# Chiltern Model Steam Engines

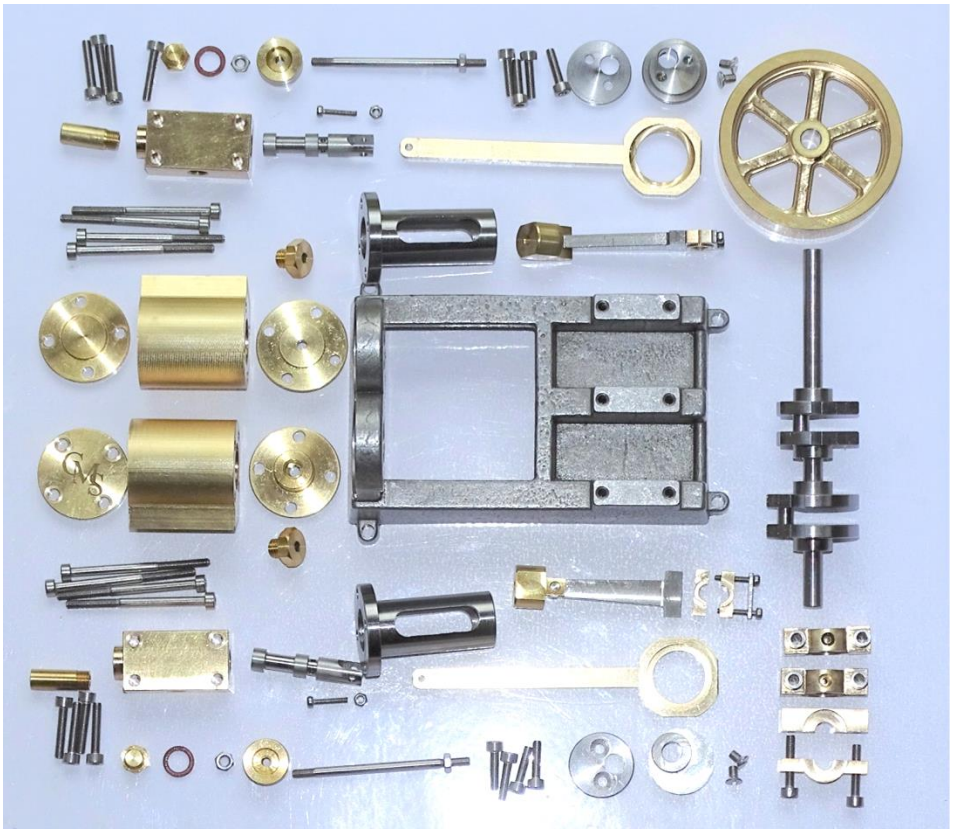
## Mill Twin Cylinder Model Steam Engine v2 Assembly Instructions v1.2

**Notes:**

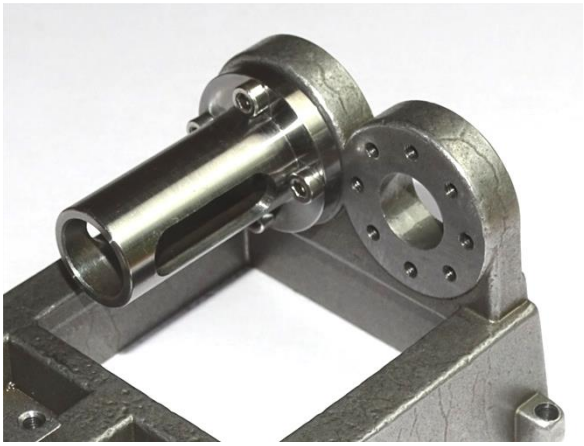
1. Model steam engines and boilers are NOT children's toys and should not be assembled or operated by children unless under close supervision of an adult.
2. If there are any questions or problems arising during assembly or operation of the engine please contact Chiltern Model Steam.
3. In overview the 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 "dry" 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 all 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 do take a long time to dry between coats, up to a week before the engine can finally be assembled. Use masking tape to cover the machined surfaces 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 capscrews, use only a small and/or medium cross head screw driver. If excessive 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.chilternmodesteam.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) socket spanner, M2 (4mm) and M3 (5.5mm) open ended spanners, 2.5mm (preferable long) 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 the 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:**

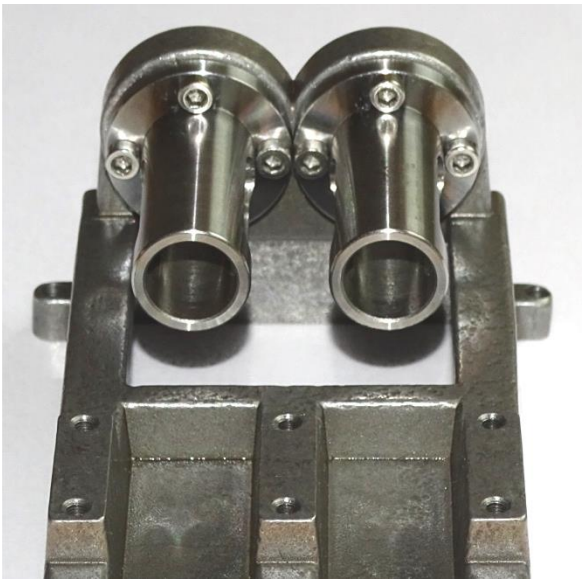
1. Locate the parts as show in the following picture and as listed on the A3 Assembly Drawing (a copy of which will have been included with the kit but also available for download from www.chilternmodesteam.co.uk). NOTE: for shipping purposes many parts will be packed semi-assembled or in place, e.g.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



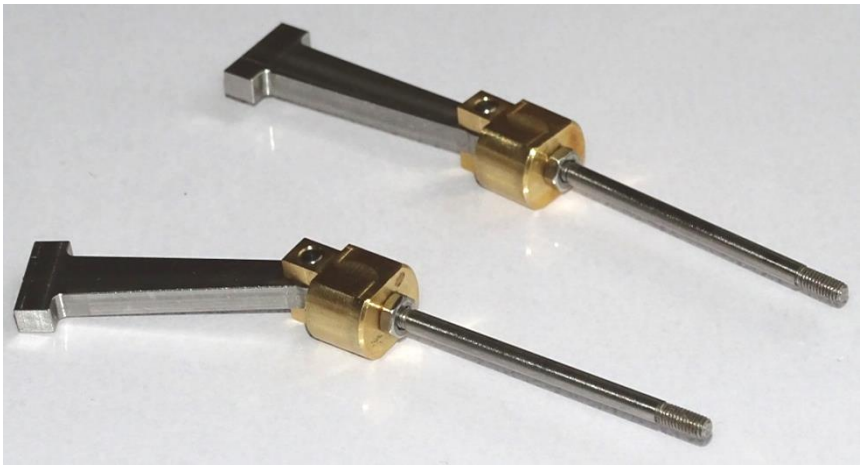
2. Fix the 2 Slider Tubes to the Base casting using the 8 M3 x 12mm cap screws. Make sure the tubes are the right way up, see photos. NOTE: a long handle 2.5mm hex/allen key is best for doing this. Check the ends of the screws do not extend out of the Base casting, file down the screws flush or just below the surface if necessary.



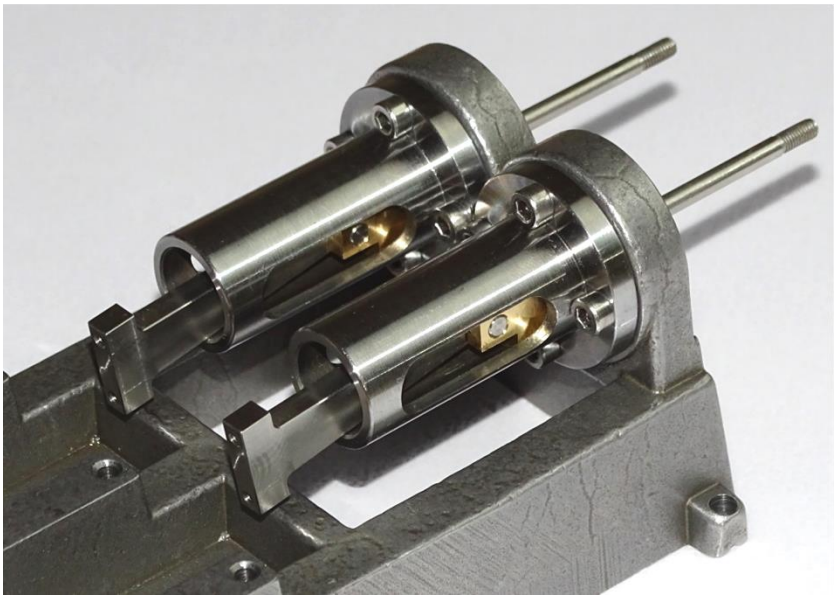


3. The 2 brass Tube Sliders should already be installed on the stainless 2 Connecting Rods using Slider Pins. If not carefully press in the Slider Pins using a small vice. There is an interference press fit between the Tube Slider and the Slider Pin and a free fit between the Slider Pin and the Connecting Rod. When fitted together the Tube Slider should be free to rotate around the Connecting Rod end.
4. Remove the Connecting Rod Bearings and Keeps from the Connecting Rods and keep the respective pairs together.
5. Screw 2 M3 nuts onto the longer threaded ends of the 2 Piston Shafts and then screw that end of the Piston Shafts into the 2 Tube Sliders and lock into place using the nuts with a 5.5mm spanner. Approximately 1mm of thread on the Piston Shafts should still then be visible.

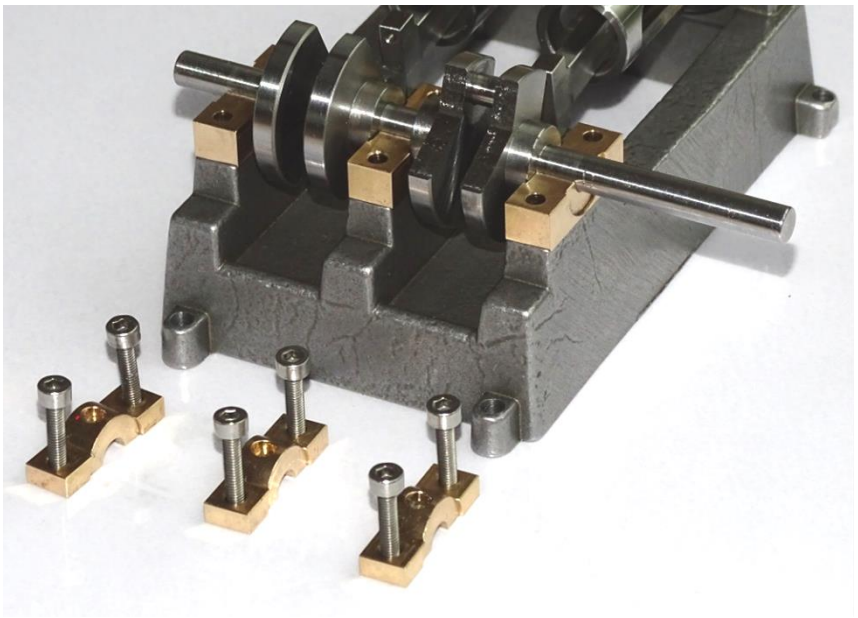


6. Push each Piston Shaft/Tube Slider into a Slider Tube.

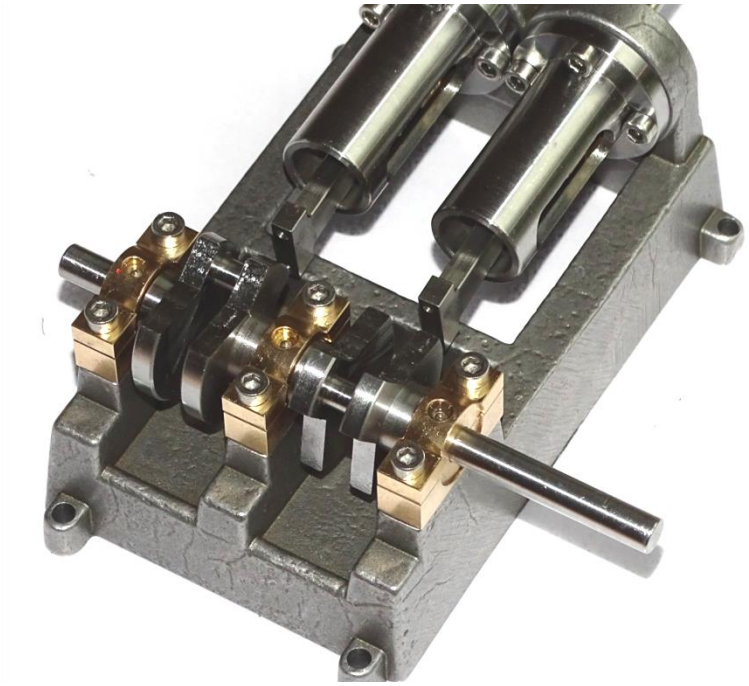


7. Remove the cap screws and the Main Bearing Uppers off the Base. Ensure these are later replaced in the same place and orientation as they are machined in pairs.

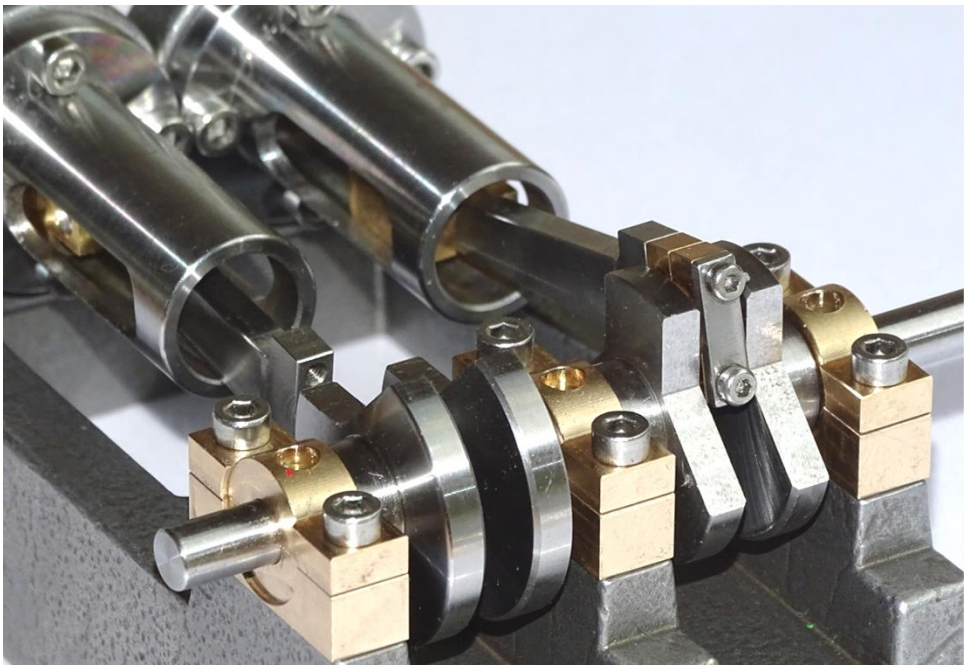


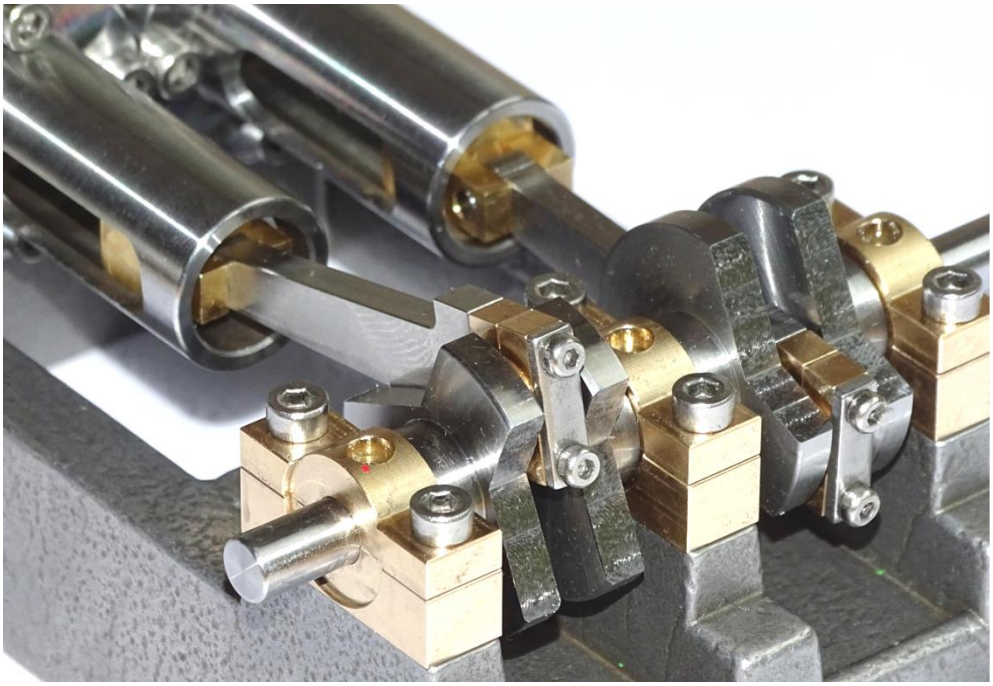
8. Place the Crank Shaft onto the Main Bearing Lowers and replace the Uppers, as shown in the following picture. Evenly and gradually tighten the 6 cap screws whilst rotating the shaft. This will ensure the bearings centre themselves properly on the shaft. Lubricate via the hole in the Upper bearings.



9. One side at a time, place the Connecting Rod Bearing halves and Keep around the Crank Shaft as shown in the following picture. Insert and tighten the cap screws evenly and gradually using the 1.6mm hex/allen key, rotating the connecting rod around the shaft to ensure the bearing halves locate centrally.

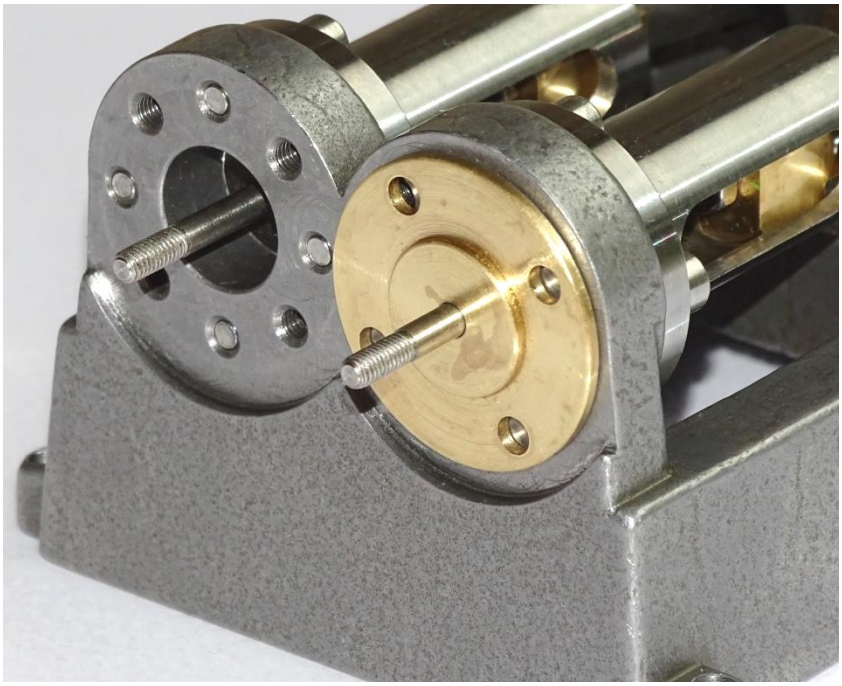




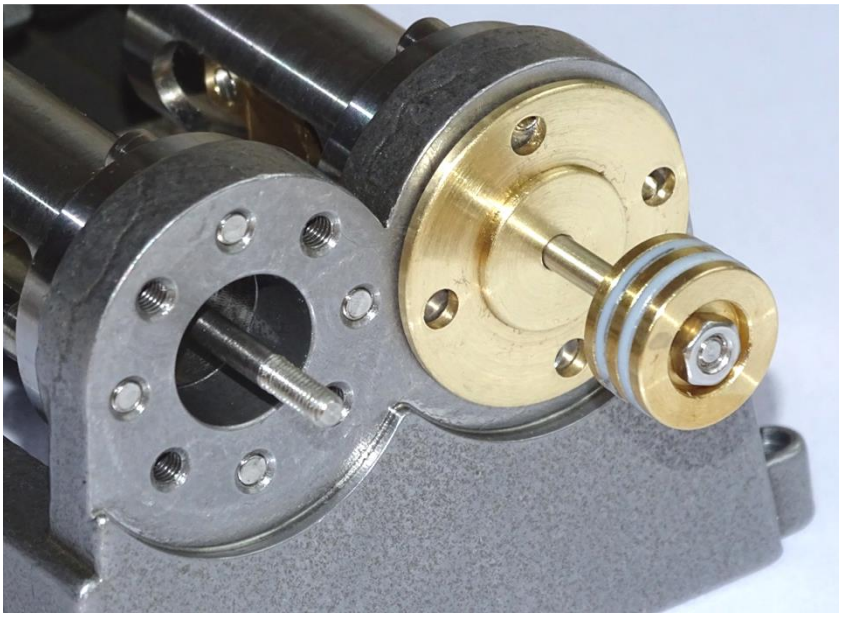
10. Check the sliders run smoothly in their tubes by rotating the crank. The tubes may need some lubrication to clean it out and ensure smooth operation.

11. Screw the Packing Nuts into the Cylinder Plate Inners.

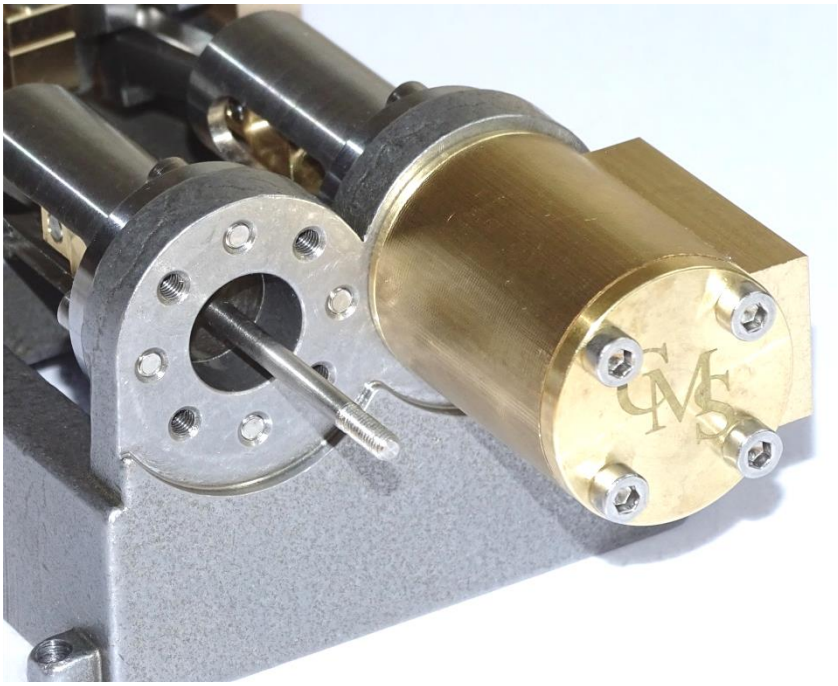
12. If it is planned to use high pressure steam - during final assembly, to improve the seal around the piston shaft, PTFE tape can be wrapped around the shaft and Packing Nut thread. When tightening the Packing Nut into the plate ensure the shaft can still move freely, that is, do not screw tight. Place one Cylinder Plate Inner/Packing Nut onto a Piston Shaft.



13. Install 2 Piston Rings on a Piston if not already in place, then screw the Piston onto the shaft and lock in place with an M3 nut using a 5.5mm socket spanner or small pliers. Be careful not to damage the Piston Rings when tightening the Piston/nut.

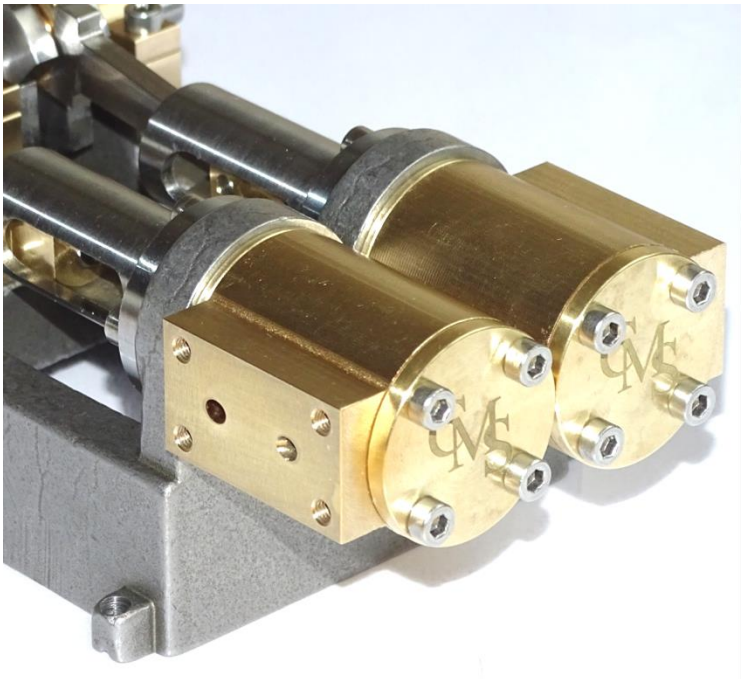


14. Place a Cylinders onto the Cylinder Plate Inner and Piston and place the Cylinder Plate End on top of that. Align the holes in the Cylinder Plates and Cylinders with the threaded holes in the Base and screw in the M3 45mm cap screws as shown in the following picture.

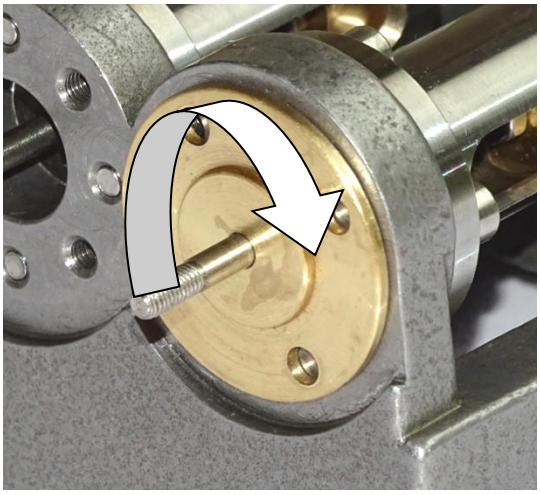


15. Before tightening the cap screws rotate the Crank Shaft to ensure the Piston can move freely in the Cylinder. There is some tolerance in the Cylinder and Cylinder Plate holes to allow them to be moved into a suitable position to allow free movement of the piston.

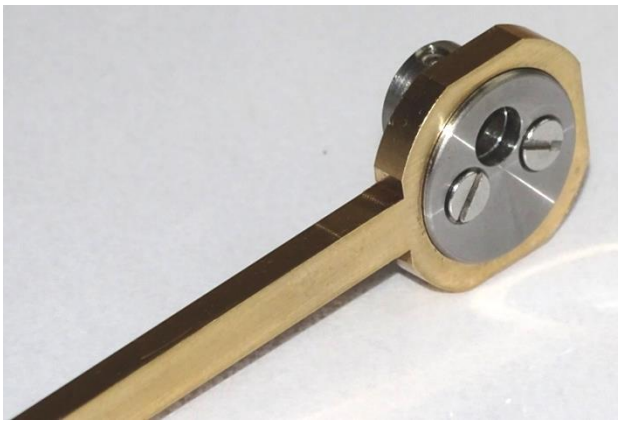
16. Repeat the above steps for the remaining side.



17. 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.



18. If not already assembled, put the Eccentric Wheels and Eccentric Wheel Plates together with the Eccentric Rods using the counter sunk M3 screws, as shown in the following picture. Then if not already in place, screw a 3mm grub/setscrew into the Eccentric Wheels which will be used to lock the wheels onto the Crank Shaft.

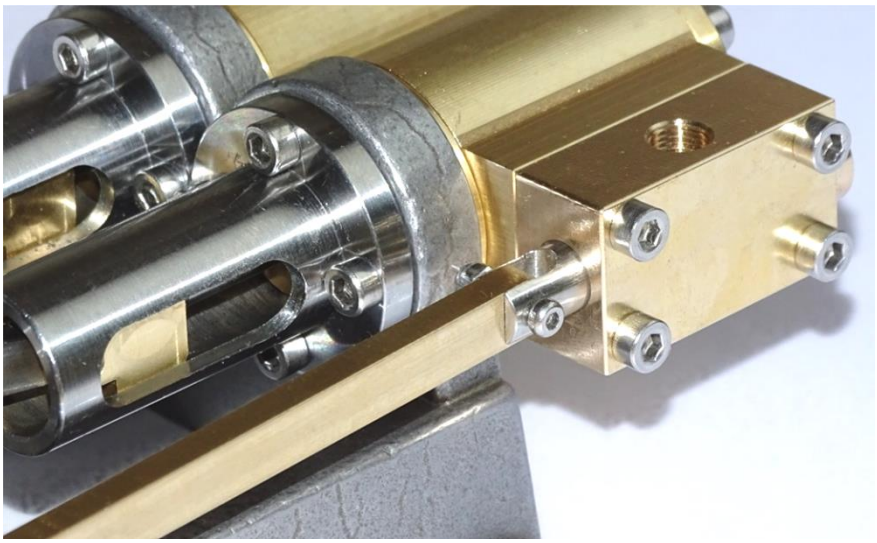


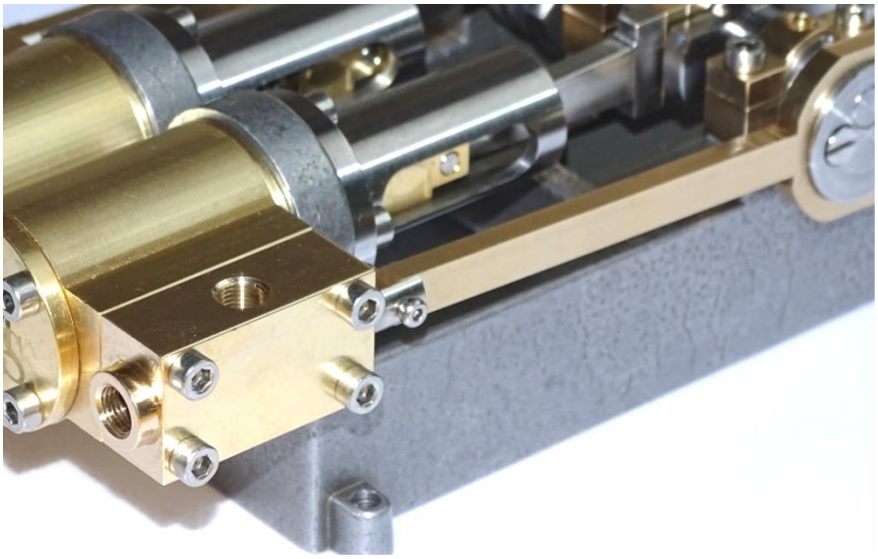
19. Connect the Valves with the Eccentric Rods using M2 10mm cap screws and lock each with a nut as shown in the following picture.

20. Push the 2 Eccentric Wheels on to the 2 ends of Crank Shaft, don't tighten the grub/setscrews yet.

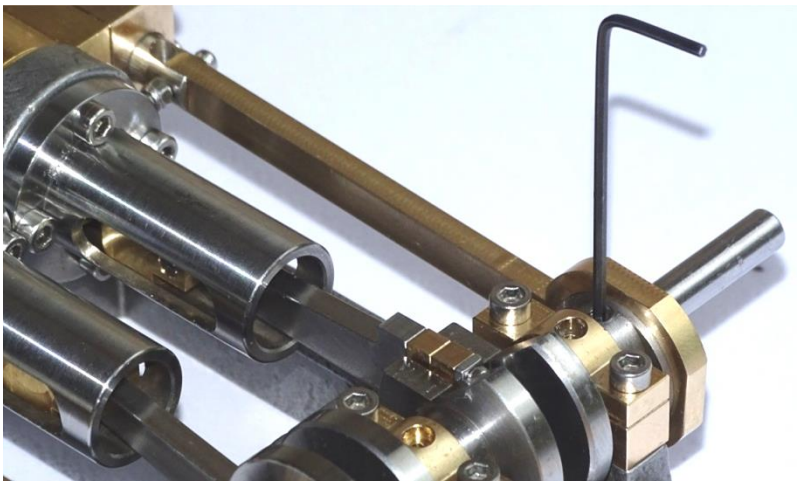
 

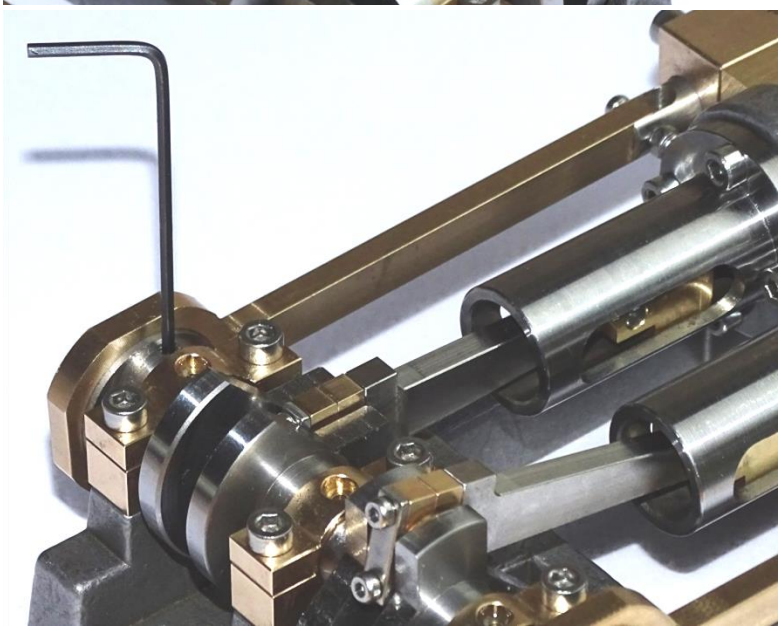
21. Insert the Valves into the Chests. The Chests can then be fixed to their respective Cylinders using 8 M3 18mm cap screws as shown in the following pictures.



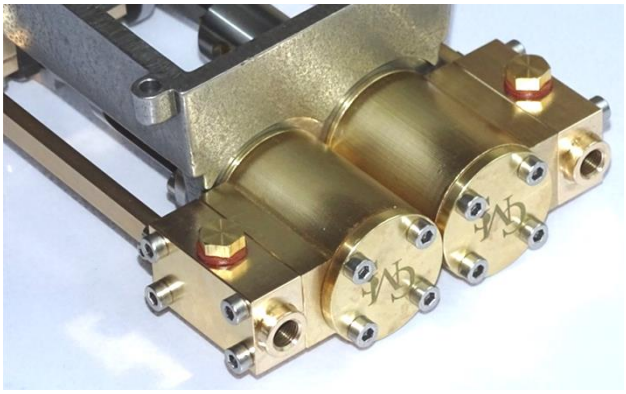


22. Valve timing is set with the angle of each Eccentric Wheel to the Crank/Piston position as shown in the following pictures. Get the respective positions correct and then tighten the grub/setscrew. NOTE: if both Eccentric Wheels are fixed 180degrees to that show, the engine will run in the reverse direction.

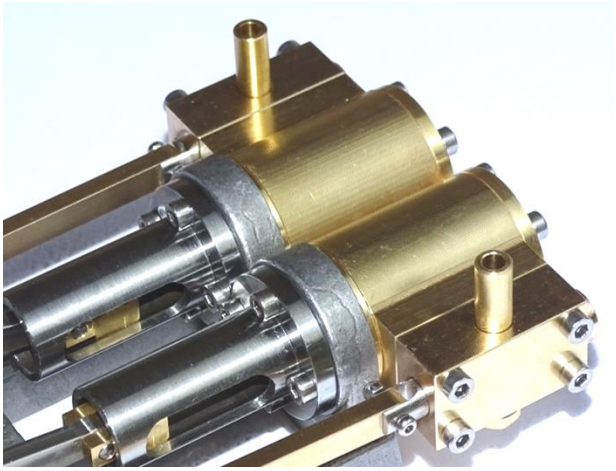




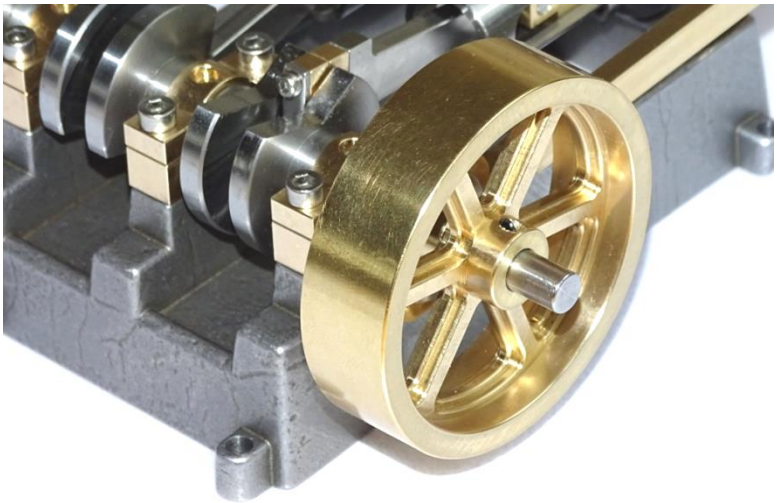
23. The steam inlets can be on top or bottom of the engine Chests. If, as in the following photos, the inlet is on top, screw the 2 Chest Plugs into the holes on the bottom of the Chests. PTFE tape or fibre washers can be used to seal the Chest Plugs if needed. NOTE: The RED Fibre washers are not now included.



24. Screw the 2 Value Inlet Pipes into the remaining holes in the Chests (these stub pipe is used for connecting to an air source). The threaded holes in the chest are ¼" x 40 tpi ME which will accommodate the most common connection to a model steam boiler.



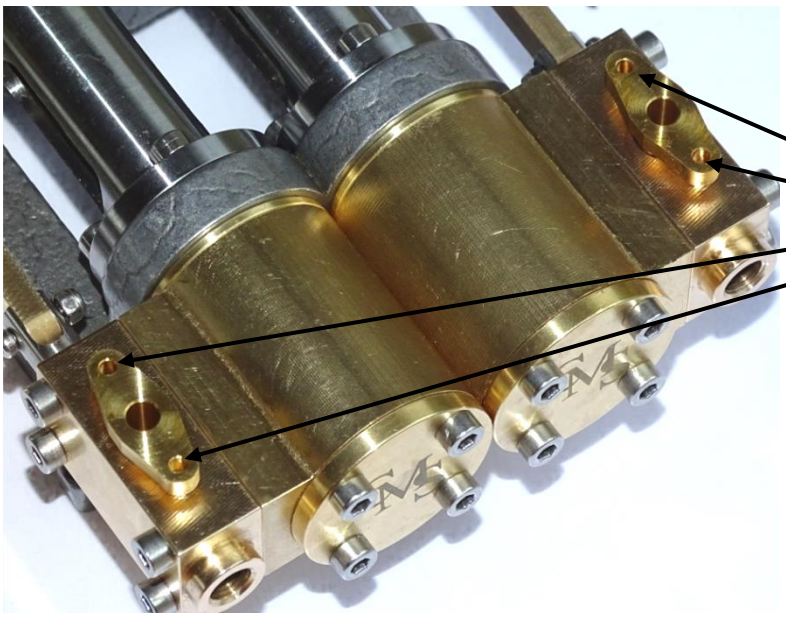
25. If not already in place, screw the 4mm setscrew into the hole in the Flywheel and push the Flywheel onto the Crankshaft. Tighten the grub/setscrew.



26. 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

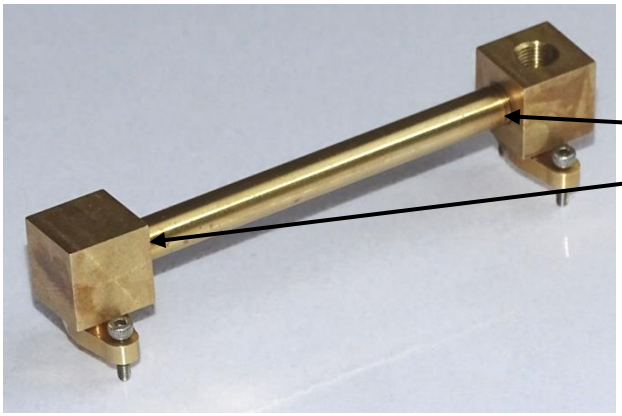
threaded holes, the other pair has clearance holes. 6 x ¼" brass locking nuts are now included.


27. Screw 2 Inlet Manifolds into the Chest inlet holes.

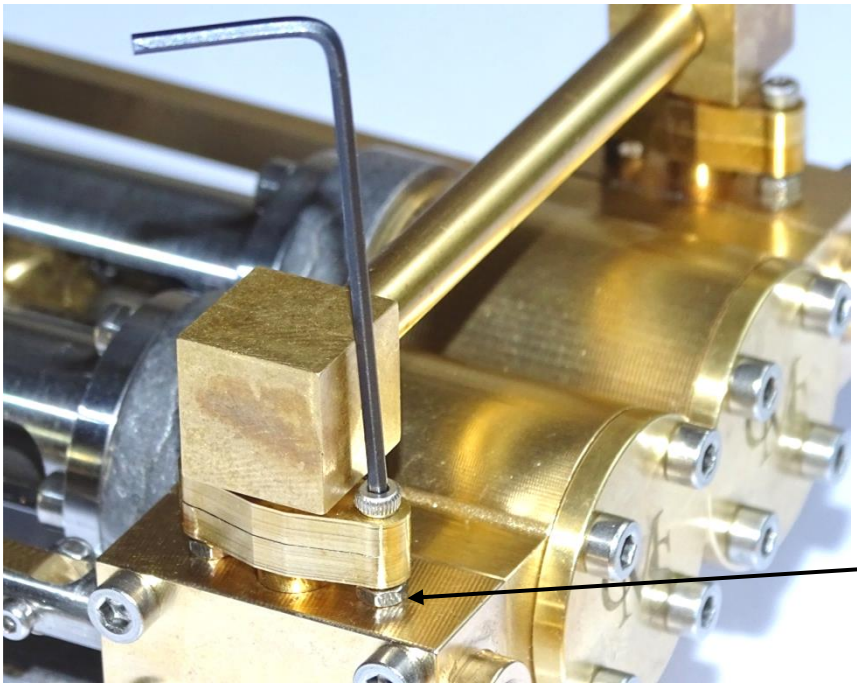



28. Place 2 cap screws in each of the remaining 2 Manifolds and ¼" brass locking nuts, as per the following picture.

29. Screw the Tee Connector to the Elbow Connector using the Link Pipe. Keeping the cap screws in place screw the 2 Manifolds into the Tee and Elbow Connectors respectively.



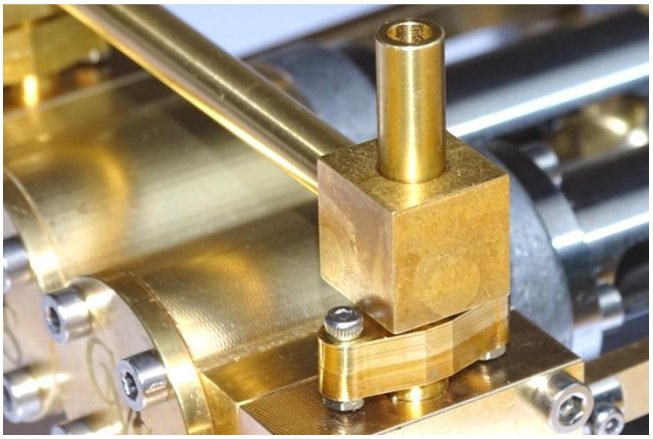

30. Place the Inlet Manifold/Connector subassembly on the Manifolds already installed on the Chests, aligning the Manifold holes to allow the cap screws to go through.



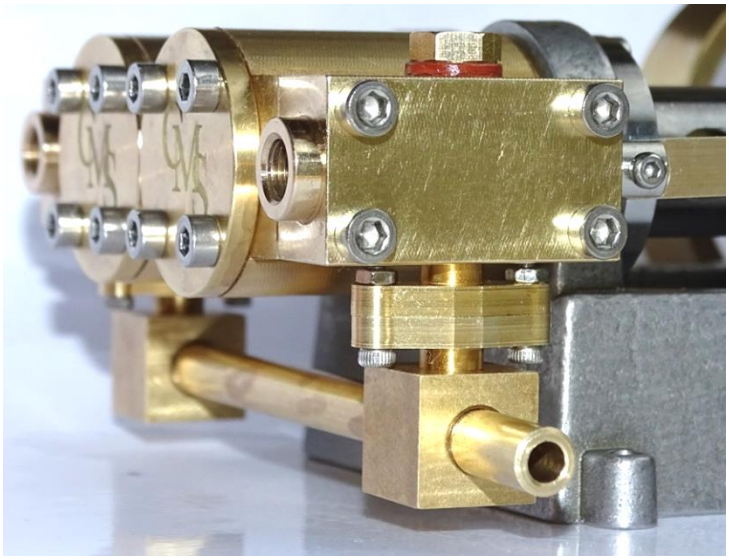

31. Some trial and error may be required to get the Manifolds to accurately mate together, i.e. screwing out or in the Link Pipe and/or Manifolds. Once aligned fix the Manifolds together using the 4 x M2 cap screws and tighten the ¼" lock nuts.
NOTE: the Cylinders/Chests also need to be level in order that the Manifolds mate accurately together.

32. 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.

33. For connecting to an air soruce the Inlet Pipe can be screwed into the tee.



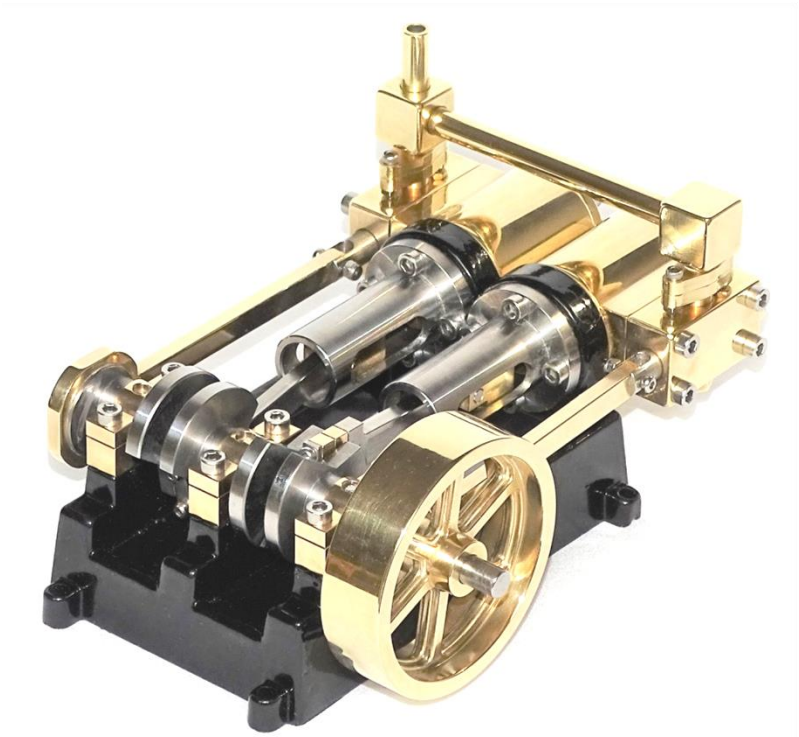
34. NOTE: The tee can be reoriented to allow an horizontal inlet direction rather than top/vertical as show in the above photo and as mentioned earlier the manifold can be installed on the bottom of the Chest/engine with Chest Plugs on the top.

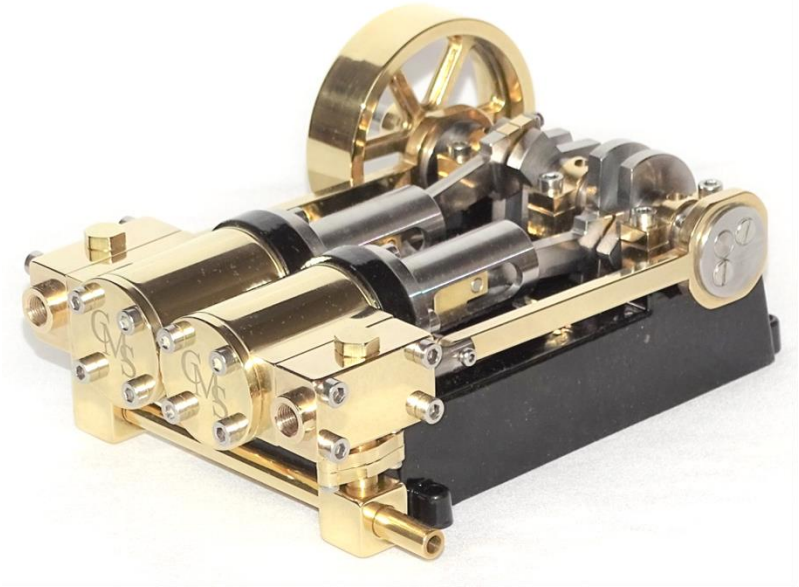


35. Lubricate the engine to ensure it operates freely.

36. To test the model a compressed air source such as a bicycle stirrup pump can be used to turn the engine over.

37. 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.





38. Please send some pictures of the completed engine to email: sales@chilternmodelsteam.co.uk.