

## GWR BULLDOG CLASS INSIDE MOTION

### ETCHED COMPONENTS

- IM1 Connecting rod (4)
- IM2 Eccentric sheath (4)
- IM3 Steam reversing lever
- IM4 Screw reversing lever
- IM5 Reversing arm (4)
- IM6 Lifting link (4)
- IM8 Expansion link (2)
- IM7 Valve rod (2)
- IM9 Cylinder block front
- IM10 Cylinder block mounting bracket
- IM11 Motion bracket front lamination
- IM12 Motion bracket rear lamination
- IM13 Valve rod guide box
- IM14 Valve rod gland (2)
- IM15 Slide bar assembly
- IM16 Piston rod gland inner overlay (2)

- IM17 Piston rod gland outer overlay (2)
- IM18 Crosshead face (4)
- IM19 Crosshead slipper (2)
- IM20 Eccentric spacer washer (3)

### OTHER COMPONENTS

- 3/32" outside diameter brass tube for cylinder tube
- 1.25mm Nickel silver wire for oil cups, valve rods, crosshead pins and lifting links
- 1.6mm Nickel silver wire for piston rods
- 0.7mm Brass wire for pinning eccentrics together
- 0.8mm Brass wire for stuffing box studs
- 1.6mm Brass wire for reversing shaft
- Brass eccentrics left (2)
- Brass eccentrics right (2)
- Rivets (6)
- 6BA screw

Most of the drawings to describe this build are on the reverse side of this piece of paper.

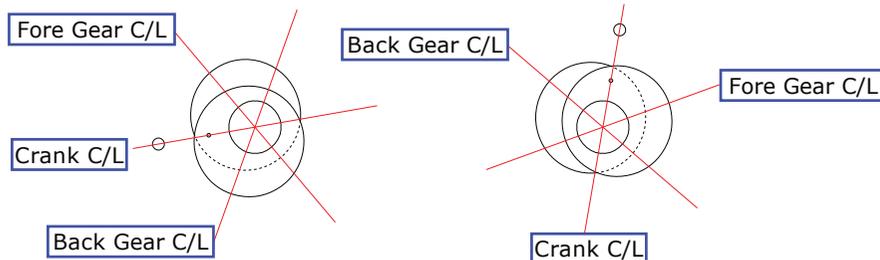
### CRANK AXLES AND ECCENTRICS.

This uses solder and pin construction. Use 60/40 cored solder with plenty of La-Co flux paste and a micro flame to generate enough heat. Use a sacrificial cheap brush and brush more flux round the axle whilst hot. More solder is good! Either solder the complete assembly in one go or assemble and then solder the left eccentrics to the left crank followed later by the right side. Solder each side in place on the axle separately.

**Eccentrics.** Ream out the holes in the eccentrics so that they are a tight fit on the axle. Then carefully open out the small holes in the eccentrics, so that the 0.7mm wire fits in the holes. Check the fit of the eccentric sheaths on the eccentrics. Drill a 3/16" hole in a small block of wood leaving the drill in the hole to act as a mandrel to align the eccentrics. Assemble the eccentric sheaths, eccentrics and 0.7mm wire pin in pairs over the mandrel and solder the wire pin to both eccentrics. Cut the wire flush with the face of the eccentrics.

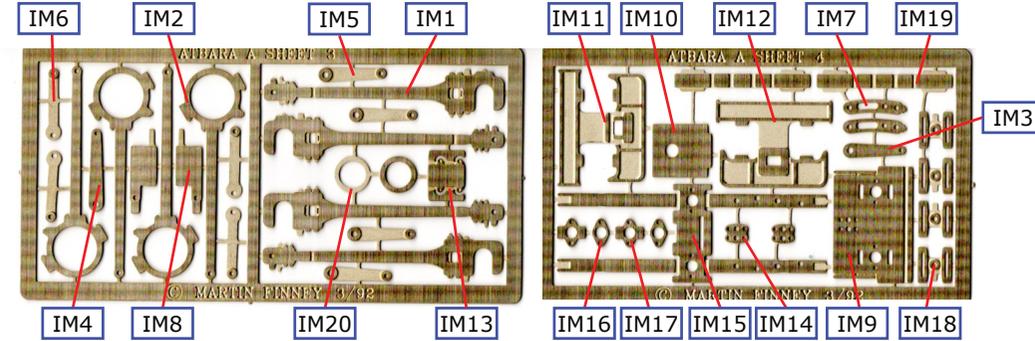
**Cranks.** Completely drill a hole on each side through the cranks down the narrowest part from top to bottom, either 0.7mm or 0.8mm depending on width of crank.

**Assembly.** Fit the eccentrics to the crank axle using the drawing to ensure correct orientation. The eccentric should be fixed at 6mm centres for finescale and 8mm centres for S7. It is probably easiest to mark the inner alignment of the eccentrics on the axle. Space the eccentrics on the axle so that pairs of eccentrics are at the correct centres and they are in the correct position with respect to the cranks.



Right Side From Centreline

Left Side From Centreline



Allow everything to cool and then re-drill through the holes in the cranks, this time going through the axle. Add a pin through each of the holes, then add more flux and solder pins in place. Check all joints are properly soldered, clean up and cut through the axle.

### CYLINDER

If you have not used the widest chassis spacers file back the width of the lower edges of the cylinder block front (IM9) to the half etched lines so that it will fit between the frames. Bend the cylinder block front to shape folding along the half etched lines. Bend the slide bars (IM15) at right angles and fit to the cylinder block front so that the slide bars with the four holes are upwards. Solder short lengths of 1.25 mm nickel silver wire into the holes in each slidebar to represent the oil cups.

Fit lengths of 3/32" outside diameter brass tube to the cylinders so that they are perpendicular to the cylinder front and protrude by 2 mm. Detail the cylinder fronts by attaching the piston rod glands (IM16 & IM17) and the valve rod glands (IM14) using 0.8 mm wire to help alignment and represent the studs.

Fix the mounting bracket (IM10) in place so that the tab fits in the slot in the cylinder front and the cylinders will be inclined at the correct angle (see drawing). Tap the small hole in the cylinder block spacer (F5) 6BA and check the fit of assembly between frames, attaching it with the 6BA screw. For the Atbara/Flower kit the cylinder assembly is packed up using both packing pieces (F37).

### CROSSHEADS AND CONNECTING RODS

Bend up the a crosshead slipper (IM19) and solder the crosshead faces (IM18) in place on the small tabs. The completed crosshead should now be a nice close fit on the slidebars with minimal slop. Repeat for the other crosshead.

Cut the 1.6 mm nickel silver piston rod wire in half. Solder a 2 mm length of the cylinder tube to the end of each piece of wire. Insert the piston rod into the cylinder and push it half way in, slide on the crosshead and insert the piece of tubing on the rod between the small projections at the front of the crosshead. Carefully solder the rod to the crosshead and check the assembly for free but not sloppy movement.

Form the joggle in the connecting rods (IM1) with the fold lines inside to make the fork around the crosshead. Solder the rods together after first fitting them over the cranks. Attach the connecting rods to the crossheads using 1.25 mm nickel silver wire as pins. Now fit the crank axle and cylinder assembly and check that everything works with no binding.

## MOTION BRACKET AND VALVE GEAR.

Emboss the rivets on the motion bracket laminations (IM11 & IM12) and solder them together. If you have not used the widest chassis spacers, the lower edges will need filing back as for the cylinder front. Bend the valve rods (IM8) through 180° along the half etched lines, with the line on the outside and solder solid. Remove the half etched fold and file into a clean, square section. Solder lengths of 1.25 mm nickel silver wire onto the half etched front for the extension of the valve rods, then check their fit in the rectangular hole in the motion bracket. Aim to get a close fit by either opening out the hole slightly or by filing the edges of the rods. Emboss the rivets in the valve rod guide box, fold up and attach to the motion bracket as shown in the diagram. Accurate positioning is essential to avoid fouling the valve rods. Fit the motion bracket into the half etched grooves in the slide bars. Before soldering in position check the crosshead clearance.

Rivet the eccentric sheaths, the expansion links (IM7) and the valve rods together paying particular attention to the direction of the rivets - the fore gear eccentric sheath rivet head is on the outside, the back gear eccentric sheath and valve rod rivet head is on the inside. Make the right side a mirror image of the left. Thread the crank axle assembly into the cylinders and check that everything works.

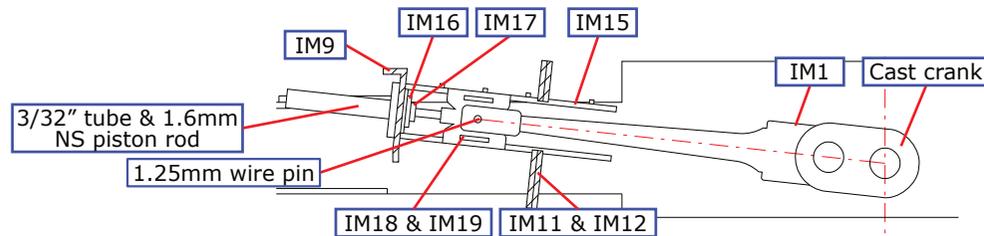
## REVERSING MECHANISM

**Screw Reverser.** The cross shaft is made from 1.6 mm nickel silver wire. The screw reverser arm (IM4) sits at the right end of the shaft. The reversing arms (IM5) are soldered back to back

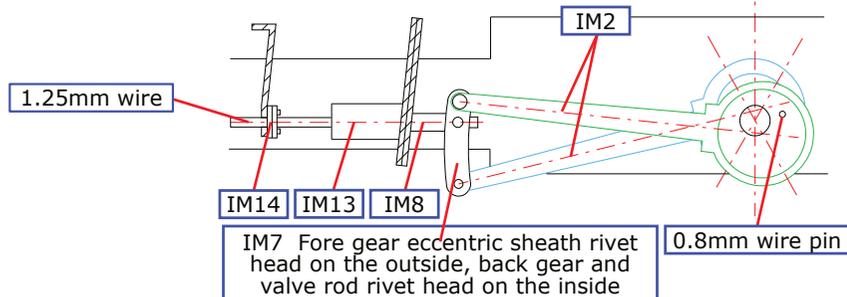
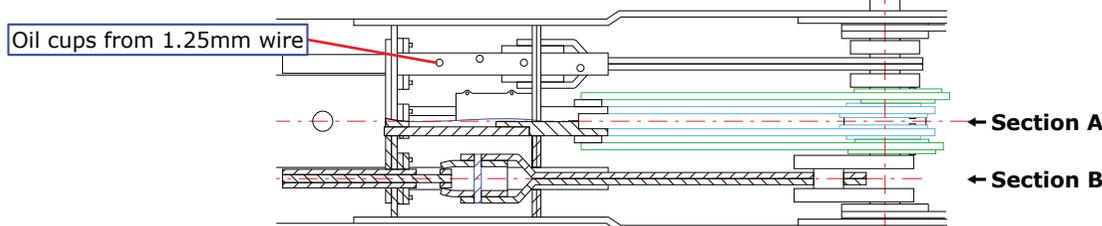
and then threaded onto the shaft so that they align with the jointed faces of each pair of eccentrics; they should be set at 90° to the screw reverser arm. Solder all the arms in place on the shaft. Thread a length of 1.25 mm NS wire through the reversing arms and thread a lifting link (IM6) either side of each reversing arm. Solder the wire in place and then solder each lifting link in place so that the link is vertical with the bulbous top set either side of the top of the expansion links. Solder the reversing shaft in place.

**Steam Reverser.** Clean up the steam reversing cylinder castings and remove the part indicated on the drawing. Drill a 0.8 mm hole in the castings to allow the 0.8 mm operating rod to be assembled onto the cylinders; position the cylinders so that the outer faces are 19.3 mm apart as shown. The cylinder sits on a stub of 0.8 mm wire that is soldered into home C in the right hand frame.

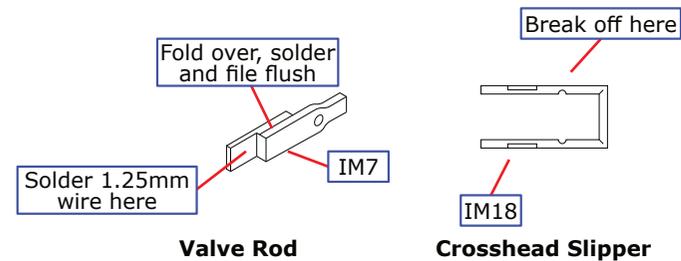
The cross shaft is made from 1.6 mm nickel silver wire. The steam reverser arm (IM3) sits at the right end of the shaft and fits over the end of the cylinder operating rod. The reversing arms (IM5) are soldered back to back and then threaded onto the shaft so that they align with the jointed faces of each pair of eccentrics; they should be set as shown. Solder all the arms in place on the shaft. Thread a length of 1.25 mm NS wire through the reversing arms and thread a lifting link (IM6) either side of each reversing arm. Solder the wire in place and then solder each lifting link in place so that the link is vertical with the bulbous top set either side of the top of the expansion links. Solder the reversing shaft in place.



Section Showing Elevation of Left Motion

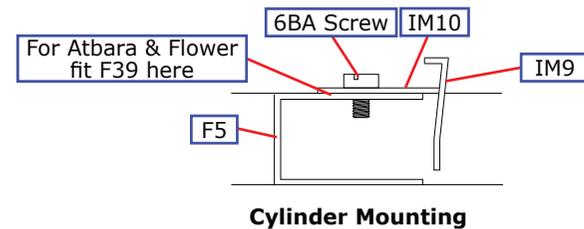


Section A Showing Elevation of Left Valve Gear

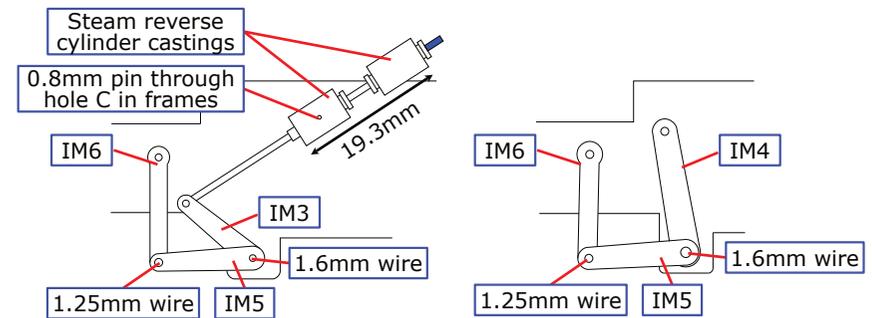


Valve Rod

Crosshead Slipper



Cylinder Mounting



Screw Reverse