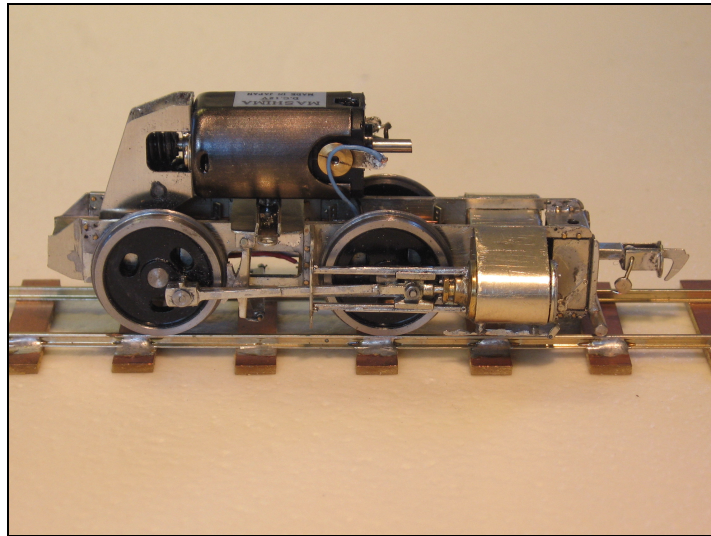


## Ffestiniog Railway Merddin Emrys.



A 7mm scale kit for 14mm and 16.5mm gauges.

Designed by Clee Model Engineers  
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## Design, development, and manufacture.

This kit is collaboration of myself, Peter Balderston ( C.M.E.) and Paul Martin of EDM. I have developed the design of etched and cast parts. EDM has supplied the ‘mechanical parts’, motor, gears, wheels, etc.

This is the second commercial 7mm kit that I have designed. The first, Linda and Blanche, taught me a lot about how to go about things. There are some things that are wrong, some have changed, and some could be better. Help me improve things, I need your input. Please comment via the 7mm NGA website, or contact EDM directly. I can not change things just for one persons view, but collectively you can help the continuous development of this kit, and of the other I intend to produce. Thank you.

The kit is based upon the recent rebuild ( 2009) of Merddin, now coal fire, and thankfully ( after application of the complete livery) there have been only minor changes to the locomotive in the last four years. Apart from the scare over a leak around one of the dome seats Merddin has worked hard for each of those seasons, being in almost daily traffic for six months of each year, and covering over 11,000 miles annually.

### *Skill Level.*

This kit is intended for modellers with good soldering and metalworking skills. It is unsuitable for assembly using glue. Because of so many variations in the prototypes you need to carefully assess what parts you need, and what may need to be modified.

*These instructions are not a blow by blow account of the assembly of every detail.* Where assembly sequence is critical, this is highlighted, otherwise I presume the builders of this kit will be experienced, and will be making themselves familiar with the prototype to aid decision they will make during the build. Otherwise, you can select what sub assemblies to build in what order. Many photographs of the prototype are included on the CD for your reference. There are a number of slightly different shots of both prototype and model. All are included as I found over the years the detail I need is on a picture I have taken that was focussed on something else ! This is why I have not included them as a paper copy, it would be too wasteful.

## General Assembly Instructions.

My preference is to solder as much together as is possible, and I like working in nickel silver sheet and brass. **This is not a kit that can be glued together.**

Take care with sharp edges and points. Wear eye protection if using wirecutters. Do not use your best cutter to cut piano wire, it is very hard.

Full blow by blow instructions are not given. This kit is for experienced modellers, who have good soldering and metalworking skills. Personally I have always used Savbit solder, Fry’s flux, and two Weller irons, a 45W TCP and a W60. Recently a resistance soldering unit and solder paste have also given good results. These may seem large, but the mass of nickel silver and brass builds up, and the rule of ‘clean and hot’ applies to all soldered joints. All parts are cleaned with a fibre stick ( from 7mm Association sales) before applying a little flux.

Note that some kits have some parts in the boiler and saddle tank assemblies that require a long reach, small diameter soldering iron, or iron tip.

For rounded parts I use a piece of plywood with a wood lip on two sides a square to solder against. A couple of small hardwood pushers are also used to form the pieces against the square lip.

Bending formers are 22 and 15mm copper water pipe, and assorted pieces of brass and steel. A set of small rolls, such as the ‘GW’ rolls is highly recommended, but not essential.

I clean up all joints using scalpels, sometimes to ‘carve’ soft solder to shape, a brass bristle brush ( sold in shoe shops for cleaning suede), and the fibre stick again. When all is complete a wash with ‘Shiny Sinks’ before painting. Note that nickel silver is a much better for paint to key to than brass.

All other tools are the best I can afford, Valorbe files, Lindstrom wire cutters, good stainless tweezers and scalpels with new sharp blades are essential. 2mm and 1/8" parallel reamers are useful but not essential to fit gearbox and axle parts.

I advise great caution using high speed mini drills and grinding wheels. Nickel Silver can build up on the wheels causing high surface temperatures. They can be unwantainly destructive and possibly dangerous. Hand tools offer more control.

Clean out any slots with the point of a scalpel. Note that we do not ask the etch company to 'etch clean', that is make sure all holes are etched right through. This is because in doing so most of the half etch rivet detail gets lost. We believe modellers can clean out holes more easily than restore the rivet detail !

Drill out small diameter holes ( 0.55mm etc) whilst the parts are still contained by the tags in the fret.

Always take great care removing parts from the fret. You can use a fine tooth ( 80 TPI) fretsaw, but this can sometimes lead to difficulties supporting the fret as you work. I find the best way to extract pieces is to ensure you know which tags to cut, turn the fret upside down, and run a heavy knife ( Swan Morton Scalpel No 4 or 'Stanley' knife with new, sharp blade, is ideal), pulling towards you, but holding the fret away from you, over the tags a number of times on a flat surface. They will then crack, and the piece extracted undamaged. This technique is especially useful for long thin parts, such as the valance strip.

### *Tips*

No 1 : When soldering moving parts together with a pin, use a paper washer between the parts to prevent the solder 'wicking' and fixing everything together. Use thin paper (cigarette paper or detail paper). Tear the 'washer' away after soldering.

No 2. When attaching nuts to sheet material use plenty of flux on the inside, then thread a bolt through, and tighten up on the nut. Apply plenty of solder, and release the bolt as soon as the solder has solidified. Use brass nuts when little use is expected, eg attaching domes and chimneys, and steel nuts when used more, eg attaching chassis.

### *Pins and Rivets*

I use a home made rivet punch, powered by a 4oz hammer. I have made the anvil ( lower) part of the press with a cut out to allow very slim right angle pieces to be rivetted after folding, once this is done there is not a problem rivetting the angle brackets, ( see Fig W1 & W2) for bunker or cab corners.



*Fig. W1*



*Fig. W2*

Thin brass pins are used locate and fix many parts together. As a general rule do not fit too many pins together at one time, hold in place by pressing onto a piece of cork floor tile or soft wood, solder together ensuring the solder flows to the pin by capillary using heat and flux. Remove and trim with a good pair of flush wire cutters.

The best pins are brass 0.55mm, use a number 74 or 0.55mm drill to open out holes, buy at least 5 at a time ! Use the point end to align parts, keep all 'off cuts', and the head end is useful in the valve gear assembly. I usually get at least 6 'joints' out of each pin, plus a head and tip.

The pins supplied are quoted by the manufacturer as being the same as those I sourced some years ago. Unfortunately they have changed the manufacturing method, and the current pins are slightly thicker, with much larger heads, and I believe, slightly softer. You will need to use a No 73 or 0.6mm drill to open out the holes.

The 0.55mm pins are in short supply, and so I have included some of these for the valve gear, otherwise use the slightly larger 0.6mm ones.

I continue to search world wide to find a source of pins as good as the original ones, that's progress.

***These instructions.***

I suggest you print off this written set of instructions, and then load up the preferred set of images and pictures onto a computer, and use these as a reference as required.

Part numbers are referred to in parenthesis, ie (101)

Assembly pictures are referred to as Fig xxx

Prototype images are referred to as Img xxx

The figures occurring in the instructions are also located in a separate directory if you would like to enlarge them.

***Prototype History and Images***

There are currently seven Fairlie bogies in use on the Ffestiniog railway, identified as A - G. In addition, two bogies exist under 'Livingston Thompson', usually exhibited at the National Railway Museum in York, and two 'new' bogies being constructed at Boston Lodge, intended to replace those under David Lloyd George. How much of the existing bogies will be use is not known at present.

(From the Fairlie appeal....)

*"To summarise the present position, there are currently nine bogies in existence, with two further under construction. The present locations are:*

*Bogies A and B – built 1988 (original 1880s rods and wheel centres) – Earl of Merioneth*

*Bogies C and D – built 1886 – David Lloyd George*

*Bogie E – completed 1998 – Taliesin*

*Bogies F and G – completed 2005 – Merddin Emrys*

*Original 1879 Merddin Emrys frames with James Spooner wheels and rods, under Livingston Thompson in York Museum*

*New C and D bogies to go under David Lloyd George are under construction using funds from the FR Society Fairlie Appeal."*

You are urged to seek out the history of these bogies in two classic summaries of their history, titled 'Musical bogies' by Jo Clulow and others on the FR Society website.

In 2013 DLG was out of traffic. The better bogies from DLG (C&D) were put under The Earl. The Earls' bogies (A&B) are to be refurbished, and returned to The Earl. The original C&D bogies are due to be held in reserve when the new ones are completed.

If you intend to model the pre 1946 period the bogies differed in a number of ways. The rear stretcher was a plain square end, and did not include the steam brake. The front buffer beam also had a curved return at the bottom, guard irons, and of course an FR dumb buffer and chain link coupling.

***Scale and Gauge***

This kit designed for use with 1/43rd ( 7mm = 1 foot) models. It can be built for 14mm gauge, using the narrow or wide cylinder block and motion brackets, or for 16.5mm gauge using the wide cylinder block and motion brackets.

The wide cylinder block version is representative of C and D bogies at present ( late 2010), but may not be in later years, as some sort of standardisation is proposed. This may mean a sacrifice to reality if you run on 16.5mm gauge track.

### *Nomenclature*

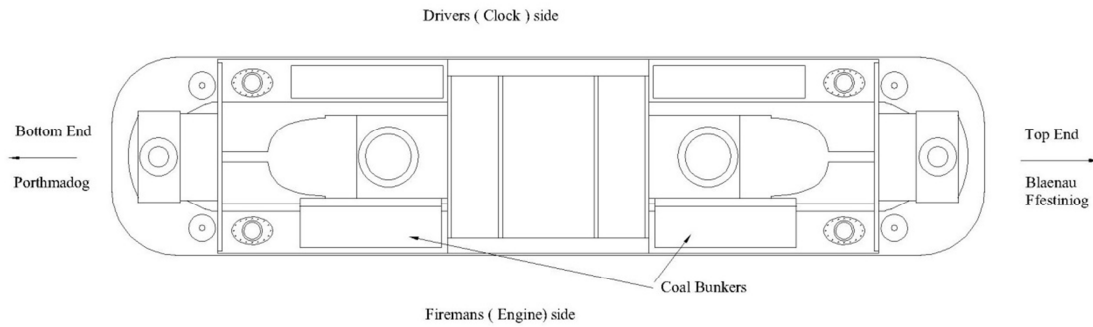
To navigate your way around a double Fairlie the standard FR definitions are used...

Top end is the end closest to Blaenau

Bottom end is the end closest to Porthmadog ( Caernarfon)

Left hand side is as the engine is facing Blaenau, the drivers side.

Right hand side is as the engine is facing Blaenau, the firemans side, the bunker side.



N.B. The use of engine and clock side is a reference to the location of the oil engine and clock in Boston lodge. It is not used as much nowadays, and with the opening of the 40 mile railway using references to direction is encouraged to use Blaenau end or Caernarfon end, however, loco crew seem to prefer top and bottom end.

### *Power Bogies*

To keep files to manageable sizes the power bogies assembly is contained in separate files on the C.D. Build up the bogies as per the instructions, noting **the lubricators on both bogies are on the drivers side, and hence you have already dictated which bogie is the top one, and which is the bottom one. Always keep the bogies, and everything else associated with them at the correct end, otherwise you will confuse yourself.**

## Superstructure.

### *Assembly order*

The bogies and superstructure can be built independently in any order.

The superstructure does need to be built in an advised order that may not seem logical at first. The prototypes are difficult to assemble as the carrier frame is very weak, and needs the boiler to hold things together. As we have cut the boiler away there is little left to do this....

The recommended method is the reverse of the norm, essential to make and fit the tanks and aprons, and ensure the cab will fit by using the supplied jig. The cab spectacle plates then hold the boiler centre section up, and then the carrier frame can be fitted from underneath. The smokeboxes and front boiler sections are then fitted to the rest of the boiler using the conical pieces and the boiler connecting plates.

Once this assembly is made the detailing and final fitting is fairly conventional, but the cab roof is left removable, and the cab sidesheets fitted last.

After painting the inside of the cab the roof is fitted to the sidesheets, and painting of the rest of the outside of the locomotive is then done.

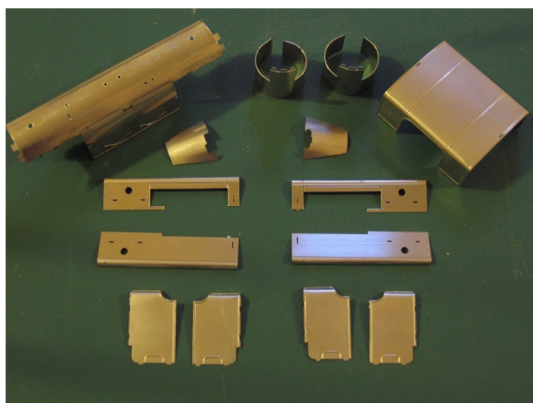
### *Checking the frets.*

There are 14 pieces removed from the fret for forming. Please check you have these included in the kit :

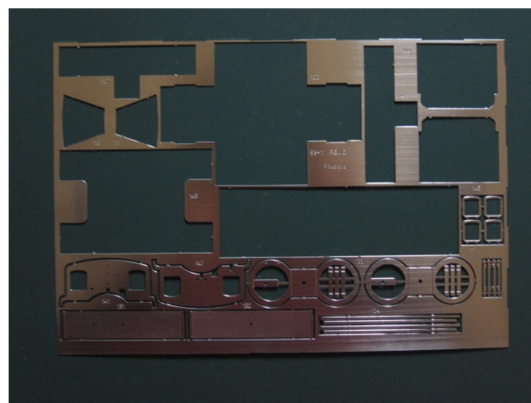
58-100	Boiler centre section x1
58-110	Taper boiler section Top end x1
58-111	Taper boiler section bottom end x1
58-112	Front Boiler section x 2
58-125	Tank tops ( 4 parts) x 1
58-143	Cab roof x 1
58-144	Cab sidesheets x 4

*Note these are formed but will still require some careful fitting to get good fits.*

They should look like the parts in Fig A.



*Fig. A*



*Fig. B*

This means fret 58-1 should look like Fig B, with the above parts removed.

The frets also have a number of duplicate parts and odd additions to fill any spare space.

### Aprons

1. Remove the aprons (117) from the fret,
2. punch out the rivet detail.
3. Remember the etches may not be clean, and so check the slots are free, the tip of a scalpel is useful to do this.
4. Also remember the edge of the material has a join line down it where the etch from each side met. Run a file over this, and also each side of the tabs a little to aid the fit.
5. Start to fit the valance (116) from the centre of the apron,
6. checking each side before tacking into position, and use a wooden block to ensure the edge is square and straight.
7. The best way to fit the valance is to pre-bend the corners around a 25mm dia bottle.
8. Use a small piece of flat board to press the valance into as many slots as possible at once, with the apron sat on a piece of cork, to allow the tabs to stick through.
9. When holding as much as possible tack the centre, and then around the corners.
10. The valance should extend beyond the end of the apron,
11. **do not trim at this stage,**
12. but finish the top surface,
13. filling in the slots with a little solder, as **it will be impossible** to finish once attached to the tank side. Fig 1 & 2.

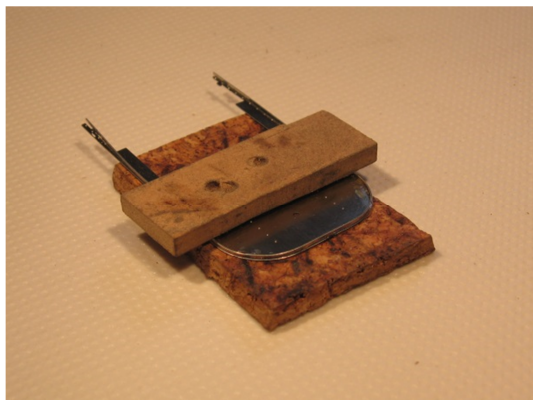


Fig. 1

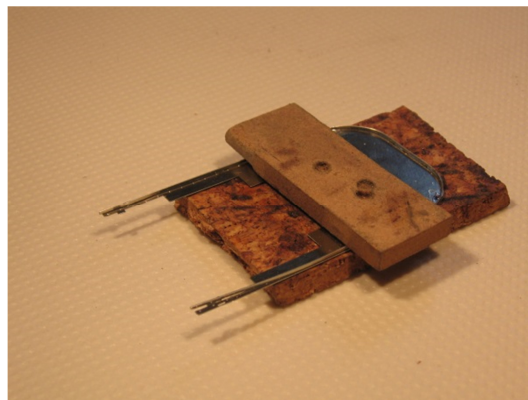


Fig. 2

14. Put aside whilst you build the tanks.(Fig 3, 5)

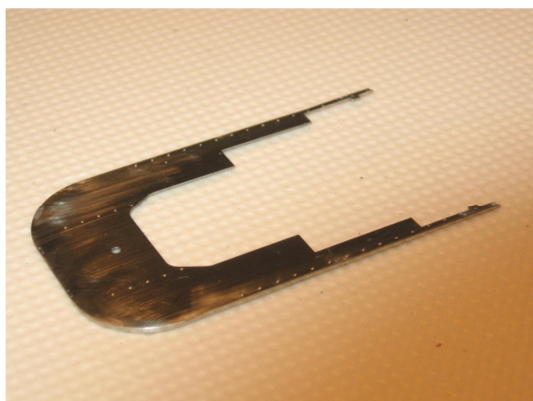


Fig. 3

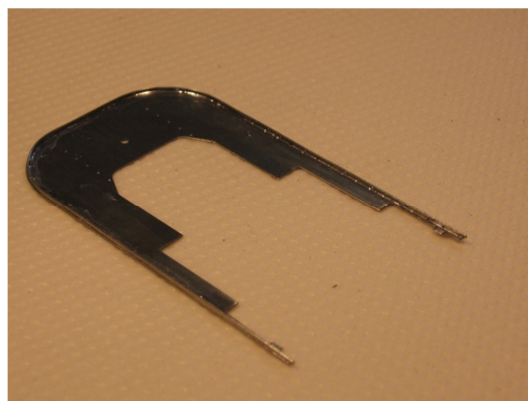


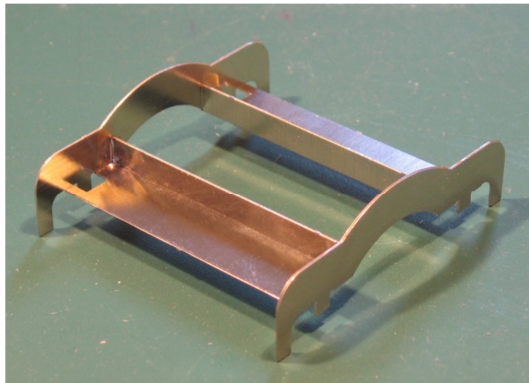
Fig. 5



### *The Tank assembly Jig.*

The jig (900) is included to ensure the tops of the tanks are spaced correctly, square and flat.

16. Fold up the inner leaves, holding the outer edges in a vice.
17. Fold the ends up and solder the corners together.
18. Check the ends are 47.4 - 47.5mm overall. The completed jig is shown in Fig C.



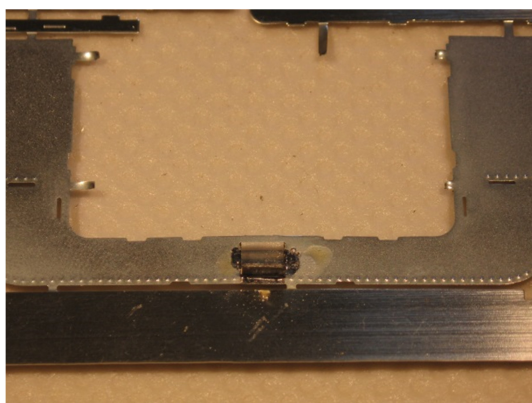
*Fig. C*

### *Tank Assembly.*

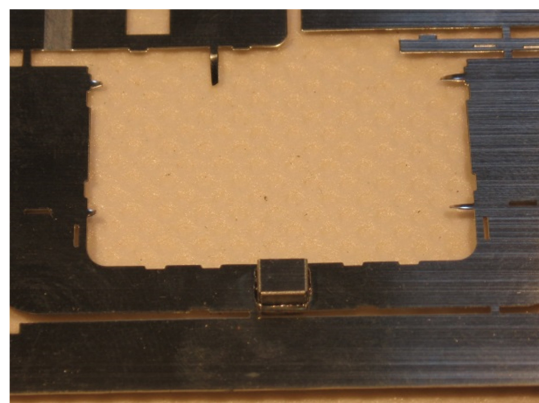
#### *The sides :*

The tanks (120 & 121) form the major part of each side of the engine. They are hollow on the inside to allow lead weights to be fixed, and make space for wires etc.

19. Construction of the tanks is the same until the tops are added.
20. **The drivers side is simpler, and so do this first.**
21. The firemans side tank (120) is identified by the square coal holes in the centre former.
22. Do not forget this one needs the tank tops with the cut outs for the bunkers as well.
23. Although outside parts are ½ etch thickness and very flexible as etched, by the time they are assembled they are very strong and it is **easy for distortion** to creep in as they are built up, and quite difficult to rectify once done, take time and care at each stage as the tanks are built up.
24. The main outside half etches must be strengthened in the centre **before removal from the fret.**
25. Cut out and fold up the centre step and
26. solder in from the back. Fig 10 & 11.
27. The outside can then released from the fret.
28. Release all the rest of the tank side parts and carefully separate them.
29. Keep in a safe place.



*Fig. 10*



*Fig. 11*

30. Scribe a line 1mm from the top of the tanks ( there are nibbles in each corner 1mm deep), Fig 12,
31. and then place in vice and
32. bend inwards by about 30 degrees. This to help the top to fit snugly onto the sides. Fig 13.



Fig. 12



Fig. 13

33. Solder the tank ends in place. Fig 14 &15.

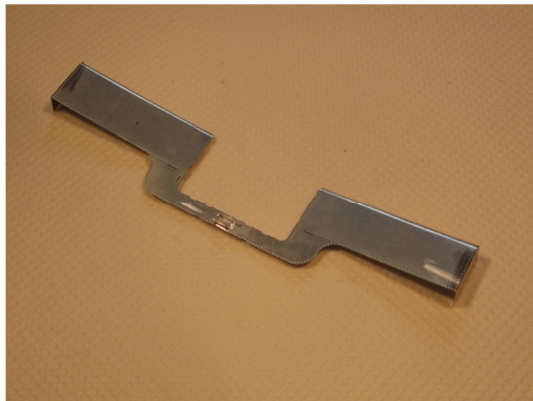


Fig. 14

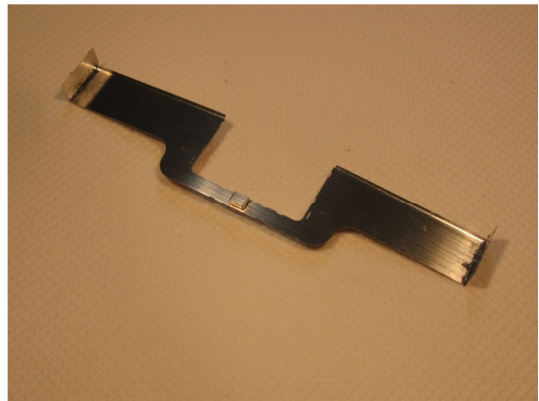


Fig. 15

34. As the tank is built up it strengthens rapidly, but **be very careful to tack parts in place initially, and then fill the seams in three or four parts**, otherwise the heat distortion builds up.
35. Next, to the tank bottom. This is made from three pieces, the centre of the main piece, a full width piece, closed on both sides, and the outer bottom pieces that are butted inside so as not to ruin the rivet detail, leaving the inside open.
36. The ends of the centre bottom are formed around a suitable cylinder, 9.5mm or 3/8" pen barrel works well. I find various felt tip pens make parallel formers or handles of tools if you do not have some stock metal of suitable diameters.
37. Solder 2 x 12B.A. nuts onto the inside of each of the centre bottoms. These are used later to attach the ashpans.
38. Use a bolt to hold the nut in position whilst soldering, and release immediately. Fig 16.



Fig. 16

39. Ensure the outside is held down on flat surface as you tack into position.
40. Note the short and long tabs on this piece, the short ones locate into the half etched tank sides.

41. Once all is flat and square tack and then run solder in short seams to keep heat distortion to a minimum. Fig 17 & 18.



Fig. 17

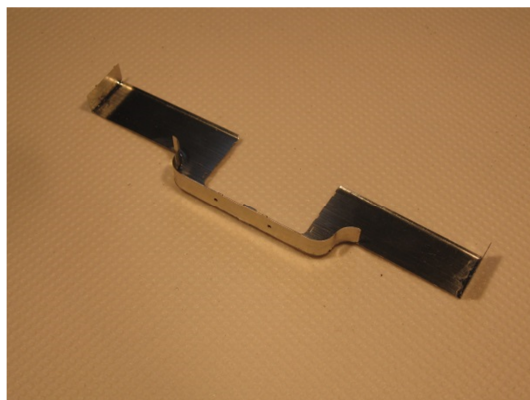


Fig. 18

42. Next fit the centre section,  
43. fold around a mandrel about 6mm diameter at the half etch areas, these being on the outside of the bend. Fig 19.

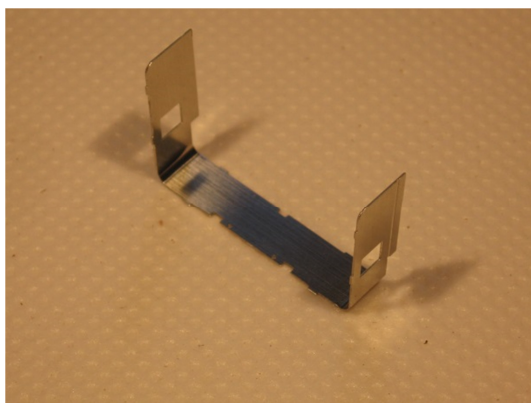


Fig. 19

44. Solder into location, and then  
45. complete the outer bottom plates.  
46. Take care **not to fill in other slots** that are yet to be used. Fig 20 & 21.  
47. Keep checking for square and parallel sides at each stage.

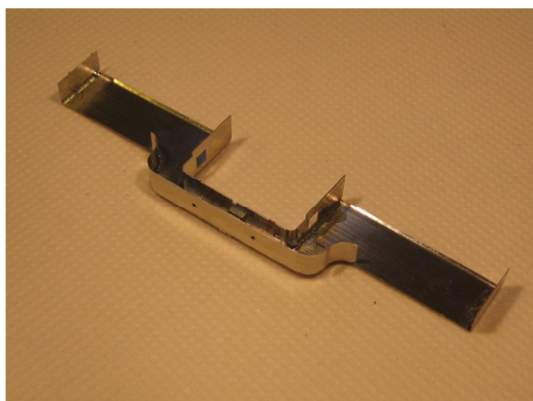


Fig. 20

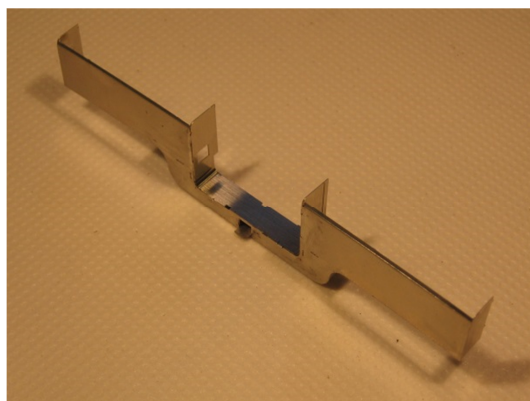


Fig. 21

48. The bending of the centre section is not entirely predictable, it is therefore essential to **check** the top of the four uprights are all at the same height **before fitting** the tank tops.  
49. Check all round with a 6" steel rule, and  
50. file down the inner sides if necessary.  
51. Try not to touch the ends as the half etch detail is soon lost. Fig 22 & 23.

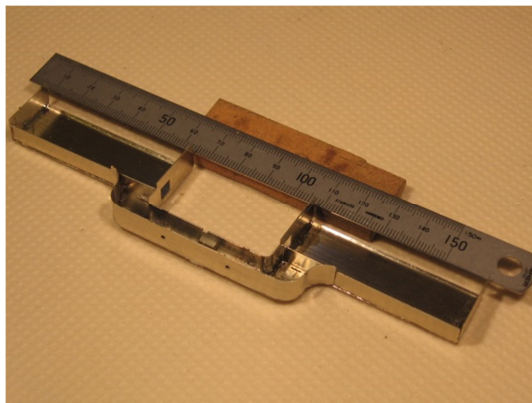


Fig. 22

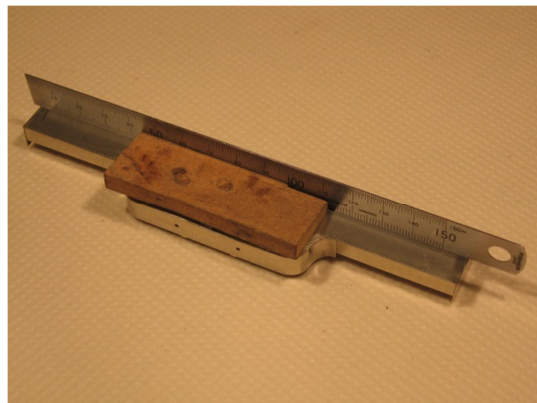


Fig. 23

52. I would advise you to clean up the piece and
53. ensure no flux is left at this stage, as once the bottom box is closed there is no way to gain access to it again.
54. The last side plate can then be fitted. Fig 24 & 25.
55. Again remove flux, tidy the edges carefully with needle files and
56. put the firemans side tank to one side.

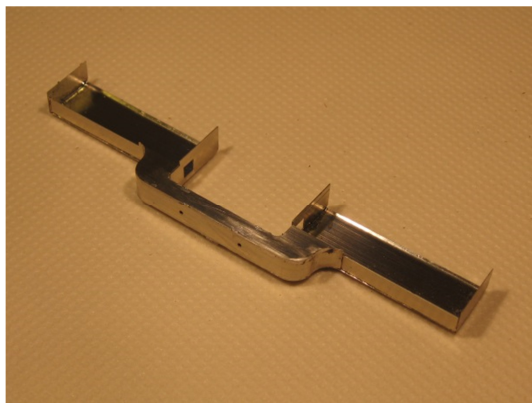


Fig. 24



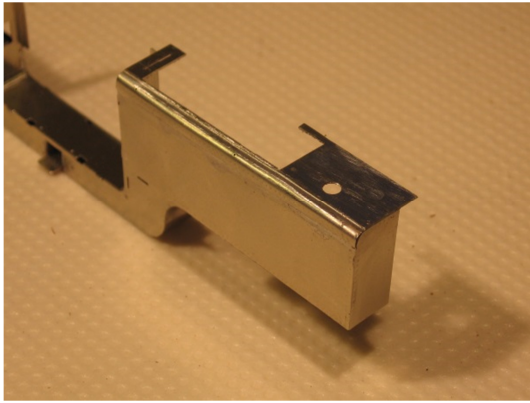
Fig. 25

*Tank Tops, Drivers side:*

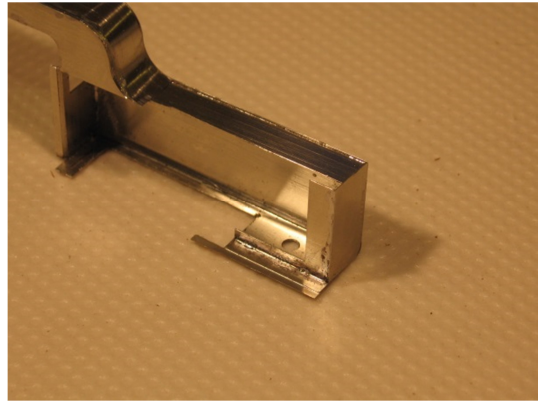
57. Ensure you have the piece without the square coal holes in the inner side.
58. Fit the top end tank top carefully, aligning the outer end with the tank end, the inner should just extend over the inner, and will need trimming when complete.
59. Try to solder the join with the sides from the inside, to **avoid solder on the rivet detail**.
60. Then fit the inner tank end (the L shaped piece).
61. Check again for straightness and square ness all round.
62. Next, tack the bottom end top in place, and then
63. check with the assembly tool (900) for the correct distance apart, and
64. can also be used to start checking for squareness.
  
65. Each tank forms a considerable fabrication in the real world, and the most recent sets were made in a large jig. We do not have that luxury,
66. but keep checking as things build up.
67. Now leave this side and build up the firemans before completing both sides together.

*Tank tops, firemans side*

68. Build up the side as per drivers instructions, and fit the tops in the same way, Fig 40 &41.

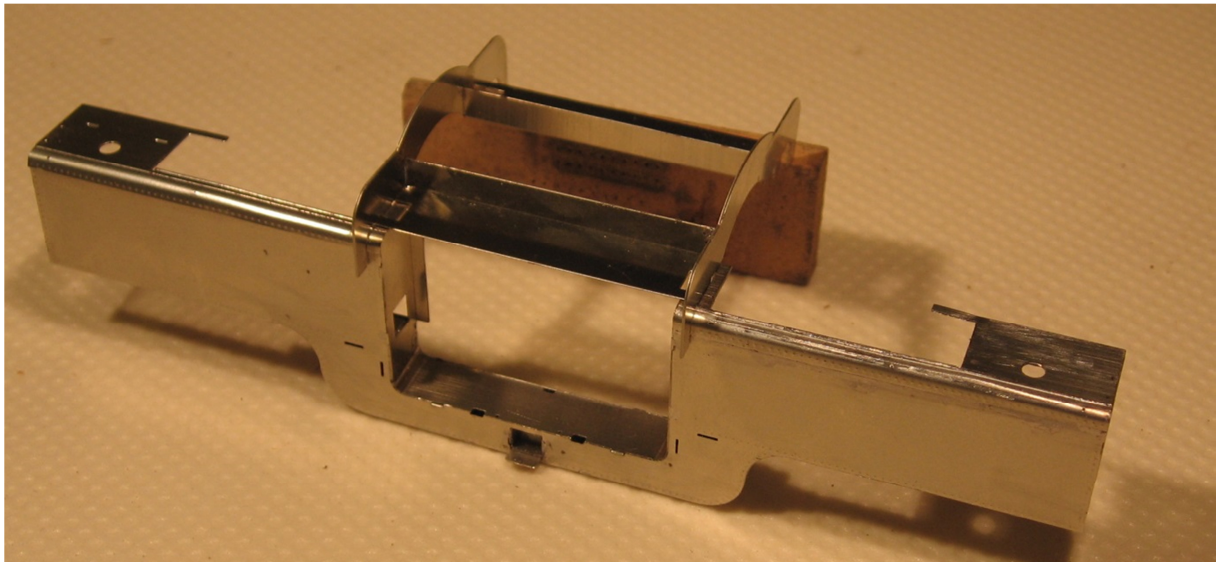


*Fig. 40*



*Fig. 41*

69. Again, check the fit with the assembly tool. Fig 42

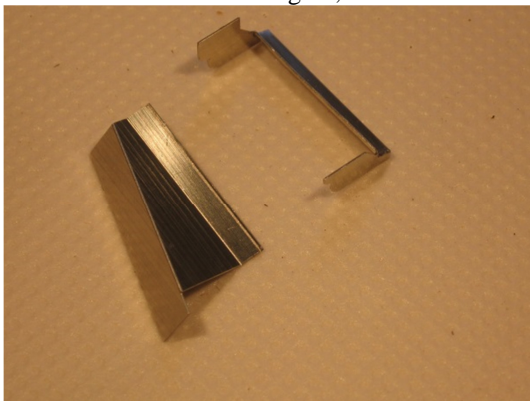


*Fig. 42*

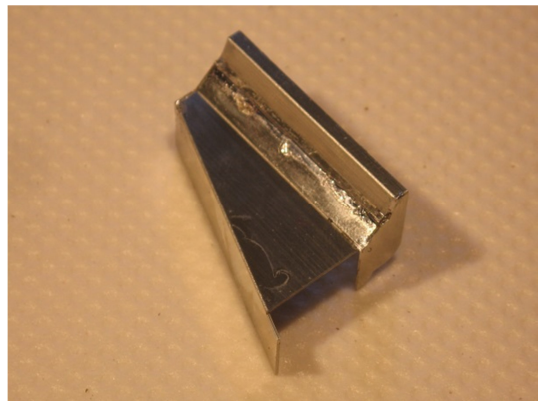
*Bunkers :*

This side then needs the bunkers fitting. The bottom end bunker (123) is split into parts.

- 70. Fold and solder the top piece,
- 71. the small edge is bent 70 degrees,
- 72. then the larger piece 20 degrees to follow the profile when you
- 73. fold the ends around. Fig 50, 53.



*Fig. 50*



*Fig. 53*

74. The lower corner fits inside the tank. Fold the lower part and tack in position.

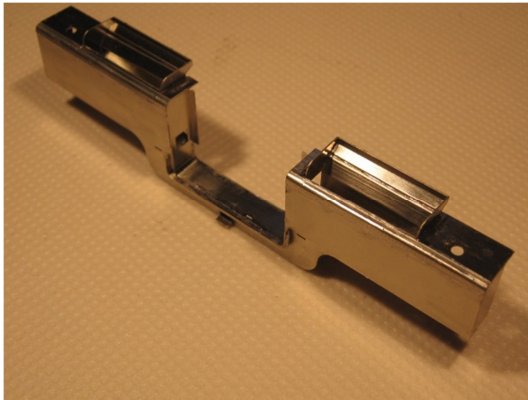
*Top end bunker :*

75. The same procedure is used for the top end bunker ( 124). Fig 54.

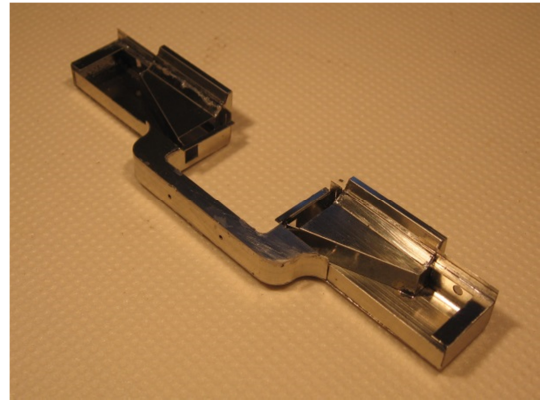


*Fig. 54*

76. Check again, place the two tanks next to each other on a couple of blocks, are they flat and parallel to each other ?? Fig 55 & 56.



*Fig. 55*



*Fig. 56*

77. Complete the side of the bunkers with the strip from the tank top etch along the side.

78. Check again for a square and level assembly.

79. At this point you can fill in the reverse corner created by the folding to get the rivet detail along the tank top edge.

80. The corner can be filed away to some extent, and then

81. filled with a bead of solder.

82. The edge is hardly noticeable once the handrails are fitted.

83. Leave the greedy boards until later.

*Outside fillet :*

84. Next the outside fillet is fitted across the bottom of the outside.
85. Enlarge the slots if necessary using the point of a scalpel on a hard wooden surface.
86. Make the bends carefully around a 4mm diameter former (an M4 set screw works well), and
87. check using the lower tank valance(126) as template. Fig 58 & 59.

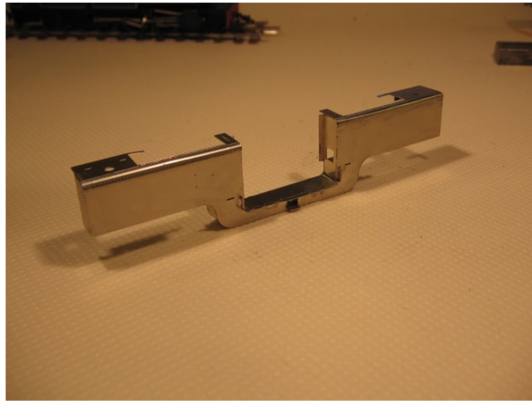


Fig. 58

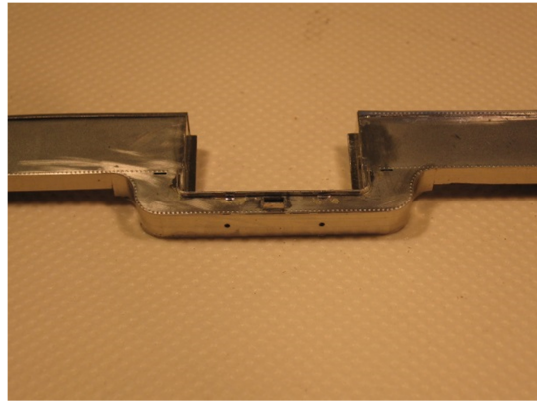


Fig. 59

88. Note the middle of (126) has parts to be used later,
89. keep in a safe place.
90. When correct tack into position,
91. check again then complete and
92. add the valance.
93. Use a little solder or solder paste to fix,
94. **do not fill the slots.**

*Tank and Aprons.*

95. The join between the tanks and aprons of the valance must be carefully filed to get a good fit.
96. In order to be certain about which join you are fitting mark the undersides of the apron with top or bottom, and or B/C for Blaenau / Caernarfon ends ( refer to the nomenclature drawing to be sure of your orientation).
97. Work on each one individually before attempting to assemble things.
98. Make up the two top tank stays (122).
99. The tank stays can be located with a couple of pins in each tank end. Fig 65 & 66.

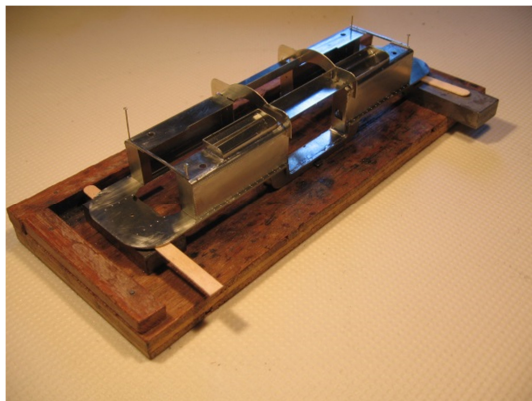


Fig. 65

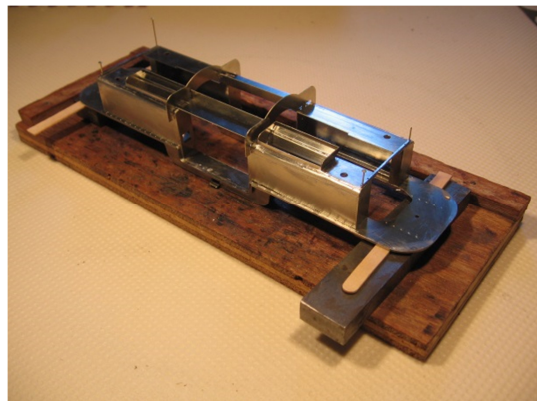
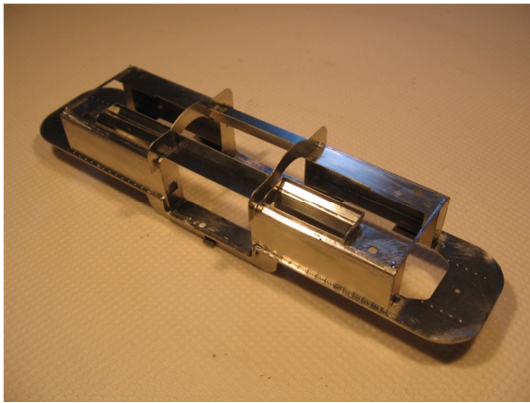
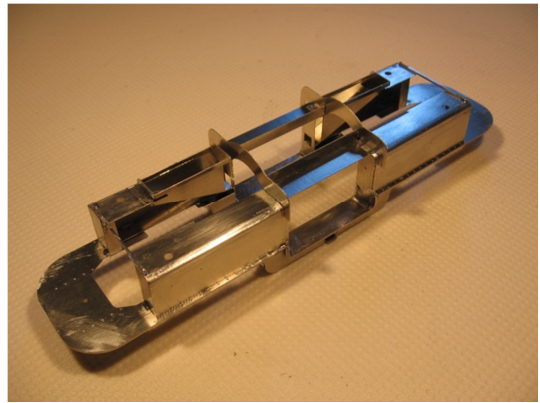


Fig. 66

100. Tack with one small solder dab each apron onto the two tank assemblies.
101. Check for parallel and square ness.
102. Check again with the fitting jig to ensure the tanks sit correctly relative to each other.
103. Attach the aprons with a tack of solder. Fig 67 & 68.



*Fig. 67*



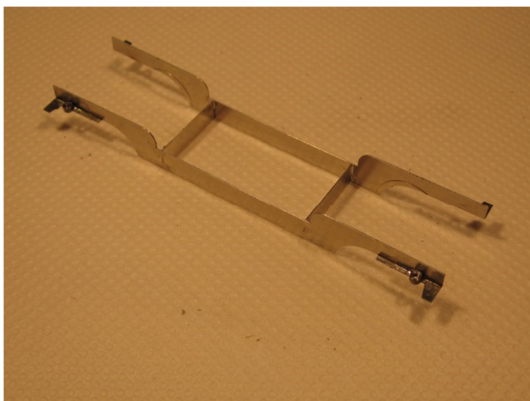
*Fig. 68*

104. Check again the two tanks are square to the aprons, and most importantly, they are parallel and level with each other along the length of the loco. Failure to get this right will result in the cab roof not fitting.
105. Once the jig fits the tanks can then be soldered all the way around to the aprons.
106. Leave this assembly securely tacked together for the meantime, and
107. complete the rest of the major assemblies **before any final seam soldering.**

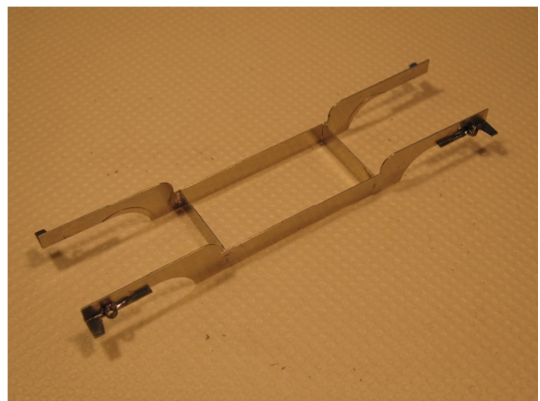
### *Carrier frame*

This is a simple assembly and very flimsy, just like the real thing. The cradle (01) holds the bogies apart, and not much else.

108. Fold up the outer ends, and then
109. solder 4 x 10 B.A. steel nuts onto the upper side of the lugs.
110. Solder in the cross members.
111. Use the bogie stretchers to check the correct width of the ends when locating on the main body.
112. Set aside for future assembly. Fig 70 & 71.



*Fig. 70*



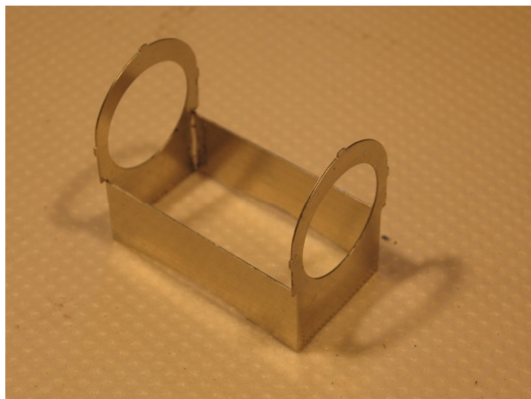
*Fig. 71*



### *Boiler centre and taper sections*

The boiler centre section is pre-rolled, but has to be made a snug fit into the firebox lower section.

113. Press out the rivets on the lower firebox ( 101) representing the foundation ring,
114. fold up and
115. solder together. Fig 80.

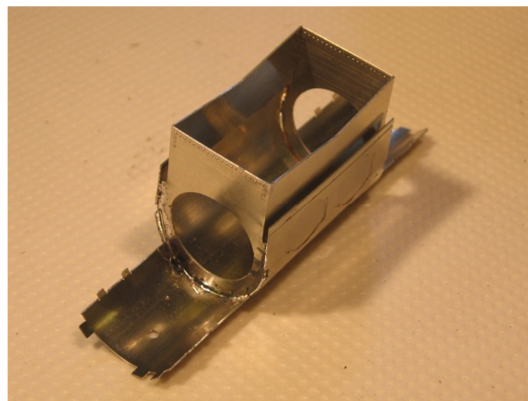


*Fig. 80*

116. Check the fit into the rolled boiler centre (100).
117. Fold the lower edges inward, and
118. once the boiler fits well solder the top centre tags of the lower section to the boiler section.
119. Then carefully work round each corner, pressing the parts together. This will take some considerable force.
120. Use a wood pusher to hold the parts together as you tack into position.
121. Note the tabs in the centre of the boiler to ensure each side comes down equally about the centre.
122. When all is fixed the seams can be filled in a bit at a time, otherwise everything will spring out of place again. Fig 81 & 82.



*Fig. 81*



*Fig. 82*

123. **Do not fit** any of the boiler fittings to the centre section until fitted into the cradle as it will prevent assembly.
124. Next fold out the boiler connecting plates ( 114), the middle part folds upwards to provide a platform for the clacks to sit on. Fig 83.

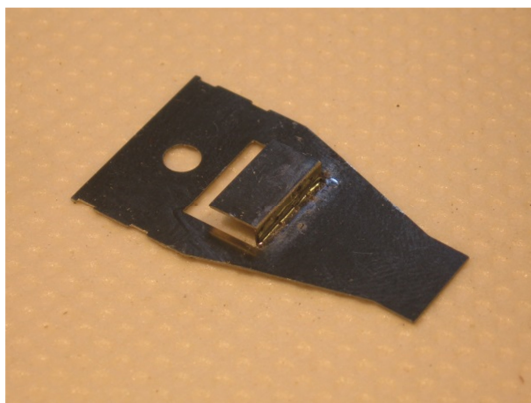


Fig. 83

125. The lugs each side of the boiler centre locate the connecting plate.
126. The clacks ( 155) need to be soldered in position before adding the taper section.
127. Note the holes for the clacks are both biased towards the drivers side so **be sure** to use the correct one at each end.
128. **Take care when removing the clacks from the sprue to leave as much of the diagonal feeds** on as possible.
129. Solder on the clacks.
130. Ensure the solder joint is very good, they are impossible to get to once the taper cladding is fitted. Fig 84 & 5.

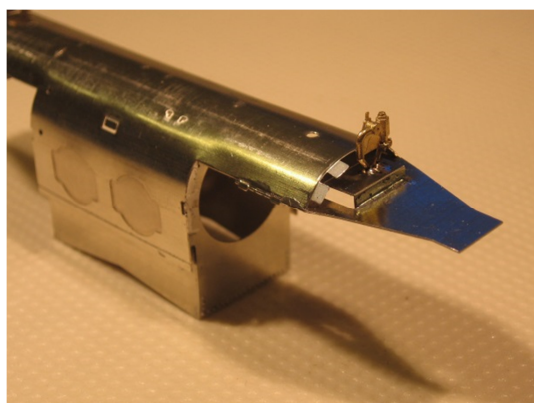


Fig. 84

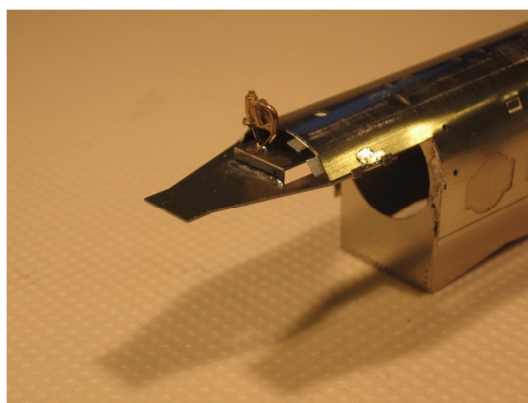


Fig. 85

131. The taper sections ( 110 & 111) are rolled but need to be formed by hand to get the final taper shape, **I suggest leaving this until** you have made up the smokebox and front boiler sections.

*Smokebox and front boiler section.*

132. Solder a 10 B.A. nut onto the underside of the top cross member to fix the chimney,
133. and a steel one onto the inside of the base (133). Fig 90.



*Fig. 90*

134. Fold up the inner and
135. solder together, using a couple of the spacers to ensure the sides are parallel and a constant distance apart. Fig 91.
136. Fit the front to the inner assembly, and
137. then carefully fix the outer wrappers, drawing a pencil line through the centre helps this alignment.
138. Form around a 20mm dia former, and
139. bend out the full thickness part at the each end of the part. Fig 92.
140. Note : The bottom end smokebox has a hole for the ejector exhaust pipe on the drivers side.

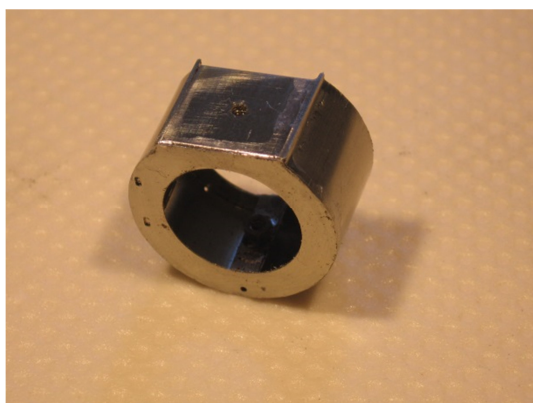


*Fig. 91*



*Fig. 92*

141. File the bottom flat. Fig 93 & 94.



*Fig. 93*



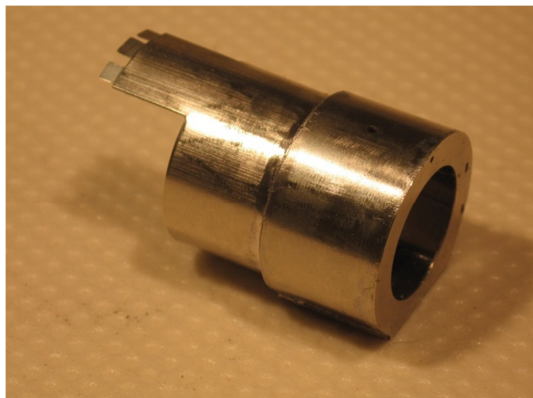
*Fig. 94*

142. The smokebox rear ring (134) are a pair of liners that form an inside ring to reduce the diameter down for the formed boiler front sections.
143. Fit the formers and solder in place, staggering the join at the bottom. Fig 95.



*Fig. 95*

144. Fit the pre formed boiler front section (112) into the rings.
145. When satisfied with the fit cut and file away the rear ring to be level with the bottom smokebox, then
146. solder the front section in position. This is important to allow the smokebox to fit onto the apron and for the boiler to slide under the tank stays. Fig 96 & 97



*Fig. 96*



*Fig. 97*

147. **Do not attach** the smokebox assembly to the taper section ( ie the permanent one) until the smokebox door, appendages and the handrails are fitted.

## Assembly of the main structure.

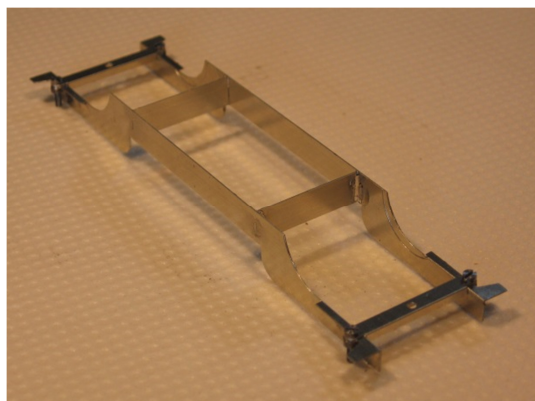
Now is time to start to assemble main body by adding the boiler and smokeboxes into the tank and apron assembly.

148. I suggest leaving the jig in place whilst doing this assembly.
149. It is essential to get the centre section in the centre !
150. Carefully check the position within the tank structure,
151. fix the smokebox assemblies in position, and then
152. check the taper boiler covers will fit at both ends. Fig 100.

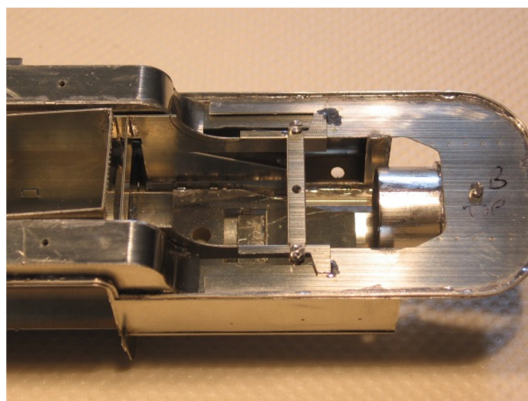


*Fig. 100*

153. Check the view at each end to ensure there is no twist in the assembly, and that the boiler centre is square and parallel with the tank sides.
154. Once you have established the centre tack the boiler sides to the tank sides, the taper sections are best left unattached to the smokebox fronts.
155. Next the cradle can be attached to the aprons.
156. Fold up the bogie stretchers (02) and attach to the cradle with 10 B.A. screws. Fig 101.
157. Drop into the main assembly and ensure it is located equally from each end.
158. Use the tabs to check the relationship with the aprons. Fig 102.



*Fig. 101*

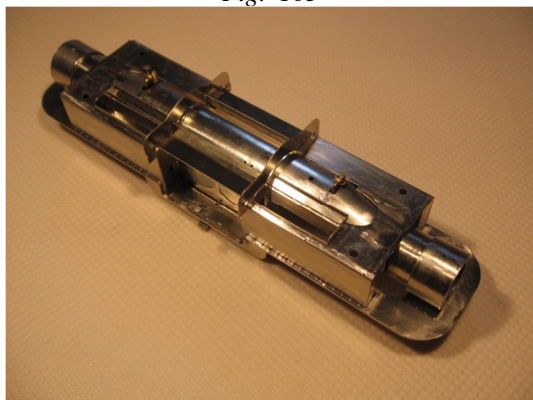


*Fig. 102*

159. The completion of the main structure requires the four fill in plates between the boiler front sections and the tanks.
160. You will have to file a feather edge on the underside of each plate, Fig 103, in order to fit them in between the tank stays and the front section. Fig 104 & 5.



*Fig. 103*



*Fig. 104*

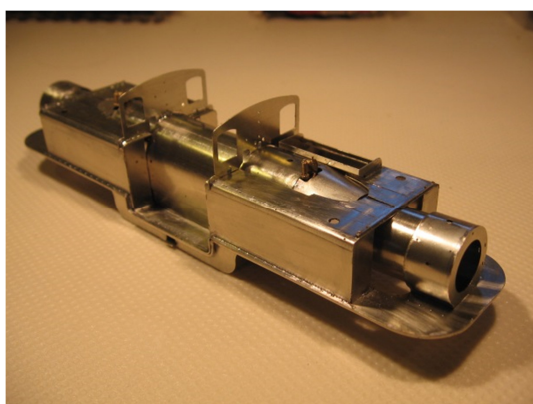


*Fig. 105*

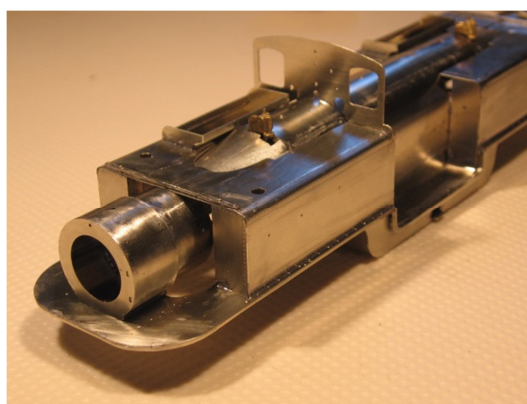
161. Yet another check to ensure all is square, and then I recommend
162. any tacks are turned into neat seams, and a
163. good clean up of all the joints.

***Front sheets.***

164. The front sheets are located using the slots that the jig located in.
165. Ensure you get the correct sheet in the correct orientation.
166. Locate them in the slots used for the jig, and fit the curve around the tank top.
167. Use a square block to aid getting them upright. Each sheet is etched looking from the front, and so the remains of the tags should be seen from the respective end of the engine, or that the larger cut outs at the bottom of each sheet are both on the drivers side,(140) at the bottom end, (141) at the top end.
168. Check the images as well.
169. Solder into position and ensure they are vertical and square. Fig 110 & 111.



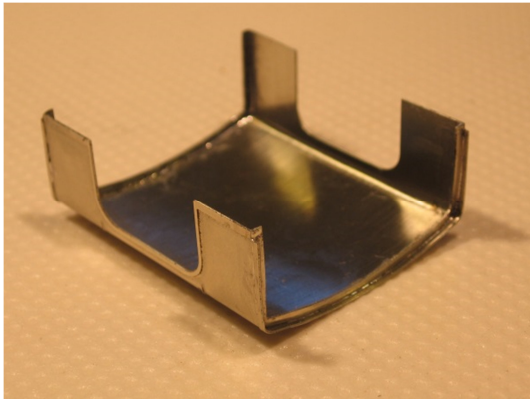
*Fig. 110*



*Fig. 111*

### *Roof.*

170. The roof (143) is preformed, but will require bringing into the final shape with the two inner flanges (146). Fig 112 &3.

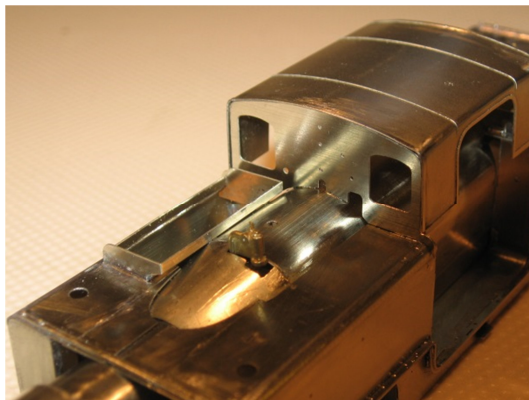


*Fig. 112*



*Fig. 113*

171. I recommend the cab roof and sidesheets are **not permanently fitted** until after all detailing and painting have been done in the cab.  
172. When a satisfactory fit has been obtained  
173. mark up the roof with top and bottom end marks so you know which way round to re-assemble. Fig 114.  
174. Note the roof has been etched with an extra 0.5mm overhang on each end. Once the assemblies are correct this overhang should be filed off to a flush finish against the cab front sheets.



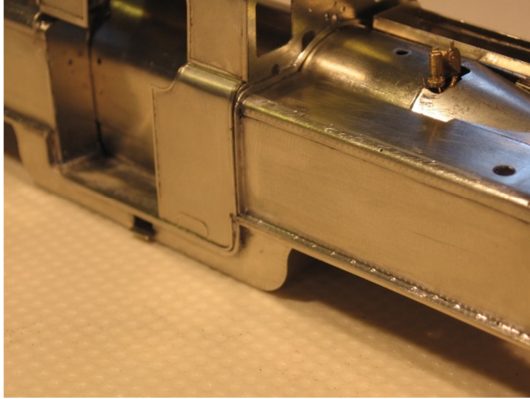
*Fig. 114*

### *Lower side sheets.*

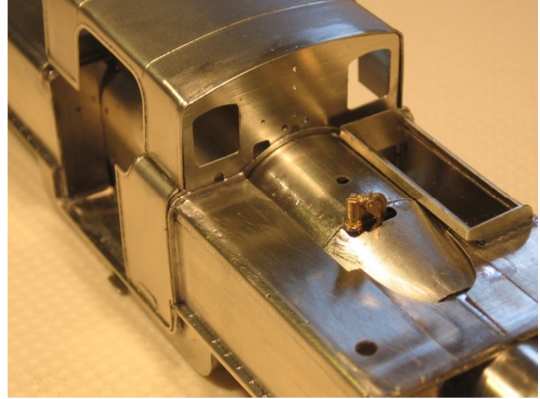
175. The lower sidesheets(144) are fitted to the outside fillets (148) with two slots,  
176. solder together and clean up.  
177. Mark up each sidesheet so you know which side you are fitting.  
178. Carefully file down the outer edge to fit around the corner at the end of the valance.  
179. Again fit the fillet to the tank profile and cab front. Fit the roof and check that fits as well.  
180. The handrails are made up from 0.5mm straight N.S. wire.  
181. Make an L shape with legs 25mm and 3mm long.  
182. Solder the 3mm leg into the indentation on the reverse of the side sheet.  
183. Cap with the small C shape part from the main tank fret.  
184. **Do not solder the roof or sidesheets** into position until you have fitted out the cab with injectors, gauge glasses etc. and possibly painted it as well.

*Lower angles*

185. These delicate parts (147) run over the top of the boiler.
186. They need to be aligned with the lower sidesheets one by one.
187. Solder into position, but again, **do not fix the sidesheet**. Fig 116 & 7.
188. File the angle with a small circular file in the middle hole about half way through the thickness, to allow the regulator shaft to sit at the correct height above the boiler top



*Fig. 116*



*Fig. 117*

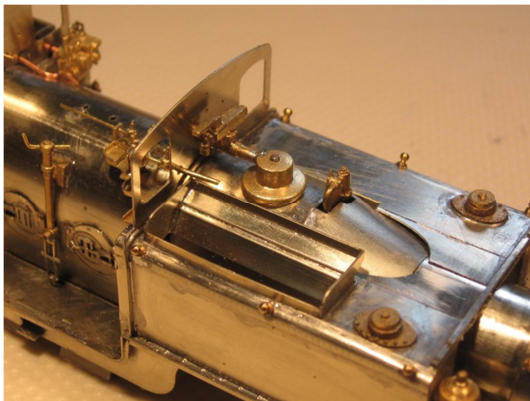
189. From here the assembly is straightforward and may be completed in any order, taking note of how you prefer to finish the interior of the cab.



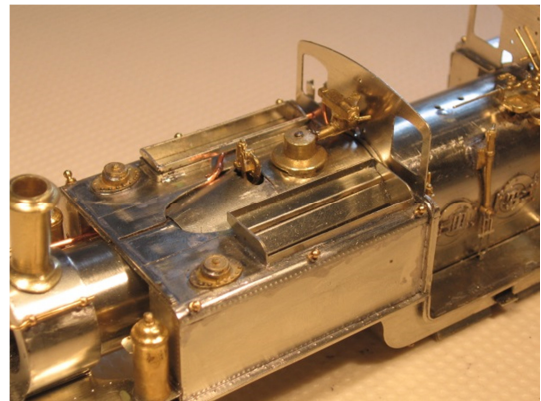
## Detailing superstructure

### *Larger castings*

190. The chimneys are fitted using 10 B.A. screws.
191. Tap the dome bases 10 B.A.
192. They need to be fitted with the **correct manifold**.
193. **Take care** when separating the manifolds from the feed sprue, there is a square box on one end of the bottom end manifold that looks like part of the feed.
194. Each pipe hole needs to be cleaned out to 0.8mm dia.
195. Fit the relevant cast manifold into each dome centre. The manifold valve points towards the cab, and fit on the boiler, and solder in place ensuring the manifold top is level. The top end in Fig 120 and bottom end Fig 121.

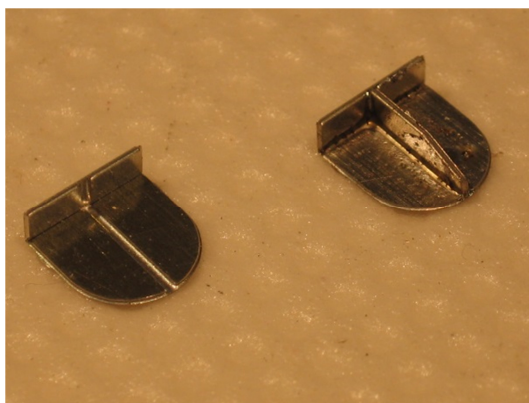


*Fig. 120*



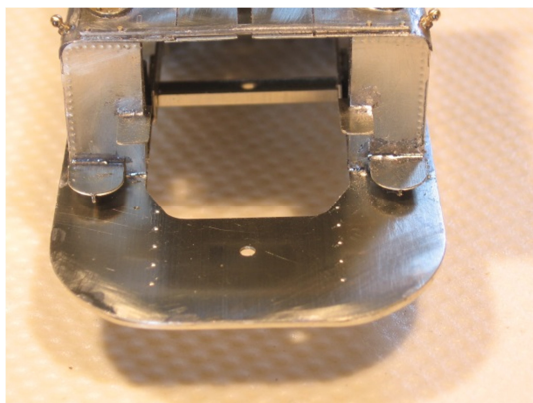
*Fig. 121*

196. The domes need to be fitted to boiler, and
197. may need the side adjacent to the bunker thinning down to ensure they sit correctly.
198. The safety valve can be soldered or glued into the top.
199. Set aside until all else is complete !
200. The four tank fillers can be soldered onto the tank tops, and
201. add the filler caps. **Fig y.**
202. Fit these before the handrails to aid cleaning up.
203. The sandpots (152) sit on a bracket (129) in front of each tank end. Fig 122.

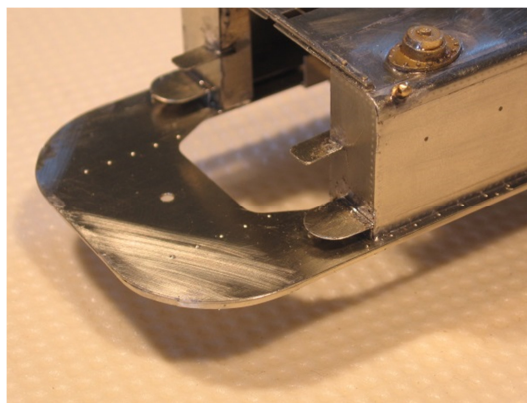


*Fig. 122*

204. Fit the brackets flush with the outside of the tanks.
205. This is a good moment to fit the footsteps that enable access onto the tank tops.
206. After fitting these add the sandpots. Fig 123 & 124.



*Fig. 123*



*Fig. 124*

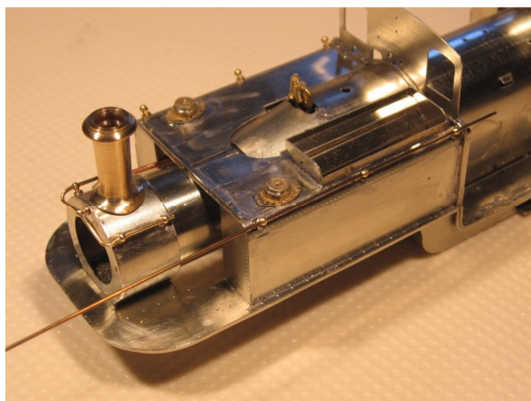
207. Then add the sandpots.

### *Handrails*

208. There are 22 handrail knobs to be fitted,

209. drill out the pilot holes to 1.1mm and de-bur.

210. The tank rails are easy, use a piece of 0.7mm brass wire to align them, and solder into position. Fig 135

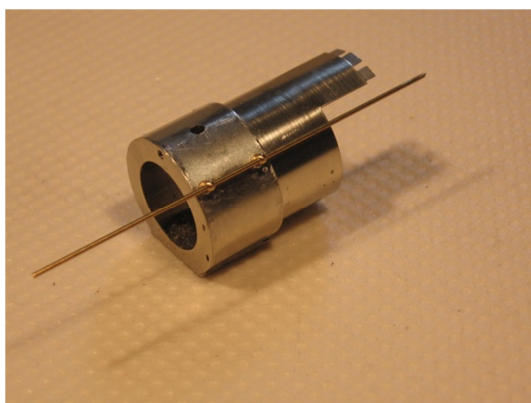


*Fig. 135*

211. The smokebox rails are not so easy.

212. Cut a piece of wire at least 50mm long, and

213. use it to align the pair of knobs on each side to be parallel with the centre line. Fig 136.

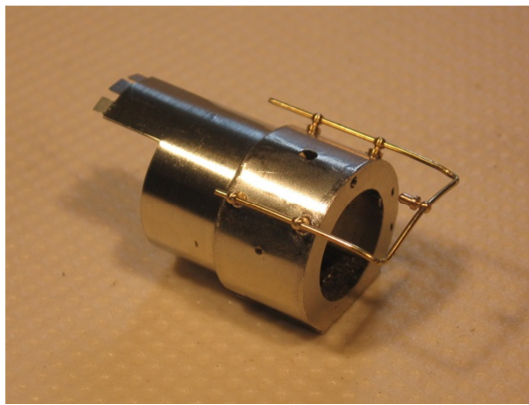


*Fig. 136*

214. Remove and curve the centre of the wire around a 20mm dia former and

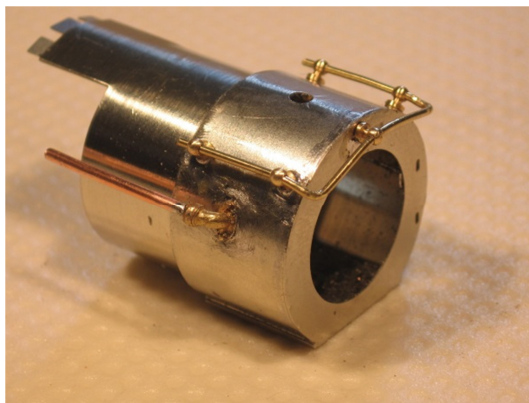
215. thread on the fifth handrail knob.

216. Note the 'corners' dip down below the level of the straight sections ( Img 3956) Fig. 137.



*Fig. 137*

217. Slide into the side knobs and
218. bend the centre to enable the fifth knob to fit in the centre.
219. Once this is soldered in the rail can not be removed.
220. Trim the ends flush to the inner knobs.
221. The bottom end smokebox also needs the elbow for the ejector exhaust fitting, along with a short length of 18SWG copper wire. Fig 138.



*Fig. 138*

### *Completion of the smokeboxes.*

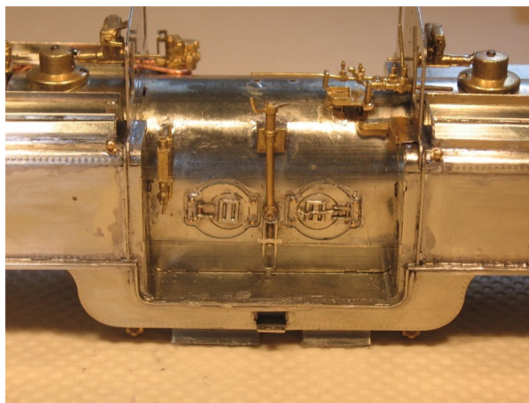
222. Once you are happy with the handrails around the smokeboxes you can fit the smokebox doors,
223. ensuring they are central to the outside of the formed assembly.
224. It is vital to get the door central and the hinges level, just
225. tack it in position and
226. take a good look to ensure it is correct, or you will always notice it !
227. The centre boss casting (on sprue 38) needs cleaning up, and
228. the centre boss of the door can be reduced in depth to look right.
229. The handwheel is very flimsy ( **take great care getting out of the fret**, the tabs are stronger than the wheel).
230. Once laminated the outside circle each side the overall thickness can be reduced, and a more circular section filed.
231. Due to thermal mass of the smokebox it may be better to attach the centre spindle and wheel with **low melt solder** or glue.

*Figures for this section are in the 'Detailing' Folder.*

### *Cab details and pipe runs.*

Various images show both ends on the inside and outside of the cab, it takes some effort to ensure you are looking at the correct end.

232. I suggest starting on the firemans side, making up the firebox doors (102).
233. The grill sits in the centre.
234. Thread a pin onto the hinges one at a time as you cut them off the tags, and
235. solder onto the main doorplate.
236. Fit the handle across the centre, and fit to the boiler centre section.
237. Note the hinges are on the outer ends.
238. The Handbrake can then be fitted,
239. together with the brake gear pull.
240. Next the gauge glass can be fitted, ensuring it is vertical. Fig 140.



*Fig. 140*

241. The firemans side has an array of pipes and blower valves (a feed in and one for each end) supported on various brackets, with the oil control valves removed this is simpler than it was, but is a bit a design nightmare.
242. Fit the bracket in the two opposed L shaped holes,
243. the pipes fit on the brackets.
244. Note the steam brake is on the firemans side of the cab, but the actuating lever is on the drivers side.
245. There is an operating rod running across the cab, over the top of the regulator operating rod. To fit this together it is better to fit out the bottom end of the drivers side next.
246. Next is the ejector, again fit the vacuum pipe at the bottom to aid a trail fit.
247. The exhaust pipe can be run along the top of tank, going through the tank top box, and diving down between the tank side and boiler casing ( it emerges as the pipe running into the elbow on the smokebox, **do not try and make this one piece**).
248. The steam feed into the top is fed from injectors,
249. **first fit** the water valve to the tank.
250. You may find it easier to fit the feed and exit pipes to the casting, shape them to go through the cab sheet, and then fit them all together on the water valve.
251. The pipes to the injector are all 0.8mm except for the overflow ( 0.5mm), these simply run down into the corner, the bottom is hidden by the drivers step ( when fitted). Fig 141-144.

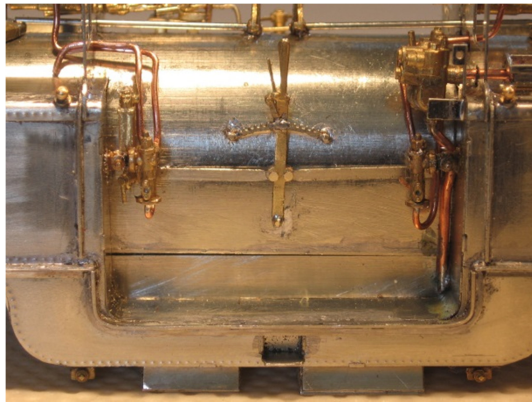


Fig. 141

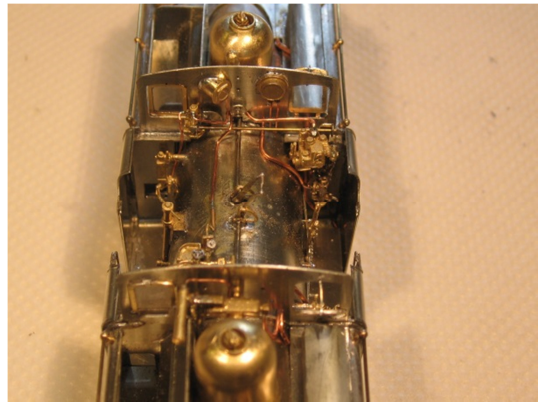


Fig. 142

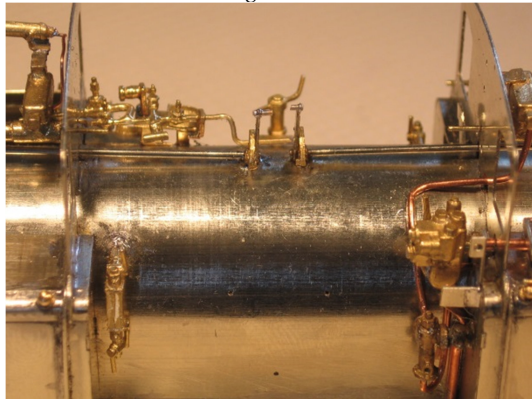


Fig. 143

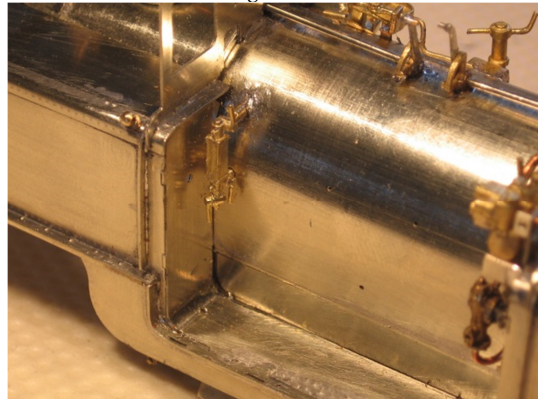


Fig. 144

252. Solder the bracket for the steam brake (149 - Cab fittings) to the steam brake casting, Img 4862, and Fig 145 & 146.

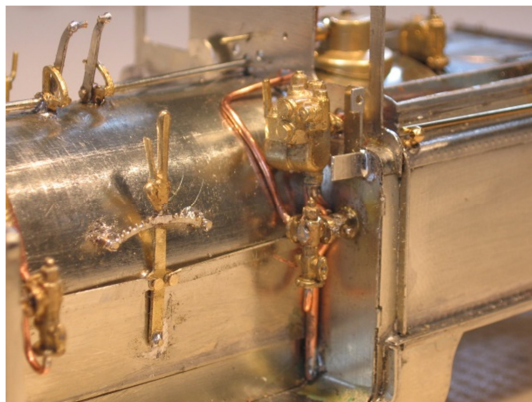


Fig. 145

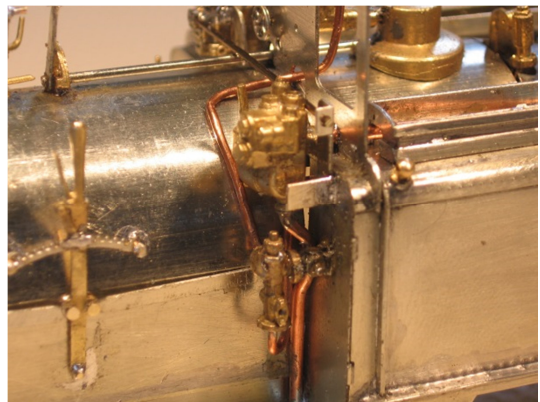
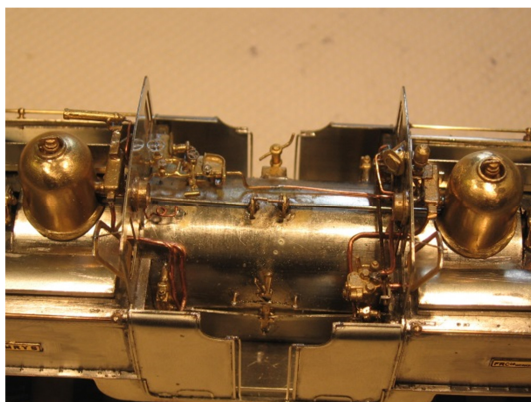


Fig. 146

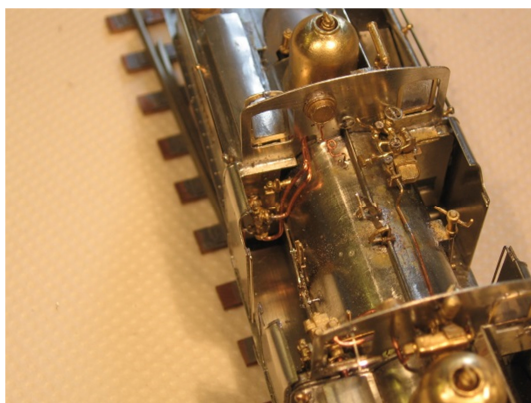
253. The steam brake is operated by a shaft ( made from 0.7mm brass) running across the cab from the bracket supporting the drivers brake handle.  
254. On the drivers side is the other bracket ( also 149) with the hole for the shaft in it.  
255. Fit as close the ejector as you can get it.  
256. **Before removing** the regulator brackets ( 161) from the sprue enlarge the through hole to 0.85mm, and  
257. remove from the sprue leaving some of the feed.  
258. Trial fit in the top of the boiler and enlarge the hole if necessary.  
259. Cut a piece of 0.9mm N.S. round 32mm long, and solder on the regulator lever,  
260. and a piece of 0.55mm pin for the regulator handle.  
261. Thread through the cab front plate and solder into position.  
262. On the drivers side next is the gauge glass,  
263. then the reversing lever.  
264. Attach the two operating rods (cut from the middle of (126) some time ago, note the notched arc sits on the outside of the lever, and attach using pins).

- 265. There is a very delicate casting of pipes for the firemans side controls. It is supported by the bracket with two right angle supports.
- 266. The ends of the blower pipes are cranked upwards at the top end, and downwards at the bottom end, this pipe can be extended across the cap of the bottom end cabsheet.
- 267. Various other small pipes can be added by studying the cab pictures, these are mainly in 0.5 and 0.8mm wire. Fig 148.



*Fig. 148*

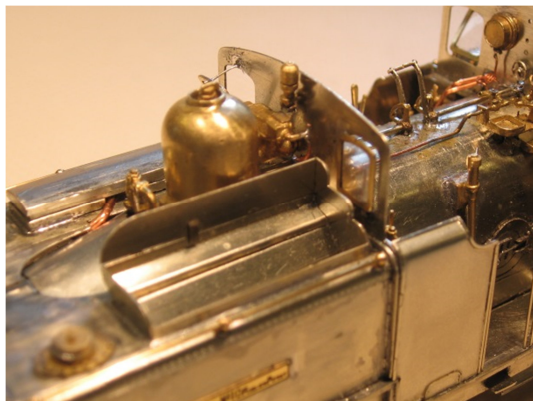
- 268. There are three main dials and indicators supplied, the drivers speedo readout (on the angled cylinder) and dual vacuum gauge are fitted to the bottom end.
- 269. The main pressure gauge is attached to the top end cab sheet.
- 270. Trim the spindles of the manifold valves and
- 271. fit large round handles to them,
- 272. smaller ones to the firemans controls.



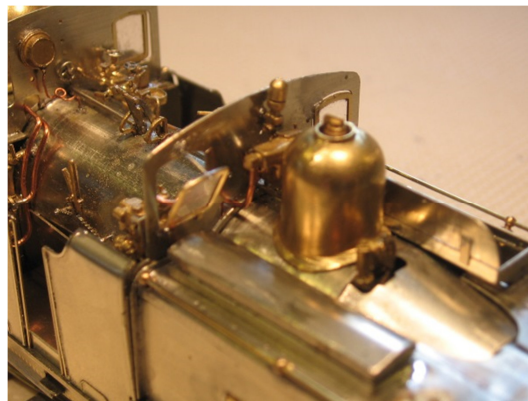
*Fig. 151*

### *Whistles and manifold detail.*

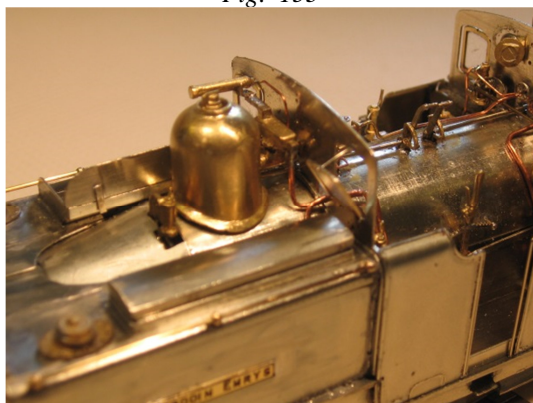
- 273. The main details to add to the manifolds are the larger pipe runs to the injectors and ejector.
- 274. The round whistle can be added to the bottom end, Fig 153 & 4.
- 275. The chime whistle on the top end is **best left until after painting**, as removing the dome can bend the mounting bracket. Fig 155 & 156.



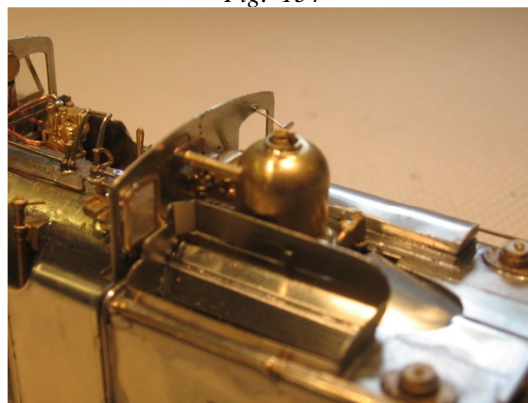
*Fig. 153*



*Fig. 154*



*Fig. 155*



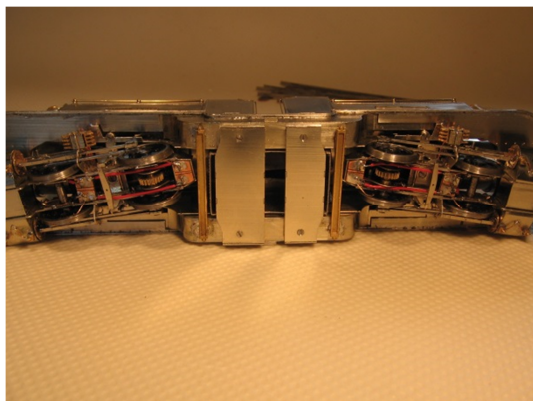
*Fig. 156*

### *Toolboxes*

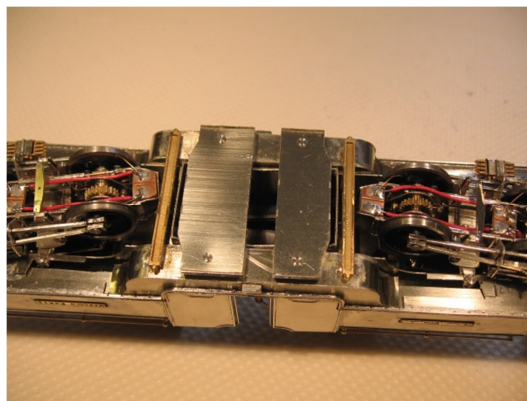
- 276. The two toolboxes are made up, the drivers side box has the ejector exhaust running through it. This is the one with cut outs in it.
- 277. Fit the lower 'skirting' around the box and then
- 278. cut out the openings to allow the pipe to go through.
- 279. **Do not fit the top on this box** until you have arranged the ejector exhaust pipe through the box.

### *Ashpans and balance boxes*

280. These are best done towards the end of the build, as the flat bottom of the tanks gives good support whilst working on the upper works.
281. The ashpans are folded up, and with luck will match the holes with the nuts soldered behind them.
282. If not, just open out the hole in the top, and countersink the holes in the bottom.
283. Fit the damper plate on the angles, and
284. fit the boxes after most of the upper works are done.
285. Use the supplied 12 B.A. x 1/4" screws to fit them, and
286. ensure they are not long enough to distort the tank centres. Fig 160 & 161.



*Fig. 160*

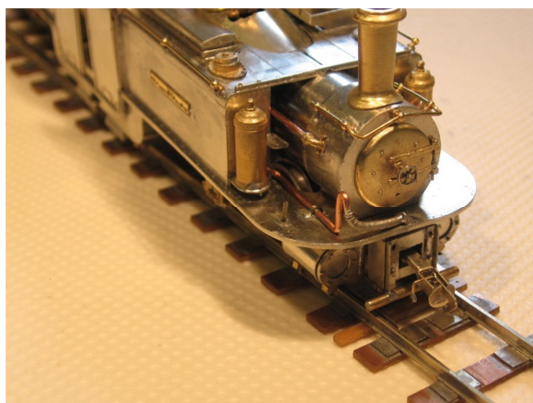


*Fig. 161*

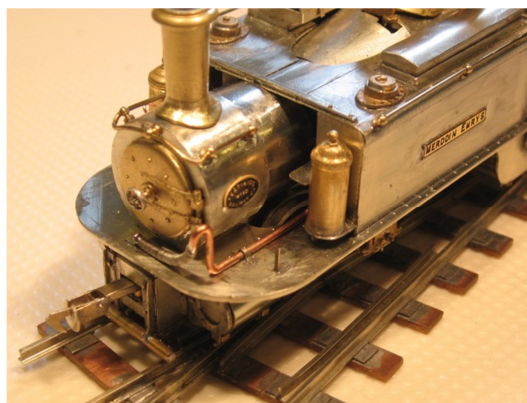
287. The die cast water balance boxes are soldered into position.

### *Vacuum Pipes.*

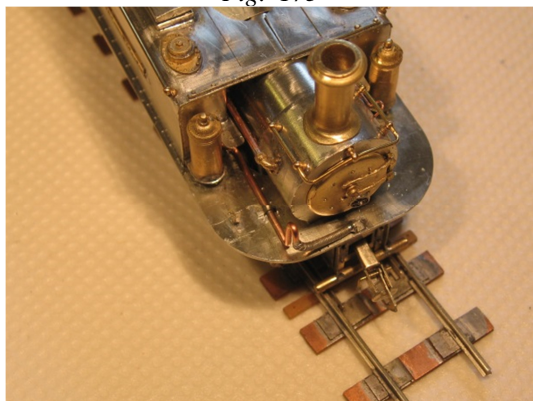
288. There are pipes at each end on the drivers side that run through the bottom of the tanks, and emerge onto the aprons.
289. Bend these up from 1.2mm dia wire. Fig 173-175.



*Fig. 173*



*Fig. 174*

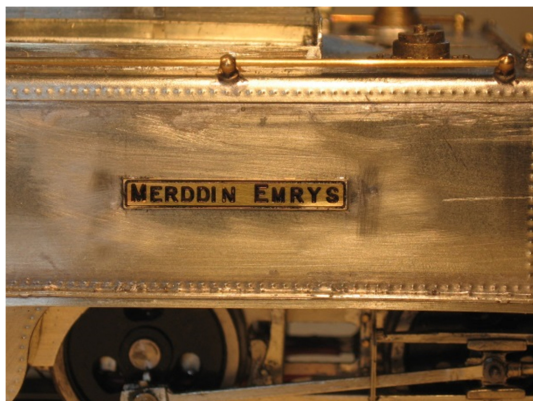


*Fig. 175*

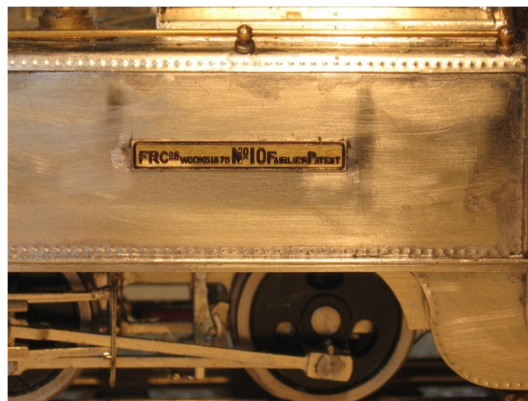


### *Name and Worksplates.*

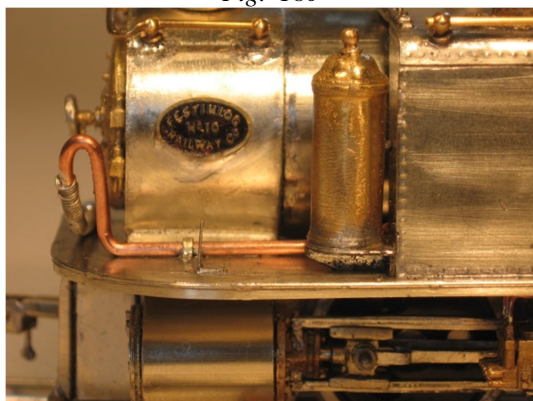
290. These can be fitted before painting, and soldered into position, but most tend to paint and then glue in position.
291. Note the nameplates are on the top end,
292. the patent plates on the bottom end.
293. On the top end smokebox there is a rebuilt plate on the firemans side and
294. the number plate on the drivers side.
295. On the bottom end smokebox there no plate on the drivers side (where the ejector exhaust is) and
296. a number plate on the firemans side.



*Fig. 180*



*Fig. 181*



*Fig. 184*

### *Spectacle plates*

- 297. Take care removing these from the fret, the bottom tabs need to be retained to act as 'hinges'.**
298. Fold together using the tabs, these are designed to sandwich a piece of 10 thou clear acrylic in place, a quick run of solder along the top edge will seal it together.
299. The edges need a radius filing on them all round.
300. Fold the bottom tabs a second time to form the hinges on the cab sheet side.
301. A 0.3mm piece of N.S. wire can be used as a curved top latch back to the cab. Fig 188 & 189.
302. As these are best fitted after painting I would glue in place with a cyno-acrylate.

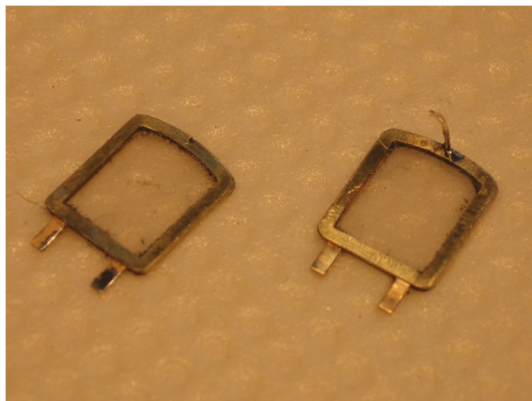


Fig. 185

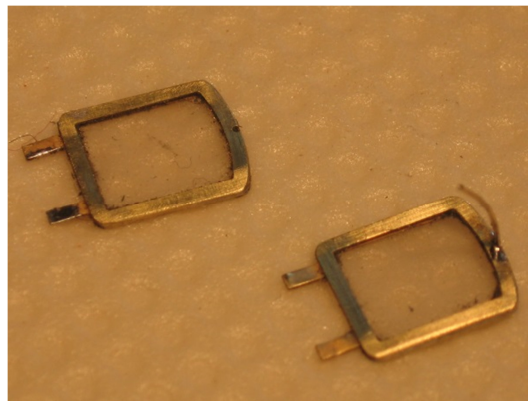


Fig. 186

### *Firemans Tools*

- 303. There are 4 main tools kept on the engine.
- 304. A pricker, flat end rake, ashing out shovel and coal firing shovel.
- 305. The pricker is made from 0.55mm wire.
- 306. The flat end rake and ashing out shovel have long handles, see the various images taken of the tank tops.
- 307. The coal shovel (with the longer blade) has two lengths, either 600 or 750 mm long.

### *Adhesive Weight*

- 308. When using power bogies it is best to ensure any additional adhesive weight is directly over the driving wheels. However, the coal bunker chutes makes it difficult to install much lead in the side tanks on the firemans side. I have found that a single piece of code 4 lead ( 1.8mm thick) 45mm long, rolled into a cylinder and fitted in the fireboxes is very helpful. I keep the cylinder clear in the middle to allow wiring between the bogies.

## Painting

If you have succeed in building the cab with a roof slides onto the front and rear sheets, and is quite stiff to insert, you may be happy to retain this as is. If you feel the cab needs to be better secured it is best to paint the interior of the cab before final fixing of the roof. The cab interior is cream, the boiler wrapper gloss black..

Without fixing to the main cab etch the cab lower sidesheets are very fragile and liable to being caught and distorted, and so I suggest after painting the cab inner to fit the roof and then the sidesheets permanently by soldering together. Do not forget to fit the drivers step on the drivers side before fitting the sidesheets.

The main colour scheme is FR maroon panels surrounded by gloss black with an orange red border, the lining is straw/black/straw with an orange red inline. An orange red line is used on the border of various panels, including the valance, cab sheets, lower tanks etc.

The upper surfaces of the tank tops, and cab roof, are a more matt finish of black. Smokeboxes are painted with a semi-gloss heat resistant black paint.

It is hoped to offer a set of transfers for the lining in the near future, please contact EDM for details.

### *Wiring and DCC options.*

If the pick ups are correctly adjusted I have found I can get reliable running from pickups on two axles. However, on double engines there is a benefit to joining the pickups from both bogies together. I drill holes through the rear of the bogie, and joining these with a two pole connector to allow easier disassembly.

For double engines I recommend fitting a decoder to each power bogie, and take power from the 'bus' linking the two bogies. The decoders are set to the same number.

## Completion

Figures 200 – 215 show pictures of a completed model. This is still from a pre-production etch, but the castings are all production parts.

### *Running in and maintenance.*

I always like to run mechanisms for some hours on a test track. Ensure the moving parts are lubricated, particularly the cross head and slide bars as these are both nickel silver. Long term I have run these Mashima motors and gear sets for hundreds of hours with no appreciable wear.

### *Further references.*

It is a sad fact there is no definitive reference work for Ffestiniog Locomotives at the present time. There are possible works in hand, (as of March 2013), and there are many books on the line with some references and pictures in them. However, at the moment it is best to use up to date reference pictures.

### *Postscript*

As these instructions are being prepared for release I was rostered on Merddin as fireman. It was only when we came to coal up that I realised the greedy boards had been removed. The FR had moved to Welsh coal that burned hotter and had a higher calorific value, hence the need for less coal per trip, and a therefore the greedy boards had disappeared. Whatever you model, you need to check the prototype !