Building the Robinson 4-6-0s

Part Two describes the planning of a model of the 'Fish Engines' - some key elements of the chassis are described

Robinson Class 8, LNER B5/3. Built in 1904 by Beyer-Peacock this engine is shown superheated and as with the picture in the last part the evidence is the rivets round the smoke box, the cab windows and the snifter behind the chimney. This engine had the larger 21" cylinders and piston valves fitted in 1938. The class was the first of the Robinson 4-6-0s and formed the basis for three later classes. Labelled as 'fish' engines, they performed a stalwart service in their early days taking North Sea fish to London although later they were used on passenger duties. Withdrawn in 1947 it was never issued with a BR number. This picture must be dated after December 1930.

Still, 43 years in service can't be bad, a lot longer than the Riddles classes lasted! Collection Jeremy Suter

Continuation

In the first part, I gave a general description of what was beginning to turn into a major project, how I had begun and a general run through on where I thought I was going to end up. As events turned out this was to become even more interesting, so in this second part I will begin to outline some more of the design and construction issues and propose some solutions. I hope these solutions will be seen to be viable in the longer term.

This article deals mainly with the locomotive.

Springing

Continuous Spring Beams (CSBs) are a proposed solution to the perennial issue of whether or not to spring our P4 models. Many models are successful without this, for example by purchasing parts such as the 'Society Springing Units' or the Alan Gibson horn blocks. Both I have used successfully in the past.

The achievements of those who use the so-called 'drop-in' wheel sets to convert modern high quality models for use in P4 are beginning to be widely acknowledged and this bodes well for future releases from such as Bachmann and Hornby since the built in springing seems sufficient for good running. For EM modellers of course, springing is most often not an issue where the use of a greater flange depth on the wheels seems to resolve the problems.

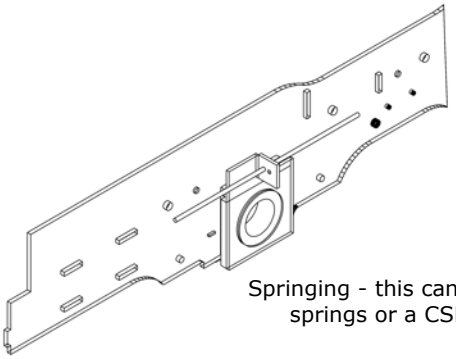
A number of modellers will attest that CSBs give excellent results but I have always been a little nervous about the calculations. The learned discussion on the Society Forum last February will enlighten some and frighten others. I am definitely in the second category.

My reservations about CSBs are two fold, firstly the calculations are done in an 'abstruse' way (although the excellent downloadable spreadsheet from the CLAG site gives a way of trying things out for different spacing and wheel loads) and secondly the calculations immediately fall down if the wheel loading is not consistent or the wheel loading is split over additional axles such as bogie and pony trucks.

A coalition solution

Not very subtle and a bit of an avoidance policy but the solution came at about 3 o'clock one morning. Since the positions of the traditional handrails used to support the steel spring could be half etched on the rear of the frames, why not provide these both for CSB spacing and for individually set springs. There are now two sets of half etched holes of slightly different sizes plus a drawing to identify them.

The other half of this issue was resolved using Brassmasters axle boxes without their springs (or the cut-outs in the frames), setting the opening in the frames to provide a good fit, but one which would allow vertical movement with a little oil. A brass overlay on the axle box with an offset tab to match the handrails knobs completed this solution.



Springing - this can be individual springs or a CSB solution

Wheels

The original wheels were 6' 0", 18 spoke with a 13" throw. These were later increased to 6' 1" to allow additional wear to take place between replacement. There are two suppliers who provide an approximate solution, Alan Gibson Workshop G4872L which is 6'0" and Exactoscale 4DW P27 which is really a V2 wheel, nominally 6' 2" but supplied as slightly worn at 6' 1".

As seems to be usual with many GC/LNER locomotives the back of the wheels is very close to the outside of the frames. Therefore the back section (about 0.25 mm) of wheels from Alan Gibson must be removed. This is easily done as shown in the picture.

The centre axle also has the Stephenson's Valve Gear. If this is to be fitted than a specially machined centre axle is needed.

The modified Gibson wheel - fix some masking tape around the spokes area and use a graver or very sharp knife to gently remove the surplus. Use very fine wet and dry to finish, brush clean and then fit the crank pins and wheels as usual.

Furniture

Furniture is the word I use to cover all the bits and pieces that cannot be constructed from flat sheet. These include

1. Chimneys
2. Domes
3. Safety Valves
4. Smoke Box Door
5. Cylinder Caps
6. Reversing Screw
7. Vacuum Cylinders
8. Back Head

The first two were extremely difficult to sort out. Originally fitted with a GCR style chimney, most of the Robinson 4-6-0s had a plethora of chimneys and domes fitted over their life spans, often seeming to make little sense .

The main reason was the grouping in 1923 when the LNER took over the Great Central. The GCR had been built to continental loading gauge, but the LNER had much tighter restrictions, in a few cases necessitating a reduction in chimney height of 6". This was on top of the fact that there was really no such thing as a standard GCR chimney, which, given the support from Robinson for standardisation was a bit of a surprise. Chimney and dome heights between locomotives varied enormously before grouping and after grouping when new designs were needed, they varied even more.

Getting to grips with this was like trying to mould hot porridge! But in one case I was able to establish that the RCTS Part 6 was incorrect in one measurement because it would have put the chimney height outside even the GCR loading gauge.

An easy solution to these problems would be to use the castings available commercially and hope nobody noticed the errors, after all, we are talking about potential errors of only 2 mm and some very nice castings can be obtained. This was not something of which I would normally approve, since I do like to get as many things correct as feasible.

Some of the other castings were not available and would have to be made, one way or the other, so I bit the bullet, raided the cash box, got permission from the lady downstairs and put a real crimp in both my business plan and my time scale.

I bought a lathe.

The new addition.

I had always wanted, but not necessarily needed, a lathe. They have been around for over 3000 years and seemed to be capable of solving so many problems in miniature engineering that it has been remiss of me never to have done just that in the 40 or so years in which I have played with building small things.

Not that I have ever trained on one, I readily admit, my apprenticeship was more attuned to electronics and aircraft rather than oily, greasy machines. A lathe was on the 'must-have' list for the far distant future. In the 70s I did use one for turning underneath bits on some carriages I was making but that was really a long time ago.

Advice was sought and freely offered, especially on the Society Forum. Really, though, I should have remembered the good advice about it not being the initial cost of the lathe, rather it was the cost of the additional tools that would stretch the budget.

Further assistance was at hand since a very kind gentleman from Leighton Buzzard gave me a quick training course on the things I needed to be able to do. At the end of the day, waiting on Milton Keynes station having missed a connection by two minutes, in mid-December with no heating and an outside temperature of -10 degrees, wasn't a lot of fun though.

I didn't go for the cheapest, or the smallest, but the range available was large although several on offer seemed to be the same machine with different badges and paintwork and sourced from China. It has a taper cutting facility which is perhaps not as calibrated as I would like, but it does work. It also has a quick change tool post but soon I realised that a 4-way tool post would be beneficial and will add that to my to-do list for the warmer weather - should have been milled and drilled in the garden shed by the time this is in print.

The cost of metals surprised me, mainly those with some copper in them but I picked up a couple of offers. A few small tools to start with as advised added to the start up cost and these included a back plate, various gauges, a set of taps and dies in metric and BA and some quality drills.

As I began work it quickly became apparent that my tool grinding skills were delinquent so as an experiment I purchased a Glanze parting off tool and shaping tool from Chronos. These were amazing, like a hot knife cutting through butter when used on brass. When funds permit I will buy a full set. With these tools there is a single type of cutting element that is common to all the tools so that will be a saving.

In the meantime, I must get back to the grindstone and make some better cutting and facing tools.

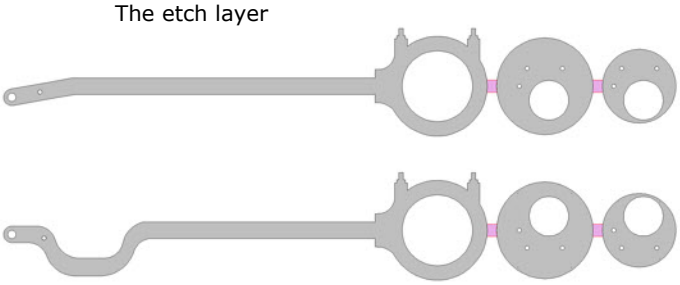
Valve Gear

The problem with valve gear, of any sort, is that I find it difficult to get the thing working without making a mess of it, or losing the smallest bits in the carpet. This part of locomotive construction has always caused problems for me, especially when I think of other ways to put it all together.

On of the nice things about inside valve gear is that in many cases it is hardly visible and can be left out. If we insist that it is visible it can usually be assembled in static form, where it can quietly gleam in the darkness under the boiler without affecting or impeding the motor and drive. There are very few models on the circuit with working inside valve gear except for such as those on Adavoyle.

This was one of the most complicated parts of the design and caused a few re-workings until I hit a sort of resolution. This was where the purchase of the lathe came into its own.

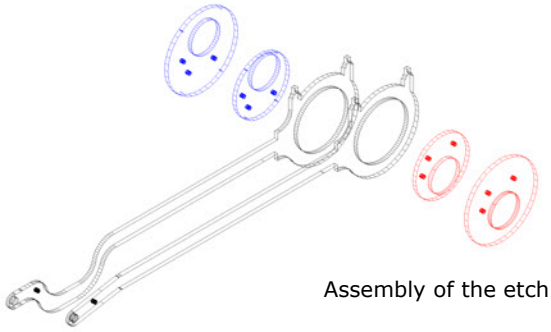
The etch layer



The initial plan was to do all of this in 0.35 N/S etched parts and on the face of it, it should have worked. The outline for the etch is shown, the pink bits are the usual tags.

The two parts on the right were to be soldered together using the 0.3mm locating holes to form a bearing. The pairs were then to be fixed back to back with the valve rods between them. No change was to be made to the 1/8" axle and fixing was to be by Loctite or a pin through the axle soldered to the outside of the bearings. The trouble was it was a real nuisance to solder up and was quite tight in use.

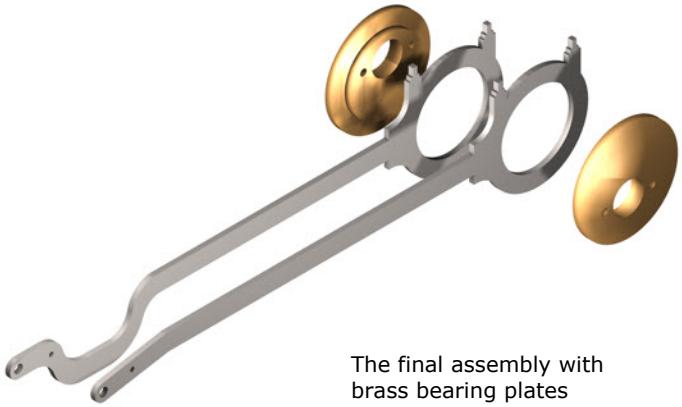
The picture shows the assembly arrangement - too many parts!



Assembly of the etch layers

This was where my new toy came into its own. While the valve rods were kept almost as first designed (although at one stage I did wonder if they would be a little stronger if they were etched in stainless steel) and the brass equivalent of the etched bearings were made.

They are 1mm wide, of which half acts as the bearing within the valve rod, with the rest of it just acting as a retaining plate. The retaining plate could of course be turned much thinner.



The final assembly with brass bearing plates

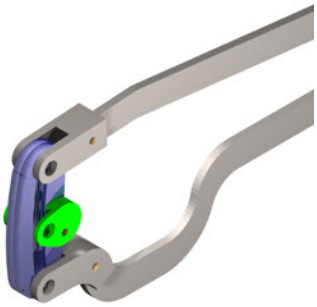
The bearing width is 0.5 mm which is very slightly wider than the etch so there is space for oil and a little slack to ease movement. Not strictly to scale but the prototypes I made could rotate freely.

The eccentric end of the valve rods needed some more work though. There are some very small parts used in making up the eccentric and they always get lost. These are the green bits in the diagram.

Although there is a locating hole (the smaller hole in the green part) through which some 0.3 mm wire could be threaded to join all the parts in the correct alignment, it was fiddly beyond words. This is what I hate about valve gear assembly.

Eccentric and Valve Rods

The etched solution



The prototype - with through hole drilled to 2.4 mm

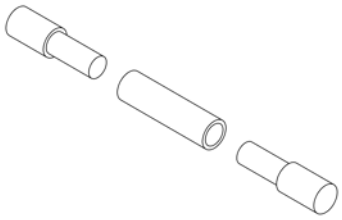
Finished eccentric using 16BA bolts as a temporary fix

The solution came early one morning - again (I do love these early morning flashes of inspiration). Simply to make the eccentric with a 'tail' and then file to the shape required. This way there was plenty of metal to get hold of while soldering and a higher melting point solder could be used.

When finally assembled this also means that the eccentric can be lifted over its full travel but I suspect I will fix this in forward to avoid problems, that is, if I can work out from the GA which is forward.

The second part of the problem was the axle diameter because at the normal 1/8" it was almost too large for the brass parts. Some axles were modified by splitting in half and turning down over a section down to 2.4 mm. A brass tube over the top, a couple of air holes and a plug of Araldite allowed fixing so that the valve gear could be set at the correct distance apart and wheels could be added later as for a normal axle. This is very similar to the 'split-axle' offering for those who prefer to have electrical isolation on their locomotive bodies.

I was very tempted to put a couple of grub screws on the brass tube so that adjustments could be made later but decided this was a step too far.



The modified centre axle. The valve gear is trapped between the brass tube and the ends and is therefore fixed. Some care is needed getting the dimensions correct but once done the wheels can be fitted over the ends and quartered normally.

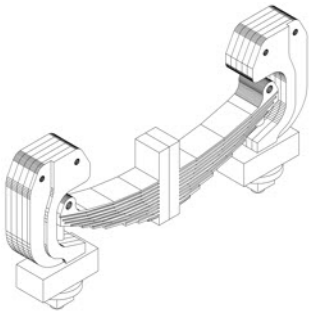
Cosmetic Removable Springs

I like to be able to remove the wheels on my locomotives. This is not always easy since parts such as the brakes can get in the way. The brakes must also be made removable. I think this says quite a bit about the deficiency in my skills since I should be able to set the wheels correctly in the first place.

The usual fix to allow the wheels to drop out is to put a keeper plate in place using small bolts through the spacers although wire springs through the top of the axles will hold the wheels in place until removed.

These keeper plates, although dressed up to look like a set of springs are only one layer deep and to a close observer this is too obvious. I prefer my spring hangers and the associated leaves to look as though they are the full depth, in the case of the Robinson locomotives this is nearly 2 mm.

The leaves on the springs can be etched to represent the actual number of leaves and this looks quite nice as well.



In the later version the two single holes have been replaced by a single fixing point for a 14 BA or 16 BA countersunk bolt through the frames and the top layer is partly half etched away so that it fits as an overlap on the bottom of the frames.

Rivets

While not a pedantic rivet counter, where the information is good I prefer to include the correct number and these should be the correct size. Getting these to work through the etching process, while in theory calculable, is really a trial and error process, especially when using different materials of different thickness. Some of the kits I have built have half etch circles in the rear of a part and the rivets are created by pushing through with a sharp implement. While this can solve the old problem of how to represent three layers on a single part without the additional cost of double etching.

I have never been able to do this consistently so have added a partial solution to the kit. There is a test area on the etch where modellers can practice and find an acceptable weight for their chosen sharp implement. This should be achievable after 80+ test holes. Its then on to the fire box and upper frames for the real thing!

And while I am writing about what I like to think of as useful ideas I decided to add additional parts on the etch to act as replacements for all those that disappear into the carpet. These are identified on the etch with a '+' sign after the part number, i.e. "27-44+2. Spring Layer" means that for Parts 27 to 42 there are two spares on the etch fret.

First and Second Build

The first chassis is completed as far as I wish to take it and is being kept simply as part of the history and a proof of concept. It looks all right to me and could easily be completed to make a working model but the areas I have changed for the second test etch are obvious. Now that this second etch, at the date of writing (Feb 2011), has arrived it will get built fairly quickly since I have a crucial advantage in knowing where all the parts fit, which somebody coming to any kit the first time will not have. I have a couple of kits from a well respected designer where I have spent more time reading the instruction notes than soldering.

On starting this second test build, feeling quite pleased with myself at how it all looked, I came upon Parts 14 and 15, or rather I didn't come upon them because they were missing from the etch (expletive deleted).

I know how it happened and why, because I had moved these parts on the master to create space for the addition of a template to drill the brass parts of the Stephenson's Valve Gear. While it took only 30 minutes using some spare metal, a file and a pin chuck to say I was annoyed would be an understatement. This is a good case of Murphy's Law rising from the ashes.

This was clearly a documentation failure and something I try very hard to avoid.

A more serious failure was the tags holding the bogie frame to the etch. Fortunately the etchers spotted this and added them for me, again this was a documentation failure.

What this means is that during this second build I have to be more rigorous than ever. While such failures would be hardly likely to end up with a customer, they add to the development costs, sometimes considerably.

And finally for this part...

I have discovered over the past few months that many more members than I had suspected are producing drawings and having etches done by various companies. Some of these are fairly small, others seem to be major projects and two I know of have been produced in the hundreds.

In the Crewe Area Group, which I joined about a year ago, there are, I believe, now five people who have followed this path.

Next Time

In the next part I shall start to talk about the upper bodywork and the difficulties encountered and the solutions arrived at.