



Chiltern Model Steam Engines

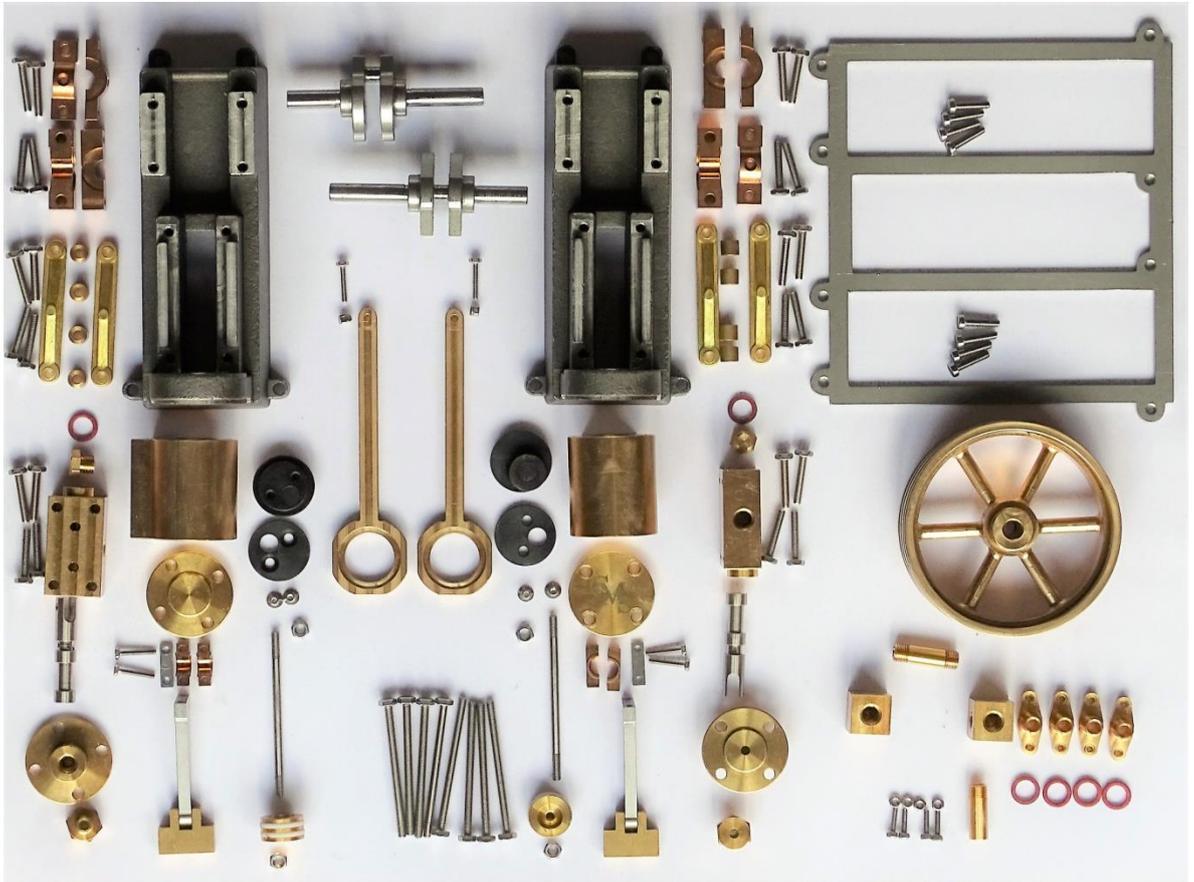
Duplex Twin Cylinder "Mill" Model Steam Engine Assembly Instructions v1.3

Notes:

1. Model steam engines and boilers are NOT children's toys and should not be assembled or operated by children unless under close supervision of an adult.
2. If there are any questions or problems arising during assembly or operation of the engine please contact Chiltern Model Steam.
3. In overview the engine should first be assembled "dry" with no oil/lubricants, thread lock or gasket sealant applied, then disassembled, polished, painted as required, and finally re-assembled lubricating and applying thread lock and gasket sealant as applicable.
4. The engine will work properly without thread lock or gasket sealant but if it is to be run under load, it is recommended that thread lock, such as Loctite 222 Screwlock (or equivalent low strength locking compound) be used to stop the fasteners from coming loose. Also that a gasket sealant, such as Loctite Instant Gasket (or equivalent), is used on the cylinder's mating surfaces with the end plates and Chest. Both thread lock and gasket sealant can be purchased for a small sum from automotive shops or on the internet.
5. Although sharp edges and burrs should have been removed during manufacturing, check all parts and if any sharp edges or burrs exist carefully remove them with a metal file.
6. It is recommended that the base castings are painted. Hammerite's range of metal paint sprays work well for this application although does take a long time to fully harden; up to a week, before the engine can finally be assembled. Use masking tape to cover the machined surfaces in which the Crosshead Slider runs and on which the Cap Spacers sit, or scrape off the paint as needed afterwards.
7. For polishing the brass components, wet and dry paper can be used - start with coarse e.g. 280 grade to get the worst marks out of the brass work and end with very fine paper, e.g. 1500 grade and finally Brasso and a rag.
8. Be careful not to over tighten or cross thread the cap screws. If more than a slight force is being used there is probably something out of alignment.
9. All parts are checked before shipping, so if a part does not seem to work perfectly try it in another orientation or position.
10. Always check www.chilternmodelsteam.co.uk for the latest assembly drawing, instructions and tips. Any questions or comments, good or bad, please don't hesitate to contact us via email: sales@chilternmodelsteam.co.uk.
11. We would be grateful if you would take some pictures of your completed model and email them to us for inclusion on our WEB site.
12. Typical tools required for assembly; M3 (5.5mm) and M2 (4mm) socket spanners, Hex/Allen Key (1.6mm key included in kit) and potentially a metal file.
13. NOTE: some of the screws as provided in the kit may need to be cut or filed to length, please contact us if this presents a problem and we will work on a solution.
14. Use a light oil for external lubrication of the engine and if running the engine for an extended period install a displacement lubricator in the inlet steam line from the boiler filled with steam cylinder oil (compounded, 220 grade).

Step by step instructions:

1. Locate the parts as show in the following picture and as listed on the A3 Assembly Drawing (a copy of which should have been included with the kit but also available for download from www.chilternmodelsteam.co.uk). NOTE: for shipping purposes many parts will be packed semi-assembled or in place, e.g. grub setscrews and bearings.



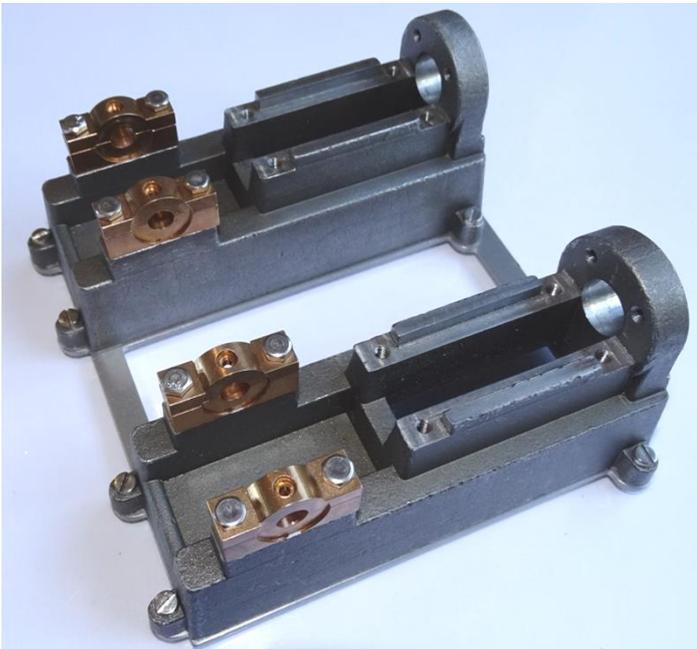
2. Screw the Piston Shafts into the Pistons, as shown in the following picture, carefully grip the shaft with some pliers to make sure it is reasonably tight (the shaft is stainless steel but can be damaged if excessive force is used). Lock the shaft to the piston using an M3 nut tightened with a socket spanner or small pair of pliers.



3. Insert each Piston Shaft into a Cylinder Plate Inner and push the Packing Nut onto the shaft and screw into the Cylinder Plate Inner. Screw an M3 nut onto the end of the Piston Shaft.

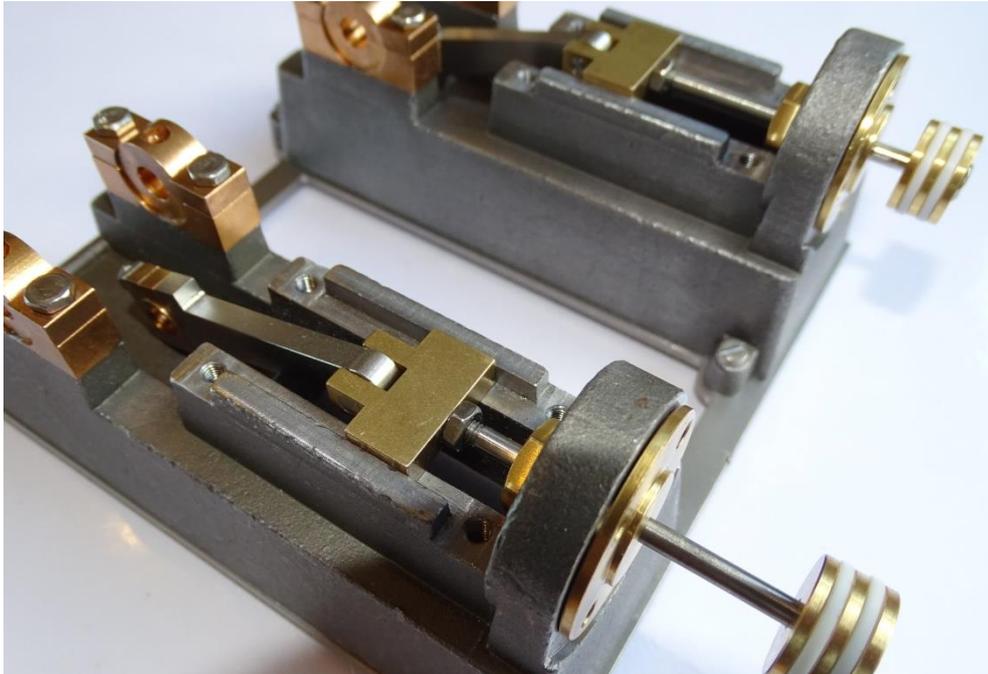


4. If it is planned to use high pressure steam - during final assembly, to improve the seal around the piston shaft, PTFE tape can be wrapped around the shaft and Packing Nut thread. When tightening the Packing Nut into the plate ensure the shaft can still move freely.
5. Mount the two Bases onto the steel Mounting Plate using M3 slot head cap screws and washers. Leave loose initially so that some adjustment can be made later. The cap screws may need to be cut/filled to length on final assembly. If the engine is to be mounted on a wooden plinth longer M3 cap screws and washers/nuts can be used.



6. Place the Crosshead Slider/Connecting Rod subassemblies into the slots in each Base, checking that the sliders move smoothly in their slots – remove burrs with a metal file if needed. Push each Piston Shaft through the hole on the end of the Base and screw into the Crosshead Slider. The Piston Shaft is locked to the Crosshead Slider using an M3 nut and a

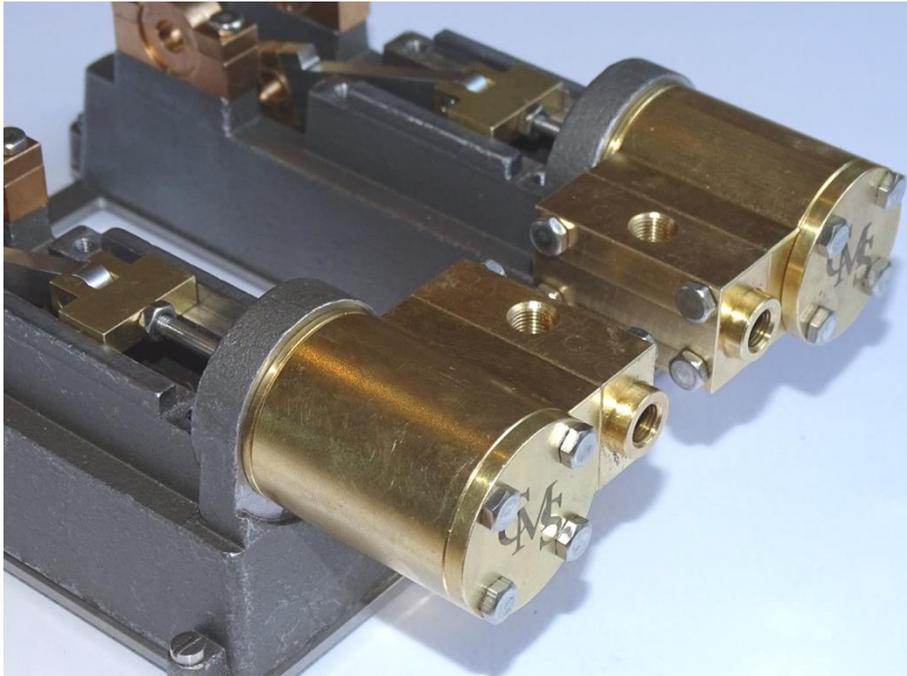
small pair of pliers or 5.5mm spanner. Usually it is not necessary but the Piston Shaft can be screwed into or out of the Crosshead Slider before locking in position to more accurately centralise the "throw" of the piston in the Cylinder.



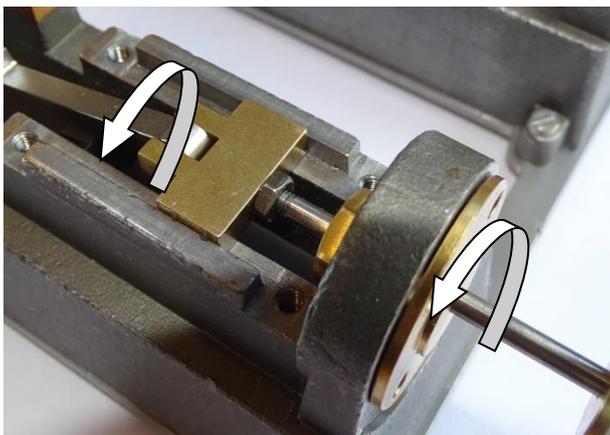
7. Using 4 18mm cap screws, fix each Chest to a Cylinder.



8. Push each cylinder over a Piston, being careful not to damage the Piston Rings (which should be already installed). See following picture to ensure correct orientation of the Chests. Then place each Cylinder End Plate on the end of the Cylinders and fix in place with the 45mm cap screws. Do not tighten the cap screws at this point.



9. Before tightening the Cylinder cap screws push the Crosshead Sliders back and forth to ensure the Piston can move freely in the Cylinder. There is some tolerance in the Cylinder and Cylinder Plate holes to allow them to be moved into a suitable position to allow free movement of the piston. Also before finally tightening the Cylinder cap screws check the Chests and aligned square with each other.
10. If after tightening the Cylinders the engine does not turn over freely try rotating the Cylinder Plates Inner by 90°. Similarly try refitting the Slides/Connecting Rods and its bearings the other way up.



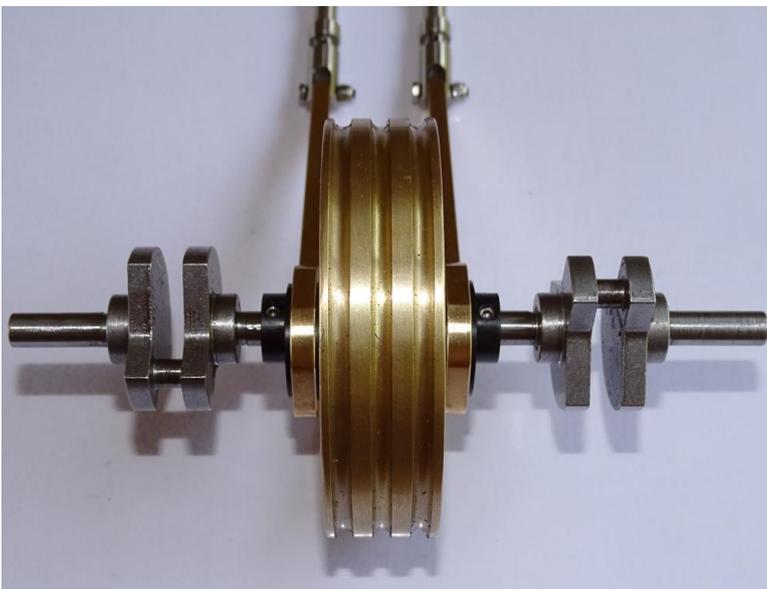
11. The inside surface on the Cylinders can be "lapped" or polished if needed to improve the smooth running of the Piston. This can be done using wet and dry paper as described earlier.
12. Put the Eccentric Wheels and Eccentric Wheel Plates together on the Eccentric Rods using the counter sunk M3 cap screws, as shown in the following picture. Then, if not already in place, screw a 3mm grub/setscrew into the Eccentric Wheel which will be used to lock the wheel onto the Crank Shaft.



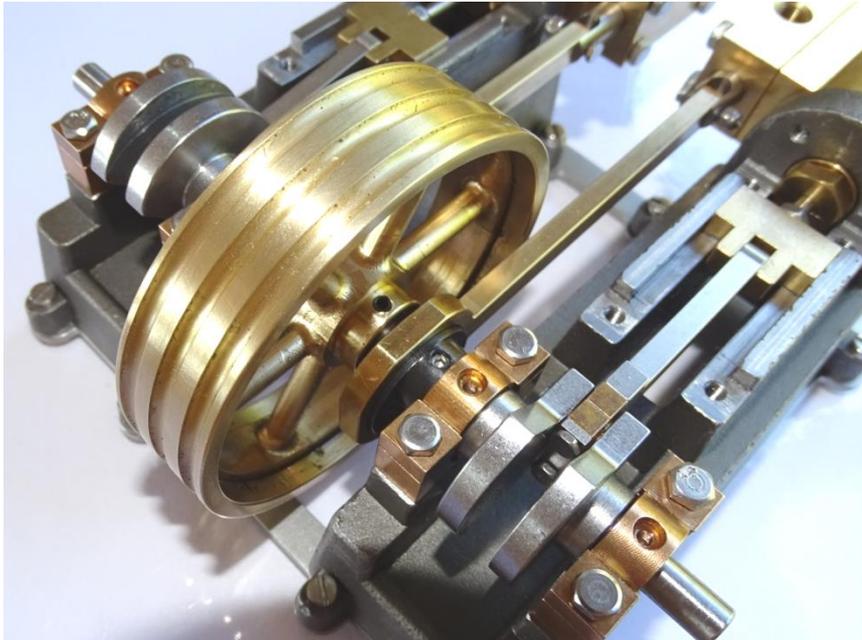
13. Connect each Valve with the Eccentric Rods using an M2 10mm cap screw and lock with a nut as shown in the following picture. The nut should be on the same side as the grub setscrew side of the Eccentric Wheel. If an M2 nyloc nut is included in the kit this can be used instead of a plain nut. Cut or file the cap screw to length as needed.



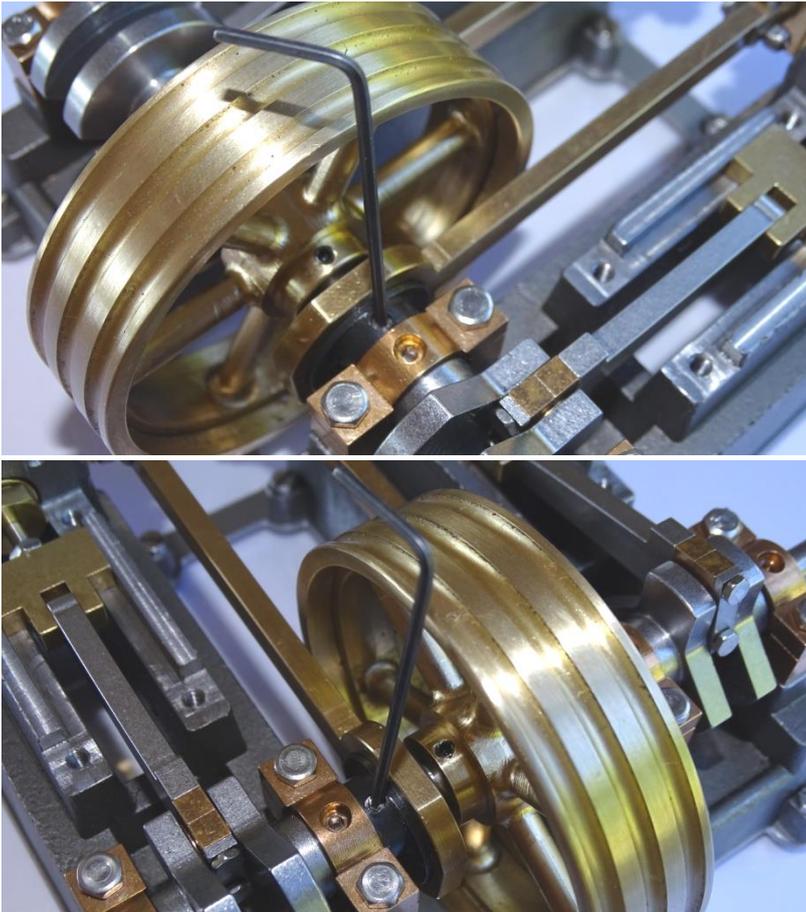
14. As per the following picture, push each Eccentric Wheel onto the longer end side of a Crank Shaft – the grub setscrew part of the Eccentric Wheel face the crank. Then push each Crank Shaft's longer end into the Flywheel hub. Ensure the 4 grub setscrews (2 each side) are in place in the Flywheel but don't tighten at this stage.



15. Remove the cap screws and both Main Bearing Uppers off each Base. Ensure these are later replaced in the same place and orientation as they are machined in pairs.
16. Push each Valve into its respective Chest and then place the Crank Shafts/Eccentric Rods/Flywheel subassembly onto the Main Bearing Lower and replace the Uppers and loosely screw in the 8 cap screws, as shown in the following picture.



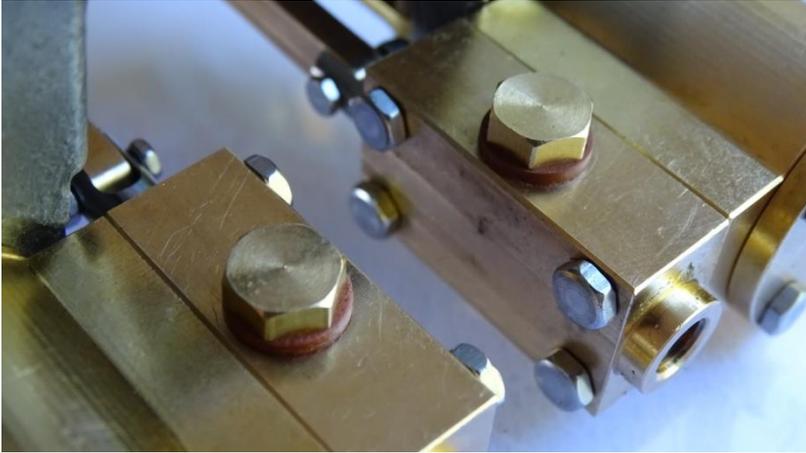
17. Locate the Flywheel so that it is central between the 2 halves of the engine then progressively tighten the 2 grub setscrews on each side of the Flywheel. Also evenly and gradually tighten the 8 Main Bearing cap screws whilst rotating the shafts. This will ensure the bearings centre themselves properly on the shaft. Lubricate via the hole in the Upper bearings as needed.
18. Tighten the 8 cap screws which hold the 2 Bases to the Mounting Plate ensuring the 2 Crankshafts still rotate freely. Some "trial and error" may be needed - loosing and retightening grub/setscrews, making small adjustments to the Crankshafts, Main Bearing and Bases – before the Crankshafts rotate freely.
19. Remove the cap screws holding the Connecting Rod Bearing Halves to the Connecting Rod and place them around the Crank Shaft as shown in the earlier picture. Keeping the Bearing Keep in place, insert and tighten the cap screws evenly and gradually, rotating the Crank Shaft to ensure the bearing halves locate centrally.
20. Set the angle of the Eccentric Wheels to the Crank/Piston position as shown in the following pictures and on the A3 Assembly drawing. Tighten the grub setscrews and check the Crankshaft can still rotate freely.



21. Fit the 2 Slider Caps on each Base together with the Slider Cap Spacers using M3 12mm cap screws.



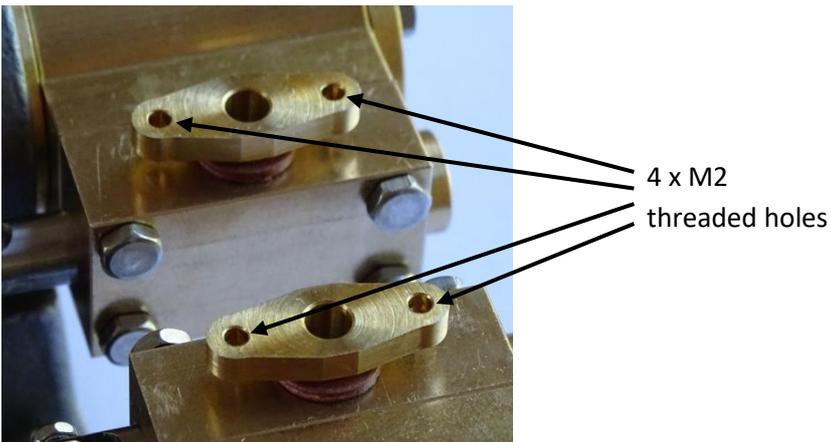
22. Screw the Chest Plug with fibre washer into the Chest top or bottom. The plug can be reversed depending on if the chest is fed with steam/air from the top or bottom of the engine. The threaded holes in the chest are $\frac{1}{4}$ " x 40 tpi ME which will accommodate the most common connection to a model steam boiler such as the Chiltern Model Steam boiler.



23. The Manifolds are an optional extra. Please note the Manifolds have now been updated since the photos were taken and no longer need M2 nuts as one pair of Manifolds have threaded holes, the other pair have clearance holes. 6 x ¼" brass locking nuts are now included.



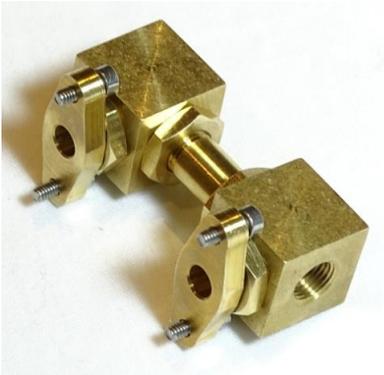
24. Screw the 2 Inlet Manifolds that have threaded holes into the remaining Chest inlet holes. Use the ¼" brass locking nuts to fix the Manifolds in position.
NOTE: the red fibre washers are no longer included as they are not really of benefit.



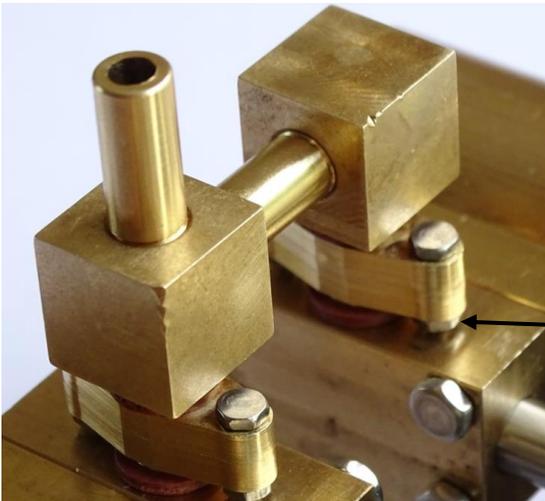
25. Place 2 cap screws in each of the remaining 2 Manifolds and ¼" brass locking nuts, as per the following picture.



26. Screw the Tee Connector to the Elbow Connector using the Link Pipe and screw in the Inlet Pipe (the stub pipe is used for connecting to an air source). Keeping the cap screws in place screw the 2 Manifolds into the Tee and Elbow Connectors respectively.



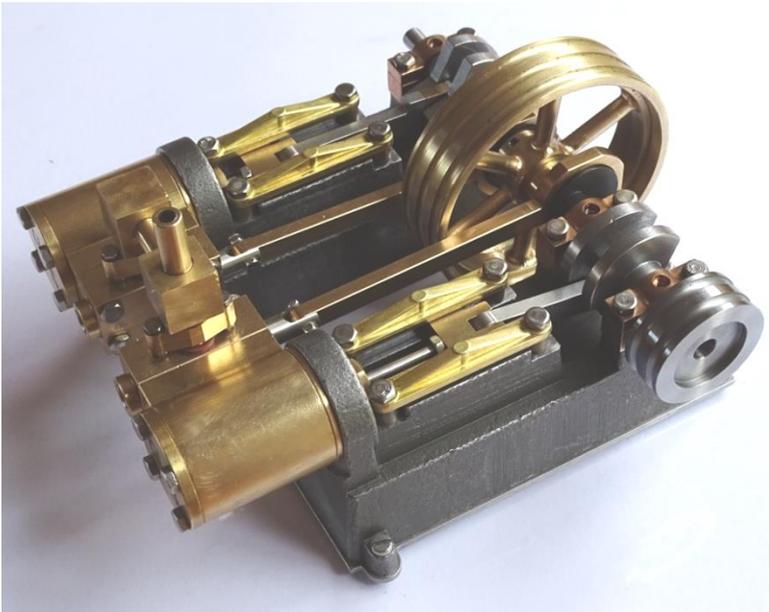
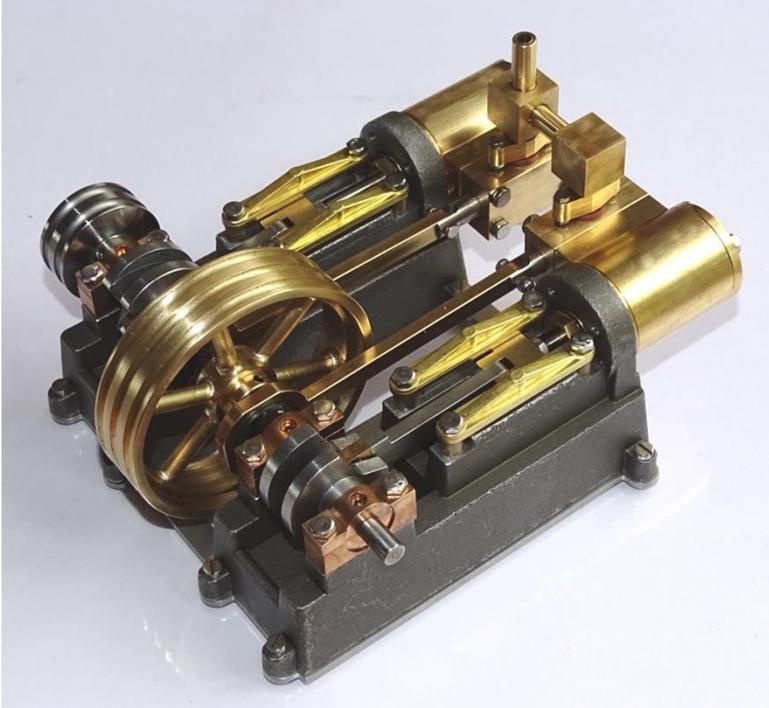
27. Place the Inlet Manifold/Connector subassembly on the Manifolds already installed on the Chests, aligning the Manifold holes to allow the cap screws to go through.



M2 Nuts no longer required

28. Some trial and error may be required to get the Manifolds to accurately mate together, i.e. screwing out or in the Link Pipe and/or Manifolds. Once aligned fix the Manifolds together using the 4 x M2 cap screws and tighten the ¼" lock nuts. NOTE: the Cylinders/Chests also need to be level in order that the Manifolds mate accurately together.
29. If later it is found that steam/air leaks from the different threads, wrap a little PTFE plumbers tape around the threads or use fibre washers.

30. Lubricate the engine to ensure it operates freely. To test the model a compressed air source such as a bicycle stirrup pump can be used to turn the engine over. NOTE: Following pictures show optional Pulley Wheel installed.



31. Disassembly is a reverse of the above instructions. Once disassembled each component can be cleaned, painted or polished as mentioned in the notes above. See www.chilternmodelsteam.co.uk for examples of completed models.
32. Please send some pictures of the completed engine to email: sales@chilternmodelsteam.co.uk.