

SER-Kits
Stephenson's Valve Gear: 7mm cast white-metal kit
19th Century swing-link version - non-working, cosmetic only

Instructions

HEALTH & SAFETY: The castings contain some lead. Dispose of filings safely and wash hands after handling. For adhesives, read manufacturer's instructions regarding vapour inhalation.

NOTE: the low-melt alloy used by SER-Kits is pliable and may be gently bent – within reason. If attempting to solder it, use only 70°C solder

WILL THIS KIT FIT MY LOCO? BEFORE BEGINNING ASSEMBLY, read the following carefully.

Although the kit is designed to fit Stirling's locomotives for the SER, it can also fit quite a wide range of other companies' locos, but you may need to make modifications. First check the fit of the motion against your drawing or model. I recommend making a tracing of the side view in Diagram 1, and laying it on your loco drawing to determine position and angle.

The gear is based on a prototype distance of approximately 8'6" from driving axle centre to front of cylinder head casting, but there is considerable scope for adjustment:

LENGTHWISE FIT

- The motion plate (Part 9) can be moved backwards or forwards several millimetres by adjusting the fit of the slide bars (Parts 7). This varies Dimension A in Diag 1.
- The distance between the motion plate and the driving axle centre (Dimension B) is limited by the axle hole in the eccentrics (Parts 17-1 to 17-4). By filing the holes into ovals, the whole valve gear can be moved up to 3.5 mm backwards or forwards relative to the driving axle.
- The fit of piston slides and connecting rods have plenty of adjustment by altering the angle of the main cranks and length of the visible piston rods, though the final result may result in positioning of valves against piston rods that would not be workable in a real steam engine. Only the ultimate purist is likely to worry about this!

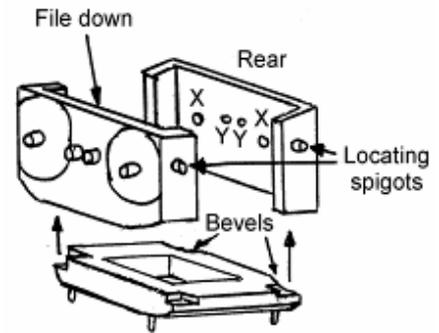
WIDTH FIT

- The kit is designed for a distance between frames of 25mm. By filing the edges of the cylinder block and motion plate, the gear can be fitted into 24mm width. **If you model S7**, I may have spare etches for the cylinder head which I can swap for the three cylinder assembly castings: please contact me.
- In many 0-6-0, 0-4-2 & 0-4-4 prototypes there is very little clearance between the lower slide bars and front axle. You may need to carve out half-moons from the bottom slide bars *after assembling the motion* to fit over the model's front axle and/or bearings. (Diag 1).
- The main cranks and valve eccentrics (Parts 14&16, 17-1 to 17-4) have 3/16" holes and are supported by the driving axle which should be a loose fit. *They are not intended to rotate.* If your model has a gearwheel on the axle, you may be able to fit the main cranks on either side, but you will need to cut the eccentric rods short. In some cases you may have to cut short both the eccentric rods and the connecting rods (Parts 15) and devise a cradle in front of the motor gearbox made from wire or thin metal to support the loose ends.

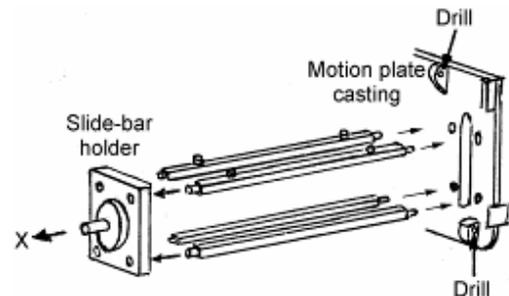
Assembly: First Stage

1. Use two-part epoxy resin (eg. Araldite or Devcon). Smaller parts can be held with Superglue.
2. *Refer to the valve-gear drawing on p.5 as necessary to identify parts.* Each part should be cleaned up before assembly by removing 'flash' and the remains of casting sprues.

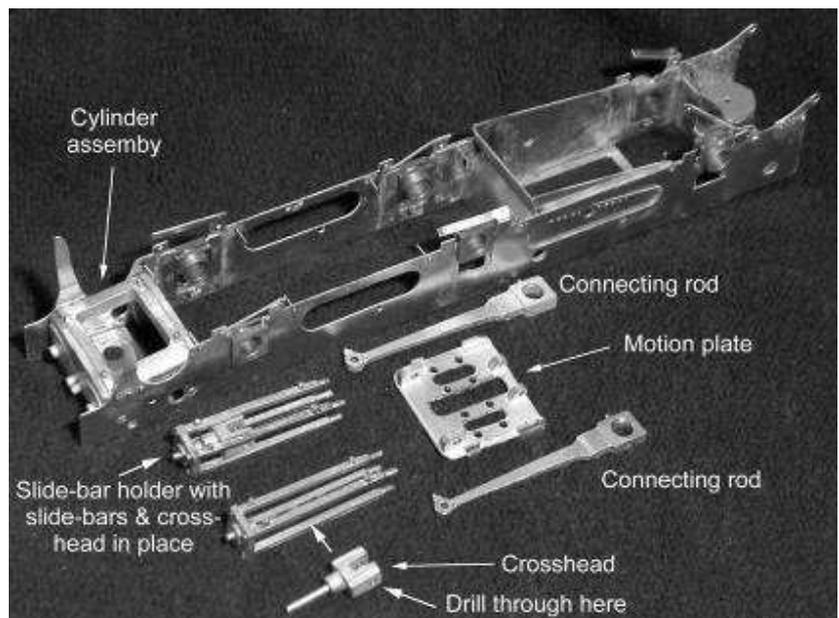
- Drill holes in your frames for the locating spigots. If necessary, file the top of the Cylinder Front and rear so that they will sit flush with the top of the frames. The Cylinder Rear (Casting 3) has two holes near the bottom corners (NOT the holes marked XX and YY in the diagram). These are for any electric leads from the pick-ups, and may need clearing out with a 1.2mm drill. The Base (Casting 2) has a 'front' and 'rear' – the rear has little bevels to clear the electric leads as they pass through the rear casting.



- Glue the three cylinder castings together. BUT NOTE: It's best to ease front and rear into the frames until the locating spigots are in the relevant holes (C in Diagram 1). Then glue the base in situ. But do not glue to the sideframes!
- Glue the Valve Spindles 5 & 6 into the holes marked Y on the above diagram. NOTE that the short spindle goes in the right hole (when viewed from the rear of the loco)
- Assemble the Slide Bars (Castings No. 7): The Slide Bar Holder (Casting 4) has a spigot one side which will fit into the hole in the cylinder rear. (X to X in the diagrams) The other side has a representation of a packing gland with hole for the piston rod. Glue 2 plain slide bars and 2 with oil-pots into the holes in the square slide bar holder, making sure the bars with oil-pots are on top. (NOTE: I find it easiest to clamp the slide bar holder in a horizontal position and glue the bars in the vertical.) Repeat for the other set of slide bars.

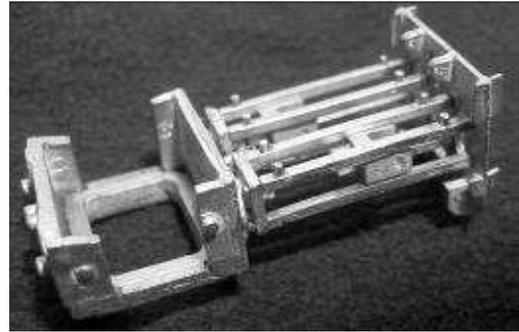


- While the glue is setting, drill holes in the brackets on the Motion Plate (Casting 9) where shown in the diagram. The same holes are labelled 'a' and 'b' in the scale drawing of the motion. *Holes in the top brackets* are for the top spigots in the expansion links/cranks (see later) and should be *1 mm diameter*. *Holes in the bottom brackets* should be *1.6mm* for the weigh shaft (see later). Also, clear out the 8 holes for the slide bars with a 1.5mm drill. You may wish to drill holes for the electrical leads from the front pickups. I suggest drilling 1 or 1.2mm just inside of the lower fixing brackets. File the edges of the Motion Plate (Part 9) to a suitable width. (It's cast approximately 25.5mm wide to ensure the flanges cast properly)
- Take the Cross-heads (Casting 8) and drill through with a 1.6mm drill where shown in the photo.
- Cut one of the the piston rods (Part 8) down to 1mm (NOTE: If you are 'stretching' the valve gear to fit your model, you may have to leave more piston rod exposed.) Slide the crosshead between the bars until the piston rod fits into the hole in the packing gland (Diag 2). Don't glue yet.
- Cut the remaining piston rod down to about 8.5 mm, (with the same proviso as above) and slide between the bars (Diag 3).



Fitting The Complete Cylinders & Valve Gear Into Your Model

11. At this stage, make a trial fit of the whole cylinder and slide bar assembly. *Without gluing*, fit the motion plate to the 8 slide bars with its brackets pointing towards the slide bar holders, and fit the slide-bar holders into the corresponding holes in the rear of the cylinders (X to X). It should look like this photo:



12. Ease the frames apart at the front, and spring the cylinder assembly into position. Later it can be fixed permanently, but here is a better method: Drill 0.6mm through the frames into the motion plate brackets, 1 or 2 holes to each bracket. Fix cut-down dress-maker's pins with a touch of Loctite. If/when disassembly is needed, these can be prised out.

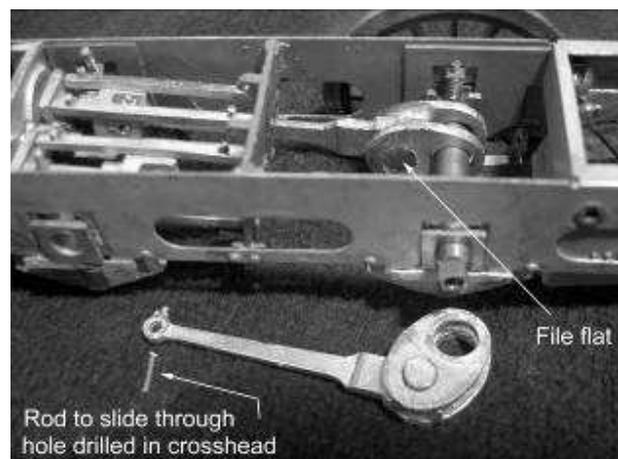
13. Glue the motion plate to the slide-bars and the slide-bar holders into the cylinders. When the glue has set, refit the assembly between the frames

Assembly continued (in situ between frames)

14. *Instructions 19-29 require the cylinder block to be to your left and the driving axle to the right.* The numbers and diagrams refer to the scale drawing of the motion.

15. Take the spigot cranks (Casting 14) and file flat the face of the cranks opposite the spigot. (Failure to do this may leave you with insufficient room for the eccentrics.) Thread the big end of one of the connecting rods (Casting 15) onto the spigot, and sandwich with a plain crank 16. NOTE: spigots should point outwards, and oil glands on the con-rods upwards. Glue the the spigot to the plain crank so that the con rod can rotate freely. Repeat for the other con rod and crank.

16. Thread one of the con rods through the furthest slot in the motion plate and into the cross-head. Hold the crank in place with an axle or piece of 3/16" rod. Thread a 6mm long piece of 1mm diam rod through the hole that you drilled earlier through the cross-head. (It's deliberately sloppy to give you room to manoeuvre.) Hold the rod in place with a spot of glue, but allow the con rod to remain movable. It should now all look like the photo:



17. Repeat with the other con rod and crank. It's designed for the crank to hang down, but you may feel that the motion is more visible if the second crank points upwards.

Valve Gear

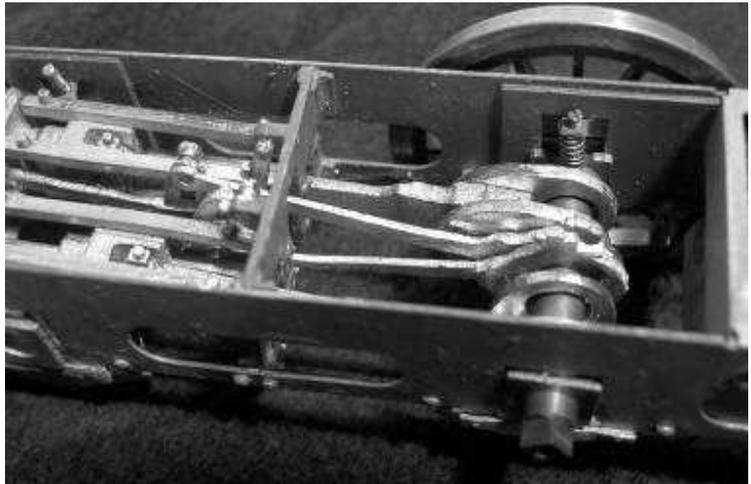
18. Now for the fiddly (more fiddly?) bit. Take your time on this, and refer to both the scale drawing of the motion and the photographs. A bit of juggling is necessary, and the parts are cast in a pliable alloy to allow this.

19. Take the 'obtuse' expansion link assembly (Casting 10) and trim the lever to 16mm. (See Motion Drawing, Part 10) Glue the lever into the slot in the valve guide and the spigot into the hole drilled earlier in the bracket furthest away from you at the top of the motion plate. (See Motion Drawing diagram 4)

20. Assemble the first two eccentrics (17) as follows: Each has a number on the casting to identify it. *Keep the numbered face towards you.* It may help to open out the axle holes even more - they are deliberately large to allow the sprung axle to move up and down. *Wedge the axle and axle-boxes to the top of their travel.*

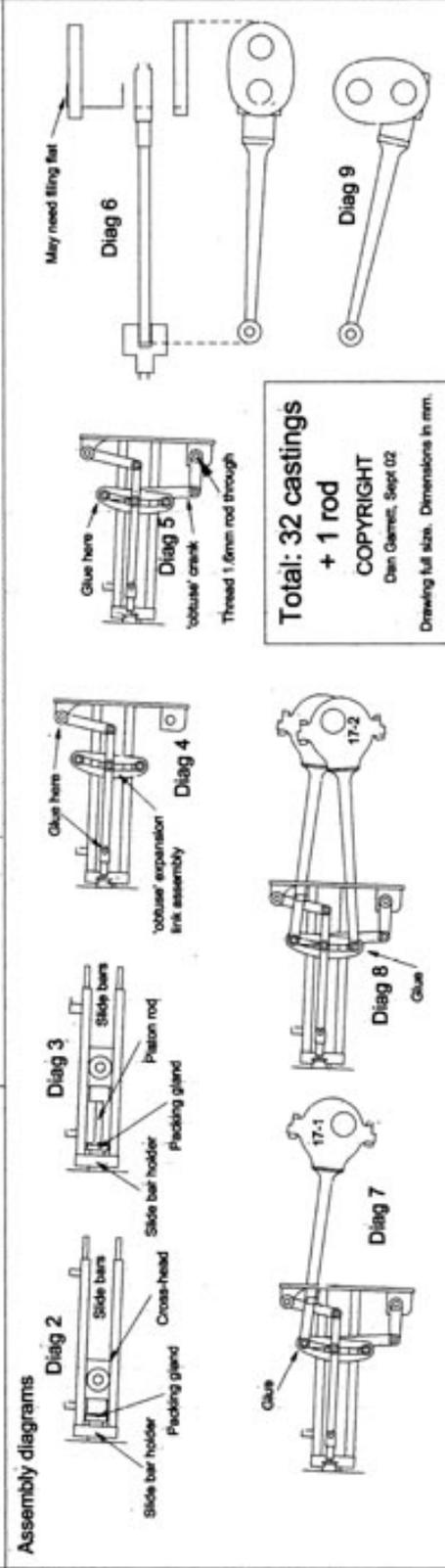
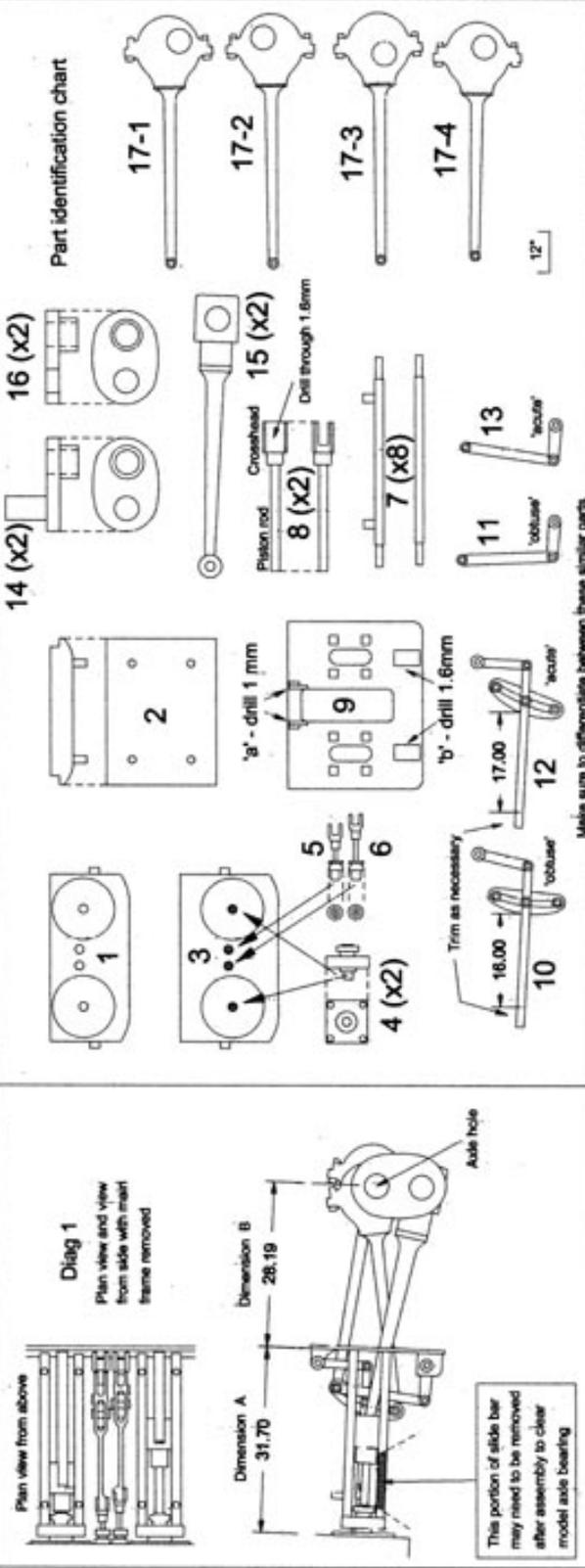
21. Thread the long rod of eccentric 17-1 through the centre hole in the motion plate and then catch the eccentric itself onto the axle. (Motion drawing, Diag 7) Glue the hole in the end of the eccentric rod onto the inner spigot at the top of the expansion link.

22. Repeat with eccentric 17-2 (Motion drawing, Diag 8), gluing to the lower spigot on the expansion link.
23. Trim the lever on the 'acute' expansion link assembly (Casting 12) to 17mm. Glue in place next to the 'obtuse' assembly. The photo shows the stage you should have reached.
24. Thread eccentric 17-3's rod through the motion plate, and catch the eccentric with the axle. Glue the hole in the eccentric rod to the *bottom* spigot on the expansion link. (Similar to Diag. 8). Thread eccentric 17-4 into position and glue to the inner spigot at the *top* of the expansion link. (Diag. 7.)
25. Remove the axle-box wedges and check that the axle can move up and down freely. Re-wedge, hold the eccentrics together with a croc. clip and glue them together with a drop of super glue.
26. Work a 25mm length of 1.6mm rod partially through the furthest lower bracket of the motion plate. ('y', left-hand in the diagram of Casting 9). This rod forms the 'weigh-shaft'.
27. Take the 'obtuse' crank (Casting 11) and run a 1.6 mm drill through the crank hole to make sure it can fit on the weigh-shaft. Referring to Diag. 5, work the long lever up from underneath between the 'obtuse' expansion link assembly and the slidebars. Thread the 1.6mm weigh-shaft through the hole in the crank. Glue the hole on the lever to the outer top spigot on the expansion link. (See Diag. 5)
28. Repeat with the 'acute' crank. Do not glue the cranks to the rod at this stage but wait till you've connected the reversing linkage later on.
29. Note that once the valve gear is assembled (and the glue set) the driving axle should still be able to move up and down by a millimetre or so for springing purposes. To ensure this, you may need to run a round (rat-tail) file through the holes in the cranks and eccentrics.
30. The final assembly is shown from above and below



SER-Kits

Parts for Stephenson's Valve Gear - 7mm scale, non-working



Total: 32 castings
+ 1 rod
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 Dan Garrett, Sept 02
 Drawing full size. Dimensions in mm.