A Journey Through Etched Design & Build. Dave Sutton

Those within the club (that pay attention) will know that my preference is for the pre-grouping, and specifically the Great Northern. But in addition, I do like the odd and quirky light railways that started out, and were gradually consumed by the big players.

Top of the list is the 'Sandy & Potton Tramway' with its 2 locomotives 'Shannon' and 'Little England'. Both of these were manufactured by George England in London, with Shannon made to order, whereas Little England was purchased after a spell at the Great Exhibition of 1851 and trials on other railways. As a 12 year old, I tried to make Shannon using the Airfix Pug as a base but a lack of skill meant it wasn't successful, and so the wish to own Shannon faded. Luckily this aberration has been lost in a fog of plastic cement, bent sprues and cereal box card (the skint modeller's favourites)

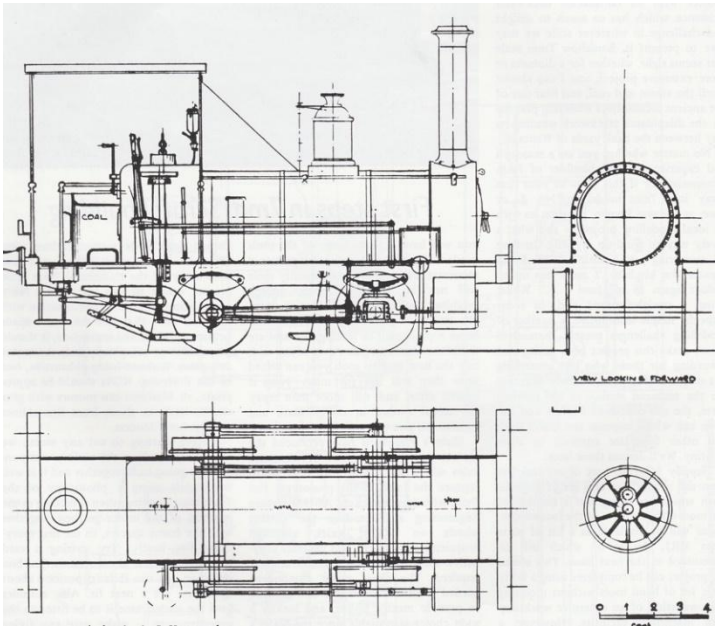
Step forward to the present day. I had been looking over the previous months at etching some parts I required for Sandy, when in conversation about these and other parts, an off- hand comment mentioned that a modeller from Bristol was building the Wantage tramway in P4. This piqued my interest and I asked how he was going to build Wantage Tramway No 5 'Jane' (as Shannon had become) He replied he didn't know, but gave me the modeller's (Robin) email address.
I contacted Robin and it transpired that he had no option but to scratchbuild her, as nothing was available. I figured at this point that if the only way to get Shannon was to scratchbuild her then this was the opportune time and I'd have a go as well. Between us we worked out what we could do and what parts could easily be etched and I volunteered to get these drawn up and etched if Robin could help with info. Between us have passed many hundreds of photographs as well as drawings, measurements and sketches. As the project rolled on another 2 modellers surfaced that were after 'Jane' and with new ideas the etch got larger and larger.

To even think of starting you must first start with a decent set of photographs, luckily 'Jane' had been photographed on many occasions working on the WTC, she was then 'plinthed' at Wantage Road before finally ending up at the Great Western Society's Didcot Railway Centre as part of the national Collection.

This shows her at Wantage with one of the many chimneys she carried and the cab sheets added when she was either at Crewe or WTC, note the buffer extensions to raise the height of the buffers, the rest is original including the handrail and knobs above the side sheets.

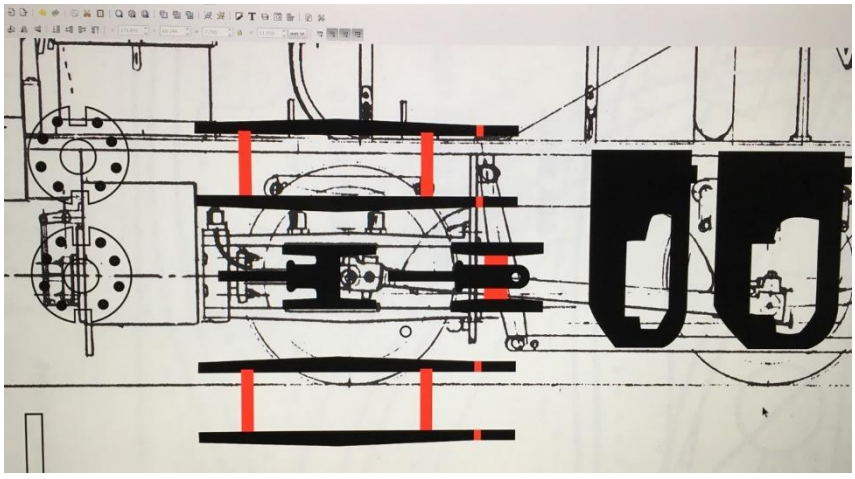
The most important information required is drawings, especially those with measurements. Luckily for me, Model Railway Journal carried a 10 part article on scratchbuilding 'Jane' in 7mm. This came with a wealth of drawings of her in her later guise, as well as many other details. I also have a sectional drawing from 'The Engineer' from 1860 which shows her original layout prior to the cab additions and buffer extensions

One of the outline drawings from the MRJ

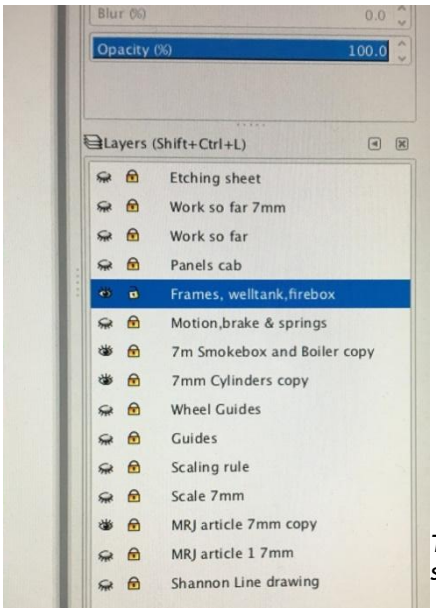


All the drawings are loaded into a 2D design program, I use one called 'Inkscape', (there are others such as Coreldraw, TurboCad and Adobe Illustrator but they can be very expensive) it's fairly straightforward to use (after a bit of practice) although it is lacking in some features important in relation to etching. In brief it draws in .SVG but for etching these need to be converted into .DXF It will convert the lines in .SVG into .DXF if they are required for cutting (such as laser or Silhouette cutter) but it does not infill with the colours required for the etching phototool. To overcome this I prepare in .SVG then convert to .PDF. The etching company are then able to use this for the phototool.

There are some simple rules to work to. The company I use requires any areas not to be etched with acid to be in Black, those areas etched ½ way from the front in Red and those ½ etched from the back in Blue. There are other rules such as Tag width as well as nesting tolerances but I won't bore everyone too much with them. I prepare the drawing using the colours but I send a Front and Back set of files so that I am able to check that colours have been deleted or converted.
When the drawings are loaded they need to be scaled to the appropriate size. Obviously I use 4mm to the foot but they can be any size required. It has to be noted that even with scaled drawings you must always use measurements to actually draw. For intricate parts found on locomotives the technique is to trace the part required from the drawing, but simply tracing could replicate an error in the original drawing; a measurement will verify it. It could be drawn 'freehand' but this is very time consuming.



This is laying out the slidebars and crosshead, The bars are traced and have strengthening ribs ½ etched to aid with alignment, the crosshead will be made from a laminate of 4 parts, 2 inner and 2 outer to form the shoulder, to the right are 2 variations of the frame plate that supports the rear of the slidebars. This area was very complex due to the tolerances required for wheels, bearings, rods and crankpins. On the left is the outline of the cylinder rear cover with the cut-outs to locate the slidebars.
This area took some 10 hours to draw and check, but on construction showed that a further 0.5mm on the width over the cylinders would have been preferred

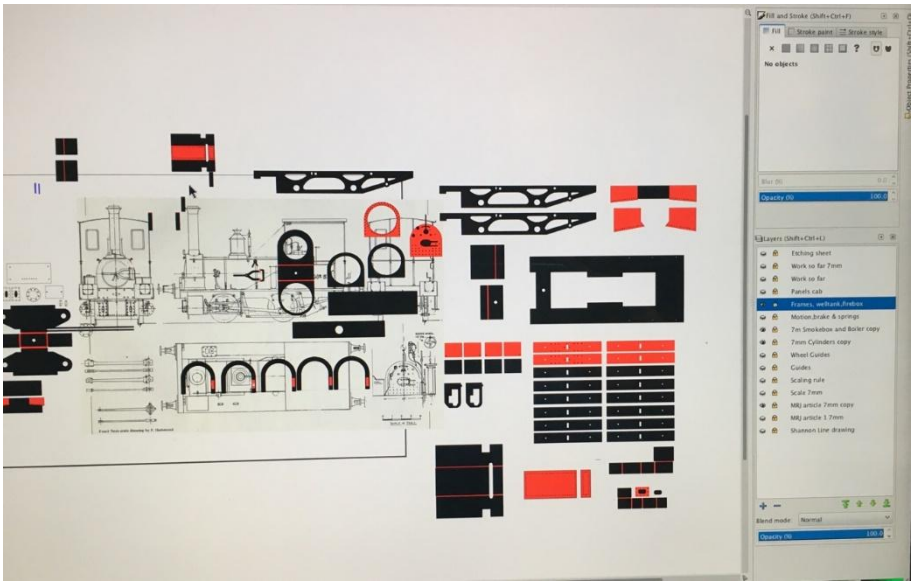


Inkscape allows you draw in many layers, and at any time you can have the layers open for viewing. This means that parts can be drawn in isolation to others but overlaid.

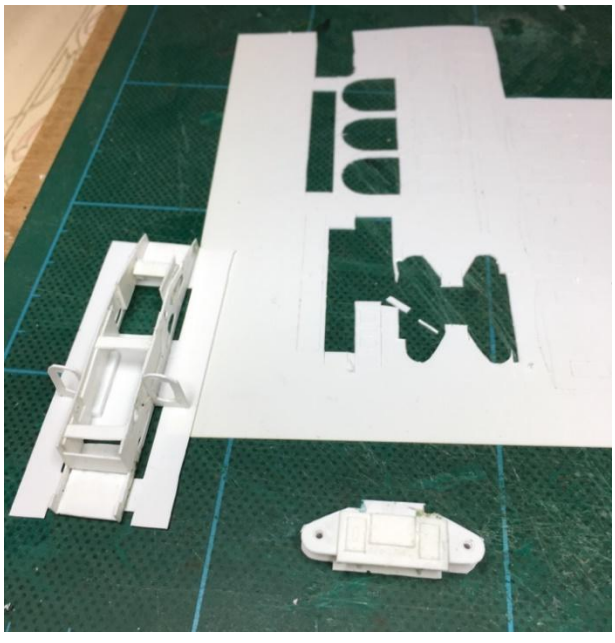
I won't go into too much detail in this article on how to use it, but I use Inkscape a lot now for either etching or cutting files for the Silhouette cutter. It does not do 3D, I use a different program for that.

Once the basic components were drawn I used the etching file to make a cutting file for the Silhouette cutter, this would mean that I could check the parts for size and fit before committing to a phototool

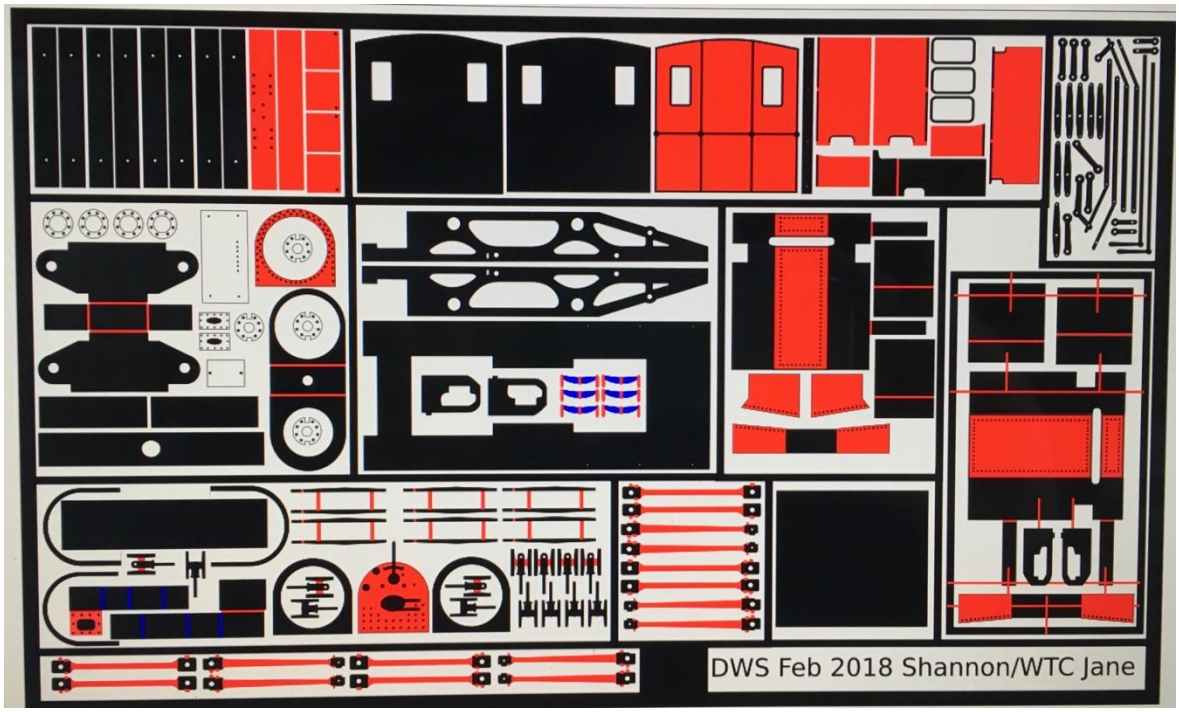
The many layers (with more to add) with some open and unlocked for editing



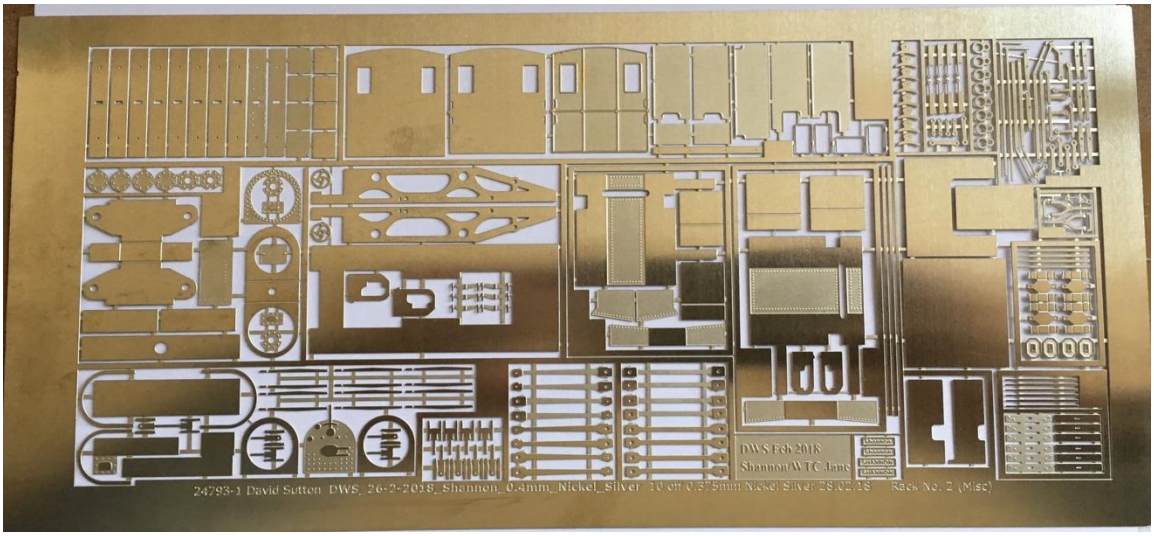
As a first fit it went well proving that the parts were of the right dimensions and fitted together



Once we were all happy with the parts they were assembled into one file and laid out in the most economical way. The cost of etching is in 2 parts, the phototool and the sheet size, keeping both as small as possible keeps the cost down. I then produced a Front and a Back to the tool.



The initial artwork before the addition of original brake parts and other.

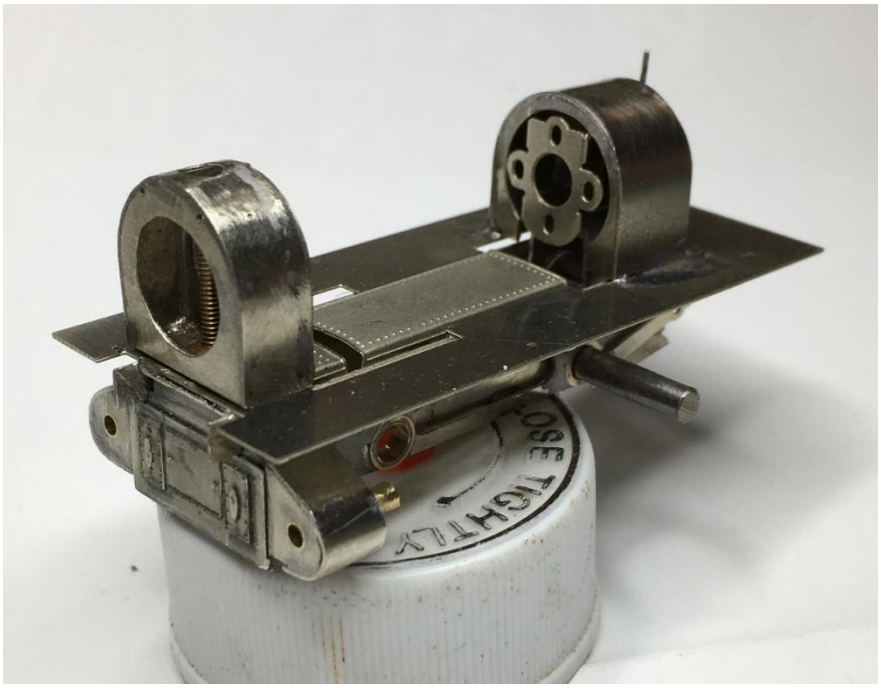


And what you get delivered.

I had the sheet etched in .4mm Nickel silver as this has more strength for chassis parts and the cab sheets which are small and unframed.
I then set to assembling the parts from the fret into various components, the buffer beams were a multi-laminate and I had put a hole for some .5mm rod to thread them all onto so that made it easier. The toolbox and oiler were a fold-up as was the well tank and the ashpan, this also had another half-etch layer with rivet detail. The cylinder block was a fold-up with plates of full and ½ etch detail added. This all went together well with no real issues identified.

The next parts were the frames, footplate, smokebox and firebox, again these went together as planned. What can be seen in the firebox space is the gearbox.

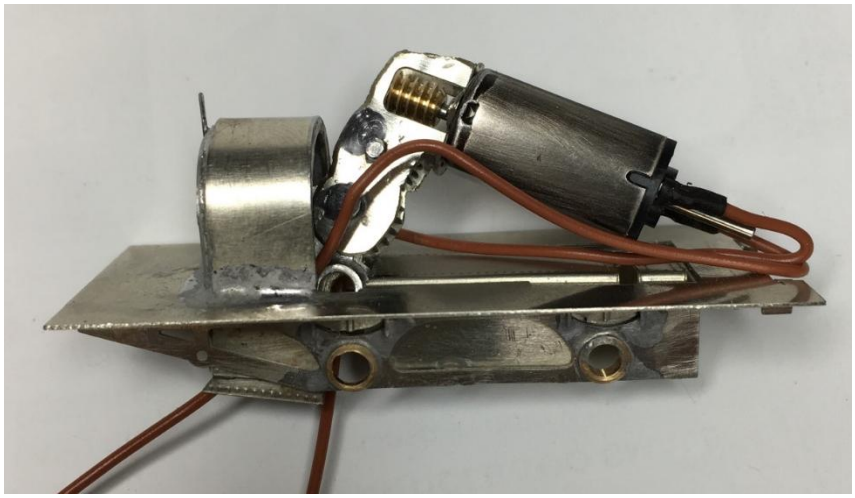
The gearbox and motor presented what was the greatest challenge with this build, I have numerous small motors that I could use but with others now building her I thought I ought to try and fit an easily obtained motor and gearbox combo. I had already used the planner from Highlevel (I loaded it into Inkscape) and identified that the combo that might work was the Slimliner + with 54:1 gears on a Mashima 1020 motor. Part of the issue was the size of the motor in relation to the boiler, Simply put, the motor is 12mm over its diameter and the boiler is 12.7mm externally.

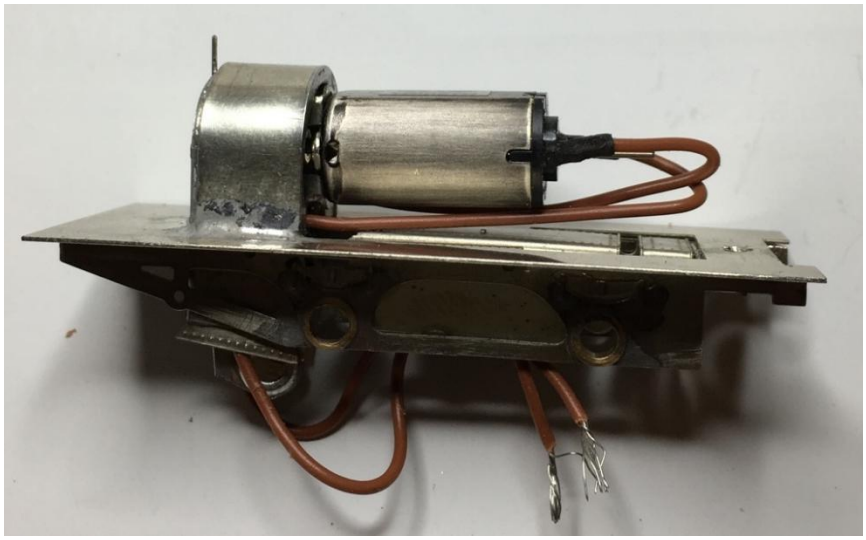


I attacked the inside of the boiler with various files until it was wafer thin and the motor slid inside.

That was the first part done, the second was getting the motor and gearbox inside the firebox and chassis.

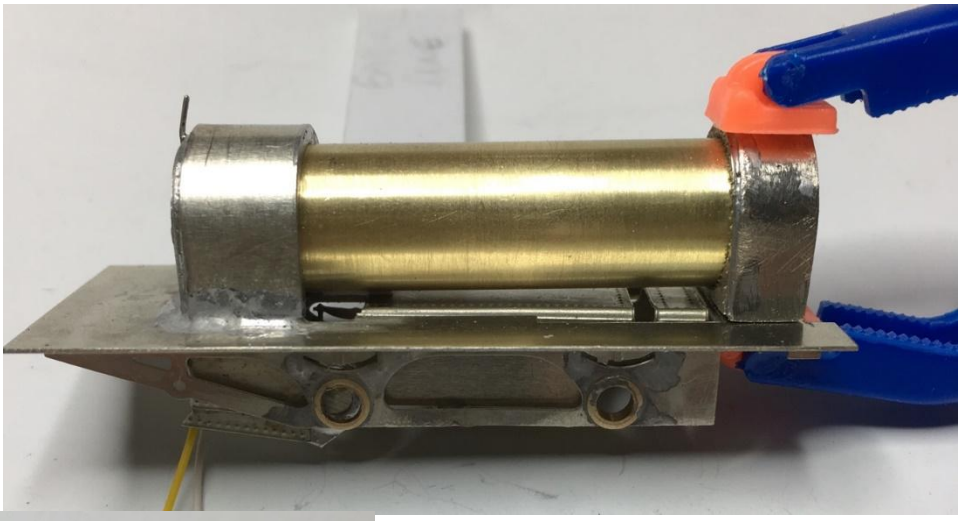
It's difficult to convey just how tight a squeeze this is, I've hacked and ground all the surplus from the gearbox as every bit of clearance helps.

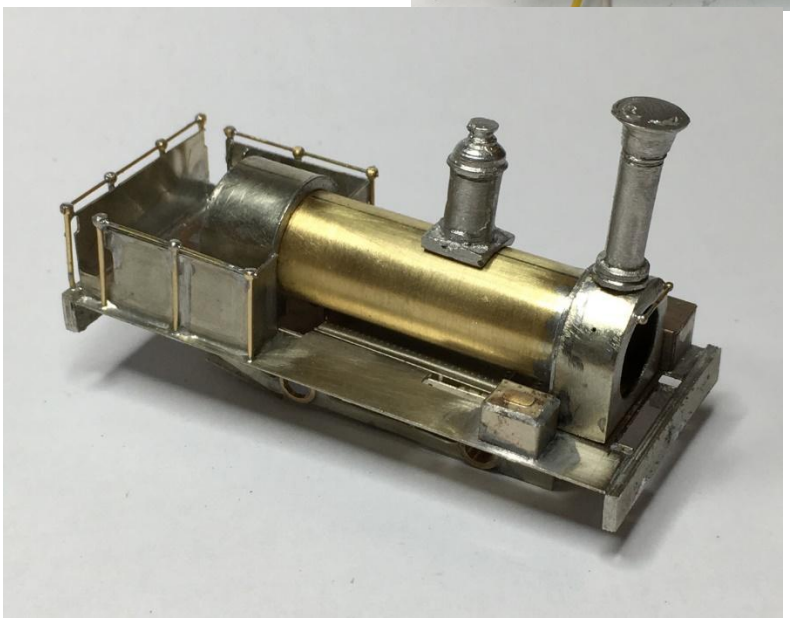




Eventually it's in, I popped a spare axle in and it lined up with the rear axle bearings. Now I had to get the boiler on, this proved difficult as I'd use too large gauge wire on the motor and the only available space for them was above the motor, so I swapped them for the finest and most flexible wire I had, and the boiler slid on with ease!

With the boiler finally fitted over the motor it showed up a 0.5mm deficiency in the height of the firebox, this was easily rectified by unsoldering and packing up with some fret.



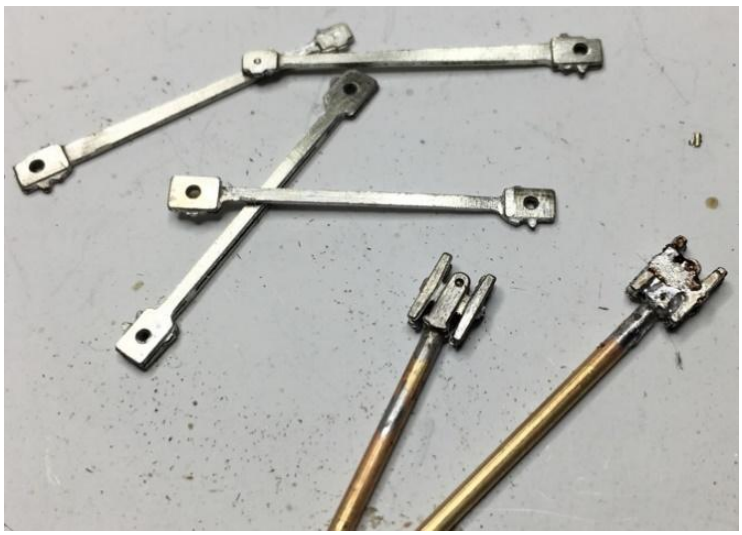


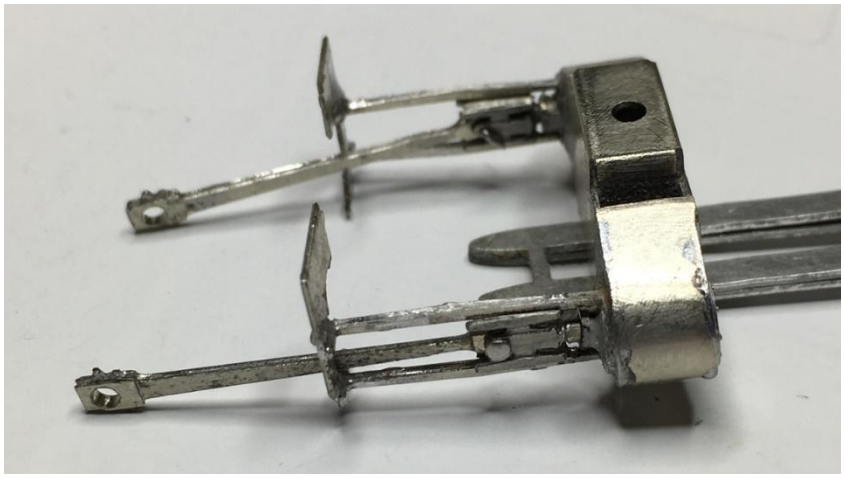
With the main parts completed I fixed the cab sheets with the aid of some Markits extended handrail knobs and Nickel Silver rod, the toolbox and oiler were fixed to the footplate and the castings for the safety dome and chimney fitted (more on these later)

Attention now turned to the motion, I had originally intended to find some castings from suppliers such as London Road Models that would be suitable, I even purchased some but all were just too big and could not be thinned or reduced enough such is the small size of this engine. I had little option but to draw the components up with the intention of laminating them,

The rods were in 2 parts, a full thickness and a ½ showing the detail.

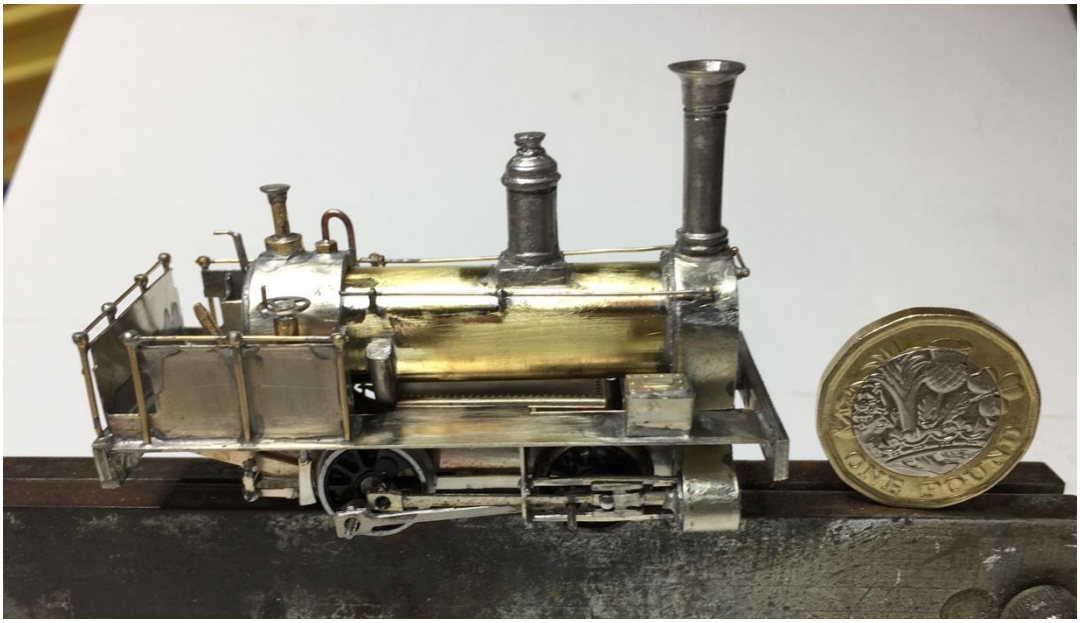
The crosshead was in 4 parts (described earlier) and was probably the most difficult part to solder. The 'pin' is to locate inside a brass rod as the piston rod





The assembled motion with just a bit more cleaning up required, rather than paint I will chemically blacken it

The smokebox door came from the spares box and had to be flattened off to replicate the original, the hinge was soldered on with some rod as a hinge pin, The clack valve is a Markits item.
With the addition of the valve and chimney castings there are just a few fittings to add to the top of the firebox, these were made from bits of rod and tube, The handbrake wheel was on the fret and was added to more tube as a brakestand, the reversing lever is again Markits but chopped about, and I have 2 crew to add when it is finally painted

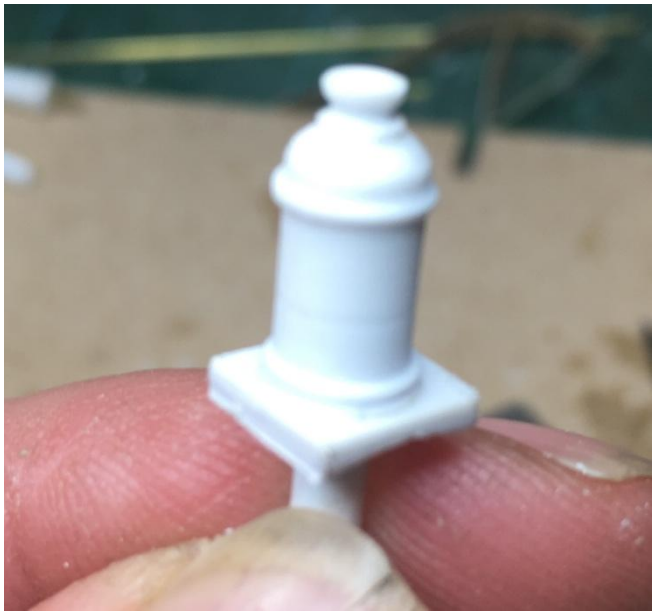


Here is the finished model ready for a final clean and paint, there is no definitive livery for her but after some investigation and help from others it's quite likely she was in 'Royal Blue' livery which was adopted by George England after Little England's spell at the Great Exhibition. As usual I found this out after I'd painted her red!

Chimney & Dome Castings

These were originally just going to be scratchbuilt in plastic, but as more came on board it became obvious that they would ideally need to be cast in whitemetal to add weight as well as produce the numbers required. So patterns were made in the homemade 'lathe'…..a 12V battery drill.
I put together some sketches with the accurate dimensions of the parts then welded together various sizes of plastic rod and tube. I added spigots to hold them in the drill and then shaped them by spinning the drill at various speeds and attacking them with the point of a knife blade, files and any odd tool I thought would work.

I needed 2 different chimneys for her original and GW pattern one, a dome, a brake cylinder for her later days and 2 water filler pipes each side of the boiler.



The finished dome.

I then used some high temperature silicon to make a mould and raided the spares box for any old bits of whitemetal (as well as Bern's spares box) Using my gas torch I melted it in a crucible which came from China (£2.10 for 4 including the postage!) and poured it into the mould. The picture shows the test pour to stiffen the mould so I can cut the airways. Getting the temperature right is difficult and I think I got it wrong once as the mould didn't have the life it should have. I did though get the initial numbers required but I have since redrawn the parts for 3D printing and obtained them this way. They are nice and crisp but lack the weight of whitemetal, the build has shown though that enough weight can be added to the chassis to overcome this.

Dave S May 2018.