

THE ORIGINAL MAGAZINE FOR MODEL ENGINEERS

Vol. 222 No. 4603 • 4 - 17 January 2019

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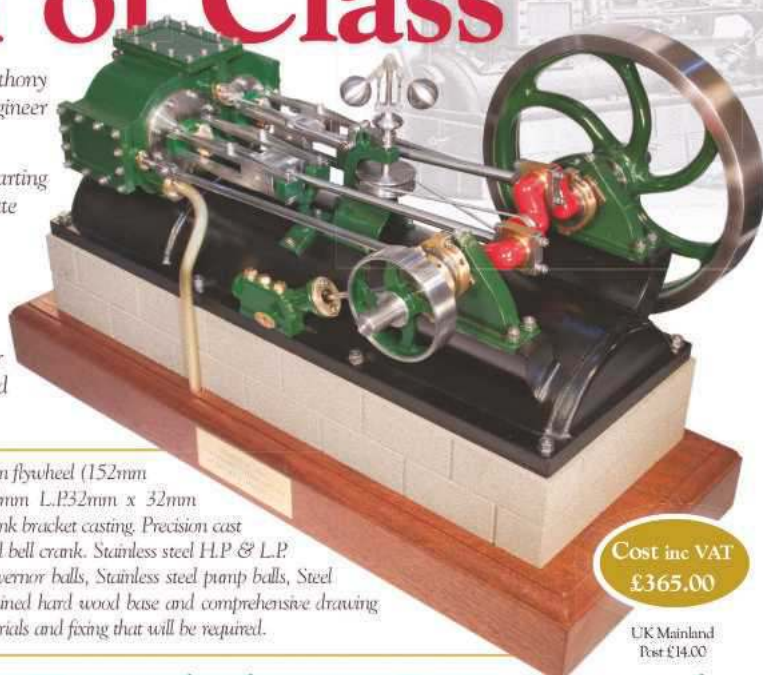
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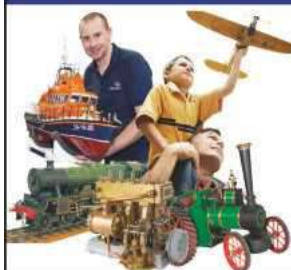


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Mystery Turbine

The mystery turbine has been identified! Mr Keith Vayro contacted me to tell me that he remembers reading about this turbine in *Model Engineer* over 60 years ago. Subsequently, I've managed to track down the article describing the engine, which appears on p.848, M.E.2925 (vol. 116), 13th

June 1957. The turbine was described, complete with drawings of the key components, by Mr R. H. Mapplebeck and was intended to drive a model power boat with a 48 inch hull. The article includes a photograph of the entire steam plant. The turbine runs at speeds up to 150,000rpm and generates a power output of 0.11bhp (about 80W). The turbine is designed on the De Laval principle (see Mike Tilby's articles for more details) and runs on steam at 200psi.

The main photograph in the previous *Smoke Rings* shows the turbine with the gearbox on the left. The main drive shaft emerges from the right of the gearbox and the right-angled shaft emerging from the front drove a feed pump, missing from the picture, the mounting for which is at the bottom left.

Many thanks to Mr Vayro for solving this mystery!

What's in Store

Now we are into the new year and let us hope that it is a happy and productive year for all of us. Perhaps it is time for the editor to whip out his crystal ball and look ahead at what's to come.

Martin Evans can be contacted on the mobile number or email below and would be delighted to receive your contributions, in the form of items of correspondence, comment or articles.
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As you will observe, in this issue we are starting a new series on the construction of the well-known ME Beam Engine. This engine was first described in *Model Engineer* over 100 years ago by George Gentry and then again, to 1½ inch scale, in 1960. Starting in the current issue, David Haythornthwaite describes a modern approach to the manufacture of this engine to 1 inch scale.

LBSC's *Pansy* has been a favourite of builders since he described it back in the late fifties. However, it is perhaps not incapable of improvement and Doug Hewson will be setting out from the next issue to do just that. Like many of its contemporaries, *Pansy* was a good impression of its prototype, in this case a GWR Pannier Tank, rather than an accurate miniature. Half a century on, modern techniques allow us, for much the same degree of effort, to create much more authentic miniature versions of the prototype and this is what

Doug is setting out to do. The result is an improvement in both the appearance and the performance of the original. As it happens, I am at an advanced stage of the build of a GWR Pannier so I shall be following Doug's articles with great interest. Unfortunately, it is perhaps too late for me to incorporate many of Doug's improvements (although I have included some of my own) but I shall be keen to see what further improvements I can include even at this late stage.

Vertical Boiler

You may like to know that your over-worked editor has nevertheless found time to build the ME Vertical Boiler currently being presented in our series by Martin Gearing. I saw the metal pack at the Midlands Show and made an impulse purchase, thinking that a small boiler might be quite a handy thing to have around. So far, I have completed the boiler itself (see picture) and I'm currently working on the fittings. I have to admit to being a little lazy and sending the firebox off to be laser cut – too many holes! I found some very nice oak strip in B&Q which I will use for the lagging.

When the boiler is finished, I will pair it up with a Stuart 10V engine that I made 30 years ago and which, so far, has only ever been run on compressed air.

I will keep you informed of progress!

Club secretaries

Many club secretaries have sent me details of their coming year's events for inclusion in our diary page. Many, though, have not. If you would like your events to be publicised, please let me have the information and I will add it to the 'master diary' for publication in due course. Make it your new year's resolution!



MARTIN
EVANS
Editor



DIANE
CARNEY
Assistant
Editor



YVETTE
GREEN
Designer

Building the *Model Engineer* Beam Engine PART 1

David Haythornthwaite

writes a series on how he built the M.E. Beam Engine. This is an old favourite and construction of this engine to 1½ inch scale was serialised in *Model Engineer* back in 1960. Times, methods and equipment have now moved on and the series describes how to build this magnificent engine in 1 inch scale from available castings.



The finished engine - front view.

Background

When I recently retired from work I was looking for a suitable project to occupy me in the workshop on those rainy days in Lancashire. I have a bad habit of using the workshop to create bigger and better tools rather than model engineering and I was looking for something with lots of challenging parts to make that would look pretty on display when completed. I finally narrowed the choice to either a Stuart triple expansion marine engine, a Southworth mill engine with Corliss valve gear or a largish beam engine.

The triple expansion engine was tempting but the finished item would not be able to run on compressed air and would involve boiler making in order to test and run it. In my youth I ran a full size twin cylinder compound mill engine with Corliss valves and one of the

engine kits from Southworth Engines looked an attractive proposition. However my lathe is a Myford Super ML7B and the flywheel looked too large to machine in the gap. Southworth were very helpful on the telephone and pointed this out to me whilst stating that someone had managed

this on an ML7. I decided not to risk it.

I was left with the possibility of a beam engine and the choice was between the Stuart Major Beam and the M.E. Beam. After much cogitating I settled on the M.E. Beam Engine in 1 inch scale and sent off to A. J. Reeves (ref 1) for the castings. I ordered both the plans and the castings - 28 in all - the spur gears for the final drive and the bevel gears for the governor drive. Reeves describe the castings on their website as 28 castings but give no details as to what they are. Three weeks later the items arrived in two deliveries as some parts were out of stock and it would appear that the count of 28 castings includes the two bronze balls for the governor. As Reeves did not include a detailed packing list, however, I was



Castings.



Baseboard frame.

never able to know whether my two deliveries of parts were correct. **Photograph 2** illustrates the castings as delivered and, to give an idea of scale, the flywheel is 9¼ inches diameter (235mm).

The quality of the castings was variable. Most were very fine but some severely rusty as can be seen in the photograph. This was not a problem but the aluminium bedplate was rough and was not straight. Also, the pillar casting had a blow hole in its surface. Reeves immediately agreed to replace these and the replacements were superb.

The plans came on four large sheets roughly 36 x 48 inches and as I found these much too unwieldy to use in the workshop, my first task was to scan them into groups of parts that could be printed out onto A4 paper. I also find it difficult to keep reading plans in imperial fractions. (Hands up all those who still use a fractional steel rule for measuring!) I use digital or decimal scales for everything nowadays so my second task was to convert all fractional dimensions to decimal.

Making a start on the baseboard

As the beam engine has almost half of the flywheel 'below ground' it is necessary to build some type of baseboard to support the engine. The plans show a wooden box construction 3⅝ inches deep and made without the use of any joints or mitres.

Quadrant beading is added at the top to give an ovolo moulding effect into which the top fits. Other builders on the Internet have gone for a realistic engine house look featuring 'stone' block walls and floor. I decided to take a middle of the road approach, improving the baseboard box by mitring the corners, making it out of hardwood and rebating the top of the sides of the box so that the top – i.e. the 'engine house floor' – fits snugly into the box sides. I also decided to cover the top of the box with something other than wood to give a more authentic look to the engine and its environment. This matter is very subjective.

It is unusual for a steam engine project to start with woodwork but this is where

we must start unless you wish to mock up a temporary, raised board on which to support the project whilst building. I bought a 50 inch length of hardwood from the local timber yard (an off-cut) to make the frame. The plan stipulates 3⅝ x ¾ inch timber and when planed up, mine was somewhere near. As I do not have a mitre saw, I borrowed one and set it to a 45 degree cut in the vertical plane and 90 degree cut in the horizontal plane. I then cut two pieces 17 inches long and two pieces 8⅜ inches long, both measured over the outside of the mitred ends. This takes some judging with chop saws but practise on a scrap piece first to see exactly the dimensions that you get. The result is four pieces of wood that will clamp together to make a box 17 x 8⅜ inches. I later wished, however, that I had made the baseboard ½ inch wider to facilitate fitting the final drive bearing.

Decide what finished thickness you are going to make the top and cut a rebate along the top of each side piece with a router or milling machine. The rebate should be roughly half the thickness of the side timbers and should drop down from the top edge of these, just enough to allow the proposed top to sit flush inside the rebates. Once the

rebates are completed and sanded, roughly assemble by hand to ascertain exactly how big the top needs to be to sit neatly inside the rebated sides.

Cut your rectangular top – which in my case is 7⅝ x 16½ inches (see my reference above to the size of this item) and this will be used as a template to ensure that the box sides are square whilst gluing together. I also cut a piece of board to fit snugly into the bottom of the box, i.e. into the non rebated section, and then glued the whole thing together with the top and bottom in place to keep everything square and to stop the mitres sliding inwards when cramped tightly. I used a box or frame clamp to do this, although string and slip knots would be equally effective providing the corners were protected. The mitres are quite delicate at the ends. I would recommend waterproof (exterior) PVA glue for this. Make sure that you do not glue the top and bottom into the construction and I moved both these components slightly whilst the glue was just setting to ensure that they remained loose. When the glue is completely dry, remove the top and bottom and glue fillets of wood into the inside corners for strengthening. The result should look similar to **photo 3** and you can see the frame

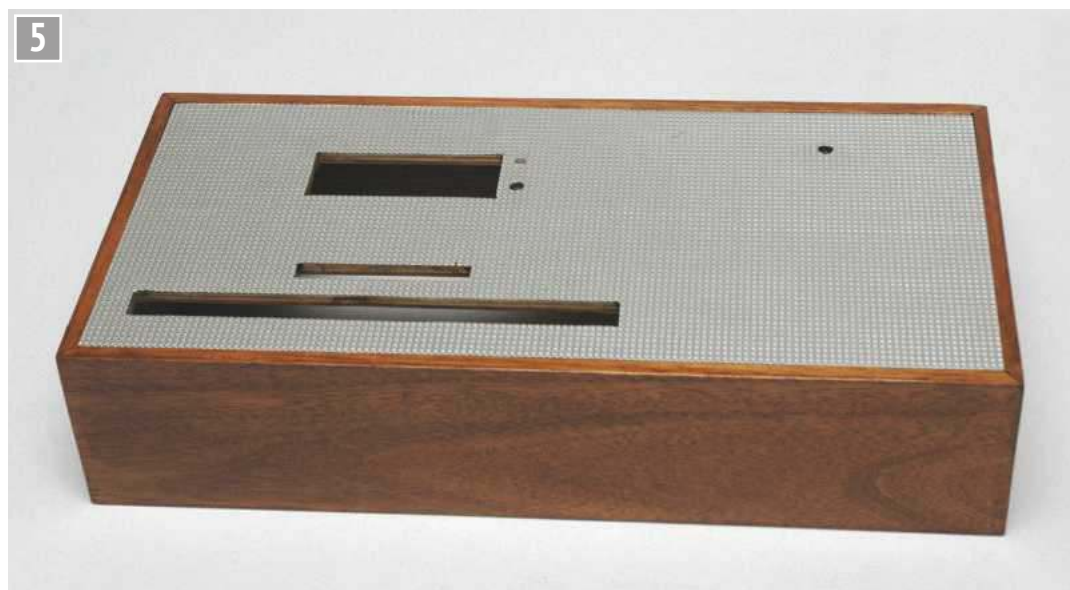


Baseboard parts.

clamp still in position.

If you are going to use a textured surface for the engine house floor, then this needs to be laminated to the top at this stage. I searched hard for something suitable and eventually settled on some 'diamond point' aluminium sheet from B&Q. This is too bright for my liking and I shall probably reduce the shine with wire wool, but it was the best I could find and certainly looks more authentic than polished wood. Various people, including Southworth engines, sell scale chequer plate but this seems to be only sold in narrow strips, probably accurate scale to the full size but I did not fancy building up the top in this way. I cut the thin aluminium sheet for my top with a sharp craft knife and steel rule. I applied contact adhesive on both aluminium sheet and wooden top and then placed the aluminium onto the wooden top whilst it was sat in the frame rebate in order to locate the laminated sheet accurately.

Mark out the cut-outs in the top from the dimensions given in the plan, bearing in mind that the dimensions are given from the outside of the box. Your top will be smaller than the box, so either adjust the dimensions or do your marking out with the lid placed in the box frame. I stuck 2 inch masking tape to the top in order to mark out and cut the openings. I removed the lid and cut the openings by drilling the corners of the rectangles



Finished baseboard.

with a fine drill then used a scroll saw to cut through both the aluminium and the wood. If you have used a textured finish on the top it is important to start all holes with a fine centre drill to stop the drill from wandering.

Finally, sand the frame with fine sand paper and give three or four coats of good quality exterior varnish. If you are to use this engine under steam, you do not want to use an interior varnish as the water and oil will destroy the finish. I wanted to darken the wood, so I used two coats of medium oak varnish which colours the finish and then finished off with two coats of clear varnish, giving a very light rub with 400 grade wet and dry (used dry) between coats to remove any dust. The finished baseboard is shown in **photo 5** although

only the major openings have been cut at this stage. I felt it best to spot the holes for the aluminium engine baseplate and the bearing pedestal after these items had been made to ensure that everything lined up correctly. Leave the top loose for now to facilitate any future work on it. It may also be a good idea to provide two simple supporting blocks for the bench so that the top can be placed on these in the workshop without marking your carefully finished base.

Engine bedplate

This item is cast in aluminium and is over 13 inches (330mm) long, so you really do need to have access to a milling machine rather than machining this on the vertical slide of a lathe. The original casting, as mentioned above, was rough in the extreme and would have required every mm to be either filed or milled to shape – which was a daunting task, especially the oval moulding on the top of the bedplate. It was immediately replaced by Reeves and the replacement was a completely different story; cleanly cast so that most parts could be finished for painting with nothing more than emery paper. Certain faces, however, do need to be machined in order to bring them into the correct position relative to each other and the underside needs to be brought

to a completely flat base.

I first mounted the bedplate, upside down, on small parallels, on the milling table, ensuring that the parallels were all on parts which were meant to be the same height and that the parallels were not fouling any of the raised areas on the bedplate or the bearing mountings. Checking the heights showed that I was going to need to take about 0.5mm off the highest parts in order to get it absolutely flat and the whole bedplate was skimmed with an end mill. Do ensure that you skim the cross members and also ensure that your mounting method does not distort the bedplate, otherwise, of course, it will not be flat when released.

Photograph 6 shows the milling process and you will see that the plate is clamped in such a way that the clamping pressure exerted by the bolts is never far away from a support underneath. I would have liked to have squared up the sides at the same setting but it proved almost impossible to line the moulded edge on the under side of the plate (actually the top) to ensure that the edges were made parallel to the overall layout of the bedplate. I decided that this was best left to be done from the actual top side, when visibility would be better.

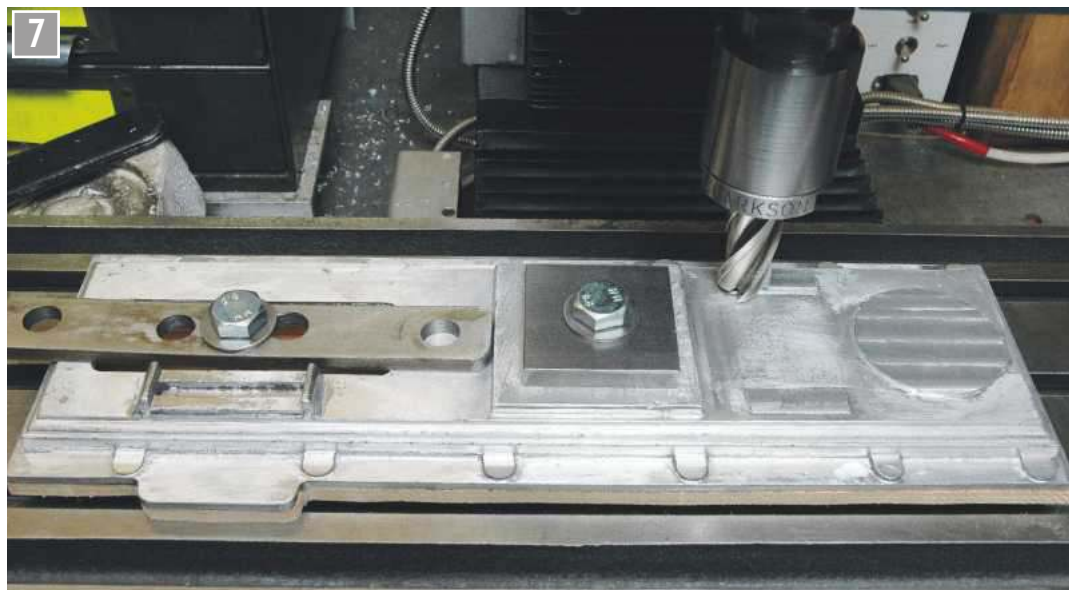
Turning the bedplate over, I smoothed off the flat areas



Bedplate underside.

with some wet and dry paper on a flat block. There were some slight bits of flash to be dressed off with a file and I decided to smooth off the oval moulding a little. I took a smooth, parallel flat file with a safe edge and very carefully ran it along the square edges of the moulding with the file handle removed. One or two strokes was all that was needed and then I wrapped fine emery round the file and finished off in the same way with the emery. Finally I used emery paper round my finger on the curved part of the moulding. Fiddly work but it did improve the finish.

Once the moulding was nice and smooth, I went all over the top of the casting with fine emery round a block and/or sanding with a very fine detail sander (Multimaster) using a fine finger tool. I sanded the entire top of the casting apart from the areas to be milled, i.e. the cylinder bed, column bed, main bearing bed and valve bearing beds. Once I was happy with this I mounted the bedplate on the table of the milling machine but mounted it upon some thin MDF which I first cut to size on the scroll saw. The purpose of the MDF under the bedplate was to enable me to mill the external perimeter of the casting without marking the milling table. The casting was clamped down in such a way as not to distort the casting and was then checked to ensure that it was still parallel to the milling table once bedded onto the MDF. The casting was lined up with the X datum of the machine by running a verdict indicator along the oval moulding. Once I was satisfied that the casting was clamped true, I endeavoured to fix an absolute datum point so that I could carry out all my machining by dead reckoning from the datum point using the DRO on my machine. This did not prove to be too easy. I found the centre of the cylinder facing and then measured the distance to the centre of the column facing and the



Bedplate topside; milling the valve bearing seats.

main bearing facing. Bearing to column should be $4 \frac{19}{32}$ or 4.5938 inches, and the distance between column and cylinder centre should be the same. Unfortunately, whilst the distance between bearing and column was correct, the distance between column and cylinder was too short so I decided to centre drill a small centre at the correct point for the cylinder (not in the centre of the facing) and deal with the consequences later. This datum point was used for milling the bedplate.

First, I went round the bedplate milling the edges with a $\frac{1}{4}$ inch end mill. Then I fitted a $\frac{1}{2}$ inch end mill and zeroed the Z reading of the DRO by touching the end mill onto some Rislra paper placed onto the top surface of the bedplate where there was no facing required. It was then easy to mill the cylinder facing and the main bearing facing to a height of $\frac{1}{16}$ or 0.0625 inch and then to mill the valve bearing facings at $\frac{1}{32}$ or 0.033 inch. Finally the centre clamp was removed and the column facing was milled to a reading of $\frac{3}{32}$ or 0.0937 inch.

The only remaining task on the bedplate was to drill the mounting holes for the twelve 5BA bolts to hold the bedplate to the base. First, I took a light skim across all the raised facings with an end mill and then measured the locations



Milling the main bearing face.

relative to my datum point. I decided that the best way was to ignore the dimensions and place the holes by eye in the centre of the pads. I did however note the readings of the DRO whilst doing one side and made the second side an exact match. I also ensured that both sides were exactly the same distance in the Y direction from the datum point that I had established. I had checked that this was reasonable when establishing my datum point. I drilled these with a No. 30 drill as shown on the drawing to take 5BA bolts. It then only remained to spot these through onto the baseboard.

Photograph 7 shows the mounting arrangement whilst milling the valve bearing seats. The clamping arrangements were changed according to the area being milled but always

leaving two clamps in place to ensure that the casting stayed in the same place.

You will see that a different clamping arrangement has been used whilst milling the main bearing facing in **photo 8**. The width of the seating is shown as 2 inches and I used my DRO set on 'Incremental' in order to ensure that this was exactly symmetrical about the bearing datum line of $(4.5938 \text{ inches} \times 2) = 9.1876 \text{ inches}$ from the established datum point under the cylinder.

References

1. www.AJReeves.com

●To be continued.

NEXT TIME

We start work on the flywheel.

Midlands Model Engineering Exhibition 2018

PART 1

- Club Stands and Displays

John Arrowsmith offers a retrospective of the club and display stands at the recent Midlands exhibition.



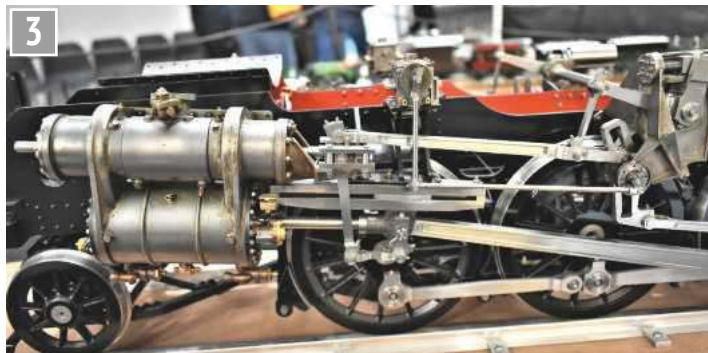
The large scale Avro Lancaster Bomber was a tribute to the RAF's 100th anniversary.

The display classes together with the club and society presentations make up the majority of the exhibition and I hope my notes will give you a flavour of what was there. The event itself was blessed with good weather for the duration which enabled both exhibitors and visitors the opportunity to enjoy the outside activities in pleasant conditions.

On entering the exhibition hall visitors were greeted by the large scale Avro Lancaster bomber provided by the Large Scale Society to commemorate the 100th anniversary of the



The 10 1/4 inch gauge LB&SCR Mogul was part of the 10 1/4 Society display.



The superb motion work on Bob Shepard's BR Class 9F.

RAF. The aircraft was a 1/6th scale replica of aircraft No. W4783 which arrived at RAF Brighton in October 1942 for an Australian Squadron RAAF 460 which was stationed there. It managed to fly 90 operations until retirement in 1944 and the original is now displayed at the War Museum in Canberra. The model itself

has an 18ft wingspan and is powered by four 38cc petrol engines (**photo 1**). In addition to this large aircraft the 10 1/4 Inch Gauge Society displayed an excellent example of an LB&SCR Railway 2-6-0 Mogul locomotive built by Lawson Billinton, a former Chief Engineer on the line, in 1922. Resplendent in the

umber livery of the railway, it attracted a lot of attention (photo 2).

The display classes this year were rather disappointing, with a number having no entries at all, but this was more than made up by the club displays which had some superb examples of quality model engineering on show.

In Class 2, for locomotives up to 3½ inch gauge, David Lee had shown his well made example of an LBSC designed 0-6-0 Mona tank engine still under construction - it will be a good model when completed. In Class 3, for locomotives up to 7¼ inch gauge, the superb chassis of a 9F 2-10-0 locomotive and tender under construction by Bob Shepard really caught the eye with some really first-class motion work and finishes (photo 3). In Class 4, rolling stock in any gauge, the 5 inch gauge model of a narrow gauge slate wagon by Derek Morris was well made and finished (photo 4).

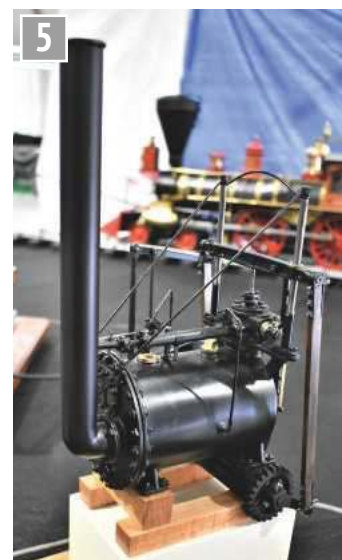
There were three nice entries in Class 5, for stationary engines. Last year's winner of the class, John Mellor, entered his lovely little Lady Stephanie beam engine and Steven Ball's two entries were also interesting models - the Trevithick dredger engine (photo 5) and a little marine steam engine were both well-made and finished. In Class 6, steam road vehicles, Richard Betts showed his under



Derek Morris built this delightful little 5 inch gauge slate wagon for Class 4.



Richard Betts is building this 4 inch scale Garrett traction engine.



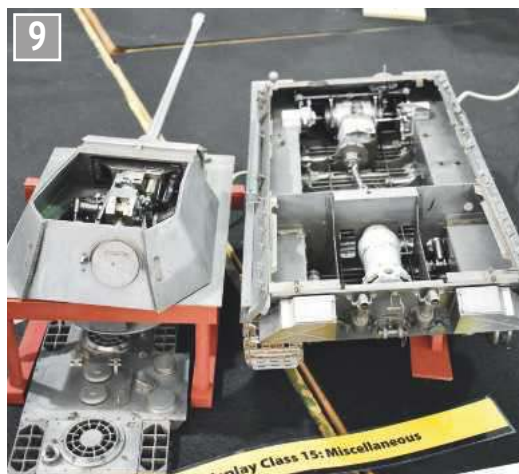
Steven Ball's Trevithick dredger engine.



Geoff Ball's Matador 4 stroke 10cc I/C engine.



The John Moorhouse singing bird in a cage automaton.



Chris Meyer is building this 1/12 scale model of a MK V Panther tank.

construction 4 inch scale Garrett traction engine which looks to be a fine engine in the making (photo 6).

Class 7, for machine tools and workshop equipment, had five entries of which four were produced by Geoff Ball and included a centre finder for use on a milling machine, a Potts milling attachment, a roller filing rest for a Boxford lathe and a top slide drilling spindle and pattern. Steven Ball displayed a sensitive drilling spindle. Unfortunately, I made an error with my camera which I didn't realise



The varied selection on the Erewash Valley display.

had happened until I returned home and of course it was too late then to do anything about it, so my apologies to those two gentlemen.

Class 8, internal combustion engines, had just the one entry from Geoff Ball who showed off his Matador 10cc 4-stroke engine which looked to be a nicely made machine (photo 7). Class 9 was for horological, scientific and automata and John Moorhouse displayed his manually operated caged singing bird, which was an interesting little exhibit (photo 8). There were no entries in classes 10, 11, 12 or 16 but good examples of these classes were presented on various club stands.

Class 14, young engineers, contained two display exhibits which had previously won awards at the show. The six axis robot arm built by Angus French and the 3D Printer built by Ewan Young were excellent examples of what young people can produce. In Class 15, miscellaneous, Chris Meyer displayed his 1/12 scale Panther MK V Tank which had a great deal of fine detail on show (photo 9).

Moving on from the display classes, the club stands were full of quality exhibits covering a very wide range of both models and equipment. The Erewash Valley MES are regular attendees at this exhibition and they had a colourful and interesting display with a good range of exhibits (photo 10). On the Nottingham SME stand



The Polly Trolley for driving 5 inch gauge locomotives on 7 1/4 inch gauge track built by Roy Hollingworth from the Nottingham SME.



A full size steam launch was the centre piece of the Steamboat Association of Great Britain display.

there was a good selection of locomotives including the winner of competition Class 3, the B1 of Alan Gent. A novel way of driving a 5 inch gauge locomotive on a 7 1/4 inch gauge railway was demonstrated by Roy Hollingworth who had built a trolley to take a standard Polly 5 inch gauge locomotive. Using a chain drive from one of the axles onto a specially built 7 1/4 inch gauge truck he could use it on the larger track. It was inspired by a similar system used in the Guinness Brewery in Ireland. This arrangement has pulled three adults up a 1 in 90 gradient (photo 11).

The Coventry MES are heavily involved with the exhibition because, in addition to their well filled and interesting stand, they operate the portable track outside in conjunction with the Polly Owners Group. They also

operate part of the machining activity in the workshop, so well done to them. In another section of the workshop Alan Savelio was busy demonstrating the Myford lathe that he has modified

to use as a CNC machine. If you needed to know how to sharpen or indeed create a four facet drill point Derek Brown was on hand in the workshop demonstrating this useful knack for anyone who wants to improve their skills.

There were some interesting engine displays as part of the Steam Boat Association of Great Britain stand (photo 12) which showed the internal workings of a typical engine used by this group. Part of the Burton on Trent MES stand included a special display in tribute to long standing member Gordon Smith; his unpainted 0-4-0 saddle tank showed some superb workmanship and some wonderful riveting on the tank (photo 13).

●To be continued.



The tribute to Gordon Smith included his last 5 inch gauge saddle tank locomotive - just look at that rivetting.

Sieg SX2 Plus Miller CNC Conversion

PART 6

Graham Sadler explains how he converted his Sieg milling machine to CNC operation.



Continued from p.865
M.E. 4601, 7 December 2018

Fig 16

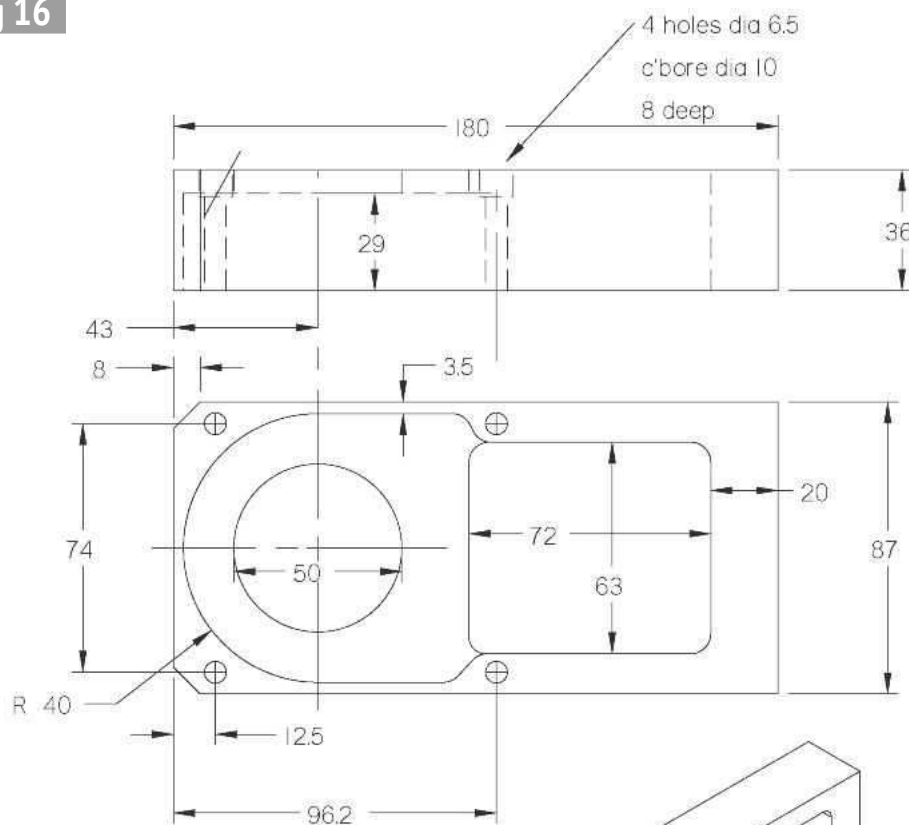
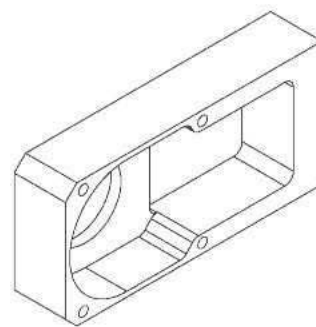


Fig 16 - Motor housing

Matl: Aluminium



Cutting the motor pulley pocket.

New spindle motor mounting

For the new housing (**fig 16**), a large lump of aluminium (actually mine was fabricated by two plates screwed and locktited together- it was in stock!) is needed for the motor mount. An alternative would be a simple base plate with the motor mounted on pillars which are fixed to a slotted plate for belt tension adjustment. However, I don't

like exposed belts. True - a cover on this could be fitted but the prospect of milling the mount from solid seemed great fun - and it was! (Milling in general and especially rotary milling are my favourite machining processes.)

Firstly, machine the outside to size then mount on parallels the right way up on the miller table. Edge finders again provide the coordinates for the counter bored mounting

holes and, for milling the 72 x 63mm hole for the motor clearance hole, cut with a long series slot drill to give a useful piece of 'scrap' (**photo 26**). Ream a small hole on the spindle centre for location upside down on the rotary table (on parallels again) then rotary mill the pocket. This exercise produces massive quantities of swarf (**photo 27**). Finally join the two holes getting as close as you dare to the mounting holes in the 'centre' but don't forget the counter bore pockets. In fact, it was clearance of these fitting bolts which limited the belt angle and thus the choice of both motor pulley diameter and centre position. There would be more scope for change with the simpler mounting outlined above.

The plate on the base of the motor is turned through 180 degrees and the fixing holes are marked on the housing when the belt is fitted and wedged tight. Use the original M6 screws. For an experiment, I used my CAM program to find how long a 12mm diameter cutter would take to produce the pockets - over 12 hours so, here, roughing out on the conventional mill would be a big time saver.

Photograph 28 shows the finished motor mounting (the slotted screws probably won't appear on yours).

Z axis components

The bearing assembly consists of a central core, with a fine pitch screw ring at the bottom (this is reduced in diameter to 29mm in mine as it was originally 30mm diameter and proved difficult to get through the bearing), a thin bearing 30 x 47 x 9mm and two needle thrust races complete with washers 30 x 47 x 4mm. The pulley is mounted below the top flange of the core, secured by four M3 set screws.

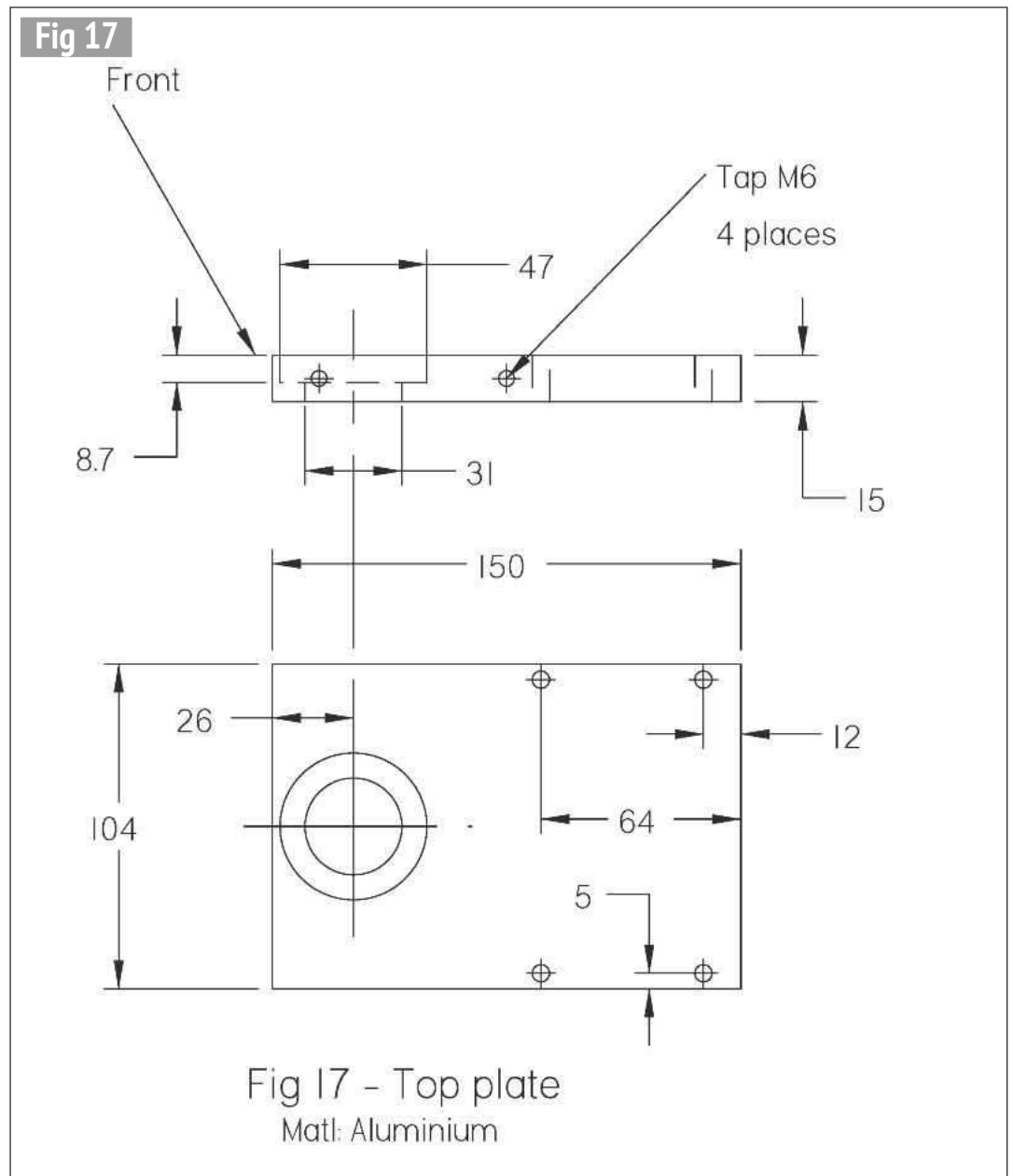
Photograph 29 will make this assembly clear. Note here the oiler for the column and the Y axis thrust assembly. The top mounting plate (**fig 17**) is bored on the faceplate and the depth is such as to leave the



Rotary milling the spindle pulley pocket.



Finished new drive motor carrier.



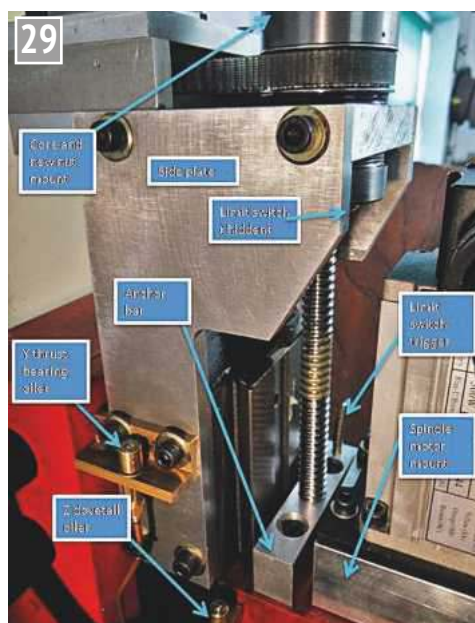
bearing just proud of the top face of the plate.

I had to do this twice. I marked out the plate to my drawings, bored the hole to suit the bearing then discovered I had changed the

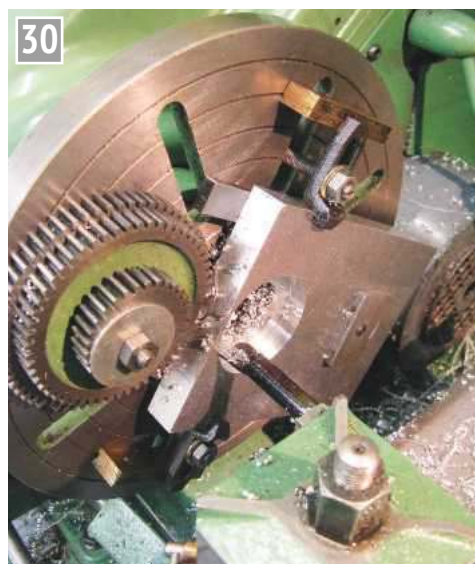
specification for the bearings for a better match to the pulley sizes and forgot to amend the drawings after a three week trip to the Normandy beaches, but it provides a nice hole to get the cables in place - says

he with tongue in cheek and growing nose... (**photo 30**).

The mounting plate is lifted by the side plates (**fig 18**) so it clears the spindle motor housing and an extra 30mm is added to the Z travel, mainly



Z axis arrangement.



Boring the top plate.

Fig 18

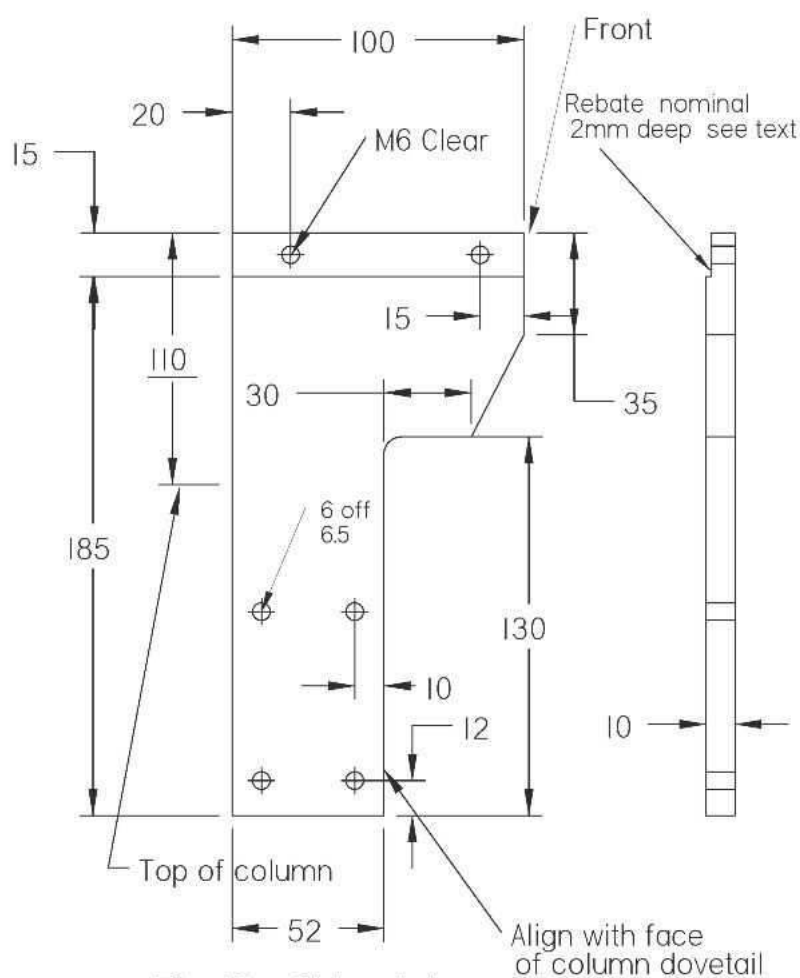


Fig 18 - Side plates

Mat: Aluminium
2 off, right hand drawn

to give better clearance when using drills. With a 10mm drill in the chuck, I have daylight of 185mm. For the nominal 2mm deep rebates cut in the side plates, aim to get these a trace undersized compared to the top plate (0.2 to 0.5mm) and the width of the column (100mm), so the gap between the plates is a smidgen too big. Then, when the mounting bolts are tightened the mounting plate is securely gripped in compression. Don't forget the side plates are handed.

To align the plates, one is clamped precisely in planar alignment, by using a ground parallel for an edge with the edge of the dovetail then the plate was clamped to this, and

also down onto the column. **Photograph 31** makes this clear. The plate should be adjusted to project 110mm

above the column and the holes transferred. The other two plates are fitted and the action is repeated on the other

side. A vertical small rebate may be needed to clear the edge of the head as it slides up the column; mine only needed this on one side due to the manufacturing tolerances. The dimensions of these components may need to be changed as they assume a column width of 100mm.

●To be continued.



Fitting the Z side plate - note the use of a parallel for alignment.

NEXT TIME

We shall complete the mechanical modifications to the machine by adding the Z axis bearing core.

Macclesfield's Paradise Mill and Silk Museum PART 2

Roger Backhouse looks at the silk industry in this Cheshire town.



Continued from p.856
M.E. 4601, 7 December 2018

Flying Shuttle

The flying shuttle was invented in Lancashire by John Kay in 1733 and is now common to most looms. Weft thread is wound on to 'pirns' or 'quills' in the shuttle (photo 15). When the shed is created the weaver pulls a lever operating the picking stick that knocks the shuttle from one side to the other, so weaving another thread in the cloth. The 'sley' comes up behind the weft thread firmly packing the thread into the fabric.

As the weaver operates a treadle, the cylinder rotates to lift the next appropriate healds.

Highly complex patterns including pictures could be woven using a Jacquard loom where sometimes thousands of cards were required for one pattern.

Tape weaving

Machines evolved to deal with specialised types of weaving such as weaving ribbons and narrow tapes. It was a major industry in itself though later rarely used silk (photo 16).



Specialist machine used to weave narrow tapes. It can weave ten at once.



Shuttle with two pirns (sometimes known as quills).

Printing, dyeing and block engraving.

One strength of the museum is the space devoted to dyeing and printing. Silk takes dyes well and the museum covers the basic chemistry and practice of dyeing. Much printing was done by hand using carefully prepared blocks (photo 17) but roller printing was also used. Various techniques were used to cut blocks and machines came in to help the process (photo 18).

Silk maps and pictures

Several examples of finely

printed silk 'escape maps' are displayed in the museum. These were supplied to Allied servicemen during the Second World War (photo 19). Macclesfield firms also made silk parachutes which were used for fighter pilots as the silk version took up less space than nylon 'chutes'.

The local firm of Brocklehurst Whiston Amalgamated developed a line in woven silk pictures starting with a picture of the new Avro York airliner. The Jacquard loom allowed such detailed pictures to be woven even in the Nineteenth Century. This post-war development had several small pictures woven on one sheet. These smaller silk pictures are now attractive collectors' items (photo 20).

Other processes:

• Cord twisting

Cords could be made for such purposes as curtain ropes. The principle was similar to rope making, as can be seen at Chatham Dockyard and Hawes Rope Works in Wensleydale. A cord has several strands twisted together and each strand is twisted in the opposite direction to the



17 Carefully cut blocks used for silk printing by hand. This was highly skilled work.



19 Macclesfield contributed to the Second World War effort. Silk parachutes were used for fighter pilots as they took up less space. Bomber crews had nylon. Many of these escape maps were produced; one was even smuggled into Colditz sewn into a jacket lining.

final cord, thus preventing unravelling (photo 21). Hooks on each small wheel draw out yarn while the other end is attached to a fixed point at the end of a walk. As the large wheel is rotated, the small hooks rotate in the opposite direction. Meanwhile, a second operator places a grooved former between the strands and this is gradually withdrawn as the carriage moves along.

• Embroidery

Silk was much used for

embroidery and when mechanised embroidery developed, the demand for threaded needles outstripped supply from hand threaders. Consequently, the industry developed needle threading machines.

Strength of materials

Like all natural materials, silk can vary in quality. Mills used tensometers to test strength (photo 22). Similar instruments were used in other textile industries.



18 Machine to cut printing blocks.

Decline

The silk industry was cyclical and often threatened by overseas competition. In the 1860's many local weavers emigrated to set up a US silk industry. They went on to campaign for protectionist tariffs, thus accelerating Macclesfield's decline.

Mills tried working with alternative threads such as viscose. A version of artificial silk or 'rayon' was

first invented by Sir Joseph Swan as viscose but it was not produced commercially until 1891, by Hilaire, Comte de Chardonnet. The process most used today was invented by Charles Cross and collaborators in 1894 and used by Courtaulds from 1905.

Viscose was known as 'rayon' from 1926; though lustrous it never had the strength of real silk but



20 One of a range of small woven silk pictures produced by Brocklehurst Whiston. This commemorates the first flight of the Avro York airliner in 1946. There are 516 picks (threads) per inch.

About the museum

Park Lane, Macclesfield, SK11 6TJ.

Parking is available in the street outside. Macclesfield railway station is about half a mile.

Recently opened, Makers Place and Silk Shop is a small shop and cafe facilities on site plus there is a Wetherspoon's pub nearby.

Tours of Paradise Mill, with demonstrations of hand weaving, are highly recommended and are bookable in advance. Whilst the museum is fascinating with several 'hands on' demonstrations, it comes to life with a mill tour as well.

Open Mondays to Saturdays 10am – 4pm.

www.macclesfieldmuseums.co.uk

Tel. 01625 612045

Admission charge applies.

Best value souvenir

Poster of workings of a Jacquard loom. Only £1.50 for a masterpiece of technical illustration.

Other places with engineering interest near Macclesfield

Cheshire and north Staffordshire are rich in engineering and other attractions including:

Quarry Bank Mill

Styal, Wilmslow, SK9 4LA

Working cotton mill with waterwheel, spinning mules and the oldest working Boulton and Watt engine. Also, country

walks and historic village.

www.nationaltrust.org

Tel. 01625 527468

Anson Engine Museum,

Anson Road, Poynton, Cheshire, SK12 1TD

One of the finest collections of stationary engines in Britain, run by dedicated volunteers.

Open April to October; Fridays and Sundays 10am - 4pm.

www.enginemuseum.org

Tel 01625 874426

Avro Heritage Museum,

Woodford Aerodrome, Chester Road, Woodford, Stockport, SK7 1AG

Aircraft and lots more about Avro. Website www.avroheritagemuseum.co.uk

Tel. 01625 877534

Check website or phone for access details as there is major

housing development nearby.

Brindley's Mill and the James Brindley Museum

214 Mill Street, Leek, Staffordshire.

www.brindleysmill.co.uk

Corn mill designed by the great canal engineer.

Restricted opening hours - Easter to end of September;

Sundays and Bank Holidays 2pm - 5pm. July and August

also open Sunday. School summer holidays also open

Wednesdays.

Admission charge.

nevertheless became very popular. Several Macclesfield mills used rayon. The polyester, 'crimplene' was invented in Macclesfield but not generally used in the town.

Hand loom weaving ended at Macclesfield in 1981 when the last weaver at Cartwright and Sheldon's Paradise Mill retired. Fortunately, local people managed to save this mill - a unique survivor - stated to have the largest collection of hand operated Jacquard looms in Europe. Several former silk workers still act as guides. Now only the firm of R.A. Smart operates nearby at Bollington using what is said to be the most up to date machinery.

References

Stan Augarten: *Bit by Bit: An Illustrated History of Computers*. George Allen and Unwin, 1985. For the Jacquard loom and its relation to Babbage's work see this interesting website: Paul E Dunne: <http://cgi.csc.liv.ac.uk/~ped/teachadmin/histsci/htmlform/lect4.html>

Louanne Collins: *Macclesfield Silk Museums - a Look at the Collections*. Macclesfield Museums Trust, 2000.

ME



21 Cord twister for making curtain ropes. Machines also make tassels.



22 Thread tensometer made by James Heal of Halifax. Other textile industries used similar devices to test threads.

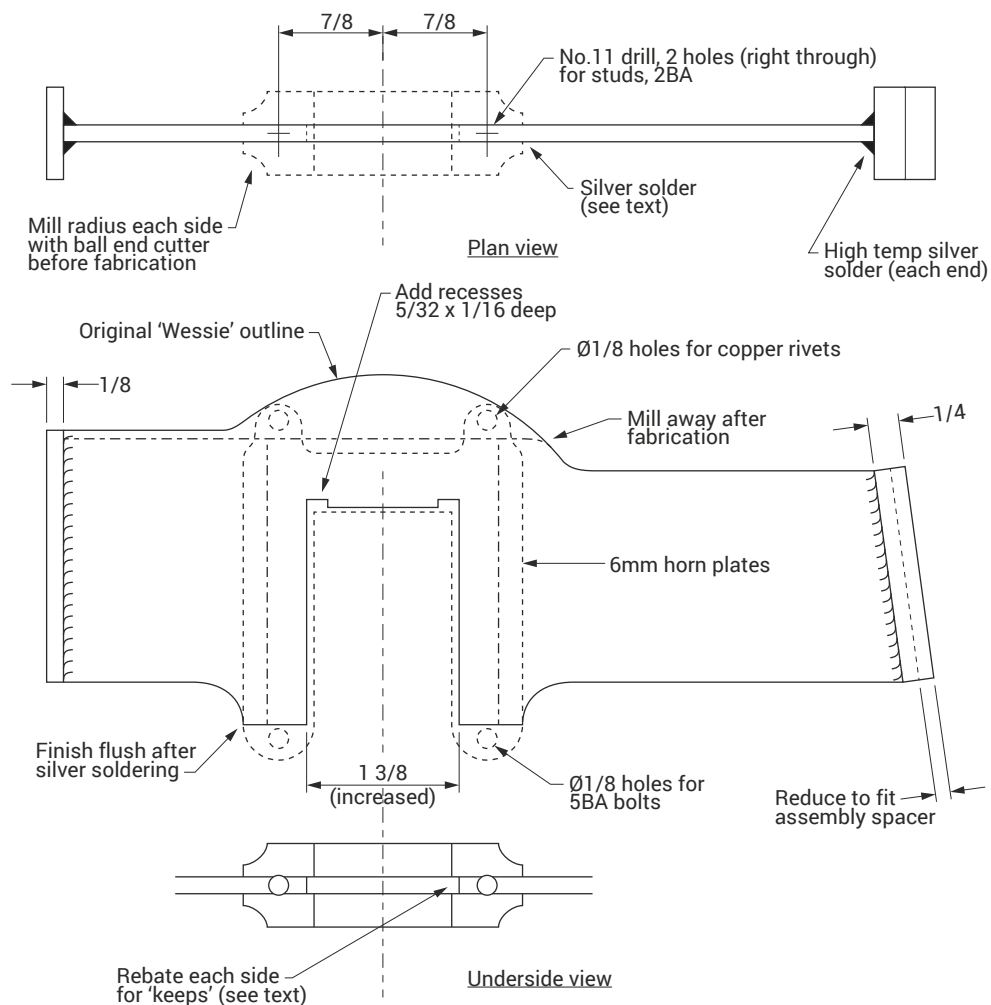
L&NWR 0-8-2T Heavy Shunting Tank Locomotive PART 4

Chris Rayward describes the construction of his 'D' tank locomotive.



Continued from p.851
M.E.4601, 7 December 2018

Fig 3



Development Of Crankshaft Centre Plate
Mat'l: Mild steel fabrication

Fitting the centre crank and yoke shaft bearings

One of the quirks of the L&NWR 0-8-0 series of locomotives was that the crank axle was supported along the axis of the chassis by a major centre bearing assembly between the stay under the boiler and the rear face of the motion plate. This not only stiffened the frame at this point but helped take

the thrust of the pistons when the locomotive was working hard. Latterly, the engines were stripped of this feature when they came under LMS ownership but to be prototypical I wanted to reproduce the original bearing assembly.

Included here is a sketch of the original plate design adopted by Nigel Thompson but from my works drawing

the assembly is more complex than depicted. What I realised at this juncture was that to fit this plate in the chassis, I would probably have to disassemble all the crankshaft parts and offer the new centre plate up from underneath, because the front flange is angled down and forwards. However, I decided to make the front flange very thick to start with to determine the

20



Two views of the new centre plate fabrication; the central slots can just be seen between them but they needed some careful filing in the internal corners to produce a clean channel for the keys.

sizes for the fitment and then it could be milled back and have a filler section added. I also decided that if I made the functional bearing itself less wide than the opening in the centre plate and fit two sliding bearing keeps in from underneath to take up the clearance, I could then fit the plate from the top first; as these two sets of clearances would allow for it to be 'jiffled' into place.

The plate is stiffened with two horn plates to provide the bearing support but I wanted to add the two hefty vertical tie bolts that are shown on my prototype drawing fore

and aft of the bearing itself. I am told the purpose of these was for the adjustment of tapered side slippers for the bearing to be given the assembled running clearance required. This centre bearing was not sprung at all; it just provided local support for the crankshaft in the forwards and backwards direction and so minimised the crankshaft bending under load.

My first task was to fit the original plate between the vertical boiler support stretcher and the motion plate and add the two end flanges with high temperature silver solder (fig 3). This

21



was to ensure they would not be disturbed when the subsequent Easy-flo soldering was carried out. Then, with help from my friend Malcom High, I obtained two steel thickening plates that I could silver solder to the original frame plate, but not before I had made the original opening for the bearing wider; up from 1 1/4 inches by about 1/8 inch. I also added two recesses in the upper corners of the original plate opening to receive small spigots on the steel slippers or 'keeps' that would be inserted later from underneath. These would act as locators and the lower

ends would be held by the shouldered closing keep across the ends held by the tie bolts. It should be possible to see the slots left in between these two plates and these are for locating the spines on the keeps.

It will also be seen that I arranged for some lugs to be added to these extra plates top and bottom, so I could drill them and position them against the central frame for bolts or rivets to hold them whilst silver soldering. To give a touch of realism I also milled down their front and back edges beforehand with a ball end cutter to simulate

22



The plate set up on the lathe top slide to drill the long holes through the fabricated joints.

23



A view from underneath the chassis to show the new assembly in place with slip gauges used to check the clearance between the plate horn cheeks and the centre of the crankshaft. Note that this view also shows the wider anchor links for which thankfully I did not have add an off-set to clear the motion plate. They will have some tube spacers on final assembly.

24



The centre stay was referenced against the lathe chuck face for alignment and the thicker flange was machined down for a 1/8 inch spacer to be added on final assembly.

the prototype appearance (photos 20 and 21).

A word about the preparation for the soldering is important as with such a large area of contact the penetration of

the solder would be restricted if the surfaces were held tightly together. So, I put centre punch marks all over the contact face of the thickening plates and these were just deep enough to

allow flux to be trapped on assembly and the solder to spread down inside (except for a very small area near one corner). The plates were silver soldered in place one at a time and nothing is likely to come apart.

Machining the new assembly was done first by hacksaw and then using a milling cutter top and bottom and the plate outline was designed so the top of the assembly would have the pads for the nuts and washers for the tie bolts. To complete the machining, I set the fabrication up on the lathe tool post and squared it against the chuck jaws to drill the long holes. I also brought the tailstock centre up to the other end of the hole drilling to check its accuracy (photo 22).

The next task was to fit the new plate assembly into the frame and check the clearances between the crankshaft and the sides of the housing using slip gauges (photo 23). The dimensions were taken at two positions of the crankshaft and showed that the centre portion of the shaft was running just 0.002 inch out of truth but I was happy that component clearances would allow for this. Having determined that the stay was the correct length, the larger front flange was set up in the lathe to

mill it down to about half its former thickness (photo 24).

I decided to make the two bearing keeps first and milled some annealed steel flats to leave a narrow key rib down the length. This key is dimensioned to fit into the slot left in the centre bearing housing. The aim was to ensure the keys fitted snugly so the dimensions are not quite the same (photos 25 and 26). The silver solder inevitably left small fillets in the corners of the slots and although I had included a recess at the top to locate the nose of the keep, this had to be chamfered to fit in the space provided.

● To be continued.

25



One of the keeps machined to fit in the slot showing the spigot on one end to locate in the frame plate notch. The second view shows a keep in place in its bearing housing.

26



NEXT TIME

I will describe the making and fitting of the bearing itself and go on to fit the yoke shaft bearing.

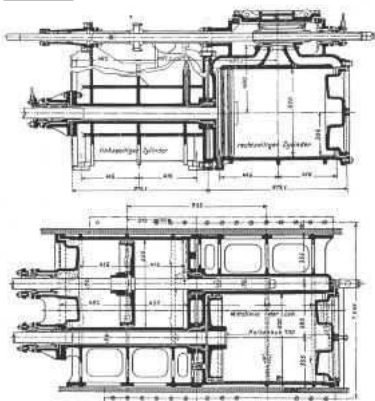
Technologie sans Frontières PART 23

Dr. Ron Fitzgerald looks at English and French locomotive design in the second half of the nineteenth and early years of the twentieth century.

Continued from p.847
M.E.4601, 7 December 2019

'The Nord, the Midi, Paris-Lyons-Mediterranean, the Ouest and the Est have adopted six coupled types... The Baden lines are worked by these engines... It was for these lines, indeed, that I designed the first of the six-coupled types. The Gotthard expresses are worked by four-cylinder compounds of the same type built at Winterthur; Roumania has also ordered some twenty engines of the same general type... The locomotive drawings were made by the Société Alsacienne de Constructions Mécaniques (S.A.C.M.) and the engines were built at their works at Belfort.' Alfred de Glehn to Charles Rous Martin.

105



Cylinder arrangement of the Nord Baltics.

Over 200 Pacifics had been built for French main line railways before the Nord introduced its first Pacific. This would have almost certainly occurred earlier had not du Bousquet decided make an attempt to leap-frog the Pacific by building two 4-6-4s, the infamous *deux orphelines*, so called because they appeared after du Bousquet's death.

According to Van Reimsdijk they were projected to work the *Nord Express*, the French section of a continuous run to Belgium, Germany and Russia (ref 1). The Nord drawing office began work on the designs in 1909 with the intention of producing a machine capable of exceeding the Atlantics power output by 50%, hence the specification called for 2,300 i.h.p. It was to be capable of sustaining 95 km/h up the Survilliers grade with 430 tons trailing and 120 km/h with the same train weight on the level.

Two prototypes were developed, both to 4-6-4. Because of the wheel arrangement and in view of the proposed duty they acquired the tag *Baltic* (photo 104). Both locomotives had the same chassis design with piston valves on the high-pressure cylinders and balanced slide valves on the inside, low-pressure cylinders. At either end of the driving wheels, identical four-wheel bogies carried the considerable over-hang. These bogies, although based upon the established Alsace type, were to a novel design with compound laminated springs outside the frames bearing on isothermos axleboxes.

The bogie design was necessary because of the extremely large, low-pressure cylinders which left no free space between the frames. These had a diameter of 620mm (24.4 inches) for a stroke of 720mm (28.7 inches) and to accommodate them they had to be offset one behind the other,

104



Nord Baltic 3.1101.

the piston rod of the leading cylinder passing alongside the wall of the trailing cylinder (photo 105). The glands were adjacent to each other and symmetrical. The trailing piston was withdrawn via the rear cover and the leading one through the front cover. The arrangement was owed to Dumoulin and whilst ingenious it is questionable whether it was, as van Riemsdijk maintains, *'...eminently practical and straightforward and presented no particular maintenance problems...'* (ref 2).

The boiler of 3.1101 was exceptionally large but relatively conventional. 4.28m² of grate area was carried entirely over the trailing bogie and the top half followed the accepted Belpaire form; the sides below the boiler centreline dropped vertically and as the boiler had a diameter of 1.71m (5 feet 7¼ inches), the total width exceeded the frame width. The barrel contained twenty-seven Schmidt-type superheater elements in 5¼ inch tubes and ninety-seven 2¼ inch tubes with Serve fins for one third of the length towards the smokebox. The smokebox was ten feet long, spanning over the high pressure to the low pressure cylinders. The two locomotives were fitted with auxiliary mechanical stokers, intended to relieve the fireman of part of his work (ref 3).

The boiler of the sister

locomotive, 3.1102, was a radical departure from normal locomotive practice in that a du Temple water tube firebox replaced the conventional pattern of Belpaire box. The development of the water-tube boiler for marine purposes was attracting considerable interest amongst engineers at this period and the French Navy was very active in exploring its potential but problems had arisen with local overheating caused by solid deposits and steam pockets forming.

Sochet, a naval contractor of Cherbourg, had introduced rapid circulation as a cure and du Temple had carried out further work in this direction from 1876. Schneider & Cie ultimately acquired du Temple's patents and began to promote the boiler for land use. The Nord's involvement was almost certainly a product of this promotional effort and from 1904 Schneider began work on a design for an adaptation of the Nord Atlantic to carry a du Temple boiler.

It proved impossible to apply the full water tube boiler to the Atlantic's frames without generating unacceptably heavy axle loadings and a compromise was reached. The firebox formed the water tube part of the boiler whilst the forward end was of the usual Atlantic type with fire tubes. Within the firebox casing the water-tube element consisted of three

drums, a single top drum and two bottom drums forming a delta configuration. The two lower drums were made of cast steel and were shielded from direct heat by refractory bricks. Banks of water tubes, six deep, made up the furnace walls forming a gothic-arch flame chamber at the firehole end.

Towards the front of the firebox they assumed a more sinuous path over a semi-circular flame tunnel, deflecting the hot gases towards the fire tubes in the lower part of the cylindrical barrel. There were 502 water tubes in total. The boiler worked at 18 bar and the wide grate had an area of 3.53m². Two external transfer pipes, one on each side of the boiler, carried water from the front part of the boiler to the lower firebox drums (ref 4).

The locomotive, Nord 2741 (photo 106), was wholly built by Schneider, their works number 2868. It had been intended that it should conform to the other members of the Nord Atlantic 2643-2675 series but first studies made it clear that the rear end weight would be excessive for a single trailing axle. As a result, the chassis was altered and the builder's list shows it leaving the works as a 2B2 (4-4-4) although the Fleury postcard (photo 106) clearly shows a conventional Atlantic wheel arrangement.

It entered service as a 4-4-4 from La Chapelle depot in April 1907 but immediately proved to be excessive in its water consumption, unable to reach the first major stop beyond Paris, Abbeville, 109 miles, without causing major concern

(ref 5). Nor was this the only failing. The water tube firebox had problems; the firebricks protecting the lower drums were inadequate leading to burning of the drums and differential expansion of the upper and lower tube zones when circulation was reduced caused leakage and failure. The direct heat on the lower part of the firetube plate also caused rapid deterioration. After 67,000km the boiler was replaced by Schneider in July 1909.

The new boiler had modified water tubes that replaced the firebrick and a further bank of water tubes was installed in front of the firetube plate to protect the lower area of the barrel. Shown at the Brussels Exhibition in 1910, Vilain says that it had run a further 38,000 satisfactory kilometres by that time. In fact, it continued to give trouble with heavy priming and after its return from the exhibition more tubes were inserted into the hearth zone and in the region of the lower drums.

This nightmarish record might be expected to have deterred du Bousquet from further ventures with water tube boilers but hope triumphed over experience. The two Baltics began to run in 1911, two months after du Bousquet's death. In Reed's words: *'Much of the detailed design and development work was done under du Bousquet's deputy and successor, Georges Asselin, who scarcely appreciated his wards'*.

To this can be added Vuillet's comment (ref 6): *'(Du Bousquet's) successor was not interested in them, nor had time to spare for them ...'*

Reed states that 3.1102 (photo 107) was built by Schneider (ref 7) but there is



Nord Atlantic 2741 with du Temple boiler.

nothing in the works register to indicate that this was so. It was almost certainly the case that the chassis was built at the Nord's La Chapelle works and fitted with a boiler supplied by Schneider et Cie. Compared to 2741, the heating surface was enlarged to 1270 sq. ft and 623 water tubes but it seems to have benefitted little from the experience of the 4-4-4.

Both of the 3.1101 and 3.1102 were massively obese. The Nord's 'strictly enforced' maximum axle loading was relaxed by 6% to 18 tons when the design was being prepared and an estimated weight in working order of 102 and 103 tons was postulated. They emerged from the works at 113 and 115 tons with a less than favourable 49% adhesive weight.

That these proportions endowed the machines with brute strength was not at issue. They proved capable of 2,200 i.h.p. (ref 8) but judged in terms of specific weight they stood badly against the Atlantics at 70 tons showing 1,500 i.h.p., 21.42 horsepower per ton in the Atlantic's favour and 19.13 horsepower per ton for 3.1102.

There were also chronic mechanical problems. Although the steam cross sections were adequate the steam pipes were lengthy and prone to leakage (ref 9). The exhaust arrangements were defective, partially because of the excessive smokebox length and the thirty tons on the bogie axles led to heating. The violent circulation in the water tube part of the firebox

caused heavy water carry-over which even the superheater could not eliminate and the water consumption was as dramatically excessive, as 2741's had been. Most seriously the water tubes frequently ruptured at the point of entry into the bottom drums which were located at grate level (ref 10).

●To be continued.

References

- Ref 1 *The Compound Locomotive*. Van Riemsdijk, op. cit., p.62.
- Ref 2 *The Compound Locomotive*. Van Riemsdijk, op. cit., p.62.
- Ref 3 *La Locomotive à Vapeur*. André Chapelon, op. cit., p.266.
- Ref 4 *Dix Décennies de Locomotives sur le Réseau du Nord (1845-1948)*. L. M. Vilain, Editions Picador Levallois-Perret, 1977, p.82.
- Ref 5 *Loco Profile 13 - Nord Pacifics*. Brian Reed, p.1.
- Ref 6 *Railway Reminiscences of Three Continents*. Baron Gerard Vuillet, Pub. Thomas Nelson and Sons, 1968, p.11.
- Ref 7 *Loco Profile*, op. cit., p.1.
- Ref 8 *La Locomotive à Vapeur*, Chapelon, p. 266 states that on test 3.1101 attained 2,800 i.h.p. but this was by no means characteristic of its normal running performance. The same figure is quoted by Vuillet but 'only for short periods'. 2,200 i.h.p. is Asselin's figure. Vuillet op. cit., p.12.
- Ref 9 *Railway Reminiscences...* Vuillet, op. cit., p.12.
- Ref 10 *La Locomotive à Vapeur*, op cit., p.77.



Nord Baltic with du Temple boiler, 3.1102.

Quarter Scale Bentley BR2 Rotary Aero Engine

PART 8

Mick Knights makes the thrust cover plate and then roughs out the crankshaft.



Continued from p.869
M.E. 4601, 7 December 2018

Next up is the thrust box cover plate, which was a straightforward piece of turning, while the milling proved interesting.

The billet was set in the four jaw, as there was just enough material to be able to turn all the diameters at the one setting, leaving the back to be faced off to finish width. This did however only leave a small area to clamp on. The centre bore is a close fit to the thrust box at 2.625 inches. The quickest option was to trepan the centre out, which leaves a potentially useful core rather than a pile of swarf (**photo 130**). A raised central area with angled sides was turned; this area is where the vanes and pockets that will encourage the flow of the air fuel mixture around the thrust box will be machined. The angles are the finished profile of the vanes (**photo 131**).

The next operation is to pitch out all the hole centres that correspond with the ones on the thrust box rear face. The radial pattern of vanes and pockets are off-set to the centreline of the securing holes in order to present the vanes in the correct orientation in the thrust box (**photo 132**).



Trepanning the centre bore.

Using a conventional milling machine the radial pattern of pockets really presents one option and that is to painstakingly generate each pocket complete before indexing the rotary table to the next position and do it all over again, as the pocket has angled sides with a convex radius at its top and a convex radius at its base and so must be traversed radially, which means mounting on the rotary table. There are eighteen pockets and so eighteen individual machining operations. Now it may not have gone

completely unnoticed that I own a small but versatile CNC milling machine, but I do not, however, have a CAD/CAM capability. There are a couple of reasons for this: firstly I haven't got round to trying to learn how to operate one and secondly, being a G-code man, part of the enjoyment of CNC machining is hand writing difficult programs and successfully executing them. I wouldn't now be without the embedded Wizards in the Mach3 control, or the on screen graphics which were unheard of when I first started to partake in the black art back in the 1980's. I did say in the introduction that I wouldn't bore people with the bones of CNC machining as this has been covered by a few authors now, myself included, but I would explain a couple of simple G-codes that will take the drudgery out of some hand written part programs.

There are no Wizards in the Mach3 control capable of generating the complete pocket program needed for



The raised vane area.



Pitching out the hole pattern.

the thrust box cover plate, apart from the top and bottom arc coordinates, so by using these couple of lines of Wizard program they can be joined by a simple G01 command to create the internal pocket profile, followed by a few area clear moves, which complete the program, so it can be incorporated in a sub routine to take the pocket to depth. All well and good, but how to repeat it eighteen times and at the correct angular position in relationship to the securing hole pattern? Simply add the G68 (Coordinate Rotation) command after calling the sub routine. All that's required is the X and Y coordinates and the angle of rotation, so if the original pocket was programmed with its zero reference point at its position on the PCD of X 64.5, Y 0, then those values will be transposed to X 0, Y 0 when the G68 is called, but there is a letter address required, which in Mach3 is X = A and Y = B, so thus far the line of program will read G68 A0 B0. All that's now required is the angular position in degrees which have the letter address 'R', in this case the first pocket is at 3 o'clock, which is of course zero degrees, so the R value will be 0 (degrees). For the following positions the 'R' value is incrementally increased by 20 degrees in which ever direction is required, i.e. + or -



Running cycle.



End of program and the finished pocket detail.



Creating service stock to carry a centre cone.



Relieving the area around the nose.

Using a Mach3 control the first few lines of the drive program will read:
G00G43H1Z10.0
G00 X64.5 Y0
G68 A0 B0 R0 (call coordinate rotation at values shown)
M98 P1001 (run sub routine)
G68 A0 B0 R20 (call coordinate rotation at +20 degrees)
M98P1001 (run sub routine) while the sub routine will call the pocket at X 64.5, Y 0
O1001
G00 X64.5 Y0

If the program is to perform different operations after the G68 section of the program has been executed, then cancel G68 by calling G69 before calling any other G moves.

This G68 Coordinate rotation can of course be used for multiple drilling operations on a PCD where the angular positions are not equally spaced.

To make sure that the width of the vane was correct, which is dictated by the

coordinates of the pocket wall, the program and the G68 positioning was checked by running a test program on a piece of scrap material. Once satisfied with the program, the first metal was cut and the program left to run its cycle (photo 133). Photograph 134 shows the completed cycle.

There are a few other vital components required at the rear end of the engine, such as the slip ring and locking nut, but I'll look at these towards the end and during the final



Pitching out the centre positions.



Generating a reference diameter between centres.



139 Roughing the radial form on the web.



140 The back centre set in the spindle.



141 Initial lathe set-up.



142 First operation completed, the nose section.

assembly, but now for some fun with the crankshaft!

The initial stages require a great deal of metal to be removed to get the billet somewhere close to the form required before it goes anywhere near the lathe. First operations were to clean up one side and produce a stepped area which will be the underside of the crankshaft nose. With the billet reversed in the vice more metal is removed to create more of the crankshaft's form. The upstanding section shown in **photo 135** is service stock that will carry a centre drilled cone to enable the billet to be milled and turned between centres. Most of the surplus material around the area that will become the cone shaped nose was removed in order to cut down on interrupted cutting when transferred to the lathe (**photo 136**). The dividing head was used as an angle plate to support the billet while the centre positions are pitched out and established by centre drilling. These positions are of course crucial (**photo 137**). The bulk of the remaining



143 Billet set between centres.

material must be removed in order to reduce the amount of centrifugal force that will be produced during the first stages of the turning process. With the billet set between centres on the dividing head a radial reference was generated by rotating the billet using the crank handle. Note the billet is locked in position using a couple of clamps holding against the nose section, as the billet must be secure to avoid the cutter snatching (**photo 138**).

With the reference diameter established, as much material as possible was removed in a series of parallel cuts. These cuts were extended to the end of the billet. To avoid too much interrupted cutting on the lathe the radial form on the top of the crankshaft's web was also roughed out on the mill (**photo 139**).

The billet is now ready to be transferred to the lathe for the initial turning operations. It's important on small lathes to try and reduce the amount

of centrifugal force generated by off-set work pieces; this is usually accomplished by introducing counter weights into the set-up. The correct amount of weight and its positioning is largely found by trial and error. The usual method of driving a work piece set between centres is via a carrier attached to the job which is driven by a drive dog attached to either the drive plate or face plate, depending on the set-up. In this case neither option was realistic, as there wasn't anywhere to attach a standard carrier, so the independent four jaw was set up with a back centre placed in the spindle, which would locate on the centre cone to establish alignment, while the four jaw would provide the clamping (**photo 140**). **Photograph 141** shows the set-up prior to the start of the turning operations. The first operation is to turn the tapered nose section and face the web to the correct distance from the front of the nose. Care needs to be taken whilst facing the web, as when the front section of the crankshaft is finally fitted to the nose both the faces of webs on the rear and front sections form a parallel area in which the master rod bronze bearing has to be snug and runs freely (**photo 142**).

With the nose successfully turned, the crankshaft billet can be returned to the mill where the service stock that carried the centre cone can be removed. Be very sure that the nose is correct as it will be difficult to revisit it on a small lathe once the service stock is removed. The crankshaft can now be returned to the lathe and set between centres ready for the important diameters and threads to be cut (**photo 143**).

● To be continued.

NEXT TIME

We shall tackle the finish machining of the crankshaft.

Lathes and more PART 30 for Beginners

Graham Sadler starts a new project - to make a boring tool kit.



Continued from p.41
M.E. 4602, 21 December 2018

Matters arising

As it's the start of a new year I'll begin by confessing to a couple of errors and clearing up a few areas of possible uncertainty!

Grinding photographs

No matter how many times an article is checked sometimes the gremlins creep in! In photo 122 (p.714, M.E.4599, 9th November) the text is correct but the photo shows a trailing edge being ground at 8 degrees not 10-12 degrees as required from fig 29. In photo 124 (same issue) the 8 degree plate (see part A in fig. 26, p.564, M.E.4597, 12th

October) is added under the tool holder to achieve the 16 degree side rake. In photo 128 (again, same issue) the tools are shown from the bottom not the top meaning tools B and F got switched so photo 131 shows tool B and photo 132 shows tool F, the super rougher at the top of photo 128. My apologies for any confusion this has caused.

Tool post

I had a good look at all the lathes on sale at the Fosse. Most of the Warco lathes have a centre height of about 30mm to the top slide platform. For the tool post, I suggest therefore the extra material can be obtained by increasing the height of the main block by the difference, of about 13 mm. The bottom step will now become about 14mm rather than 6mm. The tool holders can be made from 12 x 25mm rather than 12 X 20mm, the bottom of the slot being increased from 3mm to 8mm. For some holders, if desired, this increase will allow a slot with a shallow angle of about 2 degrees which will make height adjustment easier but the 'in and out' position bonus obtained from the setting jig when switching tools will be lost. Do not be afraid to modify my designs to suit your situation.

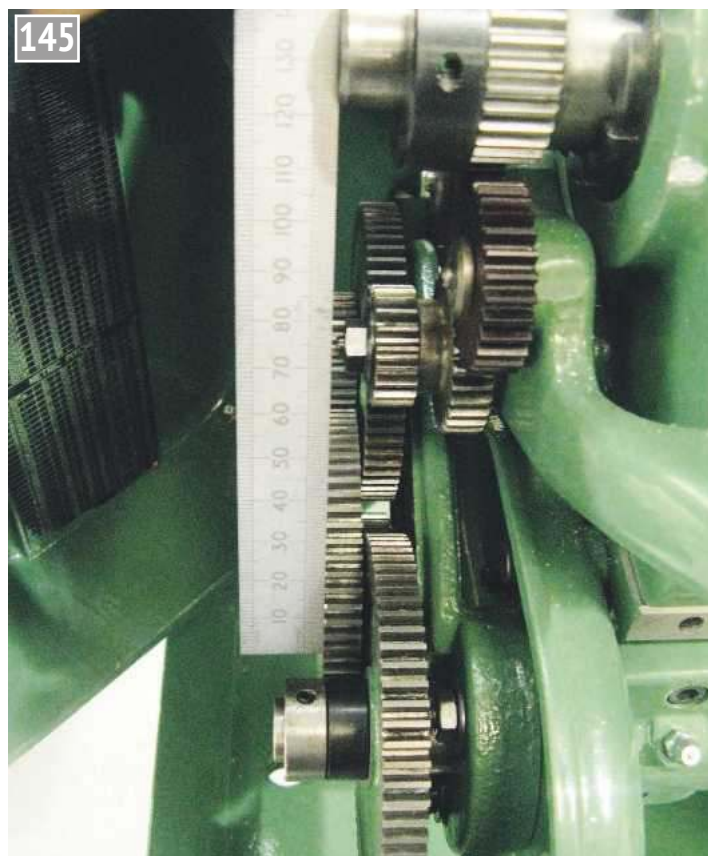
Spindle indexing arm

This in my setup is simply fixed to the end of the gearbox gear with the existing nut. I neglected the non-gearbox machines. For people without a gearbox, proceed this way. Make the gear holder to fit the spindle. The inner face

of the gear on it will be just outside the end of the lead screw (**photo 145**). Remove the collar which retains the lead screw gear. Put a rule on the gear as in the photograph and measure the distance to the face of the gear fitted to the lead screw. Machine a short spacer about the same diameter as the collar, which can be bored to fit the lead screw and faced to this length. Fit a cross grub screw with a soft end then this can be fitted with two screws about M4 and glued (epoxy or Loctite) onto the detent arm which can then have the detent pin fitted.

Dimensions

While all my dimensions have been in metric, which I find so much easier to work with, being less prone to silly arithmetic fraction errors, all the items can be easily made using Imperial dimensions. Just don't mix them up; as without experience, decent measuring equipment and a DRO this will be an extra hurdle for the beginner to overcome. Simply divide the metric sizes by 25 (25.4 if you want to be spot on) and round the result to a convenient figure (but check for any mating parts). If you have been following my exercises you will have easily gained the knowledge of how to do this for yourself. I have used some Imperial dimensions in this series where they just have to be used, e.g. the pockets for the dies in the tailstock holder and the diameter of the Myford top slide post. I have discussed where and why Imperial stock can be better than metric - a 6mm diameter bar looks small compared to ¼ inch but a



Measuring up for the short spacer required for the spindle indexing arm on a Myford lathe without a gearbox.

cheaper M6 bolt fits easily through a ¼ inch slot as we found in the clamping set so using both systems can have its uses. In this next project we will come across this problem again with boring bar diameters.

Boring tool holder

Now we can get back to business.

Up to now we have mainly concentrated on external turning and we now have a good solid means of supporting tools and we can accurately grind them. Now we need to look at equipment for producing holes and improve on the dreadful boring bar we made so long ago!

The original concept and design for this was by George Thomas in the 70's, designed it to fit into his four-way tool post. I made my kit shortly afterwards. It works very well but I have found the design needed minor updating in a few areas. In addition, I had to modify the size and shape of the main block in order for it to fit into my tool post. The principle of the design is that round boring bars are held in an eccentric split sleeve allowing the height of the tool bit to be altered, a feature not needed in piston type or most other commercial tool post designs. If you have one of this type,

then simple steel bar stock of 20 x 16mm for a 12mm boring bar or 20 x 12mm for the rest will suffice.

However, I have found that sensitive adjustments of the Dickson type on my Colchester lathe need several attempts to get a tool to exact centre height due to the clearances built into the cam locking system. One very important feature of the system is that the bar can be extended by just the amount needed to bore the workpiece, thus maintaining maximum rigidity. If you double the length of a bar the deflection is 16 times greater, while a 12mm diameter bar will be about 16 times stiffer than a 6mm bar, clearly showing that the shorter and fatter the bar the better, provided that there is space for egress of the swarf!

So this system has 6, 8, 10 and 12mm (or 13mm see later) bars of a working depth that can be easily adjusted from minimal to about 100mm if you use 150mm bars. The split sleeve itself rotates in a block in the tool post which is also split, allowing a single clamping action for both the bar and the sleeve. GHT made the bore of his to be ½ inch but while this is just about okay for ¾ inch bars, it is not good for 10mm which would make the eccentricity tiny, so this has been increased to 13mm.



The finished boring tool kit. Bars: 10 mm commercial, angled cutter in a 10mm bar, 6mm commercial (we will make some similar in future), special for a groove at the root of a pocket, 8mm for screw-cutting and a short rigid 10mm with a central push rod to clamp the tool.

The adjustment of the sleeves is by a small shouldered pin in holes in the flange of the sleeve. The original diameter of which, at ⅝ inch (16 mm), is just too small. It made the fit of the adjusting pin poor. At the same time, I have added a graduated scale which will allow repeatable adjustment

for rake of the tool. **Photograph 146** shows the holder along with the sleeves and some associated boring bars.

● To be continued.

NEXT TIME

We'll get started on making the tool holder.

ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT IS
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- **Garrett Tractor**
Chris Gunn describes the construction of the canopy for his 6 inch 4CD tractor.
- **City of Stoke**
Robert Hobbs constructs a dummy boiler for his 2½ inch gauge Pacific locomotive.

- **Midlands Show**
John Arrowsmith concludes his tour of the club and display stands at the recent Midlands Model Engineering Exhibition.
- **GWR Pannier Tank**
Doug Hewson begins the description of his new, improved Pannier Tank design.

Content may be subject to change.



ON SALE 18 JANUARY 2019

A Tipper Lorry

Lucas Hall, of the Eastleigh Young Engineers (EYEs), builds the tipper lorry seen at the recent Midlands exhibition.



My name is Lucas Hall, I am eleven years old and I like to make models at the EYEs with Patrick Hendra and I am the youngest young engineer. At school, I have DT for 45 minutes but at school they say that you must do certain projects and they tell us all the measurements. At school, there's nothing electrical but at Patrick's we can choose what we want to make, we can figure out all the measurements by ourselves and we can make our own changes. At Patrick's I also learnt how to scale. We also get 90 minutes at Patrick's. We spray paint the models whereas at school we must paint them by hand - sometimes we don't even paint them at all! Most importantly, Patrick has a great sense of humour but at school everything is a bit serious.

With the EYEs I've also made two other models, both boats; one was a paddle boat and one a speed boat. Each one was based on an old boat and they were given to me by members of the Eastleigh and District Model Boat Club.

Scaling

I sketched out the design of the lorry to get the proportions of the tipper and the cab right. I bought in the wheels and compared them with real car



The wooden chassis of the tipper lorry.

wheels to see what the scale of my lorry would be. The scale of my lorry is 1:8. I then got Patrick to sit on a stool and measured him up to decide what are the heights and the widths of the seats, the shape of the seats, the distances between the driver and the dashboard and the size of the steering wheel and the pedals. I also worked out the sizes of the doors.

Chassis

The chassis is made of wood and supports the whole model as you can see in **photo 1**.

It is made of two boxes and side pieces that carry the electrics and also the motor.

All the electrical cables, battery and receiver are in the chassis and I can turn the lorry on and off.

Guess what? The chassis also supports the springs!! Leaf springs are used for the suspension of the lorry. Each wheel has its own spring and there are three leaves in each spring to make it stronger. The springs are made from spring steel and Patrick said that I shouldn't cut them because they are too dangerous for me because the spring might jump and go into my fingers or my eyes. On cars these days they have coil springs but they used to have leaf springs.

Front axle and wheels

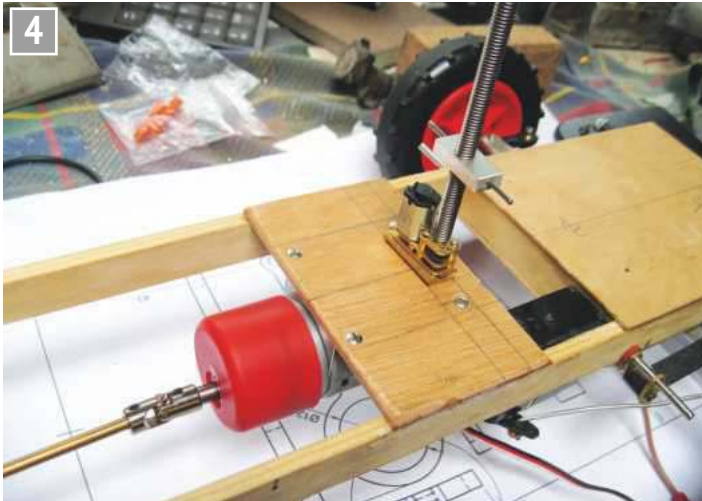
The axle is made of aluminium with swivels at each end and the springs are clamped onto the top. I had to think of a way to design it so that the tyres wouldn't wear out when the lorry goes around a corner. I did this by using Ackermann steering and controlled it with a servo. I learned how to do silver soldering! The wheels are mounted on two ball races each. You can see the design in **photo 2**.



Ackermann steering and control link.



Rear axle, spring and wheel.



Motor and screw for raising the tipper.

Rear axle and transmission

Patrick made the rear axle for me. It uses a differential and a pinion from a model car. The outside was made in black Delrin.

I coupled the axle to the wheels. You can see how I did it in **photo 3**.

I also mounted the motor under the chassis and fitted the couplings and the shaft (**photo 4**).

Cab

The cab was made of hard balsa wood and very thin plywood. I made little seats with leather cushioning and a dashboard made of mahogany wood. There are lights on the dashboard and headlights on the front of the

cab. The headlights were key ring lights and they switch on and off at the back. In between the seats there is a console like a car, which is detachable, and it has a gear stick and a hand brake. The instruments were made from brass tubing and were made on the lathe. You can see the dashboard in **photo 5**. I also made the steering wheel on the lathe from aluminium tubing and a piece of black plastic. I found that making the hinges was very tricky.

Tipper

The tipper of the lorry is yellow and it has a hinge underneath at the back. The back piece swings open to let out the sand (**photo 6**).

There is a little motor in the tiny gap between the cab and the tipper. The little motor has a threaded rod that is attached to a nut which is on the front of the tipper. Because I can't let the nut come off the thread, I had to put limit switches on the lorry (**photo 7**).

The switch that stops the tipper going too high has a long and thin rod threaded at the top end. It goes through an 'L' bracket attached to the tipper. When the tipper goes high enough a nut pulls the rod and turns off the switch which then turns off the motor.

When the tipper goes down it hits a switch on the chassis. To make all of this work, I fitted a servo underneath that moves a switch.

My lorry is radio controlled



Dashboard and steering wheel.



Hinged rear flap.

and I have run it round the house and taken it to school. I won a prize at the Littleton and Harestock Show in September and won a Very Highly Commended at the Midland Model Engineering Exhibition (**photo 8**).

I really liked making my lorry and I have started my next model which is a racing car. It is made of metal.

ME



Limit switch for the raising screw.



Lucas's lorry on display at the Midlands show.

Out and About 2018

PART 2

Martin Wallis takes his annual look at the summer season of road steam on the rally field.



Continued from p.846
M.E. 4601, 7 December 2018

The Stroud Vintage Transport and Engine Club can be relied upon at their Gloucestershire Vintage & Country Extravaganza to have more than a few interesting exhibits; 2018 was no exception. Firstly, a unique steam roller built in 1933 by Arthur Trotter of Bakers Hill, Colesford, to roll the gravel paths and driveway around his house (photos 14 and 15). The rolls are made from flat belt pullies, steel angle for the chassis and an ornate cast 'C' on one of the engine's crank webs. It is thought perhaps the engine might be from a Clarkson steam bus. The engine has two high-pressure cylinders of 2¾ inches bore by 3½ inches stroke and is fitted with Joy valve gear. Mr Trotter died in 1977 and the roller and his collection of models were bequeathed to the Gloucester Folk Museum. The roller was found to be in very poor condition, in particular the boiler which was badly corroded. Happily, in 1989 restoration started, the task taking eight years to complete and it has been returned to steam entirely through the efforts of museum volunteers. Unfortunately, in 2004, the boiler was deemed beyond



A unique steam roller built in 1933 by Arthur Trotter of Bakers Hill, Colesford, to roll his gravel paths.

economical repair and a replacement was manufactured by Bell Boilers fitted with 72 vertical fire tubes and working pressure of 125 psi. However it was not until August 2017 that the roller returned to steam and in the condition we see it in today.

The 'Runscombe Gentleman's Steam Bicycle' was built by

Mark Drake and is based on a 1950s pedal bicycle (photos 16, 17 and 18). The pedals remain fully functional and it is classed as a 'low powered moped'. It has a top speed of 25 mph but is happiest cruising at about 15 mph. The 'Runscombe' was built for fun and fully designed and modelled in CAD before construction commenced. It



The drive train from the engine mounted ahead of the boiler is via a gear reduction on the other side and then a chain and sprocket to the back axle.



The 'Runscombe Gentleman's Steam Bicycle' was built by Mark Drake. The chrome-lagged cylinder in the middle is the steam generator, to its left the water tank and under that is the fuel tank.



The water gauge on the bicycle; note the circular mirror behind to facilitate reading it while on the move.

runs on any vaporising oil but petrol is used most often. With petrol the range is 27 miles but, in practice, the range is limited to 16 miles which is the on board water capacity. The boiler or, as the builder prefers, 'steam generator' will raise steam in four and a half minutes from cold. It is a hybrid monotube and fire tube boiler, the fire tube part having 107 fire tubes, running at 125 psi with 300 degrees of superheat. The high superheat is the key to good performance but consequently requires high temperature modern synthetic oils for the engine as opposed to the more traditional mineral oils. The single cylinder slide valve engine has a bore of 31.25mm and a stroke of 40mm; it is set for 45% cut off and drives the back wheel via a toothed belt. The engine presently exhausts to atmosphere but the builder is considering fitting a condenser which, it is hoped, might boost the range to 40 miles. A pair of eccentric driven pumps are fitted beneath the engine.

To celebrate their 50th steam rally, The Great Dorset Steam Fair set a new Guinness World Record with the largest display of steam powered vehicles on 26 August 2018. They achieved no less than 472 in steam, boosted to well over 500 if you considered the number of engines present on static display, both outside and in various marquees.



The single cylinder engine drives the back wheel via a 4.33 to 1 ratio toothed belt. Below it is the twin pumps, one delivers compressed air to pressurise the fuel tank to about 30 psi, the other being a variable delivery boiler feed pump.



Richard Harvey's 4 inch scale Waltzer, it is assembled in exactly the same way as the full size, down to copious collections of wooden packing pieces to get it level on uneven ground.

The show started well for the model engineer exhibitors as the regular model engineering trade stands had clubbed together to sponsor a hog roast complete with apple pie and cream for all those with model engines in steam. A charity raffle ended the proceedings with a good amount raised and which was added to the money already raised by Tim Watson who had driven his 4 inch Burrell Showmans about 140 miles from his home in St Albans to the GDSF; a journey that took three days.

In last year's Out and About I pictured Richard Harvey's 4 inch scale 3 hill, 9 car Maxwell Waltzer, mentioning that he intended to have it completed for the 50th GDSF in 2018 - and indeed he did! A splendid and impressive sight (photo

19), no small undertaking at 16 feet in diameter. Your author noted he was using a lorry to transport it.

Keeping to the unusual - and admittedly not strictly road steam - was a steam driven pile driver brought over from New Zealand. Steam was provided by an adjacent road engine via a flexible steam pipe and immediately it started working a large crowd always gathered. It was mightily impressive and literally made the ground shake. The machine was built by the 'British Steel Piling Company (Suffolk)' in 1920 (photo 20).

With so much on show at the 50th GDSF and many hundreds of pictures, I cannot hope to do more than a quick dip into what was there. I have chosen just two engines.

Firstly, a class of engine I have never seen before: a Marshalls of Gainsborough No. 2 Light Traction Engine of 1936 (photos 21 and 22). It was built for direct ploughing and belt work on continents around the world. The engine is number 87843 and is rated at 6 NHP, the single cylinder working at 150 psi. It is probably one of the last to be made before the I/C engine took over completely. It was delivered to Msrs Meslin, Riga, Russia, in late 1936 and repatriated sometime after 2010 and has been extensively restored.

Second is an Aveling and Porter engine adapted and sold from their works for railway use (photo 23). Built in 1926, but suspected to have used some older, perhaps even second hand parts, it was the 130th and last railway outline engine built at the Invicta works. It was delivered new to the Holborough Cement Company and was used for shunting cement and coal wagons around the works. Due to lack of power, it was used as a stand by engine while other more powerful engines were under maintenance and was finally withdrawn in 1962. In 1964 she was presented



A steam driven pile driver/hammer brought over to the GDSF from New Zealand by its owner, Daniel Smith.



One of the last steam engines built by Marshalls of Gainsborough and exported to Russia. There are very few examples of this type of engine surviving.



Details of the motion on the Marshall; note the geared down feed water pump and the boiler feed water heater.



Aveling and Ported light shunting engine No. 9449 built in 1926 and owned by Mick Smith.



A Wallis and Steevens Advance roller; note the rubber tyres fitted for smoother running on hard surfaces. Owner, J. Homersham.

to the Bluebell railway and named 'The Blue Circle' after their cement brand. However, by 1966 it was again sidelined due to both lack of power and speed – top speed just 6 mph. After many years out of use it was stripped for major repairs in 1988, which proved more problematical than expected, and was subsequently sold to its present owner.

My last rally for 2018 was the Bedfordshire Steam and Country Fair held in the Old Warden Park. Happily, this year it was blessed with rather better weather and, as always, there was plenty to see.

Rollers are fairly scarce in the models sections generally and it was good to see a 4½ inch scale Wallis and Steevens Advance roller (photos 24 and 25), the scale being determined by a convenient size of boiler barrel. It was one of two built



The motion on the Wallis roller, the cylinders are commercially available 7 ¼ inch gauge railway engine castings. While the full size engine has piston valves, the model has slide valves but retains the appearance of piston valves.

and this one was purchased from Preston Services. The working pressure is 130 psi and has duplex cylinders. The new owner has grafted on a 4 inch Burrell feed pump to supplement the occasionally temperamental injectors.

My final picture is of a 4 inch scale compound Foster

showmans engine (photo 26), purchased half built and completed by the owner. The engine ran very well, in part due to the increased size of the steam passageways inside the cylinder to allow it to 'breathe' more easily.

2018 has been a memorable year with both The Great Dorset



A very fine 4 inch scale Foster showmans engine at Old Warden. The engine was purchased by the present owner in 2014 and he finished the build this year. Owner, N. Read.

Steam Fair and the Weeting Steam and Country Fair marking their 50th Anniversary rallies, and the Bedford Steam Engine Society marking their 60th Annual rally. There was certainly no shortage of models or full size engines; in all, a very impressive year.

ME

A Large Capacity Coventry Diehead

PART 1

David Earnshaw revisits his Coventry diehead attachment and reworks the design for a larger lathe.



This article is an extension of the more full article on Coventry dieheads which commenced in M.E.4581, 2nd March 2018. As such it will not give full constructional details and, should anyone wish to build this version, it will be advisable to refer to the previous articles. Where component parts differ then the revised drawing is provided here. The previous design will be referred to as the Mark 1 and was developed to suit a 'style CH' diehead. The following design (Mark 2) is my solution to attaching a 'Style CHS' diehead to a larger lathe. The heading photo, **photo 1**, shows that the outline shape of the finished unit is very similar to that of the Mark 1 unit.

To recap briefly: the two styles of diehead have different shanks. The CH style diehead, the subject of the previous article, has a shank attached by three screws. The CHS style diehead has an integral shank which has a short sliding action and also guided on two pins which makes it more complicated to attach a replacement



The finished Mark 2 attachment.

shank (**photo 2**). Because I had acquired one of each type of diehead I wanted to make use of each one and, at first, envisaged making a new shank for each so that they could be interchangeable in the same body attachment to the lathe. It would be possible to manufacture a longer shank for the CHS style but it seemed to be quite involved and I wanted to try to keep things relatively simple.

My thoughts turned to making a sleeve to slide over, and fix to, the existing shank but having a longer length. This obviously meant that the diameter of the new shank would be larger but it did seem the way to go. A disadvantage of using a larger diameter would also mean that the 1 inch diameter shank previously made for the CH Style diehead (Mark1) would be too small

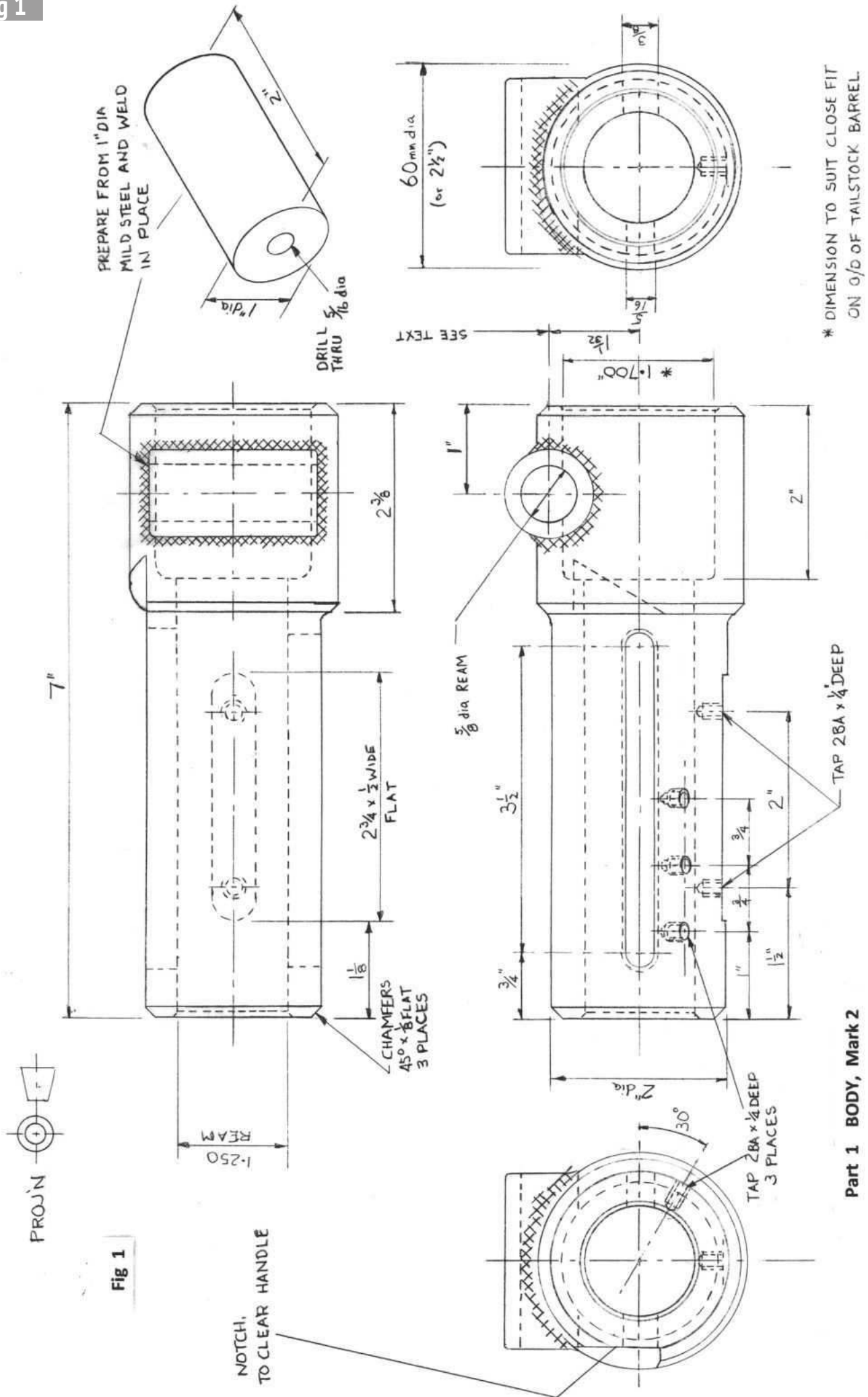
so the two would not be interchangeable. I could have remade the shank for the CH style (Mark 1) with a larger diameter but that would mean boring out the already made body to the larger size.

This, at first, seemed a reasonable option but on reflection it would not be easy to bore out the existing body, for one thing there were slots running along the length of, and into, the bore of the body and a boring tool would likely flex and chatter as it cut through the slots. A reamer, if available at that size would probably also chatter, or even jam, as the blades passed over the slots. I came to the conclusion that a second body would have to be the only way forward! The method of arresting and tripping the diehead also received some alternative thinking.



Confirming the differences between the CHS and CH dieheads.

Fig 1



A new shank diameter of 1 1/4 inch was decided upon and the dimensions of the original (Mark 1) body were sufficient to allow the body to be bored out to that size. **Figure 1** shows the dimensions for the new (Mark 2) body. Most sizes are the same as the Mark 1 body other than the main bore and the initial outside diameter of the bar. This time, 60mm diameter was used for the outside diameter instead of the 2 1/2 inch diameter for the Mark 1 unit and the main bore is 1 1/4 inches. There is no stop screw on this Mark 2 unit and so there is no need for the groove on the side of the body, nor the stop screw lug. Instead there is a series of three tapped holes on the outside of the body. These holes allow for a small stop block to be attached to the side of the body by a single screw, at an appropriate position. The lever pin is longer in order to be able to make contact with this small stop block.

The opportunity to refine the lever handle and pivot arrangement was also taken.

Body

The body, part 1, was created in exactly the same way as the Mark 1 body; a piece of 1 inch diameter mild steel prepared and welded into a hollow cut across the larger piece of steel to form the clamp boss, all cleaned up and the hole for the clamping pads bored.

The clamp pads themselves are identical to those used in the Mark 1 design and full details of them are shown in M.E.4583,



Shell reamers and arbors - a useful 'find'.

30th March 2018, page 497. The pads need to be made and fitted before any boring begins.

The stepped main bores of the body were also machined in exactly the same way as for the Mark 1 body. Extensive use was, again, made of the four jaw chuck, fixed steady and stub mandrel to grip and support the work to ensure that the two bores were concentric with each other. The same stout boring tool was used to avoid chatter. The larger end of the bore, which fits over the tailstock barrel, was finished to size using the boring tool and, after turning the job end for end in the chuck/stub mandrel and fixed steady, the same tool was also used to machine most of the waste material out of the longer, 1 1/4 inch diameter bore.

As the size of this longer bore was getting nearer to finished size I began to think about

how to finish it and, initially, dismissed the idea of reaming as I thought that I did not have a 1 1/4 inch diameter reamer. However, whilst thinking over the problem of finishing the bore I remembered that, quite some time ago at one of the Model Engineer exhibitions, I had bought some dubious looking shell reamers from one of the surplus equipment stalls.

Rummaging around through several boxes of stuff that hadn't seen the light of day for a long time I managed to retrieve the said equipment. This consisted of several shell reamers and a couple of the arbors needed to mount the reamers upon. All had some slight rusting on them, as they had when they were bought (**photo 3**) but careful investigation indicated that they showed little or no sign of use, indeed one of them, although very grubby looking, still had the protective wax on it! Some vigorous work with wire wool and 'Scotchbrite' material brought the 1 1/4 inch diameter reamer and one of the shanks back into useable condition as shown in the foreground of photo 3. This was then used, together with copious amounts of lubrication, to finish the bore to size and produced an excellent finish (**photo 4**).

The two long slots in the body were produced using milling machine and dividing head as for the Mark 1 unit.

As mentioned previously,

there is no stop rod incorporated in this Mark 2 unit. Instead there are three 2BA holes tapped at intervals indicated on the drawing and set on a line 30 degrees below the front, narrower, slot. To achieve this setting the holes were drilled whilst the work was still in the dividing head so it was a relatively simple matter to index the dividing head round a further 30 degrees to give the positions for the tapped holes.

The X index on the milling machine was used to set out the distances between the tapped holes and they were individually started with a centre drill, drilled with the tapping size drill and the 2BA taper tap started in the hole before removing from the milling machine. Special care was taken to see that the drill did not break into the main bore as this would have raised a burr inside the bore but it was important to drill the holes to the maximum depth without breaking into the bore. Similarly, when tapping the holes, care was taken with the tap not to force it too hard into the bottom of the hole as, even if the hole has not penetrated into the bore, the point of the tap can deform the metal remaining in the bottom of the hole and cause it to form a pimple protruding into the bore which would be difficult to remove.

This completed the machining of the Mark 2 body.

●To be continued.



Reaming the main bore.

Renewing the Raised Track at Bradford MES

Graham Astbury reports on the trials and tribulations of rebuilding their ageing raised track.



Continued from M.E.4601
7 December 2018

Fitting the sleepers

With the block-work completed it was now time to fasten the sleepers to the blocks (**photo 19**) with the teams working away from the station in both directions. The curves had the super-elevation spacers fitted as the gang went round the bend (literally!). As the sleepers had all been drilled using a jig in the workshop, it was obvious that the same should apply to the block-work so a jig was made which had an in-built clamp to fix it to the blocks in the right place before drilling for the screws to fasten the sleepers down (**photo 20**).

Once the sleepers were fitted, the cement grout was put under the super-elevated sleepers and between all the sleepers, followed by mortar flaunching between each of the sleepers to make sure that the rain drained off the surface of the track and did not pool. As the track is exposed to the weather, any water pooling would not only make the fasteners holding the sleepers down more



The first sleeper is screwed down.

susceptible to corroding, but any cracks where water may lodge would probably result in cracking of the block-work by freezing of the water.

The sides of the blocks were deliberately left un-rendered so as to provide free drainage from the blocks in order to try and limit or avoid water retention and thus prevent frost damage. We will no doubt see how effective this strategy is over the coming winters. To mark the date

of the track renewal, a 2017 pound coin was cemented into the flaunching at one point on the track (**photo 21**). Eventually, just as the winter snow started, the last sleeper was fixed into position (**photo 22**) and then work had to be suspended due to more snow (**photo 23**) which delayed the programme just a bit.

Laying the rails

Once the snow cleared, the rails were laid (**photo 24**).



Using the jig to locate the screws for the sleepers.



The 2017 pound coin cemented into the flaunching.



The last sleeper is fixed in position.



The snow stopped work for a few days.



The first rails are fastened down.

Progress was quite rapid with all the track being laid in a short time. Care was required at the turntable to ensure that the rails on the block-work lined up with the rails on the turntable. Some slight adjustment was needed to make sure that the turntable lock operated correctly. Meanwhile the expansion joints were sealed with a flexible sealant to keep water out and finally the last two screws were inserted to complete the laying of the rails. This was not a 'golden spike' moment – more a 'stainless steel screws' moment – as the opening ceremony had been planned and timetabled long before the track rebuilding was even started (photo 25). No pressure on the project manager!

The anti-tip rails

The anti-tip rails had been salvaged for re-use. Whilst the building of the track was going on outside, the anti-tip rails were inspected and any remains of the old welded brackets were ground off. New brackets were made to fit the rails to the block-work and were painted by one member who slowly and methodically took them home to his workshop where he primed them and painted them before returning for the team to screw them in place (photo 26). The rails were also painted and welded onto the brackets *in situ*. At the turntable, the ends of the rails were neatly terminated prior to final painting where the welds had been made (photo 27). Note the hole in the steel end plate for the



The last two screws are driven home.

turntable locking pin to go in. After welding, the remains of any burnt paint were wire brushed off and the welds painted to match the rest of the anti-tip rails.

Earthworks

Whilst the track was being laid and the anti-tip rails were being welded, a dedicated small team were busy with extending the land drain. This involved digging a trench



The anti-tip rail brackets fastened to the block-work.



A neat finish to the anti-tip rail at the turntable.



The extension to the land drain being laid into the trench.



Earth, wind and fire!

to put a flexible drain in connecting up to the other land drain to ensure that the inside of the track was adequately drained (**photo 28**). Similarly, all the shuttering had been taken off ready for landscaping the soil to be level with the track foundations. The old shuttering was piled up to make a bonfire which was fanned using a leaf blower (**photo 29**).

Testing

When all the track had been built, it was time to test the track. This was easily done by checking the 'loading gauge' clearance using one of the passenger cars to make sure that there was the correct clearance between the anti-tip rails and the cars. There were one or two minor tweaks required but on the whole everything fitted well. There was great excitement when the first locomotives were steamed up for a run around the track (**photo 30**) and finally the whole team were assembled for a group

photograph, as seen in **photo 31**. Also visible in the photograph are the 'bridges' spanning the tree roots. One final, but not visible, contribution was for the project manager to number every tenth sleeper, so that if any member driving round the track spots a problem, the exact location can be reported – much easier than saying "its over there somewhere..."

Although the track was completed before this year's running season, there remained a lot of tidying up around the track to do, including some landscaping, turf-laying and cutting down some of the bushes to make it more presentable. On the 15th September 2018, the track was officially re-opened by Diane Carney, the Assistant Editor of the *Model Engineer* (see p.595, M.E.4597, 12th October).

Summary

- The whole rebuilding project took just six months and was completed on time – actually with one day to



Firing up the locomotives for a run round the track.

spare before the Friends of Northcliffe Annual Easter Bunny Event.

- The use of concrete block-work and plastic sleepers was chosen to minimise the ongoing maintenance of the track.
- The expansion joints protected the track from expansion problems despite the summer temperatures of 2018 exceeding the

design temperature.

- The rebuilding of the track has renewed the interest of the membership in attending the track.
- The decision to replace the track in a single season rather than two consecutive seasons was not only cheaper but has allowed the next project of re-roofing the clubhouse and refurbishing the accommodation to be carried out a year earlier than anticipated.



The team of twelve hard working volunteers.

Acknowledgements

Thanks are due to Frederick Bilney and Rebeka Ashworth for taking the photographs and to the whole team of twelve very dedicated and hard-working volunteers for rebuilding the track in such a short time. Particular thanks are due to the project manager, Dave Watts, whose horological interests no doubt ensured that the project ran to time despite the ravages of the winter weather.

ME

A $\frac{1}{3}$ Scale GWR Swindon 8 inch Water Crane

PART 4

Canon Roger Davis felt that there must be better ways of watering a locomotive than sticking a piece of old hosepipe into the tank and decided to do something about it.



Continued from p.831
M.E.4601, 23 November 2018



General view of water crane (with B&WR resident Garrett Saint Leonard).

Plumbing

The plumbing of the water supply from header tank to the crane would be using 28mm standard plastic pipe and Speedfit couplings. This gauge of pipe together with the pressure given by the header tank to be described later has

proved to give a more than adequate flow even for the big tanks of B&WR resident 7 $\frac{1}{4}$ inch Garrett Saint Leonard (photo 24).

The link between the lower end of the crane's 48mm stainless steel tube and the incoming supply was made by modifying a standard 'equal straight' fitting. The JG Speedfit plastic proved very easy to machine in the lathe so it was possible to turn down its external diameter to be an easy fit in the 48mm tube running up through the column to the head unit. It was then further modified by grooving to take three external 'O' rings to ensure all would be watertight on insertion. It is held in place by two brass countersunk screws that also serve to secure the lower Delrin bearing ring (photos 25 and 26). To

ensure a good seal whilst enabling rotation of the fitting about the incoming 28mm pipe, space for three additional internal O-rings was made by removing the original toothed securing ring and plastic spacer. This incidentally makes it very simple to dismantle the crane – just unbolt and lift the whole assembly off the supply pipe!

Safety arm lock

The final items requiring design and fabrication were those for the safe locking of the water delivery arm. Again, close examination of the Swindon drawing No. 2918 and some of those historic photographs on the internet gave reasonable clues as to its construction and operation (fig 5). A comfortably shaped handle just over 7 inches long



48mm inner tube of pillar with lower bearing and modified Speedfit fitting.

Fig 5

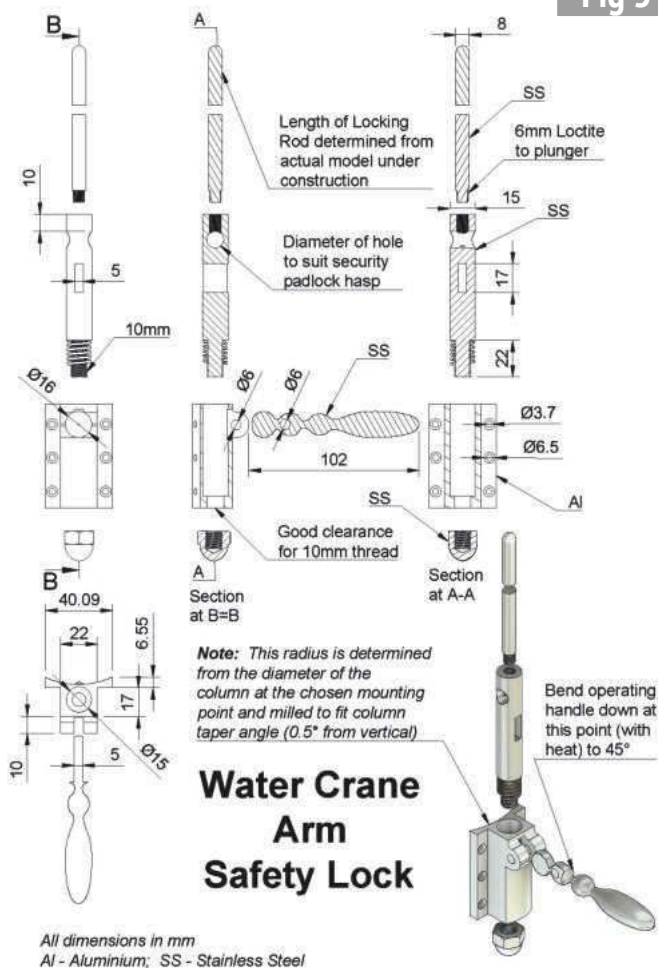
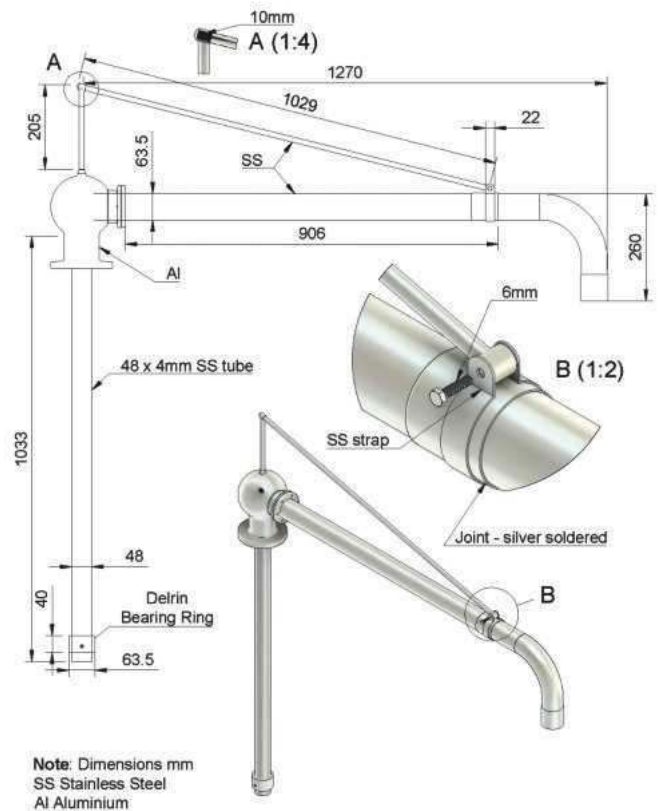


Fig 6



**Water Crane
Water delivery pipework**

engaged with a spring loaded plunger that moved vertically within a small casting fixed to the side of the column, at about shoulder height. When the handle was lifted to the horizontal it depressed the plunger that in turn pulled a long rod to disengage the head unit from the column top capital. Thus, the head and water delivery arm were free to pivot. A little cogitation showed that the casting would have to compensate for the column's taper as the locking rod needed to be truly vertical rather than parallel to the tapering side of the column.

Photograph 27 shows the initial machining of the embryo block that was held at a 0.5 degrees off the vertical in the vice and fly cut to give a snug fit at the appropriate diameter of the column where it was intended to be mounted – roughly half



Close up – lower bearing and water fitting connection in place.

way up seemed about right for this one third scale model. **Photographs 28 and 29** show the further machining operations in the rotary table towards the finished result seen in place here (**photo 30**).

The operating handle itself was turned by eye from 20mm stainless steel bar, milled and shaped at the

inner end to engage with a slot in the spring loaded plunger and drilled for the 6mm pivot bolt. Finally, it was heated to red heat at the narrowed neck and bent 45 degrees to resemble the prototype. Note that there is a non-prototypical horizontal hole drilled in a top extension to the plunger visible when

in the locked position. This allows a small padlock to be fitted when the crane is not in use; a necessary precaution these days against the curious and maybe mischievous out-of-hours visitor to the site tempted to have a swing on the arm!

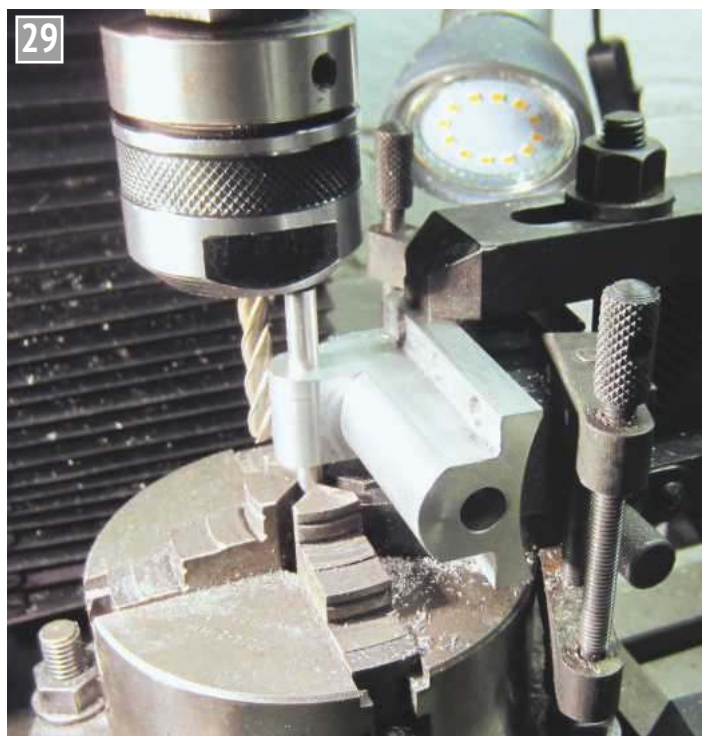
The remaining operations before installation included



Lock body machining stage 1 (fly cutting).



Lock body machining stage 2.



Lock Body machining stage 3.



Lock and water control handles.

using acid etching primer to all the aluminium parts, undercoating and then applying several top coats to the traditional GWR authentic colour scheme for such cranes. Reproducing the somewhat idiosyncratic 'mouse ears' half-way up the pillar caused some head-scratching. Setting them out symmetrically on the tapered curving surface was eventually solved with two Bosch sanding discs and a rubber band and then tracing round them with a soft pencil to give the desired paint guide line (**photo 31**)!

Crane arm support brace

The crane arm support brace (**fig 6**) is fabricated from $\frac{1}{2}$ inch stainless steel bar with an angled tube silver soldered at the top of the vertical

element to take the threaded end of the sloping element. Another short tube with 6mm through-hole is made and silver soldered at right angles to the lower end of



Defining 'mouse ears' for painting.

the sloping element. This is clamped to the delivery arm by a 22mm wide stainless steel strap with a 6mm bolt and dome nut (**photo 32**).

The final touch was a genuine leather hose or 'bag' for water delivery to the locomotives. I was fortunate in having acquired, many years ago, two beautifully tanned soft sheep skin leathers that had been intended for use by pipe organ builders! I knew they would come in handy one day for something. My ever-patient wife duly did the necessary stitching and the

finished bag was stained dark brown with leather dye before being given a number of waterproofing dressings made from a mixture of linseed oil and melted beeswax. It was secured to the delivery pipe with a stainless steel jubilee clip.

● To be continued.

NEXT TIME

Having completed the main frame we shall conclude by looking at the water control valve and installation.



First trial assembly of complete crane main components.

ME Vertical Boiler - Fittings

PART 21

A project aimed at beginners wishing to develop their skills or those requiring a robust vertical boiler for the running or testing of small steam engines. **Martin Gearing** adds to the pile of parts for boiler fittings.



Continued from p.32
M.E. 4602, 21 December 2018

Mounting stub – Item BF5 x 3

10AF Brass (fig 57)

Hold in a three jaw chuck with 15mm protruding, face off, centre drill, drill 3mm diameter x 18mm deep. Turn 6.35mm diameter x 8mm. Using a 1mm wide parting tool set with its left-hand edge against the turned face, undercut 0.5mm (1mm on a diameter dial) into the 6.35mm diameter. Thread $\frac{1}{4}$ x 32 ME x 8mm (10 turns). Chamfer the hexagon 30° x 0.5mm. Part off 16.5mm overall. Put to one side. Repeat twice more.

For each of the three stubs, screw into the $\frac{1}{4}$ x 32 ME mandrel and hold in the chuck. Face off, bringing the length between the mandrel and end face to 8mm. Turn 7mm diameter x 5mm. Chamfer the hexagon 30° x 0.5mm. Turn 6mm diameter x 2mm. Put to one side.

Spindle gland nut – Item BF6 x 2

10AF Brass (fig 58)

Hold in a three jaw chuck with 15mm protruding, face off, centre drill. Chamfer the hexagon 30° x 0.5mm.

Drill 3.3mm diameter x 8mm deep. Drill 5.5mm diameter x 4mm deep from when the drill starts to cut full diameter.

You now need to grind up a

Tolerances:

Non functional (i.e. parts not a fit or match) $\pm 0.1\text{mm}$

Functional (i.e. parts having to match) $\pm 0.02\text{mm}$



Boring internal recess.

small boring tool that will be used to machine the internal 'O' ring groove (fig 59). The figure shows the suggested sizes. The 13mm dimension behind the tip shown is not critical - and for most will be dictated by the width of the grinding wheel available. It is essential that the tool width is $2\text{mm} - 0.00/+0.20$ and that

the tip face is parallel to the tool shank to enable easy setup (photo 118).

Set the recess tool on centre height and with the cutting tip parallel to the lathe axis.

- Position the tool so that the front tool face just touches the faced end of the nut.
- Clamp the saddle and zero

Fig 57

Fig 57 - Mounting Stub x 3
Item BF5

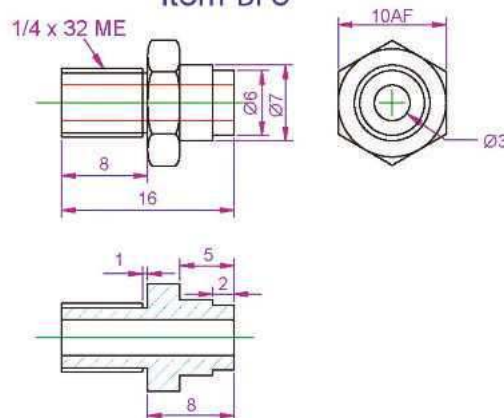
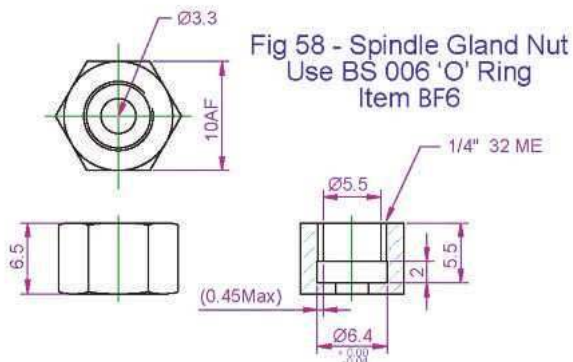
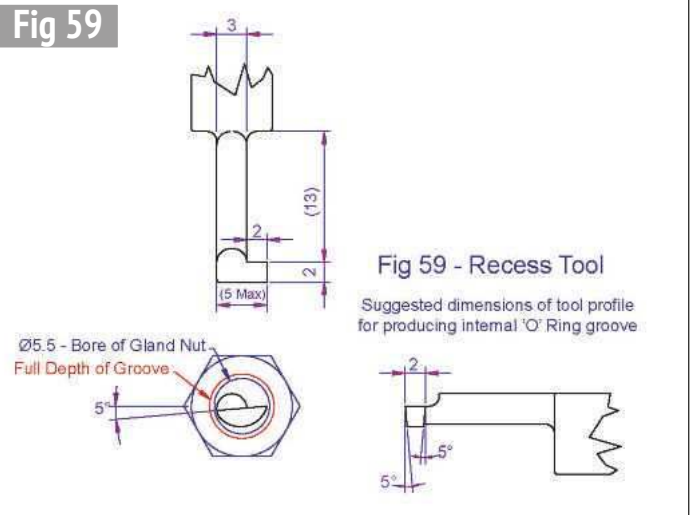


Fig 58**Fig 59****119****Parting off to length.****Setting the 'D' bit for depth.**

- the top slide feed dial.
- With the work rotating move the tool towards the centre with the cross slide until it is able to be entered into the 5.5mm drilled hole.
- Using the top slide move the tool towards the chuck 2mm and then very slowly bring the tool out towards the work using the cross slide until it JUST makes contact with the rotating drilled bore.
- Zero the cross-slide feed dial.
- Feed the tool slowly towards the chuck using the top slide a further 3.5mm (5.5mm total) and then slowly back 0.45mm (0.9mm on a diameter dial) using the cross slide.
- When the tool stops cutting slowly move it in towards the centre taking care not to go so far as to run the tool shank into the opposite side, before releasing the saddle clamp and withdrawing the tool clear.
- Thread $\frac{1}{4}$ x 32 ME x 5mm deep (6 $\frac{1}{4}$ turns).

- Part off 7mm long. Repeat for the second nut.
- For each nut, hold on the hexagon with 2mm protruding and face off to 6.5mm overall. Chamfer the hexagon 30° x 0.5mm. Put to one side.

Gauge glass gland nut – Item BF7 x 2

10AF Brass (fig 60)

The procedure for making this part is exactly the same as that for the previous part (BF6) except for the slightly different dimensions.

Clack valve body – Item BF8

10AF Brass (fig 61)

Hold in a three jaw chuck with 25mm protruding and face off. Turn 6.35mm diameter x 8mm. Using a 1mm wide parting tool, undercut 0.5mm deep into the 6.35mm diameter. Chamfer the hexagon 30° x 0.5mm. Thread $\frac{1}{4}$ x 32 ME x 8mm (10 turns).

Using a centre drill with a pilot less than 3mm diameter, drill into the face stopping when the cone formed is just

short of the core diameter of the thread. Part off 20.5mm overall (**photo 119**).

Screw into the $\frac{1}{4}$ x 32 ME mandrel and hold in the chuck. Face off, bringing the length between the mandrel and end face to 12mm. Chamfer the hexagon 30° x 0.5mm. Centre drill, drill 2.8mm diameter through, ream 4mm diameter. Drill 5.5mm diameter x 9.5mm

deep, Thread $\frac{1}{4}$ x 32 ME x 6mm (7 $\frac{3}{4}$ turns).

This method of drilling a hole accurately to depth when using a tailstock that does not have a graduated feed dial or DRO fitted produces a guaranteed result. It only requires a length of toolsteel and two identical thickness (around 0.5 – 0.8mm) steel rules or feeler gauges.

Hold the 5.5mm 'D' bit made for the hand pump body valve seats in the tailstock drill chuck. Adjust so that the tip of the 'D' bit just contacts a steel rule/feeler gauge laid across the end face.

Clamp a piece of tool steel in the tool post projecting sufficiently to contact the end face of the tailstock drill chuck. Move the saddle to lightly sandwich a 10.5mm drill plus rule/feeler gauge of identical thickness between the tool steel and chuck end

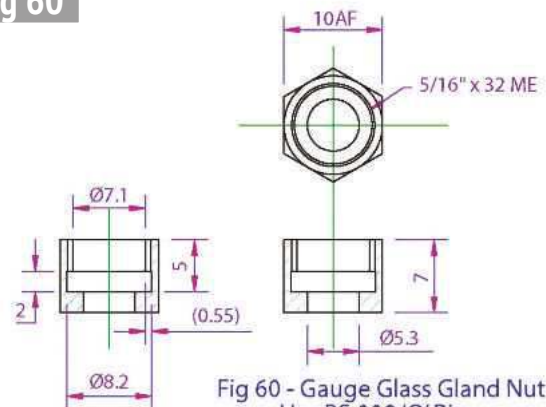
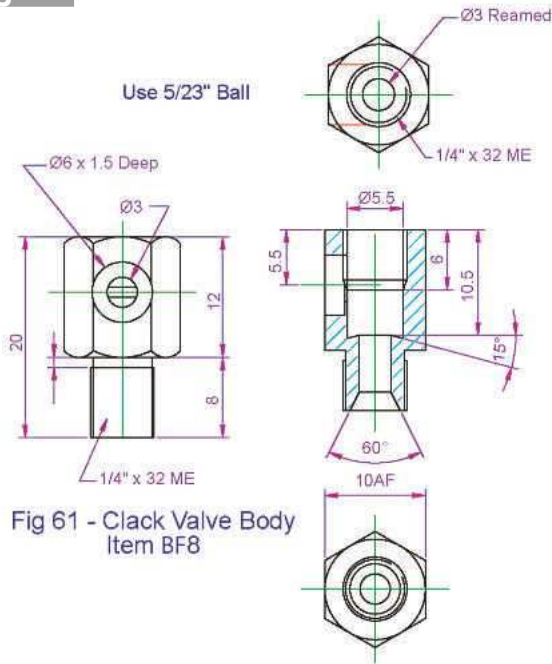
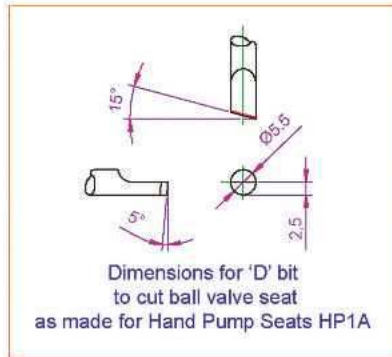
Fig 60

Fig 60 - Gauge Glass Gland Nut
Use BS 008 'O' Ring
Item BF7

Fig 61**Fig 61 - Clack Valve Body
Item BF8**

Screw into the 1/4 x 32 ME mandrel and hold in the chuck. Face off, bringing the length between the mandrel and end face to 17mm. Turn 6.35mm diameter x 3.5mm. Undercut as before 0.5mm into the 6.35mm diameter. Chamfer the hexagon 30° x 0.5mm. Thread 1/4 x 32 ME x 3.5mm (4 1/4 turns).

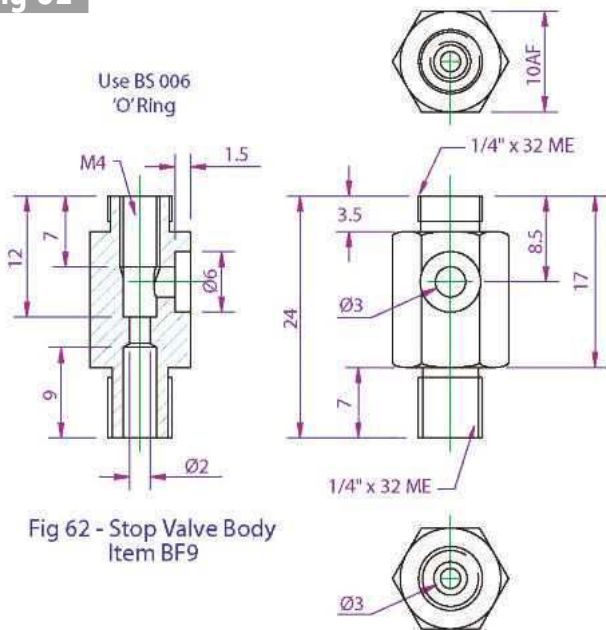
Centre drill, drill 2mm through. Drill 3.3mm x 10mm deep. Hold a 3mm or 1/8 inch diameter centre cutting slot drill in the tailstock drill chuck. Adjust so that the tip of the slot drill bit just contacts a steel rule laid across the end face and then drill 12mm plus the rule thickness deep to form the valve seat. Tap M4 x 7mm deep (10 turns).

The next step is performed on the milling machine.

Position the body in the centre of and near to the top of the vice jaws using a suitable parallel placed under the flat section of the hexagon, with the shorter thread against the fixed jaw. Centre the spindle to the middle of the body on the X axis and to the fixed vice jaw on the Y axis. Clamp the X axis and zero the Y axis. Move the work towards the column 8.5mm, clamp the Y axis.

Centre drill, drill 3mm diameter breaking through completely into the 3.3mm hole. Drill 6mm diameter x 1.5mm deep, measuring from when the drill just cuts full diameter, or use a slot drill as before. Deburr and put to one side.

●To be continued.

Fig 62**Fig 62 - Stop Valve Body
Item BF9**

deep, measuring from when the drill just cuts full diameter. Alternatively, you can use a short series centre cutting slot drill (**photo 121**). Remove, deburr and put to one side.

Stop valve body – Item BF9

10AF Brass (**fig 62**)

Hold in a three jaw chuck with 30mm protruding, face off, centre drill, drill 3mm diameter x 9mm deep. Turn 6.35mm diameter x 7mm. Using a 1mm wide parting tool, undercut 0.5mm into the 6.35mm diameter. Chamfer the hexagon 30° x 0.5mm. Thread 1/4 x 32 ME x 7mm (8 3/4 turns). Part off 24.5mm overall.

face. Clamp the saddle and remove the drill and both rules/feeler gauges (**photo 120**).

Machine the valve seat by feeding in the 'D' bit until the tailstock drill chuck contacts the toolsteel 'stop'. Remove from the mandrel.

The next step is performed on the milling machine.

Screw a union nut onto the 1/4 x 32 ME thread to protect the coned face. Position the body in the centre of and near to the top of the vice jaws, using a

suitable parallel placed under the flat section of the hexagon, with the top internally threaded face against the fixed jaw. Centre the spindle to the middle of the body on the X axis and to the fixed vice jaw on the Y axis. Clamp the X axis and zero the Y axis. Move the work towards the column 5.5mm and clamp the Y axis.

Centre drill, drill 3mm breaking through completely into the 5.5mm diameter hole. Drill 6mm diameter x 1.5mm

**Drilling for mounting stub.**

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Geoff Theasby reports on the latest news from the Clubs.



Robert Webber's NER Atlantic, referred to last time, at Norwich&DSME (photo courtesy of Pete Ottley).

Martin Gearing sent me a reference to a story in *New Scientist* about moving individual atoms around, and replacing one with a different atom. This is quite an achievement. See, however, this item by the great Richard Feynmann, 'There's plenty of room at the bottom'. He wrote it in 1959! en.wikipedia.org/wiki/There%27s_Plenty_of_Room_at_the_Bottom. Martin caught me unexpectedly in that my thoughts were elsewhere at the time and I didn't appreciate his point. Please accept my apologies, Martin, and I hope this does not deter you from future suggestions of a like nature.

Whilst at Rotherham Parkgate (see last issue) I bought an energy monitor for £4 in a charity shop. The business end clips round a cable going to your household

electricity meter and sends current consumption details wirelessly to a display unit elsewhere in the house. Thus, you can see at a glance your electricity consumption and start switching off all those smartphone chargers, TVs on standby, lights left on, to save a bit of money. Just like a smart meter without the hassle.

In this issue: spades, frames, traffic queues sur le continent, a weight limit, a square hole, Kent, hardened enthusiasts?, ploughing and bell ringing.

As promised last time, here is the NER Atlantic 2877 (photo 1).

The Model Engineers' Society (NI) The Link, November, has a trip planned to Patterson's Spade Mill in Co. Antrim. This is the last water-powered spade mill in the British Isles. Ireland had 170 types of spades, yet the mill only ever employed about a dozen men.

W. www.mesni.co.uk

Before I decided on its fate, I tried out an idea on my counterfeit dial caliper. I searched the internet for suitable dial faces and found this one, which fits the bill. Reduced in the computer to an accurate size, printed and cut to shape, it now looks like this (photo 2).

The Whistle, November, from **British Columbia Society**

of Model Engineers, details Lindsay McDonnell's piece on the new club locomotives. The frames are 1 1/4 inches thick, on purpose, as it is expected to work hard in service. An aerial view of the site shows an impressive multilevel layout using the space well. Page 7 appears twice. Is this a 'spot the differences' competition? **W. www.bcsme.org**

Steam Lines, November-December, from **Northern Districts Model Engineering Society (Perth)** shows a group of eight members from three societies flying to UK for the GDSF. Despite an early start on The First Day, they still found the last 3 miles very tedious, as they were NOT ALONE, finally arriving at 10.30. It was Huge! 2500 exhibits and 750 stands spread over several hundred acres. Leaving, it took 1 hour to exit the car park. On day two, they set off at 7am, which avoided the traffic jam, but then took 2 1/2 hours to exit afterwards. They couldn't win! Day Three had it sorted. A long day on their feet but very satisfying. Afterwards, three visited Paris and the Eiffel Tower. Again, 2 1/2 hours to reach the top, due to the large number of 'patrons'. Formidable! Then to the Paris Science Museum, the largest in Europe. Sacré Bleu, Je ne le savais pas! Jim Clark writes on making



Downloaded caliper dial in place.

a square hole in a round bar. No clever engineering, jigs or tools, just saw it in half! Mill 'half the square hole' in each piece, weld them together and Robert's your aged relative. Bill Walker found himself shedmaster at Buxton MPD (9D) in the 1962/3 winter, the worst since 1947. This was where he learned about railway snowploughs and snow clearing, in the English Peak District.

W. www.ndmes.org.au

Reading Society of Model Engineers' Prospectus, November, opens with a good picture of steam ploughing in October, using a Fowler Z7 and BB1, a 6-furrow plough, and a 450 yard pull (photo 3). John Billard is president of the Steam Plough Club. '61249' discusses research and its commercialisation. For instance, a track-testing vehicle was sold to RENFE in Spain, without consideration of their wider gauge and with untried digital electronics in place of the obsolescent analogue version that worked so well. Result? A loss valued at one third of the contract price... John Spokes concludes his series on the wheel/rail interface, by looking at the wheel. I note that small faults can be ground out without removing the axle but new wheels and greater faults are turned in the traditional way. 'Wolverton Pug' examines the 4DD units by OVS Bulleid (the double deckers). Surprisingly, for experimental units, they lasted until 1971.

W. www.rsme.co.uk

Ryedale Society of Model Engineers' Monthly Newsheet, October, says a vacuum pipe has been found in the cinders under the traverser. Dyson? Vax? I think we should be told! Unless... "Left behind again! One day, Cinders, you SHALL go to the ball...". Ben and Brent brought two Pullman carriage frames to push round whilst checking clearances, etc. The buckeye couplings kept locking up, so two Mk1 carriages were brought out and compared. This revealed that the couplings did not project



Steam ploughing (photo courtesy of John Billard).

far enough from the frames. Once adjusted by a couple of mm, they no longer had problems.

W. www.rsme.org.uk

Tonbridge Model Engineering Society's November *Newsletter* advises that Founder member Tony Billson has died. Much of his career was with Cable & Wireless, at one time serving as manager of Ascension Island satellite earth station. He was instrumental in forming the Society in 1944, just as everyone was focussed on Normandy, but the future was then no doubt clearer than in immediately previous years. Also farewell to Bill Connor, a prolific maker of models finished to the highest standards, winning many prizes. He also became an authority on motorcycle engines, taking his half-scale models to motorbike shows where he aroused much interest. Look up 'Bill Connor i/c engines' on your search engine. An enquiry from a prospective visitor asked if there was a weight limit for passengers. An answer in the negative revealed that the visitor intended bringing a child but was concerned that they may not be allowed accompany them on the



Coil winder.

train. Forward planning! Graham Hershey writes on the Kalamata Railway Park in Greece. Services were suspended in 2011 and have not yet resumed, apart from occasional charters. There are many interesting exhibits however. Editor Robin Howard visited a garden railway belonging to the Kent chapter of the *cognoscenti*, and wrote amusingly on its strange practices (Kent, that is...) with which he is familiar, hailing from that benighted place many moons ago. (I used to work with a Kentish Man, who

told me, "Kent is the garden of England and Maidstone is the dungheap" - Geoff)

W. micklow.wixsite.com/tmes

Southampton Society of Model Engineers, Newsletter, autumn, says their annual Poppy Day raised £230 for the British Legion. I see that in February, the talk is to be 'Operating a helicopter from a destroyer' which promises to be interesting. (Only yesterday I caught a YouTube short about landing such in bad weather. It was 'heart in mouth' watching and I was cosy and warm on dry land! - Geoff) Chairman, Martyn Turek, reminds us that the Society has three 'junior' junior members, aged about eight. They are learning fast, not just fetching and carrying and making the tea, but selling tickets, dealing with cash, platform duties and clearing up. They are allowed to drive the electrics back to the shed and put them away, and a driving day has been arranged for them over the winter. Good work, Southampton! Another initiative is the large range of club clothing available for members to buy. An Electric Visitors' day was spoilt by rain, making life very soggy for the hardened (softened? - Geoff)

enthusiasts who turned up. Dave Smith visited Amberley Chalk Pits museum and took many photographs of the miniature railway system, originally standard gauge. Tom Petch also provided some pictures of old Southampton trams. His father is involved with restoring No. 57. The system closed in 1949. Roger Hindley continues his tales of his life on the railways. (A good read it is too – Geoff) A final picture shows a gentleman laid supine below a locomotive on the raised track, accompanied by several suggestions. If it were a ‘Spam Can’, I might suggest he is performing an oil change but it’s a Stanier...

W. www.southamptonme.org
Portarlington Bayside

Miniature Railway announce their 3rd birthday party on 9th December. Everything A\$2! There will be music, seats, picnic tables, BBQ. The week after Christmas there will be daily running for the school holidays.

W. www.miniaturerailway.com.au

Mentioned on the M.E. website forum were Kuro Concepts e-cigarette coil winders, which it was thought might be useful to us engineering types. So, I bought the cheapest on offer and received three winders, CW-20, 25 & 30, of which the last is the largest is for coils of 2.93mm diameter plus. They are intended for winding heating elements but I saw an immediate use for making small vhf radio coils and for winding small springs. With 24swg tinned copper wire it was easy, although the smooth surfaces were difficult to grip. With 0.5mm spring steel wire, approximately the same diameter, it definitely helped to grip one piece in a small vice and it needed a winding handle on the other. The units are quite heavy for their size but not magnetic. Filing reveals an appearance akin to aluminium. A close-wound coil of maximum length 15mm can be made but it should be possible to drill out for larger spigots and longer coils until you fall



5 inch gauge 3609 at Hornsby ME (photo courtesy of Andrew Allison).

foul of the angled wire feed hole. Drilling this last could be ‘interesting’ if you try to make your own. Here is a CW-30 with two coils (photo 4).

We have just had a new kitchen installed, followed by a new floor, and the young fitter has been to fit the plinths. I don’t think he was with me when I sang, “Some day my plinths will come...”

Moving swiftly on, *Raising Steam*, from the **Steam Apprentice Club** of NTET has this great picture from Peter for the photographic competition, judged at the GDSF. A worthy winner! The club has welcomed its 6,000th member this Summer. 54 signed up at the steam fair. Next year will be their 40th. Gerry writes on his driving day at Tinkers Park. He began by steering roller *Lucy* up a hill. Being a roller, the road camber was very noticeable and maintaining a straight course kept him busy. Formula Mamod was a great success, based on the slot car idea. One entry was complete with larger wheels and a spoiler! 12-year-old Abbie wrote of her busy year, including unloading a 1903 Fowler GP from its trailer.

W. www.ntet.co.uk/sac

I’ve run out of newsletters to review. That’s the price of being topical, I suppose. I will give myself the rest of the day off...

Sydney Live Steam & Locomotive Society

Newsletter, November, says that September was unusually warm, and a total fire ban was in force. SLSLS has an exemption, so no worries there. They have two venerable locomotives, *The Old Girl*, and the Heritage 2-8-2 which, unusually, double-headed trains. When they were built, the average age of the builders was higher than the club members’ average age is now! More than 40 years ago, the society became a legal co-operative and temporary editor, John Lyons, takes co-operation as his theme, since that is what helps drive the society onwards. (Keep up the good work! - Geoff) The Small Gauge Weekend was well attended, with a good display in the clubhouse and some 2½ inch gauge locomotives on passenger-carrying duty outside. James exhibited an *Ellie*, steam tram locomotive, built in three days, just to see if it could be done! David Thomas visited the Magyar Vasuttiorteneti Park in Budapest, where may be found a railway museum. Outside was a 7¼ inch gauge track, on which the oldest locomotive was over 100, although it took 50 years to make... (Definitely the oldest yet, that I have heard of – Geoff) Many other diversions catered for other

similar activities. The main exhibits were standard gauge, arranged chronologically in a roundhouse, and the museum has its own station, used at weekends. By way of only a *slight* change, Bill Perrin writes on bells and bellringing. The style of bells turning a full circle to ring is peculiar to the UK and the heaviest is 4 tons, at Liverpool Anglican cathedral. Bill explains ‘rounds’ and change ringing, an activity often pursued by computer enthusiasts and mathematicians. To finish, Andrew has taken this deceptive shot, presenting 3609 as a full-sized locomotive (photo 5).

W. www.slsls.asn.au

And finally: A mathematician, physicist, and engineer are all trying to find the volume of a yellow bouncy ball. The mathematician gets his callipers out and measures the diameter, then evaluates the integral. The physicist fetches a bowl of water, drops the ball in and measures the displacement. The engineer strolls up with book in hand, checks for a serial number and looks up the volume in his yellow bouncy ball table.

ME

Contact:
geofftheasby@gmail.com

JANUARY

- 1 Grimsby & Cleethorpes MES.** New Year's Day charity run, Waltham Windmill, 11am-3pm. Contact Dave Smith: 01507 605901.
- 1 Romney Marsh MES.** New Year's Day track meeting, 11am onwards. Contact Adrian Parker: 01303 894187.
- 1 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 1 Southampton SME.** Frostbite run. Contact David Goyder: 02380 421201.
- 2 Bradford MES.** Bits and pieces evening, 7:30pm, Saltaire Methodist Church. Contact: Russ Coppin, 07815 048999.
- 2 Brandon DSME.** Meeting at The Ram Hotel, Brandon, 7.45pm. Contact: Mick Wickens, 01842 813707.
- 2 Worthing & District SME.** New Year steam-up. Contact Geoff Bashall: 01903 722973.
- 3 Sutton MEC.** Bits and Pieces. Contact Paul Harding 0208 2544749.
- 4 North London SME.** Videos, slides and photographs evening. Contact Ian Johnston: 0208 4490693.
- 4 Portsmouth MES.** Club night – members share their future projects/plans, 7.30pm, Tesco Fratton Community Centre. Contact Roger Doyle: doyle.roger@sky.com.
- 5 Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.
- 5 Westland & Yeovil DMES.** Frostbite run 11am – 4.30pm. Contact Bob Perkins: 07984 931993.

- 6 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 8 Romney Marsh MES.** An evening with Andy Nash, 7.30pm. Contact Adrian Parker: 01303 894187.
- 8 Southampton SME.** Surprise event. Contact David Goyder: 02380 421201.
- 9 Leeds SMEE.** Meeting night – 'Members' Current Projects'. Contact Geoff Shackleton: 01977 798138.
- 10 Worthing & District SME.** Club meeting, Fun stuff from YouTube, 7.30pm. Contact Geoff Bashall: 01903 722973.
- 11 Tiverton & District MES.** Club meeting at Old Heathcoat Community Centre, Tiverton, 7.30pm. Contact Chris Catley: 01884 798370.
- 13 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 13 Sutton MEC.** Sunday track day from noon. Contact Paul Harding 0208 2544749.
- 15 Grimsby & Cleethorpes MES.** Monthly meeting, Waltham Windmill, 7.30pm. Contact Dave Smith: 01507 605901.
- 15 Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.
- 16 Bristol SMEE.** Talk: 'GWR Fleet Transformation' – Andy Bowdidge. Contact Dave Gray: 01275 857746.
- 18-20 London Model Engineering Exhibition** at Alexandra Palace – see www.londonmodelengineering.co.uk

- 20 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 20 Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.
- 22 Romney Marsh MES.** Talk: 'On the Narrow Gauge' – Richard Linkins, 7.30pm. Contact Adrian Parker: 01303 894187.
- 23 Leeds SMEE.** Meeting night - 'Building a Replica Morgan Three Wheeler' - Jack Salter. Contact Geoff Shackleton: 01977 798138.
- 24 Worthing & District SME.** Club meeting – '50 Years Repairing Rolls-Royce', William Pullar, 7.30pm. Contact Geoff Bashall: 01903 722973.
- 26 Worthing & District SME.** Club social evening. Contact Geoff Bashall: 01903 722973.
- 27 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 29 Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.

FEBRUARY

- 1 North London SME.** Talk: 'The Development and History of Earls Court and Lillie Bridge' – Paul Godwin. Contact Ian Johnston: 0208 4490693.
- 1 Portsmouth MES.** Club night – AGM, 7.30pm, Tesco Fratton Community Centre. Contact Roger Doyle: doyle.roger@sky.com.
- 2 Tiverton & District MES.** Running day at Rackenford track.

- 3 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 5 Romney Marsh MES.** Talk: 'Developments at Maxittrak' – Andy Probyn, 7.30pm. Contact Adrian Parker: 01303 894187.
- 6 Bradford MES.** Talk: 'Walschaerts, Piston Valves and Superheaters' – Ron Fitzgerald, 7:30pm, Saltaire Methodist Church. Contact: Russ Coppin, 07815 048999.
- 6 Brandon DSME.** Meeting at The Ram Hotel, Brandon, 7.45pm. Contact: Mick Wickens, 01842 813707.
- 6 Leeds SMEE.** Meeting night - 'It's About Time' - Richard Hanes. Contact Geoff Shackleton: 01977 798138.
- 7 Sutton MEC.** Bits and Pieces. Contact Paul Harding 0208 2544749.
- 8 Tiverton & District MES.** Club meeting at Old Heathcoat Community Centre, Tiverton, 7.30pm. Contact Chris Catley: 01884 798370.
- 10 North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.
- 10 Sutton MEC.** Sunday track day from noon. Contact Paul Harding 0208 2544749.
- 12 Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.
- 12 Southampton SME.** Talk: 'Operating a RN Helicopter from a Destroyer' - John Passmore. Contact David Goyder: 02380 421201.

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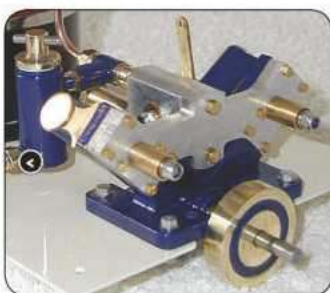
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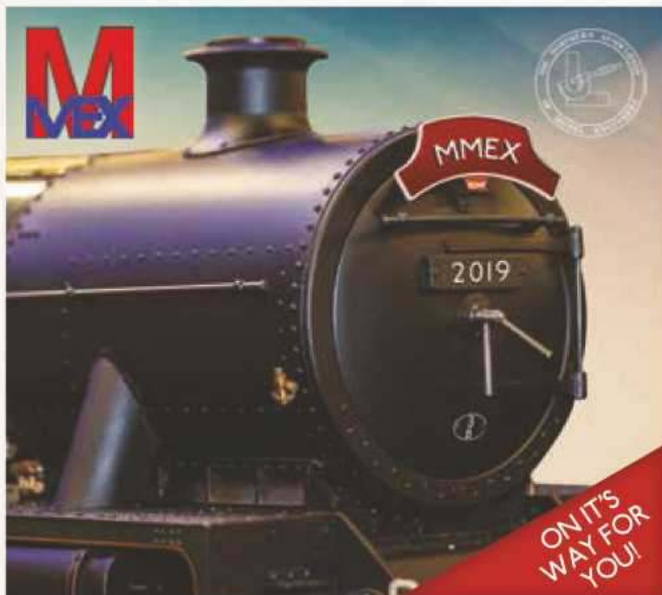
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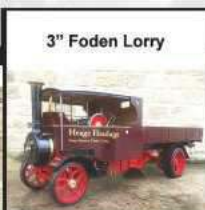
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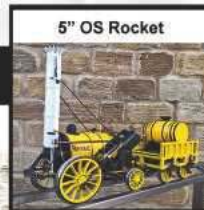
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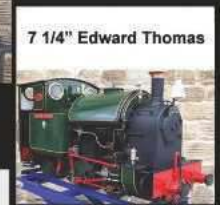
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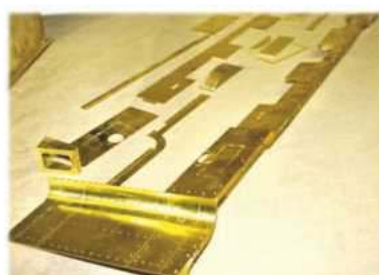
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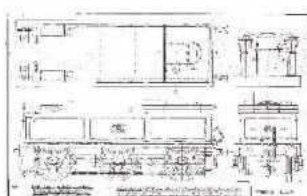
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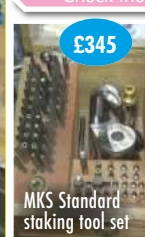
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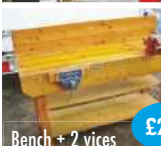
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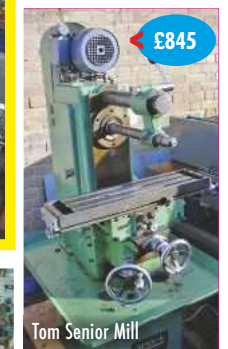
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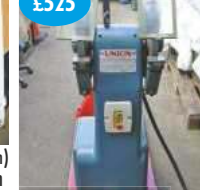
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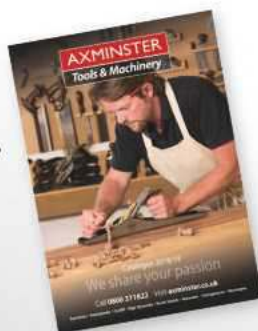
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