LMS 1P Chassis Instructions - Bachmann Model

Introduction

This set of instructions covers Rumney Models kit X.04B. This kit is designed to provide a replacement etched chassis for the Bachmann LMS 1P 0-4-4T model. A comprehensive set of etches are included along with high quality 3D printed parts for the fittings. It is designed to be built sprung using CSB beams and is suitable for EM and P4 only. It is not possible to build the chassis in OO.

The chassis was originally developed to suit the Craftsman kit, which is still available (Rumney Models X.04A), and while most of the build follows the same concept, the chassis has been reworked to suit the Bachmann body. 3D printed components such as sandboxes and a brake cylinder are included so that these items do not need to be removed from the Bachmann chassis. A printed boiler bottom is also included to fill the gap left by the removal of the Bachmann mechanism.

References:

I am not going to delve into the history of these likeable tank engines. There are plenty of publications available that go into great depth for those who are interested. Suffice to say that the prototypes changed over the years and a couple of good photos of your chosen loco at the period you intend to model it will be very useful. The builder may find the following books useful when constructing the kit:

1. Wild Swan, Midland Engines No. 1 1833 and 2228 class bogie passenger tanks. ISBN 1 874103 50 X
2. Midland Record Bumper Preview Edition. Article on Midland Railway Motor Trains in the Midland, LMS & BR period by Bob Essery, which includes some useful close up detail shots of these locos.

General Notes

Read through the instructions first and familiarise yourself with the components. Drawings and photographs are included to attempt to make the waffle clearer.

3D Printed Parts

This kit includes high quality 3D printed parts. They are produced using the latest stereolithography technology to cure photosensitive resin. They have been thoroughly cleaned and then cured to produce the parts you have. As they are cured by a certain wavelength of light there is the possibility that if left exposed to light for a prolonged period of time the parts may go brittle. This is not unlike some plastics. To avoid this please consider the following:

- Do not leave unpainted resin parts exposed to direct sunlight for any length of time. Store in a dark place.
- Make sure all 3d printed parts are properly primed and painted.
- If the kit is not intended to be built for a while, consider priming the printed parts before storing.

If these points are followed, then the printed parts will be fine. However, if you leave them for several years on a south facing windowsill, then you might have end up having problems with them… The printed parts are pushing the boundaries of what is currently possible with the printing technology. Whilst they have been road tested and tweaked for strength where necessary some still feature very thin walls and should therefore be handled with care. Parts have been removed from their supports, but they will need cleaning up. When cleaning them up please note the following:

- The material files/sands and cuts with a saw blade very easily, almost too easily. Go slowly and take care. When cleaning up, wet and dry paper is recommended, preferably with a little water to contain any dust. You can also use fine files.
- The material does not cut that well with a knife blade. Whilst not so brittle that it will crack as soon as look at it, it may fracture if you try and cut it with a blade. I can't imagine why anyone would want to try and slice the prints, but I thought I'd say it anyway. You can however use a sharp scalpel blade to pare away material if needed.
- Due to the process used to produce these parts they may need fettling to fit, i.e. parts may come out slightly oversize.
- Holes will almost certainly need opening out. Use a sharp drill.

Fixing the printed parts in place can be done using either cyanoacrylate (superglue) or epoxy glue. I have used both successfully. In both cases makes sure the printed parts and what they are being attached to are free from any grease. I have found that in both cases the glues can provide a good bond with the brass parts, so much so that the parts can break rather than the joint if you try to remove them. I put this down to the surface of the parts being not entirely smooth so there is something for the glue to key to.

The printed parts need no special cleaning before painting. A wash with a cream cleaner to remove any grease will be sufficient. Like plastics avoid using things such as cellulose thinners as this may damage them. IPA will be fine as this is what is used to clean them after printing.

Etches

Firstly, take care. Etches have can have very sharp edges. Check all holes before removing parts from the fret. The drawing process for etching if you use a CAD program as I do is extremely accurate but the actual etching process itself not an exact science. If the fret is slightly over etched, then there is no problem but if they are under etched the holes will need enlarging. I find that this is easiest to do before removing parts from the fret. The hole sizes will be noted at the appropriate points. Use an appropriate drill or a tapered reamer.

Remove one part at a time from the fret.

The instructions will assume that tags connecting parts to the fret will be cleaned up on removal of a part unless it is specified specifically in the instructions not to.

Very important:
All fold lines are through 90° with the fold line on the inside unless stated otherwise.

This means that when I say fold something up the folds should be made through 90° with the fold line on the inside. If the fold is to be done in any other way I will say so.

Everyone has their own soldering methods. I use an Antex 50W temperature controlled soldering iron with predominantly 145° solder and La-Co paste flux.

Tools

The following tools may be useful when constructing the kit:

- A selection of drill bits including 0.5mm, 0.1mm and 1mm along with something to hold them.
- A selection of tapered reamers in the range 0.5mm-1/8”
- A smooth jawed vice and smooth jawed pliers
- A selection of fine needle files for cleaning up
- Something to remove the etches with; a piercing saw with fine blade (size 6/0 recommended) or a pair of cutters
- Wet and dry paper (800 or 1200 grade) for cleaning up the prints

Construction Notes

Inside motion

How much you can fit will depend on the gauge you are working in. All will fit in P4, with a gap in the outer slide bars. You will need to leave out the outer sets of slidebars in EM (or you won’t be able to fit the csb wire) and you will only be able to fit the inner slidebars and the valve gear eccentrics.

Spring Wire

The gauge of spring wire you will need for both the driving wheels and bogie will vary depending on the weight of the body. I have included 0.014” wire for the driving wheels and 0.012” for the bogie. This was found to be the ideal combination for a model weight of around 235g. If your model is heavier then consider using heavier wire. I use plain/unwound guitar wire, and these are available as single strings from music shops or via the web.

Materials list

The following materials will be needed to complete the chassis kit:

- Straight wire in the flowing sizes: 0.5mm, 0.8mm and 1mm (or 1mm tube)
- 10 BA nut and bolt
- M2 nut and bolt
- 2.5mm x 2mm brass tube (for bogie)
- 1 x 2mm pin point top hat bearing (as used on coaches and wagons)

All of the above are available from Eileen’s Emporium amongst other good model supply shops.

Wheels and Hornblocks

Wheels, the test build and Craftsman version used Ultrascale. Drivers are standard Midland 5'3" and bogie wheels used GWR 3' ½" 10 spoke. You can also use Gibson Wheels. Bogie wheels must have 2mm axles. 1/8" axles are standard for the driving wheels, though you can use other diameter axles if that's what the wheels come with. The bore on the hornblocks (see next sections) will need to match. I will assume 1/8" axles to keep things simple. You will also need suitable crankpins.

You will also need High Level Hornblocks. The chassis kit has been designed to specifically use these. You will require 2 axle of the standard hornblocks with 1/8" bore for the driving wheels and 2 axles of the 2mm bore MiniBlox for the bogies. If building in EM you may need to use the SpaceSaver version of the standard hornblock to get the gearbox to fit.

Gearbox, Motor & Pickups

The following combinations were used on the Craftsman and Bachmann chassis builds:

- Craftsman kit build: High Level Road Runner Compact + 45:1 and Mashima 1424
- Bachmann kit build: High Level Road Runner + 60:1 and HL 1219C coreless motor

Both of these locos are on DCC with Zimo MX622 decoders. The Coreless motor has had 2 CV changes in line with the Zimo manual but otherwise both run excellently with out of the box settings.

You will need something to collect the current form the wheels. Both loco builds used 33SWG (0.254mm) phosphor bronze wire. This was formed into coiled wipers and fitted to both driving and bogie wheels. Other types of wire could be used but they will need to be of the hard variety rather than soft.

Parts List

Etched Sheets

1 - Mainframes
2b - Front Spacer (EM)
3-6b - Spacers (EM)
3-6c - Spacers (P4)
7b - Rear spacer (EM)
8 - Slidebars
9 - Coupling rods
10 - Driving wheel spring carriers
11 - Driving wheel hornguides
12 - Driving wheel washers
13b - Keeper plate (EM)
13c - Keeper plate (P4)
14 - Driving wheel spring overlays
15 - Valve gear eccentrics
16 - Valve gear connecting rods
17 - Frame overlays
18 - Brake hanger overlays
19 - Brake shaft bracket overlays
20 - Brake shoes
21 - Brakegear links
22 - Brakegear link overlays
23 - Steam brake crank
24 - Hand brake crank and link
25b - Bogie frame (EM)
25c - Bogie frame (P4)
26b - Bogie frame spacer (EM)
26c - Bogie frame spacer (P4)
27 - Bogie wheel spring carriers
28b - Bogie Bolster (EM)
28c - Bogie Bolster (P4)
28d - Bogie Bolster frame spacer
29 - Bogie wheel washers
30 - Bogie link
31 - Bogie retaining bolt washer
32 - Balance weights
33 - Coupling hooks
34 - Boiler sheeting clamps
35 - Front body screw locating plate
36 - Rear body screw locating plate
37 - Reversing rod crank
38a - Front sandbox spacers (for EM only)
38b - Rear sandbox spacers (for EM only)
38c - Brake cylinder spacers (for EM only)

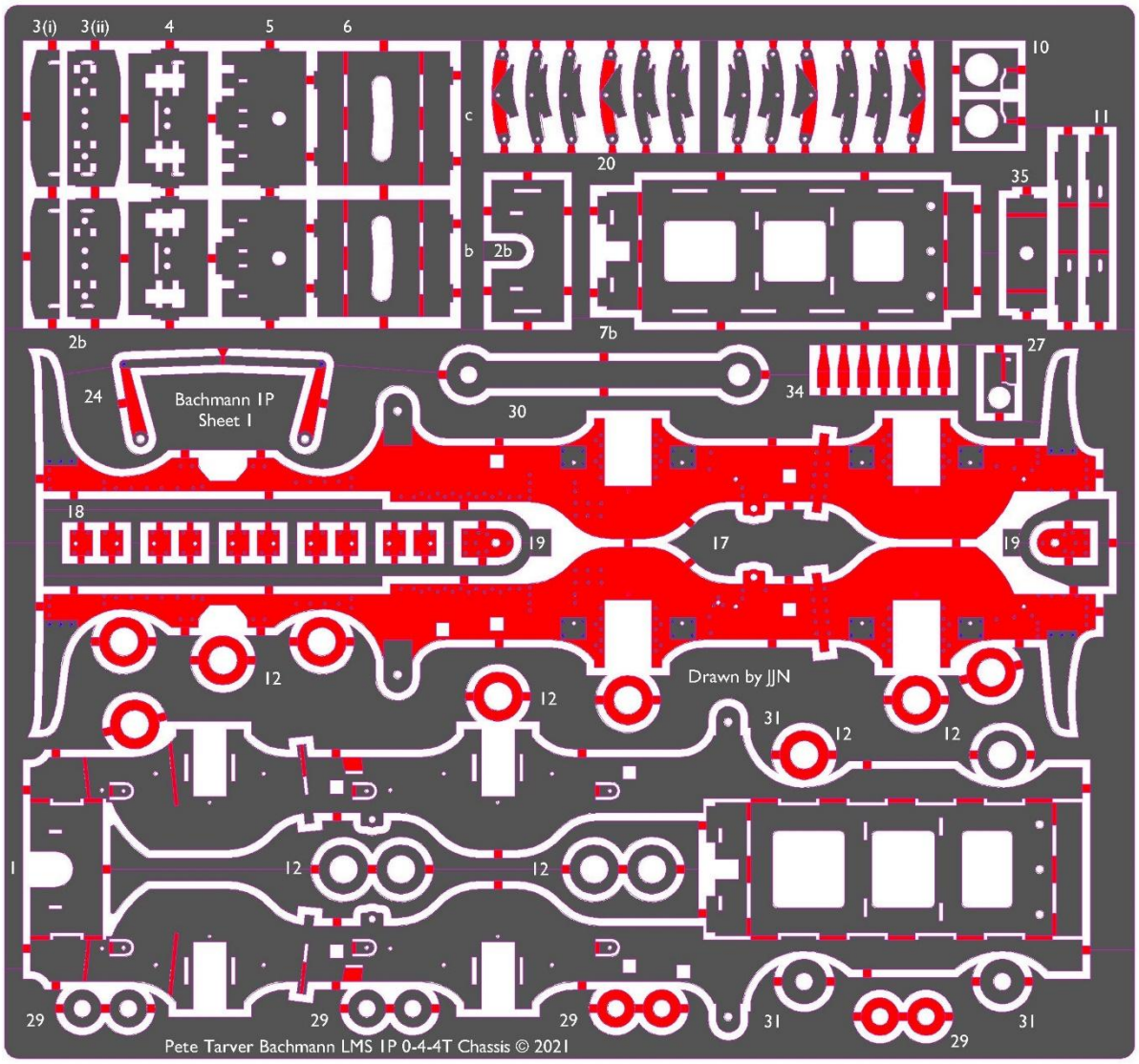
3D Prints

- Boiler Bottom
- Front and Rear Sandboxes
- Brake Cylinder
- Bogie Detailing

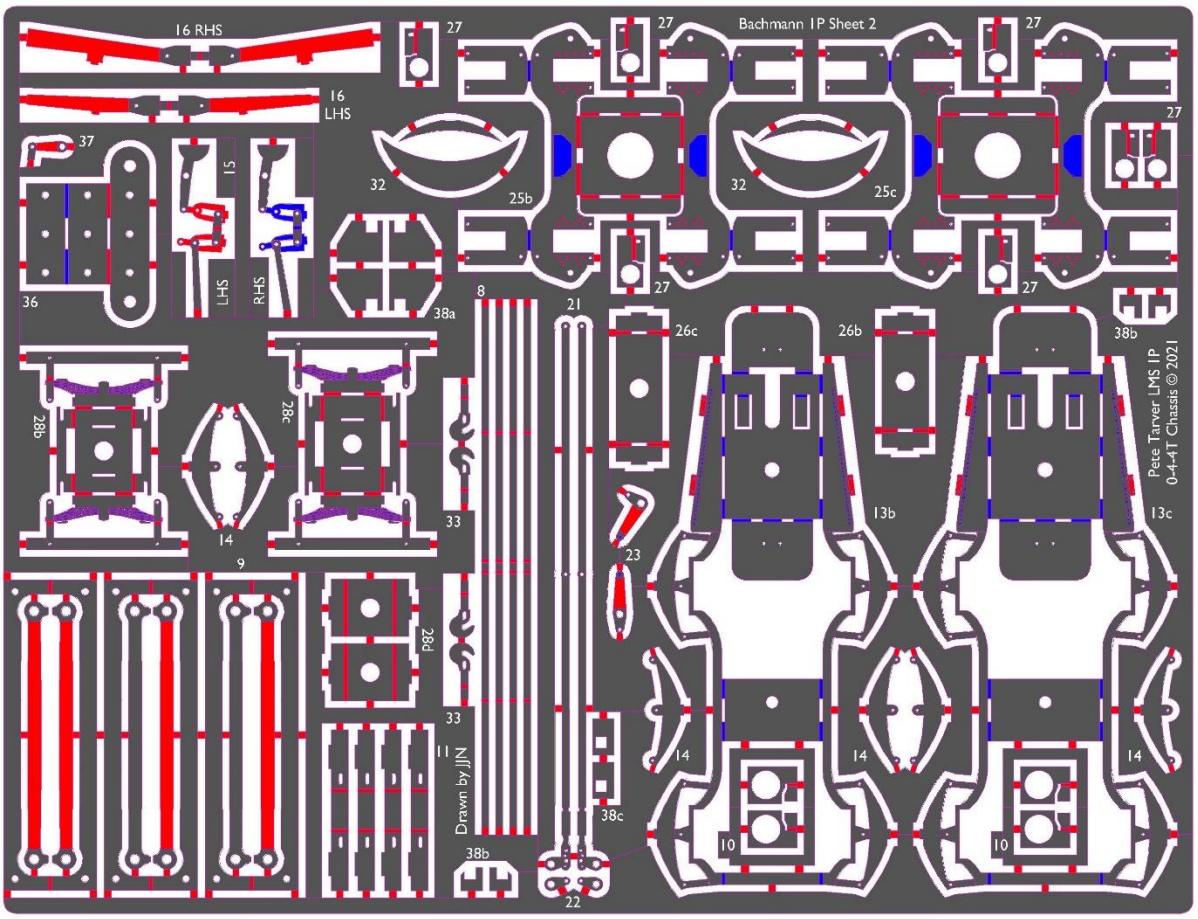
Spring Wire

- 70mm of 0.012” wire
- 150mm of 0.014” wire

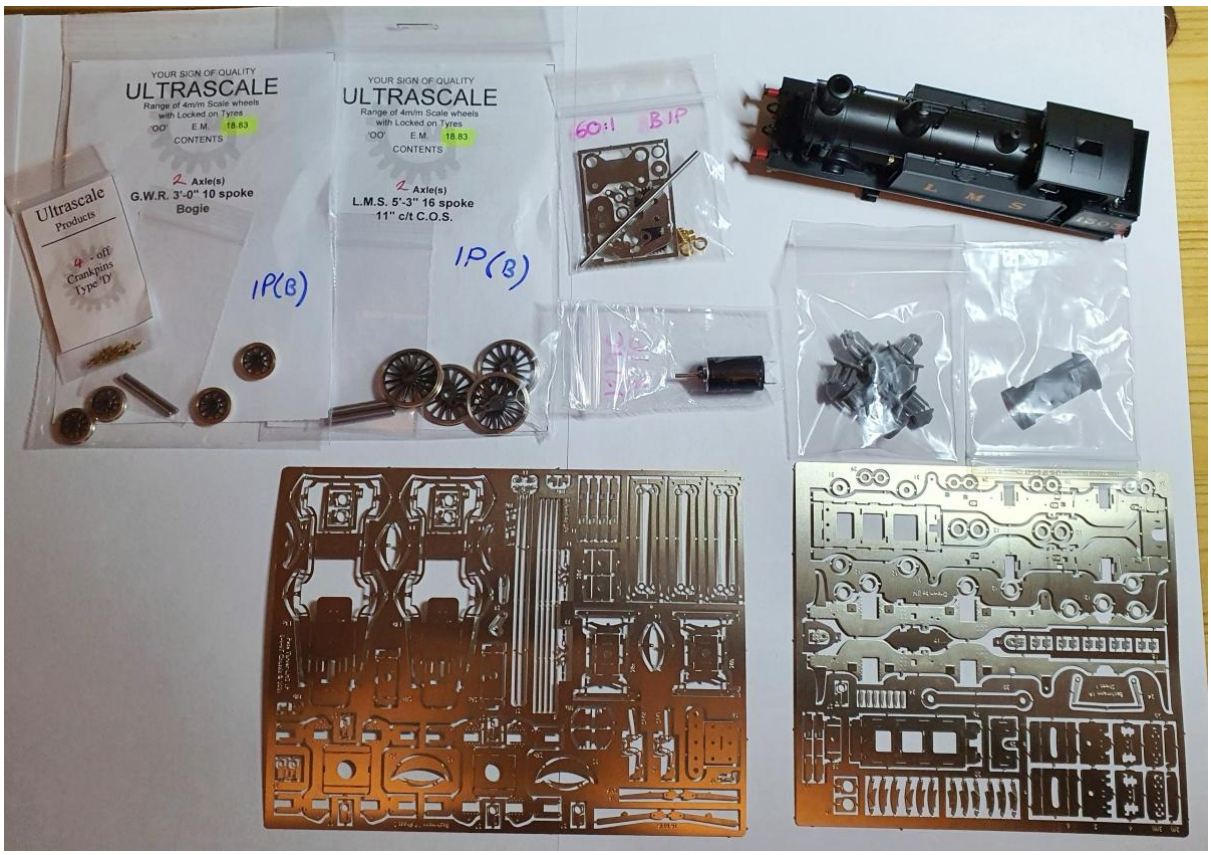
Parts Diagrams - Sheet 1



Parts Diagram - Sheet 2



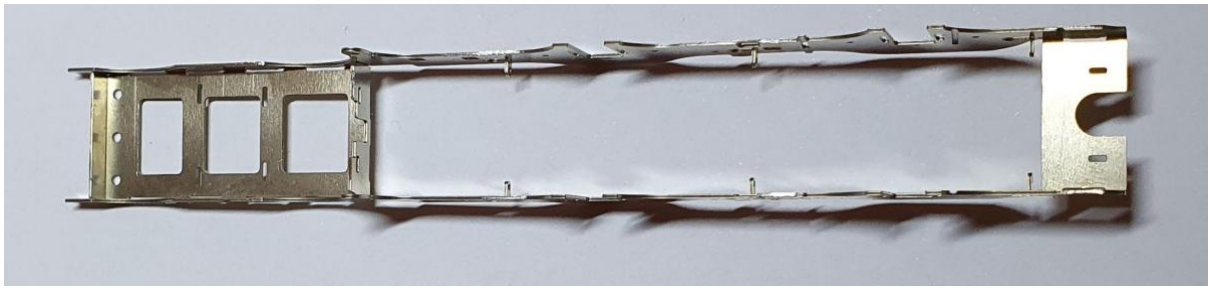
Basic Assembly Sequence and Notes



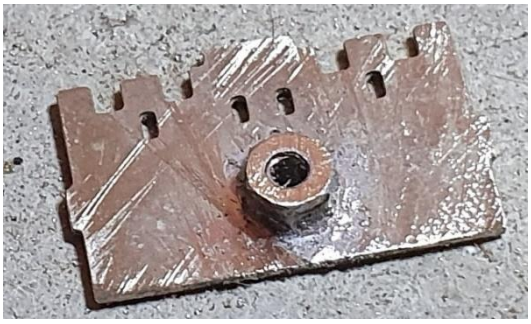
1 - Remove the mainframes (1) from the fret and fold out the 6 CSB fulcrum points. These are shaded green in the parts diagram for sheet 1 above.

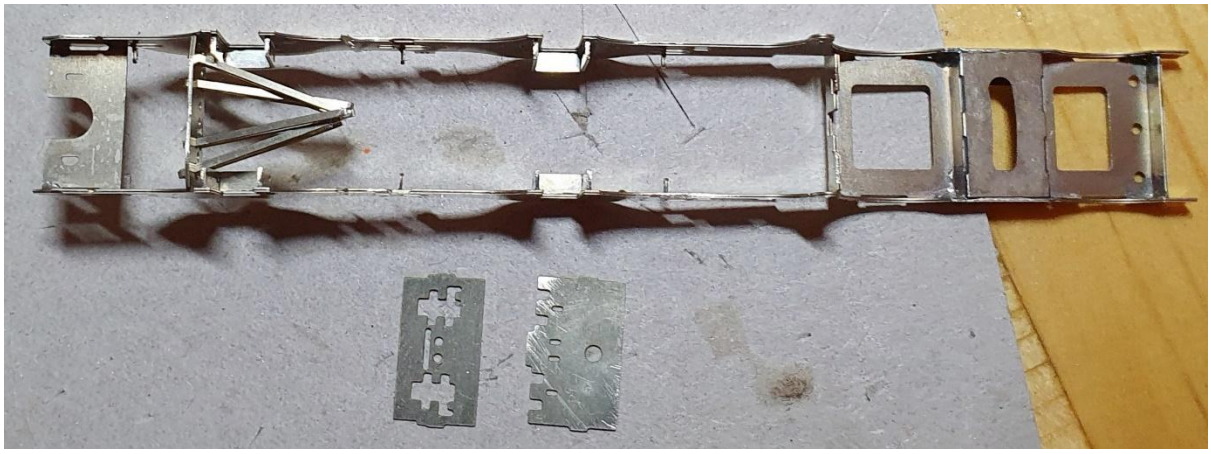
If you are building the chassis in P4 fold up the chassis making sure that the sides are at 90° to the spacers.

If you are building a chassis in EM, you will need remove frames from the spacers and file off the fold tabs. Fit the sideframes to spacers 2b 7b making sure to fold up part 7b into a C shape. Solder together making sure that the frames are at 90° to the spacers.

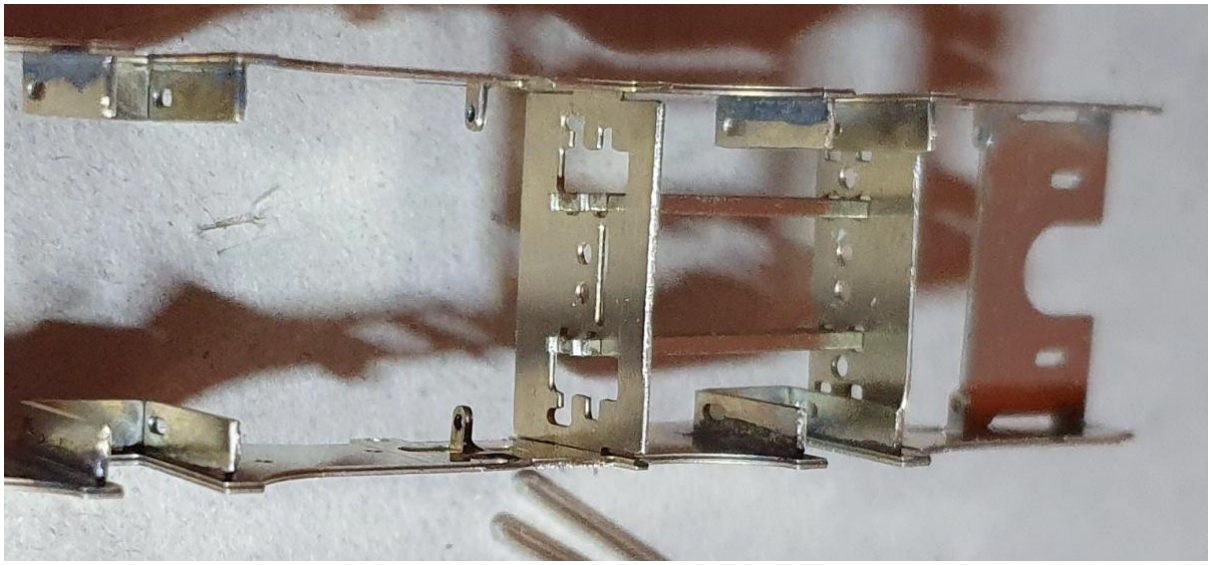


2 - Remove the appropriate set of frame spacers (3(i), 3(ii), 4, 5 & 6) from the fret. The spacers for EM are the b set. Those for P4 are the c set. Fold up spacer 6 into a C shape. See Fig 1. If fitting slidebars (8) you must fold them up and fit to spacer 3 before fitting to the chassis. Note that the outer fold lines are through 180° with the fold line on the outside, the inner fold lines are through 90°. The spacer slides in from below and you will need to add spacer 4 to the assembly and slide that in as well. Solder a 10BA nut to spacer 5 over the round hole. Fit spacers 5 so that the nut is on top of the spacer and spacer 6 before soldering the spacers in place. Note that there is a correct and only way to fit spacer 6. If the tabs and slots aren't lining up it's the wrong way around!





For the Craftsman build I fitted the slidebars first, then cut them to clear the hornguides. On this build I fitted the hornguides first, and then cut the slidebars before fitting them butting up to the hornguides. I think the former was easier, but the latter ended up looking neater as the cut was easier to do and clean up when as a separate piece on the workbench. Fitting it and aligning it was tricky as it wasn't then pre-jigged at both ends.



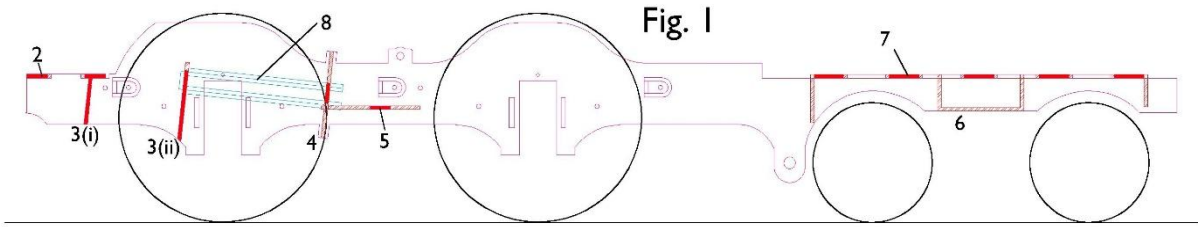


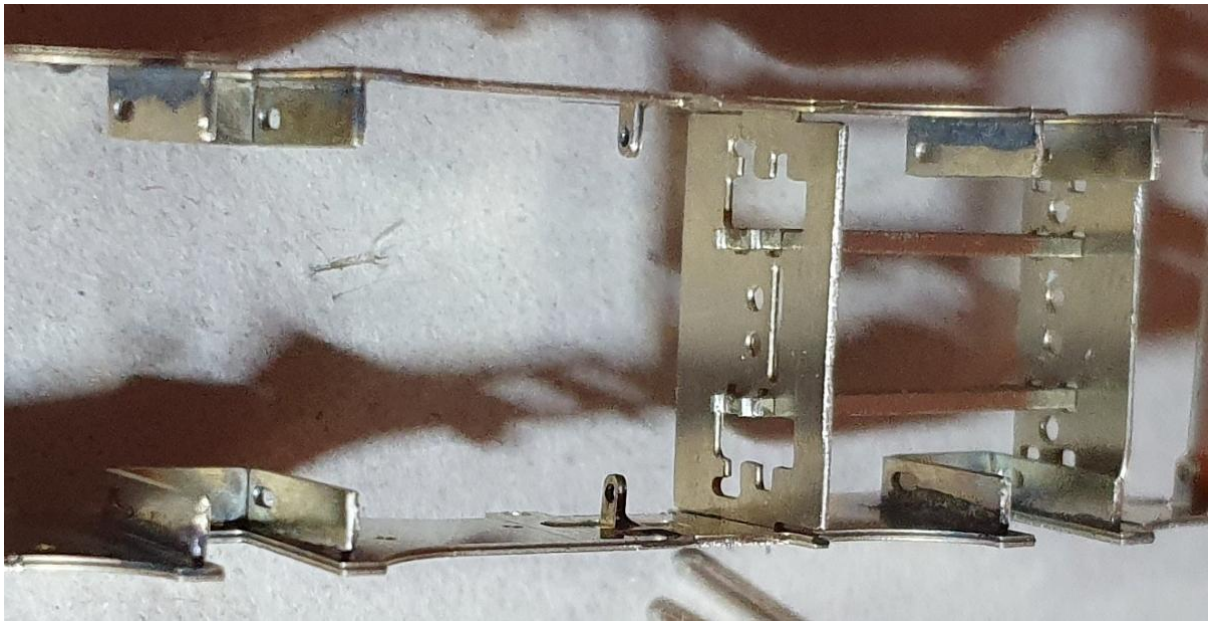
Fig. 1

3 - Next make up the coupling rods (9). These are designed to be kept attached to their own little frets while assembling. Fold the fret double and solder together. There are small holes on the fret which can be used with 1mm wire to make sure everything is aligned.

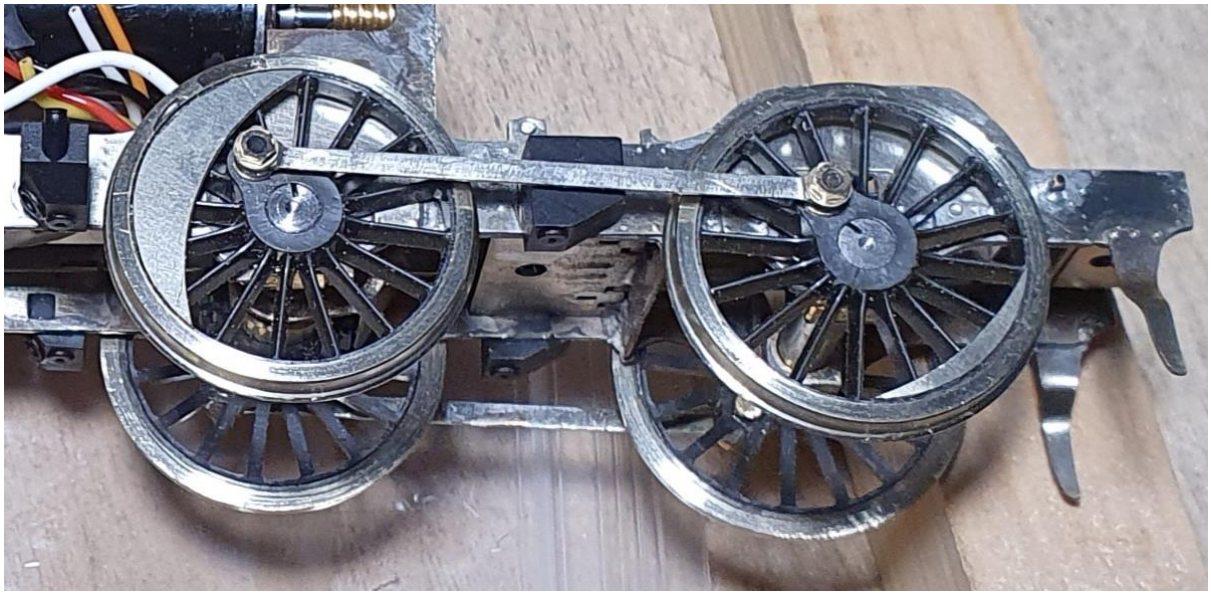
There are two options for the rods. You can use the frets with 1 half etched and 1 full thickness part on as they are or split the halves of the fret and use half etched rods on the front and back layer. The test build used the two thinner ones and is quite happy.

4 - Before removing from the fret check the fit of the holes in the driving wheel spring carriers (10) on the High Level hornblocks. Adjust with a tapered reamer if tight. Fold out spring tab and solder to back of bearing.

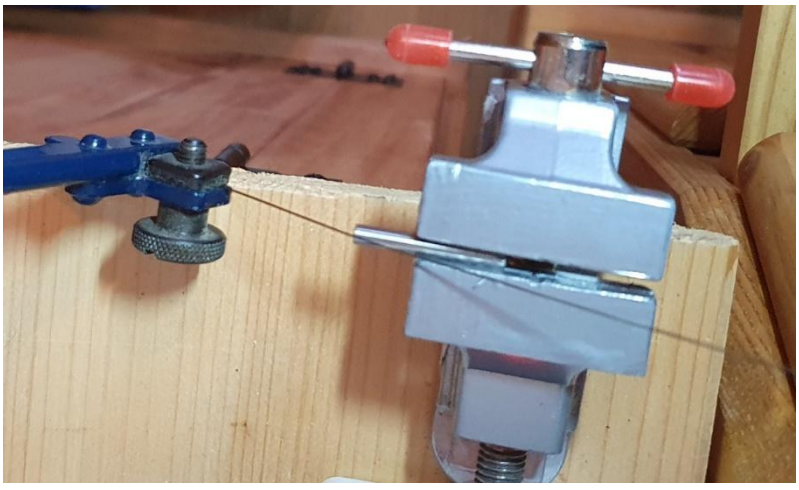
5 - Next fold the hornguides (11) into a C shape and fit to the chassis. These locate in the slots in the mainframes. Not one of the slots is a little big to allow for slight adjustment, the bearings may vary a little. At this stage it is important to make sure the hornguides are a good fit in the frames and the hornblocks are a good sliding fit in the hornguides. If the slot is tight on the etched frames the etch can be thinned easily enough at this stage with a file, which would be a far more difficult task to do once the frame overlays have been fitted. When happy solder in place. Keep hornblocks assigned to hornguides. Mixing the hornblocks and hornguides up will likely prove problematic.



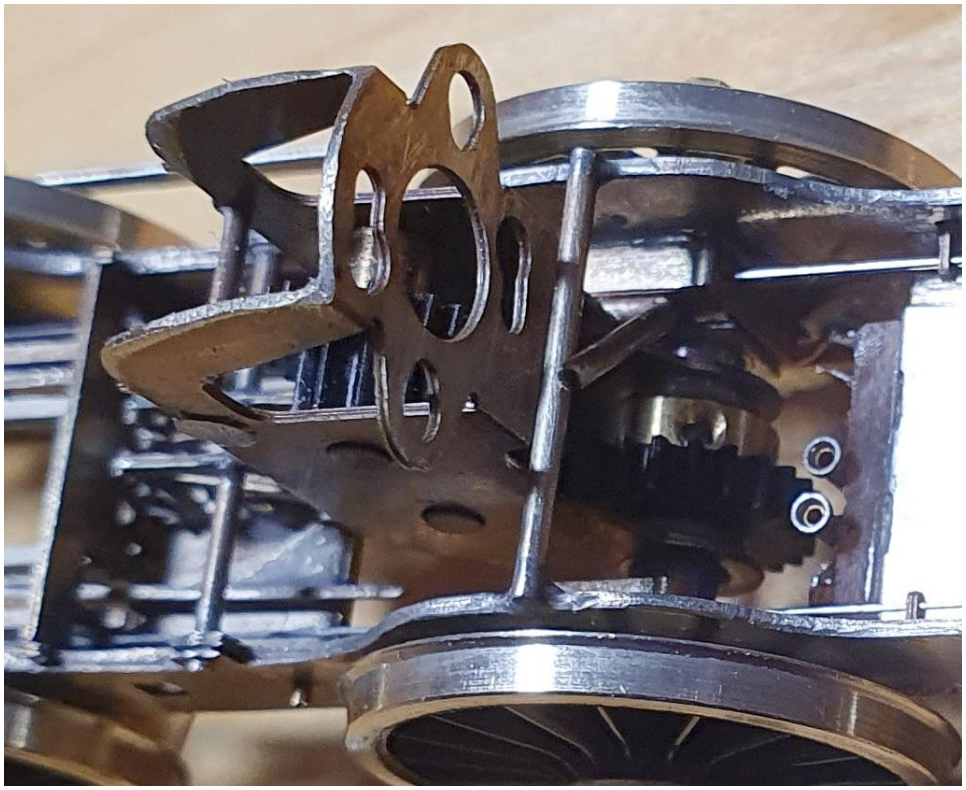
6 - Fit driving wheels. Driving wheel washers (12) are provided if needed to take out any slop. Ideally there should be none. Balance weights (32) can be fitted to the wheels before assembling the axles to make life easier later on, especially if filling in between the spokes with epoxy.



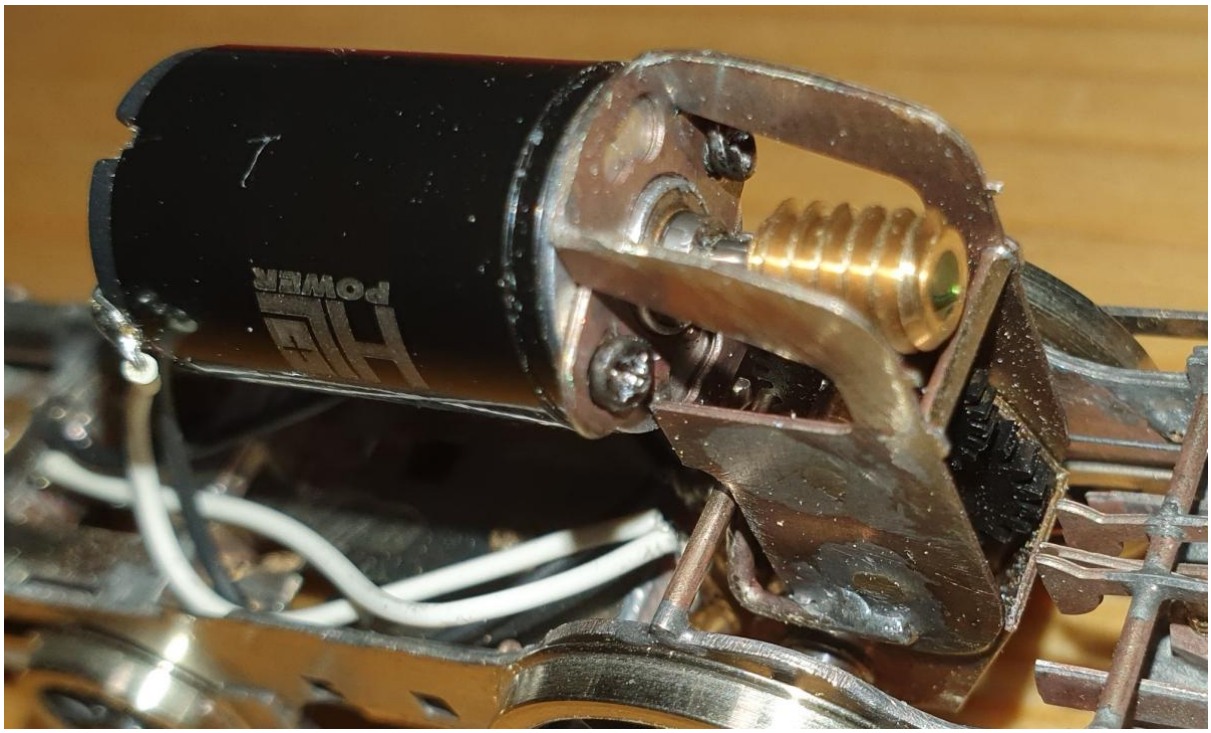
As can be seen in the above photo, the axles on the test build were slotted with a piercing saw. This was to help allow the wheels to be pinned. The slot was used as a guide for a small drill through the wheel centre, and then glue a piece of wire in once happy with quartering and running qualities. This isnt completely necessary, but a belt and braces option.



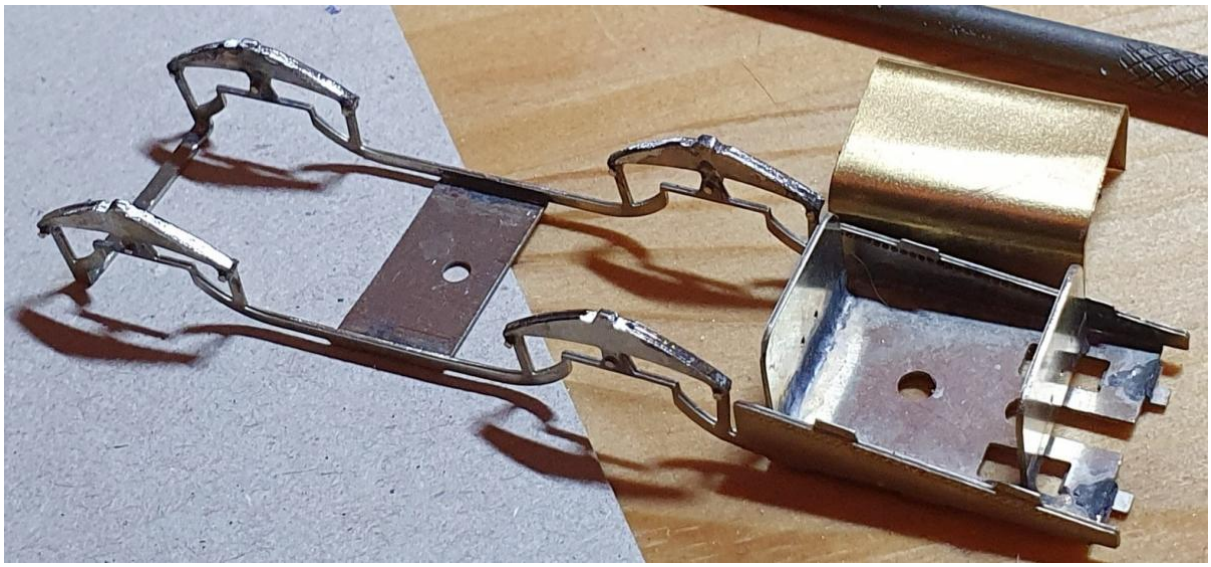
A torque reaction arm was also fitted to the gearbox. Using the RoadRunner+ (not compact) gives room to fit this underneath the motor, with a rod across the top of the mainframes. Both the L shaped piece added to the side of the gearbox and the cross shaft are 1mm nickel silver rod.



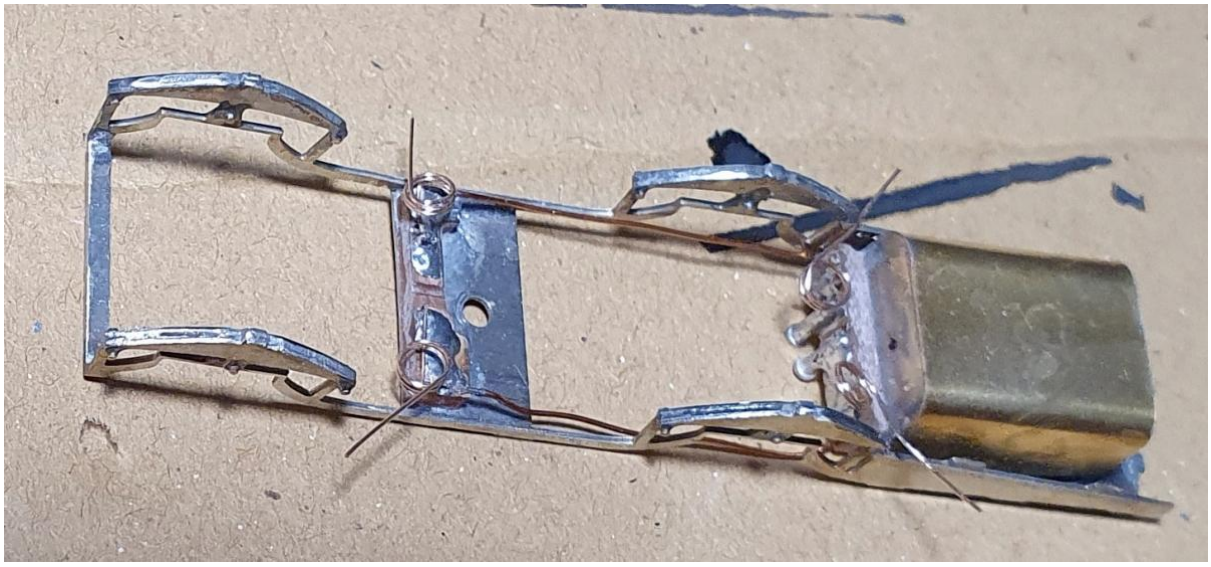
This gearbox is pushing the limits of the space, but it fits well in the round topped firebox version but does need the top corners of the gearbox rounding off to follow the curve of the motor.



7 - Remove the keeper plate (13b or c depending on gauge) of choice from the fret. Push out the rivets on ashpan sides and add the driving wheel spring overlays (14). The latter can be aligned using 0.4mm wire through the holes. They will need to be on the outside of the keeper plate when folded up so make sure they go on the side without the fold lines. Fold up keeper plate into C shape and fold down the two ashpan formers. Fold over the two tabs on the spacer at the ashpan end through 180° with the fold line on the outside and solder in place. Check against chassis. The two tabs at the back locate the keeper plate in the rear frame spacer, then use 10BA bolt to fasten to the nut soldered to spacer 5.



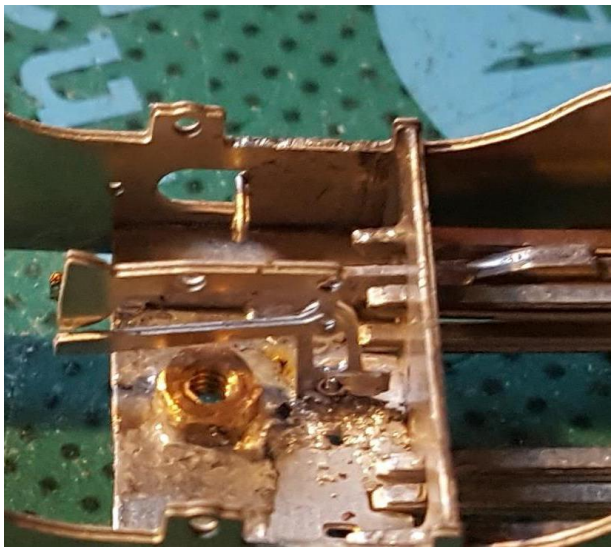
An ashpan can be created from 0.005” brass or similar. You will need a piece 19.5mm x 27.5 rolled to shape. Note that the GA drawing (as per ref 1 page 27) shows the brake pull rod pivot going straight through the ashpan(!). There are photos to suggest that this is how they were built, but there were different variations of ashpan implemented over time. On the test build the rear face of the ashpan was moved inboard and a curved ashpan rear created from plasticard. There has also been a discussion on the Scalefour Society Forum on the workbench topic of the Craftsman build by ‘MarkS’. As always, check your prototype.



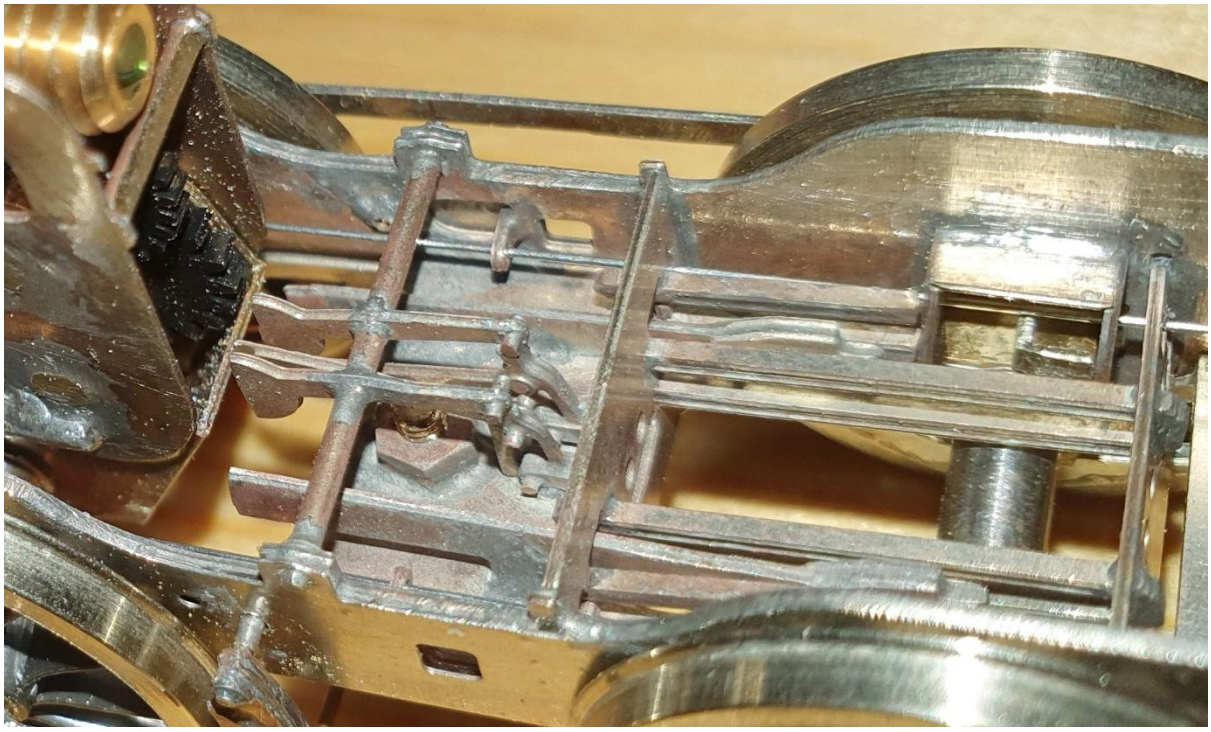
There is a little depth on the keeper spacers to locate pcb for attaching pickups to. You can get very thin PCB sheet from Eileen’s Emporium. It’s listed under their miscellaneous section. I fitted pickups to the spacer for the front driving wheels and to the front of the ashpan for the rear driving wheels, each on a PCB strip.

Also, as can be seen on the ashpan PCB, are two Harwin PCB sockets H3191-01, which accept 0.5mm wire (or a lace making pin) which allow for modules to be plug and play (see photo on page 11 of the motor wiring harness).

The two PCB trips are connected together with enamelled wire. Pickup coils are wrapped round a 2mm rod (spare bogie/tender axle) slotted with a piercing saw. Pickups are 0.254mm/33SWG phosphor bronze. 1mm rod was used to form the coils on the bogie pickups.

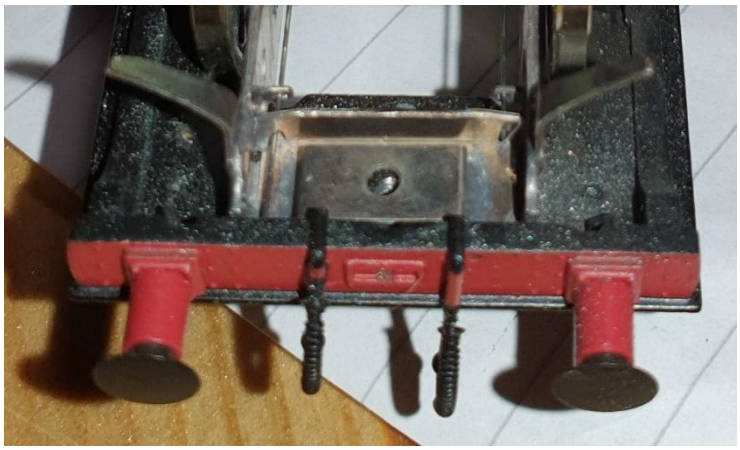


8 - Next attention turns to the valve gear (15 & 16). Note the parts are marked LHS and RHS as there is a correct side for each set. Do one set at a time. Each part folds double with the middle fold line on the outside of the fold and locates into a slot in frame spacer 5. Valve gear eccentrics (15) go in the middle, valve gear connecting rods (16) on the outside. RHS and LHS are viewed from the top of the chassis looking from the rear. Solder 0.5mm wire in place before fitting to resemble the joints and a reversing shaft from 0.8mm wire can be added to the eccentrics and frame spacers once fitted. Also fit the reverse rod crank (37) to the right hand side of the reversing shaft.



9 - Remove the frame overlays (17). Press out half etched rivets on the back and fit to chassis. Use 0.5mm wire through holes for brake hangers and 1mm wire through holes for brake shaft to align. Shape guard irons and add brake hanger overlays (18). Note these come in pairs to go each side of the axle. Also add brake shaft bracket overlays (19).

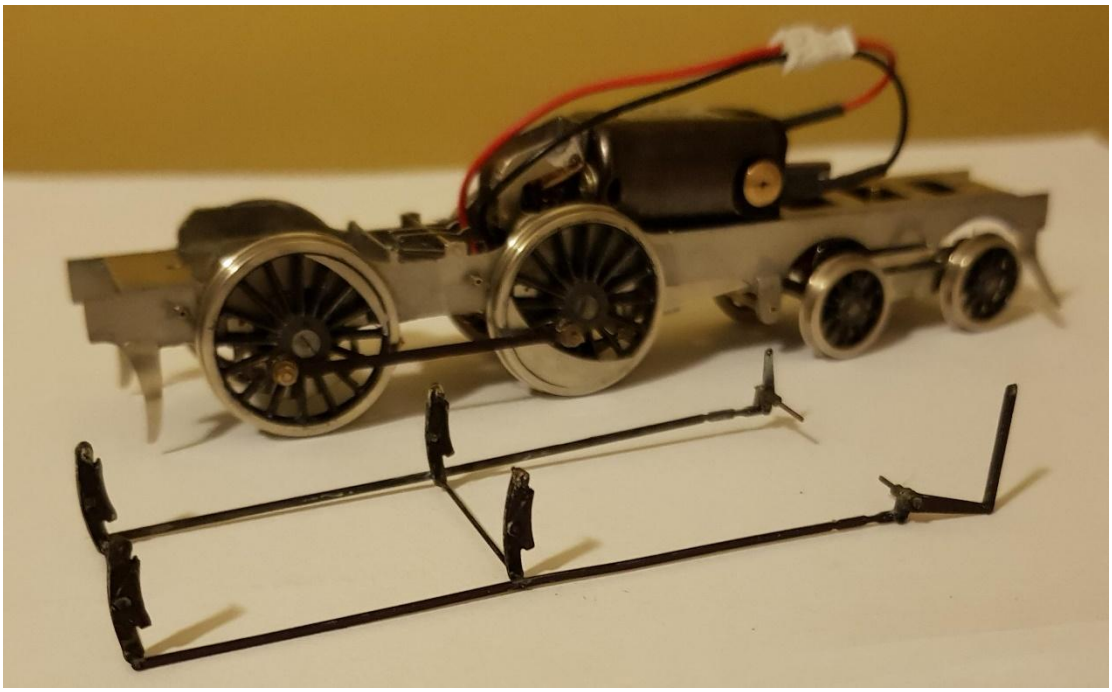
The front body fixing bracket (35) folds up into a C shape and fits into the slots in the chassis from the underside.



Remove and fold up the rear body fixing bracket (36). The part is designed to concertina together and both fold lines are through 180° with the fold lines on the outside. The 3 middle holes should be used to align the bracket with the rear of the chassis where it sits on top of it.

10 - Next make up the brake gear. All holes use 0.5mm wire except for the brake shaft which uses 1mm. Laminate the brake shoes (20) together. Fit wire in centre holes to resemble a rivet. Fit to chassis using wire. Fit brakegear link overlays (22) to brakegear links (21) and fit to chassis.

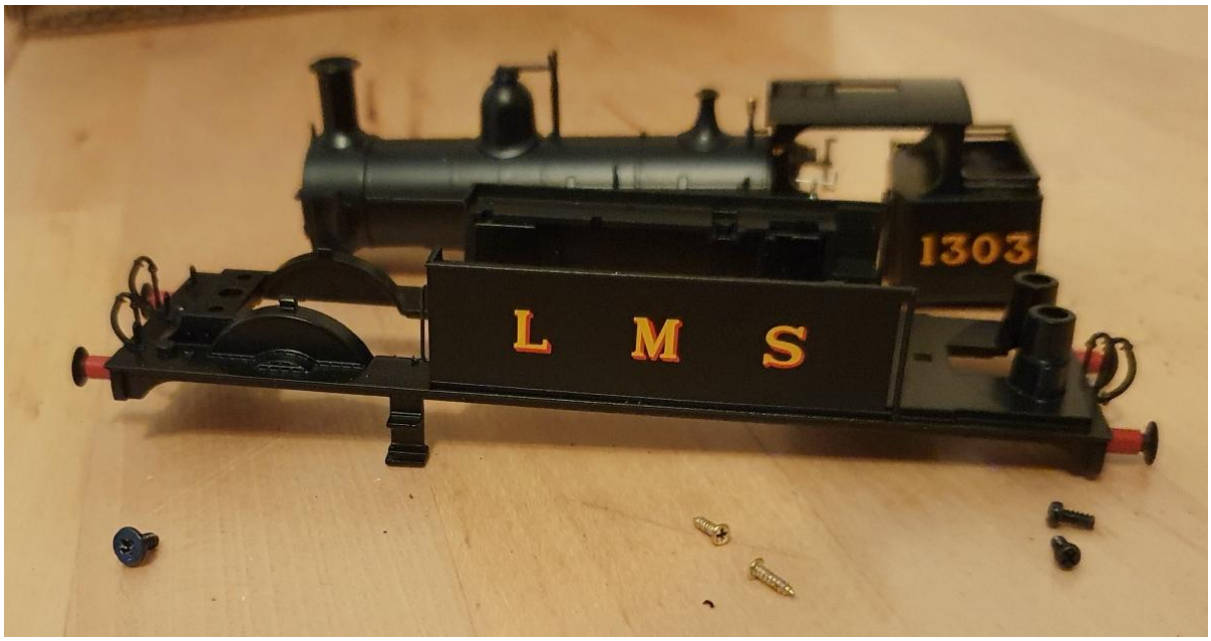
The test chassis was built with 0.5mm ID tube in the frames, and wire stubs in the brakegear assembly, so that it can be clipped on and off as required for maintenance, painting, etc (Photo from Craftsman build, same concept used this time)



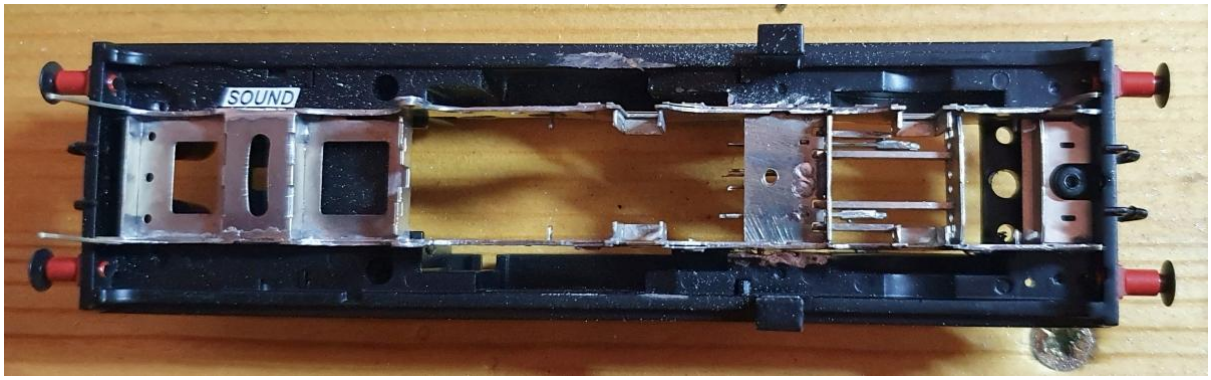
11 - Fit a brake shaft made from 1mm wire, or tube along with appropriate steam brake crank (23) (various positions and can be fitted to either side - check your prototype) and hand brake crank and link (24). The latter fits to the LHS. Folds the part double with the fold line on the outside and use 0.5mm wire to represent a rivet.

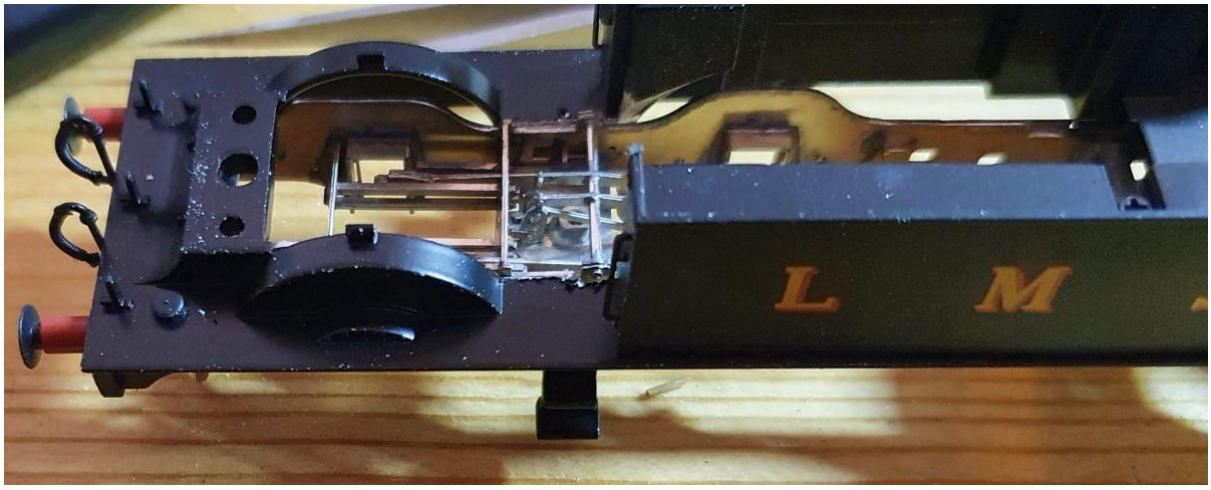
Body Modifications

The boiler/tank tops and cab can be unscrewed from the footplate/tank sides unit. While this isn't completely necessary it helps make the boiler bottom joint line up and makes life easier to keep things clean while opening out the splashers.



The splashers will need opening out to clear the wheels. Use a slitting disc in a minidrill/Dremel. The footplate also needs filing back behind the splashers to allow the frames to fit between them.

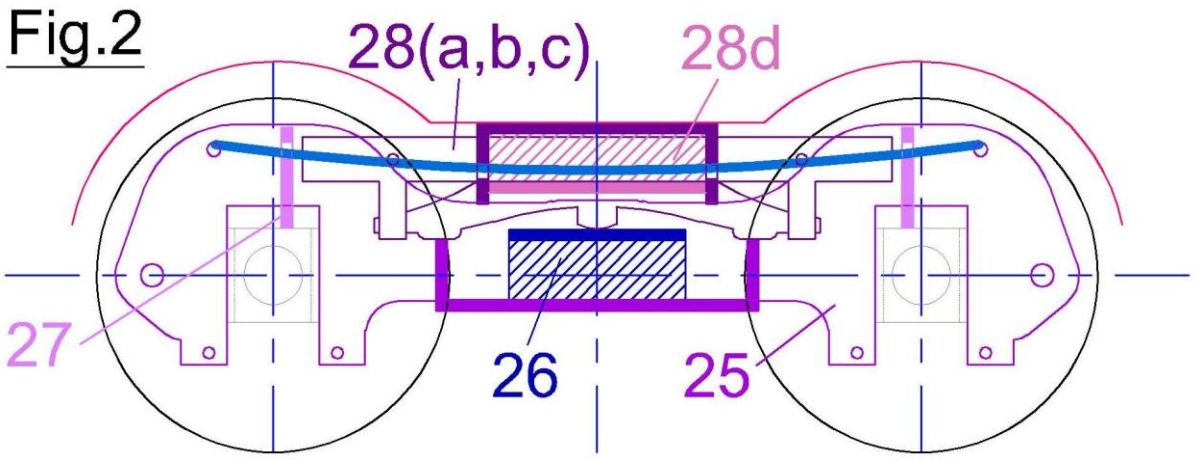




I added a roll of 1.6mm lead sheet into the boiler, and 3 sheets in the tanks. There is room for more if required in the ashpan and bunker, but these options don't put it in an ideal location for adhesion. Check the fit of the 3D printed boiler bottom. This can be painted before fitting if you want.

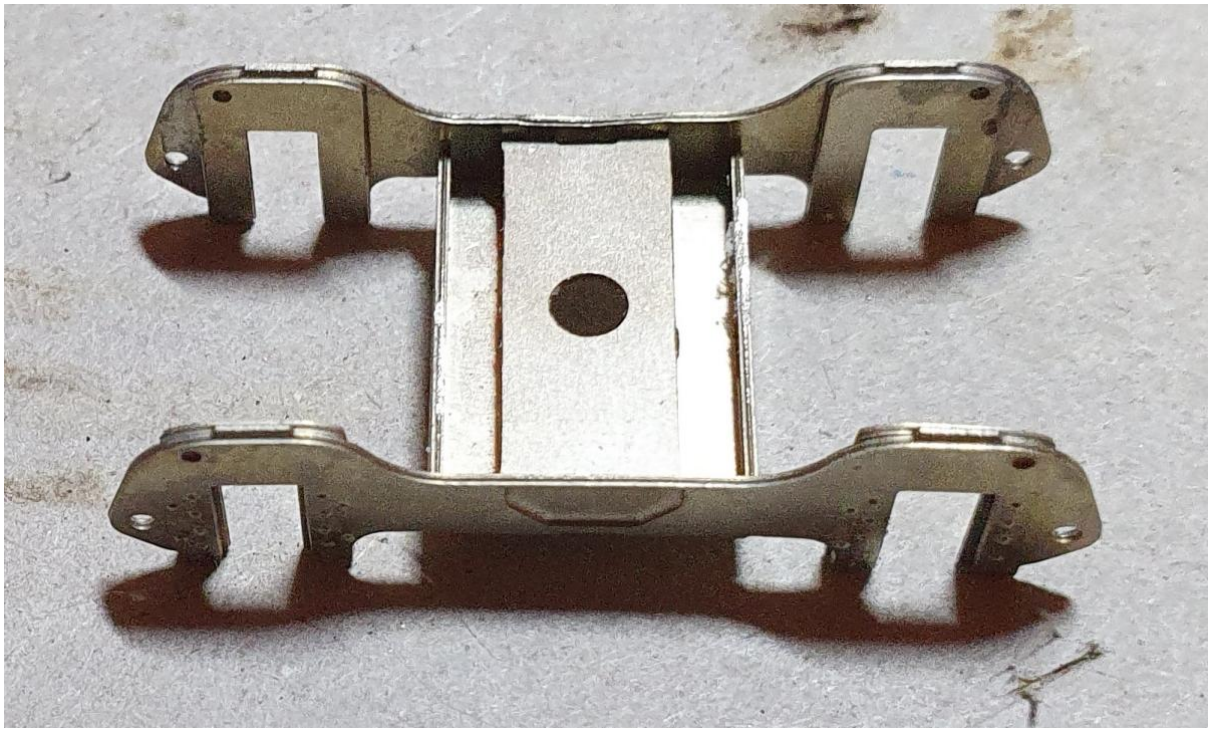
12 - Attention can now turn to the bogie. Refer to Fig.2 below and the images as you go along.

Fold out spring carrying tab on the bogie wheel spring carriers (27) and fit to 2mm Miniblox. Note the tabs are handed and tab with the small hole in for the spring wire will go on the inside of the bogie.

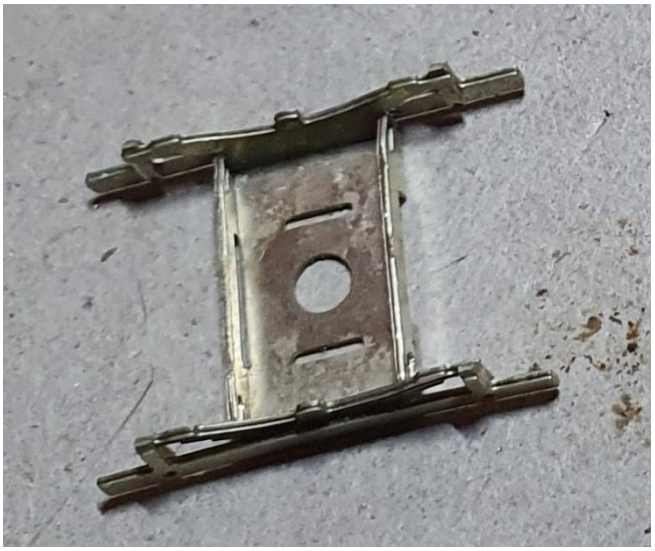


Press out the rivets on the bogie frame (25b or c depending on gauge). Check the fit of bearing making sure they are in the correct position with the tabs on the outer ends. Adjust if necessary. Fold over the four bearing guides and solder in place with 0.5mm wire in bottom pair of holes to accurately locate them and to resemble bolts. Note that the single hole on each 'hornguide' in the top outer quadrant is for retaining the spring wire. Do not fill. Fold up the rest of bogie. It will form a C shape with vertical uprights either side of central spacer. Solder 0.8mm wire in place at ends of the bogie to act as cross stays.

Fit the bogie frame spacer (26b or c) to the bogie using the slots on the bogie and tabs on the spacer. The spacer will fit within the fold up bogie rather than on top of it. Solder in place.

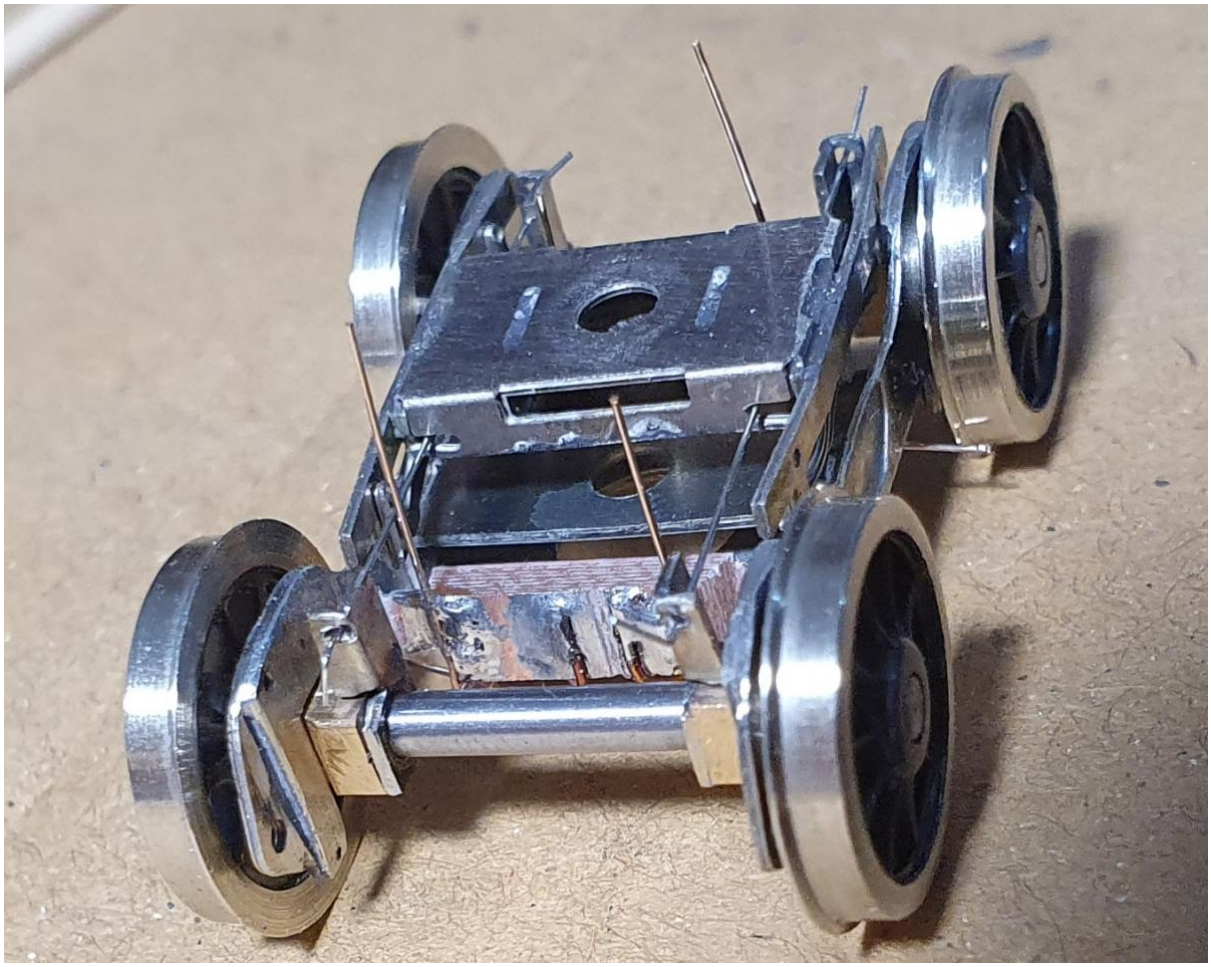


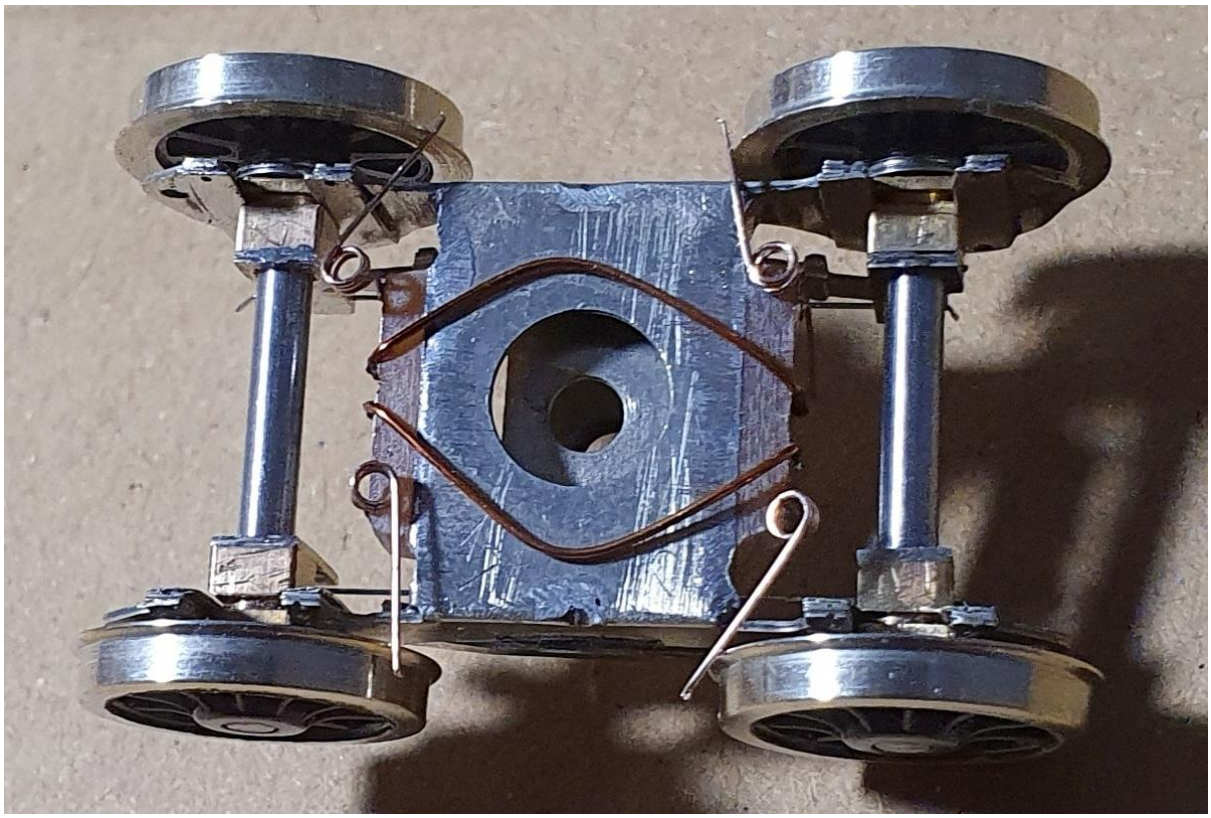
Fold up bogie bolster (28b or c) and add its frame spacer (28d). The eight short fold lines around the central rectangle with the hole in are through 90°, the other four are through 180° with the fold line on the outside. Solder together with 0.5mm wire through the holes in the cosmetic 'compensating beams' to resemble bolts.



To assemble the bogie, make two long L shaped springs from the smaller spring wire approximately 26mm x 1.5mm. Fit hornblocks to bogie frame making sure they are in the correct place. Place the bolster on top of bogie. Fit spring wire through hornblock then bolster then hornblock on the other axle. Fit short tail of spring into hole on bogie frame mentioned earlier to retain the spring wire and stop the bogie coming apart.

Fit the wheels. Bogie wheel washers (29) are included to remove any sideplay if required.





13 - Fitting the bogie.

One end of the bogie link (30) has a 2mm hole and the other a 2.5mm hole. Into the 2mm hole solder a 2mm pin point top hat bearing.

Remove the keeper plate and fit the bogie link with the top hat bearing facing upwards. Slide the part in through the rear ashpan former then bend upwards and locate into hole in rear keeper plate spacer. Once the keeper plate is refitted the bogie link should stay in place.

Form a pin and retaining bolt for bogie. Use an M2 bolt with 4.5mm length of 2.5mm x 2mm tube solder over the thread for the pin. Solder a bogie retaining bolt washer (31) to an M2 nut for the retainer.

Fit bogie to bogie link. There are slots in the bogie bolster to receive the link. Refit keeper plate. Fit the sleeved retaining bolt. This passes through bogie frame then bogie bolster, bogie link and finally the frame spacer. Use the nut with washer soldered to it to retain.

Side control springs can be used, fitting them through holes in ashpan formers on keeper plate with them acting on bogie pivot shaft. No idea on gauge of wire!

Fit the 3D printed bogie detailing. There are 3 parts to this which should be arranged as per the image alongside. The circular parts go under the bogie and should line up with the two small holes. The other tow parts are L shaped brackets with reinforcing ribs, one of which has a cylinder attached to it. The bracket without the cylinder goes on the bogie and will fit in the half etched outline on the side. The bracket with the cylinder is fitted to the frames immediately its cylinder less partner. Make sure there is clearance for the bogie to move.

14 - Sundries

If you haven't fitted the balance weights (32) then do so now. They should be arranged as follows. The front wheel is shown as per the left hand side. The right hand side should be a mirror of this.

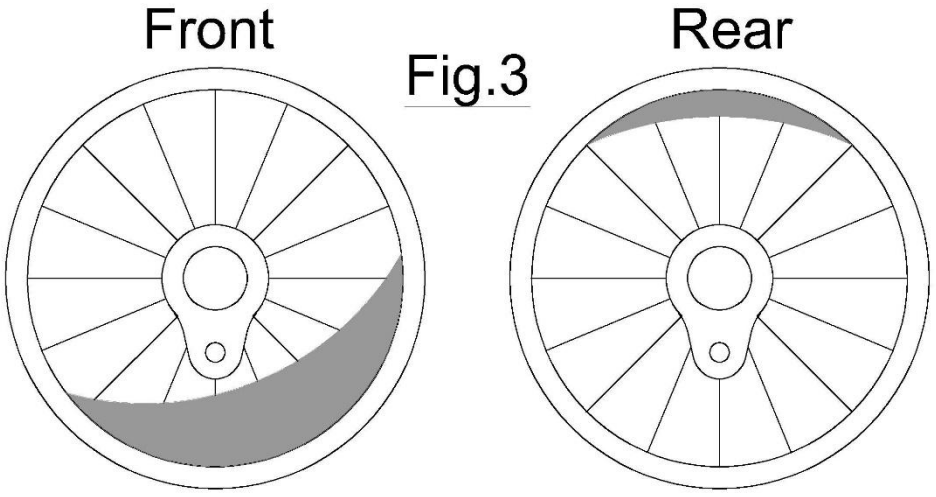
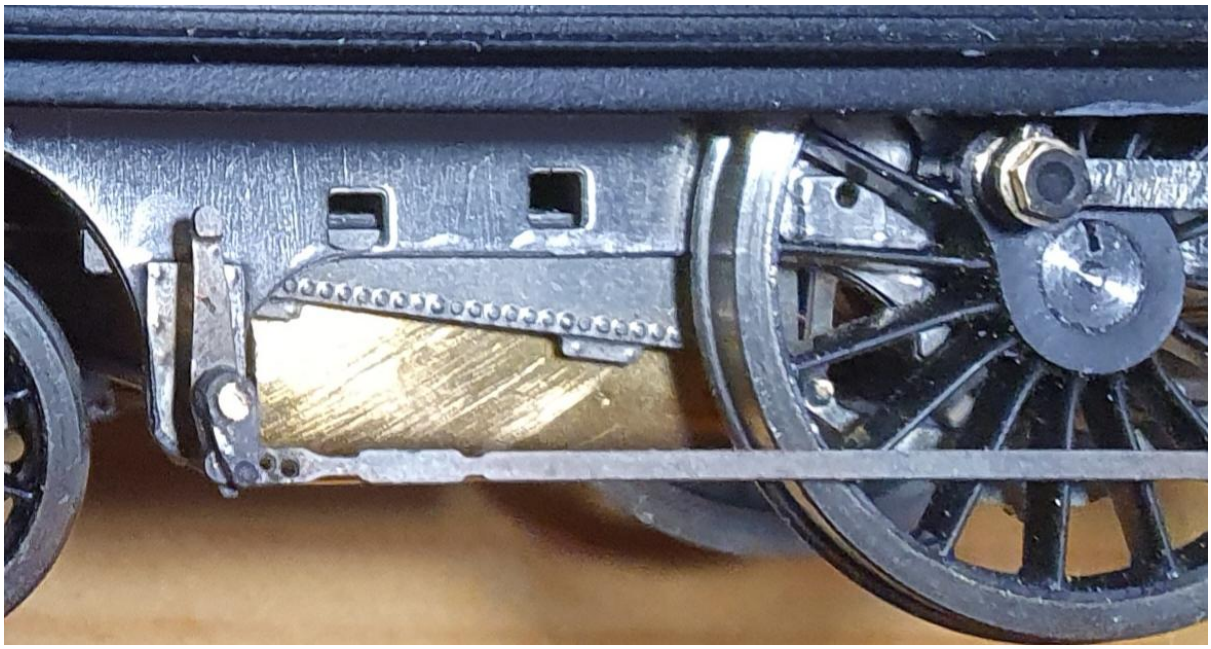


Fig.3

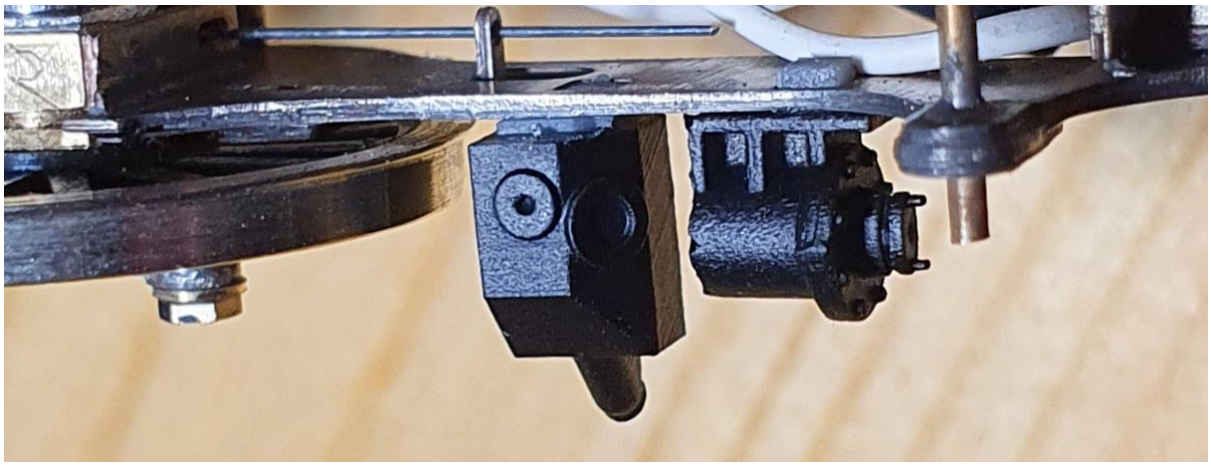
Coupling hooks (33) are included. Fold double, solder together and glue in place.

Boiler sheeting clamps (34) are also included These are for round top boilers only and you should find a good image of the prototype for their position.

The 3D printed sandboxes have a square peg on the back which locates into a square hole in the frame. The peg may need dressing with a file to make sure the fit is good. If you are building an EM chassis there are front and rear sandbox spacers (38a and b) which should be fitted between the sandboxes and the frames to make them sit a little wider. Make sure the inside edge is flush after fitting, otherwise the rear ones could collide with the ashpan/keeper plate and the front ones interfere with the CSB wire.



The brake cylinder also has square peg on the back which fits into a square hole in the frames. Again, dress the peg if necessary. Note that there are different mounting options for the brake cylinders so check your prototype. Some were mounted horizontally, some vertically. The peg on the back of the brake cylinder has been designed so that the brake cylinder is in the right place whether fitted vertically or horizontally. Again, if building in EM, a brake cylinder spacer (38c) is included to allow the part to sit in a more prototypical position.



Note that I sprayed my 3D prints with black primer prior to fitting them. This shouldn't be necessary if the chassis will hit the paint shops reasonably imminently after building. This being the test model may stay otherwise unpainted for use on the display stand for a while.

Pete Tarver & Justin Newitt - June 2022