Chapter 3 - Construction

In the Beginning…

It is desirable to read the entire construction chapter first before commencing work; sometimes an understanding of what is coming helps to determine the best way to carry out earlier work. So get reading, and you can get cutting styrene later.

Check Your Scales!!

I've said it before and I'll say it again...with every PDF page of Mason Bogie templates you print off, CHECK YOUR SCALE BARS! Check that the scale bar along the bottom and side of the page scale out to be 1:1...300mm shall equal 300mm etc. Some printers will not print these perfectly to scale. If you've tried everything and they still print undersized. Take the file to a printing place and have them try it. Another option is to take the printed page to the photocopy joint and blow up the drawings by a percentage point.

Download the PDF Templates for this Chapter.

Masterclass Options 1 to 6 2-6-6Ts (All Masterclassers to use this set)

DSP&P Heavy 2-6-6T (special drawings for larger 2-6-6T, with 45" straight boiler)

DSP&P Big 2-8-6T

Store the template pages away in a binder, and refer to them as I call for them through the chapter.

Making the Boiler

(Refer PDF Pages entitled "Boiler Profiles" and "Wimp's Way Boiler Profile" for this section.)

Step 1

Go out into the world and find yourself a 51mm outside diameter plastic pipe. ABS, PVC, Styrene, or acrylic should be fine. Those of you building in Brass can go and find a 51mm brass or copper pipe.

The Mason Bogie we're focusing on in this class, namely the light South Park 2-6-6T and the NPC Bully Boy 0-6-6T both had what was scheduled by Mr. Mason in the late 1870s as a 38" diameter boiler. The 38" diameter boiler was then lagged with timber, and clad over with a gorgeous Russia Iron (blued metal) boiler jacket, bringing the boiler diameter up to 41". At 1:20.3 scale 41" is 51.3mm.

Also note that the smokebox diameter on these Mason Bogies was made wider than the boiler shell, such that the smokebox diameter was EQUAL to the fully lagged and finished boiler…thus the Smokebox diameter was also 41". Unlike Baldwin, Rogers or most of the locomotive builder's of the day, the Mason locomotives had no visible step at the interface between boiler and smokebox. I emphasise this point, because I know many of you are already thinking about how to achieve this non-existent step at the smokebox -- forget it! From a model making viewpoint, this makes things easy, we're only needing to find one pipe size that is good for the boiler and smokebox in one!

Find that 51mm pipe! It might be a Plastruct ABS pipe, it could be a plastic beer flute, it could even be a toilet cistern pipe, because that is what the boiler of my Mason is made from...a toilet pipe! Reasonably, allowing for some difficulty in finding that pipe size, I ask you to find a pipe that is 50mm diameter minimum, and no more than 52mm in diameter. Also (assuming you've read ahead and been through this entire article in advance), you have the option of cladding over your boiler pipe with a treated brass/metal wrapper. With this in mind, you might like to find a pipe that is approx. 50.8mm in diameter; this will then pack out to 51.3mm when fully lagged.

Boiler tubing - A source:
2" ABS tubing can be ordered directly from Plastruct's web site. An 18" length is US$8.25 + $6 postage. This is exactly 50.8mm diameter. 1.5" nominal PCV plumbing pipe is 1.900" actual o.d.. You can probably beg a 3 foot piece free from a plumbing supply, but you'll have to wrap it with a 1mm layer to get it up to the right diameter. (Vance Bass).

The Big 2-8-6T and Heavy 2-6-6T (Breckenridge et al)

(Refer to the PDF boiler pages dedicated to these specific locos.)

Builders following our class, and doing options 1 through to 6 can ignore this section...you're still looking for a 51mm pipe OK!!

Notes for the Builder's of the Big 2-8-6T Mason Bogie, and anyone thinking of building the heavy South Park 2-6-6T locos. These locos had generally straight boilers, somewhat larger than the small wagon top type boiler we're building in this class. The pipe sizes you need are as follows:

Big South Park 2-8-6T Boiler - 48" fully lagged - at 1:20.3, you're after a 60mm pipe.

Heavy South Park 2-6-6T types - 45" fully lagged - at 1:20.3, you're after a 56mm pipe.

Step 2 - Cutting the Boiler Pipe

Righteе-oh, let's begin! The finished boiler length of your model will be **193**mm long from cab wall to the boiler front, but not including the boiler front itself. There will be two ways of achieving this length...the prototypical way, which includes the construction of a wagon top boiler (a boiler with a conical taper near the firebox), and the Wimp's Way which is the easy way, involving the making of a straight boiler. Some Masons, such as Torch Lake and AA Denny had straight boilers anyway, making the Wimp's Way straight boiler the way to go.

The Prototypical Way - 2-6-6T and Bully Boy:
Cut your 51mm pipe to a length of **189**mm, as shown in the PDF template sheet, entitled "Boiler Profiles". You will note this boiler/pipe length seems 'short' compared to the 193mm length of the locomotive drawings from Chapter 1. This is correct. There is to be a 4mm section to be packed to the rear of this pipe, bringing the boiler to a 193mm length. A thickness is also added at the front end in the smokebox front. You will also note we are cutting the boiler off at the cab front wall, and not running the boiler right into the cab in once piece. We've designed the boiler this way so it will be possible to remove the boiler from the BBT chassis to access the motor, without having to remove the cab. Also the Mason boiler we're building is a 'Wagon top' type. That is a boiler that tapers from a smaller section to a larger pipe, very much like the classic American 4-4-0s. The taper on the Mason Bogie occurs right in front of the cab front wall, thus the larger boiler pipe occurs separately inside the cab only. It proved to be easier to break the boiler in two, with the smaller diameter and taper outside the cab in one unit, and the larger boiler pipe inside the cab as a separate unit.

The Wimp's Way Boiler:
There is a 'Wimp's Way' boiler PDF template -- use this only in an emergency! The Wimp's Way boiler does not have a taper. What we do is make a straight boiler of 51mm diameter right to the cab wall. Then inside the cab we install the larger boiler pipe (in a coming chapter). We simply leave out the taper in front of the cab wall. Once the steam dome, air compressor and pipework is installed, it is actually pretty difficult to see that a taper is there anyway. The Wimp's Way boiler will be cut to a length of 193mm. ..that is slightly longer than the wagon top 'tapered' boiler above. Any one building AA Denny 0-6-4T of Puget Sound will be following the Wimp's Way boiler, as the AA Denny did not have a wagon top boiler anyway! The AA Denny boiler is also longer at 198mm. Use the PDF to set out your boiler length.

Cutting the Pipe:
Cut the pipe using the masking tape method outlined in the last chapter. Wrap the tape around the pipe such that that the tape meets up perfectly once it is wrapped all the way around...this will ensure you cut the pipe perfectly perpendicular to the pipe...not crooked.

Step 3 - Finding the Upper and Lower Datum Lines on the Boiler

The datum lines are drawn lines we apply along the very top of the boiler and along the very bottom. Attaching appliances to the pipe, such as domes and running boards etc, is more difficult than you might think. The pipe tends to mess with one's eyes, and only after you have finished a model will you notice, to your dismay, that the domes are not in line, and worse, the stack is pointing to the right, while the domes appear to have been applied to the boiler side, and are pointing to the left! YUCK! So we take the time at this step to work out the lines on which all object will be mounted, so everything points in the same general direction.

There are several ways to establish the datum lines:

The totally cool Vance Bass Method:
Have you seen the trick using L-section angle? If it's well made so the edges are parallel, like a piece of K&S brass or Plastruct ABS, then the edges MUST lie along the cylinder parallel to the centerline. So, just drop a piece of K&S tubing on the pipe and mark along one edge -- you're done!

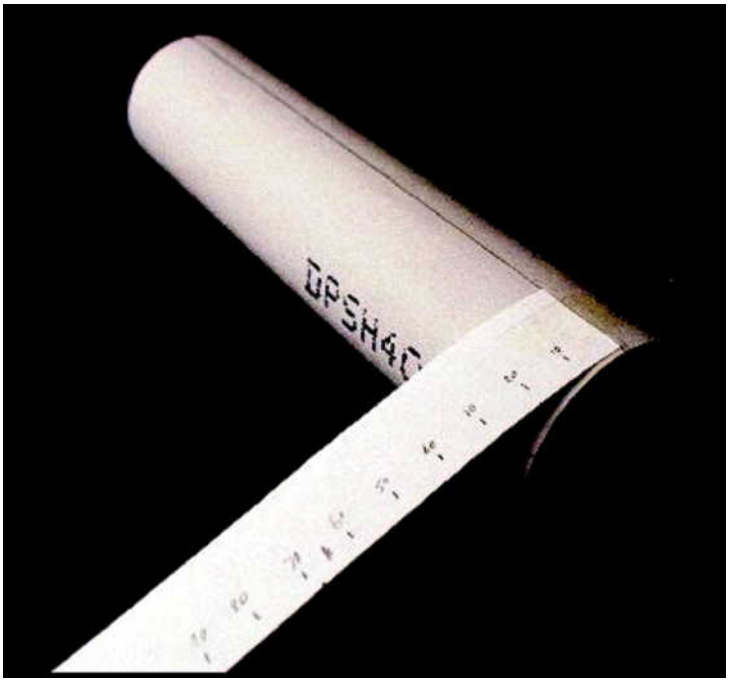
The tedious Fletch Method:
I list this method simple because it allows for other checks to double check your datum lines and checks if the ends of your boiler are cut square:

Place the boiler pipe on a nice smooth flat horizontal surface. Using tape or blu-tack or some kind of putty, fix the pipe to the bench so it won't roll. Next look close at the point where the pipe end touches the flat surface... mark a pencil line on the pipe end at the exact point where the pipe touches the bench...without moving the pipe, look at the other end of the pipe and mark the point where it touches the bench as well....theoretically both these marks are at the same position at opposite ends of the pipe and a line drawn between them will provide you with a datum line that is exactly parallel with the pipe itself (this can be achieved using Vance's brass angle idea). Draw a pencil line between the marked pipe ends. This is your upper Datum line. If you tried to draw this line by sight, you'll probably have a line that looks parallel with the pipe, but actually veers off to one side. Your domes and stack would all be pointing in different directions!!

Testing the Upper Datum Line:
Now we test the datum line. Place the pipe on end, at the edge of a table. Get a 3 ft length of cotton thread and tie a weight onto one end... use one of your brass loco parts if you like. Something small and heavy is needed as a 'plum bob'. Hold the end of the cotton onto the top end of the pipe right on the top of the datum line. Use your thumb to hold the cotton in place. Let the cotton hang taught with the plum-bob weight at the bottom hanging down near the floor. Now we let gravity tell us if the datum line we drew was accurate. Watch where the cotton aligns with the drawn datum line. Make sure the plumb bob is not swinging!! If the cotton line aligns with the drawn datum line, your datum is A-O-K. If the drawn line veers off to one side relative to the cotton line, you gotz a problem!! This whole test depends on the cut boiler end being 'square' in the first place or the boiler will not be standing vertical for the test!! If you're not sure of the accuracy of the cut end, try the plum bob test standing the pipe on the other end instead and double check it.

Step 4 - the Lower Datum Line

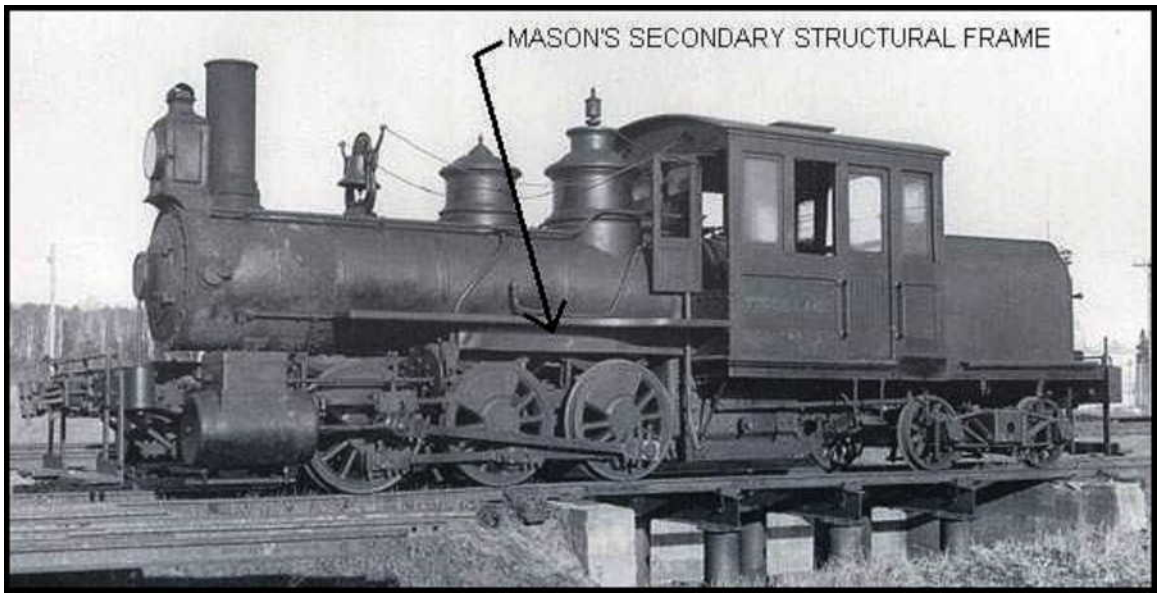
Next we need to measure the diameter of the pipe exactly. A 51mm pipe should have a circumference of 160.2mm, that's based on the 2-pie-r formula. That's: 2 x 3.1415926(pi) x 25.5(Radius). You will need to confirm your exact diameter, radius and circumference. My pipe might be slightly different to yours. To make measurements around the pipe you need a reeeeeeal thin ruler....the thicker the ruler, the larger the circumference measurement becomes! To make your own reeeal thin ruler, cut a 10mm wide strip of paper, 200mm long. Place a mark every 5mm along the edge of this length of paper. If the circumference is 160mm, then the half circumference is 80mm. Lay the paper ruler out flat and place a mark at the 80mm point. Place a bit of tape on the end of the paper ruler and stick it to the upper datum line on the boiler, wrap the paper ruler around the boiler till you reach the 80mm (half circumference) point and mark the boiler at that point. Next wrap the paper around the boiler in the opposite direction and see if the 80mm mark comes to the exact same spot. We're talking real accuracy here. If your boiler is slightly wider or narrower, the circumference will be slightly different. Do this same procedure near both ends of the boiler. Thus using the upper datum line, we're marking an accurate lower datum line exactly 180 degrees from the top of the boiler. Draw another pencil line connecting the two marks and you have the lower datum line. Again check this line is parallel with the pipe by using the plumb bob.



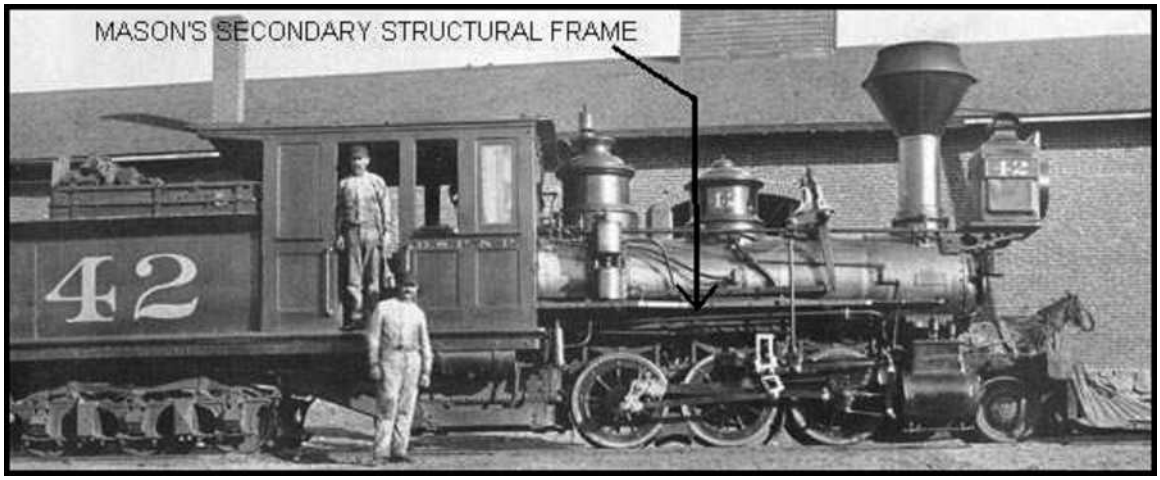
Note the upper datum line and the paper ruler taped to the datum used to mark out the lower datum under the boiler.

Step 5

Something you should know about Mason Bogie locomotives is that there was a secondary iron framework structure located under the boiler that supported the boiler independently from the chassis. Since the chassis was pivoting, the boiler was not adequately supported by the chassis frame in the traditional manner. Mason's secondary frame is visible directly below the running boards, and is seen as a vertical flat iron face that conceals the curvature of the boiler below the running boards. The BBT frame supports our model boiler to the same design.

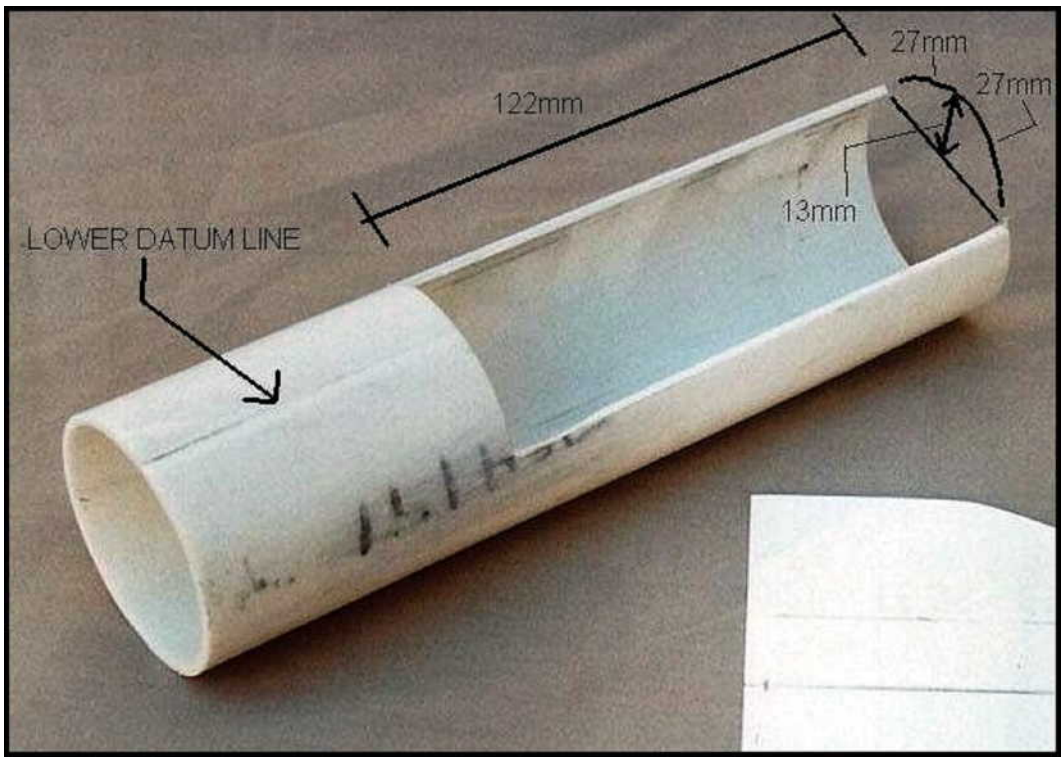


A great side view of the last Mason Bogie survivor, the 'Torch Lake', of upper Michigan. The Mason secondary framing is clearly visible.

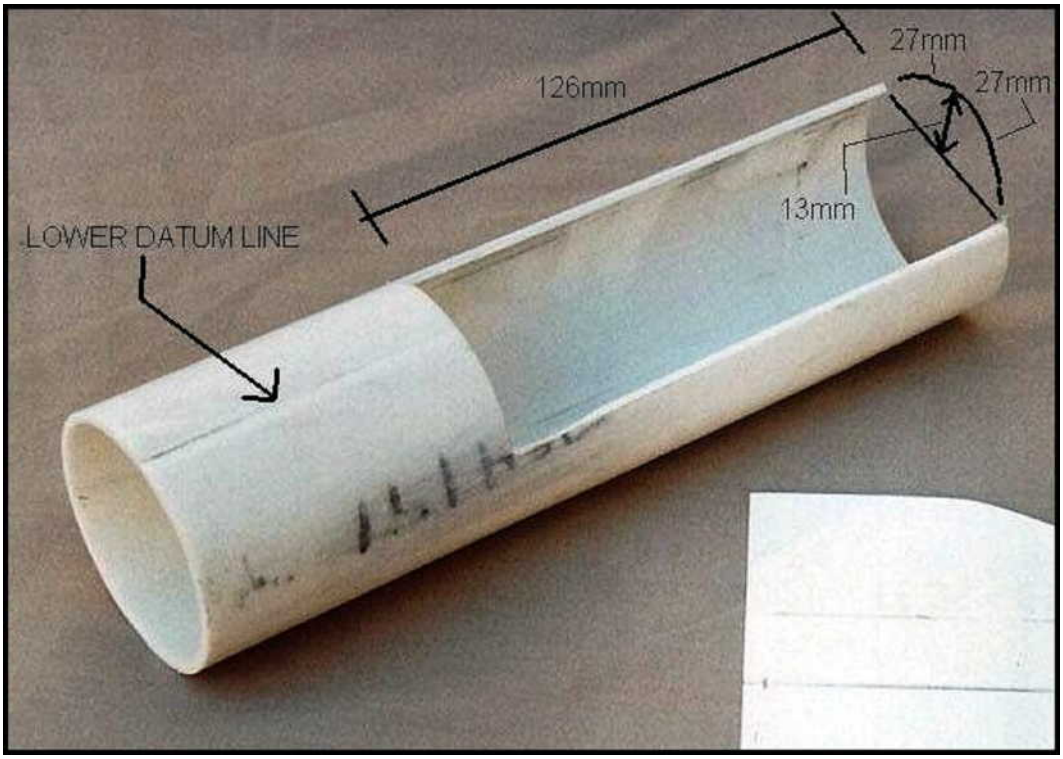


... and as seen on our famous DSP&P 2-6-6Ts!

We now need to cut out the rear bottom of the boiler pipe where it runs over Mason framing. Following the PDF template "Boiler Profiles". Remove a 122mm long section of pipe away from the bottom of the boiler. The section is to be 13mm deep...that equates to a line marked at 27mm either side of the lower datum. Cut across the boiler at the 122mm mark using a razor saw, then cut along the boiler to the extent of the area to be removed using a knife, score a deep line, then snap the section away. The cut boiler will look like this:



Cutting the Wimp's Way Boiler:
The Wimp's Way Boiler and AA Denny uses a longer boiler(193mm), and as such the cut out areas is to be 126mm long. The AA Denny boiler will also have 126mm removed. The Wimp's Way cut boiler should look like this:



The Cut boiler as seen from below.

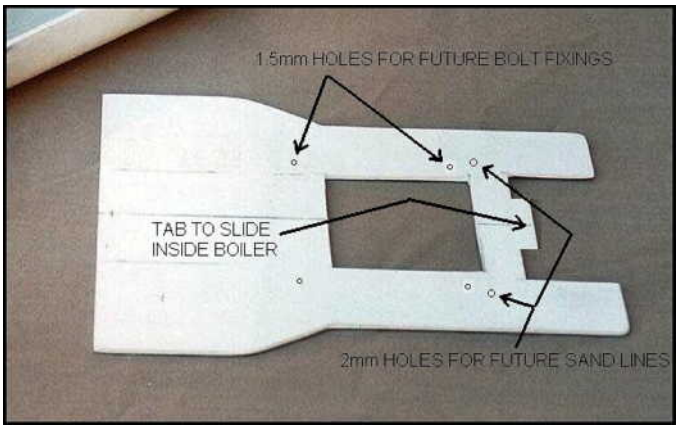
Making the Running Boards

For this step you'll need the PDF page entitled "Running Board Template", "Running Boards-Top Details" & "Running Boards -Bottom Details".

The Running boards are an integral part of the design of our Mason model. The combination of boiler and Mason secondary framing has allowed us to run the running boards across the entire width of the model in one piece. This is a great advantage because it means we can pick up our heavy model by the running boards and be assured they won't break off! The traditional method of modeling running boards required us to attach the boards separately to the curved side of the boiler. These boards had a habit of breaking off the boiler side when lifting. On the Mason we do it in one piece, easy, and fool proof.

Step 1 - The Running Board Template

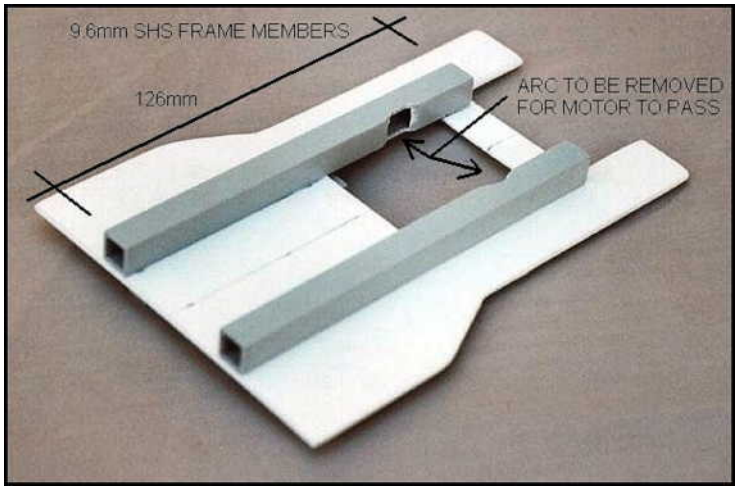
Using 2mm thick styrene sheet cut out the running board profile from the PDF template entitled "Running Board Profiles". You can drill tiny 1mm holes in the corners of the cut out areas if it helps you. Score and snap the areas to be cut out as required. Drill out the 6 or 8 holes in the styrene surface as indicated on the template PDF, that is four 1.5mm holes for future bolts, and two or four 2mm holes for installation of future sand lines. The cut out running board profile should look like this: (note options 1, 2 and 5 will have 4 sand line holes, Options 3, 4 and 6 will only have two forward sand line holes).



Step 2 - The Secondary, Sub Floor Framing

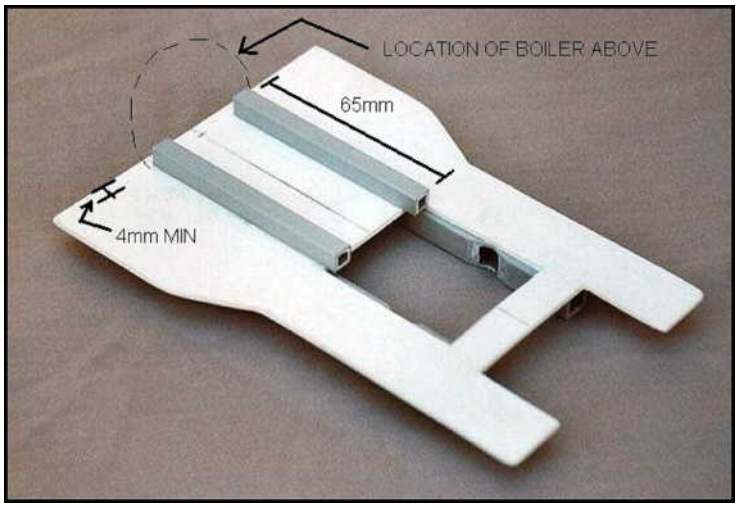
The BBT Mason Secondary Framing supports our finished boiler, but it isn't prototypically wide enough. The real framing was wide enough to just slide past the outer face of the firebox. This should make the secondary framing wider than the boiler itself. We need to pack out the sides of the BBT framing to make it look more prototypical. We also need to detail it to a prototypical finish.

Cut two 126mm lengths of 9.6mm Plastruct Square tubing (SHS). Using welder cement, attach them to the bottom of the running boards, with a clear 35mm-36mm between them (go for 36mm if in doubt), refer to the locating sketch in the PDF page (Running Boards - Bottom Details). This will allow the running boards assembly to fit snug over the 35mm width of the BBT chassis framing. Using your metal files and modeler's knife, remove two arcs from the Plastruct SHS sides as indicated on the PDF template. This will enable the cylindrical motor to pass the SHS frame members. The running boards assembly should look like this:



Step 3 - The Boiler Locators

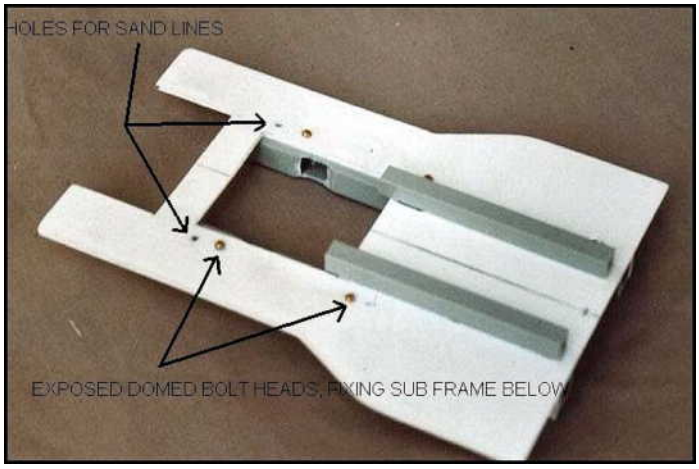
On the top surface of the running board assembly, weld into place two 65mm lengths of Plastruct 6.4mm SHS square tube. These two rods are to be placed such that they run firm against the inside face of the cut boiler. Do not glue the boiler! These two rods also should run 4mm clear of the rear edge of the running board. Refer the PDF diagram for locating help (Running Boards-Top Details). The finished upper side view of the running board assembly should look like this:



Step 4 - Bolt Fixing the Sub-floor Framing to the Running Boards

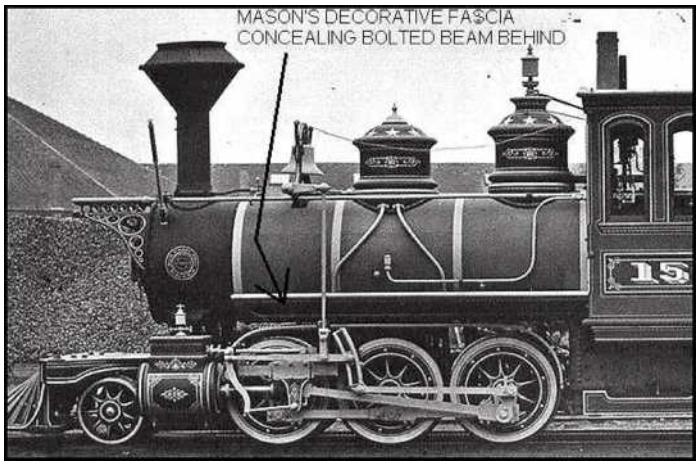
Later in this chapter we will be bolting this running board assembly with boiler attached to the BBT framing. At that point the model can be safely lifted by the running boards. In order than the running board sheet does not lift away form the Plastruct SHS members under the floor, we will now bolt the sub-floor framing to the running boards. Do this by drilling out those four 1.5mm holes through into the sub framing, I would recommend drilling into the sub framing with a smaller drill bit, such as a 1mm. Insert 4 domed topped brass bolts to fit, 10BA or similar. Tighten the bolts such that the domed head is flush with the running board top. Trim off the excess brass bolts projecting below the SHS sub framing, using side cutters, then smoothen off with a metal file.

At this point also follow through those 2mm holes for the future installation of sand lines. Drill the 2mm holes right though the sub framing. The running board assembly as viewed from above should look like this:

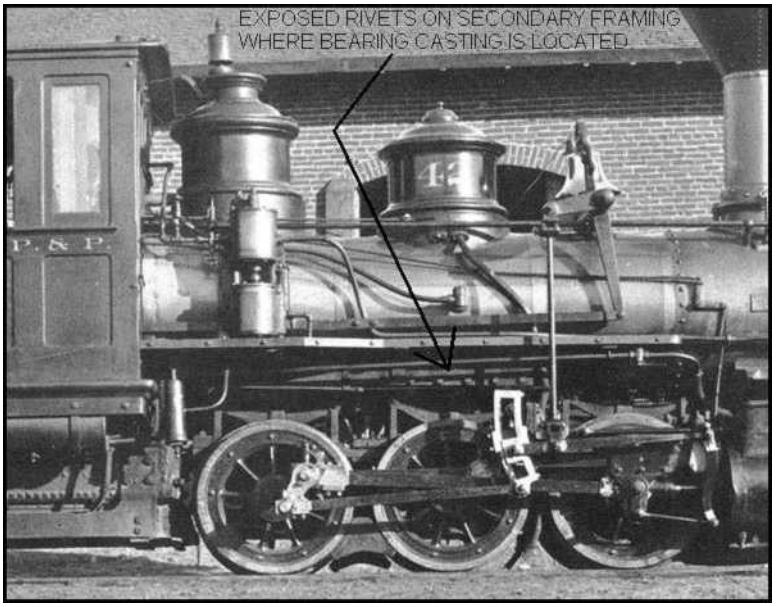


Step 5 - Detailing the Mason Secondary Framing

On some of the 6 versions of the Mason Bogie we're building in this class, there was a row of exposed heavy rivet heads seen on the sides of the secondary framing. These rivets held the massive bearing plate casting in position. This was the pivot point for the chassis and also the location where the steam supply pipe ran from the boiler to the cylinders. For such a beautifully detailed locomotive, it seems odd that Mason would leave the side of his framing with such an industrial finish. Well that's because Masons would never leave his locos with such an unfinished look! No, Mason clad over these exposed rivets with a decorated fascia. Such fascias can be seen on the builder's photos of the heavy 2-6-6T, 'Breckenridge' and the big 2-8-6T 'Denver', Bully Boy and many others.



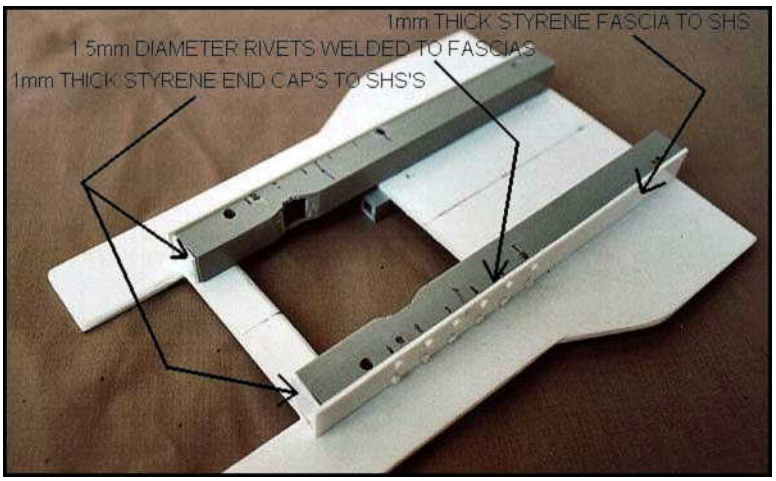
For the South Park it seems that these fascias were removed, or simply fell off relatively soon after delivery, I don't know why. All the photos of our light 2-6-6T show the fascias missing after about 1880. So I leave you a choice: you can build your Mason with the stylish clean lined fascia (seen above), or with the industrial looking rivet ridden beams that were seen behind the fascia. Thus Option 1, 2 and 5, "As Built" versions should have the clean fascias, and options 3,4 and 6 should be made will all the glorious rivets exposed! Select the appropriate fascia/beam style from the PDF drawing; Running Boards - Bottom Details..

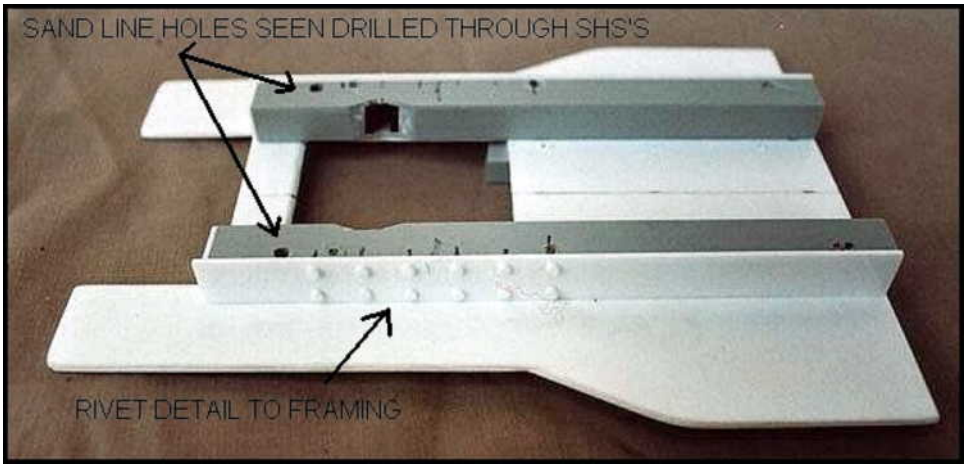


The exposed rivets seen on the side of the DSP&P #42, 'Tenmile'. The airline conceals the upper row of rivets from view.

Cut out the secondary framing detailing elements, following the PDF templates. This should be two 126mm long x 10mm tall fascia plates of 1mm thick styrene for Options 3,4, 6 or the 150mm long clean fascia for options 1, 2 and 5. Cut out the two 1mm thick end caps for the sub floor SHS members. Weld the fascia's and end caps to the side of the sub floor SHS members.

For Options 3, 4 & 6 only, use the template as a guide locate the 10 rivet heads required to both beam faces. Make the rivets by slicing 1mm tall slithers of your styrene 1.5mm diameter rivet rod. Weld the rivet heads into place. Place a daub of welder atop each rivet when located to fuse down properly. The finished running board assembly, with detailed secondary framing should look like this for Options 3, 4 and 6.:





Running Boards Edge Trim

The edges of the running boards, as built at the Mason factory, had a nice rounded wood finish. You might like to sand the edges of your running boards to a rounded finish too. Over time, as the locos aged and were maintained at the RR shops, the rounded edges were cut back, and flat faced metal trim applied to the exposed edges. It is reasonable to assume the timber edging began to break up and the retro fit metal edging helped to give the loco clean lines again, with a more robust finish. Check the 'in service' photos in the MC2002 archive and see if the version you are building could have metal edges. You can apply such edging by welding a strip of 3mm wide, 0.5mm thick styrene to the exposed edge of the running board assembly, leaving 0.5mm of trim proud above and below the running board surfaces. Using your 0.20x0.30 rivet rod, apply a line of exposed rivets to the trim. See the photo of #42 above. This was typical. I leave the desire to model this detail entirely up to you! It is only appropriate to some locos of option 4.

Time to Paint the Running Board Assembly!

Hopefully you know what sort of colour scheme you intend to produce for your model.

Some info from our Historic Advisor, Jim Wilke...

> *The painted iron nosing, supports and underside of a running board should be painted to match the locomotive - so dark green, lake, blue, black, etc., is appropriate.*
>
> *The top of a running board was different - it was a walking surface, where a painted and varnished surface would be dangerously slippery to a poor fireman. So common mineral paint was used, usually with crushed sand sprinkled into the wet paint for traction.*
>
> *In the 1880s one railroad painted running boards green regardless of the engine color. At the same time, the Southern Pacific Railroad used chrome yellow for running boards, tender tops and floorboards. I suspect the chrome yellow was for visibility and safety on dark nights, so crewmen could see where they were walking.*
>
> *Because we usually are looking down onto a model, where SP chrome yellow would be so totally distracting, its helpful to use other period solutions which won't take away from all that fine work on the rest of your model. Mineral reds, for example were common for running boards and look great to boot.*

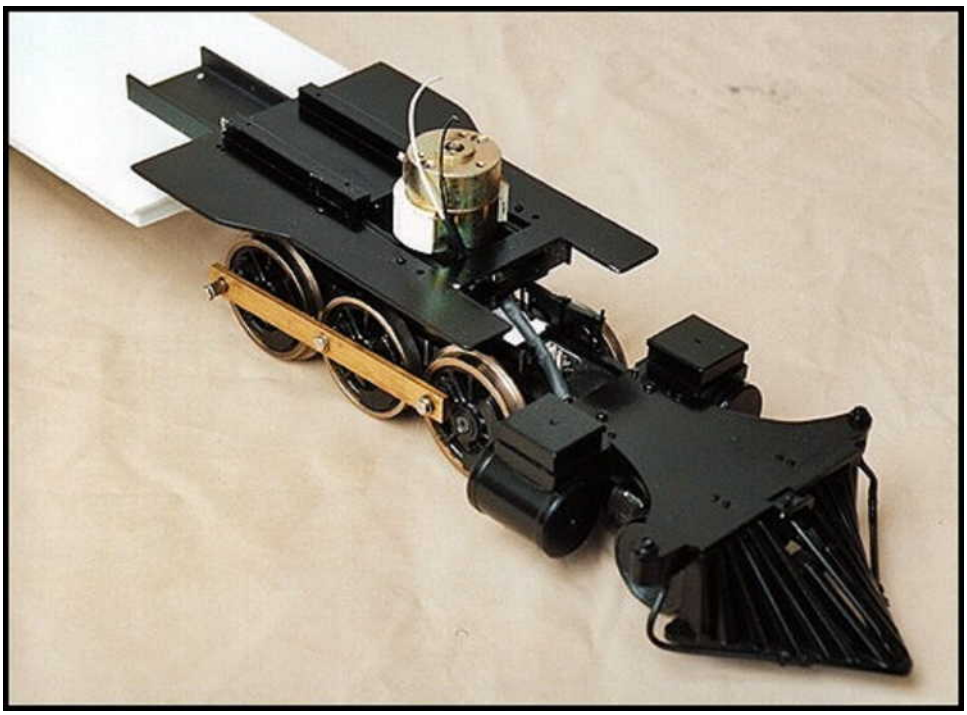
I use Scalecoat Roof Brown because it has a dark, warm tone and looks good without being distracting when looking at a model from above. I also use the Roof Brown for the top of tenders, and the floorboards of the tender frame, as all were utility surfaces and away from public view. Plus you have coal thrown on it!

In contrast, tender trucks, frames, cylinder saddle, etc., were in public view and therefore nicely painted and varnished. This also applies to the deck on the pilot beam, which was a showy part of the engine. I've stood on many a nicely painted up pilot beam in real life and haven't slipped yet.

So I recommend Scalecoat Roof Brown as the best. Other roof browns are grey-green and are not so good. But basically any dark mineral brownish red would be totally spot on, as well as any utility green.

Jim Wilke

The finished running board assembly, dropped onto the BBT chassis (not attached yet) will look like this:



Fabricating the Dome Bases

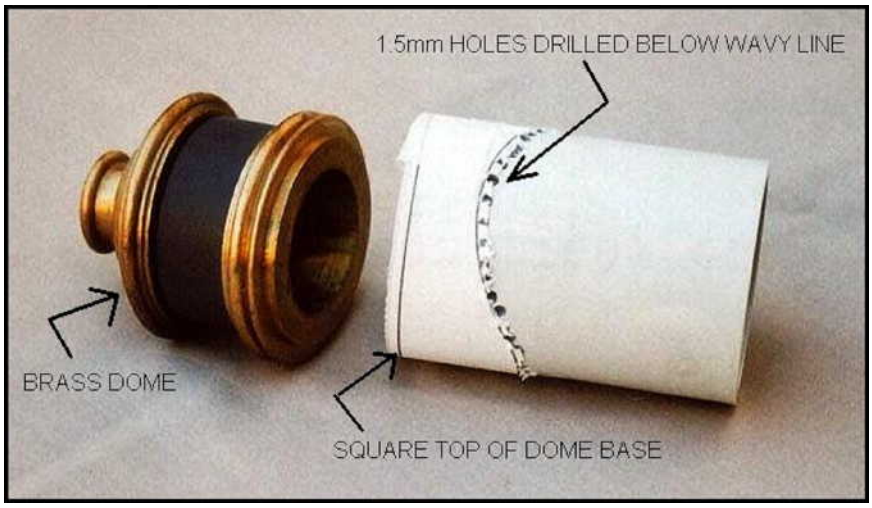
(Refer PDF pages entitled "Steam Dome Details" & "Sand Dome Details".)

In your collection of parts assembled during the quest for Mason-like bits in chapter 1, you will have obtained two fluted brass 'steam domes' from either Aristo-craft or Hartland Trains. The domes came with a lower brass ring, an upper brass fluted cap, and a central plastic cylinder...and no base! We are now going to make the dome bases that enable these fine brass domes to be seated nicely to the top curvature of the boiler. On the face of it, this is not an easy task, but actually you're about to see just how easy it really is.

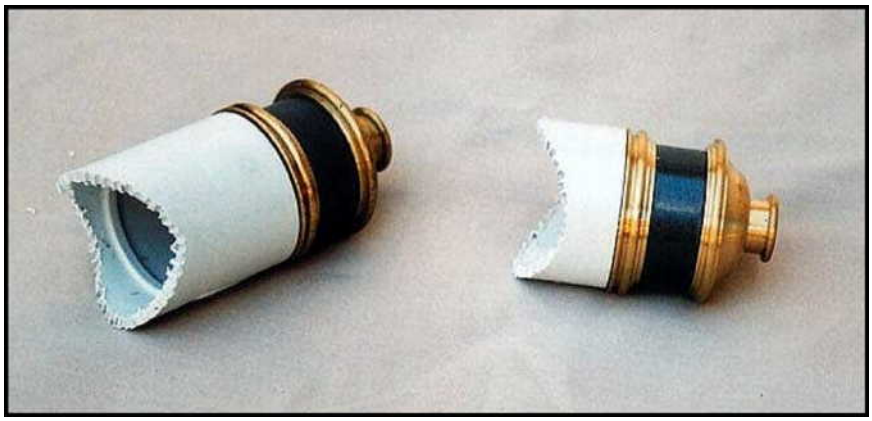
Go out into the world and find a 37mm outside diameter PVC or similar pipe. Such pipe might be found in electricians stores or plumbing outlets. Here I found the right size pipes to be electricians 'joiner' pipes...that is the small PVC pipes used to join other pipes together. Look for a pipe with a wall thickness of around 2mm. Go to the store with one of your brass domes in your pocket. When you have the correct pipe size, the brass dome base should sit snug into the pipe.

Step 1 - Cutting the Dome Base Profiles

Take your PDF page entitled 'Dome details', and look for the wavy line templates. These two wavy lines are actually the sides of the dome base all flattened out! I want you to cut out these two templates with scissors, and wrap the 'steam dome' one around the PVC pipe. If you got a 37mm pipe, the paper should wrap right round. Make sure the end of the pipe is nicely cut square; use the masking tape method to define a cutting line to get the end squared up if necessary. Apply the steam dome base template such that the straight line along the top, matches up with the cut edge of the pipe. Tape the paper template into position around the pipe. Next using a 1.5mm drill bit in your dill, drill a series of holes all the way round the wavy line into the pipe. Drill them as close to each other as possible. Drill away from the wavy line itself. The desire is that only one edge of the drilled hole actually touches the wavy line. Look carefully at this photograph - this is what I want from you:



Once all the holes are drilled, using the knife, slice between the holes, and separate the pipe into two halves...now here's where we're reeeeeeeeealy lucky! The Mason Bogies we're building had a steam and sand dome both of the same diameters - quite unusual in locomotive design. Usually the sand dome is smaller in diameter than the steam done, but not this time! With the pipe now in two parts, you'll notice you've created two dome bases in one easy maneuver! ...like this:



The dome to the right is the correctly made dome base for the Mason steam dome height. The dome to the left is the excess pipe, and will be trimmed down from the top to create the sand dome base.

Step 2 - Sanding the Dome Bases

Tape a piece of sand paper to a length of excess 51mm PVC pipe (or the pipe size you're using for your boiler). We will now use the boiler curvature to sand the rough dome base into a clean perfect fit with the boiler. Grind the dome base along the sand paper clad pipe and get sanding!! It'll take quite a bit of sanding and cleaning to get the dome base nice and neat.

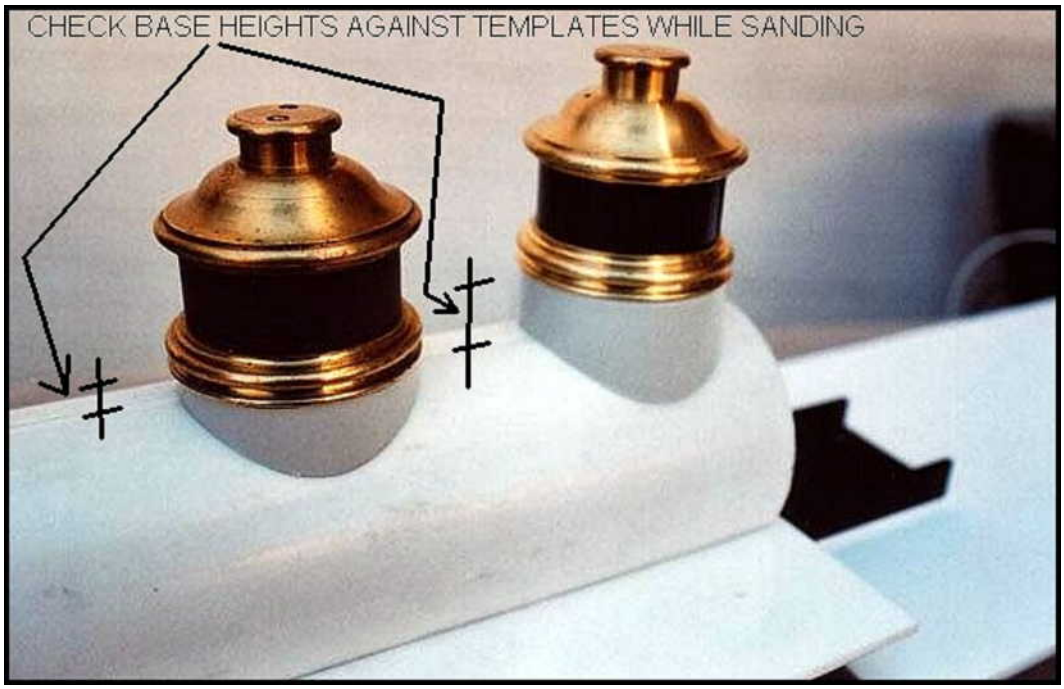
The 51mm PVC pipe clad in sand paper and my dome base being sanded to the right profile by grinding the thing back & forth over the pipe!!

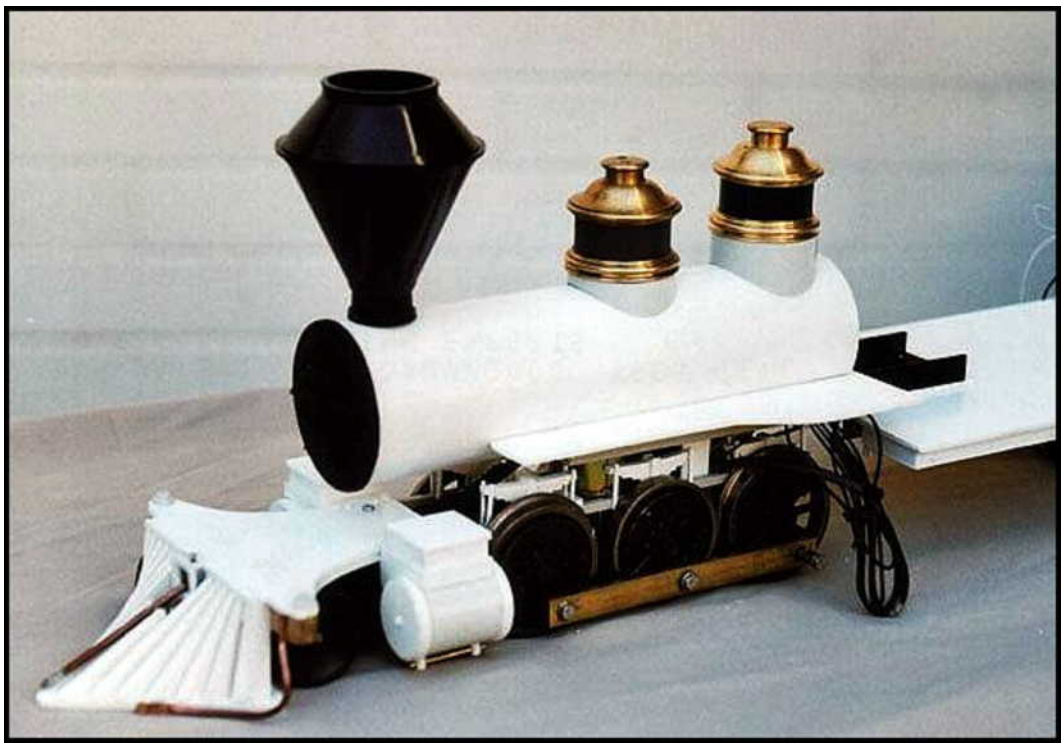
Take the sanding slowly, use a medium grade sand paper initially to get most of the meat off the bottom, and then finish off using a fine grade of paper. Sand both dome bases at this time…we will trim down the sand dome base from the top in a moment.

IMPORTANT SAFETY TIP - With every few stokes of sanding, look at the dome base and see that both short sides of the dome base are the same, and also both long sides of the base are the same...it is very easy to over-sand on one side, causing the dome base to sit off-vertical when placed on the boiler. A crooked base will mean the dome sits crooked on the boiler later.

Once both dome bases are nicely sanded, and fit snug onto your boiler pipe, using the paper 'sand dome' base template, check and trim the height of the sand dome base to match the template. At this point the steam dome base should already be the correct height, while the sand dome base will need trimming. Do your best to get the dome base heights correct, or your model will not look quite right. The domes would end up too tall or too short.

The finished dome bases with the brass domes resting above, sitting atop the boiler pipe should look like this:





The boiler shown resting (not yet glued) on the running boards, with the two domes resting in place (not attached yet), and a H-L-W smokestack and boiler front dropped on for good measure.

Finally store your domes away while we work on the rest of the boiler.

Making the Mason Wagon Top Boiler

Refer PDF pages entitled "Wagon-top Taper Profiles 1 and 2" (2 pages)

Wimp's Way and AA Denny boiler makers can ignore this step!

OK Chaps, we're about to enter a difficult part of the project, that of making the taper in the boiler to generate the prototypically wagon top boiler profile. The light 2-6-6T and 0-6-6T had a wagon top boiler similar to a classic American 4-4-0. There was a difference however. Where the 4-4-0 had the larger diameter section of boiler in front of the cab wall, with the backhead projecting only a short distance into the cab, the Mason Bogie has the cab concealing the larger section of boiler, with the taper visible directly in front of the cab wall. The steam dome on the Mason is in front of the cab wall and thus ends up mid way up the taper....just to make things really hard for us! On the 4-4-0, the taper was in the boiler section in front of the steam dome. It is some task in working out the dome base profiles and boiler tapers where Mason had the steam dome intersecting the boiler taper. I've thought long and hard about this, and I think the easiest way to do this is to forget the taper exists when producing the dome base (as made in the previous step). We then add the boiler taper around the dome base. In working the problem this way we can:

1. Firmly fix the dome down to a known firm surface -that of the 51mm boiler pipe inside the boiler taper.
2. Avoid working up a strange dome base profile on the taper.
3. Work up an easy boiler taper section with a hole for the dome base to run through.

I know all this makes no sense at all at this point, but bear with me, and you'll see what this is all about.

Step 1 - Making the Boiler Rear End

As Mentioned early in this chapter, our 51mm boiler pipe was cut to a 189mm length. That is 4mm shy of the full boiler length of 193mm. The last 4mm are to be made now, using two plates of 2mm thick styrene that provide the 'form' to which we extend the boiler taper. Go ahead and cut out the two 'boiler backing-plates' based on the templates provided on the PDF drawing entitled "Wagon-Top Taper Profiles -1". The two plates are identical in profile and are 2mm thick. Check that the inside curvature of the profile matches the **inside diameter** of your boiler pipe. Using welder cement, weld the two plates together to form a 4mm thick boiler backing plate. This backing plate is designed to fit up against the rear end of your boiler pipe.

Next follow the template for the "Taper Packer", cut this profile out from 2mm thick styrene sheet as well. Check that the inside curvature of this profile matches your boiler **outside diameter**. It is designed to fit over the boiler pipe. Weld this plate to the face of the 4mm backing plate. Make dead certain you have centered the Packer plate onto the rear backing plate properly, check the overhand to both sides of the boiler is the same. Use the PDF template to help.

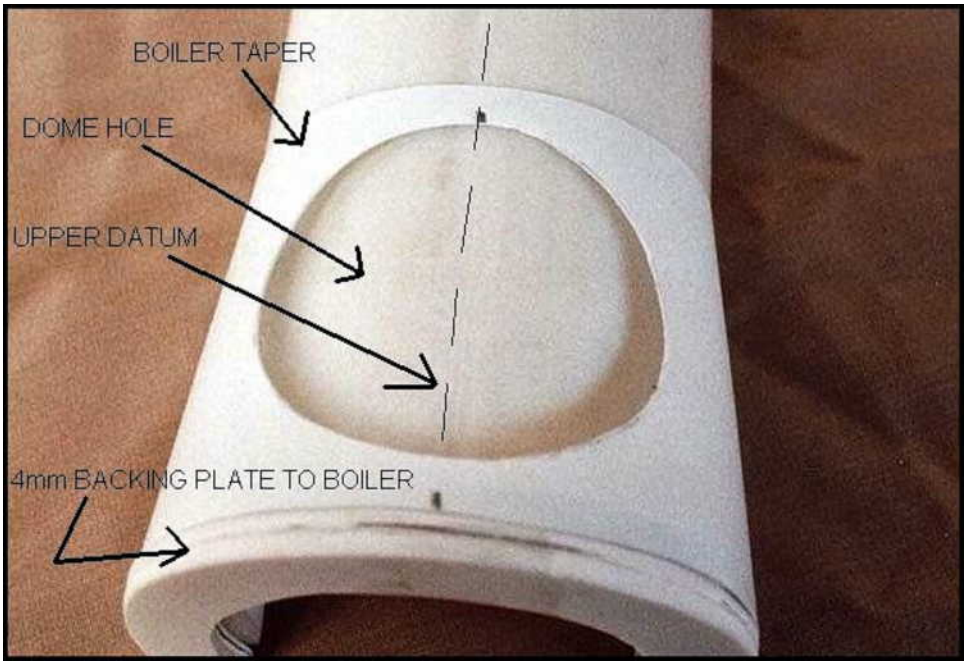
Using the epoxy glue, stick the 4mm backing plate to the back end of the boiler, the front 'packer plate' will slide over the boiler end. Your boiler is now the required 193mm length! Make sure the bottom edge of the backing plate ends in line with the bottom edge of the cut boiler base.

Step 2 - The Boiler Taper

Using 0.5mm styrene sheet, cut out the boiler taper to match the fan-shaped profile on the PDF page, "Wagon-top Taper Profiles -2". Carefully cut out the elliptical hole in the centre of the profile. Mark onto the fan shaped profile the 'upper datum' line as shown on the PDF template.

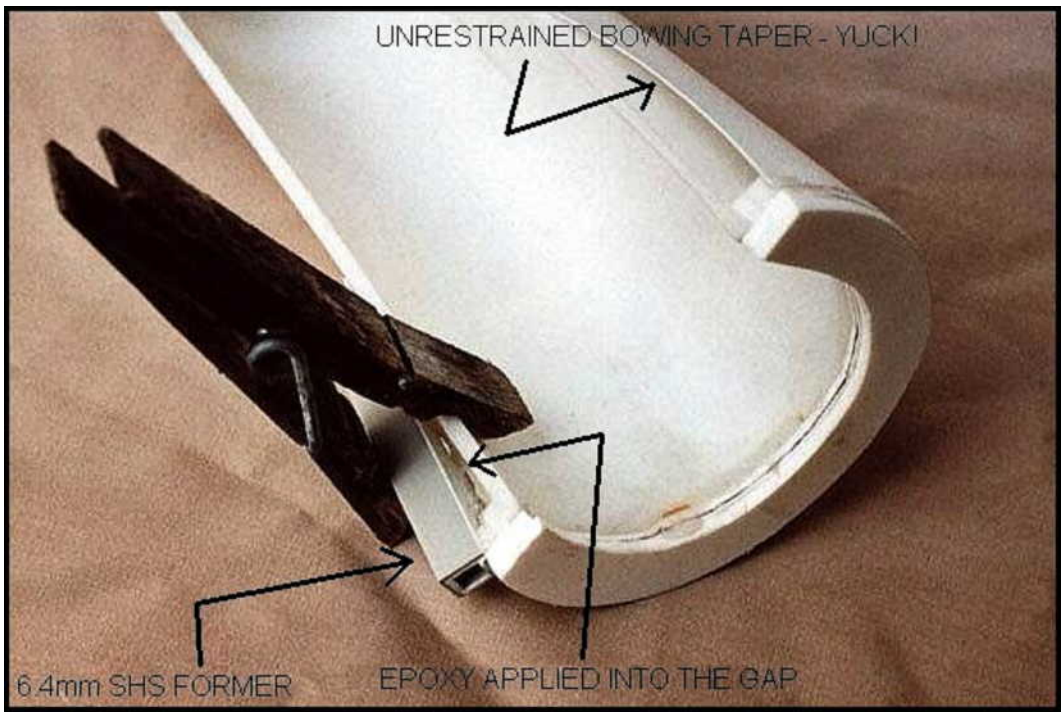
Wrap the taper profile around the boiler, keeping the upper datum marks on your template in line with the datum line on your boiler. The wider curve of the fan will sit down onto the rear boiler packer, and butt up the face of the backing plate. The smaller curve will sit down around the 51mm diameter pipe...you now have your boiler taper. Check the dome hole is square around your boiler upper datum line - you don't want your steam dome to be forced sideways because the boiler taper was applied off -centre. At this point check that your steam dome base diameter fits snug into the taper hole. You do not want any visible gaps - it must be a perfect fit. If the hole is too tight about the dome base, carefully sand the edges of the hole to widen out a bit.

Using a line of super-glue along the two curved edges of the fan shaped profile, fix the taper into place. Once the taper profile is fixed into place, using fine sand paper, sand around the joint lines along both ends of the taper, where it meets the boiler surface. Your boiler taper should look like this:



Step 3 - Stopping the Bottom Edges of the Taper from Flapping

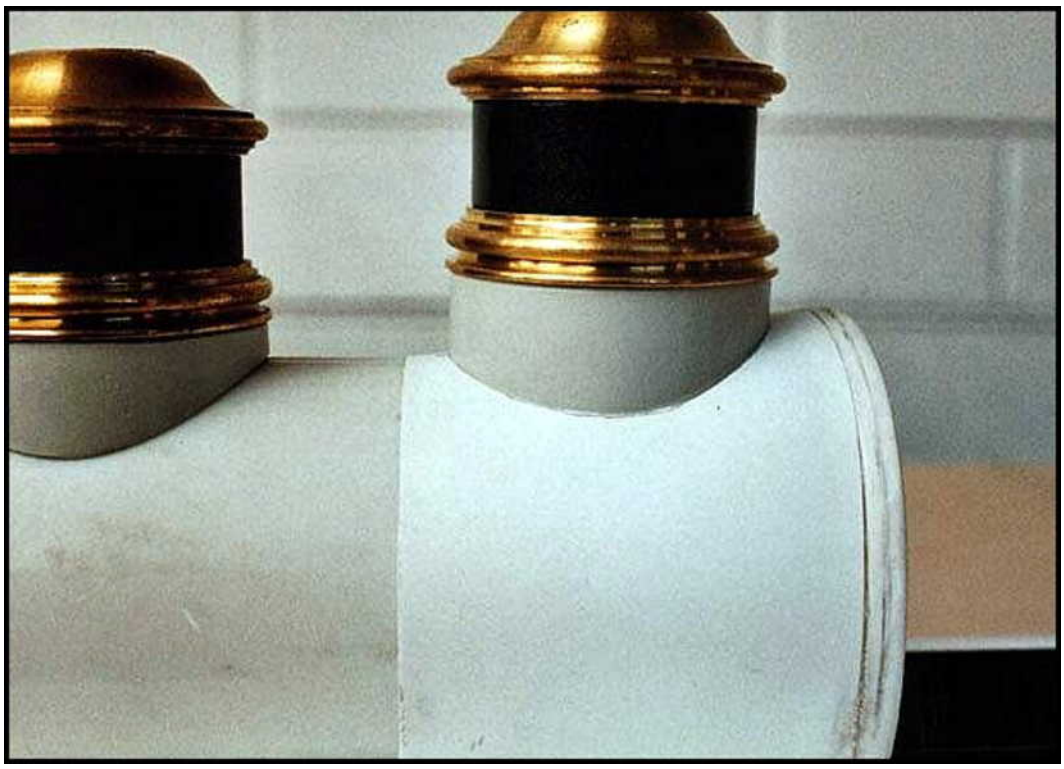
After the previous step you will notice the bottom edges of the taper are not fixed against anything, and are flapping in the breeze. Worse still is that the tension in the 0.5mm taper wrapper is causing the bottom edge of the taper to bow outward. This is easily fixed. Cut an unused section of 6.4mm Plastruct SHS square tube Cut the length of the SHS to match the length of the boiler taper. Next hold the 6.4mm SHS against the bottom side of the boiler taper using a clothes peg. This will now take the bow out of the taper and hold it in a straight line. Make up a small batch of epoxy glue and apply it into the gap between the taper sheet and boiler. You need only fill the gap to a distance of about 5mm. To insert any more glue might result in the glue running around the boiler and out the dome hole. The process is as shown in this picture:



... and seen from the other side....

Now repeat the same procedure to the other side of the taper. Both lower edges are now restrained and run in a straight line.

When you insert your steam dome into the taper hole, it should all look like this... pretty cool eh?



Detailing the Smokebox and making the Smokebox Front

Decisions, Decisions:
By now I would hope that you've read Kevin Strong's article about putting a patina on your boiler jacket, a method of using sheet metal to simulate Russia Iron. If you've done some tests, and this system seems to be working OK, you might consider applying a similar boiler jacket to your Mason model. If this is the case, then you will need to make a brass or styrene smokebox wrapper as well, because the Mason smokebox diameter was equal to the diameter of the fully lagged and finished boiler. If you are to wrap your boiler, refer to the PDF drawing entitled "Boiler Wrapper Templates."

If you will be simply painting the boiler, either black, any other color, or indeed painting the Russia Iron color on, using metallic paints, then you will be using the finished boiler pipe as is. You will not need any wrappers, and will not want to enlarge the smokebox with an unnecessary wrapper. In this case, do not use the wrapper PDF drawings.

DECIDE NOW ON WHAT YOU WANT TO DO, and then read on the appropriate section that relates to you.

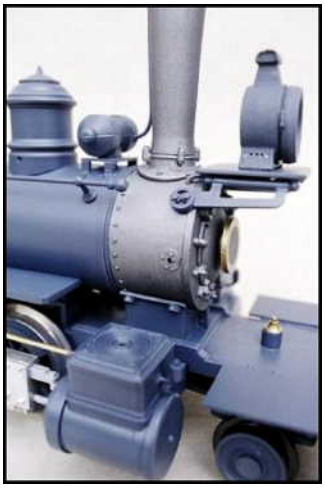
Option 1 - Detailing the Smokebox for a Painted Boiler - No Wrapper.

Refer to the PDF drawing entitled "Boiler Set-out Dimensions".

Do not use the Smokebox Wrapper template if you are painting your boiler, you will not be using a smokebox wrapper.

Detailing the smokebox without any wrapper is quite straightforward. You will need to apply a line of rivets at the lead and rear edge of the smokebox side. Use the boiler setout PDF drawing to help locate the rivet lines. Apply masking tape to the smokebox to find that line parallel to the boiler, and draw two lines where the rivets are to run.

Next dice up a whole bunch of rivet heads from your 0.20 x 0.30 styrene rivet stick. Depending on your Boiler pipe material, you can either weld these rivets individually onto the boiler using welder cement, or super-glue them on, if the plastic boiler does not take to the welder. Apply two lines of rivets with the rivets located at 4mm centres. That’s all there is to it. Next move onto the section about making the smokebox front. Once the rivets are in place, your smoke box should look a little like this - borrowed from the rivet line applied to the MC2001 2-6-0! The Mason requires two lines of rivets...one at each end of the smokebox.



Rivets along rear end of smoke box.

Option 2 - Detailing the Smokebox for a Fully Lagged Boiler Using a Sheet Wrapper

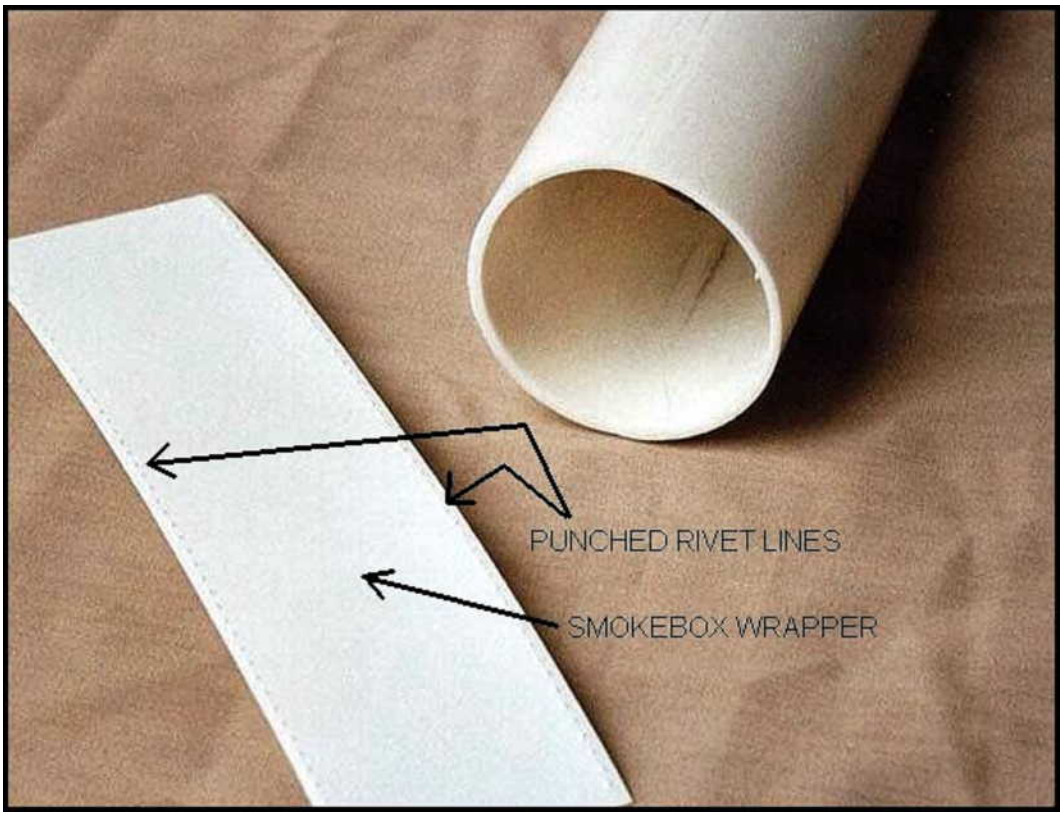
Refer PDF page entitled "Boiler Wrapper Templates."

This is the option where you make a boiler jacket to Kevin Strong's instructions and thus you will be needing to provide a smokebox wrapper as well to match the enlarged boiler diameter.

You can make the smokebox wrapper using 0.25mm styrene sheet (Evergreen make some of this), or use the clear plastic found on a shirt box. You will be wanting pretty thin plastic. It is also possible to use more of the same brass sheet used in making the Patina boiler jacket. You will be needing to paint the wrapper whether brass or styrene.

Follow the PDF template for the smokebox wrapper. Using a pointy implement, such as a heavy gauge blunt needle or a cake baking spike etc, punch each rivet into the styrene or brass sheet. This is done by placing your wrapper onto a firm base such as a block of wood, then pressing the needle into the back of the sheet styrene until a domed bulge appears on the other side of the material, forming a 'rivet'. Punch the rivets in a line at 4mm centres, along both long edges of the wrapper. When punching, support the wrapper on a firm base. The firmer the base, the cleaner, and more dome-like your rivets will be. A perfect base is a block of pine wood or similar, it is firm enough to keep the styrene in place, but allows the spike to punch into the wood, taking the rivet dome with it. Practice a little to see what the optimum punch pressure is, you don't want to punch right through the sheeting! For styrene wrappers, punching can be done by hand, simply press the spike into the styrene.

The styrene wrapper should look like this:



The Mason Bogie Smokebox Front

(Refer PDF drawing entitled "Smokebox front".)

Chaps, here you have some options. The most desirable option is to use the Aristo-craft/Delton C-16 smokebox front for the Mason Bogie. The styling is very close to accurate and the is good looking. Problem is that the C-16 has been out of production for a while now, and the limited number of smokeboxes left in the Aristo Parts dept have dried up as a result of MC2002 folks buying up. Some of you will have been lucky, some not. If you are one of the lucky ones and have a C-16 smokebox, but decided not to use it because of the hand rail stanchion holes drilled into it, fear not, a tiny bit of filler is all that is needed, and even then the location of said holes happens to occur right where the headlight bracket is mounted, so the hole is concealed. On the whole, as they say, USE IT!

You'll need to cut the C-16 smokebox front away from the rest of the C-16 smokebox, use a razor saw, and follow the scribed lines on the smokebox side. Also carefully remove the headlight bracket mounting plate at the top of the smokebox front. Try and retain a circular profile at the top where the bracket was. If you have packed out the smokebox with a wrapper, you might need to run a rim of 0.5mm styrene around the perimeter of the smokebox front, but this depends entirely on the exact pipe size you've used. You will note that the Mason fronts did have such a rim, where our Baldwin C-16 front does not, thus the rim is actually prototypical. The 0.5mm rim strip should be cut to about 1 - 1.5mm wide.

The only option left to the rest of us, who do not want to make their own smokebox front, is to use the Hartland trains 4-4-0 front. It is the right size, but stylistically not very close. it will however fill the bill, and is amply elevated to the status of 'Wimp's Way' smokebox front! Test the size of your H-L-W front against the finished size of your boiler. In some cases the H-L-W front will be slightly wider than the boiler pipe, forming a lip around the edge. This lip is typical of the Hartland models generally. If you don't like it, I suggest you sand the edge of the H-L-W front down by 0.5mm, matching its size to the boiler you have.

The rest of us make the smokebox front out of layers of 1mm and 2mm styrene sheet, with rivets welded on in the normal fashion. For those making their own smokebox fronts there is nothing to it, but to follow the templates in the 'Smokebox Front' PDF page. Cut each circle as indicated in the correct thickness, Apply the 1.5mm rivets as shown around the perimeter. Cut the hinges from 0.5mm styrene forming strips as shown. Go ahead and do it.

Right -its now time to paint your smokebox front. Whether Delton, H-L-W or scratch made, paint your fronts! I used Tamyia 'Metallic Grey' MS-5, a very dark graphite colour, then over sprayed it with Testor's Dull coat 1260.

All of us shall meet up here, where we are all to apply the same number board details to the smokebox front... and learn about the 'Great Australian Gooop.'

The Great Australian Gooop

I build a lot of models, but I can't say that many of the methods used on them are entirely my invention. Phil Creer invented the use of dress snaps, for valve handles, Kevin Strong, the boiler jackets, etc...but one thing I can claim is the use of the 'Gooop' to simulate ornate 1870s brass details.

The boiler front of the Mason bogie is unusual in that there is a typical number disk, like so many of the US locomotives, but there is also an ornate vertical handle seen just behind the disk. US steam locomotives are remembered as generally having clamped smokebox doors. The Mason Bogie however has no clamps. The door is held shut entirely by the locking mechanism associated with that handle. Like so much that Mr.

Mason has employed on his locomotives, the central locking of the smokebox door is a British innovation. The handle worked as a 90-degree turn locking mechanism. To close the door, the handle points to 3 o'clock. When the door is to close, you turn the handle to 6 o'clock, and in doing so the door tightens closed.

We will be making the ornate door handle for our model.

Quite the norm on British locomotives was the use of lever handles to secure the smokebox door. This one I can't resist... LNER #4472, "Flying Scotsman", first man made object to officially record 100MPH, way back in 1934...this claim is also now disputed!! (might have been actually 98MPH).

Step 1 - The Gooop

Cut a 16mm length of brass 1.5mm rod. Approx. 3mm from the end, you shall insert a sliver of your 2.4mm styrene tube (widen the hole in the tube with a drill bit, just held in your hand, no power tools needed). Next comes the Gooop. Mix up a small batch of epoxy, vertically dip the end of your brass rod into the epoxy and pull away. You should now have a dribble of gooey glue on the end of the brass rod. Hold the rod vertically such that the gooey blob stays hanging at the bottom end, forming a perfect pair shape...this, dear friends, is the Gooop. When the epoxy hardens, and you paint over the rod, styrene sliver and gooop in gold/brass paint, the finished effect is of a carefully turned brass ornament. You can use the same technique on brass handrail ends, cab railings etc. This styling however is only appropriate to the 1870s-1900. This 16mm rod is your Mason Bogie smokebox front door handle.

Step 2 - Making the Number Disk

Follow the smokebox front number disk template in the PDF file. This is a 19mm diameter disk in 1mm styrene sheet. Next cut a 1.5mm wide strip of 0.5mm styrene, and weld it around the edge of your disk, this forms the rim to the number disk. Finally wrap a strip of your 0.20x0.30 rivet rod material around the outer rim, centered in the 1.5mm wide rim. All of this simulates the ornate cast brass edging to the number disk.

Take your 3.2mm Plastruct tubing; this will have a hole down the centre of it. Drill a 1.5mm hole into the side of the tube near the end. Drill only one side, don't let the drill go right through the tube. Trim off the tube about 1mm away from the hole near the end of the tube. Trim off the other end of the tube about 8mm away from the hole... making a tube about 10mm long. Weld the end of the tube into the back centre of the disk, with the hole near the number disk. Next insert your door handle with gooop into the hole. Finally paint the whole shebang a brass/gold colour. You will be applying a special decal to this plate later on. It is important the disk is totally golden at this stage. Your finished door handle and number disk should look like this:

Finally take whatever smokebox front you have, and drill out a 3mm hole in the dead centre of it. The Aristo and H-L-W fronts will already have a hole, you need only widen it out. file out the hole a tiny bit more to allow the 3.2mm styrene tube to slide in. Allow for it to be a tight fit. Slide the tube, with disk etc attached, into the smokebox front as far as it will go, to the point where the brass handle is against the smokebox door. Weld the assembly, while keeping the brass handle absolutely vertical, and the number disk parallel to the smokebox front. The door hinges should be pointing in the 3 o'clock direction.

On my prototype model, I have use the C-16 front. The finished front should look like this:

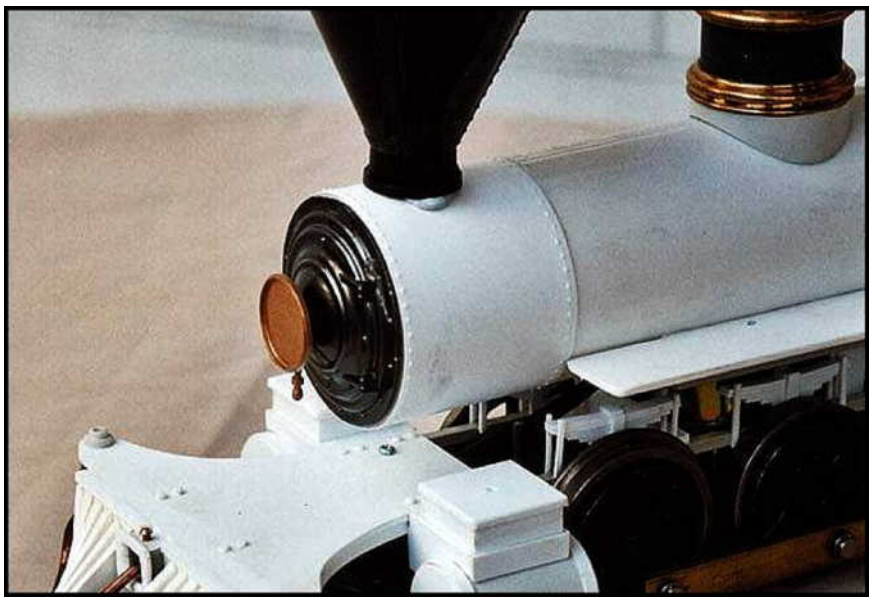
Fixing the Smokebox Front to the Smokebox

You have two options here: glue the smokebox front to your model and leave it permanently fixed, or provide some backing styrene to the back of your smokebox front, such that you squeeze the front onto the boiler like a cork in a bottle and thus provide an access way into your boiler forevermore.

I have no particular issue with either approach. Usually I recommend the front be removable, but since the interior of this boiler is so easily accessed from the motor hole and one can reach all the way into the smokebox quite easily, I see no reason why you can't just glue the front on.

To build the packers to the back of the smokebox for a removable front, follow the diagram in the PDF smokebox PDF page. There are also many other ways of doing it.

The smokebox with front attached/inserted should look like this:



Again I have blue-tacked the H-L-W stack onto the smokebox just to demo where the stack goes. No I just couldn't help myself…and I know you'll do the same!!

OK looking ahead, the fully painted and fitted smokebox with number disk will ultimately look like this. Note the tight fitment of the number disk and lever.

Making the Classic Colorado 23" Box Headlight

First some info from our Historic Advisor, Jim Wilke...

> *Headlamps were supplied by large railway supply companies, usually located along the eastern seaboard but sometimes also in the Midwest.*
>
> *The Williams Head Lamp Co. in Utica, NY is a typical example - it made lamps from the 1850s to the early 1900s, was considered a significant maker, and was favored by the master mechanics of several large railroads.*
>
> *When a railroad ordered a locomotive, it had two options: purchase the lamp separately, or have the locomotive builder install the lamp at the factory. Baldwin records sometimes specify "Williams Lamp" or "23-inch reflector" or "to be furnished by RR Co."*
>
> *Engineers sometimes purchased lamps from supply houses themselves, installing it on the engines in their charge. Usually this was a given type that fitted the runner's requirements for distance of light thrown ahead, etc.*
>
> *Nearly every make, style and patent thingamajig on a lamp was used to advertise it as the best and most universally satisfactory - the types of burners, quality of reflectors, brightness of light, etc. were hotly competitive. After 1880 illuminated number boards placed upon the top of the lamp allowed large roads like the Union Pacific better accounting of their engines by showing the numbers at night. Several different types of illuminated board were used and each had its supporters.*

They looked on these lamps as high technology, and they were. Specialized equipment and dedicated factory space were needed to produce a quality lamp; it also made sense to buy a better quality product from a firm that made its reputation making high quality lamps, and by the thousands.

The quality of reflector, and burner were usually beyond the grasp of the common tinsmith. Lamps were not made by local tinsmiths until much, much later, on isolated narrow gauge lines in the early 1900s.

Lamp cases were entirely sheet iron, hammered and stamped into shape over wooden molds. The lamp base is nearly always wood; I've never seen an original box headlamp that did not have a wooden base!

The lamp rim is sheet iron as well. A lot of model manufacturers put a brass rim on for looks - don't always trust the large shiny plastic thing on the hobby shop shelf - "shelf appeal" in other words. For an accurate appearance, it should be painted iron.

As an accessory, lamps were not always the same color as the locomotive. Salesman sample lamps at the B&O museum are painted a neutral black, with gold striping and scrollwork, and the maker name in gold on the chimney guard. Other lamps were painted in colours, probably wine, Tuscan, dark green or Lake (in the 1870s). This can be a nice detail that adds contrast to a bogie - say, dark green with a wine lamp. Landscapes were common in the 1870s, usually generic mountain lakes instead of barroom nudes.

Lamps that were delivered with an engine from the factory, such as Baldwin, were painted to match the rest of the machine.

Have fun,
Jim

Making the Headlight

Many of you are building pre 1883 versions of the Mason Bogie, and as such the really big Headlight is not necessary on your model. As stated in Chapter 1, the Hartland trains Box headlight is a perfect option to represent the smaller box headlights, such as those used in Options 1, 2 and 5. Beyond that, there is no reasons why you cannot use the commercial box headlight on what ever options you are building.

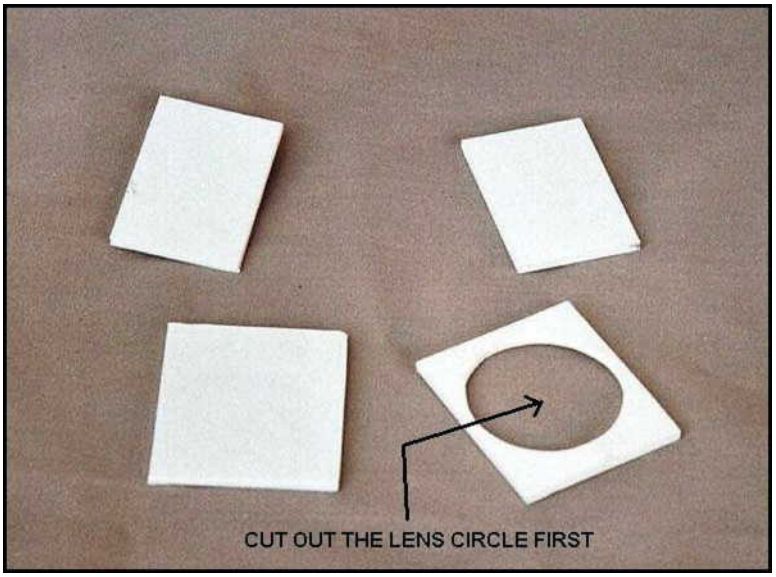
Be that as it may, the reality is that these Mason Bogies received some pretty darn huge box headlights in the early 1880s and retained them to retirement. With the enlarged headlamps came the changed headlight brackets as shown on the 2-6-6T option 3, 4, and 6 drawings. This section is devoted to making your own huge 23" headlight at 1:20.3 scale. If you're not making this headlight, go forward to the next section and we'll meet you there. For the rest of us, you'll discover that this box headlight isn't that hard to make, and you might even considered making a couple more to replace those piss weak little headlights provided with the Bachmann 4-4-0, 2-6-0 etc!

Also note our MC2002 introduction of a commercial 23" headlight soon to be offered by Fall River Productions.

Step 1 - Making the Box

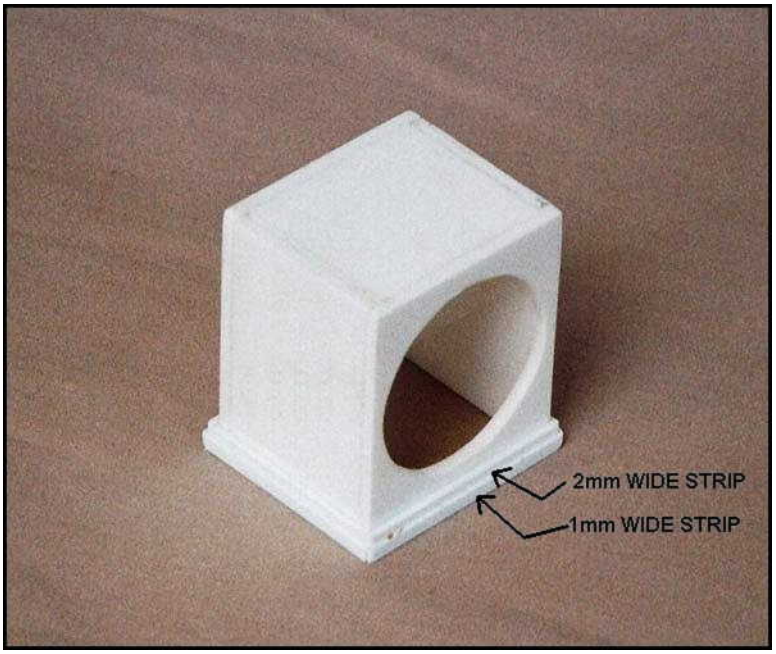
(Refer the PDF page entitled "The Colorado 23" Box Headlight")

Cut out the 4 sides and top of the box following the templates. A word of advice, it is best to cut out the big lens circle first, and then cutting the rest of the panel around that hole. All of these parts are to be cut from 2mm thick styrene. The cut parts should look like this:



Assemble the 4 walls of the headlight using welder cement. Note that the front and back walls are cut to the full width of the headlight, and as such the sidewall butt into the rear faces of these. Insert and weld the top panel into place, such that it is flush with the top of the walls.

Next cut a 2mm wide strip of 0.5mm thick styrene. Wrap this styrene strip all the way around the base. You can cut the strip at the corners if you wish, just make sure the joints are clean. Then cut a 1mm wide strip of 0.5mm styrene, and apply that over the 2mm wide strip. Align both strips along the very base of the lamp. This procedure provides the bottom edge molding of the lamp. It should look something like this:



The side access doors - These doors were used to access the headlight innards in the old days. Some have doors to both sides that opened, others opened only from one side. The doors are cut from 2mm thick styrene. Chamfer the edges to all 4 sides to a 45 degree angle, then weld the doors clean in the centre of the box sides as shown on the PDF drawing.

The lens rim - Cut a 5mm wide length of 0.5mm styrene. Wrap this strip around the inside edge of the lens opening in your lamp, so that the back edge of the strip is flush with the inside face of the lamp wall. Trim the strip where it meets up with itself around the full circle - this is the lens rim! You can leave it like this, or you can apply a second rim wrapped around the outer surface of the first. the second rim should step in slightly, so make it 2mm wide. Stagger the joints in your rims strips, but I recommend ensuring that the strip joints are near the bottom of the lens (A less visible place).

Step 2 - Making the Headlight Crown

This is the reason why most folks don't make their own box headlights - the ornate crown is too difficult!!

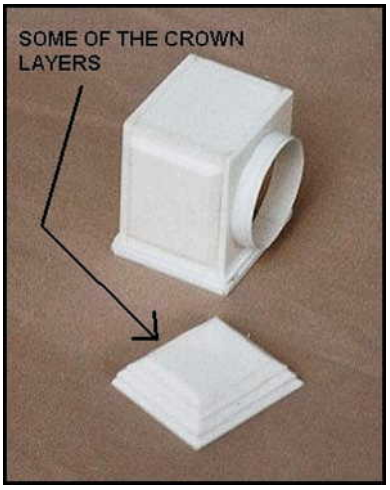
There are ways...and at this point I'll indicate three ways, and demo one of them:

Option 1 - make the crown using a modeling polymer clay such as 'FIMO' or Sculpy, as available from artsy stores. The Fimo is a type of plastic material that you can carve into shape, bake in the oven for 20 minutes, and thus produce a hard plastic component. Super-glue bonds it extremely well.

Option 2 - make the top as a plain 4 sided pyramid from flat planes of 1mm styrene sheet.(see wimp's way crown on the PDF page).

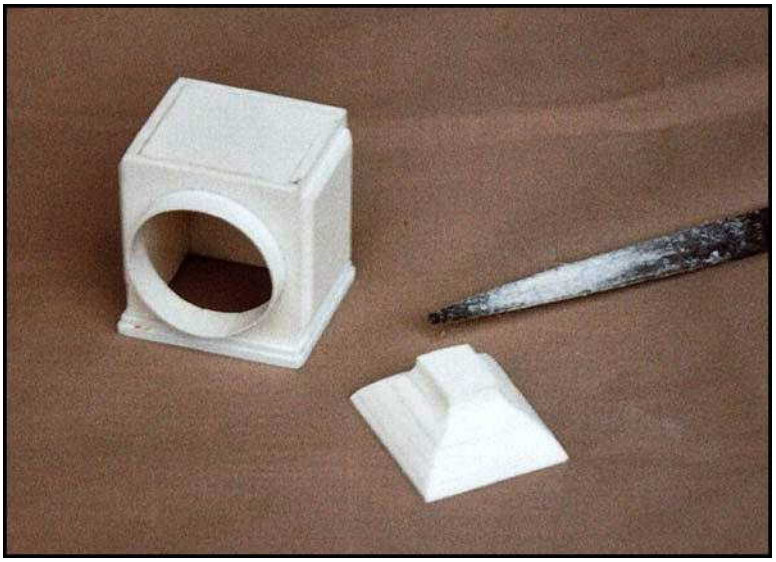
Option 3 - Build up the crown in layers of 2mm styrene, and form the profile this way. This is what I'll demo, and provide templates for in the PDF drawing. This technique has evolved from one of the methods wooden model boat builders use to form the complex curves of the model hulls. Layer by layer, you build up the profile like a contour map.

Cut out all 6 crown templates, these are an ascending order of 2mm styrene rectangles. Carefully chamfer the edges of each rectangle to a 45-degree angle using your modeler's knife. This is done to remove much of the unwanted meat in the layers before you get into hard sanding. Build up the crown separately from the rest of the headlight. Install each layer exactly centered over the last, so that a kinda stepped pyramid builds up. The building up of the layers should start to look like this:



Once all layers are in place, its time to get sanding. I found the use of a metal file to be most productive. Use one that has a convex face on one side and is flat on the other. You will use the convex filing surface to sand out the concave curves near the top of the crown. The lower area is easily sanded with sand papers and flat files.

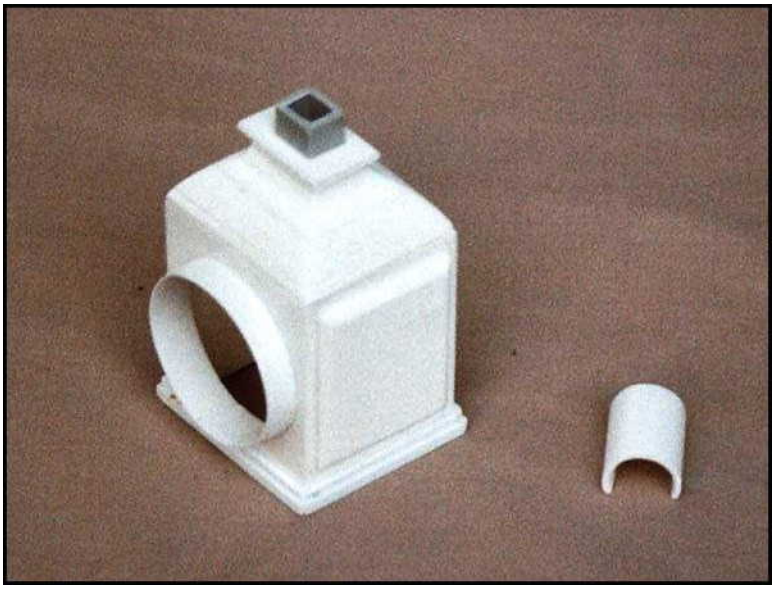
The sanded crown will look something like this:



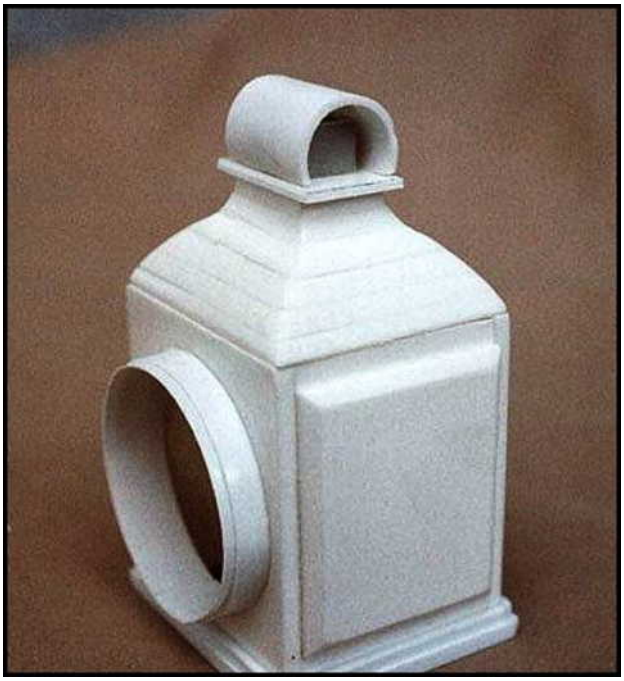
Step 3 - The Headlight Vent

Atop of the crown is an ornate vent where the heat and fumes of the oil burner escaped. The vent had a roof over to keep water out of the lamp.

We begin by making the vent base. This is a 10mm x 17mm rectangle of 1mm thick styrene sheet, per the PDF. Weld this central over the top of the crown. Next cut a 5mm length of your Plastruct 4.6mmx 4.6mm Square Hollow Section. Weld this section central over the crown. The headlight will look like this:



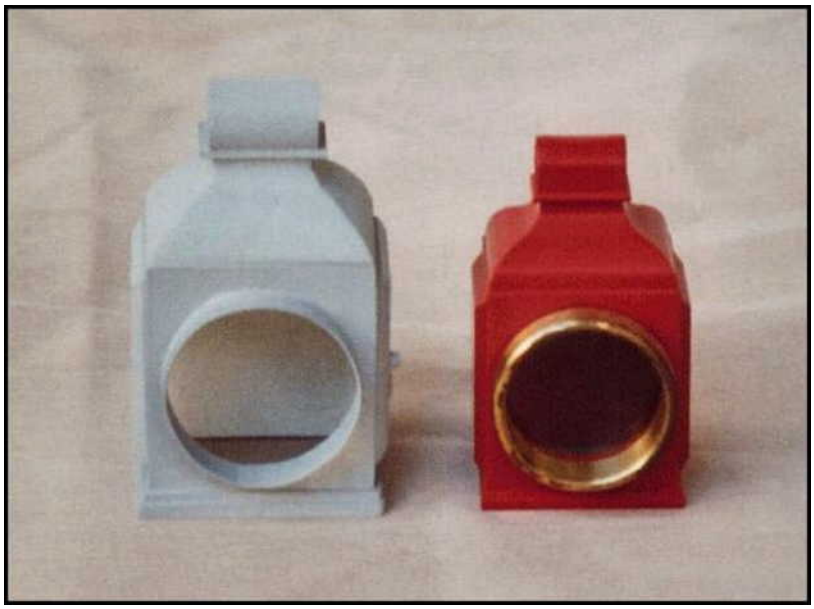
Finally cut a 15mm length of your 12mm diameter Evergreen tube, this will form the vent roof. Slice off one side so that the tube looks like that seen in the above picture. Slightly narrow the tube by pressing it between your fingers so that it sits comfortably inside the extent of the vent base. The height of the rounded roof should be about 8mm tall. Weld the roof atop the whole headlight...it will look like this:



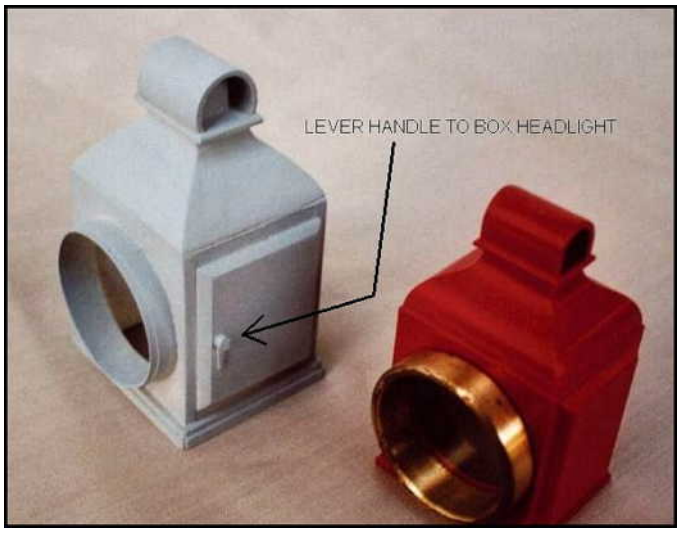
The layers of the crown evident in this unpainted headlight. Note the vent roof fixed into place.

There are options for headlight vent roofs. Many of the prototype lamps had square tops to the roof, other had angular ends. Check the PDF drawing for some of the vent roof styles possible.

For a quick comparison, here is the H-L-W 1:24 scale box headlight next to a similar type, now scratch made in 1:20.3 scale. The 1:24 scale headlight is still very useful in the pre 1880s versions of our loco.



To the side door of the box headlight you might like to add an access handle. This was a 90-degree turn brass lever. Where only one door opened, most of my photos indicate the lamp opening from the fireman's side. Thus I added the lever to that side only. The lever is made from a tiny 4mm long strip of 0.5mm styrene, with a sliver of 1.5mm styrene rod as the pivot. The lever handle on the lamp looks like this:



Step 4 - Painting the Headlight

Right-oh, it's time to paint your headlight, and place it aside for later installation. You will later build the innards of the lamp, including the reflector and installing the light bulb, but that is all later. At this time I hope you've decided what colors your loco will wear.

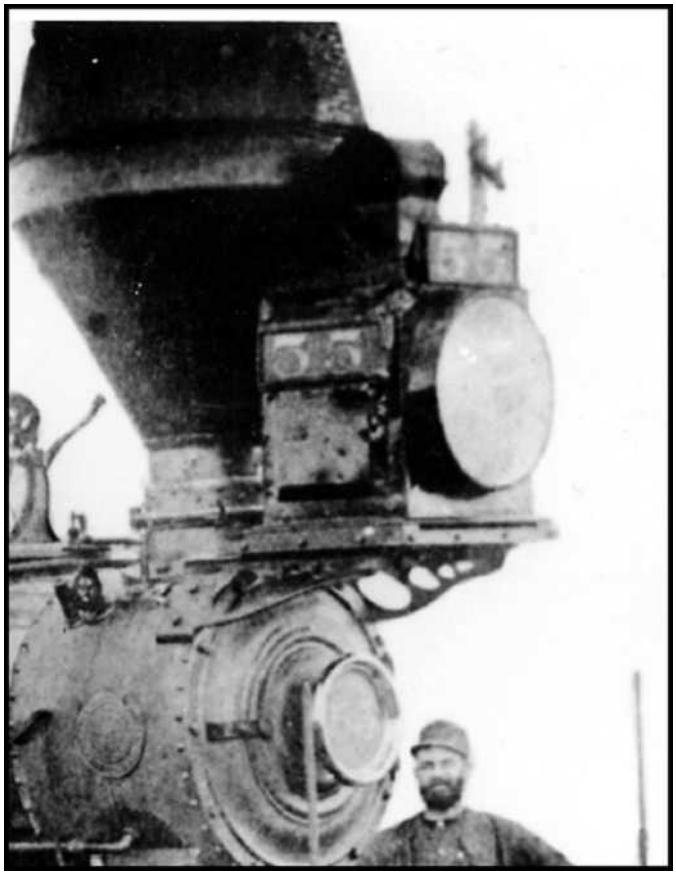
Spray paint the box headlight with a primer first; this helps to provide a good smooth and binding paint coat for your finish color. If the primer coat reveals lines in the layers of the crown, you might consider sanding a little more, or you might like to grease a very thin layer of epoxy over the crown, wipe the epoxy clear of the outer edges, leaving the epoxy in the cracks only. Then do a final sand, and apply the primer again.

I painted the box headlight black to match the generally black look of my 1885 DSP&P Mason #42. I used Tamiya spray cans, 'Semi-gloss black'. I later touched up the door handle with brass paint. The finished box headlight looks like this:

Important Note - I have painted the rim of the lamp brass. Jim Wilke, our color advisor, has since advised that these rims should be painted in a like color to the lamp - black in my case, so I have to paint the rim black again! It shall be done.

Options for Lamp Mounted Number boards

You will notice in the collection of South Park bogie photos that later era, post 1885 locos, had number boards added to the top sides of the box headlight and to the front of the crown. Traditionally these were literally glass plates, painted black with clear numbers within. Rectangular holes were cut into the box sides, and the reflector within the headlight had slots cut in to allow light to shine through the number boards. If you have the desire to have working number boards, go ahead and cut out the holes in the box headlight, about a 1mm size smaller than the number boards to be installed (shown 1:1 scale for the model in the PDF drawing). Then make the number boards from 1mm thick clear plastic sheet. Install a rim of 0.20" x 0.30" rod around the perimeter of the plate; weld the rim onto the face of the board, abutting the edge. You will need decals to install on the boards, with the numbers within to finish off the plate. Some will come with white numbers, some with clear numbers, depending on the decal type, the white numbers are better because they will show up with the lamp turned off, and light will also shine through them when the loco is running.



If you don't need the number boards to be working (as per most LS model locos!), but want the number board style, then repeat the steps above but use plain 1mm styrene sheet to make the boards in lieu of the clear stuff. Weld them to the sides of the box headlight (no cutting into the box required), and then spray paint the boards along with the headlight. At the end of the project you can insert some white decal numbers.

The Headlight Bracket

(Refer PDF pages entitled " Headlight Brackets, types 1, 2, 3, 4, 5 and 6" (6 pages in all))

There are times in this project where you will say...."is this guy nuts...I can't do that" and some of you will find out that I am indeed nuts and this step is too hard, and others will rise up to the challenge. This will occur only occasionally in this project, when making such things as the Valve Gear, bell rig, fancy optional hand rail stanchions and the headlight bracket! Fortunately there are easier options to use, but to make your model as close to accurate as possible, some harder steps are necessary.

The headlight bracket can be broken down into 4 basic style. One of them is a killer, the 2nd one is difficult but doable, the 3rd one is generally easy, and the 4th is piss easy. The 4 types also relate to the changes that occurred over time to the headlight brackets, leading from the original ornate Mason built casting, to the fairly basic replacement unit made by the South Park.

Check your options drawings from Chapter 1 and you will see the general changes from option 1 through to 4. There are two additional styles that you might consider.

The 6 basic styles are as follows:

Type 1 - As built 1878. - This bracket, built at the Mason Machine works, had a decorative cast iron triangular lower portion that bolted directly to the smokebox front. Atop this bracket were 4 ornate stubby columns that supported the headlight platform above. This 1878 type was designed to carry a smaller box headlight, raised up on the stubby columns. Bully Boy, as built, had the exact same type of bracket from 1877. Use this bracket on option 1, some of 2, and 5.

Type 2 - As built, modified, 1878-1880. -This bracket was the original Mason bracket modified to suit the installation of a larger box headlight. Again the ornate cast iron bracket was bolted to the smokebox front, but the 4 stubby columns are removed and the larger headlight platform lowered to sit directly on top of the cast bracket. This lowered the headlight somewhat, but enabled a larger headlight to fit without snagging the large smoke stack! This bracket type should be used on option 2 type locos, along with the unaltered Mason bracket described above.

Type 3 - DSP&P Installed retro-fit #1 - This headlight bracket was installed by the South Park, designed to support the large headlight platform for a large box headlight. The design of the bracket is almost identical to the cast iron types commonly used on Baldwin and Cooke locos in the early 1880s. Perhaps these brackets were provided by either company when the South Park took delivery of their first 2-8-0s from Baldwin and Cooke in 1880-1884. Unlike the Mason bracket, this type of bracket was bolted to the smokebox side, and was restricted to the upper smokebox area. This left most of the smokebox front clear for fitment of marker lights.

Option 3, 'Lake City' uses this bracket. But you will also find examples of option 2, such as Oro City with Nesmith stack, using this bracket as well. This type of bracket seems to have been used on Bully Boy later in life -- use it on Mason Option 6.

Type 4 - DSP&P Installed Retro-fit #2 - This type of bracket was developed for the South Park, and is a style synonymous with the South Park and later the Colorado & Southern. The bracket is bolted to the smokebox sides, and is fairly industrial in its styling. Made from cast iron, these brackets would become standard on all C&S locos in later years. Check a C&S 2-6-0 or 2-8-0, and you will find this bracket. It is also the easiest bracket to model. This bracket is used on Option 4.

Type 5 - The Odd bracket for DSP&P #46. I know not the origins of this bracket. It appears to be unique on the South Park roster. The Original Mason bracket, as described above, has a style consistent with most Mason locomotives dating back to times well before the Mason Bogie. The type of bracket used on #46 appears to be a bash from the later Mason bracket type used on the heavy 2-6-6T locos. You can see in the builder's photo of Breckenridge a very ornate bracket of a style not used on the Light 2-6-6T locos. My Guess is that the bracket of #46 is kit-bashed from one of those later brackets. The lower areas of the bracket has been cut off to make the thing fit on a narrower boiler and to enable fitment of marker lights.

Type 6 - I've also provided the bracket type as used on the Breckenridge and the big 2-8-6Ts. I know you guys like this bracket, but it will not fit on the narrow boilers of our light 2-6-6Ts...Keep to the styles outlined above! Type 6 bracket is for the big 2-8-6T and the heavy 2-6-6Ts.

Making the Headlight Brackets

With all bracket types, take extra care to ensure your bracket is level and installed symmetrically over the smokebox top. Measure from your upper datum line to both bracket sides to ensure they are placed equally about the boiler datum line. You do not want the headlight to be off vertical. Take care. If needed, you can add tiny styrene shims to help level the lamp platform above the brackets.

Making the type 1 and 2 brackets -As Built types

Cut out the two triangular bracket sides from 1mm thick styrene sheet, or brass sheet, Use the PDF template. You then need to bend the brackets to the boiler curvature, and nearer the top of the bracket, bend it to the vertical. The front view on the PDF page shows the end profile of the brackets. Now comes the hard part. These 1mm thick brackets are too weak to support the lamp platform and headlight adequately, nor is there any bearing surface to support the stub columns required to the top of the Type 1 bracket. If building in brass, this won't be a problem, but if building in styrene we need to find a way to support the headlight without placing load on the brackets themselves. We do this by making a fake inner bracket using 1.5mm brass rod.

Bend the two brass rods to the profile shown in the PDF page, insert the brass rods into the smokebox front (allow clearance for the thickness of the boiler tube), Behind the smokebox front, the rods will be bent down hard and flat against the rear of the smokebox front. There you will secure them with some epoxy glue. At this point you have a stable rod bracket that can support the headlight.

For Type 2 Brackets - At this point you can make bracket Type 2 just by cutting out the lamp platform from 2mm styrene and applying it on top of the brass rod bracket (Use a sparing amount of epoxy glue). Next simply apply the Mason styrene bracket parts to the side of the bass rod. Use welder cement to fix the bracket to the smokebox, and use a thin line of epoxy where the bracket runs along the brass rod in the horizontal, under the headlight platform.

For type 1 Brackets - you need to do another step before applying the platform. Using 0.75mm brass wire, bend two lengths of wire into the 'U' shape shown on the PDF for this bracket type. Solder this 'U' profile in a vertical position to the top surface of the 1.5mm brass rod support. Next insert 4 brass or plastic beads onto the 0.75mm wire up-stands. Next cut out the lamp platform from the PDF and drill four 0.75mm holes as shown to match the location of the 4 wire upstands. Insert the platform to the top of the 0.75mm brass wire upstands, such that the platform rests on the 4 beads. You now have the platform resting on the Mason stub columns! Next simply apply the Mason styrene bracket parts to the side of the brass rod, same as for type 2. Use welder cement to fix the bracket to the smokebox, and use a thin line of epoxy where the-

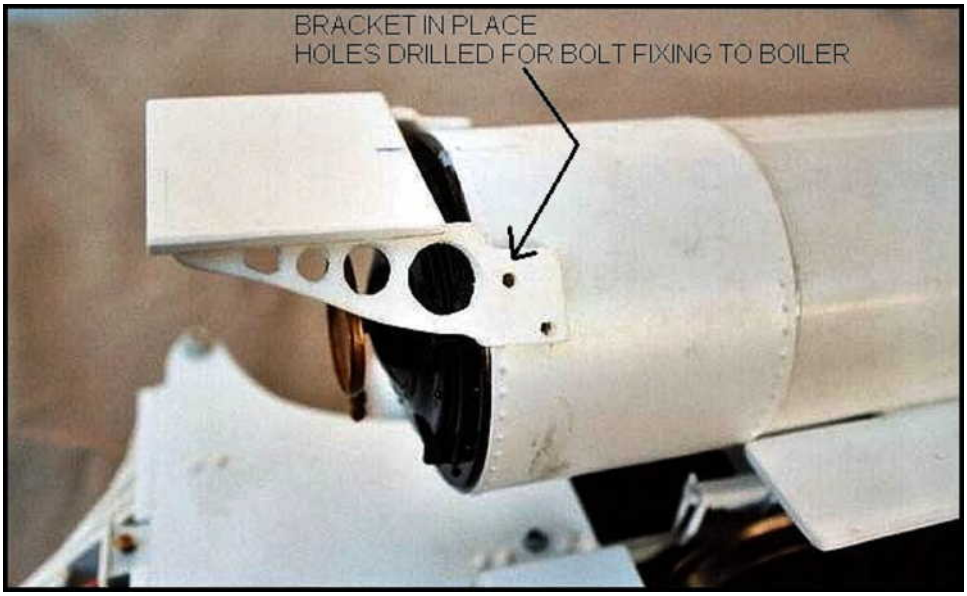
bracket runs along the brass rod in the horizontal. Brass beads might be gizmos that come in a pack like these:

For both brackets type 1 and 2, the brackets were cast iron in reality, so think about painting them black, graphite or green etc to match the color of your locomotive. They were not polished brass.

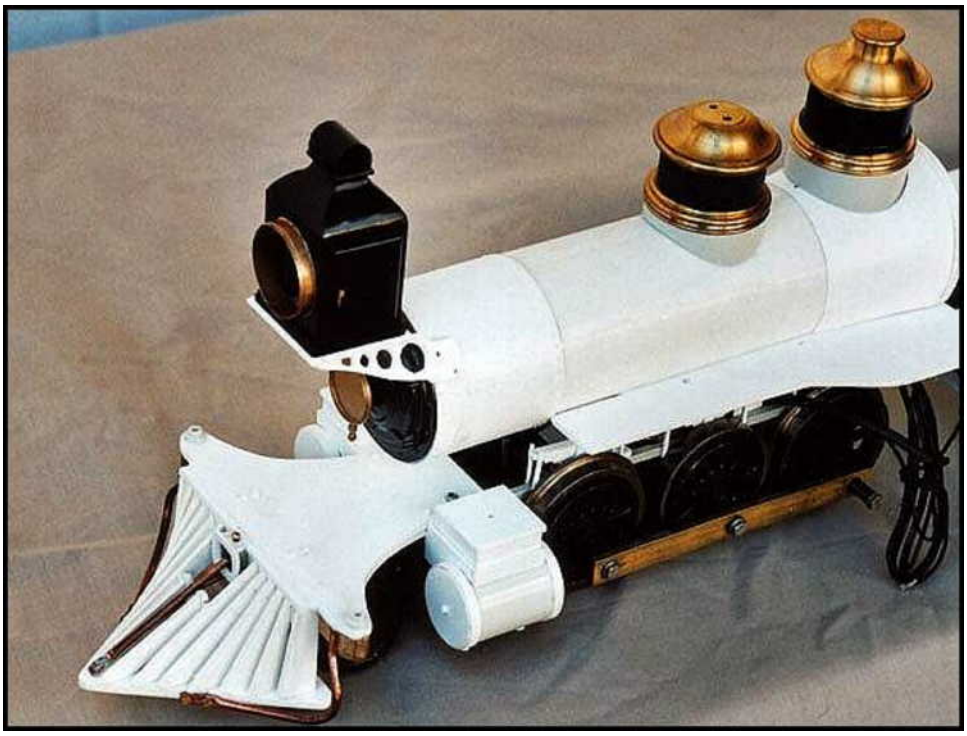
Making the type 3 and 4 brackets - Retro-fit Brackets

For type 3 and 4, things are much easier. You need only trace the bracket PDF profiles onto 2mm styrene sheet. Next drill out the internal holes in the bracket before cutting out the profile itself. Thus for option 4, drill out the four holes, using drills to the correct size and location. After the internal areas are cut out, trim to the outer profile of the bracket, and free the bracket part from the 2mm styrene sheet. Use fine sand paper and metal files to clean up the edges of the brackets. Note the angled top edge of the styrene brackets, sand the top edges to a 45 degree angle such that the lamp platform can sit hard on the angled top edge of the bracket.

Next cut out the lamp platform from 2mm styrene sheet. Now comes the hard part - applying the bracket to the smokebox. I found the easiest way was to weld the bracket arms to the underside of the platform first...the brackets will angle outward as shown on the PDF front profile (Hence the angled top edge to the brackets). When the welder has hardened, rest the completed bracket onto the smokebox, centre it about the boiler upper datum. Use a spot of welder cement under the bracket fixing points, and hold in place. When the welder has hardened, drill out the two fixing holes in each bracket arm, right through into the boiler pipe. Then install 10BA or smaller brass bolts, and tighten. You now have a really strong bracket that was easy to make.



The above view shows the classic DSP&P retro-fit (type 4) bracket welded into place. Brass bolts to be installed in the bracket will fix it in place.



The headlight bracket in place, with the lamp resting above. The headlight fixing and headlight interior will be done in a coming chapter.

Do not glue your headlight in place! You will be providing a screw fixed installation in a future chapter, including the fabrication of the lamp interior and installation of light bulb.

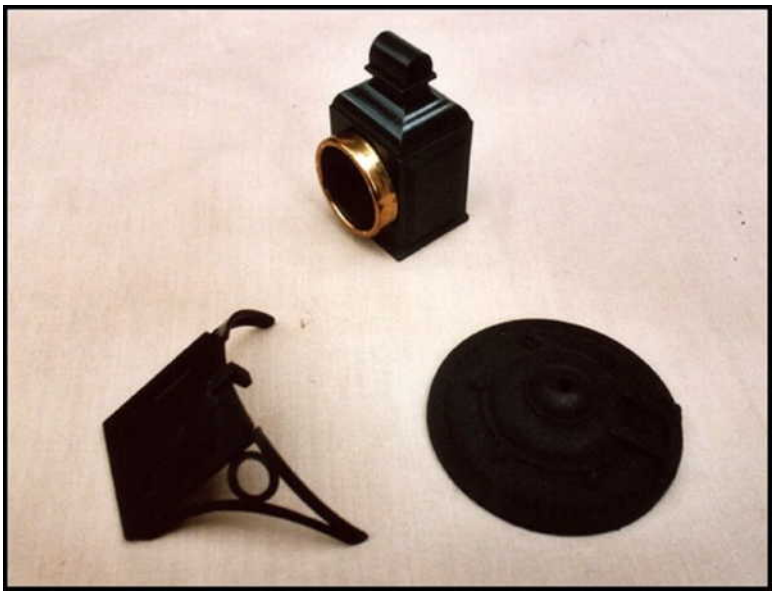
For those using the smaller H-L-W box headlight, you will notice these lamps come with a silver painted lamp insert. You can now install the silver lamp insert directly onto the lamp platform. Drill three holes into the lamp platform; two to match the H-L-W insert fixing points, and a central hole for the lamp wire to run.

The Wimp's Way Bracket

The H-L-W Bracket

Thank God there is a Wimp's way! H-L-W make a very stylish, Mason like bracket. Cost is about $5, and it will simply clip onto your smokebox front at the top, and weld into place around the smokebox edges. The H-L-W headlight will screw into place by inserting the screws into the holes provided. While not styled correctly, it will amply provide the character, robustness and general feel appropriate to this model.

The Wimp's Way H-L-W bracket and lamp kit, which snaps onto the H-L-W smoke box, looks like this:



The Trackside Details Bracket

Trackside details make a brass bracket very similar to bracket type 4. The Trackside unit however is undersized, having been cast for 1:24 scale models. When used with the 2mm thick styrene lamp platform, this bracket can be used to provide a good overall look, without all the fuss out lined above. Part number is as listed in Chapter 1.

The Accucraft headlight and Bracket

Some limited number of you will have been lucky enough to obtain one of these after Chapter 1 was published. The Accucraft headlight and bracket is a 1:20.3 casting developed for their 1880s C-16 2-8-0 models. It is perfect for Option 3, Lake City models, including the Baldwin style type 3 bracket. Use it if you have one, its not really a Wimp's Way, as it is sized and styled perfectly for this model. You also get out of making the big 23" box headlight!

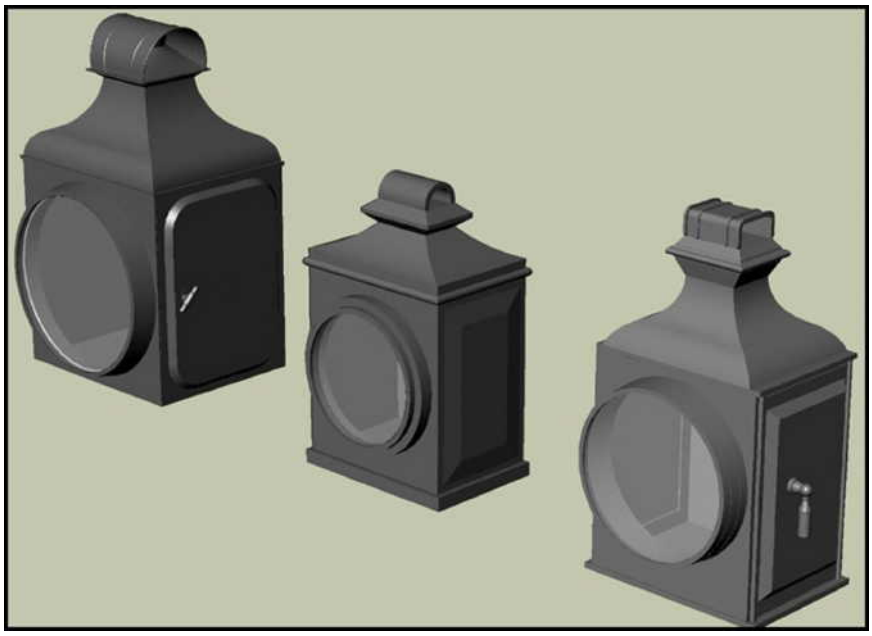
Introducing the New Fall River Productions Box headlights

As mentioned at the start of this chapter, Fall River Productions are at the advanced stages in developing a fabulous 23" style box headlight. This headlight is completely appropriate for the class and when the first become available, I will be installing this lamp onto my Mason. Go to the FRP web site, you will also notice the NPC #12 'Sonoma' headlight being offered. The Sonoma headlight is the same size as the H-L-W box headlight. This is a very stylish headlight, and well worth considering for smaller headlight options (Options 1, 2 and 5).

http://www.fallriverproductions.com/

Here is John's Computer rendered 3D views of the lamps in question. To the far left is the big 23" headlight, required for Options 2 (some), 3, 4 and 6. To the far right is the smaller 'Sonoma' headlight, which is similar sized to the H-L-W headlight. In the middle is the tiny headlight used on the Bachmann 4-4-0 and 2-6-0. Lamps...damn stylish all! Keep an eye out on the MLS MC2002 forum to get updates about these lamps, costs and delivery.

The Fall River Productions 23" box headlight.



The smaller, ornate, Sonoma Headlight.

The Smokebox Saddle

(Please refer to the PDF Pages "Smokebox Saddle")

The next part is uniquely Mason! We make the saddle under the smokebox through which the steam exhaust pipes from the cylinders ran. On traditional locos, the saddle was part of a huge and complex casting incorporating the cylinders, steam chests and saddle all in a two-part casting. On the Mason Bogie, the saddle moves relative to the cylinders due to the articulated chassis. The Mason saddle was a carefully sealed slot that allowed the exhaust steam pipes to run vertically into the base of the smokebox, allowing the smokebox and cylinders to move relative to each other. We do not have to model the actual slot, or steam pipe, because the lateral play of our chassis is much greater than the prototype saddle allowed for, but we still make the visible part of the saddle. For those building their models to run on 2ft radius curves, take note, this saddle will bind with the steam chests. Please follow the 2ft radius alternative for your saddle. This will have the lower portion removed.

For the benefit of the model makers and understanding of the actual Mason design, I have included some views of what the actual saddle looked like, including the smokebox mounted casting, and the steam exhaust pipe casting from the chassis deck. The saddle is complex, awkward and above all, fragile on our model. The prototype system had the steam pipe casting gripped inside the saddle casting. The lateral play in the system was quite minimal. There was almost no vertical play allowed between the smokebox and chassis at all. In the PDF drawing I show the deck mounted steam pipe casting and the saddle separately, then together in a form of x-ray view. To the side of that you can see the two components together in their most lateral position. Our model will pivot a great deal more than that.

The upper 'saddle' part is hollow, with much of the bottom surface open, where the steam pipe penetrates and slides from side to side.

On the model not only will any deck mounted steam pipe sway well outside the boundaries of the saddle, but on irregular track, the saddle will snag the steam pipe, derailing the loco, and worse, wiping out the steam pipe, and opening up the saddle assembly like a tin can...I know, cause I tried it! There will be times when the saddle alone will strike the pilot deck when the loco is in motion. My proposal is this:

For anyone who's building a static model, show model, or is running on 12ft radius curves, build the saddle per the prototype PDF drawings. Best to do it in brass so that the two halves don't tear each other apart when you lift the loco off the rails!

For those who want the saddle looking right, want it strong, and capable of hitting steam chests, and deck alike without it splitting apart, follow along the model saddle templates. This model saddle is basically the top half of the system only, and will not have a steam pipe at all. This leaves the deck area clear for the loco to pivot unobstructed. The saddle is made as a 'solid' in that we do not introduce the large opening in the underside of the unit. We do this to make the bottom edges strong, and self supporting, strong enough to take the knocks from the pilot deck. In the shadows under the saddle it will be difficult to see that a slot does not exist there. We make the saddle 'solid' since we're only making the top half. Without the steam pipe half inserted into the saddle, the 'hollow' type saddle will look empty and wrong. The whole assembly should look dark, and closed.

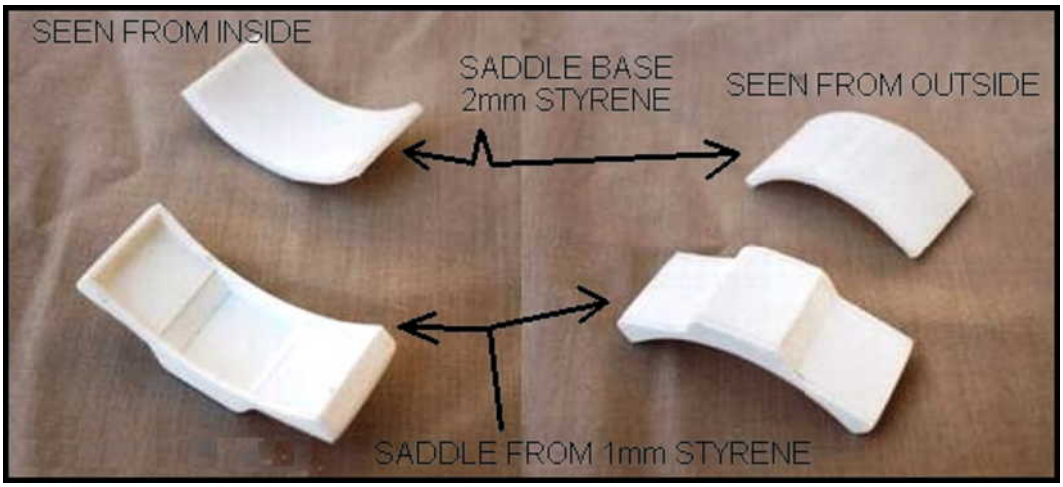
Essentially this design is the same as that used on many brass Mason models over the years. Made to be functional and aesthetically appropriate. But the final version is up to you.

Step 1 - Making the Model Smokebox saddle

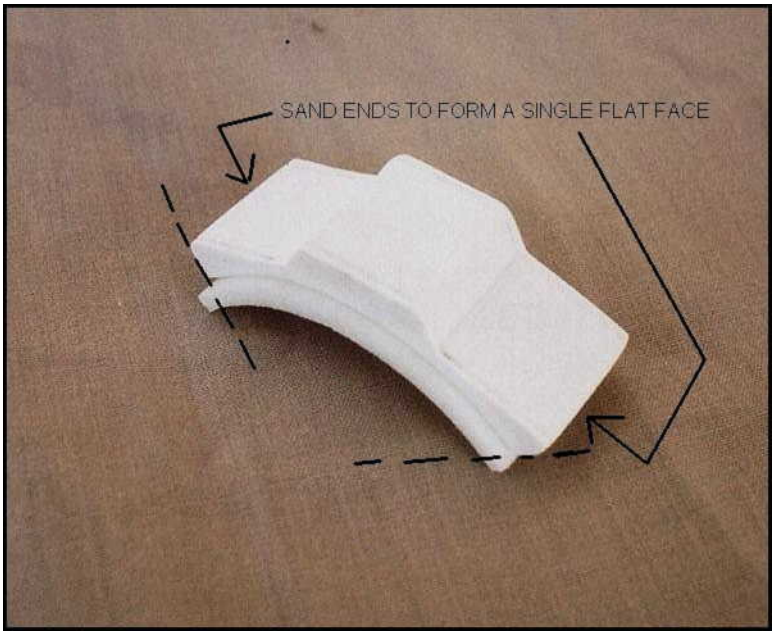
Cut out the front and back profiles of the saddle in 1mm thick styrene, following the PDF drawing. Next insert a series of seven 1mm thick rectangles of styrene between the front and back wall to form the external bottom face of the saddle. Carefully sand the joints between all the parts, as this is to represent a single casting!

Following the PDF, cut out the Saddle base from 2mm thick styrene. Warm up the part in your hands, or even assist the warming by holding it over a stove -- do not over cook it! When its warmed up a bit, curve the saddle base to the exact curvature of the smokebox/boiler diameter.

The saddle and saddle base will look like this, as seen from both sides:

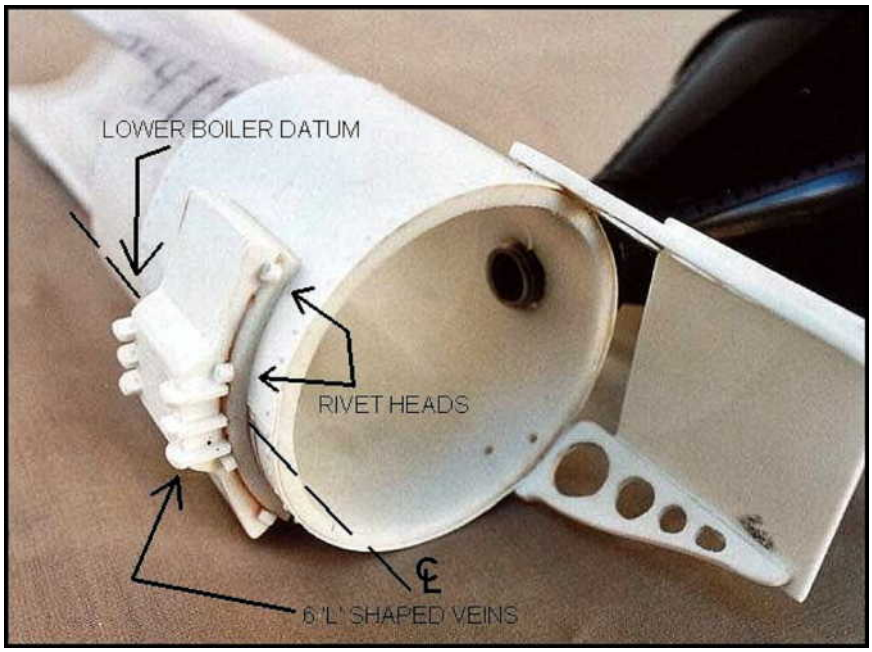


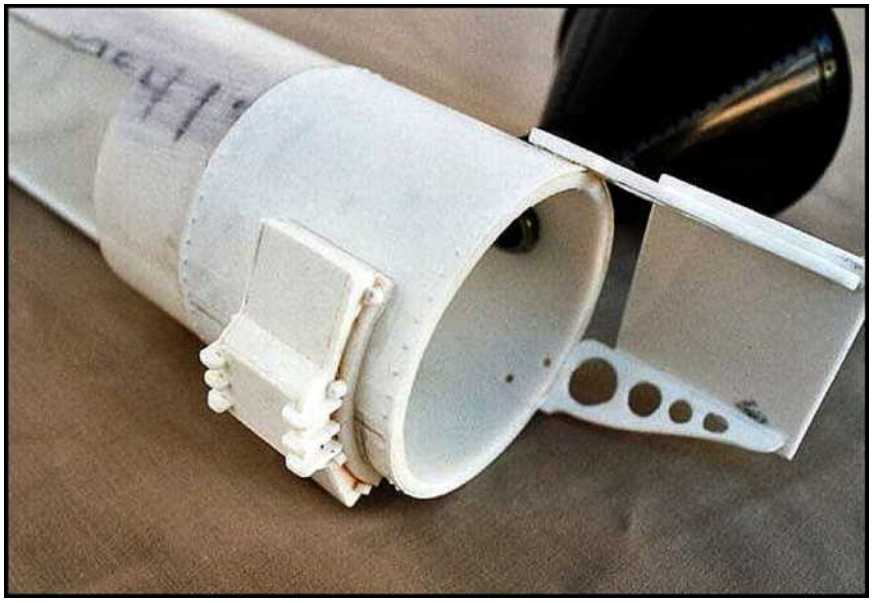
Next weld the saddle onto the saddle base, Make sure the ends of the saddle and saddle base line up perfectly. Sand the ends so that it forms one smooth flat face.



Finally attach the saddle assembly to the bottom of the smokebox, locating the centre of the saddle as shown on the PDF. Make absolutely sure you install the saddle such that it is square over the boiler lower datum line -- you don't want the saddle to be seen to one side of the smokebox! Use 5 minute epoxy to hold the saddle in place.

At this point cut out and weld into place the 6 'L' shaped vanes that run vertically on the front and rear face of the saddle. Using your 1.5mm styrene rivet rod, slice out 8 rivet heads. Weld these 8 rivets to the base plate as shown in the PDF and photo:





Making the Smokestacks

(Refer to the stack of PDF drawings set up for the Smokestack options.)

IMPORTANT!
No matter which stack you use on this model, the stack must be removable. The stack must slide into position on the smokebox, or screw in, etc... it must not be glued into place. This is essential for servicing the headlight in future, not to mention helping with any installation and operation of smoke units.

The following section will not only make a pretty cool stack of various types for your Mason Bogie, but could help you develop a stylish stack for use on your Bachmann 2-6-0s, 4-4-0s etc. At the time you read this section, you will probably not yet have your Bachmann balloon stack. These will be provided with your BBT drive if you requested the Balloon stack. Thus some of you making the Nesmith stack (option 2), or Congdon stack (option 3, 4), or the NPC Bully Boy stack (Option 6), will not be able to do much of this section. I can only ask you to wait. I do not want to waste Barry's time or money sending out individual stacks at this time, then to later send another package with your chassis. I want him to devote that time into producing your chassis. So please bear with us. Many of you will already have one of these Bachmann balloon stacks from a trashed Christmas 4-6-0, or an old plus version D&RG 4-6-0. If you have one, use it!! If you have a Bachmann Balloon stack on a operating model, and really want to do this stack...you might consider 'borrowing' the stack from your 4-6-0 until your new Balloon stack arrives. Do this at your peril! As the stack you might get to replace the stolen black stack might turn out to be a green Christmas stack, and will therefore need repainting!

I can see it already; some of you are going to get carried away with stack making. I see no reason why you might not like to try making interchangeable stacks, such that it is possible to run the loco with Nesmith one day, and Congdon on another day!!

Folks building options 1, and 5 will be using a H-L-W diamond stack, and can proceed at this time. Additionally, since we stated work on this class, H-L-W have released their finest 4-4-0 to date, that of the Disney Lilly Belle. Hartland have developed a brand new stack for the Lilly Belle, with is a classic NPC/SPC coal stack. It is highly detailed and even comes with a cinder cap!! Cost is $10. This stack is not appropriate for use on the Nesmith stack, the cone angle is too steep, but it is more than suitable for the-

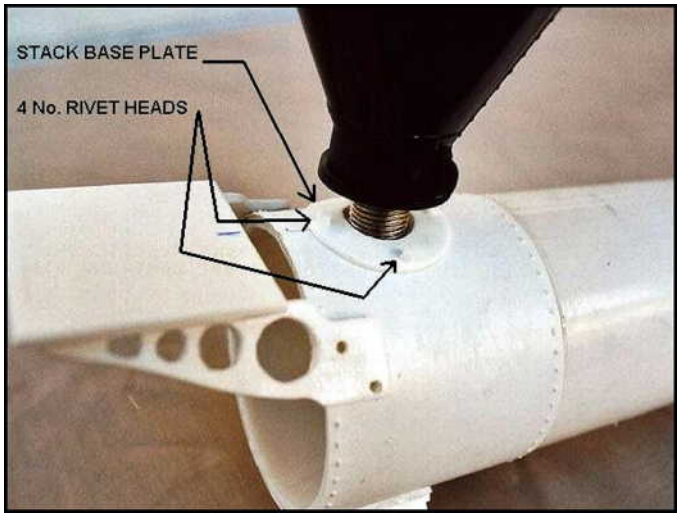
NPC Bully Boy, Option 6 stack, and can be used without alteration. The H-L-W stack can also be used for the Congdon stack, with a tad more work than when using the Bachmann balloon stack. The Bachmann stack and H-L-W stack are almost the same size, but differ in cone angle. The cost is the same at $10. If you wish to try this stack, or even get a sample to try on your Bachmann 2-6-0s and 4-4-0s (they are a perfect addition to those models), then call Phil Jensen on Tues or Thurs and order the Lilly Belle stack. This is the finest stack released onto the market that is readily available.

Smokestack Mounting Plate - needed for all stack types

Check which type of stack you are using, and follow the PDF pages to cut out the circular mounting plate profile. The Bachman stack will use a larger mounting plate than the H-L-W stacks.

Using the PDF profile cut out the smokestack mounting plate from 1mm thick styrene. Bend the plate in your hands to the curvature of the smokebox. Paste the plate onto the smokebox top, using the upper datum line as a guide to locating accurately. Use the PDF stack setout line to locate the centre point of the plate on the smokebox and weld into place. When the plate has hardened, apply 4 rivet heads of 1.5mm styrene rod to the locations shown on the PDF...two along the datum line, and two at the lowest part of the plate. Install the rivet heads just away from the plate edge, not more than 1mm from the edge. At this time there is no hole drilled into the plate centre for the stack. The hole required will vary depending on stack type used.

The stack base plate will look like this: The hole drilled in the centre demonstrates the installation of the threaded H-L-W stacks. We'll drill this hole later in this section.



Making the Stack Bases

All the various stacks are to be detailed at the bottom end in the same basic style. There are two ways to achieve this depending on the brand of stack used. There is the H-L-W stack base and the Bachmann Balloon stack base.

The H-L-W stack base

Step 1 - The Rim

On all the H-L-W stack bases you will notice a plastic rim molded on. This is great because you are already 90% of the way to producing the flanged edge to the stack. Cut a 2mm wide strip of 0.5mm styrene sheet. Using welder cement, wrap the strip around the outside face of the H-L-W rim. Keep winding the strip around, like cotton onto a reel, until you have produced a flange about 2mm deep... the face of the rim is now 2mm proud of the stack's stem. Sand off the exposed end of the strip until it is flush with the rim itself. Cut four 2mm slices of our 2.4mm diameter Plastruct tube. Carefully slice off one side from each 2.4mm cylinder, producing a flat side to each. Weld the 4 cylinders to the side of the rim, install one at each compass point, or at 12, 6, 3 and 9o'clock. Next cut 4 slices of your trusty 1.5mm rivet rod. Weld one rivet to the top of each rim cylinder. You have now produced the bolted flange plates where the lower stem is bolted to the upper stem on the prototype.

Step 2 - The Riveted Wrapper

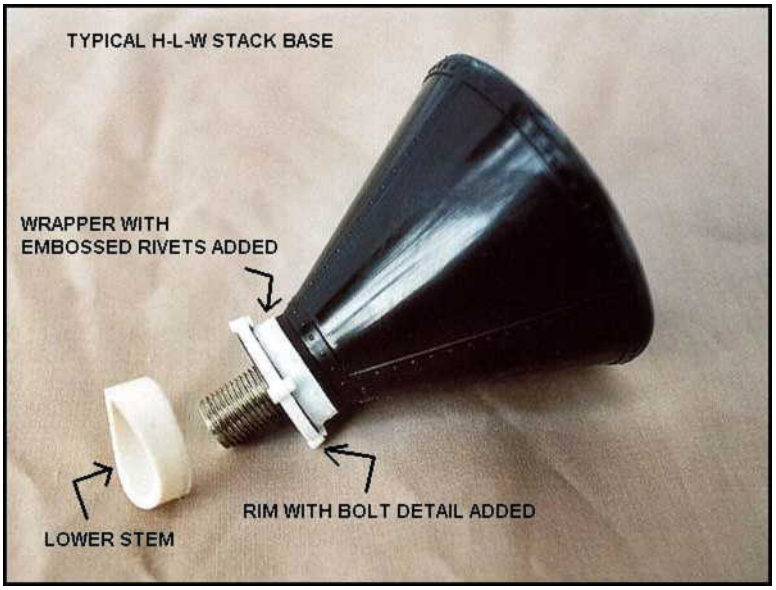
Using the PDF template cut out a strip of 0.5mm thick styrene, and emboss the rivet pattern using a spike type tool. Like making the smokebox wrapper earlier in this chapter, emboss the rivets over a firm surface such as a block of wood. This will give you the cleanest rivets. Wrap the styrene strip around the stack stem, directly above the bolted rim you've just done. When you wrap to a complete circle, trim off the excess strip.

Step 3 - The Lower Stem

Finally obtain a plastic pipe of approx. 19mm diameter or less. This will be used for the lower stem of the stack. Plastruct make such a pipe, but since you only need about a 10mm length, it just isn't worth buying! I would go to the stationery store and investigate the plastic pen and markers for sale - look for a marker with a plastic body casing of pipe size 18-19mm!! That will do nicely.

Now compare your model stack to the one in your 2-6-6T/0-6-6T Options drawings. Compare the height of your stack relative to the height of the stack shown in the drawing. The difference in height will be taken up in the length of pipe to cut for the lower stem of your H-L-W stack. Cut the 18-19mm marker pipe to that length, it will be in the order of 10mm long. Next run the end of the pipe over your spare boiler pipe, wrapped in sand paper, and sand off the bottom of the lower stem to the curvature of the boiler.

Your stack, including rim with bolts, embossed wrapper and lower stem sanded to the boiler curvature will look like this:



Step 4 - Installing the H-L-W stack to the Smokebox

You can now work up the mounting of the H-L-W stack into the smokebox top. Remember the stack must always be removable.

We need to drill out the smokebox top in the dead centre of the base plate already installed. You will ultimately drill out a hole the same size as the threaded base of the H-L-W, and simply screw the stack into place. It is very dangerous to drill out this large hole in one go. You risk shattering the smokebox, and worse, going completely crooked! So we begin small. Start by drilling the very centre of the stack location by drilling a 1.5mm diameter hole. Next drill out that hole with a 3mm drill, then a 5mm drill and so on until you get to the 8mm hole required for the H-L-W stack to screw in. Use a metal file in the hole to sand out the last of the hole for a good tight fit.

Step 5 - Attaching the Lower Stem to the Smokebox

The Slime Method of Gluing:
The Slime method is a technique I use to glue parts together using epoxy type Aryldite glues etc. These types of epoxy glues tend to leave bulging glue lines where the joints are. We don't want to see the glue lines, just a clean joint. The slime method is to basically glue the inside of the objects thus keeping the ugly glue lines out of sight.

It is now time to glue the lower stem of the H-L-W stack part to the smokebox. The stack will then screw down onto this base. Do not apply the epoxy directly to the base of the lower stem pipe, because it will bulge out of the joint line, and make an ugly mess! NO we apply the epoxy to the inside of the pipe, near the base, but not on the bottom edge at all. Then dump the stem base pipe onto the smokebox top, central about the hole drilled...and wait...the epoxy will take about 20 seconds to start sliming! It will ooze down the inside of the stem pipe onto the smokebox top within the stem area. When hardened, you'll have the stem nicely bonded to the smokebox, and a nice glue-free joint line as seen from outside...the slime method of gluing!

The Bachmann Stack Base

The alteration of the Bachmann stack base is almost identical to the H-L-W base described above, only the lower stem is already part of the stack, and there is no screw thread to use in attaching the stack to the smokebox.

Step 1 - The Rim

Midway up the stem of the Bachmann stack you need to install a rim. Cut a 2mm wide strip of 0.5mm styrene sheet. using welder cement, wrap the strip around the stem. Keep winding the strip around, like cotton onto a reel, until you have produced a flange about 2mm deep...or the face of the rim is now 2mm proud of the stack's stem. Sand off the exposed end of the strip until it is flush with the rim itself. Cut four 2mm slices off our 2.4mm diameter Plastruct tube. Carefully slice off one side from each 2.4mm cylinder, producing a flat side to each. Weld the 4 cylinders to the side of the rim, install one at each compass point, or at 12, 6, 3 and 9o'clock. Next cut 4 slices of your trusty 1.5mm rivet rod. Weld one rivet to the top of each rim cylinder. You have now produced the bolted flange plates where the lower stem is bolted to the upper stem on the prototype.

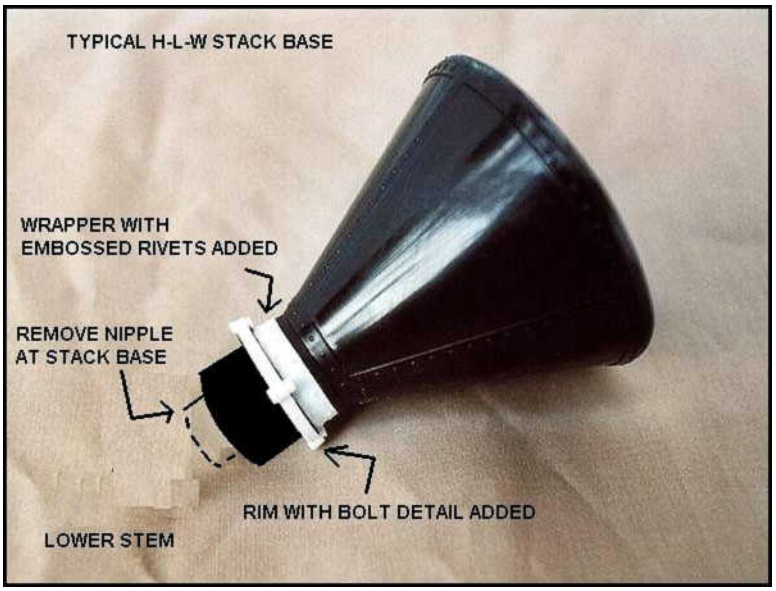
Step 2 - The Riveted Wrapper

Using the PDF template, cut out a strip of 0.5mm thick styrene, and emboss the rivet pattern using a spike type tool. Again, like making the smokebox wrapper, emboss the rivets over a firm surface such as a block of wood. This will give you the cleanest rivets. Wrap the styrene strip around the stack stem, directly above the bolted rim you've just done. When you wrap to a complete circle, trim off the excess strip.

Step 3 - The Lower Stem

Remove the nipple at the base of the stack. Next run the end of the pipe over your spare boiler pipe, wrapped in sand paper, and sand off the bottom of the lower stem to the curvature of the boiler. When sanding the lower stack stem on the spare boiler piece wrapped in sandpaper, it's really important to check for square while sanding, so the stack doesn't sit crooked. While you're sanding go slow, and look at the stack from the side and from the end of the pipe to make sure it's standing straight in all directions.

Your stack, including rim with bolts, embossed wrapper and lower stem sanded to the boiler curvature will look like this: (This is a doctored photo to indicate the concept only!!)



Step 4 - installing the Bachmann Balloon stack to the Smokebox

You can now work up the mounting of the Bachmann stack into the smokebox top. Remember the stack must always be removable.

Go out into the world and look for a plastic or metal pipe that fits snug into the inside of your fully sanded stack stem. Plastruct make such a pipe, but since you only need about 20mm length of it, it just isn't worth buying it! I would go to the stationery store and investigate the plastic pen and markers for sale -- look for a marker with a plastic body casing of pipe size equal to the inside diameter of you stack stem (approx. 10mm). That will do nicely.

Insert the marker pen pipe into the bottom of the Bachmann stack, leaving about 10mm exposed at the bottom. Weld the pipe into place using the welder cement. When hardened, apply some epoxy glue into the inside of the stack around the pipe sticking up from the base...this will make a strong base to the stack.

We need to drill out the smokebox top in the dead centre of the base plate already installed. You will ultimately drill out a hole the same size as the 10mm marker pen pipe size, that is now the new nipple on the base of the stack. It is very dangerous to simply drill out this large hole in one go. You risk shattering the smokebox, and worse, going completely crooked! So we begin small. Start by drilling the very centre of the stack location by drilling a 1.5mm diameter hole. Next drill out that hole with a 3mm drill, then a 5mm drill and so on until you get to the 10mm hole required for the Bachmann stack to slide in. Use a metal file in the hole to sand out the last of the hole for a good tight fit. You can now simply insert the stack by sliding it into the hole. Do not glue it, the stack must remain removable.

It is now time to detail the upper portion of the stack to suit the type used on your loco option.

Painting your Smokebox - All Stacks

It is now time to paint your smokebox. You can paint it black per builder's photos, or dark graphite grey, or silver etc. The color used on my smokebox was Tamiya Metallic gray MS-5. This is a high gloss dark metallic graphite color. I sprayed the smokebox, headlight bracket and lamp platform all in one go. I then matted it off with a coat of Testor's Dull Coat, 1260. Do not paint the removable part of the stack yet. You need to detail the upper portion, which we shall do now!!

Detailing the upper stack

Chaps, it’s now time to make up the upper portions of all your stack options. The best description is to follow the PDF paper devoted to your specific stack and follow the details there. In summary the changes to the H-L-W and Bachmann stacks are as follows:

General Notes About Rivet Details to the Cones

There are a number of ways to add the rivet lines to the conical sides of your stack. The Lilly Belle Stack is already riveted! But the others are very plain. The conical sections were usually made from between 4-6 segments, The segments, where joined, had a line of rivets. Most of the smaller diamond type stacks such as option 1 and 5 should have about 4 segments.

The Nesmith and Congdon comes appear to have either 5 or 6 segments to the lower cone, and perhaps 4 segments to the upper cones...which is why those cone joints appear out of sync!

Rivet Method 1

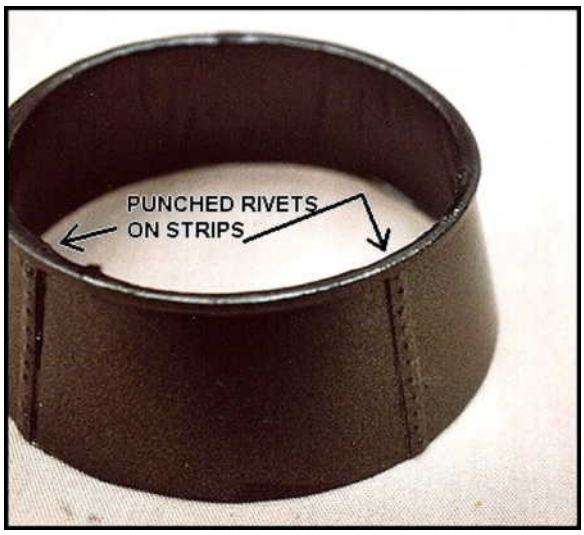
Slice a whole bunch of those tiny rivet cubes from your 0.20x0.30 rivet rod. Draw pencil lines on your upper and lower cones to work out the best rivet line locations. Then weld the rivets to the stack one at a time, at about 3mm centers.

Rivet Method 2

Use HO rail spikes, and drill a line of holes into your stack, insert the tiny pins into the line of holes. (I don't much like this approach!)

Rivet Method 3

Cut a 2mm wide strip of 0.5mm styrene, and emboss a line of rivets at 3mm centers down the centre of the strip. Then weld the strip to the cone sides...the H-L-W Lilly Belle stack is virtually made this way. Rivet strips will look like this:



A Question of Rivets

I'll leave these rivet options to you. However, after looking hard at the photos. I can see the joint lines in the Nesmith and Congdon quite well, but the rivets are barely visible. In keeping with the clean lines of our Mason, it appears that the stacks were NOT a festival of rivets. I know you guys love rivets, but this might be the time to back off on stack rivets...and I bring you recommended Rivet Method 4...

Rivet Method 4 - (Recommended for this Project)

Run pencil lines along the cone sides to work out the spacing of the segment joints, then using your knife, score a firm line into the stack sides, following the pencil lines. That’s it. Do not add any domed rivets of any kind. When the light strikes the stack, you'll see the joint lines, and the appearance is much like that seen in the photos.

Cinder Caps

At the bottom of the Nesmith stack and NPC stack only is a small cinder hatch. This is a tubular outlet with a circular cap on it. You make these using Plastruct 4.8mm tubing, capped at one end with a 1mm styrene circular patch. Apply a handle to the cap using your 0.20x0.30 rivet rod. Sand the bottom end of the 4.8mm tube to a curvature to match the circular face of the stack. Weld the cinder cap into place.

Option 1 - As Built Mason stack - small diamond type

This stack uses a H-L-W 4-4-0 diamond stack. There is nothing to do to this stack except remove some of the upper cone, to the size shown in the PDF. You can do this by cutting away at it with a knife, or by slowly sanding it down. When you get the upper cone down to the right level, use sandpaper and metal files to sand the horizontal top edge into a more vertical face. There you weld a band of 0.5mm styrene strip to create the lip at the top of the stack. Around the very top of the lip, use a length of your 0.20x0.30 rivet rod and wrap a strip around the outer face of the very top of the lip. Detail the lower and upper cone rivets to the method preferred by you, and spray paint the stack to match your smokebox color.

Option 2 - Nesmith Stack

The Nesmith is almost a dead ringer for the Bachmann Balloon stack. All one has to do is lower the height of the upper cone. An obvious Wimp's way is to simply use the stack as is, no cutting required. When applied to the Mason, it will actually look like a Nesmith!

To do it properly however, we must remove a portion of the top of the stack. Begin by removing the top cone, it just slides out. Carefully remove the screen and screen mounting from within this top cone. Use a screwdriver or knife to pry this mounting off.

Now cut away some of the upper cone, to the level shown in the PDF. You can do this buy cutting away at it with a knife, or by slowly sanding it down. When you get the upper cone down to the right level, use sandpaper and metal files to sand the horizontal top edge into a more vertical face. There you weld a band of 0.5mm styrene strip to create the lip at the top of the stack. Around the very top of the lip, use a length of your 0.20x0.30 rivet rod and wrap a strip around the outer face of the very top of the lip.

Now it’s time to make the coal baffle within the stack. There is no meshed screen required in the Nesmith -- they just didn't use a screen. The baffle is to be a disk with angled sides, to the diameter shown in the PDF. You can either make this up out of layers of 2mm styrene and sand the angled sides to a smooth finish or go out into the world and find something that looks about right and is the right size. Go to the hardware store, check the supermarkets! Here in Auz I found two possible candidates for this baffle. One is a plastic plug that is used to plug into power outlets in the home. These are used to stop kids sticking things into power outlets. The other source I found was the conical measuring cup used to measure medicine doses, and also for measuring hardeners etc when mixing epoxy out of a tin. Some baffle candidates might be these: The PVC pipe at the back is for something else -- cant remember what, but I'm sure I'll figure it out later...

You are to install this baffle in the upper cone of the stack, such that the top of the baffle is actually proud of the stack top. It will be exposed out the top by about 4mm. Hold the baffle in place by resting it on top of two 1.5mm brass rods that rest on the stack mid band as shown. Notch the baffle on two sides where the upper of the two rods pass.

Detail the lower and upper cone rivets to the method preferred by you, and spray paint the stack to match your smokebox colour.

Option 3 - Congdon Stack

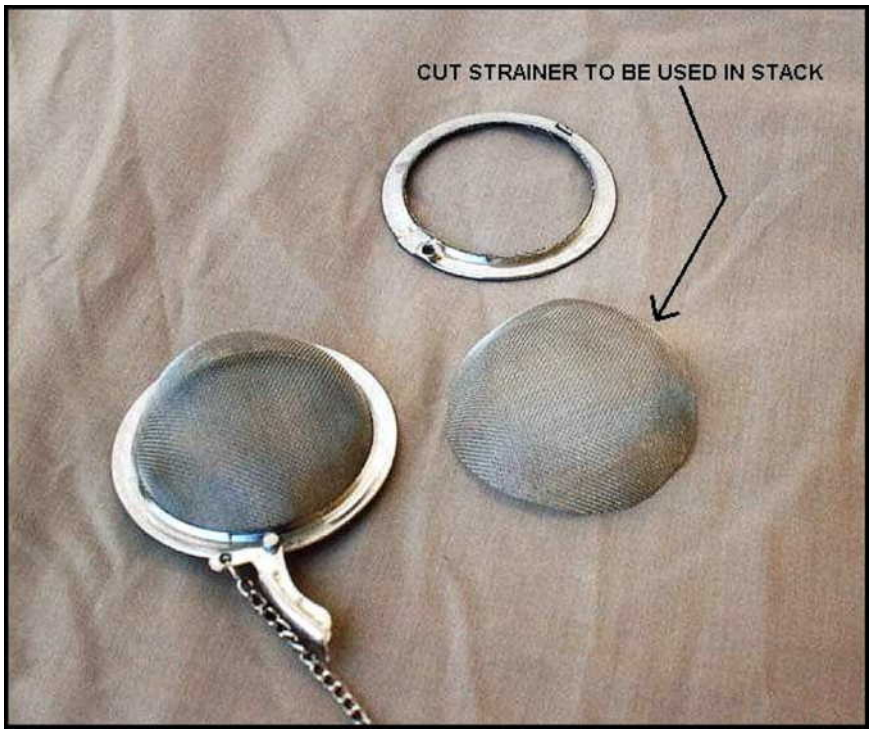
We use the Bachmann or H-L-W balloon stacks for this stack. The Bachmann stack will provide the best results in terms of size, however I must emphasize that in investigating the Congdon stack, no two of these stacks were quite the same in the DSP&P photos! There is a bit of latitude.

The Bachmann stack surprisingly matches the patent Congdon dimensions almost perfectly. The lower cone taper is within a couple of mm; the width at the top is a spot on match as is the height. The only area which does not match perfectly is the diameter of the stem. The stem of the Bachmann stack is 21.5mm. The actual Congdon at 1:20.3 scale should have a stem of 19.5mm..Big deal many of you will say, and rightly so, considering the number of variations seen in this stack type. I bring this to your attention. You can use the Bachmann stack with little worry, but for those that want perfection, think about cutting the Bachmann stem off, about 2mm below the lower cone, and inserting the cone onto a 19.5mm pipe. Then sand the bottom of the cone to continue the cone taper to the new stem size. A bit of messing around, but do-able. You will note on my demo Congdon stack, I did this alteration to see if it could be done. My stem will be narrower than the standard Bachmann stem...OK to the stack....

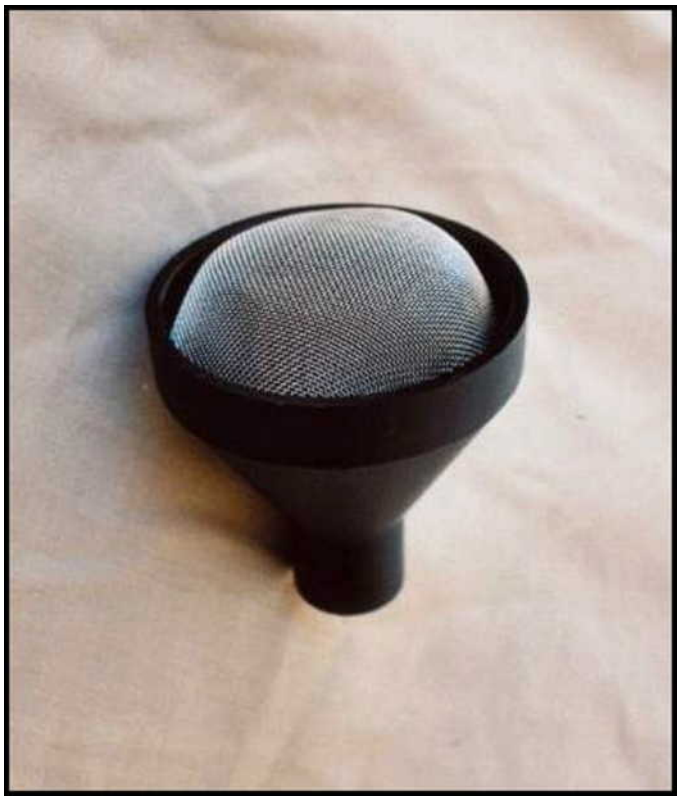
Begin by removing the top cone from the Bachmann stack and throw it into the junk box.

We now need to add the famous, unseen domed coal screen inside the stack. Go out into the world and look for a tea strainer used in the making of a nice hot cup of tea. These are stainless steel. Some come with handles, others simply as a meshed ball, which splits into two halves. Our UK brothers will have no problem finding these, as they invented it! I got a tea strainer in the form of a meshed ball for $3.50. The two halves gave me two goes at getting the screen right!

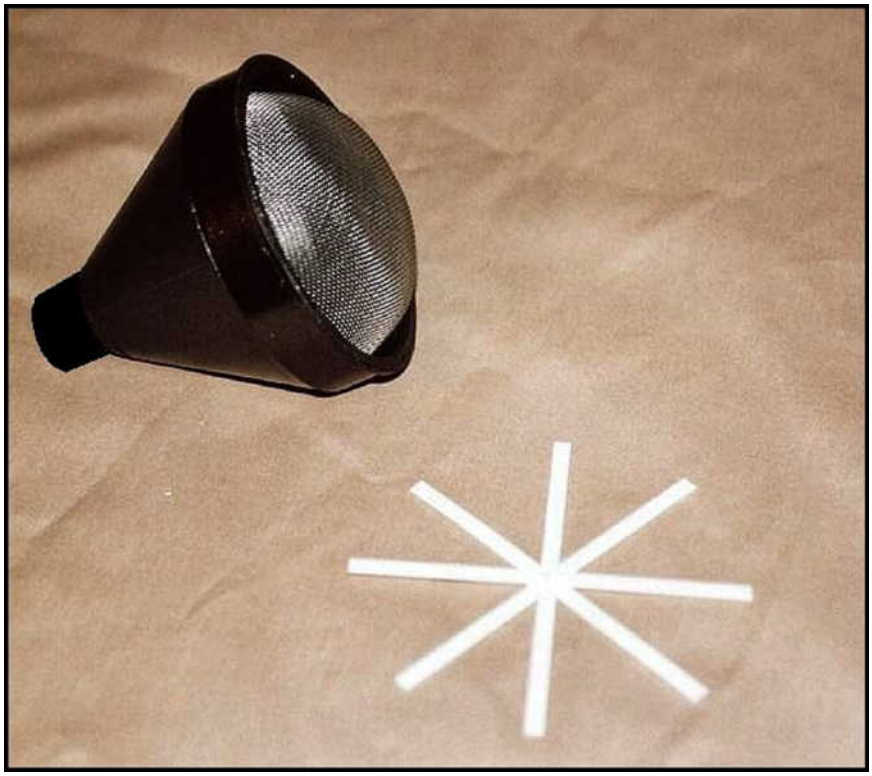
When you have your strainer, cut the rim off the meshed part using scissors (not your wife's good ones OK - take it from me, not a good idea). Your strainer will look like this:



Next insert the strainer into the top of your stack. I glued the thing into place using daubs of epoxy glue, applied from the inside.



Using your 0.5mm styrene sheet, cut four lengths at 3mm wide, per the PDF. Weld the three strips together to form a 'star'...make sure the weld is exactly in the centre point of each strip. Weld them on top of each other... thus:



At this time run a rim of 0.20x030 styrene rod around the very upper perimeter of the stack's middle (vertical) band. Weld into place.

Now insert the 'star' strips assembly into the stack top. Bend the ends down into the gap where the strainer meets stack sides. The 'star' will want to pop right out. Stick a pin though the middle of the 'star', and run it into the mesh at the very centre of the stack...this will hold it down. From below the mesh, apply a tab of sticky tape to the pin to keep the pin form lifting out, and apply a blob of 5min epoxy to the pin where it meets the underside of the mesh. When hardened, remove the tape from the pin. Your stack should look like this:

Making the Congdon Upper Cone

This part is damned difficult...it took me several goes to get this right.

There are two ways to do this:

The PDF Profile:
Cut out the taper profile from the Congdon PDF template. Cut the pattern out in 0.5mm styrene sheet and weld the cone together at the overlap. This will guarantee a good cone, to match the patent drawing. The down side is the visible overlap. Yes you can hide it with a rivet line, but think about what I said about the visibility of the rivets on these Mason Bogie stacks.

The Bottle Hunt:
This involves finding the correct shape cone from the world of plastic junk! You are to look for a conical plastic object - perhaps a plastic BBQ cup, a Coke cup with the Simpson's on the side, perhaps a plastic ketchup bottle, a shampoo bottom, a gardening sprinkler head... dunno. A conical plastic object. The difficult part is getting one with the correct taper. All of my early attempts had me cut a cone to the right size, install it... only to find the top was just too steep...too close to vertical. It plays tricks with the eyes. So I'm going to make it easy for you - we're going to make a cardboard jig first, with which you'll go out into the world and find the plastic cone with the right taper.

On the Congdon PDF drawing you'll see two circles drawn. One circle represents to the diameter of the upper end of the cone. The wider circle is the outer diameter of the lower end of the cone. Paste these two circle templates onto cardboard, and trim the edges as shown, be precise, cut exactly on the lines. Then cut out the two circles leaving a hole in the centre of the two cards. Fold the sides of the square cards into the vertical line, forming two boxes. Insert the slightly smaller box into the larger one. You now have a nice box with circular holes in the top and bottom. OK off to the shops you will go. Find those conical bits of Tupperware. When you find one, insert it into your box, though the two holes. If the plastic cone runs into the smaller hole fine and comes to a stop, but the edges of the bigger hole is wider than the plastic cone, then the cone you have is too steep .You need to find something with more of a taper on it. If the plastic cone fits snug against both hole sizes, you have a match! Take the cone home and trace a line onto the cone side using the top and bottom of the cardboard box as a guide. Then cut the cone section free of the rest of the plastic conical thing. You have your upper cone for the Congdon.

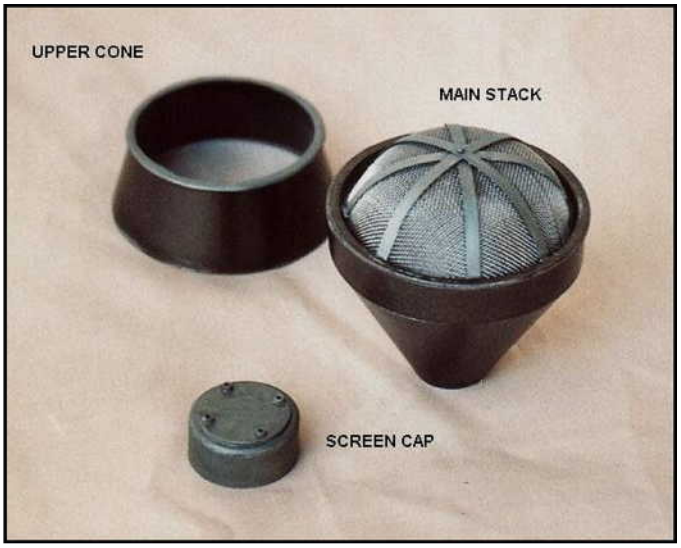
The Upper Cone Rim

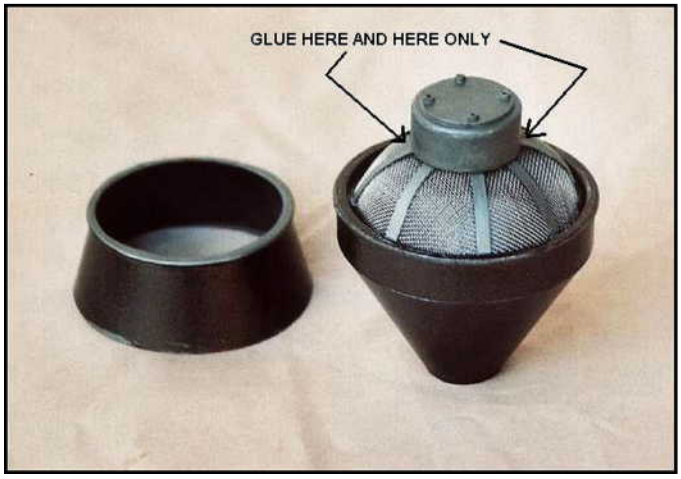
When you have you upper cone sorted out. Its time to run a rim around the very top of it. You can use your 0.20x0.30 rivet rod as a nice rimming strip, or you can pre-bend some 0.75mm brass rod into a circle that matches the upper end diameter of the cone. Then dump the brass ring onto the top and secure it by greasing some epoxy over it. No dribbles or runs, smooth it out. When hardened, give it a sand over the very top, and smooth it all out.

Making the Screen Cap

The last part of the Congdon to be made is the upper, visible end of the screen cap. Find a 26mm diameter plastic tube. Electrical conduit might be right, or yet another plastic-bodied marking pen. Rest a length of the pipe atop your screen within the stack. Rest the new upper cone atop the whole stack assembly. Measure out the line of the top of the upper cone on the side of the 26mm tube. You want to cut this tube at a line about 2mm taller than the stack top. When cut, apply a circular capping in 1mm styrene to the top 26mm tube. Round off the cap edges by sanding. Finally weld a 2nd, smaller, 1mm styrene circular capping to the top and apply four brass 10BA nuts as shown. Fill the holes in the nuts with a daub of epoxy.

Your stack parts should look like this:





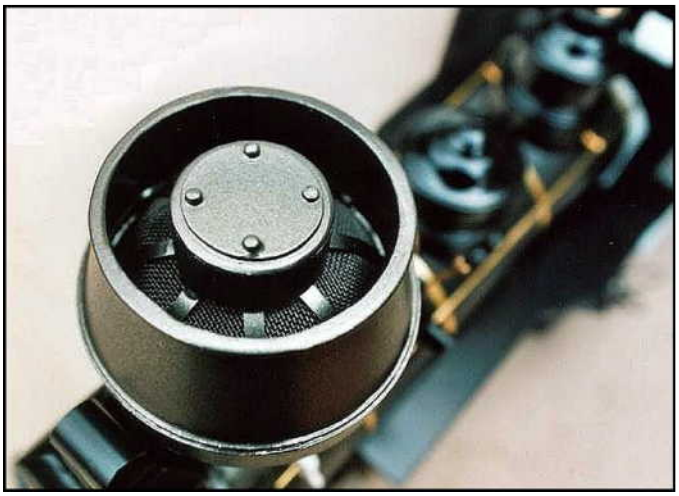
Using two daubs of epoxy glue, glue the screen cap to the 'star' directly over the centre top. Apply only two daubs of glue to where the cap actually touches the 'Star' strips. In the glued position the cap will look like this:

The Slime Method of Gluing

The Slime method is a technique I use to glue parts together using epoxy type Aryldite glues etc. These types of epoxy glues tend to leave bulging glue lines where the joints are. We don't want to see the glue lines, just a clean joint. The slime method is to basically glue the inside of the objects thus keeping the ugly glue lines out of sight.

It is now time to glue the Congdon upper cone to the main stack body, and we want to do it as cleanly as possible - no bulbous glue lines. Do not apply the epoxy directly to the base of the upper cone, because it will bulge out of the joint line, and make an ugly mess! NO, we apply the epoxy to the inside of the cone, near the base, but not on the bottom edge at all. Then dump the cone onto the stack body, centrally located... and wait... the epoxy will take about 20 seconds to start sliming! It will ooze down the inside of the cone onto the stack top within. When hardened, you'll have the cone nicely bonded to the rest of the stack, and a nice glue-free joint line as seen from outside...the slime method of gluing! If the glue does start to slime out through the joint, wipe it off.

The stack top fully installed will look like this:



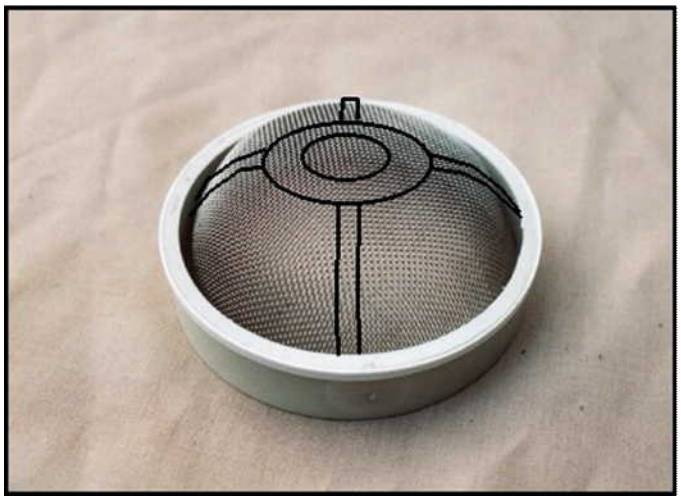
Finally detail the lower and upper cone rivets to the method preferred by you, and spray paint the stack to match your smokebox color. The finished Congdon smokestack as seen from above, with the nuts filled in with epoxy, looks like this:

Option 5 - As Built Mason stack - Bully Boy 0-6-6T

This stack uses a H-L-W 4-4-0 diamond stack. Remove the entire upper cone of the stack, and trim off the rim between the two cones. Next go out into the world and find a small PVC pipe of approx. 43mm diameter. Cut a 10mm length of the pipe, this will form the upper cylindrical section of the stack.

You are now in need of a tea strainer similar to the guys building the Congdon stack above, only you'll be looking for a smaller type. Cut the screen out of the tea strainer frame and insert it into the PVC pipe section. Glue the screen into place using daubs of epoxy from the inside.

The top of the stack should look like this:



Follow the NPC Option 5 stack template and cut out the 'star' shaped component in 0.5mm styrene. Cut out the 'cap' circle of styrene in the PDF template in 1mm styrene and weld this to the centre top of the star. Next insert the star over the screen, bending the points of the star into the gaps between the screen and cylinder wall. In concept, it will work like this: (the central top will be solid, not meshed!).

Stick a pin though the middle of the 'star', and run it into the mesh at the very centre of the stack...this will hold it down. From below the mesh, apply a tab of sticky tape to the pin to keep the pin form lifting out, and apply a blob of 5min epoxy to the pin where it meets the underside of the mesh. When hardened, remove the tape from the pin.

Finally apply the cylindrical stack top to the top of the H-L-W cone, using 5 min epoxy. Use the 'slime' method to glue it on without any glue oozing out of the joint.

Detail the lower and upper cone rivets to the method preferred by you, and spray paint the stack to match your smokebox color.

Option 6 - NPC Balloon stack

This stack uses either the H-L-W Lilly Belle 4-4-0 stack or the Bachmann Balloon stack.

If using the H-L-W stack, guess what -- you have nothing to do!! Go and use it as is.

If you're using the Bachmann stack, you have to simply add a rim around the very top of the upper cone. There you weld a band of 0.5mm styrene to create the lip at the top of the stack. Around the very top of the lip use a length of your 0.20x0.30 rivet rod and wrap a strip around the outer face of the very top of the lip. Detail the lower and upper cone rivets to the method preferred by you, and spray paint the stack to match your smokebox color.

The Russia Iron Boiler Jacket

First a few words about the Russia Iron boiler jackets used on classic American locomotives. Real Russia Iron was a form of treated metal. It was not painted. At this point I direct you to read the Russia Iron Treatise by Jerry Kitts, which will give you an excellent understanding of what Russia Iron is. Please refer to these two links:

http://www.railwayeng.com/dspp/russiron.htm
http://www.railwayeng.com/dspp/colrnote.htm

Chaps there are two basic ways to finish your boiler. This is the time to do it, before the domes get attached. The two ways are:

1. Painting your boiler.
2. Cladding your boiler in a treated metal jacket.

The Painted Boiler

At this time you must decide whether you will glue styrene boiler bands onto your boiler, then paint them, or apply real brass boiler bands after the boiler is painted.

Styrene boiler bands

Using your 0.5mm styrene sheet cut 4 lengths of 3mm wide strips. These will become your boiler bands. Take your boiler, and following the boiler setout PDF drawing, draw 4 pencil lines where the boiler bands will run. Check that the pencil lines are perpendicular to the upper and lower data lines; use the masking tape method to acquire a straight line around the boiler. Next take your 3mm wide styrene bands, apply super-glue sparingly to the rear face, and carefully wrap them around the boiler following your pencil lines. Your boiler is now ready for painting.

Paint the boiler to the methods outlined below. Spray paint over the boiler bands. You can later repaint the bands in brass/gold paint, using a small paintbrush, or simply leave the bands in the Russia Iron color. It was common for Russia Iron boiler bands to be used in lieu of brass in the 1870s and 1880s.

It was quite common in the 1870s for the boiler bands to be made from Russia Iron material, matching the boiler jacket. It also happens to be damn stylish!

or

...Paint the boiler bands a brass color! The color scheme of this loco is also demonstrates my attempt at doing a 'Lake' color scheme to a 1870s Baldwin 2-6-0. Lake is a very dark brown. The boilers in both of these models were painted using automotive spray cans.

Painting the Boiler

The Automotive Metallic Spray Cans - The Fletch Method

These are the car spray cans used to touch up damage on your cars, available as all auto stores, Wal-Mart etc. My advice in selecting these spray cans is to think dark and think metallic gray. Amidst the many metallic colors you will find, it will be difficult to keep your mind focused on the preferred color -- think dark and grey!

These paint very well, without primers. Just make sure you have no grease on your boiler. Mask of the smokebox area, already painted up in the last section. A good masking tape is actually one made by Tamiya for this very purpose. I like it because the tape does not have a strong bond, and it will not tear the paint off, when removing the tape!

Testor's Buffable Paints - the Jim Wilke Method

Russia iron is incredibly easy - no mixing complicated paints, no muss, no fuss. I found a solution which is 100% accurate to actual samples of Russia iron I've seen. I've used it myself, I love it and here it is:

Testor's "Gunmetal" Metallizer buffable paint. It's marketed to aircraft modelers who need polished metal surfaces on their plastic kits. You airbrush it (or use the spray can version) and buff when dry to a genuine metallic finish. Then use Testor's Non Buffing Metallizer Sealer to prevent tarnishing. That's it.

Three steps - paint, buff, seal. Period.

I've seen TONS of genuine Russia iron.
This is the best.

Jim

The Humbrol Paints - The Peter Bunce Method

For those members who cannot buy the Testor's paint (it is not available in the UK), could I suggest the 'Metalcote' paint from Humbrol - they have a 'Metallic Grey' color (ref 27004), which is a 14mm tinlet at £1 (UK) each.

It is very thin, dries in 30 minutes and covers well (on white it could do with a couple of coats, and the surface needs to be smooth), looks very dull black in colour till polished with a smooth cloth -- then a transformation takes place: it takes on a satiny sheen, and turns dark grey (and lives up to its name!), the beat way of describing could be like a 'B' grade drawing pencil. I used a brush (as a trial of it), but a 'sprayed on version' would be best I think.

Yours Peter Bunce

Painting a Wrapper or Jacket - The Vance Bass Method

I needed a temporary boiler jacket on my Accucraft Ruby to run before I had time to make a proper blackened brass wrapper. I knocked one out of tinplate and painted it with a black metallic paint I got at Wal-Mart, sold under the brand "House Beautiful Decorator Metallics". It is a little too sparkly compared to the blackened brass, but much more credible than the usual metallic baby blue most companies use for "Russia Iron". This may be the easiest paint for most people to find, given that there's a Wal-Mart on every corner now. (Vance Bass).

Boiler Bands on a Painted Boiler

Once you've painted your boiler, for those who will be adding real brass boiler bands, refer to the Brass Boiler Bands section below. If you've painted over the styrene bands, you can now leave them as is (Russia Iron Bands) or hand paint them a brass color.

The Russia Iron Metal Jacket Wrapper

This is where we make a real boiler jacket, to be wrapped around the PVC boiler pipe. You do not need to paint the boiler any further than the smokebox you have already painted.

Refer to Kevin Strong's article on patinated boiler jackets. You will be using this technique to make the boiler jacket for the Mason. My best advice is to get an excess of the 0.005" brass sheeting, and do a number of tests in blackening the jacket material before applying the real one to the model.

Important!
Kevin recommends wrapping a layer of cork around the boiler first with the jacket applied on top of that, for the purpose of creating the 'step' at the smokebox interface. On the Mason Bogie, this will not be appropriate, as there is NO step at the smokebox. The smokebox diameter and fully jacketed boiler diameter of the Mason are identical. Thus do not pack out the boiler with cork, simply apply the metal jacket directly to the PVC boiler pipe.

Kevin's Cork wrapper is designed for all other locomotives, such as Baldwin, Cooke etc.

Some points to observe:

1. If you have enough brass 'blacken-it', you can totally immerse the full jacket sections and obtain a very clean even finish. Take care, because if you immerse too long, or more than twice, the blacken-it will flake right of!
2. It is desirable to roll the metal jacket sections into the desired cylindrical form before applying it to the model. This will reduce the stresses places on the boiler bands holding it in place. We do not glue the jacket in any way. In fact glues will stain the jacket.
3. I rolled the jacket parts before blackening, but you could roll it afterwards. Just take care not to scratch the surface too much. Yes it can be touched up, but I have had great difficulty obtaining a totally even finish when touching up. If your jacket is to look old and used, then the touching up is desirable!
4. Don't mess with the jacket, be deliberate. Blacken it, roll it, apply it, secure it and leave it. That’s it. Don't pull and tug at it, don't sticky your domes to it and mess around with it just to see how your Mason is looking, don’t try polishing it up on the model. All this will lead to scratches and you might not like the finished look of the repair.

Making the Jacket

Refer to the PDF page entitled "Boiler Wrapper Templates."

You should have already applied the smokebox wrapper earlier in the chapter. There are two wrapper templates left on the page...the straight boiler section and the boiler taper section, with the steam dome hole cut in. Cut out the PDF templates. Wrap the paper templates around your boiler and check how well they-

fit. Make note of any alterations you need to make to the paper templates to ensure a perfect fit. The straight boiler section will allow an overlap at the base of the boiler. You will apply a small bolt through this overlap and into the base of the boiler to hold the jacket in place.

Trace the PDF templates onto your 0.005" brass sheeting. Cut the brass to suit. I used scissors. Smaller nail scissors can be used to cut out the dome hole. Be precise, you don't want any white boiler showing between your jacket and dome base, when the dome is finally located. You can always make a small hole larger, but not make a larger hole smaller. Be careful cutting out the dome hole.

Roll the jacket using a length of electrical conduit or similar 15-20mm pipe. Roll the conduit pipe back and forth over the brass sheeting atop a 20mm thick foam rubber base. The foam rubber I used was the yellow stuff that Bachmann use to pack around the outside of their Spectrum loco boxes. Slowly bring the wrapper into a curve to match the boiler curvature. Do not bend the sheeting around the pipe, just use the pipe to roll the wrapper. To forcefully bend the wrapper around the pipe will result in kinks in the sheeting.

Blacken the wrapper per Kevin's instructions. If blackening using Q-tips, or cotton buds, place your wrapper over some scrap boiler pipe to support your jacket. Blacken it up, and buff up the finish. You will be polishing away a film of brown oxide dust to get down to the cool dark grey Russia Iron finish. The rolled and blackened jacket might well look like this:

Apply the tapered section to the boiler first. Match up the dome hole perfectly. See that it all fits. You will still have a white gap between this jacket and the very back end of the boiler. This last strip will be covered by the last brass boiler band.

Take the taper jacket away again and apply two strips of double sided tape to the lower ends of the jacket. Use the thinnest double sided tape you can find, a real film thickness. You can purchase this at a stationary store. It is very strong. Place the tapered jacket back onto the boiler, using the dome hole to locate. Then press the sides down, thus holding the jacket firmly in place with double sided tape. The tape will never be removed, but its role is to hold the jacket in place until all the bands are in place. The tapered section otherwise has a tendency to slide forward!

Finally apply the straight boiler jacket section to your boiler. The rear end of the jacket will over-lap your taper by 1mm or so -- this is desirable, as it will help to clamp the tapered section in place. At the front end of the jacket, at the lower datum line, drill a small hole and apply a 10BA sized bolt. Tighten it up. This will hold the jacket in place, and prevent any forward movement. Now its time to add the brass bands.

The Brass Bands - For Painted and Jacketed Boilers

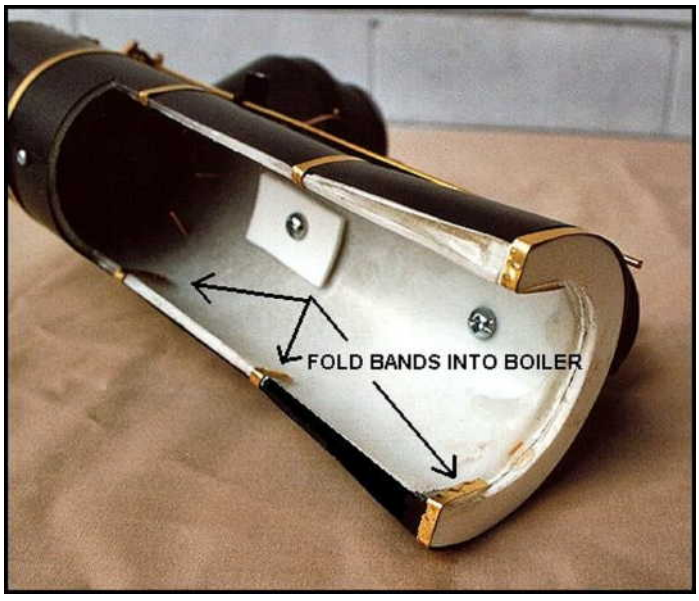
Using your 0.005" brass sheeting, Cut some 3mm wide strips. Make sure the strips are long enough to wrap right round the boiler with an inch to spare. Roll the bands a little to bring them to the boiler curvature.

The first band behind the smokebox will wrap all the way round the boiler. Apply a 1/2" length of double sided tape to the rear face of the central section of the band. That will be the area of the band that will pass over the top of the boiler. The tape at the top will hold the band in place, stopping lateral movement that could scratch your boiler. Once the band is tightened into place, the tape becomes redundant, but leave it there anyway.

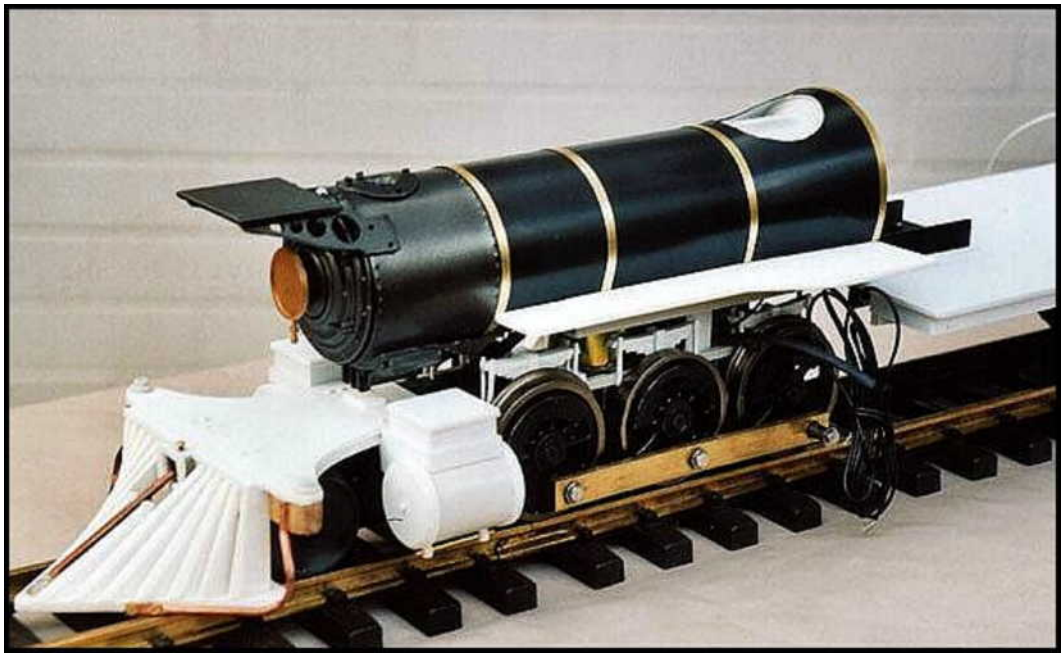
Wrap the band all the way round the boiler and allow a 1/4" over lap over the lower boiler datum line. At this location hold the band in place and drill a small hole through both layers of band and into the styrene pipe. Insert a 10BA bolt and tighten up. The first band is done.

For bands #2 and #3, apply a 1/2" length of double-sided tape to the rear face of the central section of the band and wrap the band around the boiler and fold the ends under the bottom edge of the boiler. Fold them round a 180 degree bend back into the inside face of the boiler. These bands become almost circlips. Make sure the band at the bottom edge of the boiler is hard, flat against the cut edge. Allow about 1/2" band overrun inside the boiler itself. At the very ends of the bands within the boiler apply a daub of 5 min. epoxy to hold them in place.

For band #4, apply it the same way as #2 and #3, but see that it covers over the rear edge of the tapered jacket, holding that line in place. The band will also cover over the last remaining exposed white boiler material. Fold the band under the boiler rear end. There will be a length of flat band where it runs under the end packers for the boiler taper supports. Inside the boiler, secure the ends of the band with epoxy. Looking under the boiler, it may look messy, but it does the job. A view inside the boiler with the bands wrapped around is seen below - also note the two bolt heads visible in the boiler - these are the bolts that hold the domes in place, refer later in this chapter.



The finished boiler with brass bands applied (whether painted or metal jacket) should look like this:



The hole for the dome in the boiler taper section will look like this:

Detailing the Domes

Hunt through your pile of PDF drawings and find the ones entitled "Sand Dome Details" & "Steam Dome Details."

The Sand Dome

The good news is that the central cylindrical section of the sand dome as provided by Hartland or Aristo is the correct size for use on our Mason Bogie. You can use that plastic cylinder as is. This will not be the case for the steam dome!

Step 1 - Remove the Cluster

As you are aware, the steam and sand dome diameters on the Mason Bogies we're building were identical. We were very lucky to find a commercial 1870s style dome that was the exact correct size for our 1:20.3 scale models. We purchased two H-L-W or Aristo 2-8-0 'Steam domes' with the intent of turning one of those steam domes into a sand dome. Now we do just that.

Using your razor saw, cut off the steam dome cluster from the top of ONE of your domes. Cut it off flush with the domed top, like this:

Step 2 - Making the Sand Dome Cap

We now need to make a sand dome lid or cap to replace and cover over the mess left after slicing off the cluster. Go out into the world and look for a domed button, as used by dress makers etc., or any other domed item you might fancy (end of a pen lid, tip of a screw driver handle, etc.). Make note that the sand cap is almost a squat bell shape on a Mason Bogie. Use the PDF to see the correct shape to look for. In MasterClass 2001, Norm Deyette commented on the fun he had when going to a dress making shop and asking for Baldwin styled buttons. Well chaps, its time to ask for Mason styled buttons. If they don't have any in stock, ask when they are expecting a shipment of said Mason buttons!

Paste the stylish cap (button) to the top of your sand dome using a daub of epoxy glue.

Next we need to make the dome 'final' or the little brass tip of the cap. This was the handle used by the crew to lift the cast metal lid off the dome in order to fill the dome with sand. We make the 'final' by using a short length of 0.75 brass wire, with two layers of 2.4mm styrene tube attached. If you are really clever you might even make a mini gooop for the very tip.

Step 3 - The Sand Lever

This is a little lever arm that is operated by a control rod from the cab. The lever opened and closed the sand line manifolds, allowing sand to drop down to the rails. On the Mason, like all things Mason, the lever is damned stylish! Follow the PDF template, cutting out the component in 1mm styrene. It will be an 'S' shaped lever. At the end shown, drill a 1mm hole. We will later attach the sanding control rod to the lever here.

One the top edge of the sand dome base, made earlier in this chapter, carefully file out a notch, such that the lever can slot in horizontally between the brass dome ring and the PVC base. Paste the lever in with a daub of epoxy, or super-glue.

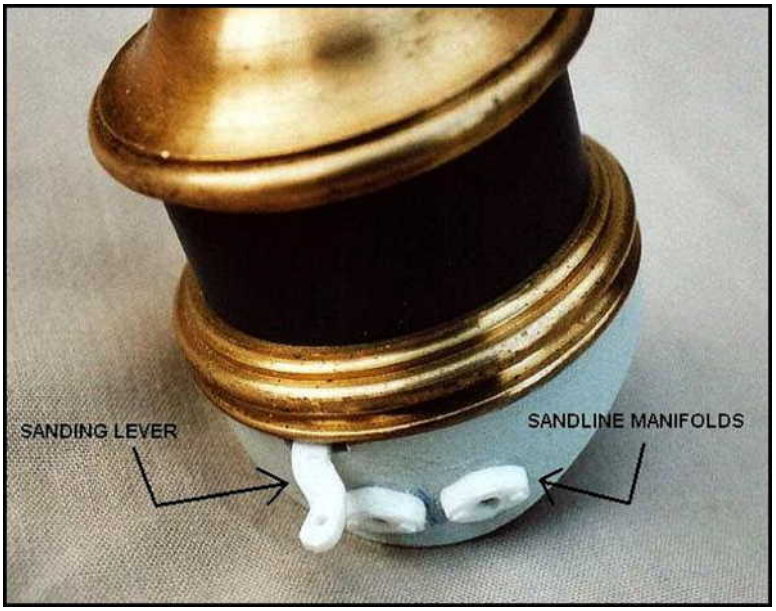
I would recommend making this lever in brass if you are able. In the time of making this dome, fitting it, messing around with it etc, I must have had the darn thing roll off the table four times! Every time the dome was undamaged, but the sand lever was history!! No wonder I never modeled this detail before!

Step 4 - The sand line Manifolds

Here is where the sand lines connect to your dome base. When the Mason Bogie was built, there were 4 sand lines attached to the dome, two on either side. These sand lines permitted sanding when the loco ran in either direction. Later the South Park removed the rearward facing sand lines. Options 1, 2 and 5 have all four sand lines, while options 3, 4 and 6 only have 2 sand lines to the forward end of the loco. No matter if your version has 4 sand lines or only 2, you are required to make ALL 4 sand manifolds! When the South Park removed the rearward sand lines, the rearward manifolds were retained, but blocked up.

Note in the next picture the finished dome, featuring sand dome cap, 'final', sanding lever and manifolds and holes drilled through the dome base only in my forward manifolds (1885 Mason!).

Following the PDF drawing cut out 4 of those diamond shaped manifolds in 2mm thick styrene. It is best to drill out of the sand line hole first, using a 2mm drill bit, then chip away around the hole to produce the manifold shape. Sand the corners into the rounded form required. Next comes the hard part. Place the sand line manifolds on end, and slice though the guts of it on a near 60 degree angle. The top of the manifolds will be the full 2mm thick, while the bottom edge shall only be 0.5mm thick. Get close to the angle with the knife and finish off with sandpaper. Wrap a small piece of sandpaper around some scrap PVC dome base pipe, and sand in a slight curvature over the back of the manifolds. Finally apply the manifolds to the lower dome base as shown in the PDF file. The manifolds are to be perfectly horizontal, and packed side by side in pairs, with 1mm between them. Place the dome base on your boiler and check from above that the manifolds are parallel with the boiler sides. When the glue is set, drill out the 2mm manifold holes right through into the dome base. Only drill out the holes where actual sand lines will be required. Later era South Park Bogies need only drill out the forward manifolds. The rear ones will only have the superficial hole in the manifold itself, not through the dome base.



Making the Steam Dome

The steam dome uses the exact same dome parts as the sand dome, but this time we retain the brass safety valve cluster atop the dome. The plastic cylindrical section used in the dome centre is too short for use on our model, so discard it. You will be making a new dome centre.

Step 1 - The Cluster Fairing

The cluster fairing is the ornate dome top that holds the whistle and safety valves in a 'cluster'. These fairings on Baldwin locos were a fairly plain brass cylinder. On Mason, Cooke, Rogers etc, the Cluster fairing could be a very fancy flared element.

Take a reeeeeal good look at your Mason Bogie options drawings from Chapter 1. You will notice that not every cluster is the same. Specifically option 3 and 6 do not have the fancy flared top. It would appear that the flared section of these domes were a separate attachment which, over time, might have been removed due to damage or loss. Folks building these options, or any versions based on specific photos that show no flared top, can use the H-L-W or Aristo dome top as is. The rest of us have to add all that fancy stuff to the sides of the dome top ourselves. Also if you don't want to miss out on that stylish finish, I will certainly not prevent you from adding this detail to option 3 and 6 type locos anyway.

We build up the cluster fairing in layers. The first layer packs out the H-L-W or Aristo fairing to be level with the existing lip. Use 0.5mm styrene to wrap around the brass, or slice a length of your 12mm diameter styrene tube. If using the styrene tube, cut down one side of the tube so that it can open up like a horseshoe. Stretch the pipe around the cluster and let it clamp shut around it. Then add a styrene fill-in where the tube doesn't quite reach. You will align the joints in the cluster side toward the cab wall (out of sight!). Attach the first packing to the brass cluster with super-glue.

Following the PDF, the 2nd layer is a strip of 0.5mm x 1mm styrene strip wrapped around the top of your styrene packer.

The 3rd layer will be a strip of 0.5mm thick styrene, 2mm wide, aligned to be flush with the existing cluster top. Attach this strip with super-glue. Wrap two layers of this strip to the cluster top.

The 4th later is a 1mm wide strip of 0.5mm thick styrene, welded to the outer top surface of the 3rd layer.

At each layer sand the joint where the strips come full circle. Also see that the joints all line up on the rear side of the dome, or the side that faces the cab wall (out of sight!).

Hopefully you have also acquired a brass whistle with your H-L-W or Aristo steam dome. If not, Trackside Details, or Ozark Miniatures make a good whistle to use. Go for a single chime type, of about the size shown on your original Mason drawings from Chapter 1. Take a look at the base diameter of the brass whistle, and find a drill bit that matches that diameter. You will now drill a small hole the dead centre of the steam dome cluster, and insert the whistle into that hole. Drill into the dome top by up to 4mm. Some whistles may be threaded at the base. Tap the hole if you so feel, but this is a non-stress area. Simply locking the whistle into place with a daub of super-glue is adequate. Your steam dome cluster with whistle will look like this:

The Safety Valves

Along with the whistle, the top of the cluster also features not less than two safety valves, used to relieve boiler pressure. Both valves are set to slightly different pressures. These valves are usually highly visible above the cluster fairing. On the Mason Bogie the safety valves are as good as hidden within the cluster fairing, with their top just above the top of the fairing. For a long time I had believed the Mason Bogie not to have safety valves on the steam dome at all. I thought Mason might have run the safety valves in front of, or behind the cab wall, venting up via long brass tubes to the cab roof (a British design!).

The Mason Bogie does, however, have safety valves on the steam dome. Because most of the valves are hidden, we need only model the very tops of them. Follow the PDF plan, and cut out two 5mm diameter disks in 1mm styrene. Cut and lay across each disk a rod of 1mmx1mm styrene as shown in the PDF. At the ends of the rod, and in the centre apply 3 rivets of 0.20x0.30 rivet rod cubes. Next super-glue these safety valve tops to the cluster top, in front of the whistle, forming a triangle. Make note of the valve rod angles as shown on the PDF cluster top PDF plan. The finished (and painted!) safety valve tops will look like this:

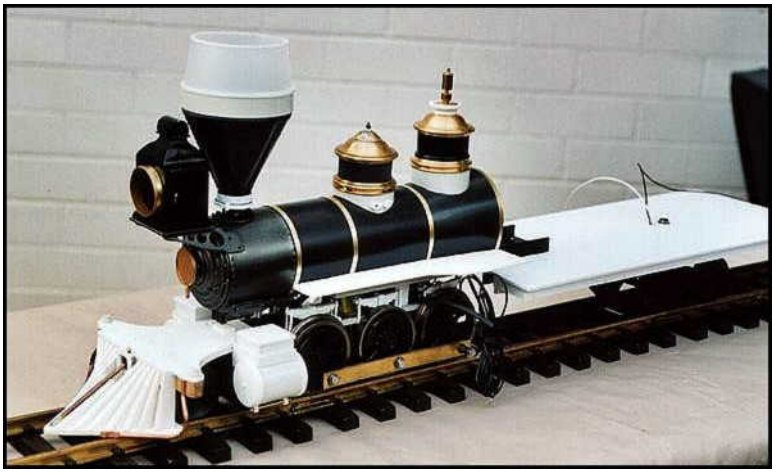
The Steam Dome Central Cylinder

We have finished detailing the dome top; we also have the dome base organized that fits nicely into the boiler taper. We now need to find a suitable central cylinder to add to the dome. As previously noted, the plastic cylinder that came with the dome is too short.

Go out into the world and find a PVC tube of identical diameter (inside and outside) to the plastic cylinder that came with the dome. You are after a cylinder of about 31mm in diameter. I successfully found a good electrical conduit joiner of that size, but the internal size was too narrow to fit the brass dome parts. In the end I resorted to a pipe I had used for the South Park Cooke 2-6-0 model I made some years ago -- that of a black Kodak 35mm film canister (35mm film in a 31mm diameter canister!).

Cut the Kodak canister so that you get a good 13mm tall cylinder out of it. I know this is very close to the H-L-W/Aristo cylinder already, but the extra 1.5mm makes a difference! The inside of the cylinder is not a tight fit with the brass dome elements at all. We need to pack out the insides of the cylinder somewhat. We do that by using more film canister, cut into cylinders, and sliced down the side, with as chunk removed so that these inner cylinders fit within the outer casing. You will pack 3 layers of film canisters within each other in order for the brass elements to get a tighter fit. From the inside, use the 'slime technique' to ooze some epoxy into the cylinder to hold the brass top and bottom in place.

Your finished domes, resting on the boiler will look like this:



The Throttle Tube

Directly below the lower brass ring, and at the top of the PVC steam dome base, we need to insert a 3.2mm diameter Plastruct tube. It will run horizontally from the steam dome base back to the cab wall. This is the tube in which the throttle linkages ran from the backhead. Drill the dome base and insert the tube, Cut the end of the tube level with the back edge of the boiler.

Finishing your Domes

At this time apply the PVC dome bases to you finished dome tops. You do not need to glue the bases on. Time to spray paint your domes. Use a good primer coat first, then paint the domes your chosen scheme (Green, Black, Lake etc). Make note of Jim Wilke's advice that the dome rings and dome tops were not brass, but cast iron and should be painted. I know, I know, the tuned brass domes you have are very stylish, and you feel obliged to leave them brass. Paint them!

Installing the Domes

We do not glue the domes to our finished boiler -- no, no, no. We bolt them on. This provides for the strongest fitting, and no oozing messy glue slopped on your boiler. Under the brass tops of the domes you will notice a bolt hole. This is a tapped hole, used for bolting the dome to the boiler. Indeed the whole dome top is a giant nut. Go to the hardware store and obtain two 40mm long bolts. If using Hartland domes, the bolt size is 5/32"x40mm. This threads nicely into the dome. If using Aristo domes, the bolt needs to be 3/16"x40mm.

Measure out the dead centre of the dome hole in the boiler taper. Drill a hole on the upper datum line, and be precise. Drill with a smaller drill first, then enlarge the hole with a larger drill to allow the bolt to slip through. Next using the PDF boiler set-out drawing, measure the exact centre point of the sand dome on your boiler. Measure from the boiler rear end. On the upper datum line drill a hole at that point to allow a bolt to slip though the boiler for the sand dome. Place the domes one at a time onto the boiler, insert the bolt from within the boiler and tighten up. Do not over-tighten the bolt enough to crack your boiler! Just firm will do. The bolt to the sand dome will be a couple of mm too long. I advise inserting a square of your boiler pipe material as a form of curved washer to pack out the inside of the boiler enough to get the sand dome bolt tight.

Check the dome alignment from the front. See that they are pointing vertical, and are in line with each other, in line with the stack and in line with the headlight and platform...not an easy task. There will be a tiny bit of play in the domes for adjustment. Loosen the bolts, move the dome a tad and re-tighten. Check the alignment again. Also check the side profile of the boiler. Check that the domes are vertical, and are parallel with each other. When satisfied the domes will go on straight, loosen the bolts, apply a drop of super-glue or Loctite to the ends of the bolts, re-insert them, tighten and check your angles and leave them. They will not come off again.

Making the Famous Mason Bell Rig

(Refer to the PDF drawing entitled "The Mason Bell Rig")

Arrrrgh!! ...is this guy NUTS?? We can't make that!! $%#$%#^%#$^!!

This is one of those times. You asked for it, so I deliver...the nastiest bit of model making you will experience in this whole venture ... the Mason Bell rig ... and you are going to enjoy making it, whether you like it or not!

The bell rig on the Mason was the ultimate in integrated design. It was the support for the forward/reverse levers of the Walschaert's Valve gear. It also formed the handrail stanchion at the bell location, and it was also the bell yoke. To make things really interesting the thing was incredibly ornate, and the bell could be rung from both sides of the boiler in a most symmetrical way.

Take your PDF page entitled "The Mason Bell Rig" -- no don't throw it in the bin -- yes that's right, take a good look at it. You CAN do this!

Some notes about this unit from a model standpoint.

1. We cannot adequately bolt the rig to the boiler, as the reverse mechanism runs right through the middle of it, and placing a bolt though the unit into the boiler will prevent us from building the valve gear properly.
2. Stresses from the valve gear will be placed on this rig. Specifically when you lift the loco off the rails, and the drive truck pivots, the links back to the bell rig will try and tear the rig right off your boiler! Take care! Build it well, built it strong, build the whole thing in brass if you can! (I did not!).
3. There are no commercial castings available that are even remotely like the bell rig, or the bell yoke even. We have to make the yoke and the bell hanger ourselves. To make the bell actually swing is even more a challenge.

So here we are at the crossroads of a totally good idea, and all I can say is hang on, enjoy the ride, make 9 crappy bell rigs, and you might get the 10th one right!

Step 1 - Working from the bottom up

To the right of the page are the templates to cut out to make the bell rig. We start at the bottom of the page. Cut out the rectangular template with the 3 holes in it. Cut out the profile in 2mm thick styrene, this is the 'base plate'. Drill the 3 holes in the base plate as shown using a 1.5mm drill bit. Bend the plate to the curvature of your boiler (shown in section directly above the template). Now I want you to **PAINT the edges** of this base plate - not the top surface or bottom, just the 2mm wide edges. You must leave the top free of paint in order to get the best gluing bond possible. The paint colour for this base plate edge shall be the same colour as chosen by you for the domes, headlight, cab and tender.

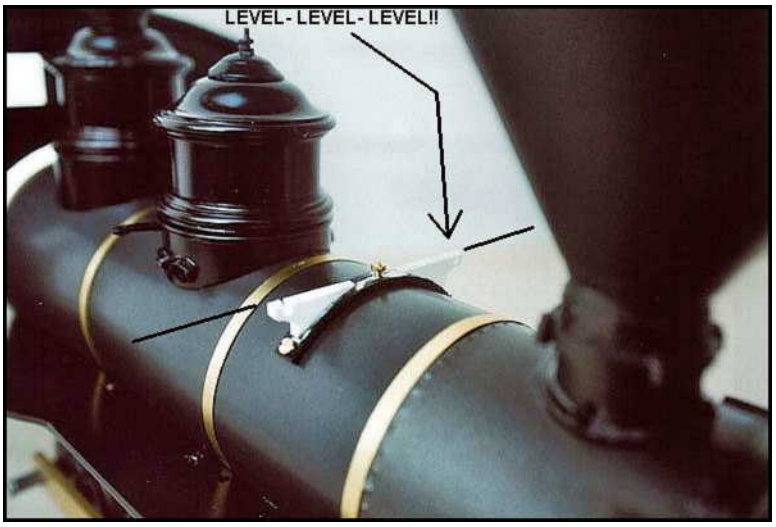
Using the boiler set-out drawing locate the centre point of this bell rig on the upper datum line (draw an imaginary line between the stack hole and sand dome to find that point). Mark the top of the boiler exactly where the centre of the bell rig is to go.

Using your smallest drill, of about 1mm size, drill a hole in the top of the boiler at that centre mark. Then widen that hole with the 1.5mm drill bit. Next apply the base plate to the boiler top. Do not use any glue. Insert a brass 10BA bolt into the boiler top, fixing the base plate to the boiler. Check that the base plate is set perpendicular to the boiler itself. Measure from the rear end of the boiler and check both sides of the base plate if you have to. It must be square.

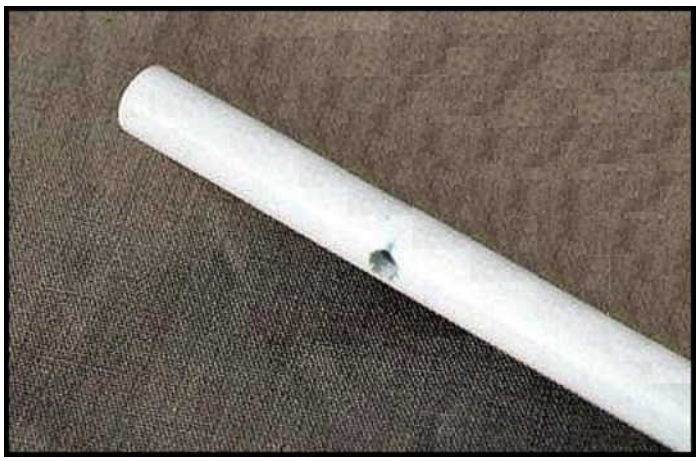
With the base plate firmly in place, drill out the two 1.5mm holes at either end of the base plate into the boiler. Use the pre-drilled base plate holes as a guide. Insert two brass 1.5mm 10BA bolts into those two holes and tighten into the PVC pipe. Your base plate is now fixed to the boiler via 3 bolts. Finally loosen out the middle (top) bolt so that the head is max 2mm above the base plate, with a gap under the head.

Step 2 - The Transverse Reverse Lever Unit

This is literally a pipe that runs across the boiler. Linking the valve gear on the engineer's side to the valve gear on the fireman's side. It will be made of 3 parts. The tube itself, which will be a Plastruct 6.4mm styrene tube, and the supports for the tube which will keep the tube level over the curved base plate. Cut out the two triangular supports from 2mm thick styrene. Make note of the two holes to drill near the outer ends of these support units. These are the hand rail stanchions! Drill these holes out using a 2mm drill bit. The hole will actually touch the outer edge of the supports Using your MEK welder cement, weld the support triangles to the base plate. Weld them to the centre of the base plate, and check that they are standing vertical. The very tops of the supports MUST be level with the top of the base plate. The whole concoction should look like this:



Next take your 6.4mm Plastruct tube and cut a 60mm length of it, to match the PDF. Measure out the half way point on the tube at 30mm. Drill out a hole on one side of the tube, at the exact centre of the length. The hole will be drilled wide enough to allow the bolt head to pass through from the top centre of the base plate. Do not glue or fix this tube to your loco yet. We'll make everything on top of the tube first. The tube should look like this:

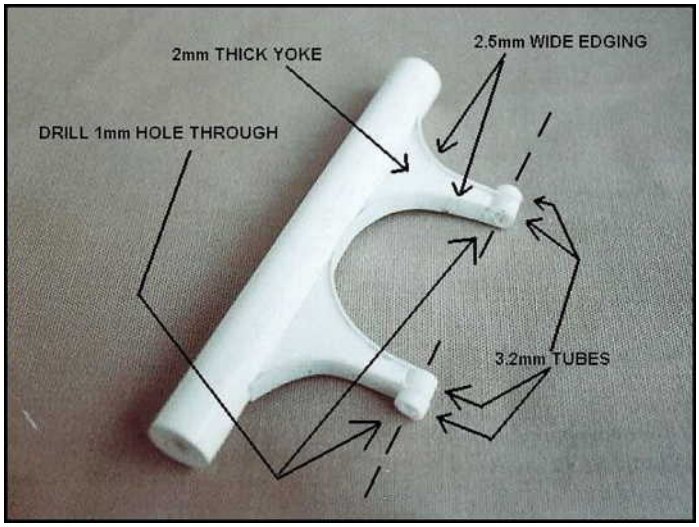


Step 3 - The Bell Yoke

Cut out the two bell yoke arm templates in 2mm thick styrene. They taper from very wide at the base to only 2.5mm wide at the top. At the top ends of these units, weld two 2.5mm long pieces of 3.2mm diameter Plastruct tubing.

Weld the two yoke arms to the top of your 6.4mm Plastruct tube at the set-out shown in the PDF template. Make sure you weld the yoke arms on the directly opposite to the central hole drilled in the 6.4mm tube.

Cut a strip of 2.5mm wide styrene from your 0.5mm thick styrene sheet. Weld the strip along the edges of your yoke such that the edges of the strip are just proud of your yoke surface. This makes for a nice rim to the yoke to simulate the Mason iron casting. The strips should run up and over the ends of the 3.2mm tubes at the top. To the outer face of the yoke, in line with the 3.2mm tubes, weld another 3.2mm tube, this time 2mm long. Finally using your 1mm drill bit, drill through the centre of the 3.2mm tubes, right through all the edging strips as well. If in doubt about being able to do this accurately, just wind the drill bit into the tubes by hand. It takes nothing to push the drill bit though those two layers of 0.5mm styrene. The bell yoke will look like this:



Step 4 - Making the Bell Hanger

Even the bell hanger is unusual in typical Mason fashion!

Cut out the bell hanger, following the PDF template in 2mm thick styrene. Its best to drill out the two holes and the central elongated hole first, then cut out the rest of the hanger by chipping away at the edges till you get the right shape. Sand the edges smooth.

To the sides of the hanger, weld two 3.2mm diameter Plastruct tubes as shown on the PDF. Now go to your parts box and get your bell out...all you need is the bell, no other structure! The old Bachmann 4-6-0 bell is a perfect fit. Ozark make a good white metal bell kit as shown in Chapter 1. If you use this bell you will find it to be a tad too tall. Cut the bottom of the Ozark bell off using your razor saw. Remove 2mm from the bottom. You can use a metal file to do this also. The Bachmann bell needs no change.

Take one of your 10BA bolts and insert it into the top of the bell, leaving the head poking out the top. Insert a washer and nut to the inside of the bell. Place the bell into the hanger, by sliding the bolt head into the gap. Centre the bolt up in the styrene hanger. Now cut out those two tiny patches of 0.5mm styrene, and apply one to each side of the hanger, locking the bell's bolt in the styrene hanger. The Bell hanger with bolt and bell inserted will look like this, the 0.5mm patch has yet to be welded into place.

Step 5 - Fitting the Hanger to the Bell Yoke

We now make the two levers that make the bell ring. K&S brass make a strip of flat brass that is 2mm wide and about 1mm thick. This is perfect. Bend two lengths of the brass to follow the end profile seen on the PDF. Using your 1mm drill, drill out two holes in each lever. One at the very top and one NEAR the bottom.

At this point you have 3 ways to secure the bell hanger to the rest of the unit:

Option 1 - Using brass pins:
Insert two brass pins to the two holes in each lever. Allow the head of the pin at the end holes to stick out by about 2mm. From the back solder the pin to the lever and trim off the excess pin, leaving just the head end soldered to the lever. This is the rope cleat.

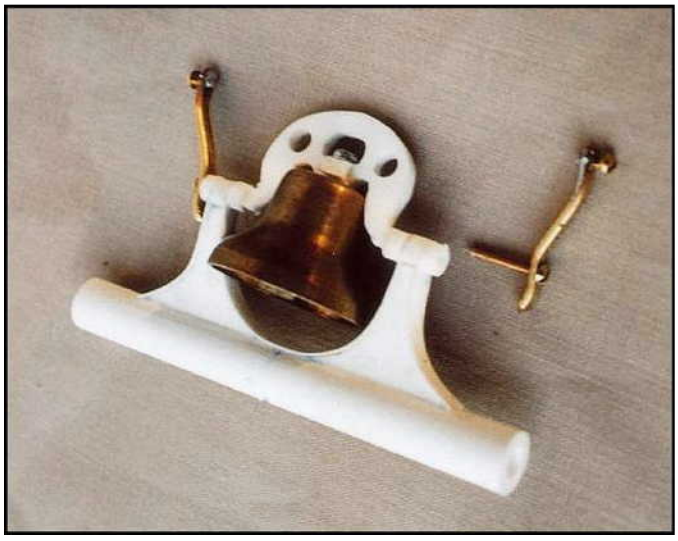
Solder the pin in the lower hole from the inside such that the head is hard and flat against the lever. Do the same for both levers. Brass pins can be found at hardware stores in the crafts section. Also small brass hinges, used on jewelry boxes come with these tiny brass pins.

Now holding the 1mm drill bit (or smaller if you have one!) in your hand, hand drill the ends of the bell hanger. Drill into the end grain of the 2mm thick hanger styrene, using the outer 3.2mm tubes as a guide.

Place the bell hanger into the yoke, aligning all the 3.2mm tubes. Place the levers on the outside and press the brass pins into the hanger. Test the pin length. If any of the pin runs out the end of the hanger next to the bell, then your pin is too long. Trim off the end of the pin to the right length (use side cutters). Place a drip of super-glue into the ends of the bell hanger and pin it right into the tiny holes. Make sure no glue is on the outer face of the 3.2mm tubes! Place the hanger in the yoke again and press the lever and pins through the yoke and into the hanger from both sides. Quickly align the levers to be 100% parallel with the hanger. Let the glue set. The bell should now swing by moving the levers. After the unit is painted, apply a drop of oil into the moving parts.

Option 2 - Using Tiny Brass 12BA bolts:
This option is identical to the Option 1, except tiny brass bolts are used in lieu of pins. The bolts are inserted and soldered at the top end of the lever, but are simply screwed into the lower holes, and into the bell yoke, locking the bolts into the hanger with super-glue. You then hold the levels parallel with the hanger by super-gluing the bolt heads at the lever. To attempt to solder the bolts from the outside will melt your bell rig!! To pre-solder the bolts into the levers per option1 will mean you can't turn the bolts to tighten them into the bell hanger! Don't worry it works!

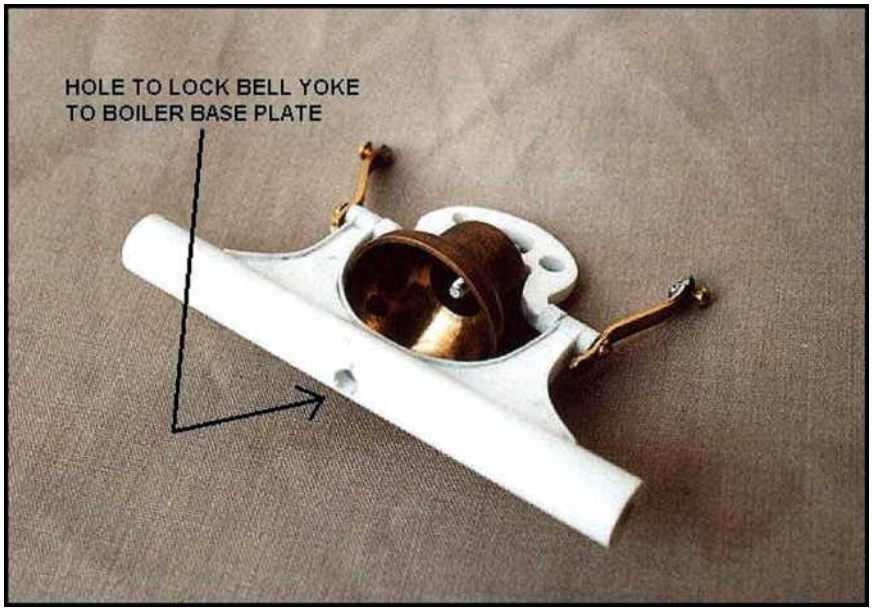
Both Options 1 and 2 look something like this:



Option 3 - A Non-swinging Bell!:
Forget the brass pins or bolts or anything. Simply bend the levers out of 1mm styrene strips, and MEK weld the whole bell hanger, yoke and levers together. It won't swing, but its possible to do! (my old Crested Butte 2-6-6T is made this way -- the bell does not swing!) I would advise setting the bell angle to be slightly forward, as if the weight of the ropes to the bell are pulling down on the levers. This is the natural 'hang' of the bell, and it will look like your bell does swing!

Step 6 - Attaching the Bell Yoke to the Boiler

Now its time to attach this whole assembly to the boiler. There is method in our madness. That oversized hole in the bottom of the 6.4mm tubing at the base of the yoke is designed to clip over the central brass bolt sticking out of the boiler base plate. Epoxy glue bonds extremely well if it can 'key' in around something. We literally 'lock' the bell yoke to the boiler base plate by using epoxy around the bolt head in the hole. It is a very strong lock.



Begin by placing the yoke and 6.4mm tube onto the boiler base plate. Run a piece of your brass 1.5mm rod down inside the 6.4mm tube. Check to see that the head of the boiler bolt does not pass higher than the inside surface of the tube. There must be a clean, open inner tube. If the bolt head protrudes a little into the inner tube, then screw the bolt down a couple of turns. If the bolt is lower than the inner tube surface, wind the bolt out a couple of turns until it is just below the inner surface.

Next apply a nice blob of epoxy glue into the hole at the bottom of your yoke assembly. Apply a daub of epoxy around the bolt head as well. Do not spill any glue over any distance wider than the base plate. At this point apply some MEK welder to the tops of the triangular base supports. Do not allow the MEK to mix with the epoxy...keep the two gluing areas apart. Now wang the yoke down onto the bolt head. Check the yoke. The 6.4mm tube must be perfectly perpendicular to the boiler. The yoke must be standing perfectly vertical. Now take your 1.5mm brass rod again and clean out any epoxy oozing inside the 6.4mm tube. It must be clear and open, and smooth. Clean it out. Then let the epoxy harden. The whole thing is locked together now. Recheck the how well the triangular supports have welded to the bottom of the 6.4mm tube. Apply another dose of MEK to the joint after the epoxy has set. Do not slop any MEK onto your boiler of you will dissolve your Russia Iron paint, or stain your metal jacket!

The Bell rig will look like this:

Step 7 - Painting the bell Rig

Phew -- now its time to paint the rig. Paint it by hand. Black, green or whatever. Remember this unit was mostly cast iron in reality, so the main body will be painted in the same colour as your cab, tender, domes and headlight. Rim the holes in the hanger with brass paint to help highlight them.

The Wimp's Way Bell Rig

You are really not going to like this at all. This is a cop-out of the first magnitude. basically you install a standard Ozark or similar bell and yoke atop the transverse reverse lever unit. Now we've all heard about the 10ft rule, and some of you will have seen several Masons bashed from LGB models that used this very technique. I don't much care for the 10ft rule...it basically implies that something that is wrong at 1ft, will look 1/10th as wrong at 10ft. Now wrong is wrong - doesn't matter how far away you look at it. Indeed the issue is whether anyone is looking at it in the first place regardless of distance. But I leave you with this...you do this to impress yourself, build what you know you can build, and be happy with what you do. Do not be happy with something that you don't like at 1ft, but think is OK at 10. Make something that you're happy with period. The Wimp's Way bell is designed to look finished, and clean. Not prototypical, but neat and tidy and prototypically viable. I'd sooner you be happy with this, than some disastrous looking styrene thing atop a well made model. Do try the correct bell rig first, at least have a go!

Wimp's Way bell rig - Please follow steps 1 and 2 above, making up the transverse reverse lever unit atop the boiler. Then apply your commercial bell to the top of this as shown in the wimpy god-awful PDF demonstrating this really bad idea. Now paint up the whole thing. If you are really cunning, you might even add some styrene fillets around the sides of the bell yoke to fatten up the thing to look more like a Mason style.

Finishing Up

That's it -- the Bell Rig is done, man!

We need only insert the valve gear rod through the tube later in this series.

Presently we'll go into the last stage of this chapter, installing the boiler handrails. These railings will run through the two holes you made in the bell rig. The finished, painted bell rig with handrails running through will look like this:

The Mason Bogie Handrails

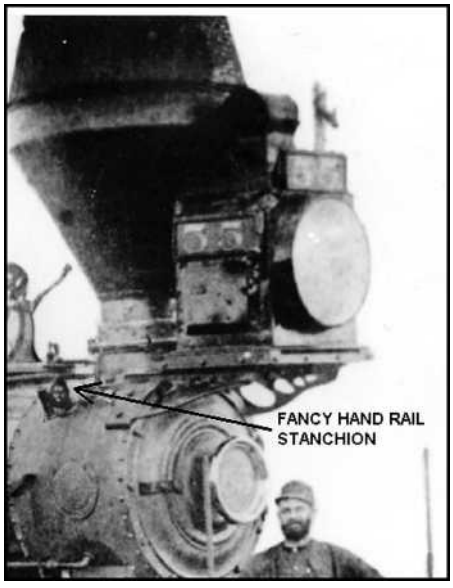
Refer to the handrail PDF drawings (3 pages).

Chaps, there are basically 3 ways in which the handrails were applied to the boiler. From 10 ft. away they all look similar. However, they are not. The three ways are as follows, and as summed up the 3 PDF pages, "Mason Handrail Stanchions."

Type 1- 'As built' 1878, DSP&P #3 Oro City, #4 San Juan, and Bully Boy.

This method is about as typical is it gets. The handrails run through the bell rig as shown above, but beyond that the railing is held in place by 4 very plain rod like stanchions typical of any Baldwin or Cooke loco. This is the easiest method of applying the handrails. You will need commercial stanchions that are min 7mm long, and a max of 9mm long. Their exact placement depends on their relative insertion to the bell rig railing location, 9mm will be basically perfect, 7mm will be short. If you are 'short' you can pack out the base of the stanchions using 2mm thick circular styrene bases. The stanchions were placed on the smokebox side and on the boiler side between the sand dome and steam dome. They are clearly seen on the San Juan builder's photo.

Type 2 - As Built 1879 DSP&P #6 Ten Mile, and all Masons to follow, including all long tender Version



This method had the railings run through the bell rig as above, but the lead end of the handrail, secured at the smokebox, was supported by a most elegant decorative stanchion. The stanchion, like the bell rig, is a 3-in-1 integrated design. The Stanchion was decorative, acted as a stanchion, was also a flagstaff holder and was also a footstep, come marker light platform! The design was essentially circular with a cast 5-pointed star in the centre, and an oval plate above. All as-built versions from DSP&P#6 onward had this front end fancy stanchion.

This type of handrail was also secured at the cab end by stub stanchions that were attached to the sides of the steam dome base. There were no boiler-mounted stanchions used.

Type 3 - DSP&P Modified handrails

This type encompasses changes that occurred in the life of the working loco.

The changes were as follows:

As the headlight brackets were changed from the boiler front mounted types to the smokebox side mounted types, the fancy lead end stanchions were moved rearward on some locos. This is seen in the above pic of #55. In the 'As Built' configuration the fancy stanchion was right up near the front end of the smokebox.

It was also common when displacing these lead end stanchions for them to be changed completely. Some post-1885 Mason Bogies, with altered headlight brackets, had their fancy stanchions removed and replaced by plain rod type stanchions similar to type 1. The rear ends of the rails were still supported by stub stanchions off the steam dome base.

What this 3rd type does is give you, the builders of this fine model, a way out of having to fabricate the fancy stanchion. You can use the 7mm-9mm long commercial stanchions per type 1 at the front end, and still be accurate to prototype.

The three types are shown in PDF drawings, also locating their set-out. Choose your option and go to it!

Use the PDF sections to locate from the upper datum where to drill the holes in the boiler pipe sides in order to get the 7mm or 9mm stanchions leveled correctly. You want the handrail to be perfectly level with a height set by the bell rig.

Demo - Building a Type 2 and 3 Handrail Installation

I shall now describe how to do a type 2 / 3 installation, with the fancy stanchion moved back to allow the smokebox mounted headlight bracket to fit. For this installation you will need two H-L-W stubby brass handrail stanchions as used on the boiler of the H-L-W 4-4-0.

Insert two lengths of 1.5mm brass rod into the lead end of the bell rig mounting holes, and slide them all the way back to the steam dome side. Do not drag the railings along the boiler sides to avoid scratching!

View the boiler from the side, and level the handrails with the boiler -- use the top of the boiler as a visual guide. Angle the rail back against the steam dome side, keeping it level all the while. At the steam dome side, where the railing touches, make a pencil mark under the touching point. Drill a 1.5mm hole in that location. Then widen that hole with the drill size needed to fit the H-L-W posts (should be about 3mm). Insert the stanchion, keeping it in place with a drop of super-glue. Run the railing through it to ensure the hole in the stanchion is facing the correct way. The finished rear end stanchion and railing will look like this:

Next comes the hard part. You've seen them there haven't you? You've seen those fancy handrail stanchion templates, plus the little 5 pointer star insert to fit into it. It's your lucky day – it's time to make that thing...and make it twice!! Begin by sticky taping the template straight into 2mm styrene sheet. Next, drill out the centre of the stanchion with a 1.5mm drill bit. Then widen to the full drawn hole size. Then drill out the 1.5mm hole at the top of the stanchion where the railing will run. Using your 1mm drill bit, drill out all the tight corners in the outer edges of the stanchion. Next chip away at the edges of the pattern around the big hole until you have carved out the stanchion. Use metal files and fine sand paper to clean it up -- it is tiny. If you are feeling particularly clever you can drill out the flag staff holder to the side. I left mine solid.

Sticky tape the 5 pointer star pattern onto 1mm thick styrene. Cut that out by chopping along the side of each point. This is quite easy to do, just don't over-chop!

Trim the points of the star until it fits snug inside the big stanchion hole.

Cut out the tiny oval profile in 1mm styrene. This is the foot step to be welded directly above the stanchion in a horizontal plane. Insert the stanchion onto the end of the handrail (still in place on the loco). Run it back over the smokebox to the correct location per the PDF, depending on the headlight bracket type used. You will need to bend the handrail back a little to allow the nipple at the base of the stanchion to pass over the smokebox side. When it is in the correct place, and centered nicely over where the stanchion should be inserted in the smokebox, mark the smokebox, remove the stanchion and drill a hole on that mark to the size of the stanchion nipple. Insert a tiny washer (10BA size) over the bottom of the nipple, and insert the stanchion back onto the railing and into the smokebox side. It should all look like this now:

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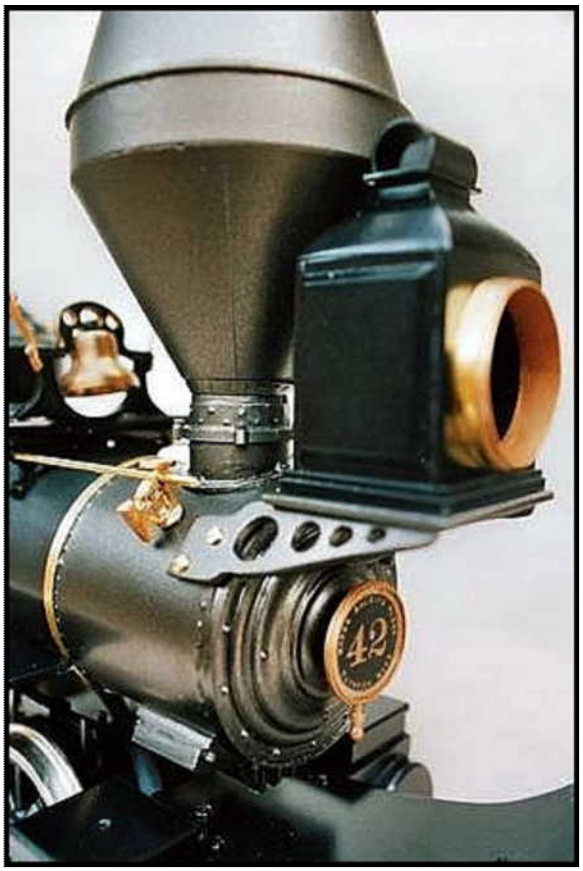

...and painted up, the stanchion looks like this:

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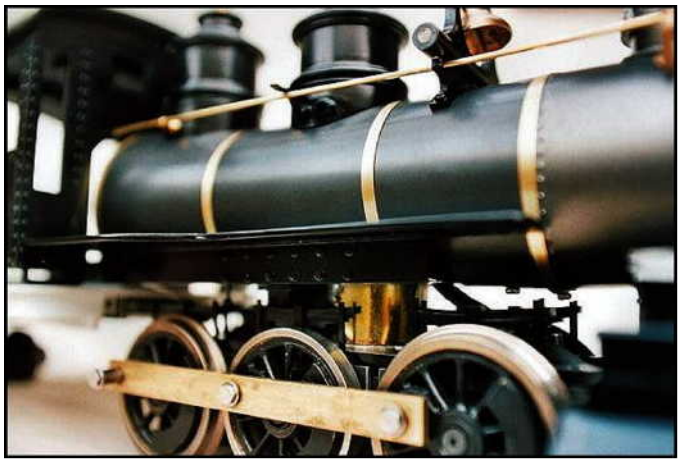
Here is a better view...

... and with the headlight removed...note the oval foot steps atop of the fancy stanchions.

... a view from below the hand rail, see how it passes through the bell rig to the steam dome stub stanchion...



The Fancy Stanchion Alternative - The Vance Bass Alternative

This is another way to make the fancy stanchions, without the chipping away around a tiny profile. Try it out if the above method fails you. Take much care with this method, as the tiny stanchions will be more fragile, and still frustrating to make.

Take two lengths of styrene tubing, one 7.5mm o.d., the other 4mm O.D., and glue them together lengthwise. Then glue a piece of 2mm x 5 mm styrene strip to the 7.5mm tube, such that it touches the tube at a 45-degree angle to the 4mm tube. Finally glue another piece of the 2x5mm strip on its edge, at a 90-degree angle to the first.

You now have an extrusion of the shape of the stanchion. Take the razor saw and saw off a couple of 2mm thick slices, and you have the body. Attach the star and platform and you're done. If you mess one up, you can just saw off another slice.

If you can make this out of brass, you'll be in a much stronger position!

What's All this With the Mason Disk and #42 on the Front of this loco?

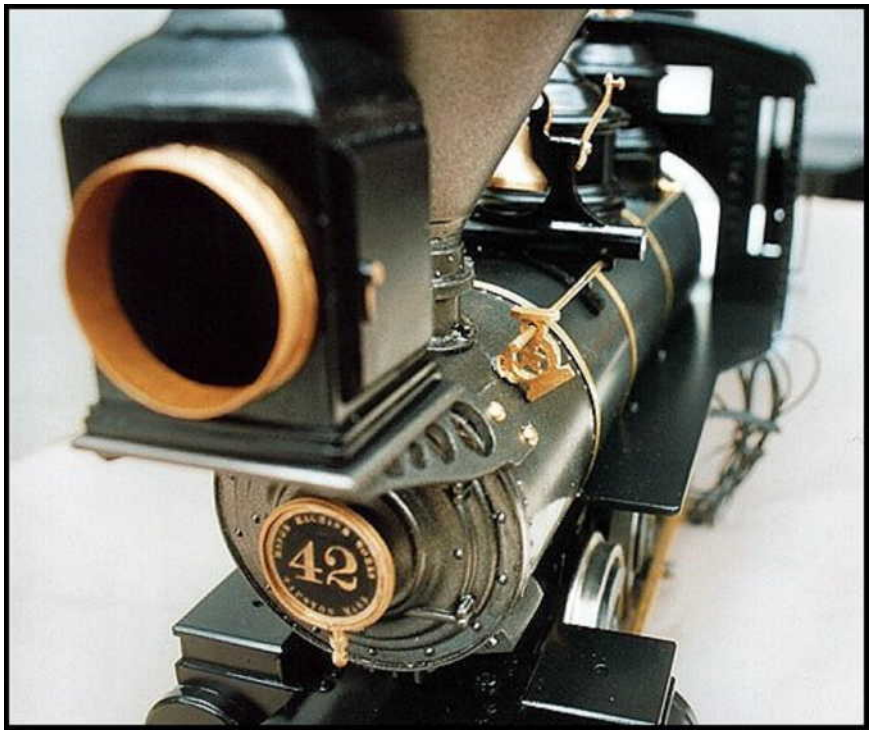
(Refer to the PDF drawings, entitled "Mason front Plates".)

Well, it's time you made your own. We will be looking at making up some decal sets later in this project for general decoration of the models, however, builder's plates and front number disks are things we can make ourselves in the normal process of modeling.
I use AutoCAD to draw up all manner of builder's plates, incorporating correct dates and serial numbers of the prototypes I'm building. We shall do the same for the Mason Bogie. At this stage you can make up the number plate if you wish.

Take out that weird page of number disks. Find the disk that best represents your loco and number, or use the blank one (place your own decal number in the centre). You can either print out the relevant disk directly onto decal paper if you have the right sort of printer, or do as we do, and photocopy the disk onto an overhead transparency - that clear acetate film used for overhead projectors. If you-

don't have access to such equipment, take your page to the local photocopy joint, they will be able to do it. Reduce the PDF drawing by exactly **50%**. I enlarged them on the PDF page to twice actual size in order to maximize the resolution. You will note that the disk size when scaled down 50% is smaller than your styrene disk plate. This is correct, since the decal we're making will fit well inside the styrene disk. Paint the styrene front disk brass/gold. The decal will be black with clear writing. Trim around the outer line of the decal using small scissors. Next apply a film of epoxy glue to the back of the decal. I'm asking for a mere greasing of the back. Insert the decal to the disk and center it up. The gold paint will show through the clear letters making a nice looking plate. That's it. We will be making the builder's plates to the side of the smokebox in the very same way, but not until the official birth of the model in the final chapter of this series, Chapter 8.

The finished front disk will look like this:



The Last Hurrah

(Refer to the PDF Pages entitles "Fixing the Boiler to the Chassis")

It is sometimes suggested, in our architectural profession, that gravity always gets the last laugh! It is for this reason that we take some care to bolt the loco together properly so that it does not come apart when lifted off the rails.

This is the broad overview of how this loco goes together:

1. The pivoting BBT 2-6-0 chassis, supported by the upper frame, can only be released from the frame from above (by releasing the upper PVC clip) Thus to access the motor or release the chassis; we have to remove the boiler first.
2. In this chapter you note that we built the boiler to the front cab wall only. The rest of the boiler, inside the cab will be a separate section. You will also note that, on the FH&PB wood cabs and the cabs you will be making in the next chapter, we do not provide a circular hole in the cab front wall for any boiler to pass through. That is because our chapter 3 boiler runs up hard to the cab front wall, and stops there.

3. We've designed the model such that you can remove the boiler (everything from this chapter) by removing 4 screws, lifting the assembly free of the chassis, and with that gain instant access to the chassis and motor. This will aid access for fitting and repairing smoke units, lighting wiring, wiring for sound etc. This access is possible without removing the cab from the chassis or tender.
4. The cab, once made, will be bolted down to the deck and will not need to be removed except for very special reasons. Access is possible, but you will not need to do it. Bolts are threaded up from under the deck.
5. The tender also bolts down to the deck and will be removable for access to battery or sound system space. Again we're designing this tender unit to be removable without removing the cab.

Fixing the boiler to the Chassis

You will only need to do this step when you have the BBT chassis in your hands. Until then I recommend leaving the boiler removable from the running boards, and no fixings through the running boards to the chassis yet.

When you do get the chassis, you will notice Barry has provided 4 tapped bolt holes to the sides of the upper metal frame, in line with where your running boards assembly sits. You will extend those 4 holes into the sides of the lower framing of the running boards. Bolts applied from the outside will then screw through the running board sides and tighten into the BBT upper frame. When you lift the loco by the running boards, the chassis will come with it, no chance of it breaking out! We have applied the bolts in 'shear' angle, which means the weight of the loco is supported by the bolts on their side, not by the thread of the bolt gripping a tapped hole. Even if your bolts are loose, the chassis cannot fall out.

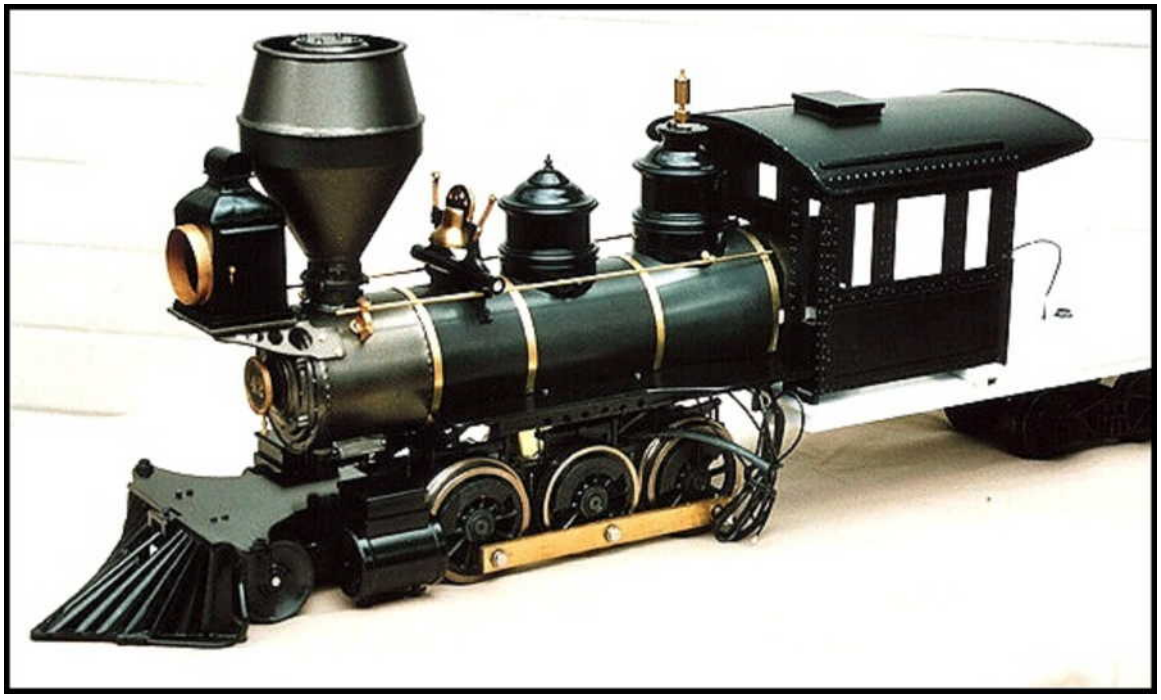
The down side of this design is that there are 4 exposed bolt heads visible below the running boards. But it is a foolproof fixing method, and access is easy. One can remove the boiler without even rolling the loco over.

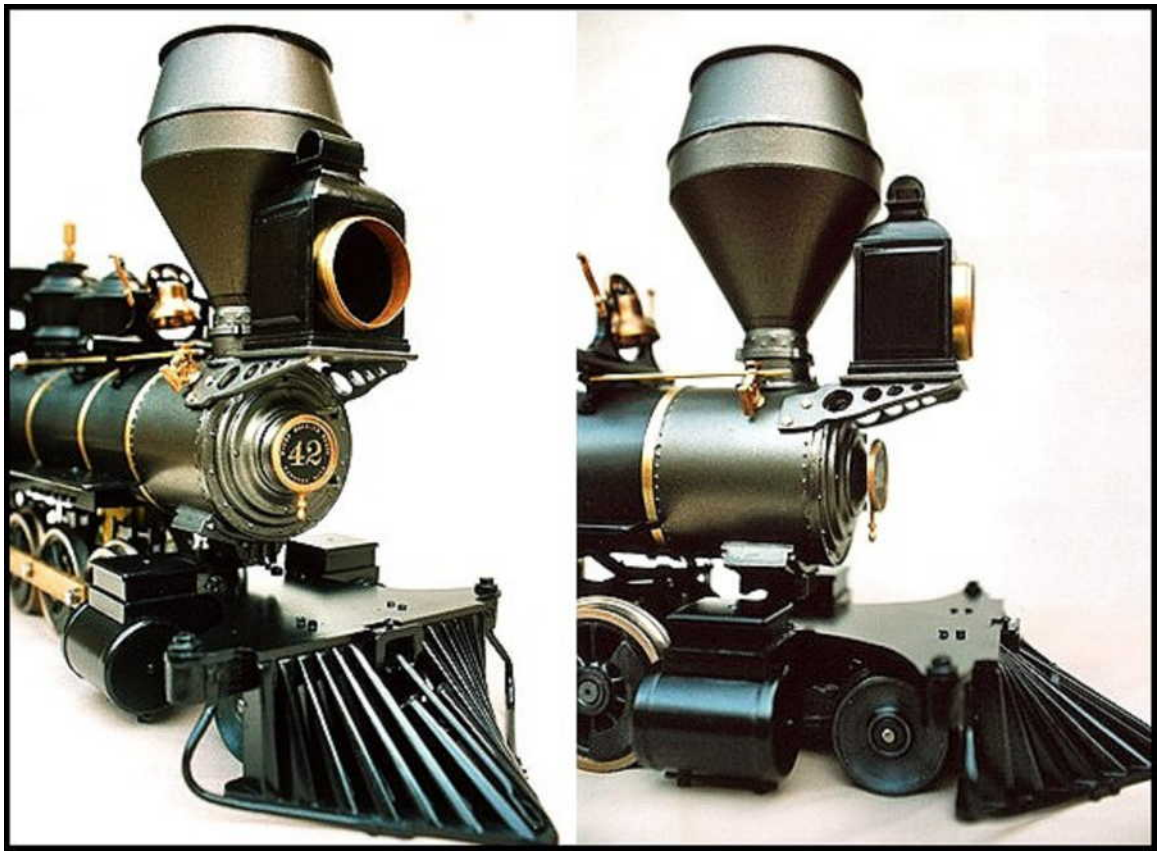
For those not satisfied with this approach, a less easy approach, and one that will place greater stress on the styrene in keeping the loco locked together, is to insert 4 bolts from under the BBT upper frame, and extend and tighten the bolts into the running boards within the boiler. The bolts run in a vertical direction and can pull out of the running board assembly. But the bolts are out of sight. To access these 4 bolts, you would roll the loco onto its side and pivot the chassis as far as it will go to one side in order to reach the bolt heads. Do this method if you wish to.

The PDF drawing "Mason Bogie Fixing Design" indicates the approach taken with this model and the option.

Well that about wraps it up for this month!

Here is what your loco will look like at this end of this month, with the BBT drive attached....The ugly steel cab is just placed there to give the model some context. The real Mason cab is quite a bit larger and better looking!

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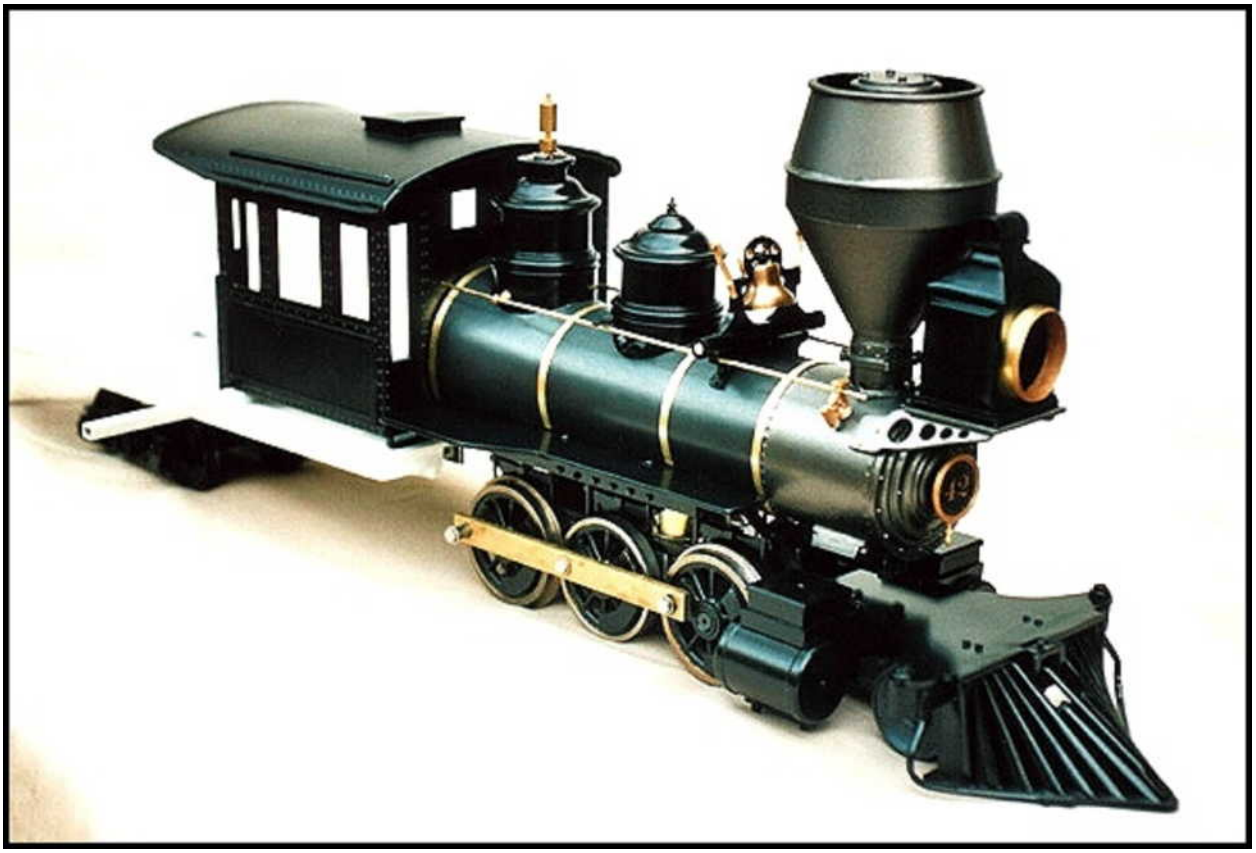
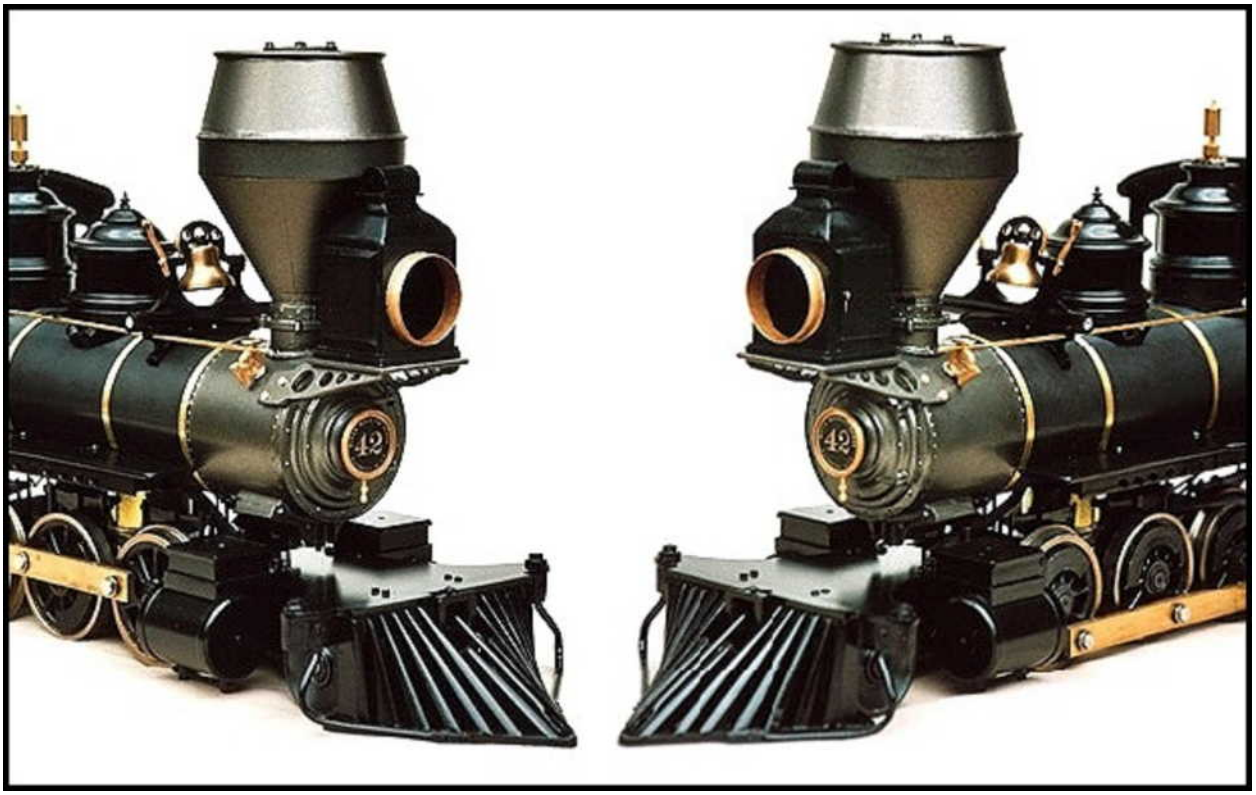




This has been a marathon chapter, really two chapters in one, but I felt it best to do all of this work in one go, rather than break it down any further. Future chapters will not be so involved, with the exception of the pipe work chapter!

Go to it, and good luck!
Fletch
Melbourne, Australia
September 2002

Acknowledgements:

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

Barry Olsen, for his ongoing efforts in pulling together your custom Mason Bogie chasses. At the time of writing we're nearing our 100th Bogie chassis.

Chuck Meckam, for his ongoing effort in developing the 6-wheel tender truck and side rods for the BBT chassis. At the time of writing the masters for both are nearly complete. The tender truck is a work of art in its own right, and I guarantee you will not have seen anything like it.

Vance Bass, for his support in providing the specialized Mason cab kits, pilot kits and now tender shell kits as well! The cab will be required in the very next chapter. Some of you will be able to take a holiday while the rest of us scratch make the thing!

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 gets a big thanks to for providing the excellent background into William Mason in this chapter. But also 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 color 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.

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!

We also welcome back to the MasterClass, our original MC2001 Veteran, Chris Walas, with an all-new shoulder, and a can-do attitude. We can't wait to see the Masons rolling out of the Walas works!

The Possum Pass & Frog Mouth Gulch RR... is proud to announce that two of its resident Marsupial Possums have recently given birth to two cute li'l Possumettes. The li'l Possums are about 4 weeks old, and spent most of that time being carried in their mother's pouches (a bit like a Kangaroo). As of last Sunday they outgrew the pouch and now ride everywhere on their Momma's back. The RR has long been named after the wild life that lives in the trees above... here are the latest additions to the Possum Roster...

Continue on with the article to read about Making Patina boiler jackets.

By Kevin Strong

A Bit of History...

Since the dawn of time, man has debated what Russian Iron actually looked like, and what color it really was. In reality, it really wasn't a "color," so much as just a way of treating raw sheet iron so that it was somewhat resistant to the elements. The result was a boiler jacket that had a nice, polished look to it. As such, it reflected whatever color was around it. In most cases, this was blue sky, and that led to the myth that Russain Iron was blue. The end result of this myth is a plethora of blue boilers on model steam locomotives.

An alternative to Russian Iron was called "Plannished" iron. Baldwin Locomotive Works used this on many of their early locos. A metalurgist can better describe the actual processes involved, but the end result was similar - sheet metal that had a somewhat polished, mirrored finish to it. Historians describe the finish as being somewhat grey in color. (This finish, to the best of history's records, not quite as mirrored as the Russian.)

Unfortunately, there's no real way to replicate that with paint. Many folks have used automotive paint. I experimented with that as well, but was never satisfied with the end result. It ended up looking like a Ford with siderods. There had to be something else out there.

Chemical Blackeners

I had seen these in the past, but never thought much about using them myself. Fellow live steamer Vance Bass used some old jewelry chemicals to patina one of his locomotives, so I figured I'd try the current-

batch of chemical blackeners on a boiler jacket, just to see how it worked. I bought a bottle of Birchwood Casey “Brass Black,” and went to work on a sheet of brass. The end result was quite nice looking, certainly better than any painted finish I had ever applied.

Feeling pretty proud of myself, I took the model to a steam-up down in Mississippi. There, I ran into another modeler, Sonni Honniger. He was working on what can best be described as a real K-27, only smaller. This thing was gorgeous, and had every last little detail the prototype has. (Sonni's an engineer on the C&TS, so access is not an issue.) His entire locomotive was not painted, but patina'd in a manner similar to mine. His boiler jacket looked awesome - a little beat up, dinged, and well loved. I combined our two methods, and will never paint a boiler again.

The Process

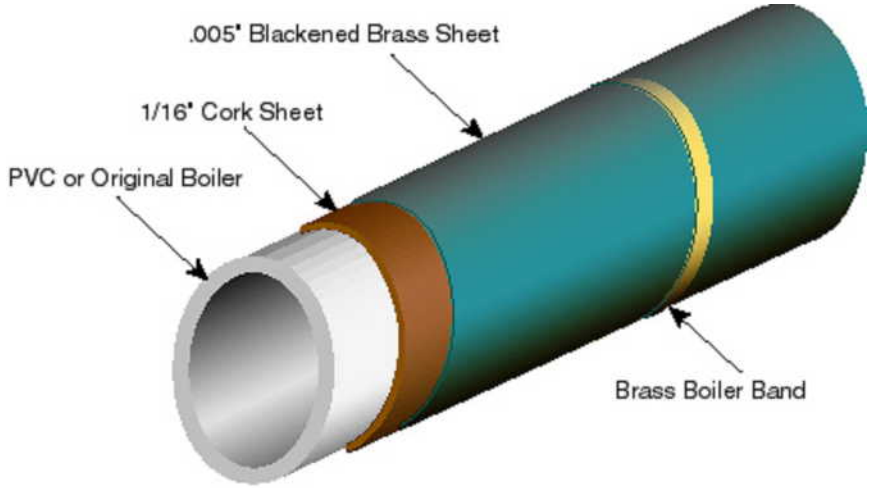
The key difference between my and Sonni’s methods lay in the thickness of the boiler jacket. I had been using .025” brass. Sonni used sheets that were considerably thinner. The jacket itself is .005" brass sheet. The thinness of the sheet allows for a much nicer finish.

The sheet is first treated with the chemical blackener. This is swabbed on with a Q-tip, working in little sections at a time until the entire thing is as dark as it can get. This will leave you with a smooth "black" brass sheet. It's not actually black, but a very dark bluish brown. You may find the blackening agent wanting to pool up, and not completely treat the areas to which you are applying the finish. There are a few ways to combat this. First, make sure the sheet is free from grease, oil, and dirt. A quick once over with household cleanser will work fine. You may want to take some very fine steel wool to the sheet as well. While this looks like it’s polishing the sheet, it’s also creating microscopic grooves that will help the liquid stay where you want it.

If you have a large supply of the chemical agent, you may try submerging the sheet into a bath. You may have to do this twice to get the darkest finish. One warning: too many trips through the bath will cause the patina to actually flake off, leaving you to start over again. If this happens, just rub the sheet with the steel wool again.

Now that your jacket is the color you want, you could apply it to the boiler as is, but the next step is what gives the jacket that “something extra.” Boiler jackets are seldom without blemishes. They are, after all, thin sheets of metal themselves, and subject to dings, scratches, and other blemishes from everyday use and handling during maintenance. To replicate this, I took the sheet outside to the driveway and walked on it. This gave a few minor nicks, dings, and pings to the sheet. A quick re-application of the blackening agent will cover any places where the patina had been scratched off. Now, you’re ready to apply the jacket to the locomotive.

Now, there are two ways to go about this. For a steam outline (electric) locomotive, it's pretty easy. In the case of the Bachmann Mogul kit-bash in the photos, the boiler was a piece of PVC pipe. The smokebox was wrapped in .005" styrene with rivets embossed in the back, similar to the techniques discussed in the MasterClass. On most American locos, the smokebox is an extension of the boiler tube, so the lagging and the jacketing add to the diameter of the boiler. To add the "lagging," I wrapped the PVC with 1/16" cork, then put the jacket on top of the lagging. I let the front edge of the jacket overhang the cork by 1/16" so I could bend it over to hide the cork lagging. Everything is then held in place by the boiler bands. (They were also blackened in a similar fashion, but not to the same degree.)



Patina Finish Boiler Jacket Construction

If you're applying this to an existing model boiler, such as the Bachmann Consolidation or something like that, the boiler is already larger in diameter than the smokebox, so you can skip the lagging step. Also the Mason Bogie does not require a different smokebox/boiler diameter, so again the lagging step is not needed. Simply wrap the boiler with the jacket, and secure with the boiler bands. In the case of the Mason, there is little difference between the smokebox diameter and that of the boiler, so again you can omit the lagging.

For a live steam locomotive, I place a "sub jacket" of .025" brass between the lagging and the thin, treated jacket. This sub jacket supports any accessories such as running boards, air pumps, domes, etc., that would otherwise just be screwed into the plastic or PVC pipe on an electric steam loco. Usually these mountings take the form of 0-80 studs that will stick out from inside the sub jacket.

Locating and Mounting the Fittings and Accessories

For the live steam version of this application, all the locating marks and fitting work can be done on the sub jacket, before the finished jacket is ever applied. Once you drill all your holes, wrap the finished jacket around, then go in from the back and lightly indent the finished sheet from the backside through the holes. You can then drill these holes out, and everything should line up. (Screw heads that protrude inside the sub jacket must ultimately be grinded or filed to less than the thickness of the lagging, which should likewise have holes cut to clear the screw heads.)

For the electric locos, there are two ways to go about locating and mounting fittings, depending on how brave you are. The first is to make your marks right onto the finished jacket. This offers one primary advantage. Since the boiler is cylindrical, and the finish is reflective, any light that is reflected will be reflected in a straight line along the cylinder. A gooseneck lamp with a single bulb makes this a fairly easy task - the trick is to not move either your eye or the lamp. (It's easy, really.) Use a small punch or scribe to lightly indent the brass sheet to locate your holes. The disadvantage to this is that if you miss your mark, you've made another blemish in the sheet. Depending on the degree of blemish, this could be a good or bad thing.

For those whose skin isn't that thick, wrap a sheet of paper around the outside of the boiler jacket, but under the bands. Make all your marks on the paper first. Then drill your holes once you're sure everything's in the right place. Loosen the bands, remove the paper, and voila! Fittings can then be screwed directly into the PVC or plastic.

Protecting the Finish

Depending on the chemicals used, the durability of the finish may vary. You want to make sure nothing is able to scratch the surface once the finish is completed. I haven't put any kind of protective coating on any of my jackets, and have had no real trouble with the finish wearing off. The advantage here is that if it does wear thin for whatever reason, be it handling or repairs, you can simply reapply the blackener to the affected area.

You may want to rub a light coating of oil over the surface to protect it a bit. This collects dust, though, and may ultimately dull the finish undesirably. Live steam locos naturally get this coating simply through everyday use.

There's also the option of spraying a clear finish over the jacket. I've not done this myself, but it is certainly an option. This would certainly protect the finish from wear and scratches.

Room for Experimentation

To date, I've worked with brass, and brass blackeners. There are other metals, and other chemical patina agents. I want to experiment with gun-bluing agents and steel sheets. There's lots of room to play with things to get a finish that fits your particular tastes. Nickel silver holds some promise, as it starts out a lot closer to a steel color than brass does. It may be possible to play with aluminum as well, although my attempts at blackening aluminum rail met with less than desirable results.

Finally

I don't know when locomotive builders and railroads started painting boiler jackets, or if there was ever a time when it became "standard practice." I do know that the majority of locomotives in my time frame (c.1900) had unpainted jackets, at least the eastern US narrow gauge locos to which I'm partial.

I'm a big fan of using "real" materials whenever possible. If a cab was build out of wood, then I want to use wood. There's not much point in simulating materials when the real thing is at hand, and easily workable. (Although I do use styrene for tenders and steel cabs, so long as they're going to be painted.) Patina'd boiler jackets are simply an outgrowth of that practice. It has a nice look, and reflects light beautifully the way I can only imagine the prototypes did 100 years ago.