Chapter 5 - Construction

Tender & Firebox

Building, Building, Building… here we go....

The Tender

Please review the content of this chapter prior to construction. Also check and recheck your PDF print out scales to ensure you have printed them at the correct 1:1 scale.

The tender is essentially made up of 3 basic components:

- The tender shell (optional FH&PB Tender former kit replaces this part of the construction).
- The tender wrappers and cladding detail.
- The hungry boards or coal boards.

The construction of the tender is per my usual methods, which I've used time and time again, and is typically described in MasterClass 2001, chapter 7. The basic technique outlined there will build a very standard American tender, useful on most Baldwin, Cooke, Porter and Rogers locos, and can be adapted to suit various eras. The Mason tender, as would be expected, is a little different, but can be built using similar principles. The primary differences lie in the way the tender cladding is done and the shape of the 'tender legs' that run inside the cab on the Mason.

We begin construction simply building the tender shell, or 'former'. This is a basic box on which we overlay the detailed cladding of the tender. FH&PB have provided a 'tender former' for this project as a plywood kit.

Many of you will have ordered and even already assembled your FH&PB tender former kits, delivered to us by Vance Bass. You can follow all of the FH&PB construction instructions with confidence. Once the former is made, you can then follow the instructions in this chapter and clad the 'tender former' in riveted styrene or brass sheet to finish the tender shell off.

A Note about Mr. Mason's Crazy Tender Design

Mason's tenders are not made quite like a typical Baldwin or Cooke tender. As shown in MasterClass 2001, Chapter 7, an 1870s Baldwin tender was simply a flat car, with the iron tender shell dropped onto the timber deck and bolted down in four places. The Mason tender is not like that (what a surprise!). Mason dropped his iron tender shell down onto the iron sub-floor framing of the tender/cab deck, and then applied the timber decking around the tank. What this means is that the bottom of the tender shell is concealed within the timber decking thickness and the bottom row of rivets is also concealed in the decking. It also means the tender heights shown in the PDF drawings of the Mason options in chapter 1 are all 2mm too tall, as I sat the tender shells on top of the deck, rather than into the deck! I needed to take the tender shell height and sink the whole thing into the deck by 2mm. We now understand the tender tank and have it correct for this chapter! This is definitely not a Baldwin loco!

Choices

Long & Short Tenders

There are a couple of choices for the Mason tender-

Firstly, you need to review your original Mason Bogie option, from Chapter 1, and determine whether you are building a LONG tender or a SHORT tender. The two tender types are the same height, width and detail, but the long tender is prototypically a foot longer than the short tender. The first three Masons delivered to the South Park all had short tenders. Bully Boy also had a short tender. From DSP&P #7 onward, locos were built with long tenders. The transition into the 'Heavy' 2-6-6T on the South Park saw the same long tenders used, through to the last two 2-6-6Ts. The last two Heavy 2-6-6Ts were fitted with Long tenders that were also 6" taller!

Please review your original prototype selection and then follow the appropriate PDFs from this chapter to build the long or short tenders.

Battery, Sound, R/C and Access

The Mason Bogie tenders run right into the inside of the cab. To remove the tender to access batteries, sound equipment of R/C gear could be problematic, because one would have to remove the whole cab before being able to remove the tender! (just like they had to do on the prototype!). For this reason we suggest that the top of the tender outside of the cab wall be a lift-off item, allowing for day to day access to the tender space. In addition, the whole tender shell will remain removable, after the cab is lifted off. I would recommend you make the top removable only if you intend to use Battery, R/C or Sound, and intend to have ready access to the tender innards. If you do not need ready access, then do not make the top removable. The more complete the tender is built as a whole unit, the stronger it will be.

Further, space in the Mason for electronics is at a premium because the elements of the Mason are quite small. The tender of the Mason is not large enough for comfortable fitment of R/C battery and sound in the one space. Depending on the systems you intend to use, plan what you want to install, and think about the available spaces. If you can fit everything into the tender, do so. Other options include installing gear in the low slung firebox below the cab floor (as covered in this chapter), also inside the backhead area inside the cab. Also consider fixing circuit boards in the ceiling space of the lift-off cab roof.

Above all, if you are running with Battery and/or sound, I would recommend you build the largest tender you can, that of the Long tenders of Option 2, 3 and 4. I would also recommend you build the tender with the tallest coal boards or hungry boards, as seen in Options 3 and 4, and that you use the space up to the top rim of the hungry boards. At the top edge of the hungry boards you'll blank off the top of the tender, forming a tank-like box. When you cover this in coal, no one will know that the tender air space runs throughout the tender shell and right up to the top of the hungry boards area. I would make this whole hungry boards unit a styrene box, that is, removable, forming the lid to the tender top.

Let's Do it...

Get the Drawings

Download all the PDF drawings for chapter 5 now!
Check for the Long Tender, and Short Tender drawings.

Download the 2-6-6T/0-6-6T Short Tender drawings **HERE**.

Download the 2-6-6T Long Tender Drawings **HERE**.

Next download all the firebox drawings:

Download the 2-6-6T/0-6-6T Firebox drawings **HERE**.

The Big 2-8-6T Package. Download the tender and firebox drawings to the big 2-8-6T **HERE**. Please also refer to the 2-6-6T firebox PDF details for the ashpan/damper design.

The AA Denny Package. Download the tender and firebox drawings for the AA Denny **HERE**. Please also refer to the 2-6-6T firebox PDF details for the ashpan/damper design.

The Tender Shell Space - Options

If you have the FH&PB tender former kits, proceed past this section onto the section about cladding the tender shell. In your set of 'long' and short' tender drawings, you'll see the three options of tender shell space-

Option 1: Allows for the prototypical coal bunker shape. If you wish to build the Mason as prototypically as possible, you will not be filling the tender full of coal and you intend to see the full tender shape right down to the tender deck, then this is the profile for you. Do not even think of using this profile if running with battery power.

Option 2: Allows for a prototypical look, non-opening tender top, and coal filled to a level above the tender top deck. This is the tender type shown in this chapter. It offers a strong construction, good tender space, but no ready access to the tender interior without removing the cab first.

Option 3: Allows for maximum battery space, and will have a removable hungry board box above the tender deck, offering ready access to the tender interior. The finished coal level will be at the 'full' level.

Please refer to the PDF diagram sheet entitled "Battery Space Options for all Tenders - Sectional View". Also refer to the PDF sheets entitled "Option 3 - Max Tender Space, Tender Access - Method 'A' and method 'B'- Removable Hungry Boards Unit" There are two pages for this option 3, showing how the top of the tender can be lifted off for access.

You must decide NOW which of the three tender formers you will build. My suggestion is to build option 1, a prototypical tender, unless you have plans for battery, sound and R/C. If you intend sound, possibly battery, and possibly R/C, then use option 3 only.

Building the Tender Shell or Tender Former

There are 4 drawings covering the construction of the tender former. Select the 4 drawings relevant to your tender shell space decision, and discard the drawings for the other 2 options - don't mix 'em up!

Take the PDF drawings entitled "Overall View". There are several, for long and short tenders, Bully Boy, 'As Built' versions and 'Modified versions'. There are 3 PDFs for the short tender, and two for the long tender. Keep these drawings at your side, as these will help you see the 'big picture' while you work through the details of the tender.

At this time, also take out the PDF drawing entitled "Top Plate Profile", "Pipe Corners to Top Plate", "Walls To Tender" and Keep the "Top Wrapper Profile" PDF drawing with you now. That's 4 PDFs in total. Make sure you have the correct set of 4 depending on the tender shell space you want!!

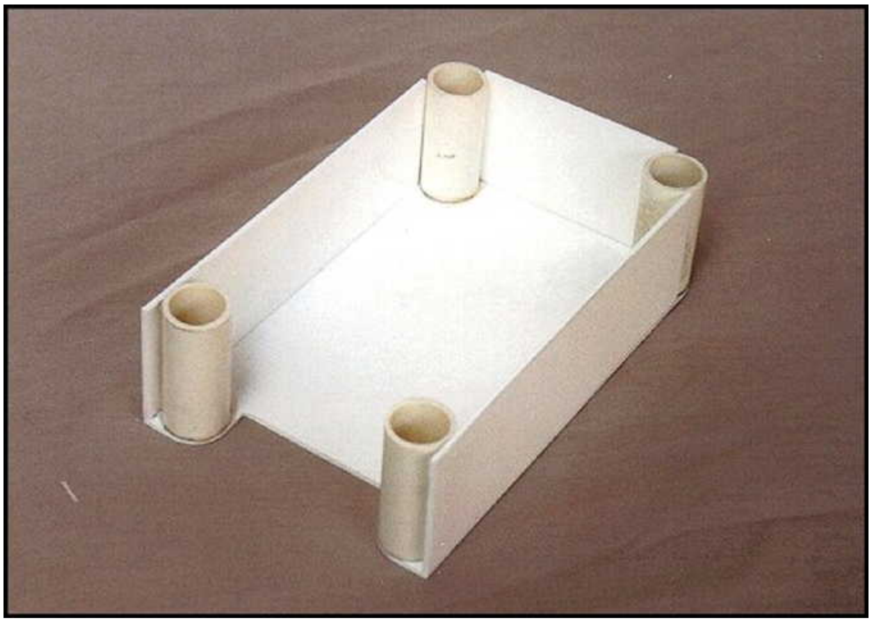
Step 1 - The Tender Deck Profile: Cut out the Tender deck profile in 2mm thick styrene sheet.

Step 2 - The Tender Corners: Go out into the world and find a plastic pipe 19mm in diameter, or as close to as you can. Since you only see 1/4 side of this pipe, the 19mm can be as little as 18mm or as much as 20mm. 19mm is the aim. You will use four 42mm lengths of this pipe to form the corners. (On the big 2-8-6T, the corner pipes will be 46mm tall). The total height of the tender deck for long and short Tenders (except for DSP&P #23 and #24) will be 44mm. The top deck profile is 2mm thick from step 1. You need to cut your 19mm pipe into FOUR 42mm tall units. Your tender deck profile and 4 pipes will look like this:

Now, glue your 4 pipes into the corners of your tender deck. Note that your tender is currently up-side-down, the tender deck profile does in fact form the top of the tender. If you have trouble gluing the pipes due to dissimilar materials, consider using an epoxy glue or another industrial glue. Since 3/4 of these pipes will be hidden inside the tender, and the outer face will be clad over, neatness is not really an issue. Just make sure you've glued these pipes strong and perfectly vertical.

Next, using 2mm styrene sheet, cut out the 3 tender sides (two sides and one rear section). Weld these sides onto the deck sheet (onto the bottom face, not the side edges). Install the sidewalls against the vertical corner pipes. Use epoxy at the interface between pipe and wall if needed. Make sure you run the outer face of the sides level with the outer edge of the pipes, refer to the PDF detail.

You construction will look like this:



Step 3 - Reinforcing

Now to reinforce the tender. This is done by inserting a couple of 42mm tall 2mm thick blades against the side walls, next to the rear pipes. If you want a larger uninterrupted tender space, then make these blades no wider than the rear corner pipes.

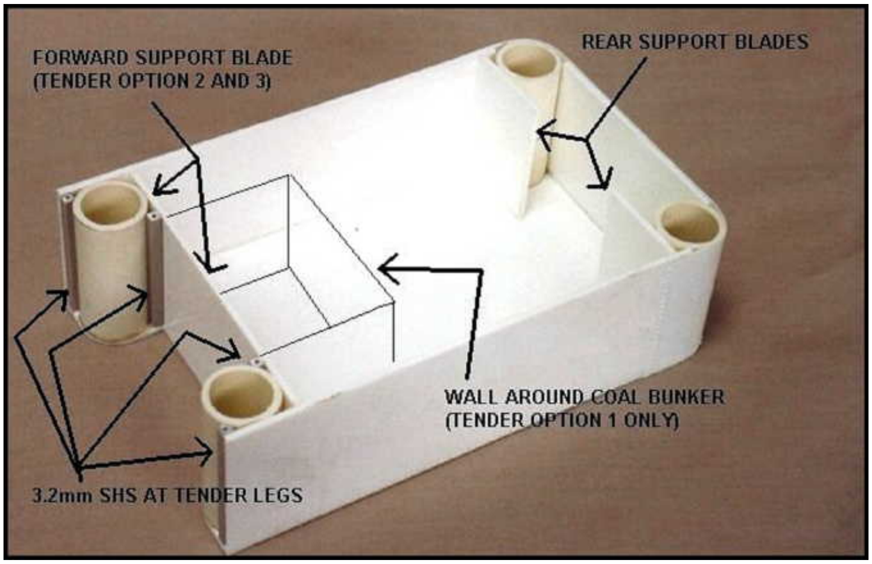
At the front of the tender, you'll run some more 42mm tall blades either across the width of the tender, for tender option 2 and 3 (as seen on my tender) or around the prototypical coal bunker of tender option 1.

At the positions shown on the PDF at the front end tender legs, insert four 42mm long, 3.2mm Plastruct SHSs at the front corner pipes in preparation for the tender leg cladding.

At this point you have completed the 'tender former'. All the tender detailing is applied to the outside of this form.

I would advise that you test the fit of your tender shell into the rear wall of your cab. Compare the set out with the 'Tender Overall View' PDF to ensure you set the tender into the cab far enough. Check side clearances and top clearance in the rear wall of the cab. If your tender is lifting your cab up, you will need to grind off a shim from the rear cab wall. Also make allowance for the 0.5mm cladding to be applied to-the sides and top of this tender. In other words check that the tender does not only fit, but is a comfortable, loose fit into the rear cab wall. At this time check all your tender set outs for the loco and mark a line across the tender top indicating the point where the tender enters the rear wall. All your external detail modeling, such as making the tender flare, will not go forward of this line.

Your tender shell will look like this:



The Tender Cladding

Here is where everyone comes together to clad their tenders. The cladding will be done using either 0.005" brass wrapping (same stuff as used on the Patina boiler jackets) or 0.5mm styrene sheet. Rivet detail can either be punched in (as shown on the prototype tender here) or drilled and insert pin heads, or apply droplets of glue to simulate rivet heads.

Rivets - A few words

In my opinion, rivets are where serious modeling addiction can lead you astray. Too many fine model makers love rivets so much, they'd rather use 'real' rivets even if the rivets are twice the size of a scale rivet – that’s TOO BIG! We all love rivets, but discretion is the better part of valor, and a nicely scaled rivet will do more for your model in the big picture.

To get a feel for the rivet sizes desired on an 1870s tender, take a look at the Bachmann 1:20.3 4-4-0 or 2-6-0 tender, then take up a pin head and compare; now you know the challenge in front of you. Rivets are good - scale rivets are better.

No matter which method you are going to use to represent tender rivets, make sure you do not make them too large. The diameter of the rivet you're aiming to make is only 0.7 - 0.8mm (1/32"). Typical pin heads are around 1.4mm wide (1/16").

The Punched Rivet Method

This is age old, and I still believe to be the best way to produce rivets of controlled sizes, including the tiny rivet heads needed for tenders. Basically, you use a metal 'spike' implement and press rivets into the rear of your cladding sheet. The size of the implement used, and the pressure applied to it, will determine the size of the rivet head. Punch the rivet heads into the rear of the styrene or brass wrapper atop a firm base, with a hint of 'give' such as a block of hardwood. This will reduce distortion in the sheet around the rivet head.

The Drill and Insert Pins Method

You've all seen it, you've all tried it and you all think it's fantastic. Drill 1000 tiny holes in the tender side and insert 1000 dress maker's pins, leaving the pin head exposed, creating the 'perfect' rivet. The process is good, and finish is good, but the scale of the pin heads is way wrong. This system is fine for use on firebox stays, some smokebox rivets, and major loco rivets, however the rivet heads are too large for use on tenders. When the edge rows of rivets along the tender sides are at about 2mm centres for 1:20 scale, the 1.4mm diameter pin heads are just too big. What you need are pins with a head the diameter of a pin shaft! Folks who love this method should go out and find smaller pins. One of the finest model makers in large scale is Barry Boggs. Barry uses the drill and insert pin method on his 2-8-2 tenders, but with a difference. He uses PIKO or similar HO rail spikes for the rivets and gets the desired effect with appropriately sized rivets.

The Glue Drip Method

This would be among the most painless ways to make rivets, and with practice can look as good as any other method. Chris Walas and Ron Cheroske have used this system successfully for a while. Basically you use a pin or pointed instrument to apply a drop of glue onto the tender side. The drop forms a nice domed blemish that makes a nice rivet when hardened. Rivets of all sizes can be done. For really small rivets, such as the tender rivets, Chris Walas successfully used gap filling super glue as a medium. Mark out your tender sides to locate each rivet and then using a measured drip of glue on the end of the spike, apply each rivet, aiming to get an equal amount of glue into each rivet.

Making the Tender Cladding

Step 1 - The Wrapper

Refer to the PDF drawings entitled "Outer Wrappers - Engineer's Side", "Outer Wrappers - Fireman's Side", "Outer Wrapper - Rear Face" and the "Top Wrapper Profile" and ensure you are looking at the correct one for 'long' or 'short' tenders! The same wrappers are used on all 3 options of tenders (re tender shell space).

Using the Tender Wrappers PDF, cut out the 5 wrapper elements. Each shall be 44mm tall. The wrappers shall be max 0.5mm thick styrene or 0.005" brass sheet Using the rivet layouts shown on these drawings, mark out pencil lines on the wrappers where the rivet lines run. There are two sorts of rivet line:

1. The edge rivets. This line of rivets prototypically hold the sheets of the tender together forming the tender shell. They run around the perimeter of each tender element, and are spaced at 2mm centres for a 1:20.3 Mason tender. When applying these rivets, I draw the line where the rivets run on the styrene, and then holding a ruler against the line, spike the rivets along the ruler edge, counting out loud: "2, 4, 6, 8, 10, 2, 4, 6, 8, 10" and so on. You'll get a line of rivets evenly spaced and nice and straight.
2. The bracing rivets. The bracing rivets are on 2 lines along the centre of the tender sides, forming a zig-zag pattern. The two lines are actually 2mm apart, with each row of rivets at 6mm centres. The two rows are 3mm out of phase. I actually mark each rivet location in pencil along these rows, and then punch them. The Bracing rivets do not actually hold the tender together, but rather hold a 'T' section member against the inside the tender sheeting. This 'T' section holds the tender sides straight, preventing the sides from bowing outward when the tender is full of water. Refer to MasterClass 2001, Chapter 7- background, for more info.

If you're using the punch method, punch your rivets into the sheet styrene or brass wrappers now, remember you are punching into the rear of the sheets!

If you're going to use the drill and pin method or glue droplet method, then I would recommend applying the wrappers onto the tender sides first, and then applying the rivets from the outside.

Step 2 - Applying the Wrappers to the Tender Former

Once you've punched or marked your rivet pattern onto the tender wrappers, it's time to apply these to the sides of your tender former.

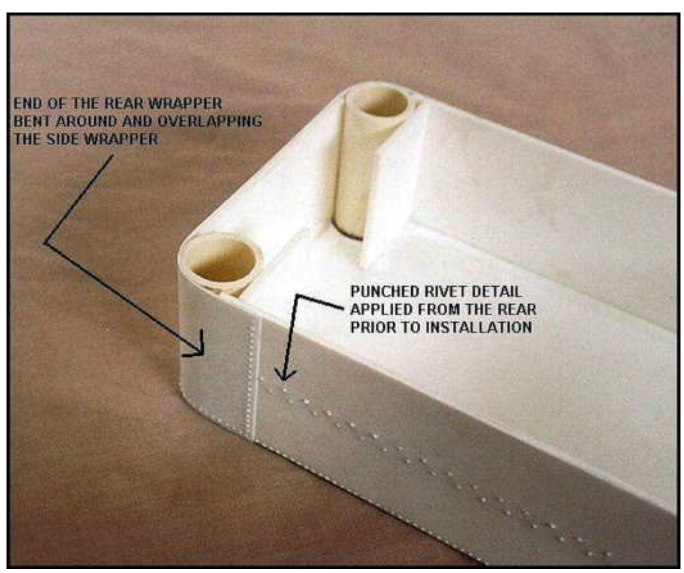
Apply the long tender sides first, aligning the leading edge of the wrapper with the leading edge of the tender former. Use Araldyte or epoxy glue to bond the wrappers to the tender form. Do not use a welder cement, as this will distort the styrene wrapper, and continues to melt the wrapper for some time after the wrapper is stuck down! A film of epoxy between the wrapper and former will provide a non melting bond, as well as provide some flexibility between the tender layers, allowing for movement when temperature changes affect the tender. Mix up the epoxy and grease the glue all over the rear side of the wrapper. Leave no area free of glue. Then place the wrapper onto the tender side and hold it firmly in place, make sure there are no air bubbles under it. Wipe clean any epoxy excess that might ooze out.

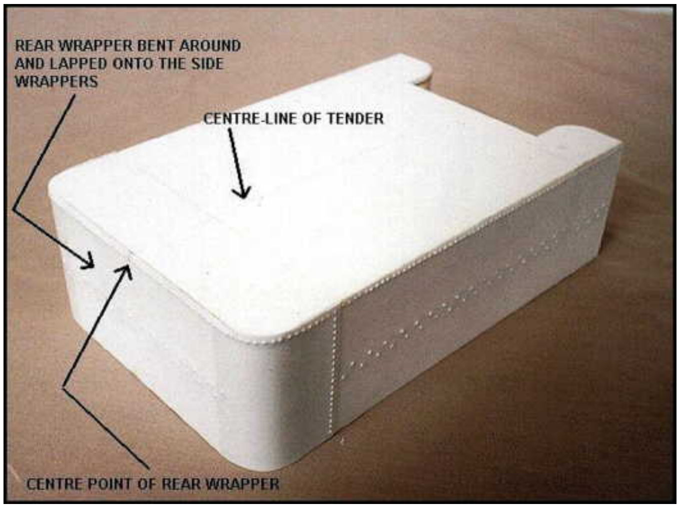
Once you have applied the two side wrappers to the tender, it is time to apply the rear wrapper. Mark out a centre point at the top of the tender rear, and also mark out a centre line to the rear wrapper. Grease epoxy over the rear face of the tender former. Do not grease the back of the wrapper this time. Apply the wrapper to the rear of the tender, aligning the centre of the wrapper with the centre of the former. Only the middle 2/3 of the wrapper will be stuck down, the ends will be hanging in space.

When the wrapper is stuck down to the rear face of the tender former and the epoxy has hardened, apply more epoxy to the rear of the wrapper ends not yet stuck down. Then fold the ends of the rear wrapper down around the radiused tender corners and flat onto the tender sides. The rear wrapper should overlap the side wrappers, simulating the lapping of metal plates. You will note how the rivet detail on the side wrappers does not run under the overlap area.

Finally, apply the two smaller tender leg wrappers to the front curved ends of the tender if building tender options 2 and 3. Use tape and clips to hold the wrappers in place around the curved tender legs. If building the prototypical option 1, you have a very long continuous wrapper to apply around the tender legs and into the coal bunker area. Apply the rivets as shown on the PDF.

Your tender shell, complete with wrappers will look like this: Tender as seen upside-down.





Tender as seen upright.

Step 3 - The Tender Flare or Collar

Referring to the same wrapper PDF sheets, drawn above the side wrappers you will see the two layers of the tender flare.

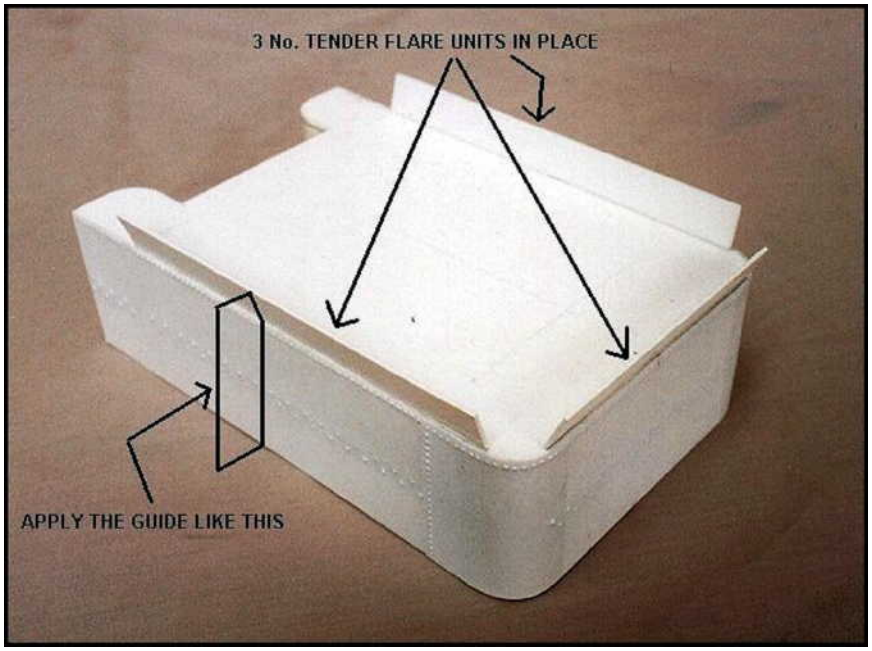
OK, we enter classic 1870s design now! Time to add the Tender flare, or Tender collar, This is the angled trim that runs around the top of the tender.

Cut out a strip of 0.5mm styrene, 11mm wide. Cut yourself a length about a foot long. That should be enough to make all the bits to the tender flare.

On the wrappers PDF is a shape called the 'Guide for Tender Flare'. This odd shaped component is to be cut out in 2mm thick card or styrene. We use this as a guide against the tender side to gauge the correct angle of the tender flare. Basically hold it against the side of the tender, with the angled cut at the top. When you apply your flare elements to the tender, let them drop against this guide, providing the correct angle.

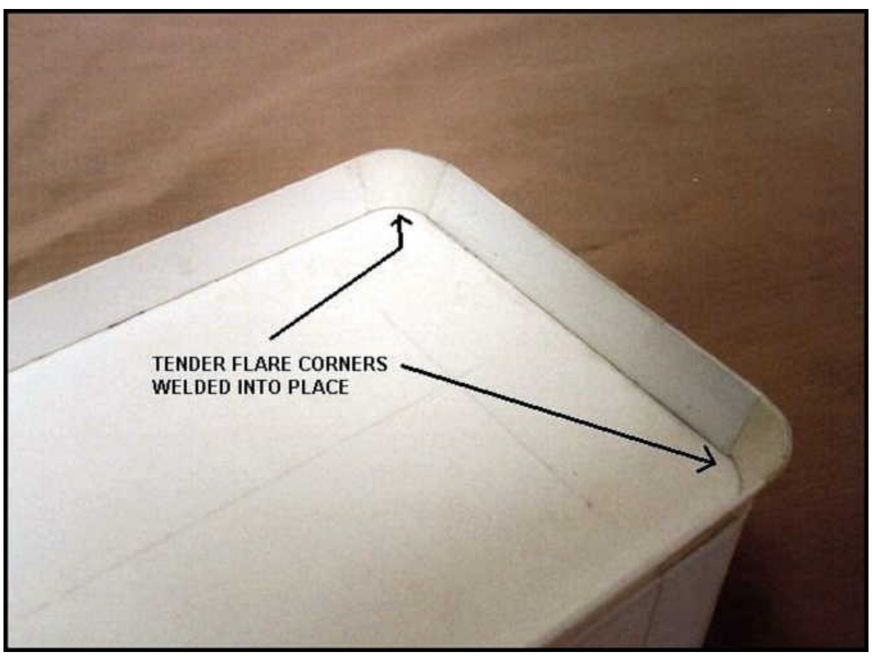
Weld the 3 backing flare parts to the tender top, using the guide to hold them in place. The backing parts are the flare elements without any rivet detail applied. You can cut more than one guide if you like. The bottom edge of the flare elements will rest on top of the tender top sheet, up next to the inside edge of the 0.5mm side wrappers. Make sure the lead end of the flare elements align perfectly with your cab wall line. The flare will abut the cab wall, but not run inside the cab.

Please note: It is possible to cut the side wrappers and outer flare as one element, and simply bend the flare at the interface. This might make the application of the wrappers to the tender former a little more difficult, but the flare will also be stronger. If your wrappers are to be brass sheet, I would recommend you cut the flare and wrapper sides as one element. To do this, simply cut out the wrapper and flare templates, tape them together, and trace them onto your styrene or brass sheet...either way, your tender with flare will look like this:



Now cut out the tender flare backing corner parts in 0.5mm styrene sheet. These are a strange fan shaped element; again use the element without the rivet detail applied. Bend the parts around the top of a pencil to get a conical curve into the styrene parts. Weld the corner elements onto the tender top abutting the side flares.

Your tender will look like this:



Now comes the fun part, detailing the flare! We have some rivet detail to add, showing the method the prototype flare was fastened together. We also need to add a rolled edge to the top edge of the flare.

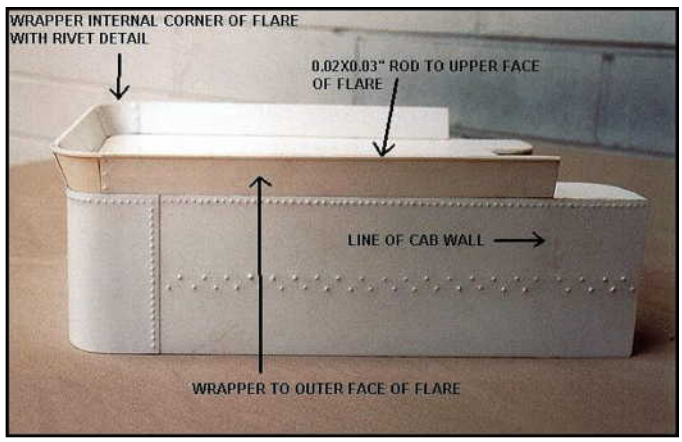
Using the PDFs showing the 'flare outer layer', cut the three 11mm wide flare strips in 0.5mm styrene. At the ends of these strips, punch in 3 rivets as shown in the PDF. Using your epoxy glue, grease a film of glue onto the back of the flare elements and apply them over the top of the flare elements already installed on-the tender. The rivet detail ends will be toward the curved rear end of the tender. You will notice that the flare outer layer overlaps onto the corner elements a tad. Good, this adds strength and provides a hint of-

metal sheeting overlapping per prototype. The flare sides are now a full 1mm thick, made from the 2 layers of 0.5mm sheeting.

Now cut out the corner flare outer layers from 0.5mm styrene sheet, punch in the 6 rivets per corner, and bend them to their conical shape over a pencil tip. The outer layer of the flare corners will in fact be applied to the inside face of the corners. The 3 rivets to be punched into these corner parts should in theory align with the 3 rivets seen on the outside of the flare...ie these are the same rivets seen from both sides of the flare!

Finally, take some of your 0.02x0.03" 'rivet rod' Evergreen styrene strips, and weld a strip flat around the top face of the entire flare. The rod should be applied against the side of the flare, aligned with the top edge (refer to the PDF). When the welder has hardened, lightly sand the whole of the top edge of the flare, taking the hard edge off the corners of the strip and rounding off the top edge of the flare itself. If you're making a brass wrapper, you can solder on a 1/32" wire bead and fill the gap with solder, or you can get 1/16" half-round brass wire from Sulphur Springs Steam Models - it's a little oversize, but looks very good and is much easier to work with.

The finished tender flare will look like this:



Step 4 - Detailing the tender top deck

OK, time to detail the top of the tender using another 0.5mm flat wrapper.

Refer to PDF drawing entitled "Top Wrapper Profile".

Choose profiles for Tender Option 1 (prototypical), or 2 or 3 (for batteries). Cut out the wrapper in 0.5mm styrene sheet. Punch in the rivet detail and glue the top deck cladding into place, up against the bottom edges of the flare.

For tender options 1, the prototypical tender, you'll be applying a full wrapper to the extent of the top deck, complete with edge rivet detail and bracing rivet lines.

For Tender Options 2 and 3 (tender full of coal), you are only making the cladding for the rear deck where the water hatch is, and the cladding atop the front tender legs, inside the cab itself. Detailed cladding inside the coal bunker and hungry boards area is not needed.

Apply the wrappers atop the tender again using a film of epoxy.

Step 5 - The Hungry Boards

The Hungry Boards are added coal boards above the tender top designed to increase the coal load capacity of the tender. As seen from the builder's photos of the South Park Masons, all the loco were delivered with metal rail-like hungry boards. On the face of it, these railings looks pretty open and useless, for they look like they would hold a wood load far better than any coal. This appears to be the case, because every photograph of as Mason in service on the South Park shows these railing blanked off with sheet metal behind in an effort to hold the coal inside the railings.

Also every in-service photo shows the extent of the railings shortened to a position forward of the water hatch. The builder's photo of San Juan shows the coal railings running the perimeter of the tender, which meant the water hatch would be quickly buried in coal!

Therefore anyone building the 'as built' version of the Mason, should build the hungry board railing right around the tender perimeter as shown in Mason option 1, 2 and 5 from Chapter 1.

Anyone building in-service versions of the Mason should make the shorter hungry boards, complete with backing sheeting, as shown in options 3, 4 and 6 from chapter 1. Additionally, it would be OK to build options 1, 2 and 5 with the railing style of Options 3, 4 and 6 because we know the railings were changed very early on.

For both Long and Short Tenders, Refer to the PDF sheet entitled:

"Hungry Boards, As Built",

"Hungry Boards, As Built - Sectional View", (For Mason Options, 1, 2 & 5).

"Hungry Boards, As Built - Bully Boy"(Optional),

"Hungry Boards, As Built- Bully Boy - Sectional View".

"Hungry Boards Modified" (for Mason Options 3, 4, & 6).

"Hungry Boards- Railing Details"

For the Long Tender there is also a "Hungry Boards - As Built - Plan View" PDF.

For Mason options 1, 2 and 5, the railings are open, without the sheet metal backing of the modified hungry boards. If building the open railings of Option 1, 2 and 5, I would recommend you make them out of flat 1.5mm wide, 1mm thick K&S brass strips, for the railings, and 2.5mm wide, 1mm thick brass strip stanchions. Solder the horizontal bars against the vertical stanchions, and bend the vertical stanchions to the shape shown in the PDF. Use 10BA or 0-80 bolts to bolt the stanchions onto the tender top.

Mason options 3, 4 and 6 (also, if you like, option 2) have sheet metal backing to the railings. Building the cladded hungry boards is much easier, because you are literally building an open styrene box, with railings welded flat against the outside. All the strength in the model is in the backing sheet. This railing-clad box will also form the removable lid to the tender top for battery access etc.

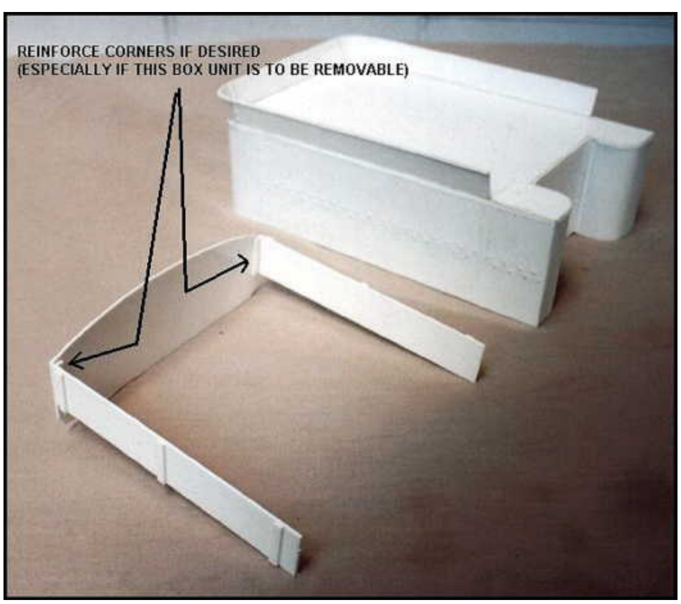
At this point, please refer to the in-service photos of your particular Mason. The railings for all the Masons are the same, but the sheet metal suspended behind the railings differs from Mason to Mason! In this demo, I have designed the backing sheet to represent #42, which also seems appropriate to DSP&P #13. DSP&P #44 however has a different shape cladding, and some Masons, such as #55 and #57 have sheeting behind the railings that rides much higher than the railing height. I have represented some of these backing profiles in the PDF, but there are more out there!

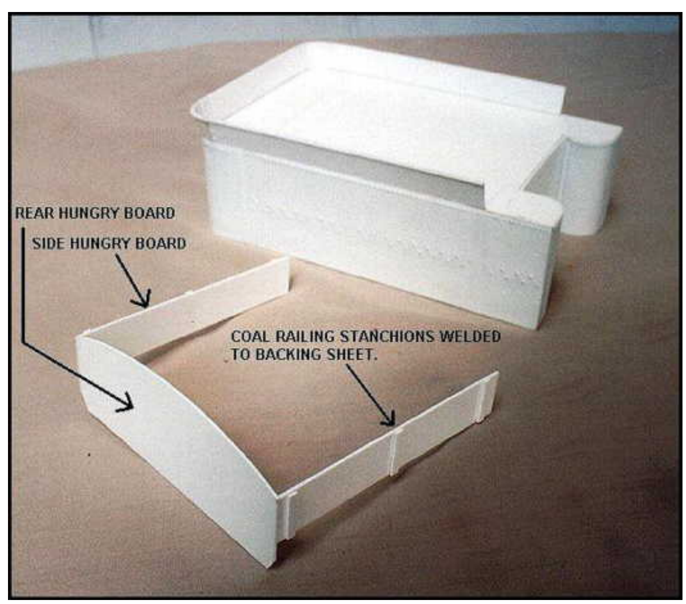
Choose your backing sheet profile to the hungry boards and cut out the 3 elements from 1mm thick styrene sheet (that's the back sheet and two side sheets).

Weld the back sheet to the two side sheets. Note that the sides are only half height, as they will rest atop of the tender flare, while the rear sheet will run down to the tender top.

You can then make your exposed coal railings from 1mm thick, 1.5mm wide styrene strips, and the stanchions from 2.5mm wide, 1mm thick styrene. Weld the vertical stanchions to the backing sheets at the locations shown in the PDF.

Your tender hungry boards unit will look like this:

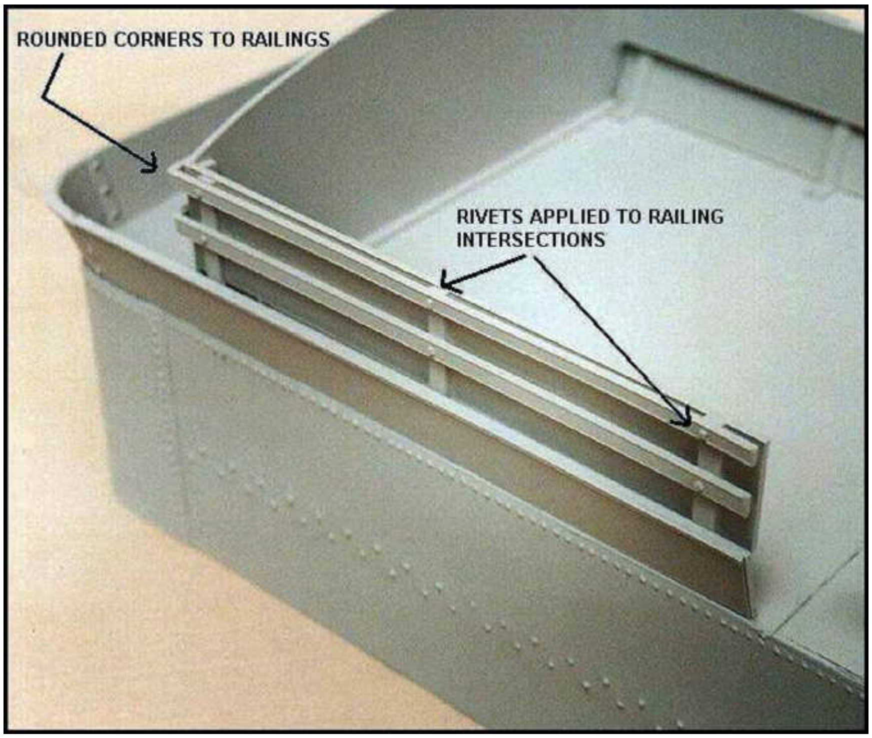




Next, weld the horizontal railings atop the vertical stanchions. At the cross over of each vertical and horizontal railing, weld a cube of 0.02x0.03" rivet rod, simulating the rivet fixing of the railings. Carefully sand the corners of the railings where they run from the side to the rear of the unit. You need a radiused corner, simulating the metal railing being bent around the corner.

For 'as built' Short Tender Masons, Options 1, 2 and 5, the brass railings follow the tender flare entirely, so remember to radius the railings to match the radius of the tender flare at the curved rear corners (brass will be easier to use here than styrene). On the 'as built' long tender version, the railings are still radiused at the rear of the hungry Boards, but this detail occurs well in from the rear of the tender, refer to the PDF entitled "Hungry Boards, As Built - Plan View, Long Tender."

The completed railings and rivets will look like this:



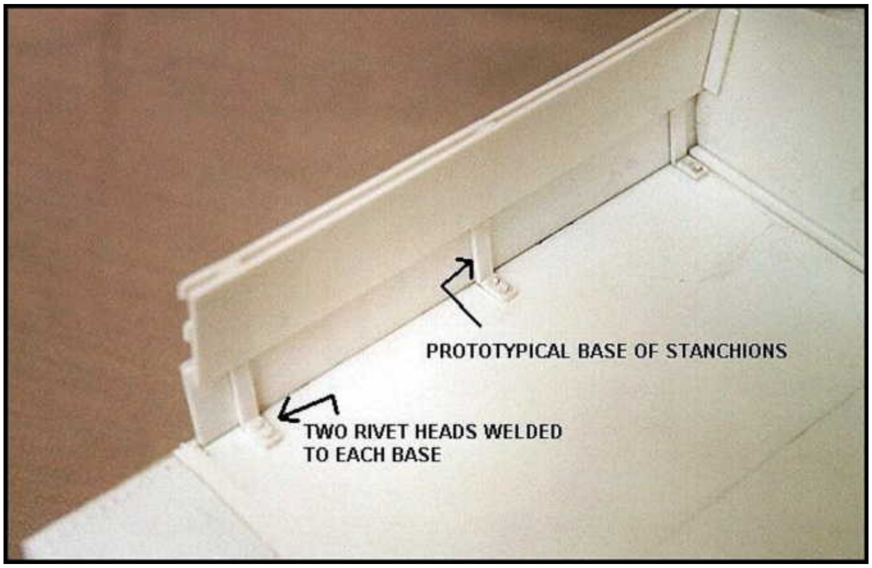
The stanchion Bases - Prototypical fixing - Tender Options 1 and 2 Only

Those building tender option 3 will be making the entire hungry board unit a removable box. IN doing this, you will be making a front styrene sheet to hold up the hungry board sides. This front sheet will rest against the rear cab wall. You will also install a styrene top to the unit, forming the complete box. Coal will later be glued onto the top of this unit, making the whole think look like hungry boards full to bursting with coal.

For those thinking of having a more prototypical hungry board detail, and exposing the bottom of the hungry boards with a half-empty load of coal, you are now required to finish the bottom portion of the railing stanchions. This is easy. In line with the stanchions on the sides, weld a continuation of the stanchion down the angled inside face of the tender flare. Where the stanchion meets the tender top weld another short length of 2.5mm wide strip. Atop each of these stanchion bases, weld a couple of 0.02x0.03" cube rivets. Repeat this action for the six stanchions on the sides. The stanchions on the rear face of the hungry board unit also turn inward, with the horizontal base just visible inside the coaling area.

When the stanchion bases are all in position, weld the entire hungry board unit to the top of the tender, the sides will be welded against the flare and the tops of the stanchions. Do this if building Tender options 1 and 2 only. Option 3 has the entire hungry boards unit as a removable box, and will not be glued down.

The finished stanchion/hungry board set up will look like this:



Step 6 - The Front Coal Boards

These are the boards used to restrain a full coal load from piling up inside the cab, burying the crew forever!

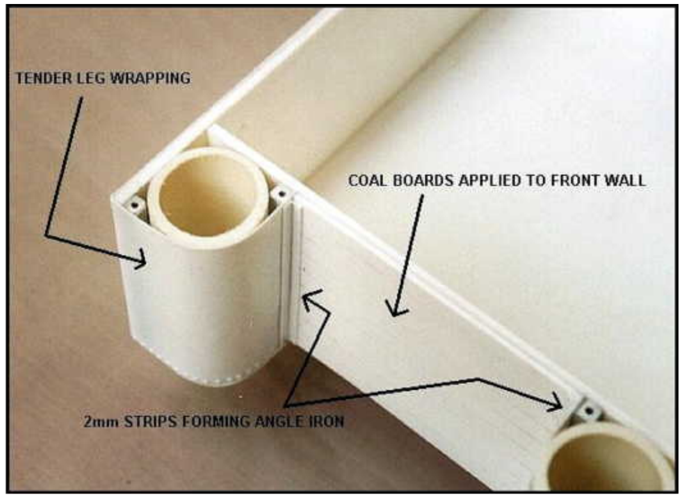
These are a series of individual boards slid down a vertical track just inside the front end of the coal bunker, forming a dam wall in effect. There was a small gap at the bottom that let the coal dribble out and permitted the fireman to scoop it up one shovel at a time.

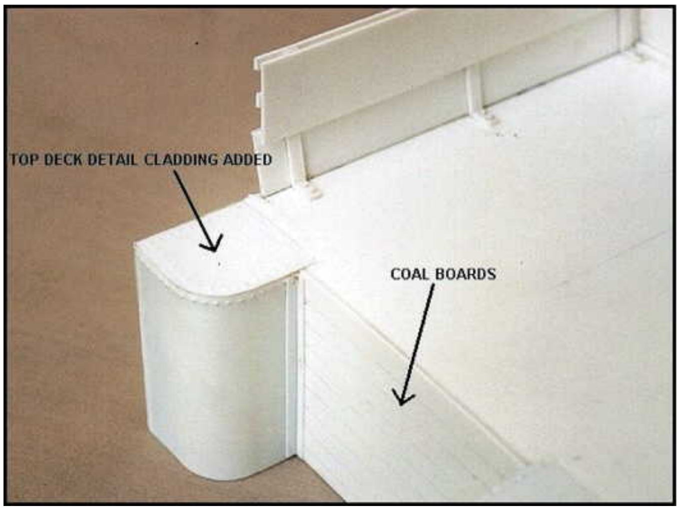
Tender Option 1 - Prototypical Empty:
For an empty tender and fully visible coal bunker, tender option 1, cut a 15mm gap at the bottom of the front wall and attach the boards over the remaining portion of the wall. You should apply the ‘L’-shaped rails that hold the boards in place on both the front and back of the boards.

Tender Option 2 and 3 - Filled and Full tenders:
For the filled-up options, we need to install the coal boards to the full height. It might surprise you, but the location selected for the front wall and brace to tender option 2 and 3 is also the location for the coal boards. We need only apply a detail veneer over this front wall, to simulate planks of wood. At the edges of the boards, we need to install two strips of 2mm wide styrene in an 'L' shape to simulate the angle iron used to hold the boards against the coal pressure behind. The profile for the coal board can be found in the middle of the tender shell space Option 2 and 3 PDFs entitled "Top Wrapper Profile".

Using strips of bass wood, or 1mm thick styrene planks, scored with wood patterns, glue the fake board veneer to the front of your tender, and weld the 2mm styrene strips along the edges, forming the angle iron.

The finished front coal boards will look like this, as viewed from the bottom:





... and the top.

Step 7 - The Water Hatch

Refer to the PDF sheet entitled "Tender Details - 1"

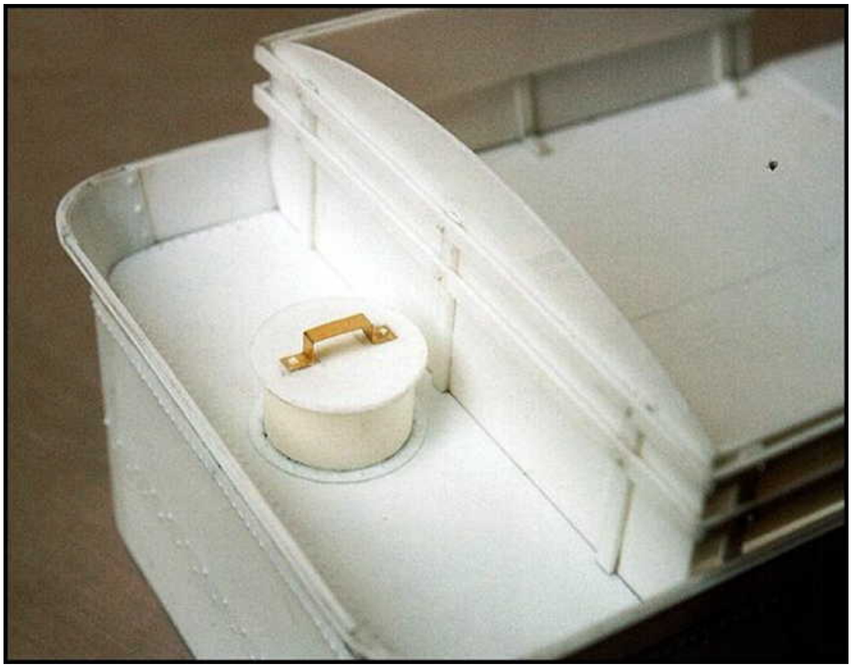
On the rear deck of the tender is a damn stylish water watch, used for filling the tender with water. Unlike many tender hatches, the Mason hatch is not hinged, but is a lift off lid, with a big handle on top!

We make the hatch by first cutting the bottom plate from 0.5mm styrene. Punch in the line of rivets around the perimeter, as shown on the PDF. Weld that plate in place on the rear top deck of the tender.

Next, using more of your 19mm diameter plastic tubing, cut a 10mm length. Stick this tube section atop your circular bottom plate.

Now cut out your lid circle from 1mm thick styrene, sand it into a nice smooth circle. The handle atop the lid can be made in about a zillion different ways, so do what you like to do. According to the engineering drawings, the lid handle was a flat metal affair, wider than it was thick. I used some of my boiler bands brass sheet, cut into a 2mm wide strip. I bent the strip into the handle profile. Then, using super-glue, glued the handle onto the lid. I then applied two rivet cubes, using super-glue to finish the look.

Whatever method you use, the finished water hatch should look something like this, with the top of the lid just above the tender flare height. For those wanting to know, this water hatch is quite large for a 1870s-tender, surprisingly large. Compare this hatch size to that on the Bachmann 1:20.3 4-4-0/2-6-0 and you'll see what I mean. What ever the reason may be, it's obvious the larger hatch was a lot more practical, and in years to come hatches would only get bigger.



Step 8 - The Hold Down Cleats

This is piss easy!

Following the PDF sheet entitled "Tender details -1", cut out the small profiles from 1mm styrene sheet, to form two cleats. Each cleat is made up of a longer vertical plate and a horizontal plate. Sand and round off the edges. Using your 0.20x0.03" rivet rod, cut out 10 rivet cubes and weld them to the vertical part of the cleat as shown in the PDF. On the horizontal part of the cleat, dice some 1.5mm rod to make two larger bolt heads (one per cleat), or use real hex bolts that you might have at the 1.5mm diameter size (10BA or 0-80). Weld the horizontal and vertical cleat plates to form an 'L' shape and weld the units to the tender rear as shown. The units and installation will look like this:

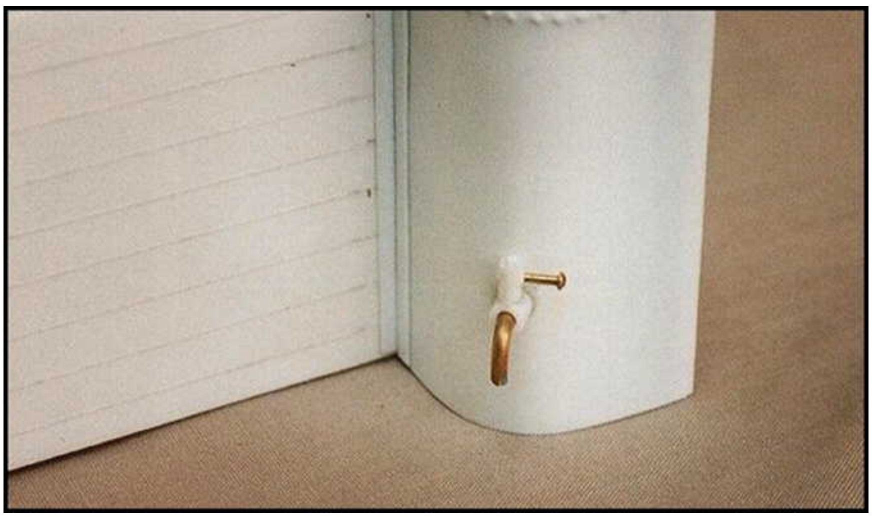
Step 9 - The Brake Wheel & Water Valves

... and we add the last details to the tender, that are to be hidden inside the cab, but make them we will!

The Water Tap

See PDF "Tender Details - 1."

Most tenders in the 1800s had a brass tap installed someplace so that the tender could be drained, or water could be drawn from the tender for a variety of purposes. Usually these brass taps could be seen on the outside of the tender on the fireman's side. On the Mason Bogie, the tap is inside the cab, on the curved internal face of the fireman's side tender leg. You can either use a casting or make your own tap. The tap will have a quarter turn handle on it, not a circular handle. I made the tap to look like the Mason tap by bending some 1.5mm brass rod into an 'L' shape. I then installed a 3mm length of 3.2mm tube on one side of the 'L' to from the body of the tap. Drilled into the top of this 3mm tube, I installed a 3mm length of 1.5mm styrene rod. In the side of this rod, was inserted a 0.75mm (.030") brass rod, with a drop of epoxy on the end. When the whole thing is painted, it will look like a brass tap. A hole was then drilled into the tender leg and the tap inserted. Following the PDF for tap style and location, the finished work should look something like this:



The brake wheel

Refer now to PDF "Tender details - 2".

Go out into the world and find an ordinary freight car brake wheel, of approx 17-19mm diameter. The wheel style you're after is one that has curved spokes. Any Delton/Aristocraft Classics brake wheel will be fine, also the new H-L-W brake wheel is good too. Otherwise search for a smaller Ozark Miniatures brake wheel. Remember not to get one too large, or it will hit the inside walls of the cab!

At the location where the brake wheel is to be installed is a cog and ratchet. Refer to the PDF for outline of installation. I messed around in my junk box and found an old slot car plastic cog that worked great for the purpose. Glue the cog to the fireman's side tender leg at the location shown in the PDF. Next cut out the ratchet lever from 1mm styrene, install a sliver of 1.5mm rod as a pivot bolt in the lever. Next drill a 1.5mm hole right through the cog and tender deck. Install your brake wheel onto a 54mm length of 1.5mm brass rod, and insert wheel and rod into the hole. Drop the wheel unit right into the tender until it touches the table top below. The top of the brake wheel should rest about 10mm above the tender top deck.

The Water Valves

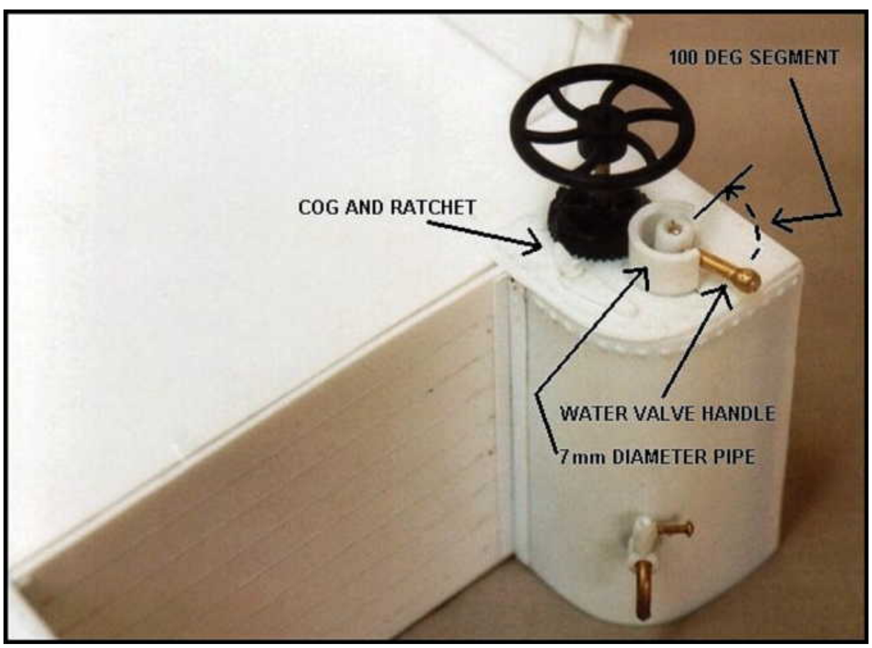
There are two water feed points from the tender that connect directly to the Injectors via sub-floor pipes. Both of these water feed points are located directly below the tender legs, and have shut-off valves on top of the tender legs. The valve handles are a quarter turn arrangement. When the handle is pointing forward, the water is 'On'. When the valve handles face toward the cab wall, the water is 'Off'. These handles connect to a long rod that runs down though the water tank to the bottom of the tender, where the rotating rod turns a valve.

On our Mason model we shall represent the valve handles atop the tender now. In chapter 7, when we add the pipe work from the tender to the injectors, we'll add the valves at the bottom of the tender.

The valve handles on this model will actually be able to turn. They are simply made, just like the prototype. The valve handles are unlike any kind I've ever seen on a tender before.

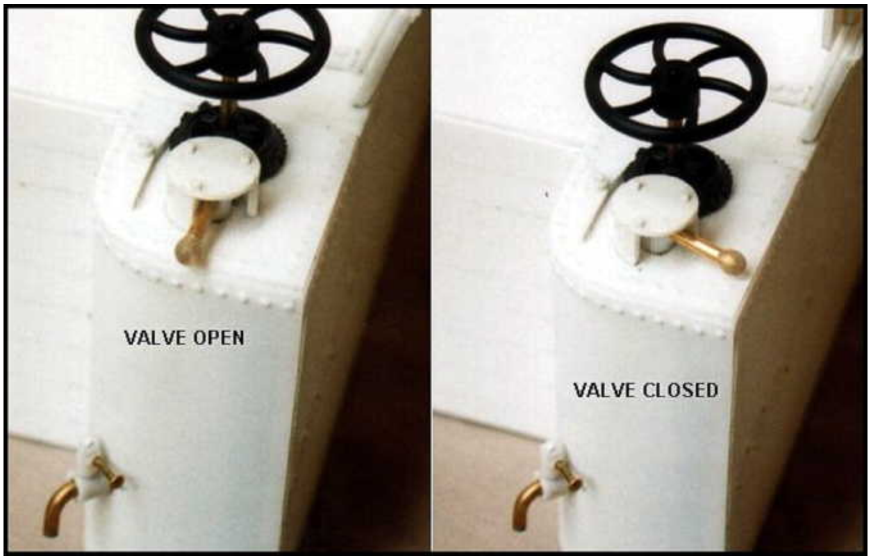
There will be two valve handles, one on each tender leg. The handles comprise two parts, the handle itself, and a housing over it. The handle is made, following the PDF, by inserting a 4mm length of 3.2mm styrene tube over the end of a short length of 1.5mm brass rod. Into the side of the 3mm tube we drill a 1.5mm hole, mid way up. Insert into this hole a short 5mm length of 1.5mm brass rod. Glue the rod in place using super-glue. Finally add a small drop of epoxy on the exposed end of the rod, forming the completed water valve handle. At the location shown in the PDF, drill a 1.5mm hole in the top of both tender legs. Insert the valve handle into the hole and allow it to turn (don't glue it down!). Next cut a 5mm tall sliver of 7mm diameter Evergreen styrene pipe. Cut a 100-degree segment out of the pipe. With the valve handle facing exactly forward, weld the 7mm pipe around the valve pivot, with the 100deg opening facing toward the side cab door.

The completed brake wheel and water valve handle will look like this:

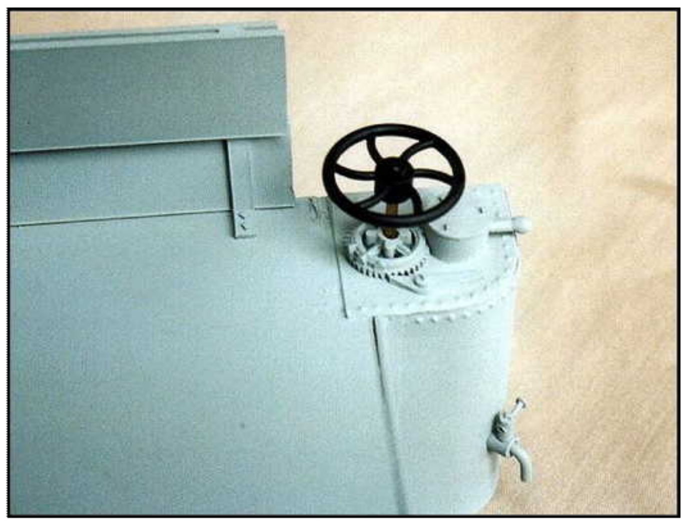


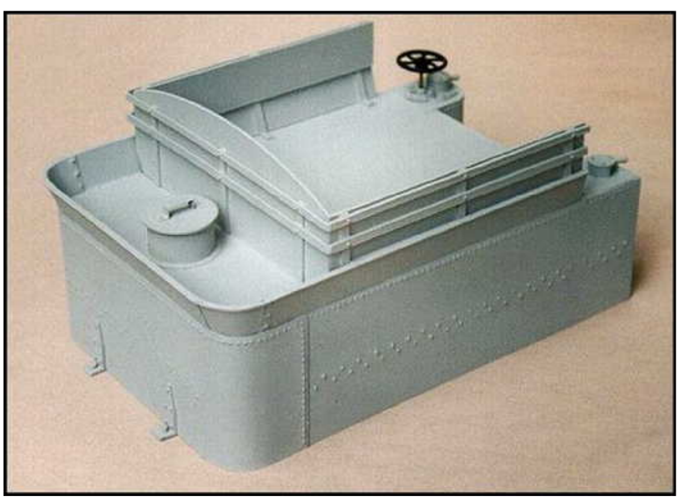
Finally we cap the top of the valve housing, with a 7mm diameter circular plate of 0.5mm styrene sheet. Weld the cover on top of the 7mm tube housing. On top of the housing are 3 large rivets. Using your 0.02x0.03" rivet rod, dice up 3 rivets per valve (6 in total) and weld them to the housing top as shown on the PDF.

The finished operating water valves will look like this. The valve on the engineer side tender leg will be the mirror image of this.

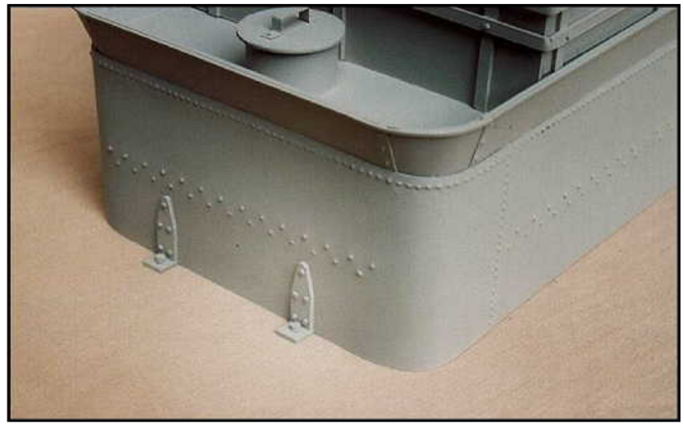


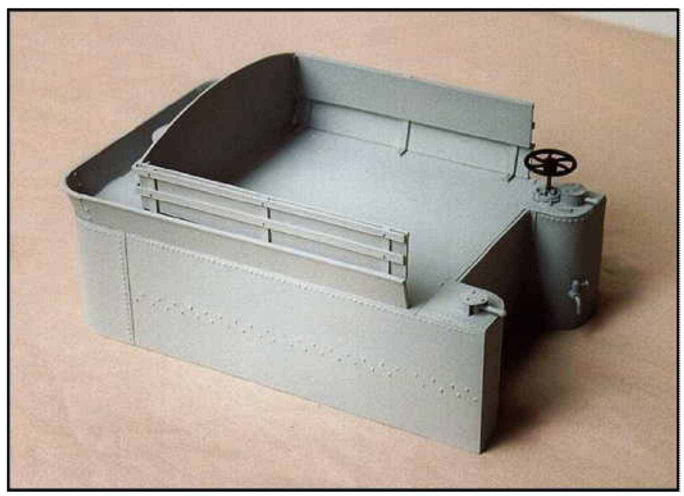
The completed brake wheel and water valve details will look like this:

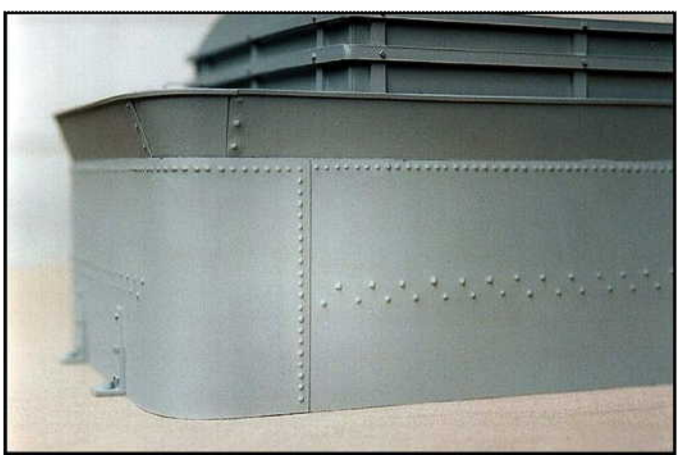




The completed Tender will look like this:







When you decide to fix the tender shell down to the tender deck from CH2, you will either weld a 10x10mm "L" angle along the internal tender sides, and screw fix into this angle from below the tender deck, or you can use some of your 6.4x6.4mm SHS welded to the inside for the same purpose. Refer to the PDF sheet entitled, "Fixing Tender Down to Tender Deck", for the concept.

The Low-Slung Firebox Assembly

Alrightalready… Time to move onto the classic Mason firebox and ashpan that was slung under the cab floor. Associated with that unit are two major structural elements, the inner structural frame and the outer braces. You've all seen the outer braces as these appear in most photos of the Mason in all eras. The inner structural frame is virtually unknown.

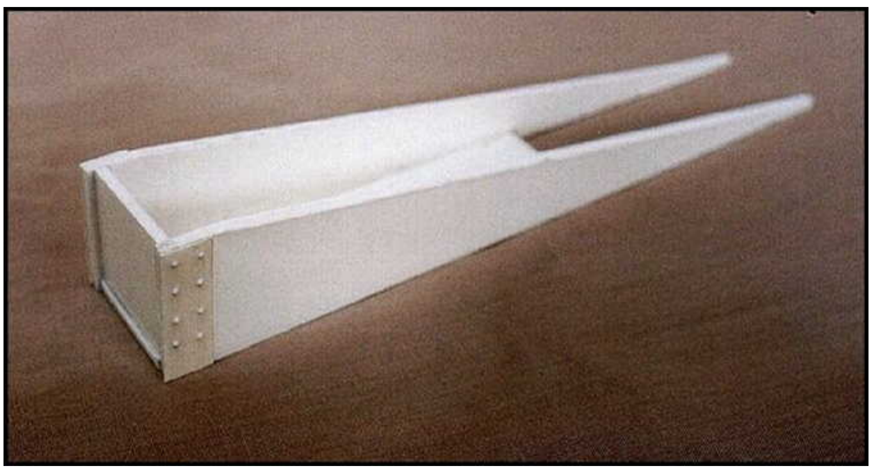
Making the Inner Structural Frame

Follow the PDF drawing entitled "Inner Structural Frame."

Cut out the base plate, end plate and two triangular sides of the unit in 2mm thick styrene as noted on the drawing.

Also cut out the two small rectangular patches from 0.5mm styrene sheet. Punch the rivets into the rear of the rectangles at the locations shown on the PDF.

Weld the 2mm thick components together, and weld the 0.5mm thick rivet embossed plates to the locations shown. That's all there is to it, the completed Inner Structural Frame will look like this: (note mine shown in this photo is wider than yours will be, that's an error on my part! It should be narrower!) The total width of the inner structural frame will be 16mm, mine is about 20mm due to a cutting error!



The Inner Structural Frame as seen above is shown upside-down. The flat base of the unit will run along the underside of the BBT tender frame.

Making the Firebox

Refer to PDF drawing entitled "Firebox Former."

The firebox construction is almost identical to the construction of a tender shell. We build a 2mm thick styrene box first, and then clad the sides with rivet detailed facings. Since the firebox is small, we do not need to use pipes in the corners to simulate the curved metal sheeting in the corners. We simply sand the corners of the 2mm thick box to produce a radius.

BIG NOTE:
You will need to access the firebox interior in future to add ash pan lights, lead weights or possibly a speaker. You will also need to access the insides to get to the 4 bolts that fix the whole firebox unit to the tender deck. The whole firebox unit will remain removable through the life of the model, because you will need to drop the firebox out in order to remove the pivoting chassis of the BBT.

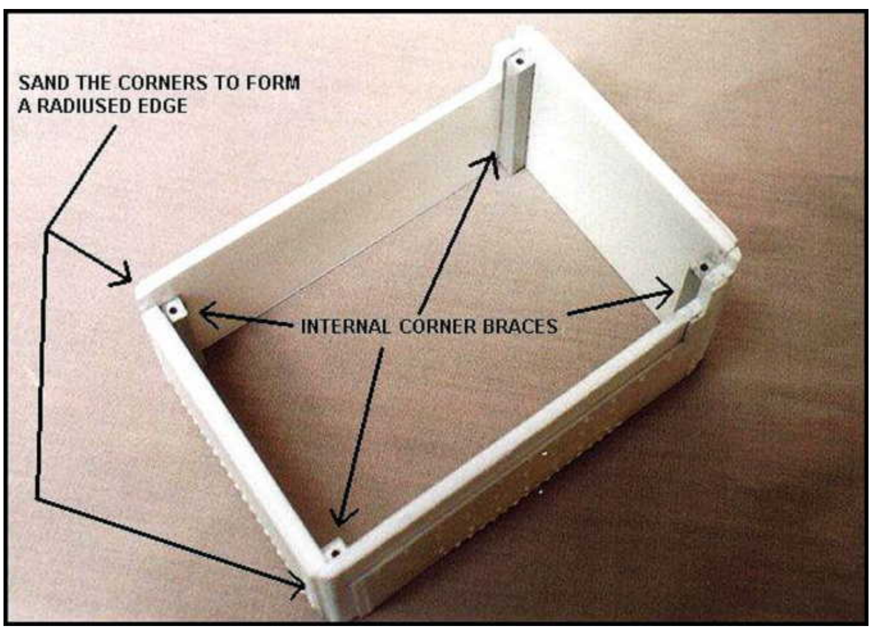
Step 1 - The Firebox sides

Following the PDF drawing, cut out the four sides of the firebox unit from 2mm styrene sheet. Weld the four sides together and brace the internal corners using 3.2mm Plastruct SHS rods, or use a Plastruct angle. Note that the 4 sides of the box are not all the same height. Make sure you keep in your mind where the top and bottom of the unit is, you are required to keep all the faces aligned at the bottom only. The wall tops will have different levels.

The corner braces run from the bottom of the unit up to a height no taller than the rear wall height. Use the same height on all 4 corners. Keep the corner braces small, so as not to waste space inside the firebox itself. We will later use the internal space of this unit to hold lead weight. There is also the option of using this firebox to hold a sound system speaker.

Once the box has set, sand the corners to create a radiused edge running the length of the unit at all 4 corners.

The completed firebox 'Box' will look like this. (Note that the lead corner braces on my unit are too tall, and had to be cut down later.)



Step 2 - The Cladding

Time to produce the cladding detail, and create the look of riveted boiler sheets. Like US tender construction, the iron plates of the firebox are essentially flat plates riveted to rolled corner sheets. Our curved corner sheets are already represented from step 1. We need only show the flat sheet iron plates riveted to the outside of the corners. Note that the sheet iron sides to be applied are not as tall as the firebox you have just made, the reason is that the firebox on the prototype was firmly bolted to the tender deck structural sub floor framing, from chapter 2. The two long framing members that run the length of the tender deck will be flat against the side face of the firebox. Our styrene frame members are thicker than the actual iron members used by Mr Mason, and we don't want the frame members to unnecessarily make our firebox narrower than it should be, so we leave off the rivet facing of the firebox where it intersects with the sub-floor framing. You will only be making the firebox cladding seen below the tender deck framing.

Refer to the PDF entitled "Firebox Outer Wrappers."

If building the "Bully Boy", or other 1877 0-6-6Ts, please refer also to PDF entitled "Firebox Cladding & Outer Braces, Bully Boy 0-6-6T."

Following the PDF, cut out the 4 cladding sheets from 0.5mm styrene sheet. There are basically two types of rivets to be applied to these sheets. The outer edge rivets are used to hold the outer firebox casing together on the prototype. The rivets exposed around the centre of the sheets are not rivets, but are firebox stays. These are domed-headed hollow bolts that hold a suspended firebox chamber within the firebox casing.

You can produce the rivets and stays in a number of ways, bearing in mind that the stays will have a larger domed head than the actual edge rivets. The edge rivet size, like those on the tender, will be around the 0.8mm diameter, while the stays will be around the 1mm size.

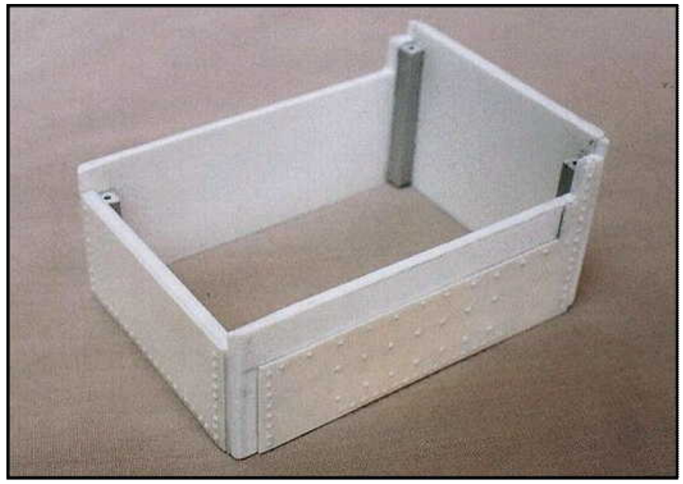
1. You can punch both types of rivets, applying more pressure to the 'stays' so that they appear larger.
2. You can punch the outer line of rivets, and drill and insert pin heads to the stays.
3. You can punch the edge rivets, and apply the stay heads in the form of diced up styrene rod, welded to the firebox sides.

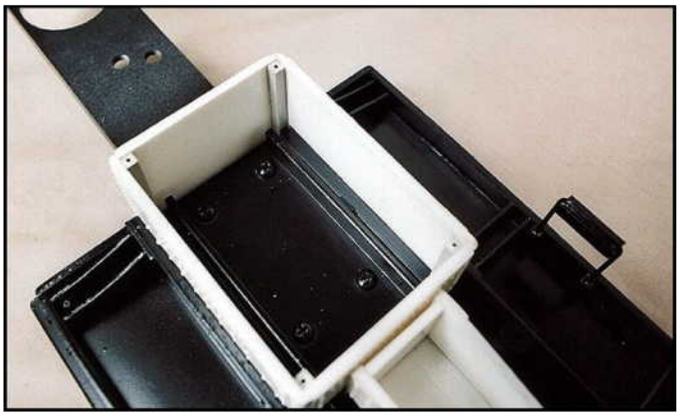
Whatever method you use, punch or drill out the rivets and stays as follows:

Edge rivets are on 2mm centres, (same as the tender). The firebox stays are on 5.5mm centres. I punch riveted both types. You will note some blank areas on the firebox sides, these areas are where the outer braces connect to the firebox, do not apply rivets here.

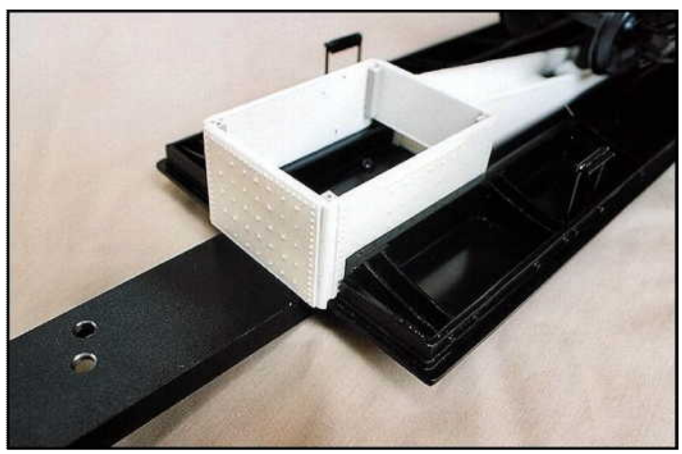
Apply the cladding to the firebox unit from step 1. Note that the cladding will run well short of the corners, simulating the typical firebox riveted metal.

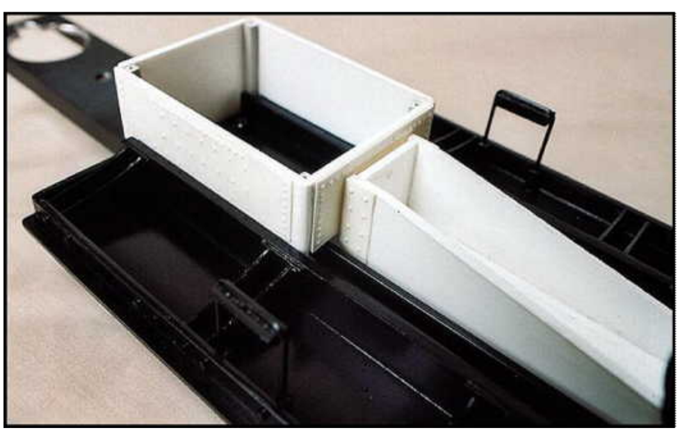
The completed firebox will look like this:





With the Inner structural frame unit and firebox dropped into the Tender deck sub-floor, the completed assemblies look like this:





The Outer Braces - A Mason Delight

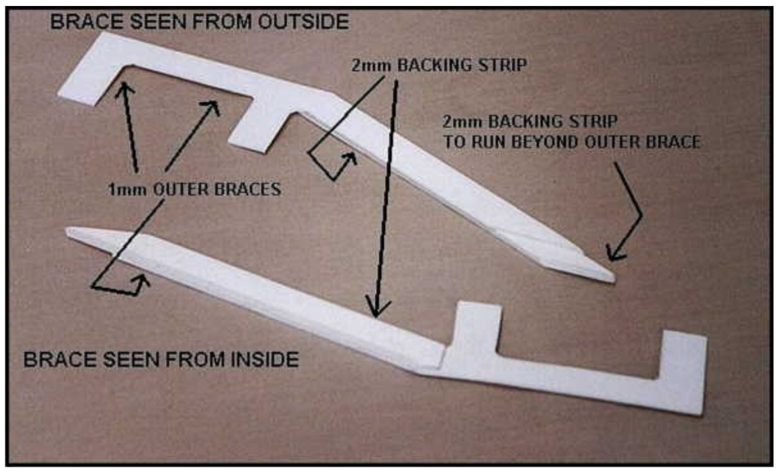
I love these elements on the Mason, those low slung angled braces that run from the very bottom of the firebox back to the tender deck. Hard to pronounce, easy to make!

Refer to the PDF drawing entitled "Outer Braces."

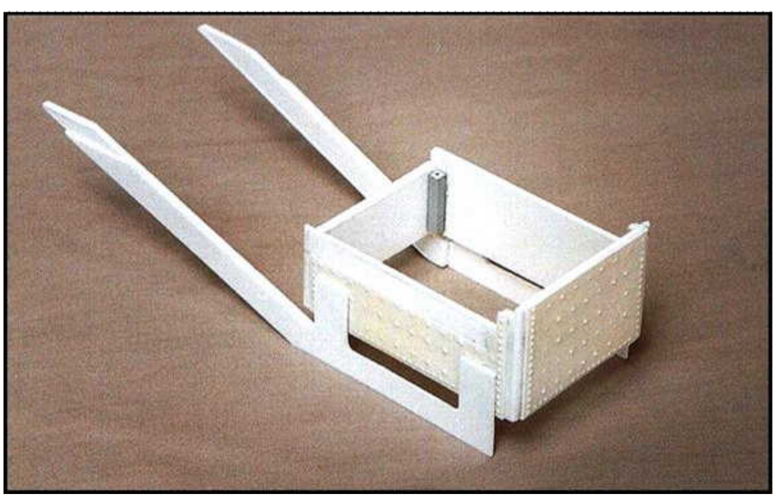
If building the "Bully Boy", or other 1877 0-6-6Ts, please refer also to PDF entitled "Firebox Cladding & Outer Braces, Bully Boy 0-6-6T."

Cut out the outer braces from 1mm styrene. We must use 1mm styrene because we do not want the bolted connection of the brace to look too thick when it is applied to the firebox side. So keep it thin. We then strengthen the braces by laminating a 2mm thick backing strip to the rear, beyond the firebox. We also make the backing element longer than the brace at the upper end in order to provide a 'cleat' for the braces to be attached to the tender sub floor framing.

The 1mm thick braces with 2mm thick backing will look like this:



Weld the braces to the firebox unit as shown on the PDF; take much care in welding these, as the location must be perfect. It might help to pencil in the location of where the braces weld to the firebox side. Then drop the firebox back onto the tender deck framing, and test fit the braces against the tender framing and firebox.



With the braces welded to the firebox sides, your assembly will look like this:

Detailing the Firebox Unit

Let’s add some details.

Refer to the PDF entitled "Outer Braces on Firebox."

If building the "Bully Boy", or other 1877 0-6-6Ts, please refer also to PDF entitled "Firebox Cladding & Outer Braces, Bully Boy 0-6-6T."

First, we apply the rivet heads to the interface between firebox and braces. In reality these are very large rivets because the method of heat shrinking rivets in the 1870s was a means in which builders could make permanent, strong, water-tight connections. On the other hand bolts could work loose, causing much distress to the boiler.

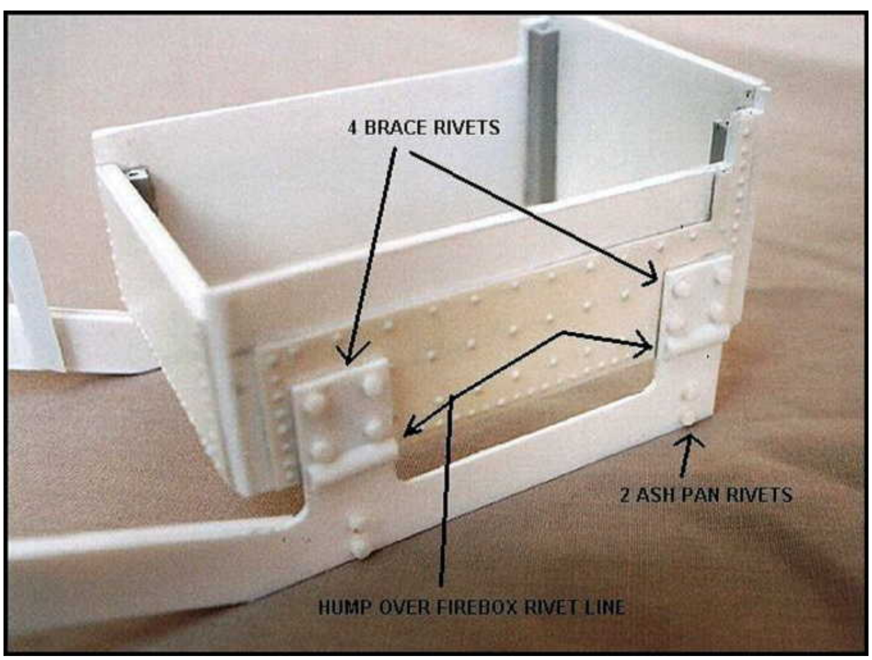
Generally there are four rivet heads to apply to the ends of the braces, against the firebox. Do, however, check your particular Mason's detail. Prior to 1878, Mason often used 6 rivets (as per the Bully Boy PDF), and some DSP&P Masons have 5 Rivets, set out like a '5' on the dice. Most DSP&P Mason have only four rivets. We make these by slicing 1mm lengths of your 1.5mm diameter rivet rod, and weld the rivets into place.

Directly below these 4 rivets is an odd striation visible on the brace side. This is actually a hump bent into the brace sheeting, and is designed to allow the brace to be firmly fixed to the firebox side, then hump over the line or rivets along the base of the firebox. The hump is easy so make. Take your 3.2mm styrene tube, cut two lengths equal to the width of the brace, and then carefully slice down the middle of the tube creating two half tubes. Weld the half-tubes to the brace side, perfectly aligned with the row of rivets along the bottom of the firebox.

Directly below the humps are two more rivets, these are used to hold the ash pan below the firebox, go ahead and weld these rivet heads in place, using 1.5mm rivet rod.

Apply all these details to all four brace interface points on both sides of the firebox.

Your detailed firebox will look like this:



The Blow Down Valve

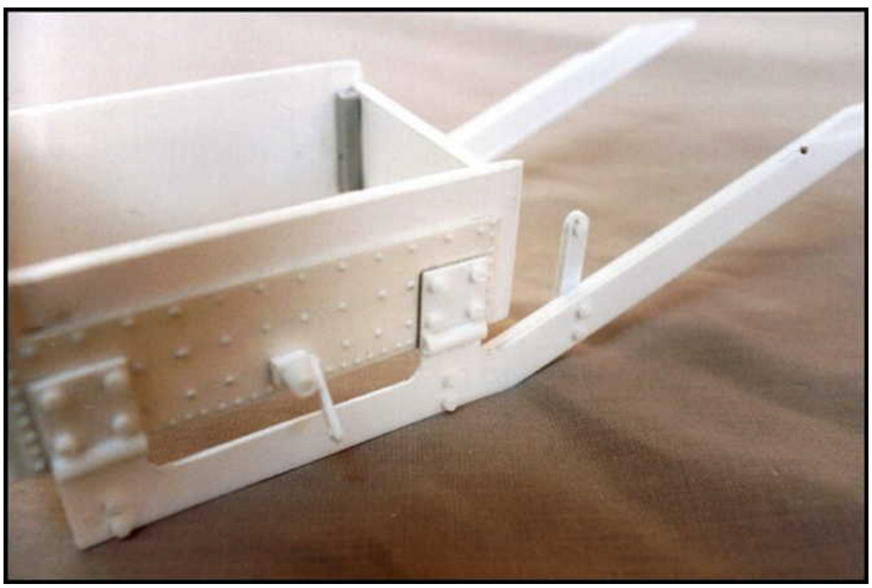
Refer to the PDF entitled "Forward Damper Levers & Blow Down Valve"

On the fireman's side of the firebox is the blow down valve, this is a large port to the lower firebox, below water line, that the fireman uses a couple of times a day to help blow out undesirable sediment from building up at the bottom of the firebox. When the valve is open a huge jet of water blasts out to the delight of most rail fans! The water leaves the 180 PSI environment of the boiler to enter normal atmosphere, and instantly vaporizes to steam at the sudden pressure drop. This valve is seriously cool, and sadly left off most models!

One important safety tip: as a rail fan, do not loiter near that blow down valve when looking at real locos. It would not be a good idea to be near it if it went off!

The valve is a simple outlet pipe from the firebox side, with a lever attached to the side. The lever is then connected to a control rod that runs up to the cab floor.

At the location shown on the PDF, apply the valve detail to the fireman's side of the firebox only (later era locos often have them on both sides!). First, cut a 3.5mmx3.5mm rectangle in 2mm thick styrene to form the base. Then cut a 3mm length of your 3.2mm styrene tube. Weld it to the square base. Finally weld a 10mm long, 1x1mm rod to the rear side of the base to form the lever. Weld on a 0.02x0.03" rivet rod to both ends of the rod to form the pivots. Weld the whole valve unit to the firebox, to look like this:



The Ash Pan

Refer to the PDF drawing entitled "The Ash Pan."

The ash pan is a simple sheet metal tray that sits below the firebox to collect all the falling cinders that find their way through the firebox grate. On early locos, such as those of the 1870s, the ash pan also had dampers on the front and back that could be used to regulate the airflow up into the firebox, and thus control the air flow and heat through the boiler.

On the Mason, the ash pan is suspended between the outer braces, and is slung below the bottom edge of the firebox. The ash pan also sits back from the outer braces, well inside the face of the firebox itself, to collect the cinders from the suspended firebox chamber within.

On our model, the ash pan only has two sides and a base. There is no front and back wall. The front and back are where the dampers are.

Using the PDF entitled "The Ash Pan", trace and cut out the ash pan sides from 1mm thick styrene sheet.

Next cut the lengths of 3.2mm Plastruct SHS as shown on the PDF. These are the spacers that hold the ash pan back from the inside face of the braces. Weld the SHS's into place as shown on the PDF. Note that the spacers on the fireman's side are in two short lengths, this is to allow the control rods of the dampers to pass. The spacers on the engineer's side are full length.

Weld the two ash pan sides to the inside face of the spacers, the bottom of the ash pan should align with the bottom of the outer braces themselves.

The Dampers

Following the PDF, cut out the two 'damper' doors from 1mm thick styrene. Do not get the two confused, the front and rear dampers are slightly different. For the front damper, cut out the two edge pieces from 0.5mm styrene and weld them onto the two short edges of the damper.

Now take some time to study the two PDFs:

"Forward Damper Levers & Blow Down Valve" and "Rear Damper Control."

Follow the levers, control rods and pivots, to work out in your mind just how the dampers actually worked!

Now, the big Decision! - Do you make the dampers movable?

I'm a model builder, building more for effect than for everything to function. I do not intend to play with the little damper levers in the cab to make the dampers open and close, so my dampers are glued into position, in a half open position! But I've been most impressed by the MasterClass members' thirst for fully functional details on this model, and as a consequence, I have generally gone to a lot more detail explaining how things worked than I had originally thought necessary. So, do you want your dampers to work?

Making the dampers pivot is the easy part, you need only fix a 0.75mm brass rod along the pivot edge of both dampers, drill a hole in the sides of the ash pan where the dampers pivot and insert the damper pivot rods into the holes. The front damper pivots downward, while the rear damper opens upward. Take some care because when the front damper is in the fully open position, it will snag the rear driver of the pivoting locomotive chassis, especially on the curves.

The real reason you might like your dampers to work is so you can fabricate all the pivots and levers used to control these dampers, right back to the control rods coming up through the cab floor! In the PDFs, I have drawn how the two lever sets work for the front and rear dampers. You can make these levers and control rods using 1.5mm wide brass strip, and 0.75mm brass rod, using tiny bolts to link the bits together.

Or like me you can cut out the levers in 0.5mm thick styrene sheet and weld them into place, with the dampers fixed in the half open position. I have pulled the front damper near closed to avoid binding with the chassis on the curves.

Where the control rods for all the dampers etc, run up through the cab floor, you can do this two ways:

1. Drill holes in the cab floor, and run the brass rods up through the floor. At the end of the rods, bend a nice loop handle using long nose pliers. Take heed, however, that your whole firebox unit must be allowed to drop away to service the loco, thus you will need to allow the control rods and handles to drop right through the cab floor, i.e., make the holes in the floor big, or disconnect the control rods from the levers every time you drop the firebox out.
2. For non-working dampers, cut the control rods off at the under-floor level, then later simply attach separate control handles to the cab floor. Visually the rods and handles will appear as one, but will break in two when you drop the firebox away. This is the method I'm using.

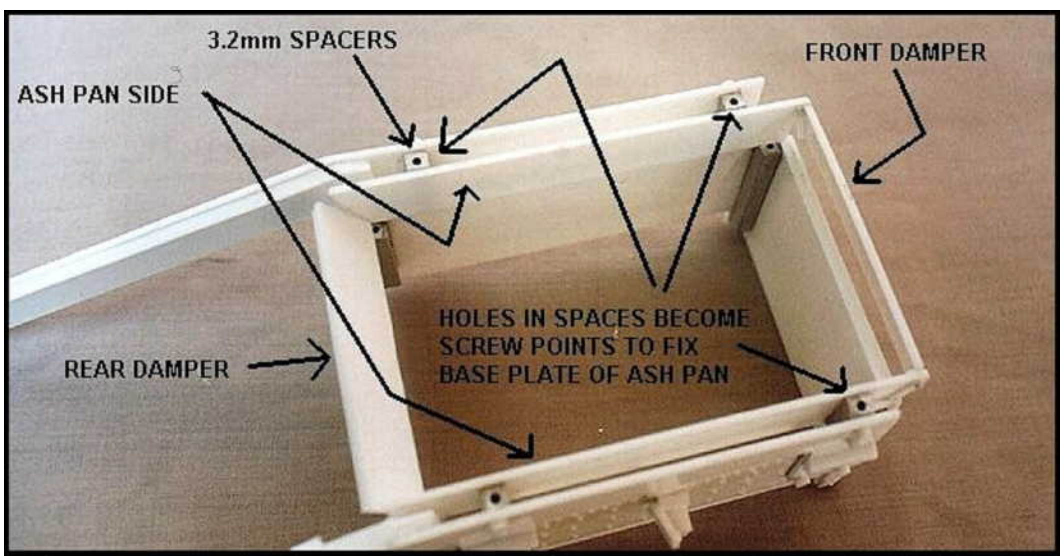
At this time, also attach the control rod to the blow down valve, either though the cab floor, or cut at floor level.

Working control rods should be 0.75mm brass rod or similar. Fixed control rods can be 0.75mm brass or 0.02" x 0.03" styrene rod, welded into place.

Using the PDF, cut out the various levers, weld them in place (if that's your way) and use 0.02" x 0.03" rivets at the points where the pivoting links are.

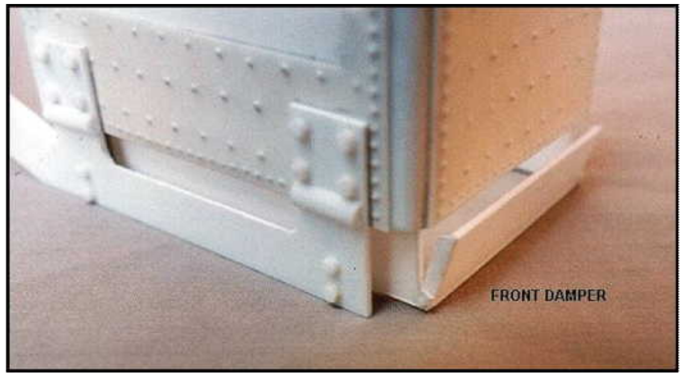
Attached to the side of the fireman's side brace is a vertical stanchion, which is a support to the front damper levers. Cut this unit out from 1mm thick styrene, and weld it to the back of the brace at the location shown. On the outside of the brace, weld two 1.5mm rivet heads.

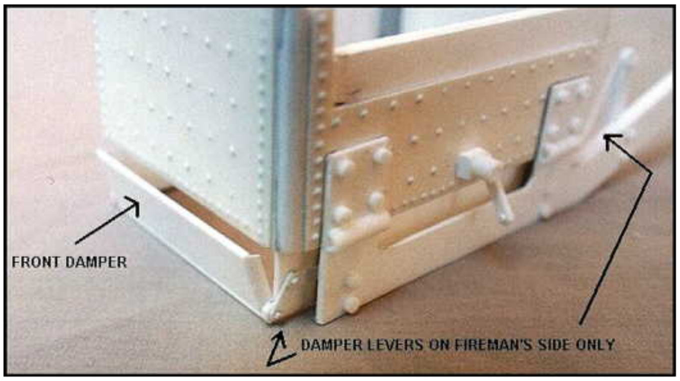
OK, with the ash pan, and dampers installed, the bottom of your firebox unit will look this:

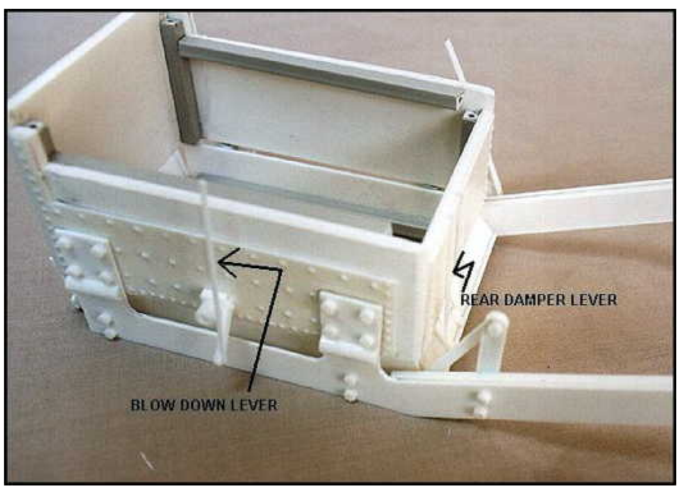


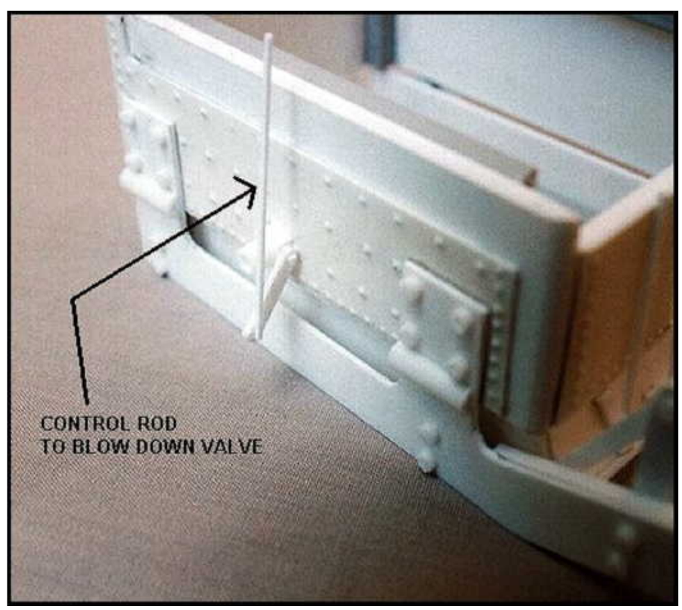
Now cut out the ash pan base plate from 1mm styrene sheet. Drill 0.5mm holes in 4 places to align with the bottom of the 3.2mm SHS spacers. Using short 8BA or #2-56 bolts, screw fix the base plate to the bottom of the ash pan. Do not glue the base, it must remain removable.

The firebox, with ash pan, dampers and levers will look something like this:









The Mason Grate Shaker

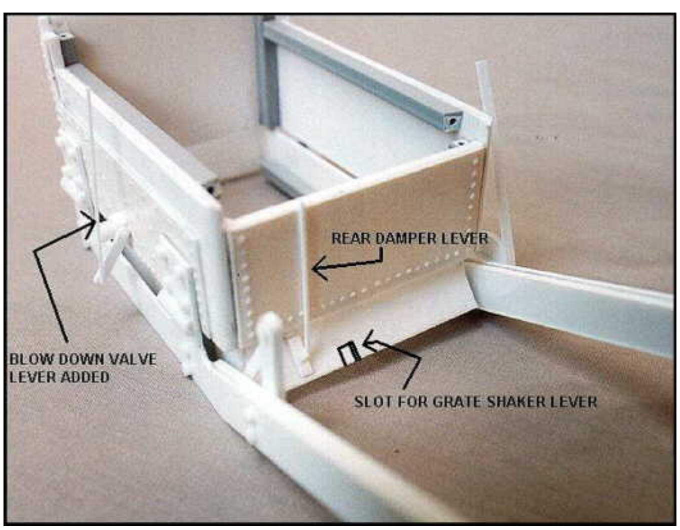
In the PDF set you will see a diagram of the Mason Grate Shaker - "Firebox Grate Shaker - For Information Only". It is optional as to how much of this you want to model. The grate shaker is a set of levers that end with a pull handle on the cab floor. The levers run down to the ash pan and through a slot in the back of the rear damper. They then connect to a row of pivoting 'finger grates.'

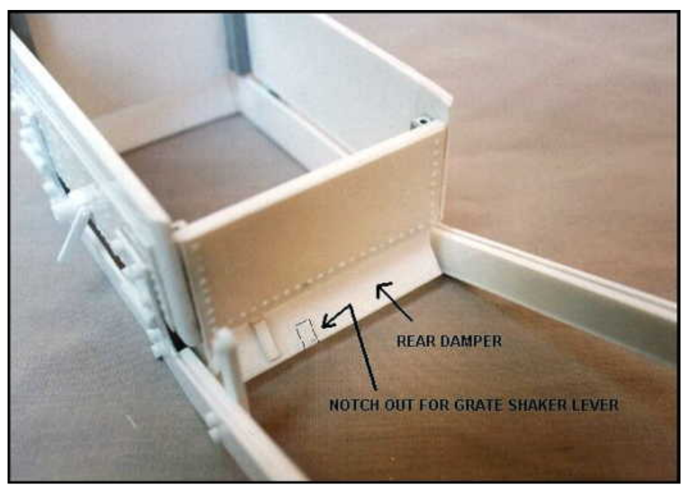
On locos that burned coal with a lot of impurities, the grate shaker was used to shake up the coal resting on the grate in an effort to prevent the impurities fusing together to form a hard glassy substance called 'clinker'. If left to bake, the clinker will harden and fill the holes in the grate, effectively closing off the air path through the grate, and preventing the boiler from steaming. Over the years there were many wild and weird ways to shake up the coal on the grate. In the 1870s, the 'finger grate' was popular. Basically this was a row of pivoting interlocking fingers, that ran across the width of the firebox. When the fingers were in the normal horizontal position, a neat grate was formed, with about a 50% free air space across the grate. When the shaker was brought into action, the fingers would rock, breaking away from the grate pattern, and breaking up any clinker resting on the grate. See the diagram.

To build the grate shaker levers, you will need to make the rods from 1mm thick styrene or brass, back to the cab floor. You will also need to attach the inner structural frame to the back of the firebox unit permanently, because there are some levers to be pivoted on the fireman's side of the frame.

Some of you are considering slinging a row of finger grate elements in your firebox to build the fully working grate shaker...well do it if you must, but do consider where to draw the line. Will you also be going back over your model to install the flue sheets, boiler flues, suspended firebox chamber, steam valve within the steam dome etc.? This is a model, and generally I draw the line at what can actually be seen. I would not build the grate shaker, just the visible levers seen outside the firebox.

You need to apply a notch in the rear damper as follows:





The Johnson Bar Spring (Reverse Spring)

Chaps, this is a gizmo unique to Mr Mason! A Johnson bar spring or reverse spring, of all things!

Back in the 1850s, Rogers Locomotive Works developed a counterweight system between the frames that would counterbalance the weight of the Stephenson valve gear reverse links. Basically, to put a loco into forward motion meant one 'dropped' the valve gear relative to the chest valves. To put the loco into reverse meant the whole Stephenson gear had to be lifted up. On smaller, pre-1850s locos, the weight of all the links and rods associated with the valve gear was not such a burden to lift. Once the locos became larger, there was a hell of a lot of iron to be lifted.

When the engineer puts the loco in forward motion, he would move the Johnson bar forward; as soon as the Johnson bar had been disengaged from the ratchet, the weight of the valve gear would pull the lever forward with much torque - watch your fingers, chaps!

To bring the loco in reverse meant you had to pull the Johnson bar all the way back, and what back breaking work that was - don't let go now!

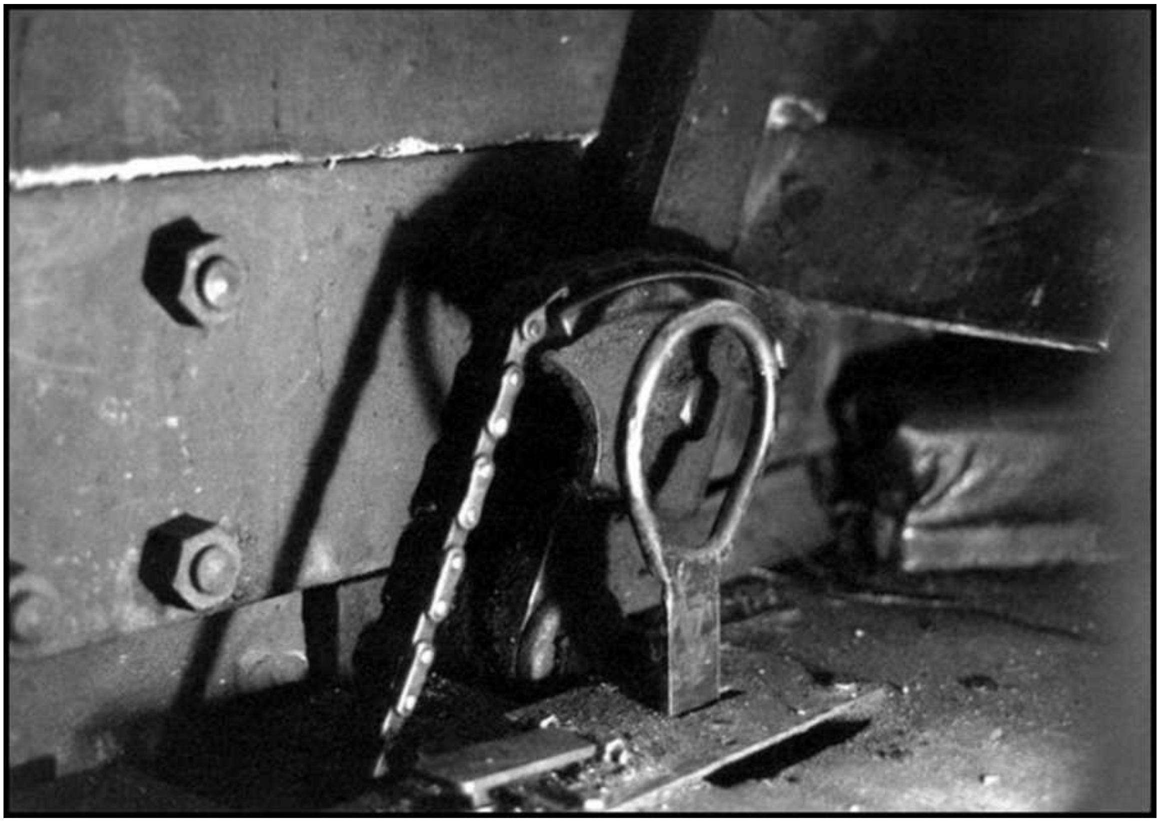
So, Rogers added a counterbalance to the system which meant one could move the Johnson bar forward or reverse with the same amount of effort, and the lever would not take your head off when trying to move it! Now you know why the British didn't use a Johnson bar, but used the much smarter wheel and thread method.

By the 1860s and ‘70s, all Stephenson valve gear systems were counterbalanced.

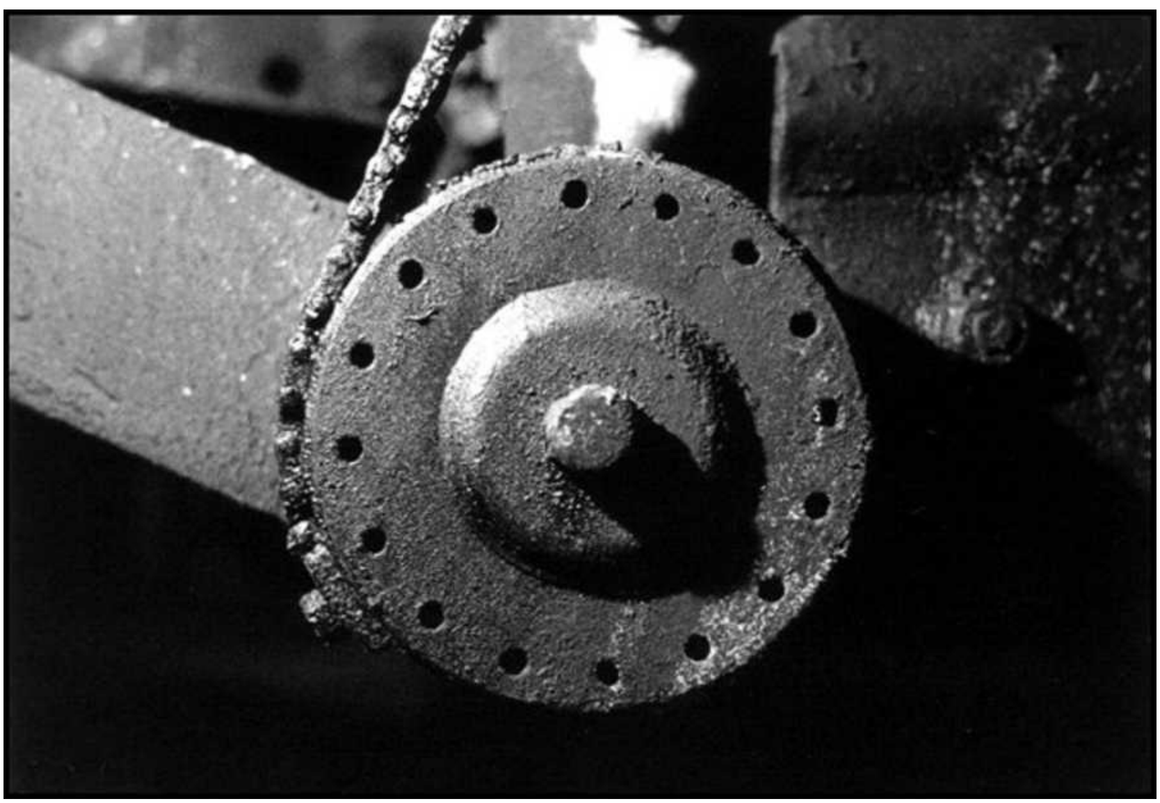
Mr. Mason had a problem with his Bogie locos: There was little space between the frames to include the valve gear and counterweights, along with dry steam pipe and main bearing of the chassis. So he did something rather clever. To the rear of the Johnson bar, acting against the forward thrust of the valve gear, he applied a weight. This weight would retard the forward thrust, and aid the engineer bringing the Johnson bar back for reverse motion.

On the Mason Bogie, this weight to the rear of the Johnson bar was applied in the form of a giant watch spring, coiled about a disk. The disk was attached to the outer bracing frames. A chain ran from the disk back to the Johnson bar via a hole in the cab floor. The chain was a classic chain saw type, or motor bike type chain, still used today. All the Mason Bogies were to use this system, whether with Stephenson or Walschaert's, because both types used lifting rods to lift the weight of the valve gear.

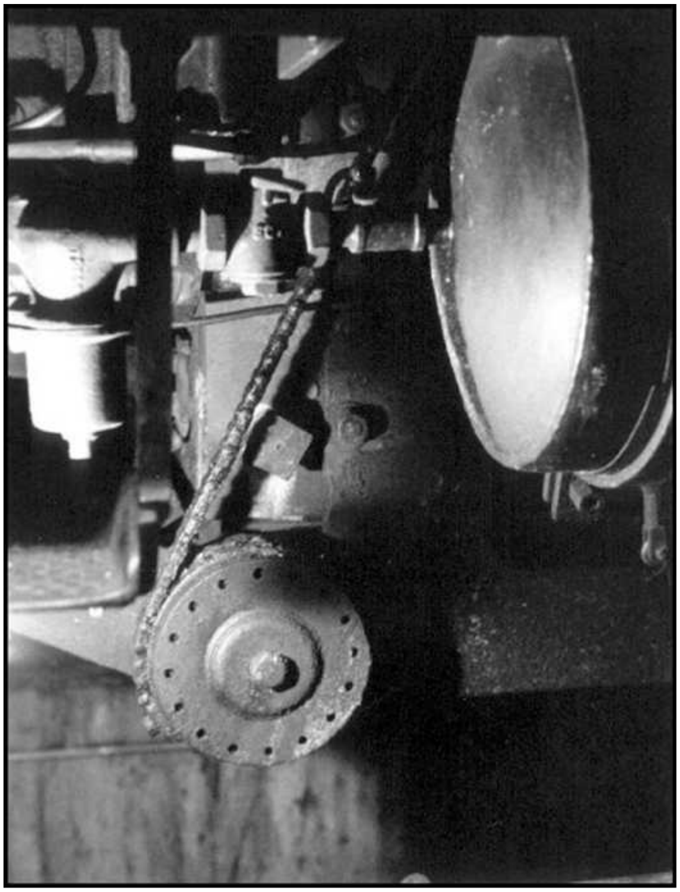
Beautifully Intact, and the only one in the world, the Johnson bar spring can today be seen in working order on the Helca & Torch Lake #3, 0-6-4T "Torch Lake", these photos by George Sebastian-Coleman.

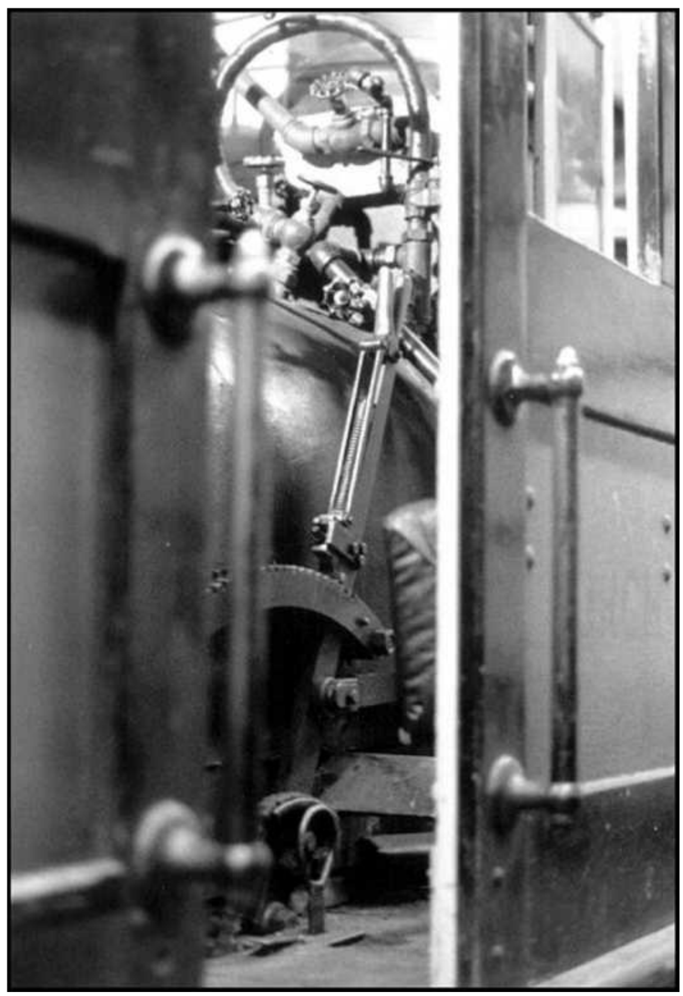


The chain coming up through the cab floor, and attaching near the base of the Johnson bar of Torch Lake.



A close up of the real Johnson Bar spring as seen on the Torch Lake, note the use of the thin chain bolted to the 8 O'clock position on the disk.





Finally a view through the cab door to the full Johnson bar.

Making the Reverse Spring

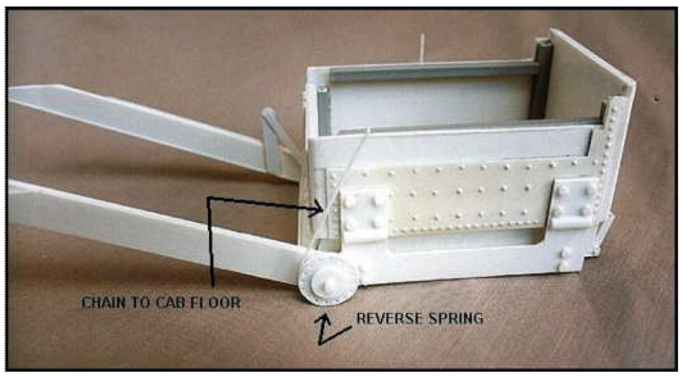
Refer to the PDF entitled "Johnson Bar Spring."

The coiled spring disk is made up from 4 layers of styrene disks!

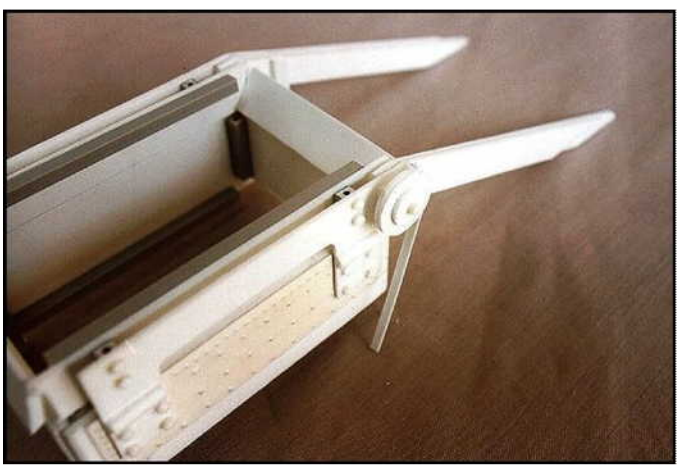
1. The base layer is a smaller diameter disk of 2mm styrene, which will be welded directly to the firebox outer brace.
2. Atop that is the main disk, made from 1mm styrene.
3. Outside of the disk we attach a detail facing. The facing is to have a line of small holes around the perimeter as seen in the above photos. We cut out the disk from 0.5mm thick styrene sheet, and then either drill or punch from the rear, a perimeter of 0.8mm wide holes.
4. Atop that detail we add a smaller 1mm thick disk and atop that a 1.5mm bolt head from our 1.5mm rivet rod.

Well, put all the layers together and attach the thing to the engineer's side outer brace.

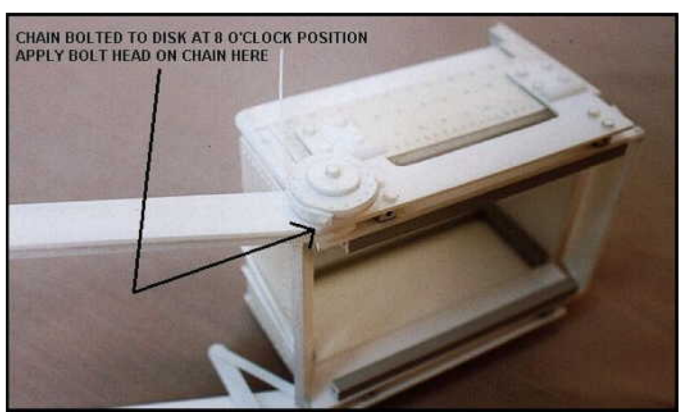
The chain can be some hugely complex thing made up of slivers of styrene interlocked if you like, or you can simply use a 2mm wide strip of 0.5mm styrene. Check the photos again, the chain is not thick, and all greased up looks more like a rubber fan belt. Apply a rivet of 0.02x0.030" rivet rod to the chain end at the 8 o'clock position of the disk. Again because the firebox will remain removable, I have chosen to break the chain at the floor level.



The finished Reverse Spring looks something like this:



... and seen from below...



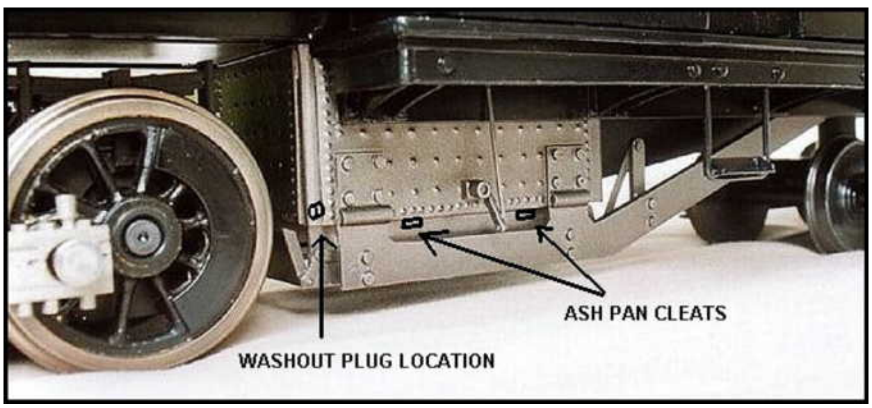
Some Last Details

There were two sets of details I forgot to add to my firebox unit prior to painting. They will be added to my model pronto, but let's not forget these two details.

Refer to PDF drawing entitled "Firebox Details."

To the top sides of the ash pan we need to add two 2mm thick square patches, with a 1.5mm bolt head to each. Install two of these units to both sides of the firebox. These are actually a small cleat used to hold the ash pan up against the bottom of the firebox casing. While the ash pan is held firmly in place by the rivets in the side of the outer braces, there is nothing to stop the thin walls of the ash pan bending, and falling out of line with the firebox side, hence the cleats! I'll add them now, you can too!

Finally on the 45-degree point right on the bottom of the rounded lead corners of the firebox are two wash out plugs. Literally corks in a bottle. Please weld on a 2mm length of your 1.5mm rod directly to the bottom lead corners of the firebox. At the very top of the 1.5mm rod, install a 1mmx1mm square of 1mm styrene, forming cube like top to the plug. The crew would unthread these plugs using a big monkey wrench...the square part is where one uses the monkey wrench!



Fitting the Firebox Unit and Inner Structural Frame to the Loco

This is probably best done after you have your chassis or BBT drive in hand.

Refer to the final PDF sheet entitled "Fixing Firebox to Tender Deck" and "Options for Firebox Space" for review. You will need to refer to these again after you have your BBT chassis.

The firebox and inner structural frame assemblies will be screw fixed to the Mason tender deck - no gluing! Both assemblies are to be fitted as separate units, unless you have been crazy enough to fit a working finger grate, and need the two assemblies together so that all the levers and links work!

The firebox is screw fixed from inside the firebox unit up into the 6.4mmx6.4mm SHS that are part of the tender deck sub framing from Chapter 2.

The Inner Structural frame will be screw fixed directly to the underside of the BBT aluminium tender frame. You will always want the firebox unit removable, and its best to be able to unscrew it, without removing the Inner Structural frame unit. So, mount them separately.

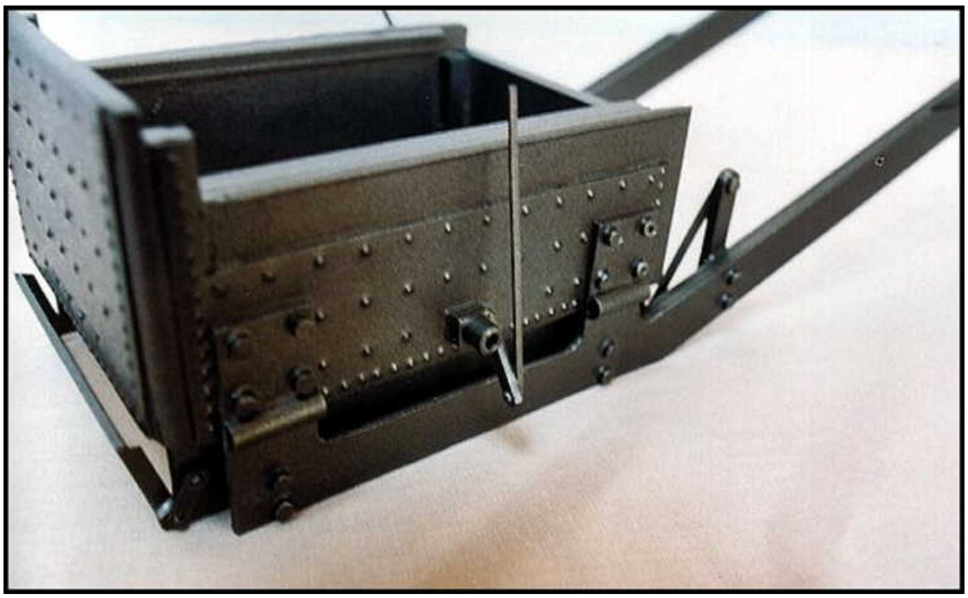
That’s it! Done for this chapter!

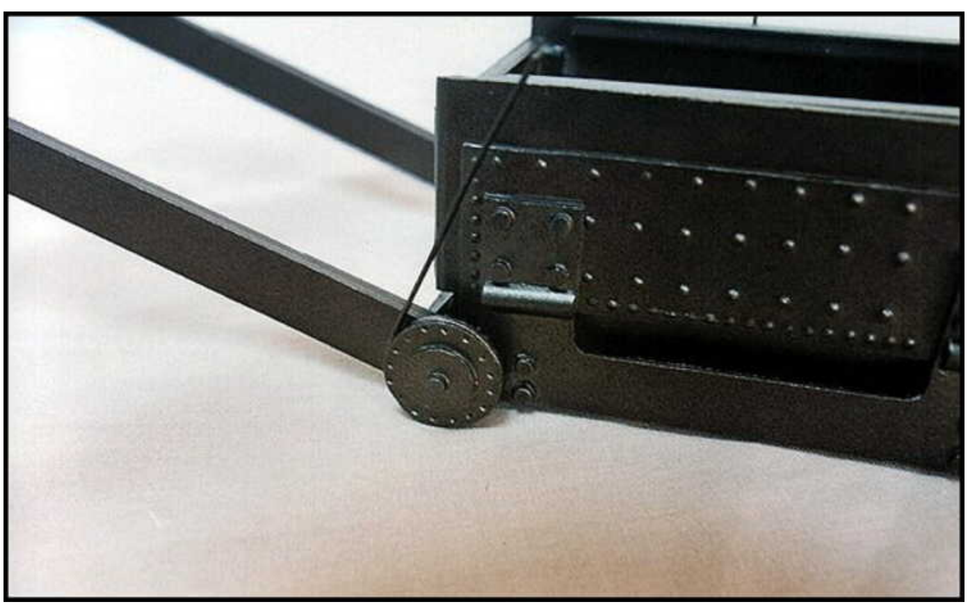
The firebox units are completed (except for the details above, and some added damper levers as follows). I spray painted the unit Tamiya Metallic grey, with a dusting of Testors Dull Cote over the top. On the prototype, the metallic paints used to protect the exposed firebox walls would be the same as used on the smokebox. So what ever colour you used on the smokebox, repeat on the firebox.

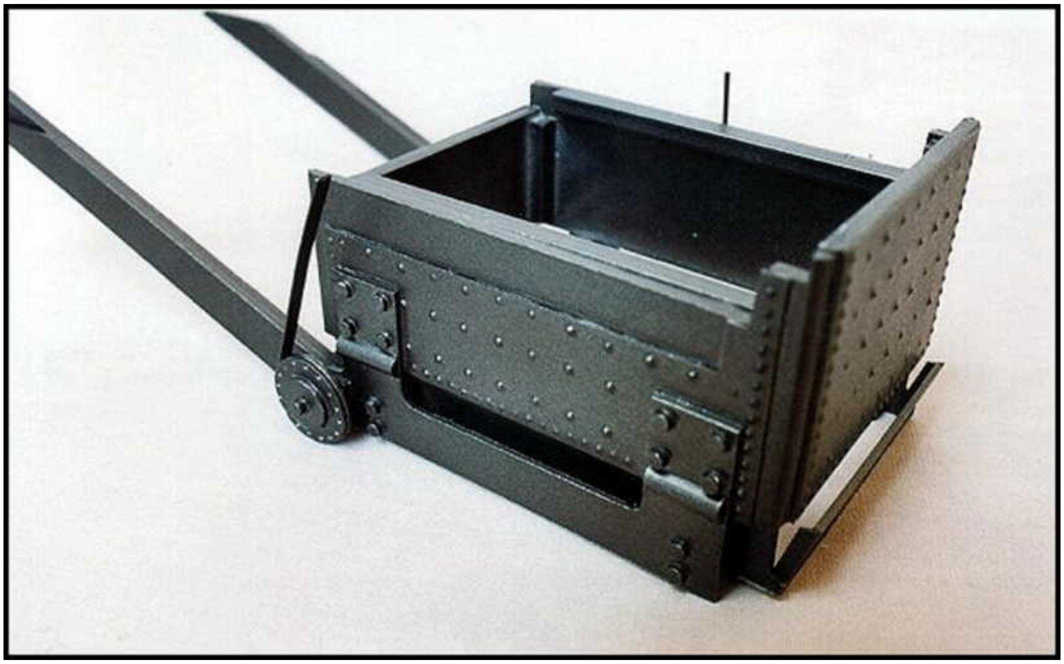
The outer braces can also be the same metallic material if you like, but on 'as built' and pre 1885 Masons, the outer braces were also ornately decorated, and colourful. If your loco is green, then the braces should be green, if you loco base colour is Lake or wine, then repeat that colour here on the braces.

The inner structural frame will be black along with all the rest of your sub floor framing.

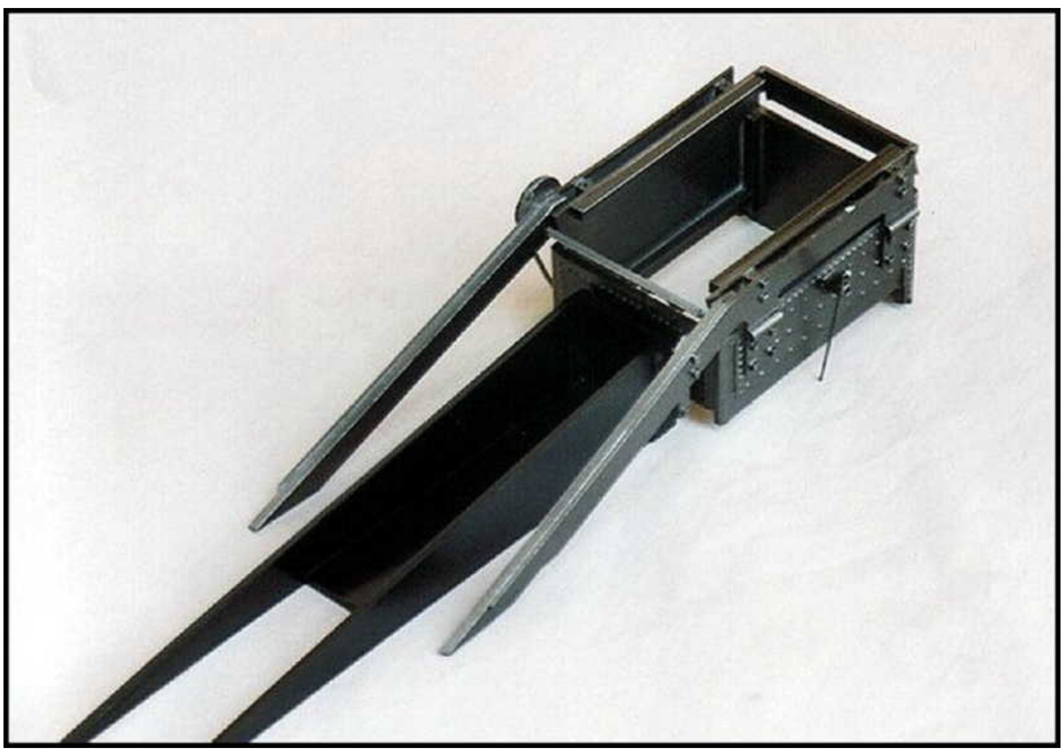
The competed firebox:



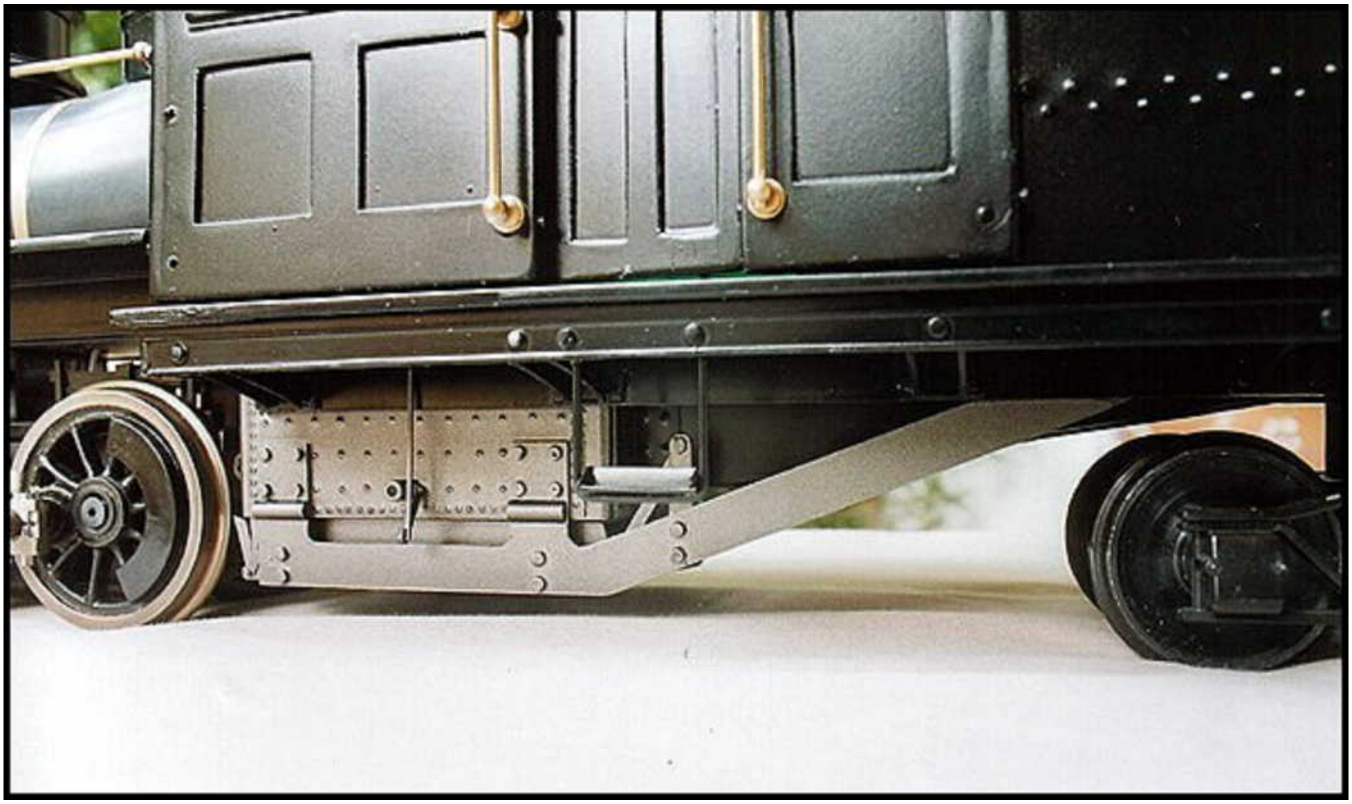


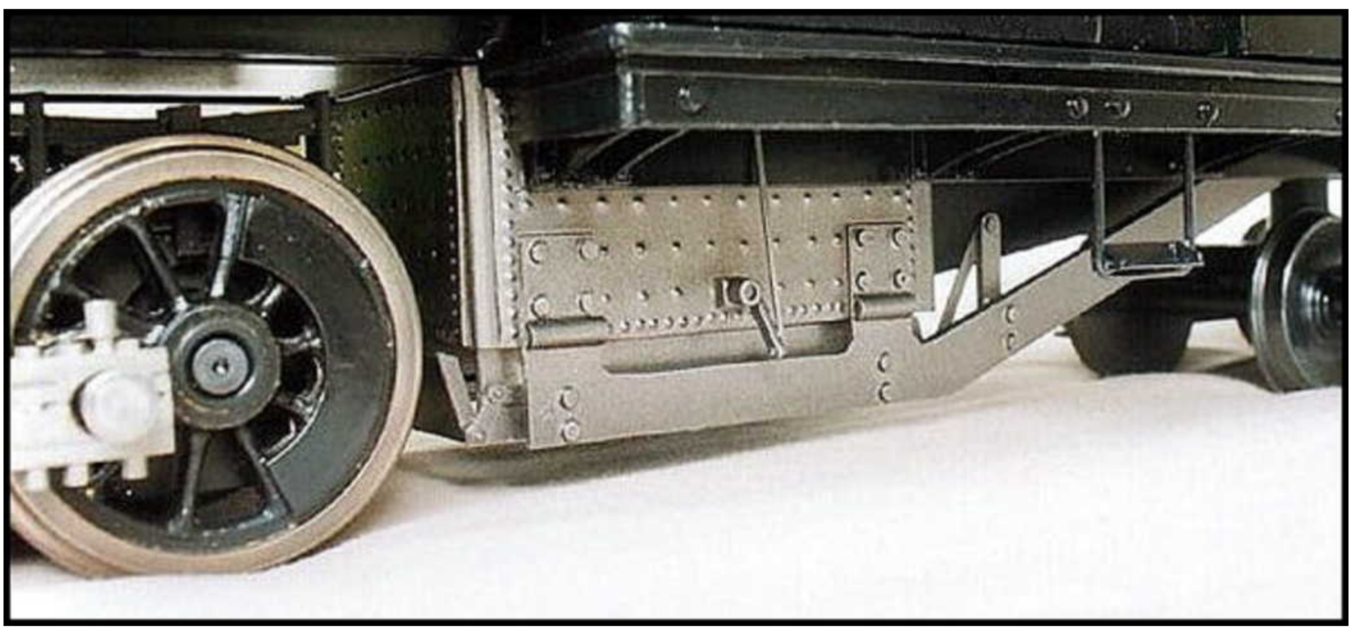


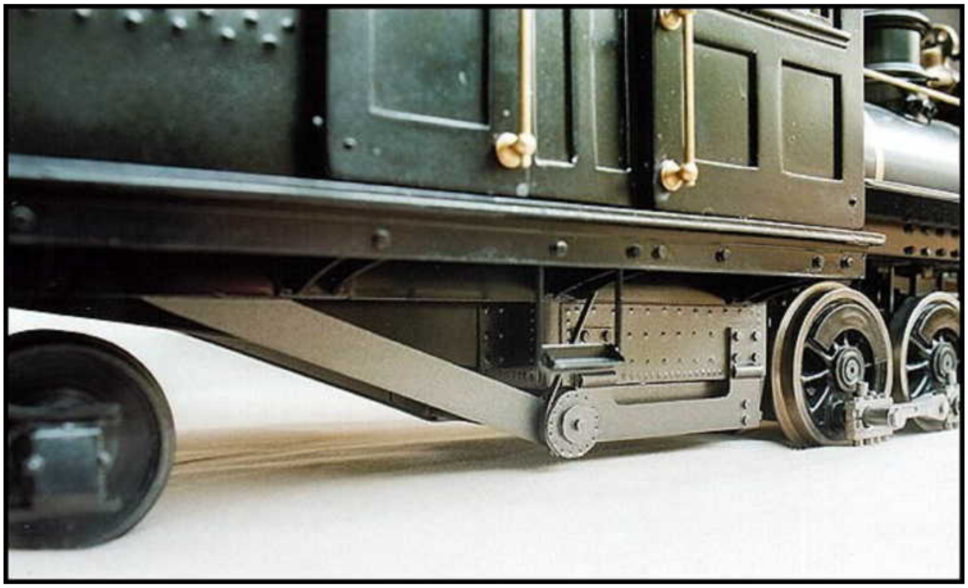
Now shown with the Inner Structural Frame sitting behind the Firebox:



Now a view with the firebox and Inner Structural frame fitted to the loco:





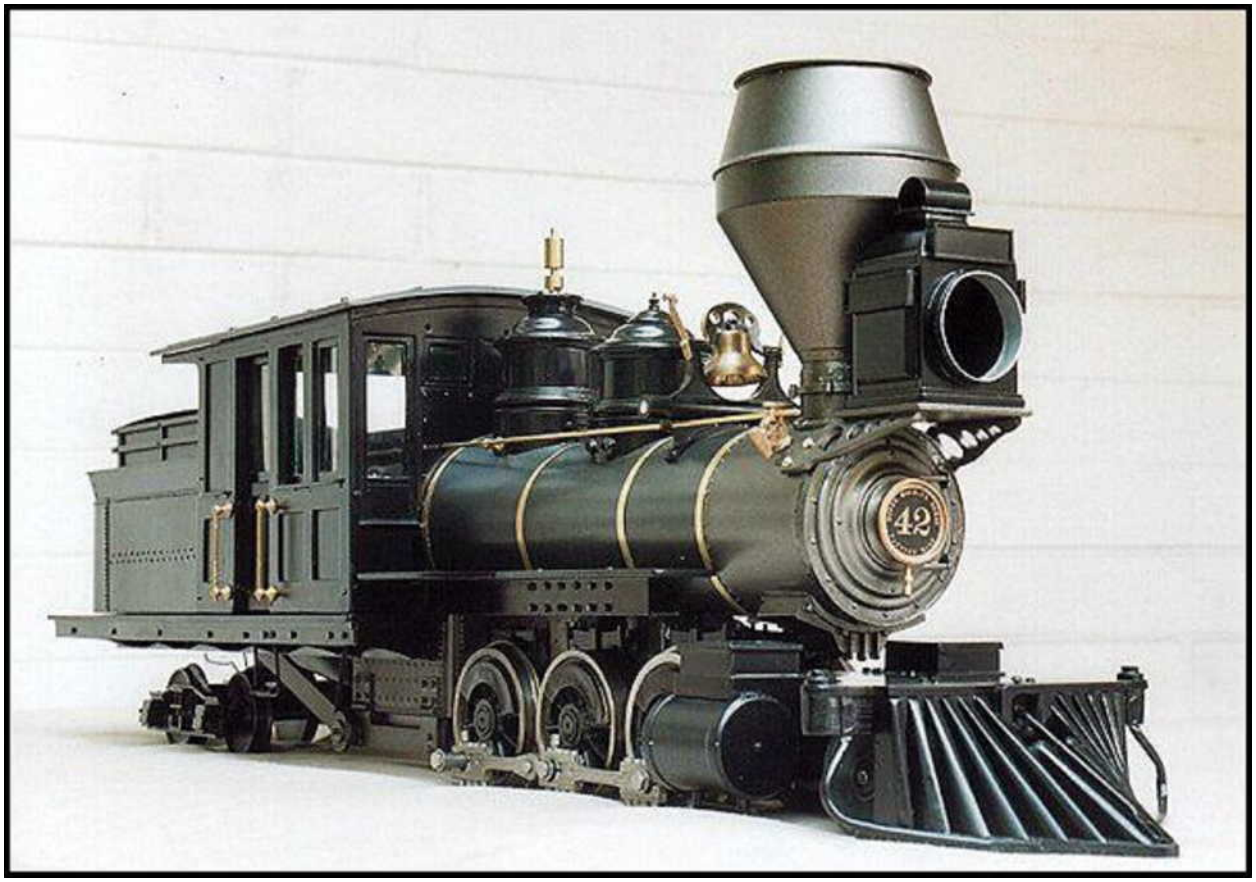


As seen at the end of Chapter 5
The Completed Mason Bogie Locomotive:

Note the painting of the tender shell should be to match your Mason's base colour, as in green or Lake or Wine etc., or black for post-1885 versions like mine.

In these photos I have spray painted the entire tender unit in one go, I still need to go back and paint the hungry boards, because on post 1885 versions, the hungry boards were anything but black! They look to be a consistent grey colour in all photos. Even in the shiny black painted view of #44, the hungry boards are clearly a grey colour. I'll be using a Tamiya dark grey, similar colour to the cab roof.

Enjoy.



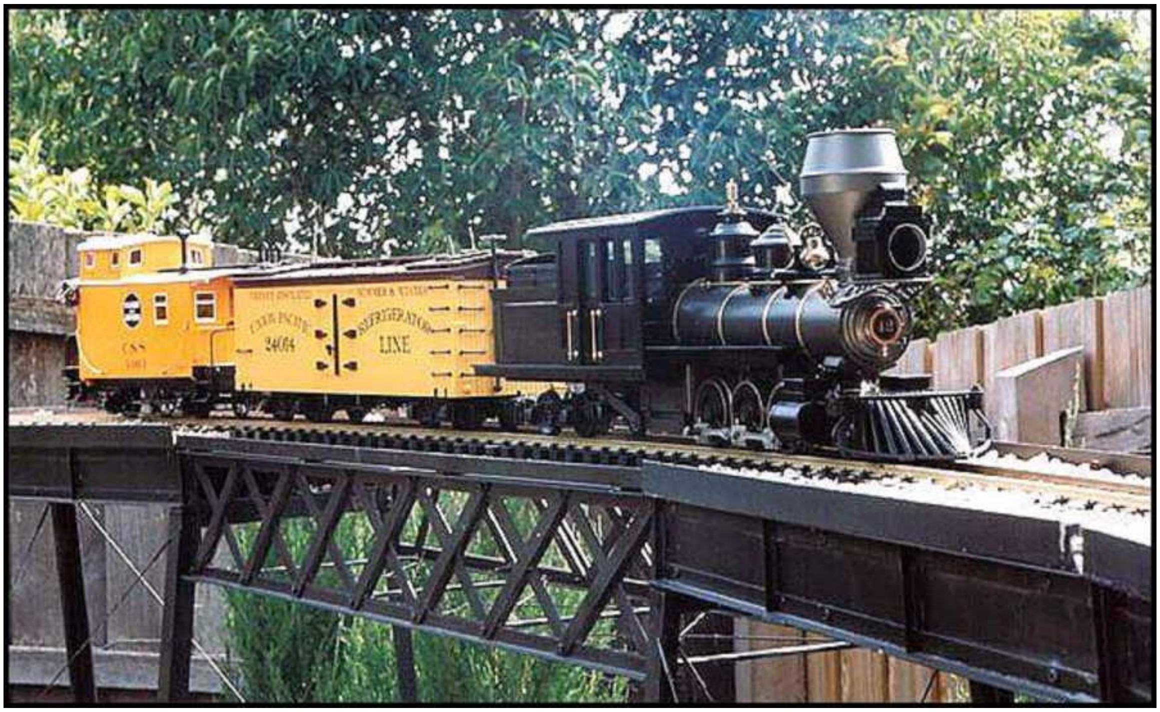
Keep going for more photos!!

Keep going for more photos!!

A view of the loco on my Garden Railway... note how the light plays on the patinated Russia Iron jacket.

Head to head with a Bachmann Kansas Central 1:20.3 2-6-0. This will give you an idea of the size of the Mason.

On the Georgetown Loop Bridge. The Reefer is an appropriate Union Pacific Tiffany, an out of the box Bachmann product, good for post-1885 Masons. The Waycar is all wrong, soon to be fixed via Mr. Bunce's Waycar series!



Good luck, lads,
David Fletcher,
March 2003

Acknowledgements:

Many thanks go to the many people who have helped pull this chapter together.

Steve Conkle, for his superbly researched background into the Boston, Revere Beach & Lynn RR.

Barry Olsen, for his ongoing efforts in building your custom Mason Bogie chassis. The casting samples are starting to come in now, so the future looks good.

Chuck Meckem, for his efforts in developing the 6-wheel tender truck and side rods for the BBT chassis, as well as new products such as the NPC stack.

Vance Bass, for his support in providing the specialized Mason cab kits, pilot kits and tender shell kits.

We are also indebted to Vance for proofreading all my swill! There are a lot of words, and even I don't understand what I've written sometimes.

George Sebastian-Coleman A big thanks for his hidden work in helping us build a model that reflects the prototype as much as possible. George is an invaluable knowledge base and we are all benefiting from the experience.

Jim Wilke, for his on-going contributions in helping us decipher the unusual colour schemes of the 1870s.

John Clark, of Fall River Productions, for stepping up to the plate and manufacturing the big 23" box headlight for our class. Thank you, John.

Tom Farin for his work is building and maintaining the Mason Bogie Archive. A fabulous resource.

Art Wallace. Huge thanks to Art, whose drawings are central to this project. Every detail and concept as to the workings of the Bogie machine are derived from Art's work. This is his research. All that stuff about dampers, shaker grates and sprung Johnson Bars are entirely based on the details provided by Art in his drawings.

Scot Lawrence for building the Mason Colour schemes web site for us to use. Colour info provided by Jim Wilke, Jerry Kitts, Doug Heitkamp and Rob Sloan.

Lastly, a big thanks to Shad Pulley, owner of myLargescale.com for hosting this class, and the many hours spent up-loading such extraordinarily wordy scripts!

...and now for something completely different..

Mini-class 2003

An Idea...

Phil Jensen of Hartland Trains, supporter of this class and supplier of most of the detail parts for MasterClass 2002, asked if I could a play with some new Hartland parts and the new H-L-W modular gearbox, in a narrow gauge loco based on the CP Huntington. The real CP is a standard gauge loco, 1863 Danforth Cooke 4-2-4T 'Single', now preserved at the California State RR Museum. The model uses Hartland parts entirely, except for a new small wagon top boiler, and cab/tender deck. The model now resides with Phil in Nebraska, and is aptly named, 'Sir Phil Jensen'.

If anyone is interested in building this loco for themselves, please contact me via e-mail (**fletch@myLargescale.com**). The model is mostly a kit-bash, using unaltered Hartland parts, and a scratch-built boiler. It is not a complex model, but good painting goes a long way to bring out the character. If there is enough interest, Phil will put together a common parts list for the bash - almost a Hartland kit if you like - and I'll write up a couple of articles covering the assembly...a DIY CP Huntington. The scale of the model is, at rough guess, at about 1:22.5. This is not a MasterClass, but a small kit-bashing series to be called 'Miniclass 2003'. Here she is, the 'Sir Phil Jensen':