

Smokebox Construction

The smokebox sits right at the front end on a real, full size, live-steam traction engine or roller and it provides five main functions:

- Access to the internal boiler tubes for cleaning purposes.
- A chamber in which a blast of steam from the exhaust up the chimney causes a partial vacuum below it in the fire tubes - that way drawing air through the fire.
- A support point for the chimney.
- A place to attach the steering arrangement (*although some engines had this mounted further back, actually sitting under the front of the boiler barrel – but we shall not be going down that road for simplicity's sake*).
- Somewhere hot to fry your bacon and sausages or boil your kettle when it's brew time.
-



In this live-steam model we need only two of those functions as it serves only to support the chimney and have the steering mounted under it, plus it also provides the necessary appearance of a conventional live steam traction engine.

At the front of **PYRTE**, the smokebox is basically a 3 inch (75mm) length of the same copper boiler tube, slit at the bottom to allow it to be opened up a little, with the gap filled in with a copper strip. There is a plate silver-soldered on the front with an easily produced brass cover held in place by a long bolt (*with a fancy handle on it – as can be seen in the picture*). This long bolt is attached to a plate inside the smoke-box (*although this is not shown on the drawing below*).

To produce the smoke-box tube, square the ends in the lathe using the same method as used in shaping the boiler barrel. The smoke-box needs a top centre line marking for the chimney, and one at the bottom that will need cutting to open the diameter up to fit over the boiler front end. We'll be filling the gap shortly, so don't worry too much about that for now.

While you have it in the lathe, at the rear end, a mark at $\frac{3}{16}$ (5mm) is scribed around the circumference showing the drilling points for the bolts (or rivets – brass nuts and bolts are easier, and the heads can be shaped to look like rivets if the mood takes you, once they are installed) that hold the smokebox onto the boiler barrel.

I used brass countersunk screws, 4ba again, with the outer smoke-box countersunk to allow the tops of the screws to sit flush (allowing easy smoke-box removal if need be for any painting and maintenance that may be required) with a view to having the insulation and the outer boiler sheet (cladding) covering them and held in place by bright brass boiler banding.

A mark on the top line for the centre position of the chimney saddle is needed at 1½ inches (37mm) from the front edge. While it is still in the lathe, the rear and front marks of the chimney saddle outer positions are marked at 2¼ and ¾ inches (57mm and 19mm) from the front along the top and

also scribe very lightly 1½ inches (37mm) either side of the top line, roughly at 1½ inches (37mm) from the front again – *what you will be doing is to bore a hole in the top to fasten the chimney on with, and these marks allow you to centralise the chimney saddle).*

At the front, a “door-plate” to fasten the smokebox door onto is needed and is silver soldered into place, although before this is done the smokebox needs to be split along the bottom line (the perch line, the underside) from the front to the back and the enlarged smokebox diameter made to fit onto the boiler barrel.

Once you have cut along the bottom line, you need to produce two circular plates to match the outside diameter of the boiler barrel.

Mark two circles in the 13-gauge sheet, at exactly 4 inches in diameter (or to match the outside diameter of your barrel), with the front one having a second mark at 3½ inches (82mm) in diameter (*this is the smokebox door size to allow centralisation of your smokebox door*) and a third at 3 inches (75mm) in diameter (the front access hole). This one is your door-plate – a thinner plate, say 16-gauge, is fine if you do not have enough of the 13-gauge, as these plates are under very little load at all.

The rear (4 inch) plate needs a circle marking on it at around 2½ inches (60mm) and the inside circle wants removing. This is not critical, but the bigger the hole the easier the soldering as it will be used to keep the rear of the smokebox diameter at the right dimension, and will allow silver solder to be applied to the front plate from the inside through the rear plate, and once the soldering is done will be heading for the recycle bin.

Trim these two plates precisely to the boiler diameter dimensions, and with the rear one set at a ½ inch (12mm) from the rear, and the other a flush fit at the front with the marked rings on the outside, clamp the split smokebox with wire around them.

This will leave a gap (at the base of the smokebox) that needs filling with a strip of 16-gauge copper, being silver soldered in place and that way strengthening the smokebox.

With this strip a tight fit and softened and bent to the same round shape as the smokebox – you could use a flat strip and round the underside off with a fine file on completion - a second layer of copper, treated the same way (overlapping both sides by a quarter of an inch or more) can be placed



above this strip on the inside of the smokebox (*seen in this early blurred picture and butting up to the plate at the front end*).

My filling strip was a nadger's under ¾ inch (10mm) wide, but you will have to adjust these measurements to a good fit for your particular boiler diameter – you can see where my supporting plate was bolted in the centre, and this also acts as a drain hole if one is ever needed. You may also have noticed the supporting plate in this picture is longer than the smokebox, and you need to keep it around a ½ inch (12mm) shorter at the back end so that the smokebox can slip on the end of your boiler without this obstruction, plus the flat on the smokebox door plate was later

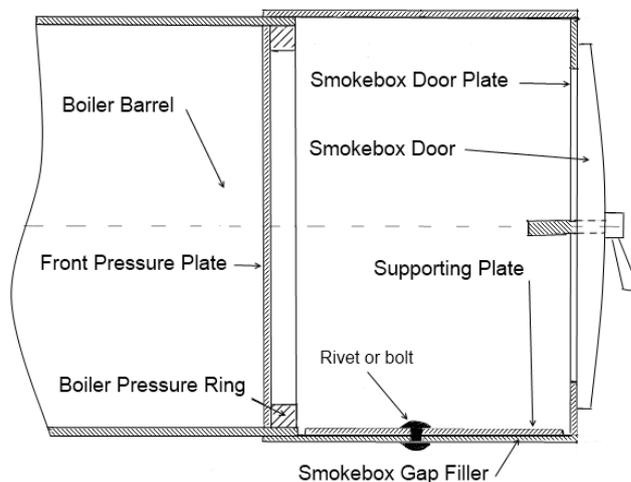
removed as the build progressed – so no need to have that.

The length of this wider plate (the supporting plate) should be 2¼ inches (57mm) and sits butted up to the rear of the front plate (*although this one was longer and proved to be a bit awkward when it was soldered into place as I tried assembling it on the boiler*) and should be sat centrally along the length of the filler plate, which is 3 inches long to match the length of the smokebox chamber.

Rivet or bolt the two plates together, with the supporting plate set back from the front end by the thickness of your doorplate and sitting centrally along the length of the filler plate (*not quite shown true on the drawing below*).

Bolting is fine as the smokebox on this model does not need to be airtight like the usual steam engine fashion, so when the bolt is removed, everything is ok.

With the smokebox sitting on its front end and the door plate inside and flush with the front end and the filler piece sitting centrally along the length of the supporting plate, slip the rear plate just



inside the top end (rear) and tighten the smokebox up with your wire (*use steel rather than copper wire, as copper wire, being softer, would give too easily, and that way allow the completed smokebox to warp or be a lousy fit on the front of the boiler barrel*), you can then silver solder the gap-filling plate and its supporting plate, along with the front plate into position – but do not attach the rear plate as this is purely to keep the rear end of the smokebox to size.

This sectional drawing shows the arrangement and position of the parts.

Getting a perfect joint is not particularly important here, as the smokebox does not have to be airtight, like in a conventional traction engine smokebox, but a tidy external finish is needed.

The smoke-box now should be a simple tube, thickened at the bottom internally by your supporting plate, with the same internal diameter as the external diameter of your boiler, and should just fit on the outside of your boiler.

It now needs divisions on the back end on the $\frac{3}{16}$ inch (5mm) line for the brass bolts. I used sixteen 4BA by $\frac{3}{4}$ inch steel bolts here, (steel was used to temporarily bolt the smoke box onto the boiler for fettling purposes) as it is a very easy division to produce with the paper method.

Set the smokebox tube up in the 3 jaw and check the ends by skimming very lightly. Now with your piece of paper, you need to mark the bottom centre line along its length (using the old paper method and working from the already marked top centre line – the chimney line).

Scribe the bottom line in.

Starting at the top centre line at the rear of the smokebox, mark these sixteen points along the $\frac{3}{16}$ inch (5mm) line and drill them with a 3.6mm size drill (clearance), trim the inside smooth, then slide the smokebox over the front of your boiler barrel, lining up the top lines of the smokebox with that on the boiler barrel, making sure the back end of the smokebox coincides with the five-sixteenths inch (8mm) back from the front line you put on the boiler barrel, and that the barrel and smokebox are dead straight in line, otherwise your chimney may end up all over the place and the traction engine appearance will be a little cock-eyed.

I suggest you drill one hole, the top one, making a point of checking the bolt will sit centrally on the width of your front anchor ring of your boiler, trim it before bolting it, then move on 180 degrees to the opposite one on the smokebox, with the same procedure, especially the lining up of the two parts.

The third and fourth holes are then drilled at the 90° and 270° positions, checking again the line of the two parts. *(The easiest way to do this is to place a straight-edge sitting along the top/side/bottom edge of your smokebox and check that the boiler barrel sits parallel to it.)*

Doing one hole at a time is the safest option, and each time you clean the burrs through the front, you can check that the bolt is sitting centrally through the front anchor ring of your barrel, and in no way is it penetrating the pressure side of the barrel itself, or the pressure plate, even though you have to remove the bolts in the smokebox from the barrel to check it.

If you have ideas about exceeding this 50lb/sq in. working pressure, then I would advise not using soft solder at all on the smokebox, otherwise you may just find you have a few parts falling off as you are steaming round and you may end up with the boiler barrel sitting on the floor at the front end, with the steering and front axle having gone walk-about on its own.

Once this is completed, remove the smokebox.

In the vice, holding the smokebox by its ends between pieces of timber, a hole needs to be made at $\frac{1}{4}$ inch (6mm) diameter, using the central point for the chimney that was marked on the top line ($1\frac{1}{2}$ inches – 37mm - back from the front) as the centre for the chimney.

The SMOKEBOX DOOR



The smokebox door is a simple brass $\frac{1}{4}$ inch (6mm) plate at $3\frac{1}{2}$ inches (87mm) in diameter with a $\frac{1}{16}$ inch (1.5mm) lip cut away at 3 inches (75mm) in diameter at the rear to locate it against the smoke box front plate and the front face rounded off for appearances sake.

It is bolted through the centre into a threaded steel flat sitting to the rear of the smokebox front plate, and has a fancy handle soldered onto the screwed rod, again for appearances sake.

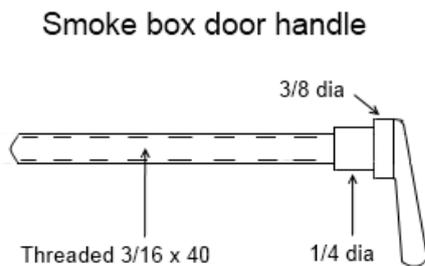
With the hole in the centre bored out to $\frac{1}{4}$ inch (6mm) it can be mounted on a carrier and worked in the lathe very easily.

As can be seen here, from the outer edge I made a flat cut for $\frac{3}{8}$ of

an inch (10mm) before digging in a little and rounding the rest off towards the centre, that way having the full ¼ inch (6mm) thickness in the centre.

As has been said, the rear face is turned down to 3 inches (75mm) in diameter for a depth of 1/16 of an inch (1.5mm).

The rod at the rear is a simple flat of ⅛ inch (3mm) steel, being ½ an inch (12mm) wide and just fitting inside the diameter of the smokebox.



With a ⅝ inch (10mm) diameter steel rod being the basis, it is turned down to ¼ inch (6mm) after ⅛ of an inch (3mm) to produce a flange and then to 3/16 inch (5mm) after another ¼ inch (6mm) for another 2 inches (50mm). - because of this thin diameter it is best to do the final reduction in two sections before parting off and running a 3/16 x 40 thread on it - *the 2 inches (50mm) length is needed to leave room to get the threads engaged initially*

during assembly.

The handle part of this rod is a simple ⅛ inch diameter (3mm) piece of steel at ¾ of an inch (19mm) long with a slight taper cut on it with the head rounded and is soldered onto the end and needs to be leaning away from the face of the smokebox door.

Because of this arrangement, no hinges are necessary as the door is simply removed if needed.

Before this is placed on, insulation is best installed inside the smokebox and up against the boiler front plate, although that is best left until the boiler itself is insulated.