

## **4mm SCALE INSIDE MOTION KIT - GWR DUKE 4-4-0**

### **MAKING THE CRANK AXLE**

First ream out the holes in both the cranks and the eccentrics so that they are a tight fit on the axle. Then carefully open out the small holes in the eccentrics, preferably with a small taper broach, so that the 0.45mm wire is a force fit in the holes.

Check the fit of the eccentric sheaths (part 155) on the eccentrics. Cut a small notch, to fit the 0.45mm wire, in the web of the cranks. The crank and eccentrics can now be pinned together with a short piece of 0.45mm wire.

The cranks and eccentrics together with the eccentric sheaths are now force fitted on the axle with the cranks set apart by a distance which corresponds to the cylinder holes in part 162 (8.25mm) and with the right side crank leading by 90°. The correct spacing is achieved by using the spacing washer, part 173.

When you are satisfied with the setting of all the components carefully silver solder the cranks and eccentrics to the axle. The eccentric sheaths must of course remain free. Now very carefully remove the axle between the crank webs. A Carborundum disc in a mini drill works well and allows very gentle pressure to be used. I suggest you don't use a hacksaw!

The axle bearings will need to be filed back so that there is clearance for the cranks with a little side play on the axle.

### **CYLINDERS**

If you are modelling in EM gauge file back the width of the lower edges of part 162 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 (part 168) at right angles and fit to the cylinder block front (part 157) so that the slide bars with the four holes are upwards. Solder short lengths of 0.7mm wire into the holes in each slide bar to represent the oil cups.

Fit lengths of 1/16" outside diameter brass tube for the cylinders so that they are perpendicular to the cylinder front and protrude by 1mm. Detail the cylinder fronts by attaching piston rod glands (parts 169 & 170) and valve rod glands (part 167) using 0.45mm wire to help alignment and represent the studs.

Fix the mounting bracket (part 163) in place so that the tab fits in the slot in part 162 and the cylinders will be inclined at the correct angle - 1 in 10 -. Tap the small hole in the cylinder block spacer (part 11) 10BA and check the fit of the assembly between frames attaching it with the 10BA screw and packing it up using the packing piece (part F20).

### **CROSSHEADS AND CONNECTING RODS**

Bend up the crosshead slipper (part 172) and solder the crosshead faces (part 171) in place on the small tabs. The completed crosshead should now be a nice close fit on the slide bars with minimal slop. Repeat for the other crosshead.

Cut the steel piston rod wire in half. Solder a 1mm 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 (part 154) 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 0.7mm 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 (parts 164 & 165) and solder them together. For EM gauge, the lower edges will need filing back as for part 162. Bend the valve rods (part 161) through 180° along the half etched lines, with the etched line on the outside and solder solid. Remove the half etched fold and file into a clean, square section. Solder lengths of 0.7mm wire onto the half etched front for the extension of the valve rods, and 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 filing the edges of the rods or both.

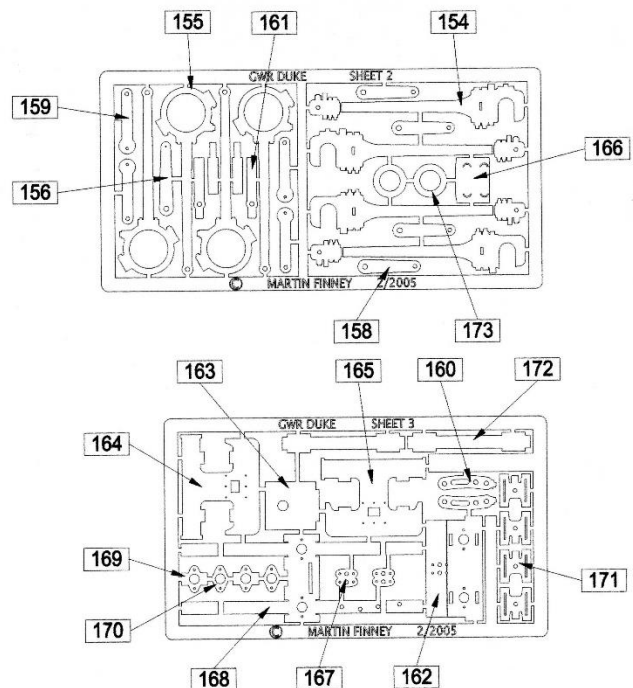
Emboss the rivets in part 166, fold up and attach to the motion bracket as shown in the diagram. Accurate positioning is essential to avoid fouling the valve rods. Fit the motion bracket into the half etched grooves in the slide bars. Before soldering in position check the crosshead clearance.

Rivet the eccentric sheaths, expansion links (part 160) and valve rods together paying particular attention to the direction of the rivets - see diagram. Make the right side a mirror image of the left. Thread the crank axle assembly into the cylinders and check that everything works.

Finally using the diagrams, assemble and fix the reversing mechanism. The reversing arms (part 158) are laminated back-to-back.

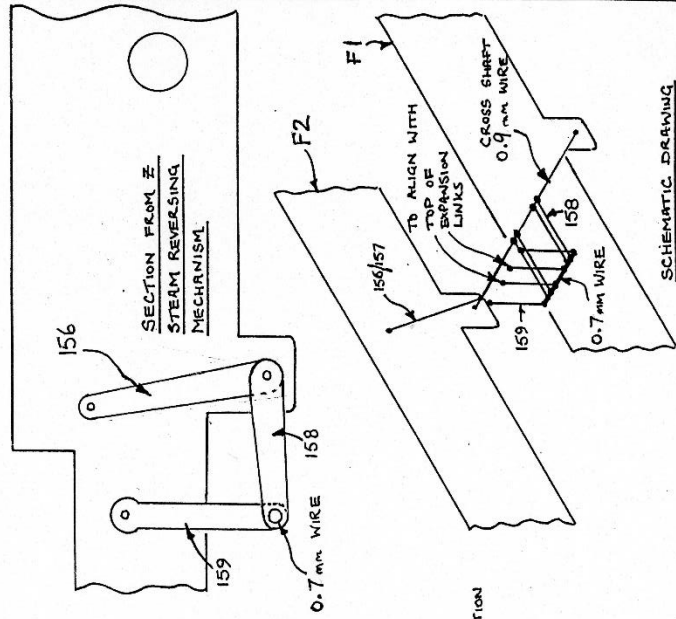
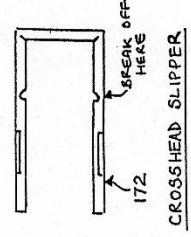
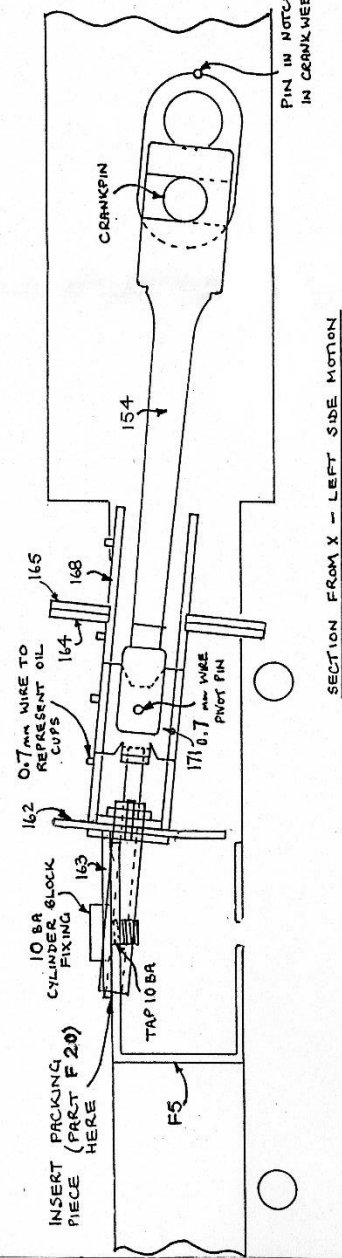
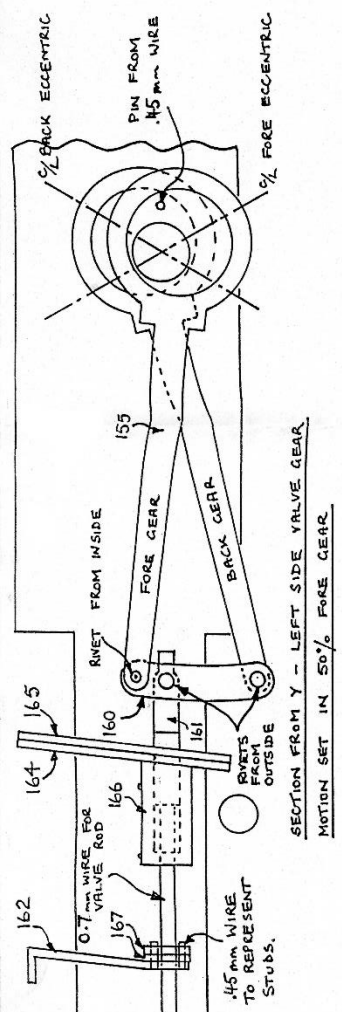
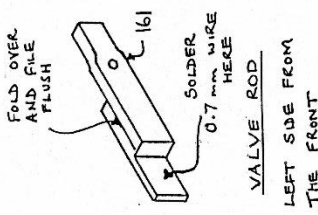
### ETCHED COMPONENTS

- 154 Connecting rod - (4)
- 155 Eccentric sheath - (4)
- 156 Reversing lever
- 158 Reversing arm - (4)
- 159 Lifting link - (4)
- 160 Expansion link - (2)
- 161 Valve rod - (2)
- 162 Cylinder block front
- 163 Cylinder block mounting bracket
- 164 Motion bracket - front lamination
- 165 Motion bracket - rear lamination
- 166 Valve rod guide box
- 167 Valve rod gland - (2)
- 168 Slide bar assembly
- 169 Piston rod gland inner overlay - (2)
- 170 Piston rod gland outer overlay - (2)
- 171 Crosshead face - (4)
- 172 Crosshead slipper assembly - (2)
- 173 Washer - to space out the eccentrics - (3)

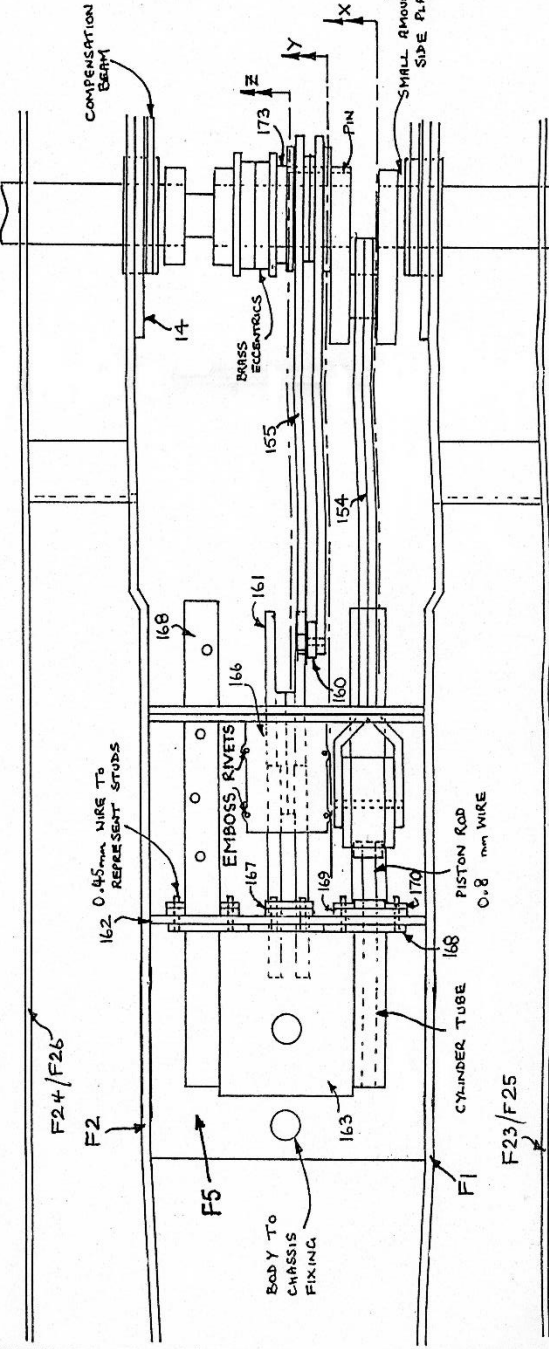


### OTHER COMPONENTS

- Rivets - (6)
- 10 BA screw
- Cast cranks - (2)
- Brass eccentrics - (4)
- 1/16" outside diameter brass tube - for cylinder tube
- Steel wire - 0.8mm - for piston rods
- Brass wire - 0.45mm - for pinning eccentrics together
- Brass wire - 0.7mm - for crosshead pins and lifting links
- Brass wire - 0.9mm - for reversing cross shaft



**SCHEMATIC DRAWING SHOWING THE ARRANGEMENT OF THE REVERSING MECHANISM**



**GWR DUKE 4-4-0  
INSIDE MOTION  
MARTIN FINNEY 7/2005**