MLS MasterClass Mini - 2005

"THE SINGLES"
Build a Classic American 4-2-4T Locomotive

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MasterClass Mini 2005
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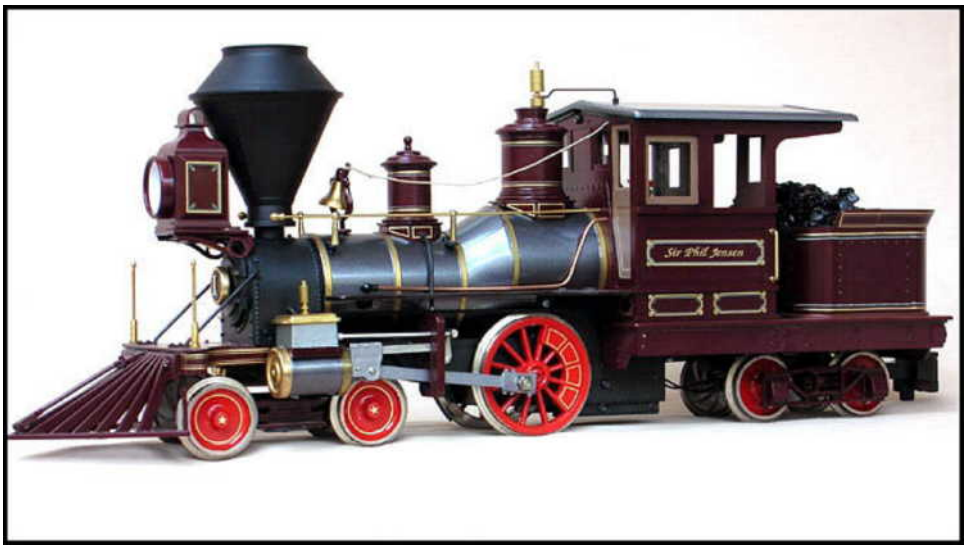
Chapter 2 - The Boiler & Superstructure
Construction

We're back and its time to finish things up…!

Alright-already... time to build the superstructure to our gorgeous locomotive!

I suggest you read all of this chapter first before starting work; the order of construction may differ from the order of these instructions.

The construction of the superstructure for the locomotive is undertaken in sub assemblies, or modules that are detailed completely, painted and set aside as completed elements, only to be brought together near the end. Take care to complete each sub-assembly in turn, rather than doing them all at once and paint each assembly before the final assembly. The colour scheme and paints used are up to you. Jim Wilke has outlined the colour schemes used on the real *"C.P. Huntington"* over her lifetime in the *'background'* section of the previous chapter, but also bear in mind that this is a freelance loco, based on a real prototype, and as such the colour scheme really is up to you. Personally I prefer mine to be based on a real colour scheme. Had such a 4-2-4T been built for a NG railroad by Danforth Cooke in the 1860s or early 1870s, the scheme shown on my model is one possibility of what it may have looked like.



The *"C.P. Huntington"* - Decal Set:

MLS are pleased to provide a decal set for this locomotive, as seen in the picture above. The decal set comes complete with wheel line-work and stars, decorative dome trim, pilot trim, cab, headlight and tender line-work as well as the fancy line-work applied to the smoke stack as seen on the preserved loco today (Not seen on the above model). The decal set is based on the decoration of the real *"C.P. Huntington"* as she looks today and can be applied over a variety of base colours, such as Wine (used above) Lake-Brown, Dark Blue, or Dark Green. The cab panel decoration comes complete with the names, 'CP Huntington' and 'Sir Phil Jensen', or as a blank panel. You can also request your own locomotive name from Stan. Mine is named after a personal friend and hero of mine, and supporter of this class, Phil Jensen.

The decal set has been produced by **Stan Cedarleaf** of MLS, and is available for $35.00 per complete loco set, plus postage costs. Please contact Stan to order your set. Each set comes complete with 3 pages of decals - two pages do a complete loco, the 3rd page is redundant - for screw-ups!

Let's Get Started!

Download the Drawing PDF sets for this chapter here.

(Note: That the same PDF's are needed for all versions. If building the 'Judah', you just don't need to use all the parts)

The Pilot PDF:

Due to public pressure, and the difficulty in finding *Lionel* and *Accucraft Pilots* in Chapter 1, I've created a PDF for the *"C.P. Huntington"* Pilot, in the above PDF set; **CPH-CH2-2.pdf**. The pilot is based on the current CPH pilot style, including the pilot steps. Please cut and assemble using 2mm styrene sheet.

We build the CPH pilot in the same way that we built the Mason pilot, except build it using 2mm styrene, instead of the 2.5mm thick material. For further reference and a quick run down of the assembly method to use, refer to MasterClass 2002, Chapter 2:

MLS MasterClass 2002 - Build a Mason Bogie - Chapter 2

The *"As Built"* CPH 1860's Gothic Cab:

Also due to public pressure, we have drawn up the complete templates for making your own 1860s Gothic Cab from layers of 1mm styrene sheet. The cab represents the style used on the *"Original"* Danforth Cooke 4-2-4Ts (and other locos) during the 1860s.

Assembling The Cab: There are obviously 4 walls to assemble to make a full cab. Each of the 4 walls is made from 3 layers of styrene. The three layers need to be literally laminated together forming a single 3mm thick wall, made from the three, 1mm thick layers.

The layers are:

- Inside layer (this is the backing layer)
- Middle layer
- Outer Layer (this is the outermost layer)

You need to weld the wall layers together. Try to spread the welder evenly (brush it on) to one wall face only, and drop the next layer down on top of it. Use books or something to press them together flat. Don't use too much welded, or let it pool, just grease the parts with welder. With two layers welded, then grease the face of the middle layer and apply the outer layer to it, again press it together and press flat with books. Each layer should dry in about 5 minutes.

NOW the most important thing to note is that the side edges of the wall layers WILL NOT ALIGN, but the top and bottom edges will align. The inside layer is actually smaller than the outside layer. This is so the corners of the cab, where the completed walls come together are all stepped and interlocked. Thus when welding the layers together just use the windows etc and top and bottom edges to get the layers aligned. Just ensure the side edges are equally not aligned at both edges!

Next weld the 4 walls together. This is done by holding a sidewall up, and butting the front wall into the back of the sidewall. You will find the front face of the front wall is exactly level with the front edge of the sidewall. Do exactly the same with the rear. You will not see the edges of either the front or rear wall's edges from the side; they are always covered by the sidewalls. Reference the **AS-BUILT-CPH-4.pdf** drawing *(Plan View - Cab Wall Layers)*.

For further reference take a look at the Making of the Mason cab in MasterClass 2002 Chapter 4, just look at how the corners come together, it's exactly the same:

MLS MasterClass 2002 - Build a Mason Bogie - Chapter 4

Once the 4 walls are joined together, apply the top arch details to the upper sides of the 4 walls. Again the side pieces will overlap the edges of the front pieces.

I usually reinforce the cab corners (below the window line) with 4.6mm SHS, welded in place. Also along the top edge of the sidewalls, you can weld an angle 3.5mm x 3.5mm or so. This will keep the cab walls straight, and also provide a surface to weld the roof. The angle will also help to keep the rear cab outreachers straight - they are very long on this cab, reaching well over the tender! Roll the roof piece on the floor... on carpet so that it can sink in a bit. Use a bit of pipe or something and roll over the styrene like dough. It will begin to curl up. Test the roof curvature on your model, and roll some more. When the curvature matches the cab, place the roof in place and weld it from the inside of the cab, but not too much welder, or it will ooze right out onto the outside cab walls!

Here are some views of the cab in construction, as built by Rick Raively:

Modifying The Heartland Cab:

Rummage through your Hartland kit for the cab kit. The cab kit contains 4 cab walls, cab roof, two cab grab rails and side window frame trim. Take out the 4 cab walls check their fitment to each other (they only go together one way!). When you've worked out how they are supposed to fit, use welding cement to glue the 4 walls together. Take great care not to get your fingers stuck to the walls sides, or your finger prints will sink into the sides! Not nice. Also be sure that each of the corner joints are pressed hard together. Ensure the 4 walls are square in all 3 dimensions. Use a drafting angle to check the 90-degree intersections.

Here are a couple of the cab wall parts.

Typically the Hartland walls are green, allowing you to paint the exteriors, leaving a green interior. A locomotive such as this from the 1860s-70s however would have had a polished wood interior, so painting the interior brown may be an option.

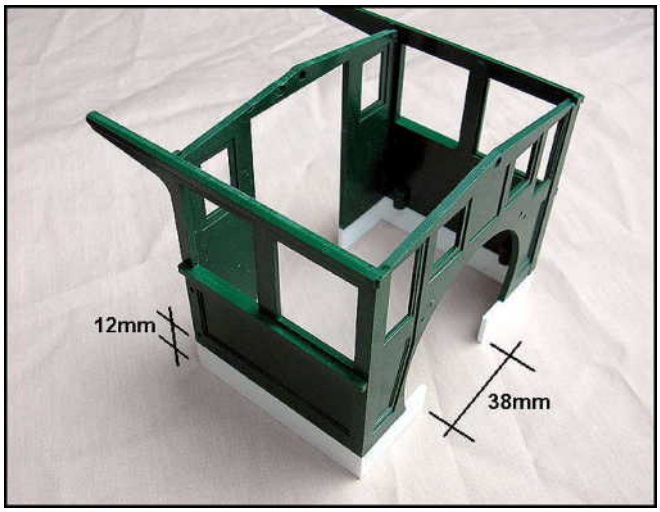
Step 1 - Extending the Height of the Cab to 1:20.3 Size:

The real *"C.P. Huntington"* has a tall panelled cab. This is most useful to us, because we will extend the height of our cab by adding some more panelling to the lower edge of the cab walls, and hide the joints behind ornate moldings! In doing so we shall add 12mm extra height to the cab. If building the *'Judah'* 4-2-2 tender loco, you can ignore this step, as the *'Judah'* has no cab extensions.

You will notice that the Hartland cab wall thickness is approx 2.5mm thick. What we shall do is create 2.5mm thick extensions by laminating 2mm and 0.5mm styrene sheet together. Begin by cutting about a 400mm length of 2mm thick styrene, 12mm wide. Also cut a 400mm length of 0.5mm styrene sheet, 12mm wide.

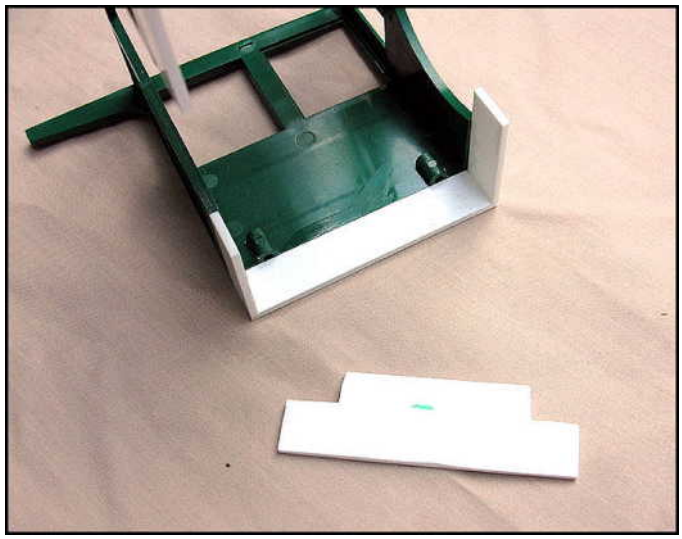
Align the 2mm thick strip along the base of the cab walls; mark off 6 lengths of styrene strip to match the wall lengths. The two lengths below the sidewalls should match the cab wall length exactly. The strips below the rear walls should match the lengths of the two wall elements on the rear. On the front wall, the extensions are to run beyond the wall lengths, leaving only a 38mm gap between the two sides. This 38mm opening aligns with the width of the firebox on your chassis.

Weld the 2mm thick strip directly to the bottom edge of the cab wall. Align the inside face of the styrene with the inside face of the cab wall. Apply to all cab sides, check your corners - keep them vertical and in line with cab edges. Next weld the 12mm wide 0.5mm styrene strip on top of the 2mm base layer. The outer face of he 0.5mm sheet should align with the outer face of the cab wall. The application of styrene extensions should look like this:



Step 2 - Supporting the Cab Wall Extensions:

Time to support those wall extensions to protect them from buckling, and to enable a better hold to the Hartland cab. Cut out a 60mm long plate of 2mm styrene sheet, 20mm wide. Trim the styrene sheet to match the internal length of the cab wall. Next, cut out notches in the upper corners of the plate to align with the existing fixing points on the lower cab walls. Cut two plates to the same pattern. The plates should look like this:



Next weld the two plates to the inside face of the two sidewalls of the cab, aligning the bottom edges with the very bottom of the cab walls. Weld hard and firm.

Step 3 - The Cab Trim:

To hide the joints in our cab walls, and also give it some decorative punch, we will add some trim strips along the tops and bottoms of the panel extensions. Cut yourself a 400mm length of 1mm styrene strip; make the strips 2mm wide.

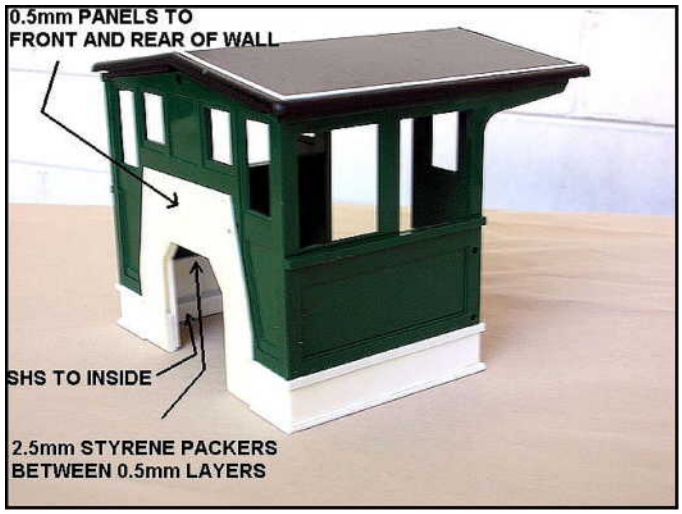
The Upper strip: Along the bottom of the Hartland cab wall area; apply a 2mm wide strip around the complete perimeter at a position just above the styrene extensions. Weld the strip in place such that the very bottom of the strip is in line with the very top of the cab extensions. This means the strip is welded to the cab wall proper, and does not actually touch the extensions at all.

The lower strips: Along the very bottom of the complete cab, apply a 2mm wide strip. Weld this strip to the sides of the cab wall extensions, with the bottom of the strip aligning with the bottom edge of the walls. Next cut a 1mm wide strip of 1mm styrene, creating a 1x1mm rod. Weld this rod on top of the lower 2mm wide strip, right along the perimeter of the cab's base. The finished upper and lower strips should look like this:

Step 4 - The Front Cab Wall:

On the front cab wall we need to apply a filler panel. This is to close the gap between the huge Hartland 4-4-0 boiler down to the narrow proportions of our *"C.P. Huntington"* boiler. It also serves to replicate the metal panels bolted to the cab wall on the prototype.

Take the ***PDF entitled "Front cab wall" CPH-CH2-6.pdf*** and cut out the template in 0.5mm styrene. Cut out the pattern twice. One is used for the inside face one for the external face of the front wall. Weld the styrene plates to the cab wall, aligning the base with the bottom of the cab. Take care to centre the panels properly on the cab wall. Using some 2mm and 0.5mm thick styrene strips as packers between the inner and outer panels to provide rigidity. The cab as seen from the front will look like this:



Cab Roof Strips - note on the above photo, the white styrene trim around the cab roof edge. This is a 2mm wide strip of styrene, 1mm thick. It is welded to the roof, 2mm inboard from the edge of the roof, creating an edge molding of sort. This detail is optional.

Finally to the inside face of the sidewalls, apply lengths of 6.4mm SHS or 10mm x10mm styrene angle as shown on the PDF. These SHS or angles provide for the fixing of the cab to the deck later in the project. Weld them to the sidewalls good, they need to be strong.

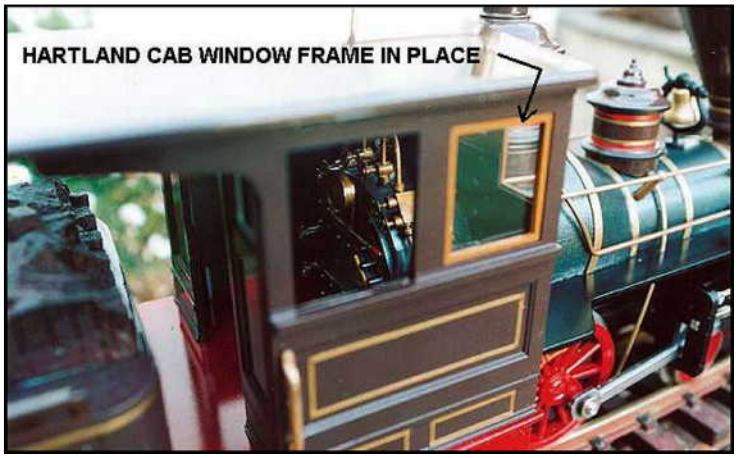
Step 5 - Final Details to the Cab:

Apply the two H-L-W handrails to the cab sidewalls. There are holes preformed for the handrails to slip into.

Following the PDF of the front cab wall, note the FOUR 1.5mm holes to be drilled:

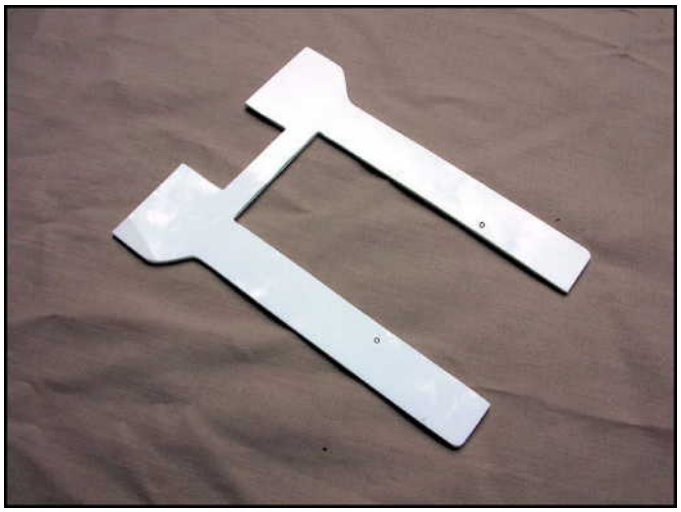
- Hole #1 is for the bell cord.
- Hole #2 and #3 are for the water feed pipes.
- Hole #4 is for the blower steam line.

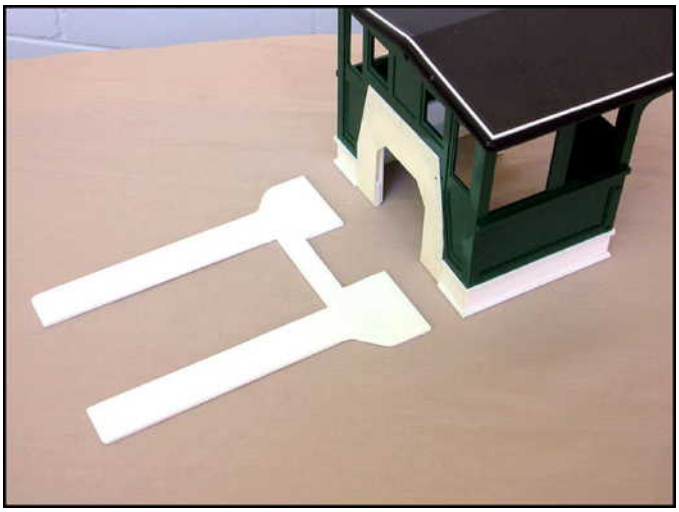
OK, now you're ready to paint the cab. Consider also painting the separate window frames in the cab kit prior to inserting them into the cab. The window frames come with a vertical and horizontal mullion of typical post 1900 design. Using your knife trim out those central mullions such that the window frames are now just outer frames. Paint and glue them into the forward of the two side windows. The cab window will look sorta kinda like this:



Step 6 - The Running Boards:

This is an easy step! Take the ***PDF entitled "Running Boards Template" (CPH-CH2-3.pdf)*** trace the funny looking pattern onto 2mm thick styrene and cut the part out. Sand the edges to a nice semi-rounded edge. Take note of the little holes to be drilled into the running boards for the sand lines to pass. Drill the holes using a 2mm drill bit (or thereabouts). The sand line that will run through these holes will be 1.5mm thick. *Folks building the "Judah" 4-2-2 will need to cut out a slightly different running board template, that includes the cab floor in a longer unit* ***(CPH-CH2-29.pdf)***.





Building the Boiler:

Step 7 - The Boiler Pipes:

The CP Huntington Boiler is made from 3 Pipe sizes:

- Smokebox pipe (37-38mm pipe).
- Boiler Pipe (42-43mm pipe).
- Upper Wagon-top Boiler Pipe. (50-51mm pipe).

Cutting Pipes -You will be cutting the 3 pipes following the ***PDF sheet entitled "Boiler Pipes" (CPH-CH2-8.pdf)***. To cut a boiler end perpendicular to the pipe (i.e., cut the bloody pipe square), there are several methods.

1. Use some wide masking tape, wrap it around the pipe evenly... when the tape wraps right the way round back to the point of origin and aligns with the start of the tape, then the tape is perpendicular to the pipe. Use the edge of the masking take as your cutting line. Use a Jeweler's saw to cut the pipe. Cut slowly and watch to stay on that line. When cut, roll the pipe along a tabletop and look to see of the edge of the pipe visually wobbles as you roll it. If it wobbles, the pipe is not cut square.
2. Use a square piece of paper (make sure edges of the paper are cut at right angles). Wrap the paper tightly around the pipe until the edges meet at the start and finish of the sheet. Align the edges of the paper, creating a perfect paper cylinder around the pipe. The edge of the paper is perfectly perpendicular to the pipe, mark the pipe with the pencil along the edge of the paper and cut along the line. Do the visual *'rolling wobble'* check.

Boiler Pipe: We start with the boiler pipe itself, because the other two pipe sizes relate to this pipe. Go out into the world and search for a 1 ft. length of 42-43mm PVC or styrene pipe. Maximum size of pipe to be no more than 43mm. The 42mm is the outside diameter of the pipe, not the inside! Using the PDF, follow the templates to cut the boiler pipe to the correct length.

If you cannot find a 42mm pipe, then look for something a little smaller... such as a 36-38mm pipe. If using as smaller pipe, we shall use the one pipe to run right through from smokebox front to rear of boiler. Therefore you need to cut the pipe at the extended length shown in the PDF. This *'narrower boiler'* method will require you to apply a 1mm styrene wrapper to the wider boiler area, packing out the boiler area to the required 42mm.

This is the tricky bit - illusions work in model making all the time... sometimes for good, but often for bad. Nothing will destroy the lines of your loco more than running boards that are not level against the boiler. Running boards that run uphill toward the front make the boiler look awkward like it runs uphill also. A crooked boiler looks just woeful! So we gotta talk about datum lines... yeah I know I've been harping on about this since MC2001! But we need to apply some lines to the boiler pipe sides so that your stack, domes and running boards are all plumb.

The Datum Lines: The aim:

- Make sure the running boards are level down the boiler side.
- Make sure the running boards are level as seen from the front...both sides much be the same height!
- Make sure that the domes and stack all point in the same direction, and that this direction is VERTICAL... UP! Not sideways as seen from the front!

The easiest way to draw a straight line along the side of a pipe is to use a small length of equal angle... such as a 10mm x 10mm Angle. Drop the angle onto the pipe side and right away that angle will only sit on the pipe exactly parallel with the pipe. Vance Bass taught me this one it's served me well on numerous locos now! Draw a pencil line along your boiler pipe. Call this the *"lower datum"*, or the line that runs along the very bottom of the boiler.

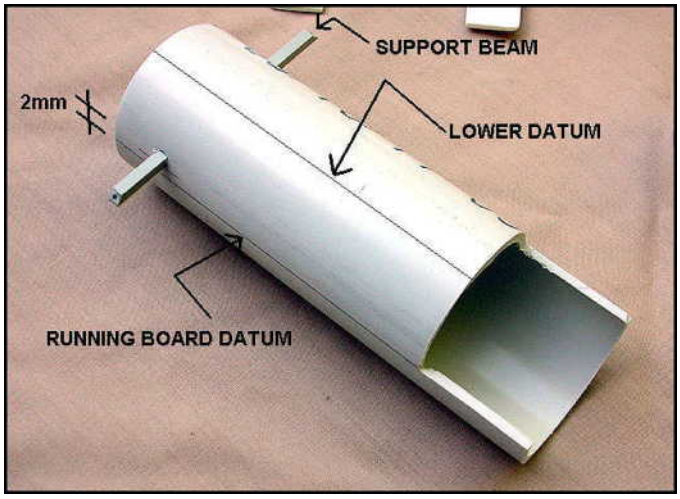
Next draw the upper datum. The upper datum is the line that runs along the very top of the boiler and is the line you use to attach the domes etc. in the right line. Do not draw the upper datum by eye or you will get it wrong every time. Drop of the end of the boiler pipe down onto the ***PDF entitled "Boiler Pipes" (CPH-CH2-8.pdf)*** in the area labeled *'Datum lines.'* Align your lower datum with the *'lower datum'* point on the PDF. Now make a pencil mark on the end of the pipe exactly where the *'upper datum'* line is shown on the PDF and also the two *"running board datum lines"* shown near the lower datum point. Make sure these 3 marks are good and clear on your pipe. Next get your 10mm x 10mm angle again rule lines along the pipe length taking off from those 3 datum points. You should now have an upper, lower and 2 running board lines drawn on your boiler. Next, drop the pipe end down onto the PDF again, but this time drop the other end onto the page. Again align the lower datum with the point on the PDF. Check that the 3 other datum points align with the ends of your ruled lines -- if they are out, START AGAIN!! The reason they may be out is that your 10mm x 10mm angle might have a sprue on it, or is bent, or you did not keep your pencil vertical as you drew. Perfection may not be possible, but you want that datum to check all the way to within 1mm of the marks on the page.

Right, now that the datum lines are sorted, time to cut out that section from the rear of the boiler. This is where the firebox butts into the boiler. Use a Dremel tool or jeweler's saw to cut along the two running board datum's to the point 30mm in from the end of the boiler. Then cut between the two datum cuts, perpendicular to the boiler pipe. Cut out that rear section completely, sand and clean up the cut. Your running board assembly will run hard against these cut edges. The top of the running boards will be in line with the running board datum for the length of the pipe.

Next, we need to apply the running board support beam toward the front end of the boiler.

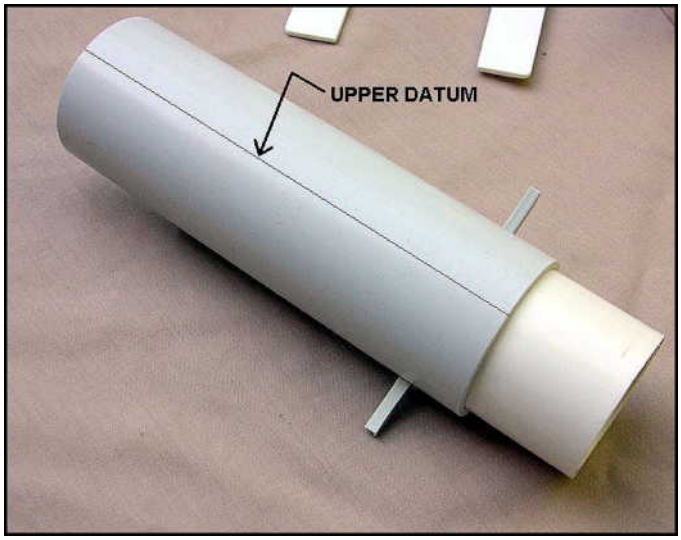
This beam should be 3.2mm Plastruct SHS and should run right across the width of the boiler in one piece. Use a drill bit that is the same diameter as the diagonal width of the SHS. Drill a hole in the boiler side to both sides as shown in the PDF. The top of the hole should be exactly 2mm lower than running board datum lines, that is, level with the bottom of the running board unit. Insert the 3.2mm SHS beam and drop your running board unit in place. Check to see the running boards are level with your running board datum line. If the boards droop to the front, add a 0.5mm shim of styrene on top of the 3.2mm SHS to raise up the front end of the running boards to level. If the running boards run up hill, slide the 3.2mm beam out file out the bottom of the holes a little to lower the beam. Don't worry if there is now an elongated hole where the beam runs it. So long as the hole does not extend above the running board datum line, it will be hidden behind the thickness of the running boards themselves.

Check that the beam is level across the boiler as seen from the front. Level means level with the cut out section at the rear of the boiler. Use a couple of blobs of epoxy on the inside the boiler to bond the beam into place



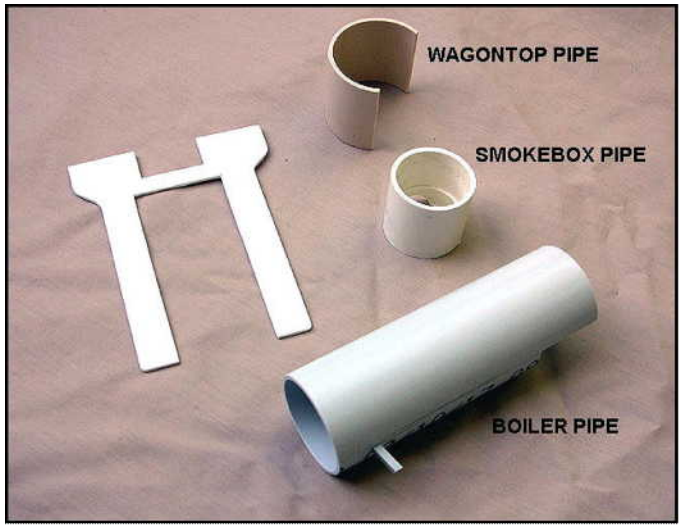
The boiler pipe trimmed to length, with the rear area trimmed out as shown - follow the PDF. Running board support beam also shown inserted into the boiler.

Smokebox Pipe: The smokebox pipe will be a pipe smaller than the boiler pipe. This will be a pipe that slides snug inside the 42mm boiler pipe. I used a PVC pipe connector that happened to be the right size. Slide the pipe into the boiler front end until it stops against the running board beam inside. My smokebox pipe is 37mm in diameter. Cut a length of this pipe approx 50mm long, check against the ***PDF titled 'Boiler Pipes' (CHP-CH2-8.pdf)***. If the pipe you find is just too tight to slide into the boiler pipe, then use a Dremel tool and grind out sides of the pipe slightly in the area where the pipe should slide into the boiler.



Smokebox pipe shown inserted into boiler pipe, stopping against running board beam.

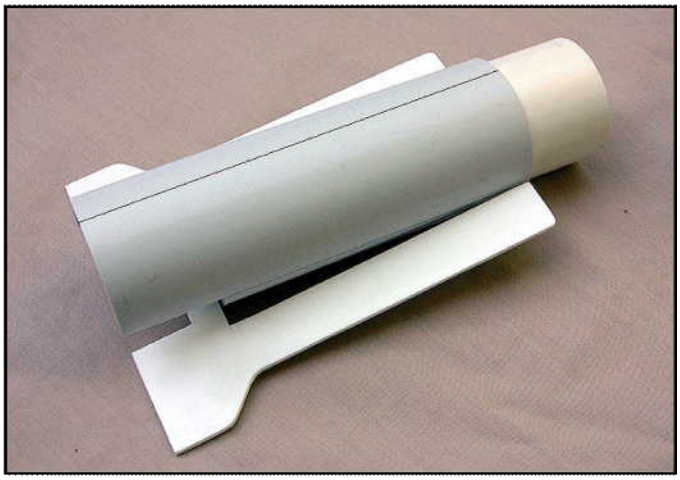
Wagon-top Pipe: For the wagon top we cut up a section of 50mm PVC pipe. Not more than 51mm, not less than 49mm. Cut a length of the pipe following the ***PDF titled 'Boiler Pipes' (CPH-CH2-8.pdf)***, trim off one side to create an arc pipe. Use your 10mm x 10mm angle to ensure you cut lines exactly parallel with the pipe.

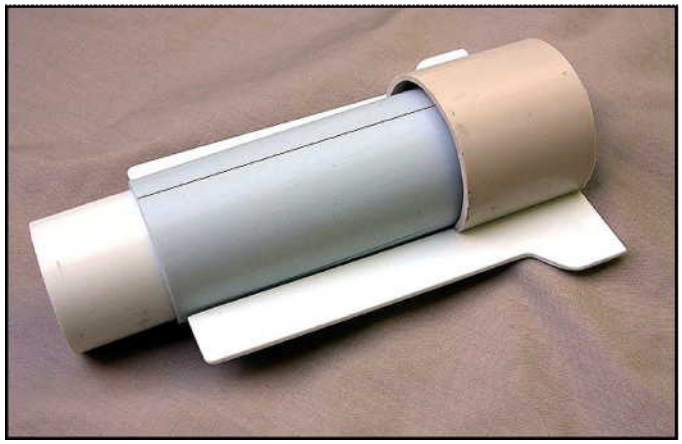


The three pipes look like these:

Making the Wagon-top: Now comes the interesting part, we need to build a strong wagon-top section to the boiler.

Take the running board assembly; slot it into the base of the boiler loosely like this. Do not glue the running boards in place yet.





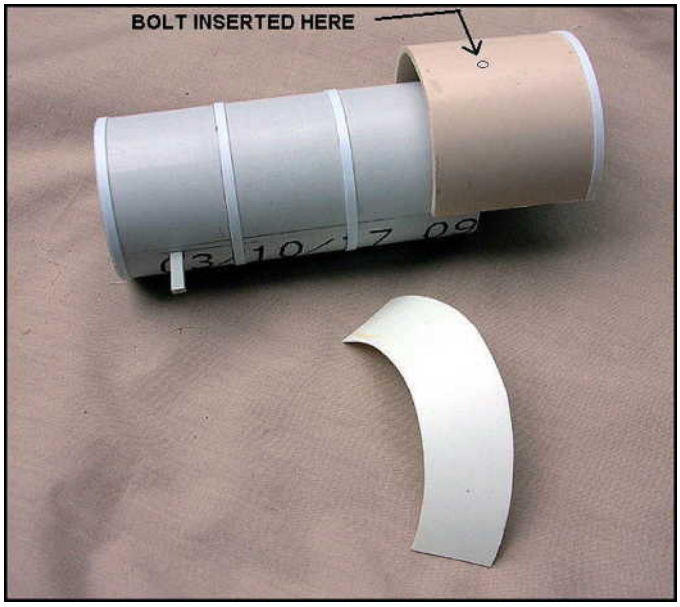
Next take your wagon top pipe section and drop it over the top of the rear end of your boiler like this:

Keep holding the running boards hard against the bottom of the boiler. This will locate the height of the wagon top above the boiler pipe. Measure the height of the space between the top of the boiler pipe the inside top of the wagon top. It should be a space in the order of 12mm tall. Use a 10mm SHS, 40mm long, with some layers of styrene sheet as packers either side and create a spacer between the two pipes. Use some CA cement to glue the spacer to the top of the boiler, exactly on top of the Upper Datum line, and then glue the wagon top down onto the top of the spacer. Check to see that the wagon top section is square with the boiler, pointing in the same direction and that the tops of the two pipes are parallel. Now insert a bolt down through the top of the wagon top, through the SHS spacer, down into the lower boiler. Make sure you drill and insert this bolt approx 5mm forward of the dead centre of the Wagon-top pipe. The dead centre position should remain free for the fixing of the steam dome centre later on.

Step 9 - The Boiler Bands:

Cut some strips of 0.5mm styrene, 2.5mm wide, not more than 3mm wide. Draw some lines on the boiler side following the boiler band positions as shown on the ***PDF titled 'Making The Wagon Top' (CPH-CH2-10.pdf)***. It's best to draw a line to one side of each boiler band, rather than a line down the centre, this way you can see what you're doing while trying to apply the boiler bands exactly perpendicular to the pipe. Use the paper cylinder, or wide masking tape method to draw these pencil lines plum with the boiler pipe. You don't want the boiler bands leaning forward or back as seen from the side! OK, now apply a greasing of CA to the back of your 0.5mm styrene boiler band strips. Start gluing the strips on from the lower datum boiler line (so the boiler band joint is out of sight), slowly wrap the band around the pipe following your pencil lines. Be careful, nothing bonds better than this thin styrene to PVC pipe, so you don't get two goes at this! Get it straight on the first go. The only boiler band we don't apply at this point is the one at the lead end of the wagon top. We apply that after the wagon top flare is done.

The boiler bands should look like this:



Note - It is perfectly reasonable to not use styrene strip for the boiler bands. You can spray paint the completed boiler later on then wrap real brass strips around the boiler instead. Brass bands do not need to be glued to the boiler at all. Instead drill a hole in lower datum along the boiler base at each position where the boiler bands go. After the boiler is painted (later on), wrap the brass bands around the boiler and insert the ends into the holes in the baseline of the boiler. Bend the ends back against the inside of the boiler pipe so that the boiler band is tight to the boiler side, secured from inside the boiler via the bent ends inserted in the base. The two bands that run around the wagon top can simply be folded around the cut bottom edge of the wagon top

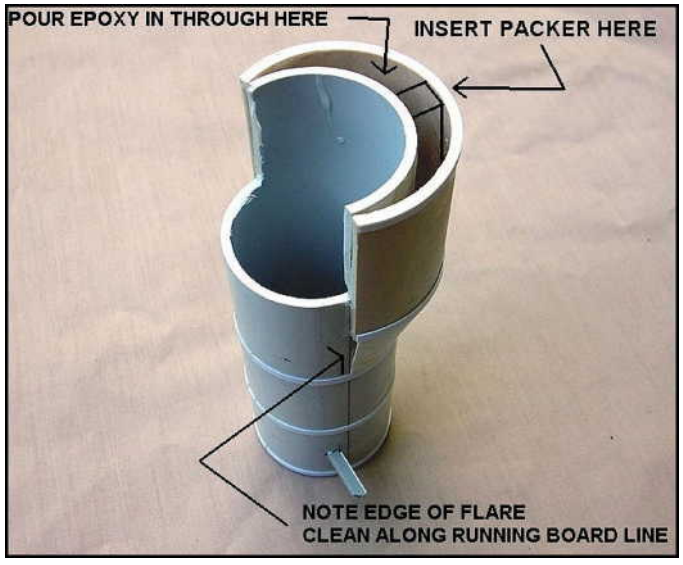
Step 10 - The Wagon Top Flare:

Following the ***PDF titled 'Making the Wagon Top" (CPH-CH2-10.pdf)***, cut out the fan shaped object using 0.5mm styrene sheet. The flare will look like the previous photo.

Use a bit of spare pipe and roll the flare like dough with a rolling pin. You don't need to roll it into a tight curve, just begin to coax it into thinking it's curved, so that it is bent like the above photo. Use a roller to do this, don't bend it by hand or you will get kinks in it.

Now, take note of the centre line of the flare. Just drop the flare section onto your pipe, such that the leading edge of the flare butts hard into the edge of the rearmost boiler band on the narrow boiler. Align the flare centreline with the upper datum on your boiler pipe. Bend the flare around the boiler on either side of the datum. The flare should form nicely around the pipe, with the leading edge always clean against the boiler band the rear edge just covering the exposed edge of the wagon top. If the fit is good, you're ready to glue the flare in place. If the fit is not good - the flare doesn't meet the upper wagon top, or does, but only in places, or the sides do not align with the running board datum lines, then make a note of the errors draw the differences onto your flare PDF, trim out a new flare and try the fit again. It's OK if the flare goes beyond the wagon-top edge, or extends beyond the running board datums on either side, because you can trim them back after the flare is glued in position. The reason your flare may be different might be due to slightly different pipe sizes, different location of boiler band or different wagon-top height. None of these are a problem, just be prepared for the flare to not fit perfectly without the need to adjust the template slightly.

OK, now to glue the flare. Run a line of CA along the inside leading edge of the flare (this is the smaller arc in the flare). Butt the flare into the boiler band edge again. Press the flare around the boiler, gluing the leading edge to the smaller pipe only. Quickly get some masking tape and run some tape over the flare at the leading edge so you can relieve your fingers. Still holding the flare in place, run a 2nd piece of masking tape around the rear end of the flare holding the upper edge of the flare to the wagon top pipe. The whole flare is now held in position, glued at the front edge, but held by tape at both front and rear edges. Next check the edges of the flare where they will meet the running boards. It should be a nice shallow triangular space between flare and the narrow boiler pipe. If the flare is blowing outward, apply some masking tape along the edge to pull it back to a flat face long the flare. Cover the exposed triangular spaces under the flare at the running board line with tape.

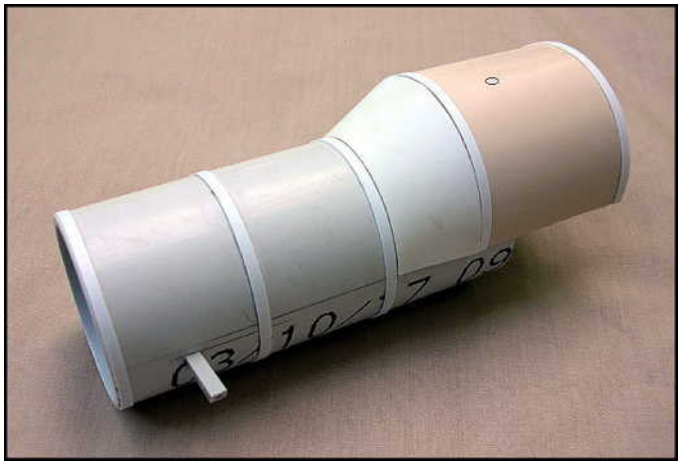


Mix up a batch of 5 min epoxy, or Aryldite. Pour in a bunch from the rear end of the boiler. Pour it in through the space between boiler pipe and wagon top pipe as seen from the rear.

The epoxy will build up inside the leading edge of the flare. You can fill the entire area of the flare with epoxy if you wish, but I don't. I fill it about half way then turn the boiler upside down, flat on the bench.

All the epoxy oozes to the inside face of the flare, reinforcing the entire inside of the flare area. Allow some to ooze back to the junction between rear of flare and start of the wagon top pipe. You need glue here to fix the rear end of the flare in place. When the stuff's gone hard, carefully remove the tape. Watch for any delaminating, especially at the edges where the running board line is. If the epoxy is hard, you can use CA to hold the flare back to the epoxy in a case of delaminating. If you find there is not enough epoxy in there and the running board opening is dry, make up some more epoxy and pour it into the triangular spaces at those locations. All in all, you will now have a fully cast wagon top flare to the boiler, reinforced by epoxy, with a 0.5mm styrene sheet outer facing. Now get sanding, sand along the upper edges especially, so that the upper edge of the flare is level with the wagon top.

Now apply that final boiler band around the top of the wagon top, right next to the top of the flare. The whole thing should look like this:

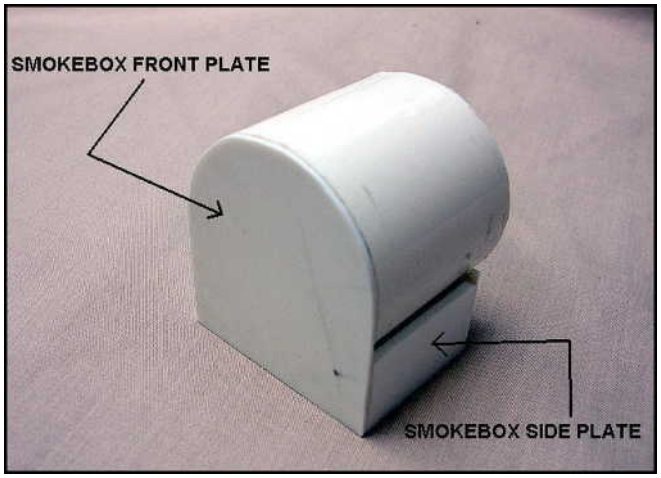


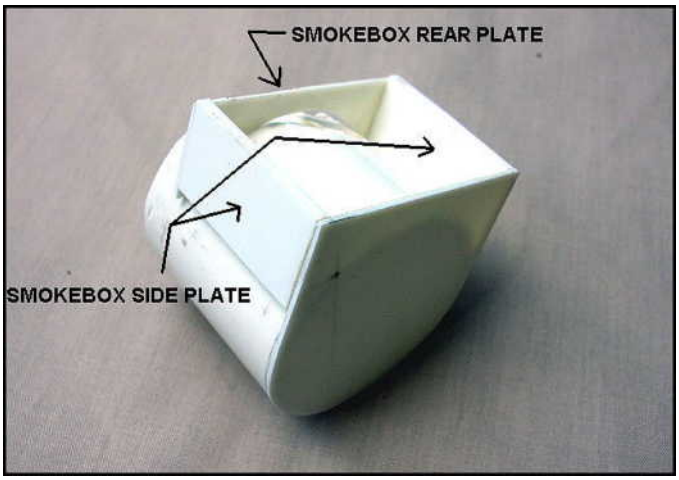
Step 11 - The Smokebox:

The *"C.P. Huntington"* has a classic 1860s style smokebox, of the *'trunk'* type, or shaped like a *'D'* there is no saddle. This same design was used on a lot of Civil War era locos, such as the sister loco, Danforth Cooke & Co.'s *"Texas"* of *The Great Locomotive Chase* fame. The Rogers *"The General"* also had this style of smokebox. While not a favorite of mine (I like a good Baldwin style saddle any day) this type of smokebox is remarkably simple and easy to make - which for us is a bonus!

Take the smokebox pipe you cut in Step 7 and prepare to detail it. Using the ***PDF titled "Smokebox Patterns" (CPH-CH2-11.pdf)***, cut out the smokebox front plate and rear plate and two sides using 1mm thick styrene sheet.

Glue the front plate over the front end of the smokebox pipe, aligning the edges. I use CA for this. Weld the two side plates onto the rear edges of the front plate, along the straight edges. Then weld into position the rear plate onto the edges of the side plates. The thing will look like this:



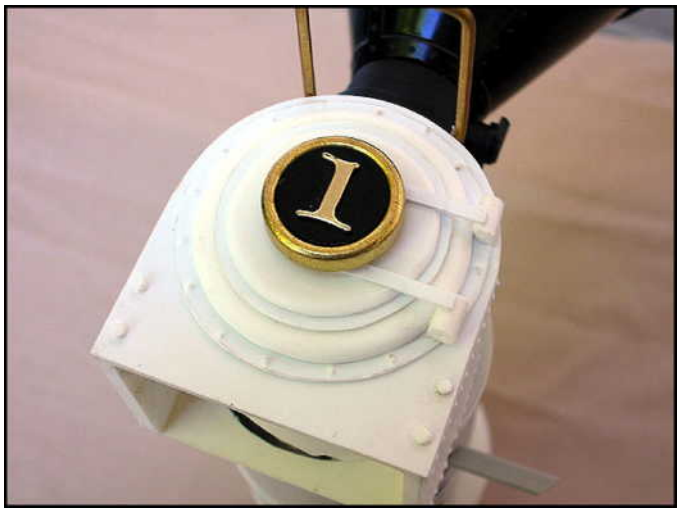
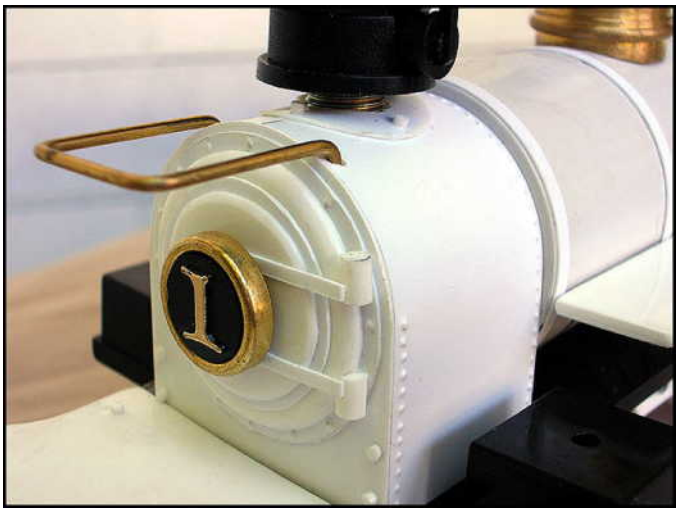


Now, from the smokebox ***PDF titled 'Smokebox Patterns' (CPH-CH2-11.pdf)***, cut out the *'Smokebox Wrapper'* using 0.5mm styrene. Note the positions of the rivet heads along the edges. The front edge only has rivets toward the ends, while the centre edge is free of rivets. Using a ruler, punch in rivets at 2mm spacing along the front and rear edge of the wrapper. Using epoxy or CA, smeared thinly all over the rear face of the wrapper, press the wrapper over the smokebox assembly, and down over the sides of the side plates. The leading edge of the wrapper should be flush with the outer face of the front and rear plates.

Now, to the smokebox front. There are a bunch of PDF's to follow here, using the ***PDF titled 'Smokebox Details (CPH-CH2-12.pdf)***.

- Smokebox front face in 0.5mm styrene. This should be welded to the front plate, with the edges level with the finished smokebox wrapper.
- Cut out all the funky circles in the PDF. There are 4 circles to be cut: two in 0.5mm styrene, two in 2mm styrene. The larger 0.5mm styrene circle should have a line of rivets punched in around the perimeter.

The two 2mm thick circles should have the edges sanded to a nice taper. Weld the 4 circles together in ascending order, apply this to the smokebox front, and cut the 0.5mm door hinge strips and 3mm tubes for hinges. Measure the centre of the smokebox door - be precise and then drill the centre to enable the Hartland number plate '1' to slip in. Weld them all into place so that whole thing looks like this:

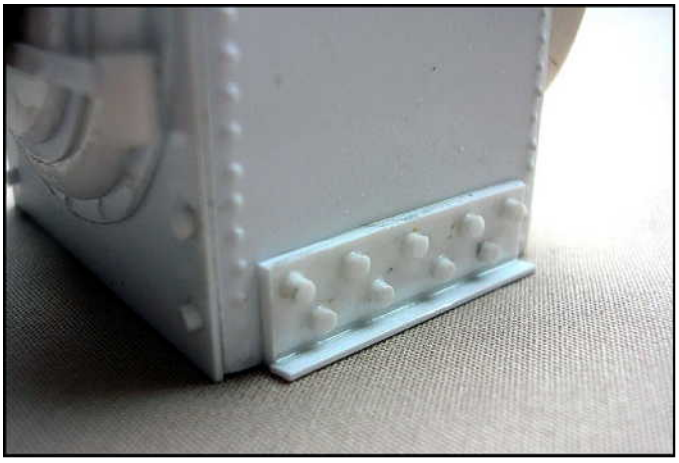
Additional Smokebox Detail:
On the front of the smokebox there are 4 large rivet heads shown on the PDF and can be seen in the above photos. Slice up some 1mm styrene rod into rivet heads and weld them into place as seen above.

On the top of the smokebox is a mounting plate for the stack. Using an angle along the smokebox base, create a new *'Upper datum'* to the top of the smokebox. It must be a taken from a line running vertical exactly centre of the smokebox front plate perpendicular to the base.

Using the ***PDF titled "Smokebox Patterns" (CPH-CH2-11.pdf)***, cut out the *'smoke stack base'* in 0.5mm styrene weld it to the exact centre of the top of the smokebox. Bend it around the curved smokebox top. Trim four 1mm rivets from the 1mm rivet rod and weld them in the 3, 6, 9 and 12 o'clock points on the smokestack base, as seen above.

Along the bottom of the locomotive's smokebox are some heavy mounting plates use to mount the cylinders to the side of the *'D'* type smokebox.

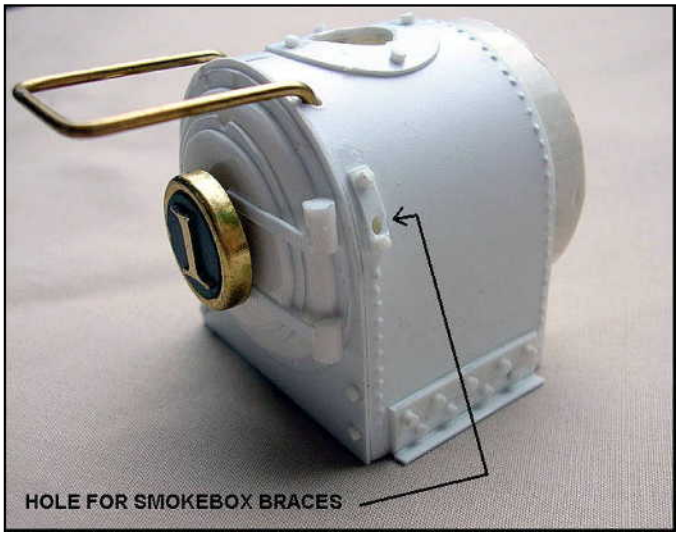
These are easy for us to make. Using the ***PDF titled "Smokebox Details" (CPH-CH2-12.pdf)*****,** follow the details in the PDF for the making the smokebox *'Mounting Plates'*. You will form 2 'L' shaped patches of 1mm thick styrene. Apply these to the central bottom of the smokebox sides. Next cut 18 slivers of the 1mm diameter rivet rod to produce 18 rivet heads. Weld them to the vertical face of the mounting plates in a *'zig zag'* pattern as shown in the PDF.



The mounting plates on both sides of the smokebox will look like this:

There are two small slivers of styrene to go on the upper front of the smokebox. These are to be the smokebox braces *'mounting plates'*. The other end of the two braces run down to the pilot deck. Trim out the two plates and weld them to the smokebox sides as shown on the ***PDF titled "Smokebox Details" (CPH-CH2-12.pdf)***. Drill a 1.5mm hole toward the bottom end of the plates on either side. These holes should be just above the exact centre side line of the smokebox pipe. The smokebox braces run up to a position above smokebox centre sides. At the top and bottom end of the braces plate, weld on 2 more 1mm styrene rivets.

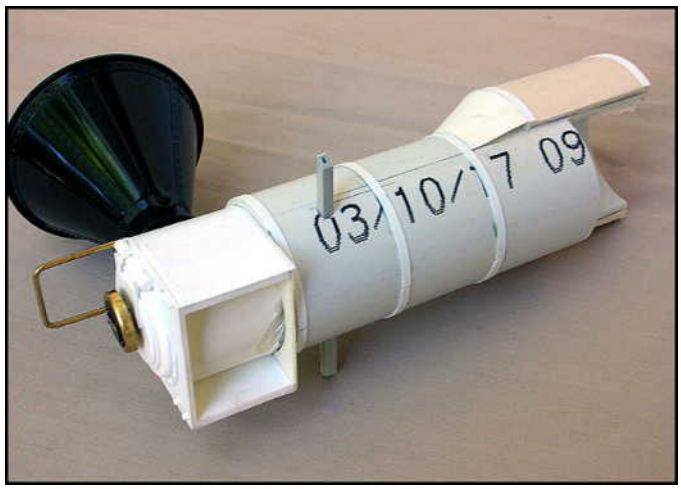
The plates for the braces on both sides of the smokebox will look like this:



Note the hole drilled at the top of the smokebox door for the globe wire to pass though from the headlight.

Next take your Hartland *'Stevens Stack'* which should have a threaded metal base to it, measure the threaded width and drill out the top of the smokebox to enable the stack to screw in. Go slow and do a bit at a time. I find the best way is to use a small drill bit... maybe 2-3mm in diameter, drill the dead centre then on slow revs work the drill bit around the circle, making the hole wider with every pass and working out the hole by hand. Stop periodically to check if the hole is big enough for the stack to screw in. Better to be undersized than to drill out too much. The hole should be a tight fit to the stack thread; indeed, use the thread to actually 'tap' the plastic of the smokebox (cut threads in it). Now cut a 5mm length of 12mm Evergreen styrene pipe, just a short length. Make sure the top and bottom of the cut pipe are square.

Wrap some sandpaper around a spare length of smokebox diameter pipe and run one end of this 5mm tube along the sandpaper pipe, creating a curved base to the pipe to match the smokebox profile. Insert his 12mm diameter sliver of pipe onto the bottom end of the Hartland stack and thread the stack into the smokebox top. The Evergreen pipe will hide the exposed stack thread also level the stack. Tighten the stack such that the cinder hatch on the side of the stack is facing to the loco's side (it doesn't matter which side). Mine ended up on the Engineer's side! If you can't get the cinder hatch to face the right way, unthread the stack again just give the threaded metal piece a quarter turn in the base of the stack, then re-insert into the smokebox.



Keep the smokebox as a separate assembly from the boiler. Its good to be able to slide it into the boiler and remove it. This will help with painting also, as you can spray paint the boiler 'Russia Iron' and the smokebox black (or brown) without masking anything. With the smokebox slid into place, the boiler assembly will look like this:

Step 12 - Running Board Fitment to Boiler:

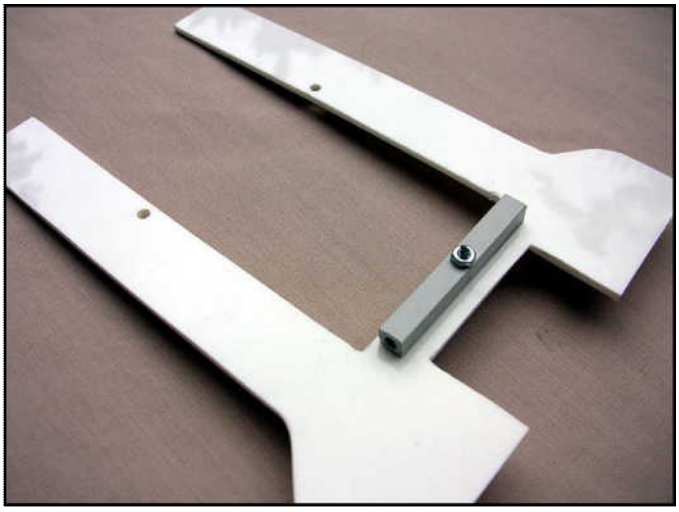
We need to do a little more work to the running boards unit now. Back in the ***"CPH Running Boards Profile" PDF (CPH-CH2-3.pdf)***, there is some info about applying some Plastruct SHS members to the upper and lower faces of the running board unit.

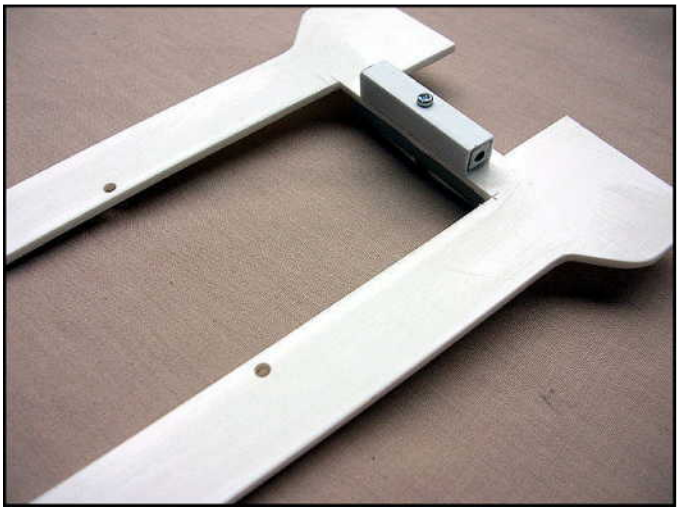
Let's do the top first. We need to apply a short length of Plastruct 4.6mm x 4.6mm SHS to the central area of the running board unit. Cut the length of the SHS to match exactly the open space width at the rear of the smaller boiler (within the wagon top). When welded in place, the SHS will help to keep the rear of the running boards centred to the boiler. If you wish, you can add some long small bolts right down at running board level that screw through the boiler side into the open hollow of the SHS. However, I prefer to just glue the upper running board to the inner boiler avoid exposed screws in my Russia Iron! At this point however, **do not** glue the running boards to the boiler. They will not be attached until all the parts are painted near project end.

The lower SHS is fitted to the exact same place as the upper SHS (so there is a 4.6mm x 4.6mm SHS on both sides of the running board unit). The length of this SHS should exactly match the internal width of the firebox width on your chassis from Chapter 1. This is the width of the top of the firebox area, just ahead of the drive wheel. Before welding this SHS to the bottom side of the Running board unit, insert a 2mm thick sliver of styrene to pack the height of the SHS. This SHS will ultimately be used to screw the boiler down to the chassis at the end of the job.

Now run a bolt right through from the bottom SHS, through the running boards up through the upper SHS tighten with a nut on top.

The running boards as seen from above will look like this:





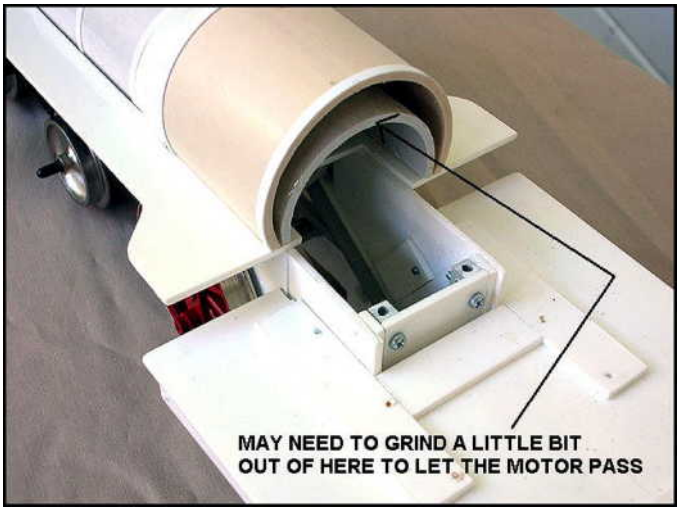
I used a 1mm thick SHS around my 4.6mm x 4.6mm SHS, however this had to be changed. Use a plain 2mm packer to lift the 4.6mm SHS away from the deck as shown in the PDF.

The Running boards as seen from below will look like this:

Test the Boiler-to-Chassis Fit:

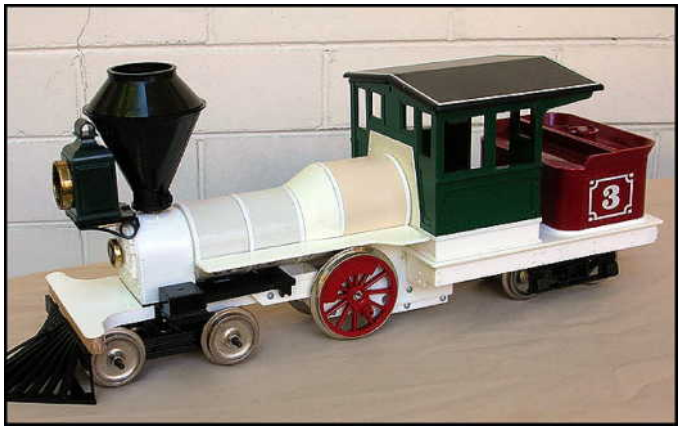
At this point, even with the running boards loose under the boiler/smokebox, do a test fit of the boiler over the chassis. The smokebox side should be centred about the centre of the cylinders up front; the bottom of the cut boiler should butt clean into the front face of the firebox unit, just above the drive wheel. With the motor in place, you *may* find that the top of the motor snags the rear edge of the inner boiler tube. Grind out a little of this inner boiler, but avoid damaging the rear edge of the wagon top pipe over it. Grind enough for the running boards to rest down snug over the top of the chassis firebox top.

With the boiler in place, the boiler-to-chassis fitting will look like this:



Motor removed for clarity.

Also drop the cab into position to see that the top of the motor is not snagging the opening in the front of the cab wall. If it does hit the front wall, grind out a little of the cab faceplates to let the cab rest down onto the deck nicely.



The fitment of the boiler to the chassis should look something like this.. Ignore my added headlight lack of cylinders and rods; also your frame is probably fully painted by now! I built my loco in a different order to you!

Step 13 - The Headlight:

OK, now on to the headlight. You know, thinking about it, the headlight and domes, more than any other U.S. loco feature, is what brought me into the U.S. loco building thing. I just love the U.S. domes and headlights! In our CPH Mini-class, the headlight is a stock Hartland part from your kit, but is also by far the best box headlight available to large-scalers. It does not appologise for its size -- more often than not in large-scale, headlights are too small! This Hartland box headlight, which is perfect for our model, is the most used headlight of all time on my models. The headlight kit comes with a bracket (made of a base and two framework sides), the box headlight, brass rim, vent element, reflector part and globe and clear plastic lens.

Using welder cement, weld the headlight vent to the top of the box headlight (it's the lil' *'D'* shaped gizmo). Weld it on straight and parallel to the box headlight in all directions.

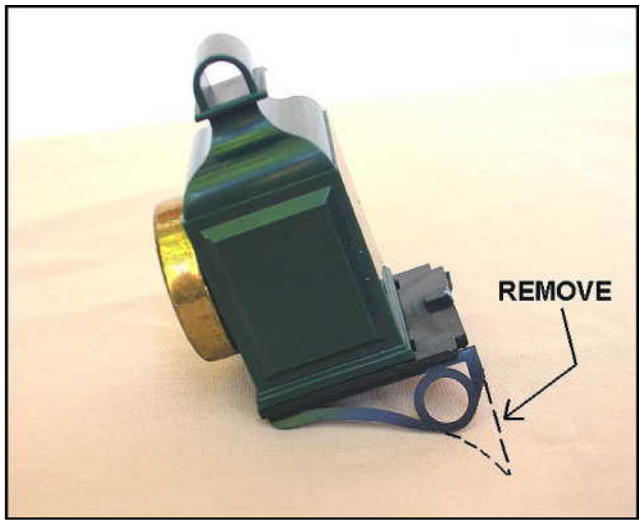
The clear plastic lens for the headlight usually has a blue protective film applied to both sides, peel 'em off and just squeeze the lens into the front of the headlight, press the brass rim on from the outside to hold the lens in. No glue is needed. Whatever you do, DO NOT use CA glue on this.

Slip the two curved support frames into the edges of the headlight base plate, these three parts are all molded in a strong flexible black plastic.

The Hartland headlight bracket is based on the bracket used on Central Pacific 4-4-0 #173 after the 1870s rebuild. This is the loco Walt Disney used for his *"Lilly Belle"* live steam 4-4-0, which was translated into the *"C.K. Holiday"* as a larger version when the Disney Park opened in the 1950s. The Hartland headlight bracket was developed for the Carolwood Pacific offering of the Hartland *"Lilly Belle"* 4-4-0. So we come full circle, the bracket was designed by CP Mechanical Superintendent Stevens, who was the guy responsible for looking after the *"C.P. Huntington"* in the 1870s/80s was involved in some of her rebuilds. Many of the early CP locos came from the Mason Works, who designed a headlight bracket like this one as standard -- I think this is the origin for the Stevens version. Anyways, we get to use one on our CPH model!

If you wish to use the full Stevens style headlight bracket, I see no reason not to. The smokebox diameter is smaller than the Hartland 4-4-0, but if you raise up lamp platform above smokebox top, you should be able to wrap the bracket around the smokebox sides to the centre middle positions.

If you're going to model the loco to look more like the 1875 rebuild, as she looks today, then we can do a simple mod to the bracket to bring the overall style of the bracket in line with the style on the loco today. You can do this by trimming off the bracket extensions that run below the 'circle' at the bracket mid-point, thus. Sand the trimmed areas to a nice clean finish.



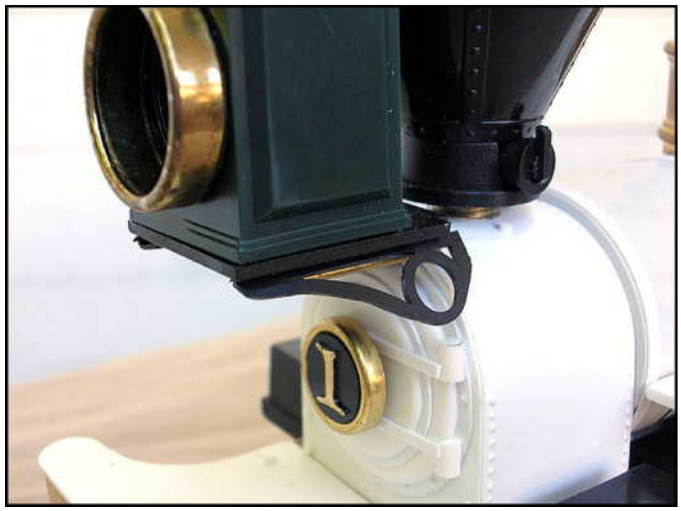
The headlight reflector is usually a coloured single element, including the parabolic part and the base. I find it useful to sand the very back of the reflector and the two sides of the base, so that the box headlight can slide over the reflector, down over the base easily without being too tight.

Weld the reflector part to the top of the bracket base plate. Square it up with the base, toward the front end; Slip the box headlight over it (but do not glue the box part!). Use the outer box headlight to align the whole assembly properly on the base, before the reflector innards are firmly glued to the base. You want the headlight to sit right up at the front of the bracket exactly as seen above.

At this point, slide the box off the reflector and let the reflector dry onto the base plate. You can either be satisfied that this reflector assembly will remain nicely welded to the base plate (which it can), or you can drill two holes into the base from the bottom and insert two screws to fix the reflector completely into place. Insert the globe from outside the reflector, pushing the wires down through the base plate. Then slide the outer box headlight body down in place. I used a small length of 4mm styrene tube to hold the globe vertical and central in the reflector.

Since this bracket cannot easily support the headlight in a meaningful manner, we need to provide a fake bracket to the smokebox top to support the whole thing.

I used a bit of 1.5mm brass rod, bent into wire *'angle'* to form a new lamp shelf that will be hidden behind the plastic bracket. Follow the ***PDF titled "Smokebox Details" (CPH-CH2-12.pdf)*** to get the wire shelf sorted out.

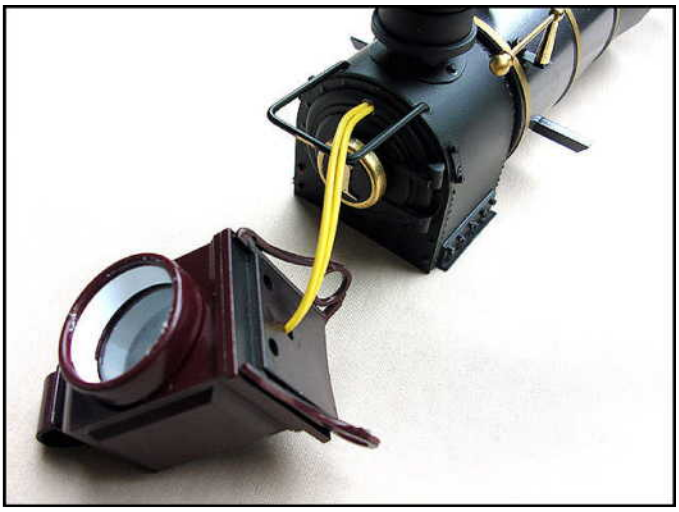


Using the upper datum line on the smokebox. Mark a position equally on either side of the datum to drill the two 1.5mm holes for the fake bracket. Insert the bracket into the smokebox top and check the levels of the platform. It ***must*** be level and parallel with the smokebox base, aligned with the smokestack, etc., as seen from the front. When satisfied the bracket is level, apply a couple of daubs of epoxy inside the smokebox against the wire ends to hold them in place and maintain the level of the bracket. The brass wire bracket can be seen in place in all the smokebox photos above. With the headlight dropped onto its perch, the thing will look like this, but is reeeeal loose!

Step 14 - Painting the Smokebox and Headlight:

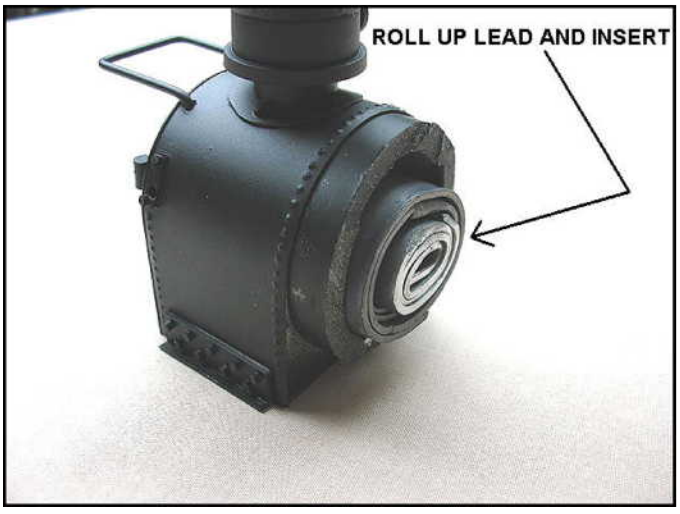
Time to paint your smokebox and set aside to dry. Paint the box headlight and plastic bracket too. Paint the inside of the reflector silver or white.

When painting the box headlight, note that the brass rim on the front were seldom brass in real life, but were painted to match the headlight body. The inside of the rims were painted white. When the smokebox and headlight are painted, insert the wires into the hole near the top of the smokebox front like this:



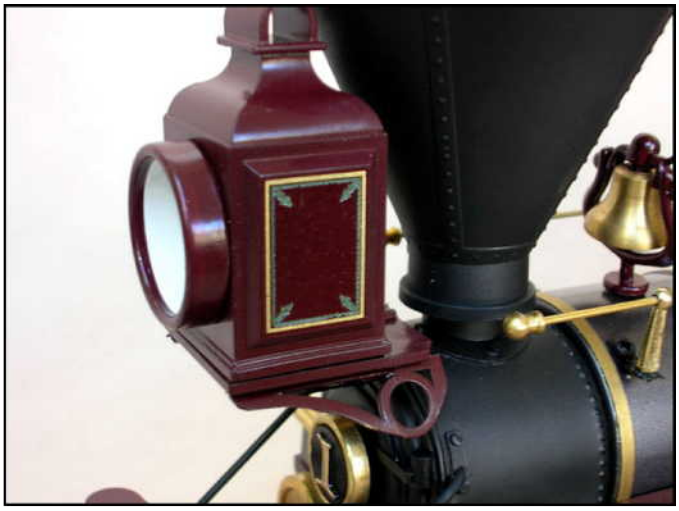
At this point, it would be timely to add the ballast to the smokebox. This loco's pulling power is dependent on weight, but more specifically, 90% of the locos weight must be loaded into the space between the pilot truck and main drive wheel. There must be NO added ballast to the rear of the drive wheels. We will fill the smokebox with lead, as well as the boiler from the front all the way to the motor. You might even like to add lead inside the sand dome, but do not add lead inside the steam dome.

I used 1mm lead flashing lead, as used for flashing roof gutters etc. It comes in a roll from the hardware store. I cut the lead using scissors and roll up into tight lil rolls of lead. I use a hammer to bash the lead into these tight rolls. Trim a strip of lead approx 40mm wide, 150mm long, roll tight into a cylinder just less than the smokebox inside diameter. Make sure you can push it past the bottom of the stack, poking into the top of the smokebox. If you want a smoke generator in this model, I suggest installing it in the stack only, not in the smokebox, we need the smokebox space for lead! Oh, and before you think filling the stack with lead is a good idea, forget it, you dont need that kind of stress on the smokebox top or stack, nor that high centre of the gravity.



I used a few daubs of epoxy around the lead roll to hold it into the smokebox like this:

You can choose when you want to finally attach the headlight assembly to the brass wire bracket, but now is OK. Smear some epoxy on the top of the brass wire bracket, drop the lamp assembly into place, square it up and let it set. You may also want to add Stan's decals to the sides of the box headlight at this point. The finished headlight in place will look like this:



Step 15 -The Domes:

As advertised in the ordering lists for this project, there was an option to purchase two brass domes in addition to the CPH kit. The two domes were a 4-4-0 sand dome (which will become the steam dome) and a small Marsh sand dome. The two domes are these classically Baldwin-styled domes, downright fine and some of the best domes on the market - *not* Danforth Cooke style, but stylish domes nonetheless

These are easy to use on the CPH model. Refer to the ***PDF entitled "Fitting Hartland Domes" (CPH-CH2-13.pdf)***.

The Hartland Sand Dome: The same dome is fixed to the boiler by simply screw fixing a 4.6mm x 4.6mm Plastruct SHS to the exact position the sand dome will rest (midway in the 2nd section of the boiler). The length of the SHS should exactly match the inside diameter of the brass dome. Screw the SHS into position flat along the upper datum line squeeze the brass dome down on top. Leave it like that for now. You can paint it later finally fix it into position by applying a few daubs of epoxy into the inside of the dome, dropping the dome over the SHS and letting the epoxy ooze down onto the SHS. Never put epoxy on the bottom edge of the dome or it will ooze over the boiler. Keep it well inside the dome, away from the bottom edge, so it can slime down to the boiler top without ever being visible to the outside.

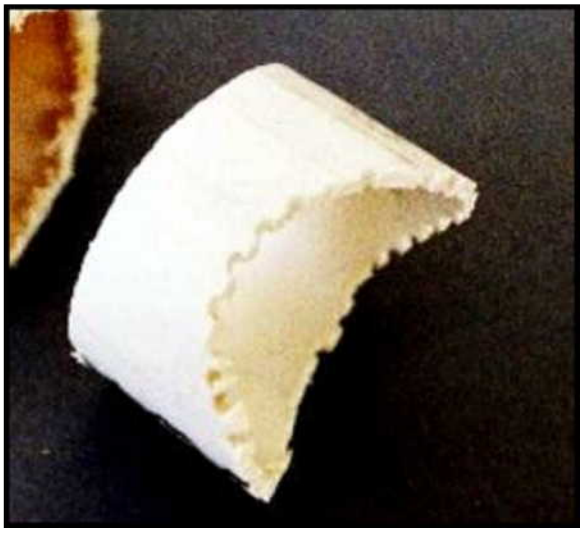
The sand dome in position will look like this, but don't glue it down until all the parts are painted at chapter's end.

The Hartland Steam Dome: The steam dome needs a little more work than the sand dome.

You need to find two sizes of PVC pipe for the steam dome. Look at electrical conduit, especially the conduit connectors. Also note that there are many plumbing fitting in this size that have a octagon pattern to facilitate tightening of fittings. This octagon formation can become a really great Danforth Cooke dome base! Here are some of the connectors:

For the steam dome we need a new pipe to replace the Hartland centre tube. This is to be a pipe 28-29mm in diameter. You need a pipe to match the Hartland tube, but taller per the PDF. The existing dome centre section is way too squat for this loco. Cut the tube to the right length and slip it into the brass top and bottom of the dome.

Now for the base. Either a plain pipe or one of these *hexagonal* pipes can do it. Take a length of pipe approx 33-34mm in diameter. Approximate the profile of the dome base, as it would form over the wagon-top boiler by drilling a series of small holes along the line and snapping the end of the pipe off like this:



Trim off the end of the pipe to create an even, flat-topped pipe, around 3mm tall at the narrowest points. Then get some more of that 50mm wagon-top pipe, wrap sandpaper around it and sand the some base like mad, sanding the drilled holed smooth like this:

Take great care while sanding to keep an eye out for the level of the dome... check to see you are sanding evenly so that the top remains level with the pipe and the domes will stand vertical.

Finally, drill a 4mm hole in the exact dead centre of the Wagon-top boiler, right on the upper datum line. Drill right through the 10mm SHS support between the two pipes. Check the inside of the Hartland dome top; there is a thread in the top. Find a bolt to run into that thread, the bolts I use are 5/32" x 50mm (You will need to shorten the bolt tad after testing the length on your model). As shown in the ***PDF titled "Fitting Hartland Domes" (CPH-CH2-13.pdf)***, insert the bolt from inside the boiler, up into the dome. Drop all the dome parts in order onto the wagon-top: dome base, brass base, dome centre tube, and then brass dome top. Tighten the bolt. The dome is now secured to the wagon-top boiler, no more glue needed!

Finally get your pliers and break off the finial on the top of this steam dome - or just grind it off with the Dremel. Cut a 6mm length of 12mm Evergreen pipe. This 6mm sliver of pipe will become the steam dome cluster. Drop the 12mm pipe onto the top of the dome like this and lightly glue it in place with CA:

Weld a 1mm wide band of 0.5mm styrene strip around the very top edge of the 12mm tube, as seen to the right. Mix up a small batch of epoxy and fill the inside of the cluster up to the top surface. Let it pool so that it naturally forms a level top. Your steam dome is done!

When painted the domes will look like this. You can drill a small hole toward the rear of the steam dome cluster and insert the brass Hartland whistle as shown in the picture.

The Scratch Made Danforth Cooke Domes:

The secret to making some reeeeeeealy good Danforth Cooke Domes is to find the right bases. Look at the ***PDF entitled "Steam Dome Profile" (CPH-CH2-15.pdf)*** and ***"Sand Dome Profile" (CPH-CH2-14.pdf)***. There are two Octagon templates shown there. Cut them out and head off to the Hardware store. Look for pipe connectors with the monkey wrench octagons applied that exactly match those PDF Octagons. Try and get close chaps, because the fancy decal work to the sides of the Danforth dome bases on our model are based on those Octagon sizes.

I used regular pipe connectors from the hardware store for my domes, perfect to those profiles. Here are two connectors that worked for me!

The sand dome base well under way.

Next, sand the bottom of the Octagon bases into the curvature of the boiler. Wrap sand paper around the 42/43mm PVC pipe to sand the bottom of the dome base to suit:

For the steam dome base, I wrapped sand paper around the 50mm size of the wagon top boiler sanded that base to the right contour. Again, take care while sanding that the top of the base remains level in all directions.

With the curvature of the bases done, now its time to trim off the tops of the pipes down to the correct height. The sand dome base should be approx 4mm tall from the top of boiler datum to top of dome base. The top of the steam dome base is less, approx. 3mm.

Next cut out the two octagon templates in 1mm styrene from the templates entitled 'base plates'. These are about 1mm wider than the Octagon of the dome bases. Glue these to the top of the bases using CA. Get them nice and central over the bases, with the flat sides aligning with the Octagon sides.

Now it's time to get layering. Like the smokebox door, the domes are made up of a series of 0.5mm, 1mm and 2mm disks. Cut them all out as shown on the PDF's. Don't get the two domes' parts mixed up! Layer them up per the exploded diagram in the PDF.

Keep the dome bases and upper domes separate to help with their fixing to the boiler later.

The completed dome bases will look like this:

Sand Dome Base

Steam Dome Base

Give the finished assembly a light sanding to smooth out the edges and round stuff off.

Dropped loosely onto the dome base, the steam dome looks like this:

With the pipes and disks all cut and layered together, the steam dome upper will look like this:

The sand dome is layered up in a similar method. Keep checking to see that the pipes for the central section are of the right length, not too tall, not too short. I used a Hartland brass handrail 'acorn' to the top of the sand dome. If your kit only came with two acorns (for the two hand rails yet to be done), then you will need to make your own finial. This can be done by applying a drop of 5-minute epoxy onto the end of a length of 1.5mm brass rod. A daub of epoxy applied to the end of the rod will goop into a drip shape at the bottom of the rod. Hold the rod vertical, with the goop at the bottom end until the goop goes hard. Drill a hole in the top of the sand dome and insert the rod, leaving the goop standing out as a finial. The drop should be painted out with the dome, so brass is not essential here. Apply the SHS's to the tops of the dome bases as a 'key' for the positioning of the upper domes later. Drill two 1.5mm holes into the sides of the sand dome base for the sand lines to come later.

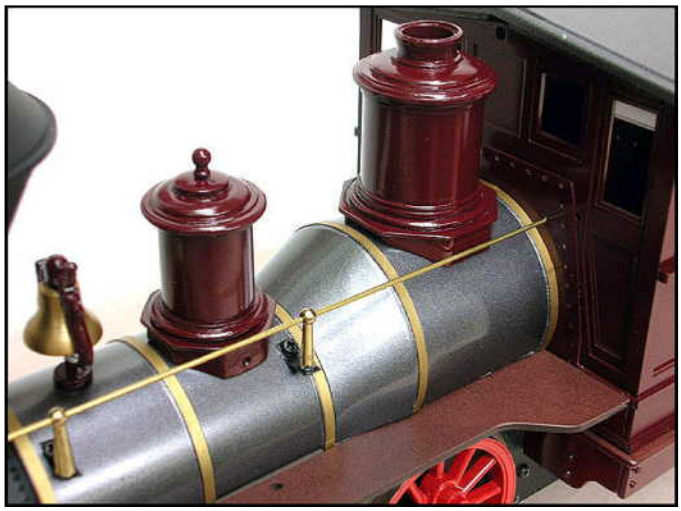
The finished domes, prior to painting and installation on the boiler will look like this:

The upper dome assemblies will slip neatly over the SHS's mounted to the dome bases.

With the upper domes dropped onto the bases, the finished domes look like this:

Note 1.5mm holes drilled into the centre of the sand dome base sides in preparation for the sand lines.

After the domes are painted, take the dome tops off the bases again drop the bases into position on the boiler. Use the upper datum lines to get the position correct. Drill a hole through the SHS's on the tops of the dome bases, right down into the boiler top. Using self tapping screws or bolts, tighten the dome bases onto the boiler top. Again, drop the dome tops into place, leave them loose until the final works, but keep checking that the domes are vertical and in line with the stack, in line with the cab walls etc.



The painted domes in place will look like this:

The boiler, however, should not yet be painted at this point. We need to drill some more holes in the boiler before painting.

Step 16 - More Holes in the Boiler:

The Bell: The above photo also shows the bell in place. Drill a hole in the upper datum in the centre of the first boiler section. Insert the bell. Leave it loose for now until the boiler is painted.

The Handrail Stanchions: Follow the ***PDF entitled "Hand rail stanchions" (CPH-CH2-17.pdf)***. This is a tough bit of work. Like running boards, handrails that are not parallel and level with the boiler can create the most ghastly illusions of crookedness. GET THESE HAND RAILS RIGHT!

There are two ways to do it; both will require FOUR 8-9mm tall handrail stanchions from Ozark Miniatures, or Trackside Details etc. I used older Bachmann 4-6-0 taller stanchions on both my models. These are unusually tall stanchions and not always easy to find.

Method 1: Method 1 is typical of NG locomotives in general, is simpler to carry out than Method 2, and is stronger. The method is to drill holes into the boiler side. Mark out the holes locations per the PDF, using the upper datum to ensure the holes are in the same position of both sides. Insert the handrail stanchions straight into the boiler side, insert the 1mm brass rod for the handrail, and glue the two Hartland acorns onto the forward end of the hand rails.

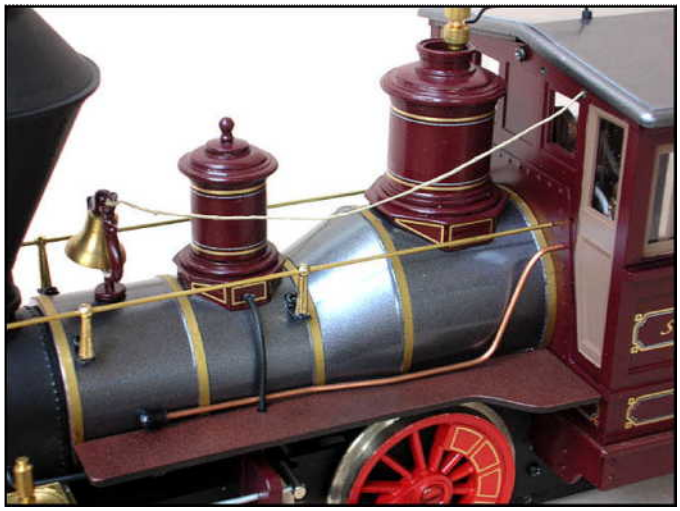
The completed handrails of this simpler method will look like this:

Method 2: The second method is more typical of the actual *"C.P. Huntington"* and was very common on many 1870s locos - that of vertical stanchions on horizontal outreachers. Make the outreachers first using 4mm wide strips of 0.75mm thick brass. I cut my strips from a larger sheet of brass using the Dremel. Follow the ***PDF (CPH-CH2-17.pdf)*** to get the brass outreacher plates cut to size. Also note that it might be easier to drill the two holes in each outreacher before you cut out the final outreacher part. Apply a bend to the outreacher as shown on the PDF. One end is bolted to the boiler side, (align the holes in the boiler side correctly per Method 1), the hole size on the other end should match the stanchions you've bought. Slip the stanchion into the hole and glue it in place. If you're really courageous, you might trim the excess stanchion poking through the outreacher and apply some solder to the bottom to hold it all together.

The outreachers will look like this prior to installation on the loco:

Then apply them to the loco, use 10BA or #0 bolts (shaft size 1-1.5mm) inside, and tighten the outreachers in place. No glue is required.

Apply the 1mm brass rod for handrails and two Hartland acorns to the forward ends. The finished outreacher type handrails will look like this:



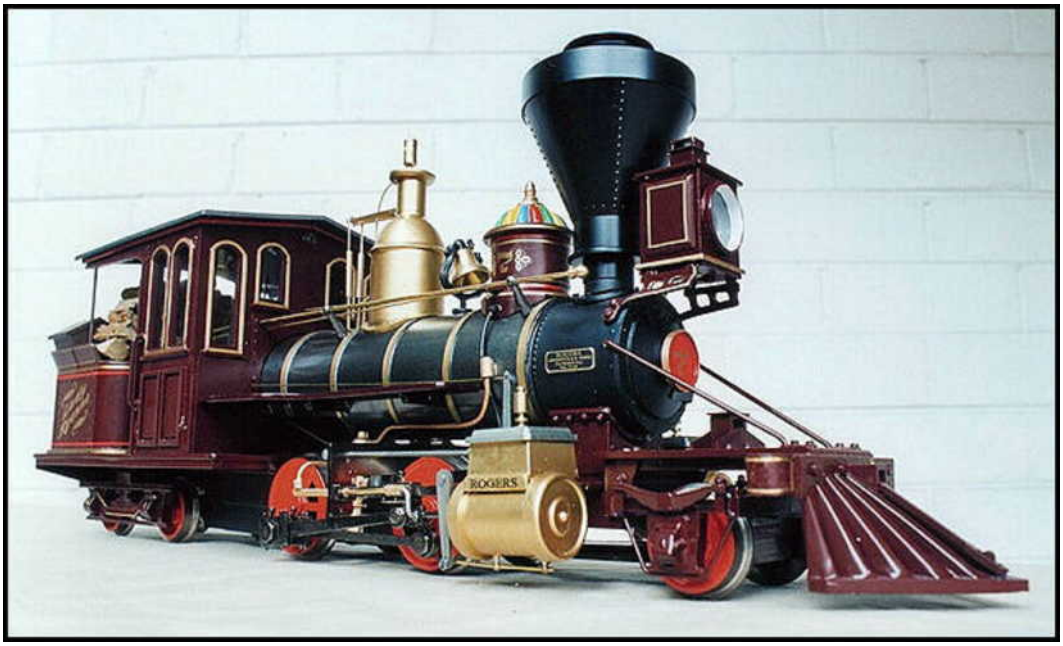
The Check Valve Holes: The final two holes to be drilled in the boiler are seen in the above photo. You need to drill a hole on the exact side centre-line of the boiler on section 1 of the boiler, directly below the bell. Drill a hole on both sides of the boiler in the same spot. Using a 2mm drill bit, drill out a hole on either side as shown on the ***PDF "Handrail Stanchions" (CPH-CH2-17.pdf)***. Test the hole's size with the two black plastic check valves that come with the CPH kit. They must be a reasonably tight fit; because no glue is going to be used on these check valves.

Step 17 - Painting the Locomotive:

It is time to paint all the assemblies. The smokebox and headlight are already painted. At this point, unscrew your handrail stanchions, remove the check valves, unbolt the domes, and pull the smokebox section clear from the boiler. Drop the loose running board unit out as well.

I would seriously consider applying the decals to each sub assembly after painting, before assembling the loco again. Especially, apply the dome, cab and tender decals. Go the end of this article to read the summary of decal layout.

If some of you are going to be using the Tamiya range of mini spray cans, they are very fine and smooth, about the best there is, but some colours, such as the *'Maroon'* that I used on this loco, do not cover well over light coloured substrates. It takes like 20 coats to stop the white styrene or light grey primer showing through. You really don't want to use more than 2 topcoats of the final colour or you start losing detail and clean edges. As such, I find it helpful to use darker colours as a base first. Normally matte colours cover well, where gloss does not. On my model, I lightly sprayed all the *'wine'* coloured areas with flat black first. Then all it took was two coats of maroon to finish. The Tamiya *'Maroon'* is also very glossy, so glossy in fact that it's hard to see the loco through all the shine. I tone them down using a semi-gloss topcoat after the decals are on. The other thing to note about using darker paint colours, as substrate is that you can use these colours to manipulate the final colour appearance. The topcoats are somewhat transparent. Some of my darker plum coloured locos, such as *"Lady Ryanne"* and the NZ Rogers, were painted using the same Tamiya *'Maroon'* colour, except on those I sprayed the whole loco dark blue first. Then two coats of *'Maroon'* on top created a purple/plum colour, not wine, because the blue substrate alters the look. On this 4-2-4T, I wanted straight dark maroon, so black was used as a substrate, no colour at all. The Tamiya paints are more like tinted lacquers than solid paints and as such several light coats are what is needed to get good smooth solid colour. Enamel sprays like you get in the hardware store, are far more solid and take much less paint to cover, but can get gluggy too. Regardless of the paint type selected, never overdo the spray painting. Go slow, with light layers. If paint seems to be pulling away from a detail and appears not to be painting, DO NOT dump more paint on it, the paint will only continue to run away from the detail and you'll end up with huge ugly runs streaking down the model. Again I state, go light and ignore details that appear not to take the paint. If painted in light layers they will paint fine.



The Cab: If you have not already, paint the cab the colours you want. The inside cab should be polished wood colour for pre 1880s and green for post 1880s. The cab roof is painted a light lead colour to represent the sheet lead used on cab roofs of this era. I used *'Tamiya - Light Gunmetal"* for the Roof.

The Running Boards: Also paint the running board unit. Paint the top a muddy brown colour. I used *"Tamiya - Dark Earth"* as a base colour to the running board tops and then dusted the tops with a light spray of flat black. This gave the boards a textured look as seen above. The underside and edges of the running boards were sprayed in the loco base colour (in my case, Wine).

The Domes: Domes should be painted to match the loco's base colour; in my case this is *"Wine."* I painted the domes and bases in one go.

The Boiler: The boiler should be finished in *"Russia Iron."* I've done lots of Russia Iron boilers and while everyone has their preferred methods, there are two paint methods that really stand out as being above average for painted jackets. There is also one metal treatment method for the experienced modeler.

Testor's Metalizer, Buffable Gun Metal: The first is the Testor's Metalizer Paints and Sealers *"Gun Metal."* This is a buffable paint. You will need an airbrush for this paint (there are no spray cans available). Prime the boiler pipe first, using a model grey primer. Then spray on the *"Buffable Gun Metal"* evenly. Wait to dry, then buff per the instructions. When dry, apply a Metalizer sealer coat of clear finish onto the boiler. Do not use a sealer coat other than the one stipulated by Testor's or you may get a bad paint reaction. This is a darn cool Russia Iron colour. The colour is right and there is no fleck whatsoever in the painted surface, just a pure smooth porcelain like finish. It's a very, very good paint, but it is not available everywhere. Certainly here in Melbourne, Testor's paints are short in quantity and range and the spray can variety are almost non-existent.

Tamiya *"Gun Metal"*: The 2nd paint method us to use standard Tamiya *"Gun Metal"* in the spray can. This is a virtually identical colour to the Testor's product above and two models painted in either method standing next to each other look the same from 1 ft. away. The difference is that the Tamiya product is available everywhere as a spray can, no airbrush necessary. The real difference is that this product has some silver fleck in the paint surface that can be seen up close. I don't have any particular problem with it, but should you have an air brush and access to the Testor's range, go with the *'Buffable'* stuff. It is the better of the two.

Metal Blackeners: The final method is the blackening of brass boiler wrappers. This will require you to buy and cut 0.005" brass sheet into wrappers than can be secured to the sides of the PVC pipe boiler, flare and wagon top. When the brass wrappers are blackened using *"Blacken It"* or similar blackening chemicals, it will change the brass to a Russia Iron like colour. For my money, the wrappers are too dark to be a convincing 'as built' Russia Iron, being considerably darker than the two paints described above. BUT, they make a really neat jacket for a 10 yr old loco, which has been kept clean and polished with several years worth of tallow on the Russia Iron, darkening it somewhat. Outside, these wrappers really come into their own, where the colour and lightness or darkness of them just doesn't count so much... the light just shows the boiler jacket up as *'different'*. Please refer to Kevin Strong's article on this method of jacket making at this link:

MasterClass 2002 - Chapter 2 Construction - Patina Finish For Your Boiler

I've built models with jackets treated in all 3 methods outlined above. All are good. I have my preferences, mostly relating to era and style. I will always use a brass wrapper with *"Blacken It"* on post 1890s-1900 black locos (such as my Mason Bogie #42 and 1900 era C&S #7). But I do prefer the painted jackets for the 1870s-1880s colourful machines, where the lightness of the jacket is important and an essential part of the loco's colour scheme. When applying the blackened brass wrappers to a coloured loco, such as wine, green brown etc, the wrappers tend to look 'black', whereas applied to a black loco, the wrapper turns up a some special colours. Choose your poison!

Boiler Bands: The boiler bands can be.

- Hand painted in gold (I don't like this!).
- Gold vinyl strips cut to size - this is a clean and neat way to do it and is what I used on this model. The gold vinyl is sign writer's material, designed for external use and very sticky!
- Real brass bands from brass strip as described earlier.

The Tender Tank: The tender tank is a stock Hartland part. Before painting it you need to remove the flare from the front end of the tender. Using a Jeweler's saw, cut vertically down at the exact point on the tender flare where tender side face begins to curve around to the front. Cut the vertical slot on both sides of the tender. Do not over cut through the flare and cut the top of the tender -- better to just stop shy of the top. Then, using your knife, score along the inside interface where flare meets tender top. Then bend and snap the unwanted forward flare off.

The tender will look like this:

Rummage around in your Hartland kit to find the tender water hatch as seen in the above photo. Some of you may have it already attached in place; others will be loose (some of you may not get one at all!). If you missed out, using a 10mm tall length of 12mm diameter Evergreen tube and make your own water hatch. Sand the cut edges to the flare and then spray paint the tank in primer before the final coloured coat to match the loco's base colour. After the tender is painted, we will add a coal or wood load to the forward half of the tender top.

For the really cool modeller: I admit it, I don't much care for the big rivets on the sides of the Hartland tender, they do have 'character' and when painted actually don't show up too loud. BUT, some of you guys might like to think about sanding off those big rivets and creating as tender wrapper of 0.5mm styrene sheet, punched with rivets along the top and bottom perimeter only, much like the smokebox wrapper you did. Apply the wrapper around the outside of the tender shell, using the shell as a former, exactly like the tenders we made for MC2001 and 2002. Additionally, the tender flare on the real CPH was virtually twice the height of our flare, so you could laminate a new 0.5mm styrene flare to the sides of the existing flare and increase the external height of the flare. The height of the tender shell itself is correct and does not need to be altered.

Also, note that I'm treating this tender as one fully loaded with wood/coal. The real tender had a typical 'U' shaped plan, just like the tender shells of the Mason or 2-6-0. On the ***PDF titled "Tender Mods - Optional" (CPH-CH2-18.pdf)***, you will note an option for removing the front of the tender shell to create a more prototypical tender form. If you're going to load it to the teeth with fuel, or intend to put sound inside the tender, then don't change it.

OK, put it all back together again now! Make sure all the decals are applied to the sub assemblies. Bolt the domes onto the boiler and use Loctite on the bolts. Add the bell in place -- if tight, no glue is needed; if loose, use a dash of epoxy. Avoid CA on this or it may fog the paint on the boiler jacket. Slide the smokebox back in, pull the headlight wires back to the rear of the boiler. Add the handrails in place.

Lead to the Boiler: Now get that roll of lead flashing again and cut a strip 10mm wide, by about 200mm long. Tightly roll the lead into a solid cylinder of lead, 50mm long. Keep rolling more lead onto the cylinder until the diameter is just a tad less than the diameter of the smaller boiler pipe. Ensure that you can slide the lead in avoiding the dome bolts. Use a couple of daubs of epoxy to hold the lead in as you slide the cylinder into the boiler from the rear, sliding it all the way forward until it hits the running board support beam up the front. MAKE SURE there is no lead extending into the open cut end of the boiler. The lead must be completely within the full tube part of the boiler. If the end of the lead cylinder projects past the open cut area of the boiler, the lead will snag the front of the firebox area on the chassis, just ahead of the drive wheel. Adding the lead like this will place the weight of the loco directly between the pilot truck and drive wheel to give maximum adhesion/traction possible for this model.

The Backhead:

I love doing this part. It's like rigging a sailing ship. Everything you do here has a purpose; every valve and gauge had a job to do. Hey, why don't you go back and re-read the background to MasterClass 2001, Chapter 6, this will outline what all these things we're about to do were actually for:

MasterClass 2001 - Chapter 6 - Background

The Backhead to our *"C.P. Huntington"* is somewhat simpler than the 2001 Mogul, as there is no brake system and there are fewer controls, however in 1:20 scale we have some real fun with the valves this time.

Here is a glimpse of the real *"C.P. Huntington"* Backhead.

Everything fits the bill: On the fireman's side there are two white steam lines; one is for the injector, the other for the blower. However, on the Engineer's side there are also two white steam lines, when there should only be one! The farthest most line is for the engineer's side injector. The other mystery line is redundant, having been installed in later years for the air compressor (now removed). There is also a control for the fuel oil, when she was an oil burner for a time. We will build all of the backhead per —

this photo, except we will not be adding those extra steam lines, as our locos are not fitted with those appliances. Note also that the water glass is set to a 60 deg angle and not vertical on this baby. Mostly because the boiler is so low down relative to the crew that the angled glass helps to make vision easy without having to crouch down to read the water level. Most likely this loco had no water glass at all when built, just tri-cocks. Note also one gauge only: the steam pressure gauge. There is no brake system, so no gauges are required. You'll note a manual hand brake wheel on the tender, which would have locked the brakes down on the tender truck only. Control of the loco's speed, as well as stopping would have been done using the Johnson Bar.

Step 18 - Modelling the Backhead:

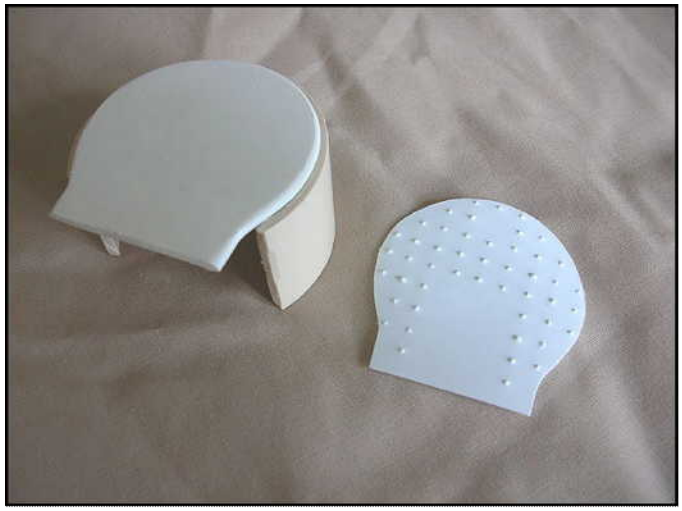
For modelling the details of the backhead, in addition to the styrene sheet and pipes already used, we need to use 1mm brass rod, 0.75mm brass rod, one 5-6mm dress snap and some 5mm plastic spherical beads. We will also need a number of small flat head nails, with heads of 3.5-4mm diameter, shaft of 1-1.5mm diameter, 1/2" length.

We will be showing you the making of 1870s style backhead appliances, and no castings are needed at all to complete the backhead. This is in part due to the complete lack of castings available here in Auz, also because I like making this stuff and the castings are expensive to buy and import. I tend to save up for more important things such as wheels and motors, rather than valves for the backhead, so I make my own. Despite all that, many of you may choose to buy every part on this backhead as a casting from **Ozark Miniatures** or **Trackside Details**.

The parts you may choose to buy include:

- 3 - Tri-cock Valves.
- Water Glass & Shut Off Valves.
- Throttle assembly.
- Johnson Bar & Quadrant Assembly.
- 2 - Early Edna Lifting Injectors.
- 3 - Globe Valves.
- 1 - Pressure Gauge Assembly.
- 1 - 1870s Style Firebox Door.

This first part is easy, take your 50mm diameter pipe, the same type of pipe used on the wagon top, and cut a section nominally 28mm long. Use the ***PDF titled "Making the Backhead' (CPH-CH2-22.pdf)*** to trim the bottom of the pipe to a *'C'* shape. The idea is to create the extension of the Wagon-top into the cab. The lower firebox area is already made and already inside the cab made as part of the chassis. We just need to add the boiler on top of that firebox area. Next cut out the backhead back plate in 2mm styrene as shown in the PDF, sand the edges to a nice rounded form and test the fit to the end of the 50mm pipe. You want this back plate to actually be a smaller diameter than the pipe, creating a visible step between pipe and back plate I used epoxy on the inside of the 50mm pipe to hold the back plate on. CA will also do the trick. Finally cut out the backhead wrapper from 0.5mm styrene sheet and punch in the *'stay bolt'* pattern as shown in the PDF. Note that the *'Stay bolt'* pattern does not cover the entire backhead, there are spaces left for the fitting of appliances.



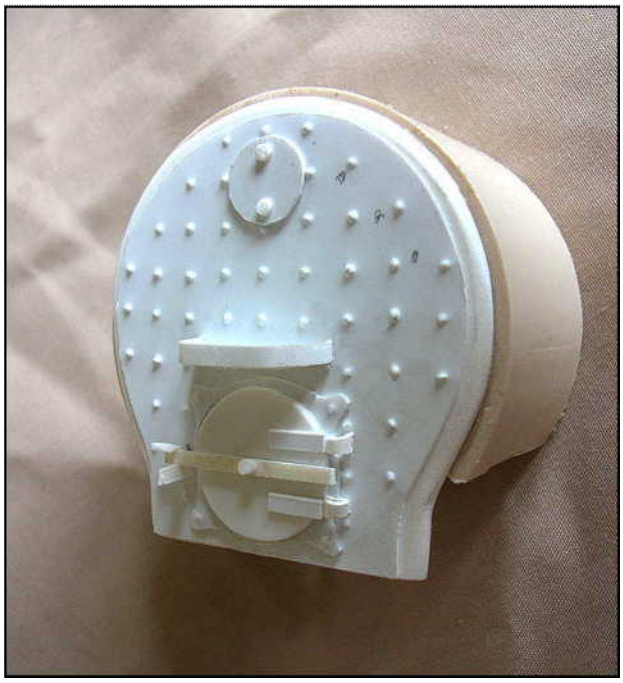
The assembly so far will look like this:

The Back Plate Details: Using the ***PDF titled "Making the Backhead" (CPH-CH2-22.pdf)*** showing the backplate details, cut out the elements that make up the firebox door -- this included a bottom layer of 0.5mm styrene sheet, punched with some rivets, an outer door made from 2mm styrene and some 0.5mm styrene strip hinges and latch. The 2mm door element must have the edges sanded to a nice domed finish.

Cut out the oil can shelf from 1mm sheet and wrap a 2mm high 0.5mm styrene trim to the outside, creating a *'lip'* on the outside.

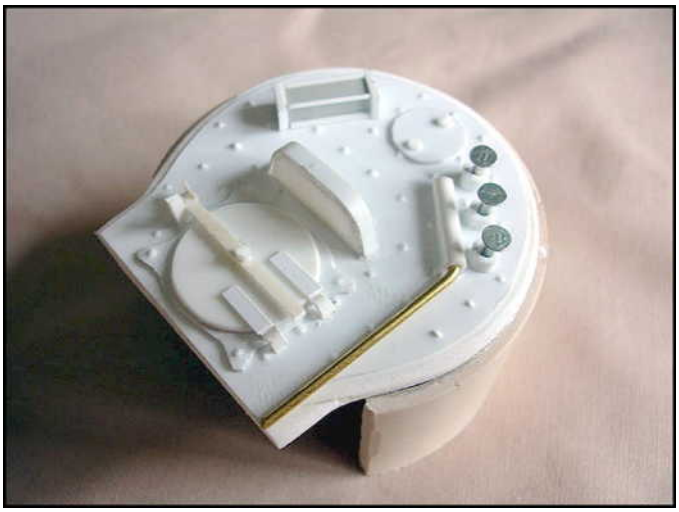
At the top of the back plate, a circle of 0.5mm thick styrene is to be applied. This is the end of the Throttle Valve assembly. Just weld the lil styrene disk in place and apply two 1mm styrene rivet rod rivets to the disk as shown.

With the firebox door, oil can shelf and throttle valve plate all welded in place, the backhead looks like this:



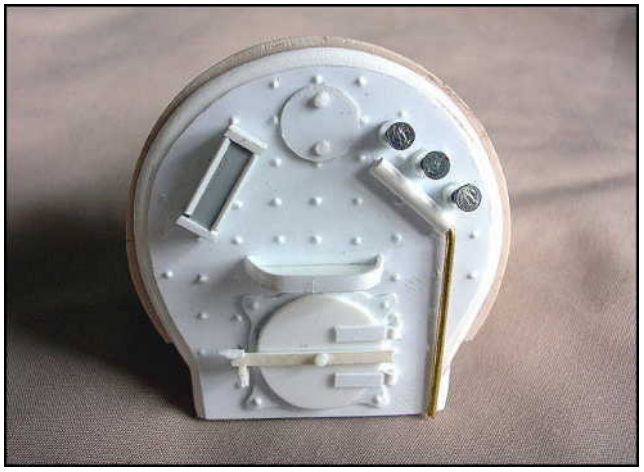
The Tri-Cock Valves: I've changed my methods a little, here, especially moving to 1:20 scale. The older method of using dress snaps for Tri-Cock handles just isn't much good. They are too large for that purpose, but are great for other valves such as on the turret. So, my new method is to use stylish aluminium flat head nails instead. The flat heads of the nails are only 3.5mm in diameter, with a 1.5mm shaft. So go out into the world and find some nice clean neat flat head nails, with 3.5-4mm diameter heads. We'll use them for the small Tri-Cock knobs and also for the smaller valve handles on the injectors. Using the ***PDF titled "Detailing the Backhead" (CPH-CH2-23.pdf)***, mark out the 3 positions of the tri-cock handles on your backhead. You'll see them marked already on the above photo. Drill the three holes with the 1.5mm drill bit. Next, cut three 2mm tall slivers of 3.2mm styrene tube. Slide one tube onto each nail and insert the nail into the backhead. Weld the 3.2mm tube to the backhead and allow the heads of the nails to project 5mm out from the back plate.

Next following the PDF make up the tubular gutter drain from 3.2mm tube and weld it to the back plate, parallel and below the three Tri-Cocks. Bend up some 1mm brass rod to form the drain line out the bottom of the gutter.



The whole Tri-Cock installation will look like this:

The Water Glass: Following the ***PDF titled "Detailing the Backhead" (CPH-CH2-23.pdf)***, for the water glass, we make the glass itself from a short length of your grey 4.6mm Plastruct SHS. Cap the top and bottom with 6mm x 6mm square of 1mm styrene. Next make the bars that run along the corners of the water glass from strips of 0.5mm styrene, cut into 1mm wide strips (or thereabouts). Weld the water glass assembly to the backhead in the diagonal location shown. Make note that the dead centre of the water glass should be approximately horizontally level with the middle Tri-Cock on the other side of the backhead. You can see the glass attached to the backhead in the above photo and here:



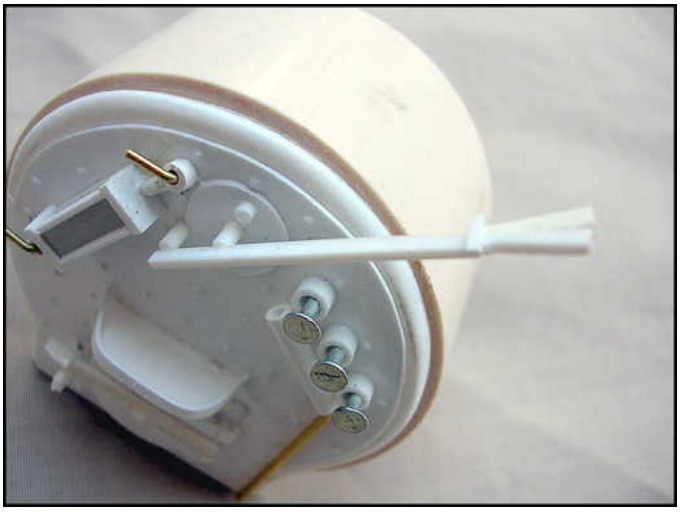
The Water Glass Shut Off Valves: To the top and bottom of the glass we need to add some shut-off valves. These are a 90-degree lever type valve designed to enable to crew to shut off the water to the glass in the event of the glass breaking while the loco is under steam. In the event of breakage, before too much pain is caused by escaping steam and boiling water, the fireman can shut off the glass by banging his shovel onto those two levers, instantly isolating the glass.

To make the valves, add two 3mm lengths of your 1mm styrene rod to the top and bottom of the glass. Weld them flat onto the backhead surface. At the tips of these rods, weld a 2mm styrene tube, cut as a sliver 1mm tall. If you don't have this 2mm tube, don't buy one - no need to for such a small amount of material. Instead cut some 1mm styrene into a 2mm diameter disk. Next bend some 0.75mm brass rod into an *'L'* shape with an arm approx 4mm long.

Drill and insert the levers into the disks/2mm tube like this:

The above photo shows the throttle arm in place already... we do that next!

The Throttle Lever: Following the ***PDF titled "Detailing the Backhead" (CPH-CH2-23.pdf)***, cut two strips of styrene from 1mm thick sheet. The strips should be 1.5mm wide, creating a length of 1mm x 1.5mm rod. Trim out the handle end as shown in the PDF, then form and weld on a latch at the handle end as shown in the PDF. At the backhead end, two rods of 1mm styrene need to be welded on end to the centre of the throttle valve plate, and just next to it. The throttle handle should run on a steep 45-degree angle.



Weld the throttle lever to the ends of the two 1mm rods as follows:

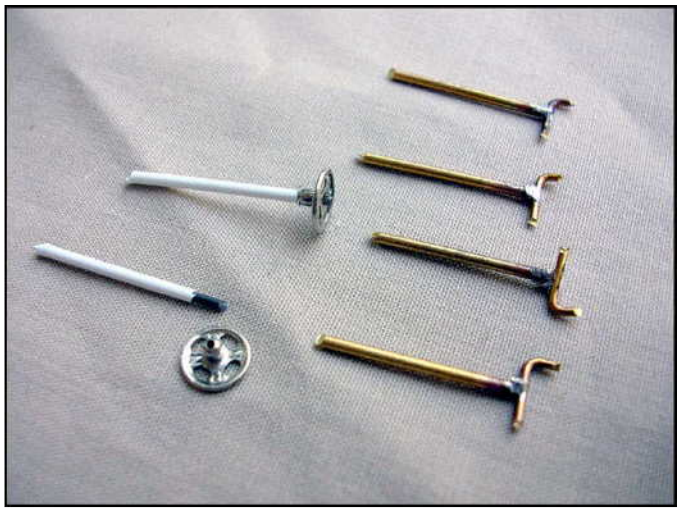
The Turret Valves: There are three valves to be made for the *'Turret'*. The *'Turret'* is the upper part of the backhead where steam appliances are plugged into the boiler steam supply. In later years the *'Turret'* would actually be a physical manifold of steam pipes all manifolded off the one fitting. In the early days, such as our 1860s-1880 locos, there was no physical *'Turret'* and each valve separately plugged into the boiler top. There will be three individual *'Turret'* valves to make. Two are for the LH and RH Injectors; the 3rd valve is for the Blower.

Using the ***PDF titled "Making the Backhead Valves" (CPH-CH2-24.pdf)***. We begin by making the two different types of valve handle. There are the disk type knobs and the winch handles.

The Winch Handles: We need to make 4 of these. Cut a 1" length of 1mm brass rod. Also cut a 7mm length of 0.75 mm brass rod. Bend the 0.75mm rod into a *'L'* shape with 5mm on one arm and 2mm on the other (or there abouts). Sticky tape the two brass parts against each other like a big *'T'* on a wooden board and solder the lil *'L'* arm to the end of the 1mm rod.

The Knob Handles: We did these in MC2001. Take that single dress snap, use the thinner metal snap in the pair and discard the heavier domed half. Use some 1mm Plastruct wire/rod. This is a steel wire coated in styrene made by Plastruct. Cut a 1" length of the wire, strip the styrene off the very top 2mm of the rod and insert the dress snap onto the exposed wire and glue with CA.

The two handle types will look like this:



Once the Winch handles are all soldered, you may like to goop tiny drips of epoxy onto the two exposed ends of the 'L' handle, creating bulbs on the ends and also a bulb around the soldered interface in the middle.

The Globe Valve Assembly: Go out into the world (preferably to an arts/crafts store, or beads store) and look for some reeeeally cheap plastic beads, perfectly spherical, with a hole down the centre. You need 3 beads, 5mm in diameter, preferably in plastic.

I keep a bag of beads for all kinds of 1870s stuff. Here's my bag...cool eh?

These ones are all plastic, with that gold coating on them. I use them for globe valves, hydrostatic lubricators, crosshead water pumps and dome finials. This bag has beads ranging from 2mm - 12mm diameter... I tend to loose them faster than I use them and usually these beads show up all over the place... in the curtains, under the carpets, in drawers, even in the car. But when I need one, I just go hunting around the house; usually one will show up, maybe in the washing machine.

Following the PDF, you'll see that the body of these globe valves is as follows:

The Two Injector Valves: Stacked up in this order, the following elements:

- Nut.
- 3mm long section of 3.2mm styrene tube.
- Bead.
- Nut.
- Then insert your winch handle right through the layers like a skewer.

Drill a 1.5mm hole in the side of the bead. Drill the top of the backhead and insert the end of the valve handle rod right into the backhead.

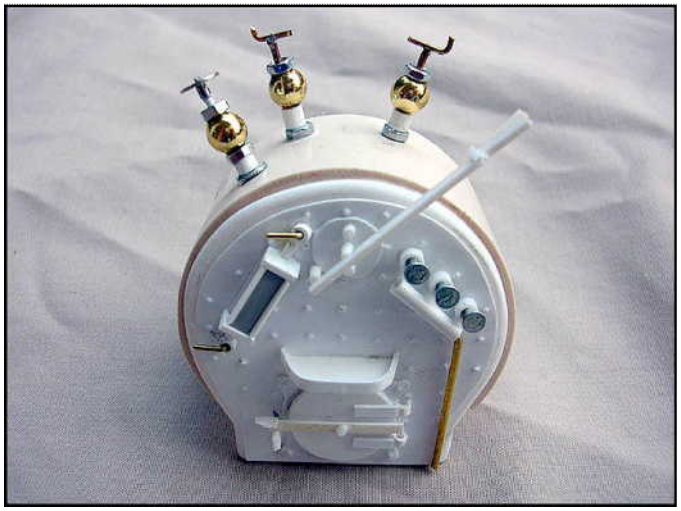
Blower valve: Stacked up in this order, the following elements:

- Washer.
- Nut.
- Bead.
- Nut.
- Then insert the knob valve handle down through the lot into the backhead.

Drill a 1.5mm hole in the side of the bead. Drill the top of the backhead and insert the end of the valve handle rod right into the backhead.

Locate the position of the three valves using the PDF. The two injector valves are toward the rear end (near the cab front wall), centred either side of the top centreline of the backhead. The blower valve is at the 10 O'clock position on the fireman's side toward the front of the backhead - nearer the crew.

The 3 valves inserted in place look like this:

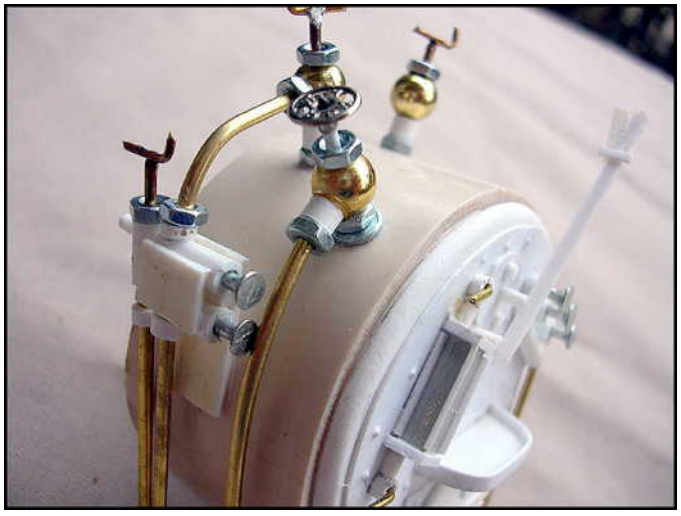


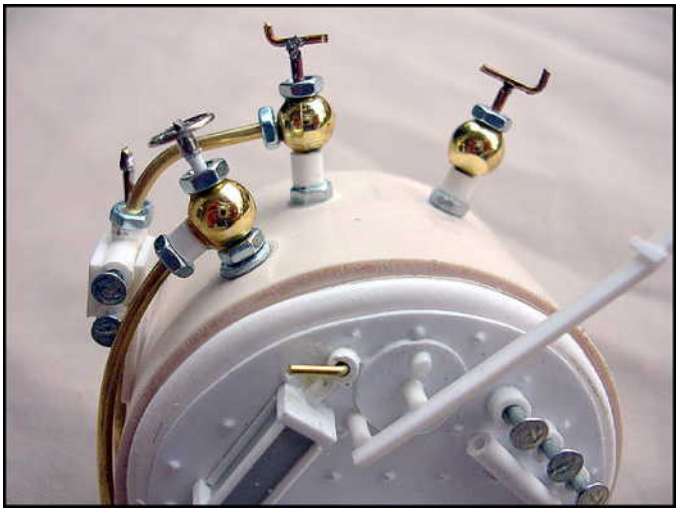
In the above photos, I show a styrene tube near the base of the blower valve. This should not be there. The bead sits on a nut, down hard on the backhead, per later photos. I had to change this, because the blower pipe got in the way of the injector.

Fireman's Side Injector and Blower Line: I think it best you follow the step-by-step ***PDF (CPH-CH2-25.pdf)*** for the construction of the Injectors and fit-off of the blower. Take your time; the real fun is getting the 1.5mm brass rod to bend to the correct arc to meet the globe valve at the top and the injector on the side. Watch your injector height too; it should be quite high up, above the centre side of the backhead.

The injectors we're making are to represent the early version of the Edna Lifting Injectors. Trackside details and Precision Scale Co. make castings for these, however the PSC one is small at 1:24 scale.

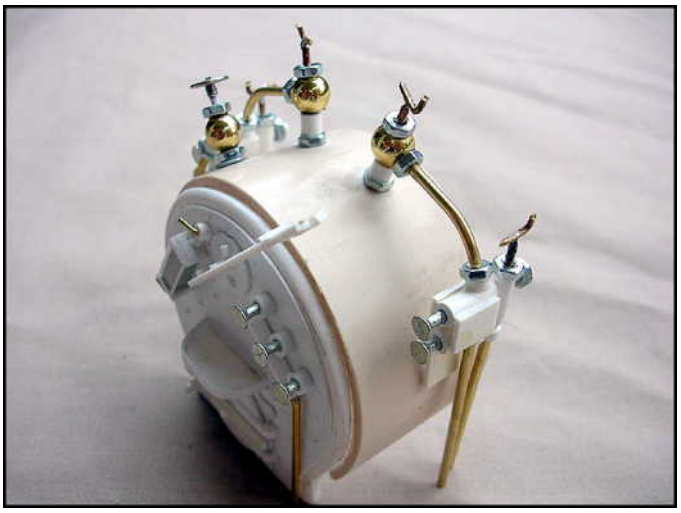
Here is the fireman's side injector and blower line installed:





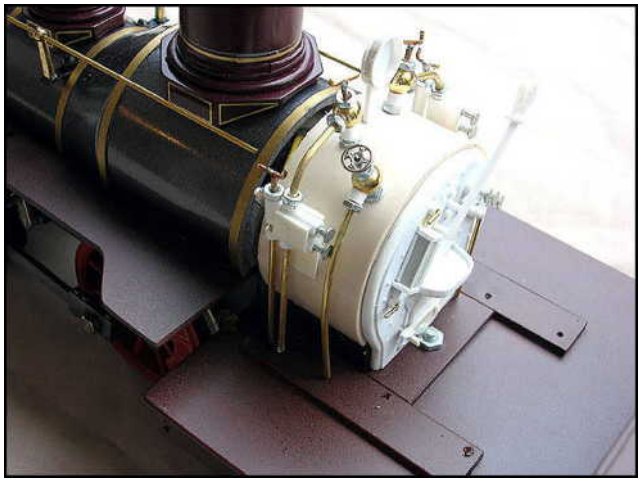
Engineer's Side Injector: The Engineer's side injector is identical to the Fireman's side, only in total reverse. The trick is to work the 1.5mm brass rod between globe valve and injector, such that both side injectors are set at the same height. Look for symmetry.

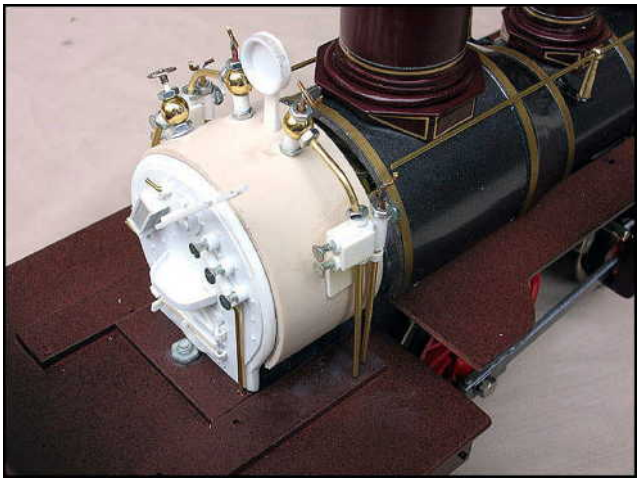
Here is the photo of the Engineer's side injector:

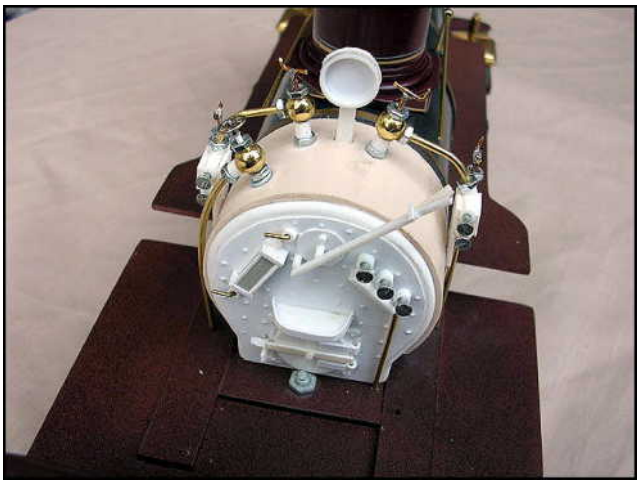


The Steam Pressure Gauge: Cut the pressure gauge disk out from 1mm thick styrene. The disk should be approx 9mm in diameter. Either wrap an edging strip of 0.5mm thick, 2mm wide styrene around the perimeter, or if you have a 9mm styrene tube, cut a 2mm high sliver and weld this ring onto the face of the gauge. Cut a 4mm wide, 1mm thick styrene support for the gauge. I ran it right into the top of the backhead to make a strong connection. Refer to the ***PDF titled "Detailing The Backhead" (CPH-CH2-23.pdf)*** for fitment and size details.

With the pressure gauge in place and backhead assembly dropped onto our loco (not glued) looks like this:

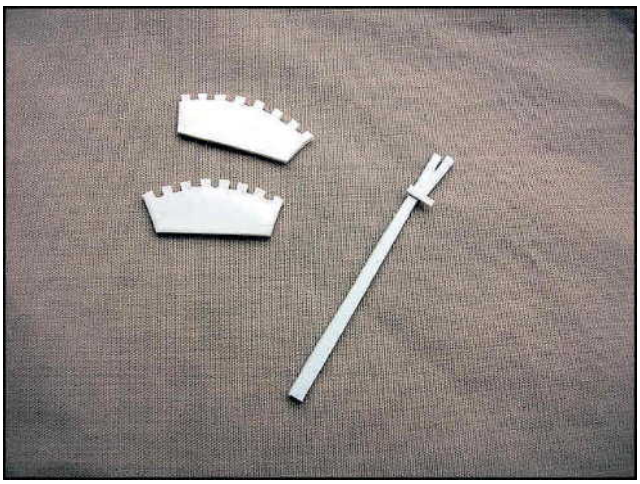






This completes the fabrication of the backhead. We still have the Johnson bar to make!

The Johnson Bar: Following the ***PDF titled "Making The Injectors" (CPH=CH2-25.pdf)*** for the Johnson bar, use 1mm styrene to make the lever and handles, as well as two ratchet plates. I cut the teeth area of the ratchet by cutting a series of 1mm long cuts radially along the outer edge of the sheet. Then cut every second space out, leaving the teeth good as gold! Here are the basic Johnson bar parts. There will also be a diagonal lifting rod -- 0.5mm x 0.5mm rod to be attached after the thing is assembled.



Fully painted and with the Johnson Bar complete and installed, the backhead, dropped into position inside the loco will look like this. Note that the backhead is still at this time not fixed in place.

Step 19 - The Locomotive's External Piping:

Folks, we're in luck: there are very few pipes to be added externally to this model... cool eh?

Basically, we need to add:

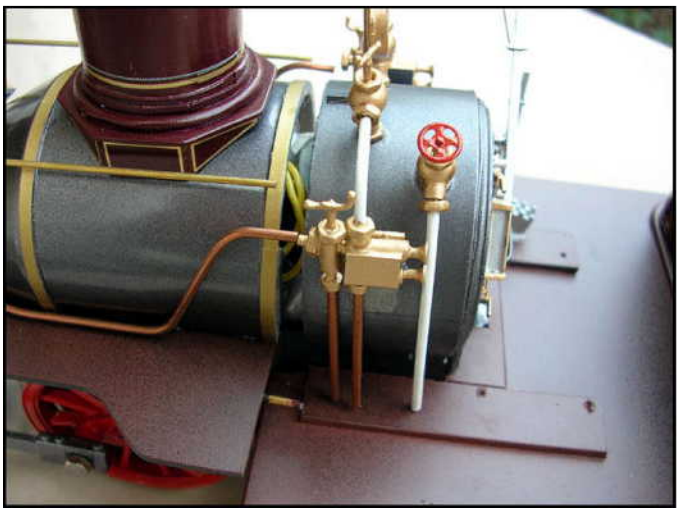
- The feed water pipes to both sides of the boiler.
- Sand line pipes to both sides of the boiler.
- A blower pipe running under the running boards of the Fireman's side only.
- A whistle rod above the cab roof.
- Bell cord to the bell.

The ***PDF titled "Backhead In Place - Injectors" (CPH-CH2-27.pdf)*** also shows how the Injector pipes run under the cab floor, however these are completely out of sight on our models and in some cases will snag the full movement of the tender truck. For this reason, I show where they go, but have not added them to the model.

Feed Water Lines: Make these either using brass 1.5mm rod or 16 ga. copper wire, with the black Hartland check valves inserted on the ends, or preferably, buy some 1.5mm diameter copper tube. Feed water pipes like these were never brass, they were copper or steel. Thus, use copper or paint the brass rod copper or black. The CPH today has black painted feed water lines.

Here are the Hartland check valves being inserted onto the 1.5mm copper tube:

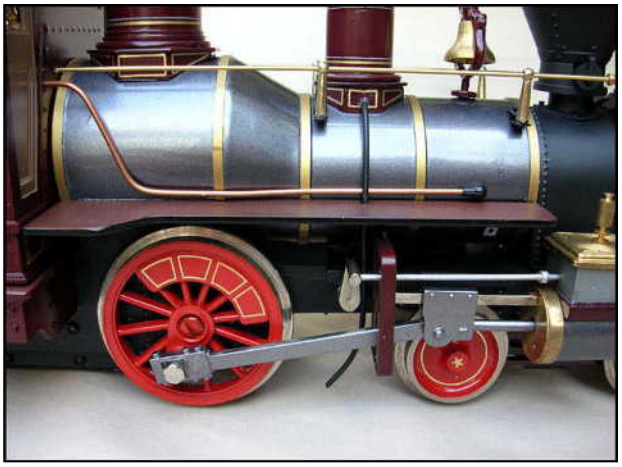
Follow the ***PDF titled "Backhead In Place - Injectors" (CPH-CH2-27.pdf)*** to bend the feed water line to the correct profile. The check valve end should push nicely into the holes drilled into the boiler sides prior to painting and the cab end of the line should press comfortably into the holes drilled in the cab wall.



Before completing the bending of the pipes, you want to try and aim to get the end of the pipe close to the ends of the injectors, they won't physically touch, but should look like they come from the same cab fitment - somewhat like this:

The Sand Lines: Using the ***PDF titled "Backhead In Place - Blower" (CPH-CH2-28.pdf)*** work up some sand lines in 1.5mm brass rod. These can be left brass if you like, or painted black, or wine, or what colour you chose for the base colour of the loco. Note that they curve in two directions and can be tricky to install. I insist that you have applied the decals to the sand dome base before fitting the sand line into the 1.5mm hole drilled in the dome base. So you can just push the rod through the decal film into place. Take great care getting these sand lines into place, as they have a habit of forcing your hand with the rod end catching on the boiler side, scratching the Russia Iron. If you like, make the sand lines from soft solder wire first, bend it into shape on the model, then remove and copy the form in brass rod. Once set up, the sand line should be fixed into the sand dome base with a tiny daub of epoxy or CA... NEVER feed the CA tube right against the dome base - it'll go squeesch and slop CA all over the boiler side! Apply a daub of glue on the end of some wire and apply it that way, with the glue tube well away from the loco. If it helps to slide the handrails out while applying the sand lines, do so. Once the handrails are slid into place finally, apply a touch of CA on the leading stanchion to prevent them sliding out.

The feed water lines and sand lines in position on both sides of the loco will look like this:



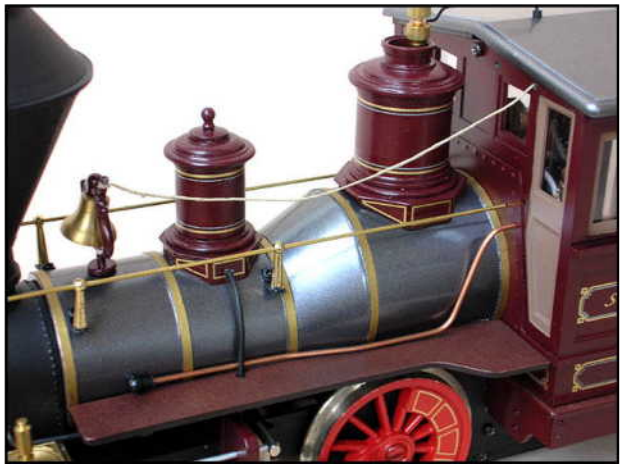
The Blower Pipe: Painted black, this is a long pipe that runs from the cab wall, below running boards all the way forward to the smokebox side on the engineer's side only. Use the ***PDF titled "Backhead In Place - Blower" (CPH-CH2-28.pdf)*** to locate, the photos do not adequately show the pipe in the darkness under there!

The Whistle Rod: Use some of the 0.75mm brass rod to create the whistle rod. Bend one end around the narrow end of the whistle and the other end inserted into a hole drilled into the cab roof.

Use a styrene or copper 1.5mm-2mm ferrule at the cab roof if you wish. Like this:

The Bell Cord: I use ship-rigging rope for my bell cords, some are better than others, but the hemp is usually easy to wet to straighten out and apply.

Something like this:



The Cab Windows: At this point the loco is still essentially a loose fit setup, with nothing bolted into position. We will do this shortly. Now is the time to fit the cab windows. Some of you may have gotten lucky and had some thin clear sheet provided with the cab kit, most will not (it is not standard with Hartland cab kits). Inside the cab you will see recesses molded around the windows. These recesses are for the glazing to sit in. Using thin clear plastic, of the shirt box variety, or book cover, cut out patches of clear material to match those recess shapes inside the cab walls.

Apply the windows into the walls using epoxy, or a contact adhesive... NEVER USE CA unless you want the windows to fog up! Just some daubs of epoxy in the corners of the clear material, then apply the window in place carefully, avoiding smearing the glass. You don't want to see glue from the outside!

Bolting It Altogether

Running Boards to Boiler:

Now is the time to unite the running board assembly to the bottom of the boiler. Drop the running boards in place; with the lead ends on top of the support beams and the rear end hard below the Wagon-top area. Use some plastic cement to weld the front end of the running boards in place. The rear end is a little more tricky. Mix up some epoxy glue (Huntsman - Araldite) and apply it to the inside of the boiler just above where the running board's SHS is mounted. Hold the running boards and boiler firmly together and allow the epoxy to ooze down over the SHS and around it. This will lock the running board rear end to the boiler. If you are not satisfied with bonding it in this way, you can run some small screws horizontally through the lower Wagon-top straight into the SHS ends. This will lock it completely, but leaves screw heads exposed on the lower edge of the boiler.

Headlight:

Next, solder the headlight wires to the wires connecting the chassis wipers to the motor. Check for shorts on the track before adding any more loco parts to the chassis. If you're thinking about directional lighting using a diode, well that's neat, except that railroad men seldom jumped out of the cab to light and extinguish the oil headlamp while moving back and forth! It just stayed lit. It's not an electric lamp and there is no dynamo!

The Boiler to Frame:

Bolt the boiler assembly to the chassis first. Push it hard backward, so that the bottom of the boiler firmly rests about the front of the firebox on the chassis.

Just lift the boiler a tad and look for that SHS mounted under the running boards. Take a measurement of where the hole in the centre of that SHS will be, when the boiler is dropped into position. Test some self-tapping screws or bolts inside some spare 4.6mm x 4.6mm Plastruct SHS, not too tight, not too loose. Drill a hole in the outside of the firebox exactly where the SHS is under the running boards. Repeat on both sides. Insert the two screws to either side of the firebox, fixing into the SHS under the running boards. This fixes the rear end of the boiler to the chassis.

Now, at the front end of the boiler, you have some choices. A long screw up though the existing hole between the cylinders, right into the smokebox pipe, is a good spot for a bolt. Or, you can insert a bolt further back, through the frame centre just behind the pilot truck. Screw up into the bottom of the PVC boiler. You want to allow the bolts to self-tap the plastic, so try not to over-drill the holes in the boiler base. The bolt that holds the pilot truck might also project above the frame and prevent the boiler from resting down properly. You can either drill a hole in the boiler bottom to allow this bolt to pass into it, or you can use the pilot truck bolt as a fixing bolt to hold the boiler as well. It is not essential.

At the front end of the smokebox, it's time to add those lovely smokebox braces. You need to work some 1.5mm rod into these braces, with 3-4mm bent ends to slip into the pilot deck and into the smokebox side. The bent tabs at the ends of the braces are bent 90 degrees relative to each other.

The braces in place look like this:

Affixing the Cab:

Before fixing the cab, we need to lift the roof off one last time. Remove the backhead unit sitting in there loose, apply some daubs of epoxy to the inside rear of the backhead (where it touches the front wall of the cab) and glue the backhead to the wall of the cab (not to the chassis floor). You may also choose to look at bolt fixing this unit to the floor or cab wall. Next screw the cab roof in place, using the two screw holes at the apex of the front and rear cab walls.

Drop the cab with firebox unit into place; push it hard up against the back of the boiler. Drill and insert 4 1/3" long self-tapping screws up through the cab floor into the SHS/angles welded to the inside cab walls.

Make sure you check your alignments before drilling, check for:

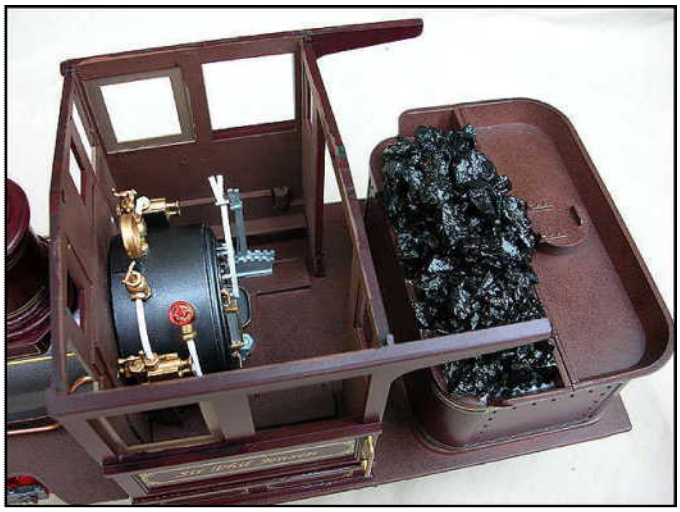
- Is the cab on the deck straight?
- Does the deck project evenly either side of the cab wall?
- If I drill here, will it cut up along the outside of the cab wall and wreck everything? Try and drill well inside the cab area.
- Will the screws meet the fixing angles along the bottom of the cab wall?

Screw the cab into place, re-insert the whistle and whistle rod into place on the roof.

Affixing the Tender Unit:

First, let's add some coal to that tender. I use real coal, crushed in an old sock with a hammer. I mix the coal up in a pot of 70% PVA, 30% water, stir it all up and then spoon the coal into the top of the tender area. It dries hard like a big thick epoxy casting!

The coal load in place looks like this:



Or you may want the loco to be a wood burner. I use old stalks from lavender bushes to cut into cords of wood. Here's how a woodpile on the rear of an identical tender may look:

OK, lets fix the tender down now. There is not a lot inside the tender to fix into, just two narrow slivers of plastic inside the sidewalls of the tender. These are perfectly good to screw into, using 1.5mm shaft bolts. However if you wish to augment the fixing of the tender, by welding some styrene SHS or angles to the inside of the tender, by all means do so!

Like the cab, before drilling up through the bottom of the deck, check:

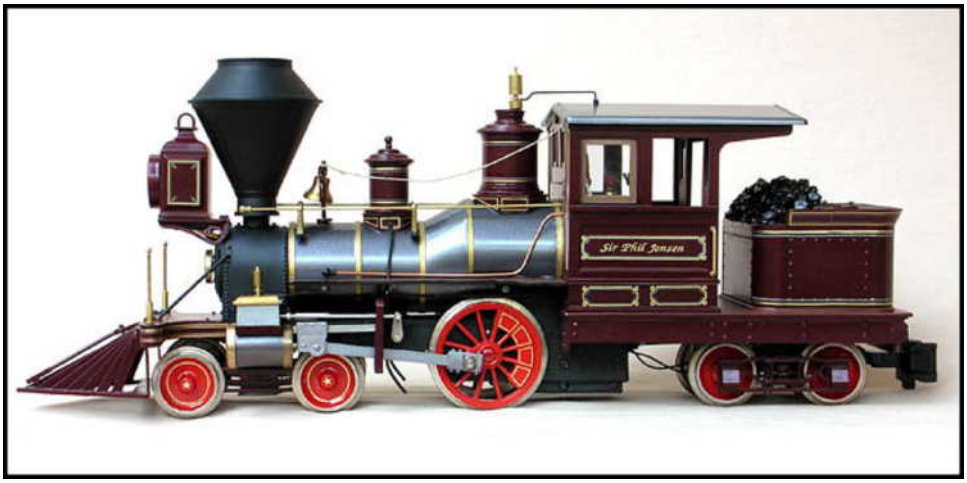
- Is the tender tank squared up on the deck, straight, with equal amounts of deck projecting around the tank?
- If I drill here, will it cut up along the outside of the tender and wreck everything? Try and drill well inside the tender shell area.
- Will the screws meet the fixing angles along the bottom of the tender?

Bolt the tender down using minimum of 2, or a maximum of 4 bolts. You could also just glue the tender into place, BUT, if your rear truck nuts and bolts fall out and the truck comes loose, you won't be able to get back in there it tighten it up, or make adjustments to the tender spring tension etc.

Believe it... *YOU'RE DONE!*

That's it gang, your loco is done! Go out and run it! ***Remember to grease the axle bearings*****,** especially the drive wheel bearings.

Your finished loco should/may look similar something to the class demo - The *"Sir Phil Jensen"*:




Sir Phil Jensen


Sir Phil Jensen
1


Sir Phil Jensen

Stan Cedarleaf's *"C.P. Huntington"* Decals

As noted previously, Stan Cedarleaf is producing decal sets to decorate your models as shown above. The decal set includes 3 pages of fancy decals, with some redundancy in case of mess-ups. The sets are $35.00 per set, plus postage. Please contact Stan Cedarleaf directly if you wish to order a decal set. Also remember to ask him for any additional items you may like, such as loco numbers, special names, logos for the tender etc.

Please visit Stan's web site and e-mail your orders to Stan, requesting the CPH decal set:

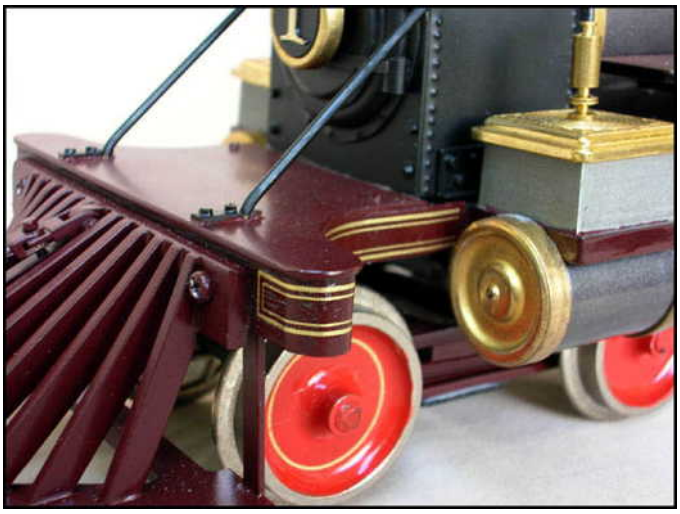
Cedarleaf Custom Railroad Decals

You should really install the decals at the time when the various sub-assemblies are built and painted, before the loco is finally assembled.

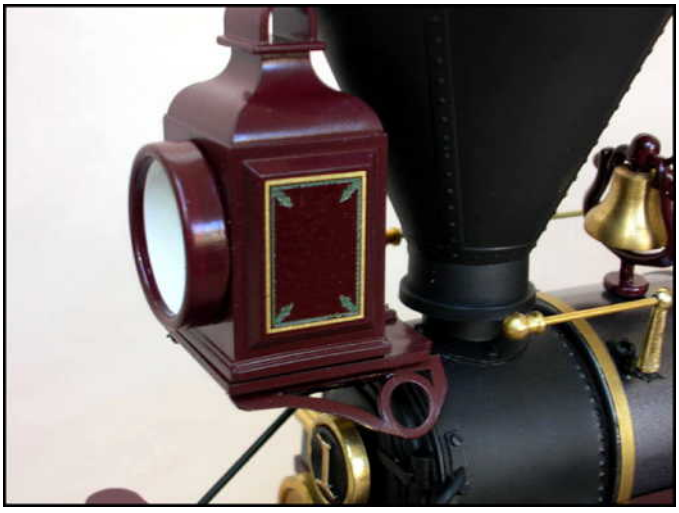
Refer to the ***PDF titled "CP Huntington Decal" (CPH-CH2-1.pdf)***. This is a full-scale copy of the decals you will be buying. Where the lines are shown black, these will in fact be printed in gold. The entire set is coloured in green and gold as the basic colours.

Note: On the PDF, the labels that indicate what parts of the loco the various decals are meant to be applied to. Let's go through them while looking at the model:

The Pilot Deck: Two strips of decals to be applied along both sides of the pilot deck, wrapping around to the pilot. The closed end of the decal 'boxing' should be on the pilot beam, the open end of the decal should butt into the cylinder area. These decals contain ONLY gold lines, no green lines at all:



Decals applied to side of pilot deck.

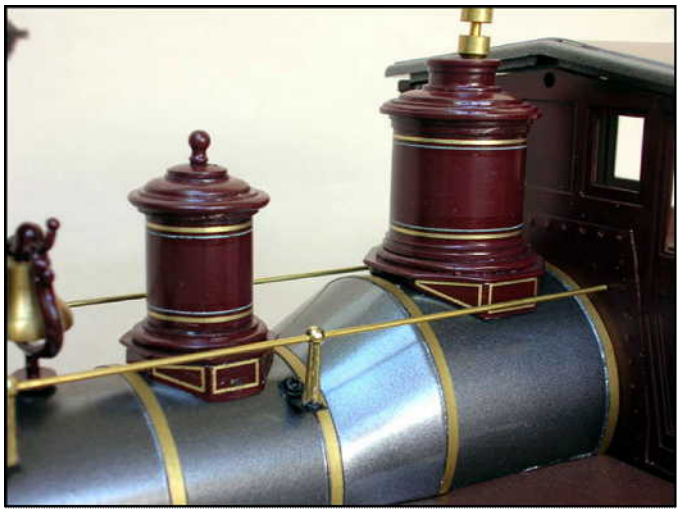


Headlight decals in place.

The Headlight decals: These are to be cut out as plain rectangles and applied to the side of the headlight box like this:

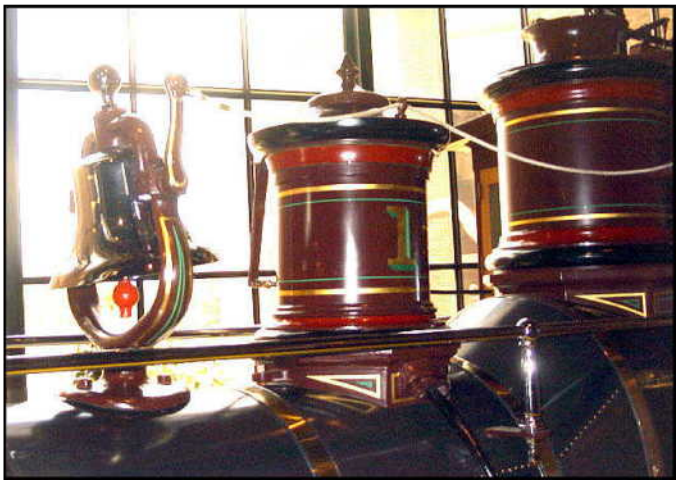
The Smokestack Decals: Use these decals only if building the *"C.P. Huntington"* version with paint scheme as seen today in the museum. The line-work on the stack such as this would never have been used in an operational manner, but it sure looks cool on the static loco today! There are 4 segments to apply to the stack, apply the larger ones to the lower cone first, and use the rivet lines to align the decals properly. Then apply the upper decals to match the positions of the lower. There are no rivet lines as a guide on the upper cone, so use the lower decals as a guide to locate properly.

The above stack I lined with gold vinyl, however in the decal set, the line-work is now finer, with gold and green line-work in parallel.



The Sand & Steam Domes: The domes require decals to the Octagonal bases, as well as stripes about the central cylinders. Use the special gold/green strips from the decal set; wrap them around the dome cylinder ends with the gold facing outward and the green facing inward. Like this:

Additionally, if you are modelling the CPH to the colour scheme of today, there are heavy black and red bands to be painted onto the cornices of the domes, near the tops and bottoms. You will need to hand paint these molding colours:



The Cab Wall Decals: There are a number of decals to be applied to the cab walls:

1. Main cab panel on the sidewalls. Can be a plain box, or can have *"C.P. Huntington," "Sir Phil Jensen,"* or a name of your choice applied.
2. Two sub panels below the main panel in the cab extension area. Cut these two boxes as ONE decal, keeping the spacing between the boxes intact. The total setout of the two boxes is identical to the larger box on the main cab panel.
3. In the lower cab extension at the front, below the forward doors are a small box decal.
4. On the rear walls, below the rear windows, on the lower cab extension areas are a box decal.

Decals seen at front and side of cab, this set shows no name in the main cab panel. Look at finished photos to see *"Sir Phil Jensen"* box applied in its place.

Lower rear cab panel decals added.

The Tender Decals: The tender decals comprise green and gold line-work to the tender flare and heavy green and gold lines to the upper and lower tender tank.

The tender flare decals come in three parts and are kinda tricky. Before soaking the decals, you need to trim the open end of the flare side decals such that the last 15mm of the decal lines at the far end are separate from each other, like two tails on the end of a larger decal. You want these two tails separate so that you can wrap them around the rear corner of the flare. You will have to manually curve the tails around the upper and lower edges of the flare, maintaining the separation between them to be consistent with the flare sides. You will need to do this to both rear corners of the tender flare. Then apply the straight green and gold line-work across the rear of the flare, overlapping the ends of the side decals.

The tender tank decals are much simpler, apply the heavy green and gold lines around the tank in 3 sections (2 sides and rear), there is no gold line-work required on the front face of the tender. Install the line-work with the gold line facing outward and the green facing inward. Note to start and stop the decal lines either side of the rear tank cleats. The total tender decal installation will look like this:

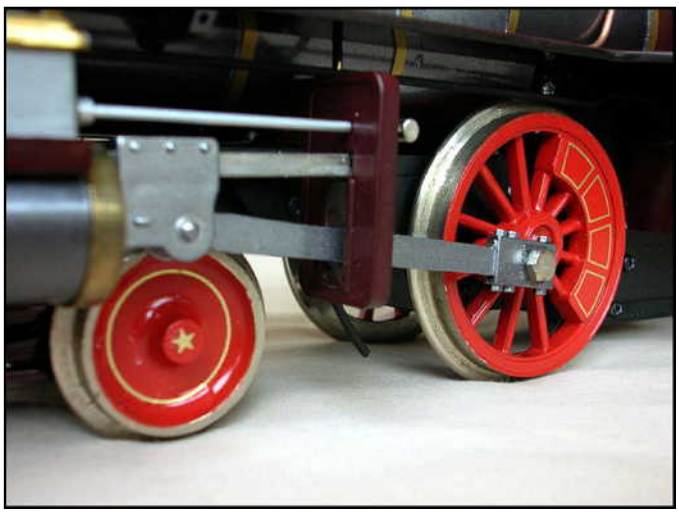
The Wheel Decals: The wheel decals include.

- Drive wheel counterweight line-work.
- Line-work to pilot and rear truck wheels.
- Stars to pilot truck hubs.

The counterweight decals are simple to apply, but just watch to centre them on the counterweight properly. If you start the decal alignment at one end of the counterweight, it will be out of line with the wheel spokes. Basically every wheel spoke should align with a gap in the gold boxes on the counterweight.

The pilot and rear truck wheel lines are really tricky. Before wetting the decals, you need to cut out the gold circles, and then trim out a 10mm diameter hole in the middle of the circle. Then, wet the decal, such that a donut-shaped decal comes off. You need to apply the gold ring around the wheel hub as evenly as you can, both in a perfect circle and centred, otherwise as the wheel turns the gold lines will visually 'wobble' and look awful. You have lots of spare gold rings to use, so it may take a few tries. On the hub of the pilot truck wheel, apply one tiny gold star.

I've also provided larger gold stars to the drive wheel hub. If you work out a way to apply a *'hub cap'* over the screw in the hub, then use one of these gold stars to finish the job. The chassis wheels will look like this:



Well, that about wraps it up. This is *MasterClass Mini 2005*, coming to a close... except for one final thing:

If you enjoyed building this little loco using the MasterClass format here at MLS, then I ask that you do one more thing; consider going over to Chris Walas' **Figureclass**, and make your own 1:20.3 scale crew for this locomotive using Polyclay to Chris' excellent instructions. Start here:

MLS FigureClass By Chris Walas

I hope you enjoyed the model making and history of these often over looked locomotive designs, known as *'The Single.'*

The method of chassis construction is useful to a host of locomotive scratch-builds and the method for making domes and wagon top boilers will serve you well on other projects.

Good luck.
David Fletcher
June 2005