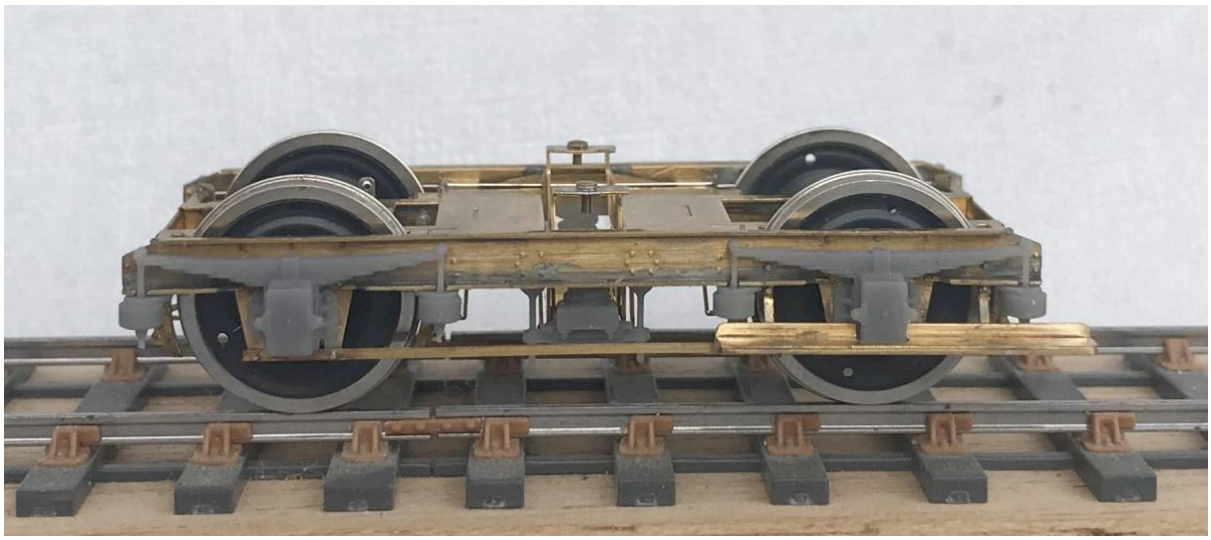
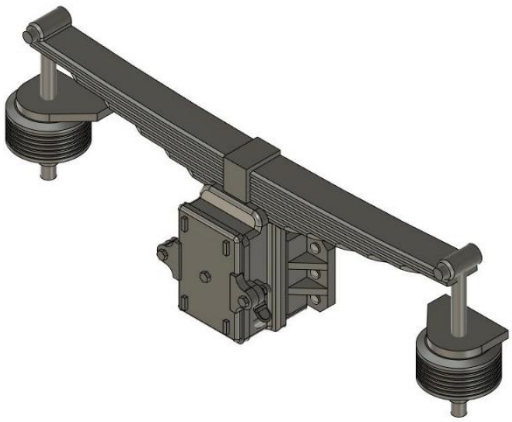
LMS Riveted Coach Bogie Instruction

Introduction

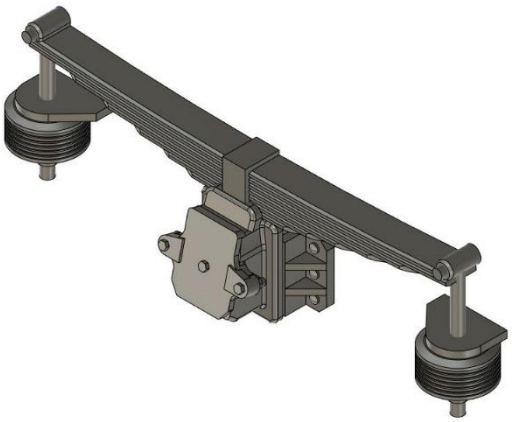
This kit covers the Rumney Models kit E.110A and E.110B. These are designed to build into a complete, fully sprung model of an LMS riveted coach bogie. They were the standard LMS coach bogie until the introduction of the welded version in 1935 from which point both types were used. The difference in the two kits lies solely in the axleboxes. E.110A includes flat, vertical platefront axleboxes and E.110B an earlier smaller sloping platefront box. The later seems to have been fitted initially to only period 1 stock with the former fitted to everything else though I'm not sure the crossover was that distinct. The kit covers both dynamo and non-dynamo bogies, and guard irons are included for motor trailers. Provision is also made for variations in footboards.



E.110A - Later Vertical Axleboxes



E.110B - Early Sloping Axleboxes



Notes

Read through the instructions first and familiarise yourself with the components. Drawings and photographs taken during the construction of the test etches are included to attempt to make my waffle clearer. Note that not every single photo may be of this particular kit, but suitably illustrate the item in question. Parts are numbered on the fret and I've tried to do this in build order.

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 the springs still feature very thin wires in the form of the damper hangers and should therefore be handled with care. The springs and axleboxes have a bar printed with them to avoid the hangers getting broken. This bar should only be removed when fitting. Parts have been left on the supports they were printed with to help prevent damage to them before use. They will need removing from the supports and cleaning up. When removing them from the supports and cleaning them up please note the following:

- The springs have a spigot on the back above the axlebox. This is for to help aid location. Be careful not to cut it off.
- Parts should be removed from the supports using a pair of flush cutters or a piercing saw with a fine. Only use flush cutters, one side of the blade needs to be straight, so it makes a |/ shape. Cutters where each blade forms a \/ rather than being completely flat on one side should be avoided as they may cause damage. I tend to use a piercing saw.
- If using cutters, the place to cut them is right against the printed part. This is the designed in weak point. Avoid the temptation to cut the supports away from the printed parts as this may damage them. If using a piercing saw, then the closer you cut to the part the less you will need to clean up. Be aware of the following point though:
- 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.
- The material does not cut well with a knife blade. Whilst not so brittle that it will crack as soon as look at it, it is likely 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 or a cutting broach. Smaller holes for things such as brake lever guards and door springs will almost certainly appear as an indentation rather than a hole.
- Please dispose of the waste support material responsibly. It cannot be recycled.

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.

Etches

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 unless the instructions tell you different.

Everyone has their own soldering methods. I now 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 wagon:

- A selection of drill bits including 0.3mm, 0.5mm, 0.85mm, 1mm, 1.45mm and 2mm
- A selection of tapered reamers in the range 0.3mm-1mm
- A smooth jawed vice
- A selection of needle files
- A piercing saw with fine blade and/or a pair of flush cutters
- Wet and dry paper (800 or 1200 grade)

Technical

The coach bogies are designed to be built fully sprung with both primary (wheels to bogie) and secondary (bogie to bolster) suspensions arranged by steel guitar wire ‘leaf’ springs. The suspension is designed to provide 0.42mm deflection on both the primary and secondary springs using 0.009” guitar wire with 180g total load. The primary suspension is arranged in individual springs that are soldered to the spring carriers in which the wheel bearings sit. For this you will need a suitable flux. I use Carr’s Black label. Secondary springs are arranged on the two point contact between two simple supports principle and are simply fitted into place.

If your coach weighs significantly more than 180g then you should consider using 0.010” steel wire for the primary springs but leave the secondary springs at 0.009”. Suitable guitar wire should be available from your local music shop.

Ride height of the coach can be adjusted using pads mounted on the coach underframe. This is covered towards the end of the instructions.

Materials list

Spring wire and pins to act as a bearing point between bogies and body are included along with the 3D prints but you will need to obtain some other items to complete.

Your favourite brand of 3’7” wheels are of course required. I use Exactoscale wheels but Alan Gibson, Ultrascale or Branchlines will also suit. Note that Branchlines wheel are a scale 3’6” whereas the others are 3’7½” (14.5mm) despite what the labels may say.

Pinpoint bearings will be needed. I use Alan Gibson as their waisted ones are nice and deep.

The following sizes of wire will be needed. Eileen’s Emporium is a good source for these, and they do mixed size packs if you don’t want huge quantities of one size.

0.31mm	Brakegear/tiebars
0.5mm	Sideframe overlay location
1mm	Fret location pins

Steps (where required) are designed to be constructed from 3mmx1mm brass angle in conjunction with the etched parts. Again Eileen’s Emporium are a good source for this.

Bolts, nuts and tube will be needed to fix the bogie to the body. There are two options:

- M2 bolts and nuts + 2.5mm outside diameter, 2mm inside diameter brass tube

or

- 10BA bolts and nuts + 2.5mm outside diameter, 1.5mm inside diameter brass tube

I dislike using screw threads as a bearing surface hence the tubing.

Contact details for the above suppliers can be found below.

Eileen’s Emporium (brass wire, brass angle, tube, nuts and bolts)
Unit 19.12 Highnam Business Centre
Newent Road
Gloucester
GL2 8DN
www.eileensemporium.com

Alan Gibson (Pinpoint bearings)
PO Box 597
Oldham
OL1 9FQ
www.alangibsonworkshop.com

Etched Parts List

1 - Main bogie frame
2 - Solebar overlays
3 - Step hanger backing
4 - Sideframe bottom angle

5 - Inner brake shoes
6 - Bolster guide

7a - Top plate (inner end)
7b - Top plate (outer end)
8 - Inner end for dynamo bogie
9 - Dynamo belt cut out overlay
10 - Corner plates

11a - Internal frame longitudinal angles (inner end)
11b - Internal frame longitudinal angles (outer end)
12 - Internal frame cross angle
13 - Bolster safety loops

14 - Outer brake shoes

15a - Brake rigging (inner end)
15b - Brake rigging (outer end)
16a - Brake rigging overlays (inner end)
16b - Brake rigging overlays (outer end)

17 - Tiebars
18 - Spring carriers
19 - Bearing washers

20 - Bolster

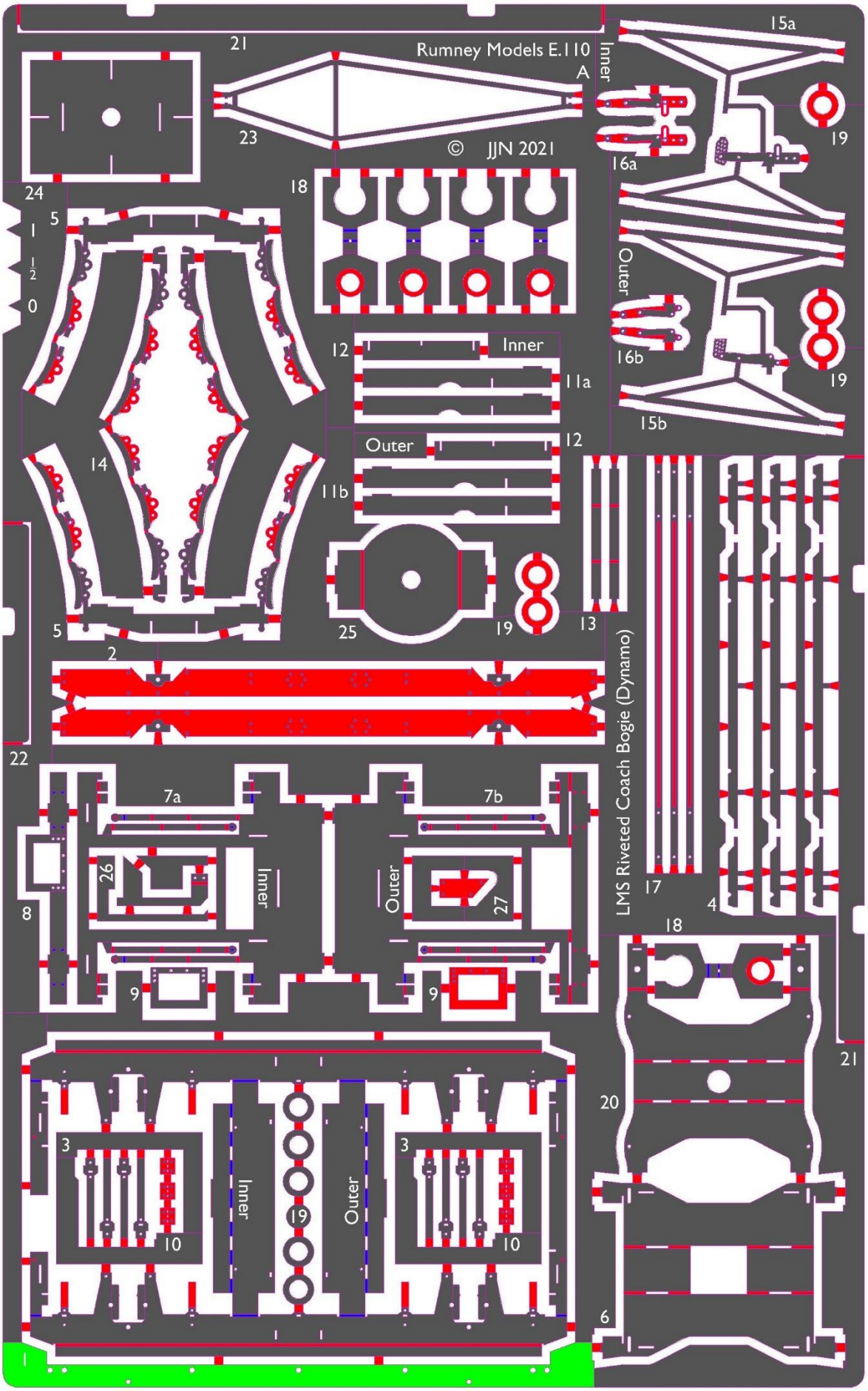
21 - Outline for long footboards
22 - Outline for short footboards

23 - Top brake links

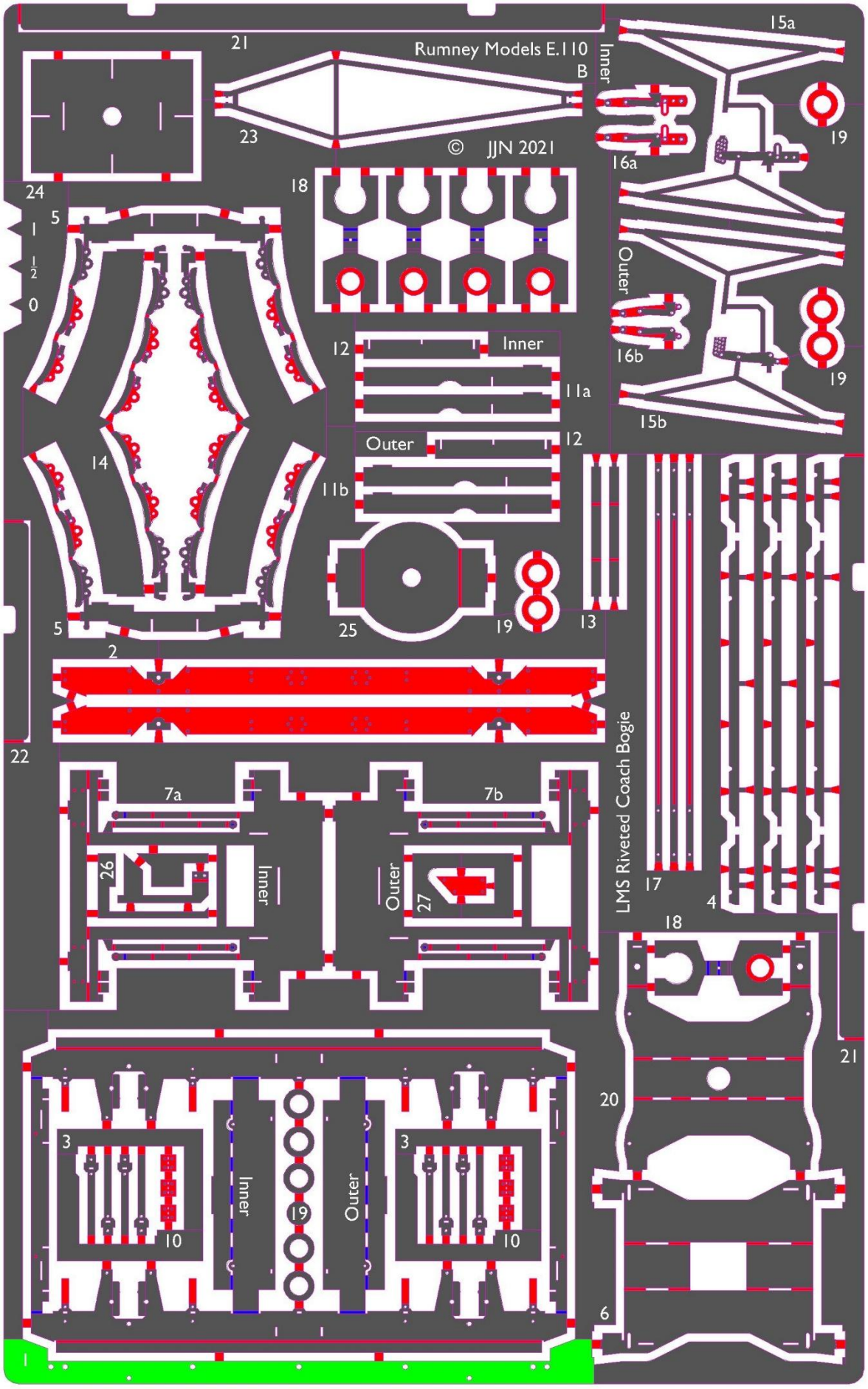
24 - Bogie pivot plate
25 - Pivot locating plate

26 - Guard Iron
27 - Guard Iron overlay

E.110 Fret A - Dynamo Bogie



E.110 Fret B - Non-dynamo Bogie


Rumney Models E.110
B
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LMS Riveted Coach Bogie
Inner
Outer
21
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18
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14
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11a
11b
25
19
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15a
16a
15b
16b
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7a
7b
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1
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10

Construction

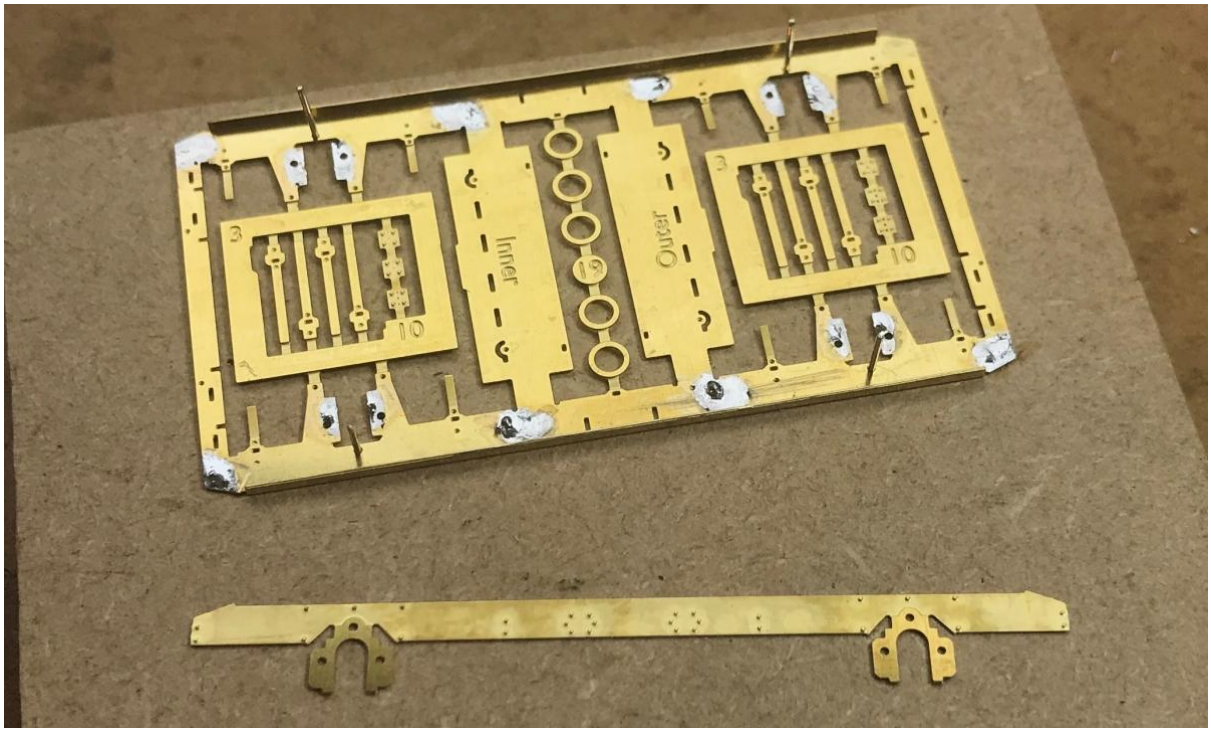
Much use has been made of pins to align the various parts during assembly. Some of these pins need to be inserted into a block of wood or piece of mdf as part of the construction process. You will therefore need a flat piece of wood or mdf to act as an assembly jig. I use a small piece of mdf.

Main Bogie

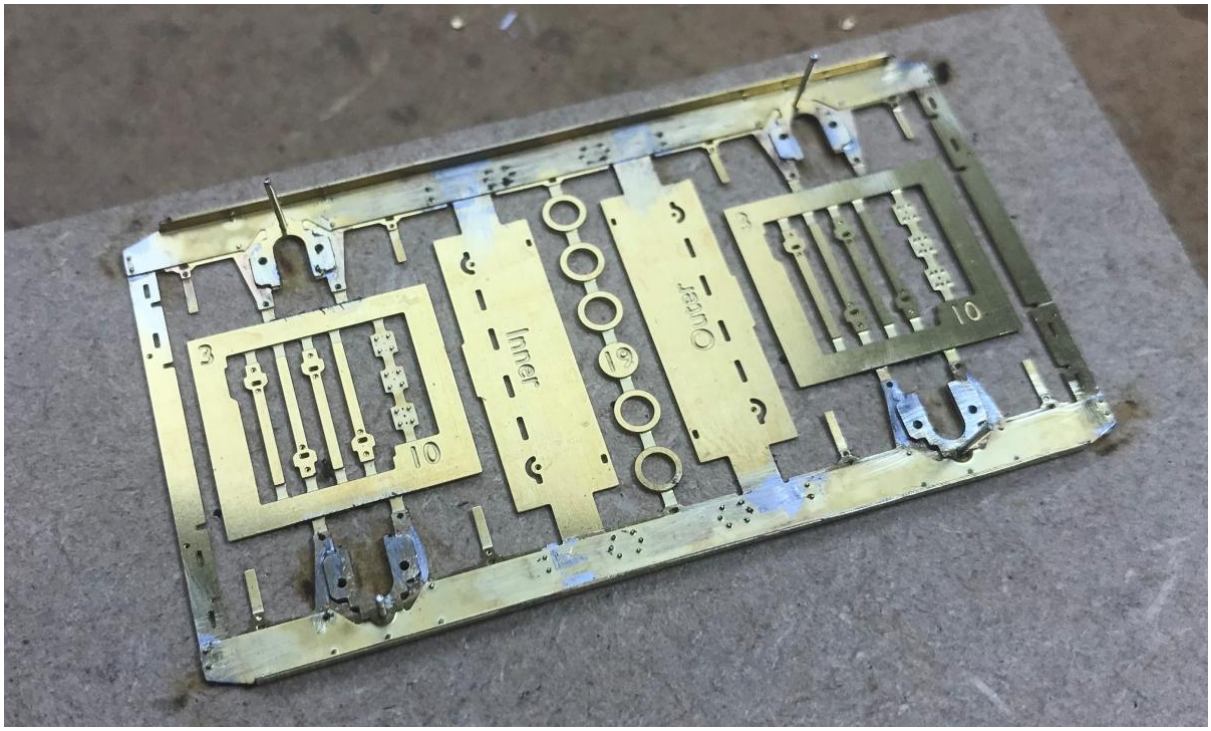
Start with the main bogie frame (1). Make sure all the small holes can accept 0.31mm wire and remove from the fret. Don't remove the small frets contained with the bogie frame at this time. The main bogie frame needs to be folded along the two longer outer edges. The two folded sections will form the top of the solebars. Clamp the main bogie frame in a vice or similar to make the folds. See image below. Do not fold any other parts at this time.

Note the four holes above the axleguards. Use the main bogie frame to drill four 0.5mm holes into your piece of wood or mdf. Use lengths of 0.5mm wire with the ends chamfered to pin the main bogie frame to the wood or mdf with the writing visible. See image below.

The four 0.5mm 'pins' will be used to locate the solebar overlays (2). These differ from the test etch in not having the outline of the axlebox on them. You will need to solder the solebar overlays in place and so may want to tin the areas where the solebar goes. Take care not to fill any small holes with solder.

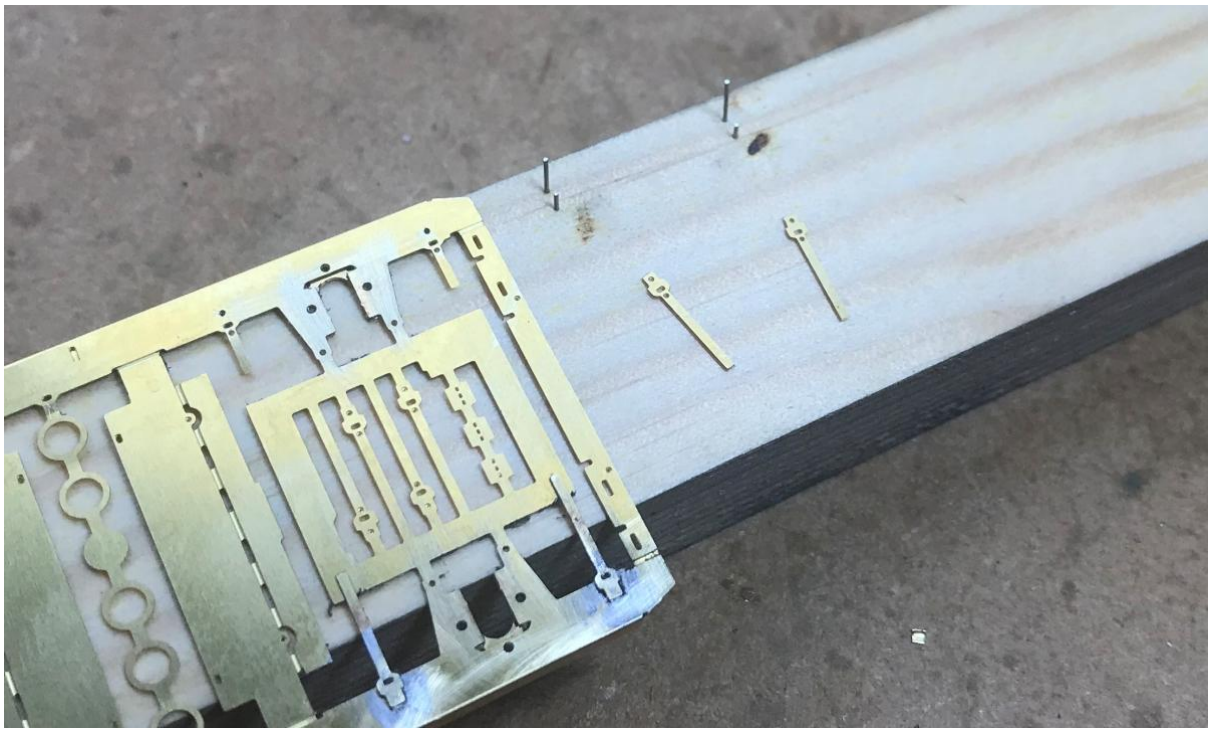


Locate the solebar overlays in place using the 0.5mm wire pins and solder in place. Don’t solder the pins in place though, they will need to be removed and the holes used again.



Step Hangers

Before continuing with the assembly of the bogie frames the step hangers need to be sorted out. The steps on these bogies varied so you will need to check your prototype to see if you need any and what the arrangement is (amongst other things). The main bogie frames are labelled inner and outer to help with where you need to fit the steps. Inner and outer refer to the coach overall, so outer is the bit where the buffers are.



The hangers are designed to use one and a half layers of etch to give them some strength. This means and amount of work, sorry if you're modelling period 1 coaches with full length footboards. The half etched payer is already attached to the main bogie frame but the full thickness step hanger backing (3) will need to be located in place. If you turn the main bogie frame over you will note a pair of small holes above each of the step hangers (there will also be a small rectangular slot which we will come to later, the holes are the thing to concern us at the moment). You need to drill these holes 0.31mm through the solebar overlay so that the step hanger backing can be pinned in place. Only do this where you will need the steps.

Find an offcut of wood that will fit in between the folded down solebar tops and drill pairs of holes for each step hanger into the wood. See image above. Insert 0.31mm wire pins into these holes and locate the main bogie frame on top of these pins. You may find it easier to locate the main bogie frame with just one pin and then the other can be added afterwards.

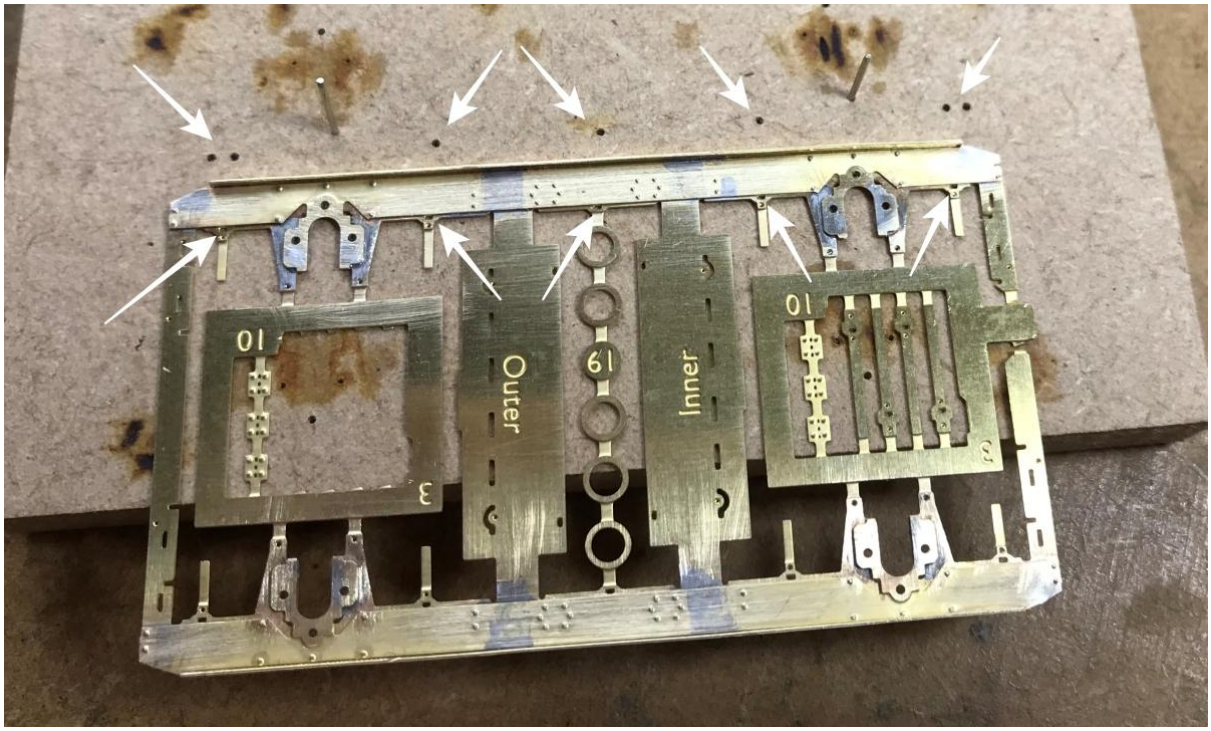
Once the main bogie frame is located on the pins the step hanger backing can be added. Solder in place (including the wire 'pins'). Make sure the step hanger bracket is soldered to its half etched counterpart and then cut and file the 'pins' flush with the back.

Remove the main bogie assembly from the wooden holding jig and turn over. Trim the front of the step hanger backing locating pins so that they resemble bolts.

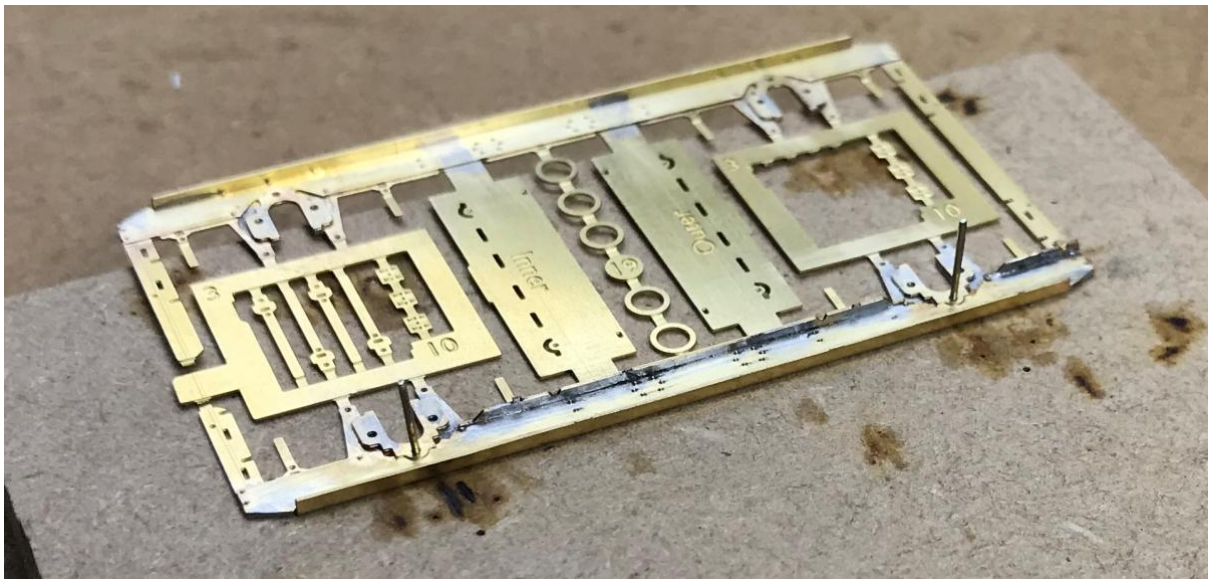
Completing the Solebars

Next the bottom of the solebar channel needs to be added. The solebar bottom channel (4) comes in three parts and is designed to be located in place using tabs and slots in the main bogie frame. In order to do this you will need to add some holes to the bogie assembly jig you made earlier or make a new jig so that the solebar bottom channel can sit flush against the main bogie frame. I could have made the locating tabs shorter and avoided this but they then would have been a nightmare to fit.

There is a drilling jig on the fret to help drill the holes. This is the area shaded green in the parts diagram. There are 7 holes in a row and another two offset. The two offset are etched 0.5mm and are designed to take the 0.5mm pins used to locate the solebar overlays in place. Drill the 7 holes in a row 0.6mm. Fit the main bogie assembly in place on the jig using the 0.5mm wire 'pins' so that the 0.6mm holes drilled in the wood or mdf correspond with the small rectangles etched along the bottom of the solebars. If this is not clear hopefully the picture below will make it so.



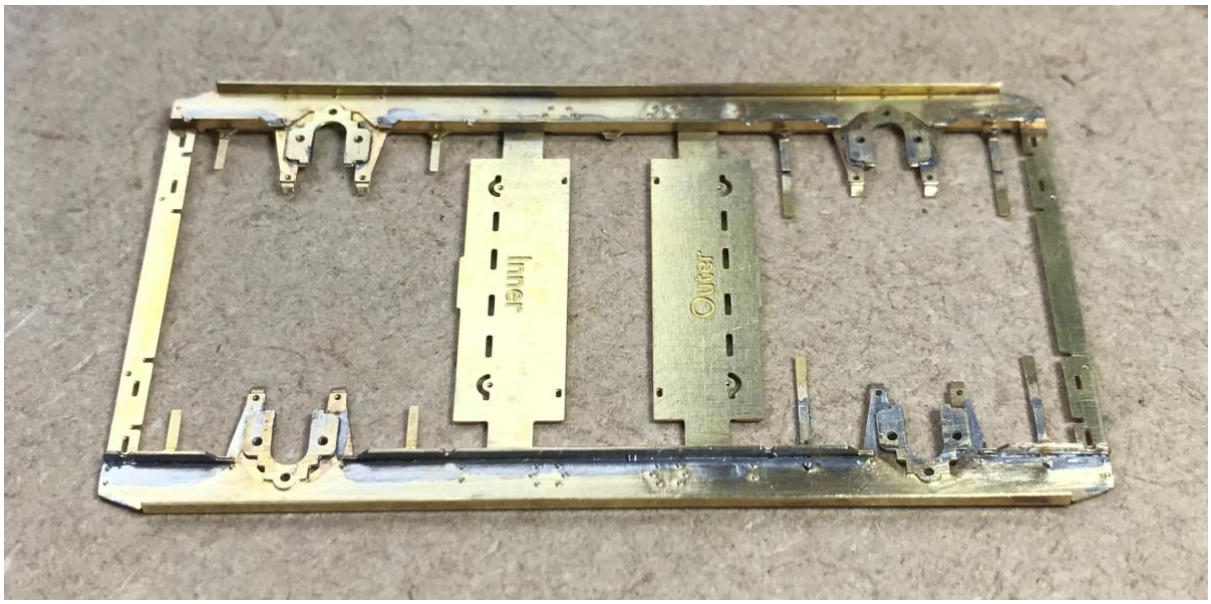
The solebar channel bottom can then be fitted and soldered in place using the tabs and slots for alignment. Make sure the solebar bottom channel is fully home and square to the solebars sides. The longer section goes in the middle and the shorter ones to the outside.



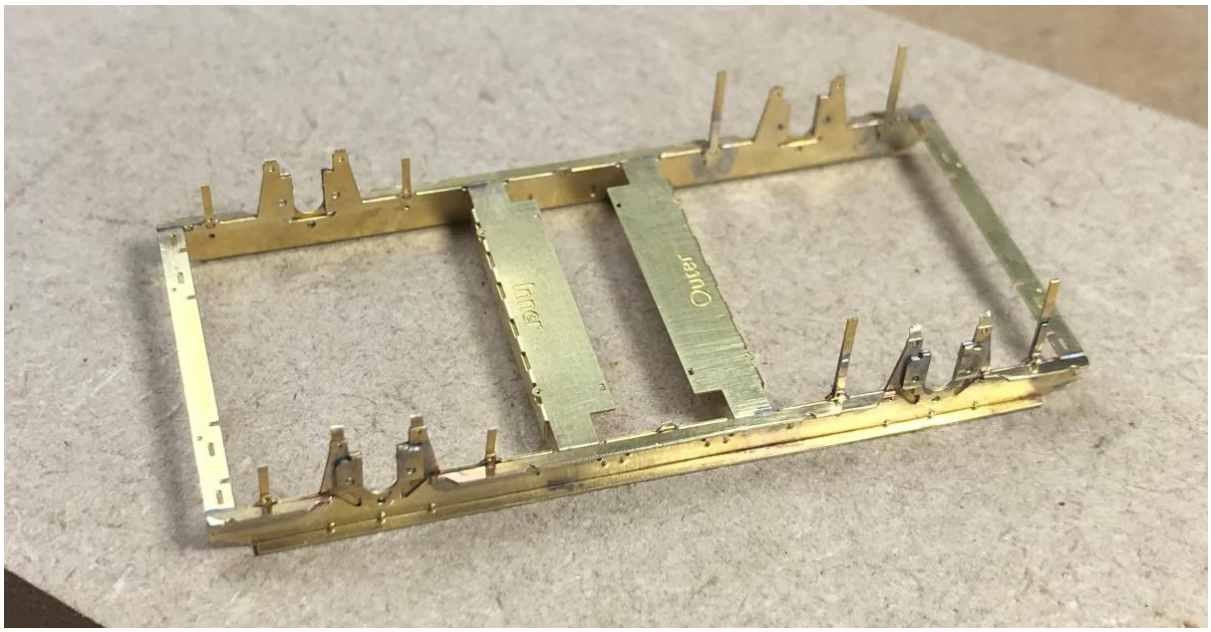
Once all the solebar bottom channel parts have been fitted trim and file the tabs flush at the back and clean up the visible edges.

Back to the Bogie Assembly

At this point the small frets located within the main bogie frame can be removed and stored safely.



Next fold up the sides or solebar making sure they are at 90° to the spacers. It's easy for the bogie to get a twist through it if the four corners are not at exactly 90°. Take care when folding. See image below.



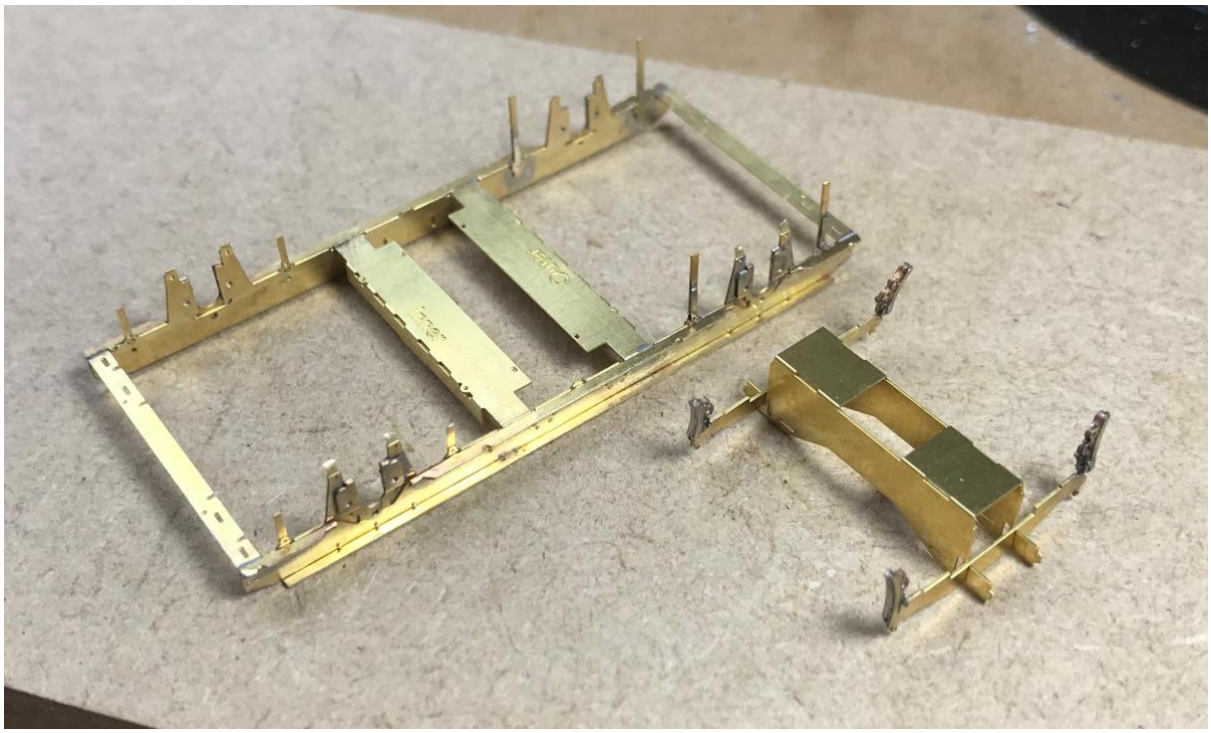
Inner Brakes and Bolster Guide

The inner brake shoes (5) need to be assembled now. The part consists of a spacer and outline of the brake shoe and hanger along with two layers for the detail on the brake shoes. These parts are not deigned to be separated from each other. They work by simply wrapping the half etched detail parts around the main full thickness outline of the brake shoe and hanger.

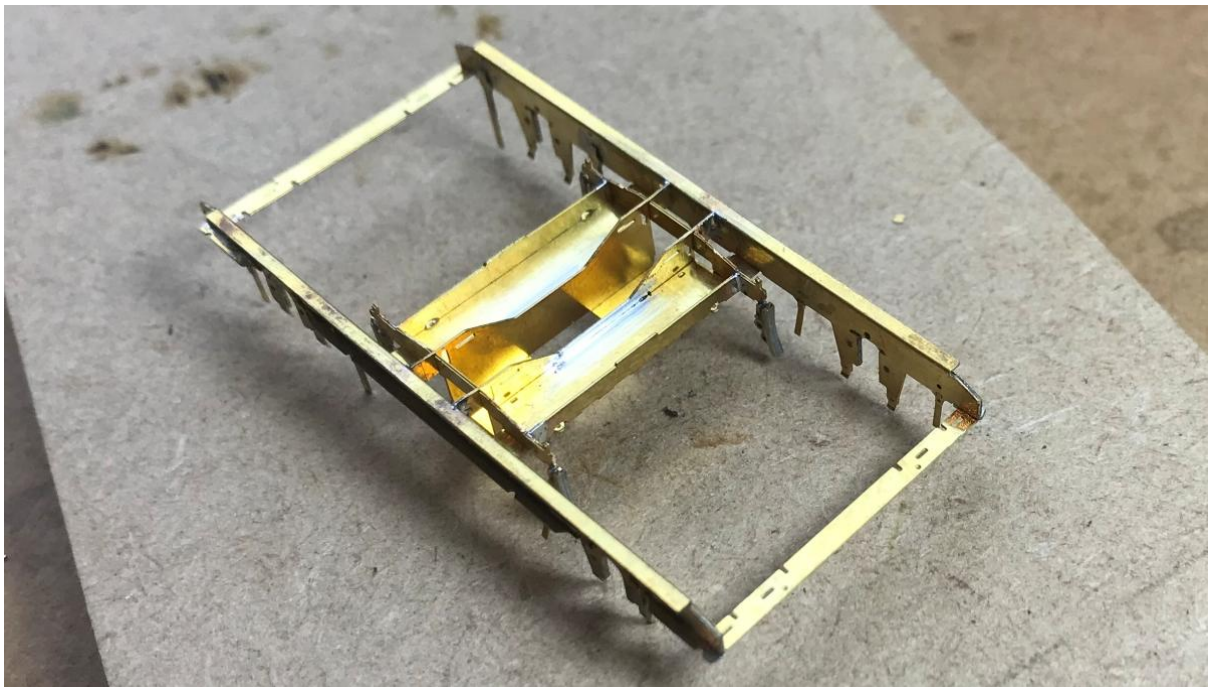
Make sure the small holes at the point where the hangers meet the brake shoes can accept 0.31mm wire and remove from the fret. Wrap the half etched detail parts of the brake shoes around the spacer/full thickness hangers and shoes. Use 0.31mm wire through the holes at the point where the hangers meet the shoes, clamp with a pair of tweezers and solder together along the shoe. Trim and file the wire to represent a bolt. See image below.

Remove the bolster guide (6) from the fret and fold into a C shape. Take care to make sure the folds are all through 90°.

The outer brake shoes are designed to fit into the bolster guide using the slots provided. I don't solder the parts together at this point but wait until everything is fitted to the bogie frames.



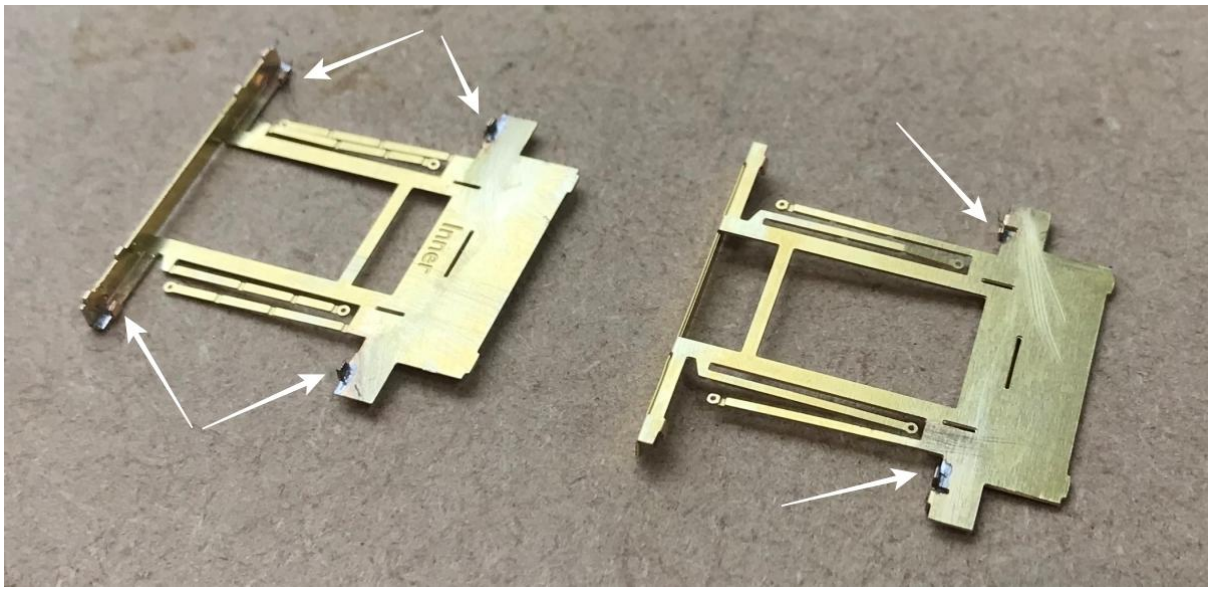
Fit the three parts together to the bogie frames. They go in from the top with the bolster guide fitting into the slot in the middle of the bogie. There are small tabs in the outer ends oof the bolster guide that fit into slots in the backs of the solebars. Once theses tabs are engaged everything should lock in place. When you are happy with the fit of everything solder the parts together.



Top Plates and Framing

Next the top plate (inner end) (7A) and the top plate outer end (7B) need to be fitted. Note that the top plate (inner end) on the dynamo bogie is slightly different what will be the end of the bogie is a separate piece. We will deal with the others first and then come to the inner end on the dynamo bogie last. If you are building a bogie for a motor fitted vehicle then read the note at the top of the next page before doing anything else.

Remove from the fret and push out the eight half etched holes on the ends to represent rivets. These are at the along the edge opposite to the writing. Once pushed out the end can be fold up. Don't solder at this point. There are several small tabs to be folded up. Four are to be folded up towards the writing side and the other two go in the opposite direction. See image below.

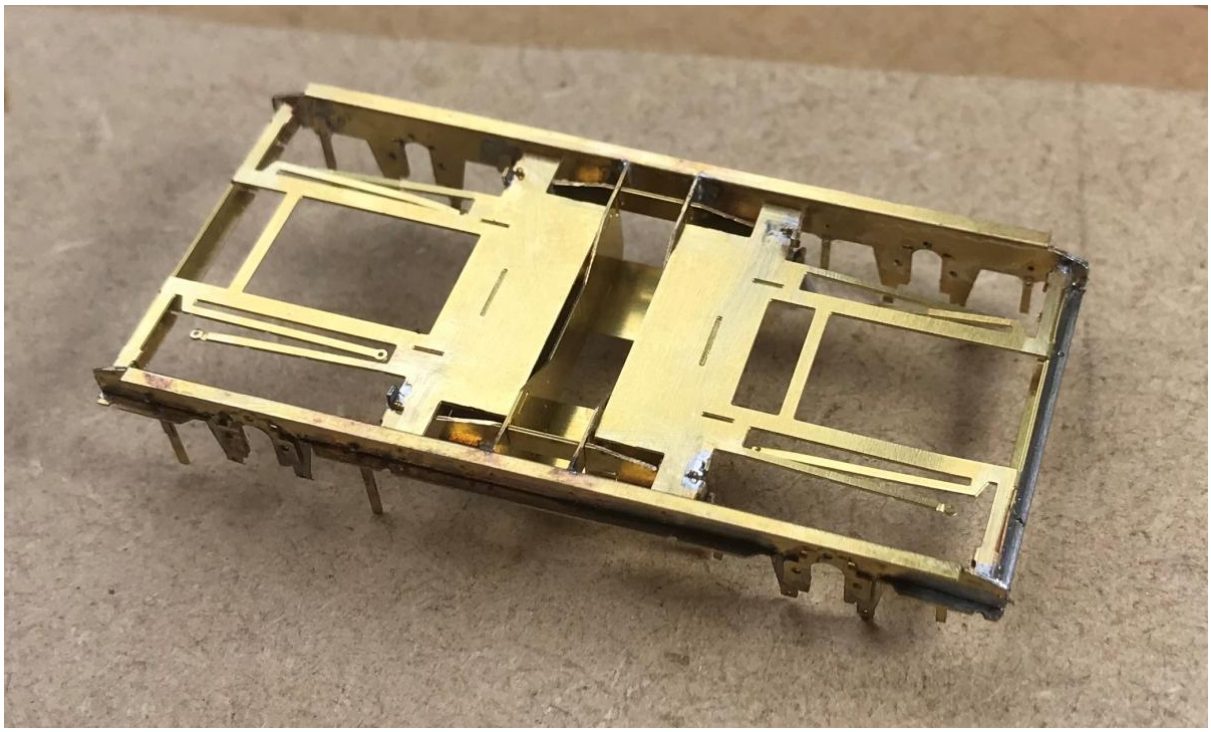


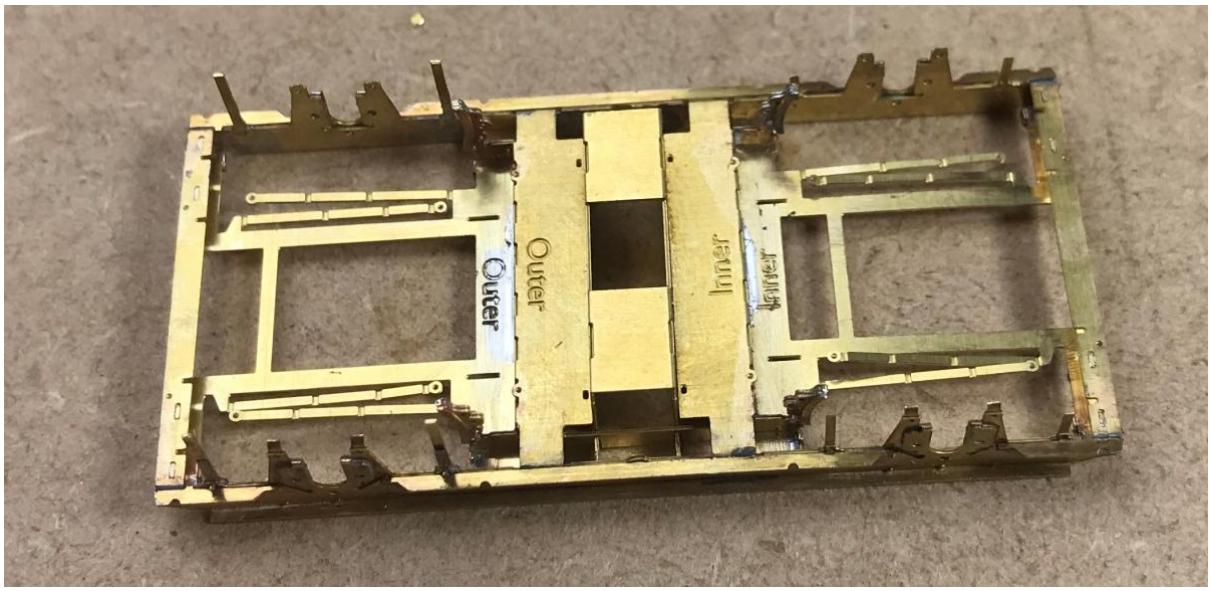
Motor Fitted Vehicle Note

If you're building a motor vehicle and want to fit the guard irons that are provided, then the outer pairs of the eight half etched holes on the correct top plate end need to be drilled out rather than pushed as the guard irons will be located using these. The inner pair of holes can be pushed out as per the instructions. This will of course be the bogie end that will be beneath the cab. I'm not sure if that is the dynamo bogie or the other one?

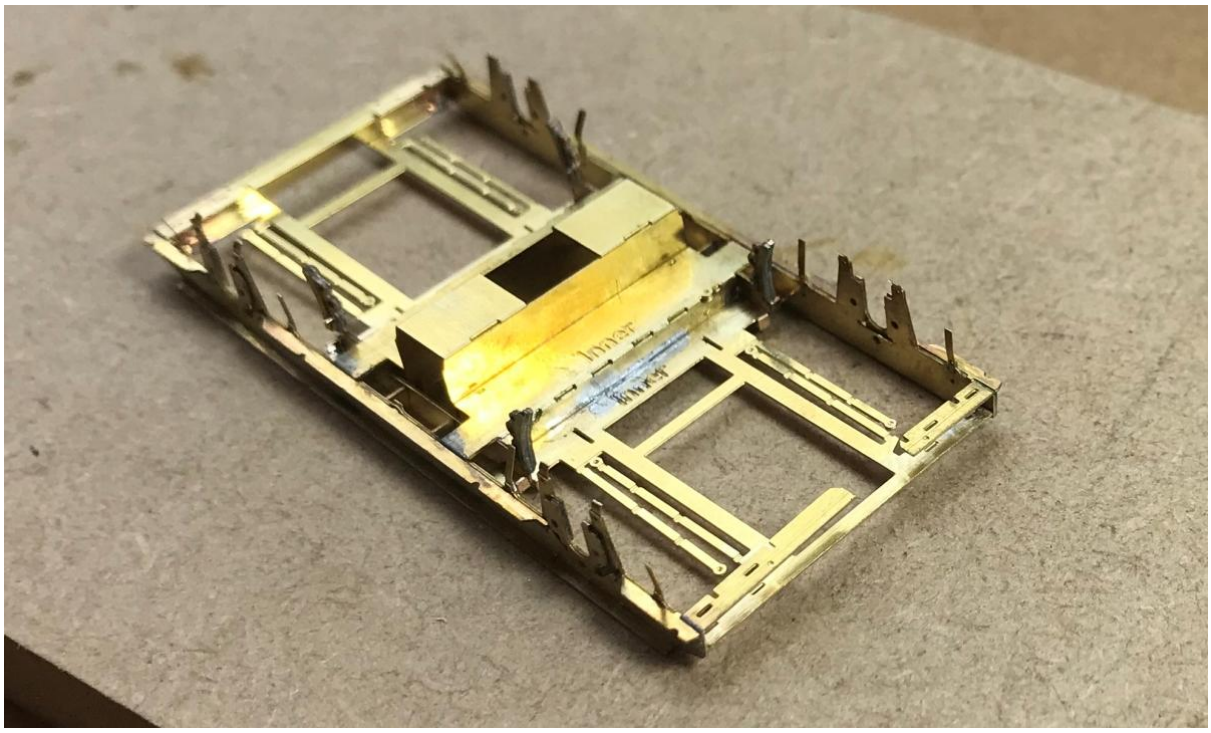
Instructions Continued…

These top plates can then be fitted to the bogie frame. There are tabs on the top plates that locate them in place with corresponding slots in the bolster guide and the end spacers. The side with the writing goes towards the bottom of the bogie. Once you are happy with the fit solder in place. See images below. There will be detail that needs to be added in the four corners so you may want to use a higher temperature solder at these points to stop it from becoming unsoldered later.

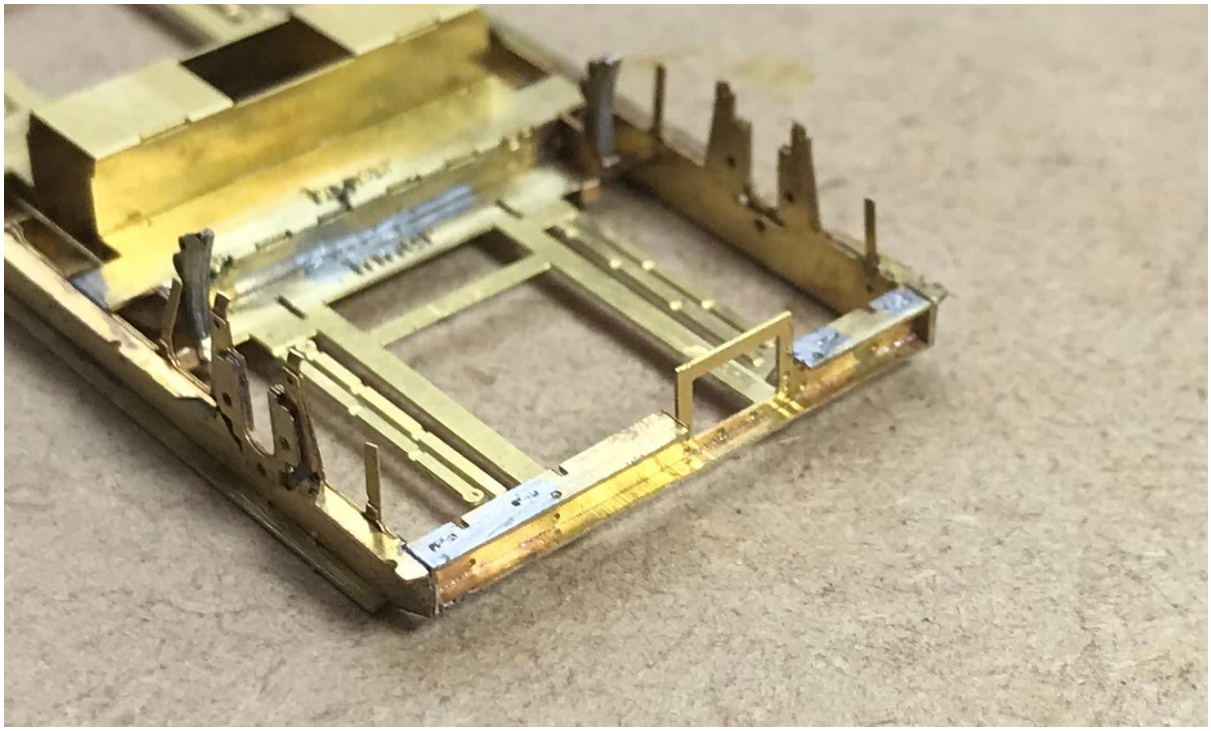




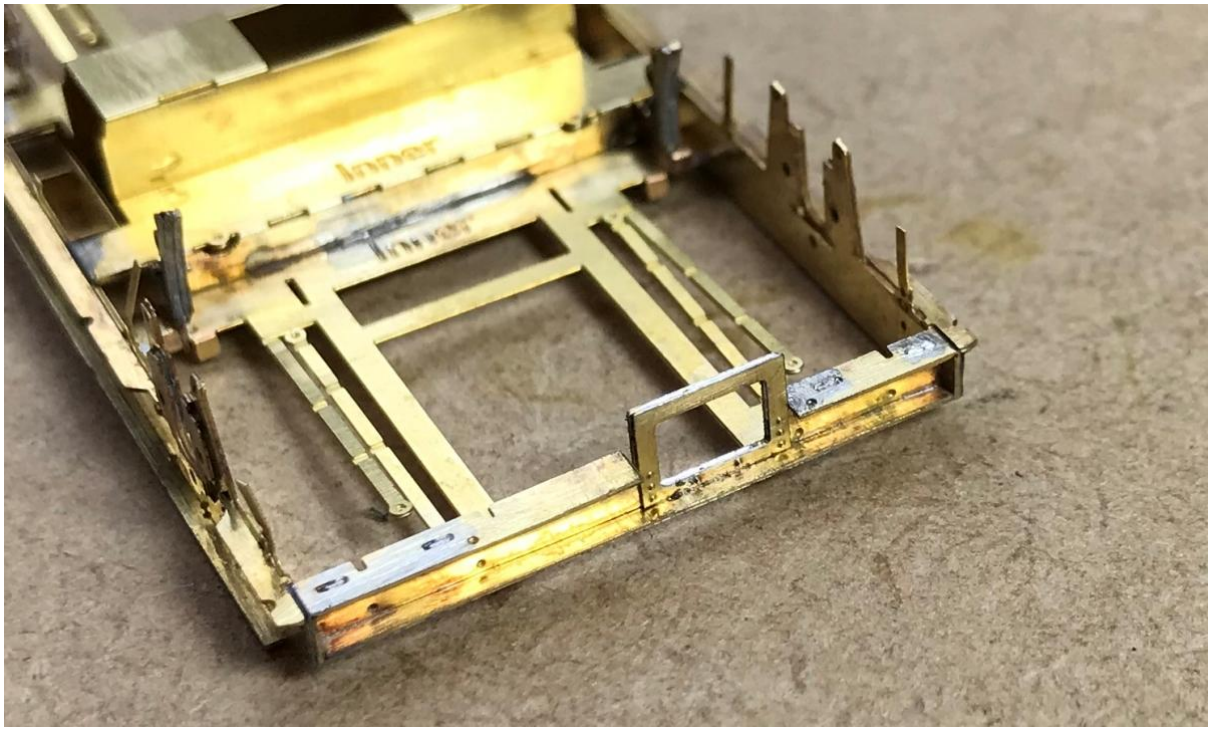
Once you have got the three ‘normal’ top plates in place the inner end on the dynamo bogie can be done. This differs from the others by having the end as a separate piece. Remove the top plate and fold out the tabs as per the others. Fit to the bogie frame with the writing facing towards the bottom of the bogie. Solder to the bogie frame around the bogie centre only.



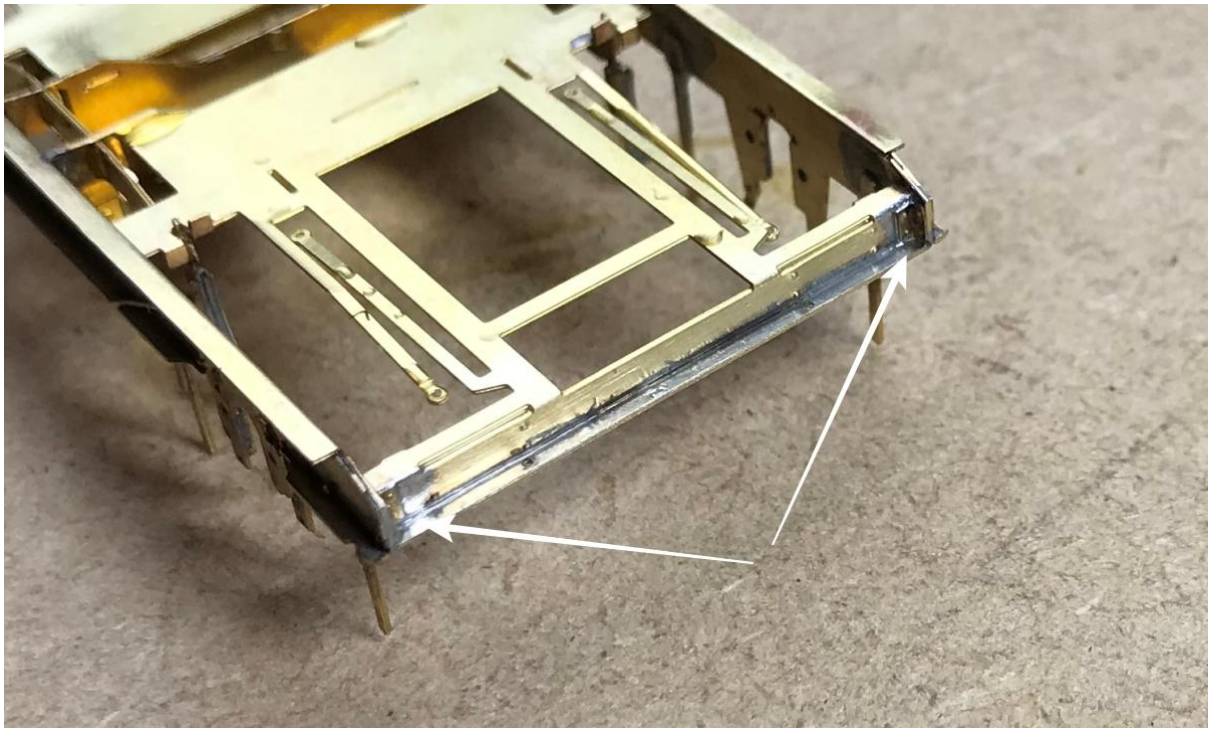
Remove the inner end for dynamo bogie (8). Push out the eight half etched holes to represent rivets. Fit the inner end to the dynamo bogie with the rectangular cut out in the space between the end spacers on the bogie frame. See image below.



Remove the dynamo belt cut out overlay (9) and fit in place on the outside of the inner end for dynamo bogie. The rivet detail on the overlay should correspond with the holes around the top of the cut out. See image below.

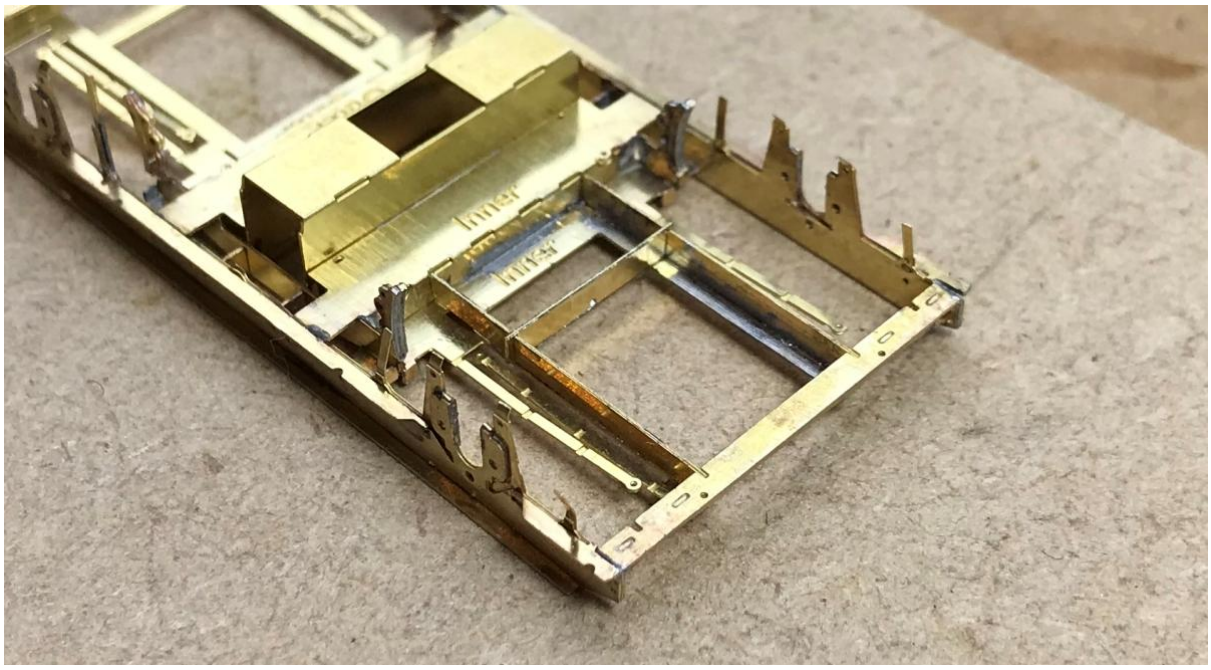


Remove and fold up eight corner plates (10). These are on one of the small frets that were located within the main bogie frame. Solder them in place on the bogie ends at the point where the end meets the solebars. See image below. This is where a solder with a slightly lower melting point than the one you used on the top plates at the corners may come in handy.



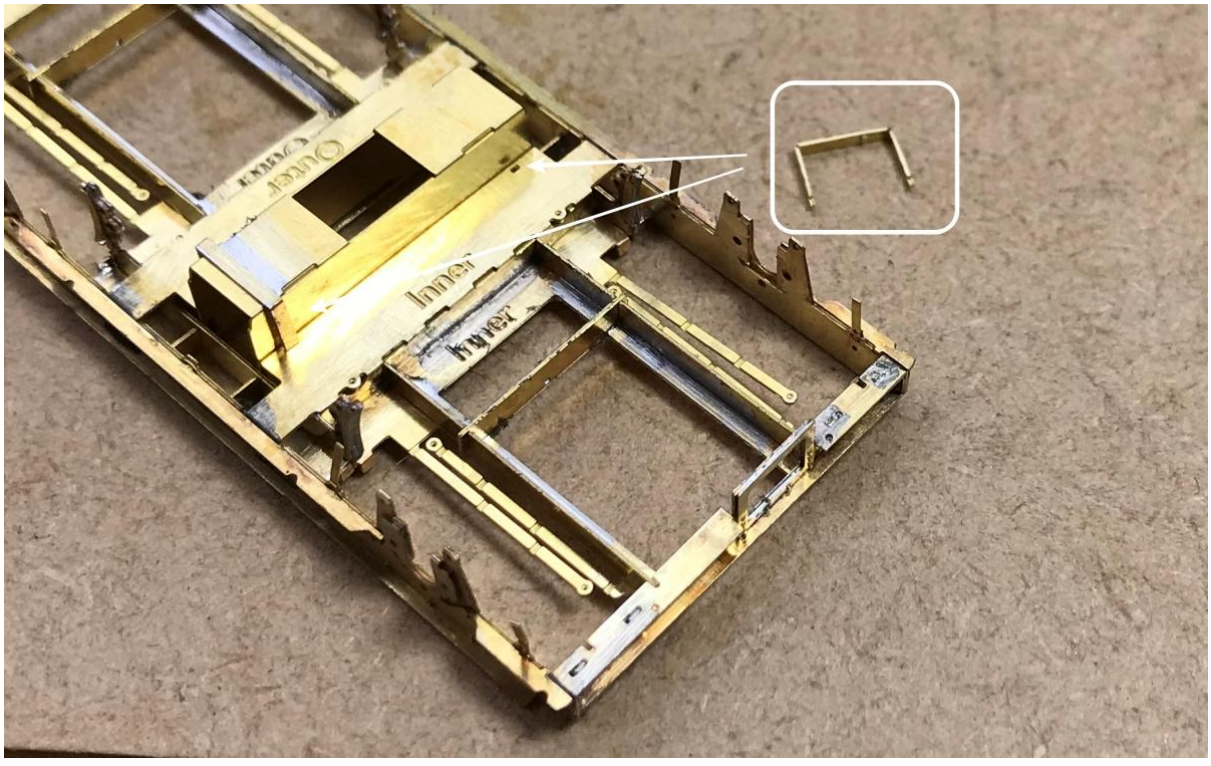
There is some framing to be added to the bogie. These consist of a pair of longitudinals and a transvers spacer. Not that they are different for the inner and outer end of the bogie.

Remove the internal frame longitudinal angles (inner end) (11a). Locate in place on the main bogie There are tabs towards the centre of the bogie and the outer ends fit into notches in the bogie ends to aid location. Make sure they go on the inner end of the bogie. Solder in place. Remove the internal frame cross angle (12) and fit into place using the slots in the longitudinal angles. Solder in place. See image below.



Repeat for the outer end of the bogie using the internal frame longitudinal angles (outer end) (11b).

There were two bolster safety loops (13) fitted to the bogie and I have included a representation of these. Remove and old into C shapes. Fit using the small slots in the main bogie and solder in place. See image below.

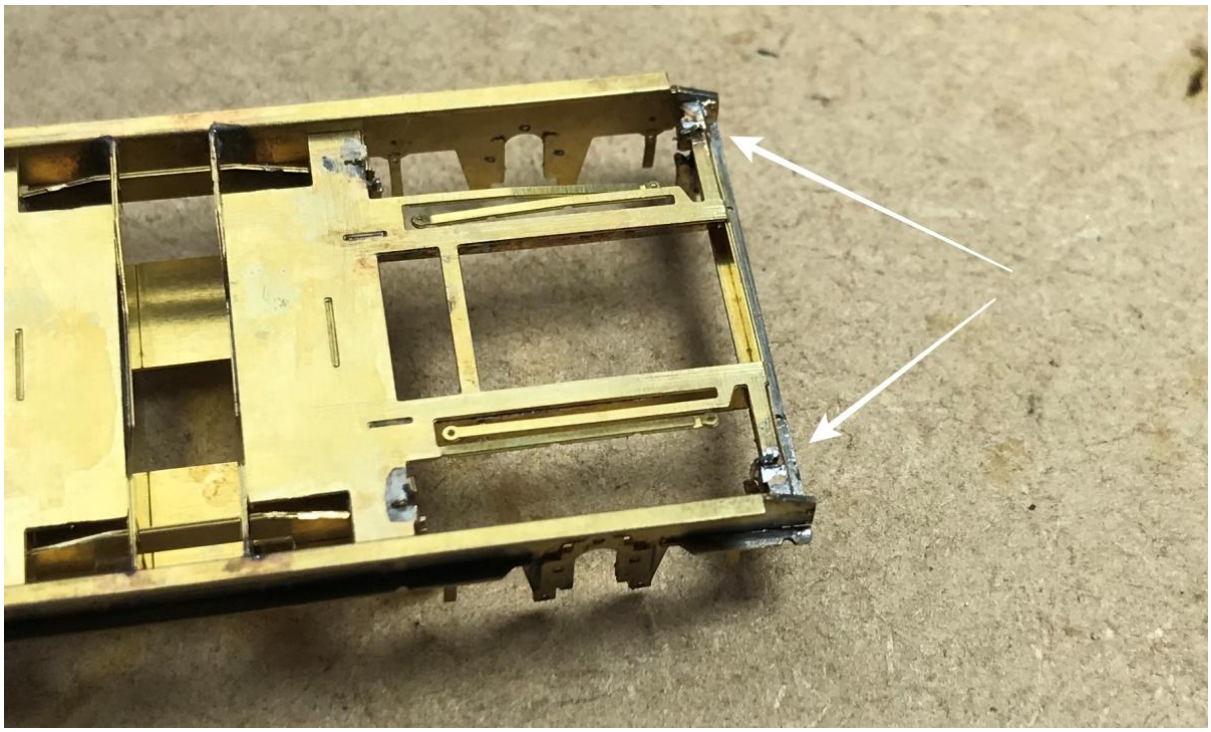


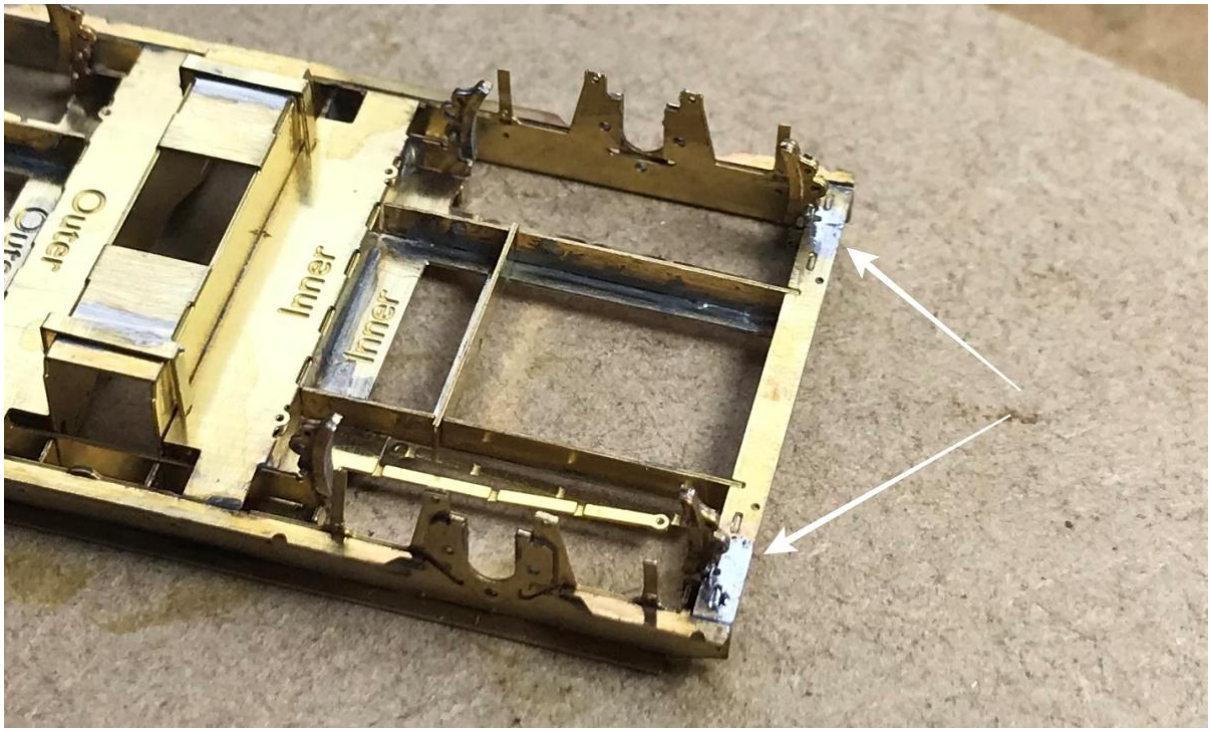
Outer Brake Shoes and Brake Rigging

The outer brake shoes (14) are designed to be folded up as per the inner brake shoes with the half etched detail layers for the shoes wrapped around the full thickness brake shoe/hanger outline.

Make sure the small holes at the point where the hangers meet the brake shoes can accept 0.31mm wire and remove from the fret. Wrap the half etched detail parts of the brake shoes around the spacer/full thickness hangers and shoes. Use 0.31mm wire through the holes at the point where the hangers meet the shoes, clamp with a pair of tweezers and solder together along the shoe. Trim and file the wire to represent a bolt. See image to the left.

Fit the brake shoes in place at the bogie ends. There are slots in the top of the brake shoes and also in the bottom of the ends to aid alignment. When you are happy they are properly in place solder to the bogie. See images below. Make doubly sure they are solder in securely.

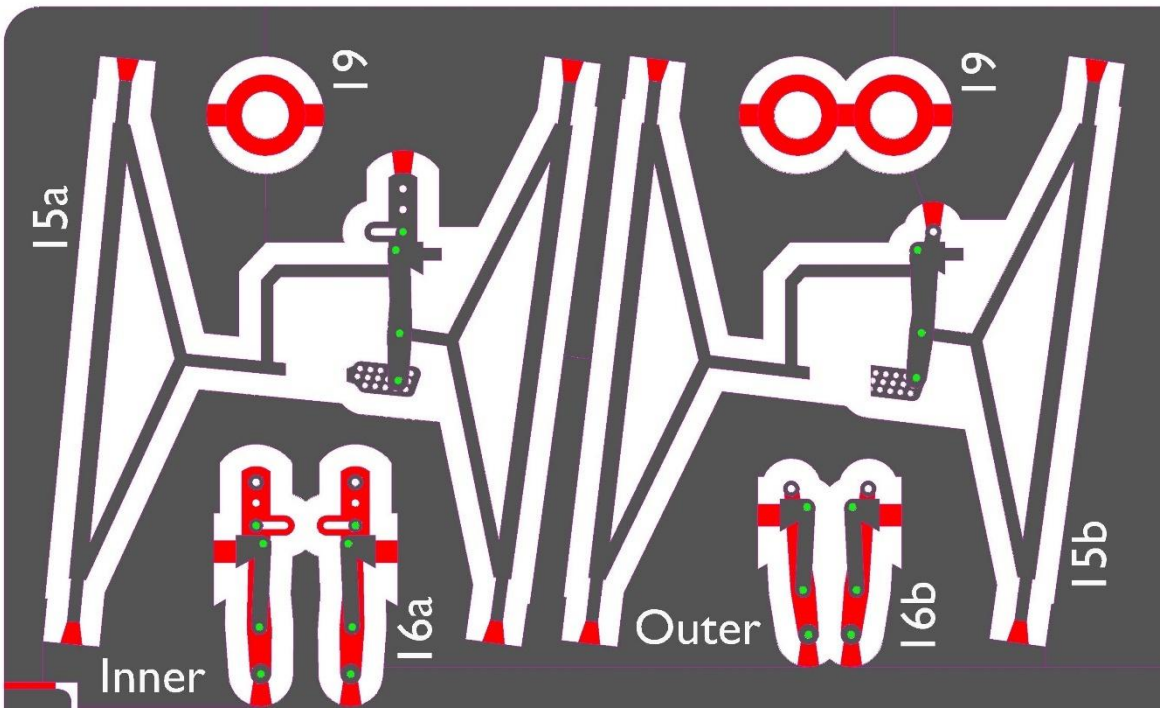




The next job is to tackle the brake rigging. This consists of an outline of the hangers and brake yokes and then half etched detail layers for the hangers. Note that the brake rigging is different for the inner and outer ends of the bogie. I find it easiest to use 0.31mm wire pins to locate the parts together using a piece of wood drilled to take the wire as a holding jig.

Start with the inner end. Remove the brake rigging (inner end) (15a) and use it to drill the holes that are shaded green in Fig.1 into a block of wood or piece of mdf.

Fig. 1

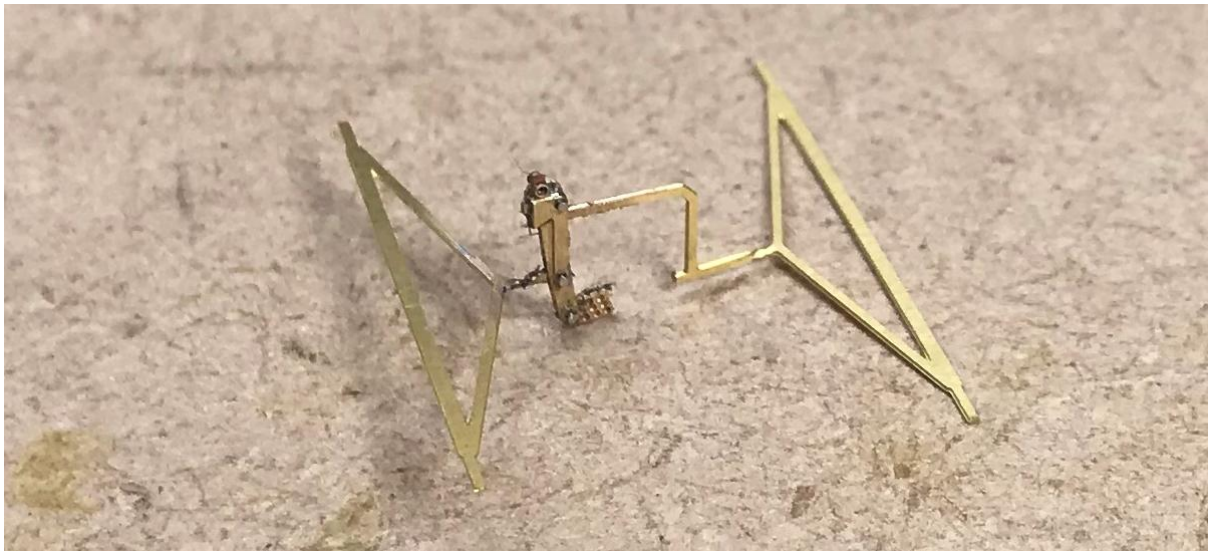


Make sure that the holes that are shaded green in Fig.1 on the brake rigging overlays (inner end) (16a) can accept 0.31mm wire and remove from the fret.

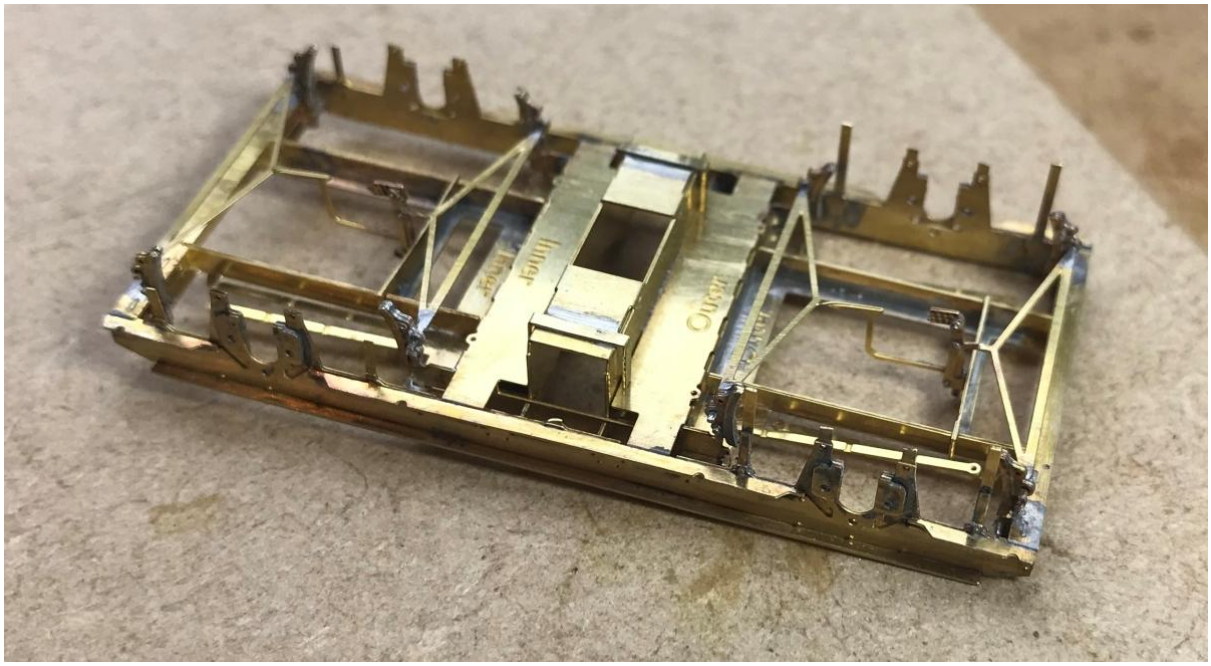
Using 0.31 wire inserted into the holes in the holding jig layer the brake rigging and the overlays up so that the overlays are sandwiching the brake rigging.

When all three parts are fitted onto the jig solder in place. The wire can then be trimmed and filed back to represent bolts.

Twist the brake yokes through 90° at the point where the triangle meets the pull rods. See image below.

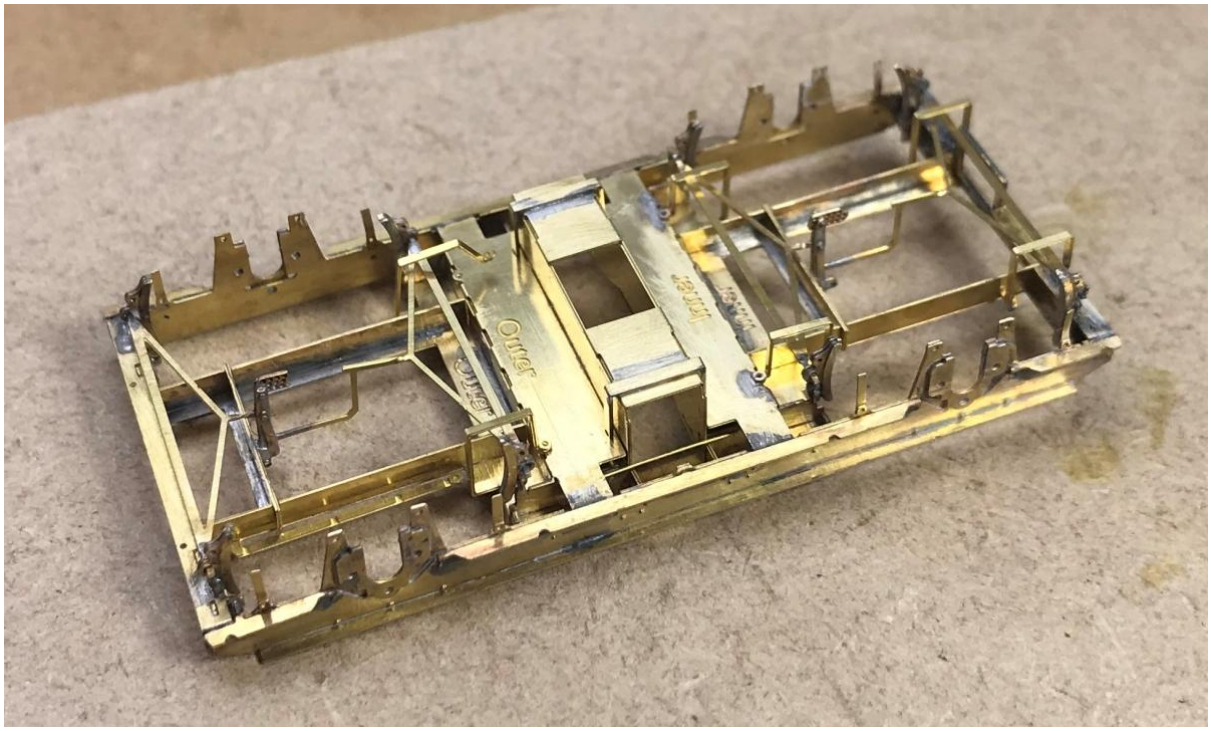


Fit to the bogie. The yokes go into the larger holes in the brake shoes and then there is a tab that fits into a slot in the internal frame cross angle. This may need to a bit of gentle persuasion of the brake shoes to get everything in. Once in place solder to the cross angle and make sure all the brake shoes are upright.

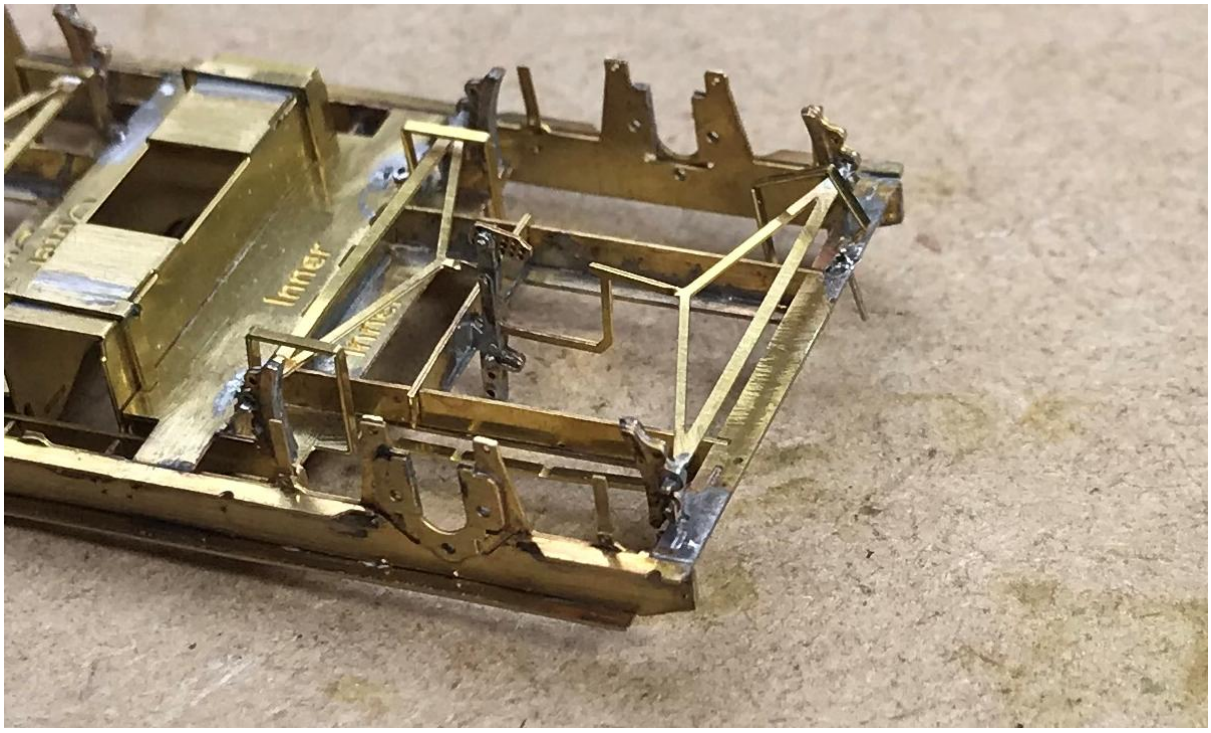


Repeat for the outer end using the brake rigging (outer end) (15b) and the brake rigging overlays (outer end) (16b). Again refer to Fig.1 for the holes to drill.

The brake yokes have safety loops. These are attached to the top plates and are designed to be folded up around the yokes. Start with the inner yoke safety loops as these are the ones on the outside of the top plates. See image below. All the folds are through 90° with the fold line on the inside. There are half etched holes in the ends of the safety loops which should correspond with half etched holes in the bottom of the bogie. Solder in place at the point where the safety loop meets the bogie.



Repeat for the outer ends. I used wire to pin them in place but this was unnecessary really.



Tiebars

The tiebars (17) are designed to be removable if you wish in order to allow the wheel sets to be easily dropped out. I would recommend following this route as it will be tricky to get the wheels in and out if you fit them permanently in place. If you do want them to be soldered permanently in place, then leave the fitting of them until after the spring carriers are assembled and the wheels fitted. Either way you will need to make sure the holes will accept 0.31mm wire before removing the tiebars from the fret and follow the same method of construction below.

You will need to solder 0.31mm pins through the holes in the axle tiebars. I find the easiest way of doing this is to use one pair of the tiebars as a jig and drill four 0.3mm holes into a piece of mdf or scrap wood. Short lengths of 0.31mm wire can be located through the holes in the tiebars and into the holes drilled into the wood. Make sure the slot along the middle of the tiebar is visible. Solder the wire in place and whilst still pinned to the wood file the wire back to represent bolt heads. Tiebars are fairly vulnerable, so in order to strengthen them I have included a slot into which you can solder a length of 0.31mm wire. This will make them a lot more robust. See image below.

Remove the tiebar and trim the other end of the wire. You will need to make sure there is at least 1mm of wire projecting from the back of the tiebars otherwise the spring carriers will be able to fall out of place when everything is assembled. It is also a good idea to leave at least one of the pins in the tiebar as long as possible to give you somewhere to hold them when painting. Once the tiebars and the chassis are painted they can be tack glued together on final assembly. The glued joint can be broken and the tie bars removed if you find it necessary to remove the wheels at any point.

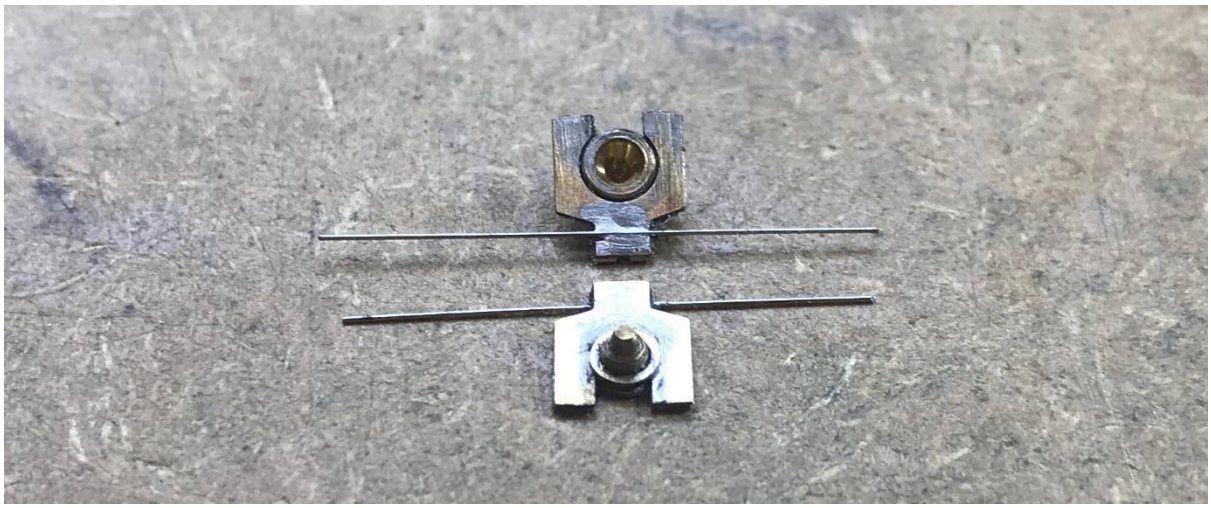
Spring Carriers

The spring carriers (18) can now be assembled. They are designed to be folded double and the springing wire soldered to the carrier using the etched slot as a guide. Make sure when soldering the wire that it is firmly in place.

The pinpoint bearings will need to be fitted at the same time. They will need to be of the waisted type. I use Alan Gibson bearings as they are nice and deep but because of this you may find that the carriers need packing out a little to take up any slop. Bearing washers (19) are included for this purpose. There should be a good fit between the axles and the bearings with ideally no sideways movement at all. If you don't want to use the Gibson ones you need to make sure you use a waisted type of bearing or they won't fit into the printed axlebox. Trying to open out the 3D prints to get standard top hat bearings to fit is likely to break the prints.

I find the easiest way to assemble the spring carriers is to make a small jig consisting of an off cut of mdf or wood with a 2mm hole drilled into it.

The spring carriers are designed to be folded double about the middle. This is the broken fold line. The other etched line is where the spring wire will be soldered to. The spring carrier can then be placed so that the bearing locates through the hole in the carrier and the wood. The etched line for the spring wire should be visible. The bearing can then be soldered in place. The spring wire can then be located in its etched guide line and soldered in place using a suitable flux. I use Carr's black label. The spring wire needs to extend at least 7.5mm either side of the point where it is attached to the carrier. They will need to be trimmed but do this whilst checking against the bogie after cleaning the carrier up. If the wire is too short the spring carriers will fall out.



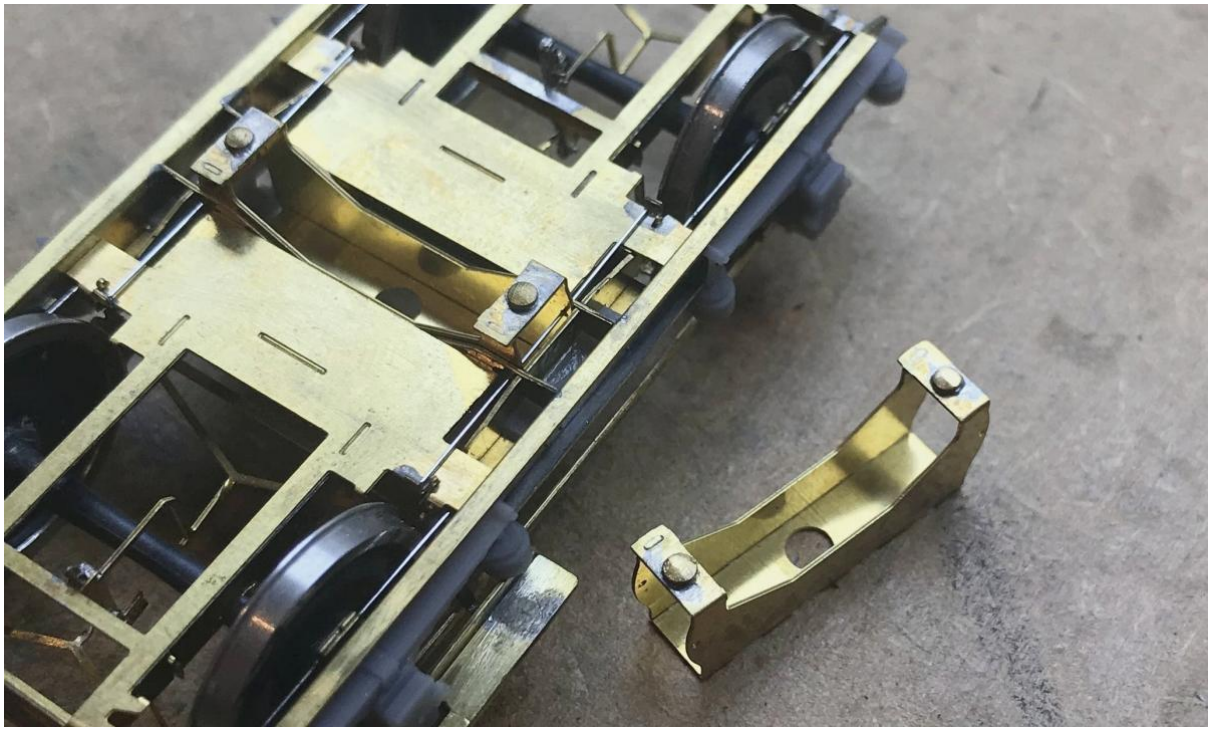
Test fit the carriers and shorten the springs at the ends if required. If you find you need to add washers to remove slop then do so over the bearing on the outside of the spring carrier. This will have the added advantage of reducing the bearing surface area between carrier and axleguard which is a good thing.

Bolster

Make sure that the two small holes in the bolster (20) can accept the shanks of the brass pins provided (this should be 0.7mm), remove from the fret and fold into a C shape about the rectangle with the hole in the middle. This is the bottom of the bolster. At the top there are two small rectangles with the small holes in and also two small slots. These parts need to be folded down so that the slots engage with the tabs on the opposite side of the bolster. Make sure everything is at 90° then solder the two top parts in place.

Cut the tails of the four pins provided in the kit so that there is only 2/3mm left attached to the head. The pins fit into the holes in the two parts across the top of the bolster. Solder the pins in place. Check the fit of the bolster in the guide. If it's tight then twist the bolster slightly out of square to narrow it a fraction.

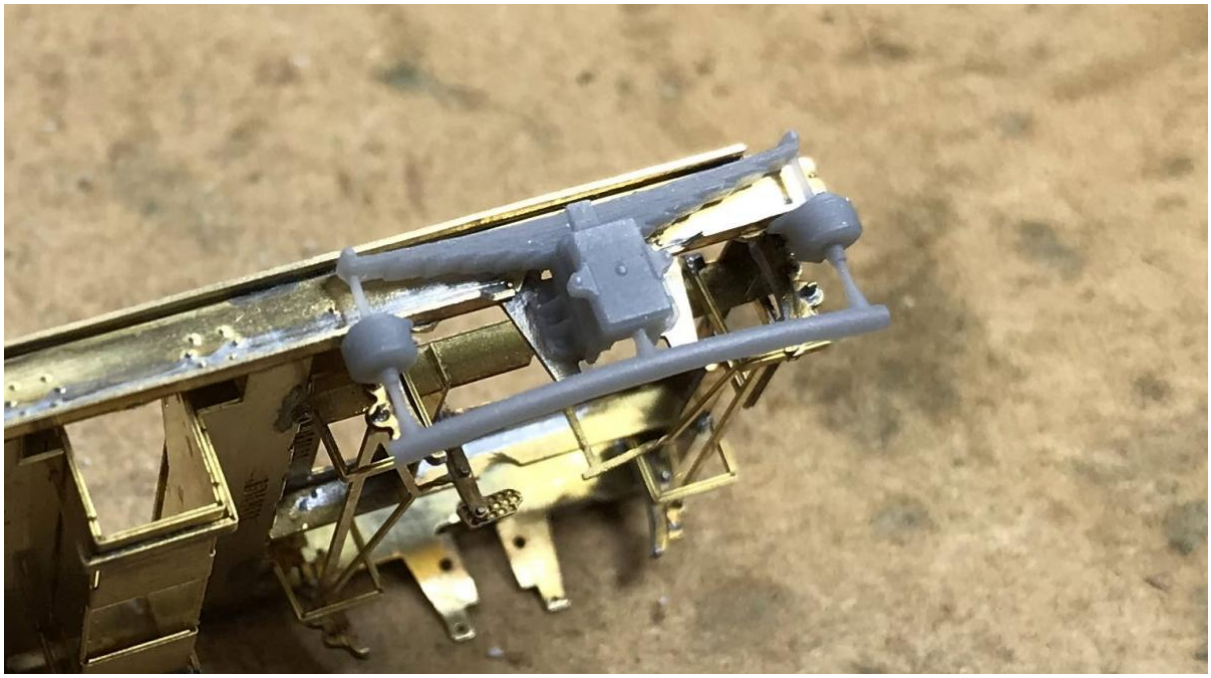
Cut two lengths of 0.009" steel spring wire to 19mm long. These need to be fitted in place with the bolster in the bolster guide. The spring wire fits through the slots in the bolster guide and holes in the bolster. See image below. The four tabs on the top plates that point upwards should be enough to retain the spring.



Springs, Axleboxes and Bolster Detail

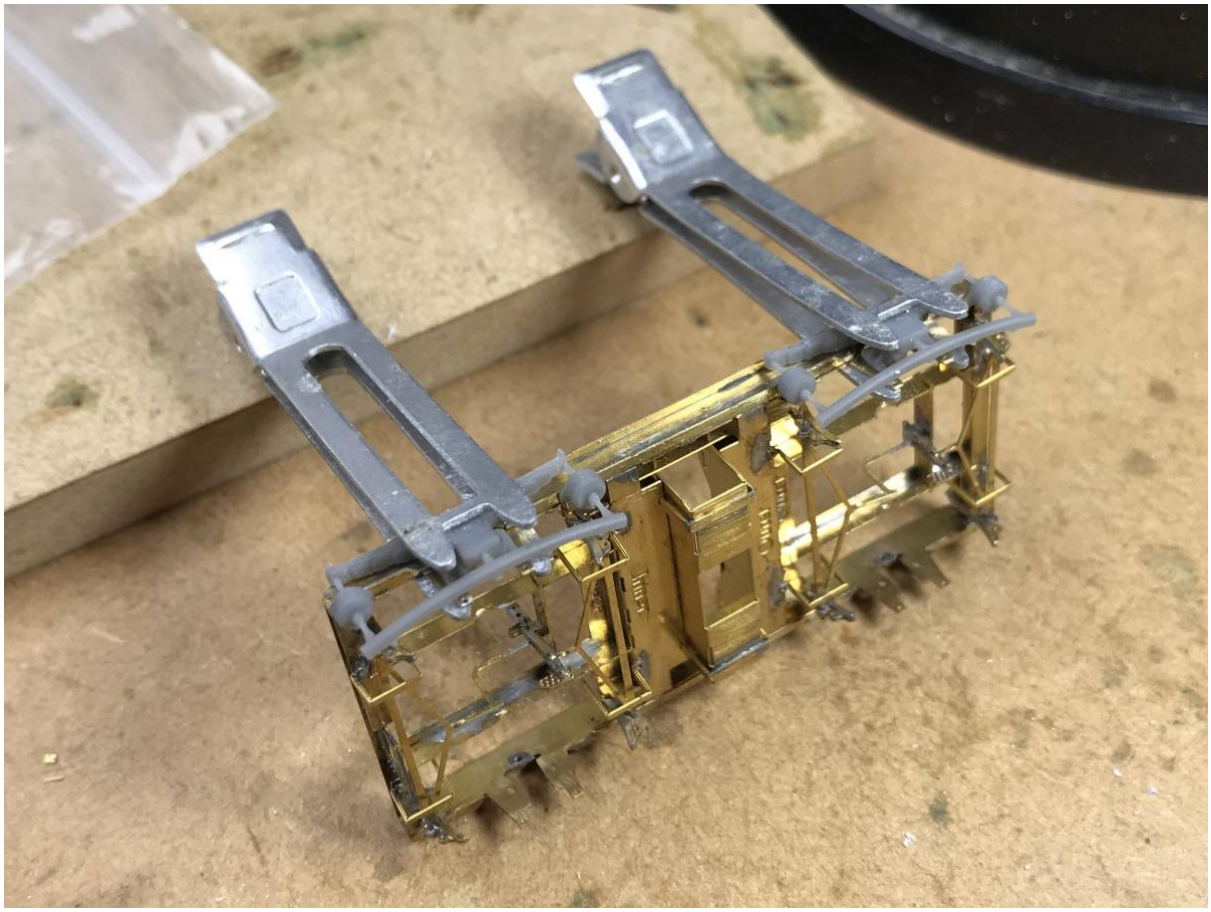
With the bogies all but finished the printed springs/axleboxes and bolster detail can now be fitted.

Remove the springs and axleboxes from their supports with a fine bladed piercing saw. Note that there is a spigot on the back of the springs just above the axlebox, make sure you don't remove this. Leave the connecting bar that joins the bottom of the axlebox and the hangers in place for now. Clean up the remnants of the supports with files and/or emery paper. With everything cleaned up check the fit on the bogie. The spigot goes in the holes that were used to align the solebars and the detail overlays. These will need to be opened out to 0.7mm diameter.

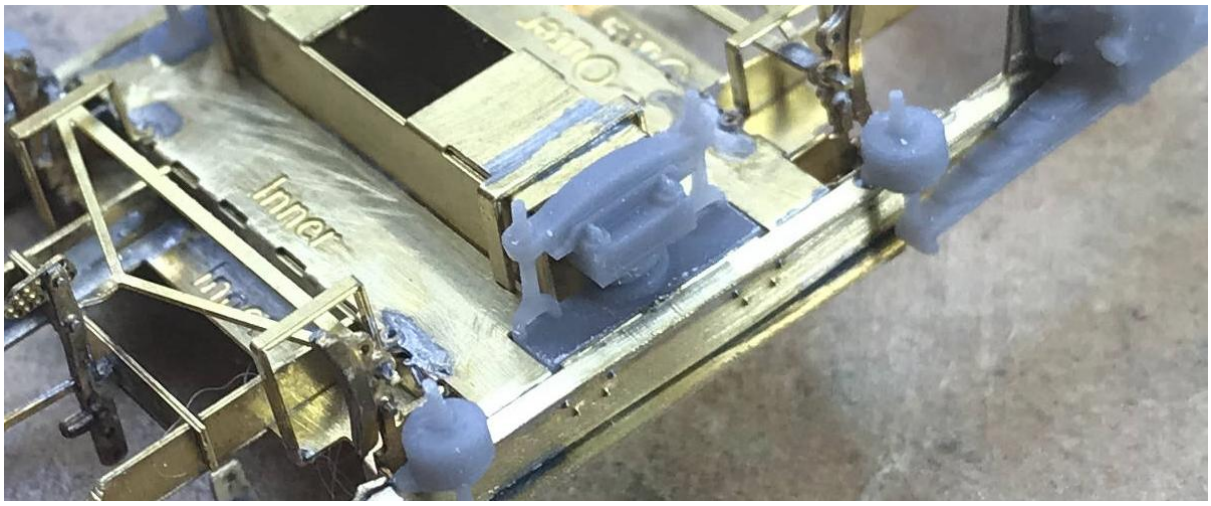


I left the connecting bar on when fitting most of the springs in place though for the last two I took it off before gluing and the hangers seemed ok with this. Whether removing the bar before or after gluing in place, it should only be done when everything has been completely cleaned up and you should cut it below the dampers first and then at the axlebox. Again, I used a fine bladed piercing saw.

I used epoxy to fit the springs/axleboxes holding them in place with some aluminium soldering clips. You can use superglue but there won't be any adjustment if you do. Trying to remove the prints to realign them when they have been superglued in place is likely to break something, most likely the hangers.



The bolster detail can be cleaned up in the same way as the springs/axleboxes. The bolster detail fits into the space behind the middle of the solebar. When happy with the fit, glue in place.



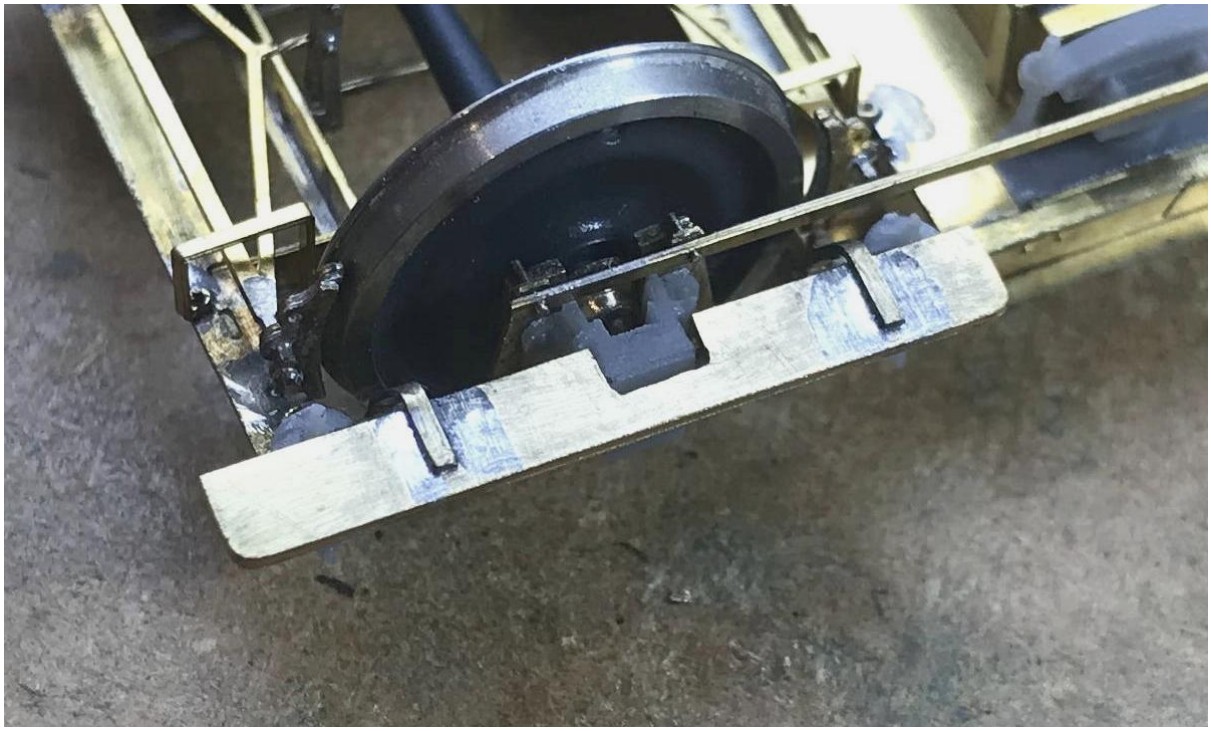
Footboards

If required now is the time to make and fit the steps. These are designed to use 3mmx1mm brass angle with and etched outline soldered to the inside. The cut out for the axlebox can then be removed from the bras angle using the outline provided. This will provide for a robust step with dimensions that are something like the real thing.

There are two different outlines for the steps, those for long footboards (21) and short footboards (22). Remove the ones you require (if any) and solder them to the inside of the brass L section. Drill a pair of holes in the brass angle suing the cut out in the outline as a guide and then create the cut out in the brass angle suing a piercing saw. See image below.

Once the cut outs for the axleboxes have been made the footboards can be cut out of the brass angle. Put a radius in the four corners.

The footboards can then be fitted to the bogies once. This will call for some deft work with a soldering iron but if you're quick then the prints shouldn't suffer any damage. Mine didn't. The hangers for the footboards need to be bent outwards and then the bottom flat. The footboards should sit on top of these hangers. The bottom bend should be at the pint where the half etched part of the hanger ends. Some fiddling may be necessary to get everything sitting where it should. When happy quickly solder the footboards to the hangers. Some aluminium soldering clamps may be useful when attaching the footboards. See both images above and below.



Top Brake Links

On the prototype the two sets of clasp brakes were linked by rods that passed over the top of the bogie and either side of the pivot. I have included these top brake links (23) for anyone that wants to fit them. Thye should just clip into the holes in the tops of the brake rigging and can be soldered or glued in place. Once fitted you won't be able to remove the functional bolster so you need to decide whether you want to paint the bogie with the bolster in place or not as this will affect when you might want to fit the links (if you want to fit them at all!).

Pivoting Plates and Adjustment

I dislike using screw threads as bearing surfaces and so have etched the holes in the bogies to 2.5mm diameter in order to be able to use a sleeve of 2.5mm outside diameter brass tube with the locating bolts. It may be a little extra work but there will be no catching of the bogies on the pivot bolt when moving up and down or turning.

If you are fitting the bogies to an RTR coach then you might be able to just use M2 bolts with a sleeve of 2.5mm outside diameter, 2mm inside diameter tubing into the existing hole. You may also find that the screw will self tap into the RTR plastic if they've used a smaller diameter screw. If you're really lucky they might have used an M2 one! It's worth checking before carving the underframe about.

If you are fitting to a kit built coach then you can use the bogie pivot plate (24) and pivot locating plate (25) provided. You can either use M2 or 10BA bolts. If using 10BA bolts you will need 2.5mm outside diameter, 1.5mm inside diameter brass tube to use as a sleeve. This will need opening out slightly for the 10BA bolt.

Remove the bogie pivot plate from the fret and fold into a channel. The locating bolt can then be soldered in place from the inside of the channel. The hole in the bogie pivot plate is 2mm so I would suggest that you open it out to 2.5mm if using 10BA bolts and use the brass tube sleeve to align. This assembly can then be soldered to the pivot locating plate using the tabs and slots as an aid. See Fig. 2 below.

The pivot locating plates have lines etched at the mid points of the sides to help align them on the coach floor. The intersection of these four lines will mark the pivot centre.

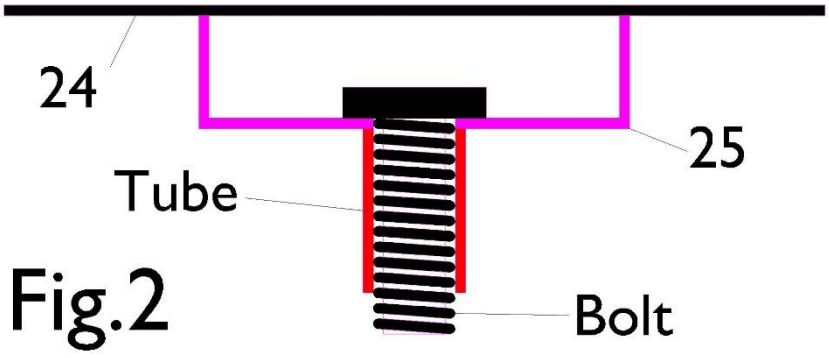


Fig.2

Height adjustment is via pads over the top of the bolster and attached to the underside of the coach. These can be made from plasticard or metal sheet. Ideally, if you are using plasticard, there should be a metal layer acting as the bearing surface for the pins on the bolster, 0.005" or 0.010" sheet would be fine, perhaps a scrap piece from the fret? Make sure that each of the pads is the same thickness and then the coach will sit completely level.

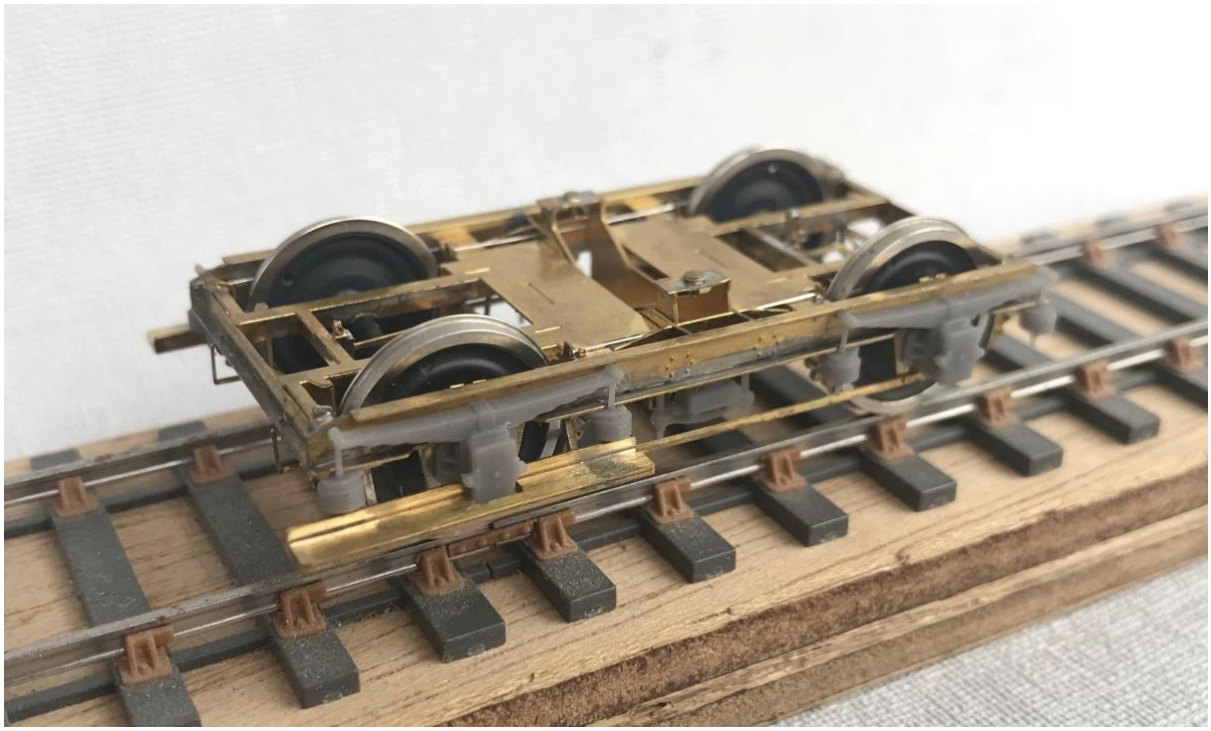
Guard Irons for Motor Coaches

Earlier I mentioned the guard irons that were fitted to driving cab ends of motor coaches. If you want to make use of these then you should have drilled some locating holes in the appropriate place when fitting the top plates.

There are two parts to them, the guard ions (26) and a guard iron overlay (27). The guard irons have two small holes in them which need to be able to accept 0.31mm wire. You will need to add 0.31mm wire pins to these holes to help locate the irons in their holes. This part with the holes folds into an L section which attaches to the end of the bogie and is towards the outside of the bogie when fitted. The trapezoidal part at the bottom points towards the wheels and the overlay goes on top of this. Make sure the overlay goes on the outside of the bogie, it should be visible when fitted.

Notes on Weighting

The bogies are designed to operate on a load of 180g. They can be used on heavier coaches, but you will need to up the gauge of the primary springs. This was noted in the technical section at the beginning. On lighter coaches you should add some weight to bring the total coach weight up to around 180g with the weight evenly distributed. Include the weight of the bogies in the 180g.



Painting

I now use Halfords grey primer in a tin through an airbrush with cellulose thinners to prime just about everything, including plastics. The primer is synthetic and has no adverse effects on the types of plastics used on RTR railway models and kits nor 3D printed resin. The cellulose thinners used evaporate so quickly that they don't have time to attack the plastic. You can then put your choice of paint over the top. Don't use the red oxide in a tin on plastic though as it won't adhere, and the paint will just come off.

Care should be taken with bearing surfaces. This includes the bolster and spring carriers. You may want to remove the bolster for painting and mask off the slot in which it fits. Blackening the bolster may also be an option. If you're removing the wheels for painting, blacken the spring carriers and mask off the area where the spring carrier makes contact with the axleguards.

Justin Newitt - November 2021