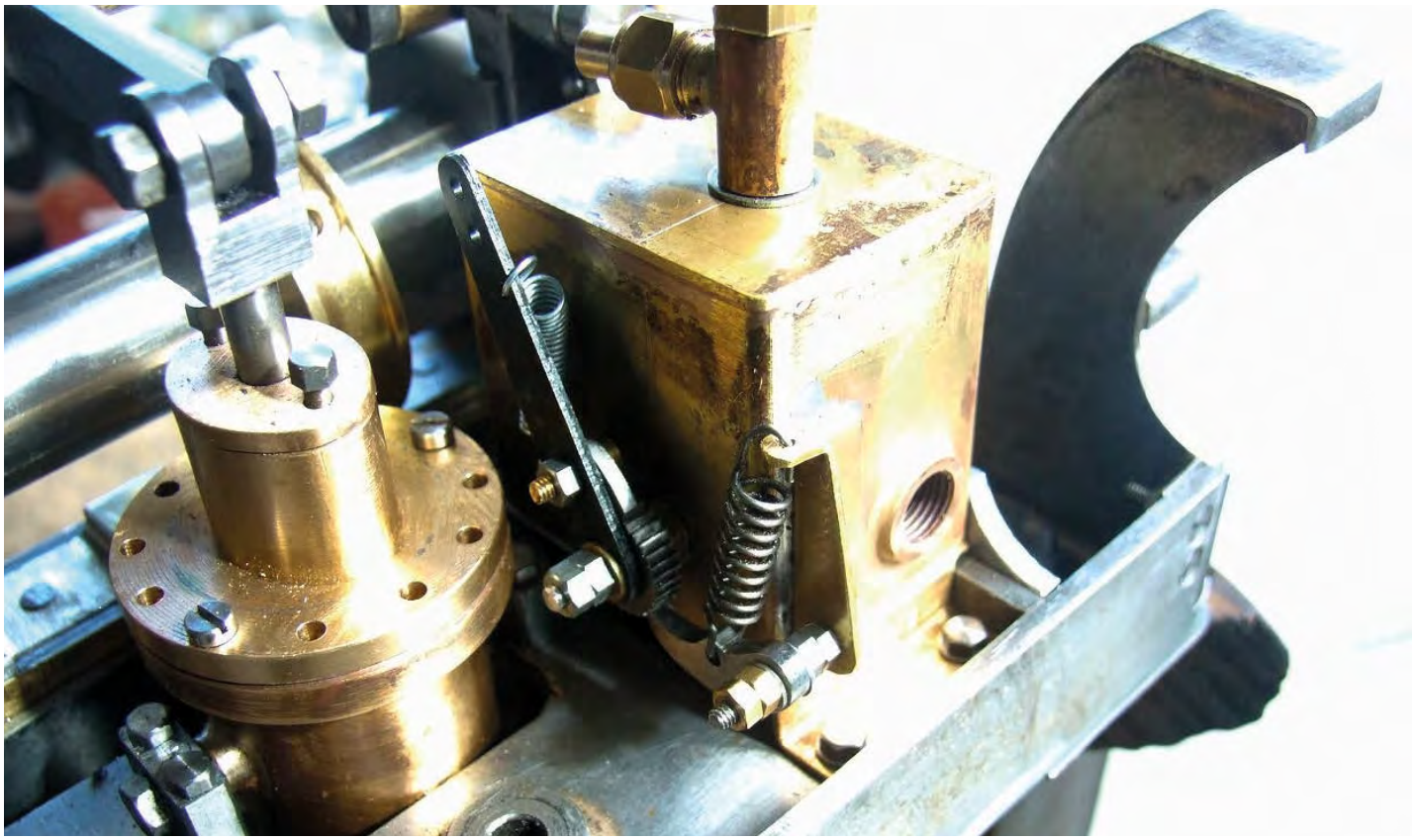
BELOW
A further view of the completed tank assembly which has just fitted in alongside the steam brake cylinder.

To make the pawl you need a small piece of 3/32" thick gauge plate. Check the distance from the pivot hole to the ratchet wheel and this should be the dimension I have given on the pawl drawing, but the pawl length can be varied to suit the parts being used. Mark out the holes and drill them, then cut the plate and copy the shape I have suggested. The end that engages with the ratchet wheel is just finished to be a narrow line (not a sharp edge) and all the curved edges can be filed smooth prior to heat treatment. For such a small part I just placed the pawl on the edge of a firebrick and heated it till it was red hot before knocking it off into a tin of oil – for those who have not read my notes before ordinary machine cutting oil will do. The part is so small that in my view tempering is not necessary; the part begins to cool anyway as it drops into the oil and the degree of quenching is not as severe as it would be if we had used water. Burnish the pawl with fine emery tape and try the hardness with a fine file. The file should simply slide over the surface and not make any impression!

To assemble the pawl on the pivot bolt, tighten the bolt on the bracket, then put on another nut as a spacer followed by the pawl with a washer on each side of it. The two outer nuts are locked together to set the clearance for the pawl. Now I realise that the pawl is running on the thread of a bolt rather than a plain surface but in operation the angular movement is so slight that any tendency to wear will be minimal. The alternative would be to make up a special stud with threads either end but I did not think this was justified.

Next time I will conclude by describing the pump drive eccentric strap and add the pipe bracket under the dragbox.

« TO BE CONCLUDED »



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CarFest North takes place at Bolesworth Castle, Cheshire, from July 28th to July 30th. The brainchild of Chris Evans, it is in aid of the BBC's *Children in Need*. As well as Steam World there's music, cars, food, lots of family fun, more cars and a 'car'-nival parade. Did I mention cars?

More information and online ticket sales are available at **www.carfest.org**

STOP PRESS! Saturday July 29th is now sold out.

Kempton Steam Museum

Mark concludes his guided tour of the Kempton Steam Museum and tells the story of the 2ft railway built there to transport coal to the boiler house

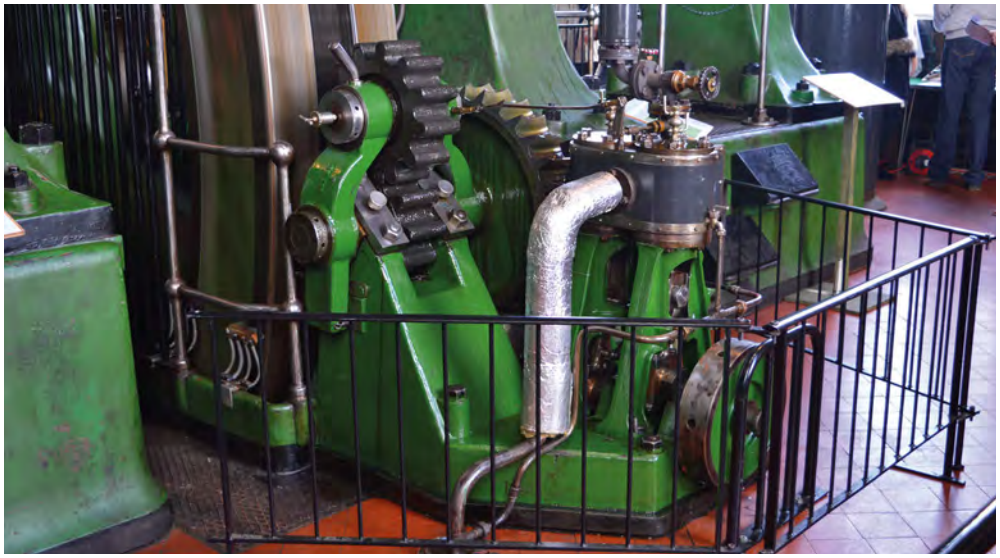
BY **MARK SMITHERS** – CONTINUED FROM PAGE 15 JUNE 2017

In order to get the 1000-ton engines from the makers to their Engine House when new, they had to be transported in sections which, apart from the 30-ton crankshafts, were limited to approximately 16 tons each, owing to the maximum permitted loading of the railway trucks. They would appear to have made the final stage of their journey to the Kempton Works over a private standard gauge siding that had been laid to connect with the LSWR's (later SR's) Waterloo-Shepperton line on the 'up' side of Kempton Park Station. The massive flywheels (two per engine) are amongst the most immediately apparent features of the engines to any casual observer and each of these weighs 33 tons, being cast in two semi-circular halves.

Once the cylinder steam jackets had been preheated to the requisite degree, starting of the engine could take place. It is during this process that the toothed rack on the circumference of each flywheel came into its own as these racks were each designed to engage with spur gearing driven by a two-cylinder simple vertical

ABOVE – Starting up Engine No. 6 on operational demonstration days is always a great occasion at the museum, and the moment is captured in this view, which also gives a good impression of its overall size. The toothed arrangement of the flywheels, necessary for the Barring engines, is also shown to advantage here. The sheathing for the drive from the crankshaft to the camshaft is also very much in evidence.

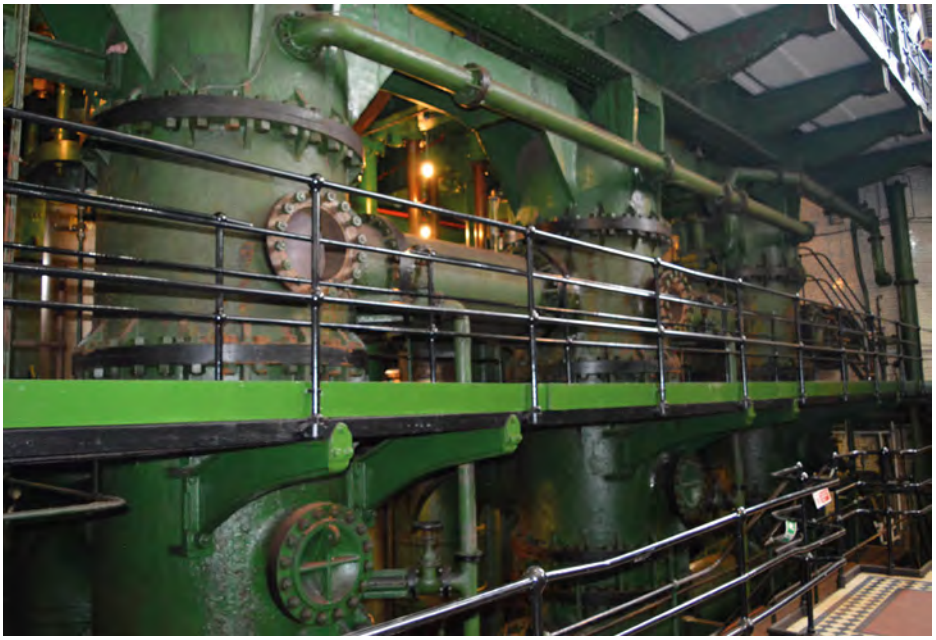
BELOW – One of the two-cylinder Barring engines used for starting No. 6 is shown in this view. During the starting process (which would allow steam to pass through the whole of the engine's main steam pipework to the condenser), the Barring engines would take three minutes to effect one revolution of the flywheels. As can be seen from the photograph, their transmission arrangements consisted of a worm gear driving onto an intermediate shaft carrying a spur gear on the left hand side (looking towards the main engine), which in turn engaged with a final drive spur gear that connected with a toothed trough in one of the main flywheels. Once starting was achieved, the final drive was automatically disengaged and the 'swivelling arm' bearing housing for the last spur gear (part of the engaging/disengaging mechanism) can be seen here to advantage.



ABOVE – This plaque on Engine No. 6 denotes the pump ram capacity in single and double ram modes of operation.

ABOVE – The oil reservoir tower for Engine No. 7 is shown in this view. The upper two reservoirs were filled with low viscosity bearing oil (feeding the gravity lubrication system), whereas the lower reservoir was filled with high viscosity cylinder, or 'steam' oil, feeding the mechanical lubrication system.

BELOW – The sight feed mechanical lubricator that feeds the cylinders, valve spindles and piston rods can be seen in this illustration. It was driven from the camshaft, although it is currently inactive on Engine No. 7.



ABOVE
The pumps worked by Engine No. 6.

BELOW – One of the valve springs, removed from its accompanying casing, for the high pressure cylinder of Engine No. 7 is shown in this view.

LEFT
This is the upper external part of Engine No. 7's high pressure cylinder. Visible in this view are the push rods (actuated by the camshaft, the valve rockers, the spring casings and the cladding for the cylinder steam jacket. Note that owing to the cylinder's size, only one inlet and one outlet valve is fitted at each end.

BELOW
The upper part of the medium pressure cylinder of Engine No. 7 is shown in this illustration. Note that by way of contrast with the preceding view, owing to the larger size of the cylinder, two inlet and two outlet valves are necessary at each end. The respective sets of valves (inlet and outlet) are worked by a single rocker arm and coupled together by a rod as can clearly be seen here.

ABOVE
The two Frazer & Chalmers steam turbines have been retained as part of the museum, along with their Worthington & Simpson centrifugal pumps and one of these pumping sets (No. 9) has been partially dismantled to show visitors its modus operandi. The steam turbine, David Brown reduction gearbox, and centrifugal pumps are all clearly visible in this view, as is part of the overhead travelling crane which was used in the assembly of the 'Triples' after their initial delivery from the makers.

A ground level close-up of Turbine No. 8 showing its condenser in the foreground.

RIGHT
What lies beneath: the upper part of the pump ram (with connecting rods to the crosshead) that was driven by the medium pressure cylinder of Engine No.7.

BELOW
This impressive arrangement of gauges is associated with the steam supply and pump performance relating to Turbines 8 and 9, hence the '1933' date.

starting engine. As No. 6 operates 'light' today, only one of these engines is now necessary for starting operations on demonstration days but both certainly earned their keep during the pumping era when the 'Triples' had to be started under load. Nowadays, No. 6 is normally run at a crankshaft speed of 16 revolutions per minute but the engine was designed for a normal safe working limit of 25rpm.

The role of the 2ft gauge railway in the Kempton Park Waterworks story has already been referred to and will now be considered in greater detail. Under the provisions of the Metropolis Water Act of 1902 the responsibilities of the New River Company were taken over by the Metropolitan Water Board. These included not only the Kempton Park pumping station but also the nearby Hampton Works. Coal for this latter entity at this stage was normally shipped in by river, being unloaded at the wharf, and then transported by means of skips, carts and barrows to the boiler stokeholds.

This was an unsatisfactory state of affairs, being vulnerable to interruption by flooding or industrial unrest on the part of lightermen, in which case cartage from Kempton Park Station needed to be resorted to. Following a meeting of the Metropolitan Water Board in 1912, therefore, it was resolved to construct a 3.5 mile 2ft gauge railway system that linked Hampton Coal Wharf to its adjacent boiler houses by means of two branches and provided a third branch, a little over two miles in length, that linked the Hampton and Kempton complexes. The railway was authorised by the Metropolitan Water Board Act of 1913 and facilitated not only the supply of coal to the Kempton Works from Hampton Wharf (as an alternative to the LSWR siding), but also the supply of coal to Hampton from Kempton via the standard gauge siding as an alternative to river transport. Hence the reliability of coal supplies to both sites was greatly enhanced.

ABOVE
The Jenbach-Hunslet four-wheel Diesel Spelthorne and bogie passenger carriage acquired from the Devon Railway Centre are seen in passenger operation on the Hanworth Loop during the first operating day of 2017.

Construction of the railway was completed by the summer of 1916, although its three locomotives, Kerr, Stuart W/Ns 2366-8 (respectively Hampton, Kempton, and Sunbury) were completed during the previous year. These 0-4-2T locomotives were not built to one of the maker's standard designs but to the specification of the Board. The design was an attractive one; use of Walschaerts' valve gear; the cab; the partially 'rounded' side tanks, the chimney and smokebox having Kitson influences in their configuration (the railway's Locomotive Superintendent, George Tyas, was a former Kitson employee), whilst the pony truck and cylinder/steam chest configuration were more recognizably of the maker's design, the former having affinities with the Brazil class and its relatives; the latter being very similar to the Joffre class specification, albeit with a longer stroke.

These locomotives measured some 15ft 3in long over buffers and 6ft wide; the cylinders were 8.5in by 12in. The coupled wheels were 24in diameter, fixed wheelbase 3ft; total wheelbase 7ft 6in and weight in working order 10.75 tons. There were approximately 140 wagons, most of which were of the Board's four-wheel 'V' skip design constructed by the Darlington concern of MacLachlan & Co. Ltd.

The 2ft gauge railway remained in use, at least in part, until 1945, with most of its infrastructure (apart from a few small fragments) including locomotives and rolling stock being scrapped some two years later. Much of the trackbed remained intact, however, and in 2003-4 the Metropolitan Water Board Railway Society was formed with the intention of restoring a working 2ft gauge railway on as much of the old Hampton – Kempton Park section was is feasible, both as a means of transport for visitors to the Waterworks Museum and as an independent attraction. In 2013 the functions of building and operating such a railway were vested in a new company, the Hampton & Kempton Waterworks Railway Ltd. A short circular demonstration line, known as the Hanworth Loop, has been constructed in a field to the west of the Kempton Park Engine House on the remote side of the A316, and this opened in May 2013 with the aid of the locomotives Thomas Wicksteed and Alistair, then on loan from the London Museum of Water and Steam.

Shortly afterwards, the railway received its currently only resident steam locomotive. This is Darent (Andrew Barclay W/N 984 of 1903), originally built as a 2ft 6in gauge 0-4-0 wing tank for Provan Gasworks in Glasgow where, as No. 3, it remained in use until 1959 when it was sold for scrap. Rescued two years later by Mr. R.P. Morris, the engine was displayed for several years at Gloddfa Ganol slate quarry before eventually coming into the ownership of the 'Provan Group', based at the Eynsford Private Railway in Kent. By this stage a kit of parts, it was re-gauged to 2ft (necessitating the raising of the boiler and modifications to the frames to accommodate the firebox, which no longer fitted between them), swapping its life-expired wing tanks for a saddle tank. After a period spent visiting other 2ft gauge railways in the UK, and receiving a cab and taller chimney in 2009, Darent was put up for sale again in 2011 and on August 31st 2013 the engine arrived at Hanworth Loop.

At the time of my visit Darent was out of service awaiting replacement mudhole doors and gaskets but these items were shortly afterwards obtained from their suppliers and the locomotive was expected to be in running order once again well before this feature appears in print. Discussions with Thames Water concerning future access to the original trackbed remain in progress, although the final choice of route for any new 'point-to-point' line has yet to be determined. ■

BELOW
The project to re-create the Hampton and Kempton Waterworks Railway is an important addition to the Kempton Waterworks Museum site and the current running line is the Hanworth Loop, situated a small distance from the building that houses the 'Triples' and turbines. The railway's resident o-4-oST steam locomotive Darent (named after a tributary to the Thames near Eynsford during its period of ownership by the 'Provan Group') is seen here posed for the camera, although sadly it was out of service at the time of my visit, awaiting the fitting of new gaskets for the boiler mudhole covers.

More Convertible Rolling Stock

Jan-Eric completes his convertible wagons

BY **JAN-ERIC NYSTRÖM –** CONTINUED FROM PAGE 32 JUNE 2017

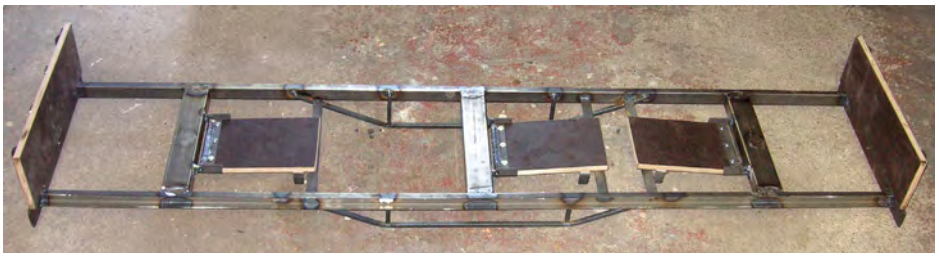
And now, back to the goods/passenger wagon! With the frame welded, I needed a way to attach the two plywood halves of the wagon which will form the bottom part of a bench. Photograph 12 shows the solution – three plywood flaps, hinged to the frame stretchers. One of the flaps, with its simply constructed hinge, is seen in close-up in photograph 13.

The hinge pin pivots in holes drilled in flat iron tabs, welded to the frame. The tabs also prevent the flap from moving sideways. When in this lowered position the flaps are totally hidden within the wagon frame. Braces made of flat iron keep them from dropping down too far. In photograph 14 the three flaps are in their raised position, ready to accept the L-shaped sides of the seat. Note the three 'sticking plaster'-shaped braces on the side of the plywood. U-shaped brackets on the flaps engage with these, and keep the seat together. Photograph 15 shows how one of the shanks of a bracket fits into its brace.

The bogie frames (photograph 16) are extremely simple, being welded from pieces of channel, flat and rectangular iron. The two bogies rotate around their kingpins and are separated from the frame by a 5mm thick Delrin thrust washer. Strips of slippery Teflon are attached to slightly bent metal supports (photograph 17). These strips, which are attached to the bogie frames, enable the bogies to rotate smoothly, even when the wagon is fully loaded.

A finished bogie is shown in photograph 18. The axle boxes are held in place with flat iron 'pedestal binders', attached with small M4 bolts into the tapped holes in the pedestals.

The frame and the bogies, including the cast iron axle boxes and wheels, were all painted with matt black rust primer, available in spray cans. One can, judiciously applied, sufficed for the entire wagon. The fake leaf springs are purely cosmetic and very simply made, shaped from pieces of flat iron. The actual springing is by the coil springs above the axle boxes. When the wagon is fully loaded the springs will bottom but that is intentional. This prevents the wagon from rocking sideways but still helps the bogies negotiate a slightly uneven track. If there is a dip in the track, a wheel won't 'ride in the air'; instead the spring will keep it touching the rail.



ABOVE – PHOTOGRAPH 12
The heart of the convertible wagon; three flaps that will enable the wagon box to be transformed into a seat, attaching it to the frame.

BELOW – PHOTOGRAPH 13
A close-up, showing the simple construction of the flap hinge.

In photograph 18, the wagon is standing on my light, portable track, which is very uneven as it crosses gravel walks and lawns. The rails are 10mm hot rolled, square section. I have tested this wagon on my track, and have experienced only two derailments, in places where the track was tilting strongly – it was actually skewed – but this has been corrected and the wagon now runs without any further snags. The museum track, for which this wagon is built, is much sturdier and certainly much better laid – it is made of 20mm x 25mm rectangular tubing. There, I have experienced no problems whatsoever.

Photograph 19 shows the two different configurations of this 'convertible' wagon: top, as a low-sided open goods wagon and, bottom, the passenger configuration, with the bench top attached to the 90° flipped halves of the 'box'.

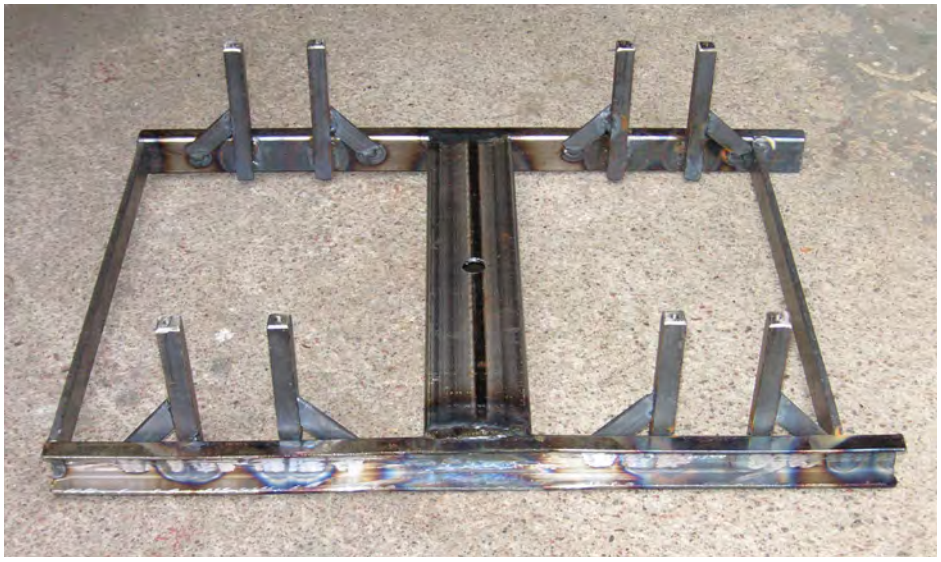
ABOVE – PHOTOGRAPH 14
The frame is now ready to accept the two wagon halves, which will become the seat sides and foot boards.

ABOVE – PHOTOGRAPH 15
Securing the seat side to a flap.

The bench is held in place with three bolts on either side, fitting into steel tabs on the underside of the bench. In the goods wagon configuration the same bolts and bolt holes are used to attach the two halves of the wagon floor to tapped holes in the frame stretchers. The bench top has to be stored elsewhere – it is too large to be hidden inside the frame.

The bench has handles at both ends, giving the passengers something to hold on to and preventing them sliding off the bench. The handles have four points of attachment each; two bolts into the plywood end pieces of the bench and two bolts attached to tabs, welded to the vertical bars, extending into the seat and bolted to the side.

Photograph 20 shows the wagon from the end – note the steel reinforcements on the plywood end; I expect these to be kicked by many small feet over the years...



ABOVE – PHOTOGRAPH 16
A bogie frame, of very simple welded construction. Note the tapped holes in the pedestals.

BELOW – PHOTOGRAPH 17
Teflon strips reduce friction.

BELOW – PHOTOGRAPH 18
The frame, bogies, axle boxes and wheels are all painted with rust primer. Note the purely cosmetic 'fake' leaf springs, shaped from hot rolled flat iron with an angle grinder.

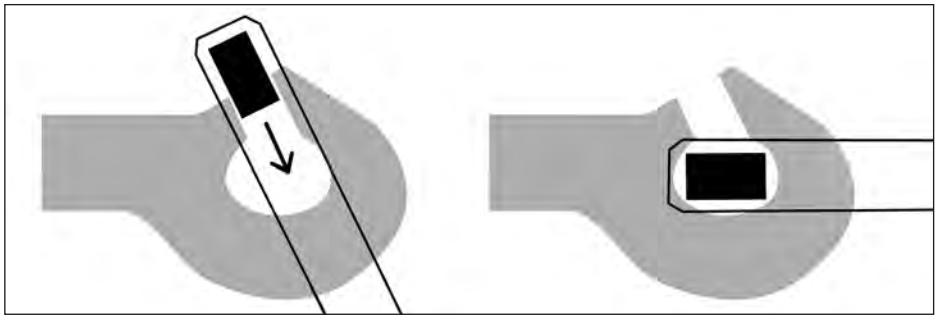
ABOVE – PHOTOGRAPH 19
The two configurations of the convertible wagon; at top as an open goods wagon, and at bottom as a passenger wagon equipped with foot boards and a long bench with handles bolted to the rotated wagon halves.

ABOVE – PHOTOGRAPH 20
The rear end of the wagon – note the steel reinforcements on the end piece.

I can use the spring-loaded hook-and-shackle couplers and buffers just as in full scale, making the coupling between the wagons 'elastic', but this is not the best possible way of running with passengers – I prefer a more rigid coupling with draw bars. I have made several simple draw bars, consisting of two pieces of flat iron and one short, rectangular bar, welded together. This reduces the number of loose pieces from six to three; the two-pronged draw bar, the coupling pin, and a cotter pin, all seen attached between two wagons in photograph 21.

The rectangular end on the drawbar can be inserted into the hook at an angle and will lock in place when rotated, as seen in figure 3. These drawbars cannot work themselves loose, which might happen with the hook-and-shackle couplers. Safety First, as always! ■

ABOVE – PHOTOGRAPH 21
A safety drawbar connecting the coupler hooks.



LEFT – FIGURE 3
The drawbar locks in place after insertion.

BELOW – PHOTOGRAPH 22
The inaugural run of the new wagon at the Finnish Railway museum. Now, something needs to be done about that ugly, angular propane wagon the driver is sitting on...

Building a Panther Tank

Chris discusses the steering and brakes for his Panther tank

BY **CHRIS MEYER** – CONTINUED FROM PAGE 36 JUNE 2017

STEERING UNIT

With the sprocket centre line having been established, and to keep the housings looking correct, the centres of the intermediate and input shafts were fixed, and there was very little scope for 'juggling' with the steering unit. I also had to keep the overall width of whatever steering unit I used within close limits because I had to be able to fit the couplings each side.

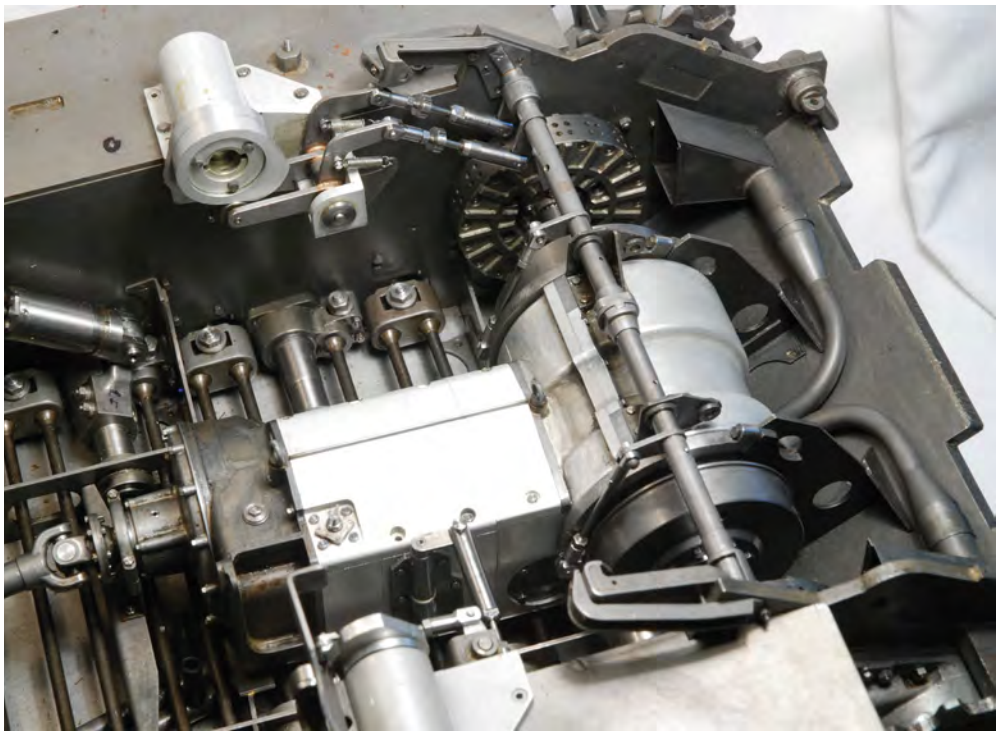
With these limitations in mind, I decided to copy the American designed, controlled differential, sometimes known as the 'Cletrac' transmission (the trade name used by The Cleveland Tractor Co.). This was fitted to all the earlier USA tanks including the Stuart, Grant and Sherman; an example is on show in the tank museum, which gives a clear view of the various gears used, which are 12, 27, 33 and 48, all being divisible by 3.

Inside the cage the two 48 tooth spur gears are locked to the output shafts. The large bevel gear was bolted to one side of the cage on the full size unit. The six 12 tooth pinions, three each side, equally spaced around the cage, are long enough to mesh with the pinions on the opposite side. They also engage with the two 48 tooth gears. On the outsides of the cage, the 33 tooth spur gears are locked to the pinion shafts and mesh with a 27 tooth gear fixed to the sleeves enclosing the output shafts. The inner members of the external contracting brakes are fitted on the outer ends. This form of steering can be quite difficult to understand, compared to the clutch and brake system I mentioned.

On the controlled differential, when the brake on one side was applied it did not lock the track, only slowing it, with the opposite side speeding up, turning the vehicle without reducing the mean speed.

For my unit, I followed the gear tooth numbers of the original, at least to begin with.

The minimum tooth size I dared use was 48DP. Even had I been able to get 33 tooth gears the diameter over the tips of the teeth, plus the casing thickness, set the output shafts too high to line up with the final drive inputs, which by then were 'set in stone', as they say. I also had to allow clearance over the torsion bars. The required reduction in height was not very much though so, by using 30 tooth gears on the pinion shafts and sleeves and thinning the casing, I achieved this reduction. The steeply angled nose and glacis plates only added to the problem.



ABOVE PHOTOGRAPH 21
The steering unit in place within the chassis of the tank.

That seemed to settle the height issue. On paper, the overall width looked to be the next problem as, apart from the width of the cage, there were the bearing housings within which the sleeves rotated, the brakes and the output shafts to which the couplings were keyed, protruding either side.

I kept redrawing the differential unit to attempt to shave more and more off certain parts. I did find this an interesting challenge, I must admit, because one had to keep in mind the possible loads on the transmission, particularly when turning on soft ground or climbing an incline. As I mentioned earlier, the USA unit has a bevel gear fitted to the cage which engages with a bevel pinion on the end of the gearbox. Unfortunately I could not find a suitable bevel gear that did not require an increase in the outside diameter of the casing. As an alternative I fitted a 40DP 70 tooth spur gear which acted as one side of the cage. This gear engages a 35 tooth gear and integral bevel both keyed to a shaft. This runs at the rear of the casing, as low as possible. The mating bevel is fitted to the front end of a temporary gearbox that I had knocked up earlier. This had two speeds, low and high, engaged by a dog clutch and I wanted to get the vehicle running to try out the change mechanism and get some idea of suitable gear ratios.

CLUTCH

As an experiment, I made a single plate clutch, copied from a diagram of a Borg and Beck unit. This was fitted in a housing at the back end of the gearbox. The clutch disc was only 1.32"diameter, to keep the housing to scale size. The rear cover

had a 'nose' that carried the input which connected to the propellor shaft. Because the temporary gearbox was longer than the proposed final gearbox, the 'nose' was overhanging the crossmember that supported the back end of the steering box assembly, so I just added an extension to which the saddle bolted.

Originally I installed a motor, maximum speed unloaded about 6400rpm, using 9.6 volt batteries, with a simple resistance type speed controller. As on the full size vehicle (FSV), the motor was mounted slightly to the right in the engine bay with a 1.3 to 1 gear unit that dropped the drive to the correct height of the propellor shaft running under the turret basket to the main gearbox.

The differential unit performed quite well and it was interesting to discover the different turning circles when running on carpet, concrete, grass and bare earth, etc. The smallest radius was 19", both on carpet and earth. Track slippage seemed to occur on concrete, increasing the radius. Early on, when running on fairly soft ground, I found that the brakes were slipping. The linkage to the brake bands appeared to have too much 'give'; although I managed to improve the brake grip with a bit of tweaking I realised a major redesign was needed, and I carried this out later on.

I would like to add that a lot of the parts that I have written about so far were made many years ago and have gone through various modifications and additions, some bits having been scrapped!

ABOVE LEFT PHOTOGRAPH 22
The steering unit removed from the tank.

ABOVE RIGHT PHOTOGRAPH 23
A view of the steering unit with the cover removed to reveal the inner workings.

RIGHT PHOTOGRAPH 24
The overall width of the steering unit is no more than about three inches.

RIGHT PHOTOGRAPH 25
Some of the internal parts of the controlled differential steering unit.

BRAKES AND CONTROLS

As I mentioned earlier, I was not all that pleased with the brakes, finding that adjusting the bands to give more grip caused them to drag when they were supposed to be off. Apart from the undesirable extra loading on the transmission, the vehicle would sometimes swerve about causing the odd collision with other objects, on one occasion damaging a track link by hitting a steel legged table.

After a lot of sketching, I reckoned I could fit cork lined shoes and springs within drums of a reasonable diameter. I made back plates which were bolted to the covers on each side of the steering unit, these housing the operating levers and cams plus the anchor pins, and this was achieved without increasing the width of the device.

The brakes are operated by two pull rods, with threaded adjusters at each end, which go up to connect to links which are part of a cross shaft assembly. This shaft runs in a brass bushed tube bolted to the top of the steering unit housing. Some of the photographs show a coupling in the centre of the tube, which is there just to add a bit of realism to my project. On the FSV the joint could be split, allowing the sections to be taken apart. The shaft has bearings located on brackets fitted to each side plate.

The links obviously have to work independently so were silver soldered to two tubular sections, one bushed, running on the left of the shaft, the other right hand section being pinned to the shaft. There are two more links, one soldered to the left bushed section and the other pinned to the far left end of the shaft, operating the right hand link. These have adjustable connections to two cam followers, part of an actuator bolted to the left side sponson plate. There is another actuator on the right side plate to operate the gear change mechanism. The cam spindles run on bearings and have a slotted socket at the cam end.

Two radio control servos, each with a similar socket fitted on the outputs, drive the actuators through short shafts with a cross pin each end. As the brake linkages are not directly connected to the servos, as often seems to be the case, the brakes can be adjusted with the radio gear off the model.

On the FSV, the shaft assembly has the two steering levers fitted on the left, and these open valves which operate hydraulic cylinders mounted on the brackets I mentioned earlier, which are bolted on each side plate.

When the driver pulls either lever upwards to its limit the appropriate track brake locks on resulting in a skid turn. These brakes, fitted to the final drive input flanges, are not to be confused with the two steering brakes fitted each side of the steering unit. If a lever is partially applied, the particular steering brake is released and a clutch engages an auxiliary drive connected to the epicyclic gear on that side. This drives the output at a lower speed, providing a controlled turn, the radius of which is dependent on whatever gear in the main gearbox is engaged - the lower the gear the smaller the radius. If either the foot or handbrake is used, both the track brakes are applied.

ABOVE – PHOTOGRAPH 26
The two speed gearbox, mounted between the steering unit and the clutch housing.

ABOVE – PHOTOGRAPH 27
The clutch housing attached to the gearbox.

ABOVE – PHOTOGRAPH 28
The clutch unit.

ABOVE – PHOTOGRAPH 29
The cross shaft for the brake controls and one of the track brake housings.

Although the controlled differential steering, as used on the Sherman, was a much simpler and cheaper unit to produce and maintain, it did not have track brakes. This made tight or skid turns impossible. Only turns at a fixed radius of about 35ft could be made. Larger radius turns could be achieved by slipping the brakes but this caused overheating in a very short time.

« TO BE CONTINUED »

A Table for Turning

BY **JOHN ARROWSMITH**

John recalls his day at the opening of the new turntable at the Newport club

In May I was invited to the City of Newport MES to open officially their new locomotive and stock turntable which has been built by members under the guidance of the designer, Eddie Atree. This new facility at the club adds to the very impressive traverser that was built by members a couple of years ago. The new turntable allows any locomotive from 5" and 7¼" gauge and up to a ton in weight to be unloaded from any vehicle height completely safely and easily. It can then be moved via the existing traverse onto the adjacent steaming bays ready for steaming or preparation.

The turntable has fully adjustable vertical movement via a chain driven gear box with a series of pulleys and steel cables providing the drive for turning through 360 degrees. All this can be accomplished by one operator without any additional help or equipment. You can imagine the banter when yours truly stood on the table and tried out the operation of the machine – "where's the music and your monkey" being typical!

Seriously though this is a superb piece of equipment the like of which I have never come across before and it is a real tribute to its designer and builder. The club site here is progressing well and, with facilities such as this and the traverser, they are building a great miniature railway on their 5½ acre site. They have the capacity on site to host large scale rallies so I will not be surprised to hear that this increased ability and hard work by the members has been rewarded by the receipt of an invitation to hold such an event. If you get the chance to visit them do take it because the welcome and hospitality are second to none. I look forward to receiving an invitation to their next major innovation.

I hope my photographs show you the super engineering and thought that has been put into building the turntable. It was also good to talk to visitors from Cornwall, Somerset, South Wales and the Midlands, some of whom had brought and steamed their engines for the day. It all added to a great day out. My thanks to the Newport club for their hospitality and welcome, which was much appreciated. ■

ABOVE
The new turntable waiting for its first locomotive of the day, viewed from the vehicle loading end – note the rotation and vertical adjustment handles at the far end.

RIGHT
This fine 7¼" gauge Black 5 was a visitor from the Swansea club.

ABOVE
Eddie Atree demonstrates how easily the turntable rotates with a 7¼" gauge Holmside and driving truck on the track.

ABOVE
A closer view of the operating handles and the rotating and lifting machinery.

LEFT
The novel way of receiving 5" gauge locomotives onto the table.

BELOW
Drive spindle to the rotating cables.

BELOW
The three wise men responsible for the turntable (left to right): Tony Hall (chairman), Eddie Atree (designer) and Phil Pritchard (club secretary).

BELOW
John Matthews brought his 7¼" gauge 0-6-0 Romulus all the way from Cornwall.

CLUB NEWSROUND

BY **JOHN ARROWSMITH**

I know lots of clubs and societies are always trying to increase their income to enable them to carry out improvements for the club and the area they operate in. A fairly new scheme operated by Tesco called the 'Bags of Help Scheme' could be a way of both helping your club and providing an additional feature for the local community. The Burnley & Pendle Miniature Railway operates in Thompson Park in Burnley and is one such club which has received a £1000 grant from Tesco for help towards a new station. The 7¼" Gauge Society AGM is to be held there in September so if the new station is finished in time it will be given a good test by this event.

Another club which has benefitted from this scheme is the Rugby MES who have received a magnificent £12,000 grant towards their new station and facilities. This month the annual IMLEC competition will be held at the Southport MES over the weekend of the 6/7/8th July. If the weather is kind it will be a great venue for this event as the club have a fine track and facilities which all make for a good weekend. This month sees the annual Model Steam Rally and Exhibition at the Guildford MES in Stoke Park over the weekend of the 1st /2nd July. This two day event is well worth attending as the club has excellent facilities and really makes the effort to put on a good show.

The new workshop area in the engine shed at the Bournemouth SME is progressing well with the workbench re-located in its new position. As soon as the ceiling liner is completed along with all the electrics the new centre lathe can be installed. All this work however has impacted on the 16mm Group who also use the same space. They are attending to other jobs such as painting the new anti-vandal track covers as well as improving the layout of the steaming bays and marshalling yard. They are intending to operate the Garden Railway on the first and third Saturday of the month so, if you live in the area and would like to get involved, I'm sure members there would be pleased to see you. Another project being considered is the construction of a separate 16mm track for their Junior Section members to use. This sounds like a good idea to me and I hope it is successful and that they get a good response from the juniors. The lathe course run by the club is also popular and when the new lathe is fully installed it will add a new dimension and variety to the 'students'.

Following the theft and damage to their track earlier in the year members at the Canterbury & District MES have put in a great deal of effort to replace the whole circuit ready for full operations again. This has been a tremendous achievement in such a short time. They will be operating again on 9th July from 11am.

At the Grimsby & Cleethorpes MES track laying has been the main focus for the Thursday Working Group, where a great deal of work has taken place ready for the new operating season. The rubble removed from the re-laying has been used for the new track extension which has saved them some money through not having to buy new material. The work has also included building five new points and a crossover for the station departure line. They are still waiting for a promised donation from a local company which will help club finances when it is forthcoming.

BELOW
Barry Green emerges from the gloom of the Grimsby & Cleethorpes tunnel with his American switcher locomotive.

The committee are looking for ideas and suggestions to improve the steaming bay area. This work will probably be next winter's project. The club received a visit from Radio Humberside back in March which gave them some good local publicity; various members were interviewed and with Greg Marsden's locomotive in steam providing the background sound effects it was a good event for them. One of their members, Roland Lingard, has celebrated his 100th birthday so it was congratulations all round for this long standing member. Their first public running day on 26th March was a fine day which brought out the crowds and provided the club with a good financial boost.

A serious problem has emerged at the Leeds SMEE with their access road being flooded following periods of heavy rain and members are being asked for their ideas for a solution. It has been suggested that the problem is being caused by a higher water table created by the mothballing of the power station. We will have to wait and see how this can be alleviated. They have lost one of their stalwart members with the passing of Glynne Hughes in February. Glynne made many contributions to the operation of the club including the electronic form of the club newsletter. He also provided the annual Christmas quiz which was always thought provoking. He will be sadly missed by all at the club. Examination of the club's passenger carriages revealed the bogies to be in an unsatisfactory condition and not really repairable. The committee decided that all should be replaced with new units. Replacements were sourced at the Midlands MEX last October where three sets were obtained to trial the suitability. Some modifications to the braking system have resulted in a good serviceable component so these new type bogies will be fitted to all their carriages. On examination after the trials the CNC machined wheels clearly showed that the 'coning' was very effective in maintaining rail contact in the middle of the tread. The society is organising an August Rally over the weekend of 12th/13th August with a variety of steam attractions and historic vehicles. Camping and caravanning facilities are available so if you are interested or wish to book contact leedssmee@sky.com for more information.

The Pietermaritzburg MES located at Pelham in South Africa had a good AGM meeting earlier in the year, having the committee re-elected without any new nominations, as many UK clubs do. It was reported to the meeting that track maintenance was ongoing with re-ballasting taking place along with sleeper replacements. All passenger carriages have been fitted with new drawbar pins and easy to use "R" clips to ensure all couplings meet the required safety standards. In addition, a great deal of ground maintenance has been carried out and the club is very grateful to Ray Teichmann for looking after this part of the club's work programme. It was also reported that the Western Province Live Steamers, who hosted the annual 'Steam Meet' over the weekend of the 24/26th March had a very successful event with lots of visiting locomotives. PMES is due to host this event in 2019. The members were also informed that two new locomotive boilers had passed their tests and two new locomotive driving licences had been issued. This all sounds very positive and we look forward to seeing these new engines in operation on their track very soon.

A member Joe Foster, at the Richmond Hill Live Steamers in Canada, has just finished rebuilding a 4-4-0 locomotive he bought about three years ago. The transformation is amazing and the rebuilt locomotive bears no resemblance to the original except for the 4-4-0 wheelbase. It looks like a superb piece of model engineering. The club's track suffered some damage during the winter months along with some trees which have fallen, and all this will have to be cleared up before operations can begin again. The date for the All Clubs Meet at Hamilton has been set for the 17th September, and this will be a good opportunity to meet other model engineering groups and enjoy a day out at the Museum of Steam & Technology. This museum has three different tracks available, 7¼", 4¾" and 3½" gauges, as well as a large area for road vehicles. It sounds like this will be an interesting event to attend.

At the AGM of the Society of Model and Experimental Engineers (SMEE) the retiring Chairman Alan Wragg was presented with an inscribed glass paper weight by President Mike Chrisp in appreciation of his tenure for the last two years. The new Chairman is Allen Berman while Martin Frost has been appointed as the group's Secretary. Their society magazine 'The Journal' is now produced by an editorial group with Alan Wragg responsible for overall co-ordination and layout. This arrangement seems to be working very well with another excellent edition. Among the many topics discussed is a note about the Digital Group's ability to transmit the proceedings from general meetings at Marshall House to distant members. This does need an experienced operator to manage the software in real time. A new volunteer has come forward to supplement the small operating group, which hopefully will encourage more members to assist with this new facility for country members. During the year 44 new members were enrolled which is always good news. The payment of subscriptions has also been improved with the introduction of a 'PayPal' payment system. This has considerably reduced the workload of the membership secretary. The Society's training programme is also working well with a number of new entrants. Among other presentations at the AGM John Littler received the Kennion Shield for his work with exhibitions, restorations and trophy maintenance. ■

BELOW
Alan Wragg presents John Littler with the Kennion Shield at the SMEE AGM.

YOUNG ENGINEERS

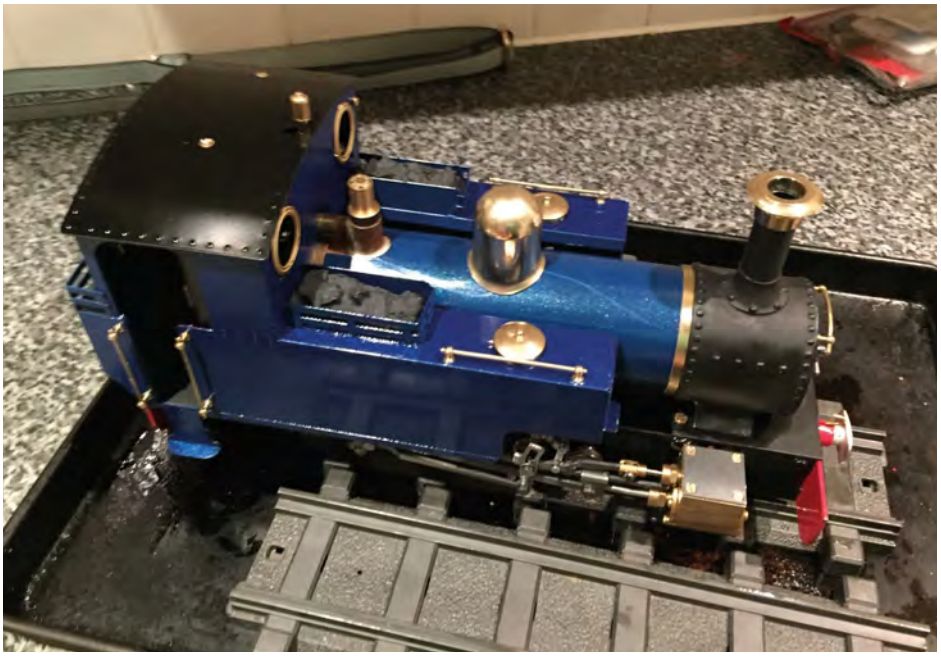
BY **JAKE BLOHM**

This month we have an article by a young member from the Chelmsford Society who was exhibiting at the London Model Engineering Exhibition at Alexandra Palace. Jake Blohm is eleven years old and this is his account of how he came to build his first steam model.

I became interested in steam trains when I was three years old when I started watching Thomas the Tank Engine. This interest has stayed with me and I still go to a lot of train shows and model clubs. I had a wooden train set I remember playing with a lot before I got an electric train set which I would also play a lot – building lots of different tracks.

When I was six years old I got a Hornby train set that I still use today. I bought a 1 out of 1000 Spencer train that I am lucky to have. I have taken apart a lot of things to find out how they work. This includes two desktop fans and two desktop computers. I had a lot of fun taking these things apart and, with the bits I had collected, I built a robot that had a spinning head that could store items in it. I was five years old when I built this and when I was seven years old I also built a go-kart. I also have a Lego Mindstorm that allows me to build a lot of different things. My current project is a car which I can control with my iPad.

About two years ago I started making a tank control RC car, but when I went to Maplin's for advice they told me to go to Chelmsford Society of Model Engineers (CMSE), so we went and decided to join to get some help and advice. Having seen the steam engines at the club I wanted to buy one for myself. I was going to get an electric engine, but when I went to one of the CMSE's open days and saw a G-scale steam locomotive I decided to get a steam locomotive instead, with a recommendation that I should look at Roundhouse and when I did I saw the Lady Anne and bought it.



ABOVE
Jake's locomotive *Lady Anne*.

BELOW LEFT
The Go-Kart built when Jake was seven years old.

BELOW
Jake with *Lady Anne* trying it out on the track.

Building my steam engine I got stuck on putting star washers on, so we went to the club and they helped me a lot and taught me tricks that helped me so I could continue building. I have learned a lot from building the steam engine and was very excited to run it for the first time when it started to steam up. I could not wait to show the club. I went to the club to run it on the track and it worked perfectly, although it did not work on the points. The good news is that they are going to make a G-gauge track layout that my engine can run on and I can show people my locomotive running every time I go.

When they asked me to bring it to Alexandra Palace for the Model Engineering show, I said yes and gave it to them for exhibition. The next time I saw it was on the stand and I was so happy to see it on display, then I got asked to put these notes in the magazine. I could not be happier.

I hope you enjoyed Jake's account of building his first locomotive. ■

JULY DIARY

1 Bridgend MR. Public running at Parc Slip Nature Reserve noon – 16:00.

1 City of Newport MES. Public running at Glebelands 13:00 – 17:00. NP19 7HF.

1 Crowborough Light Railway. Public running 14:00 – 17:00 every Saturday. TN6 2TN.

1 Ickenham & District MES. Public running noon – 17:30.

1 North Wilts MES. Public running at Coate Water Park 11:00 – 17:00.

1 Nottingham SMEE 3½" Gauge Rally at Ruddington. Contact club direct for more information.

1 Romford MEC. Public running at Ardleigh House from 14:00. RM11 2LL.

1 Burnley & Pendle MR. Public running Thompson Park noon – 16:00 every Saturday/Sunday.

1/2 East Herts MR. Public running Van Hague Garden Centre 11:00 – 17:00.

1/2 Guildford MES. Annual Rally and Exhibition at Stoke Park 10:00 – 17:00 each day.

1/2 Merthyr Tydfil DMES. Public running in Carfarthfa Park noon – 17:00.

1/2 Model Engineering Soc. of Northern Ireland. Public running Ulster Folk Museum 14:00 – 17:00.

1/2 South Downs Railway. Public running from noon Pulborough Garden Centre.

1/2 Sussex MLS. Public running at Beechurst 14:00 – 17:00 every Sunday.

2 Ashmanhaugh LR. Open Day Public running 14:00 – 17:00.

2 Basingstoke MES. Public running at Viables Craft Centre 11:00 – 16:00.

2 Carlisle MES. Public running 14:00 – 16:30. CA2 4PS.

2 Chelmsford MR. Public running at Meteor Way 14:00 – 16:30.

2 Chingford MEC. Public running at Ridgeway Park 14:00 – 17:30.

2 City of Oxford SME. Public running at Cutteslowe Park 13:00 – 17:00.

2 Coventry MES. Public running at Ryton Pools MR 13:00 – 16:00 every Sunday.

2 Crawley MES. Public running at Goffs Park LR 14:00 – 17:00.

2 Esk Valley MES. Vogrie Park Railway 14:00 – 17:00 every Sunday.

2 Frimley Lodge MR. Public running 11:00 – 17:00 Sturt Road.

2 Fylde SME. Public running at Marshmills MR Thornton Cleveleys 13:30 – 16:00.0

2 Doncaster MES. Thorne Park Railway public running 10:00 – 16:00.

2 Gravesend MMES. Public running in North Kent 14:00 – 17:00 every Sunday.

2 Grimsby and Cleethorpes MES. Public running at Waltham Mill noon – 16:00 every Sunday.

2 Halesworth DMES. Steam Up at Reydon nr Southwold.

2 Harrow & Wembley SME. Public running at Roxbourne Railway 14:30 – 17:00 every Sunday.

2 Lancaster & Morecombe MES. Open Day at Cinderbarrow 10:30 – 15:45.

2 Leicester SME. Public running at Abbey Park 13:00 – 17:00 every Sunday. LE4 5AQ.

2 Malden DSME. Public running at Thames Ditton Railway 14:00 – 17:30.

2 Mid Cheshire MES. Public running at Sandiway Wood noon – 16:00. CW8 2EB.

2 Mold MES. Public running at Celyn Wood Northop 11:00 – 15:00.

2 Moorlands Railway Charity Open Day. Public running 14:00 – 17:00 between Scarborough and Whitby.

2 North London SME. Public running at Colney Heath 14:00 – 17:00.

2 North Staffs MES. Public running Brampton Park 14:30 – 16:30 every Sunday.

2 Northampton SME. Public running in Delapre Park 14:00 – 17:00.

2 Nottingham SME. Public running at Ruddington 11:00 – 16:00 every Sunday.

2 Polegate MES. Public running at Polegate Oaks 14:00 – 17:00 every Sunday. BN26 5AY.

2 Portsmouth MES. Public running Bransbury Park 14:00 – 17:00 every Sunday.

2 Plymouth MS. Public running in Goodwin Park 14:00 – 16:30.

2 Rochdale SME. Public running Springfield Park noon every Sunday.

2 Ryedale SME. Public running at Gilling 12:30 – 16:30.

2 Sale Area MES. Public running at Walton Park noon – 16:00. M33 4AQ.

2 Southampton SME. Public running at Riverside Park 13:00 – 16:00. SO18 1PQ.

2 Southport MES. Public running at Victoria Park 11:30 – 16:30.

2 Sutton Coldfield MEC. Public running at Little Hay 10:00 onwards.

2 Taunton SME. Public running at Vivary Park 14:00 – 17:00.

2 Teesside SMGR. Public running in Preston Park 12:30 – 16:00.

2 Welling DMES. Public running at Falconwood. 14.00 – 17:00.

2 West Riding SMLS. Public running at Tingley 13:30 – 16:30 most Sundays.

2 West Cumbria Guild of ME's. Public running at Curwen Park 13:30 – 15:30.

2 West Huntspill SME. Public running at New Road 14:00 – 16:30 every Sunday. TA9 3QE.

2 West Wilts SME. Club Track Day White Horse Country Park 10:00 – 16:00.

2 Wirral MES. Public running at Royden Park 13:00 – 16:00 most Sundays.

4 Bromsgrove SME. Public running at Avoncroft Museum 11:30 – 15:00.

7 Rochdale SME. Annual Models Night 19:00 – 21:00 Springfield Park.

7/8/9 Hereford SME Summer Steam Up and Boating Gala. Public running on Sunday noon – 16:30.

7/8/9 IMLEC at Southport SME. Contact club direct for more information.

8 Brighton & Hove MR. Public running at Hove Park 14:00 – 17:00.

8 Millerbeck Light Railway. Princesses and Heros Day. Dress to impress.

8 National 2½" Gauge Rally at North West Leicester MES. Coalville 11:00 – 16:30.

8 Westland & Yeovil DMES. Public running at Westland Leisure Complex 11:00 – 16:30.

8/9 Avonvale MES. Public running at Dunnington 11:00 – 16:00.

8/9 Cheshire Steam Fair Daresbury Warrington from 10:00 each day. WA4 4AG.

8/9 North Wilts MES. Charity Weekend at Coate Water Park 11:00 – 17:00.

8/9 Rugby MES. Narrow Gauge Event at Rainsbrook Valley Railway 10:00 – 17:00.

8/9 Stourport Vintage Steam Rally at Coney Green Farm 10:00 – 17:00 each day. DY13 0TE.

9 Bedford SME. Public running at Summerfields Railway 10:30 – 16:00.

9 Brighouse & Halifax MR Open Day. Public running Ravensprings Park 13:30 – 17:00.

9 Bristol SME. Public running at Ashton Court noon – 17:00.

9 Cambridge MES. Public running Fulbrooke Road 13:30 – 17:30.

9 Cheltenham SME. Public running at Hatherley Lane 14:00 – 17:00.

9 Coventry MES. Steam Special at Ryton Pools MR 13:00 – 16:00.

9 Harlington LS. Public running at High Street 14:00 – 17:00.

9 Leeds SMEE. Public running at Eggborough from 10:00.

9 Lincoln DMES. Running Day at North Scarle from 08:45.

9 Milton Keynes MES Traction Engine Rally at Caldicotte MR Lakeside Grove, MK7 8HP.

9 Sutton MEC. Sunday Track Day from noon.

9 Valley Road MES. Public running at Floralands Farm Park from noon.

9 Worthing DMES. Public running at Field Place 14:00 – 17:00

9 Wolverhampton DMES. Public running at Baggeridge Park 13:00 – 17:00 every Sunday.

14/15/16 The Weeting Rally at Fengate Farm, Weeting 10:00 – 17:00 each day. IP27 0QF.

14/16 Echills Wood Railway Standard Gauge and Diesel Weekend. Public running on Sunday.

15 Leyland SME. LMS Themed Day. Contact the club direct for more information.

16 Chichester SME. Public running at Blackberry Lane 14:00 – 17:00.

16 Huddersfield MES. Public running at Greenhead Park 11:00 – 16:00.

16 Northolt MRC. Public running at Northolt Village Community Centre 14:00 – 17:00.

16 Pinewood (Wokingham) MR. Public running 13:30 – 16:00.

16 Worcester DMES. Public running at Diglis 14:20 – 16:30.

21/22 Frimley Lodge Open Weekend noon – 16:00. Limited public running with visiting locomotives.

22/23 South Downs Light Railway. Teddy Bears Picnic 11:00 – 15:30.

22/23 Stafford DMES. Public running at Stafford County Showground from noon.

22 OLCO Lions Meet at Leyland SME. All things Titfield Thunderbolt, from 10:00.

22 Warship Day public running at Picnic Field Railway, Audley End, Essex 10:00 – 17:00.

23 Bradford SME. Diesel Day at Northcliffe 10:00 – 17:00.

23 Cardiff MES. Public running at Heath Park 13:00 – 17:00.

23 South Durham MES. Portable track at Head of Steam, Darlington Railway Museum 10:00 – 16:00.

23 Taunton SME. Public running at Creech St Michael 14:00 – 17:00.

25 East Somerset SMEE. New Wine Festival running.

28 Chesterfield MES. Public running at Hady 11:00 – 15:00.

29/30 Kinver MES 55th Anniversary Weekend 14:00 – 16:30.

29 Evergreens MR Open Day. Public running 10:30 – 16:00 at Stickney.

30 Doncaster MES. Thorne Park Railway Summer Festival 10:00 – 16:00.

30 High Wycombe MES. Public running at Holmer Green 11:00 – 17:00.

30 Phoenix MES. Public running at Telford Steam Railway 11:00 – 16:00.

30 Scottish Model Engineering Trust. Public running at Wester Pickston Railway from noon.

Details for inclusion in this diary must be received at least EIGHT weeks prior to publication. Please ensure that full information is given, including the full address of where every event is being held. Whilst every possible care is taken in compiling this diary, we cannot accept responsibility for any errors or omissions.

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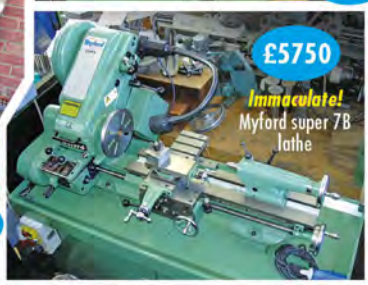

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