



# Chiltern Model Steam Engines

## Single Cylinder Beam Model Steam Engine Assembly Instructions v1.2

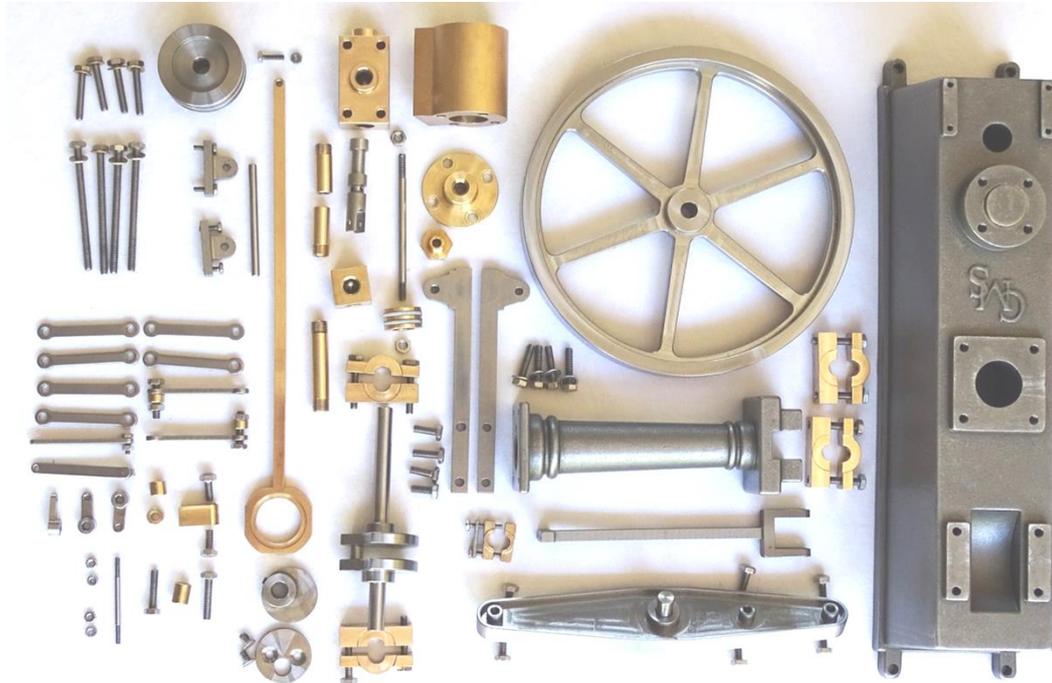
### Notes:

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 steel parts 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 cap screws, 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. Always check [www.chilternmodesteam.co.uk](http://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](mailto:sales@chilternmodelsteam.co.uk).
10. 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.
11. Typical tools required for assembly; M3 (5.5mm) and M2 (4mm) socket spanners, M2 (4mm) and M3 (5.5mm) open ended spanners, 1.5mm (or 1/16") Hex/Allen Key, 4mm drill bit and a metal file.

**NOTE:** some of the screws as provided in the kit will need to be cut or filed to length, please contact us if this presents a problem and we will work on a solution.

**Step by step instructions:**

1. Locate the parts as show in the following picture and as listed on the Assembly Drawing (a copy of which will have been included with the kit but also available for download from [www.chilternmodesteam.co.uk](http://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. Install 2 Piston Rings on the Piston if not already in place, then screw the Piston onto the shorted threaded end of the Piston 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.



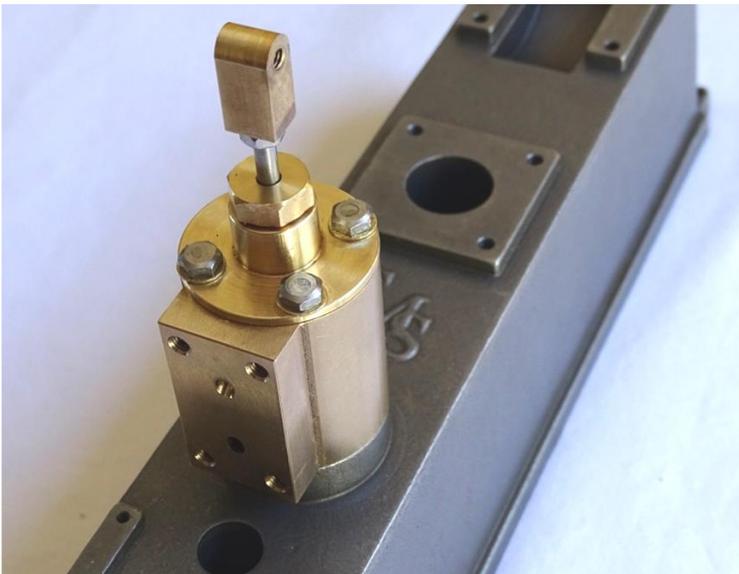
3. Screw the Packing Nut into the Cylinder Plate Inner and push onto the shaft as per the following picture.



4. Screw an M3 nut onto the Piston Shaft and then the Shaft Parallel Spacer. Approximately 1mm of thread on the Piston Shaft should still then be visible. Lock the Shaft Parallel Spacer in place with the M3 nut with a 5.5mm spanner..



5. Carefully push the Piston into the Cylinder and place the Cylinder onto the Base. Make sure the Cylinder and Cylinder Plate Inner are all in place before screwing in the 43mm cap screws with optional brass washers. The purpose of the optional brass washers is only to stop the screws from marking the surface of the Cylinder Plate Inner. Make sure the Piston/Shaft can move up and down smoothly as the cap screws are tightened. 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.

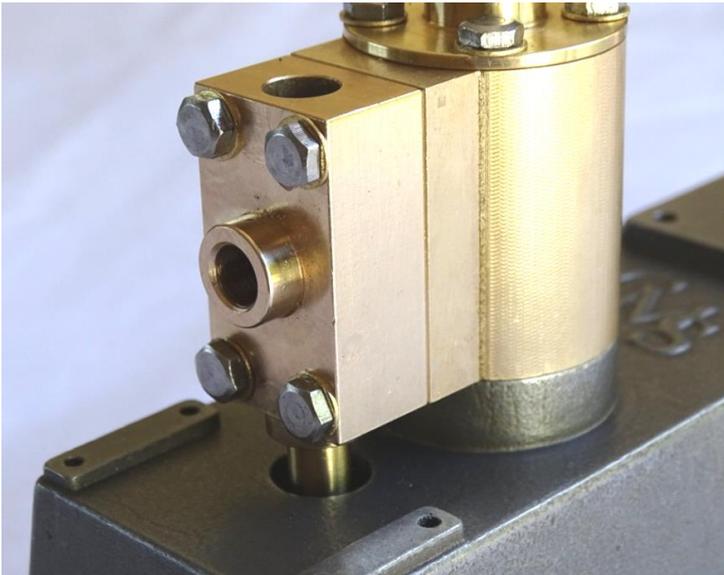


## Single Cylinder Beam Model Steam Engine – Assembly Instructions v1.2

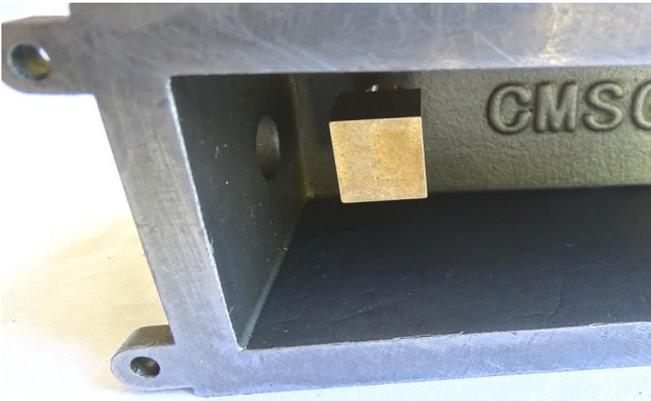
6. If it is planned to use high pressure steam - during final assembly, to improve the seal around the piston shaft, PTFE tape can be wrapped around the shaft and Packing Nut thread. When tightening the Packing Nut into the plate ensure the shaft can still move freely, that is, do not screw tight.
7. Screw the Outlet Pipe (the brass pipe with threads on both ends) into the Chest.



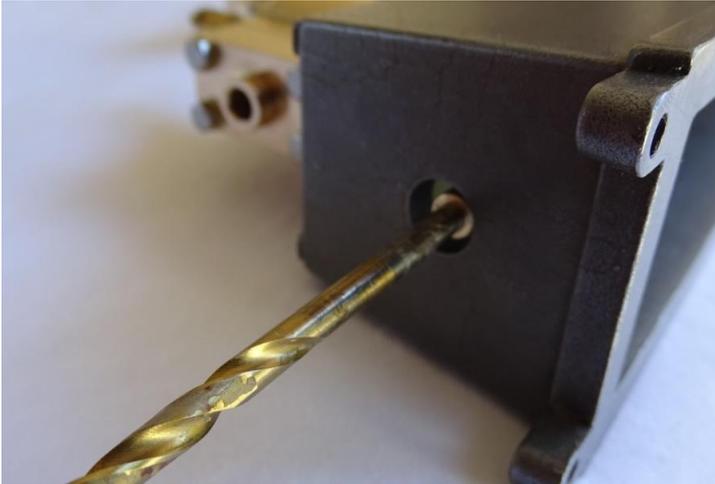
8. Using 4 18mm cap screws and as earlier optional brass washers, fix the Chest onto the Cylinder with the Outlet Pipe pointing down through the hole in the Base.



9. Screw the Elbow onto the other end of the Outlet Pipe under the Base.



10. Align the Elbow's threaded hole with the hole in the end of the Base and using the end of a 4mm drill bit (or similar) screw the short stub Inlet/Outlet Pipe into the Elbow.

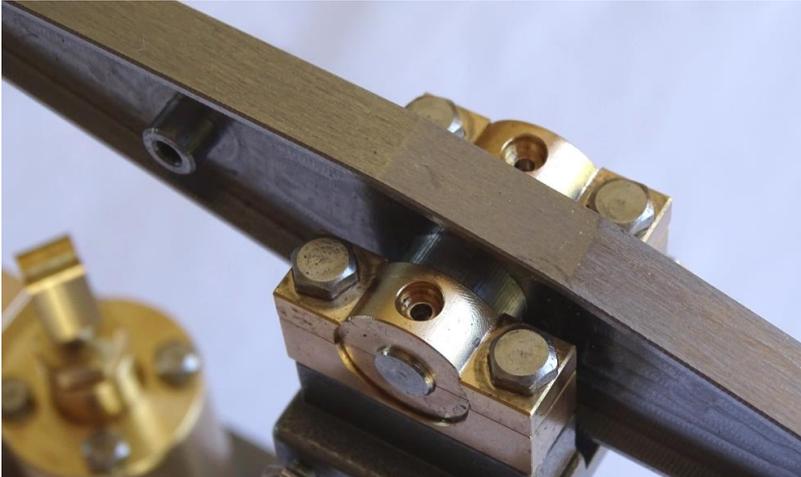


11. There is also a hole at the other end of the Base which can be used for the outlet, e.g. if steam is to be directed into a collector/container at that end of the engine. Also, to ensure a good tight steam connection, PTFE tape can be used on the various threads during final assembly.
12. Fix the Column to the Base with 4 12mm cap screws and optional steel washers. If the Column is painted later the optional steel washers will prevent the screws from damaging the paintwork. The tapped holes in the top/sides of the Column need to face the sides of the Base not the ends, see also picture in next step.

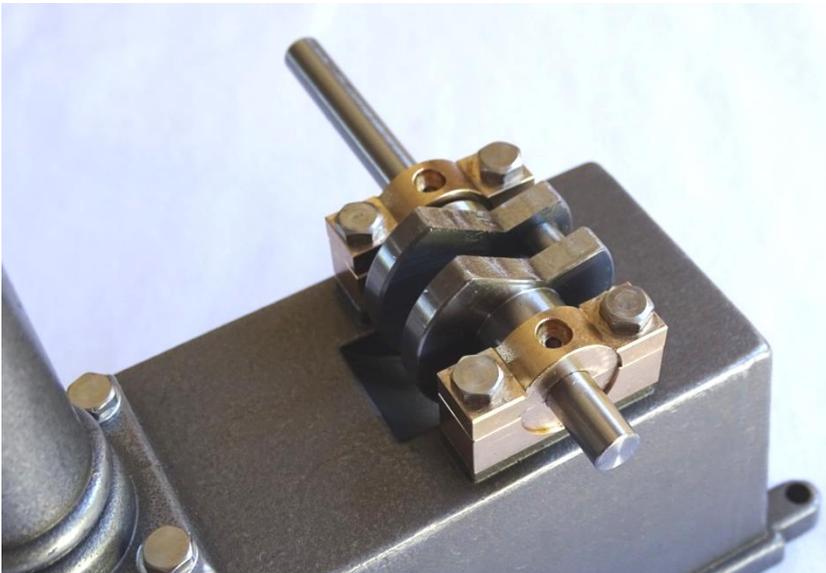


13. The Beam Shaft should already be installed in the Beam. If not the shaft is a press fit in the central hole in the Beam and so will require a vice. Ensure the shaft is installed evenly with equal lengths of shaft protruding each side.
14. Unscrew the cap screws and remove the 2 Bearing Uppers from the top of the Column, keeping the respective bearing pairs together and in the same orientation to their Bearing Lower. Place the Beam/Beam Shaft on the Bearing Lower – the half of the Beam with the 4 tapped lugs should be towards the Cylinder, see the picture. Replace the Bearing Uppers and

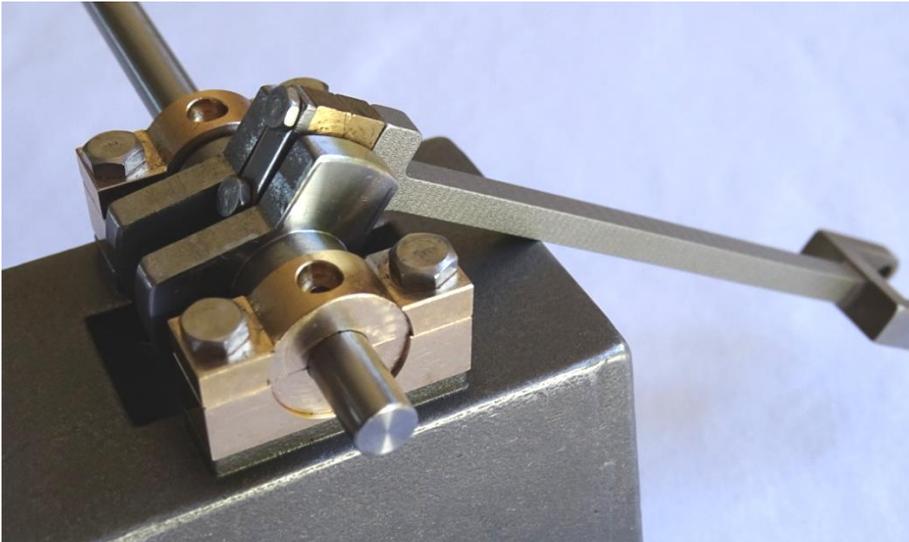
tighten the cap screws evenly to ensure the shaft locates centrally in the bearings and can move smoothly.



15. Remove the cap screws and the Main Bearing Uppers off the Base. Ensure these are later replaced together in the same place and orientation as they are machined in pairs and aligned on the base.
16. Place the Crank Shaft onto the Main Bearing Lower and replace the Uppers, as shown in the following picture. Evenly and gradually tighten the 4 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.



17. Remove the Connecting Rod Bearing Halves and Keep from the Connecting Rod and keep the pair in the same orientation. Place the Connecting Rod Bearing halves and Keep around the Crank Shaft as shown in the following picture. Insert the cap screws through the Connecting Rod Bearing halves and Keep and screw back into the Connecting Rod - tighten evenly and gradually using a 4mm spanner, rotating the connecting rod around the shaft to ensure the bearing halves locate centrally.



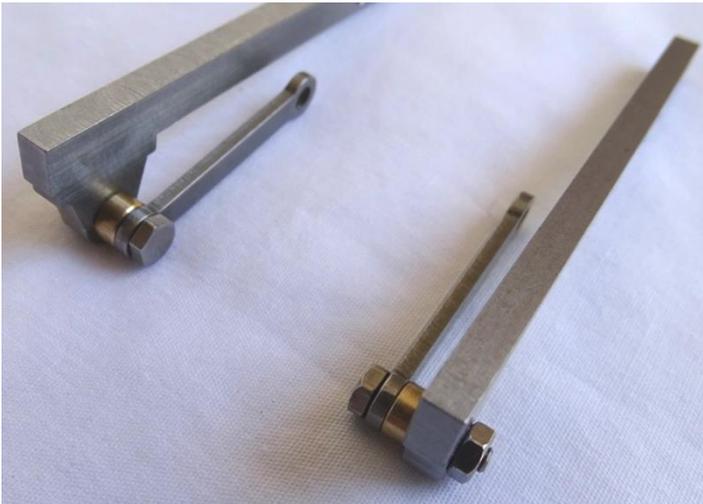
18. The Connecting Rod is fixed to the Beam using 2 Pivot Screws.



19. Screw the 2 Pivot Screws through the Connecting Rod holes into the threaded lugs on the Beam. The threaded lugs are tapped right through the Beam so that the 2 Pivot Screws can lock against each other in the middle when tightened. Turn the Crank Shaft to ensure the Beam/Connecting Rod can move freely.



20. Push a short cap screw through one hole of a Parallel Link, place a Parallel Spacer Outer (the shorter brass spacer 3mm long) on to the cap screw and screw this into the threaded hole in the Column Arm. Repeat for the other Column Arm but from the other side of the arm mirroring the first Column Arm, see following picture. Tighten the cap screws then back them off approximately half a turn to ensure the Parallel Links can rotate freely before using M3 nuts to lock the cap screws. The cap screws can be filed to length in final assembly.



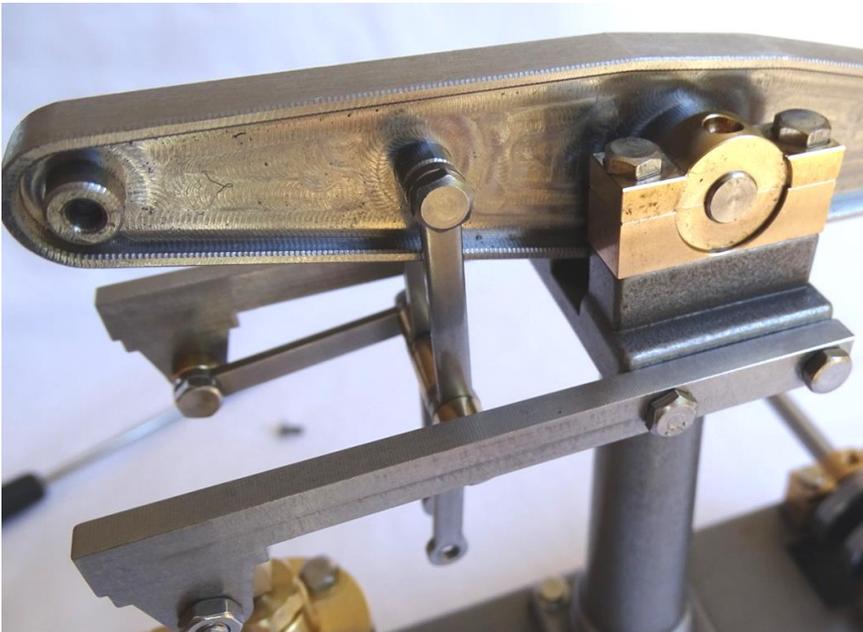
21. Push a 15mm cap screw through the other hole of the Parallel Link connected to the Column Arm, in the opposite direction of the cap screw holding the Parallel Link to the Column Arm.

Place a Parallel Spacer Inner (the longer brass spacer 5mm long) on to the cap screw and place 2 Parallel Links onto the cap screw. Screw on the Parallel Spacer Centre onto the cap screw holding the Parallel Spacer Inner and Parallel Links together.

Repeat for the Column Arm on the other side resulting in the 2 sides being connected by the Parallel Spacer Inner. See following picture.



22. The Parallel Spacer Centre is threaded through so that the 2 cap screws are locked in place by tightening them against each other inside the Parallel Spacer Centre. When the 2 cap screws are tightened it is important to ensure that all the Parallel Links can still move freely but are not overly loose. To achieve this it will probably be necessary to file the cap screws to length – do this gradually by testing and refitting a few times.
23. The 2 Column Arms are fixed to the Column using 4 10mm cap screws. The outer of the 2 Parallel Links adjacent to the 2 Parallel Spacer Innerts (not the ones touching the Parallel Spacer Centre) connect to the Beam's inner lugs using 2 Pivot Screws and washers.



24. As per the Connecting Rod, the Pivot Screws lock against each other in the middle of the Beam lugs when tightened. The Pivot Screws will need to be shortened using a file, as mentioned earlier, do this gradually by filing and refitting a few times to ensure the Parallel

Link can still move freely but is not overly loose when the Pivot Screws are tightened. It may also be necessary to chamfer the openings of the Beam lugs' threaded hole so that the Pivot Screws can screw further into the lugs (both sides). Carefully use a 4mm drill to chamfer the lip off the hole a little at a time.



25. Fix the remaining 2 Parallel Links using 2 Pivot Screws to the outer Beam lugs in the same way as above.
26. The 2 Parallel links on each side not yet connected at both ends, are screwed to either side of the Shaft Parallel Spacer using the Pivot Screws. The Shaft Parallel Spacer is fixed to the end of the Piston Shaft. The threaded hole for the Pivot Screws is tapped through as per the Parallel Spacer Centre.

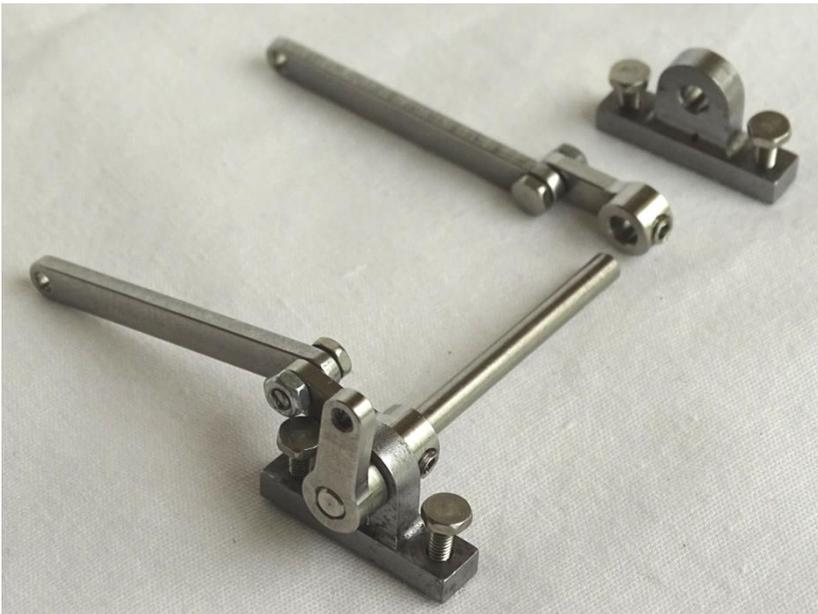
As earlier, the Pivot Screws will need to be shortened, again do this gradually by filing and refitting a few times to ensure the Parallel links can still move freely but are not overly loose when the Pivot Screws are tightened against each other in the Shaft Parallel Spacer. It may be easier to do this by taking the Shaft Parallel Spacer off the Piston Shaft, get the Pivot Screws to the right length, refit the spacer on the shaft and then fit the Pivot Screws.



27. Fix the 2 Eccentric Links to the 2 Eccentric Levers using 2 M2 cap screws as per the following picture. The holes in the Eccentric Levers are threaded, so tighten the M2 cap screws then back off half a turn before using an M2 nut to lock the cap screw. Eccentric Links need to be able to freely rotate but not be too loose. The M2 cap screws can be shortened neatly during final assembly.



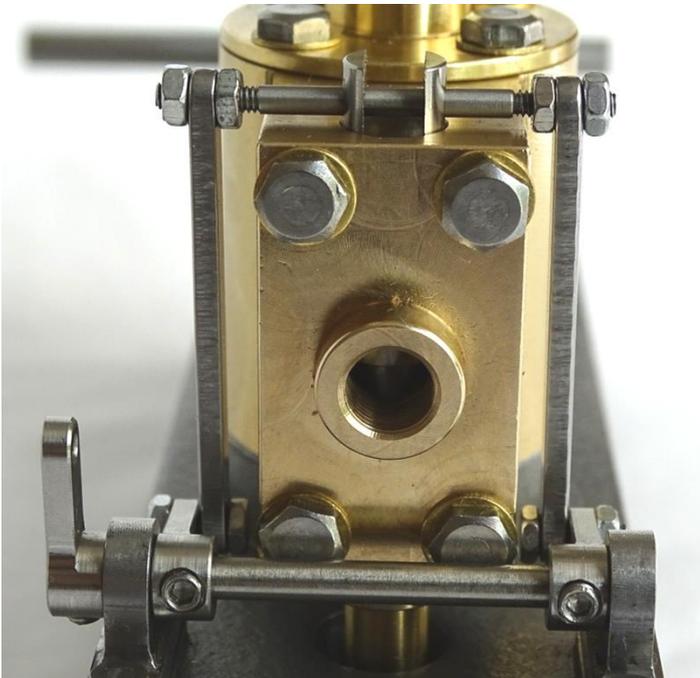
28. Push an Eccentric Lever/Link onto the Eccentric Lever Shaft, then an Eccentric Lever Shaft Bearing on that end, then the third Eccentric Lever (not connected to an Eccentric Link), as per the following picture. If not already in place, fit the short grub/set screws in the Eccentric Levers but just tighten the third Eccentric Lever to the shaft at this stage.



29. Check and cut to length the 4 M2 cap screws used to fix the Eccentric Level Shaft Bearings onto the Base by trial fitting them in place.
30. Push the Valve Pin through the holes in the Valve and screw an M2 nut onto each threaded end of the pin. Push the pin through the free hole in the left hand Eccentric Lever (as shown in the above picture) and loosely secure using another M2 nut. Push the second Eccentric Lever/Link onto the Valve Pin and Eccentric Lever Shaft and loosely secure using another M2 nut. Finally push on the second Eccentric Level Shaft Bearing onto the free end of the and Eccentric Lever Shaft.



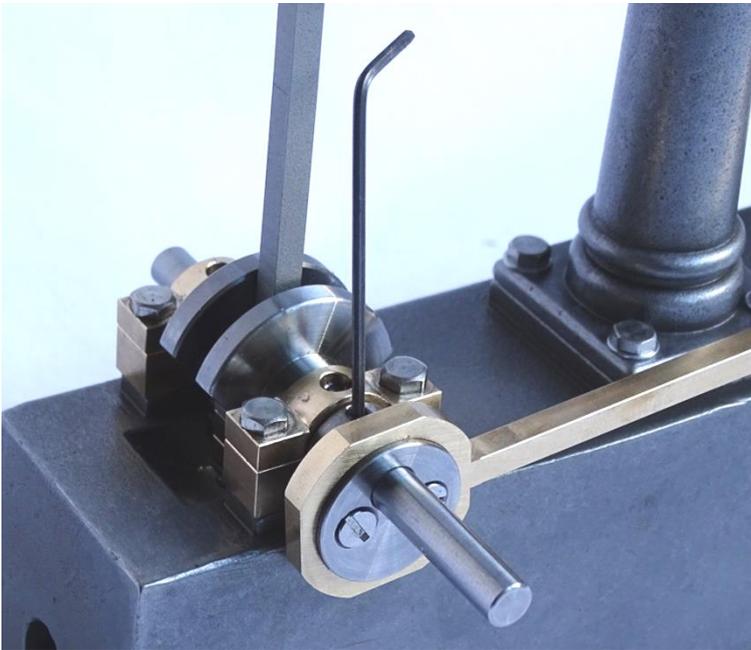
31. Push the Valve into the Chest and screw the Eccentric Level Shaft Bearings to the Base using the 4 M2 cap screws.



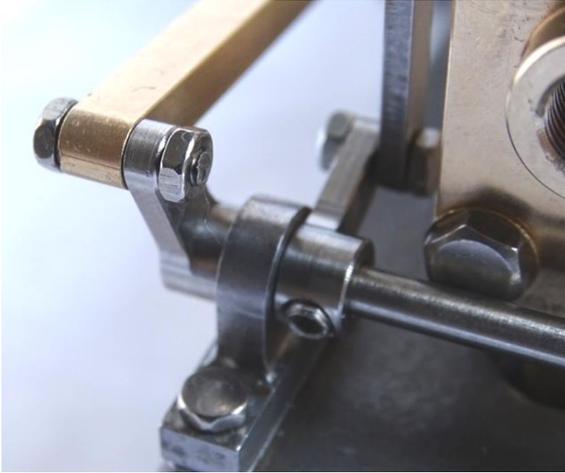
32. Make sure the valve is pushed all the way down into the Chest and tighten the grub/setscrews in the 2 Eccentric Levers to the Eccentric Lever Shaft. Tighten the M2 nuts on the Valve Pin so that the Eccentric Links are equi-distant and parallel with the sides of the Chest. Check the whole Eccentric mechanism and Valve can move freely (a bit of oli may be useful), then loosen the grub/setscrews.
33. Put the Eccentric Wheel and Eccentric Wheel Plate together with the Eccentric Rod 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 Wheel which will be used to lock the wheel onto the Crank Shaft.



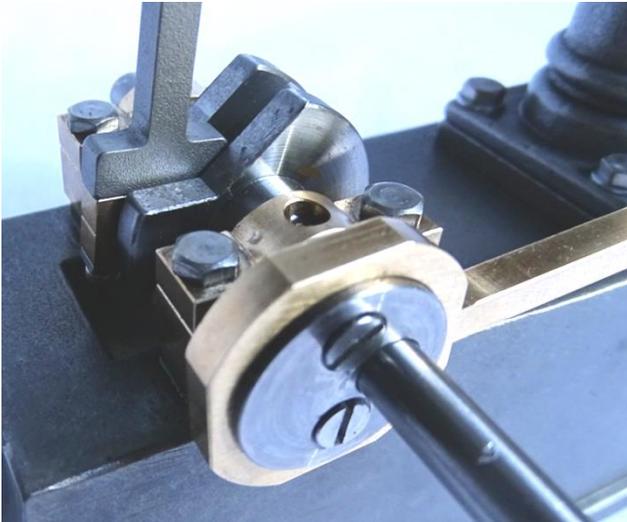
34. Push the Eccentric Wheel onto the long end of the Crank Shaft and lock into position on the shaft with the grub/setscrew as per the following picture – this is the Valve timing. NOTE: If the Eccentric Wheel is positioned 180 degrees to the Crank to that shown in the picture the engine will run in the reverse direction.



35. Fix the end of the Eccentric Rod to the outer Eccentric Lever using an M2 cap screw. The Eccentric Lever's hole is threaded so tighten the cap screw and back off approximately half a turn before locking the cap screw in place using an M2 nut so that the rod/lever can move freely. Shorten the M2 cap screw neatly during final assembly.



36. Rotate the Crank Shaft so that the Eccentric Rod is fully back away from the Cylinder as per the following picture.

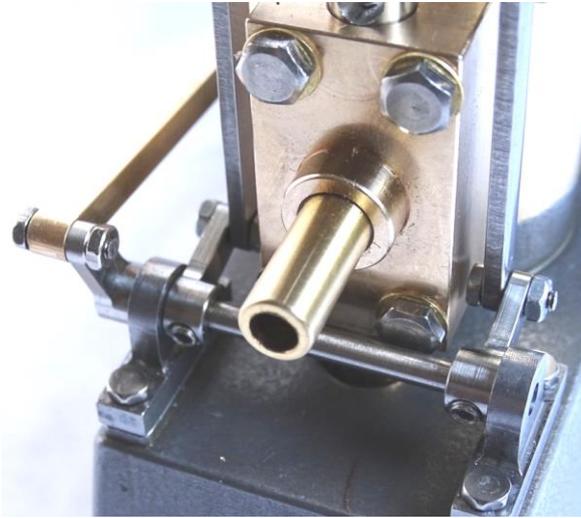


37. Make sure the valve is pushed all the way down into the Chest and tighten the grub/setscrews in the 2 Eccentric Levers to the Eccentric Lever Shaft. Check the Eccentric mechanism and Valve can move freely but rotating the Crank Shaft.

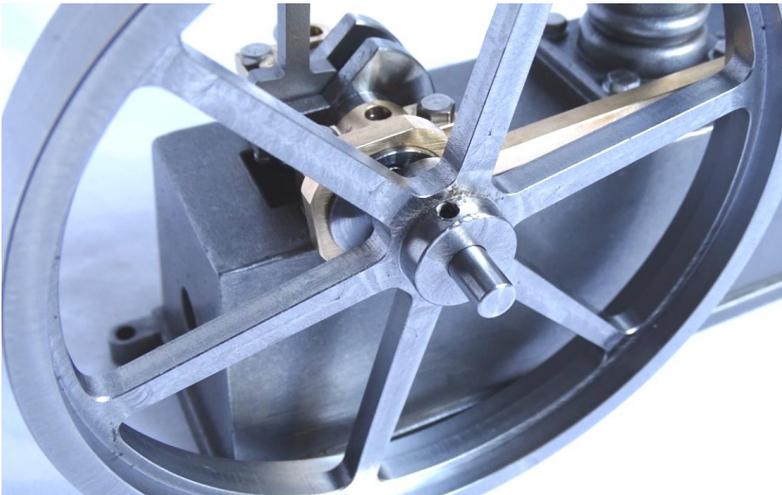


## Single Cylinder Beam Model Steam Engine – Assembly Instructions v1.2

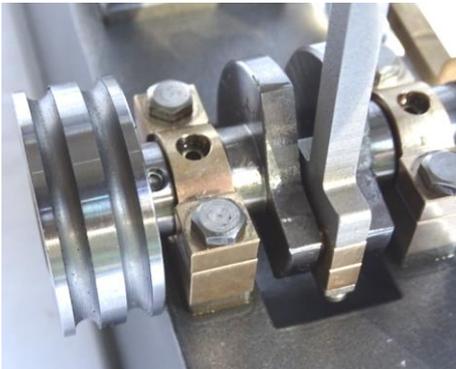
38. Screw in the Inlet Pipe which can be used to connect to pump or compressor for testing the engine. PTFE tape can be used to seal the pipe if needed. The threaded holes in the Chest are  $\frac{1}{4}$ " x 40 tpi ME which will accommodate the most common connection to a model steam boiler.



39. If not already in place, screw the 4mm grub/setscrew into the hole in the Flywheel hub and push the Flywheel onto the long end of the Crankshaft. Tighten the grub/setscrew.



40. If not already in place, screw the 3mm setscrew into the hole in the Pulley and push the Pulley onto the short end of Crankshaft. Tighten the grub/setscrew.



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41. Lubricate the engine to ensure it operates freely and test using a compressed air source. A bicycle stirrup pump, for example, should be able to turn the engine over.
42. 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](http://www.chilternmodelsteam.co.uk) for examples of completed models.
43. Please send some pictures of the completed engine to email: [sales@chilternmodelsteam.co.uk](mailto:sales@chilternmodelsteam.co.uk).

