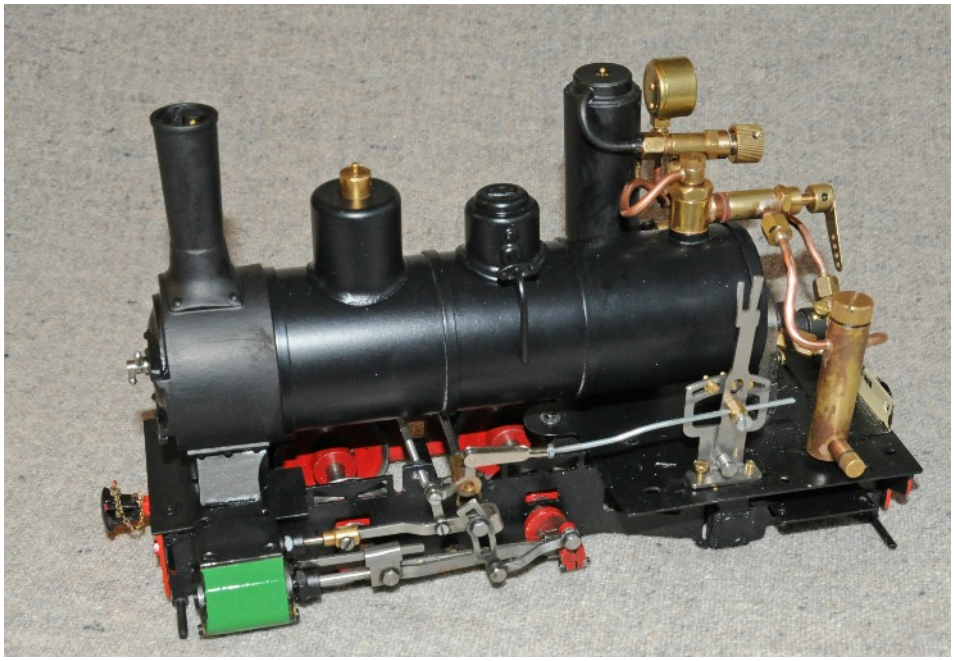
“Victory” - Assembly of Roundhouse parts and fitting of boiler



Introduction

These instructions cover the construction of the “Victory' chassis with simplified Walschaerts valve-gear. The valve gear is of a simplified design, which does not make use of a combination lever. No machining is necessary, though certain parts may require the use of hand tools to obtain a good fit and a small number of holes require drilling during the construction of the valve-gear. In the following pages I will take you through the construction step by step with the aid of written instructions, diagrams and photos. I have made the instructions as clear and concise as possible. Anyone with a little patience and care can build a working steam locomotive to be proud of using the minimum of hand tools.

Before starting to assemble the chassis **check that you have received everything** and read through all the instructions fully so that you identify all parts and understand where each is fitted. Refer to diagrams and pictures at all times as these will make it clear which way round certain parts go and what holes are used. From experience, Roundhouse has found that with this type of working model, it does not pay to work to 'too close a fit' in certain areas when assembling. Pay attention to any clearances and slotted holes etc. otherwise you may find that the first time you steam it up it will not run. The reason for this is expansion. A lot of heat is used to generate the steam and some of this is passed through the loco causing all parts to expand slightly. As several different materials are used, and some items get hotter than others, expansion is not uniform throughout. What seems perfectly free running when cold can lockup solid when hot, unless allowances have been made. The geometry of the valve-gear is quite precise and any alteration could have a bad effect on the smooth running of the finished engine.

Finally, bear in mind that this loco is designed to make use of Roundhouse components but differs from a Roundhouse loco in a number of respects. Please read the instructions carefully before you begin. Where possible, key differences in the assembly methodology between “Victory” and a Roundhouse loco have been highlighted.

Tools Required:

The following tools will be required during construction:-

Small and medium sized screwdrivers

Small (Swiss) files (needle files)

Drill with 1.6mm *or* 1/16” drill bit

Pair of long / short nose pliers

Wire cutters

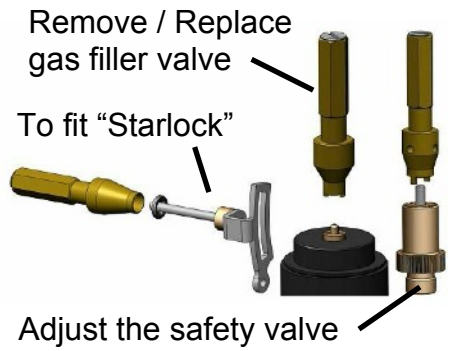
Small clamp (tool makers clamp or similar)

Spanners: 10BA, 8BA, 7BA, 5/16”, 1/2” and 9/16”

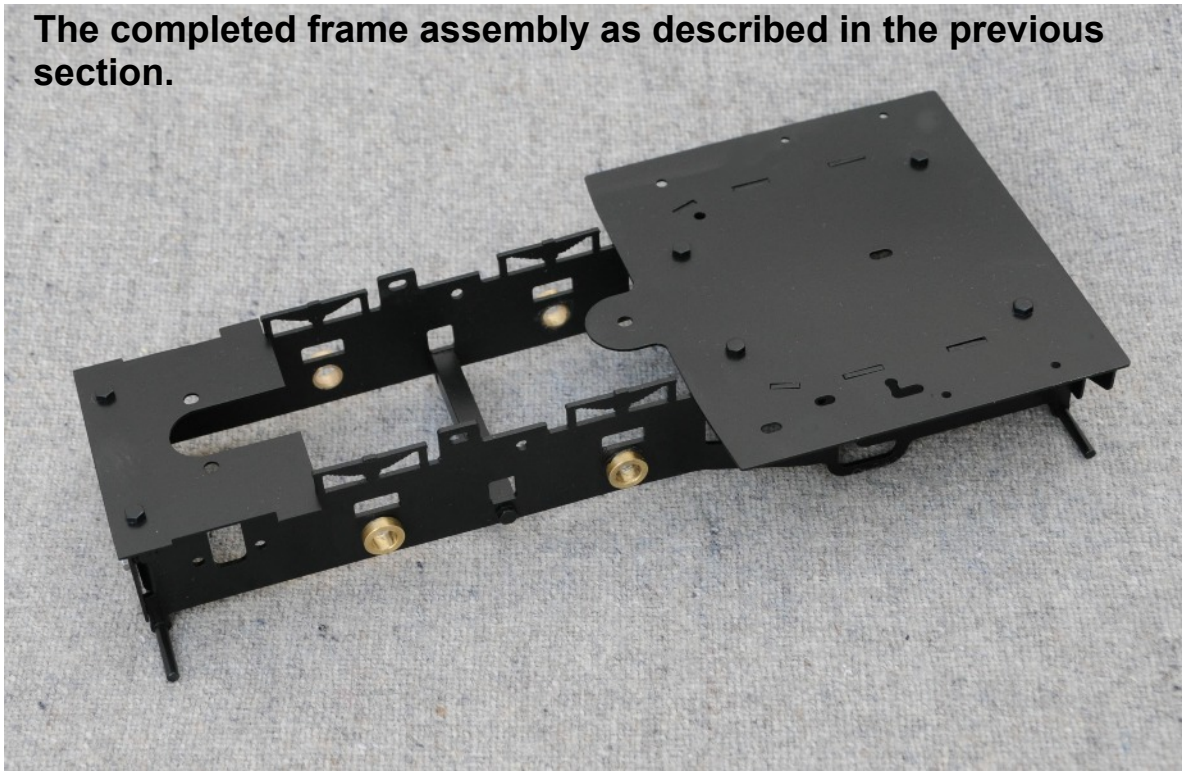
Hexagon keys 1.5mm & 2.5mm are supplied by Round-house with their parts

2 broaches or reamers for the “Victory” laser cut parts. (dependant on hole size 3 to 4mm or a 5.6 to 7.0mm are useful)

I found the Roundhouse Multi-Tool very useful as it is a normal screw driver with additional items as shown.



The completed frame assembly as described in the previous section.



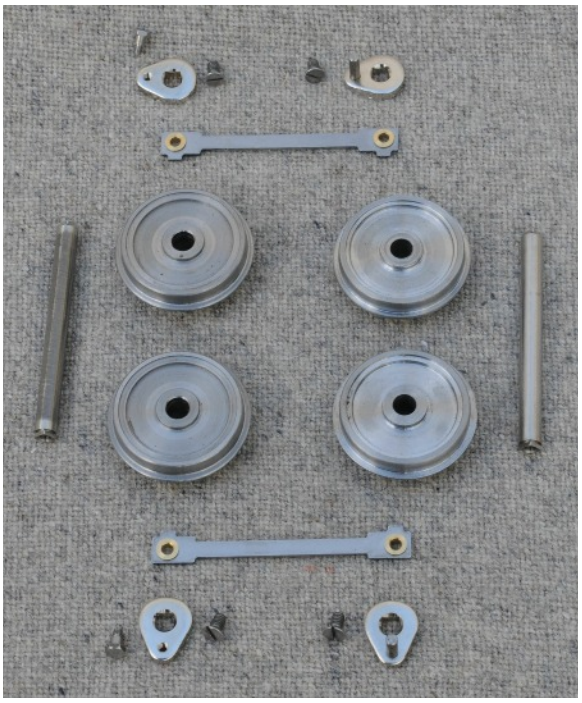
Roundhouse Parts

The Roundhouse parts for the "Victory" kit are packed in a box.

The items supplied are as shown, carefully sealed and packed in bubble wrap.

The Wheels, Axles and Outset Crank Assembly

The wheels and axles can now be fitted after first cleaning any paint out of the axle bushes and checking for free running by pushing one axle through each pair of bushes. Confirm also that there are no burrs in the hole in each wheel: turn the grub screw in until visible when viewed through the hole, turn it back out and then confirm that a Ø6.4 +0.1-0 drill passes through the hole without binding.



Starting with the right hand side wheels (see next page), first press the **outside crank with plain crank pin** (see below) onto the rear axle and then push the axle partly through one axle bush. Don't be concerned if the crank cannot be pushed fully home at this stage. Slip two loco' wheels on from inside the frame with the bosses and grub screws facing each other and towards the inside of the frame. Then push the axle through the other bush. Ensure that the axle rotates freely. If it doesn't very carefully clear the bore diameter through with a Ø6.4 +0.1-0 drill. Now fit the opposite outside crank with plain crank pin (see below). The outside cranks have square holes in the centre to ensure the ***quartering*** is correct. One side of the centre hole is countersunk, and should be to the outside, so that the fixing screw finishes up flush with the outer face of the crank.
Now convention says that the right hand side should lead. All this means is that when the model is running forward the right hand crank is 90 degrees, or a quarter of a revolution, in front of the left; hence the term 'quartering'. This is the norm for Roundhouse, though it would make no difference at all to the running of the loco if it were the other way round.

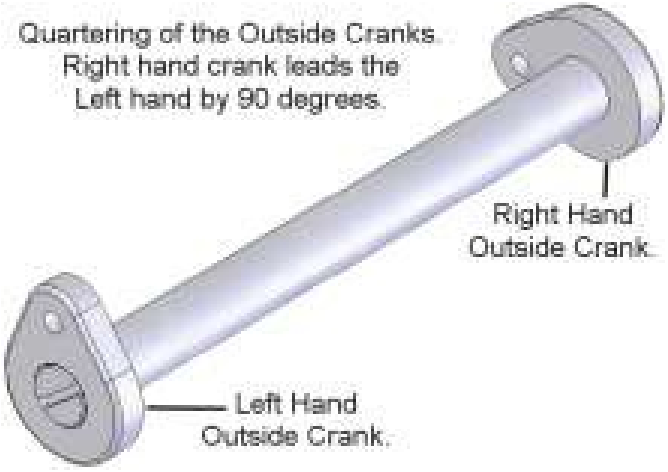
You should now have outside cranks with plain crank pins at each end of the axle, quartered with the right hand lead. The crank pins should, of course, be pointing outwards. To ensure that the cranks are fully home, i.e. the back of the wheel is in contact with the shoulder of the axle, press the cranks onto the axles by gripping each assembled wheel set between the jaws of a vice before fitting the screws. Remember to protect the jaws of the vice with scrap copper or brass sheet.

Check the end float in the axle by sliding it from one side to the other. If this movement is excessive check that the cranks are fully home on the axles. If the movement is excessive on the rear axle only, check that the frames are parallel. If they bend <u>in</u> slightly at the rear, loosen the bolts securing the rear footplate to the frames and bias the frames <u>outward</u> whilst tightening the bolts. It should <u>not</u> be necessary to fit washers to correct excessive end float.

Repeat for the front axle using the **plain outside cranks**. Note that the countersunk hole in the middle of the crank is on the outside face.

Plain Crank showing Outer face

Outside Crank with Plain Crank Pin fitted showing outer face

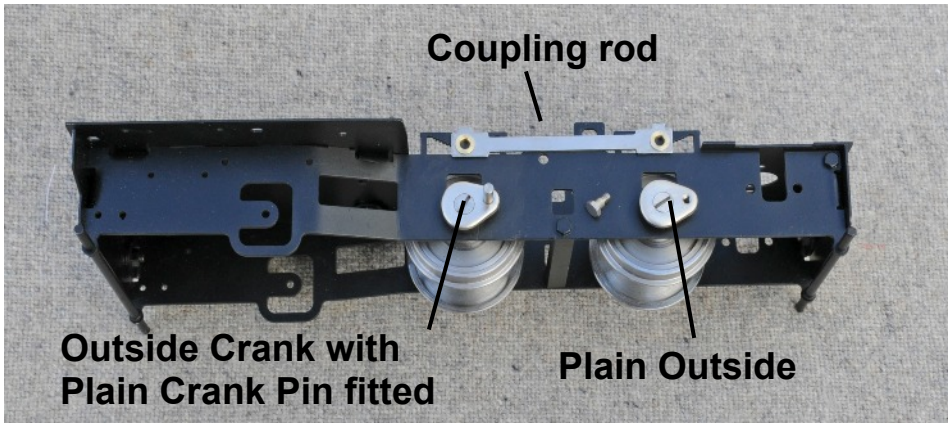


The driving wheels are moveable on their axles and are locked in place by a small grub screw. They should be adjusted so that the steel gauge supplied with the laser cut parts will just slip between their inner faces. Ensure that the wheels are evenly spaced relative to each side frame. Do not over tighten the grub-screws. Note that the wheel gauge can be used for either 32mm gauge (SM32) or 45mm gauge ('G' scale) depending on which end is used. Make sure again that both axles rotate freely.

0.4mm thick 5BA brass washers are supplied with the Victory fixings. Take two of these and place one of them over one of the rear crank pins and then push a coupling rod on after it, checking that the two lugs are pointing to the top and that the shoulder on the bush is on the outside of the rod. Connect the front end of the coupling rod to its outside crank using a short crank pin with the other 0.4mm 5BA brass washer between the rod and the crank. NOTE: You pressed the bushes into the coupling rods when you built up the frames. 2 slightly thicker (0.6mm 5BA) steel washers are supplied with the Roundhouse parts. These are used later in the build. Do not use these here (as would be the case with a Roundhouse loco) as this may result in binding between the front axle crank and the coupling rod.

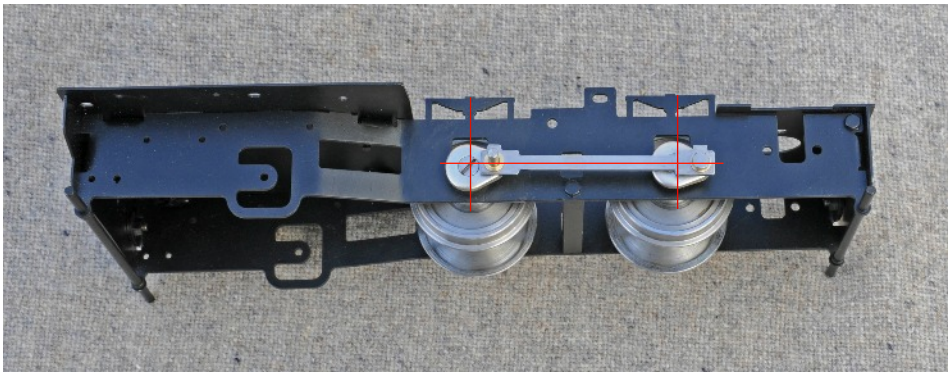
Repeat for the opposite side.

Slowly rotate both front and rear wheels together and feel for any tight spots. If they stick at all, look which side has its outside cranks at or near front or rear dead centre (that is pointing to the front or rear of the chassis). On that side remove the front crank pin and check to see how the hole in the coupling rod bush aligns with the hole in the outside crank. You may find that, with the cranks in the position where you felt the tight spot, the hole in the bush is offset to the front or rear of the hole in the crank. Slightly enlarge the hole in the front coupling rod bush - the hole is machined 3.2mm, so enlarge it using a 3.3mm drill or reamer if you have one, otherwise elongate it in the direction as it is offset with a small round file to remove the bind. Remove only a very small amount at a time and keep trying it until the wheels rotate freely without any tight spots. Don't forget that a 5BA brass washer included in the Victory fixings should be between the outside crank and the coupling rod on all four cranks. You have achieved free movement when you can push the chassis backwards and forwards, on a smooth surface like a plate of glass, using just your little finger.



Additional items are as follows:

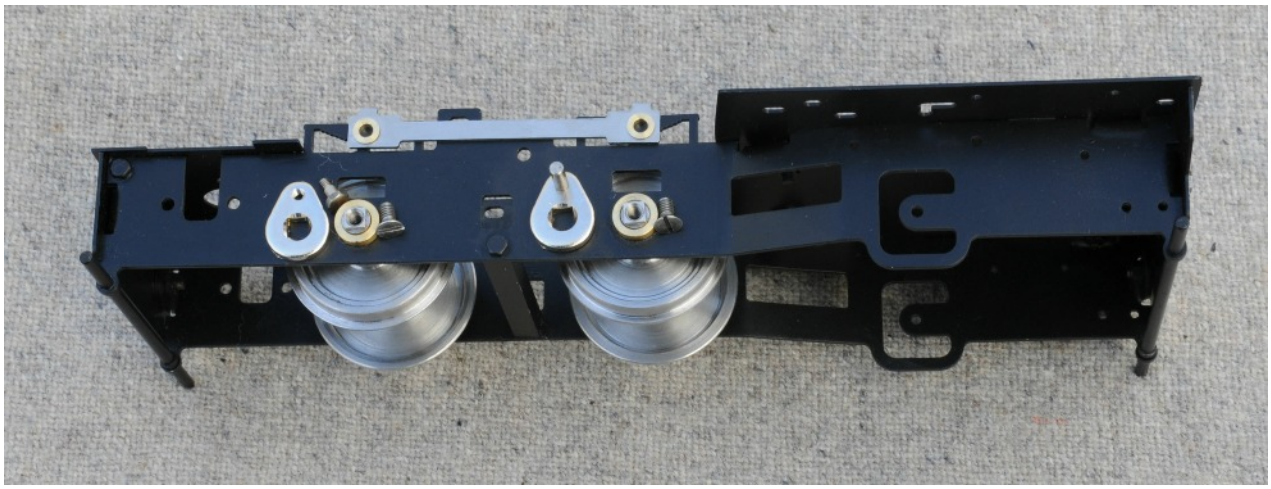
Short crank pins. - 1 off as shown Washers - 2 off as shown.



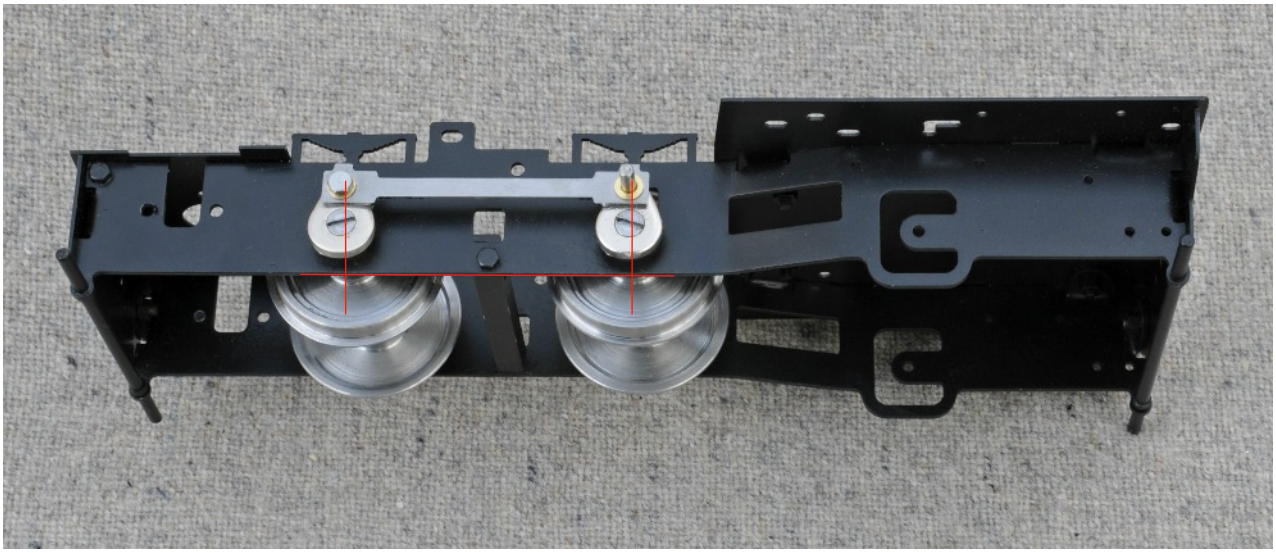
Don't be tempted to move to the next stage until the chassis rolls freely.

This shows the right hand side set up so that the cranks are at 90° to the vertical line, as shown by the red lines.

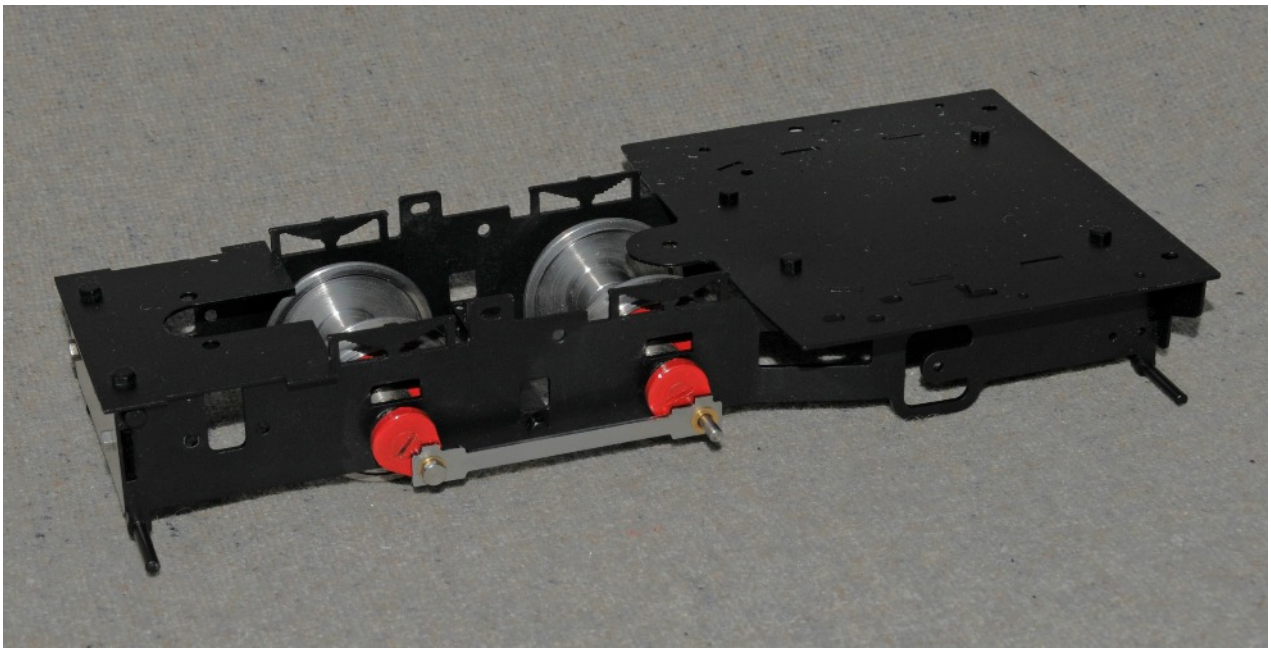
The coupling rod is fitted and the short crank pin held lightly, to prevent the wheels rotating.



Now look at the left hand side without rotating the right hand side of the previous view.

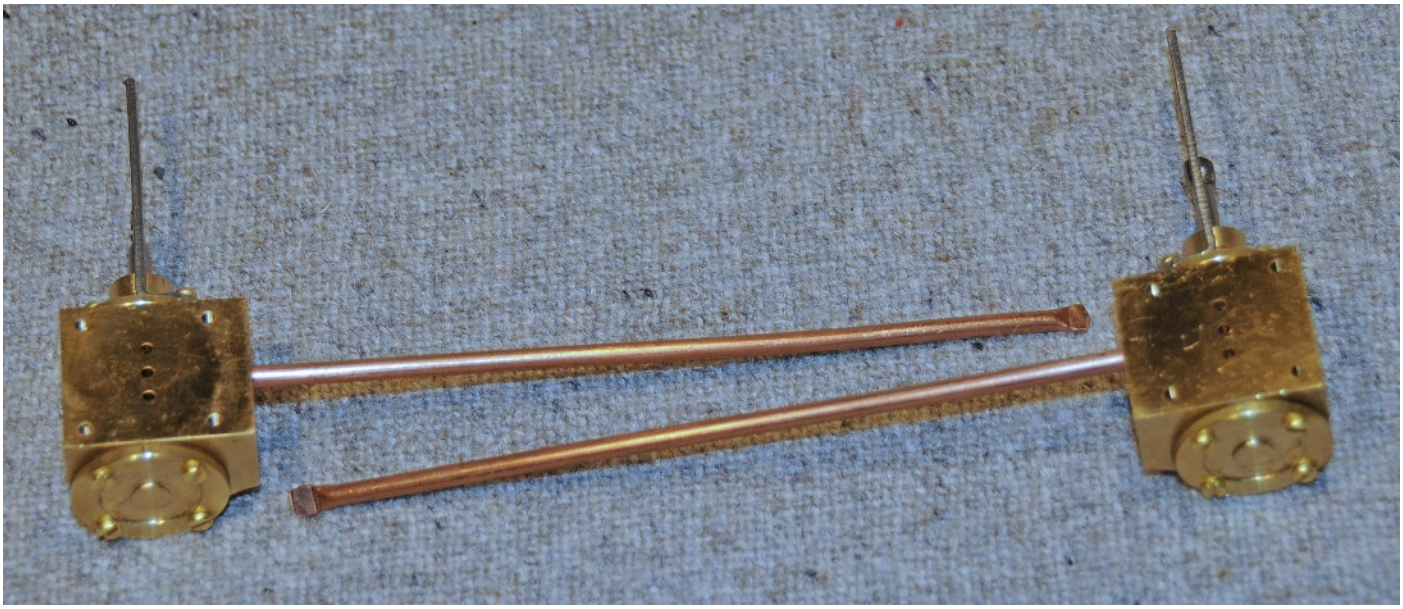


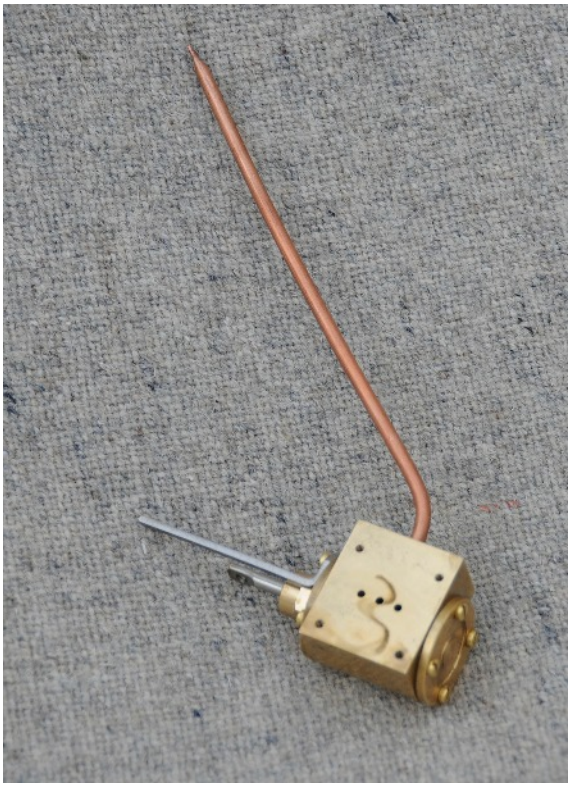
Now fit the coupling rod with the outside cranks as shown still ensuring that the position is in the correct place.



This is a good point to remove the coupling rods and paint the outside cranks if you wish to do so.

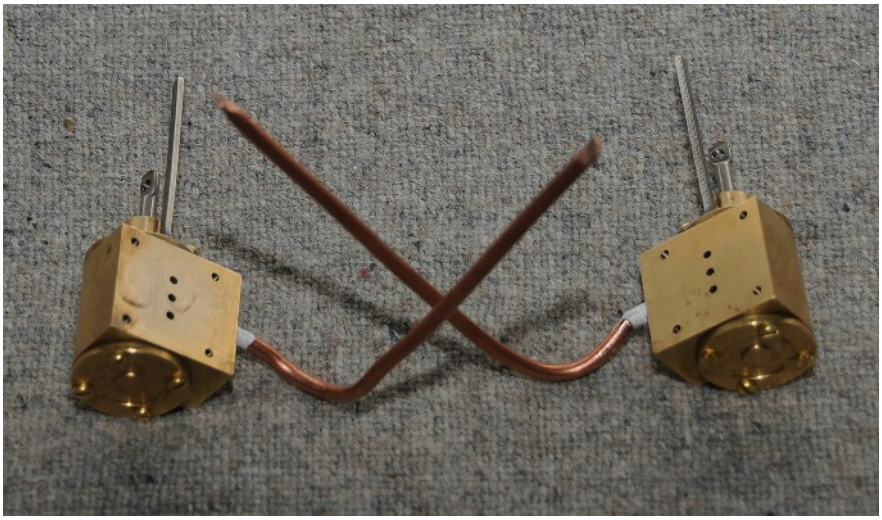
Prior to attaching the cylinders to the frames, the exhaust pipes are formed. The exhaust pipes are threaded into the cylinders. Before you start, make sure that the pipes are screwed home fully. The pipes are made of copper, which is soft, so take care not to over tighten. Limited movement is desirable.





The right hand cylinder is shown with the first bend to the exhaust pipe formed. The pipe bends up at 90 degrees to the top of the cylinder. The bend needs to be formed such that, when the cylinder is fitted to the frames, the portion of the pipe pointing upwards is central between the frames and will therefore fit nicely inside the chimney.

The left hand bend is a mirrored image of that on the right.



There is an extra slight bend forward as shown in this photo.

You can seal from the exhaust pipe to the cylinder with PTFE or an alternative sealant. Take care **not** to cover the bore through the pipe.

The next step is to form the superheater pipe with the aid of a jig. The design is shown on the next page and the forming instructions follow.

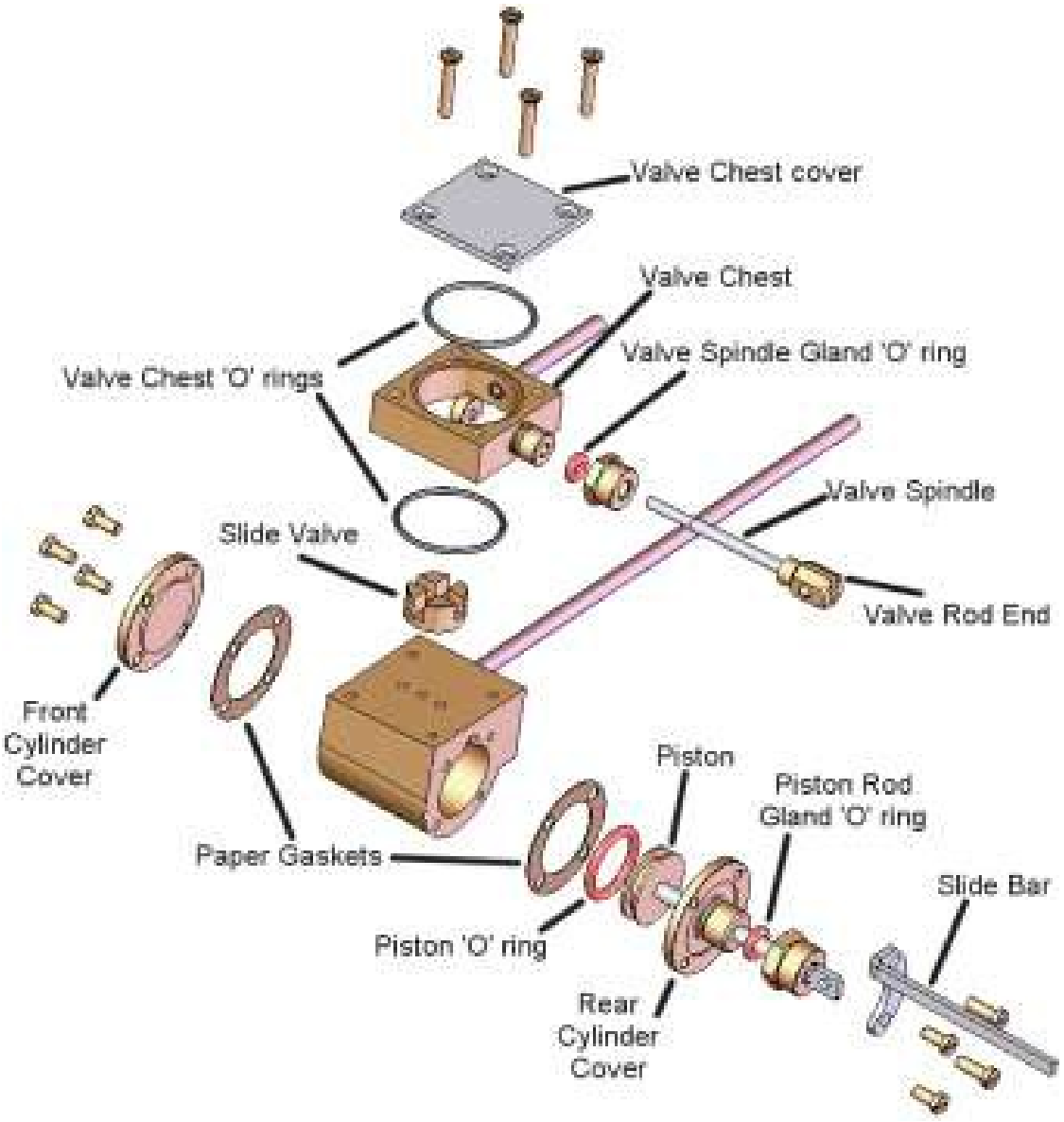
Cylinders

Having formed the exhaust, you are now ready to fit the cylinders to the frames.

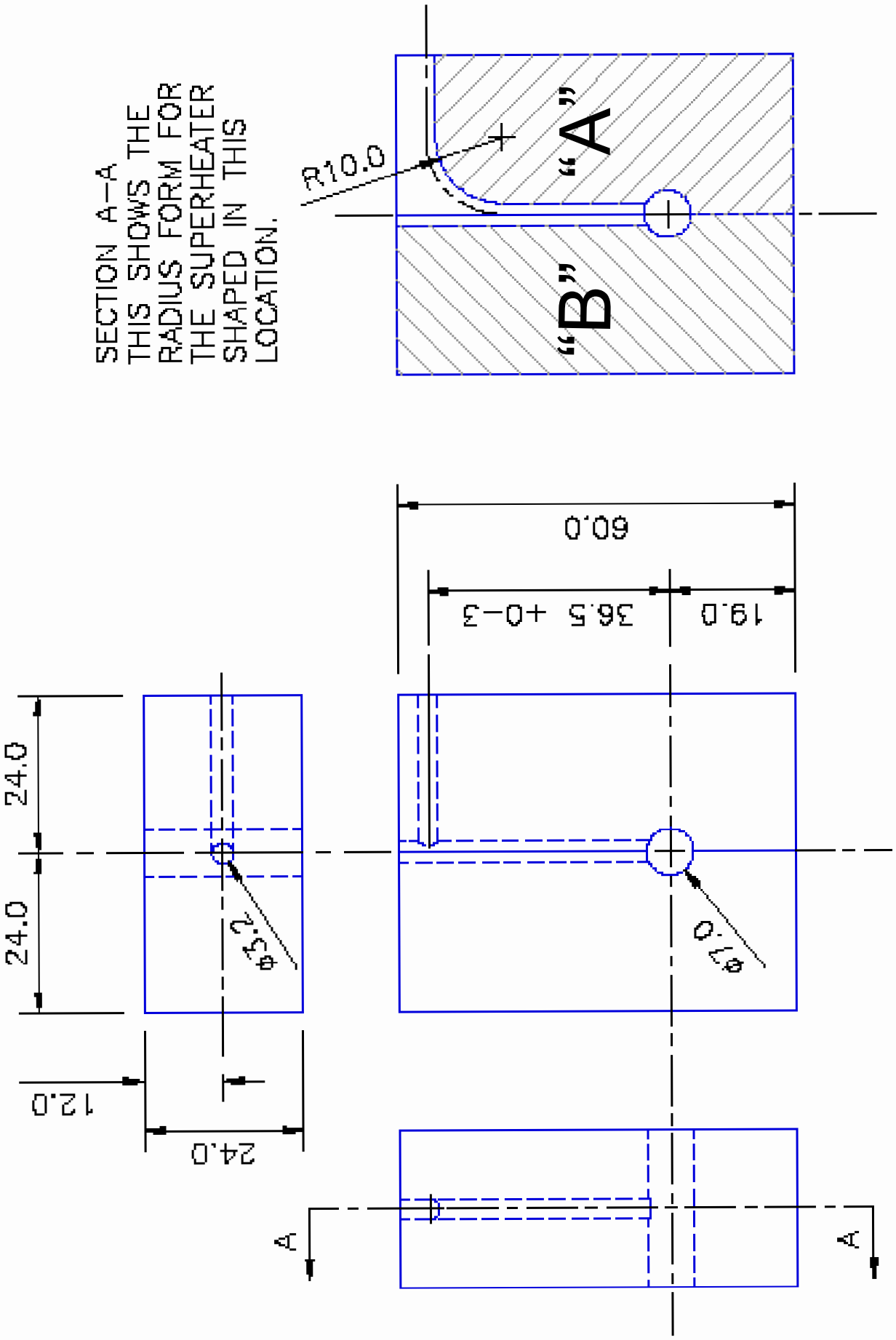
Using two socket cap mounting screws and washers, fix one cylinder block to the chassis through the 2 outer holes either side of the slot for the steam pipes at the front of the frame. Make sure that the washer fits between the head of the socket screw and the frame. The copper exhaust pipe should be bent forwards and slightly up out of the way.

The exhaust pipe has been formed in the previous step. Don't worry about its final position at this stage. Check that the cylinder blocks are level to the frames and tighten up the socket screws with the Allen Key provided.

Do not fit the valve chests at this time as the inlet pipes need to be formed, which is described on pages 12 and 13 and requires that the superheater pipe has been formed, which is described on pages 9 to 11.



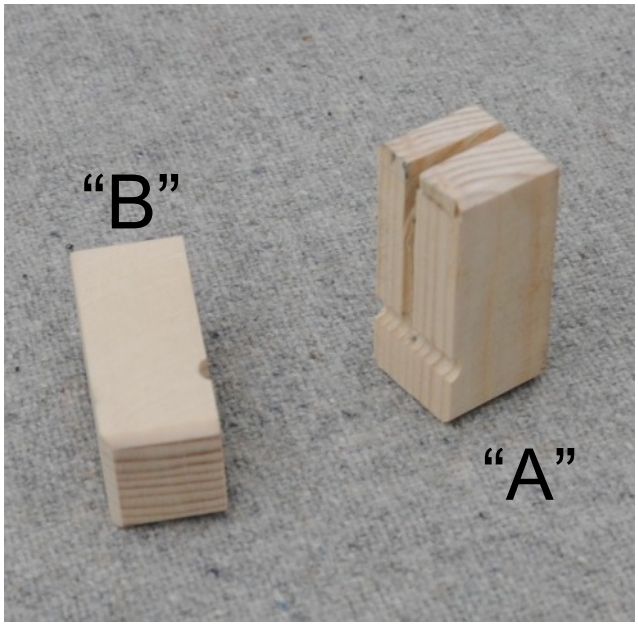
Superheater Jig - from two pieces of wood.



The jig will only be used once so can be made from soft wood.

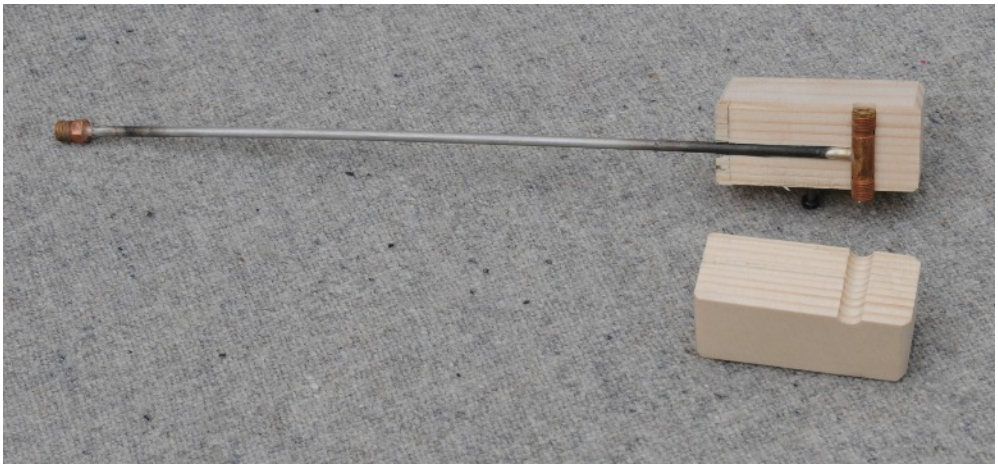
With the two pieces of wood clamped together drill the holes as shown on the drawing.

File the radius on part “A” and use the radius checking tool provided with the 1.0mm section laser parts.

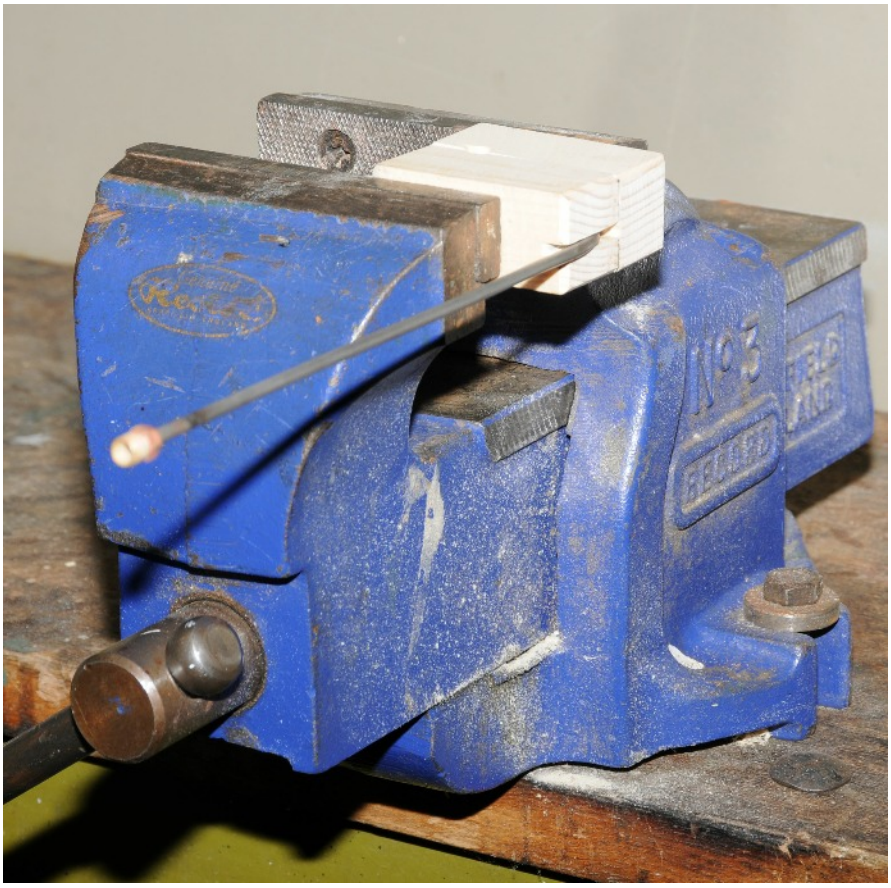


The superheater can now be fitted to part “A” of the former. It is supplied by Roundhouse with union nuts and “O” rings fitted - **these need to be re-moved before forming.**

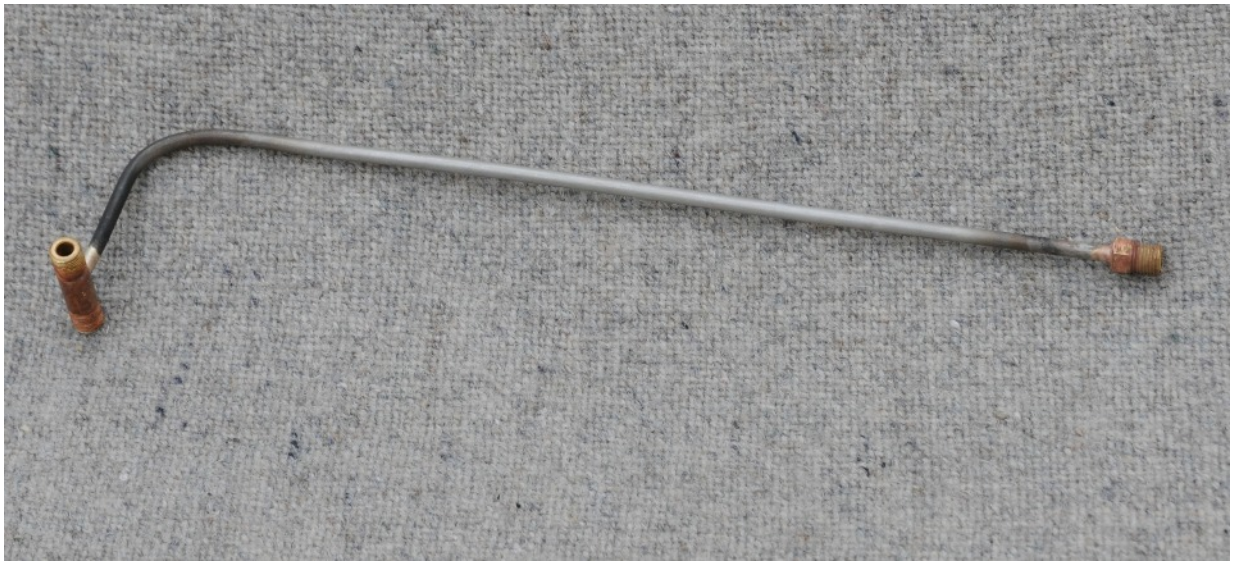
You are now ready to clamp part “A” to part “B”.



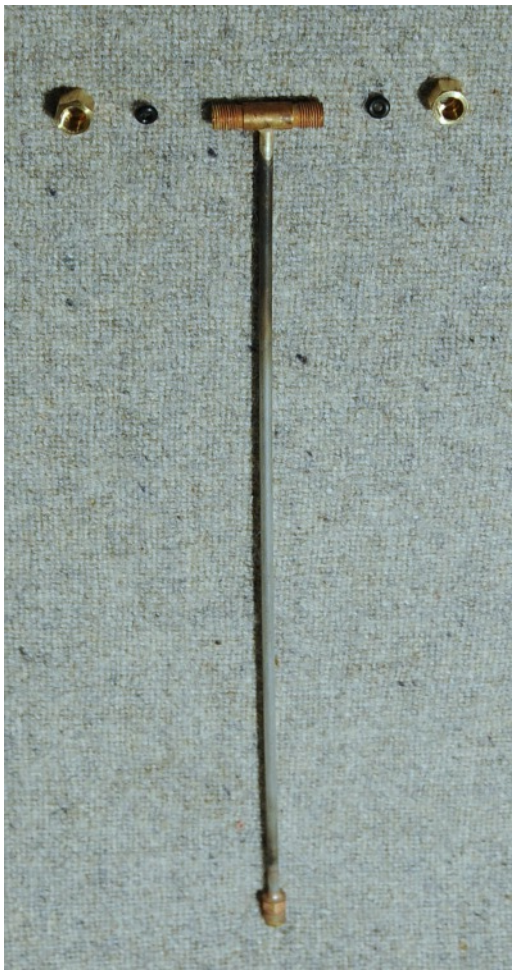
“A” & “B” are now clamped together with the superheater in place ready for forming.



The superheater has now been formed with a simple pull around the two wooden jigs.



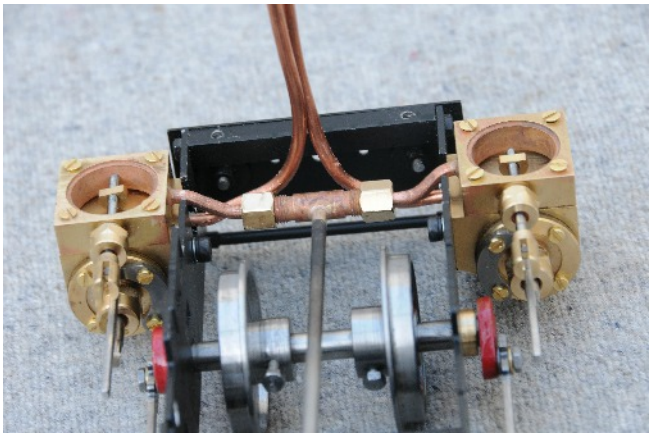
The superheater is now ready.



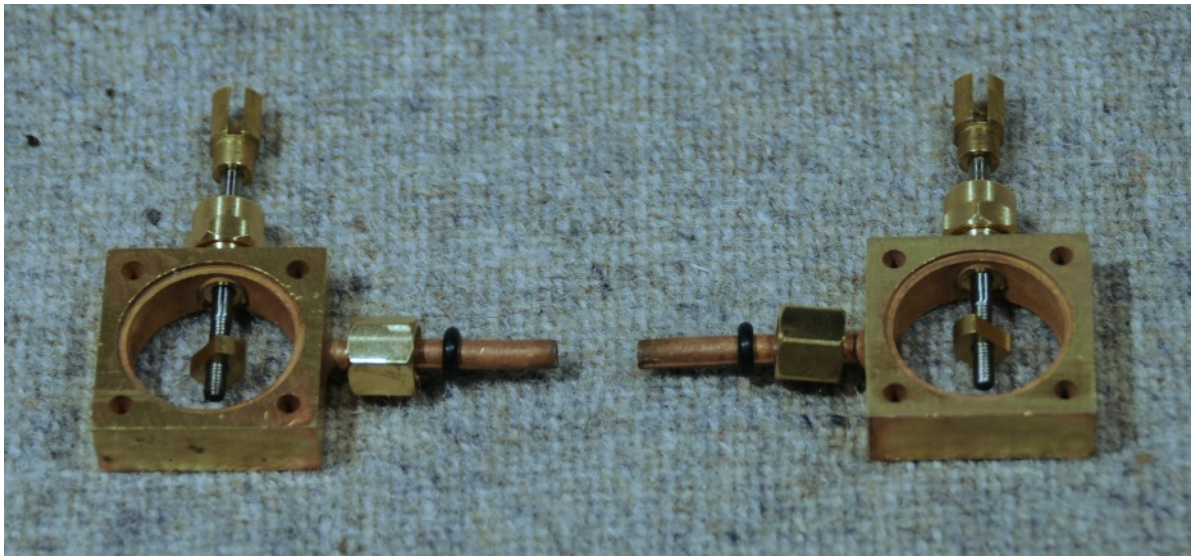
To the left, the superheater is shown un-formed as supplied by Roundhouse with its union nuts and “O” rings.

The union nuts and “O” rings go over the pipes from the valve chests but should not be fitted until the pipes from the valve chests have been formed.

Forming the superheater pipe has already been described on pages 9 to 11.

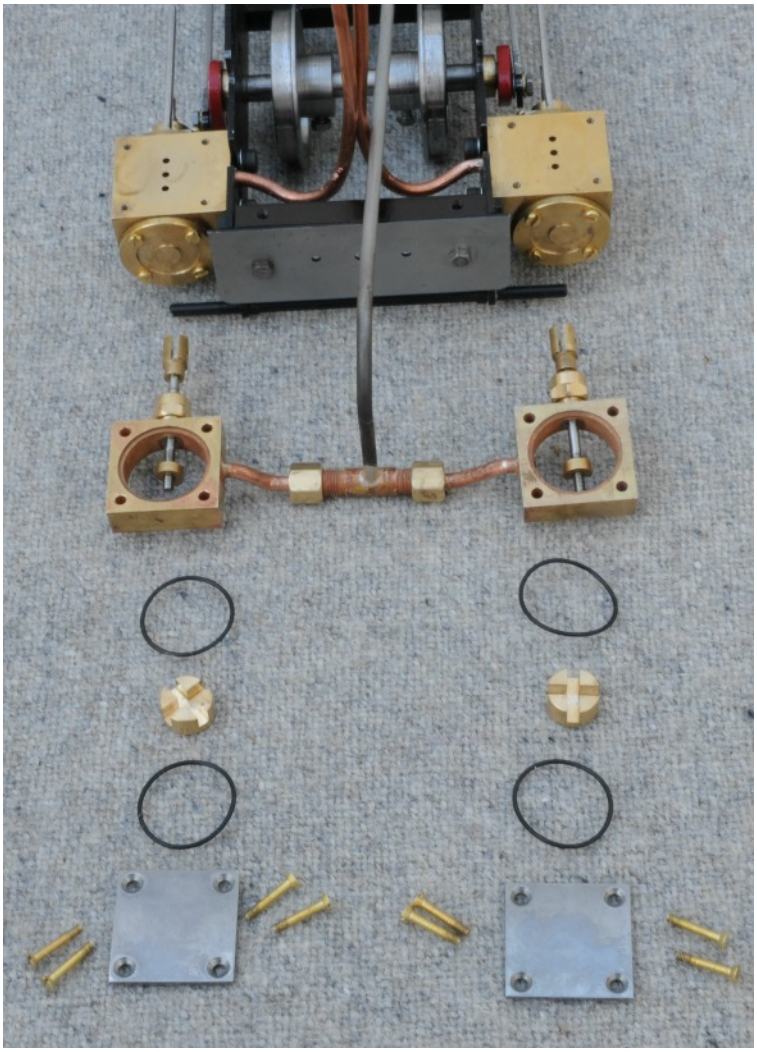


This shows the superheater fitted, but still needing to be formed, so you can see the relative positions of the pipes and components.



Each valve chest includes a steam pipe, which requires forming to align to the superheater, which is below the level of the valve chest so that the superheater “T” piece is below the cheese head screws used to secure the smokebox to the front footplate. Refer to the photo above and the one on page 14 for details of the bends to be formed.

It should be formed so that when located the fittings and pipes will clear the underside of the the smokebox mounting plate. Once the pipes have been formed as shown above, attach the valve chests to the superheater and trial fit them on top of the cylinders. Adjust the bends and the distance between the 2 valve chests as necessary.

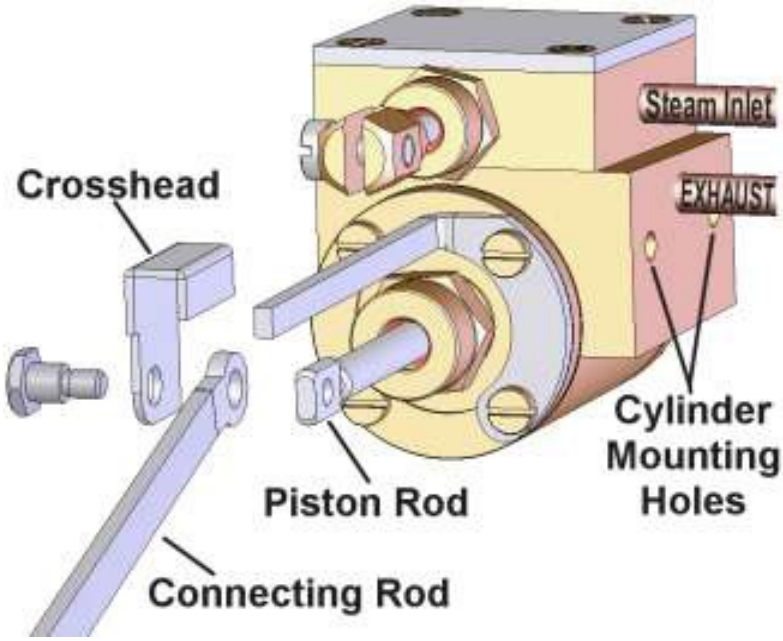


This shows the valve chests and associated components ready to fit on top of the cylinders. Note that the valve chests have been loosely fitted to the superheater. There are 3 reasons for this:

- It avoids mixing the valve chests up, because they are now right and left handed as a result of forming the inlet pipes.
- The forming of the inlet pipes can be verified to ensure that both valve chests are at the same height. Lay a straight edge across the top of the valve chests to confirm this and adjust the forming of the inlet pipes as required.
- The assembly can be adjusted for width so that the pipes are pushed into the superheater far enough to achieve the required separation between the valve chests and that the superheater is central between them. This is best done before fitting the valve chests to the cylinders.

Now, rotate the valve chest & superheater assembly through 90 degrees, so that the them lie on their front edges and you can access the lower face of each chest. Smear the recesses at the bottom of each chest with a little oil or Vaseline. Take one of the black valve chest 'O' rings and press it lightly into the recess in the chest. Repeat for the other valve chest.

Next, take the slide valves and place them on top of the cylinder blocks, one on the left and the other on the right, so that they cover the three holes in the centre of each cylinder face. Pick the valve chest/superheater assembly up by the superheater pipe and place it over the cylinders, taking care that each valve nut fits into its slide valve. Take care that the 'O' rings remain in their recesses, though they should not move as the oil/Vaseline will tend to hold them in place. If either moves, it can easily become trapped under the edge of the valve chest. If the valve chests don't spring back from the cylinder face when lightly depressed then the 'O' ring has remained in place. Also check that the valve nut has the round side facing uppermost and that the flat side is located in the slide valve slot.

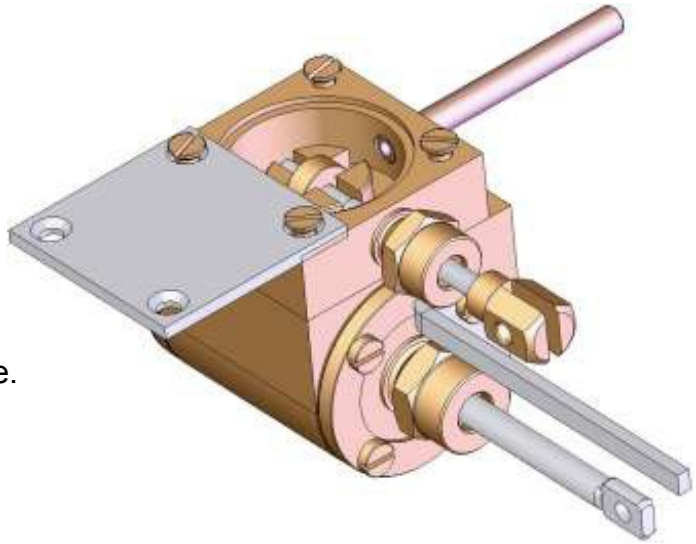


This Roundhouse picture shows the left hand cylinder and valve chest assembled, along with the orientation of the Crosshead and connecting rod.

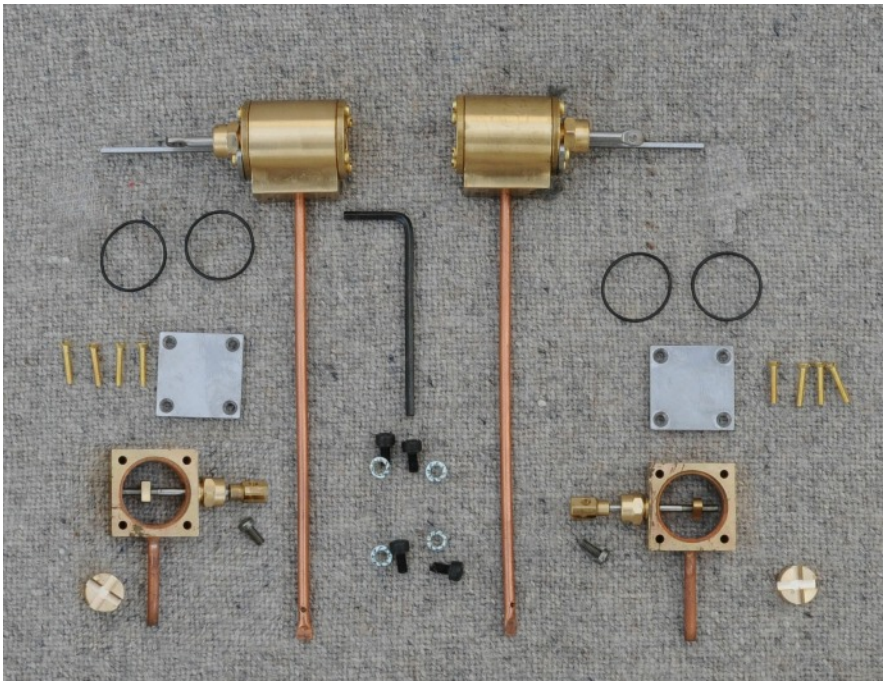
Using just two of the brass counter sunk screws half fit the valve chest cover so that it is offset to the outside, as shown in the diagram. This allows you to see into the valve chest to adjust the position of the slide valve later on when setting the timing. Do not fit the top valve chest ‘O’ ring at this stage.

Using the Roundhouse “Victory” parts include a specially designed stainless steel superheater. The superheater has a 'T' connector silver soldered to one end which connects the two cylinders. Slide one of the 2 hexagon union nuts onto the steam inlet pipe followed by an 'O' ring. Now slide one end of the superheater 'T' on and loosely screw the union nut onto it with the 'O' ring inside. The superheater should be pointing upwards for now. Put a union nut and 'O' ring onto the inlet pipe of the second cylinder and fit this to the chassis ensuring that the inlet pipe fits into the open end of the 'T'. Loosely screw the second union nut onto the 'T'; then position it centrally between the frames and tighten up both union nuts just sufficiently to squeeze the 'O' rings a little. **Do not** over-tighten or you will crush and damage the rubber 'O' rings. Extend both piston rods and check that they are parallel to the top or bottom edge of the chassis, or more simply, that they are pointing straight at the centre of the rear axle. If not,slacken off the two cylinder mounting screws that you have just fitted through the frames, move the cylinder round a little until it is in line and re-tighten the screws.

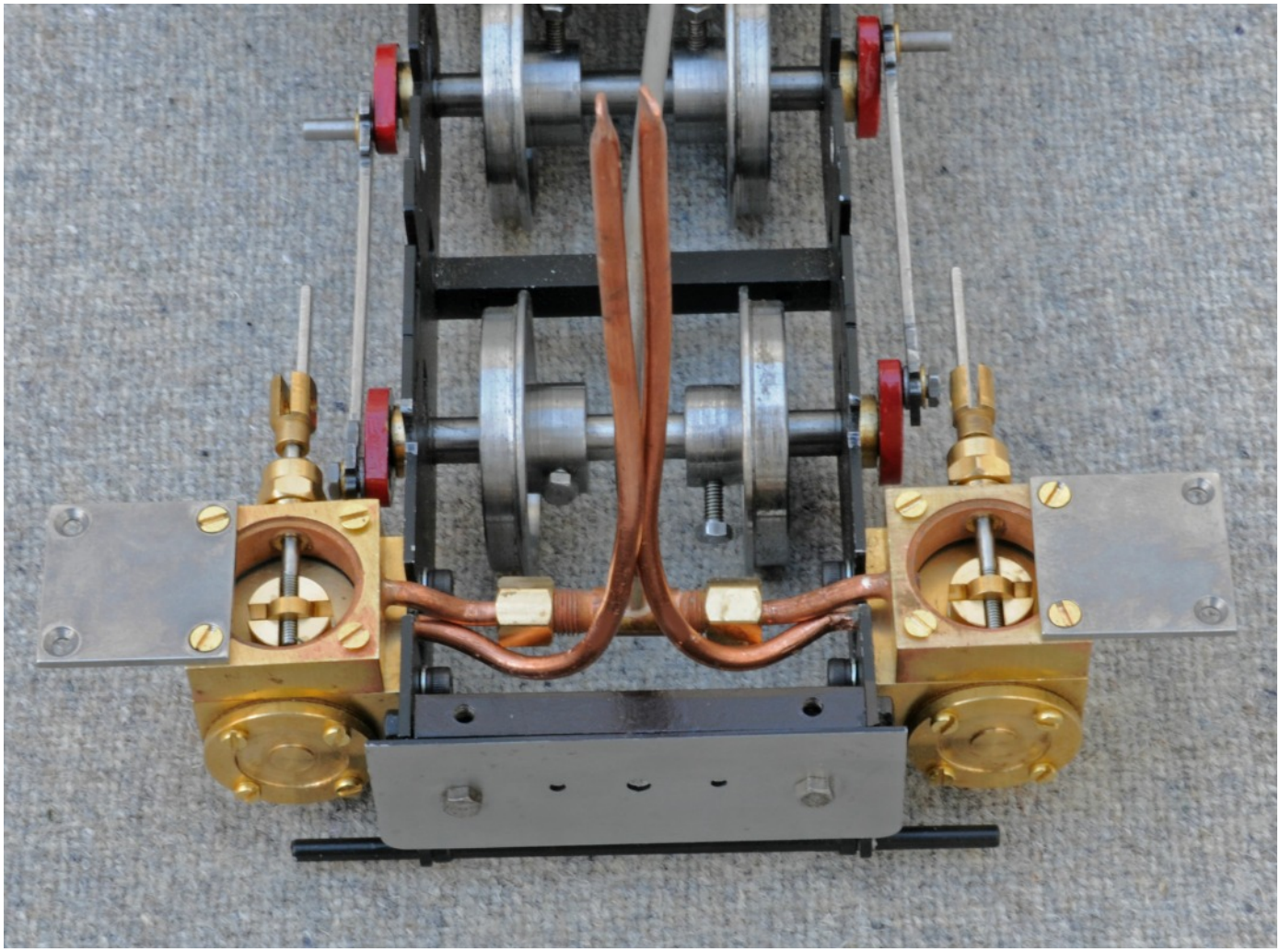
See the next page for the photo’s showing the formed pipe work.



This picture was provided by Roundhouse.

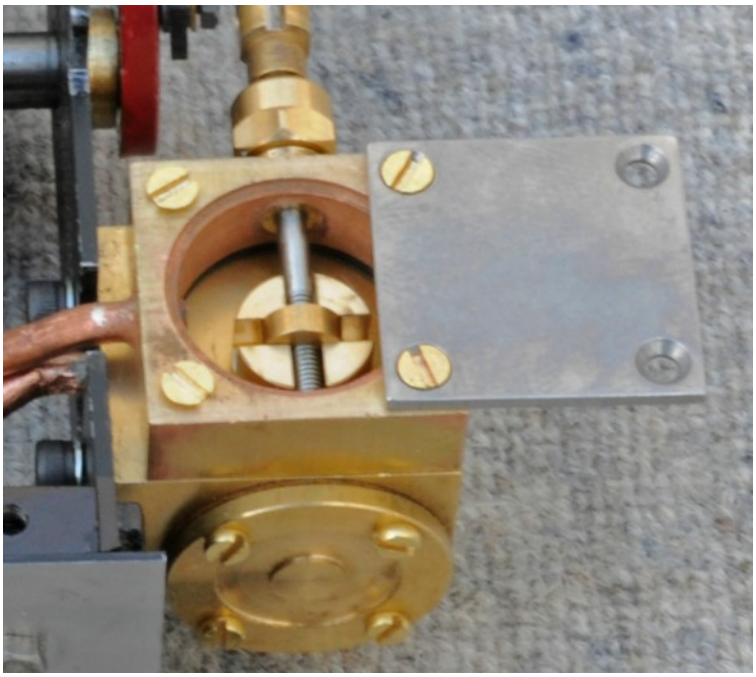


Parts supplied for the cylinders.



Note: when assembling the valve chest ensure that the items are correctly located, as shown.

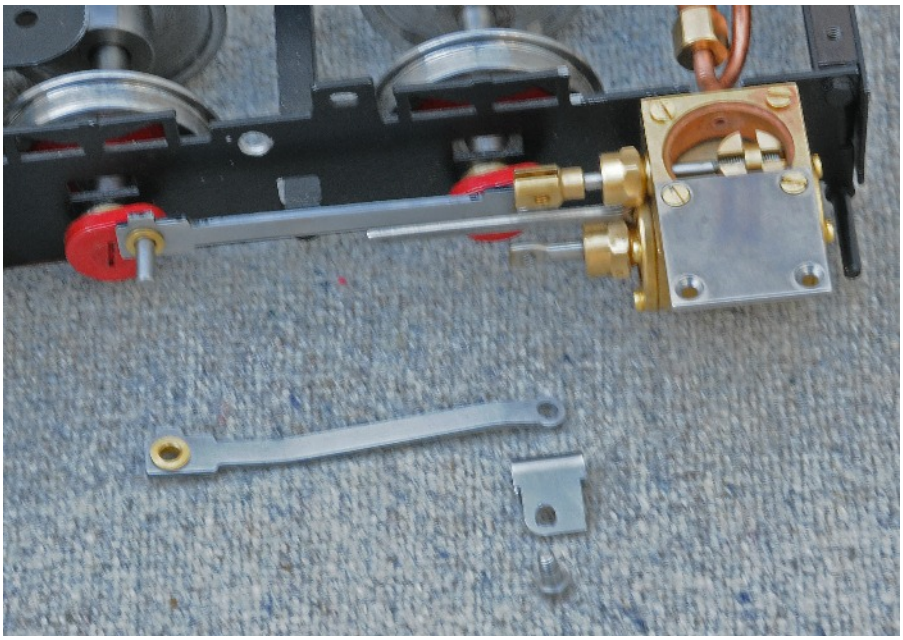
Prior to going further, you may want to fit the smokebox to its mounting plate and fit the assembly to the frames, to confirm both the correct alignment of the exhaust pipes and sufficient clearance between the top of the superheater “T” piece and the cheese head screws used to secure the smokebox to the footplate.



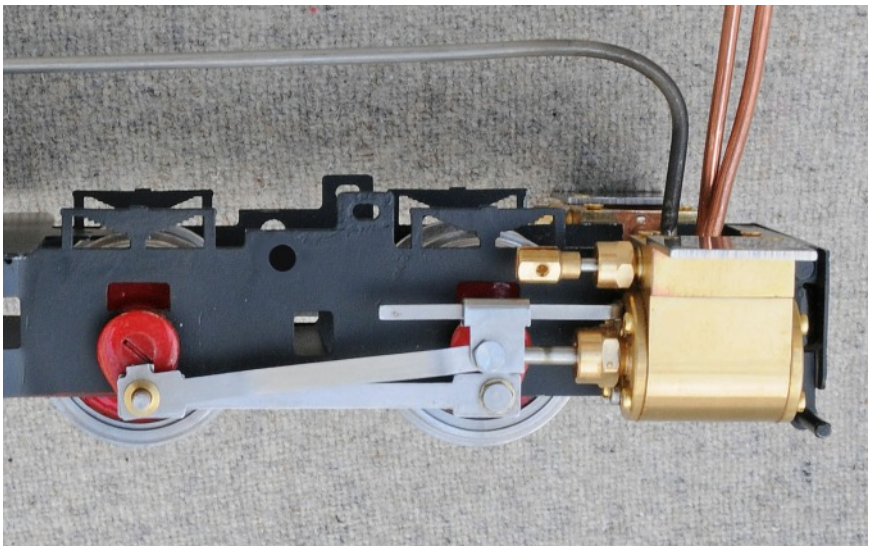
Connecting Rod - “ Victory” version

As with the coupling rods the two lugs at the rear should point upwards. The smaller, rounded end connects to the piston rod and the larger squared end fits over the rear crank pin. The rods are cranked outwards because the piston rod is further out from the chassis than the outside crank. Unlike a Roundhouse chassis, there is no need to fit a 5BA steel washer over the rear crank pin because the bushes in the coupling and connecting rods will create a 0.7 mm clearance between the two rods. Therefore, just slide the connecting rod 'big end' over the crank pin. Confirm that the “little end” is parallel with the machined and threaded face of the piston rod. If it isn’t, the rod may have been bent too little or too much and will need to be adjusted gently. Push the cross head screw through the stainless steel crosshead and then through the connecting rod 'little end' and finally screw it into the end of the piston rod. Confirm that there is still a small amount of movement. Repeat for the other side and then rotate the wheels to check that it all operates smoothly. You will now feel the resistance of the pistons sliding up and down the cylinders, though there should be no tight spots. We are now ready to move onto the valve gear.

Concentric Rod - as used from the “Victory” laser kit - right hand side (both photos).



The Roundhouse crosshead and the short crank pin are also shown.

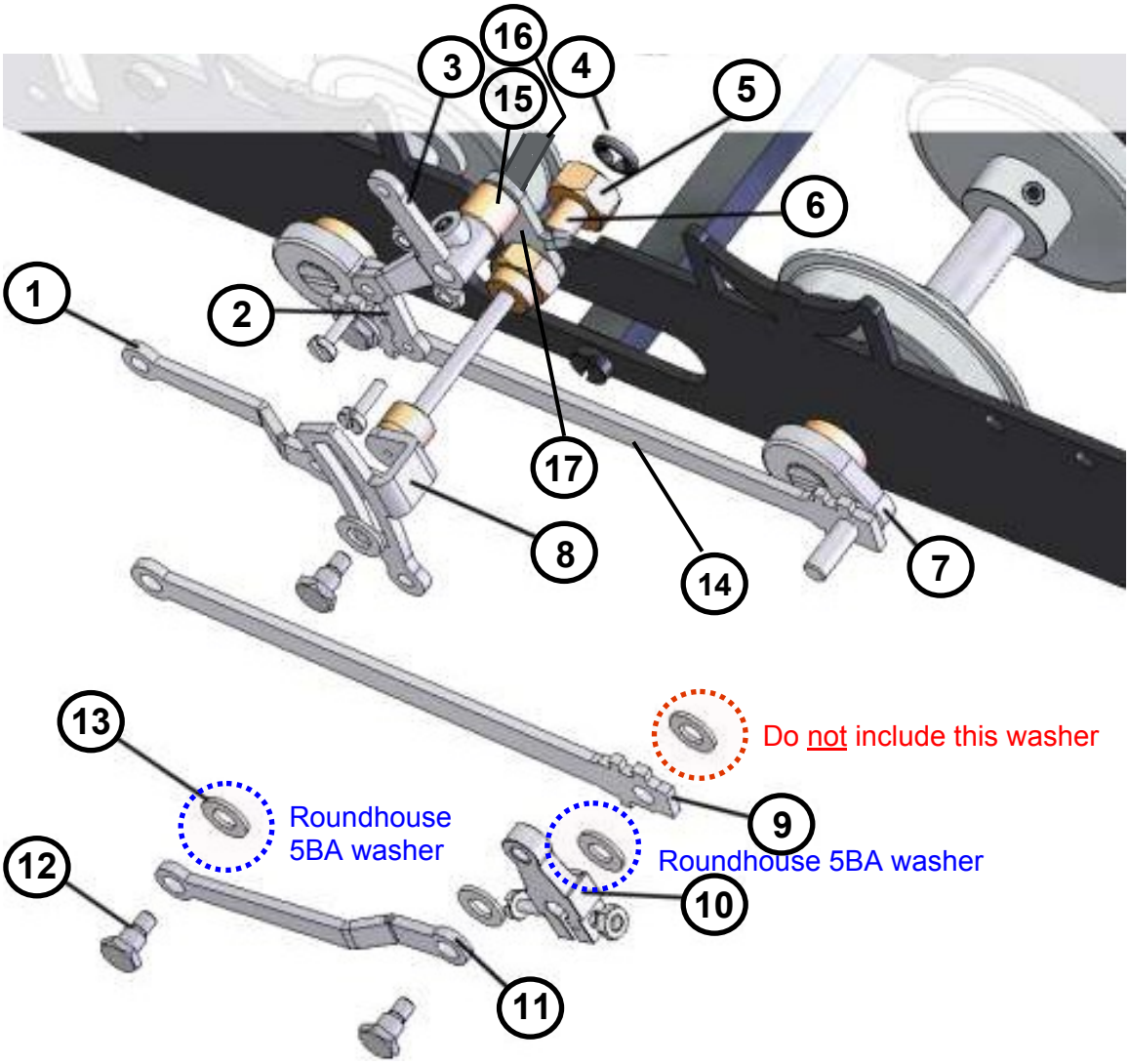


As you can see this side is now finished, so you are ready to move onto the left hand side. Ensure that the wheels will rotate, although they may be a little tight as all the parts are new and have not yet freed up.

Construction of simplified Walschaerts valve-gear

This Roundhouse picture shows the individual items and their description.

The screws, nuts and washers included are identified in the table below.



1 - Radius rod

2 - Lifting link

3 - Lifting arm (Left)

4 - Starlock washer

5 - 2 BA Nut

6 - Expansion link bush

7 - Return crank (See fixings)

8 - Expansion link

9 - Connecting rod (“Victory” item)

10 - Return crank & fixings

11 - Eccentric rod (“Victory” item)

12 - Short crank pin

13 - 5 BA steel washer (5 off - see notes)

14 - Coupling rod (“Victory” item)

15 - Weight shaft spacer

16 - Weigh shaft

17 - Weigh shaft bracket (Penguin)

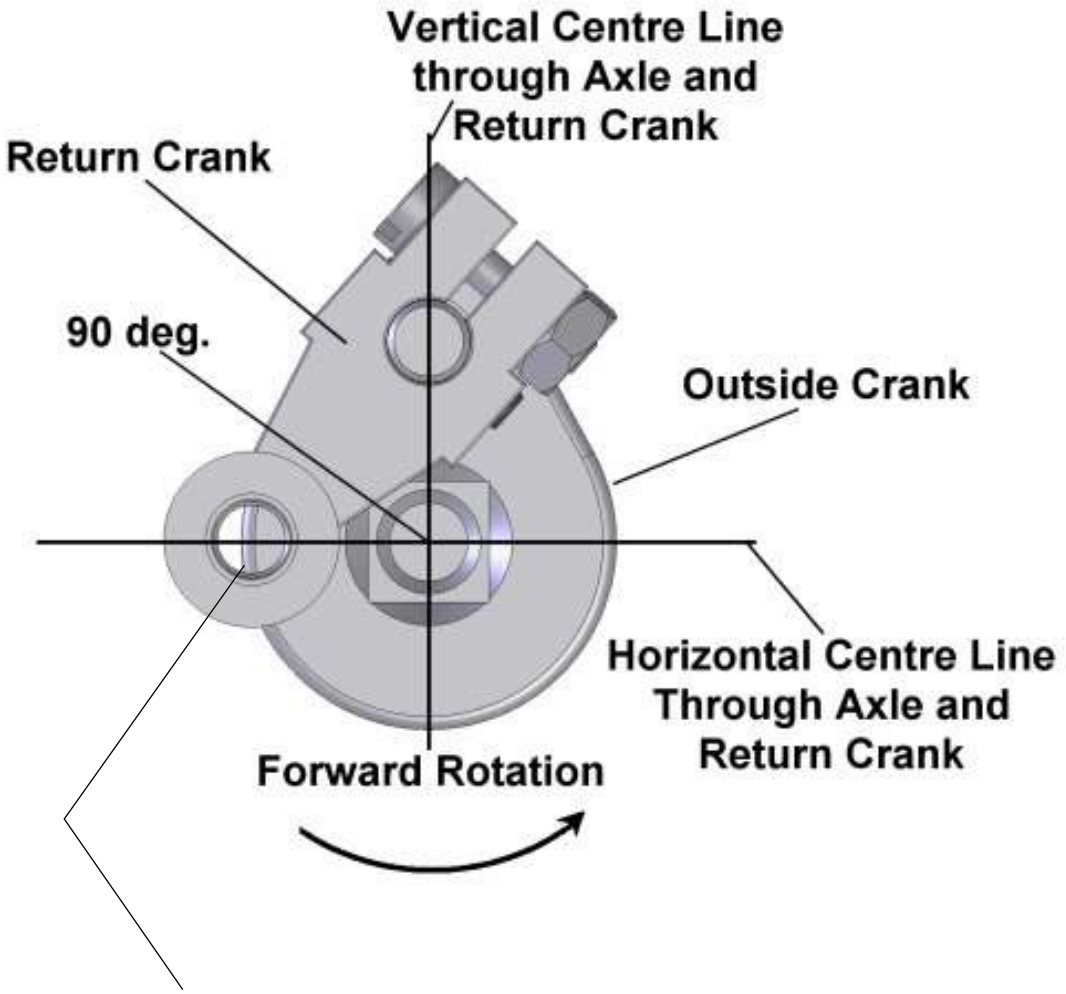
Construction of simplified Walschaerts Valve-gear

Refer to the drawing below showing an exploded view of the left hand valve gear. Note that this this is a Roundhouse drawing – the "Victory" connecting rods are cranked as explained earlier

Fit the return cranks first as these will then retain the coupling and connecting rods, not forgetting yet another 5BA steel washer between them and the connecting rods. The positioning of these is critical to the correct running of the engine and when the valve-gear is all assembled and tested, they can be pinned in place to prevent any movement. For the moment, however, just clamp them in position using the steel screws and nuts provided.

Refer to the diagram below and note that the return crank always leads the crank pin in forward rotation.

This diagram shows the left hand side return crank. The right hand side is a mirror image of this so that the return crank is still leading the crank pin by 90 degrees in forward rotation.



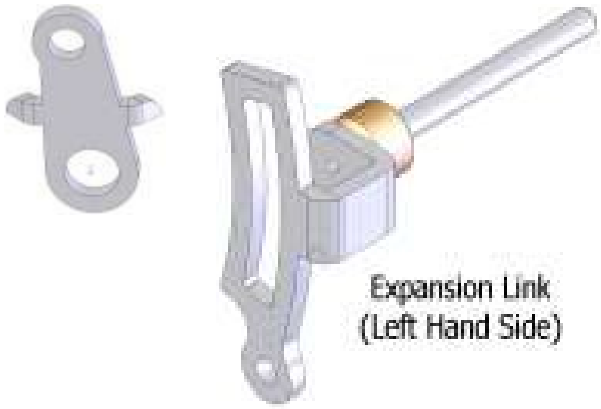
The Roundhouse drawing clearly shows the position in which the return crank should be positioned. Do not assume that the radius of the outside crank is in line with the return crank centre line.

Weigh Shaft

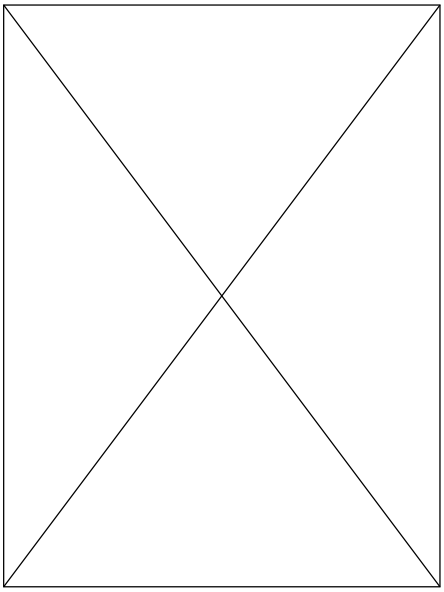
The weigh shaft can now be assembled. Take one weigh shaft bracket, or **'Penguin'** bracket as they are commonly known at Roundhouse (use your imagination here), and push the threaded part of an expansion link bush through the larger (bottom) hole. Note that the smaller top hole is offset and, when bolted to the frame, will be slightly in front of the expansion link pivot point.

The two small **'Wings'** sticking out from the sides of the **'Penguin'** brackets should be bent backwards slightly using a pair of pliers. These will locate on the top face of the chassis to keep the bracket in position. Remove the expansion link from the bush and unscrew the nut. Push the expansion link bush through the hole in the chassis and refit the brass nut on the inside. The threaded part of the bush should be inside the frames. When tightened up the **'Penguin'** bracket is held tight against the outside of the frame with its **'Wings'** resting on the top edge and the top hole slightly forward. Do not over tighten the nut as the bush may break.

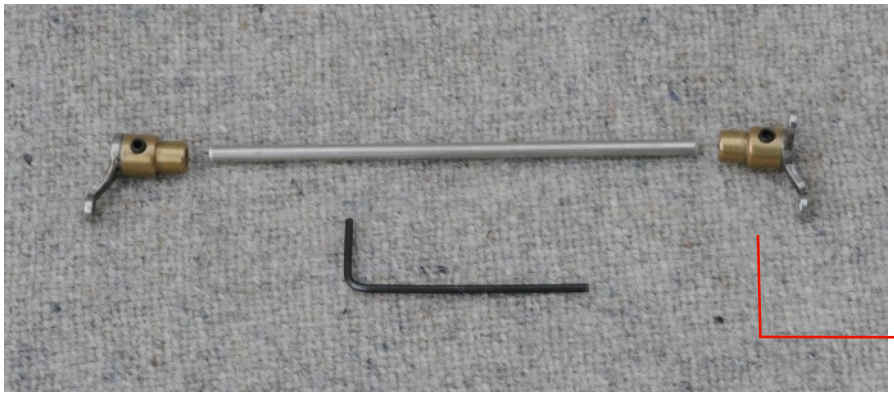
Repeat the procedure with the other side then slide the weigh shaft through the top holes. The pivot pins on the expansion links can now be pushed through the bushes. Note that these are handed and, with the tapped hole to the bottom, the U shaped extension that connects the expansion link to its pivot pin should be to the rear. Starlock washers are pushed onto the ends of the pivot pins between the frames to hold them in place, but should not be pushed on so far that they prevent free rotation. If you look closely at the Starlock washer you will see that there is a cross cut into the centre and that the edges bend inwards slightly and form a cone on the other side. The 'cone' side should be pushed onto the pivot pin using a pair of long nosed pliers.



Here are all the Roundhouse left hand side items.



The Starlock washer should be fitted after testing is complete as it is difficult to remove without damaging the washer or burring the pivot pins.



This shows the three weight shaft parts plus the hexagon key.

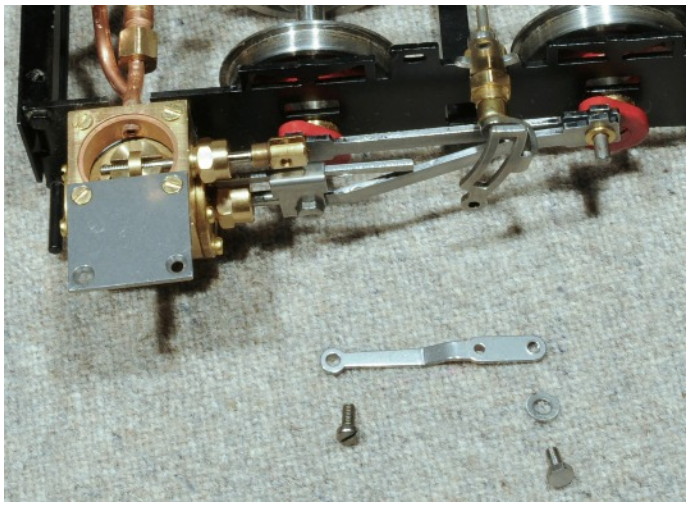
The item nearest should be fitted on the left hand side.

Radius Rods

Before fitting, the crank pins which form the slide block in the expansion link have to be prepared. This simply entails screwing one into the tapped hole in the thick end of the radius rod and filing off the excess thread that sticks through at the rear. File the thread off flush to the back then remove the screw again.

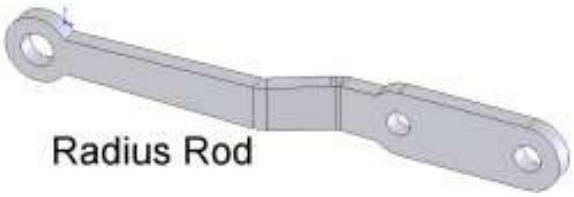
Take the prepared crank pin, fit a steel washer and then pass it through the curved slot in the expansion link and screw it into the tapped hole in the radius rod. Note that the radius rod is also **'joggled'**. This time the **'joggle'** should be inwards to bring the thinner end of the radius rod nicely in line with the valve spindle on the cylinders. Fit the thinner end into the forked end of the valve rod and screw the steel screw (supplied with the cylinders) through the hole to connect up. Confirm that the radius rod moves up and down in the expansion link - if it doesn't locate the source of the bind and correct it before proceeding further. Slight roughness on the inside edges of the curved slot in the expansion link is likely to be the problem, which can be gently smoothed of with a needle file.

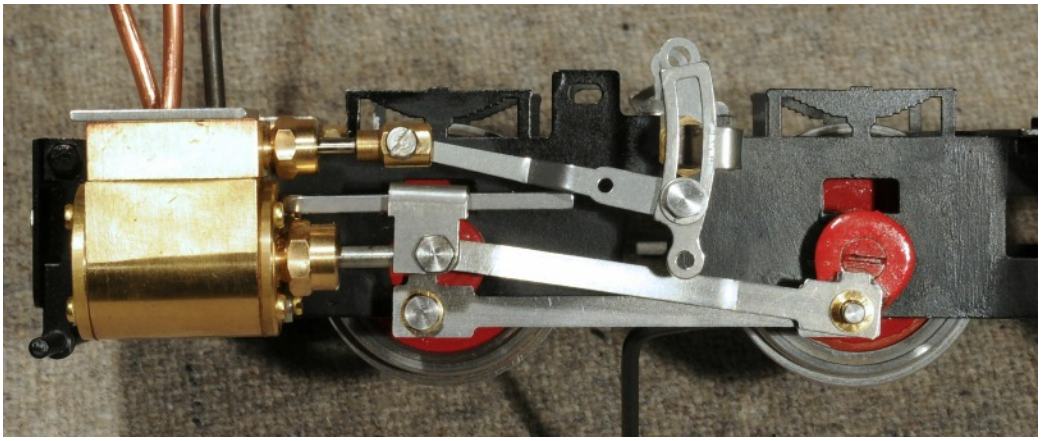
You now have the main links connected. Check that the radius rod is at the bottom of the curved slot in the expansion link. Rotating the wheels now should result in the valves at the top of the cylinders being moved backwards and forwards. What is needed now is a means of raising and lowering the radius rod and holding it in position so we now must assemble the lifting links, etc. - see the next page.



Slide the left hand lifting arm onto the left hand end of the weigh shaft. Note that the lifting arms are handed and the left hand has a second arm, which points upwards and slightly forwards for attaching the reversing rod.

Using the M2 steel screws, connect the lifting arm to the radius rod. The screws pass through the holes in the arm and radius rod without binding and screw into tapped holes in the lifting links. If there is a slight bind, open up the hole with a 2.1mm drill or a circular needle file. Do not tighten the screws, but leave a small gap to allow for movement as the lifting gear operates. Fit an M2 steel nut to the screws at the back of the lifting link and tighten these up.





If you are building a manually controlled loco, the steel reversing rod can be used to hold things in position while they are pinned. Fit the Quick Link to the end of the reversing rod, open out the Quick Link with a flat bladed screwdriver and push the pin in the Quick Link through the top hole in the lifting arm (the one pointing upwards).

Lifting arm (Left)

Set the valve-gear to mid gear, that is, operate the lifting arm until the hexagon screw that drives the radius rod and slides up and down in the expansion link is exactly in the centre of the curved slot. Check this by rotating the wheels and watching the radius rod. There should be no fore and aft movement whatsoever. Keeping it in this position, clamp the end of reversing rod to the side of the chassis with a toolmakers clamp or similar. There is also a hole in the reversing servo bracket. If the end of the reversing rod is bent at right angles (plenty of rod is supplied) the bent end can be pushed through the hole, providing an even more secure fixing point. Regardless of how you secure the rod double check the position of the radius rod before proceeding.

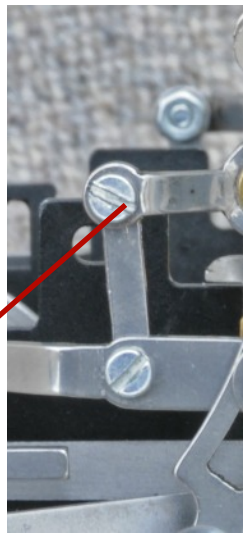
Tighten the grub screw in the top of the lifting arm casting boss to lock it in place. Keeping everything clamped in place assemble the right hand lifting arm and link and set that side to mid gear.

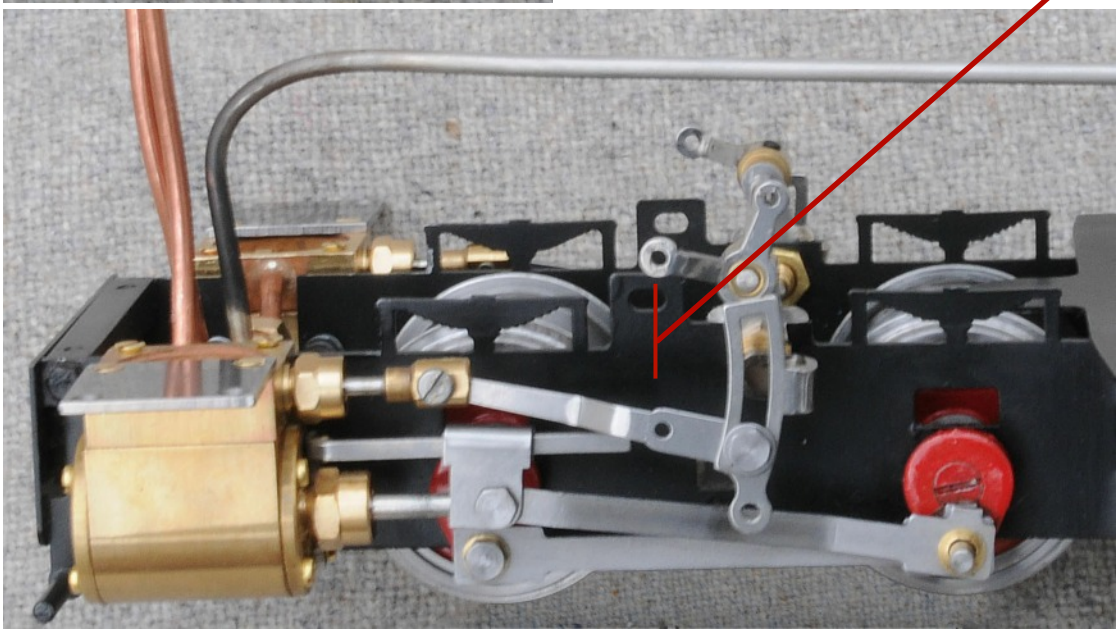
Hold the links in position and tighten the grub screw as before. Take great care with this operation and ensure that the radius rods on both sides are exactly in mid gear, or they will be lifted unevenly when the lifting arms are operated.

The valve-gear is now assembled and we can move on to timing before finally pinning the return cranks in position.

The lifting links and fittings are shown on the left and shown assembled on the right.

Do not tighten the cheese head screw as it may need to be removed whilst setting up the valve timings.

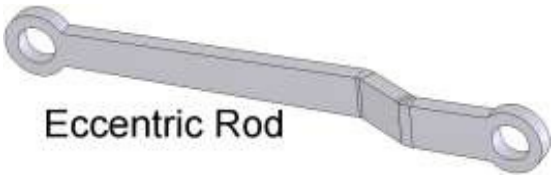




The lifting arms ready for the lifting links to be fitted

Eccentric Rod - “Victory” version

The eccentric rods can now be fitted to connect the return cranks and the expansion links. These rods are slightly tapered and the thicker end has a **'joggle'**. They are attached by 6 BA shouldered crank pins with a 5 BA steel washer between. The thicker end goes to the rear with the **'joggle'** outwards.

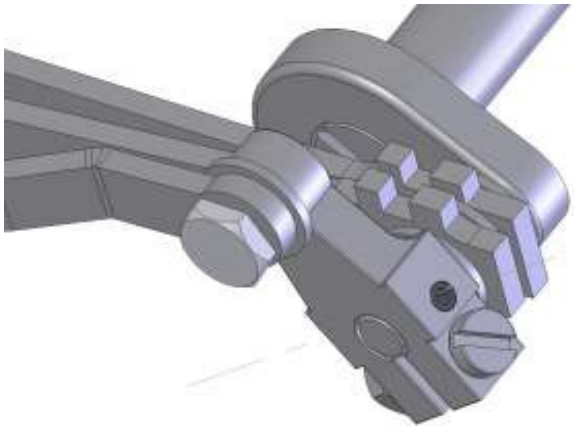


Return Crank

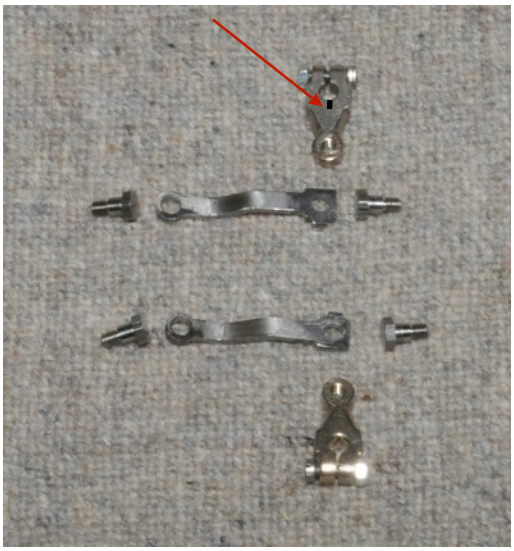
See: “Construction of simplified Walschaerts Valve-gear”

Make sure that the return cranks do not move when fitted.

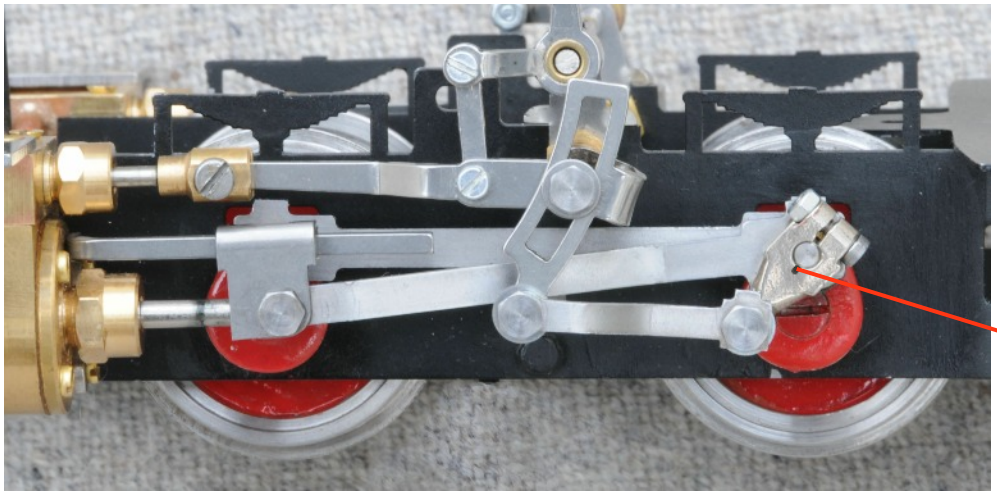
The Roundhouse approach is to drill a hole so that the return crank can be pinned in the correct position.



If extending the narrow slot, cut here as shown.



This shows the return crank and eccentric rod as shown on the Roundhouse picture and previous page. I did not drill for the pins but I did increase the clamping slot by making a very narrow cut for 1mm as shown by locating it into a vice and cutting it with a small saw. An M2 x 12mm socket cap and nut is supplied amongst the fixings provided by the Association as it is easier to clamp the return crank with a socket screw than with the cheese head screws. Once I had checked that the return was correctly positioned it was held in place with Loctite (an adhesive-like fluid used to lock screws or nuts in place). Make sure that no Loctite comes into contact with the connecting and



This shows the increased slot as discussed above.

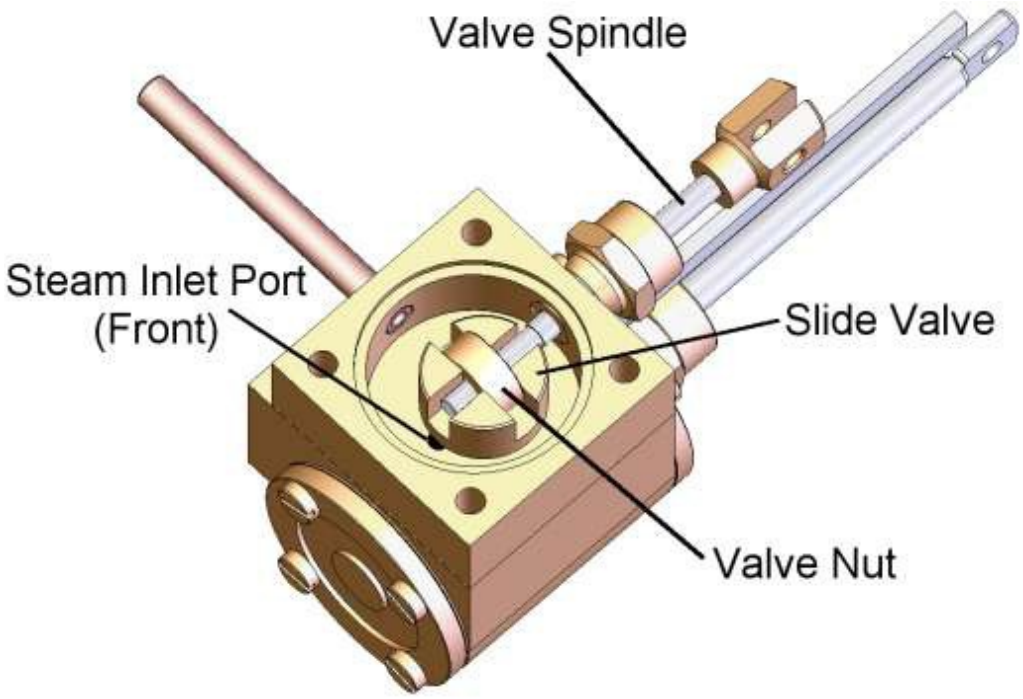
Valve Timing

This is adjusting the valve position so that it opens and closes at the correct time and is checked visually by watching the valve movement. To enable you to do this, remove the valve chest covers (four screws in each) and replace two screws loosely in order to hold the valve chest in position.

NOTE: the valve nuts are flat on the bottom and care must be taken to ensure that the flat side remains to the bottom. If a valve nut rotates the slide valve will be clamped firmly onto the steam ports and the valve spindle may be bent.

With the valve-gear still clamped in mid gear and the valve chest covers removed from the cylinders look down into the valve-chests and note the position of the slide valves. They should be sitting centrally over the steam inlet ports, covering both. If they are not, disconnect the radius rod from the valve spindle fork end and rotate the valve spindle to screw the slide valve in the desired direction. Re-connect the radius rod and re-check position.

There may be a small amount of fore and aft free movement of the valve if the spindle is moved with the fingers, which just uncovers the steam ports. If this is the case, adjust the valve position so that the ports are opened an equal amount when moved thus. Repeat this with both sides until the valves are correctly positioned.



Unclamp the end of the reversing rod and move it forwards so that the radius rods are aligned with the expansion links. Position them near but not right at the bottom and clamp the reversing rod in place again. The valve gear is now set for forward running, so rotate the wheels by hand in a forward direction and watch the slide valve movement. The edge of the steam ports should become visible (crack open) as the crank pin on the drive axle is at dead centre. The front steam port should be cracking open at front dead centre and the rear steam port at rear dead centre. If the return cranks are correctly positioned this should be the case. If not, rotate the return crank on the crank pin a very small amount and re-check. When satisfied that the timing is as close as you can get it the valve chest covers can be fitted. Place a second ‘O’ ring into the top recess of the valve chest. Ensure that the `O` ring seals between the cylinder blocks and the valve chests, and between the valve chests and the valve chest covers, and that they are fully in their respective recesses before tightening down the valve chest covers. The chassis can be test run on compressed air if available to check operation. Don't forget that the radius rod should not be raised or lowered right to the ends of the expansion link slot and use plenty of oil on all working parts. Slight unevenness in running can normally be overcome by slight adjustments when the locomotive is running under its own steam, see fine tuning.

Fine Tuning

There are 2 ways to fine tune the valve settings – using compressed air or steam. If you have a small compressor capable of delivering 2 bar pressure you can use it to test your locomotive “on air”. You will need to make a connection between the compressor and the loco. If you temporarily attach one side of the lubricator to the superheater, you can push a suitable flexible pipe onto the side (see the picture of the lubricator on page 28). Don’t worry if there is slight leakage of air – once the valve gear is correctly tuned the locomotive should run on 1 bar or less.

Alternatively, when the locomotive is capable of running on the track under its own steam, that is after the boiler, etc. has been fitted, the timing can be fine tuned for best performance.

Please note that it will require running under steam for several hours before it reaches its best performance. At Roundhouse, every engine they build is run at the chassis stage for at least 8 hours in both forwards and reverse. This is because all the working parts have to **'bed in'** properly. Initially, steam will leak past the slide valves to a greater or lesser extent, but this will eventually stop as the two surfaces **'bed in'** and form a good working seal. The first few hours of running therefore may be a little stiff and jerky at slow speeds and lacking in power.

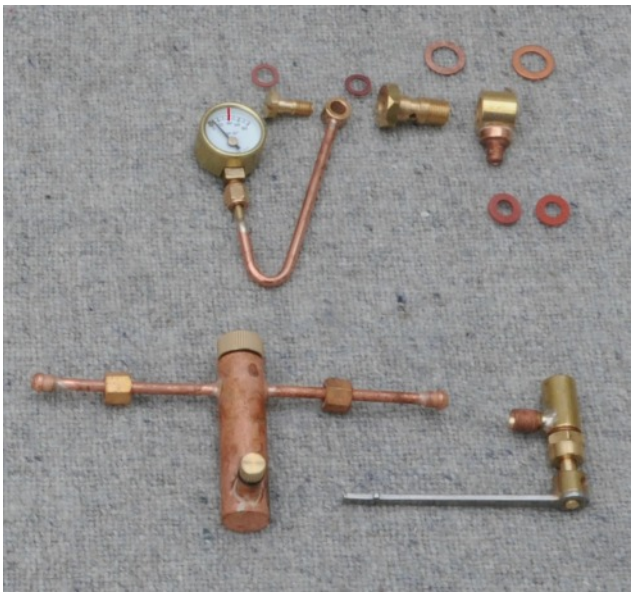
It is a good idea to run the chassis supported on blocks for a couple of hours before progressing to the track test and adjustments. Use plenty of oil on all working parts.

Set the loco off on a reasonably level length of track at a slow speed. If it stalls, note the position of the drive crank pins if either is at front or rear dead centre. Repeat this several times and it will soon show up if there is a ' dead spot' at any particular point of the valve cycle. If, for instance, it keeps stalling with one particular crank pin just after rear dead centre then this would indicate that the slide valve is opening a little late. Disconnect the radius rod and rotate the valve spindle half a turn to move the slide-valve forwards a fraction as detailed in valve timing earlier. Re-connect the radius rod and try the loco again in both directions to check that your adjustment has not simply removed that dead spot only to replace it with a different one. A short time spent running the engine and making any adjustments just half a turn of the valve spindle at a time should soon show its optimum positions.

Boiler & Gas Tank

The boiler, smokebox and chimney, gas burner and cast boiler mounted foot are shown above – once they and the other parts on this page are fitted the loco is almost ready to be tested in steam.

These are the “gas” parts. The pipe will have to be formed similar to the way in which the “steam” pipes were formed earlier – this is described in the coming pages.



These are the “steam” parts.

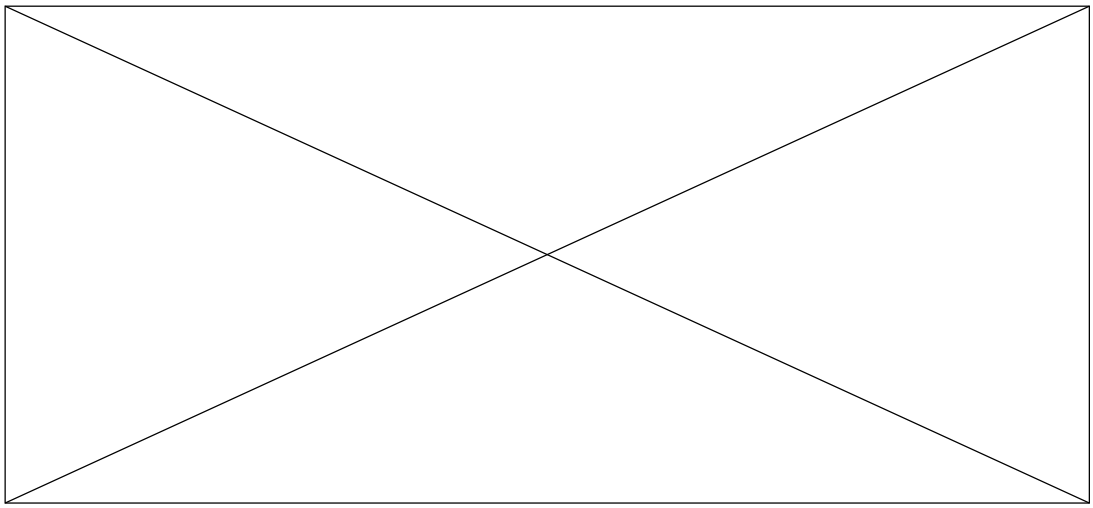
The steam regulator in this picture is for the manually controlled loco. The radio controlled version is very similar except that the valve needle seats on an ‘O’ ring and the valve spindle is designed to connect to a servo. A radio controlled regulator is shown in the upper photo on page 37.

Roundhouse will normally have set the pressure gauge to 40 psi. In the event that it does not already have a red line at 40 psi one should be marked on the glass dial. A red mark should also be marked on the brass frame around the glass, see picture.

The boiler is a single flue type, of copper construction, fully silver soldered and pressure tested. It is designed to operate at a pressure of 40 psi. When used in conjunction with the Roundhouse burner and gas tank:- if the boiler is filled and then sufficient water withdrawn to create a steam space (10-15ml), the gas will run out before the water does providing the gas is not replenished once steam pressure is reached or during the run.

The smoke box and boiler should be cleaned ready for priming and painting, after masking the threaded items on the boiler or covering them with blue tack.

It may be useful and save time to fit the sandbox and boiler bands at this stage, prior to painting. Refer to the assembly instructions for the brass etched parts for fitting details for the sandbox and boiler bands.



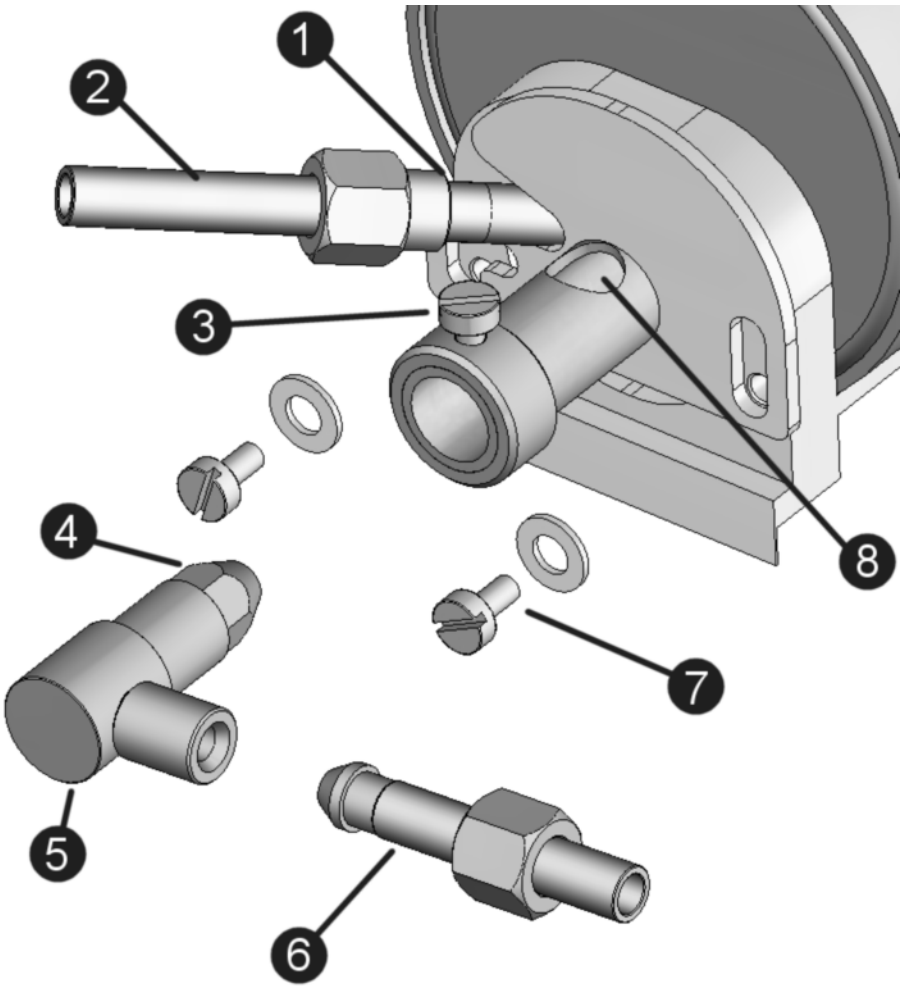
Remove any masking tape (or blue tack is this is what you used). Check that the boiler fits into the smokebox. If required clean the bore of the inside of the smokebox and the outside diameter of the boiler at the point where it mates with the smokebox.

These parts are now ready to fit onto the chassis.

Fit the smoke box mounting plate with the 2 brass screws. If there is insufficient space between the screws and the top of the steam fittings to the valve chests then don't fit the washers.

The dart assembly should also be fitted prior to fitting the smoke box to the boiler. Note also that once fitted the smoke box and mounting plate can only be removed as a unit, because the brass screws holding the smoke box to the plate will be covered by the steam pipes. The mounting plate latches under lugs in front of the leading dummy spring and is difficult to remove once the boiler is secured in place and the body is attached to the frames. Therefore, if you intend to fit (for example) a Chuff Pipe, it needs to be fitted before final fitting of the boiler.

The assembly can now be attached to the front frame spacer.



Gas Burner

1). Superheater Pipe.

2). Lubricator Pipe.

3). Gas Jet Block retaining screw.

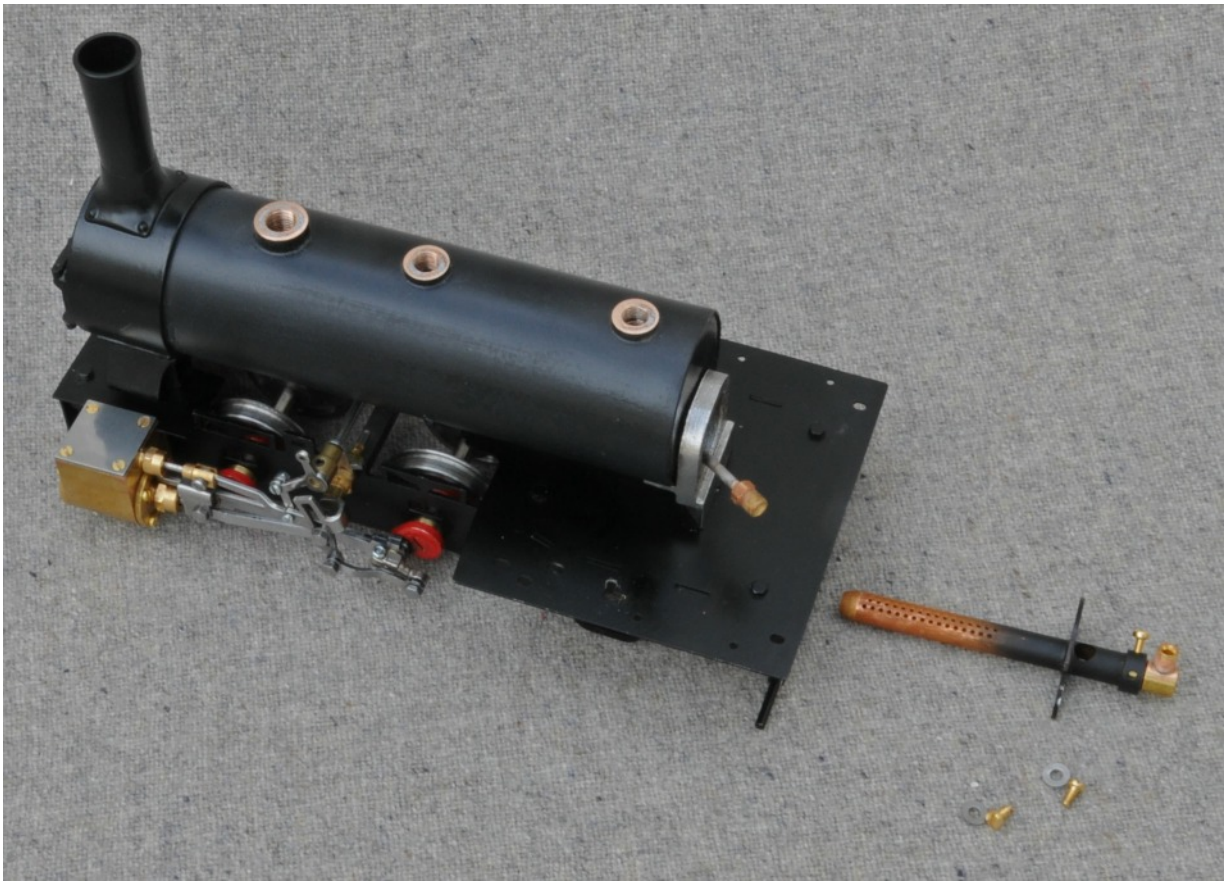
4). Gas Jet.

5). Gas Jet Block.

6). Gas Pipe.

7). Gas Burner fixing screw.

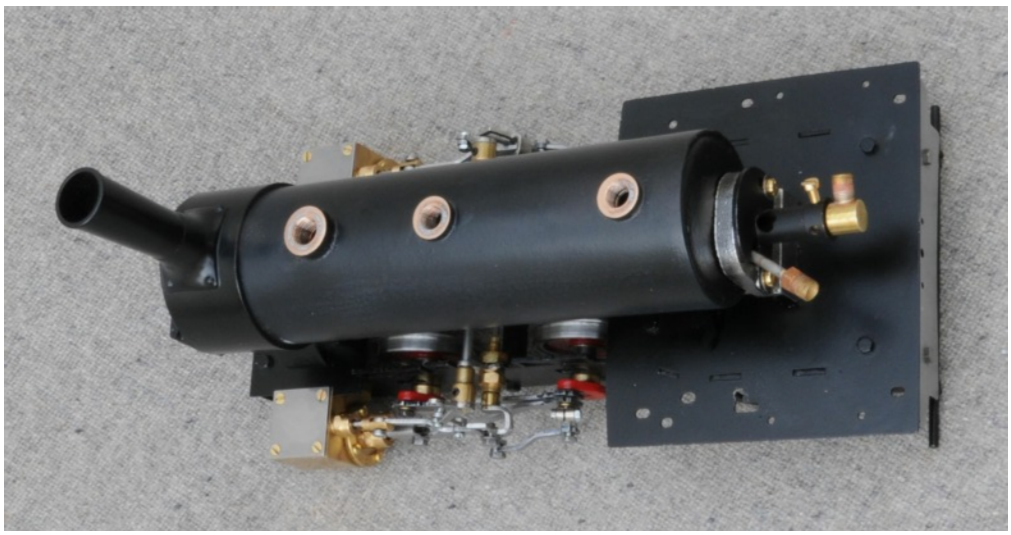
8). Air Inlet Holes.



The boiler is now fitted and supported as shown with the superheater through the single flue in the boiler.

The rear end of the boiler can now be located using the cast boiler mounting foot held in place with a single brass screw and washer to the foot plate.

The superheater is then formed to one side so that the gas burner assembly will fit.



The gas burner and gas jet can now be fitted using the brass screws and washer. The gas jet will be adjusted when the gas pipe is shaped and connected.

The gas tank can now be united with the bracket that includes the servo support.

The fittings as shown are 8BA and 6BA bolts and nuts.

It is easier to fit the gas tank to the bracket using the 8BA fittings first before mounting the assembly onto the foot plate.

If a radio receiver is being fitted it is also easier to attach the regulator servo mounting posts before fitting the gas tank.

This is now ready to fit onto the foot plate with the 6BA fittings.

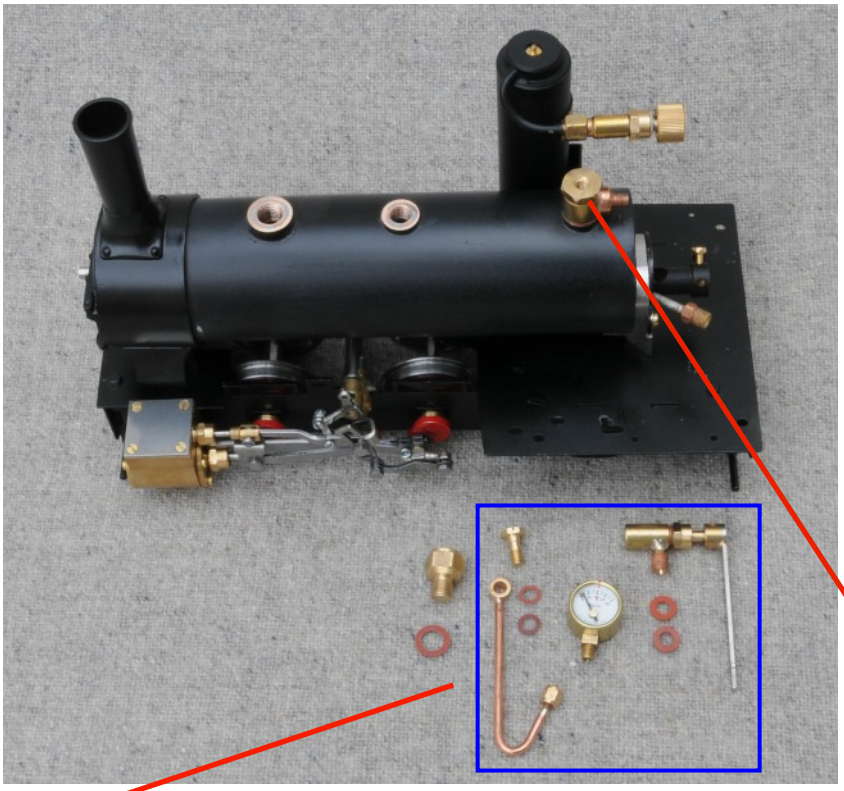
The Roundhouse 'FG' type gas burner has been designed to operate efficiently within the confines of the centre flue and requires no adjustment other than initial positioning and the screw holes on the mounting flange are slotted to allow for this. Ensure that the superheater tube is well over to the left of the flue for its full length. Then fit the burner to the boiler using the two brass screws provided. A cut-out is provided on the left hand side of the mounting flange to accommodate the superheater.

The right hand mounting slot allows the burner tube to be raised or lowered inside the flue and for optimum performance it should be positioned to the bottom to allow maximum space above the burner for the gas to burn correctly.

Check that the jet is tight in the jet block (4BA spanner) then push the jet block into the burner body as far as it will go, (up to the step in the jet block) before nipping up the retaining screw.

Check all unions and connections and make sure they are tight.

Steam Valve



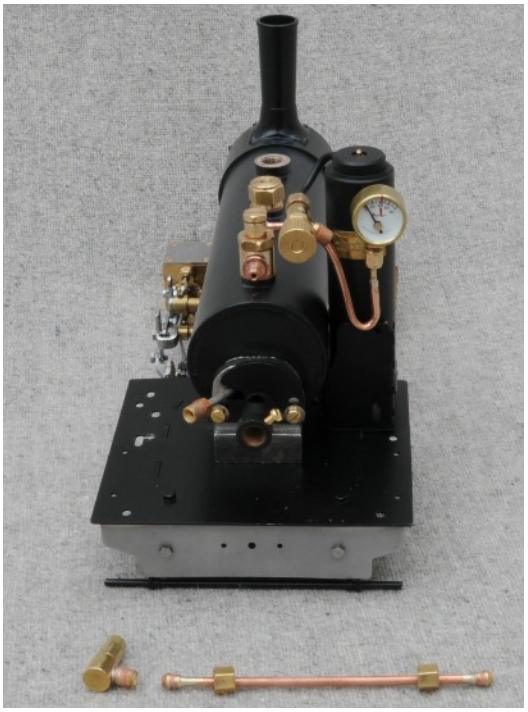
The parts in the photograph on the right should be fitted to the boiler as shown above. The parts shown surrounded by the blue box are supplied by Roundhouse. The sandbox locating plug and fibre washer, to the left of the blue box, are amongst the components provided by the Association.

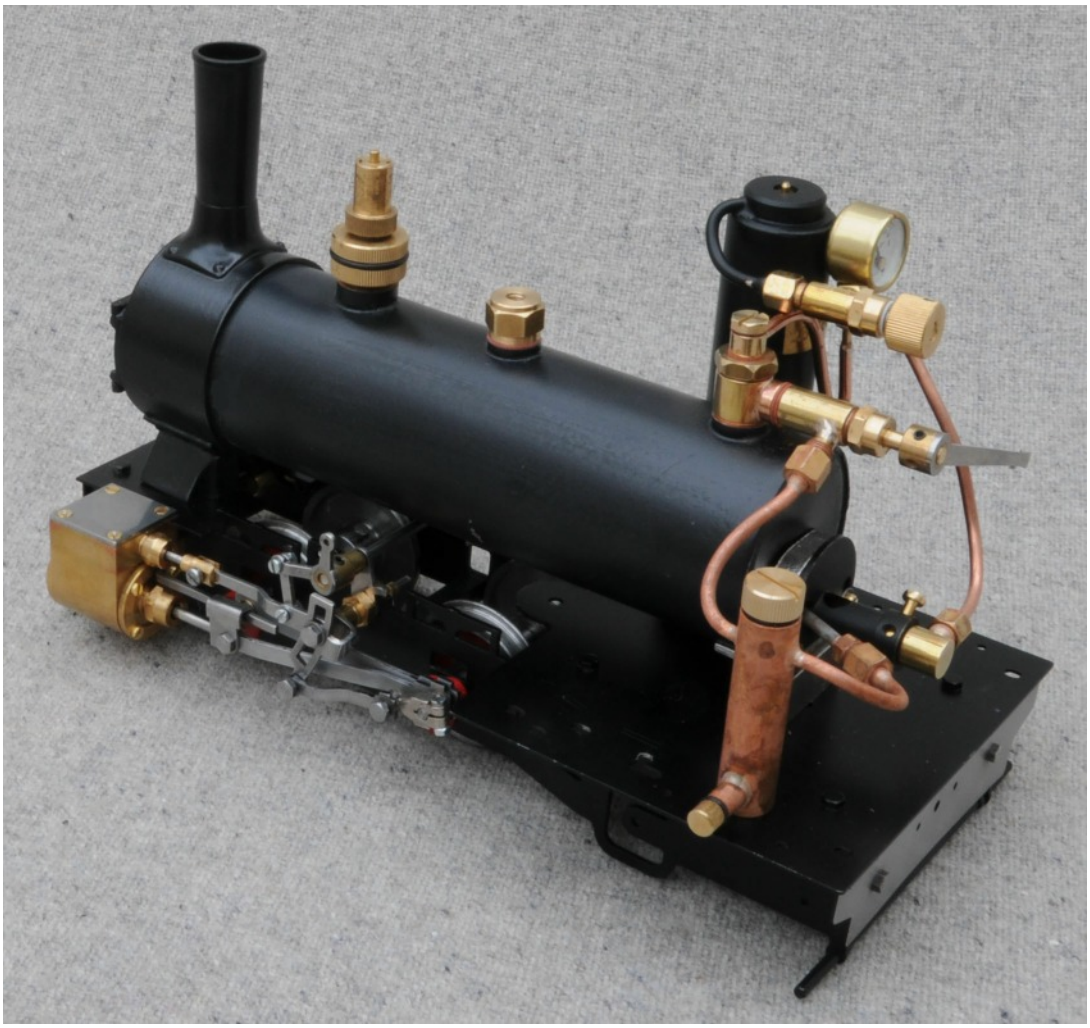
The other parts are then ready to be fitted but be very careful when fitting the pressure gauge.

The regulator shown is for manual control but the fitting of a radio controlled version is identical.

This shows the steam pressure gauge after fitting. Be very careful not to keep trying to bend and form the pipes, as the more they are manipulated the stiffer they will become. Re-heating could cause other problems such as silver soldering needing to be re-done.

The gas burner pipe can now be formed but make sure that the regulator (both types) has free movement and is clear to operate correctly.





The steam oil lubricator can now be mounted and the pipes formed. The right hand side is connected to the superheater. The left hand connection is to the regulator. As all fittings have to be tight, so that steam and gas do not leak and the regulator has to be set to an angle as shown. Therefore there are additional red fibre washers, to “space” the regulator from the steam turret and thereby achieve the right angle. Wrap the threaded end of the regulator with a little PTFE tape to promote a steam tight joint rather than rely on the fibre washer to achieve a good seal. The steam oil lubricator should be positioned centrally between the cab steps.

Gas Tank

The gas tank is constructed of heavy gauge metal, fully silver soldered and pressure tested to 500psi at the factory. Positioning of the tank is very important for both safety and good operation. Butane gas is stored in the tank as a liquid, but changes to a gas as it mixes with air. As gas from the top of the tank is drawn off more of the liquid below it turns to gas and this process causes a drop in temperature, which also lowers the pressure within the tank. To offset this temperature drop, Roundhouse gas tanks are designed to fit in the locomotive cab or bunker where they can make use of the conducted and radiated heat from the boiler to maintain a good working pressure within.

If allowed to get cold, then the pressure of gas can drop until it is insufficient to maintain steam production so it must be kept slightly warm to combat this.

If however, it is allowed to get too hot, the pressure of the gas inside the tank can become dangerously high and this must **never** be allowed to happen. It is important therefore that there is plenty of air space between it and any hot items such as boiler or steam pipes. Under normal operating conditions, the temperature of the tank should not be allowed to get higher than 40 degrees Celsius. Ideally, it should be mounted in the side or rear of the cab and the filler valve must always be to the top where it can be easily accessed. It can be disguised by a roof vent, dummy coal or other suitable item if required.

The standard system is supplied with a 1” (25.4 mm) diameter by 3¾” (95 mm) high tank, but if this does not fit your requirement, alternative types are available for fitting in rear bunkers or under cab roofs.

Gas filler valve

This is a self venting type and is supplied ready fitted to the gas tank and pressure tested for leaks at the factory. The term self venting refers to the way it allows gas to vent out of the side of the valve as liquid is injected into the tank. This ensures that a full charge of liquid is received by the tank. Should it be necessary to replace it at any time it simply screws out of the tank and is sealed by a small 'O' ring.

Gas regulator

This is a needle valve and the body can be rotated to any angle by slackening the union.

It has an internal 'O' ring as its main seal, and, if not lubricated from time to time this can become dry with a consequent loss of fine adjustment to the burner. See the **Trouble Shooting** section.

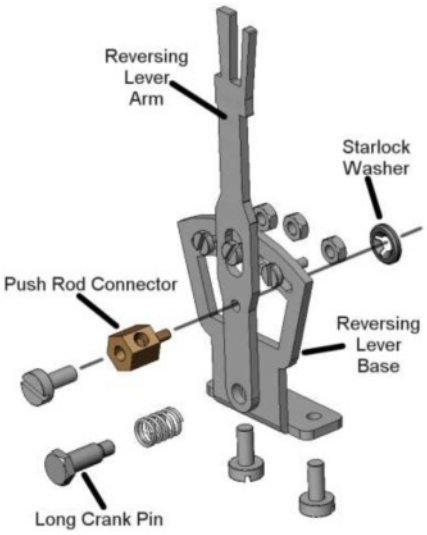
Safety valve

The safety valve uses 'O' rings both internally and externally to take care of the seals. It should be screwed into the boiler bush until finger tight. It is a 'slow release' type, which means, it gradually starts to blow off as the pre-set pressure is reached. It is factory set to start lifting at just under 40psi. The normal working pressure of this boiler is 40psi and during the first steaming, check that the safety valve is not allowing the pressure to rise above this pressure. The pressure at which the safety valve operates can be reduced or increased by screwing in or out the fitting in the top of the valve that the stainless steel rod protrudes through. A pair of tweezers or fine nosed pliers if screwed clockwise (down), then this will compress the internal spring and increase the boiler pressure. If screwed anticlockwise the pressure on the internal spring is reduced and the boiler pressure will lower. Usually no adjustment is required, but, if necessary, usually no more than half a turn is needed. Be aware that whilst you are adjusting the safety valve hot steam will be released by the safety valve so wear gloves and take precautions.

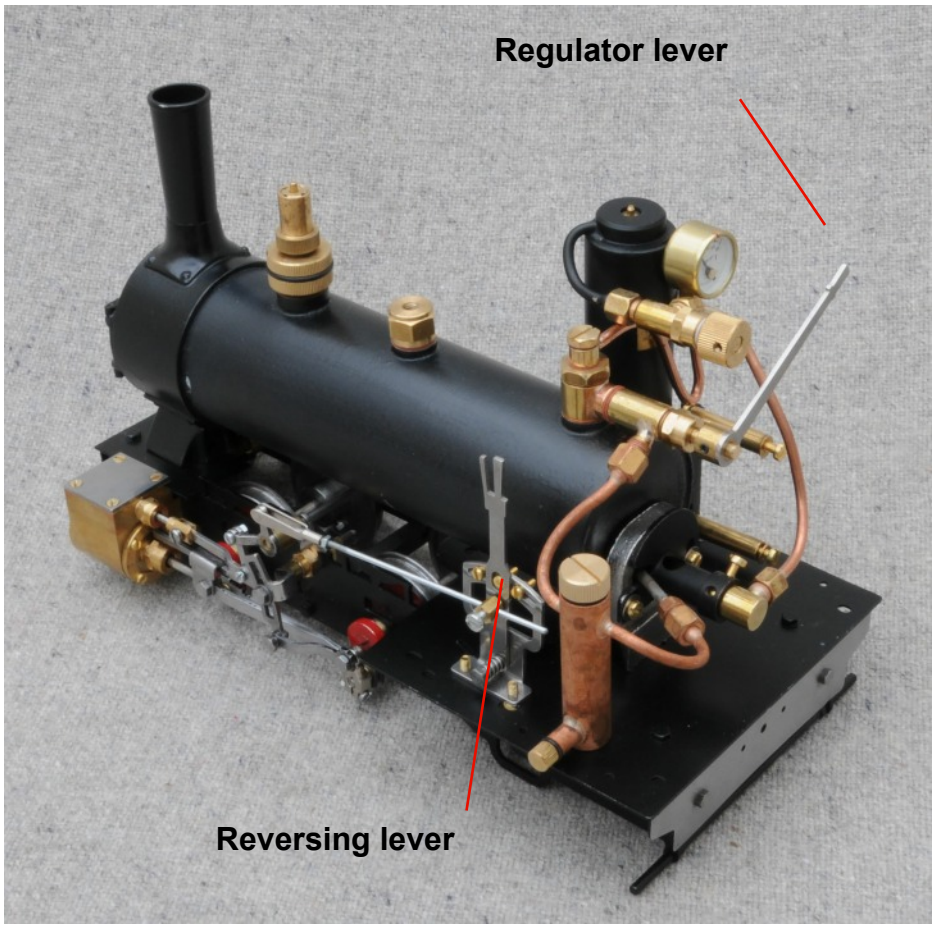
Reverse Lever

If you have ordered a kit of parts from Roundhouse to build a manually controlled loco a set of parts are included to construct a reversing lever for manual operation that can be mounted on the footplate. Refer to the diagram below which shows how the reversing lever is assembled. Check that the Reversing Lever Arm is orientated as shown in the diagram below. Then attach the push rod connector to the Reversing Lever Arm with the Starlock Washer as shown. Place the spring over the Long Crank Pin and push the threaded end of the Long Crank Pin through the hole in the bottom of the Reversing Lever Arm and screw into the threaded hole in the Reversing Lever Base. Fit an M2 screw and nut to the top central hole in the Reversing Lever Base, which will allow the Lever to stay at mid-gear. Now fit an M2 screw and nut to either side of the lever. This will allow you to move the valve gear between Forward, Reverse and Mid-Gear. The exact position of these screws can be determined by running the chassis or loco on blocks and moving the lever as it is running until the optimum position is found.

The assembly should be securely fixed to the chassis or footplate using the M3 brass screws so that the valve-gear is held firmly in gear. The reversing lever should be fitted so that the reversing lever arm and the push rod connector are facing towards the inside of the cab - they will foul on the cab side if fitted the other way around. Adjust the lever for smoothest running in both forward and reverse then tighten the stops accordingly.



The diagram above shows the reversing lever assembled for use on the right hand side of the loco. Though only a cosmetic point the picture to the left shows the lever assembled for use on the left hand side of the loco.

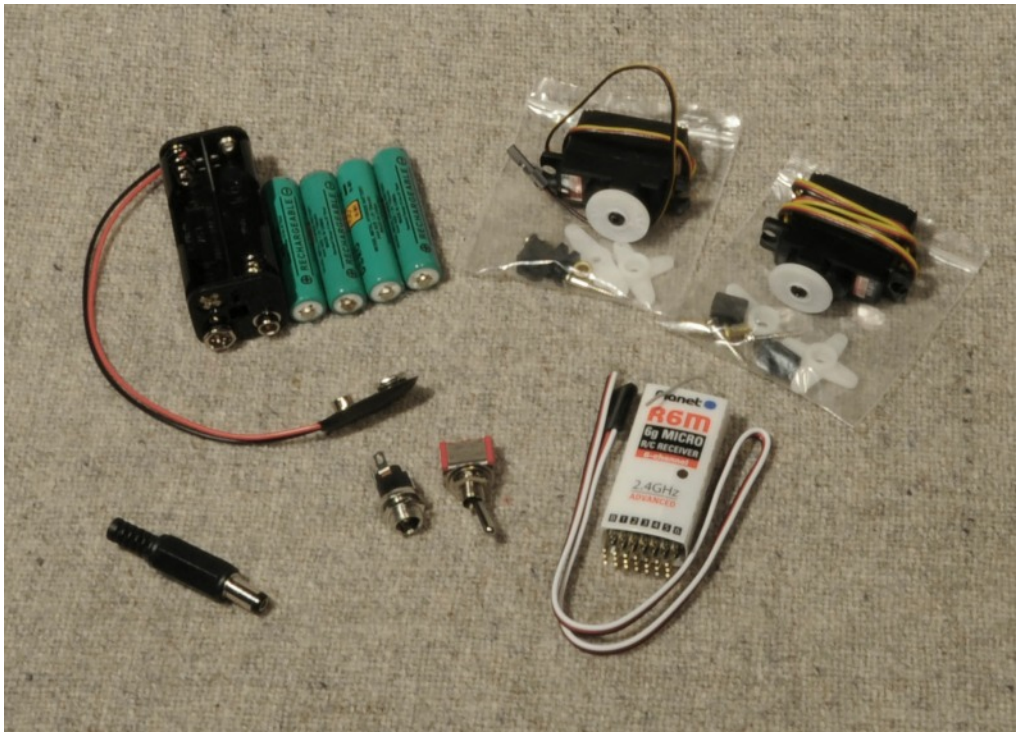


The regulator servo mounting posts are discussed further on in the setting up of a radio controlled loco'.

Radio Control

This valve-gear is suitable for operation using radio control and “Victory” has been designed with the installation of radio control in mind.

The following parts will be needed to install radio control.



	Maplin Part Number
Switch - SPDT - Locked both	FH00A
2.1mm DC power socket	JK09K
AAA x 4 battery holder	LG79L
PP3 battery snap	HF28F
AAA x 4 rechargeable batteries	Typical as N06BW
2.1mm plug if a Brian Jones charger is chosen.	RR60Q

Smart Charger - Axtronicics, are available from:-

www.brianjones.free-online.co.uk

as well as

Hitec HS-81 9 servos (2off)

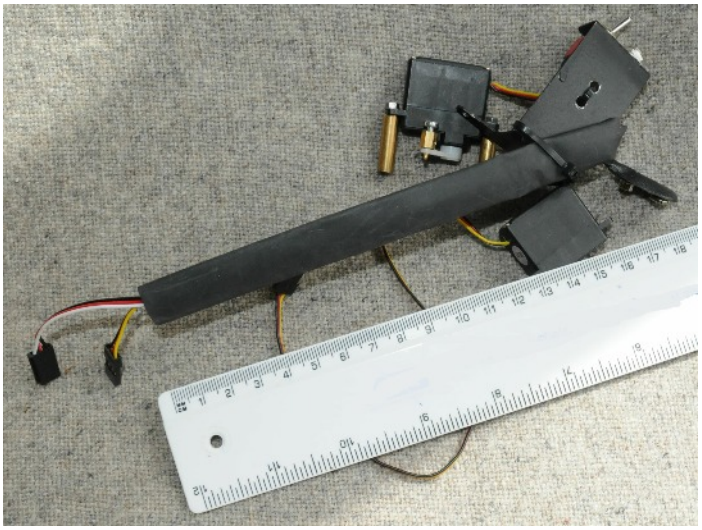
These are available from Roundhouse with the radio control if required.

R/C Lead - male connector 30cm typical to a JP Futaba 7721006

Radio receiver - As shown a Planet R6M with a T5 2.4GHz transmitter.

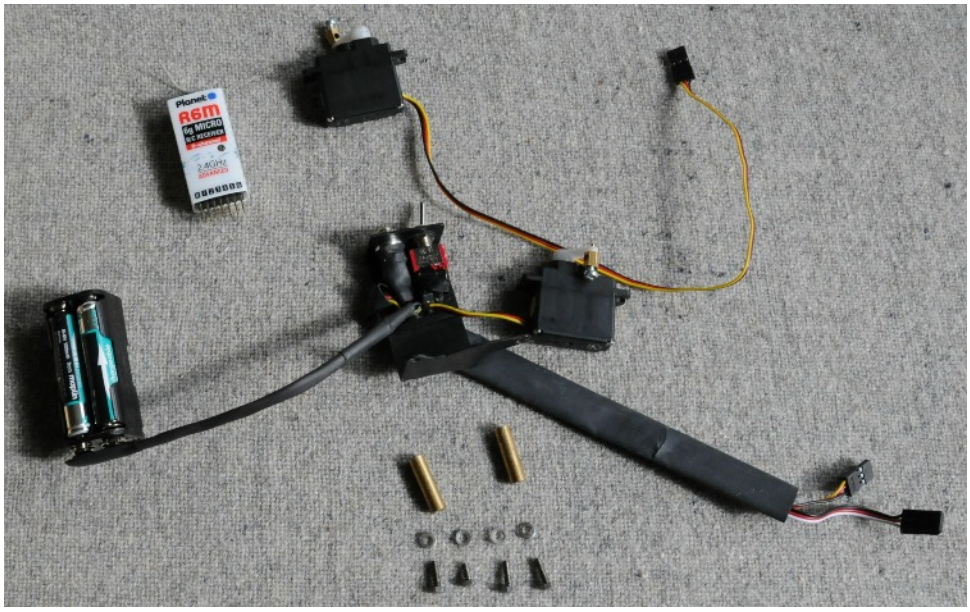
The electrical items are shown in the following photos.

As you can see the cables from the battery holder are fitted into heatshrink tubing. Then you need to solder the ends to the Battery Switch and Charger Socket. These items are available from Maplin.

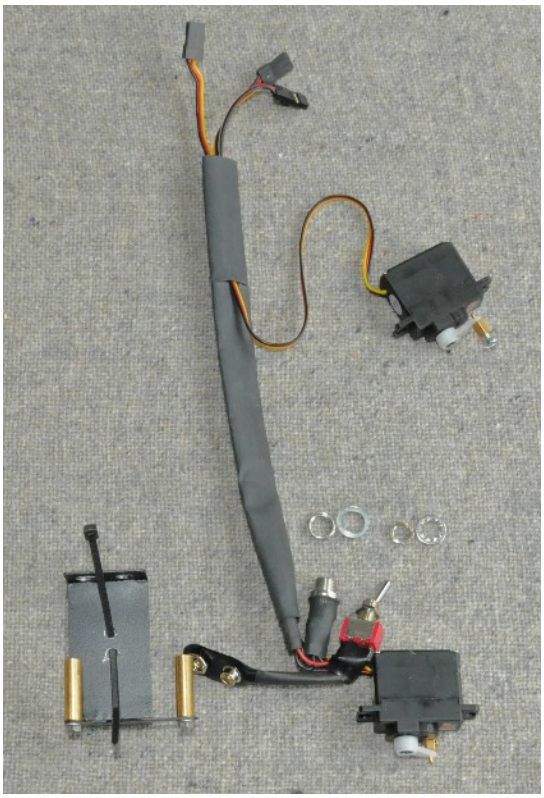


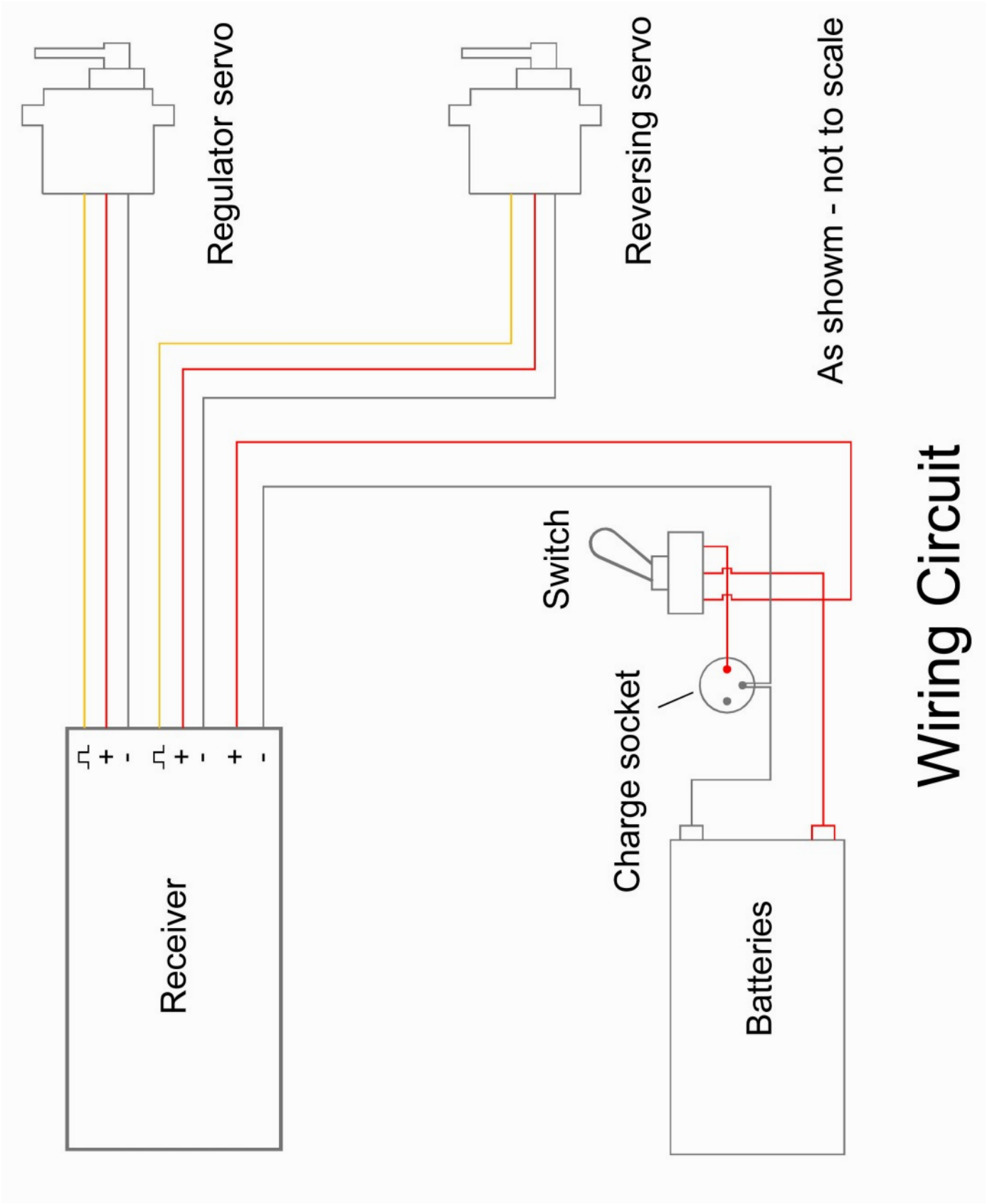
The switch is set so that the receiver is on when it is in the forward position.

When the switch is OFF the batteries can be recharged.



These pictures show the wiring loom from different positions. The cable from the switch etc fits nicely under the boiler. The “water tanks” (described in the section covering construction of the etched parts) will hold the batteries on the left and the receiver on the right. There is an additional etched receiver support if preferred that fits inside, in front of the rear buffer beam.



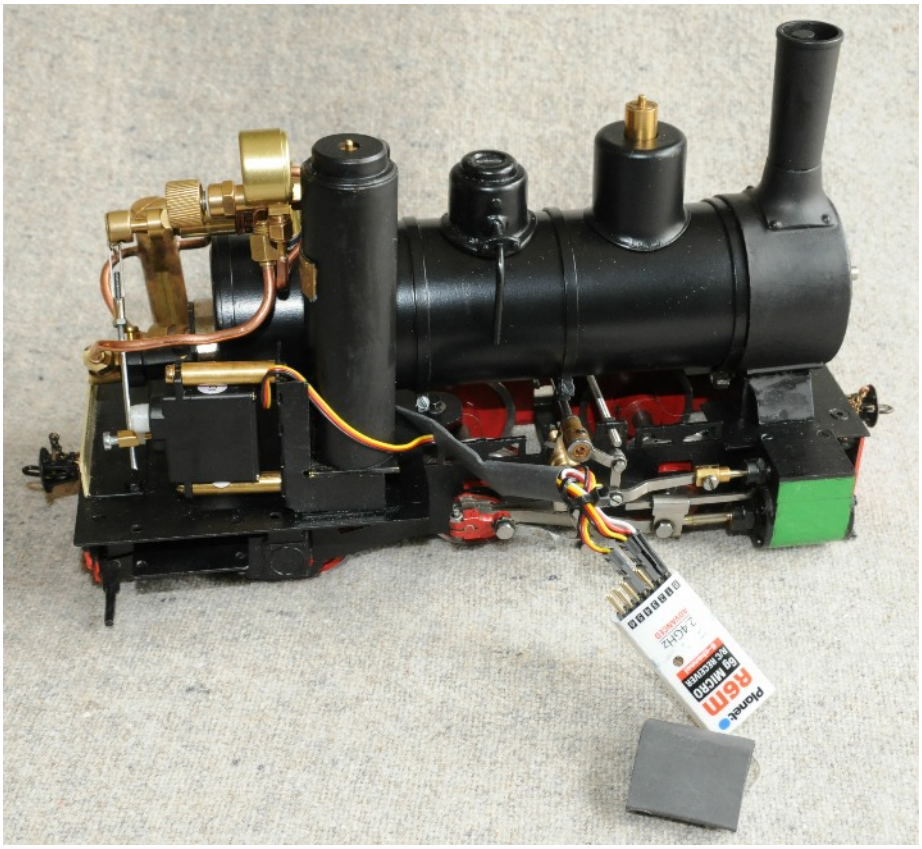

Regulator servo
Reversing servo
As shown - not to scale
Wiring Circuit
Switch
Charge socket
Receiver
Batteries

This shows the radio control items ready to fit.

Charging socket, switch and servos are shown in various positions.

The batteries are shown on the left hand side and can be pushed into the water tank on this side.

The radio receiver is fitted in to the right hand side water tank.



In this view, the heatshrink tubing has been removed so one can see the wiring.

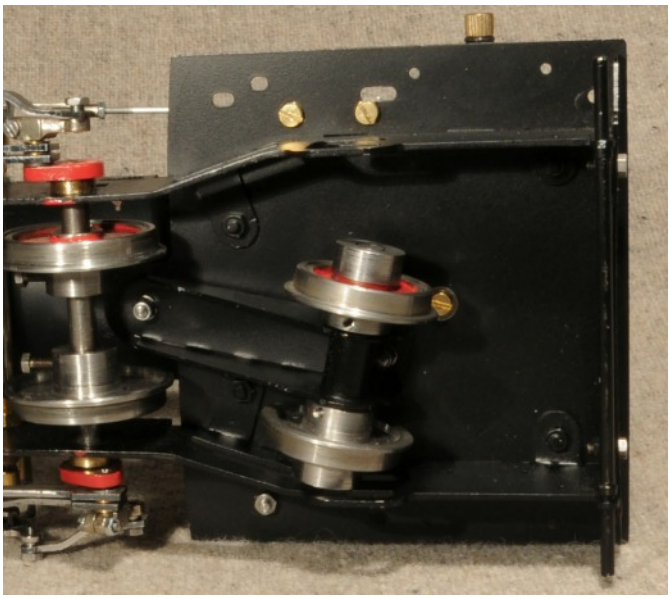
The last part of this section - **Pony Wheel & Cab Steps**

The fittings are as follows:-

6BA x 3/8” x 2 hexagon headed screw.

6BA x 2 Nyloc nut

6BA x 5

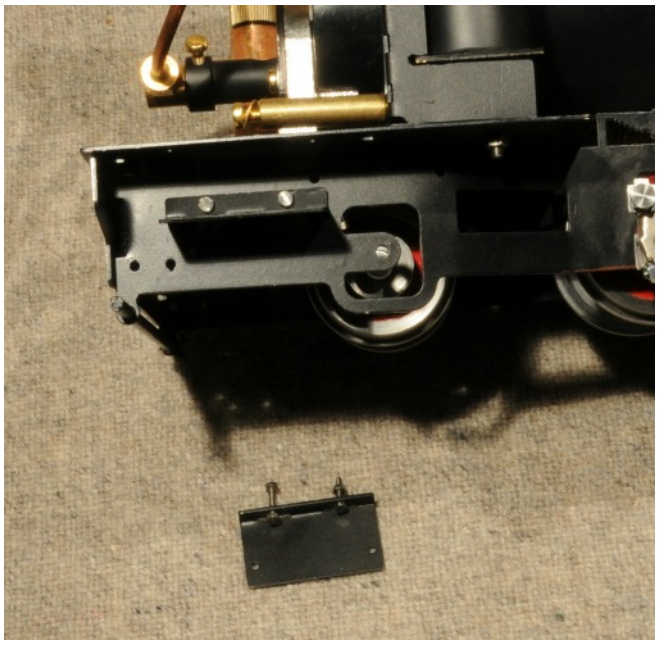


Take the hexagon head screw, plus a washer, and push it through the upper surface of the pony truck. Underneath push on another washer and then the Nyloc nut. Tighten into position.

Push another hexagon head screw, with a washer attached, through the hole in the footplate so that it protrudes below the footplate.

Turn the loco over and then push on another washer, then the pony truck assembly at its forward pivot point, a final washer and then the Nyloc nut. Tighten, then lightly undo to ensure that the pony truck swivels freely.

Check that the six wheels now align on the track. If not, gently pull the pony wheel down so that it is tangential with the other wheels.



The cab steps are located as shown and fitted with 2 x 10BA x 1/4” hexagon headed screws and nuts.

Fit both sides in the same way as shown.

This completes the assembly of the steam and (if fitted) radio control components to the chassis. Now move onto section 3 of this guide – assembly of the body.

Preparing for Operation

Even though you have not completed the “Victory” kit, you may wish to test the loco in steam and on the line. These instructions, courtesy of Roundhouse, will help you do this.

Filling the Fuel Tank

The filling of the gas tank should only be carried out in a well-ventilated area, where there are no naked lights or other lighted locomotives close by. Ordinary Butane or Iso-butane gas (as used in gas cigarette lighters) is the preferred fuel, though for economy, the larger canisters as used for blowlamps or camping stoves etc. are better. The larger canisters have an EN417 threaded self sealing valve on top and require a special adapter to couple up to the filler valve on the locomotive. A special brass gas filler adapter is obtainable from your local garden railway supplier or direct from Roundhouse.

Mixed gasses are also available and may be used if ordinary butane or iso-butane are not available, but see the ‘**Trouble Shooting’** section for more information on this subject.

Before attempting to fill the gas tank make sure that the gas control valve is closed by turning it clockwise.

The filler valve for the gas tank is on top of the tank. Invert the gas canister and place its nozzle over the gas filler valve. Support the tank from underneath and press the canister down. The gas will be heard hissing as it enters the tank and a small amount will escape around the valve. This is quite normal. After about 20 to 30 seconds, liquid gas will emerge from the valve showing that the tank is full. Remove the canister immediately.

Filling the Boiler

The boiler is filled through the boiler filling plug in the top middle of the boiler. Distilled water is recommended, as sold for battery topping up, but clean soft water can be used if this is not available. Rain water is also an acceptable alternative, provided that it is adequately filtered. We know of several people that use the paper wine filters for this purpose, with good results. Do not use demineralised or de-ionised water, as this is not the same as distilled water and could cause long term damage.

Remove the boiler filling plug and, if using a syringe, fill the boiler right to the top with clean water. There has to be a space above the water to allow steam to be raised so insert the end of the plastic pipe into the boiler and withdraw 30 ml of water with the syringe.

Replace the boiler filling plug finger tight.

Lighting the Burner

WARNING: Before lighting read the section on gas system troubleshooting and be aware of potential problems. If the gas system is not operating correctly **shut it off immediately** or damage may result.

Move the locomotive to another location before lighting. Butane is heavier than air and small pockets of gas can collect around the locomotive during filling.

To light the burner, hold a lighted match or cigarette lighter over the top of the chimney and **slowly** open the gas regulator by turning it anti-clockwise. The gas should ignite almost immediately with a pop as the flame travels down the chimney and into the boiler tube. The burner should be audible but not too loud.

NOTE as stated above, the gas regulator should be opened slowly until the burner ignites. If opened too quickly, particularly when the engine is cold or if the gas tank has just been filled, it is possible that the flame may not travel back into the boiler flue but stay in the smokebox. If this should happen, the burner will sound quite different to normal and the blue flame will be visible in the smokebox if viewed down the chimney from a safe height. Should this happen, turn off the gas immediately or damage may result and then relight it. If the problem persists, and it is not possible to ignite the burner correctly, then a dirty jet should be suspected and cleaned as detailed in the '**Trouble Shooting'** section.

For the first couple of minutes keep the burner on low. This is important, as until it warms up, the flame will be a little unstable and turning it up too much could cause it to go out. Also, with a completely full tank, liquid gas could be drawn off instead of vaporized gas, which can also extinguish the flame. After a couple of minutes, the gas control valve can be opened more to speed up the raising of steam. Open the gas regulator slowly to about one full turn. The full range of adjustment (closed to fully open) is achieved within the **first full rotation** of the gas regulator knob; any more is unnecessary.

Trouble Shooting

This system is designed for use with Butane or Iso-Butane gas. Mixed gasses, i.e. Butane with a proportion of Propane mixed in, are available, and may be used if straight Butane is unavailable. These come in a variety of mixes ranging from 90/10 to 60/40 with one of the most common being 70/30. The figures refer to the proportions of the mix i.e. 70/30 contains 70% butane and 30% propane. If using mixed gasses, always choose the one with the largest proportion of butane. The addition of propane slightly alters the property of the gas. This can make the burner a little more difficult to light when cold or after filling the gas tank. Always open the regulator very slowly when lighting, and only just sufficient for ignition to take place. Opening too much too soon may extinguish the flame until the burner reaches normal operating temperature.

The tiny jet in these units can become blocked by small particles of dirt making the burner difficult to light, burn weakly at normal operating temperatures*, burn in the smokebox or fail completely. If any of these should happen, clean out the jet as follows. (* On very cold days, a burner may start off burning weakly due to the temperature of the gas but should increase to its normal level as the engine warms up warms up. This is quite normal). Carefully, disconnect the gas pipe from the jet block using a 2 BA spanner.

Note when connecting or disconnecting the gas pipe and jet block, do not use excessive force. Always hold the end of the gas burner near the air holes to support it otherwise it is possible to cause damage by bending the body.

Slacken the screw retaining the jet block and slide it out to the rear. Remove the jet from the jet block using a 4BA spanner. Wash out the jet in fast evaporating thinner (Cellulose or similar). Blow through the jet from the front, which should clear most blockages. Although the hole through the jet is tiny, if you hold it up to the light you should be able to see quite clearly if it is blocked or not. If in doubt, fit a new jet. A spare gas jet is included with the toolkit. Do not use wire to clean the jet as this can damage the precision hole and may upset the delicate balance of the gas system. Reassemble in the reverse order, putting a small amount of PTFE tape round the thread of the jet. Ensure all connections are tight. When re-positioning the jet block in the burner ensure that it is pushed in as far as it will go.

The gas regulator has a spindle 'O' ring housed inside the body, which may need lubrication from time to time if the control becomes 'spongy' in operation, making precise gas control difficult.

As stated previously in the lighting instructions, the full range of adjustment for normal burner operation is achieved within the first full rotation of the regulator knob, and it should only be unscrewed more than this for maintenance purposes and when the tank is empty and their are no naked lights nearby.

To lubricate it, remove the knurled knob which is retained by a 4BA socket grub screw (.100" AF Allen key required) in the side. Beneath the knob is a back-lash spring and white PTFE washer, which will slide off the spindle. Unscrew the hexagon retaining nut then screw the spindle out of the body. The 'O' ring can now be lubricated.

Replace the spindle followed by the retaining nut. Slide the white PTFE washer and backlash spring over the spindle and replace the knob. Note that the grub screw that holds the knob in place tightens into a groove near the end of the spindle.

Pressure vessel care and maintenance

Gas tank

The gas tank is used for the storage of LPG (liquefied petroleum gas) in the form of butane, iso-butane or as set out in the 'owners handbook'.

The tank is fitted with a self-venting filler valve which contains no serviceable parts. Should the filler valve become defective in any way it must be replaced with a new item.

It is recommended that the gas tank should undergo the following checks carried out by a 'competent person', club, society or pressure vessel manufacturer, every year:-

Thorough visual inspection.

And every five to ten years:-

Hydrostatic pressure test to not less than 1.5 and not more than 2 times the maximum working pressure.

Maintenance & Trouble Shooting

The following section is only relevant once the boiler is fitted as full testing can only be done under steam.

When new, the cylinders will require running for several hours before they reach their full performance as the slide valve must ' bed in'. A cylinder lubricator must be fitted to ensure that there is an adequate supply of steam oil at all times.

The piston rod and valve spindle glands are fitted with 'O' rings and should not be over-tightened. If a steam leak develops just nip up the gland nut enough to stop the leak and no more. Over-tightening will have an adverse effect on running.

The piston is also fitted with an 'O' ring, which can easily be replaced if it becomes worn or damaged.

Cylinder covers are sealed by gaskets, and valve chest joints are sealed by `O` rings. Any leaks which develop here during the first few hours of running can usually be cured by simply tightening the relevant screws. **Note** that these are small screws and will break if over-tightened - be careful.

Because the slide valves are held onto the port faces by steam pressure, it is possible for small particles of dirt, lime scale etc., which are carried through with the steam, to become lodged between the two and thereby break the seal necessary for operation. This would show up as excess amounts of steam being exhausted up the chimney with a continuous hiss coupled with loss of power or failure to run at all. The remedy is quite simple and involves removing the valve chest cover, lifting the valve chest just enough to remove the slide valve from the side and cleaning the valve and port face. The valve face can also be 're-made' to remove any score marks etc. by carefully rubbing it on a piece of fine emery paper or wet & dry paper placed on a very flat surface. Make sure that you hold the valve perfectly flat down onto the abrasive and remove a very small amount at a time. Take care not to rotate the valve spindle or nut and replace the slide valve the same way round as it was and there will be no need to reset the valve timing. Squirt a little steam oil into the valve chest as you replace the parts to help lubricate and seal the valve.

If all is operating correctly, when running the locomotive slowly, you should hear the separate beats of the exhaust up the chimney as the valve opens and closes.

If, when hot, the chassis seems to stiffen up, re-check the following because, as stated earlier, expansion can alter the fit of something you thought was OK when cold.

Is there still a little side play in the axles? The outside cranks may be pressing on the axle bushes.

Do the wheels still rotate freely without sticking at front or rear dead centre? The coupling rod holes may need a little more attention with the file.

Technical Help

You should now have a running chassis and a better knowledge of what makes a steam locomotive work. If not, don't despair. Roundhouse offer technical help regarding the use of their components over the phone during normal working hours, or by emailing them at:-

support@roundhouse-eng.com - we will do our best to get you through any difficulties.