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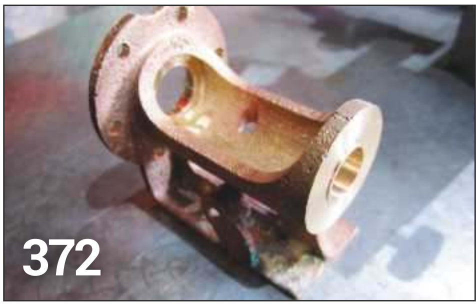

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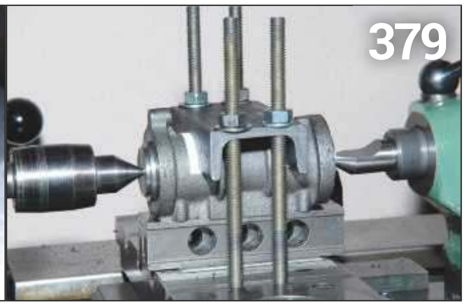

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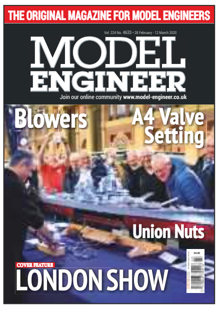

ON THE COVER...

A model of USS Missouri*, constructed entirely from Meccano, attracted a lot of attention at the London show (photograph John Arrowsmith).*


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SMOKE RINGS

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IMLEC 2020

Tom Parham writes:
Entries are invited for this year's International Miniature Locomotive Efficiency Competition (IMLEC), which is to be held at the Maidstone Model Engineering Society. The society was founded in 1929, and construction started on the track, located in Mote Park, in 1949. We have expanded a bit over the years, and facilities have improved somewhat. As a club we have decided that it was time that we should present our facilities for the use of IMLEC. The competition will take place on the weekend of the **10th-12th July.**

I would like to take this opportunity to invite all to apply to take part in the competition or to come along to watch. We will endeavour to accommodate all entries, potentially commencing the competition on Friday afternoon if deemed necessary.

Steaming up at the Maidstone track.

For the competition we will run in our usual anti-clockwise direction of our 1826 foot long dual gauge aluminium raised level track. The minimum radius on the running line is 50ft, and the maximum gradient is approximately 1 in 80 for a short section, predominantly 1 in 100 for much of the climb. The track can be a demanding drive, with the climb starting around the first bend. Although varying in grade, the climb stops at the exit of the far end loop, before commencing the long descent back to the station.

The intention is for the final run of the competition to be early afternoon on Sunday, leaving time for those travelling a long distance to have a comfortable journey home. We will be passenger hauling for the public after the competition has come to an end. Visitors are welcome to participate in public running should they wish to although spark arrestors will be required for those that do.

With plenty for visitors to the 450 acre park to enjoy, it's a great location to visit for all the family, regardless of whether or not you are entering. There is a leisure centre located within the park and a large, recently refurbished children's play area, a watersports centre etc.

For any more information, or to be sent an application form, please feel free to email me at tom_parham@hotmail.co.uk or call me on 07754 281280. More information on the club may be found at www.maidstonemes.co.uk

The closing date for entries will be Friday 3rd April.

Model Engineer Competition

I am pleased to report that the competition organisers have already received over a dozen entries for this year's competition, to be held as part of the Doncaster exhibition from the 8th to the 10th of May. Why don't you join them? Think how proud your model would be to win a medal at the exhibition. The fame! The glamour! There is still plenty of time to polish up your model and send in your application form. The last date for the receipt of applications is the 10th of April. Copies of the forms and rules may be found in *Model Engineer* issue 4630 (17th January) or on request by email from Mike Law at **post@michaellaw.co.uk**

One of this year's competition entries.

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

Part of the Club Shield winner's display was this fine locomotive workshop scene by the Harlington Locomotive Society.

The London Model Engineering Exhibition

PART 1

John Arrowsmith reports from Alexandra Palace.

Alexandra Palace was again the venue for the 24th London Model Engineering Exhibition which these days encompasses other forms of modelling as well. Almost 50 Clubs and Societies filled the Great Hall with a wonderful variety of excellent models, colour, the whiff of live steam, demonstrations and an activity zone where visitors could try out different aspects of modelling - in other words something for everyone. A good range of traders attended with just about everything anyone would want for their modelling interests. The attendance was good over the three days and organisers were pleased with all the contributions made by everyone.

A large display by the West London Meccano Society was placed Second in the Club Shield competition.

As usual the Club Shield Competition was enthusiastically entered by all the stands and a keenly contested event saw the **Harlington Locomotive Society** (**photo 1**) selected as the overall winners with the **West London Meccano Club** in Second place (**photo 2**) and the **Eastleigh Young Engineers** display was awarded Third place (**photo 3**). There was a great deal to see on the club stands and knowing where to start is the main problem. The **Harlington Locomotive Society** displayed a fine example of a working locomotive shed complete with many of the usual maintenance tasks being performed both in the building and outside. The working welder was a nice touch (**photo 4**).

The **West London Meccano Society** had a long display stand and included a guest builder with a superb example in 1:100 scale of an American battleship the *USS Missouri*. Painted in the correct haze grey the model featured all working gun turrets, propellers, anchors and radar scanners. It took the builder, Steve Briancourt, six and a half years to complete, amounting to about 6000 hours of work (**photo 5**). A special display of Meccano was provided by George Illingworth who had on display his large collection of fire engines covering many different types over the years. It was an impressive sight and added a great deal to the exhibition (**photo 6**).

The **Eastleigh Young Engineers** display included a number of award winning models including the 6 axis robotic arm which was designed and built by Angus French, who was 16 at the time. The **Chelmsford SMEE** once again produced an amazing selection of models covering just about every form of model engineering from traction engines to a working funicular railway (**photo 7**). Three rotating turntables had an array of working models (**photo 8**) alongside some very well-made locomotives. A selection of useful workshop tools also caught the eye (**photo 9**).

The largest steam model on show was the 10¼ inch gauge model of the LMS streamlined Coronation pacific 4-6-2 exhibited by the **10¼ Inch Gauge Society** who also had a selection of wagons on show (**photo 10**). Another very large locomotive was displayed on the **Northolt Model Railway**

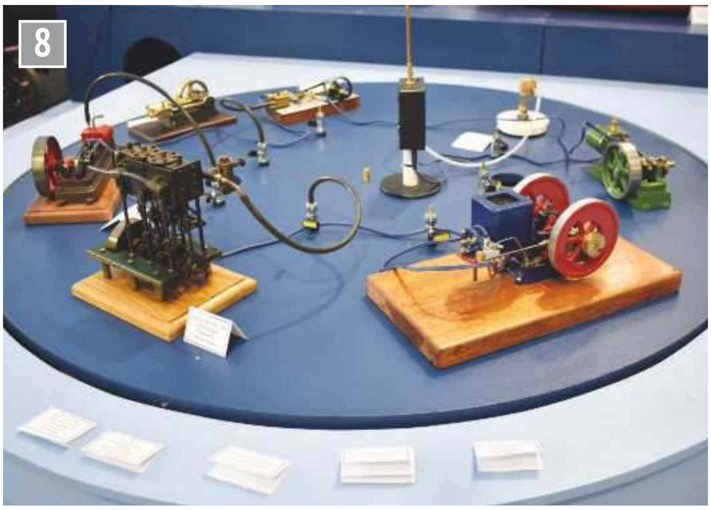
The Eastleigh Young Engineers display gained Third place in the Club Shield competition.

Inside the Harlington workshop.

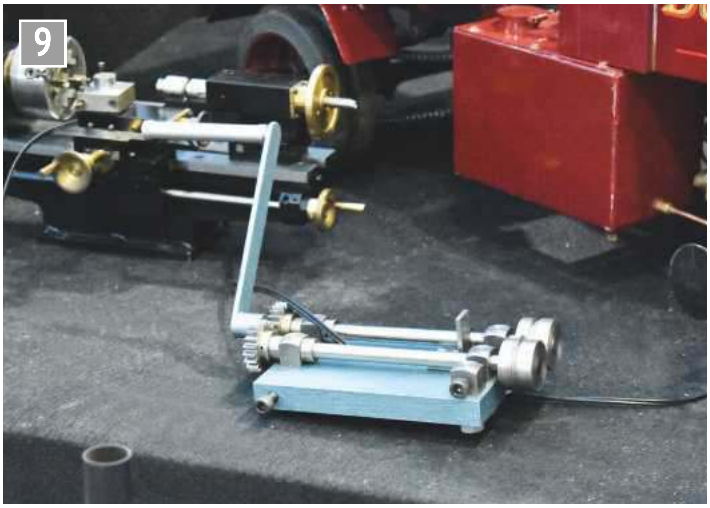
Steve Briancourt's wonderful Meccano USS Missouri *provided lots of memories.*

George Illingworth's display of Meccano built fire engines was a real attraction.

Another excellent display by members of the Chelmsford SME.



One of the three working turntables on the Chelmsford stand.



A useful bead roller was part of the Chelmsford display.

The 10¼ Inch Gauge Society Coronation Scot and rolling stock.

Club stand with the 7¼ inch gauge American **Big Boy** 4-8-8-4 which is being built by member Alan Antiss. This is a major piece of work and Alan had brought the inner engine, cab and tender to the show (**photo 11**). The tender is a job and a half on its own with five fixed axles and a four wheel bogie, all of which are fully sprung. Assembly of the tender used 2900 rivets with some parts being fixed with car panel adhesive (**photo 12**). Additional locomotives and rolling stock (**photo 13**) were also a feature on the stand where a very nice 5 inch gauge mineral wagon caught my eye (**photo 14**).

The **St Albans & District MES** (**photo 15**) provided a well made range of excellent models from sailing ships to traction engines (**photo 16**) with some very nice locomotives and powered

The front end of the inner engine on Big Boy *under construction by Alan Antiss.*

Big Boy*'s tender with some of the 2900 rivets.*

Part of the display by the Northolt MRC.

This little ballast wagon was part of the Northolt display.

An excellent presentation by the St Albans & District MES.

A nice 1½ inch scale Allchin under construction by a member of the St Albans MES.

The Maidstone MES presented a well filled display.

A superb 9F was part of the Maidstone MES display.

This fine Midland Single was also part of the Maidstone MES display.

BR Standard locomotives on the Sussex Miniature Locomotive Society stand.

This excellent 5 inch gauge Britannia *was part of the Sussex MLS display.*

A 5 inch gauge BSK coach was the work of Mike Jack from New Zealand.

launches - all part of an impressive display. If superbly made locomotives were your main interest then you could not better a superb display by members of the **Maidstone MES** who, for the third year running, had a completely new selection of locomotives on show (**photo 17**). The 5 inch gauge BR 9F 2-10-0 built by Paul Tomlinson used modern machining methods for most of the engine. Having bought the chassis from a well-known supplier and redrawn the drawings into 2D and 3D format using modern techniques, the remainder of the build took just two years (**photo 18**). A prize winning Midland Single built by Edgar Playfoot was another outstanding model on the stand (**photo 19**).

From the adjacent **Sussex Miniature Locomotive Society** (**photo 20**) came a display of BR standard locomotives with an example of most classes, the main exception being the **Duke of Gloucester** 8P. An excellent example of a Britannia 4-6-2 (**photo 21**) combined with a standard Class 4 and a Class 5. A new standard Class 3 Tank 2-6-2 chassis designed by Mike Jack also stood out as a superb example of modern methods of building. The BR Mk 1 BSK Coach in 5 inch gauge was built by New Zealand engineer Mike Jack and was a superb example of the type (**photo 22**).

Promoting the values and events of the **7¼ Inch Gauge Society** were a couple of very different designs of locomotives. The 0-6-2 N2 tank locomotive with condensing gear built by Bruce Harvey was

A prominent display by the 7¼ Inch Gauge Society.

On the Southern Federation stand was this lovely 5 inch gauge L&Y 0-6-0.

paired with an example of a Bassett Lowke 'practical' 0-6-0 tank locomotive circa 1967 and built by P. Waring for the Kings Newham Light Railway (**photo 23**). Combined with photos and information about the group, visitors were presented with a clear insight into what the society was about.

Information, photographs and models featured on the stands of both the model engineering bodies that look after members' interests in the UK. The **Southern Federation and the Northern Association** provided lots of details regarding the official paperwork and details of the Young Engineers schemes promoted by them (**photos 24** and **25**).

Members of the **Ickenham & District SME** (**photo 26**) had a good compact display of work including a small N gauge layout depicting scenery and workings of Southern Germany which filled a nice corner of their stand. Peter Partington's Foden steam lorry is making good progress and he showed both the axles from his Foden C Type. Brian Hoare's 2 inch scale Burrell traction engine was a good example of the prototype (**photo 27**).

The **Society of Model and Experimental Engineers** had a comprehensive display of models and equipment on their stand. John Clarke's little shoemaker's sewing machine and workshop was an attractive piece of work (**photo 28**). The well-made model of a 'Twin Wasp' was from their archive and was an excellent example of these internal combustion engine types. It was a radial engine R-1830 with a capacity of 130cc and built by Ron Harris to a design by Bob Roach (Australia). The original, circa 1932, was fitted to B24 **Liberators** and Douglas C47's (**photo 29**). The centre lathe demonstrations were popular, as always.

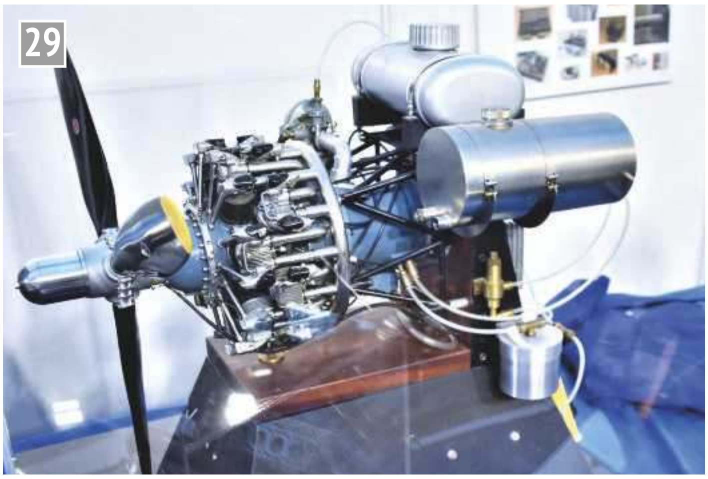
●To be continued.

The Northern Association display.

The Ickenham & District SME had a nicely balanced display.

Brian Hoare's fine 2 inch scale Burrell traction engine.

Part of the extensive SMEE stand was this super little shoemaker's workshop built by John Clarke.

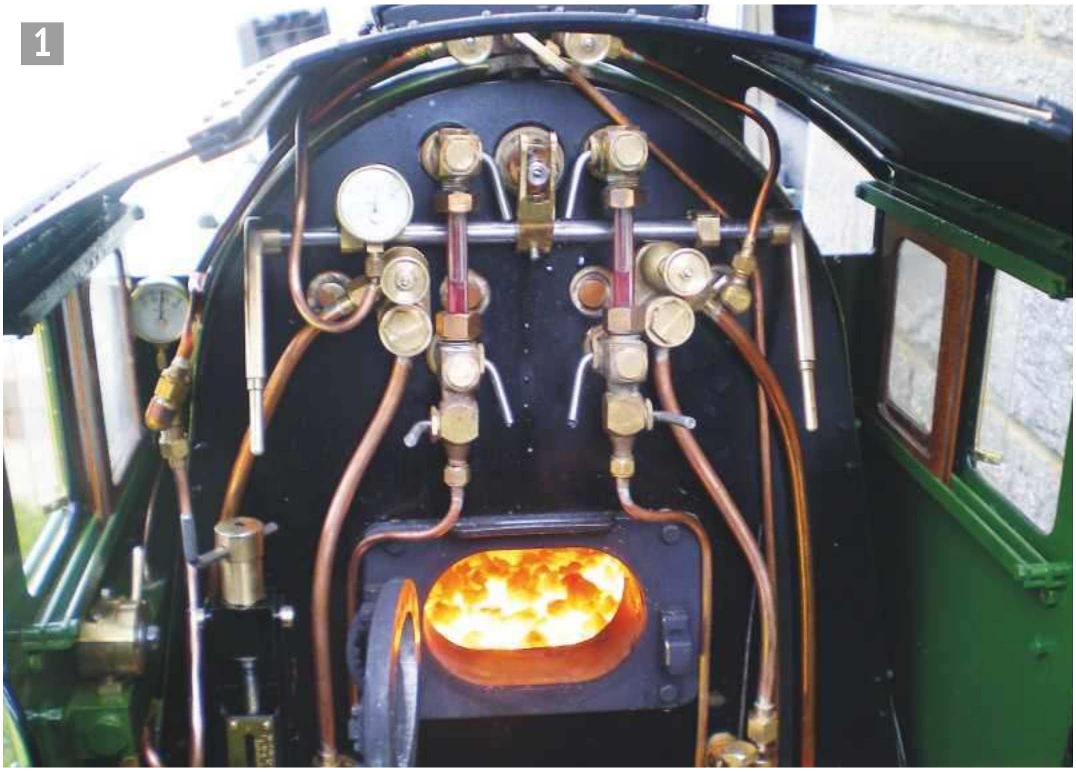


This twin Wasp radial engine R-1830 was built by Ron Harris and was part of the SMEE display.

Union Nuts, and How to Make Them

PART 1

Brian Baker asks 'why buy union nuts?' when it is not difficult to manufacture your own.



The Editor might give you a prize if you find more than 12 union nuts in this picture, or... he might not (Nope! I found 14 – Ed.).

It's surprising how many union nuts are to be found on a completed locomotive - I gave up counting at 50 on my 7¼ inch A3. Even in this partial cab shot (**photo 1**) I counted over twelve. I am a great fan of steam operated drain cocks (**photo 2**) and to fit them to the A3 I needed 22 union nuts and olives of various sizes. Now you can buy them but not always in the size you want and when you break one on a Saturday afternoon your Sunday morning steam up is in doubt, unless you can quickly borrow or cadge a replacement, or better still make them yourself.

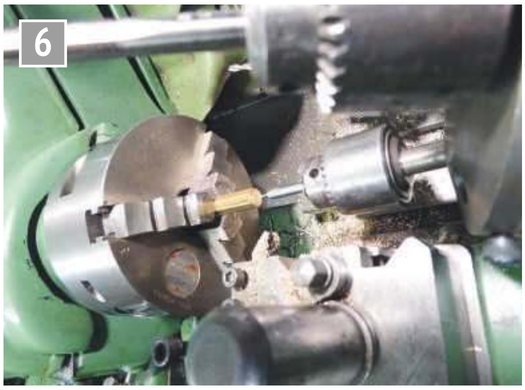
I have also had problems with the brass olives that are supplied with commercial union nuts. In order to fit the extension that is silver soldered onto the pipe used, the hole through which the pipe passes in the nut has to be larger than necessary just to pass the pipe (**photo 3**). I have had instances where this larger hole weakens the nut to the extent that the olive retaining part of the nut breaks away. Also, I have had the olive, which is usually made from brass, break away from the copper pipe (**photo 4**).

All this leads me to make my own union nuts and olives and I

Nuts and olives of different sizes are basic parts of this steam operated drain cock.

You can see how the hole in the left-hand nut, used with a brass 'sleeve' type olive is larger than the one with the copper crushable olive. INSET: Here is the remains of a brass olive, which appears to have suffered corrosion prior to breaking.

It all just about fits in to the work space. All the tools needed.



Centre drilling the faced hexagonal brass bar.

Six tool turret rotated and here is the drill for the pipe size.

The tapping drill, complete with paper depth stop.

am writing to set out the simple steps that enable beginners to our delightful hobby to make some more of the parts that we all use. They are very quick to make and once you get into the swing of it you will make lots more than you immediately need, which you will of course keep for your next model.

Many years ago, I made this six station tailstock tool holder (**photo 5**) and, whilst you could make one, I know they are commercially available. For this operation you will use five of the six stations, as well as a parting tool - mine is rear mounted, upside down - and a bevelling and finishing tool in the toolpost, of which more later. Do not be put off having a go at making union nuts if you do not have a tailstock tool holder because you can put the required tools in your tailstock drill chuck, changing them as required. Keep the tools in the correct order to speed up manufacture.

Having inserted into the three jaw chuck a length of suitable sized brass (or steel) hexagon material, this should be clamped to allow about 3 nuts to be made before it has to be unclamped and slid forward again. Obviously, you will choose the size of material to be appropriate for the size of nuts you are making. Brass hexagon is widely available from our suppliers.

Firstly, face the end off flat, as I will show a little later, and centre drill this end (**photo 6**) - this should be the first tool in the turret. Then, using a drill which will give a hole about 4 thousands of an inch (or 0.1 mm) larger than the pipe you want the nuts for, drill into the end for a depth of about ½ inch (12 mm) (**photo 7**). Make sure that the hole you have drilled is as deep as the full depth of the nut you are making. Some sizes of union nut e.g. ¼ inch x 40 TPI can be used for ⅛th or 5/32nd diameter pipe, so make sure the hole you drill is the right one for you. I often make these union nuts for stock and I drill them the smaller size, opening them out later if needed for larger pipe.

The next operation is to drill in tapping drill size for as deep as the depth of thread required. You can make up a collar that goes around the drill stem and is secured with a brass screw, or, as I do when I only want a few union nuts of a size, put a piece of tape round the drill (**photo 8**). This drilling operation will produce a 'V' shaped base to the inside of our nut and this needs to be flat, for proper seating of the olive, so the next tool in the turret is a 'D' bit which, if used carefully, will leave a flat bottom to the nut without increasing the depth too much (**photo 9**).

Now the thread, corresponding to the tapping size drill used, is cut. I find that most plug taps have a small tapered starting bevel on them and if used on brass will start the thread without using a 2nd or taper tap, although it might need a bit more of a push to start it cutting (**photo 10**). I usually cut the tread manually, by pulling the lathe's belt backward and forward until the full depth of thread is obtained as the tap 'bottoms' in the hole.

The 'D' bit gives a flat seat at the operating face of the nut.

Tapping the thread - I usually pull the belt round by hand but it could be cut under power.

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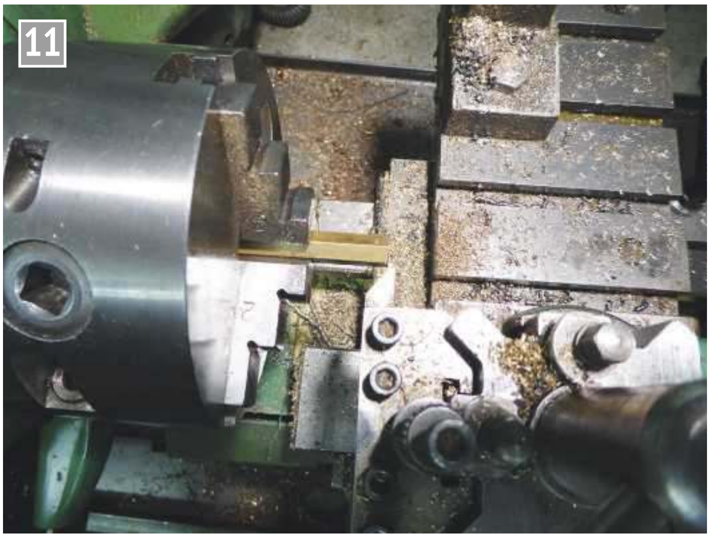
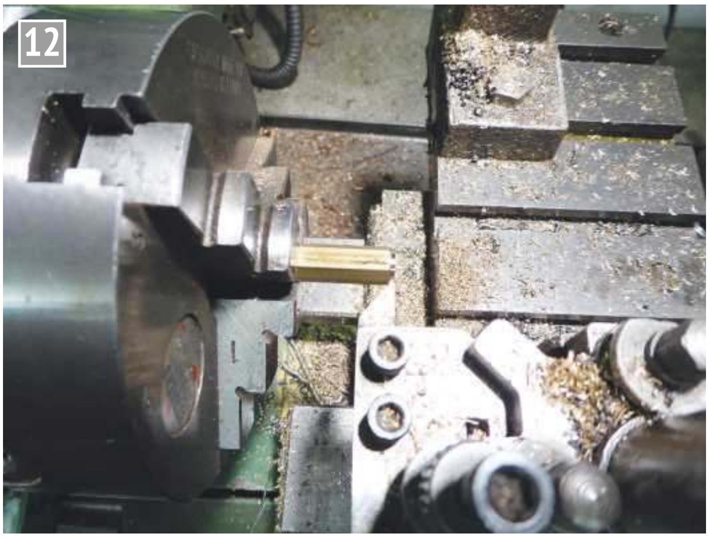


The bevelling tool set up with its short horizontal face about level with the hexagonal face of the material ...



... so that just a skim is removed.

Now we pull the tailstock turret back towards the right-hand end of the lathe and use the bevelling and finishing tool. It is ground from a piece of square tool steel with one cutting face at 45 degrees to the lathe axis, but with a short piece on the right hand side of the tool steel parallel to the lathe axis, and the third facing part of the tool left at 90 degrees to the lathe axis (**photo 11**). I give each of the cutting faces relief of about 7 degrees. This tool is first used to cut the bevel on the nut and the small turned end (**photo 12**). The facing operation is done a little later with this same tool.

At this point I measure the depth of thread that I have obtained and, allowing $\frac{1}{16}$th of an inch extra (1.5mm), set up the parting tool (**photo 13**). Having parted off the embryonic nut, I use the facing part of the bevel tool to face the end of the hexagonal material ready for the next repeated machining sequence (**photo 14**).

Eventually, once you get into the rhythm of the production, you will produce a small pile of part finished nuts (**photo 15**). A word of advice here - always make more than you think you will need, for 'dropping allowance' and the extra jobs which always crop up.

Now we need to put the bevel on the back of the nut so, gripping them in the three jaw chuck, reverse way round, use the bevelling tool to cut the bevel in exactly the same way as we turned the other end, trying to make them match as well as you can. Face off the untidy burrs from parting off (**photo 16**). Finally, I usually put the pipe sized drill through again to clean the hole drilled earlier (**photo 17**).

●To be continued.

The depth gauge calliper, used to set the parting off depth. The one shown was a free gift to Model Engineer *subscribers quite a while ago.*

The bevelling and facing tool facing the stock ready for the next repeated machining sequence.

A bunch of half-finished nuts.

Bevelling the rear and facing off the parting remains.

Cleaning out the hole through which the pipe will pass.

PART 6

Magdalen Road Revisited

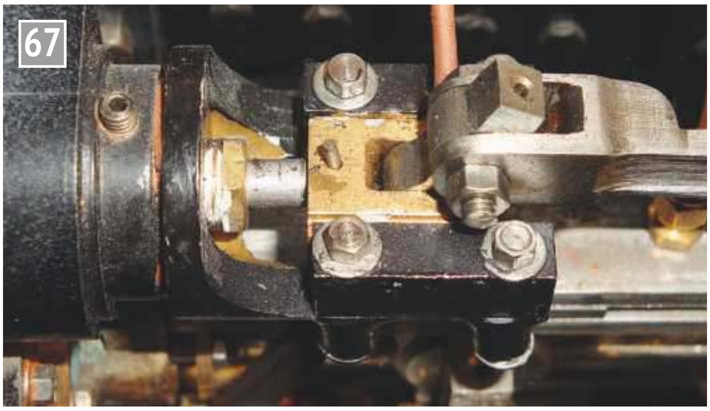
Jeremy Buck invites us back for a further tour of the Magdalen Road garden railway.

Continued from p.313
M.E. 4632, 14 February 2020

A4: Setting the valves and finishing the chassis

I had never set piston valves before, let alone on a locomotive with conjugated valve gear, so I had been somewhat apprehensive about the prospect of doing it on the A4. As noted above, the valve gear is essentially a straight copy of Don Young's design for *Doncaster*. One difference was that the connection between valve crosshead and spindle was a screwed thread on the end of the spindle engaging with a tapped hole in the crosshead. However, there was no room to provide a locknut. In contrast, Don specified a tapered pin through crosshead and valve spindle.

Unhappy about the difficulty of achieving true concentricity with a screwed connection very close to the gland, I had decided to adopt Don's arrangement and modified the valve crossheads accordingly (**photo 67**). This was all very well but it did mean that setting the valves required the piston valve bobbin to be adjusted in position on the valve spindle which, of course, could only be done by removing it and the spindle from the steam chest, which in turn required the front valve crosshead guides to be removed, which in turn required the two to one gear to be stripped down.



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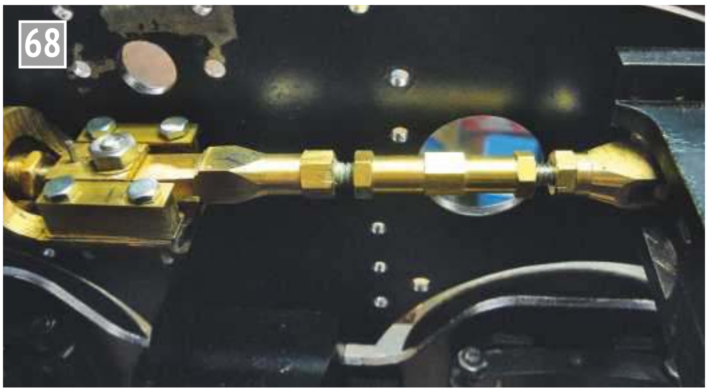
A4: Outside cylinder piston valve crosshead showing tapered pin connection. The top of the pin had had a collision with the combination lever!

Don's description of valve setting in *Locomotives Large and Small* does, I think, make light of what, if his instructions are followed to the letter, is a tedious process. His recommendation for two DTI's - one reading the end of the valve spindle, the other the crosshead - seemed to me to be very awkward to set up, especially for the inside cylinder. I will not say that it is impossible but I thought the investment in time to make attachments on which the mount the DTI's (and I have only one DTI anyway) indicated that I would need to find another way.

Also, he does not mention that the valve has to be removed from the steam chest to make the necessary adjustments in setting (in thousandths of an inch). I could see that requiring more than one iteration and, indeed, doubted whether the adjustment of the bobbin on the spindle could be controlled with a precision consistent with the DTI readings. Also, I could not face having to remove the inside valve spindle to make adjustments so I had included a turnbuckle in the drive link (**photo 68**) to allow the necessary adjustment without extraction of the valve spindle and bobbin – or so I thought.

After some thought I concluded that the circular ports largely negated any benefit from the very precise setting of valve position, theoretically possible using Don's method, in order to achieve equal openings of the front and rear ports. Instead, I set each valve bobbin to move symmetrically fore and aft about a point equidistant between the ports. Of course, for the valve events to be correct this required the ports to be in the right place and at that point I realised that I did not know if they were.

It would have been comparatively easy to establish their positions when the cylinders were off the frames but by this time they were bolted to the frames and the valve gear had been erected. I made a simple trammel, as shown in photo 55 (part 5, M.E. 4632, 14th February), comprising two 7⁄32 inch diameter 'pegs' that could be adjusted in position by trial and error until both fitted a port, one at the front and the other at the rear, when inserted in the steam chest. An adjustable plate could then run up to the front of the steam chest and be locked to fix a datum for the ports. When I set out to check the measured spacing of the ports against the required dimension, it



68

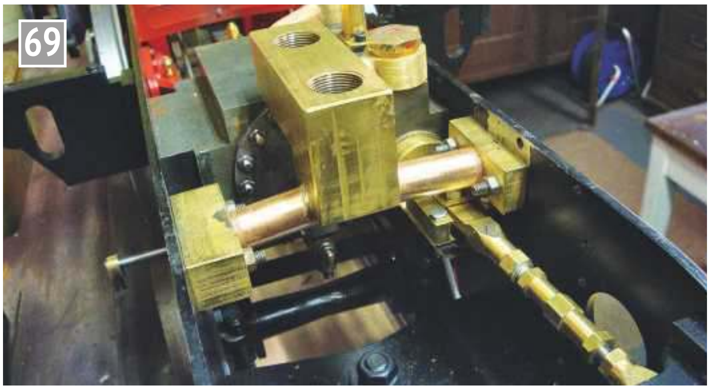
A4: Connecting link between 1:1 lever and inside cylinder valve crosshead. If I was doing it again I would adopt a finer thread for the turnbuckle.

came as something of a shock to find that nowhere on the cylinder drawing or Don's notes on machining it is this dimension given explicitly, it being necessary to derive his intent from dimensions of the valve liners and the complex cylinder block casting.

It turned out that the design intent was $\frac{3}{32}$ inch lap and zero exhaust clearance for the valve bobbins that I had made in accordance with Don's dimensions. Checking the port positions using my trammel revealed that the required port spacing in each of the outside cylinders was exceeded by about 0.09 inch with consequential exhaust clearance and increased lap if I used the bobbins unchanged. (This error was unrelated to the different lengths of the valve bobbins that I had earlier identified and corrected.) Errors of this magnitude were too large to be tolerated so I had no option but to make a further modification to the length of each bobbin to match the port dimensions in the cylinder in which it would be installed. The evidence is visible in photo 55.

I could now set the valve in each outside cylinder by setting the crank midway between forward and backward dead centre with the locomotive in mid gear. In this position the combination lever was vertical and the bobbin could be set on the valve spindle, by measurement from the datum (the front of the steam chest), to sit symmetrically about the ports. The crank was then rotated through 180 degrees and the position of the bobbin checked. The exercise was then repeated to get the best result for both crank positions.

To set the inside cylinder valve I used the same method but, because the exhaust steam pipework, which obstructed access to the front of the steam chest (**photo 69**), could not be removed without

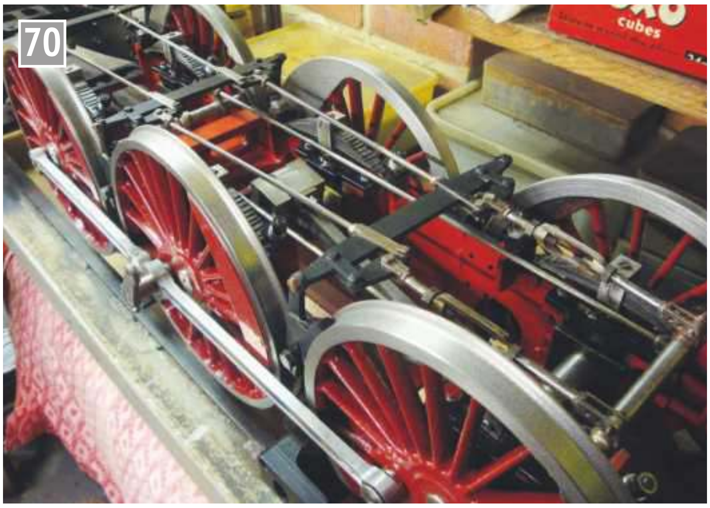


A4: The inside cylinder valve cannot be accessed from the front after installation of the outside cylinder exhaust pipework.

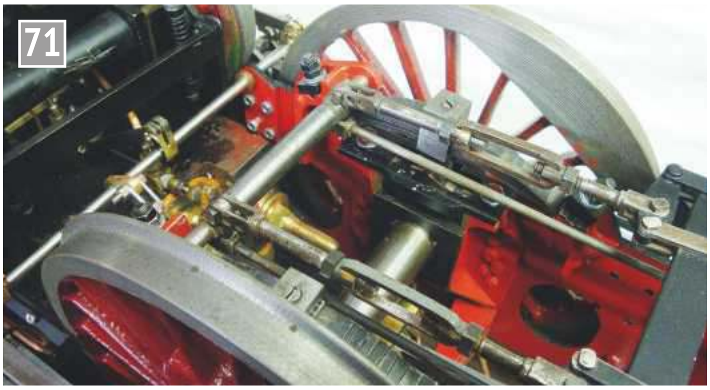
dismantling the outside cylinders, I had to work from a datum at the rear of the steam chest. Removal of the, just accessible, tapered pin that connected the valve spindle to the forward guide enabled the release of the valve spindle and bobbin from the rear end. My trammel gauge revealed that this bobbin, too, required correction to match the ports. After correction and re-assembly I did have the satisfaction of being able to use the turnbuckle link to adjust the valve position, in mid gear, to be symmetrical about the ports. As with the outside valves, I set the crosshead midway between forward and backward dead centres (using steel rule and dividers) with crank first up and then down to set the valve. An interesting observation from this exercise was that the inside cylinder stroke was $\frac{7}{32}$ inch less than the $2\frac{5}{16}$ inch stroke of the outside cylinders. How was it that I had not noticed this when rebuilding the crank axle and later when setting the length of the piston rod to achieve equal clearances at each end of the cylinder?

It proved impossible to achieve exactly the same setting of the valves, relative to the ports, with crank up and crank down but the biggest difference was just over 30 thou which I thought was tolerable.

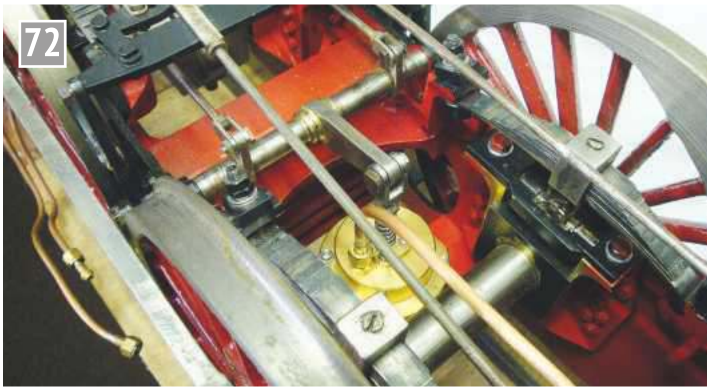
I was now able to turn my attention to full forward and reverse settings and the need to provide positive stops at the reverser to limit the die block travel. I confess that at this point I had no idea what the maximum cut offs would be; fortunately my son came to the rescue by modelling the valve gear in the Dockstader program which indicated that cut offs of between 65 and 70% could be achieved with the die block comfortably within the travel permitted by the expansion link. The hardest part then was to set the lengths of the stops which took the form of a block between the screw and the base of the reverser for reverse gear,



A4: Fully compensated brake rigging viewed from underside.



A4: Close up of brake rigging at leading coupled axle showing the adjusters.



A4: Close up of brake rigging at rear coupled axle showing the cross shaft and connection to the vacuum cylinder.

and a suitably dimensioned extension the screw within the barrel for forward gear. The only practicable way was to use trial and error. Initially, I had not intended to provide a cut off indicator but it became apparent that this was desirable and fortunately I was able to arrange this to be integral with the stand.

Having set the valves I connected up the air compressor again. This time the wheels began to revolve without assistance when the air was turned on, and after a little initial stiffness, the wheels rotated smoothly at pressures down to about 15psi.

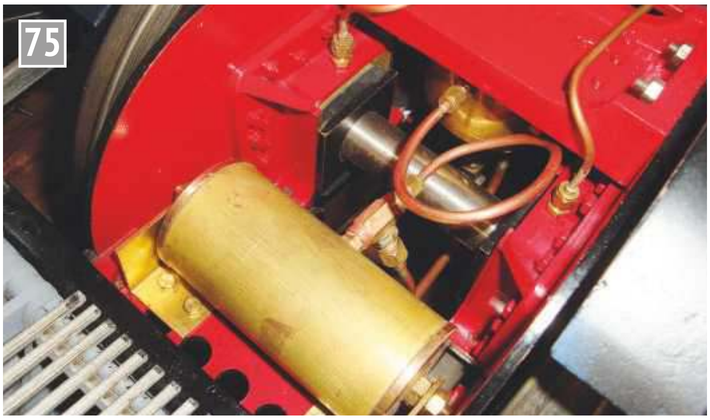
Finally, on the chassis, I made and fitted new brake blocks, hangers and compensated rigging, complete with adjusting screws (**photos 70**, **71** and **72**) and working vacuum brakes based on the system described many years ago in *Model Engineer* by Brian Hughes and adopted also by Don Young in his *Doncaster* design. However, my installation differs from both in that brake power is provided by a single 1½ inch bore vacuum cylinder with rolling ring piston (**photos 73** and **74**).

This is mounted, along with a vacuum reservoir immediately forward of the firebox (**photo 75**). It was designed and made by my son. He is a far better machinist than I am. I used a vacuum limiting valve from the PNP range, mounted, due to lack of space in or below the cab, on the tender – as described later. Incidentally, the non-return valve in the vacuum cylinder was adapted from a valve supplied with the diaphragm in a PNP vacuum cylinder.

The bottom side of the vacuum cylinder connects to the train pipe to which the vacuum gauge is connected via a tee connection. I had originally intended that the train pipe be extended forward to the dummy vacuum connection at the front of the locomotive but finding a route for a pipe that would, in any case, have no practical use proved too difficult and the idea was abandoned. A separate vacuum gauge is tee'd into the pipe that links the vacuum reservoir to its counterpart on the tender.

A4: Vacuum cylinder prior to installation.

A4: Vacuum cylinder parts showing the rolling ring.



A4: Vacuum reservoir.

●To be continued.

PART 2

Building Dancer

The Engine

Dancer on the Mahurangi River.

John Olsen constructs a 1:1 scale steam launch.

Continued from p.299
M.E. 4632, 14 February 2020

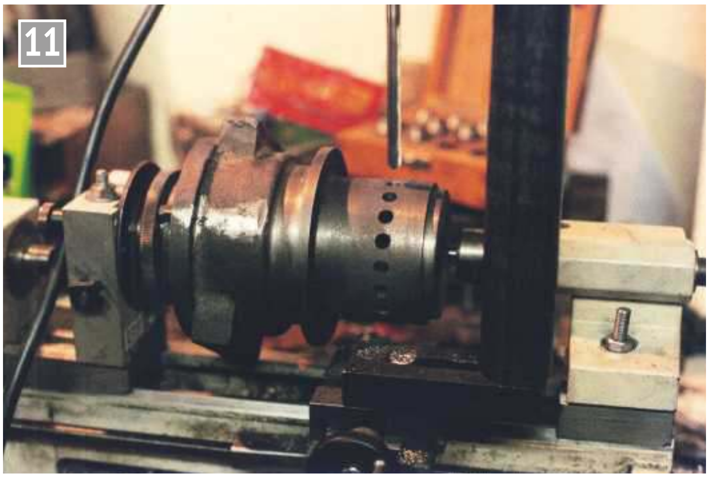
Dancer has a modified version of the A. A. Leak designed compound engine, described in *Model Engineer* back in the 1980's. As mentioned in the first article, I started on a set of patterns for this back before the turn of the millennium, at a time when my main machine tools were a Unimat 3 and a six inch AMMCO shaper - certainly not adequate tools to undertake the machining of the castings for a 3 inch HP, 5 inch LP by three inch stroke engine! I did acquire a larger shaper around that time, a ten inch Alba. The theory was partly that I might manage to acquire larger tools as time went on. It is also true that once people see that you have made a good start, they are often very helpful about offering access to larger equipment. Having made two patterns, the baseplate and one support column, everything went into storage while we went to work in Germany for two years. Actually, the Unimat and a small drill press came with us and I did most of the work on a Stuart Double Ten in the *keller* of our German apartment.

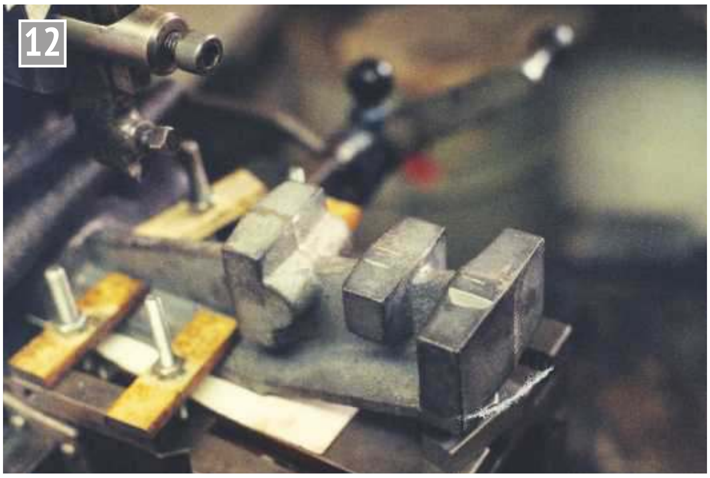
On return from Germany I was quite keen to proceed with the project. I visited a foundry in Palmerston North that has frequently been very helpful to model engineers. They provided some useful advice so I increased the draught on the existing patterns and proceeded to make some more. This included a pattern for the crankshaft, since they were able to cast spheroidal graphite iron. **Photograph 10** shows the castings, along with the patterns. Thus armed with the bulk of the main castings, and having received my late father's Myford ML7, I was able to make a good start on the machining.

For the larger items, such as the bedplate, I enrolled in a night class at a polytechnic,

10

Castings and patterns.


Dividing ports for the Edwards air pump using a Unimat 3.


Machining one of the columns on the 10 inch Alba shaper.

where I was able to use a milling machine and a larger shaper. A fellow steam boat builder allowed me access to his commercial machine shop to machine the low pressure cylinder. One advantage of the Leak design is that the cylinder block is made from separate pieces bolted together. I took advantage of this to change the design slightly, so instead of having a piston valve on the HP cylinder and a balanced slide valve on the LP mine has piston valves on both ends. I didn't actually take as much benefit from this change as I should have, as I could have made the ports much more direct than I did.

The design with separate pieces enabled me to bore the high pressure cylinder and both piston valves and their liners on the Myford. **Photograph 11** shows that the Unimat did take part in the project. It was the only machine I had with dividing facilities at the time, so the photograph shows it machining the ports in the Edwards air pump, with the aid of some raising blocks. The ten inch Alba was a useful size for some of the components. **Photograph 12** shows it at work on one of the columns.

About a year into this work, I had occasion to start a new job, located in Auckland, about 400 miles from where we had been living. So we had to pack up the workshop and I had to go forward and start the new job, while my wife would fly to Auckland and go house hunting with me at weekends. We were very fortunate in finding an ideal house being offered in a private sale. It turned out that he was an ex steamship engineer, which may have helped us in negotiating a price that the bank would go along with. The most attractive feature of the house to us was the large drive- in garage workshop under the house, with plenty of room for machine tools and building the boat. As mentioned in the first article, the headroom was the main limiting factor. The fact that the house had an outstanding view over Auckland Harbour towards the Rangitoto mountain did not hurt in the least.

Shortly after arriving in Auckland, I was able to buy an RF45 mill drill and also found an 18 inch Alba shaper complete with an excellent swiveling vice. The shaper needed a bit of restoration work but enabled me to tackle much larger jobs. Naturally it arrived after the bulk of the larger work had already been done. I still only had the Myford for turning work but you would be surprised what an ML7 can tackle with a bit of thought. The high pressure cylinder, the piston valve housings and both of the piston valve liners were able to be bored on the Myford. **Photograph 13** shows the high pressure cylinder being bored. It is not obvious from the photograph, but the cylinder is mounted on the faceplate using a sacrificial piece of aluminium plate about half an inch thick. This gives somewhere for the boring bar to run out before starting on the faceplate. A similar set-up was used for all the bores done on the Myford. This gave bores parallel to a smaller error than I can detect, i.e. under about one thou. I found this quite impressive for a machine that was new in 1953, with only relatively small white metal bearings.

The largest single turned item was the crankshaft and the offset turning for the big end journals would obviously not be able to be done on the Myford. However, I adopted an approach that I first saw advocated by Professor Chaddock in *Model Engineer*. This is to remove the bulk of the material for a crankshaft between centres in the milling machine. I wrote an article about this for *Model Engineer* some years back (**ref 3**). I had done this with the crankshaft for my Stuart 10V on the Unimat, reducing about three pounds of free cutting mild steel bar to about a three ounce crankshaft.

The original Stuart crankshaft, from a very old set of castings obtained second hand, had a terrible hard spot at the weld in the middle. I gave up on trying to get a good finish on it. The cast spheroidal graphite crankshaft for the Leak engine had proportionately less material to be removed. I was able to use a Vertex BS0 dividing head to support it between centres using offset pieces that I had incorporated into the pattern. This enabled me to take it down to about twenty thou over the nominal size, albeit with a terrible finish that you would never try to run a bearing on.

With a smaller crankshaft, the next move would have been to put it in the lathe and do some very light finishing cuts to bring it down to the final size. This not being practical, I found


Boring the high pressure cylinder on a Myford ML7.

an automotive machinist who was able to take it down to size on his crankshaft grinding machine. He told me afterwards that I should have milled down a little closer to the final size, since the graphite component of the SG iron was clogging his grinding wheel and he had to dress it frequently. The grinding gave a beautiful finish on the journals.

Once it was home, I was able to cut away most of the offset pieces with a band saw before finish turning them to match the adjacent journals. This was done in the Myford, which was just able to accommodate the part between centres. After the balance weights were added I was also able to true these up between centres in the Myford. So when people ask how I turned the crankshaft, I take great pleasure in replying that I did it in the Myford… which does raise a few eyebrows! A part of one of the left over offset pieces was tested with a hammer to check the properties of the material. A quarter inch section about an inch wide was able to be hammered over to almost a right angle before a crack started to develop, confirming that the material is much tougher and more malleable than ordinary grey cast iron. **Photograph 14** shows the crankshaft in place in the bedplate.

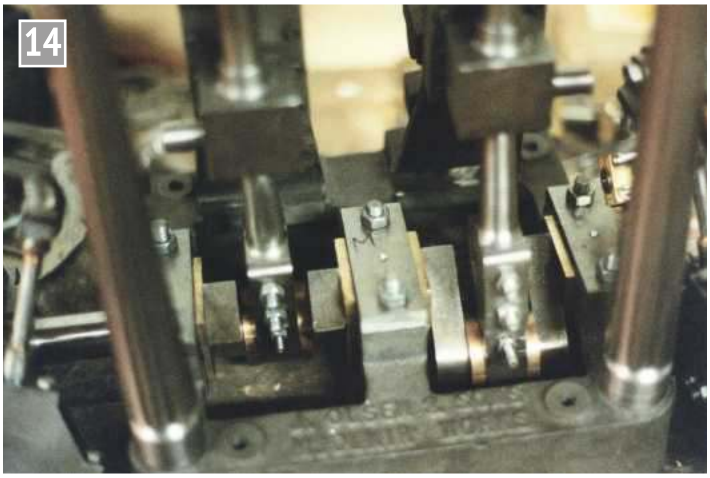
Another interesting part of the machining was when I made the expansion links. This was done quite early on using the six inch shaper, using an auxiliary table that pivoted at one side, controlled by an angled bar across the machine. This gives a large radius curve, the radius being controlled by the angle at which the bar is set. This was based on a special planer vice for doing curves in an old American machine shop practice book. I described the set-up in a *Model Engineer* article (**ref 4**). **Photograph 15** shows an expansion link in place.

The flywheel was partly done on the milling machine using a rotary table and was finally trued up on the engine itself once it was running on air. A compound table was bolted down next to the engine and a carbide tool was clamped onto the table and used to make light cuts across the face and the rim. The flywheel set up on the rotary table with a round ended milling cutter is shown in **photo 16**. By the time the flywheel was machined, most of the engine was starting to come together and **photo 17** shows it before painting and applying the wooden insulation to the cylinders.

The Leak engine is of quite a short stroke compared to many other designs. Although I have not of course been able to discuss the reasons for this with the late Mr. Leak, it seems likely that in this he was following a trend in some of the later Edwardian steam launch engine designs. Some of the Simpson Strickland designs also have quite a short stroke. It is interesting to speculate about the possible reasoning for this.

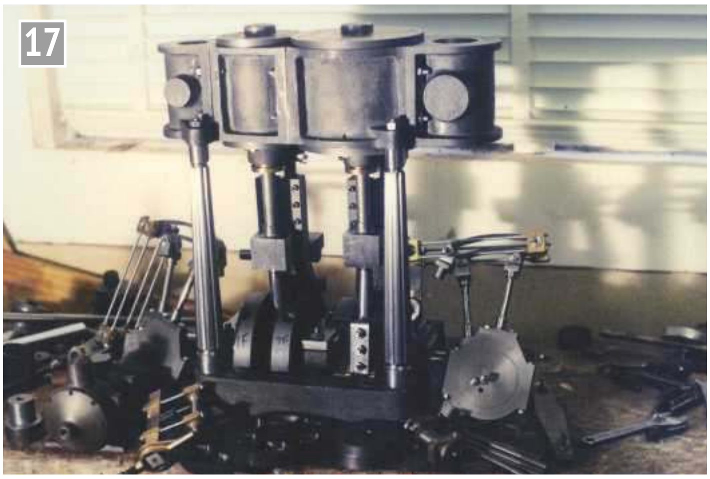
A shorter stroke engine is of course more compact. For the same loads on the bearings, it can turn at a higher speed. This is partly because the reciprocating masses will be a little less, both the piston rod and the connecting rod being shorter. The other factor is that even for the same weight of reciprocating parts, the loads on the bearings will be less at any given speed and hence for the same load the engine can turn over faster. As a result, it turns out that the shorter stroke engine can give the same power as the long stroke engine for the same bearing loads but turning at a higher speed.

This turns out to be of

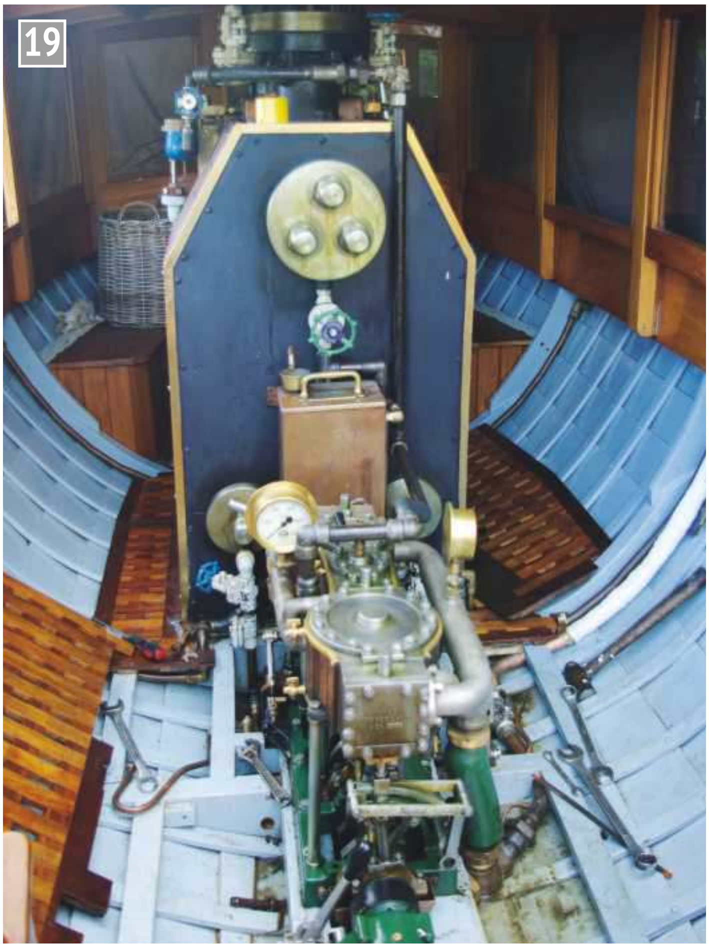

Crankshaft in place on bedplate.


Detail of valve gear.

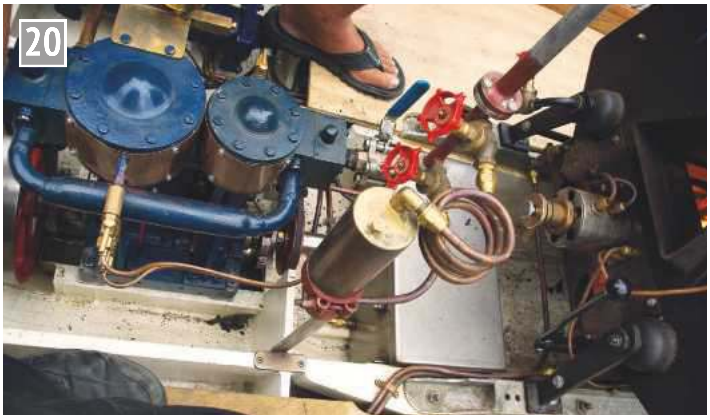

Machining the flywheel with rotary table and milling machine.


Starting to come together.

Running on steam at a club meeting.



Modified Simpson Strickland engine fitted to Galilee II.



Reliable compound engine fitted to Clansman.

interest for steam launches, since one of the limiting factors is the large size of propeller that a steam engine tends to need. The maximum size may be limited by the choice of hull, especially where a hull designed for internal combustion is being repurposed. It may also be limited by the draught of the proposed cruising water, in particular on canals. So, although a smaller propeller turning at a higher speed will be a little less efficient, it may well be worthwhile going that way to reduce the draft.

In the particular case of *Dancer*, the Leak engine will run happily to at least 600 rpm and the propeller used is 22 inch diameter by 22 inch pitch. So far burner limitations have prevented finding out how fast she can really go but performance is certainly adequate. The limit for a displacement hull like this is the hull speed, which for *Dancer* should be around 7 to 8 knots, and it does appear that she is capable of about this, although so far I have not been able to take any proper measurements. I have now got the burner going much better so hope to better determine the performance next time she is out. A higher speed engine like this will not appeal so much to those who like to see the parts turning around slowly. My own thought on that is that I would love to build a side wheel paddle steamer, where the rpm would indeed be much lower and a diagonal compound engine would be beautiful to watch, but my wife is somehow reluctant to permit another steam boat project! **Photograph 18** shows the engine running on steam under test before installation in the hull.

If anyone is inspired to build a Leak engine, castings and drawings are available in the UK from Camden (**ref 5**) to do so. These would be to the original plans, i.e. with a balanced slide valve on the LP cylinder. It is worth noting that there are some significant errors in the original drawings with the *Model Engineer* articles, and they are a little incomplete. I have not seen the Camden drawings so do not know if they have corrected the errors and omissions. The condenser referred to in the articles for instance never appeared. This need not be a problem since most small steam launches use a keel condenser anyway.

There are other possibilities for small steam launch engines. Original engines from the early days are naturally quite hard to find, although *Galilee II*, shown in the first article, has a modified Simpson Strickland engine. This has been converted from a compound to a triple expansion engine by the addition of a low pressure cylinder. This is shown in **photo 19**. *Clansman*, also featured in the earlier article, has an engine built from castings supplied by the Reliable Steam Engine Company in the USA, shown in **photo 20**. *Kotare* also has an American engine, from castings by the Elliot Bay Steam Launch Company, based in Seattle. Another resource that I should mention is the Steam Boat Association of Great Britain (**ref 6**). The association puts out a regular magazine, *The Funnel*, so it is worthwhile joining even if, like me, you are some distance away. This would be a good way for British readers to find out what is available to them locally.

●To be continued.

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3. *Milling Crankshafts*, John Olsen, Model Engineer Vol. 200 Issue 4316.

4. *Cutting Curves on the Shaping Machine*, John Olsen, Model Engineer Vol. 194 Issue 4247.

5. Camden Miniature Steam Services **www.camdenmin.co.uk**

6. Steamboat Association of Great Britain **www.steamboatassociation.co.uk**

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■ Armstrong BA helicoil full kit 0-2-4-6 £30 plus postage. Myford box set imperial 2 morse collet set. £125 plus postage.
T. 01332 671126. Derby.

■ Boxford lathe 4/3 jaw chucks, 4 way toolpost, drill chuck, tooling, DTI on magnetic base, tooling, taps, dies. Boxed sets good condition spare motor on cabinet stand, metal stock, various. Private sale £1200 ONO. Buyer collects. **T. 01723 513070. Filey, Yorkshire**.

■ Chester DB7 lathe, imperial less than two years old, hardly used due to health reasons, all original accessories. Only £300, buyer collects. Proxxon PD400 plus complete set of collets, boxed never used. Cost £2470 bargain at £1000 for quick sale, purchased may 2019. Bargain.
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T. 01670 521432. Ashington.

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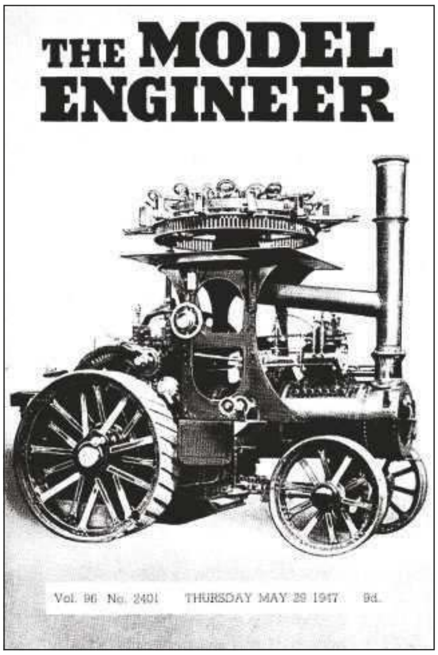
AD OF THE MONTH

■ Myford 'M' lathe, 1ph longbed with reverse, imperial and metric change gears, three and four jaw chucks, 9 inch back-plate on Myford stand, collect only, £350.
T. 01205 364810. Boston.



Parts and Materials

■ Complete sets Clarkson 5" gauge Duchess cylinders and wheel sets, frame stretchers, frame steel, assorted loco plans, would suit most 5" gauge locos. 1 to 59 Don Young magazines, good condition £100 the lot. Can post, you cover postage.
T. 01234 210640. Bedford.

■ 'LBSC' Virginia, 4-4-0 3 ½" gauge large boiler version, drawings, manual, full set of castings, laser cut frames erected with axleboxes and axles. Good workmanship, £325. Buyer collects.
T. 01283 760917. Burton upon Trent.

■ Six 7 ¼" Driving Wheels partially machined to approx. 9 5/8" diameter with 22 spokes. Sensible offers please.
T. 01491 641466. Henley on Thames.

■ Two 7 ¼ g injectors BR/GWR pattern, unused as supplied new by Doug Hewson. £200 the pair including P&P. Pansy driving wheel castings (six) part machined. £0 the set plus P&P. Email photos of either on request.
T. 01706 822473. Ramsbottom.

■ Certified copper boiler for ANNA locomotive along with machined cylinders, leaf springs, axle boxes with ball bearings, laser cut and drilled frames, buffer beams, finished axles wheels, and more. Lost interest. £3500 ONO. **T. 01772335771. Preston**.

Magazines, Books and Plans

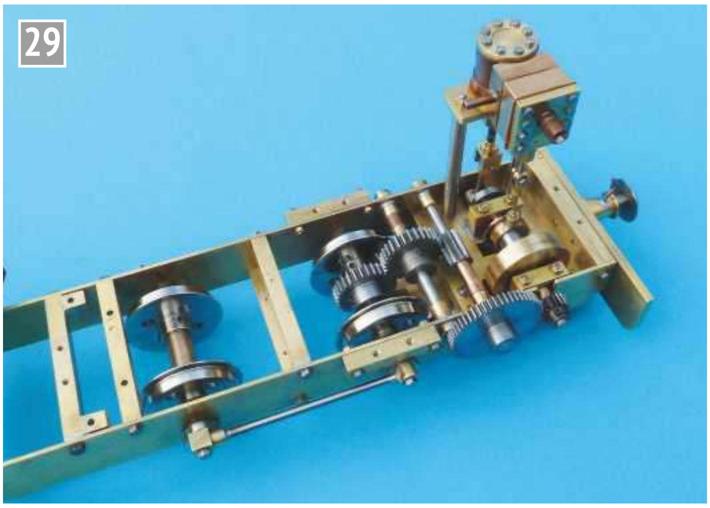
■ Plan starling 22.5cc in-line twin two stroke glo-plug engine, plus micrometer boring head. (plans unused) £6 including postage.
T. 01869 248558. Oxford.

Wanted

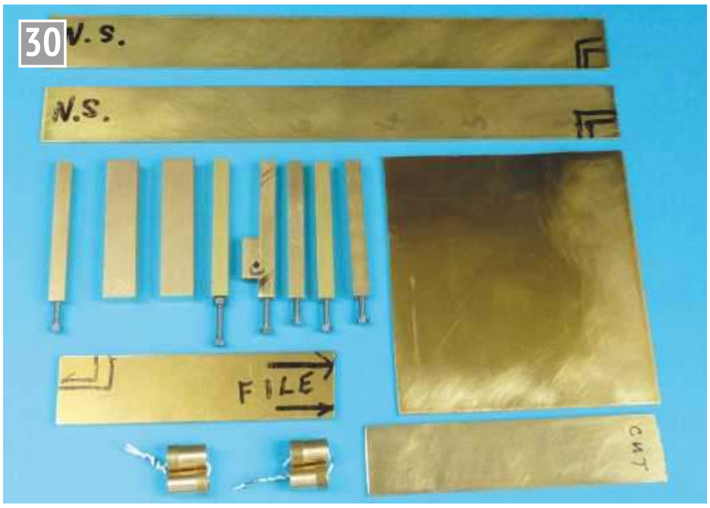
■ Vintage and antique hobby miniature black lever powered metal shaping and shearing tool with rectangular black base and red wooden oval handle on black level with gold oval or round maker's name on upper base (size unknown). [*This sounds like a 'Juneero' tool, used to carry out various tasks with a 'perforated strip' construction system resembling Meccano – I had one in my teenage workshop – Ed.*]
T. 01444 248011. Burgess Hill.

■ Asian lathe WARCO model 1327 must be in good order. **T. 01208 77862. Bodmin**.

Vertical Boiler Locomotives



Frames, wheels, axles, coupling rods and gear train.



Frame components.

Martin Ranson presents a pair of 32mm vertical boilered locomotives.

Continued from p. 287
M.E. 4632, 14 February 2020

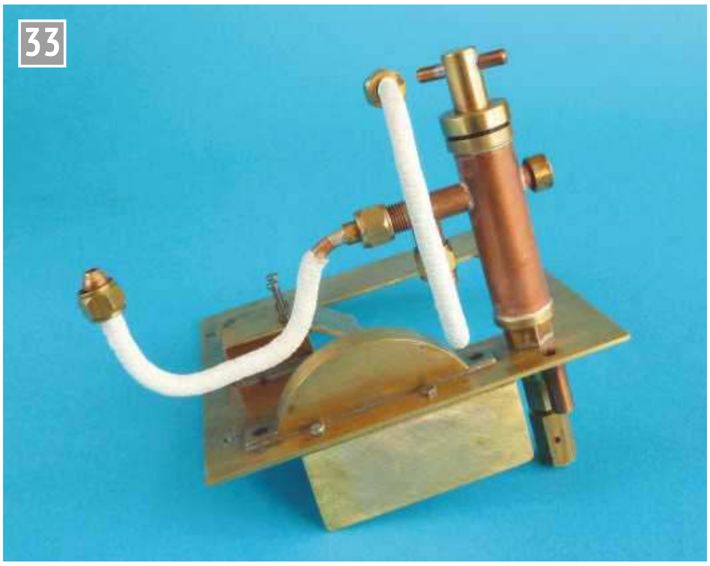
Frames

These (**photo 29**) are made from 1.5mm brass sheet and are 1 inch in height. The spacers shown are ¼ inch square brass rod. Note that all the frame spacers are EXACTLY 2.25 inches in length; it does make sure that nothing gets twisted and distorted when all the bolts are tightened up. Some of the spacers have a bracket silver-soldered to them to mount an extra component. **Photograph 30** shows the component parts, including the four bushes for the driving axles. The interior and exterior lengths of these determine how much sideways slack will finally end up on the axles. This takes me quite a bit of head-scratching! Must be something wrong with the calipers and micrometer! Can't be me as a pensioner? With the correct spacer fitted on the inside of the driving wheels it is very easy to set up the distance between the wheel flanges. Note the front frame spacer is removable with the front beam (**photo 31**). These two items can be soft soldered together as a pair. This makes it easy to remove the entire cylinder assembly if needed.

There are three plates bolted to the top of the frames. The one at the rear is

Buffer beam.

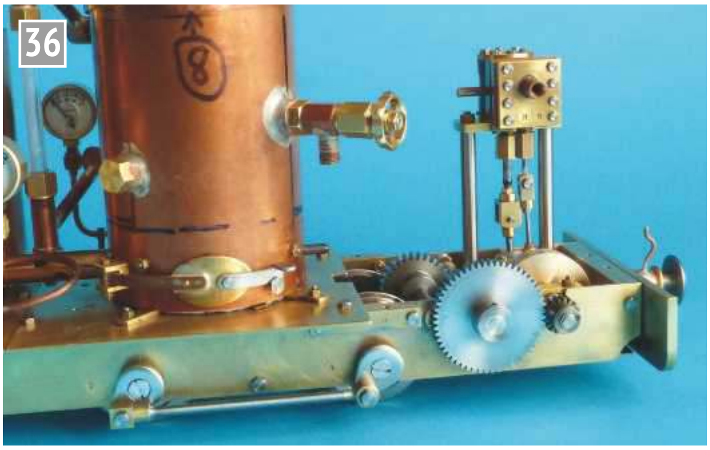
This plate supports the boiler.



Front plate with the guards for the gears.

Another view of the front plate.

The front surround.



Coupling rods.

to support the gas tank, the removable vertical surround and the gas supply valve. The centre plate (**photo 32**) is to carry the boiler with all its fittings and underneath the boiler firebox is a thin brass sheet with a layer of 2mm Kaowool beneath that. This is to provide some heat insulation. The front plate (**photos 33** and **34**) supports three spray guards, the gunge trap, the displacement lubricator and the two bushes for the removable front surround (**photo 35**). The cylinder is not fastened to this front plate, but is bolted down to spacers mounted between the frames. This means the front floor plate can be removed and still leave the actual steam cylinder in working order. If the lubricator and gunge trap are removed from the front base plate, the plate can be unbolted and lifted upwards even more easily. It is very simple to reach the gear train from on top or from below the frames.

Wheels and axles

The track in my garden is not as large as I would like. It has ended up with lots of sharp curves of 30 inch radius, several commercial points of 38 inch radius and one home-made point of 30 inch radius. A few years back I tried to work out what would be the best distance between the wheel flanges to allow for a bit of clearance on the curves and points. The figure I slowly arrived at was 1.232 inches. This does not make anything jam anywhere when the locomotive is moving, and nor does it allow the locomotive to flop about all over the place if the wheels are too loose. This is using Peco SM 32 code 200 track; possibly some other makes of track may work better with a slightly different distance between wheels.

The actual spacing of the flanges can be a bit awkward to measure as some wheels do not have a sharp corner where the tread meets the flange - needs a bit of 'guesstimation'. There are some dimensions which keep cropping up on each of my locomotives. This is assuming the driving wheels and axles are from Roundhouse. The axles from Roundhouse have a length between the inside edges of the crank discs of approximately 2.600 inches. If I swap the crank discs between axles this figure only varies by 1 or 2 thou. This dimension was used as the starting point for working out all the frame widths and bearing bush widths.

All my locomotives have used the same size for the interior frame spacers. I try to make them all EXACTLY 2.25 inches in length as this avoids any chance of distortion when all the frames are fastened together. The outside width of the axle bearing bushes is machined to be a total of 2.551 inches, which gives a small amount of side play to the axle. This does allow for the actual frames to vary slightly in thickness - if I buy a nominal brass sheet of $\frac{1}{16}$ inch thickness then it does vary between 1.5 mm, 1.6mm or even 16 SWG. The differences are only small but can leave too much unnecessary end-play or an axle which is too tight onto the bearing bushes. The inside width of the axle bearing bushes is usually set to be 1.665 inches. This puts the wheels at the correct distance apart and can be changed to allow for any washers or drive gears to be fitted or not.

Coupling rods

I have tried using commercial axles from Roundhouse and also making my own. There are advantages to both. My problems usually come from the fact that I do not possess any precision machinery to make the distance between the axles EXACTLY the same as the distance between the holes in the coupling rods (**photo 36**). This usually ends up with the wheels jamming somewhere as they rotate. On some of my locomotives I have made one end of each coupling rod as a screw adjuster.

With a bit of juggling between each side I can usually get the wheels to be nearly free for the full 360 degrees of rotation. If I open out one of the holes by a few thou. they then spin freely. At this point I can feel some well-equipped model engineers screaming at me to do it properly but my method is by hand without much machinery. If I use silver steel for the coupling rods then the join between the rod itself and the end bush can be soft soldered when lined up. One of the advantages to home-made axles and cranks is the fact that the axle length can be varied to suit a particular model.

One of the things which I have tried to make on a small lathe are the actual wheels. I gave this up very rapidly and bought all the wheels from Roundhouse, as it takes forever on a small lathe to make my own.

Another advantage of home-made axles is the ability to silver-solder one crank onto the end of each axle - these are then fixed forever and cannot be re-assembled out of line. On the simple engines I build there are usually only four driving wheels which means two of the cranks are already fixed. The third crank can then be set at 90 degrees to one of the fixed cranks. In actual fact, this third crank can end up as 89 or 91 degree spacing as the locomotive will run just as well, providing the other crank is set to the SAME angle.

One of my best methods for checking the exact distance between the coupling rod centres, compared to the axle centres, is to make a pair of stub axles, for which the larger diameter matches the axle bearing bush and the smaller diameter matches the holes drilled in the coupling rods. The stub axles fit in the axle bearing bush holes and the coupling rod assemblies are fitted over the two small pins. The screw adjuster can be altered to make the rod slide into place.

●To be continued.

NEXT TIME
We'll make the cylinders.

ISSUE NEXT ISSUE NEXT ISSUE NEXT ISSUE NEXT IS
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- **London Exhibition**
  John Arrowsmith completes his report from this year's exhibition at Alexandra Palace.
- **Steam Turbines**
  Mike Tilby rounds off his series on steam turbines with a few words on safety and discusses ways of making model turbine blades.
- **GWR Pannier Tank**
  Doug Hewson makes a set of authentic brake gear for his 5 inch gauge GWR pannier tank locomotive.
- **Barclay Tanks**
  Terence Holland completes the modifications needed to *Douglas* to turn it into *Airservice Constructional Corps No. 1*.
- **Rob Roy Rally**
  Rex Hanman reports from the recent *Rob Roy* rally held at the Andover Model Engineering Society's track.

Content may be subject to change.

ON SALE 13 MARCH 2020

A Boiler Feed Pump PART 4

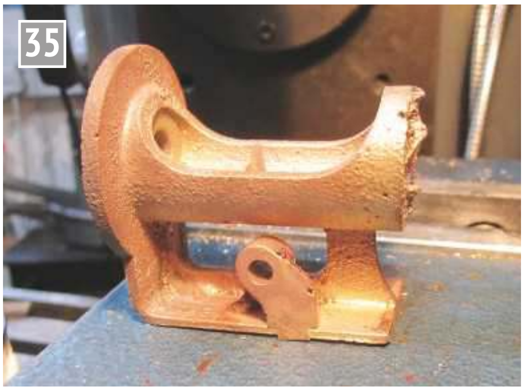
Ian Couchman redesigns the boiler feed pump for his Ruston Proctor traction engine.

Continued from p. 248
M.E. 4632, 14 February 2020

Coupler

This is the bit which joins the steam end to the pump (**fig 7**). There's one part which it wasn't practical to cast in place (I have done it using lost wax, but that's another story!). This is the pivot for the operating handle (**photo 35** - I'll explain later). After machining the bottom face of the coupler flat (**photo 36**), adding a slot for the pivot and machining the end of the pivot bracket to match, the two were silver soldered together. Getting all the hot work out of the way now avoids distortion problems later.

After mounting the casting in the four jaw chuck (**photo 37**) and centring the flange, the end was faced and the holes in both ends were bored, thus ensuring that the holes were in line. The casting was then turned around in the chuck, trued up and the pump end machined (**photo 38**). On the mill, the mounting holes were drilled and the clearance cut-out on the top was milled. Next the steam gland was made and fitted (**photo 39**). This is a press fit into the coupler. It also protrudes by $\frac{1}{32}$ inch (**photo 40**), which fits into the bore of the cylinder to locate the cylinder accurately when mounted. The last bit to be made here is the pump retainer (**photo 41**, with a gland nut). This is a close fit in the coupler and the pump body



a

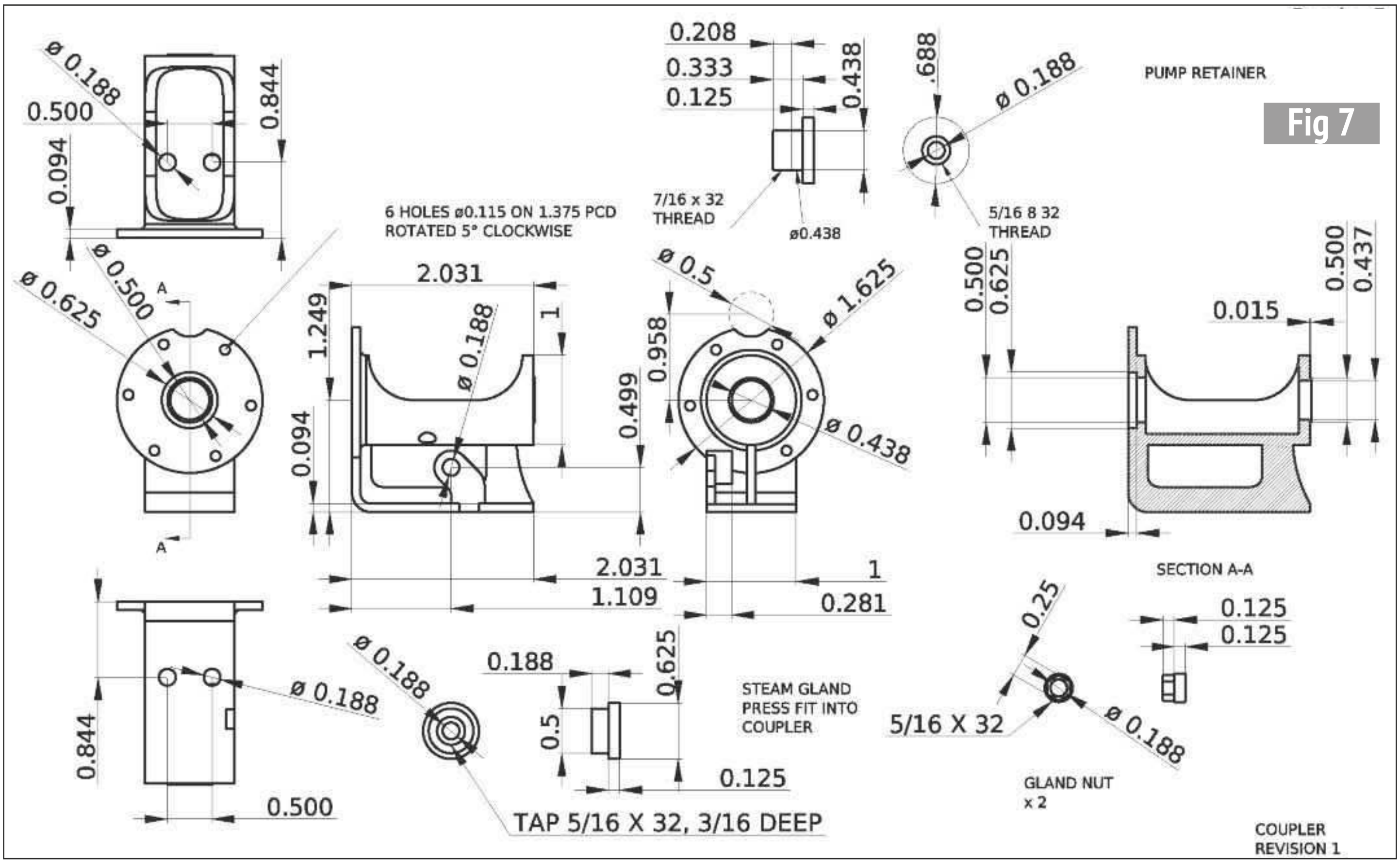
Machining the base of the coupler.

Facing and boring the coupler casting.

The finished coupler.

The coupler with the steam gland fitted.

A view of the steam gland register.



screws on to it. The retainer can be rotated to get the pump alignment correct.

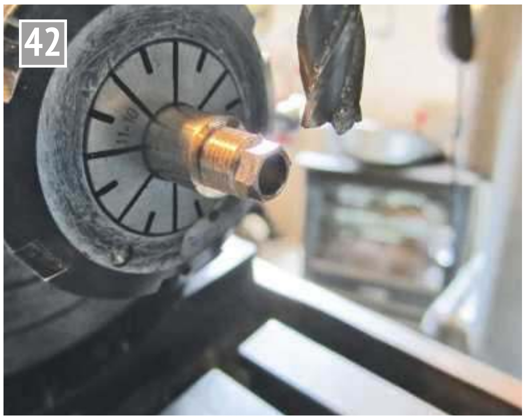
We need two gland nuts (**photo 42**), one for the steam end and one for the pump, which fit as shown in **photo 43**, after adding some packing. I use graphited PTFE for this. And so we have the complete coupler assembly (**photo 44**).

The pump

For some reason, I have very few pictures of this part. However, most is straight-forward machining (**figs 8**, **9** and **10**). Starting with the pump body, held in the four jaw chuck, the bore is bored to size, the end connecting to the coupler is faced and the locating spigot produced. The threads are cut in each end and the external connection points drilled and tapped ⅛ inch BSP. The casting is moved to the mill, the top surface faced and holes drilled and tapped as necessary (**photo 45**). Note the clearance recesses being cut to clear the non-return valves on the lower plate. We also need a plug for the end of the body (**photo 46**).


41

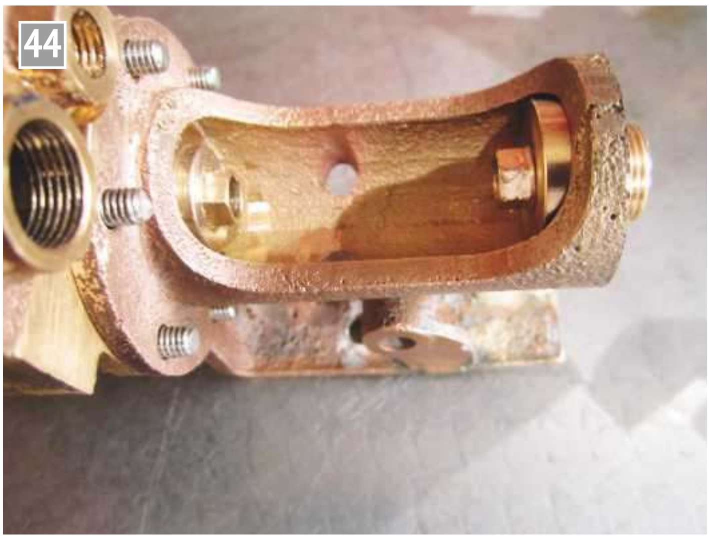
The pump retainer with its gland nut.


42

Forming a hexagonal end for the gland nut.


43

Steam gland and gland nut fitted.


44

The complete coupler assembly.

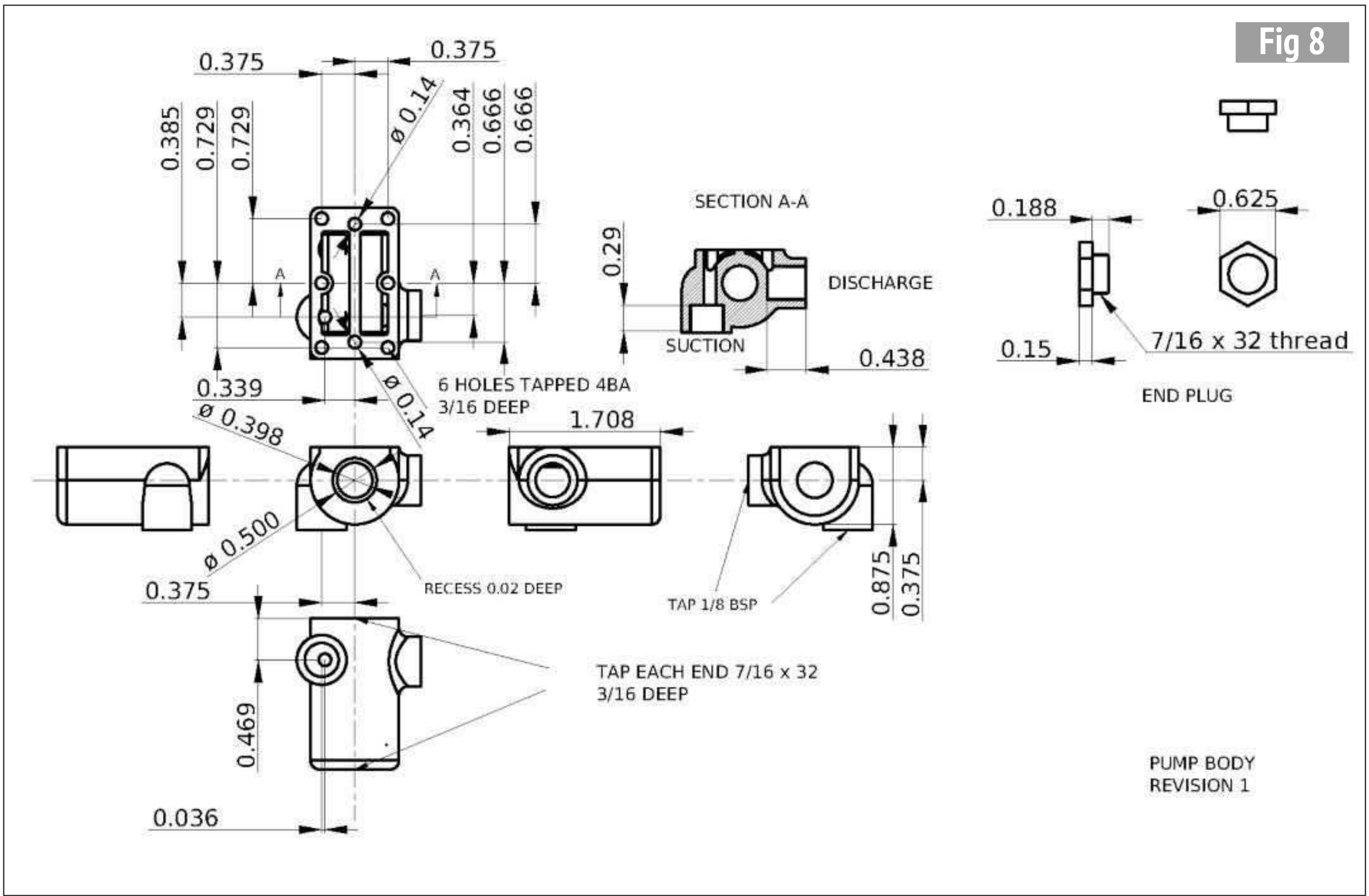


Fig 8
0.375
0.375
0.385
0.729
0.729
ø 0.14
0.364
0.666
0.666
SECTION A-A
0.188
0.625
0.29
DISCHARGE
SUCTION
0.438
0.15
7/16 x 32 thread
0.339
ø 0.398
6 HOLES TAPPED 4BA
3/16 DEEP
ø 0.14
1.708
END PLUG
ø 0.500
0.375
RECESS 0.02 DEEP
TAP 1/8 BSP
0.875
0.375
TAP EACH END 7/16 x 32
3/16 DEEP
0.469
PUMP BODY
REVISION 1
0.036

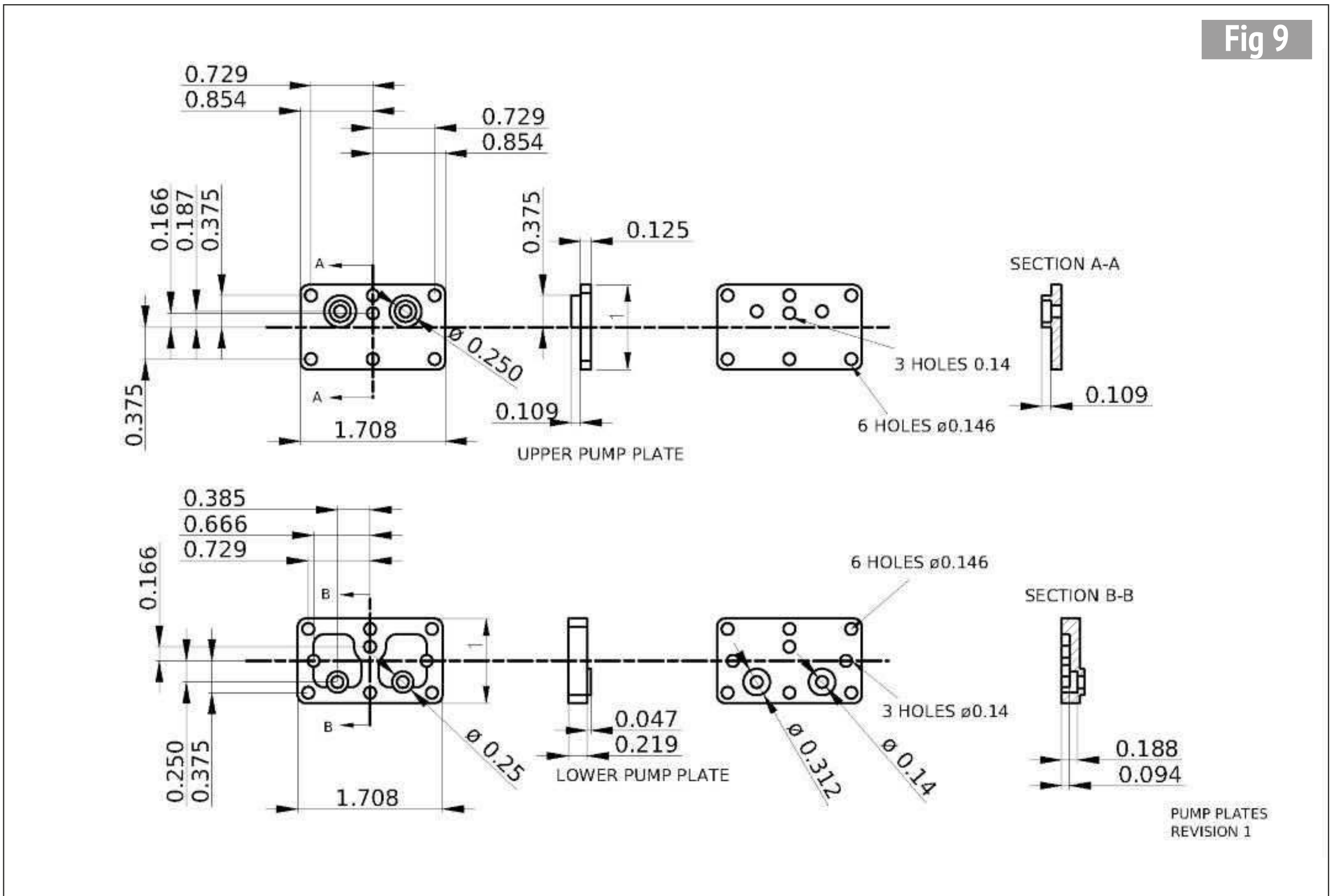


Fig 9
0.729
0.854
0.729
0.854
0.166
0.187
0.375
0.375
0.125
SECTION A-A
ø 0.250
3 HOLES 0.14
0.375
0.109
0.109
6 HOLES ø0.146
1.708
UPPER PUMP PLATE
0.385
0.666
0.729
0.166
6 HOLES ø0.146
SECTION B-B
3 HOLES ø0.14
0.047
0.219
ø 0.25
0.188
0.094
0.250
0.375
LOWER PUMP PLATE
ø 0.312
ø 0.14
1.708
PUMP PLATES
REVISION 1

Moving on to the plates, first the plain face was machined and holes drilled. The ball seats were cut with a ¼ inch slot drill. The depth is important as this limits the lift of the ball. The centre hole was drilled under size then finished with a slot drill, ensuring a truly round hole for the ball to seal against. Now for the tricky bit! The sides with bosses need to be faced - but how to machine around the bosses? If there was just one, then it would be a simple job on the lathe, but with the two, we need another approach. I ground the end of a boring bar to an angle and used that, reversed in the boring head, to cut a recess around each boss (**photo 47**). Then, using an end mill, the face was machined to just above the depth of the recess just created, giving the results in **photo 48**. That just left the four nibs around each boss, which were quickly removed by running the end mill around, leaving a flat face with a small clearance recess around each boss.

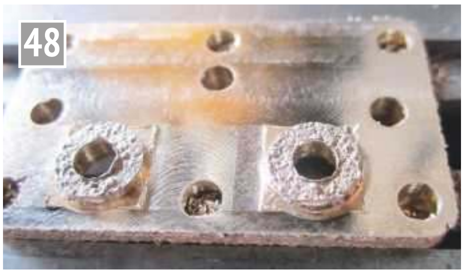
All that remains now is the cover. This is a simple facing job, followed by machining the two bosses as shown in **photo 49**. These bosses limit the lift of the balls, so need to be the correct depth from the face. Finally, the cover is turned over and the mounting holes drilled.

●To be continued.

Machining the pump body.

Making a plug for the end of the pump body.

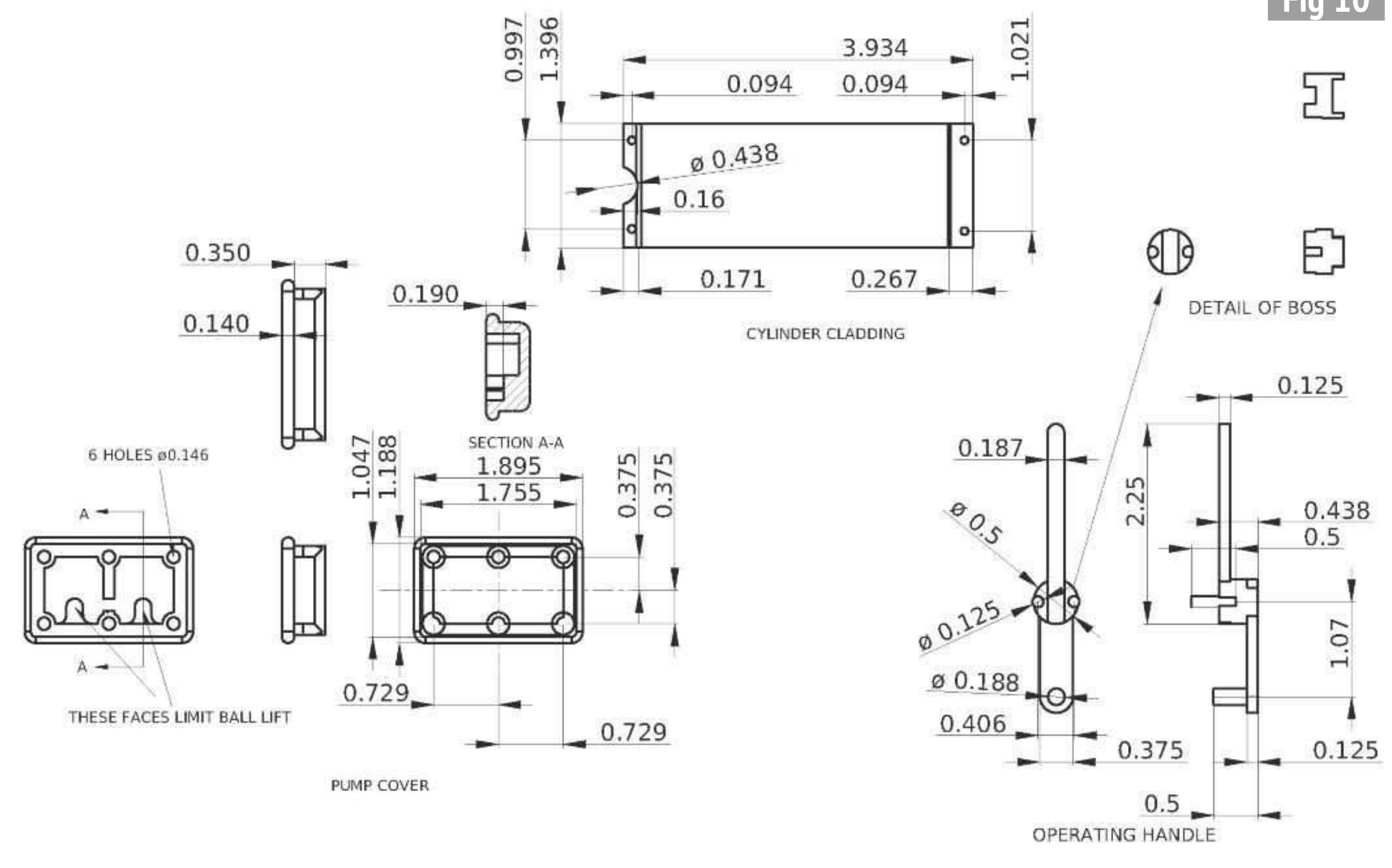
Cunning use of a boring head to cut a recess around each boss.



Finishing the pump plates.

The pump cover.

Fig 10



The Stationary Steam Engine PART 5

Ron Fitzgerald takes a look at the history and development of the stationary steam engine.

Continued from p.227
M.E. 4631, 31 January 2020

The Newcomen Engine

Whatever frailties the first Newcomen engines may have had they did not deter the building of further machines, as several are known to have been erected between 1712 and 1715. In an article by John Allen (**ref 33**) based upon an account book compiled by Edward Short, an engine is recorded as working at Bilston to the south-west of Wolverhampton by the end of 1714. The coal owner was John Compson who commenced making regular payments of £2.18.0. per week to Short in December 1714. Short appears to have been manager of the mine or of the engine alone and the remittances were transmitted to Thomas Newcomen. The April 1715 payment was countersigned by Newcomen while others were received on Newcomen's behalf by John Dunsford. Sums were also paid to Short for maintenance and consumables used by the engine. Allen conclusively establishes the existence of the Bilston engine from late 1714 but his attempt to use it in an attempt to substantiate his claim for the Conygree site's priority by arguing that it disposes of the claim for the Wolverhampton site is not convincing.

The Bilston engine seems to have been one of a batch of machines built at virtually the same time. The consolidated list in Rolt and Allen's *The Steam Engines of Thomas Newcomen* (**ref 34**) shows an engine supplied to Woods Mine, Hawarden in Flintshire, built after April 1714 and before November 1715, and one for John More at Austhorpe near Whitkirk, Leeds which according to Smeaton was built about the year 1714. At an earlier period, there is evidence for a family connection between the Gascoigne's of nearby Garforth and the collateral branch of the Newcomen family in Lincolnshire that might have accounted in part for this geographical leap (**ref 35**).

The early Newcomen engine was centrally important in James Lowther's attempt to develop his Whitehaven coal properties. By an aggressive programme of buying out smaller coal owners Lowther had built up a consolidated block of coal reserves but the coastal pits were severely encumbered by water. Various appliances had been tried to drain the workings with indifferent success. The Lowther's mining agents were the brothers John and Carlisle Spedding. As early as 1712 John Spedding had drawn the Savery engine to Lowther's attention although this may be a reference to the Newcomen engine as the two were frequently identified as the same under the terms of the patent. There were no immediate results but in 1715 Lowther was discussing further possibilities directly with Newcomen in London after which Newcomen made a formal proposal. The engine first worked in the winter of 1716/17 but the pumps were made of timber and John Calley's son had to be constantly in attendance. It was here that news of his father's mortal illness reached him from Austhorpe in Leeds. Calley left Whitehaven to be with his father but arrived after his death.

> The second decade of the eighteenth-century was the age of the joint stock company, culminating with the magnificently disastrous collapse of the South Sea Bubble.

Of this early group of engines possibly the most important was that built for the Griff Colliery, a mile to the north of Bedworth. If Desagulier's account of the earliest Newcomen engine is accepted then the owners of Griff Colliey had shown a very early interest in the Newcomen engine. For reasons now unknown, these overtures of 1711 did not result in a working engine but enthusiasm seems to have revived three years later. By 1714, Richard Newdigate had leased his coal at Griff to the partnership Richard and Stonier Parrott and George Sparrow (**ref 36**). An agreement was reached between the coal partnership and Thomas Newcomen, who was described variously as merchant, gentleman and ironmonger. Newcomen undertook:

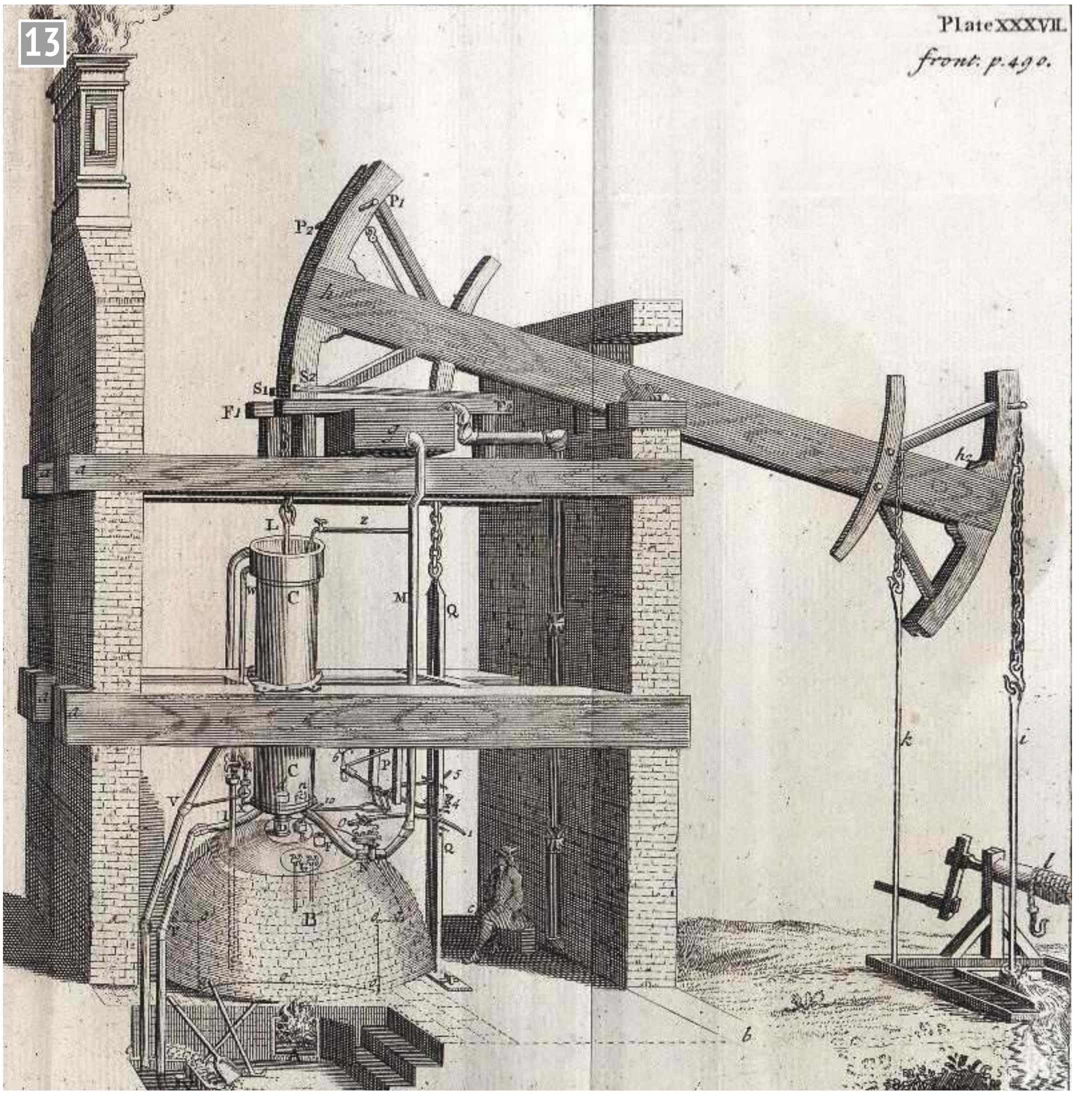
…at his own charge …to set up on some part of the colework called the Griff an engine to draw water by the impellant fforce of ffire which should cast up Seventy hogsheads of water per hour… not above fforty seven yards from the sough…

(1 hogshead = 64 gallons of pure water, 63 gallons wine and 54 gallons ale and beer.)

The partners were to pay £7 per week to Newcomen for draining their mine but the maintenance of the machine was the responsibility of the coal owners. Marie Rowlands (**ref 37**), author of a paper on Stonier Parrott, at one point says that this agreement was entered into soon after the partners had taken over Griff Colliery in April 1714 but in a later part of the article she states that the agreement was dated a year later, 7th March 1715/16. If the erection of the engine followed the signing of the agreement then it is unlikely to have been at work before that time and correspondingly it must have followed the Bilston engine and possibly the Hawarden and Austhorpe engines. The Griff engine however, represents something of a first maturity for the Newcomen engine and it served as a model for subsequent machines (**photo 13**).

John Allen attributes the responsibility for building all of the engines up to November 1715 to either Thomas Newcomen and/or John Calley but in that year there was a formal reorganisation of the way in which the engines were purchased and, possibly, built. In May, Thomas Savery, the holder of the master patent, died. His executor was John Meres, clerk to the Worshipful Society of Apothecaries, which had a connection in the supply of medicines to the Commission for Sick and Wounded Sailors, of which Savery was an agent. As an executor, Meres combined self-interest with discharging his duties to the widow Savery. Her financial security was assured by an annuity raised on Meres' own house but in exchange she signed over her rights to any interest in the patent, which still had eighteen years to run. The balance of advantage transpired to be firmly in Meres' favour.

13



The Griff Colliery Engine. A Course of Experimental Philosophy, *J. T. Desaguliers.*

The second decade of the eighteenth-century was the age of the joint stock company, culminating with the magnificently disastrous collapse of the South Sea Bubble. Meres was evidently influenced by the vogue for joint stock companies and he had already been instrumental in launching the Navy and Laboratory Stock Companies, both of which profited from government contracting at the expense of the indigent sailors it was superficially intended to serve. Using this company structure as a precedent, he formed the *Committee of the Proprietors of the Invention for Raising Water by Fire*. Newcomen was an unnamed member of the committee but John Allen believes that Edward Wallin represented his interests. Calley also seems to have been allotted an anonymous share. There were six proprietors apart from Wallin, all connected with the City of London and its Guilds. Funding to support the activities of the Committee was to be raised by share capitalisation with a paid-up value of £21,600 distributed over eighty shares. A dividend of 11% was promised.

The proprietors did not involve themselves in the physical construction of the engines but rather licensed use of the patent, charging by royalty. Almost immediately a sub-monopoly was arranged whereby Richard Parrott, his son Stonier and George Sparrow were authorised to act as agents for the proprietors. The Griff engine acted as the template. At Griff the Proprietors had been paid £420 per annum for each mine drained. The costs of construction of the engine and running costs were to be met by the ultimate user who was to be the owner of the machine. Newcomen possibly supplied drawings in some form and seems to have acted as site engineer during the time that the engine was building. By a further clause in the Griff agreement, Sparrow and Parrott were empowered to build engines on their other Warwickshire coal holdings but this clause was subsequently to be applicable outside the Midlands. The father, Richard Sparrow, played little part in the extension of the partnership's dealings and it was his son Stonier with George Sparrow who together contracted to erect further engines in Warwickshire and, more significantly, in the north-east of England.

The Tyneside coalfield was prospectively the most promising market for the Newcomen engine with coal owners increasingly desperate to clear water from their ever-deeper collieries. The sophisticated water-wheel driven pumping installation that Sir Thomas Liddell had erected in 1670 had been overwhelmed as the mines went deeper and grew more extensive. Sir Thomas's son, George and his partners William Cotesworth and Francis Baker were faced with a radical decline in coal output that could only be countered by more powerful pumps. Parrott and Sparrow's approach met with a ready response.

An agreement with Liddell and partners was signed in May 1715 for an engine to pump Gateshead Park and Felling Park collieries with provision to supply further engines to other pits in the coal owner's combine. The terms of the agreement were that Sparrow and Parrott were to be paid £600 per year for drawing 12,800 gallons of water 50 yards up to a water drift but they were also to receive a two-fifths share in Park Colliery and a half share in Felling. The terms are a measure of the coal owner's desperation but progress was slow and duplicitous dealings with other coal owners in the area soured the relationship between the Liddell consortium and the engine partnership. When completed the engine proved to be incapable of handling the water load and draining the Felling and Park Colliery was deferred for a later generation of engines.

Parrott and Sparrow's involvement with Liddell drew in Henry Beighton, possibly as engine designer. Beighton was probably the single most important figure to be involved with the earliest Newcomen engines after Newcomen and his partner Calley. Born in 1686 at Chilvers Coton near Griff, his background and education are obscure but by the time that he was associated with the Newcomen engine he was accomplished as a draughtsman, cartographer, surveyor and mathematician. He was admitted as a Fellow of the Royal Society in 1720. Beighton's engraving of the Newcomen engine, published in 1717, two years before Barney's print, was the earliest known illustration of a Newcomen engine and in the year following he prepared *A Mechanical, Mathematical & Philosophical Acc't of the Engine for Raising Water by Fire.* This, now lost, manuscript was apparently a tabulation of engine statistics with commentary. It was later published in the 1721 edition of *The Ladies' Diary,* a curious synergy only partly explained by the fact that Beighton was the editor of the journal. Concurrently with his involvement in the Liddell collieries Beighton had erected an engine independently of the Sparrow/Parrott partnership at the Oxclose Mine, Washinton Fell in Co. Durham. Thereafter he appears to have withdrawn from engine building although he continued to be active in the Royal Society until his death in 1743.

Sparrow and Parrott remained the most prolific builders of engines up until the mid-seventeen-twenties. Together and separately, they had been involved in at least fourteen machines, the majority in either the Newcastle or the Midlands coalfields. In many cases their remuneration took the form of shareholdings in the colliery to which the engine was supplied. As their commitments increased their financial resources became increasingly precarious. A taste for legal action does not seem to have added to their financial stability. In 1725 Parrott attempted to induce Cotesworth to finance an attempt to challenge the proprietor's patent, claiming that Savery's engine was not original and, probably with more justice, that the Newcomen engine was wholly dissimilar to the Savery engine. This action was not proceeded with and if Newcomen was aware of the threatened litigation his view is unknown.

John Allen's list of Newcomen engines shows at least 78 had been built by the end of 1729, the year in which Thomas Newcomen died. The patent still had four years to run during which 27 more machines were added. Between 1712 and 1733 the Newcomen engine had become firmly established in virtually every British coalfield although its later stronghold in the Cornish mines had suffered a delayed start, due to depression in the industry. After the very first experiments no engine was built for Cornish mines until 1720 when the Wheal Fortune engine at Ludgvan was erected. Even thereafter, only two other Cornish engines entered service before 1733. It was only after the brothers Jonathan and Josias Hornblower moved from Shropshire to Cornwall in 1745 that the successful use of the Newcomen engine in the South-West really began.

The first continental Newcomen engine went to Jemeppe-sur-Meuse, Liege in 1720/1, erected by John O'Kelley under the distant consultation of Beighton. Fischer von Erlach built engines in Hungary with Isaac Potter, a name forever linked to the Newcomen engine by the Potter Cord and also in Germany and Austria whilst Martin Triewald, after serving his apprenticeship in England, returned to build his own engine at the Dannemora copper mine in Sweden in 1727. The two first engines used for public water supply were built in the same year, 1726, one in London for the York Buildings Waterworks Company which had earlier tried and failed with a Savery engine and the other for a water supply company drawing from the Seine at Passy to supply Paris.

Over two decades the Newcomen engine had become internationally accepted as a practical machine for lifting water in bulk. Its operation had been widely examined in the technical literature of the day and a new generation of engineers capable of building successful machines was ready to supplant the *Committee of the Proprietors of the Invention for Raising Water by Fire* when the patent expired.

●To be continued.

NEXT TIME

We'll see how John Wilkinson helped James Watt make a success of his engine.

REFERENCES

33. *Edward Short and the 1714 Newcomen Engine at Bilston, Staffs,* John S. Allen and Julia M. H. Elton, T.N.S. Vol 74, 2004. P.281 et seq. The account book is now lodged at Wolverhampton Archives and Local Studies Department.

34. *The Steam Engines of Thomas Newcomen*, Rolt and Allen op. cit. appendix table. The table lacks full source annotation but an earlier article by Allen, T.N.S. 42 1968-9 gives full annotation.

35. West Yorkshire Archives, Morley. WYL115/DZ/253. *9 December 1596. Annuity: 1. Joan Newcomen of Saltfleetby Lincs. 2. John Gascoigne of Parlington. To party 1. Annuity of £20 issuing out of Barnbow Hall.*

36. *Stonier Parrott and the Newcomen Engine,* Marie Rowlands, M.A., T.N.S. Vol 41, 1968-9 P.49 et seq.

37. *Stonier Parrott and the Newcomen Engine*, Marie B. Rowlands, M.A., ibid.

Building the Model Engineer Beam Engine

PART 16

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.

Continued from p. 238
M.E. 4631, 31st January 2020

Port face

In the original drawings, the cylinder was cast in one piece but there must have been considerable difficulties in creating the steam ports. On my drawings there is detailed a cylinder modification, where the port face has been made a separate casting which is to be bolted to the cylinder itself, thus simplifying the casting of the actual cylinder. I milled the port face on all sides that were intended to be flat and was left with the task of machining the side of the port face that had a spigot on it. This spigot is to create the exhaust manifold. **Photograph 132** shows how this face was faced in the lathe whilst bolted to an angle plate on the lathe face plate. The exhaust pipe was turned to ⅜ inch diameter and then threaded to attach a steel manifold and flange for the exhaust arrangement. I would have liked to have used an ME ⅜ inch x 40 thread but I thought that it was too fine for threading in cast iron. I therefore used ⅜ inch BSF, which looks clumsy in this scale, but will be covered by the steel fitting. Finally the steam passage for the exhaust was drilled 7/32 inch as shown in the photo. The machined port face casting is laid on the machine table in **photo 133**.

132

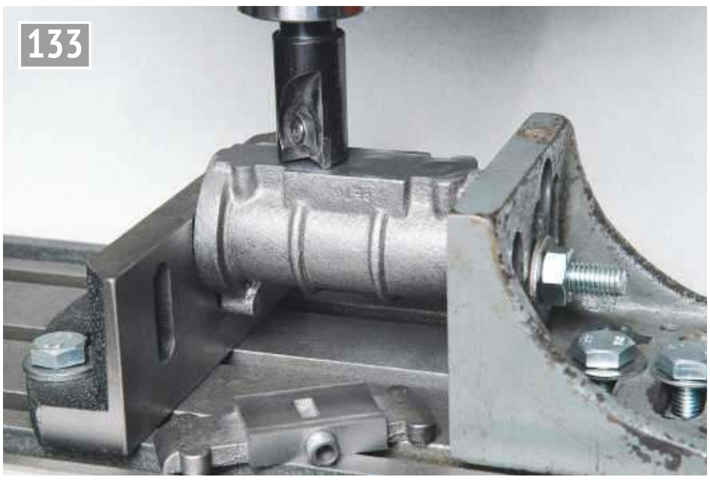
The port face is machined separately from the cylinder.

Machining the cylinder

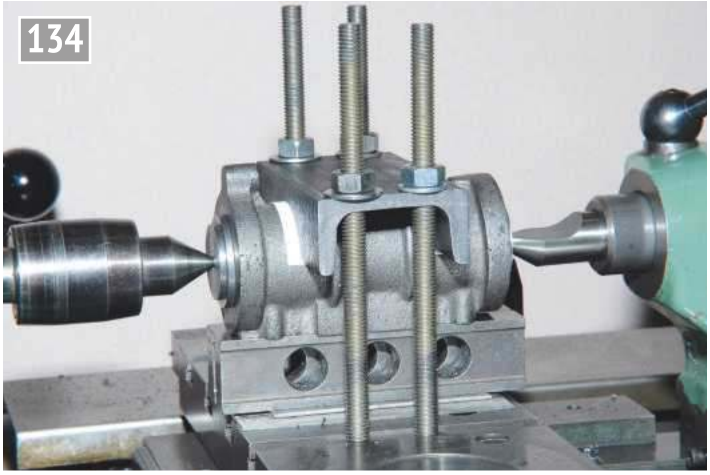
I shall call the face of the cylinder where the port face is bolted the port face of the cylinder casting although the actual port faces are on the port face casting itself. The purpose of the port face casting is to transport the inlet steam from the steam chest to the ends of the cylinder, without the foundry having to make long, complicated steam ports in the cylinder casting. I decided to machine the port face of the cylinder first, as once a flat machined surface was created this could be used as a reference surface for all other machining. I checked that the bore of the cylinder was more or less concentric with the outside – which it was – and made two plugs to go into either end of the bore. The plugs were made to be a push fit into the ends of the bore and were created on the lathe complete with centres; I was then able to mount the cylinder between centres in the lathe, locating the item by the cores for the bore.

The cylinder port face was lightly milled flat as shown in **photo 133**, then the cylinder was mounted between centres in the lathe and the port face was 'clocked' to ensure that the cylinder port face was parallel to the core of the bore. Mine was about 20 thou out of parallel, so it was set up once »

133



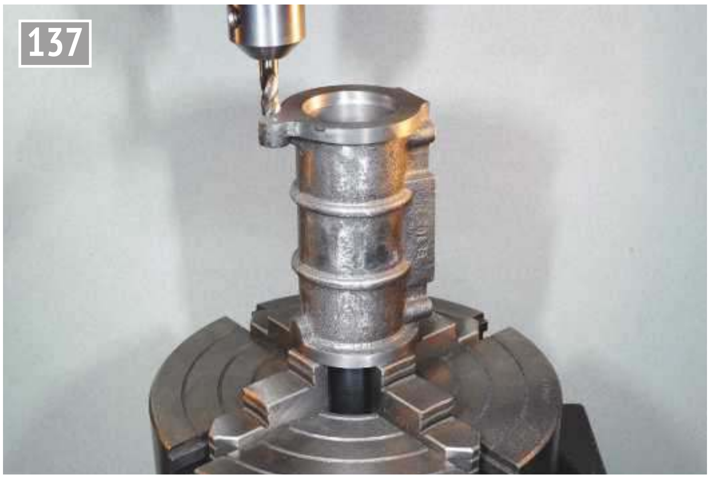
Machining the mating surface for the port face casting.



Setting the cylinder up for boring.

Boring between centres.

Facing the cylinder, mounted on a mandrel.



Shaping the outside of the flange.

again as shown in photo 133 and the level was adjusted to correct this. The cylinder port face was then milled down to the correct position relative to the bore.

The cylinder is too long to bore with a boring head, in my opinion, as there would be too much spring in a boring tool that would be long enough to reach right through the bore. The best method of machining the bore seems to be using a boring bar between centres on the lathe. For those who have not used a boring bar before, it is simply a stout bar mounted between centres in the lathe and carrying a tool steel cutting bit mounted transversely through the boring bar in a reamed hole. George H. Thomas describes making one of these in his book, *The Model Engineer's Workshop Manual* but his version is much more refined than mine. My boring bar is about 30 thou under 1 inch diameter (a strange size!) and would just fit down the core in the casting.

The casting must be bolted down onto the cross slide, although those with a lathe with a bigger swing capacity than the Myford may prefer to bolt it to a vertical slide, which makes packing to the correct height unnecessary. The body of the casting is a few thou short of 1.5 inch diameter and the drawing calls for the bore to be bored to 1.25 inch. This means that the walls of the finished bore will be only ⅛ inch thick in cast iron! Care needs to be taken as to how to bolt this down as too much pressure in one place on the casting would distort the casting – or even break it. I made a saddle for the casting from a short piece of heavyweight 2 x 1 inch channel that was in my 'bits box'. I cut a couple of arcs 1.5 inch diameter out of the sides - using a boring head - and the saddle sat nicely onto the casting. Bolting the casting down as shown in **photo 134** and using a strip of thin card under each side gave a very firm clamp whilst spreading the clamping load over a wide area.

In order to line up the casting with the lathe centreline, I replaced the core plugs which I had made earlier and mounted the casting between centres. It was then an easy job to fit parallels and steel shims underneath until the casting felt to be held firmly down onto the cross slide of the lathe. The saddle was then placed on the top of the casting and the whole assembly bolted down firmly – and hopefully safely – onto the cross slide, ready for boring (photo 134). Myford owners will note that I have a circular plug to place in the top slide void in order to stop the swarf from falling into the cross slide body. This is a very necessary accessory but if you make one, do remember to drill a small hole in the centre, as I did, so that it can be removed by lifting with a paper clip.

Photograph 135 shows boring taking place. Be sure to lock the cross slide gibs firmly in place to ensure that the cross slide does not move. It is very difficult to adjust the cutter accurately in a boring bar, but providing that you make the piston to fit, then a few thou in the diameter of the bore is unimportant. Obviously the bar has to be removed to check the diameter of the bore. The tool bit is adjusted by measuring the amount that it protrudes from the bar and the resulting bore should be the diameter of the bar plus twice the protrusion of the tool. This makes the setting of the tool very awkward and I finished up with the bore about 9 thou oversize, particularly as I did not wish to take very fine cuts in case the tool started to rub and chatter. This will be compensated for by making the piston slightly oversize to fit the bore. You will notice that I did not create the slightly larger counter bores at each end at this stage because of the difficulty in accurately controlling the cut and also because the length of the cylinder was still unfinished and therefore was too long.

The cylinder was fitted to an 1¼ inch expanding mandrel for facing the ends to length and also for turning the outside of the bottom flange. **Photograph 136** shows the cylinder being faced on the mandrel. I had to wrap a strip of heavy duty kitchen foil three times round the mandrel as my bore was oversize. The bore was checked to ensure that it was running true and an indexed tip tool used. The overhang looks frightening and I would not have attempted this in steel, but taking fine cuts of 10 thou on cast iron worked a treat.

After facing the end of the cylinder, I realised that the bore was actually running about 5 thou out of true and that this was due to my three jaw chuck. I changed to a four jaw chuck and clocked it absolutely true on the end of the bore. The external circumference of the bottom flange could then be turned and also, at the same setting, the bore was counter-bored with a normal boring tool to 19/32 inch for ½ inch depth as shown on the drawing in order to stop the piston wearing a ridge at the end of its travel. The cylinder was then reversed on the mandrel and re-clocked so that the top end of the bore could be counterbored 19/32 inch for 5/32 inch depth in similar fashion. The exterior of the top flange of the cylinder cannot be turned on the lathe, due to the port face and the entablature stay support being in the way. The chuck, complete with mandrel and cylinder, was therefore transferred to the rotary table on the milling machine and the exterior of the flange was milled as far as was possible as shown in **photo 137**. The flanges on my casting were a bit on the small size to obtain the correct diameter. Nothing I could do about that, so I finished them about 20 thou under size. I think this is much preferable than being left with a rough surface.

I had centred the rotary table very accurately under the mill spindle and had zeroed the DRO on my mill. This seemed a good time therefore, to displace the mill table by 13/32 inch and drill the 2.8mm hole for the entablature support stay.

The best method of machining the bore seems to be using a boring bar between centres on the lathe.

Cylinder cover

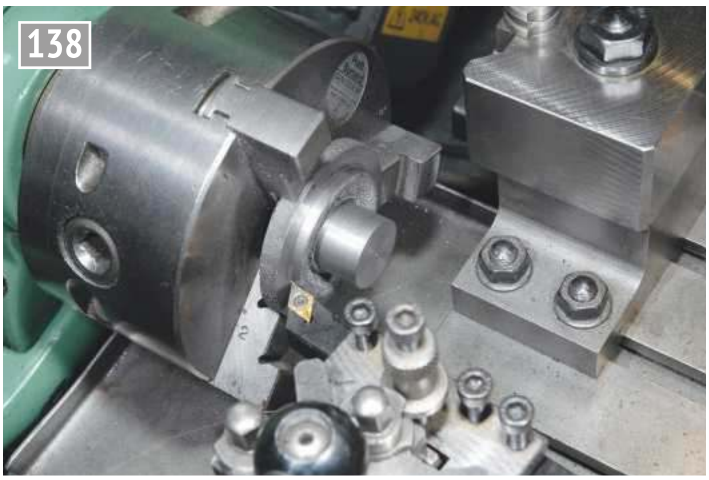
The outside circumference of the casting was ground as near circular as could be judged by eye and it was then mounted in the three jaw, using outside jaws, with the chucking piece towards the tailstock. The chucking piece was then turned cylindrical and the outer portion of the face turned smooth, as shown in **photo 138**. The job was then reversed and held by the chucking piece, using normal jaws. The outside circumference was turned to size and the thickness was brought to size, making the diameter of the central portion to be a nice close fit onto the end of the previously bored cylinder. At the same setting, the middle was then centre drilled, drilled through and reamed 7/32 inch for the piston rod bushes, in order that the piston rod would run exactly true to the cylinder (**photo 139**).

The job was again reversed in the three jaw and checked for concentricity. If your three jaw chuck proves to be less than accurate you should clock it to run true in the four jaw. The top surface can then be brought to shape and the flange for the stuffing gland brought to size and shape. I found this to be a very awkward part and had to grind up some small HSS tools in order to do this as the area round the back of the flange is very restricted for space. Finally, the central hole was drilled and reamed 11/32 inch for a depth of 7/16 inch to take the cylinder gland. I was very tempted to fit a dividing device to the lathe mandrel and to drill the 6 holes for the 8BA studs at this stage. However, I would have needed to re-chuck the part to ensure that I did not try to drill the chuck jaws, so I left this until later. I was also not sure at this stage whether I would put six, or twelve, studs on the cylinder cover. Six are shown on the drawing but I have seen it done with twelve and it looks superb. Twelve studs leaves you in danger of interfering with the cylinder ports at a later stage. If you drill the holes now, please drill them tapping size at this stage so that you can use the cover to spot the stud tapping holes onto the cylinder.

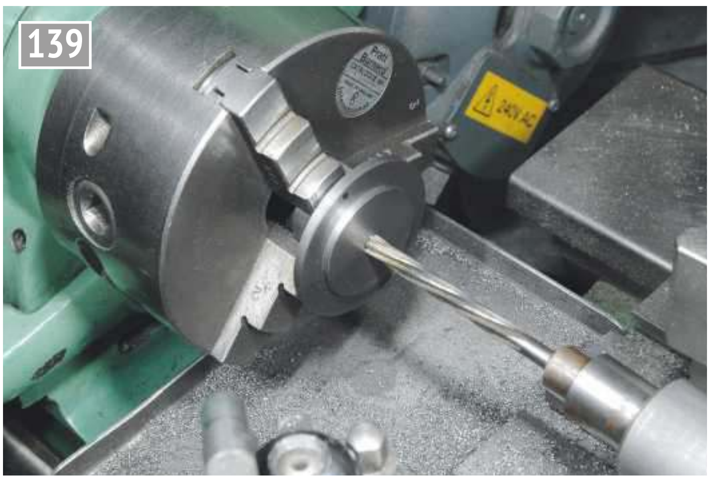
The small bush and the cylinder gland are straight turning jobs from phosphor bronze. The cylinder gland can be drilled with three stud holes at 120 degrees and, after drilling tapping size for 10BA (1.4mm), spotted through to the cylinder cover and then opened up to clearance size.

●To be continued.

NEXT TIME
We move on to the steam chest.



Machining the chucking piece on the cylinder cover.



The cylinder cover register and bore are made at the same setting.

POSTBAG

Write to us

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Guns

Dear Martin,
Having read your Smoke Rings column in issue 4627 (6th December 2019), I can understand your explanation of the inability to print the article about the semi-automatic pistol on presumably good advice.

It is a pity that you have had to can this article but as you rightly say in the current climate where people, (hopefully) not model engineers, seem to only be able to settle differences by carrying and using weapons i.e. knives and guns. It always seems to surprise me that given our firearms control laws which I believe are some of the most restrictive in the so-called civilised world, that criminals seem to be able to obtain them (firearms) with ease.

If I remember rightly it was mentioned a couple of years ago in Smoke Rings that somebody had come up with the idea of banning or restricting the sale of metal working tools, both hand tools i.e. files hacksaws etc. and also machinery, to the individual as the individual may be like minded to turning his/her hand to making guns etc.

As an engineer you are probably well aware that any reasonably skilled person such as a metal worker in any of the old style jobbing engineering workshops with manually controlled machinery, i.e. lathes, drilling and milling machines etc. could use these facilities to make weapons and no doubt any model engineer if so minded could use their lathe, drill, mill etc. to do so.

I well remember during my army service between 1974-1980 when I served in REME as a gunfitter on tanks, the regiment I was attached to had a 4 month tour in Belfast city centre over the Christmas/New Year of 1975/76.

During this time another regiment or the police raided a garage - I'm not sure if it was in Belfast or not - but apparently the search team found a batch of either Sten or Stirling sub machine guns being made.

The only difference between the military issue ones and the ones being made was the barrels on the ones found were not rifled i.e. they were smooth bore, as apparently the people making them could not do the rifling grooves in the barrel, but for the purpose they were being made for i.e. close range work the lack of rifling would not matter.

So - yes - I can understand your pulling this article as – yes - it would have made interesting reading but I suppose it is your call as editor and under the circumstances the right one. I still have an interest as an ex-REME mechanic in reading books about weapons whether they be tanks, field artillery or even small arms as an interest but I would not even think about owning such a device let alone carrying one on the streets, apart of course from when I was in Belfast during those troubled times.

Even today it is still all too easy for the criminal if they are so minded to obtain firearms and indeed use them as sadly all too often prepared to use them as we read in the newspapers often daily. Only last week I understand there was a drive by shooting in the Turnpike Lane area of Wood Green, North London.

Let us hope that it is a more peaceful time in 2020 and hopefully things might change so that you may be able to run the article but I suppose you have to take legal advice on matters like this.

Yours sincerely, J.E. Kirby (Mr) (Stoke Newington, London)

Foundry

Dear Martin
I've been following *Luker*'s articles on 'Backyard Foundry Techniques' and I was particularly interested in his mention of 3D printing. I spent the past year learning how to draw all over again, with CAD this time. To practise I've been designing a 3 cylinder marine steam engine. I've been powering my launch with a Stuart *Swan* that I built from castings in the 1980s. *Swan* was designed in 1906 and lately I've wanted to try a wee bit more modern engine. I settled on the single acting poppet valve steam engines designed by Anton Bohaboy in the 1950s, variations of which are still used in tethered flash steam hydroplanes.

Starting from an ancient sheet of plans I scaled it up and stretched it to 3 cylinders but with the same swept volume as the *Swan*. I've also added provision for a sliding camshaft, similar to the one used on the Dieter Uniflow engine. To date I've printed a 1/3 scale model that seems to work when turned by hand so the next phase will be to print 'sacrificial patterns' in ½ scale for shell moulding with the 'lost PLA casting' process to make aluminium parts. My files are drawn full scale and one need only type in the percent scale one wants to print.

At ⅓ scale the engine is about as small as my fingers can manage with the smallest fasteners being M2. It should be a useful size as a model. At ½ scale it might develop enough power to run a scooter. At full scale I'm hoping it will surpass the performance of the *Swan* which is rated at 1¼ BHP at 1,000 rpm (I've never driven mine past 800!).

I've worked out most of the details but I've never designed an engine before and I'd be grateful for input from readers about what I've left out. At present I've made one set of drawings to print a model and a second set with printed parts fattened up for casting and subsequent machining of an aluminium model. The latter drawings have a file name starting with the prefix 'C_'. Just remember when printing to add a 2 or 3% fudge factor to allow for shrinkage of printed part and of aluminium.

If anyone would like to print and cast their own copies of the engine all the files are available at www.thingiverse.com/thing:3877037

'Steamboat Ed' Haas

Dear Martin,
I have been fascinated reading the series 'Backyard Foundry Techniques' by *Luker*. I have watched iron casting demonstrations previously at www.ironbridge.org.uk (on most Wednesdays) but to read the detailed instructions is wonderful. On the other hand, I think that the articles (particularly part 3) have been let down by the illustrations in figure 7; they are, at best, confusing.

Figure 7 problems start at the top two illustrations. The core print it shown as the same diameter as the pattern body but the complex core shows no enlargement of the parts to fit in the core print i.e. there is no room left for the iron to flow around the body of the pattern.

I understand that it is possible to make complex cores as shown; the article in vol 222 issue 4610 illustrates very clearly that super complex cores can be constructed. However, the photos and advice in the article under discussion describe and show only cylindrical core boxes - why not stick to that for figure 7 and make the core obviously smaller than the pattern body with correspondingly smaller core prints?

Part 5 of figure 7 is really confusing. The article describes (and shows) the in-gate cut in the drag, not the cope (as does the illustration figure 5 in part 2) - does is matter in which it is cut? Surely the diagram should illustrate the article? It also shows the sprue but not the risers. What part 5 does illustrate is that the core more or less completely fills the hole left by the pattern with the exception of small collars (shown in black) leaving no room for iron.

Next (and here I am unsure of my grounds) photo 22 certainly looks like the top box but the hole in the sand goes all the way through so I suspect that the title should be 'Cylinder top box with sprue constructed and pattern removed'. It is still missing riser(s) which are blind with the exception of small breather holes.

So in summary, it is a super-useful article for someone with aspirations to do back-yard iron casting - but figure 7 just adds confusion. Part 2 figure 5 saves the day a bit except that it is a bit unclear how the core box produces the cylindrical core and, if constructed in wood, how does it get on at 150°C for an hour?

Ray Foulkes
(long-time subscriber to *Model Engineer*)

Pure Water

Dear Martin,
I have just noted Stuart Merton's (issue No.4623) comment on sourcing pure water. May I suggest another source of pure water that comes at no cost at all.

Most people who have a workshop are constantly battling the deadly rust bug. A lot of people use heating to raise the RH, but this does not actually remove the moisture that causes the rust. The better solution here is to purchase a dehumidifier which will remove this moisture and lower the RH in the room.

And the by-product of a dehumidifier is - water. Unless there is some contaminant in the air, this water should be absolutely pure, suitable for use in a boiler. We use it in our iron to prevent it scaling up.

Regards, Chris Pattison (Tauranga, NZ)

Oiling Axleboxes

Dear Martin,
I have just been reading the 'Magdalen Road Revisited' article in the latest magazine, and seen the writer can't see any oil pots for the rear axle boxes. It was a common for Martin Evans to design locos with the end of the axle drilled and then cross drilled at the axle box, thereby forcing a squirt of oil in the axle end would force oil into that axle box. It is not obvious as an onlooker, unless you are familiar with his designs. I do not know if Mr. Buck has considered this as an option as he states that he can't see any method for oiling.

I hope this may be of help.

Tom Parham (Maidstone)

Rack Locomotives

Dear Martin,
Tony Reeve's letter in ME4627 (6th December 2019) contained some interesting anecdotes, and comments on the content of *Model Engineer* with which I can only agree. However, I would like to comment on Mr Reeve's reference to the Mt. Lyell railway's five rack adhesion 0-4-2T tank engines with four cylinders, two for adhesion and two for the rack which he says were (I assume, in that respect) quite unique.

The metre gauge Dampfbahn Furka-Berkstreke (DFB) in Switzerland has repatriated from Vietnam two 0-8-0T (Swiss designation HG 4/4) locomotives, the propulsion system of which exactly matches Mr Reeve's description. SLM Winterthur who built five of the locomotives during the period 1924 to 1929 referred to it as 'System Winterthur'. Two more were built by Machinefabrik Esslingen in the same period. One of the two repatriated locomotives has been restored to full working order and returned to service in 2019. I believe that it is intended that the other one will be similarly restored in the fullness of time. Also repatriated were two 2-6-0T (HG 3/4) locomotives originally built by SLM Winterthur in 1913/14. Both have been restored to the same high standard as that achieved with the HG 4/4. They do not feature the independent rack and adhesion drives that characterise the HG 4/4. A third HG 3/4 was not repatriated from Vietnam, having always been resident in Switzerland; it is on loan from the Furka Oberalp Bahn (now part of the Matterhorn Gotthard Bahn – operator of the famous Glacier Express) which operated the railway until the section through the Furka Pass was made redundant in around 1982 by the opening of the base tunnel from Oberalp to Realp. There are also two 2-4-0T (HG 2/3) rack locomotives, built in 1902 and 1906, one of which is operational. The locomotives operate on the ABT rack system but use adhesion on flatter sections such as in the stations, where the rack is dispensed with.

The DFB is a most remarkable railway which, due to the extreme climate (much of it is buried under several feet of snow during the winter), is able to operate on less than 100 days per year. Despite this it has assembled a collection of magnificently restored rack locomotives and well appointed coaching stock. Starting from Oberwald it follows the river Rhone through a scenic gorge before passing through a spiral tunnel immediately before reaching Gletch, where 100 years ago it was possible to see the end of the Rhone glacier. From Gletch the railway enters some of the most desolate scenery in Switzerland, climbing to the Furka tunnel before descending to Realp. In the descent it passes over the Steffenbach Bridge which has to be retracted every year to protect it from winter avalanches. All the stations have turntables, even Furka summit at 2163m. The railway is operated by quite the friendliest and most informative group of people that I have ever met at a volunteer run railway and I strongly recommend that railway minded enthusiasts who travel to Switzerland visit and support it.

Best Regards, Jeremy Buck

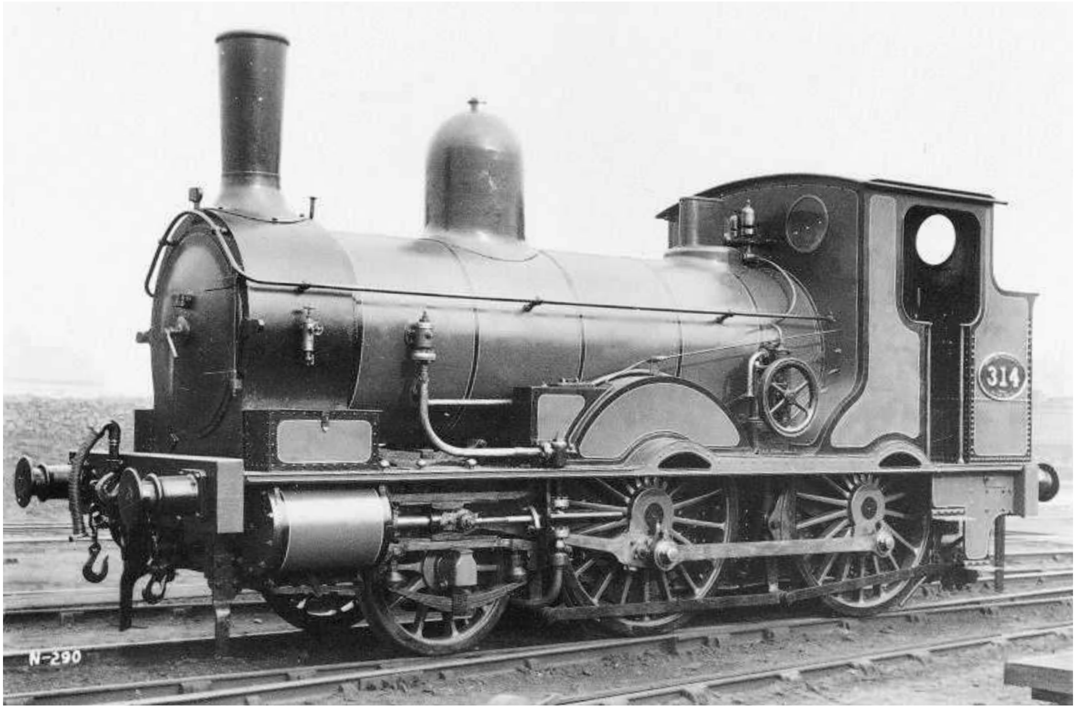
Wenford

PART 4

A 7¼ Inch Gauge 2-4-0 Beattie Well Tank

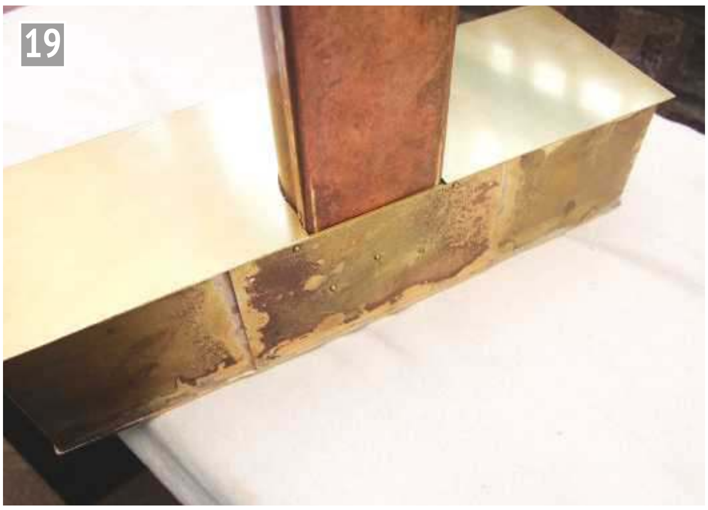
Hotspur catches up on the description of his Beattie well tank.

Continued from p. 252
M.E. 4631, 31 January 2020



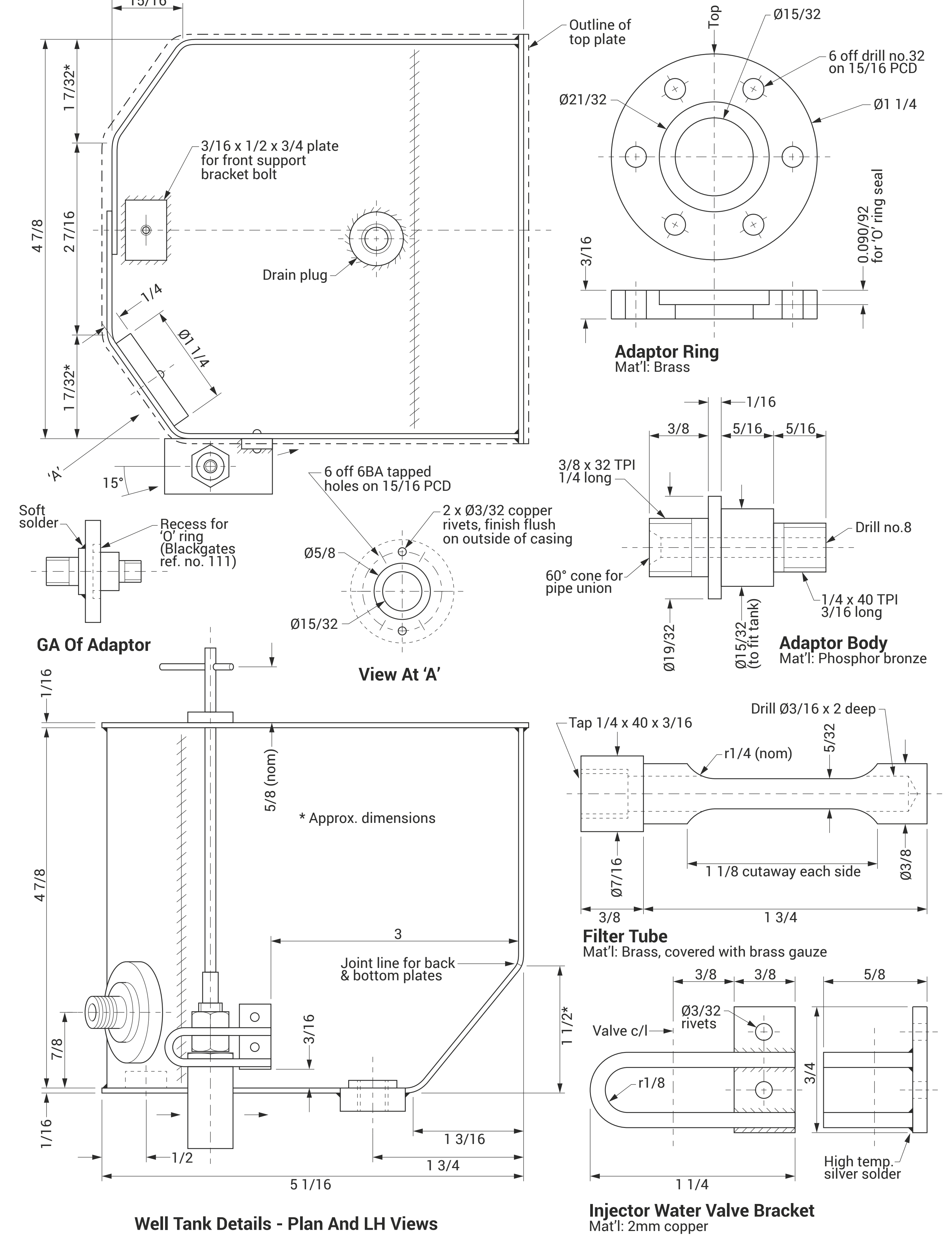
Completing the bunker tank

The first task is to complete the bunker tank by putting the top plate on. This requires the plate to be cut out and fitted around the water entry passage to be as good a fit as possible. I found I needed a couple of slivers of brass strip to fill the small gaps that would not be able to be bridged by the solder. These sat on the hoop already in place underneath so they could not fall into the tank itself. **Photograph 19** shows my top plate and the technique for the silver soldering is worth a comment. The first operation was to solder the circular joint around the water inlet casing from above. Then, the tank was cleaned and turned over to solder the top front edge and, as in the case of the initial operation to attach the base plate, the heating from the gas torch works effectively if directed up from underneath so the edge to be soldered is not only on a flat surface but slightly overlapping a firebrick or an equivalent substance. I have found that using a slice of the insulation material supplied for the hearth assembly by CUP Alloys (usual disclaimer) is excellent as it is both reflective of the heat and flat. My second illustration (**photo 20**) shows a typical set-up where the soldering is carried out in stages and a significant



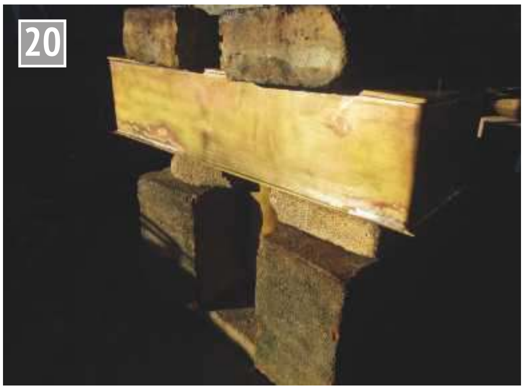
Here the tank top plate is ready for silver soldering around the water entry casing. Due to the curved shape some small slivers of brass were required to fill the gaps alongside the water entry passage. These could not fall in because the hoop support underneath provides a ledge.

Fig 4


5 1/8
15/16
Outline of
top plate
1 7/32*
4 7/8
2 7/16
1 7/32*
3/16 x 1/2 x 3/4 plate
for front support
bracket bolt
Drain plug
1/4
Ø1 1/4
'A'
15°
Top
Ø15/32
6 off drill no.32
on 15/16 PCD
Ø21/32
Ø1 1/4
0.090/92
for 'O' ring seal
3/16
Adaptor Ring
Mat'l: Brass
1/16
3/8
5/16
5/16
3/8 x 32 TPI
1/4 long
Drill no.8
60° cone for
pipe union
1/4 x 40 TPI
3/16 long
Ø19/32
Ø15/32
(to fit tank)
Adaptor Body
Mat'l: Phosphor bronze
Soft
solder
Recess for
'O' ring
(Blackgates
ref. no. 111)
GA Of Adaptor
6 off 6BA tapped
holes on 15/16 PCD
2 x Ø3/32 copper
rivets, finish flush
on outside of casing
Ø5/8
Ø15/32
View At 'A'
1/16
5/8 (nom)
* Approx. dimensions
4 7/8
3
Joint line for back
& bottom plates
3/16
7/8
1 1/2*
1/16
1/2
1 3/16
1 3/4
5 1/16
Well Tank Details - Plan And LH Views
Tap 1/4 x 40 x 3/16
Drill Ø3/16 x 2 deep
r1/4 (nom)
5/32
Ø7/16
1 1/8 cutaway each side
Ø3/8
3/8
1 3/4
Filter Tube
Mat'l: Brass, covered with brass gauze
3/8
3/8
5/8
Ø3/32
rivets
Valve c/l
r1/8
3/4
High temp.
silver solder
1 1/4
Injector Water Valve Bracket
Mat'l: 2mm copper

weight is placed on top of the tank to maintain the plate in a flat condition. This assembly operation is best undertaken slowly with sensible cooling and cleaning between the phases before the next solder run. **Photograph 21** shows further progress.

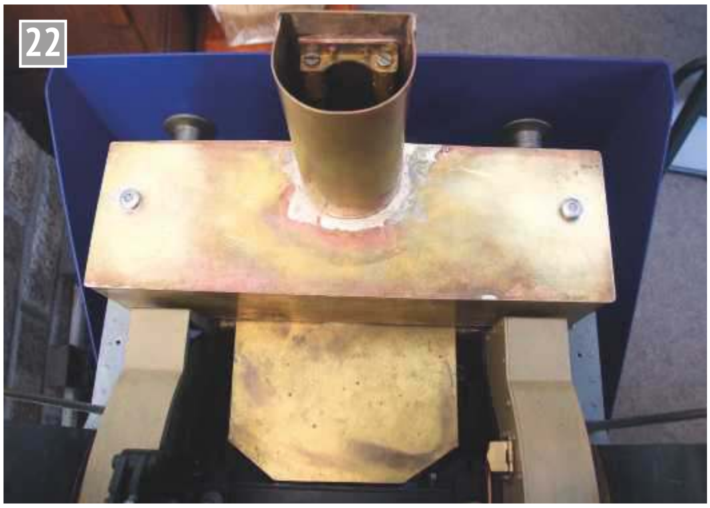
It should be pointed out for new readers that the bunker platework and this tank are held down onto the chassis using two vertical tie bolts that are secured under the outside rear angle castings attached behind the buffer beam. These tie bolts have to pass down through two brass or copper tubes that need holes to be centred and drilled down through the tank so they can be silver soldered in place. The position of the holes for these tie bolts was originally given on the drawing for the bunker steelwork and so the holes in the coal space baseplate should be used to mark out the tank holes now required. Once spotted onto the top of the bunker tank, two 5/16 inch diameter holes need to be drilled right down and through the base of the tank for the two short tubes to be silver soldered in place. I used copper and they were left at least 3/16 inch proud so they could take the heat and make a good joint. It was also useful to swage out the top ends to prevent them falling through. After cleaning, the tank was turned over and the bottom ends completed. These tubes provide the clearance holes for the tie bolts and after soldering the ends were filed back to leave them standing just 1/32 inch proud, top and bottom.



The tank is now turned over to solder along the edge of the bottom plate keeping the fireproof insulation just behind the edge of the sheet to allow the best heating condition.

This shows the soldering task is reaching a conclusion and minimum distortion has occurred.

Previously I have mentioned how the accumulation of tolerances requires some marking out *in situ;* well when I came to assemble all the parts for the bunker assembly, I had to adjust the tie bolt tube diameters to allow the bolts to fit. I had used a thick walled copper pipe for the two tubes just described and these were drilled through to gain an additional 1/32 inch clearance. I used the angle plate on the cross slide again for the drilling operation and, as is usual for copper, the task was done quite slowly with plenty of cutting oil. P**hotograph 22** shows the two rear tanks positioned in the chassis with the two tie bolts in place.



A view of the tanks assembled back onto the chassis with the tie bolts in place. Note the space around the bunker tank to be taken up by the rear steel cab structure.

Progress with the well tank

We can now tackle the controls to be fitted to the rear well tank and in placing the shell of the structure in the chassis, I found that the lower part of the front sides was accessible through the rear wheel spokes. This means that any fittings sited in this region can be adjusted or removed without dismantling the cab! With the size of tank I have specified there is also just room for the required valves to be added on each side and the tank should be able to be fitted into the chassis with them attached. My drawing (**fig 4**) shows the details for the injector water valve mounting on the left side and the adjacent water outlet adaptor.

Expediency has meant that my injector valve is a proprietary purchase for 3/16 inch copper pipe and it has a simple straight through water flow with a 90 degree off/on operation. For the layout of the pipes it is necessary to angle the body of this valve to be around 15 degrees to the engine centreline and with the water outlet side pointing to the rear under the tank. On my valve the top fitting of the body is a hexagon the same size as the clamping nuts so rather than rely on just these nuts to maintain its position, I have formed a double bent bracket which has a hexagon in the lower section to engage with this fitting. P**hotographs 23** and **24** show what I mean.

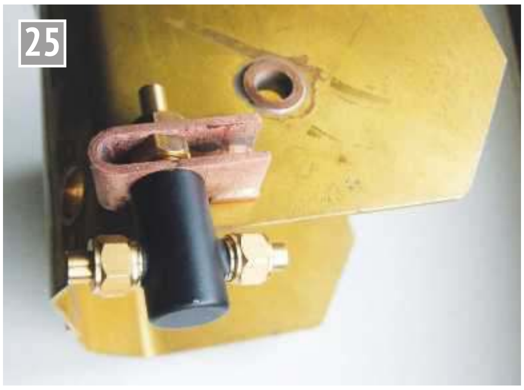
Cut out a piece of 2mm thick copper strip a full 5/8 inch wide and about 3 inches long. Mark out and drill a hole of 5/16 inch diameter, 1¼ inch from one end. Place one of the hexagon nuts over the hole and draw around the outline

Here are the first two stages in producing the injector water valve bracket with the mounting pad silver soldered in place.

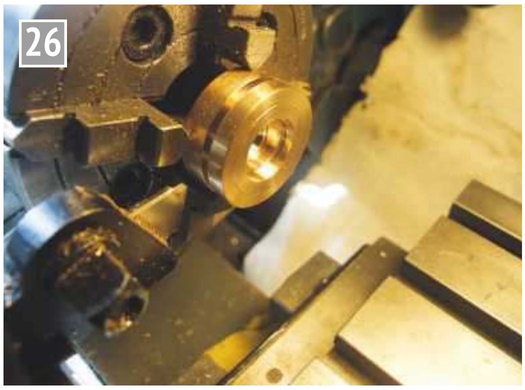
so it can be filed out. A small 3/16 inch triangular file is ideal and with care a shake free housing can be made that will locate over the valve body fitting. The task requires the strip to be annealed and bent over to form a 'U' shaped section to leave a vertical gap of ¼ inch and, as it is copper, it is easy enough to bend it through 180 degrees. Another simple hole is made in the top half of the bracket to accept the threaded portion of the valve fitting. The bracket is completed by adding a small flanging strip recessed into the rear end and attached with high temperature silver solder and the fabrication is then riveted to the body of the tank as shown. The bracket will be sealed with silver solder when the base of the tank structure is added. **Photograph 25** shows the final assembly of the valve and a top fitting to steady the extended operating shaft which will be added later with soft solder when the silver soldering is complete.

The second item I can describe is the water outlet connection on the left hand angled front face of the well tank. This is a flanged adaptor that is attached to the tank face with 6BA stainless bolts and it has an O-ring seal and so it is best made as a fabrication. The main body of the adaptor is turned from 5/8 inch diameter phosphor bronze bar to provide strength for the outlet pipe union nut thread (3/8 inch x 32) and the main body is turned down to fit the tank mounting hole. The inner end has a smaller thread on which is fitted the filter sleeve with a 5/16 inch x 40 thread. There is also a flange near the centre to which is soft soldered the larger brass mounting flange which has the recess for the sealing O-ring. This minimises the amount of turning and waste of expensive material.

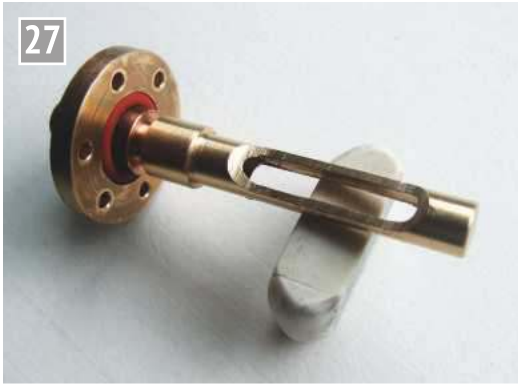
Start by noting the size of the hole in the mounting bush already added to the angled tank face. Turn a brass ring and bore the centre to be the same size as the tank hole,



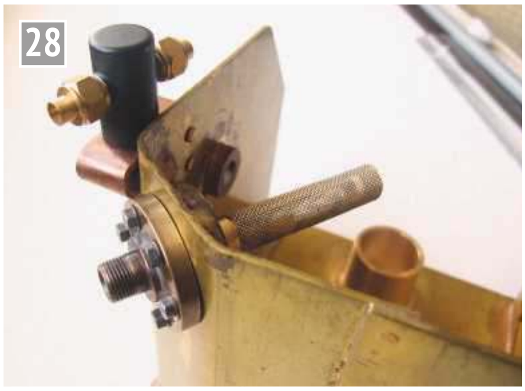
This view shows the water valve in position on the left side of the tank and a top fitting will steady the operating rod once the body of the tank has been fully silver soldered.



Turning the brass adaptor flange and marking off the PCD for the fastening holes.



This is the adaptor assembly with the filter support tube in place.



The completed water outlet adaptor mounted on the tank with the filter tube and its gauze in place. Stainless bolts will be fitted on final assembly.

then form the mating face with its O-ring recess and add the scribed diameter for the six 6BA fastening holes. **Photograph 26** shows the result in the course of being parted-off. Adding the 6BA clearance holes (drill No. 32) for its attachment to the tank is simple enough.

The adaptor body is a simple turning exercise and the outer thread is made with a tailstock die holder in which the die has been expanded to its maximum. If a 3/16 inch pipe nut is too tight when tried on the thread, the die can always be relaxed a little. Do keep in mind that the thread will be larger than the original diameter as the bronze material is 'swaged' upwards slightly during the cutting operation. Put a BS No. 4 centre in the end of the thread for the pipe nipple and drill down to a depth of 1⅛ inch with a No. 7 drill for the water way. Withdraw the stock material from the chuck a short distance and support the bar with a tailstock rotating centre. Now, using a parting tool, machine the shoulders to the dimensions on the drawing. The main diameter should also fit the hole in the tank fitting so it will be realised that careful sizing with a vernier calliper is called for. Soft soldering the two parts together should be done with a minimum of solder from the outside and the assembly can then be clamped to the tank to spot through for the 6BA tapped holes.

The last part is the gauze water strainer sleeve turned from a length of ½ inch diameter brass. Turn the smaller end first to be 1¾ inch long. Cut off the overall length a full 2⅛ inch then turn it round to drill and tap the internal 5/16 inch by 40 TPI thread and drill down with a 3/16 inch drill to leave a closed end. The smaller diameter has a pair of relieved sections filed on each side as detailed and shown in **photo 27**. It is, of course, imperative that any stray burrs or 'theshes' of brass are carefully removed from inside this sleeve before adding the gauze. Adding soft solder to 'tin' the outside of the sleeve provided a base onto which the small piece of brass filter gauze could be wrapped and attached using a large separately heated soldering iron. I find a pencil flame torch too risky with thin gauze. However, I found that the alternative of attaching the gauze sleeve with Araldite to be just as satisfactory.

Once the adaptor had been fitted to the tank, it easily allowed the tank to be refitted into the chassis. **Photograph 28** shows the completed adaptor with its filter assembled onto the tank.

●To be continued.

NEXT TIME

I will describe the details for the right hand side of the tank.

A Draught Proposal

PART 1

Peter Kenington re-examines the electrical side of the humble steam-raising blower and proposes a couple of simple (and cheap) alternatives to traditional solutions for powering this essential piece of kit.

Typical (commercial) steam-raising blower.

Typical lead acid 'gel' battery often used in powering steam-raising blowers.

The humble steam-raising blower (**photo 1**) is generally given very little thought by most model engineers. I have seen a huge variety of incarnations, ranging from commercial designs (both 'high quality' and 'built to a price') through competent amateur designs made from old car windscreen washer motors and the like, to the downright Heath-Robinson – we have one 'design' at Hereford SME which falls apart every time I (or anyone else) uses it! They all have one thing in common though; they all need electrical power and this can present a few challenges. Like most challenges, in solving them, opportunities also arise and I hope to outline both in this article.

Current considerations

There are two main areas to consider in respect of blowers and their electrical supply. Is the traditional lead-acid battery the best option to provide power (in the absence of a dedicated supply at a steaming bay) and, when a dedicated supply is present, is it 12V, 24V or both and how can we deal with this uncertainty? At Hereford, both voltages are available and it depends upon who was last using the supply as to which is connected to the steaming bays – running a 12V motor at 24V is not to be advised! So, given my electronics background, I set out to re-examine these questions and propose a few simple solutions. The result is what I consider to be a truly universal blower supply arrangement:

- It will cope with any supply voltage from under 6V to over 24V and yet provide a constant blower speed, irrespective of the supply voltage. It will not change speed, for example, even if a 'helpful colleague' switches the steaming bay supply from 12V to 24V or vice versa.
- It features a portable battery supply which doesn't self-discharge to any appreciable extent, even if it is left unused for months on end.
- It is impossible to wire-up the wrong way round!
- Finally, it features the ability to vary the blower speed across a huge range (from standstill to the maximum rated RPM of the blower motor) irrespective of whether a battery or a fixed-supply is used, enabling precise control of the draught on the fire to be achieved, from first lighting through to final steam-raising.

And all this for far less outlay than a 'traditional' alternative. Just sign on the dotted line here, Sir, if you please…

A hard cell

The traditional portable power supply of choice for most model engineers is a lead acid battery – typically in the form of a 'gel' battery (**photo 2**) as these have little risk of leaking their corrosive chemicals if not stored upright. I have a (non-model engineering) friend who more or less wrote off his (admittedly, old) car when an old car battery he was transporting in his boot fell over. The rear end of the car corroded quite rapidly thereafter, eventually forcing him to scrap the car.

Whilst gel batteries overcome the spillage problem, they still have a few significant drawbacks:

- They are heavy and most people would 'notice' (involving four letter words and a possible trip to A&E) if one was dropped onto their foot.

- They are capable of providing a huge (explosive) current if accidentally shorted out (spanners can get everywhere…), again causing possible injury.
- They self-discharge and need to be constantly topped-up with charge, even if most of their overall capacity hasn't been expended in one running day or they simply haven't been used for a while (we all do this diligently, of course … OK, maybe we 'forget' occasionally).
- They have a poor shelf-life. Even if treated optimally, meaning keeping them at around 21 degrees centigrade for the whole of their lives (= not in the garage/shed) and continuously (24/7) topped up with charge, never discharging them more than around 30 – 50% of their capacity, etc., then they will still typically lose around 50% of their capacity after 3 – 4 years. With typical (very sub-optimal) treatment, these figures reduce drastically.

Wouldn't it be nice if there was a simple, cheap, alternative which wouldn't elicit words of any length if dropped on a foot, wouldn't trouble the over-stretched NHS unduly and could be safely ignored from one month to the next, knowing that it would work faithfully despite this abject neglect? Let me introduce you to *ReCyko*™ (other brands exist) – **photo 3**. He (sorry, it) sounds like a superhero (you can discuss him with your 'Avengers'-obsessed grand-kids and they'll be impressed), but is, in fact, a brand name for a type of Nickel-Metal Hydride (NiMH) battery which sacrifices a small amount of absolute capacity (~10% or so relative to the 'best' high-capacity cells) for a very low self-discharge rate (think Duracell™-like shelf-life).

There are other, alternative, brands available (*Hybrio* being one) and many of the mainstream manufacturers now produce their own variants. They usually claim to be 'always ready', have a 'long-shelf life' or a 'low self-discharge' and the like. They typically have capacities in the region of 2000mAh (for an AA cell type), which is sufficient to power a typical (5 inch gauge size) 12V blower for around 6 – 7 hours continuously – even a full-size locomotive should have a decent fire going in that time! In practice this often means that a battery pack made from these cells may only need charging once or twice in a running season (depending upon how 'keen' the owner is). Another advantage of the battery-pack approach is that if one cell fails for some reason, it can be replaced, there being no need to discard the whole pack. In the case of a lead acid alternative, the whole battery will need to be replaced.

3

ReCyko batteries in various guises/generations.

4

Empty 10-cell battery case and PP3-style connector. Note that these cases are also available in a 'linear' configuration, i.e. with all 10 batteries sitting side-by-side. It is a matter of personal preference as to which is chosen.

The business case

"This all sounds very good", I hear you say, "but all of these cells, plus a battery case and connector must surely be more expensive than my trusty old lead acid solution – new technology always costs doesn't it?" Firstly, NiMH is not a particularly new technology (it's been around for decades) and even the low-discharge variants have been around for a good few years, so we're not proposing a 'bleeding-edge' technology solution here. The comparative costs are:

- Lead acid battery (*Yuasa*, 2.8Ah, eBay, new): ~£16.
- NiMH near-equivalent (*ReCyko*, 2Ah, eBay, new): £7.59 for 8 (i.e. ~£15 for 10, with 6 'free' cells for your other household needs); battery holder + lead ~£4.25.

All prices include shipping and are based on UK suppliers.

So, the answer is that it doesn't make much difference either way, cost-wise – in other words, all of the advantages, discussed above, come free!

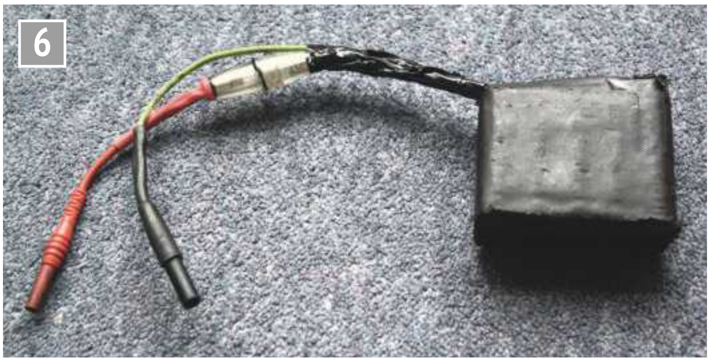
An armoured battery

Putting the battery system together is very straightforward and involves only a modicum of simple (soft) soldering. **Photograph 4** shows the main components needed – a 10-cell battery case, suitable for 'AA' size cells and a 'PP3' style battery clip to attach to the battery case. **Photograph 5** shows the populated battery case with the battery clip attached.

Whilst it is possible to dispense with the clip and solder directly to the terminals on the battery case, this is not easy to do without melting the plastic surrounding the terminals. For this reason, whilst arguably not essential, it is preferable to utilise the battery clip shown. This can be dismantled, to remove the thin wires attached to the battery clip terminals, allowing them to be replaced with something a little more substantial ($1mm^2$ cross-sectional area or greater) – this will probably involve destroying the integrity of the clip but this doesn't matter as

5

Populated battery case with PP3-style connector attached.



Assembled battery pack, complete with in-line fuse-holder. This particular example has seen 5+ years of service (without needing to change the cells).

In-line sockets and plugs – note that the sockets (on the left) are the CPC version and the plugs (on the right) are from eBay; the former are of a higher quality!

the individual terminals 'snap' onto the connections on the battery case and are then held further by the tape (see below).

It is also a good idea to include an in-line fuse-holder (**photo 6**) just in case of accidents, although the flash from a shorted NiMH battery pack is much less intense than that of a lead-acid battery (and it would be good practice to include a fuse-holder in lead-acid based systems as well). An anti-surge fuse of 5A should be plenty for most blowers, although if you have a *Romulus* and a blower which wouldn't look out of place on the front-end of a light aircraft, then you might need to go for something larger.

The cable I used for the battery pack and, later, for the speed controller is specified as follows:

- Type: multi-strand (50 strands @ 0.25mm diameter each).
- Conductor cross-sectional area: 2.5mm^2.
- Overall diameter (including insulation): 3.5mm

This is about the largest diameter cable which the in-line connectors I used (discussed below) will accept. It is very conservatively rated from a current handling perspective, as it will cope with at least 15A! (Most blowers require less than 0.5A.) I chose it mostly for its durability and because I had some lying around.

As an aside, I used a different type of cable for my main blower (which is not the blower shown in photo 1). I re-used some of the heat-resistant mains flex from an old (and long since discarded) domestic iron. The heat-resistant properties of this cable make it very suitable for use around hot steam engines, with the live and neutral wires having a suitable colour-coding (blue for negative and brown for positive). The earth wire can be cut short and left unused.

At this point, it is worth discussing the connector arrangement employed (and shown, in part, in photo 6) in a little more detail. The connectors are all 4mm 'banana' plugs and the shielded types have been used here (to eliminate the risk of accidental short circuits). They have been 'sexed' to ensure that an inadvertent polarity inversion (i.e. connecting the blower the wrong way around) is impossible for even the most ham-fisted assistant (or grandchild, as they are otherwise known). The connectors I used are available from CPC (www.cpc.co.uk) or eBay (at about half the price!); they are shown in **photo 7** and the CPC part numbers are:

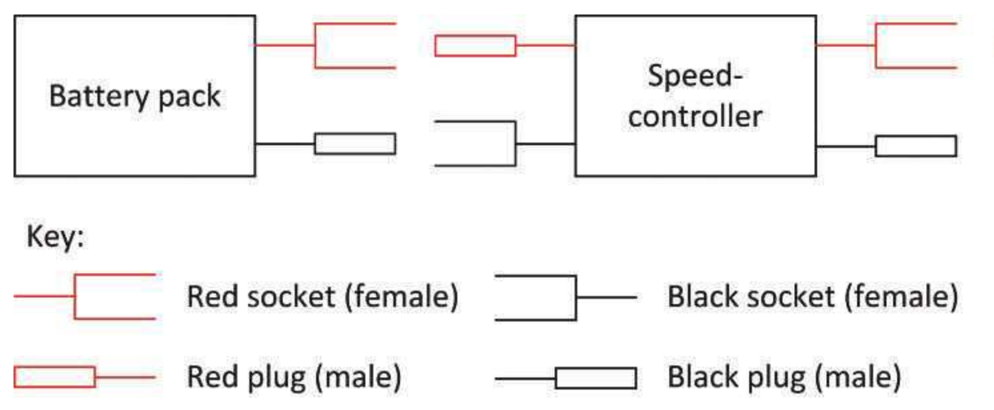
- Red in-line socket (female): CN06234 (bottom left).
- Black in-line socket (female): CN06233 (top left).
- Red in-line plug (male): CN06638 (bottom right).
- Black in-line plug (male): CN06637 (top right).

It is possible to 'sex' the connectors throughout the system to ensure that it is impossible to connect them the wrong way around (although, arguably, the red-black colour scheme does make it abundantly obvious which way around they should go!). I will confess that I didn't adopt this sexing system in my original battery pack (photo 6), for reasons discussed below.

The proposed system is (see **fig 1**):

- Blower positive connection: red plug.
- Blower negative connection: black socket.
- Speed-controller output positive connection: red socket.
- Speed-controller output negative connection: black plug.
- Speed-controller input positive connection: red plug.
- Speed-controller input negative connection: black socket.
- Battery pack positive connection: red socket.
- Battery pack negative connection: black plug.

The above scheme also has the advantages that it is impossible to insert the speed controller module the wrong way around (which



Diagrammatic representation of the blower, speed-controller and battery pack system, showing details of the suggested connector sexing.

Fig 1

may damage it) and that the blower can be connected directly to the battery pack (i.e. omitting the speed controller), if desired, without having to re-solder any connections.

As a final part of the project, a set of crocodile-clip to 4mm banana plug/sockets can be made (**photo 8**), to allow the blower and speed controller to be connected to a 12V or 24V supply provided at a steaming bay. If the proposed connector sexing system has been adopted, then these leads should reflect the connector types used on the battery pack, i.e.:

- Red crocodile clip: red socket.
- Black crocodile clip: black plug.

There is, of course, one drawback to the connector sexing proposed above; it would be possible for an individual of limited intellectual powers (i.e. an idiot) to connect the positive and negative battery terminals together and thereby create a short-circuit (and a lot of heat in the wiring, or worse). I will leave it to the reader to decide how likely they, or anyone else who is likely to use this system, is to do such a foolish thing and thereby to decide whether to adopt this connector sexing scheme or a safer alternative (i.e. having sockets on both the battery positive and negative leads and relying upon the differing colours of the sockets to ensure correct blower rotation). The pack shown in photo 6 was constructed at a time when my steam-mad son, Matthew, was very small and would fiddle with *everything* and I was a little concerned he would experiment with connecting plug to socket... With greater maturity, he's now moderated this behaviour (he only fiddles with *most* things...).

Once all of the connectors have been attached, and heat-shrink sleeving added to provide improved strain-relief on the connections, the 'armouring' can be added. The 10 cells should now be inserted into the battery case and the output voltage from the pack tested (using a multimeter set to a 20V DC scale). If all of the cells are fully charged, then the voltage reading should be approximately 14V.

The 'armouring' itself is simply a few layers of good quality 'gaffer' tape. This is strong, durable, insulating and, should the need arise, relatively easy to remove (to change one or more cells, should one fail in the dim and distant future). Clearly an alternative would be to purchase (or even 3D print) a suitable box in which to house the battery case, although this is not really necessary.

Crocodile-clip to banana-plug leads.

●To be continued.

NEWS

The Winter Storms Visit Sunderland

Peter Russell, Secretary of the City of Sunderland Model Engineering Society, reports on the damage.

When we arrived at the clubhouse on the morning of Thursday, 12th December we were met with a horrifying sight. Probably due to the gales of the previous few days, a large tree had fallen over and was lying across the small track. It was obvious from what we could see that a significant amount of damage had been done to the track, but exactly how much would have to wait for the tree's removal.

On closer inspection it was apparent that the tree was rotten right through at the base and it was a sobering thought that the track had been in use on the previous Sunday. Thankfully this track, built in 1946 and comprising of raised concrete arches – thought to be the first of its type and copied by many other clubs - is only used by club members, as access is via a fairly steep set of steps and unsuitable for the public.

It has to be said that the City Council (our landlords) were quick off the mark and had the tree chopped up within a couple of days. This let us see the full extent of the damage. At least three of the concrete arches making up the track needed to be removed and replaced. This led to another problem; there was no-one left who had a hand in building this track, so no-one knew how it was all joined together.

Fortunately, next to the track is a steaming track, built in the same fashion and long enough that we could afford to lose a few arches to replace the broken ones.

A week or so later and we met with a couple of council officers who immediately agreed to undertake all the necessary work to repair the track. Good as their word, the job was immediately put out to tender, a contractor appointed and the job done. All we have to do now is replace the rails.

ME

Brill 22E Tram Truck

Ashley Best describes an American design of tram truck that was widely used on British trams.

Continued from p.224
M.E.4631, 31 January 2020

The typical British electric tramcar had become established early in the 20th century. Mostly they were double deckers on either four wheel single trucks or, for larger cars, a pair of four wheel bogie trucks. It is interesting to note that most of these trucks were American designs. Britain was only later to develop its own successful truck types. Of the makers that supplied these early trucks, the most successful was the Brill Company of Philadelphia. Their two most prolific products for the British market were the 21E four-wheel truck and the 22E maximum traction truck for eight-wheel cars. This latter design forms the subject of this article.

Brake shoes

The brake shoes are awkward things to make. I first achieved a satisfactory result by casting them in white metal in silicone rubber moulds. For this process, a small wooden box is made, plasticine used for the original impression, a release agent (wax spray will do) is applied, then silicone rubber cured with hardener is poured. Once the rubber has set, the plasticine is removed; release agent applied again and given a second pouring of silicone rubber, which is then allowed to cure. Then, the mould is split to remove the pattern and a sprue way is cut with a very sharp knife.

Photographs 49, 50, 51 and **52** show respectively, the casting processes as follows: metal being heated, then being poured, followed by the mould being opened to reveal the brake shoe holder parts and finally the set of cast brake parts. This method is also applicable for other items and I have successfully cast brake hangers and even seat frames.

However, for this model, I made all the parts from brass with shoes and shoe holders as separate items. The shoes on tramcars cover flanges as well as wheel treads. A fair representation can be made quite easily from well-annealed brass. The method involves

Making brake shoes.

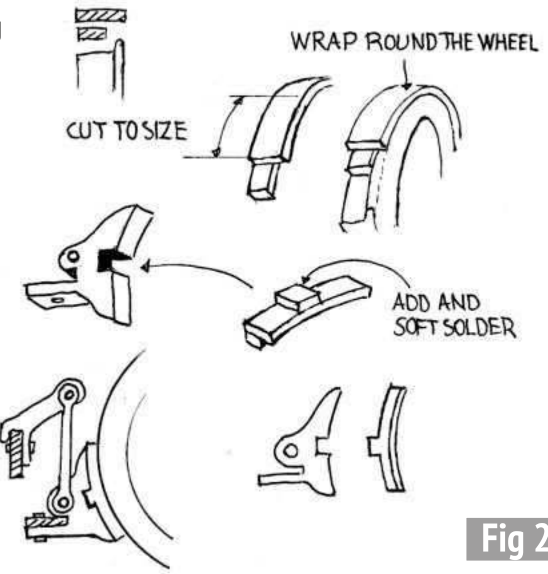


Fig 29

Source for motors, gears, castings and plans:
Model Engineering Secretary,
Tramway & Light Railway Society,
9, Manor Close,
Bognor Regis,
West Sussex
PO22 7PN
Or e-mail: **tlrs.mesecretary@tramwayinfo.com**

wrapping a strip around a wheel and then a wider piece to the full width of the tread and flange. **Figure 29** has sketches to make this clear. Brake shoe holders are the parts fitted to the brake beams and accept hangers from the hanger brackets; these I made from brass by assembling, filing and drilling. **Figure 30** shows the method and **photo 53** is of the parts including a finished holder. The holders and shoes are united using araldite or lead solder, so that the joint between them can be seen just as in the prototype (**photo 54**). The shoes on the real tram were cast iron and this is a fact to be remembered when the model is painted as the shoes are not painted, but the rest of the brake gear is. I dwell on this part of the truck construction because it is an important part of the project with many suitable outcomes. If merely to represent the brake gear, then this can be achieved by making dummy shoes and holders in any suitable material - wood or plastic is satisfactory. With expertise in milling techniques, the shape of the holders can be achieved over a long time. I imagine that 3D printing could also be used. My first efforts were to cut the whole shape from suitable brass bar and, apart from the difficulty, it took ages. Having eventually made one I decided to use it as a pattern for the previously mentioned white metal casting. The current fabricated design described here is easy to make in a short time - indeed very much faster than cutting from the solid. All eight, for both trucks, took only a little longer to fabricate than one cut from the solid.

Brake gear

The brake leverage system is all held in brackets fitted to the rear cross beam – yet another load on this essential feature (**photo 55**). The brakes pull back towards the car centre. Brake rods to operate the driving wheel brakes are cranked to clear the cross beam support brackets and other obstructions.

Casting: melting the white metal.

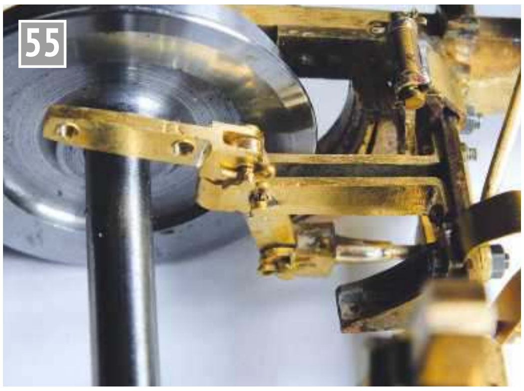
Casting: pouring the metal.

Casting: moment of truth – opening the mould.

Casting: the results.

Fabricating a brake shoe holder.

Shoes are glued or soldered to the holders.

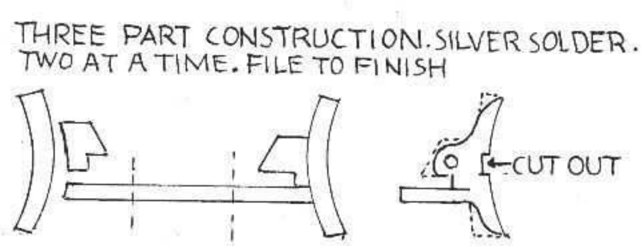


The brakes are attached to the rear cross beam.

Compensating brake leverage on each truck is activated by a curved arch bar at the rear which is fitted with a small pulley wheel seen clearly in **photo 56.** The pull rod for this goes to the car centre which has yet more compensating levers to equalise the pull on each truck (**fig 31**). Thus, in effect, there are three equalising brake lever systems on each tram. From whichever end of the tram the brakes are

Fig 30

Fabricating the brake shoe holders.



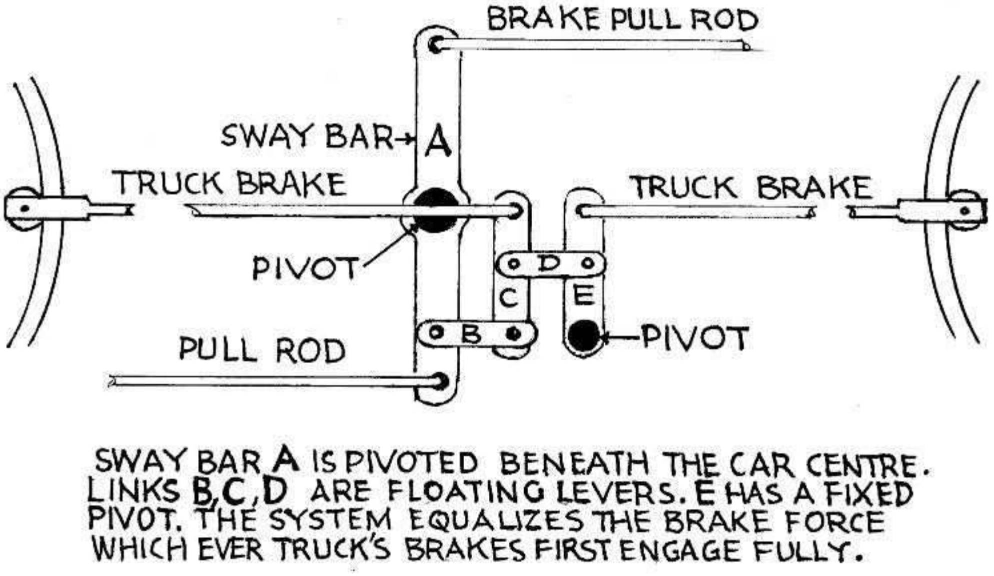
applied, the force, in theory, will be equalised over all eight wheels. The Brill Company rather optimistically claimed that this system removed the possibility of wheels locking up and skidding so wheel flats would be eliminated.

Assembling the truck

Although assembling the side frames and cross beams with the additional bracing is reasonably straightforward, the brake gear is a fiddly job. The whole construction uses only 10BA and 12BA bolts, set screws and nuts - apart, that is, from the side bearing rubbing gear which uses 14BA and even these could be replaced at a pinch with 1⁄32 inch pins. Shackle pins, brake hangers and brake beams are best assembled first. The brake rods with 10BA tapped ends for adjusting nuts go next. All this takes a long time and patience as each shackle pin has to have 1⁄32 inch split pins inserted to prevent it falling out. Small pliers with narrow jaws, tweezers and probably a magnifying lens are essentials as is a very good directional light. Before putting together all the internal equipment, the motors and gears should be given a thorough testing. It is extremely irritating should it become necessary to dismantle the truck to ease stiff bearings.

A feature of these trucks was the fitting of safety chains attached to an eye bolt on the truck frame close to the pony wheels and linked to the car body underframe. This was to prevent the truck swinging around and possibly even over-turning the car in the event of a derailment.

Brake compensating levers. Fig 31

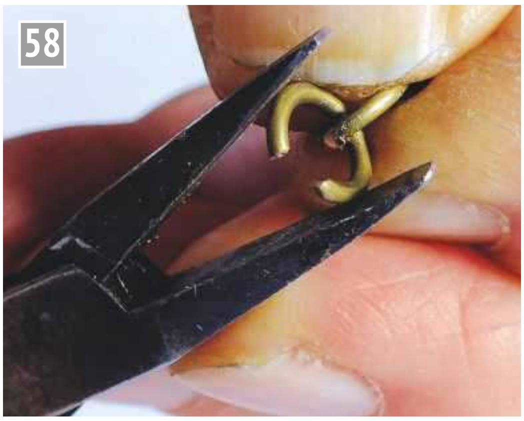


A key component of the brake compensation.

Cutting the links of a chain.

Chains

Making chains is not difficult. Wire of suitable gauge is wound round a rod exactly in the same way as forming a spring. With a piercing saw, the rings are cut into separate parts, each of which will form a link of the chain (**photo 57**). The individual pieces might need to be further cut with side cutters to exactly the desired size for squeezing to form the chain links (**photo 58**). The join of each link can be given a touch of soft solder and smoothed with a needle file for appearance's sake. The number of links in various Brill drawings varies between twelve and fourteen (**photo 59**). The last link has to be fitted to the eye bolt before sealing with soft solder.



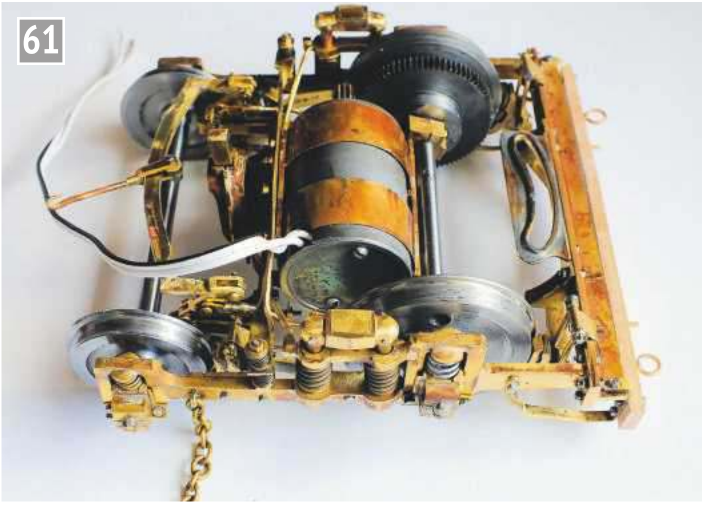
Closing a link.

Chain manufacture.

Dismantling

An often neglected consideration in model making is the need to dismantle a model. This is really very important, especially if the model is made to work. Just as the real prototype wears, so too

A completed truck.



Another view of a finished truck.

does the model; adjustments might be necessary. There is at least one occasion when dismantling has to be done and that is when the model is painted. It is possible, with careful masking of parts and with great care, to apply paint to the bare metal finished work, but a better job is possible on a dismantled model.

The truck described in this article was, right from the start, built with dismantling being a consideration while, at the same time, assembly also needed an orderly approach. Being a smallish scale made this even more important. I have tried to make taking down the model as easy as possible. The removal of one side frame is almost enough for most purposes. This requires all the bolts to be removed down the frame including the pilot board bracket, the four 12BA nuts and bolts on the front cross beam and the motor beam spring post. The whole side frame complete with axle boxes can then be slid off the axles. Brake rods might need to be disconnected and certainly will if the wheels need to be dropped. When dismantling is required, boxes for small parts are essential as otherwise it is almost certain that parts put on one side would vanish!

The prototype trucks of this design were a huge success and used in America and Britain in large numbers. As an example the Metropolitan Street Railway of New York used no other design and at one point had four thousand in use. In Britain, most large tramway systems operating bogie tramcars used the 22E trucks. In model form it works very well and behaves exactly as it was designed to. It is an example of sound, innovative engineering and a tribute to the Brill Company's designers of over a hundred years ago (**photos 60** and **61**).

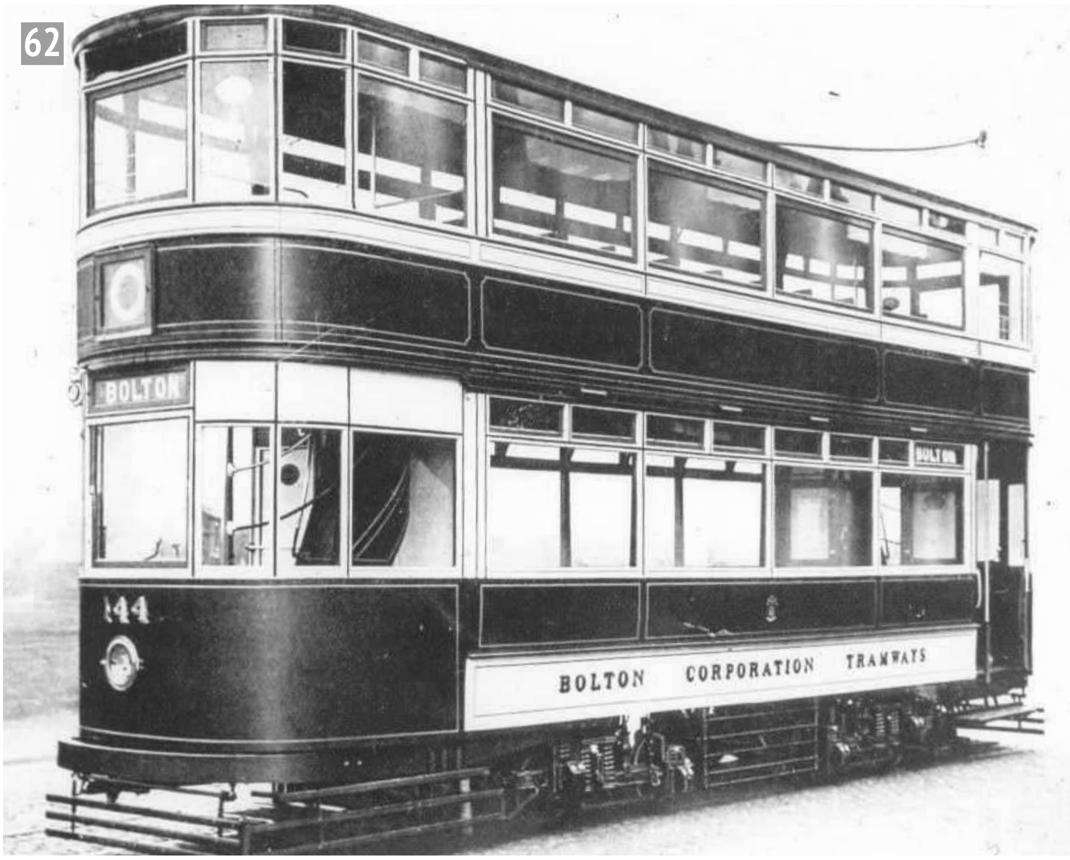
The model described in this series has been a most interesting project as well as something of a challenge. The completion of a pair of trucks will, it is hoped, enable a model to be made of one of Bolton Corporation's large enclosed bogie cars introduced 1927/8, probably the last use of this truly brilliant 22E truck design in Britain (**photo 62**).

Acknowledgements:
Thanks to my wife, Ann for reading and typing from my script and for taking most of the photographs.

Bibliography (unfortunately some of the following are out of print):-

Electric Railway Cars and Trucks (1905): by John Stephenson Co. ISBN 0-911760-11-3
J.G Brill Company: by Debra Brill ISBN 0-253-33949-9
Electric Railway Dictionary (1911): by Rodney Hitt. An Adam Gordon reprint: ISBN 978-1-874422-79-2
Gears and Gear Cutting (1988): by Ivan Law.
Reprinted by Special Interest Model Books Ltd. (2003) ISBN 978-185242-911-2
Engineering; 28th November, 1902 (extract).

ME



A tram built on a pair of Brill 22E trucks.

CLUB NEWS

Geoff Theasby reports on the latest news from the Clubs.

My Bolide (...is over the ocean, my Bolide is over the sea...) Ahem! In an effort to reduce weight, I decided to change the design and make the driving axle from 16 mm Acetal rod. I then, of course discovered an immediate snag. It is flexible! Turning a length in the lathe, as you depart the vicinity of the chuck, it shies away from the cutting tool, resulting in the piece being thicker as the chuck recedes. So, this is what steadies are for. I bought a travelling steady, which worked well, but the unsupported far end or the rod, too long for the tailstock, whirled about so I needed a fixed steady too. My lathe supplier is out of stock and a supplier of alternative parts could not confirm its suitability for my machine. Therefore, I wait... (update... Christmas came and went, as did the New Year, then my computer became deranged and I spent a week sorting it out. Thanks to Linux being 'open source', by dint of much burning of the midday oil, persistence and enormous amounts of string, I was able to resurrect the incipient corpse and normal service will be resumed as quickly as possible). Anyway, back to the steady, early one morning, about 1am, I had a thought, but I will not discuss that here... Another thought concerned making a simple fixed steady, and, having thunk, so convinced was I that it was viable, I abandoned the arms of Morpheus and went into the workshop to make it. ***It works!*** Later that day, at a more reasonable hour, I had a properly dimensioned, working, drive axle.

In this issue: Rams, 'Glad all over', horn fun, a locomotive not called Joseph, an inverted tram and an Urn.

Welling & District Model Engineering Society, *Magazine,* December-January reveals the reason why fairy lights are so called. Joseph Swan, co-inventor of the electric light bulb, created them for performance of G&S operetta, Iolanthe, in 1882. The next year, a colleague of Edison's put them on a Christmas tree. Two interesting models from the Society's October Open Day were a De Winton 'coffee pot' and a Campbeltown & Machrihanish locomotive of 1906, *Argyll* (**photo 1**). This was the only UK 2 foot 3 inch gauge line outside Wales.
W. www.wdmes.co.uk

John Arrowsmith has passed on to me a flyer for **Eastbourne Miniature Steam Railway**, a 7¼ inch gauge line in East Sussex. It is currently closed until April and does not appear to have a model engineering club associated with it.

Bradford Model Engineering Society's December Monthly Bulletin describes the recent talk on hydraulic power, which was perfected by Sir William Armstrong. As well as the hydraulic ram used in cranes and lock gates, a three cylinder capstan was also in quite common use.
W. www.bradfordmes.co.uk

Two issues of *Blast Pipe,* November and December, from **Hutt Valley & Maidstone Model Engineers Societies** introduce new editor Stephen Sandford and give fulsome thanks to Peter Anderson, with a full write up to come. He will be difficult to follow, so the editing and publishing arrangements have been reviewed, including going 'paperless', i.e. all electronic. An interesting short item concerns William Congreve's anti-forgery invention, a machine for producing very detailed engravings.
W. www.hvmes.com

Reading Society of Model Engineers, *Prospectus*, December, has a seasonable ghost story by John Spokes.
W. www.prospectpark railway.co.uk

City of Sunderland Model Engineering Society are planning a new exhibition on 6/7 June 2020, to be located in Roker Park. Two dealers and a number of exhibits are already lined up. More details as they become available.
W. www.csmes.co.uk

Following up on the items in *M.E.* 4628 and 4632 regarding monorails, YouTube has videos of Lartigue, Erwins and Road Machines types, at Amberley and Oswestry, plus original B&W film, *Monorails* will find them.

The current Newcomen Society publication, *Links,* has details of what is thought to be the oldest miniature locomotive in existence, of 12 inch gauge. It is rather big for a model, possibly intended for a garden railway and may have been made near Wakefield. It resembles a Stephensons' 'Patentee' of 1833 and bears a plate 'Leatham & Co.' The Leathams were wealthy Quaker bankers at the time and this may have been for an outdoor railway in the grounds of one of their houses, also in

C&MLR Argyll, at the Welling Open Day. (Photo courtesy of Editor, Tony Riley)

Martin Ford's 'weathered' 16 Ton wagon from G1MRA N&J. (Photo courtesy of Martin Ford.)

G1 Gladstone by Tony Armstrong. (Photo courtesy of Dick Comber.)

Wakefield. This model normally resides at the Head of Steam, Darlington, but until April will be on show at the NRM. The Newcomen Society will celebrate its centenary next summer. In South Yorkshire, it runs a series of talks on such diverse subjects as Radar, armour plate and Advanced Manufacturing to name a few recent talks.
W. www.newcomen.com

A delicious *divertissmente* discovered on YouTube was this one of train horns, which is quite entertaining. https://www.youtube.com/watch?v=NpZTW-3C20A

And for bus enthusiasts... https://www.youtube.com/watch?v=cO9hKRmNsUI

Peveril, December, from the **Manx Steam & Model Engineering Club** refers to Halloween, when members dress up and frighten the public and their fellow members, says Editor, Mike Casey. (Some can do that without dressing up, I hear – Geoff.) As for the Orchid Line, the two day event was as popular as ever. John Messenger describes the line's building. As it is built on the Curraghs, a very interesting - ecologically speaking - location (a bog ...), lots of willow branches, Terram matting, life expired sleepers and hard core went into it to make a stable base. Shades of Chat Moss, John says. The construction of the Douglas Corporation Merryweather fire engine model, *Raglan,* has been finalised and it was steamed in August; it is currently fired by LPG.

Nottingham Society of Model & Experimental Engineers' *Kingpin*, Winter, reports that the new extension was first used in earnest for the Firework Spectacular. Trains left the station every five minutes and 900 passengers were carried during the event. See https://tinyurl.com/u3o2d86 Three-year-old Jack Hollingsworth, a regular visitor, has been given his own locomotive, a battery operated Class 08 and when asked to decide what colour, picked that of 08 682. Big brother is in use with Bombardier in Derby and the livery was designed by the winner of a children's painting competition.
W. www.nsmee.org.uk

The second part of the **Gauge 1 Model Railway Association** *Newsletter and Journal*, winter edition, is just as absorbing as the first (see *M.E.* 4632). I also received a glorious 2020 calendar with this periodical, for which many thanks, guys and gals. First, here is Martin Ford's weathered Accucraft wagon, as mentioned in that issue (**photo 2**). Tony Armstrong's *Gladstone* is a reminder of the days when locomotives were not all black. In 1927 this locomotive was the first to be preserved from private subscriptions, organised by the Stephenson Locomotive Society. The colour may not be accurate, as the photo was taken on an old digital camera. However, designer William Stroudley thought it was green anyway! (**photo 3**). A GTG in Bad Konig, Germany revealed Frank Herold's scratch-built unique DRB BR19 model 19-1001, originally built by Henschel in 1941, which had eight oscillating cylinders working in pairs on alternate axles. These were normally hidden under a streamlined casing (**photo 4**).
W. www.g1mra.com

Sheffield & District Society of Model and Experimental Engineers' *Steam Whistle* for December pays tribute to Alistair Lofthouse, who runs ALD Print, which prints the periodical and also markets 3-D printed railway items. Alistair produced the reproduction 1949 exhibition catalogue mentioned in *M.E.* 4628. We also learn that David and Anita's fine fairground organ has raised £8,000 for local charities. (These instruments are wonderful and fascinating and I have a number of recordings of various survivors – Geoff.)
W. www.sheffieldmodelengineers.com

Roger Backhouse writes to say, '**York Society of Model Engineers'** planned exhibition is to be held on Sunday 21 June, which will also be an open day at the Society. (Sounds promising! – Geoff.) This is the first they've held for many years and will display something of the range of members' interests - which go far beyond miniature locomotives. It will be held at the Society's track site in Dringhouses.
W. www.yorkmodelenineers.co.uk

Frank Herold's G1 Henschel of 1941. (Photo courtesy of Bill Read.)

>>

Tom Hardy's urn. (Photo courtesy of Editor, Jim Clark.)

In 1908, Whanganui, in NZ, where Debs grew up, was the first provincial town to install a tramway. No 12 has been preserved and recently, Debs having a feed from the Whanganui community website, saw an item about preserved tram, *Mable* (sic) 'She' has a website; https://www.visitwhanganui.nz/mable-the-number-12-tram/

The Cam, December, from **Cambridge & District Model Engineering Society,** advises us that the carriage shed is well on its way to completion. For some, arcane, undisclosed reason this seems to involve lost tennis balls. Mike Muirhead visited a metre-gauge railway in Beirut and found it barely functioning, but, yes, there was a service, of a sort. A wonderful experience followed and he had a lovely day in beautiful Lebanon. That was in 1970, neither the train nor its excellent website survived the 1974 bellicosities, so 'you had to be there'. President, Ian Morris produced a seasonal, politically correct page of advice on how to conduct operations during the festivities. Patrick Ross, in *Reflections of a Traction Inspector*, discusses drivers' misdemeanours and the concomitant investigations and penalties. Photo Gallery reveals all about those tennis balls...
W. www.cambridgemes.org.uk

Steam Lines, Jan/Feb, from **Northern Districts Model Engineering Society (Perth)** had to cope with a State-wide total fire ban for the Sandgropers weekend, so there was no steam power! Only a couple of diesel outline locomotives ran, apart from those gas-fired, so there was a corresponding increase in other aspects. Some were even tempted to the 'Dark Side' of the Garden Railway, says Jim Clark, in his descriptive article. (Geoff thinks – 'Come into the garden railway, Maud...') Sunday was cooler so a little steam traction was allowed. Gilbert Ness' continuing tale of Tasmanian railways explains that there are 611km of TasRail track, freight only, in six divisions, mostly in the North. A 5 inch gauge Blowfly, built by the late Ted Symonds, has been donated to the club by his widow. The boiler was in good order when tested and the machine has been restored and is almost complete again. Bill Walker writes on the valve gear of early locomotives, whilst a fascinating piece about a seemingly incompatible couple of engineers, Doug and Eddy, built a couple of radial aero engines together and became so close that when Eddy died, he requested that Doug, his new friend and 'last apprentice', read the eulogy at his funeral. Tom Hardy has made this wonderful wooden urn. Jim Clark says, 'The patterns were built up by gluing blocks of different types of wood together to form segment rings, which were then glued on to previously glued rings and turned, building up the urn in two halves. The two halves (top and bottom) were finally glued together to produce this quite astonishing result. Unlike veneer inlay, the patterns extend right through the walls to the inside, which is also turned and finished to a high standard (**photo 5**).
W. www.ndmes.org.au

Looking through the latest local auction catalogue, I spotted a (tautological) Mercury Hermes *Scooterette* and found another wonderful Internet subculture, on the cyclemotor boom of the 1950s. The Scooterette was remarkable/infamous because its introduction caused the demise of the company! Basically a heavy duty bicycle with a puny engine and encumbered with body panels, it had a recoil starter under the seat, meaning the rider had to dismount in order to restart and its platform would not accommodate shoes bigger than size 9! The engine broke so often that Mercury sued the makers for £20,000, but still expired.... A total of 1200 Scooterettes were made and had not all sold, even several years later.
W. www.under50.cc

Another picture from the Sheffield Auctions, presenting a somewhat sad appearance, is the IoMR *Crellin* (**photo 6**).

And finally: my twin brother said he didn't understand cloning. I said, 'That makes two of us.'

Contact:
geofftheasby@gmail.com

Beyer-Peacock IoM Crellin ***at Sheffield Auctions.***

MARCH

1 **North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.

3 **Romney Marsh MES.** Talk: 'Update on Clan Line' – Colin Clark, 7.30pm. Contact Adrian Parker: 01303 894187.

4 **Bradford MES.** AGM, 7.45pm, Saltaire Methodist Church. Contact: Russ Coppin, 07815 048999.

4 **Brandon DSME.** Meeting at The Ram Hotel, Brandon, 7.45pm. Contact Mick Wickens: 01842 813707.

4 **Bristol SMEE.** Themed topic evening on model turbine building with John Beddis. Contact Dave Gray: 01275 857746.

4 **Leeds SMEE.** Meeting night – jumble sale. Contact Geoff Shackleton: 01977 798138.

5 **Sutton MEC.** Bits and pieces. Contact Paul Harding 0208 2544749.

6 **North London SME.** Work in progress. Contact Ian Johnston: 0208 4490693.

6 **Portsmouth MES.** Club night – 'Fuel for the Navy', 7.30pm, Tesco Fratton Community Centre. Contact Roger Doyle: doyle.roger@sky.com

6 **Rochdale SMEE.** Sale of items from Richard's workshop, 7.30-9pm, Castleton Community Centre. Contact Rod Hartley 07801 705193.

7 **Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.

8 **North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.

8 **Sutton MEC.** Sunday track day from noon. Contact Paul Harding 0208 2544749.

10 **Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.

13 **Tiverton & District MES.** Club meeting at Old Heathcoat Community Centre. Contact Chris Catley: 01884 798370.

14/15 **The Midlands Garden Rail Show,** Warwickshire Exhibition Centre. See www.meridienne exhibitions.co.uk

15 **North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.

15 **Guildford MES.** Public Open Afternoon 2-5pm. Contact Mike Sleigh: pr@gmes.org.uk

17 **Nottingham SMEE.** AGM. Contact Tony Knowles: 01623 795242.

17 **Romney Marsh MES.** Products of the winter workshop, 7.30pm. Contact Adrian Parker: 01303 894187.

18 **Bristol SMEE.** Spring auction (presumably an auction in the spring, not an auction for springs – Ed.). Contact Dave Gray: 01275 857746.

18 **Leeds SMEE.** Meeting night – 'Some Unusual Locomotives' – John Charlesworth. Contact Geoff Shackleton: 01977 798138.

20 **Rochdale SMEE.** Members' projects and problems, 7.30-9pm, Castleton Community Centre. Contact Rod Hartley 07801 705193.

22 **North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.

22 **Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.

24 **Romney Marsh MES.** Members' social afternoon, 2pm. Contact Adrian Parker: 01303 894187.

26 **Sutton MEC.** Club night – new and interesting items. Contact Paul Harding 0208 2544749.

28 **Romney Marsh MES.** Track meeting, noon onwards. Contact Adrian Parker: 01303 894187.

29 **North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.

29 **Portsmouth MES.** Public running, 2-5pm, Bransbury Park. Contact Roger Doyle: doyle.roger@sky.com

31 **Romney Marsh MES.** Track meeting, 11am onwards. Contact Adrian Parker: 01303 894187.

31 **Wigan DMES.** 'Free and Easy' night. Contact: wigan_mes@aol.com

APRIL

1 **Bradford MES.** Spring auction (only members may bid), 7.30pm, Saltaire Methodist Church. Contact: Russ Coppin, 07815 048999.

1 **Brandon DSME.** Meeting at The Ram Hotel, Brandon, 7.45pm. Contact Mick Wickens: 01842 813707.

1 **Leeds SMEE.** Meeting night – trophy night. Contact Geoff Shackleton: 01977 798138.

2 **Sutton MEC.** Bits and pieces. Contact Paul Harding 0208 2544749.

3 **North London SME.** Talk: 'Fantastic Journeys by Traction Engine' – Prof. Timothy Watson. Contact Ian Johnston: 0208 4490693.

3 **Portsmouth MES.** Club night – 'Microscopic Examination', 7.30pm, Tesco Fratton Community Centre. Contact Roger Doyle: doyle.roger@sky.com

4 **Bristol SMEE.** Members' night – 'On the Table'. Contact Dave Gray: 01275 857746.

4 **Tiverton & District MES.** Running day at Rackenford track. Contact Chris Catley: 01884 798370.

5 **North Wiltshire MES.** Public running, Coate Water Country Park, Swindon, 11am-5pm. Contact Ken Parker: 07710 515507.

5 **Plymouth Miniature Steam.** Public running, Goodwin Park (PL6 6RE), 2 – 4.30pm. Contact Rob Hitchcock: 01822 852479.

5 **Portsmouth MES.** Public running, 2-5pm, Bransbury Park. Contact Roger Doyle: doyle.roger@sky.com

5 **Stockholes Farm MR.** 'Wakey, Wakey Day' and AGM, from 10am. Contact Ivan Smith: 01427 872723.

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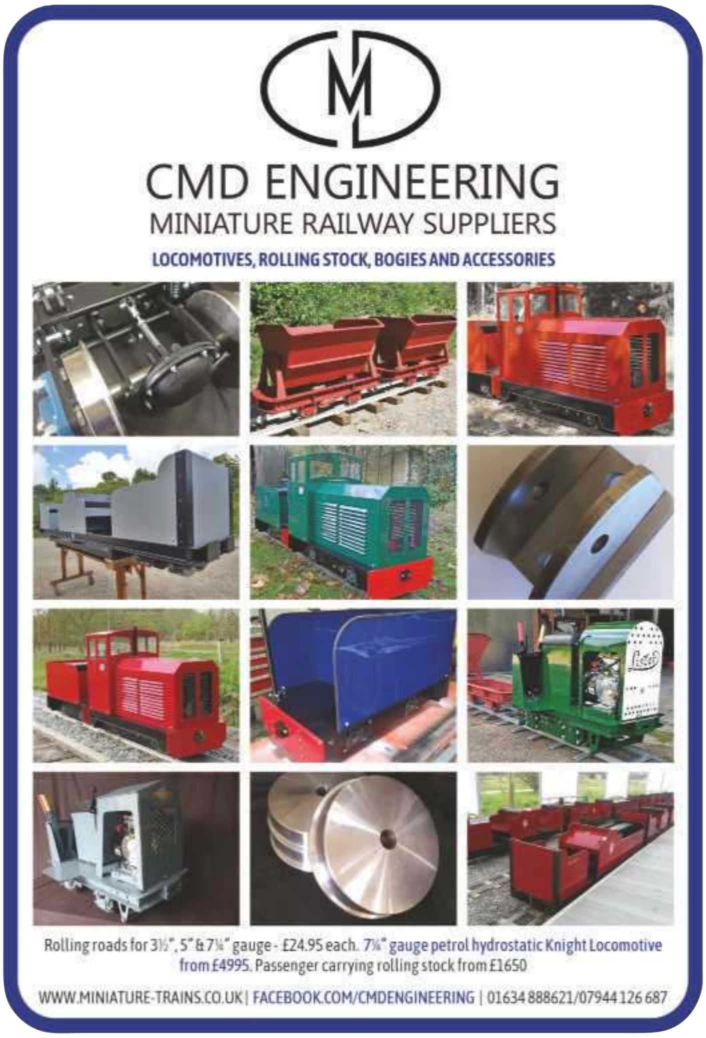
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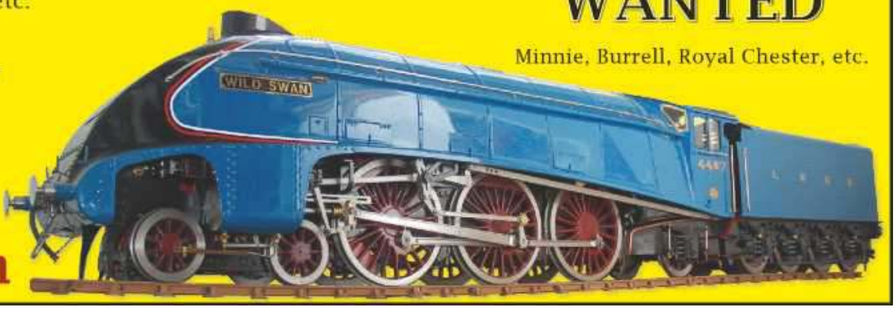

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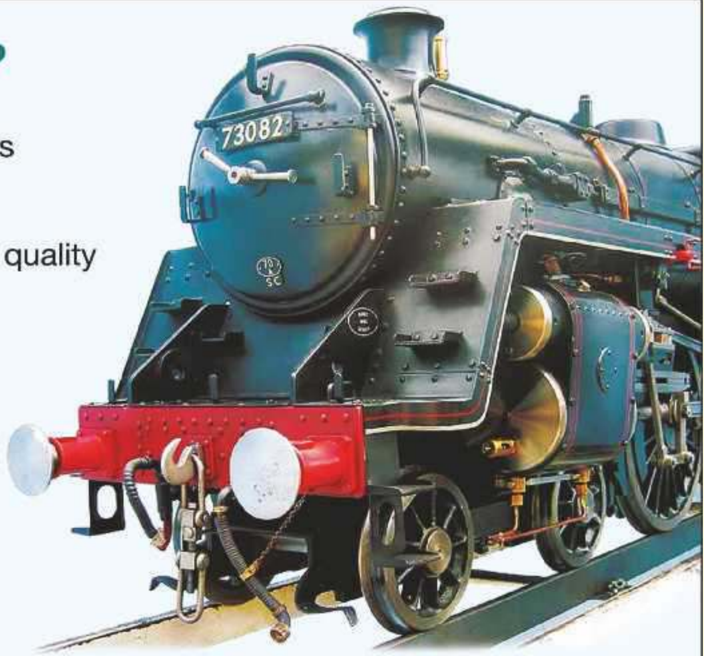

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The plant will consist of a horizontal Mill Engine driving a Dynamo which will supply electricity to the street lamp. A shaft driven water pump will deliver water to the vertical boiler which is fired by butane gas that provides steam to drive the Mill Engine. A water tank of ample size will supply the boiler which will give about 45 minutes steam time at approximately 400 rpm. The exhaust steam will pass to a steam oil separator; the oil in the steam dropping down inside the separator and the steam then passing out and up the exhaust pipe attached to the chimney.

The boiler is made from copper tube silver soldered and then pressure tested to 150 psi. The boiler is heated via a ceramic burner situated beneath the boiler giving sufficient heat to generate steam pressure up to 80 psi. There are ample steam valves around the plant for controlling the passage of water, steam and exhaust steam each being connect by polished copper piping adding to the attraction of this fine model. A bell type working whistle is fitted to the chimney with a pull down chain to activate it. The plant is mounted on a 14 inch square brass polished chequer baseplate bolted to a polished hardwood base with blue baize beneath.



The price for this fine kit delivered within the UK is £3750.00 which will be delivered by UPS. Delivery will be during October if not before, subject to your requirements. You can now place a reservation on payment of £250. The balance will be required by the end of September.

The kit will have an engraved brass plaque stating the number of the model from number 21 onwards or a number of your choice together with a second plaque with your name and date confirming the model was commissioned by you.

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