

HB6 Double-Teatime instructions



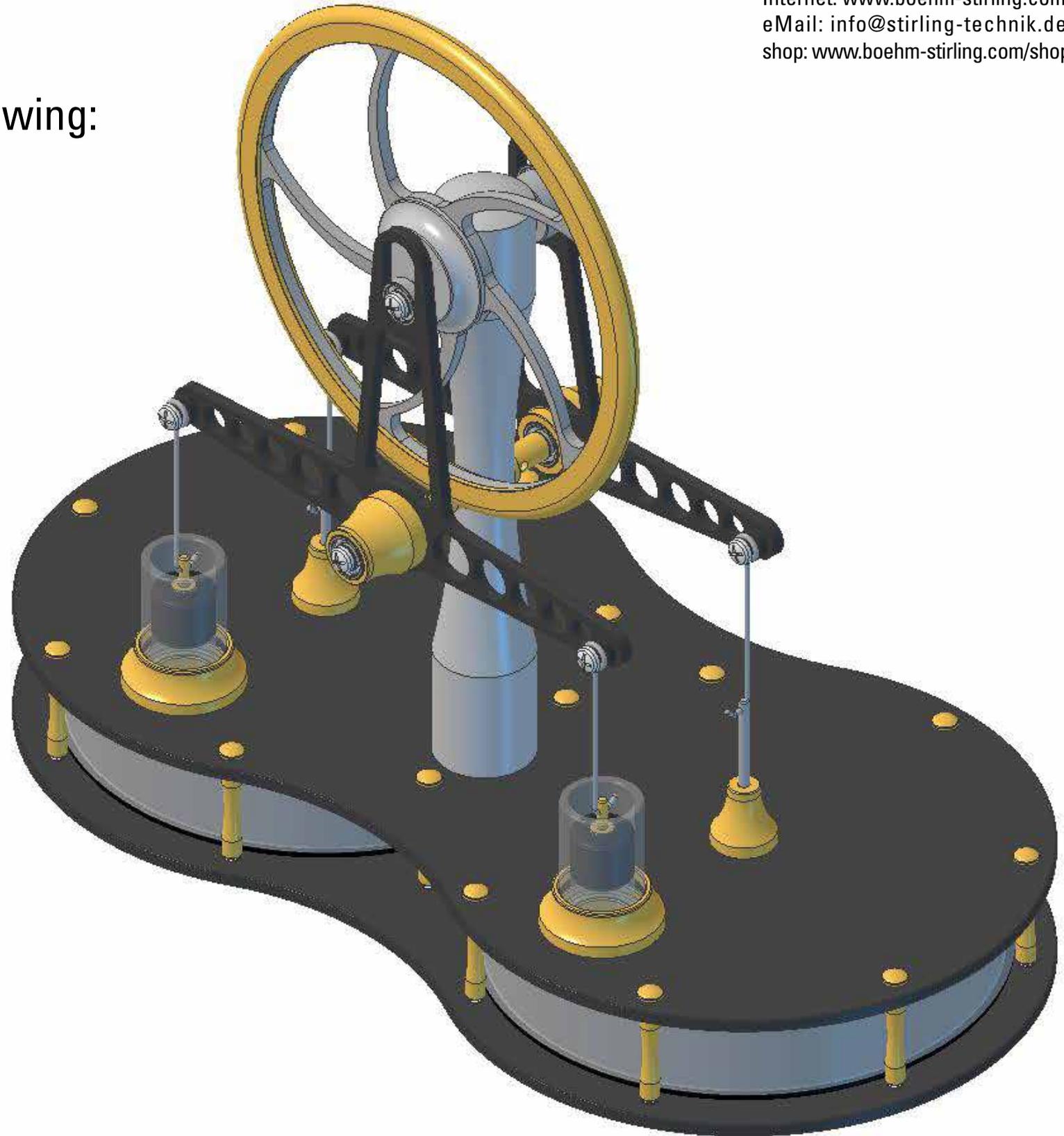
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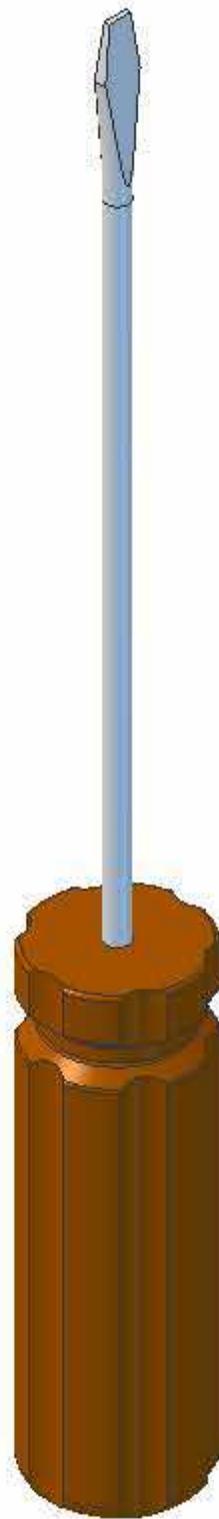
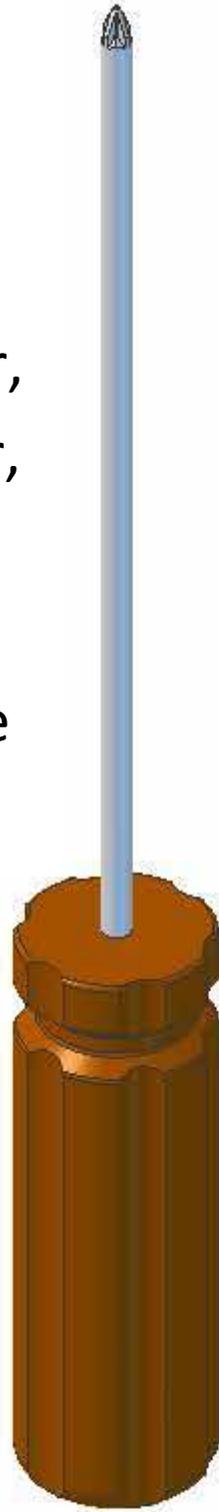
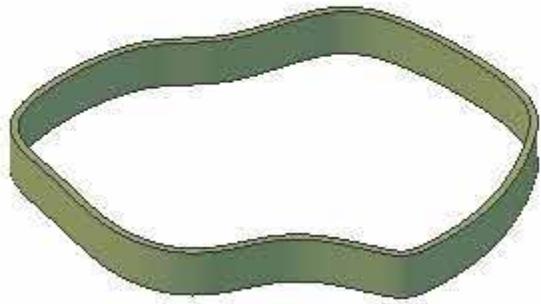
This document covers the following:

- [Tools required](#)
- [Parts list](#)
- [Assembly instructions](#)
- [Operating instructions](#)
- [Maintenance](#)

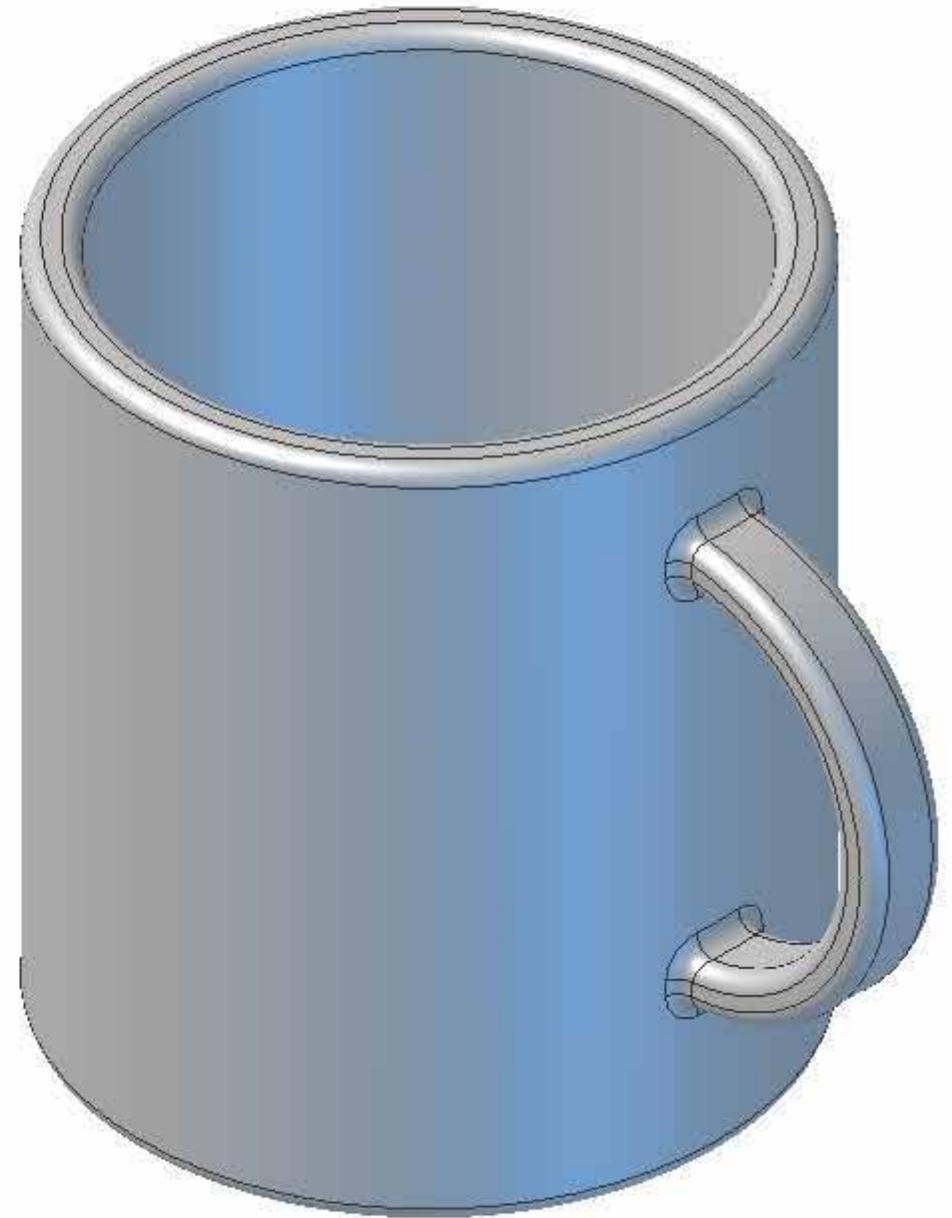


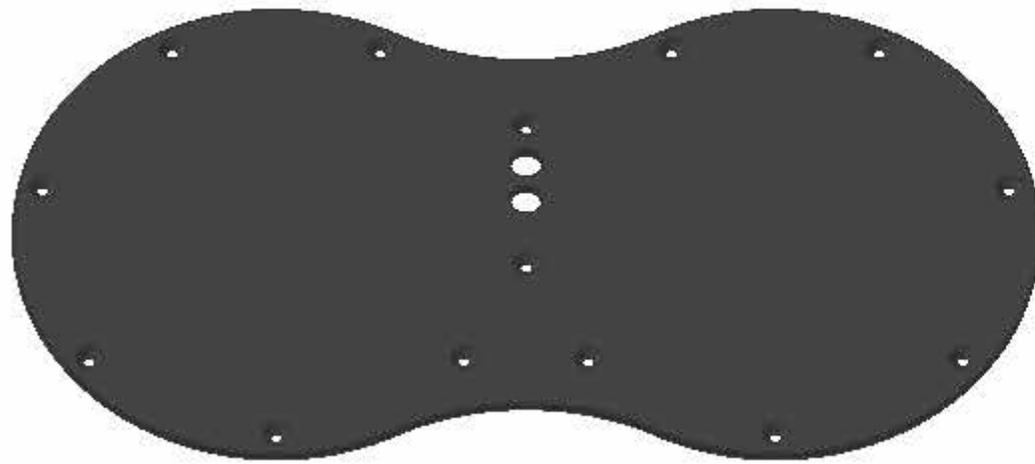
Tools you will need to assemble your HB6 DT Low Temperature Stirling Engine:

Cross-point screwdriver, Flat-bladed screwdriver, Elastic band, coffee or tea mug x3, tommy bar x2 (supplied in separate labelled bag).

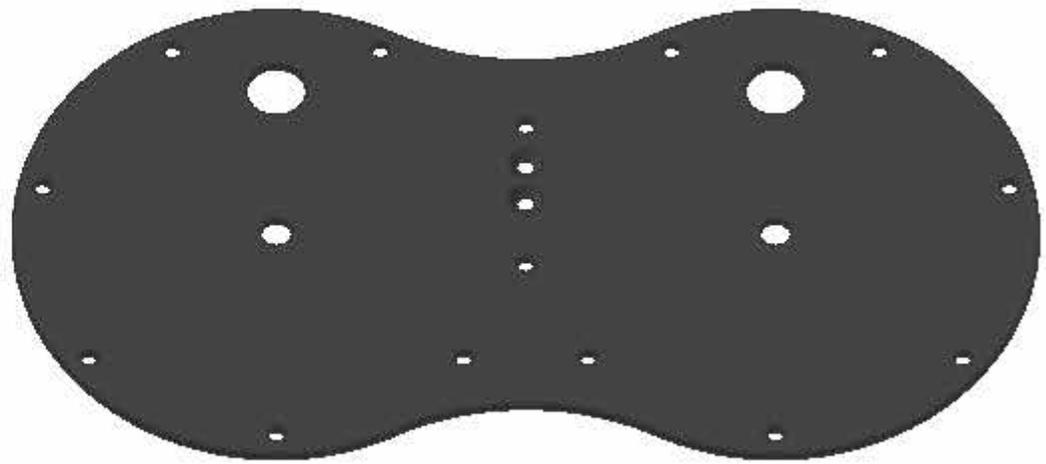


Tommy bars are plain, without any drilled holes

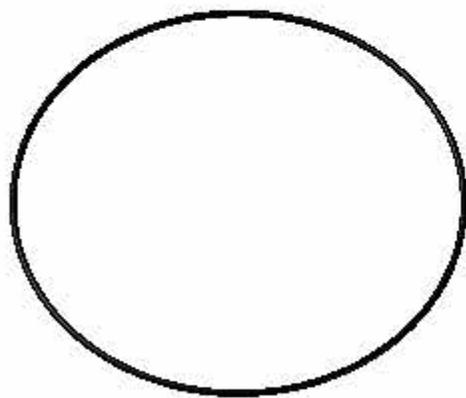




Bottom plate x1



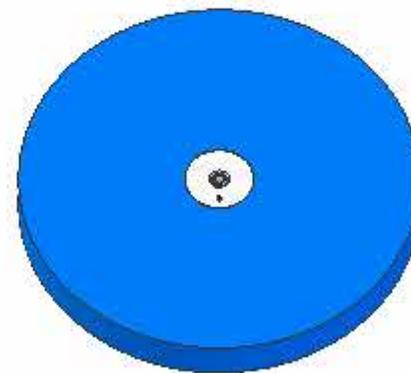
Top plate x1



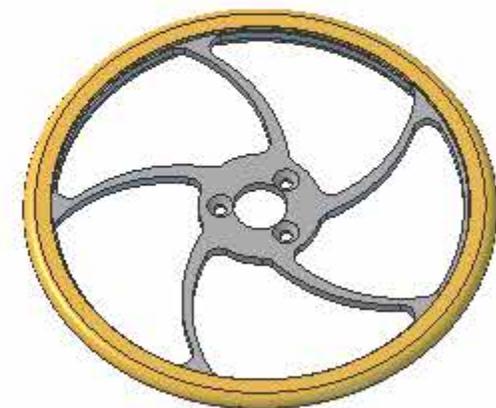
75mm O ring x4



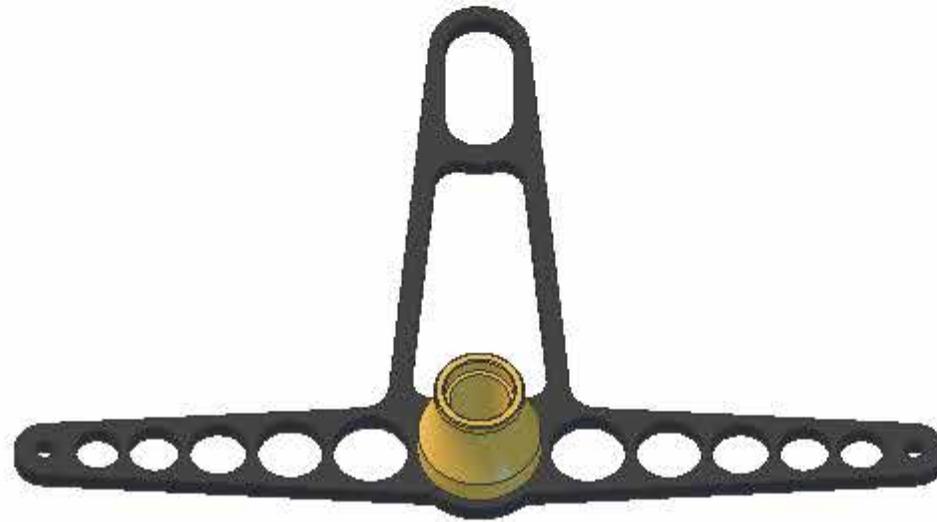
Chamber wall x2



Displacer x2



Flywheel x1



T-bar x2



Main pillar x1



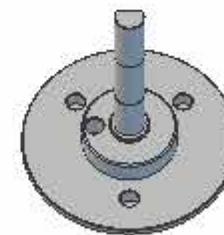
Cylinder x2



Piston x2



Gland x2



Hub/axle x1



Crank x1



Conrod x4

Note: Conrods & Conrod bushes
Pre-assembled with M2x6mm
roundhead screws from late 2016
onwards.



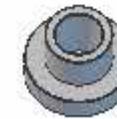
Conrod bush x4



Gland stem x2



Ball-race
bearing x8



Bearing bush x2



Chamber pillar x14

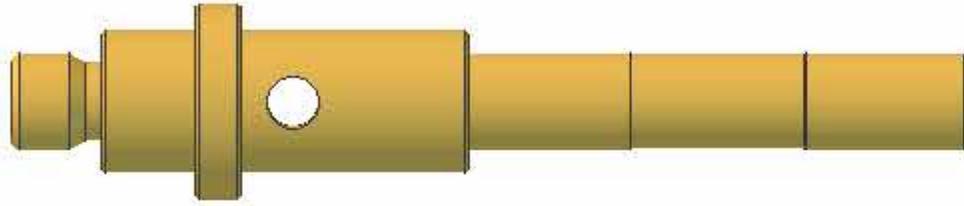


13mm O ring x2

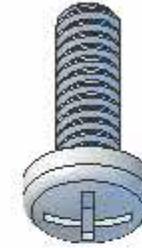


7mm O ring x2

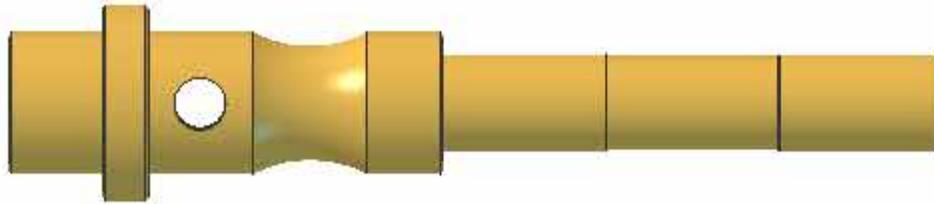
Note: Pre-assembled with Conrods & Conrod bushes from late 2016 onwards.



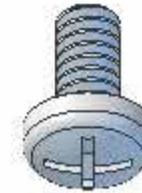
T-bar carrier rear x1



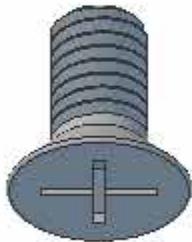
M2x6 roundhead x8



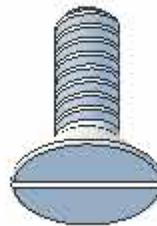
T-bar carrier front x1



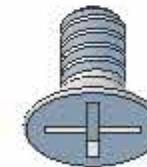
M2x4 roundhead x1



M3x6 countersunk x2

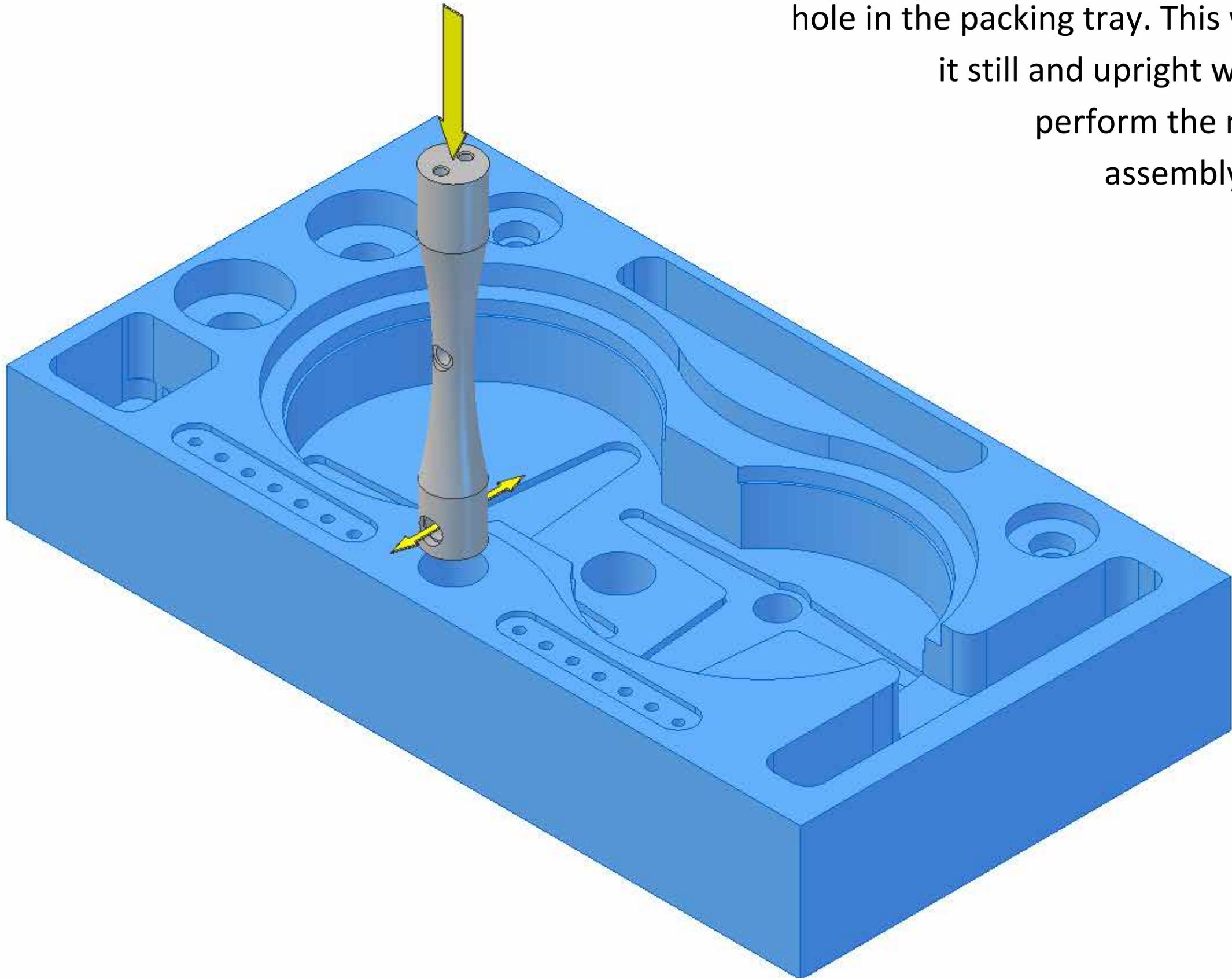


M2x6 countersunk x14

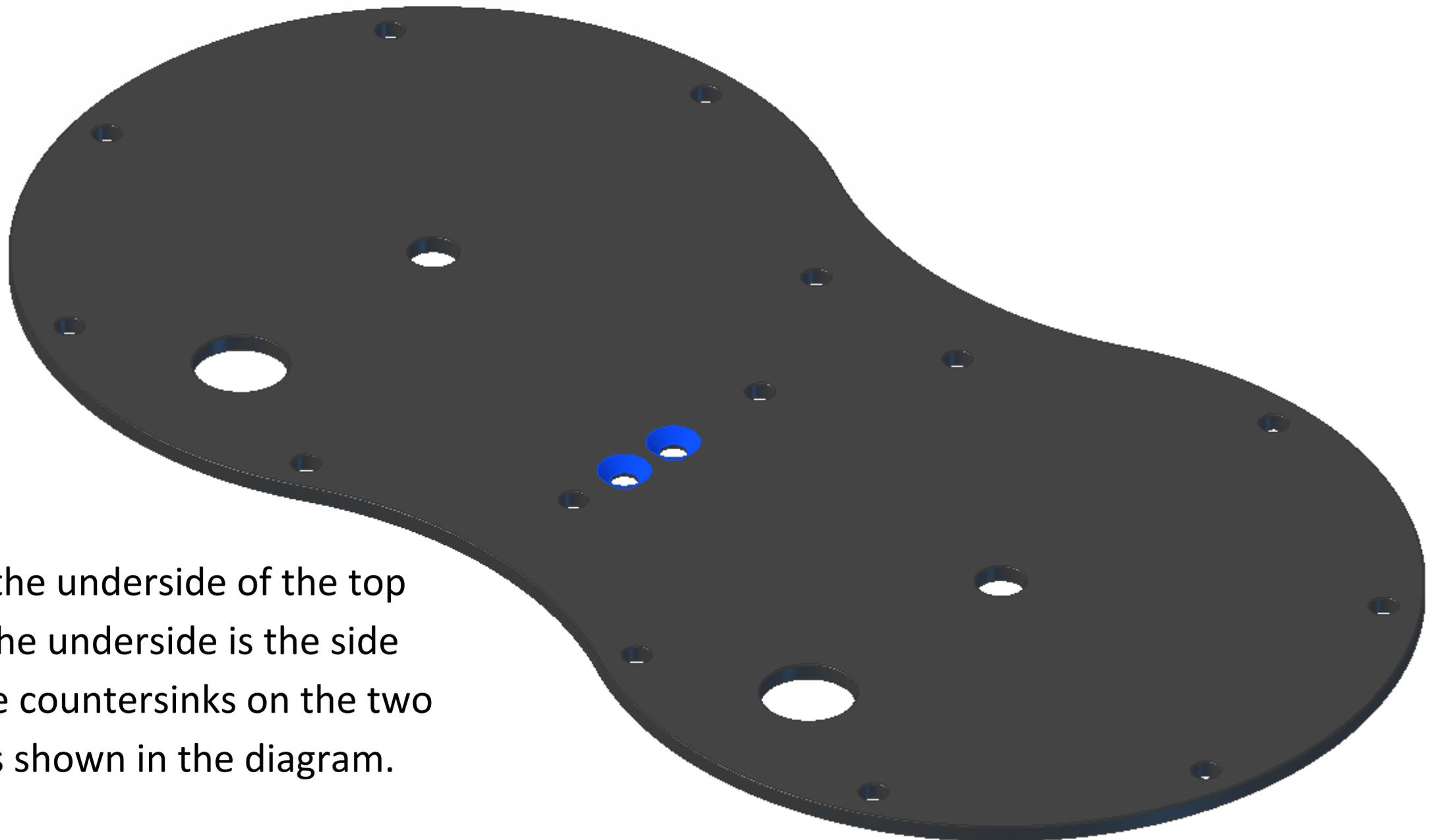


M2x4 countersunk x3

Align the hole in the main pillar as shown in the diagram and push the pillar into the hole in the packing tray. This will hold it still and upright while you perform the next few assembly stages.

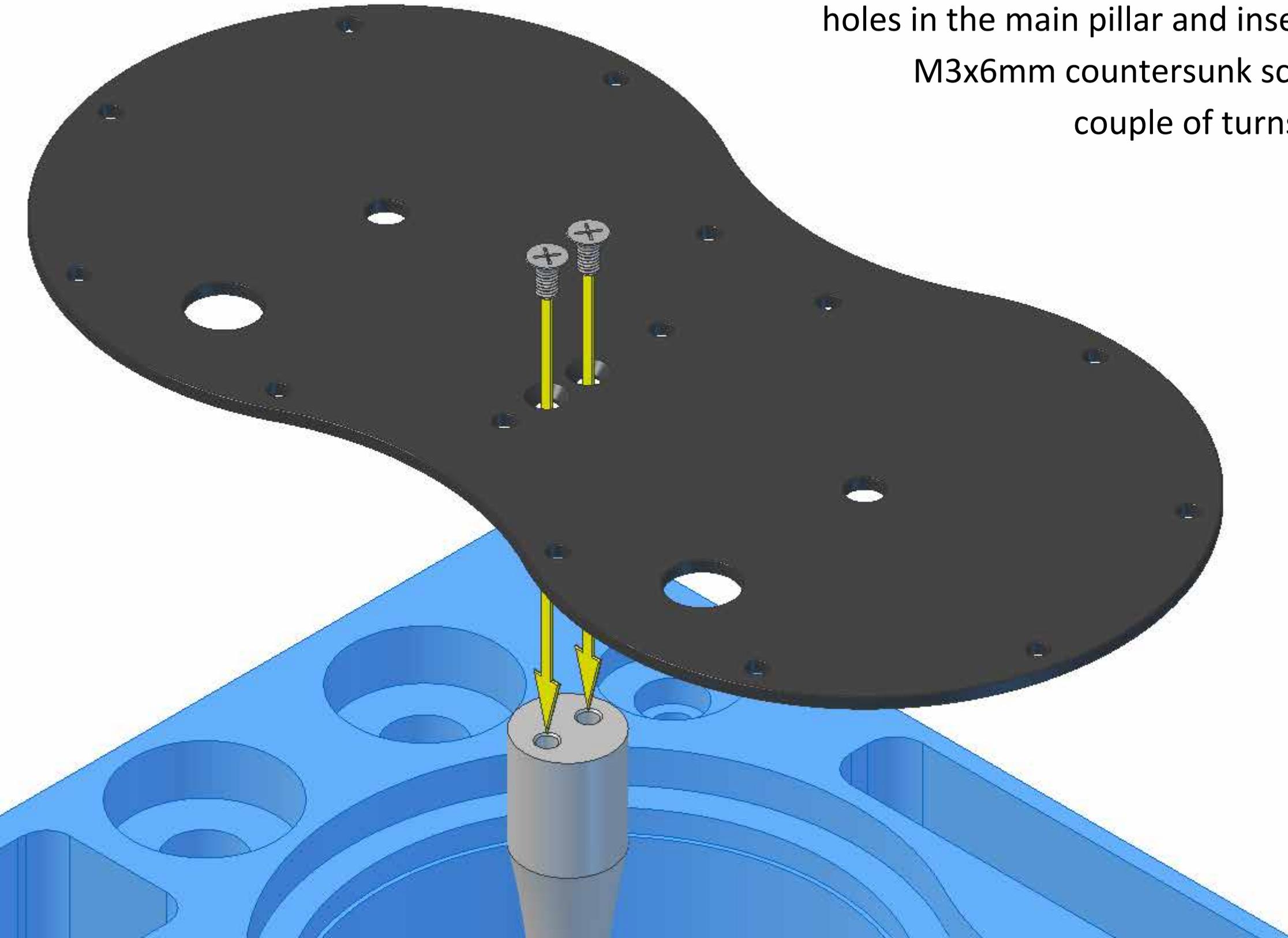


If you have solar (acrylic) or polished (stainless steel) plates you will need to remove the protective film from the top plate now. Once you have removed the film try to handle the plate by its edges, this will minimise fingerprints. Solar (acrylic) plates have protective film on both sides, polished (stainless steel) plates have protective film on one side only. Black (aluminium) plates do not have protective film.

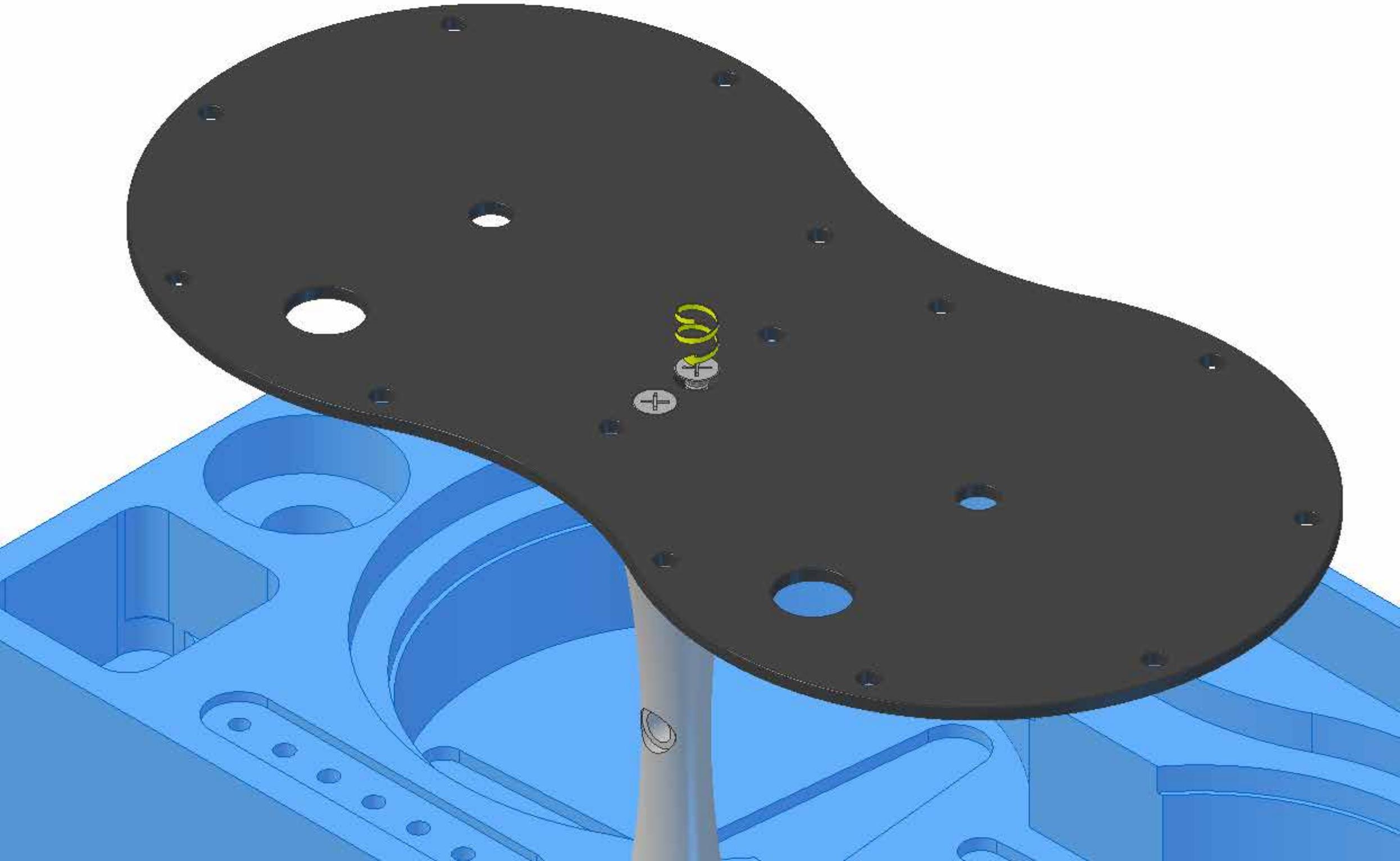


Locate the underside of the top plate. The underside is the side with the countersinks on the two holes as shown in the diagram.

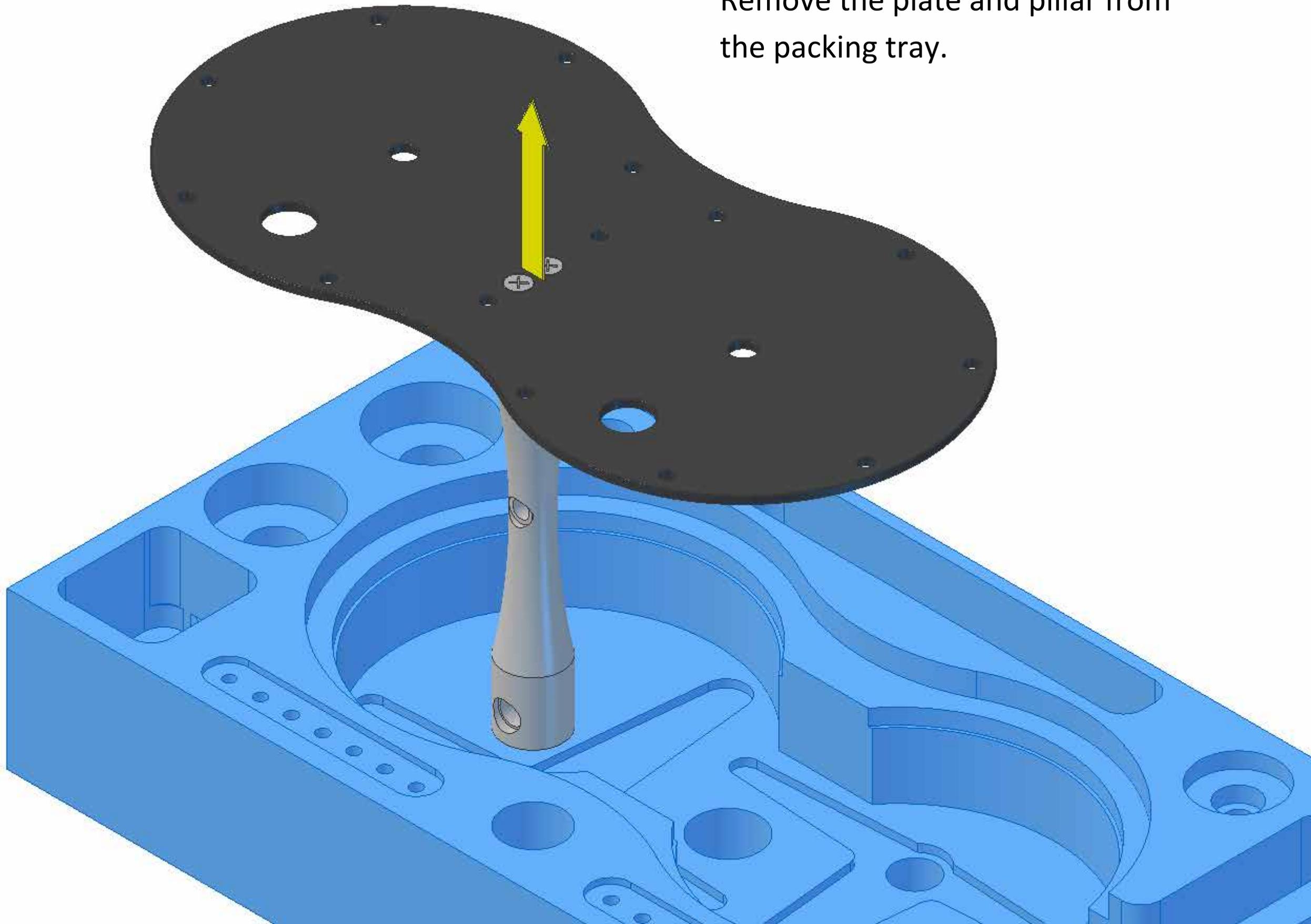
Position the top plate over the main pillar, with the underside of the plate facing upwards. Align the two countersunk holes in the plate with the two threaded holes in the main pillar and insert two M3x6mm countersunk screws a couple of turns each.



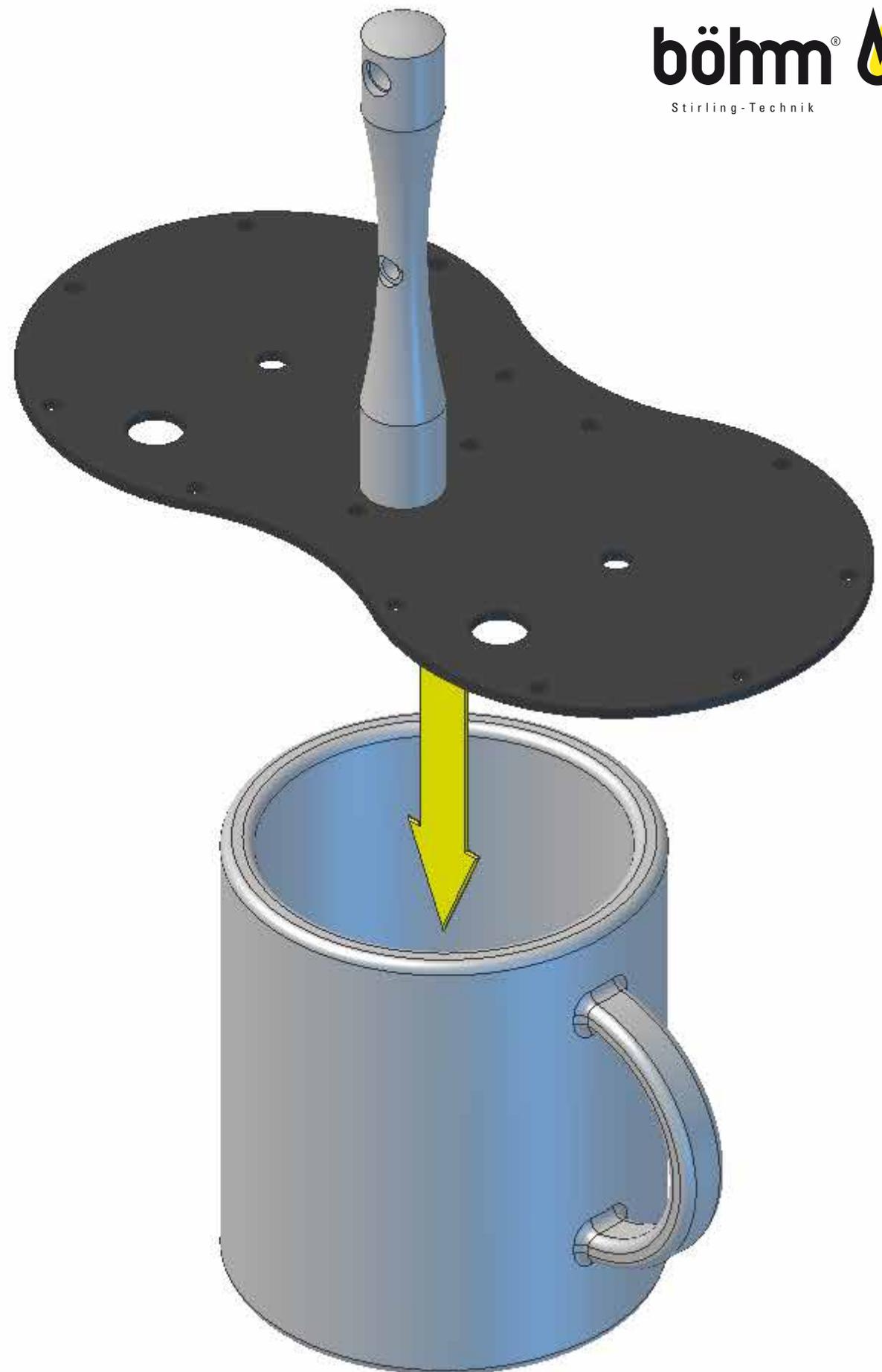
Screw the screws in until they both touch the top plate lightly, then fully tighten.



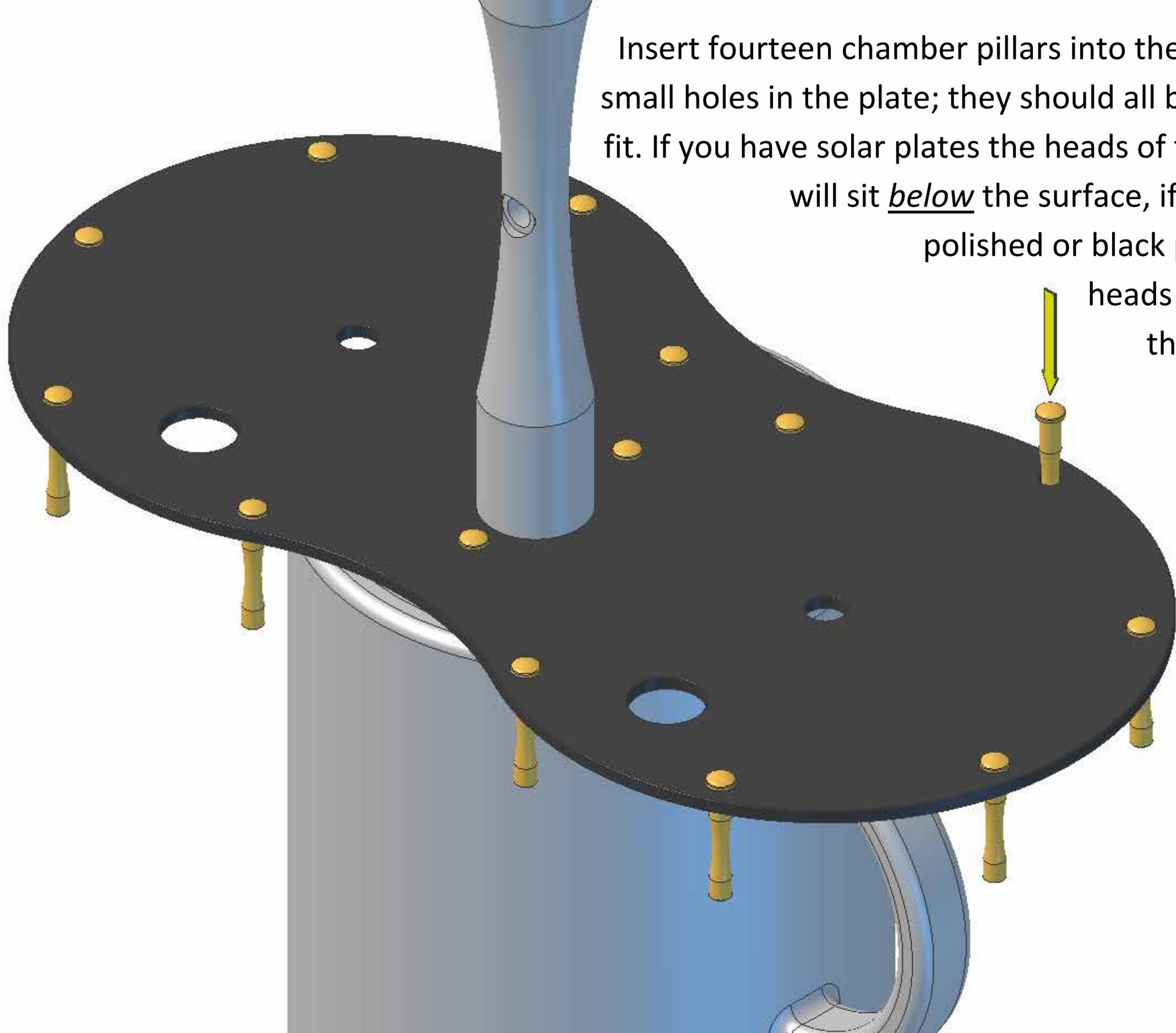
Remove the plate and pillar from the packing tray.



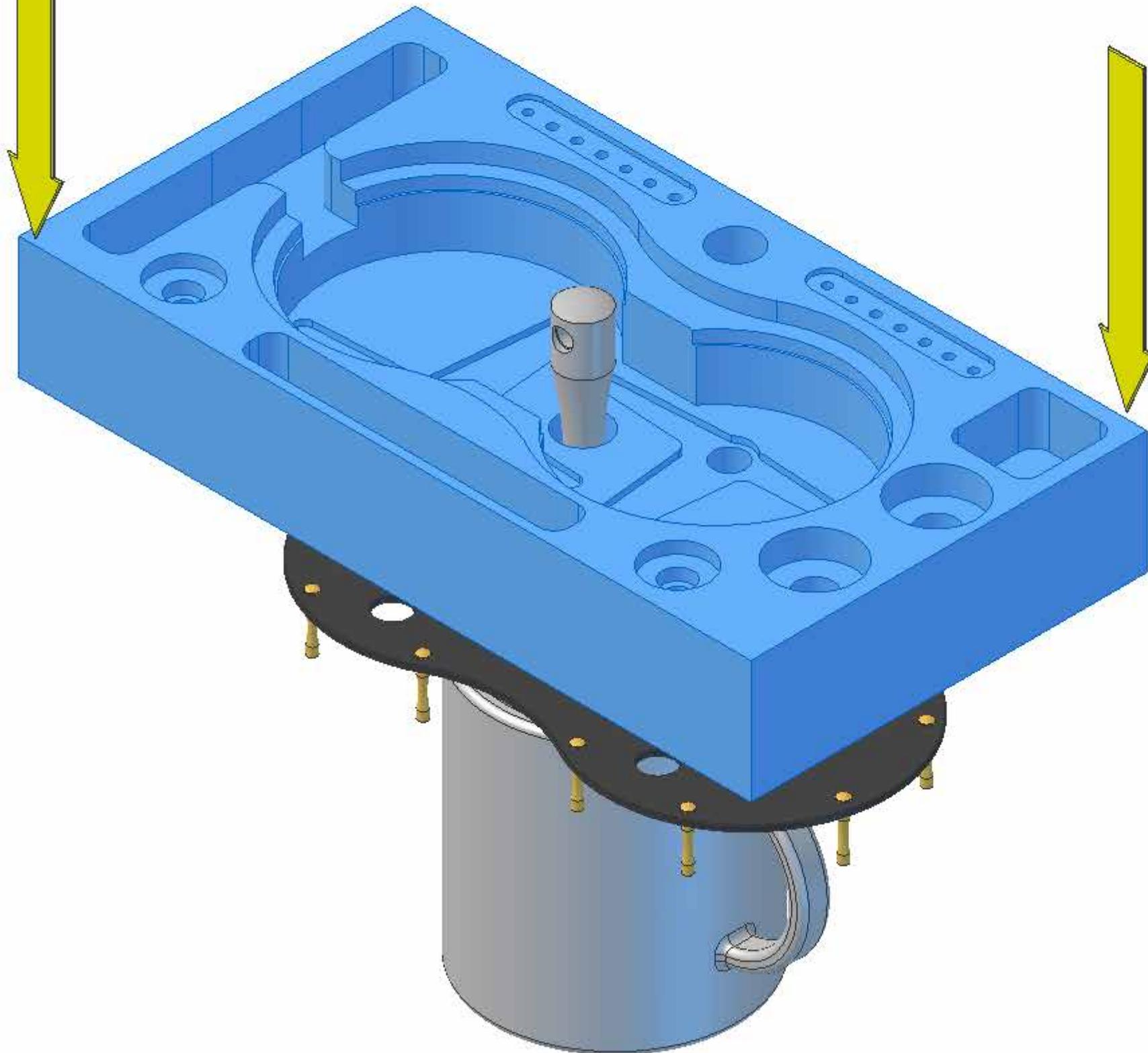
Place the plate and pillar over the top of a coffee mug. This will hold it still so that you can use both hands to perform the next few assembly stages.

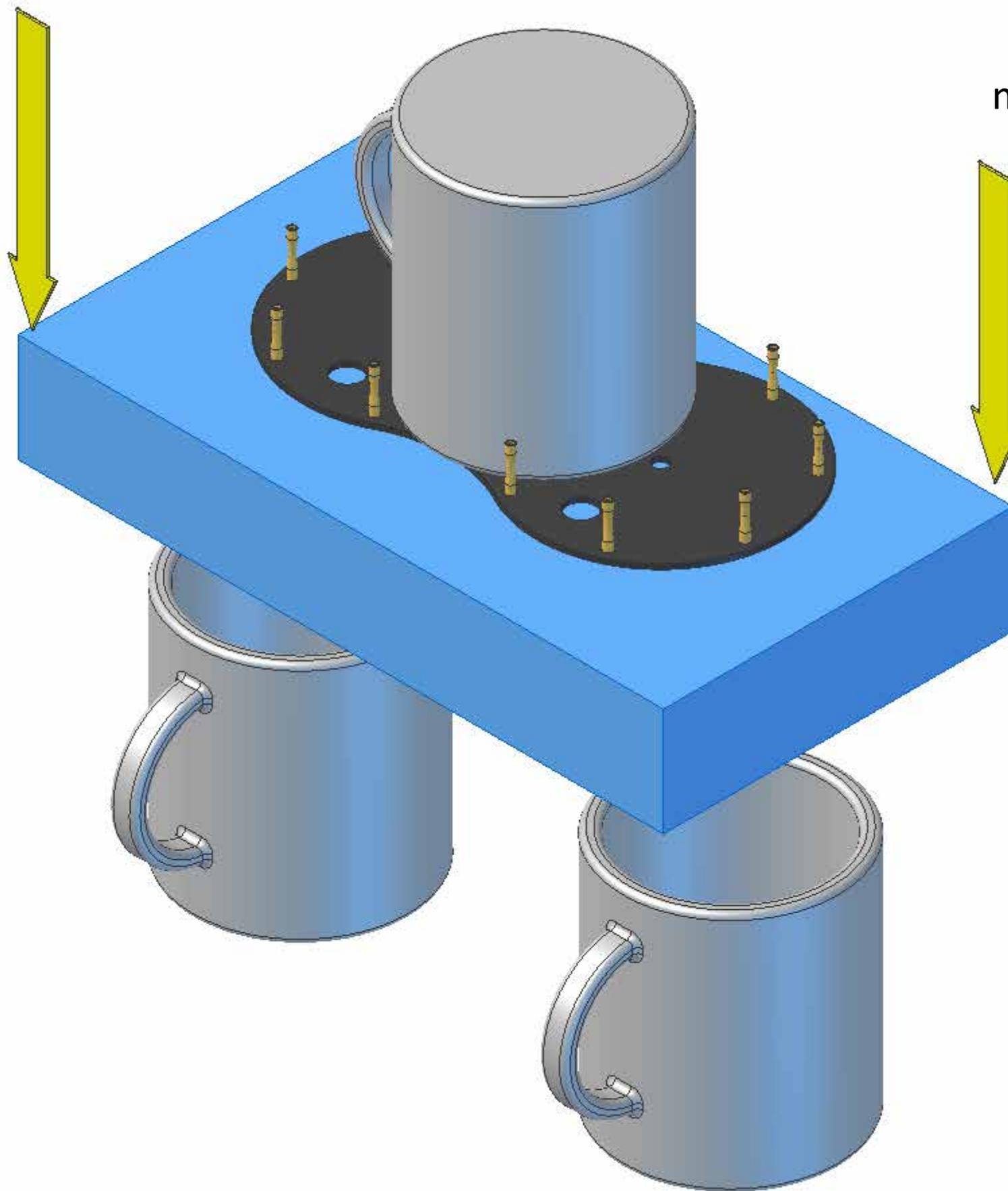


Insert fourteen chamber pillars into the fourteen small holes in the plate; they should all be an easy fit. If you have solar plates the heads of the pillars will sit below the surface, if you have polished or black plates the heads will sit on the surface.



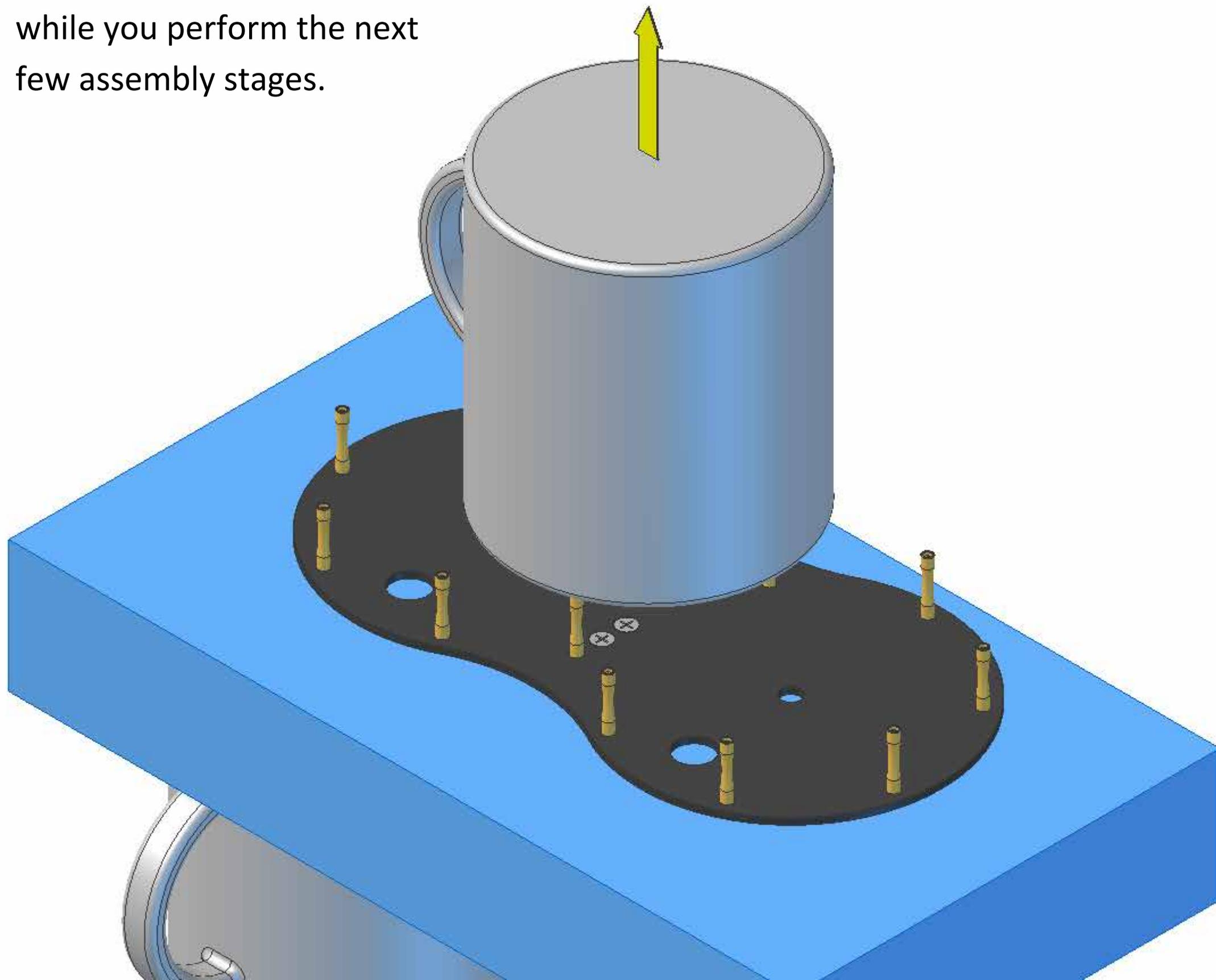
Carefully align the hole in the bottom of the packing tray with the main pillar and lower the tray down until it sits on top of the chamber pillars.



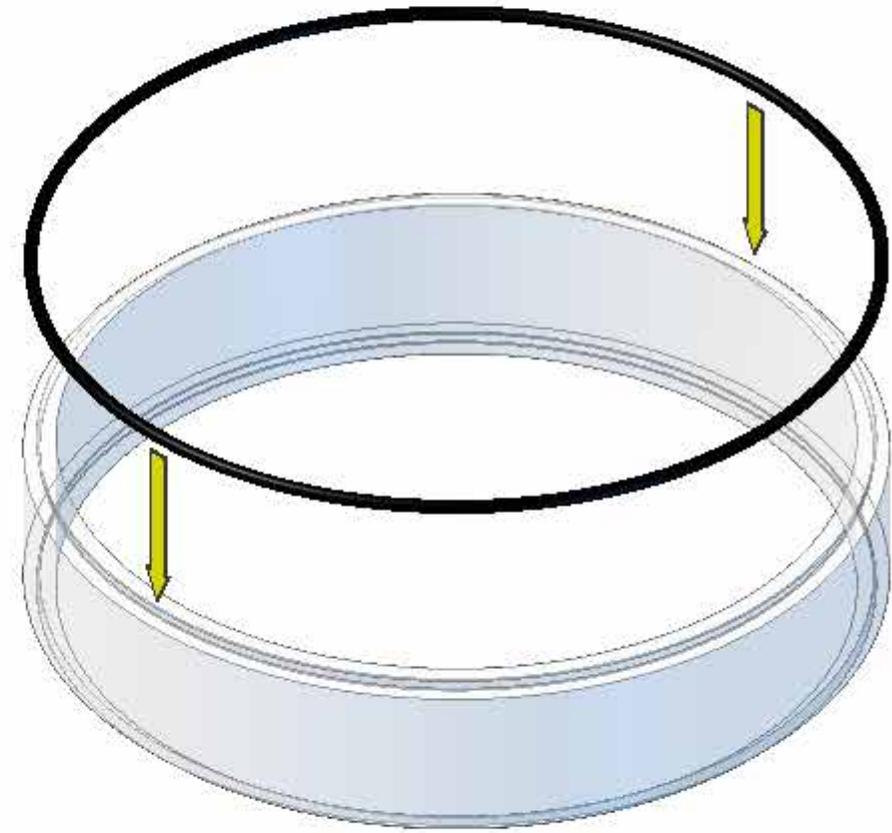
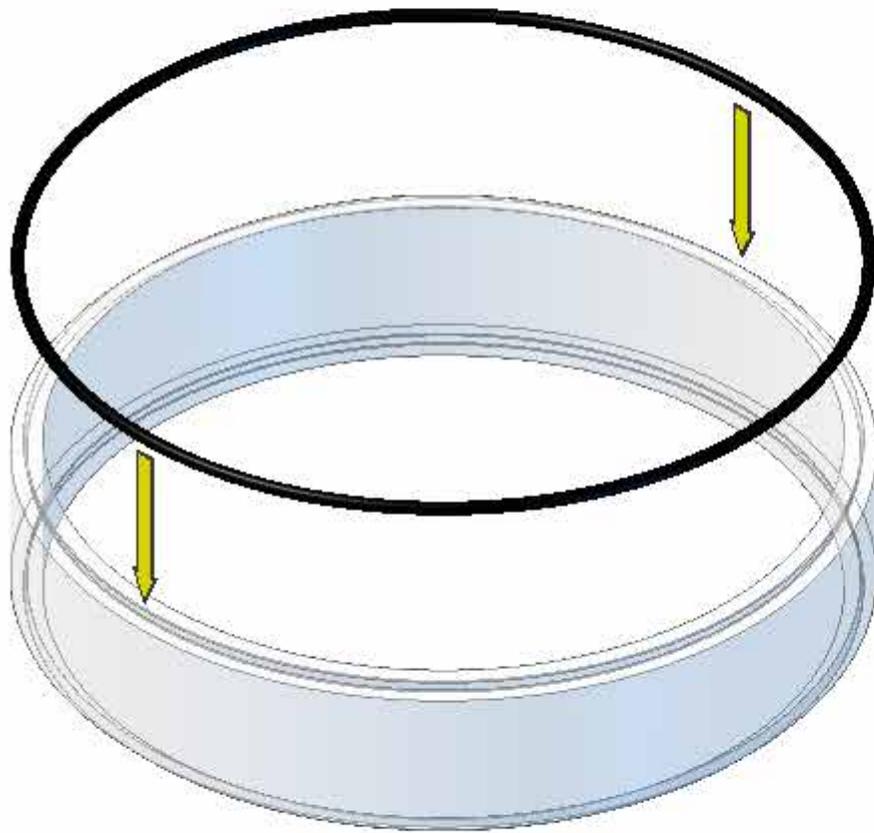


Hold the packing tray, mug and top plate firmly together so that the chamber pillars do not fall out of the plate. Carefully turn upside down and place on top of another two coffee mugs.

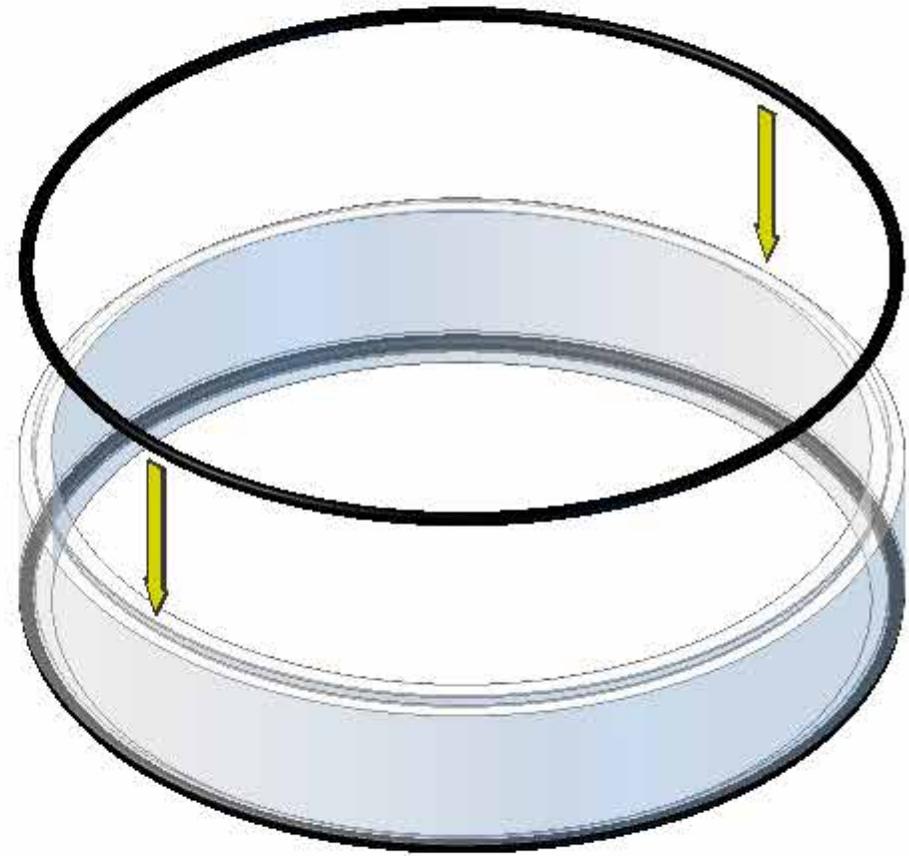
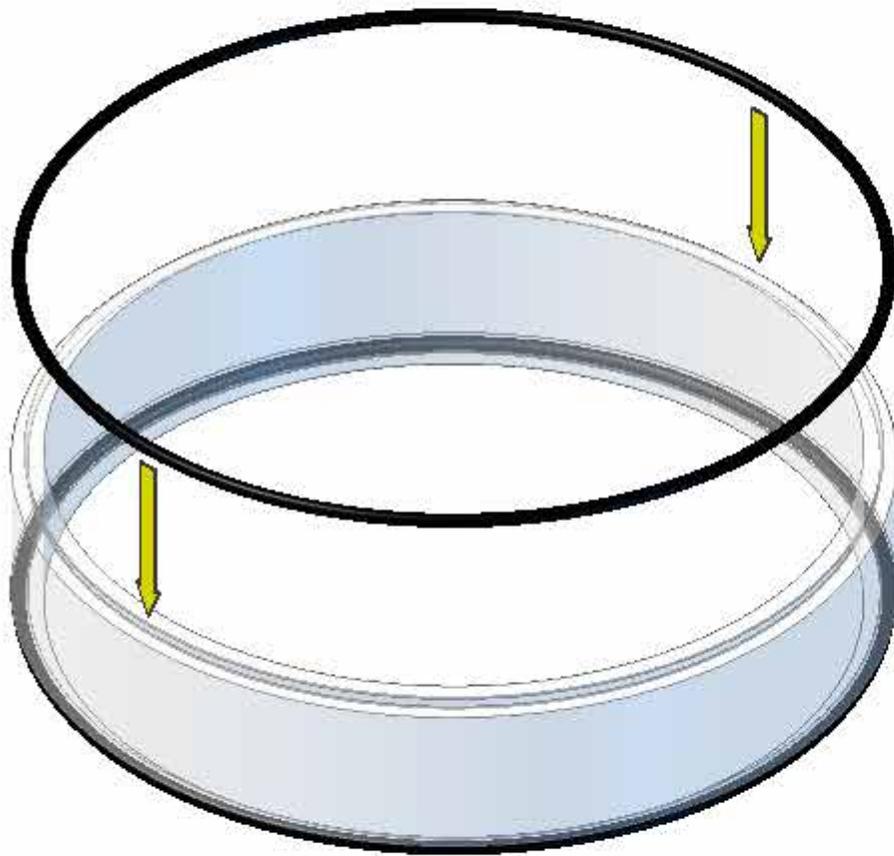
Remove the top mug. The packing tray will hold the chamber pillars in a vertical position while you perform the next few assembly stages.

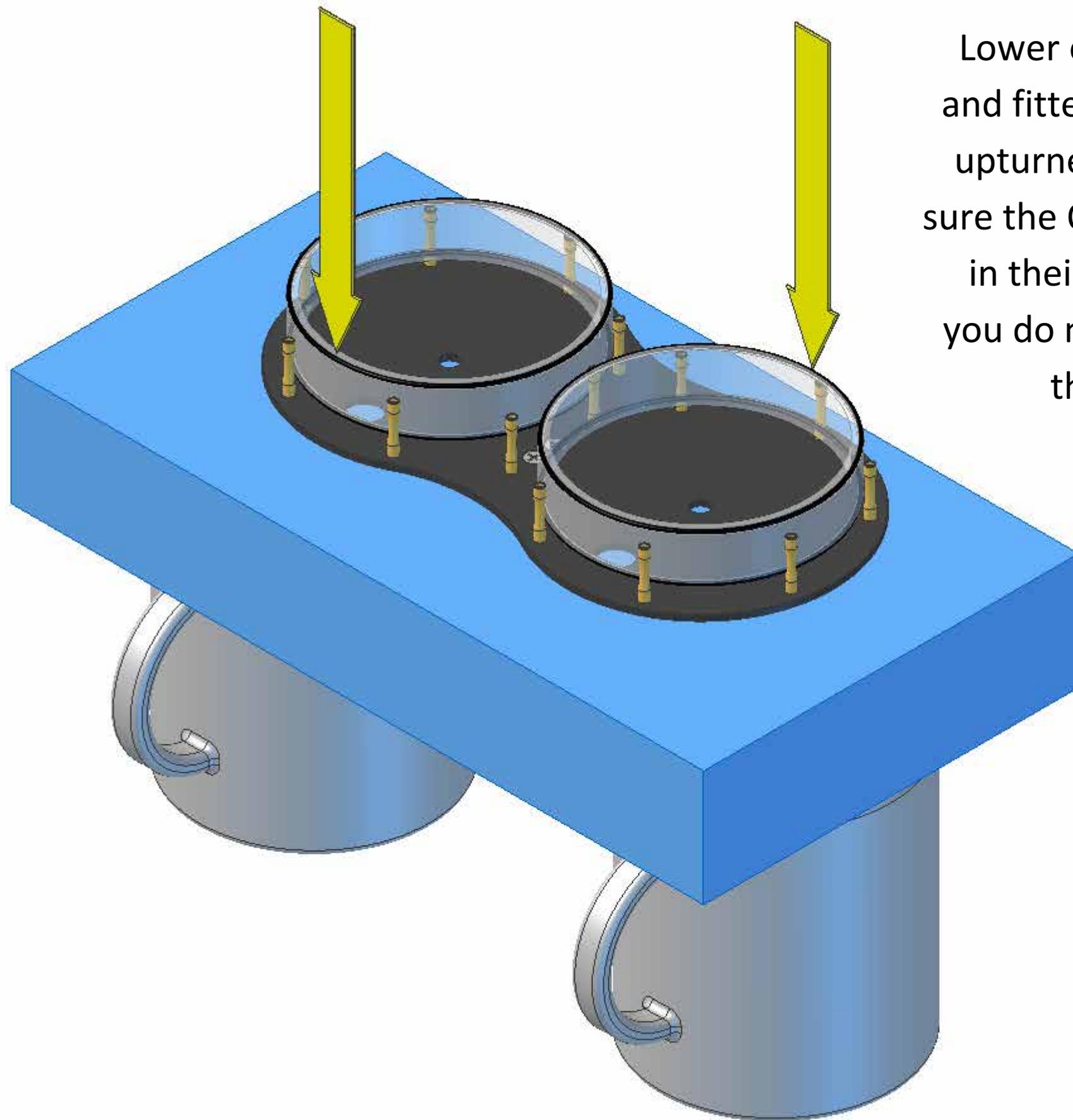


Wipe the first acrylic chamber wall with a dry cloth to remove any fingerprints. Stretch a 75mm O ring over the rebate on one end. Repeat for the second chamber wall.



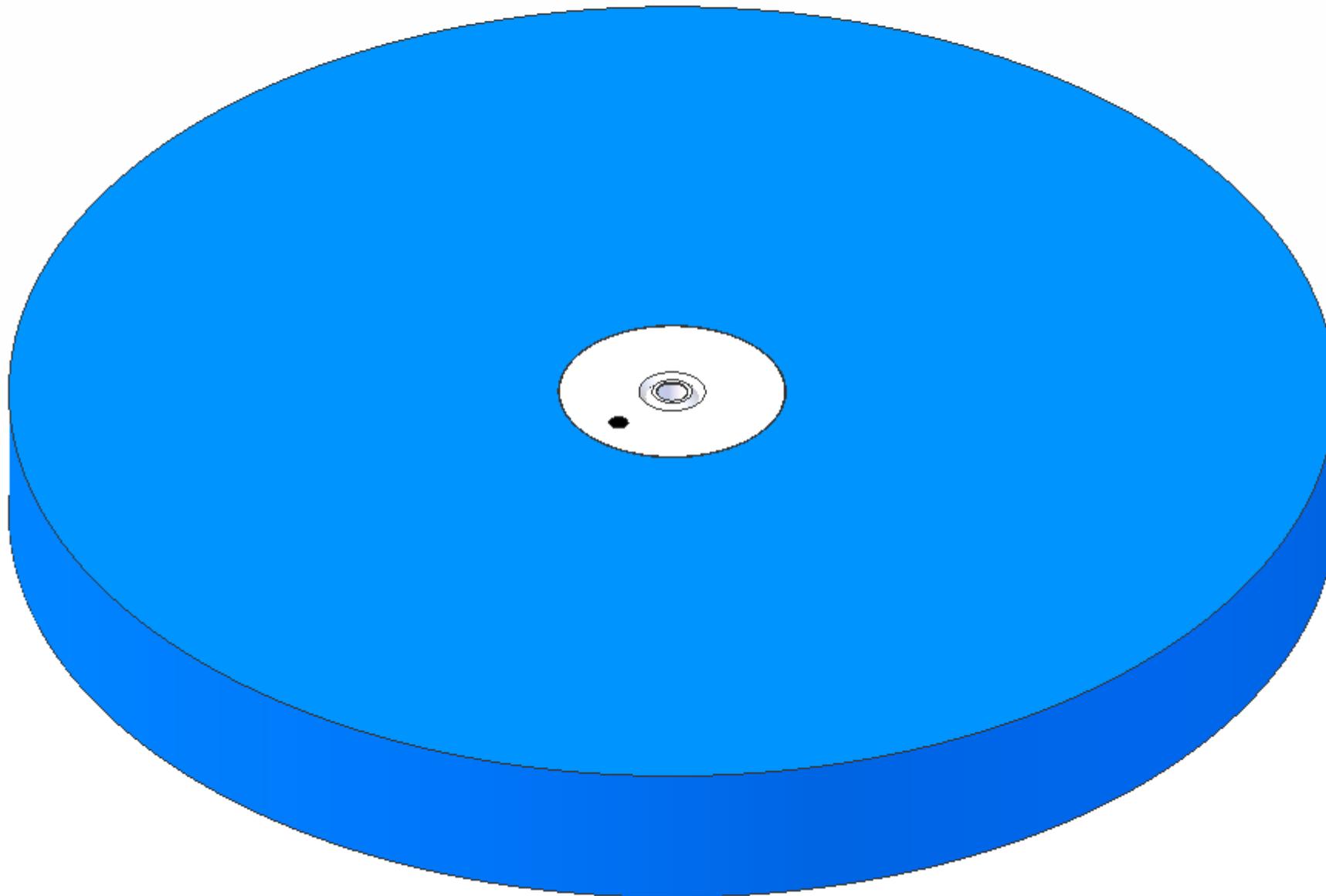
Stretch another 75mm O ring over the rebate on the other end of the first chamber wall. Repeat for the second chamber wall.



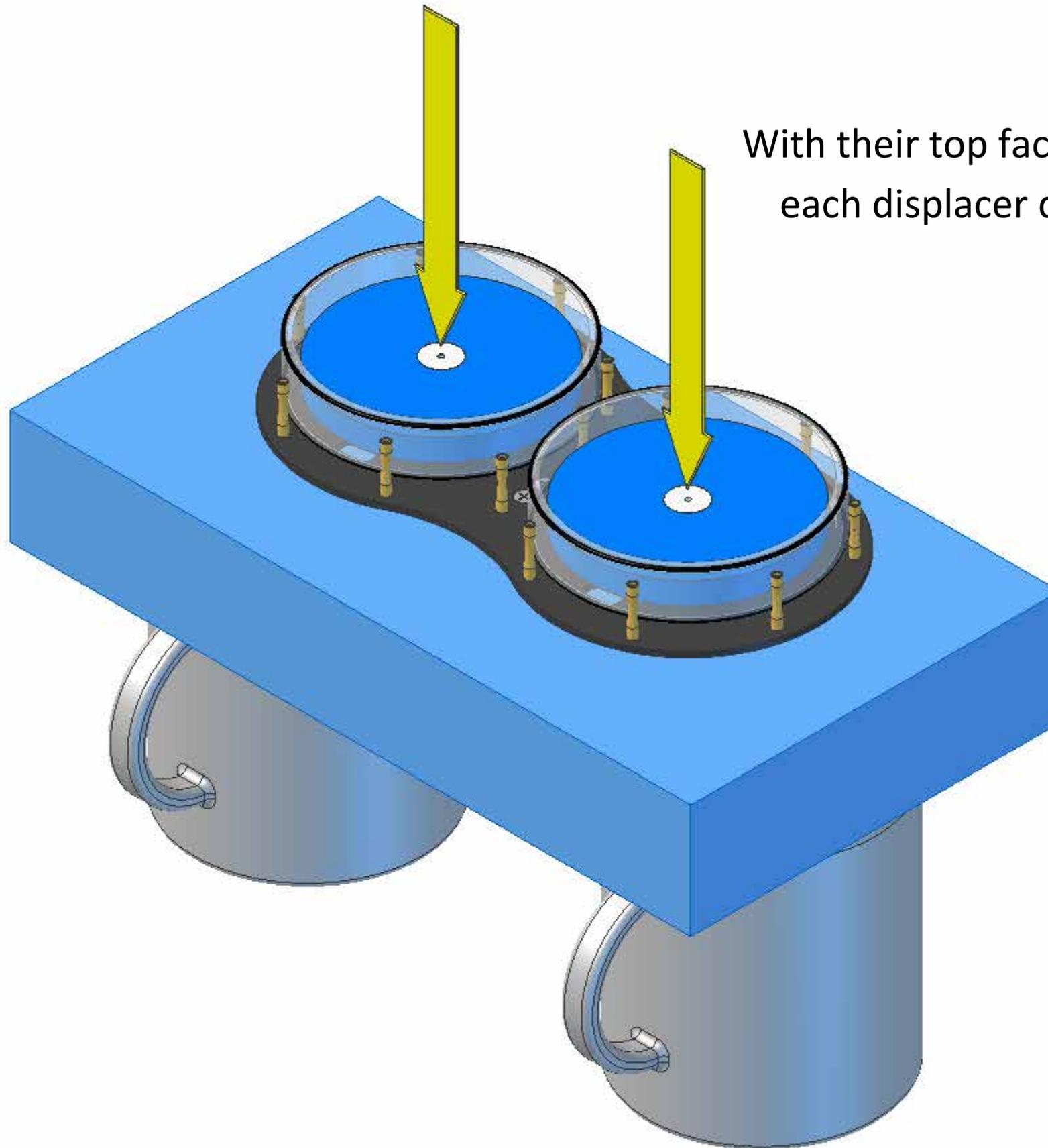


Lower each chamber wall and fitted O rings onto the upturned top plate. Make sure the O rings stay seated in their rebates, and that you do not dislodge any of the chamber pillars.

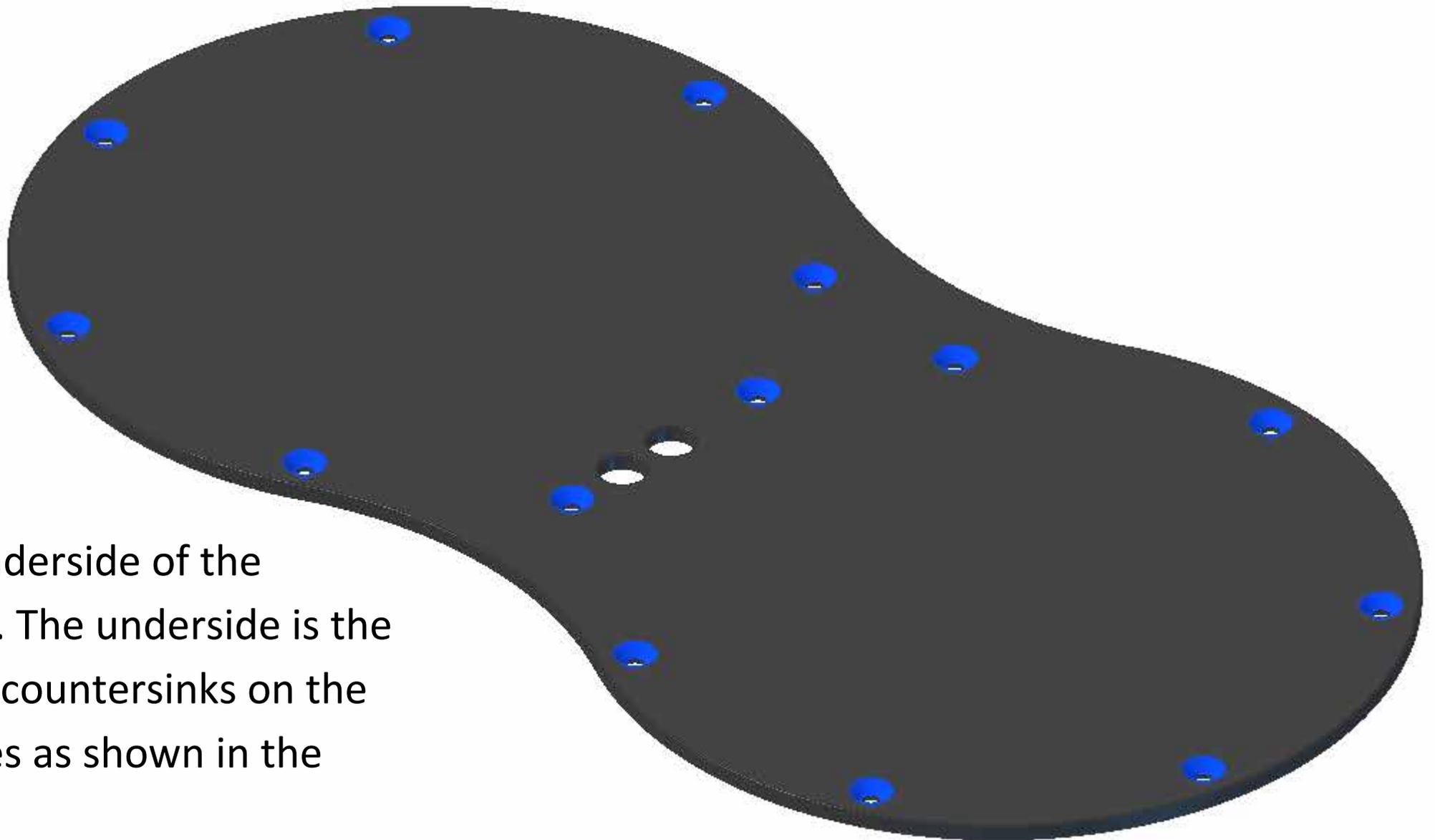
The top faces of the displacers have been marked with a coloured dot near their centres.



With their top faces downwards, lower each displacer down into the engine.



If you have solar (acrylic) or polished (stainless steel) plates you will need to remove the protective film from the bottom plate now. Once you have removed the film try to handle the plate by its edges, this will minimise fingerprints. Solar (acrylic) plates have protective film on both sides, polished (stainless steel) plates have protective film on one side only. Black (aluminium) plates do not have protective film.

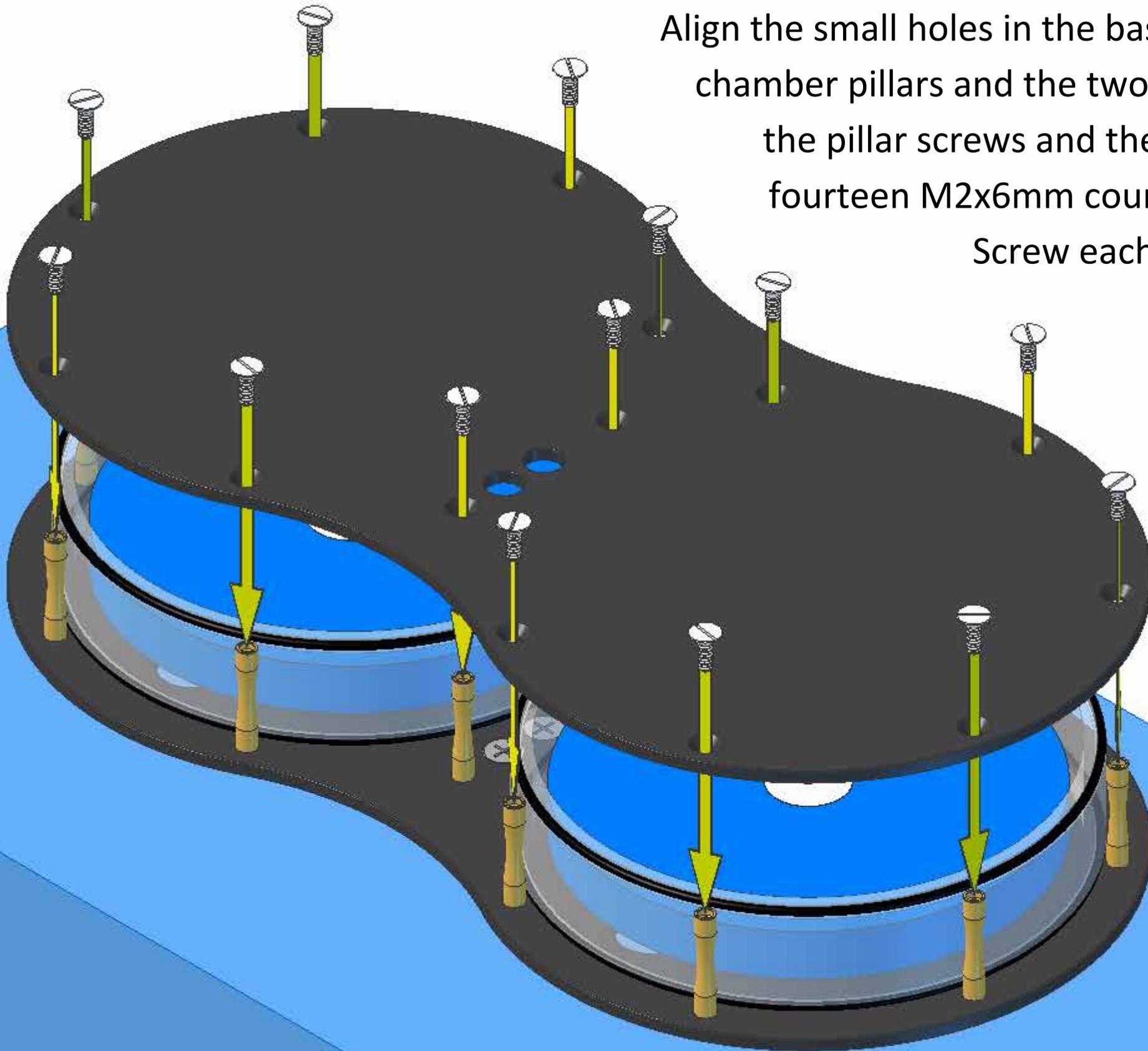


Locate the underside of the bottom plate. The underside is the side with the countersinks on the fourteen holes as shown in the diagram.

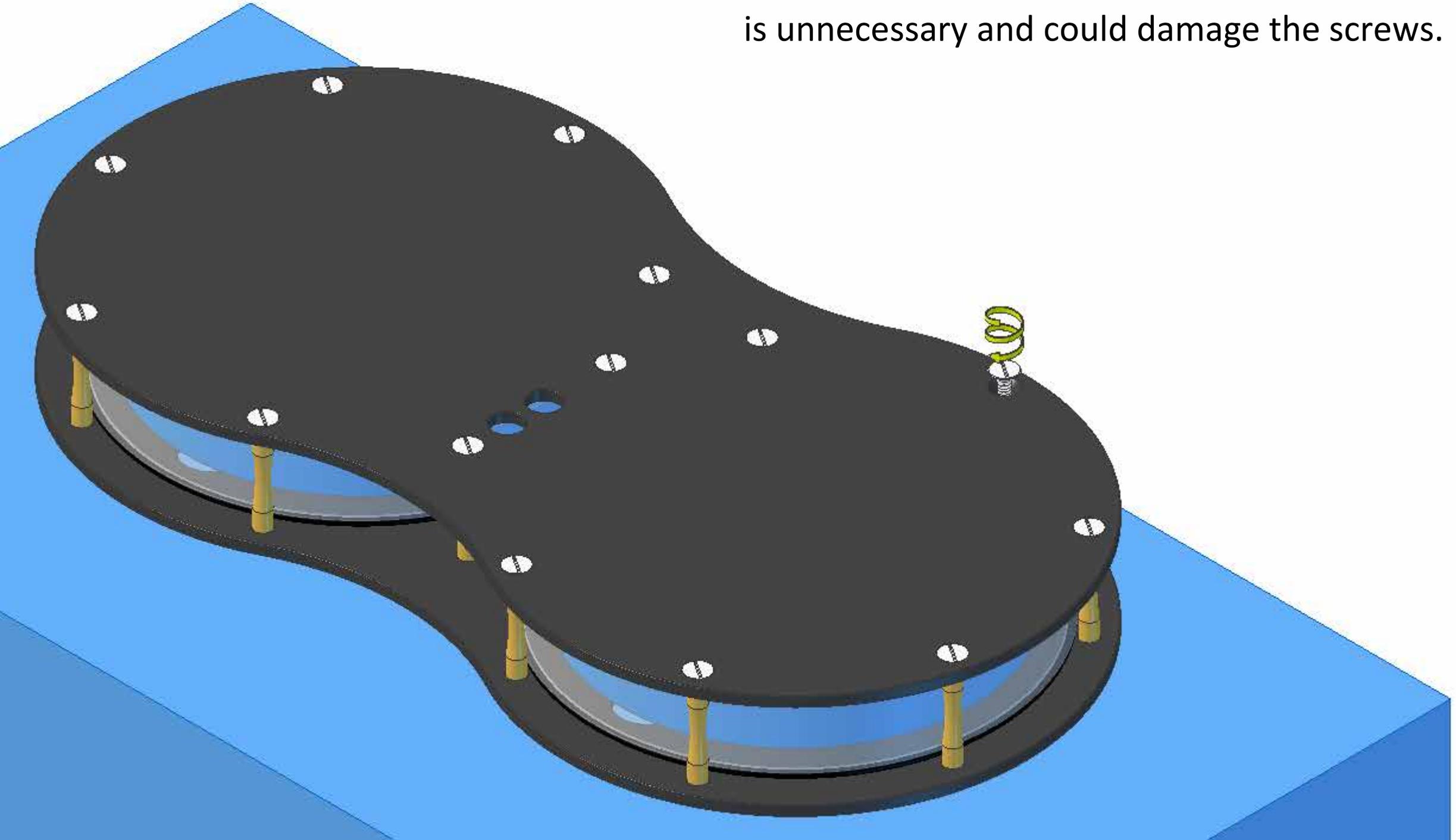
With the underside facing upwards, lower the bottom plate onto the engine.

Align the small holes in the base plate with the chamber pillars and the two large holes with the pillar screws and then start inserting fourteen M2x6mm countersunk screws.

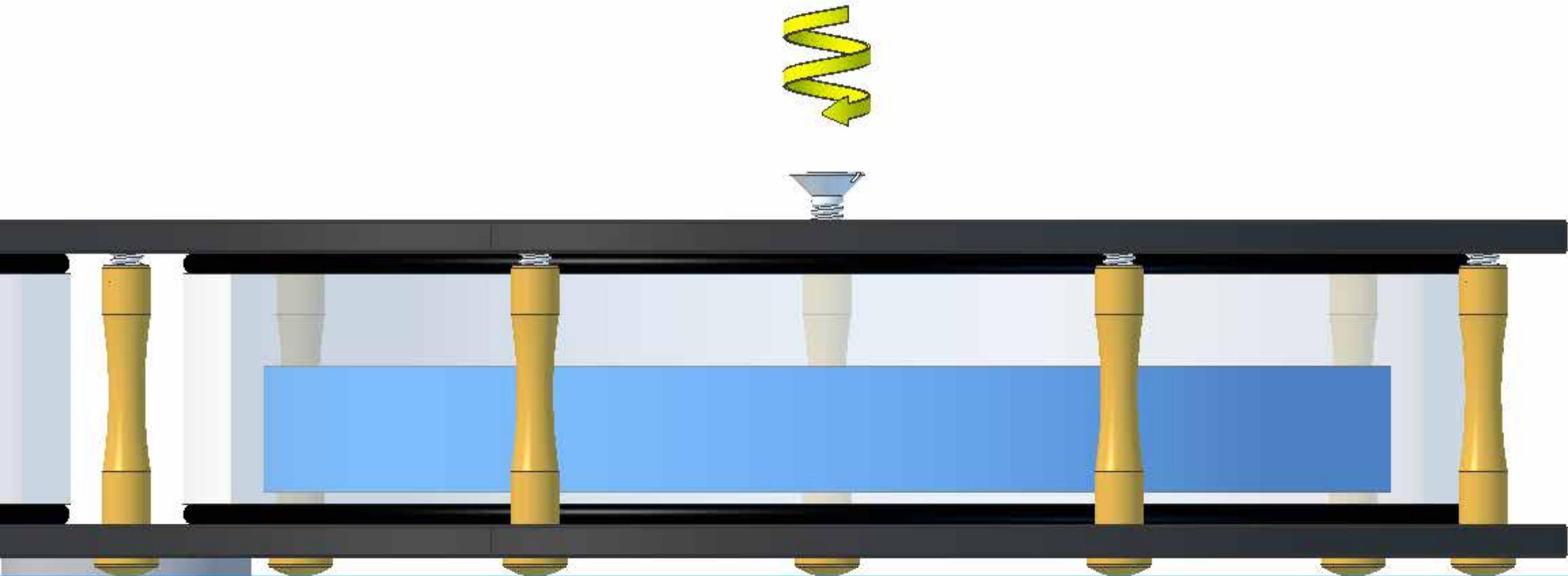
Screw each screw nearly all the way in.



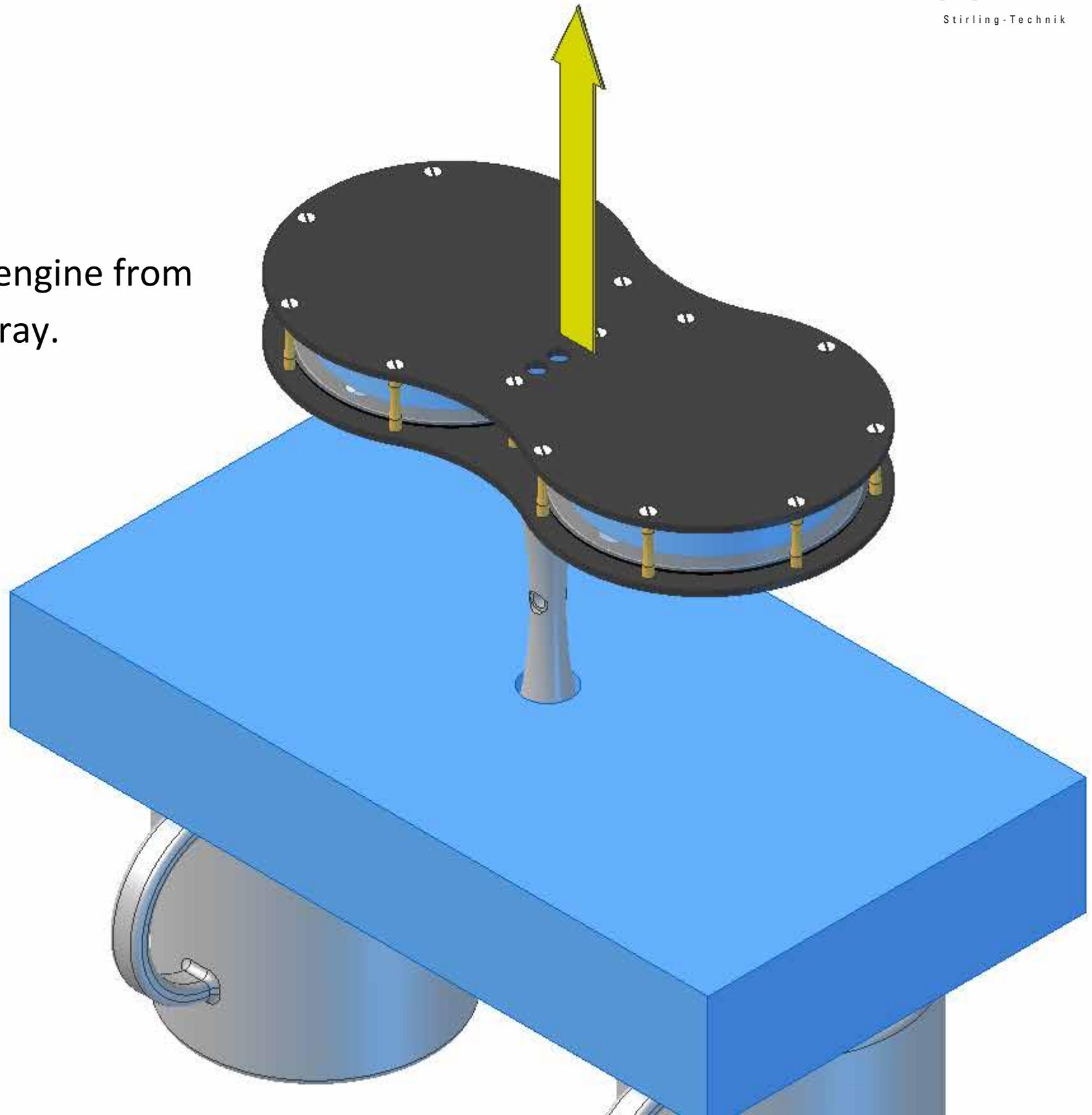
Screw all the screws in until they touch the bottom plate lightly and then start to tighten them. You might need to pinch each pillar with your thumb and finger to stop it spinning while you tighten the screws. Using the front middle screw as number 1, work around the screws clockwise in the order 1, 6, 11, 2, 7, 12, 3, 8, 13, 4, 9, 14, 5, 10. Tighten the screws sufficient to hold the bottom plate in place without any sideways movement, any tighter is unnecessary and could damage the screws.

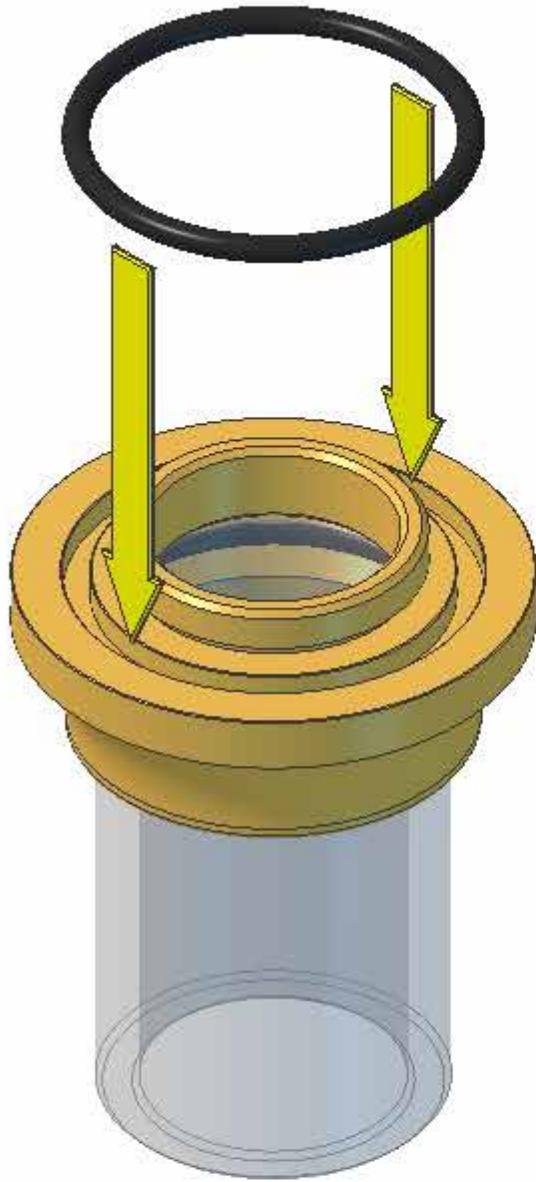


The chamber pillars are deliberately short and will not touch the bottom plate. This is so that they cannot conduct heat directly between the two plates and retard engine performance.

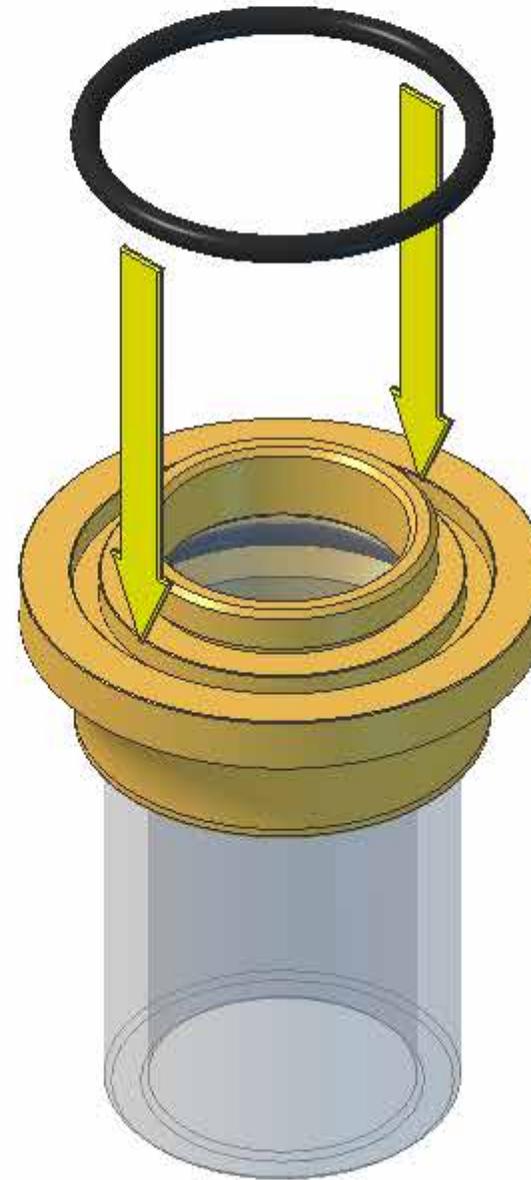


Remove the engine from
the packing tray.

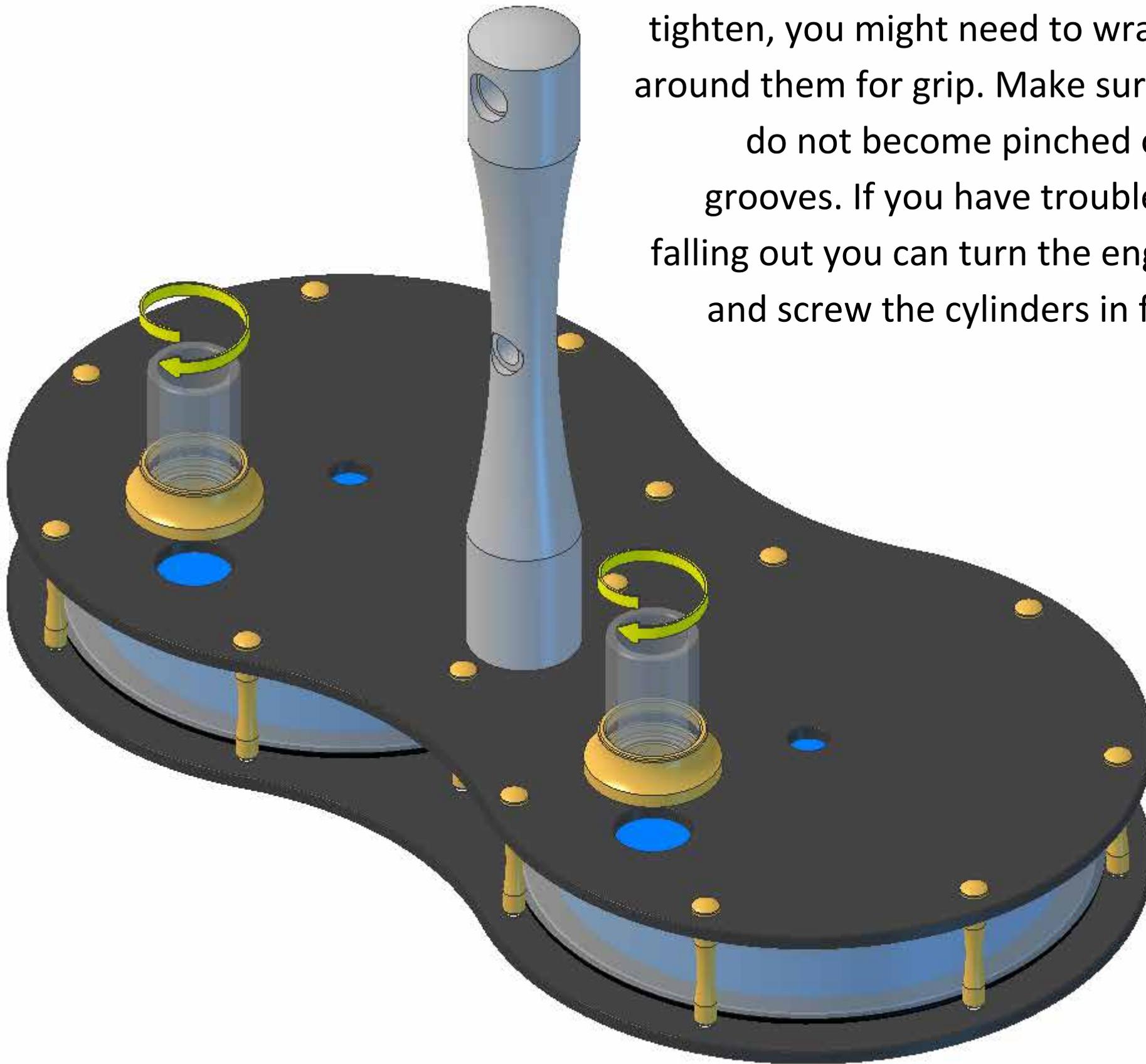




Insert two 13mm O rings into the grooves in the bottoms of the cylinders.

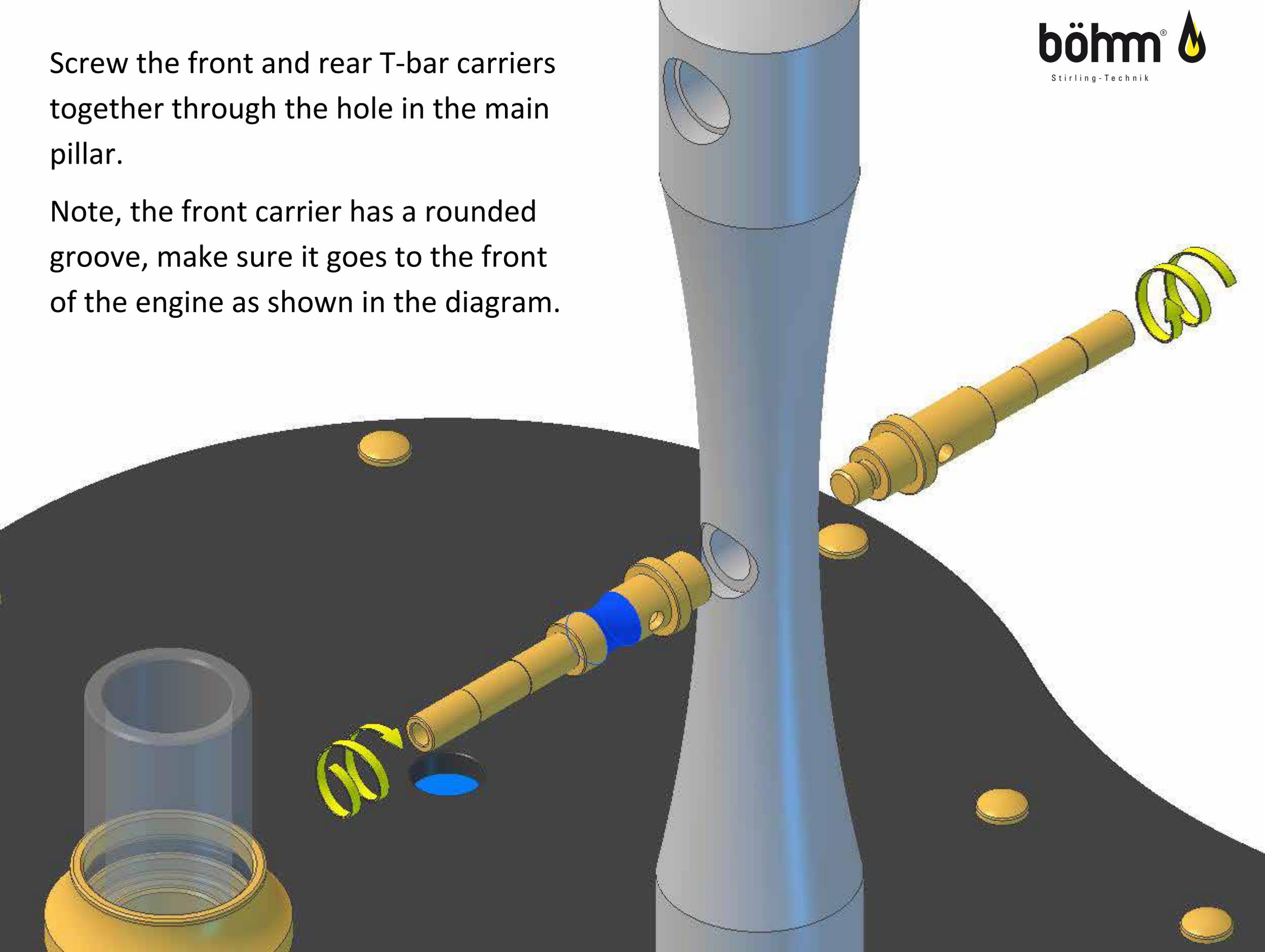


Screw the cylinders into the top plate and fully tighten, you might need to wrap an elastic band around them for grip. Make sure that the O rings do not become pinched or fall out of their grooves. If you have trouble with the O rings falling out you can turn the engine upside down and screw the cylinders in from underneath.



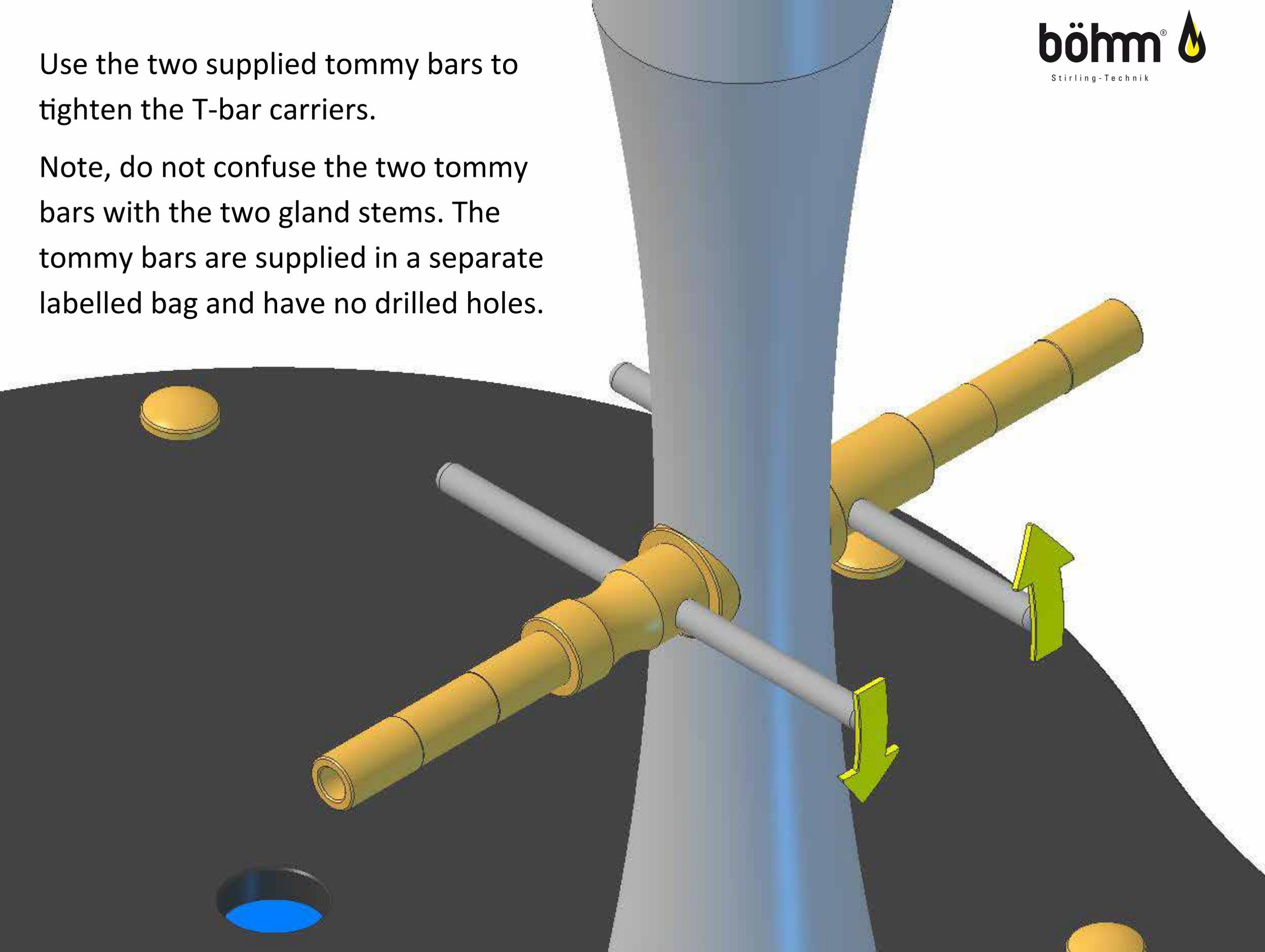
Screw the front and rear T-bar carriers together through the hole in the main pillar.

Note, the front carrier has a rounded groove, make sure it goes to the front of the engine as shown in the diagram.

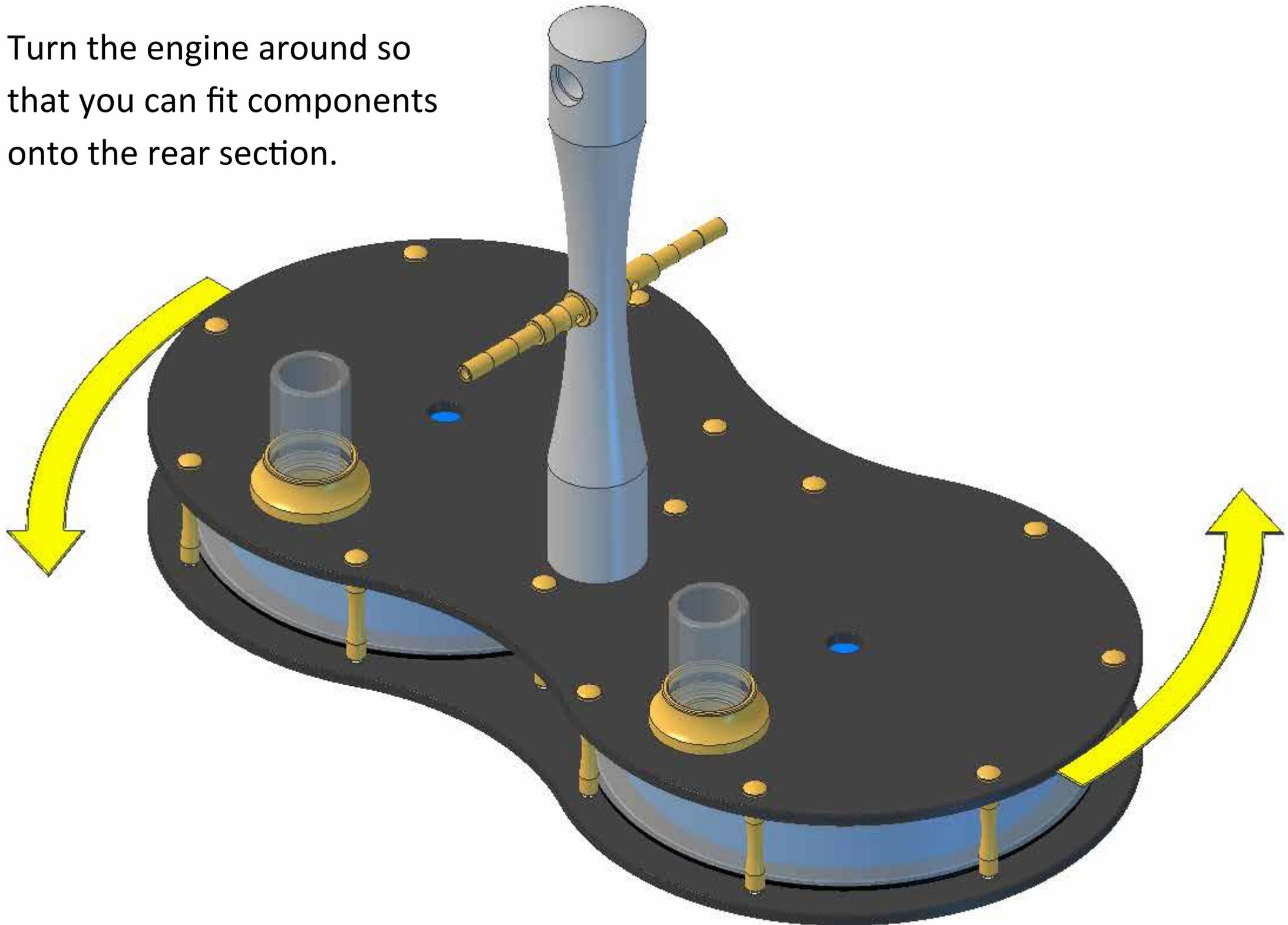


Use the two supplied tommy bars to tighten the T-bar carriers.

Note, do not confuse the two tommy bars with the two gland stems. The tommy bars are supplied in a separate labelled bag and have no drilled holes.



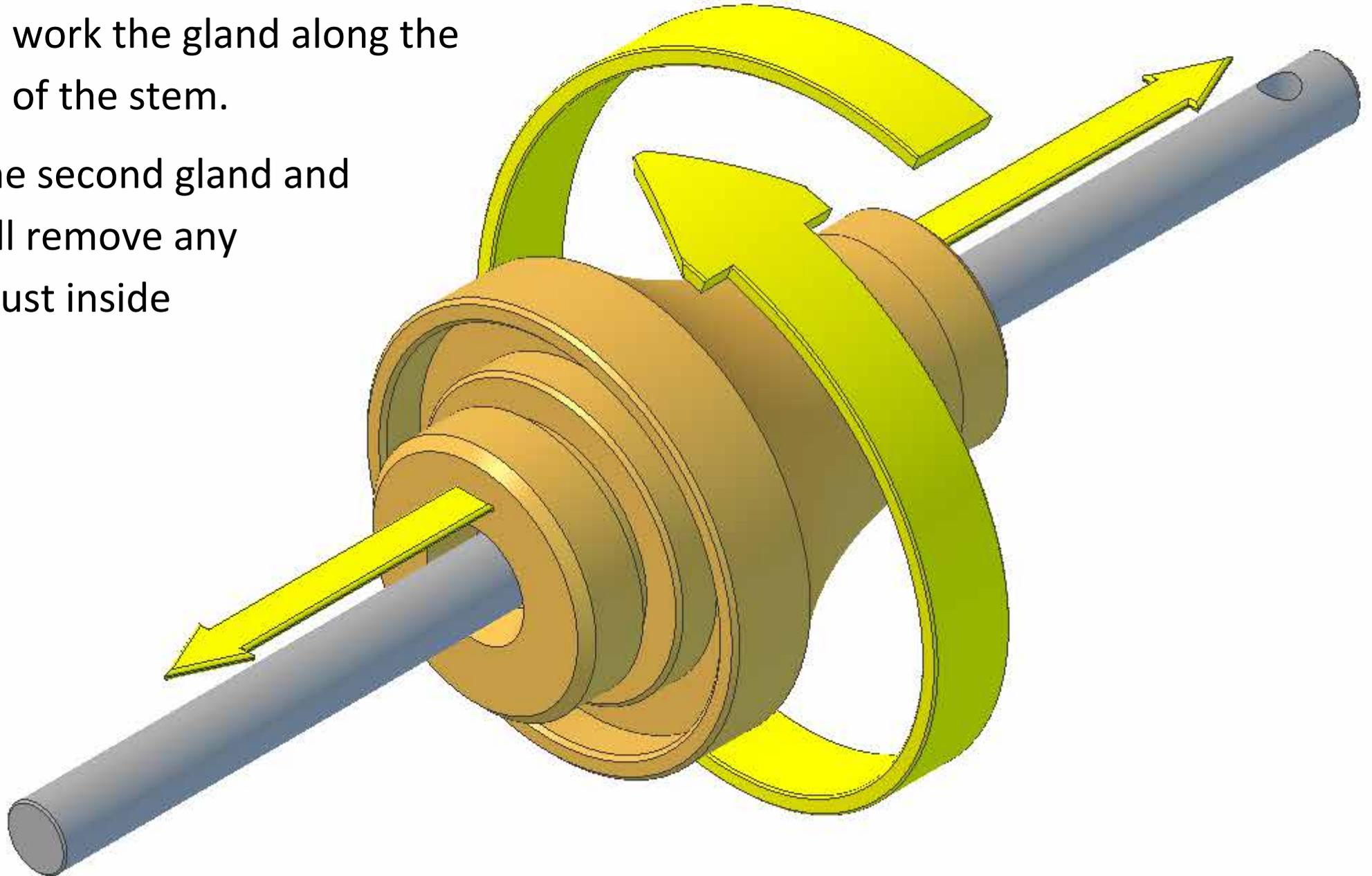
Turn the engine around so that you can fit components onto the rear section.



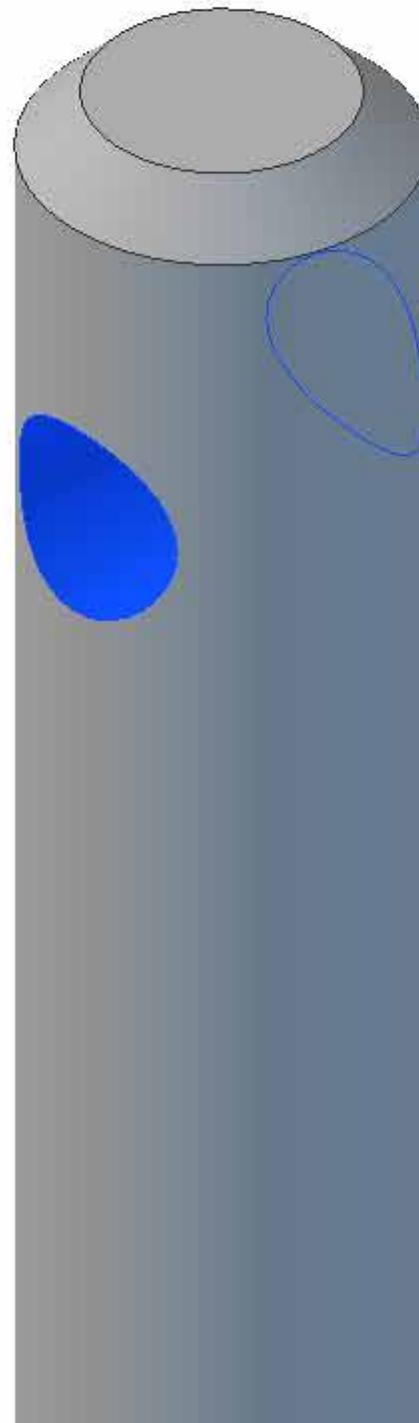
Slide a gland onto a gland stem, hold the stem between the thumb and forefinger of your left hand and roll the gland along the side of your right hand forefinger.

As you roll it, work the gland along the whole length of the stem.

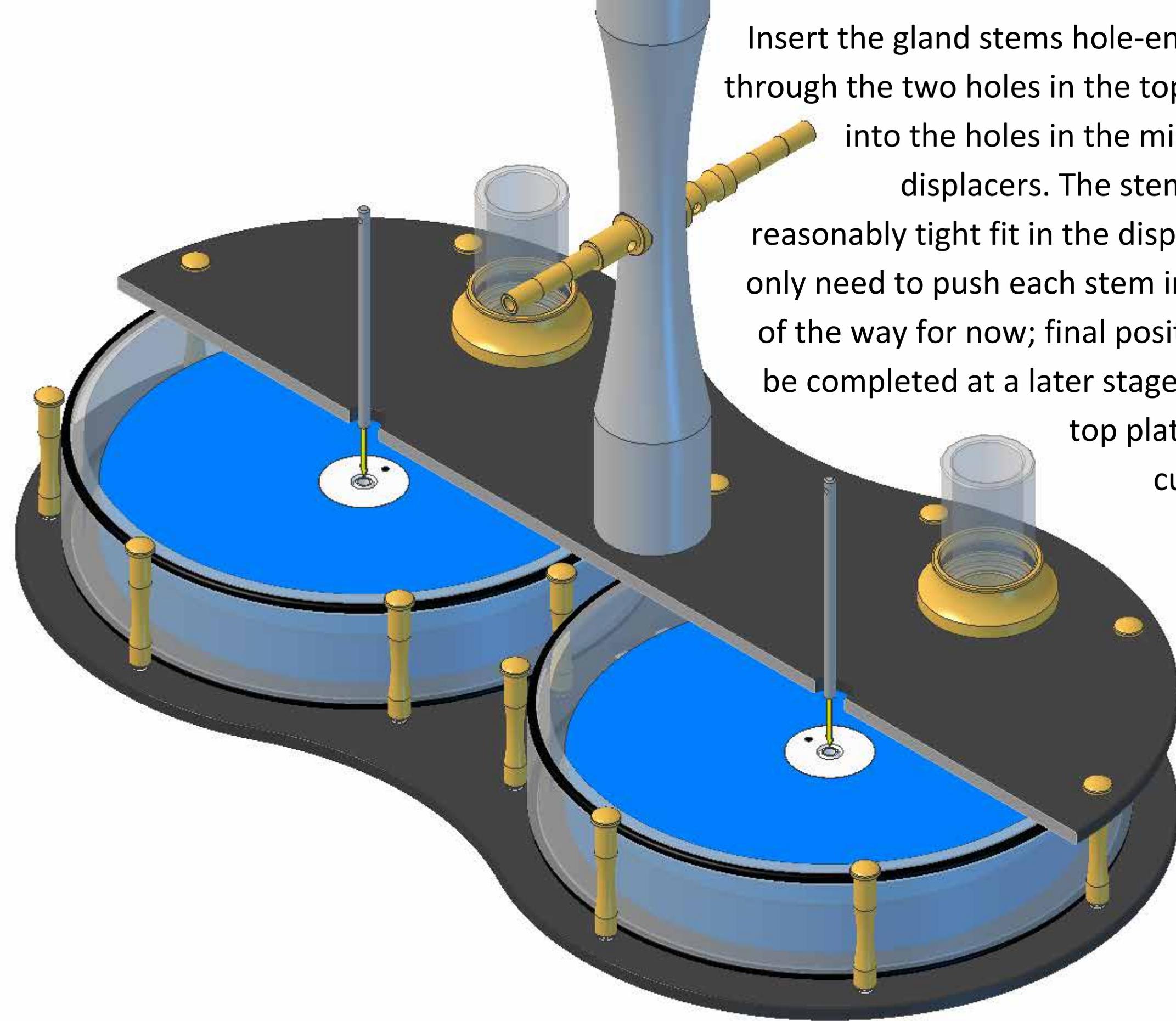
Repeat for the second gland and stem, this will remove any particles of dust inside the glands.



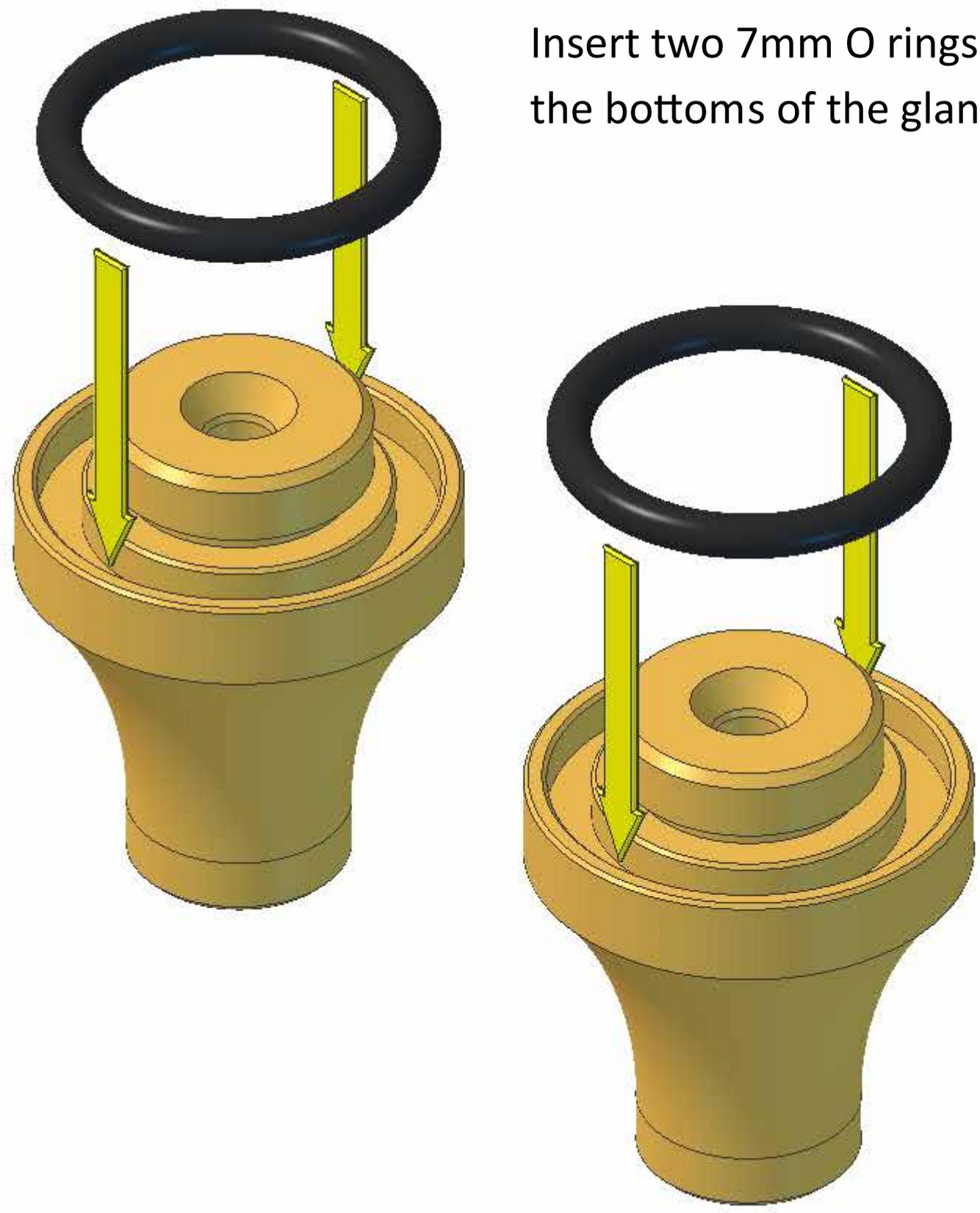
Wipe the gland stems with a clean cloth or paper towel to remove any dust and fingerprints. One end of each stem is plain and the other has a small through it. The hole-ends should point upwards in the next assembly stage.



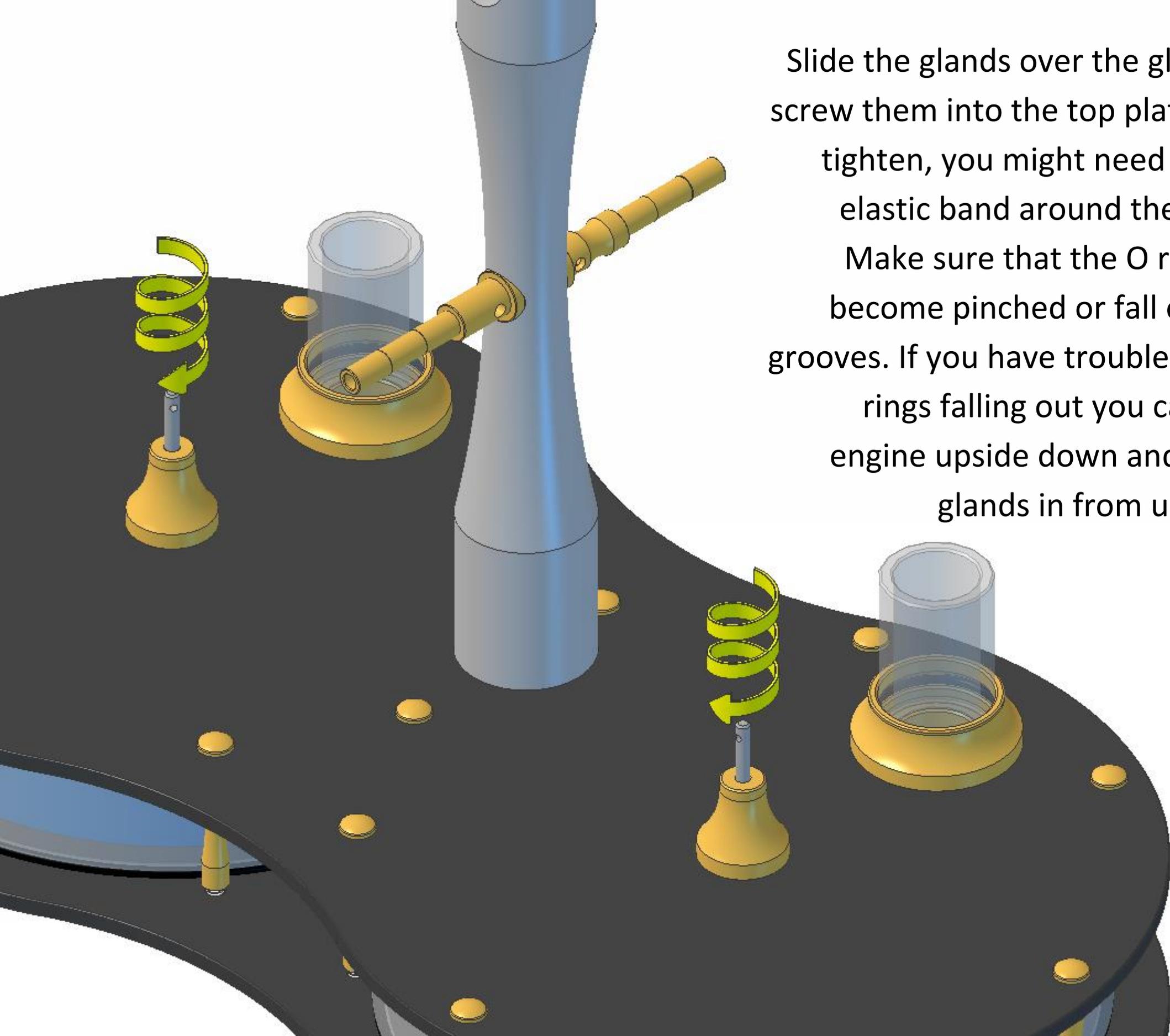
Insert the gland stems hole-end upwards through the two holes in the top plate and into the holes in the middle of the displacers. The stems will be a reasonably tight fit in the displacers. You only need to push each stem in a quarter of the way for now; final positioning will be completed at a later stage. Note, the top plate is shown cut away for clarity.



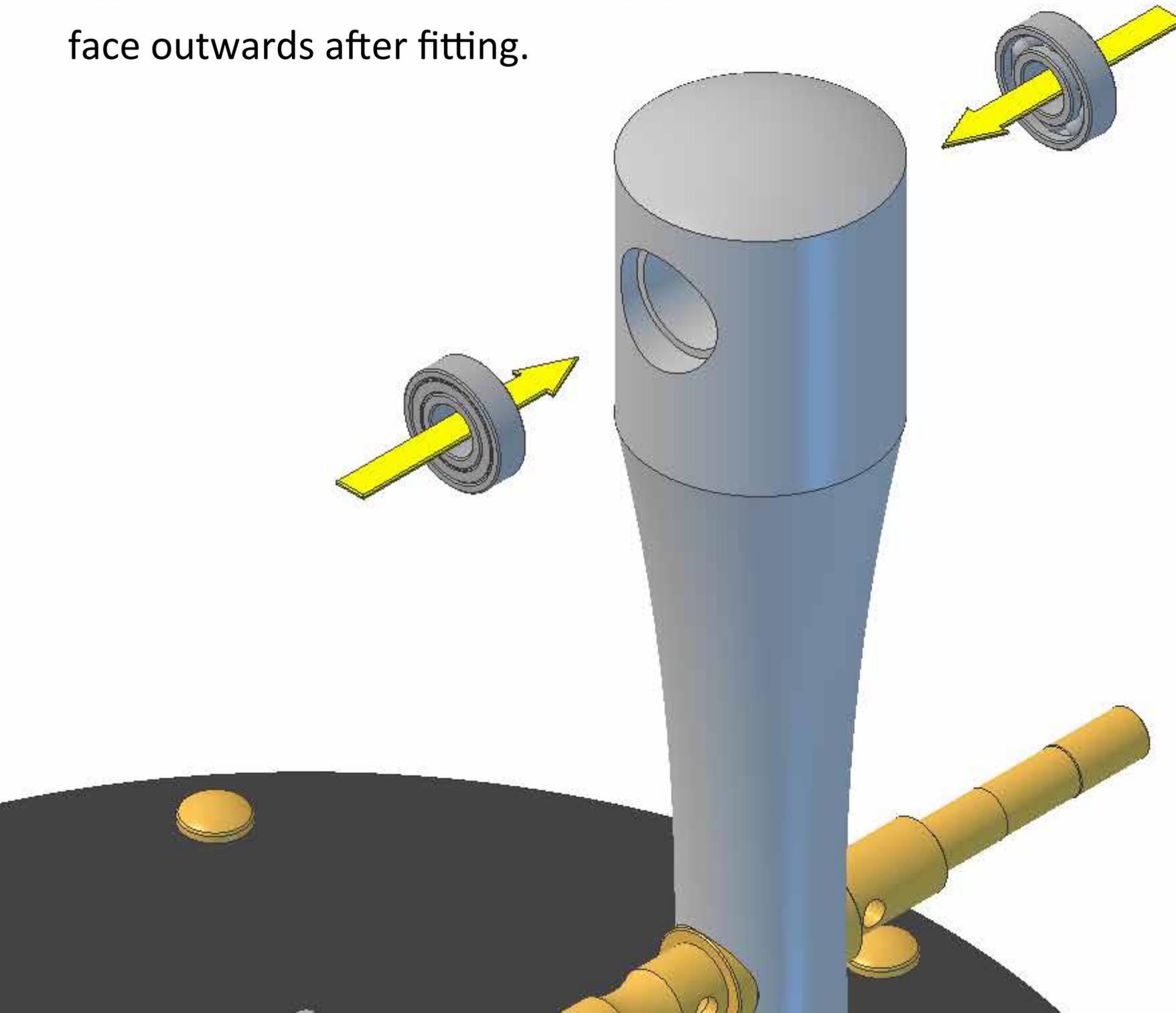
Insert two 7mm O rings into the grooves in the bottoms of the glands.



Slide the glands over the gland stems, screw them into the top plate and fully tighten, you might need to wrap an elastic band around them for grip. Make sure that the O rings do not become pinched or fall out of their grooves. If you have trouble with the O rings falling out you can turn the engine upside down and screw the glands in from underneath.



Fit two ball-race bearings into the recesses in the top of the main pillar. The bearings have a dust shield on one side and are open on the other. The shielded sides should face outwards after fitting.

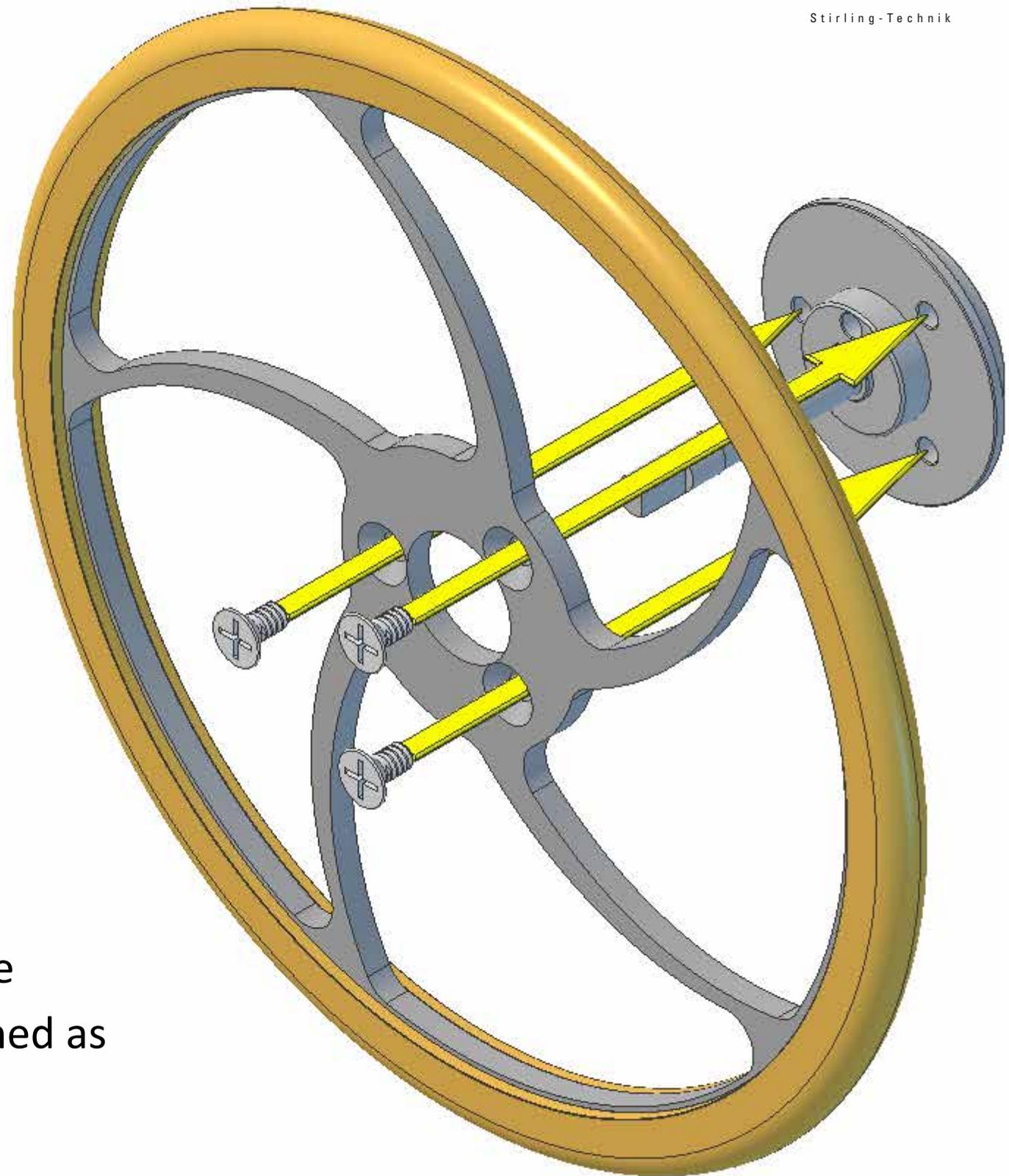


Insert the hub/axle into the flywheel and fit the three M2x4mm countersunk screws, aligning the spokes as shown.

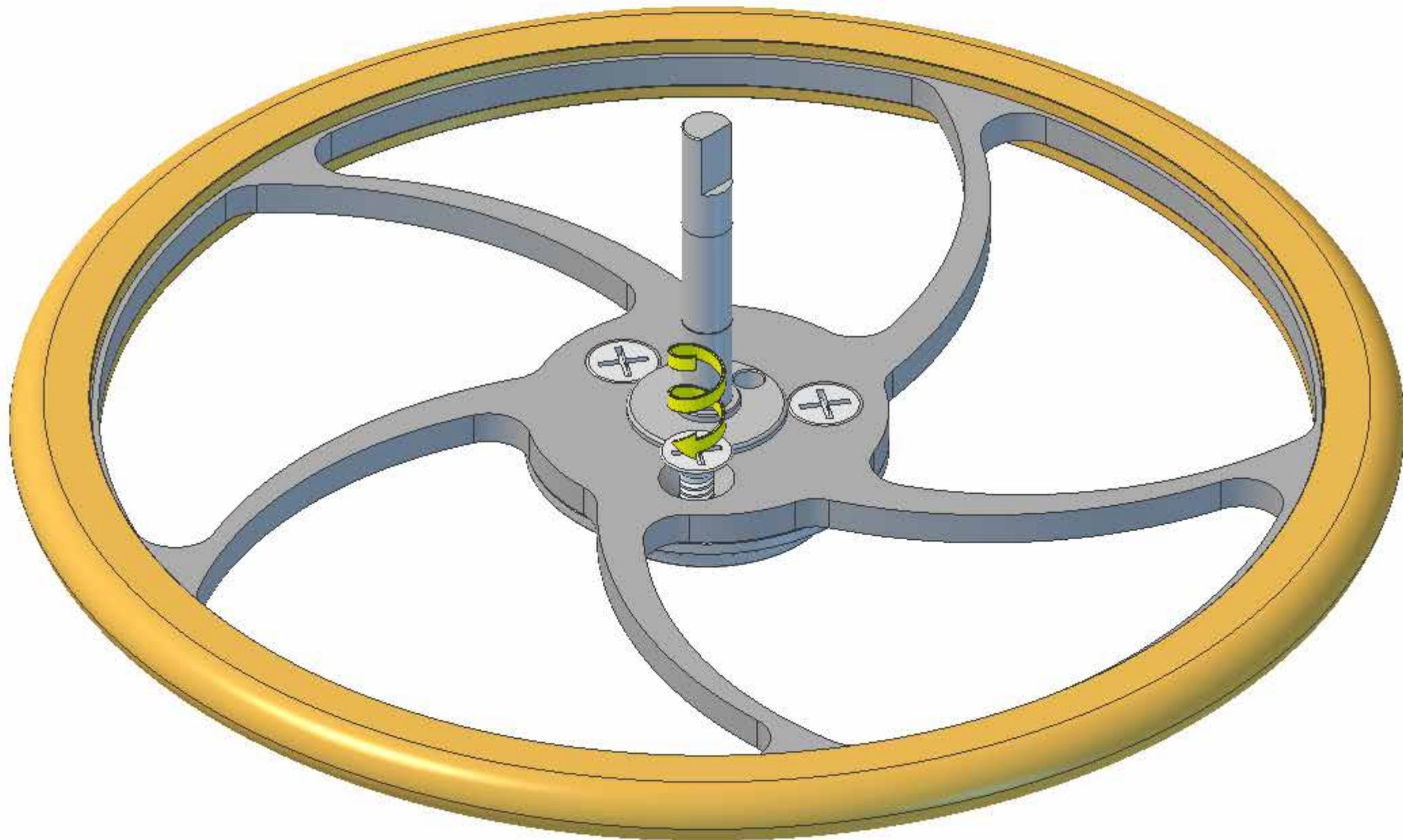
The three holes in the flywheel and hub are spaced so that there is only one way that they will all line up together.

This ensures the flywheel counterweight is in the correct position.

Note, the three holes in the flywheel are countersunk on one side; this side should be positioned as shown in the diagram.

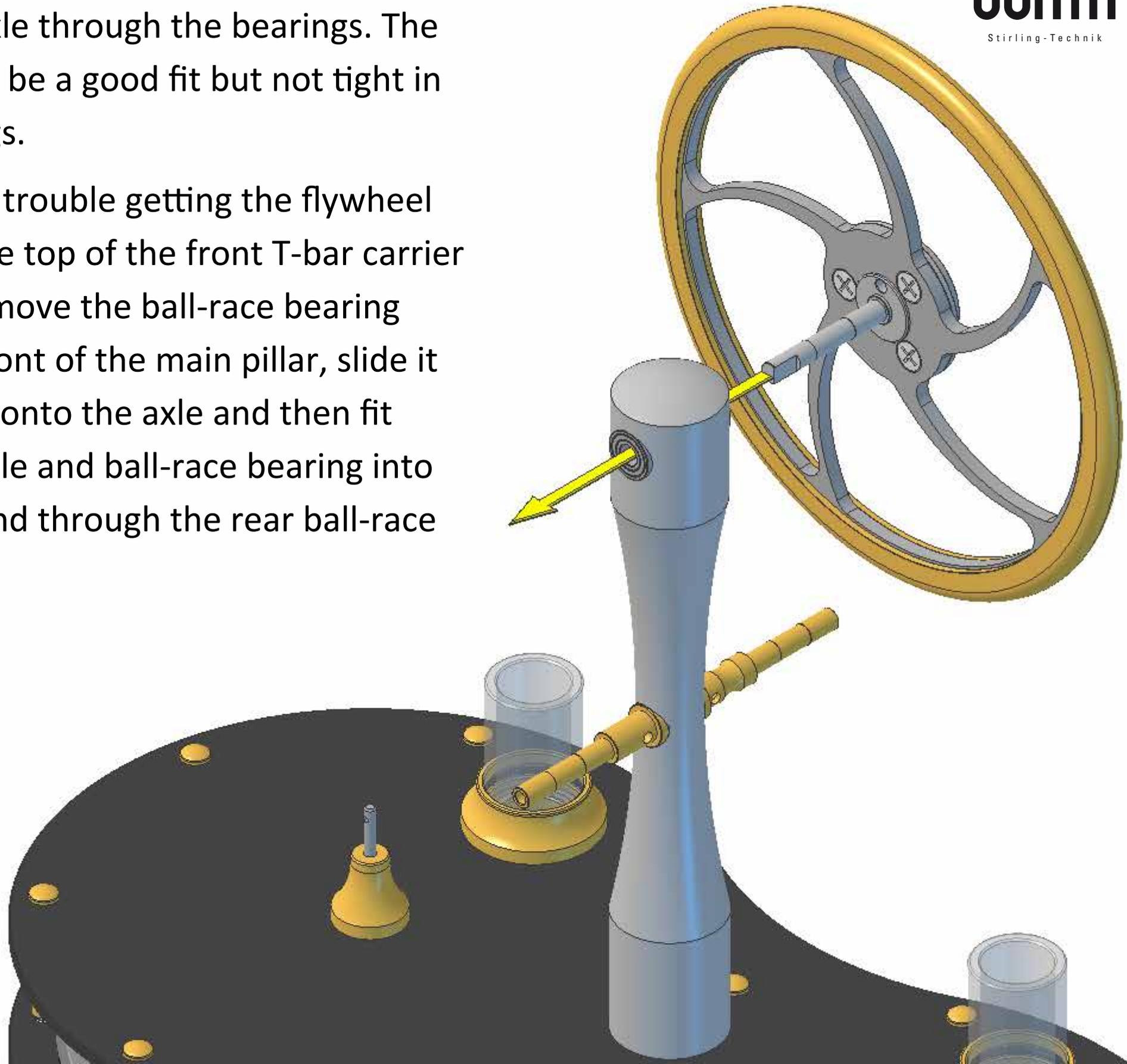


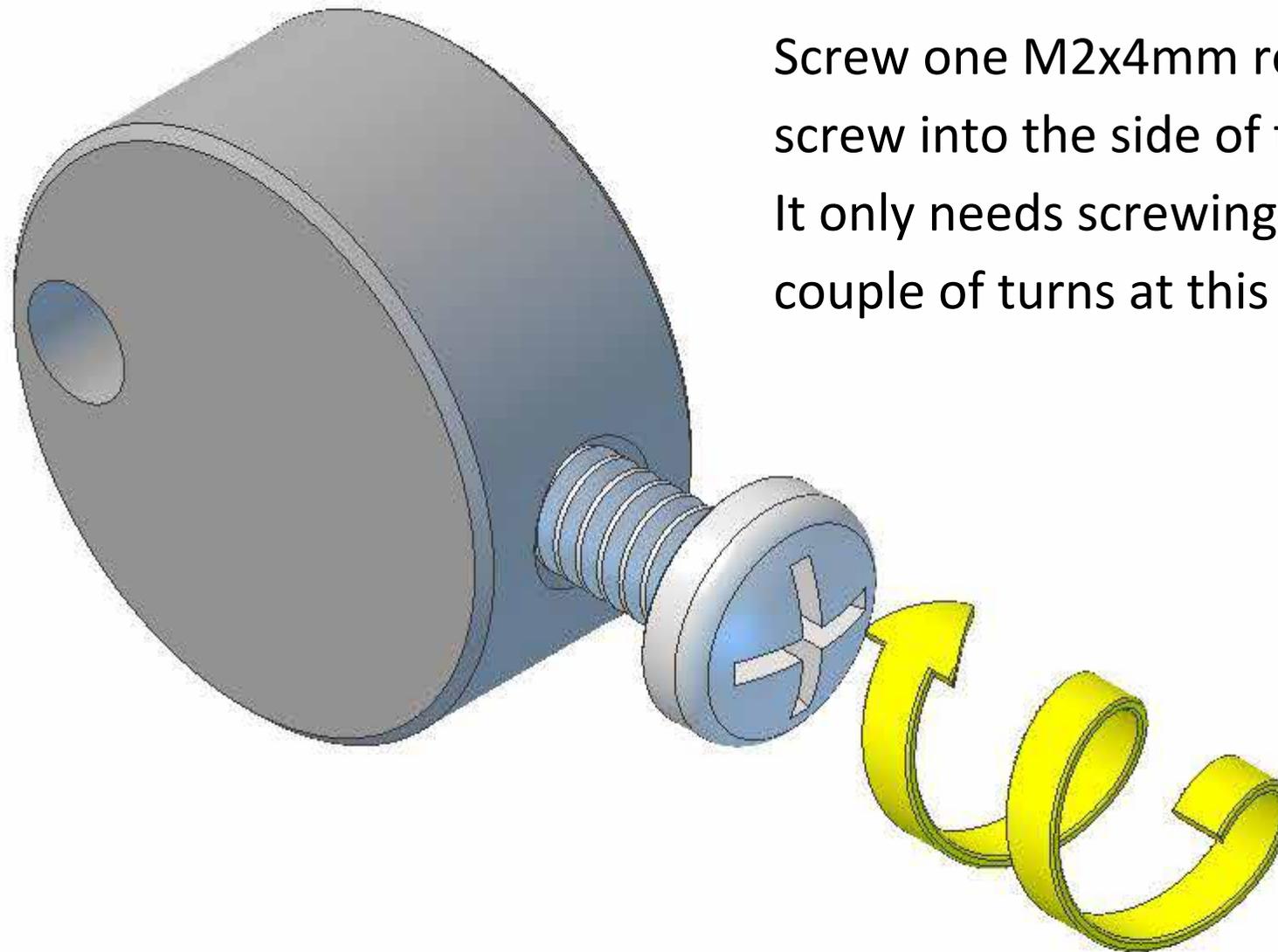
Screw the three screws in until they all lightly touch the flywheel, then fully tighten.



Slide the axle through the bearings. The axle should be a good fit but not tight in the bearings.

If you have trouble getting the flywheel rim over the top of the front T-bar carrier you can remove the ball-race bearing from the front of the main pillar, slide it all the way onto the axle and then fit both the axle and ball-race bearing into the pillar and through the rear ball-race bearing.

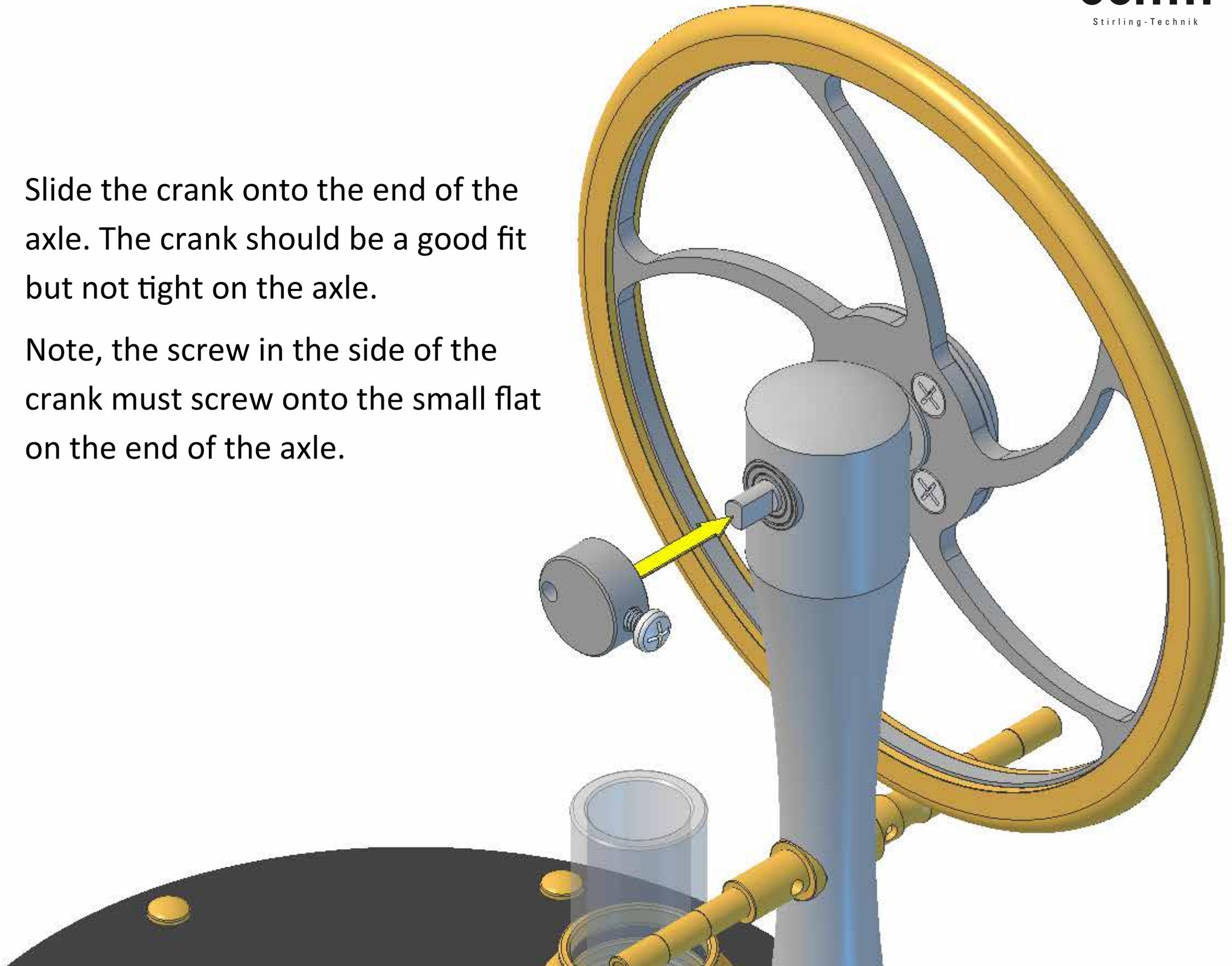




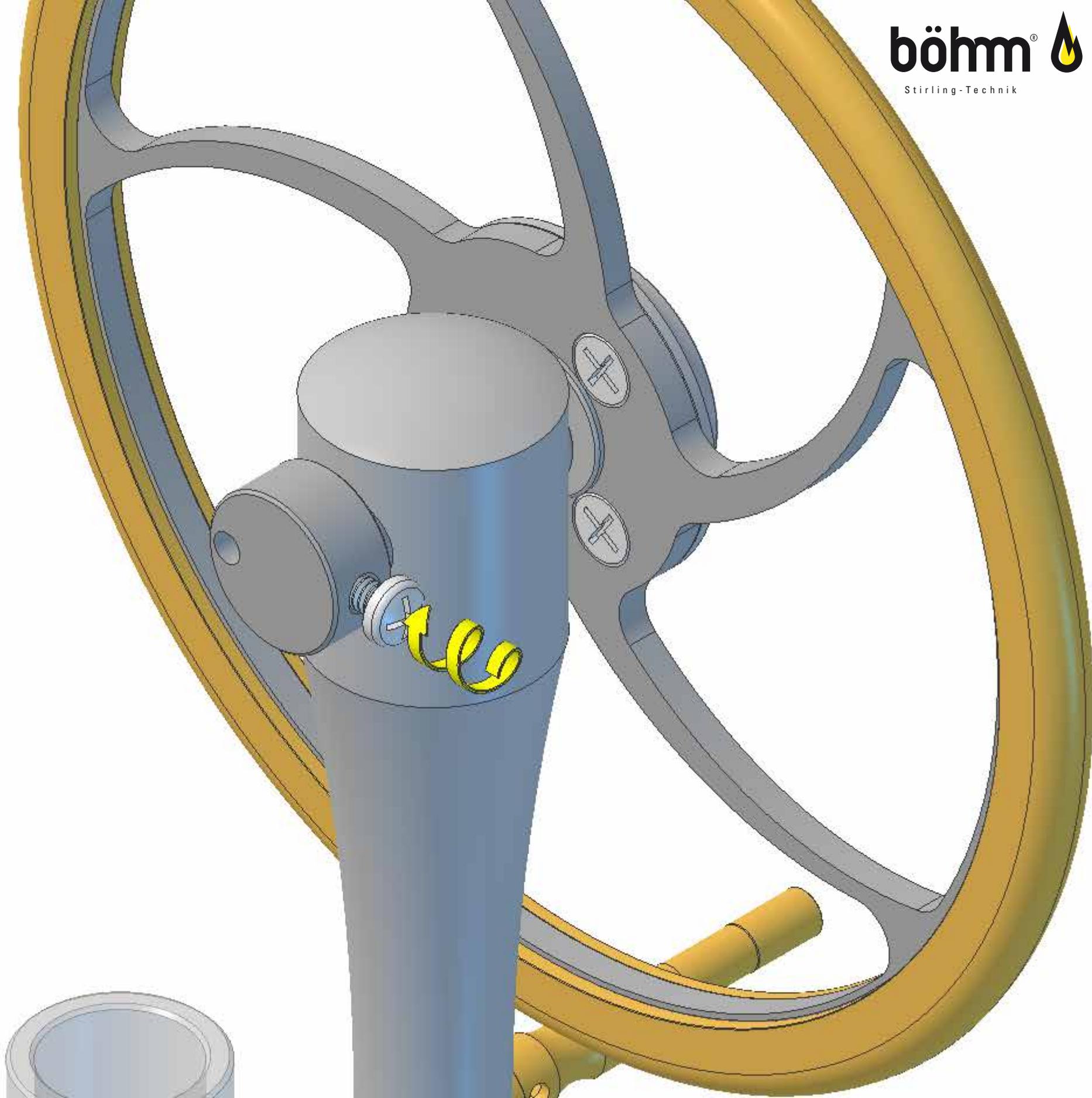
Screw one M2x4mm roundhead screw into the side of the crank. It only needs screwing in a couple of turns at this stage.

Slide the crank onto the end of the axle. The crank should be a good fit but not tight on the axle.

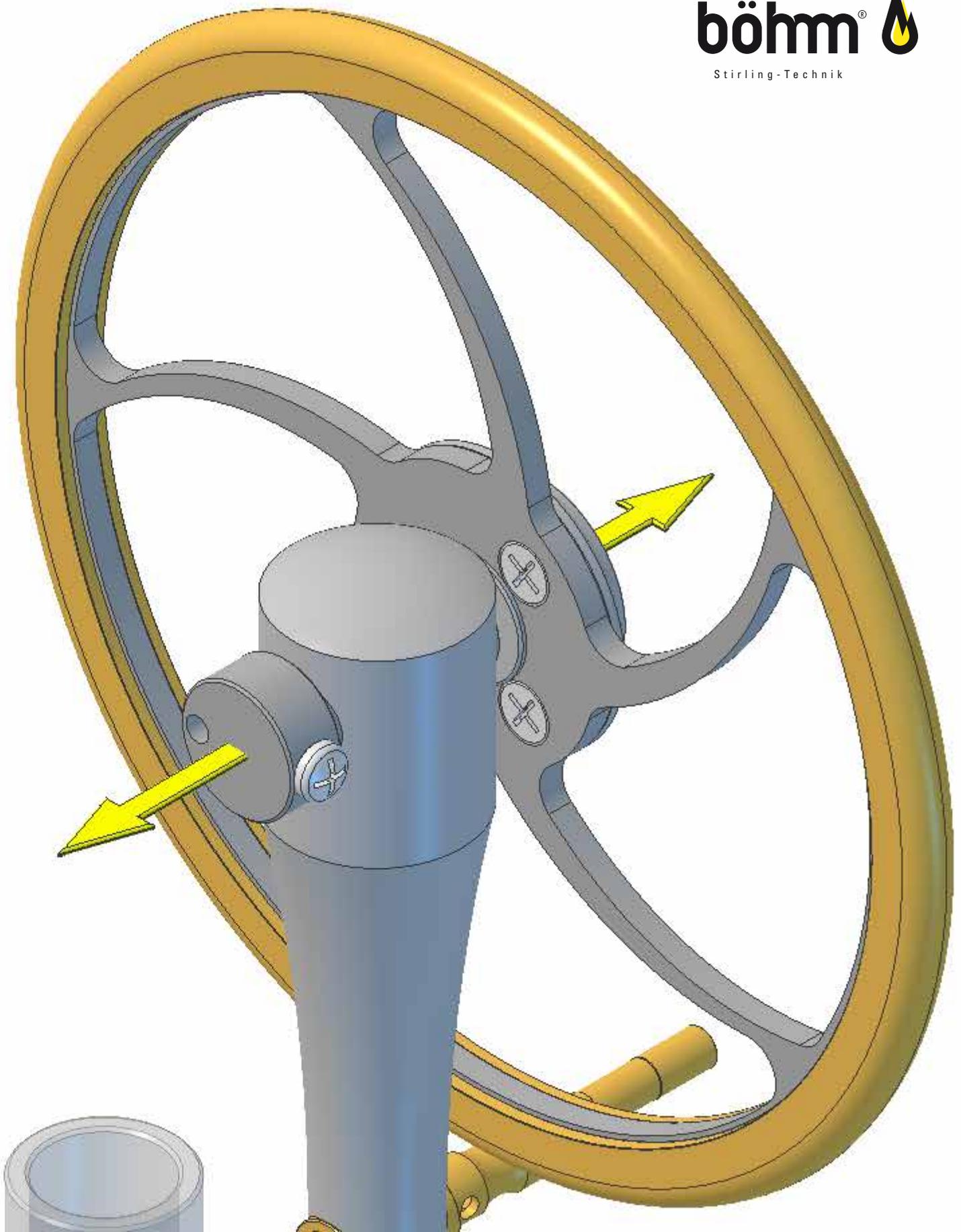
Note, the screw in the side of the crank must screw onto the small flat on the end of the axle.



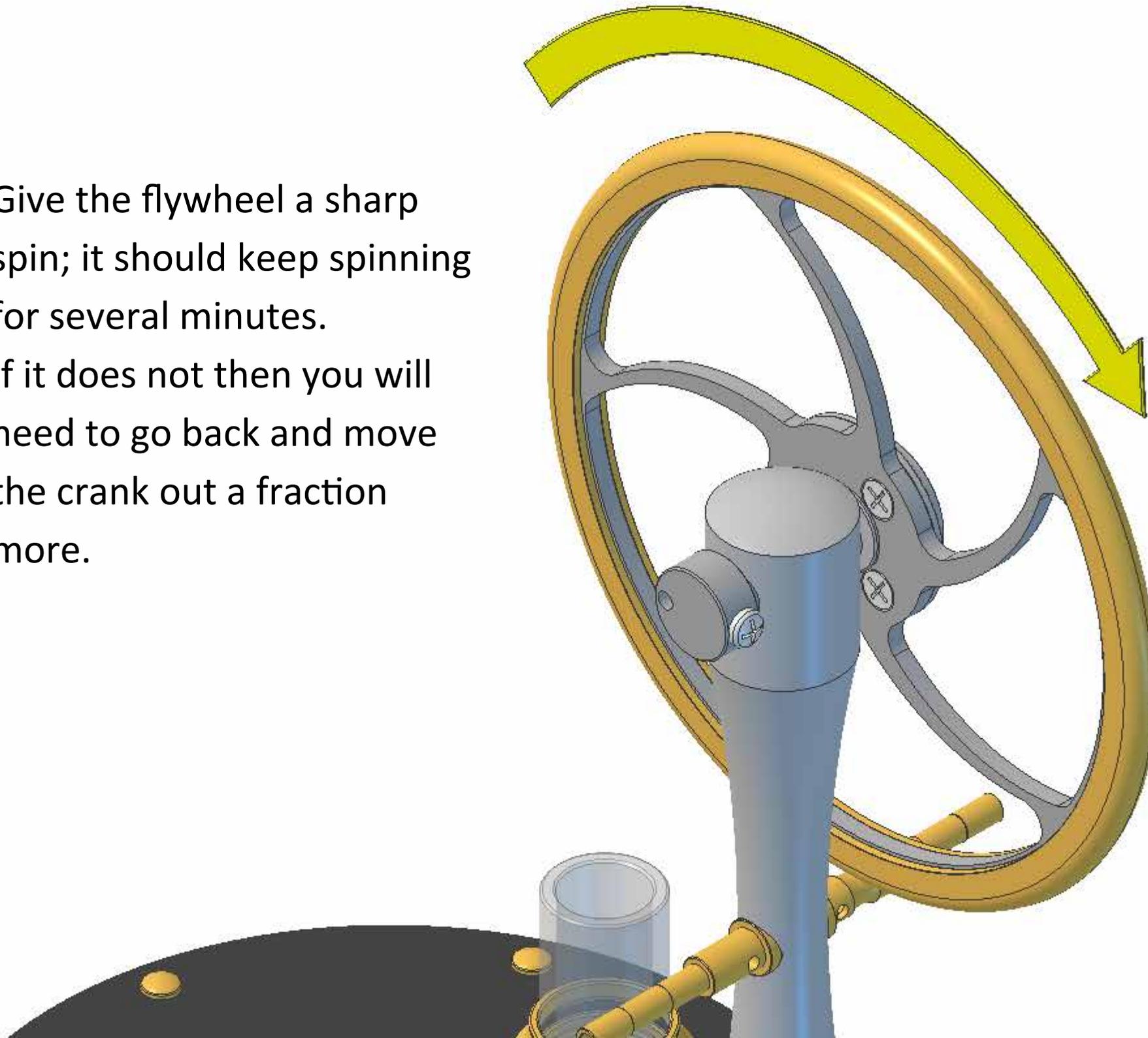
Make sure the
crank screw is
square on the axle
flat, then fully
tighten.



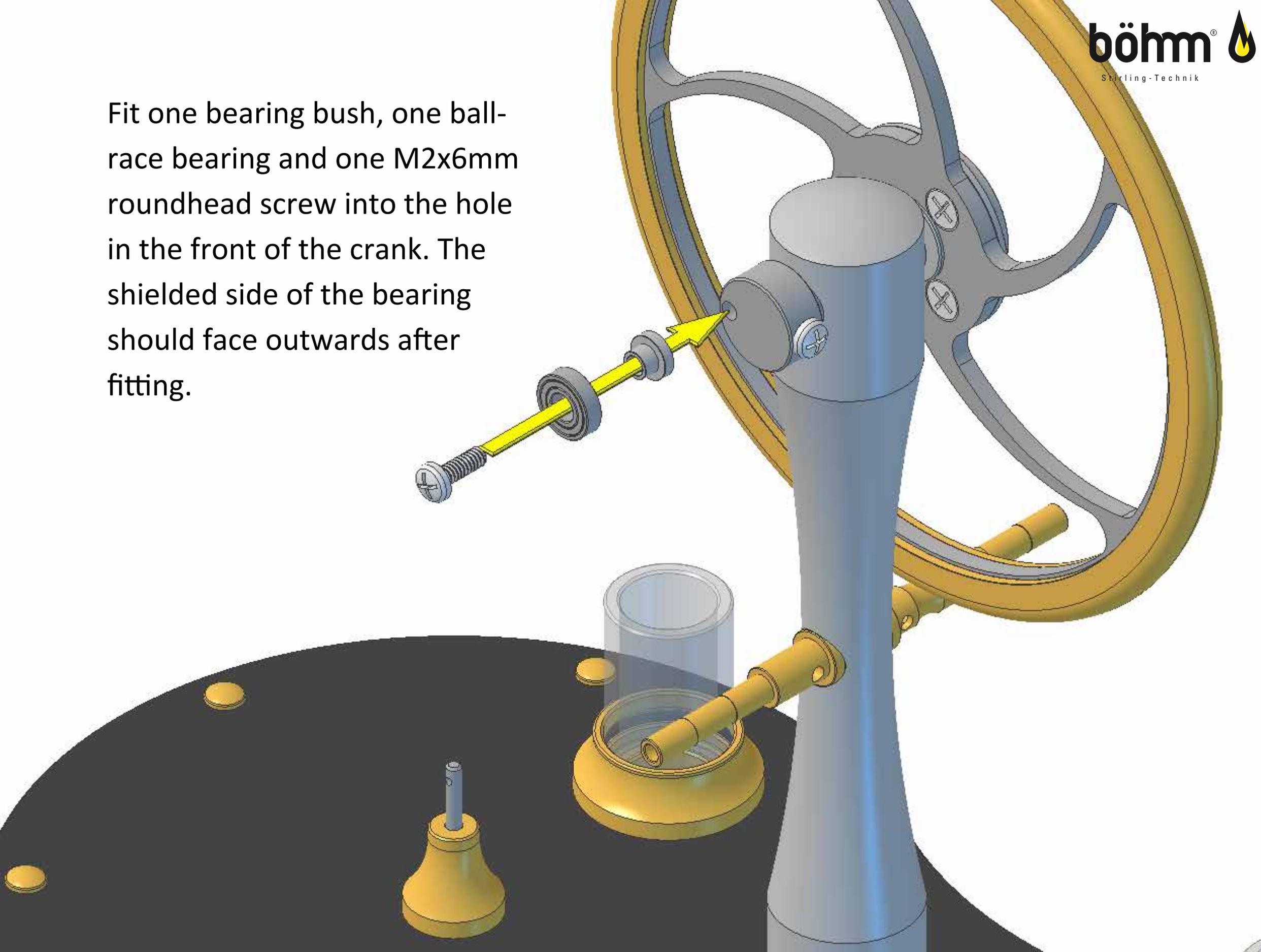
Gently push the flywheel back and forward, there should be a small amount of movement here. If there is not, slacken the crank screw, move the crank out a fraction and tighten. Make sure that when tightening the crank screw again it stays located on the small flat section on the axle.



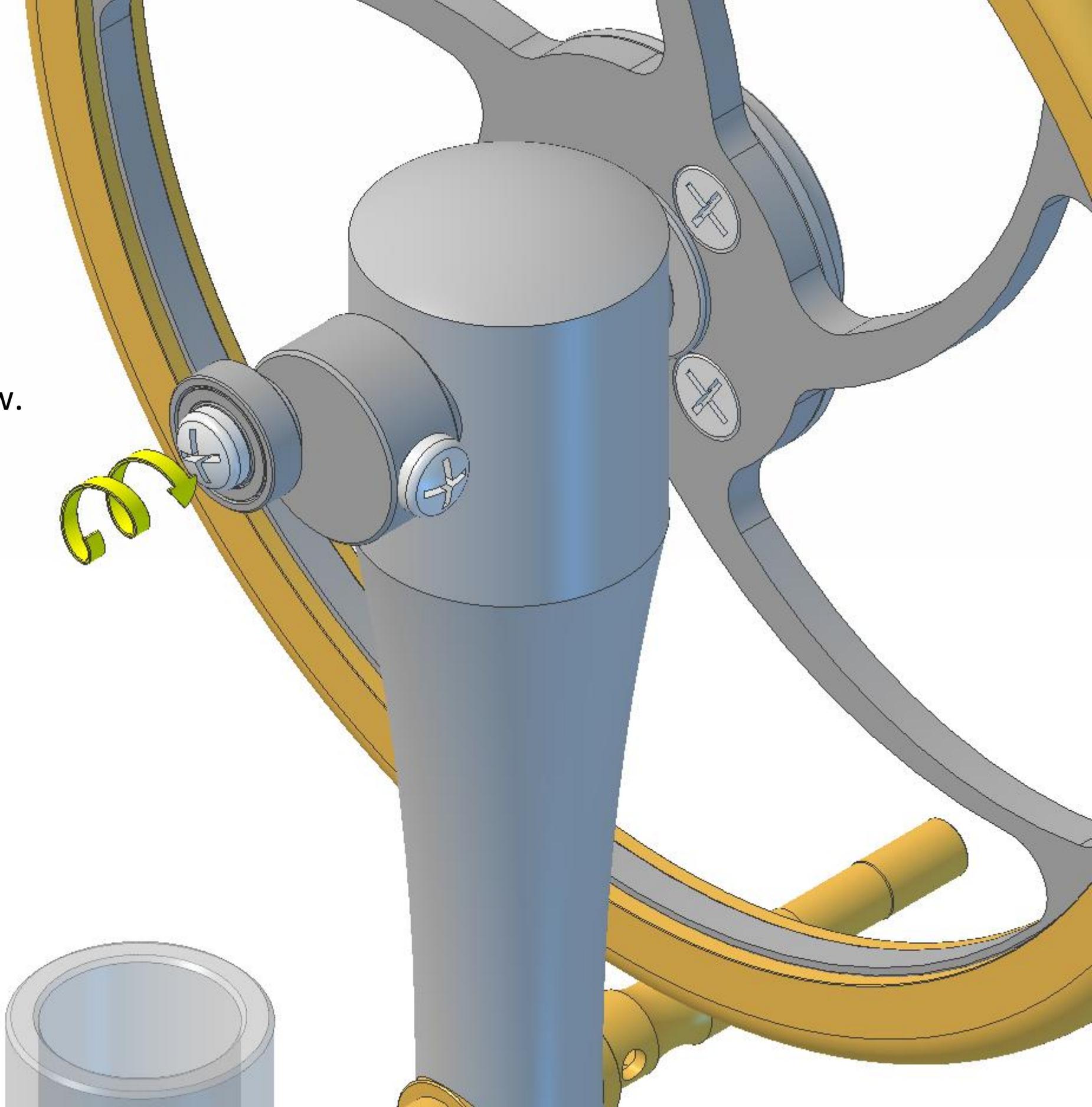
Give the flywheel a sharp spin; it should keep spinning for several minutes. If it does not then you will need to go back and move the crank out a fraction more.



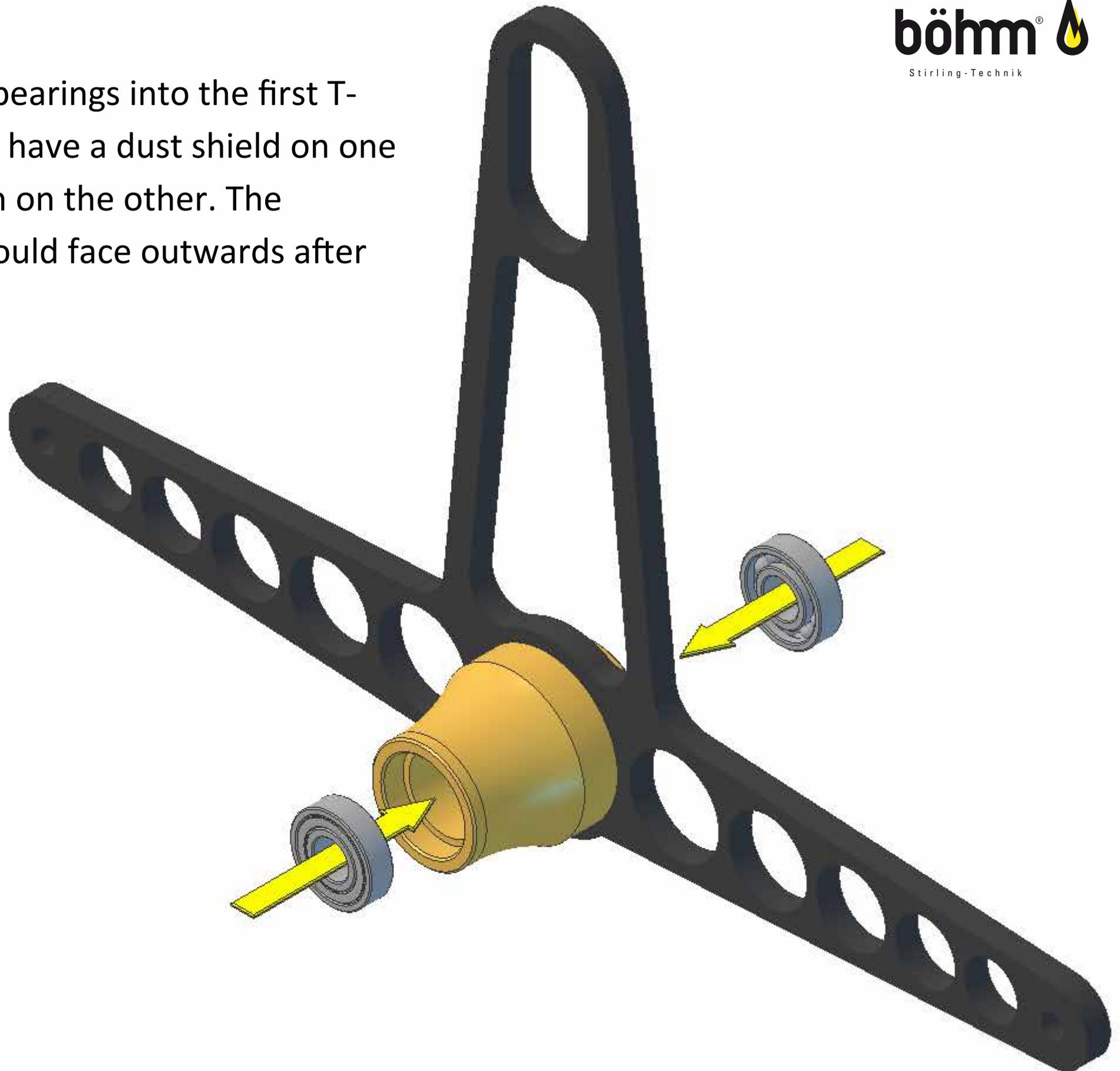
Fit one bearing bush, one ball-race bearing and one M2x6mm roundhead screw into the hole in the front of the crank. The shielded side of the bearing should face outwards after fitting.



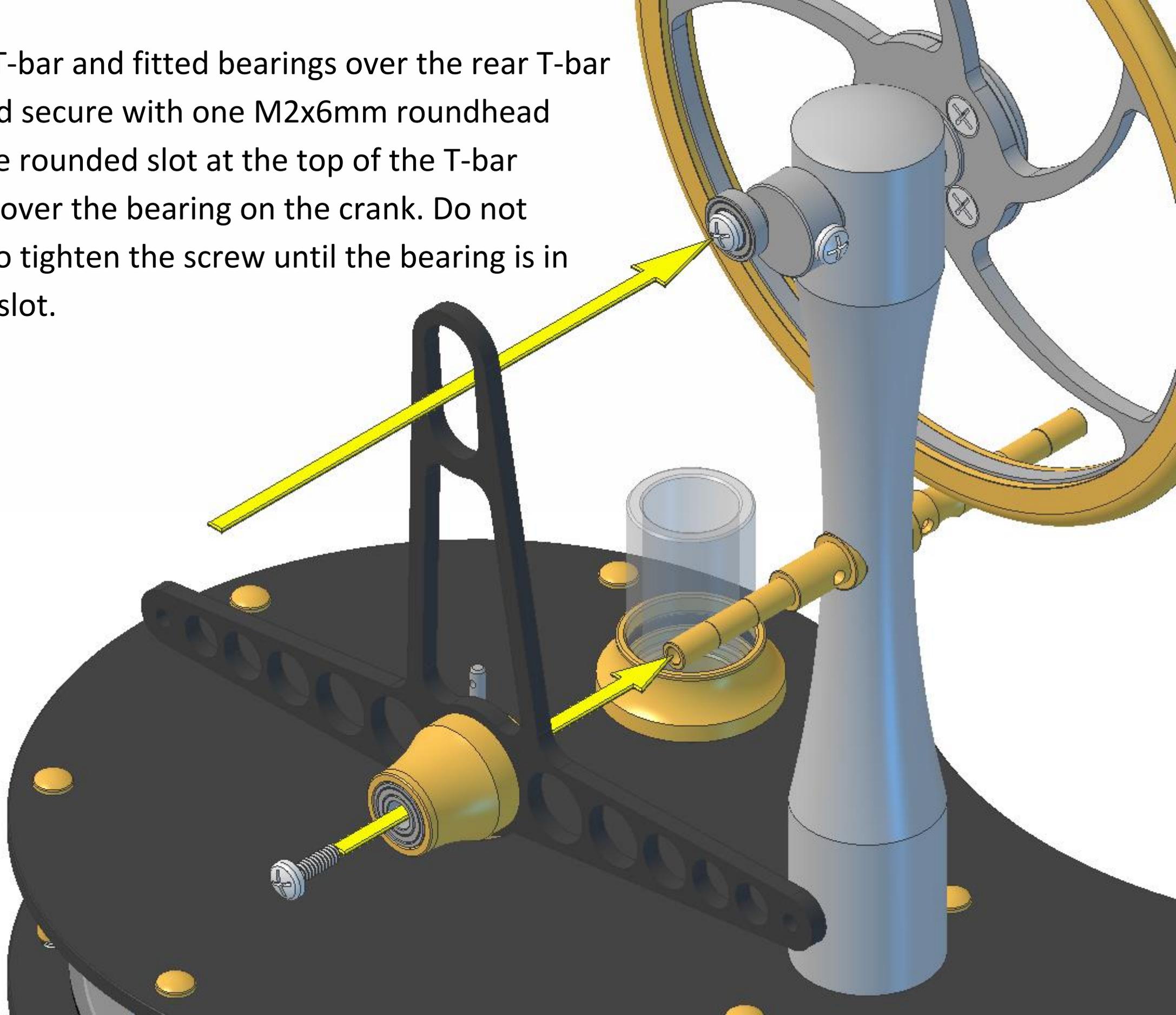
Fully tighten the screw.



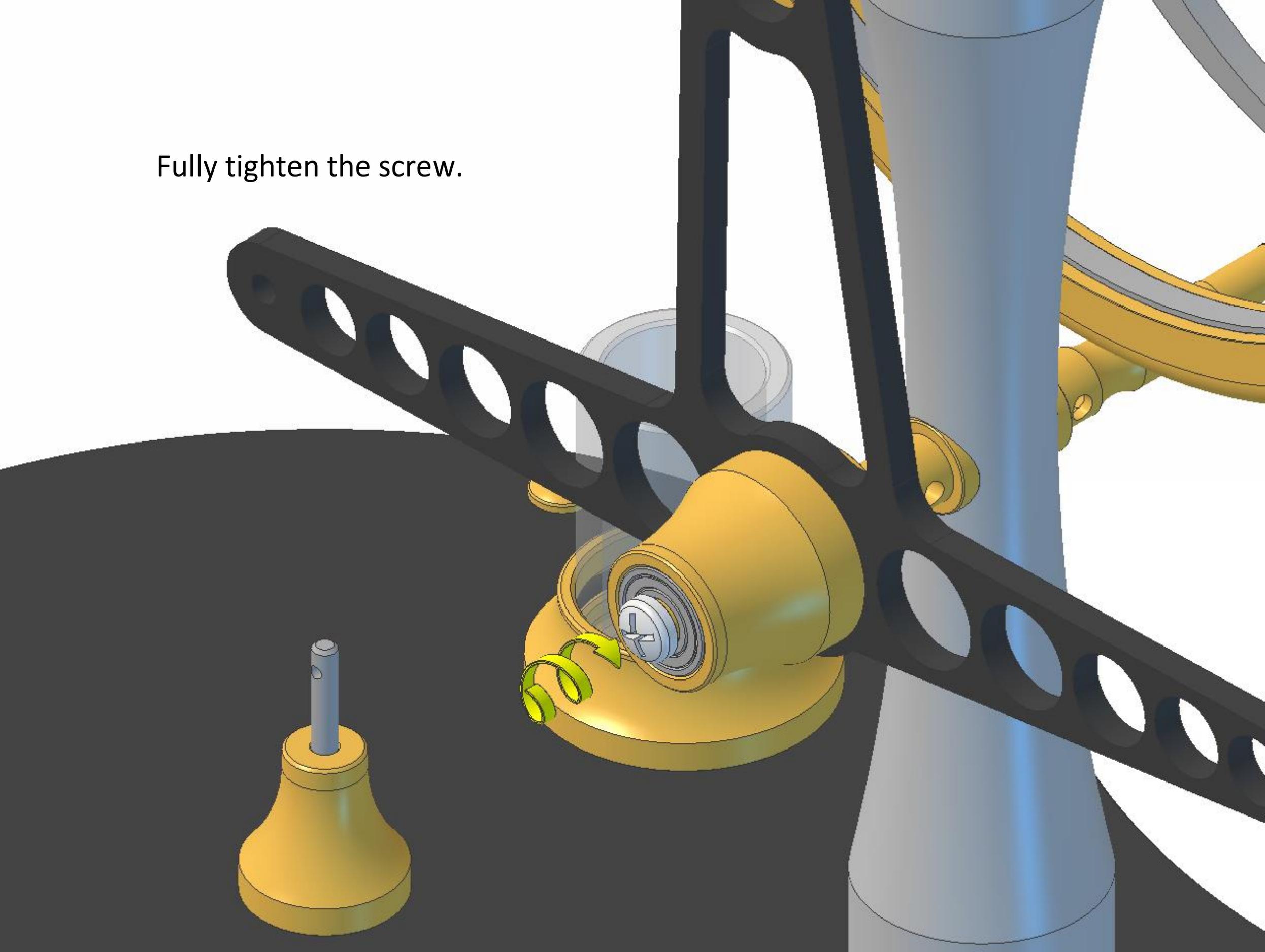
Fit two ball-race bearings into the first T-bar. The bearings have a dust shield on one side and are open on the other. The shielded sides should face outwards after fitting.



Slide the T-bar and fitted bearings over the rear T-bar carrier and secure with one M2x6mm roundhead screw. The rounded slot at the top of the T-bar should fit over the bearing on the crank. Do not attempt to tighten the screw until the bearing is in the T-bar slot.



Fully tighten the screw.



Fit one conrod onto one conrod bush and secure with one M2x6mm roundhead screw. The screw only needs screwing in a couple of turns at this stage. Repeat for the second conrod.

Note, the hooks on the bottoms of the conrods should be aligned as shown in the diagram.

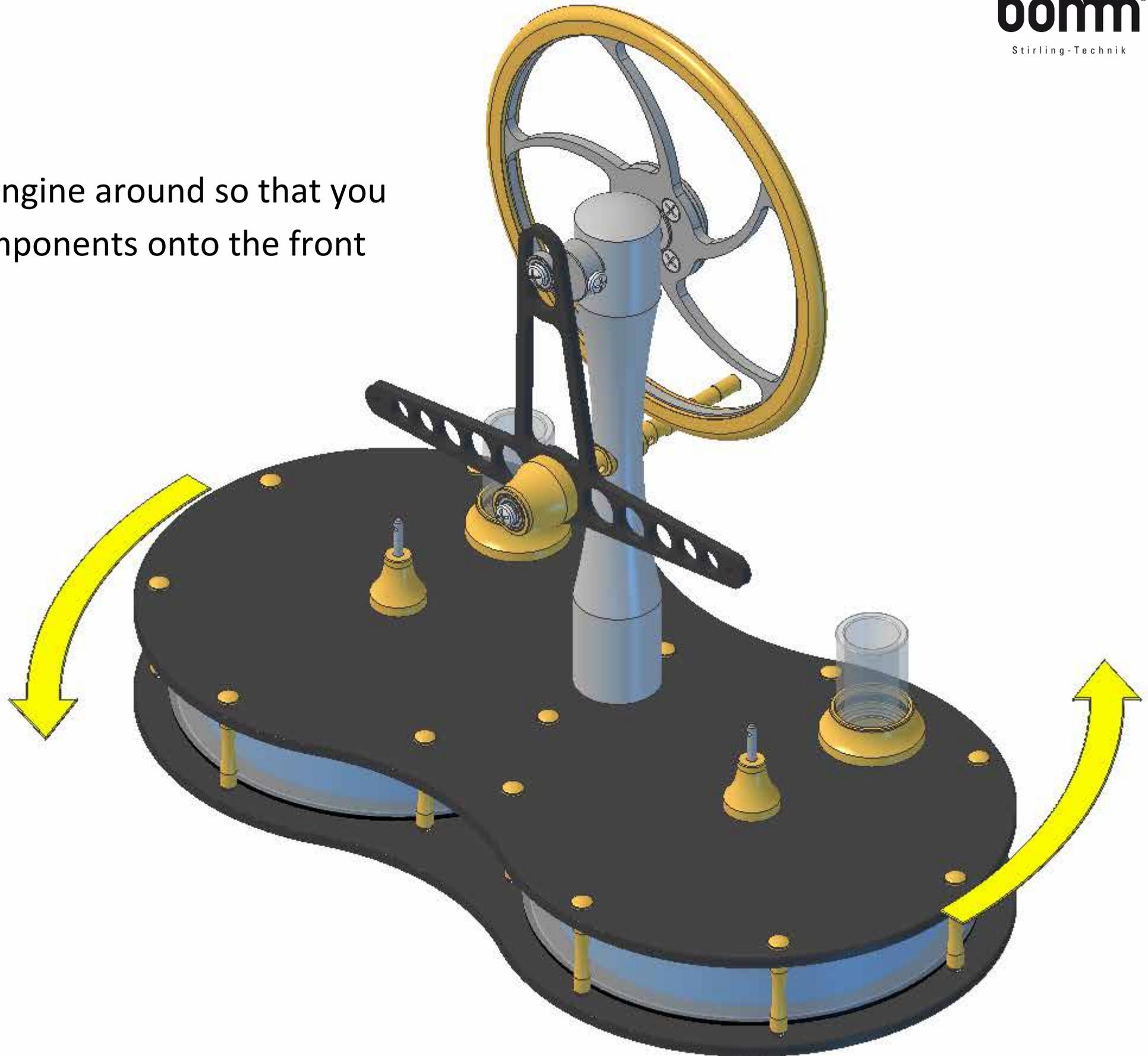


Screw the screws in until they just touch the bushes. Do not over-tighten or you could cause the bushes to expand and pinch the conrod eyes, which could prevent your engine from running.

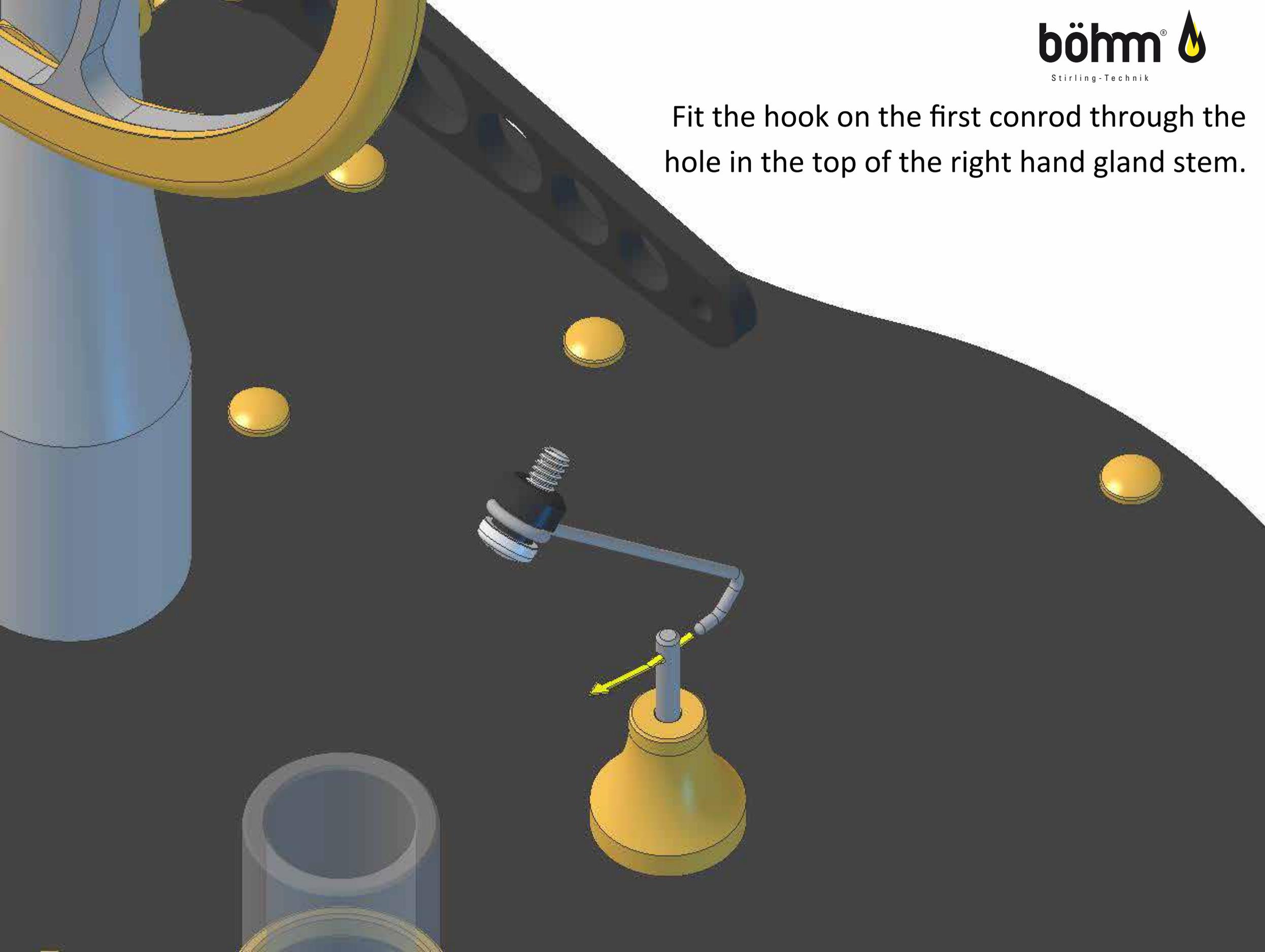


Note: Pre-assembled
from late 2016 onwards.

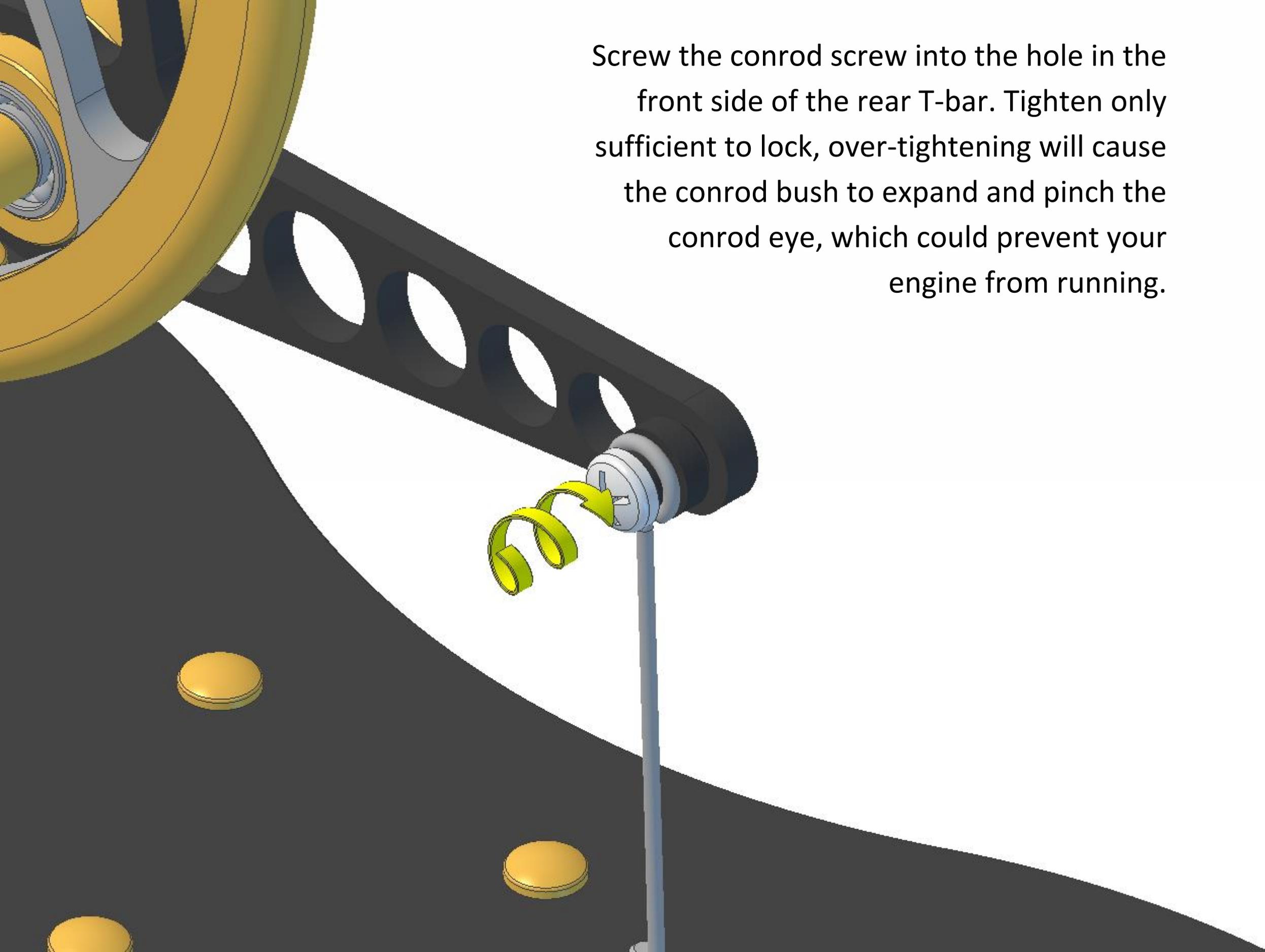
Turn the engine around so that you can fit components onto the front section.

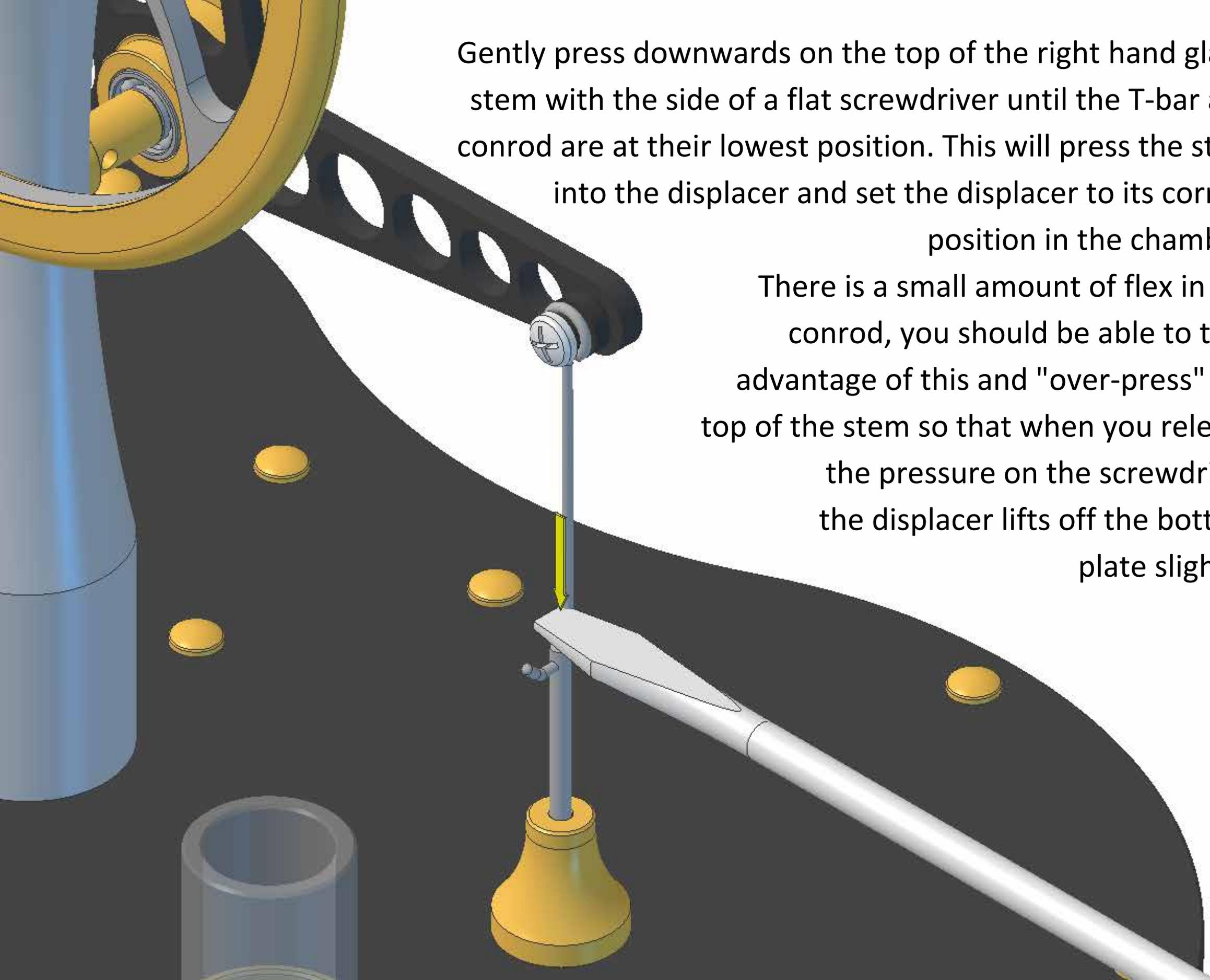


Fit the hook on the first conrod through the hole in the top of the right hand gland stem.



Screw the conrod screw into the hole in the front side of the rear T-bar. Tighten only sufficient to lock, over-tightening will cause the conrod bush to expand and pinch the conrod eye, which could prevent your engine from running.

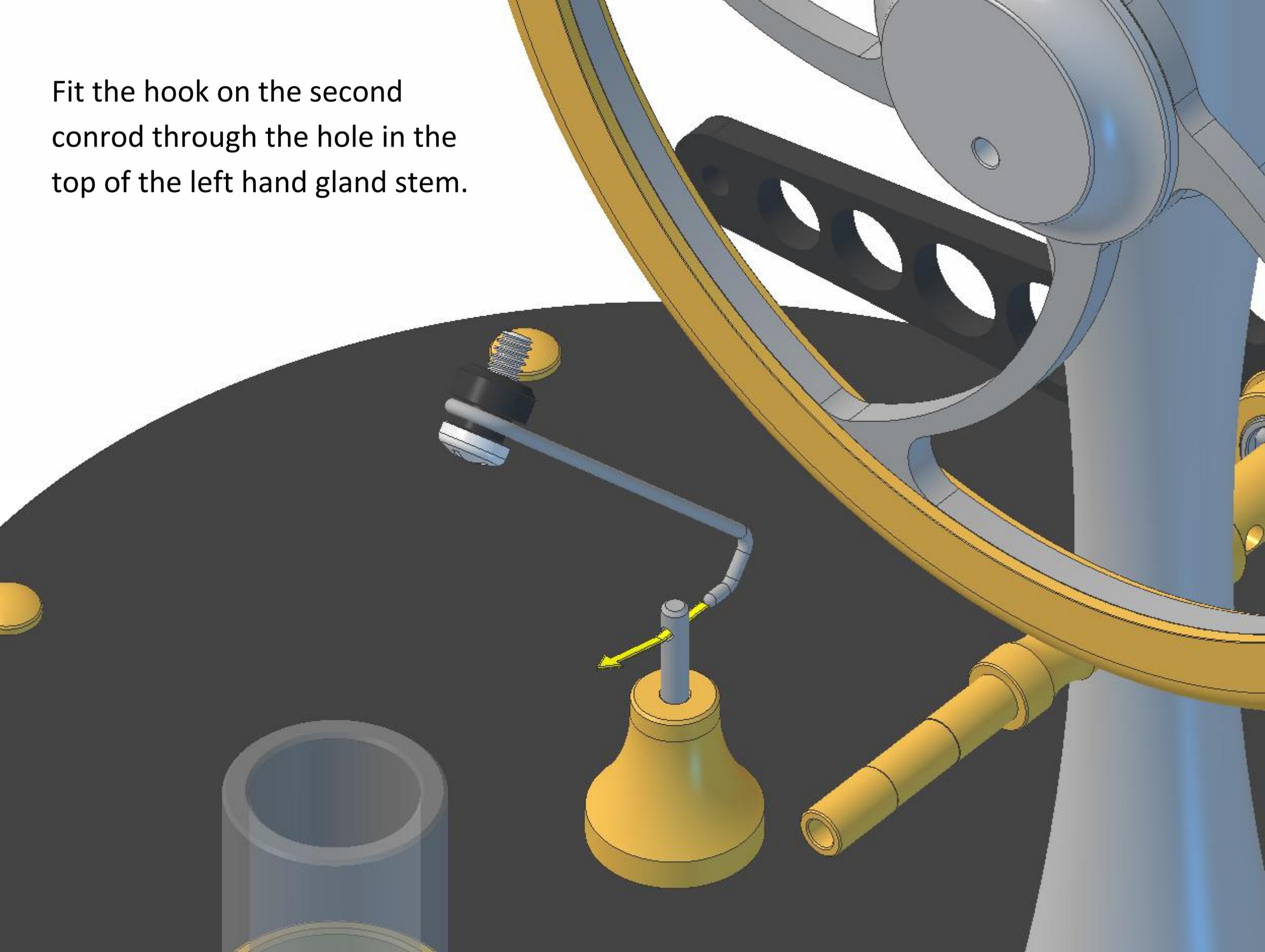




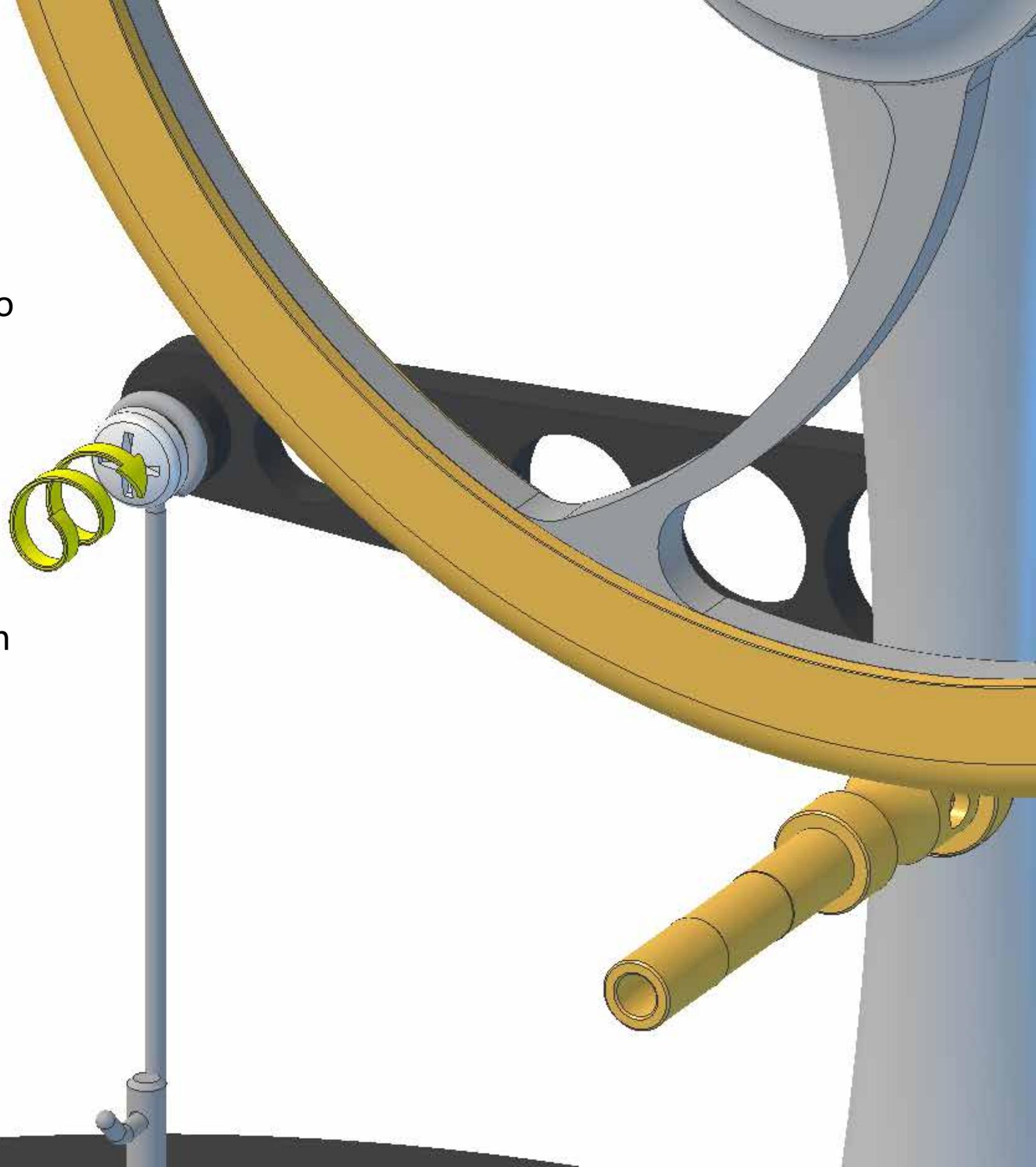
Gently press downwards on the top of the right hand gland stem with the side of a flat screwdriver until the T-bar and conrod are at their lowest position. This will press the stem into the displacer and set the displacer to its correct position in the chamber.

There is a small amount of flex in the conrod, you should be able to take advantage of this and "over-press" the top of the stem so that when you release the pressure on the screwdriver the displacer lifts off the bottom plate slightly.

Fit the hook on the second conrod through the hole in the top of the left hand gland stem.

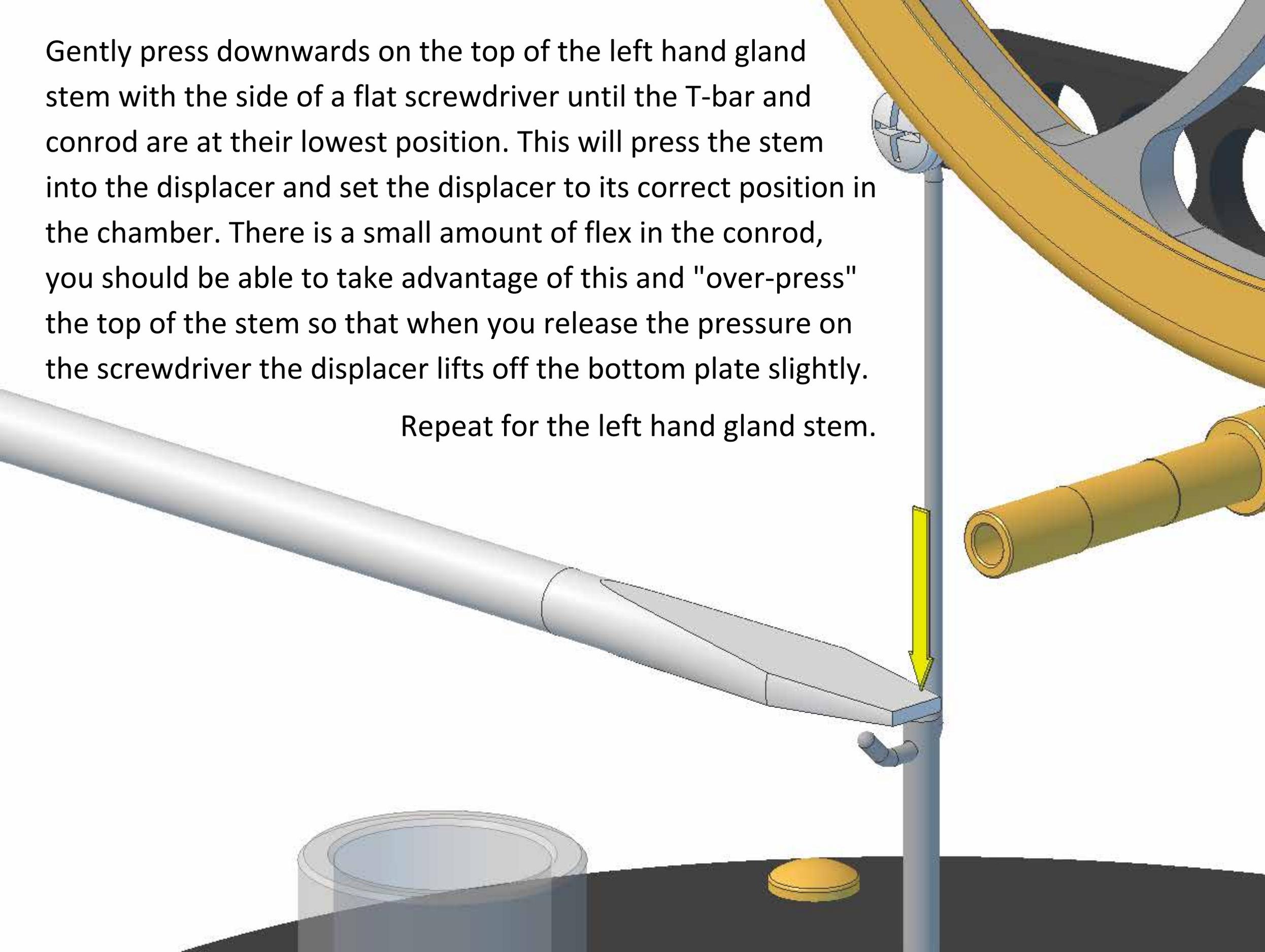


Screw the conrod screw into the hole in the front side of the rear T-bar. Tighten only sufficient to lock, over-tightening will cause the conrod bush to expand and pinch the conrod eye, which could prevent your engine from running.



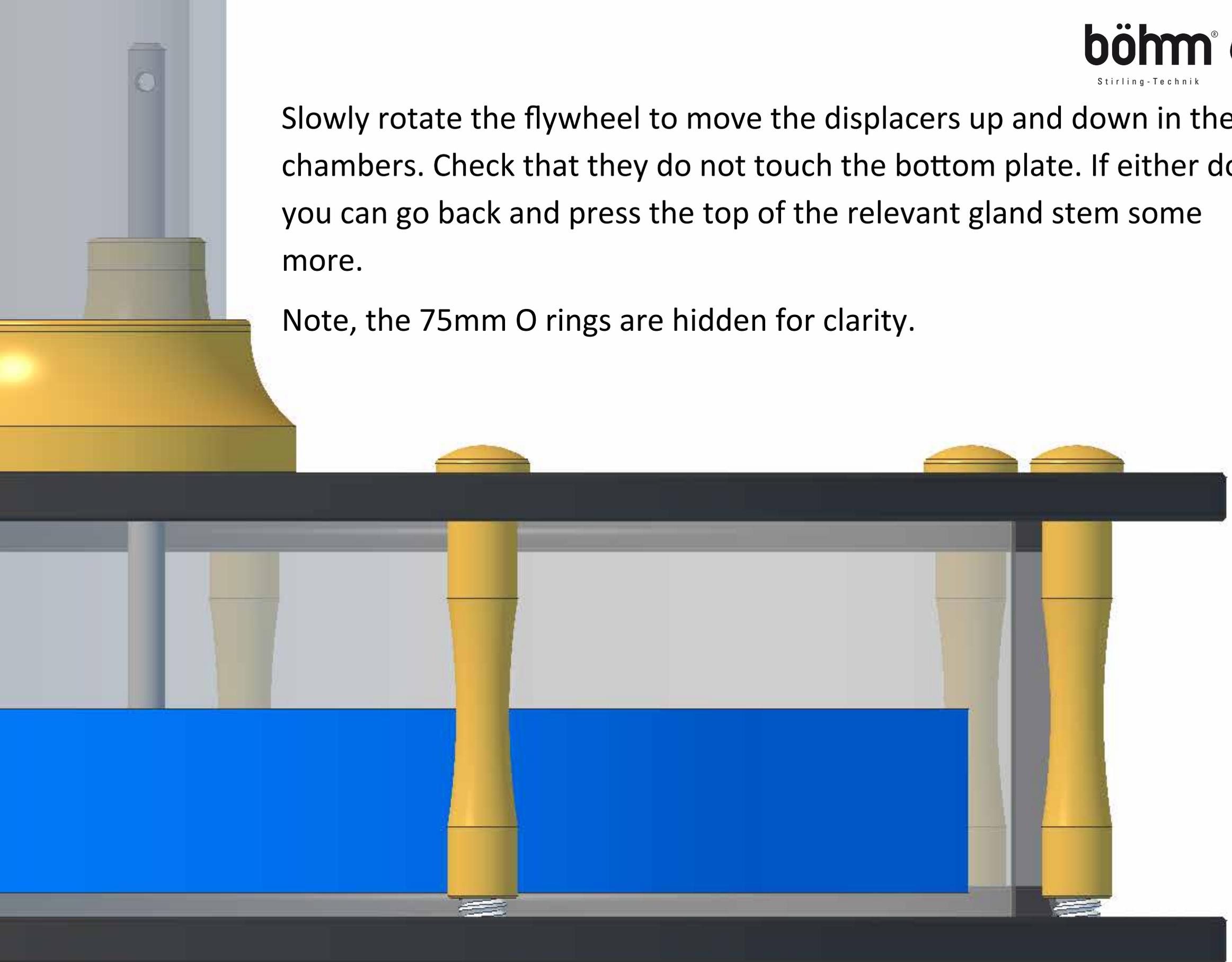
Gently press downwards on the top of the left hand gland stem with the side of a flat screwdriver until the T-bar and conrod are at their lowest position. This will press the stem into the displacer and set the displacer to its correct position in the chamber. There is a small amount of flex in the conrod, you should be able to take advantage of this and "over-press" the top of the stem so that when you release the pressure on the screwdriver the displacer lifts off the bottom plate slightly.

Repeat for the left hand gland stem.

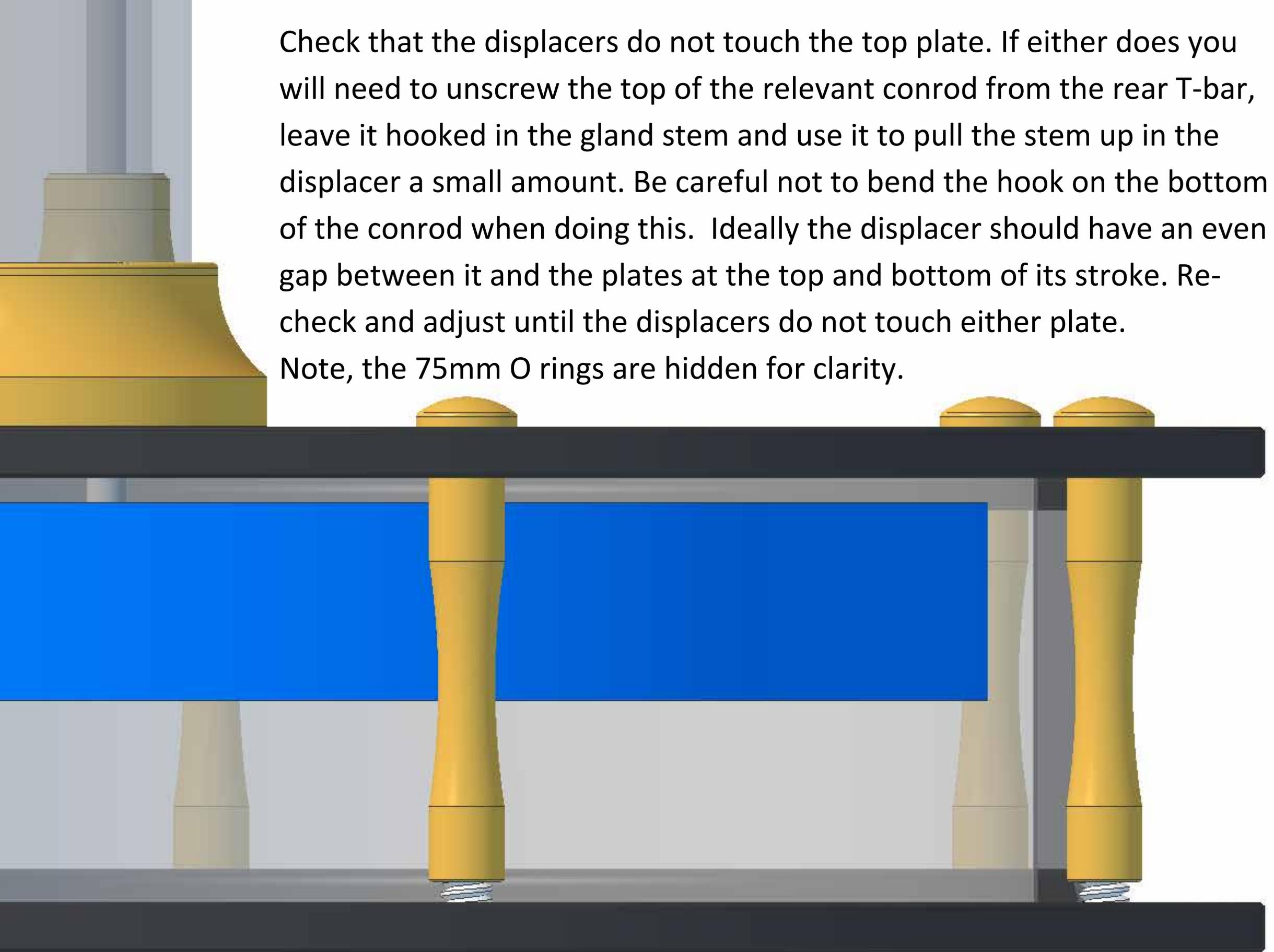


Slowly rotate the flywheel to move the displacers up and down in their chambers. Check that they do not touch the bottom plate. If either does you can go back and press the top of the relevant gland stem some more.

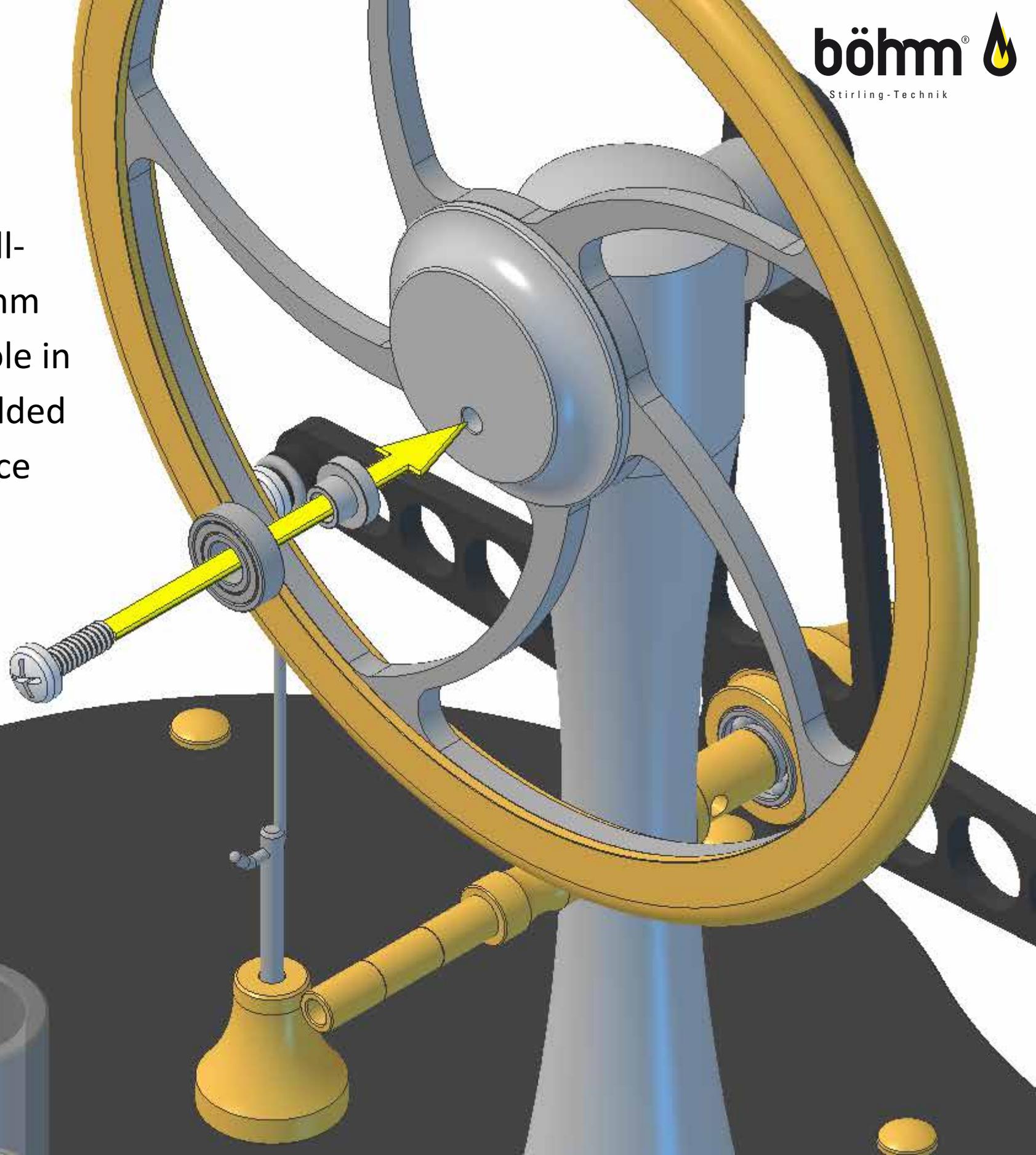
Note, the 75mm O rings are hidden for clarity.



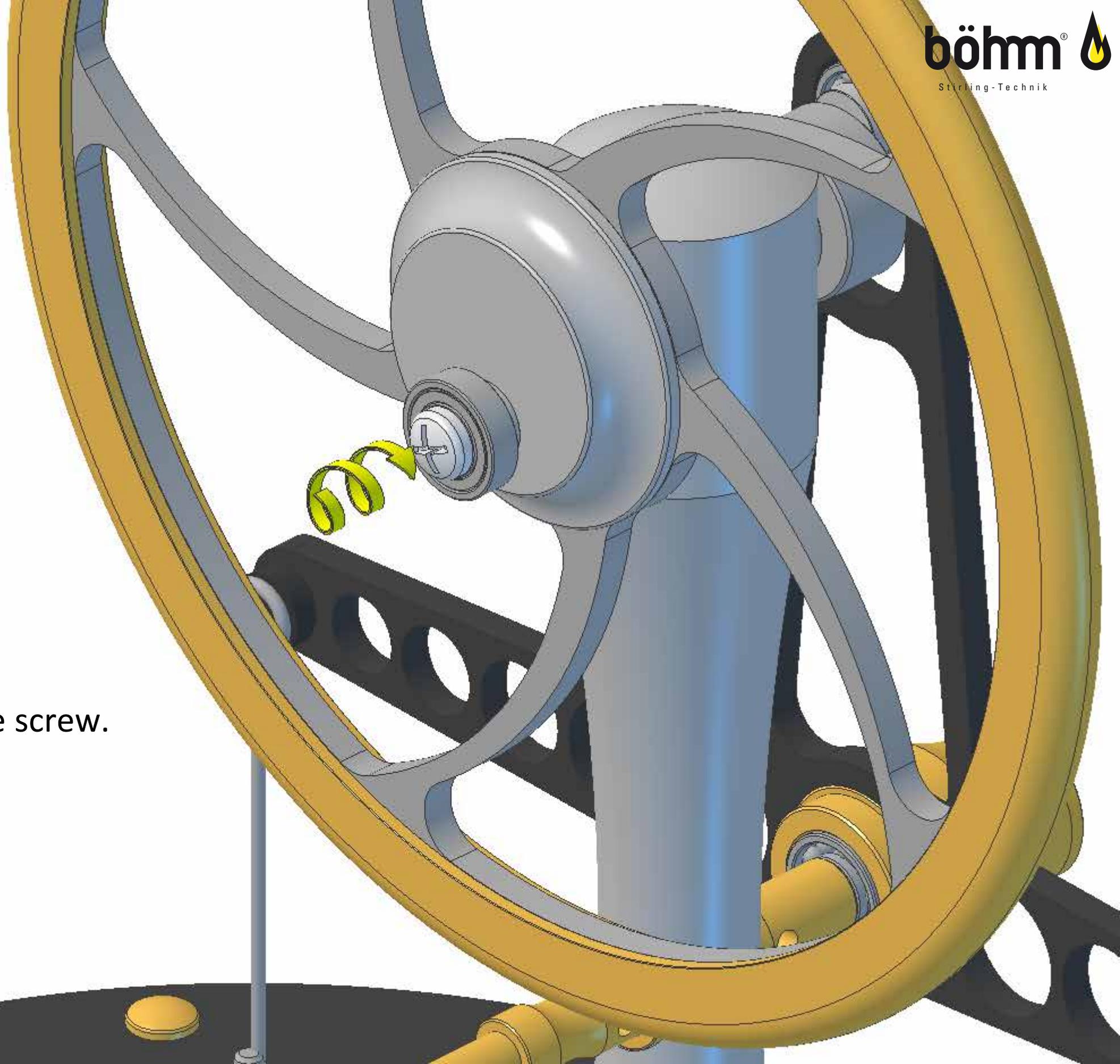
Check that the displacers do not touch the top plate. If either does you will need to unscrew the top of the relevant conrod from the rear T-bar, leave it hooked in the gland stem and use it to pull the stem up in the displacer a small amount. Be careful not to bend the hook on the bottom of the conrod when doing this. Ideally the displacer should have an even gap between it and the plates at the top and bottom of its stroke. Re-check and adjust until the displacers do not touch either plate. Note, the 75mm O rings are hidden for clarity.



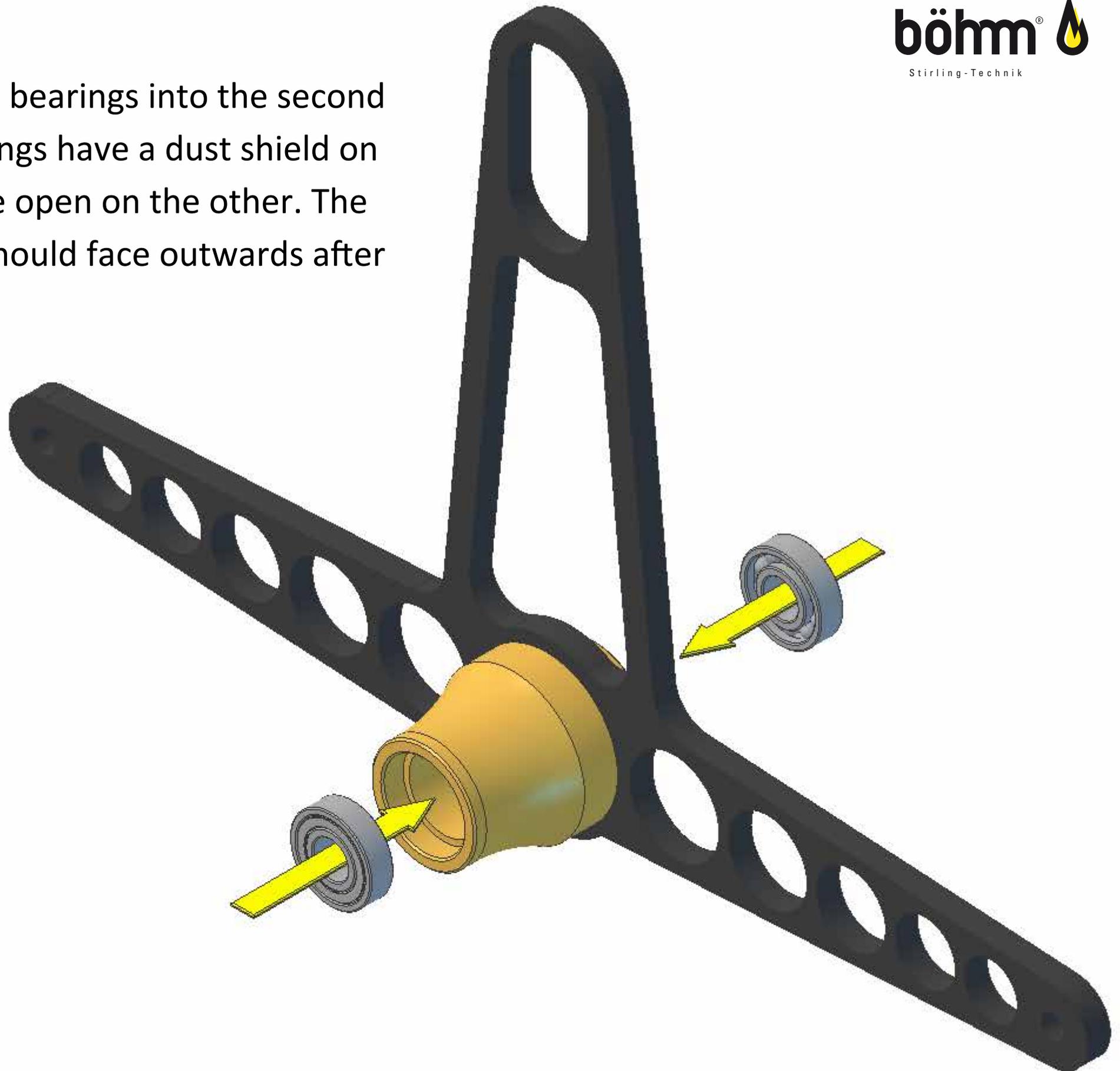
Fit one bearing bush, one ball-race bearing and one M2x6mm roundhead screw into the hole in the face of the hub. The shielded side of the bearing should face outwards after fitting.



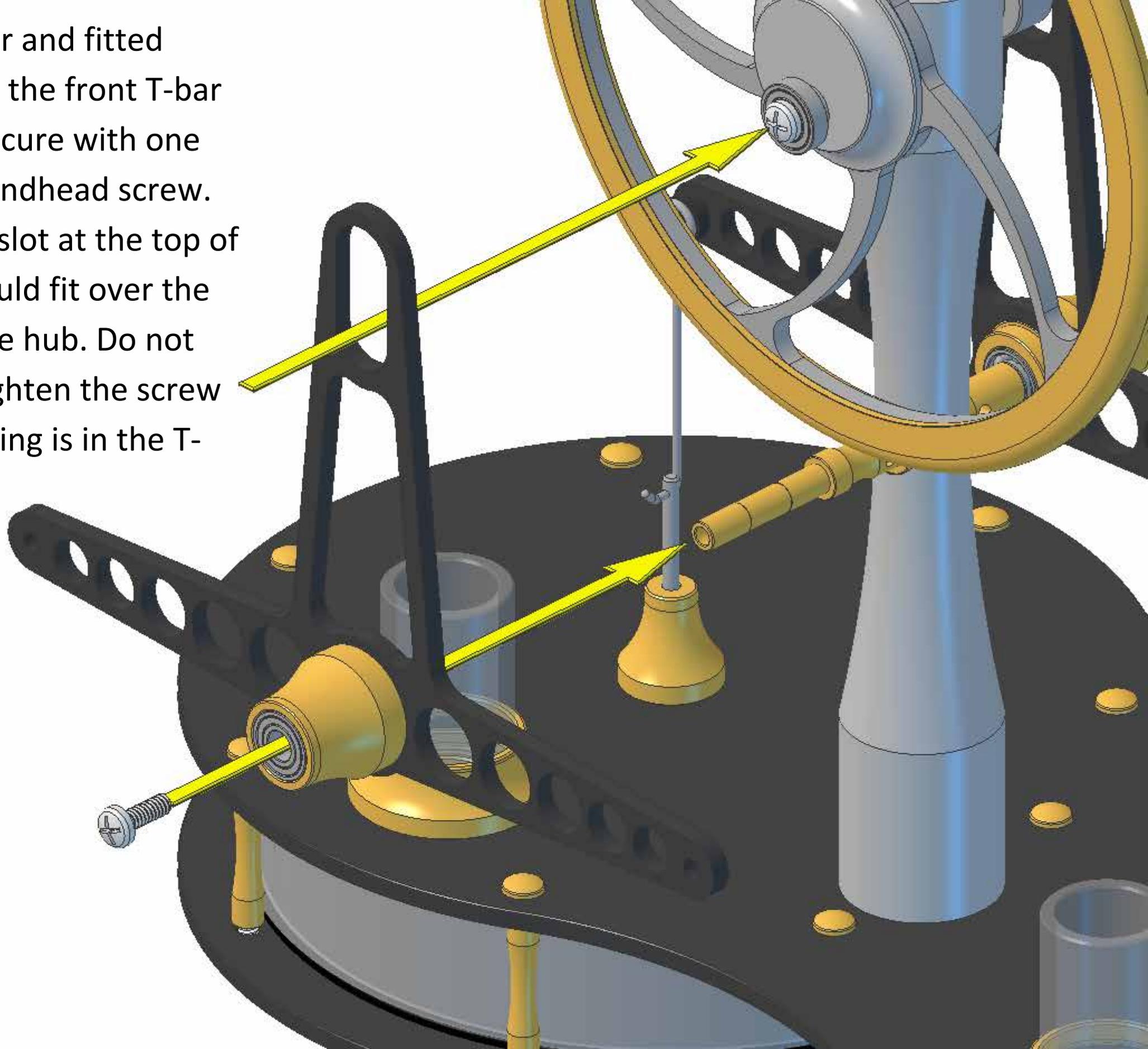
Fully tighten the screw.



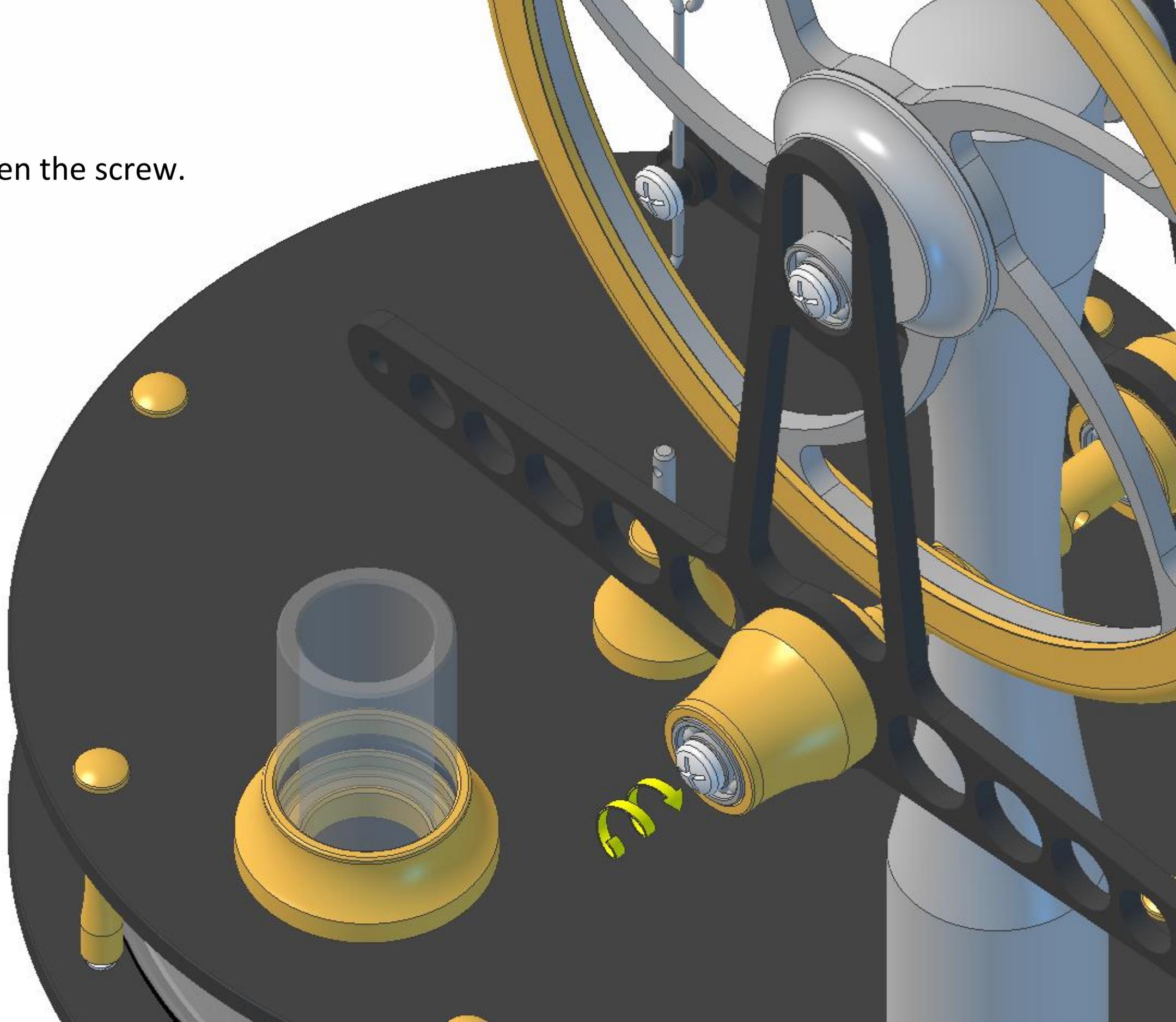
Fit two ball-race bearings into the second T-bar. The bearings have a dust shield on one side and are open on the other. The shielded sides should face outwards after fitting.



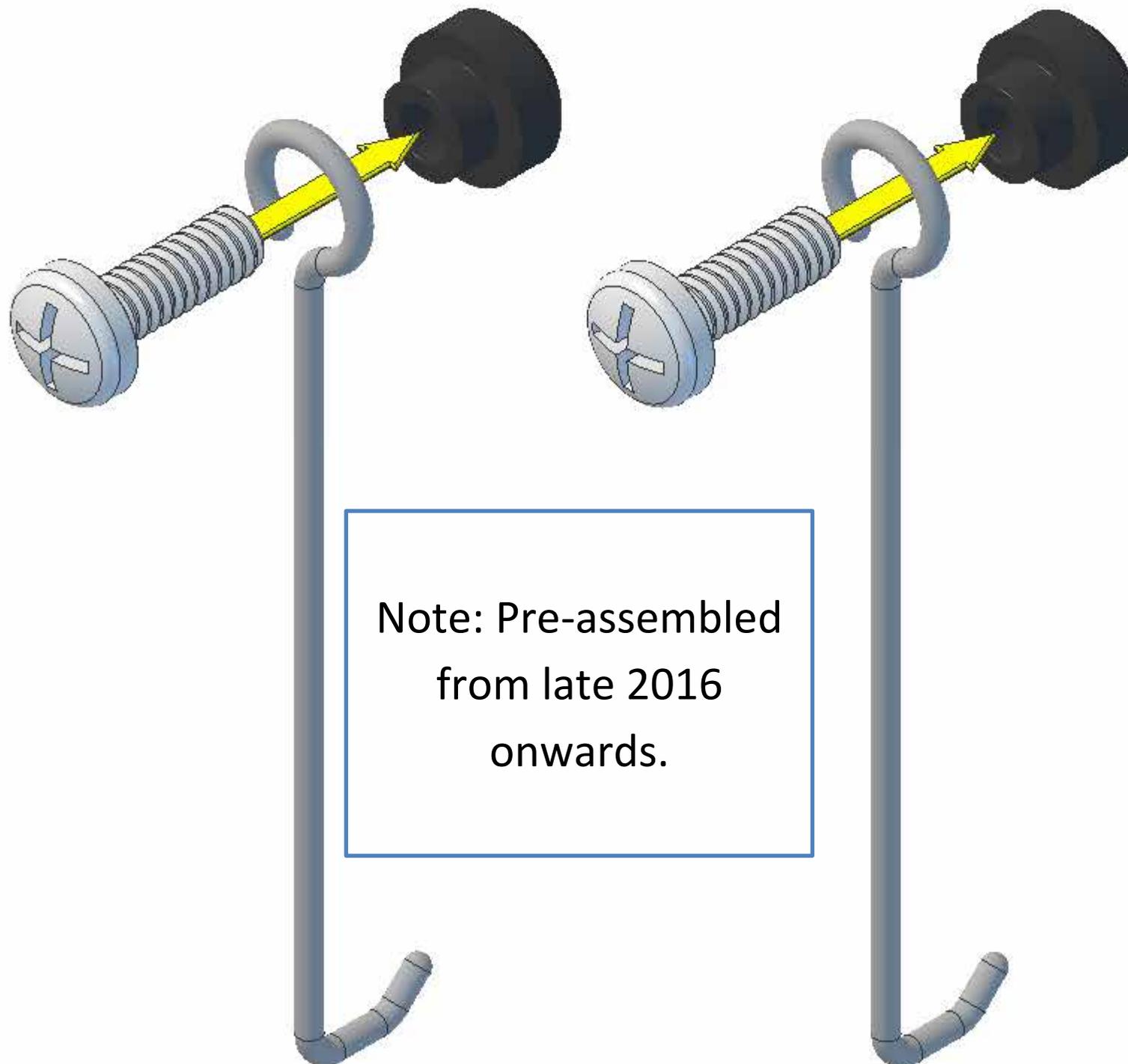
Slide the T-bar and fitted bearings over the front T-bar carrier and secure with one M2x6mm roundhead screw. The rounded slot at the top of the T-bar should fit over the bearing on the hub. Do not attempt to tighten the screw until the bearing is in the T-bar slot.



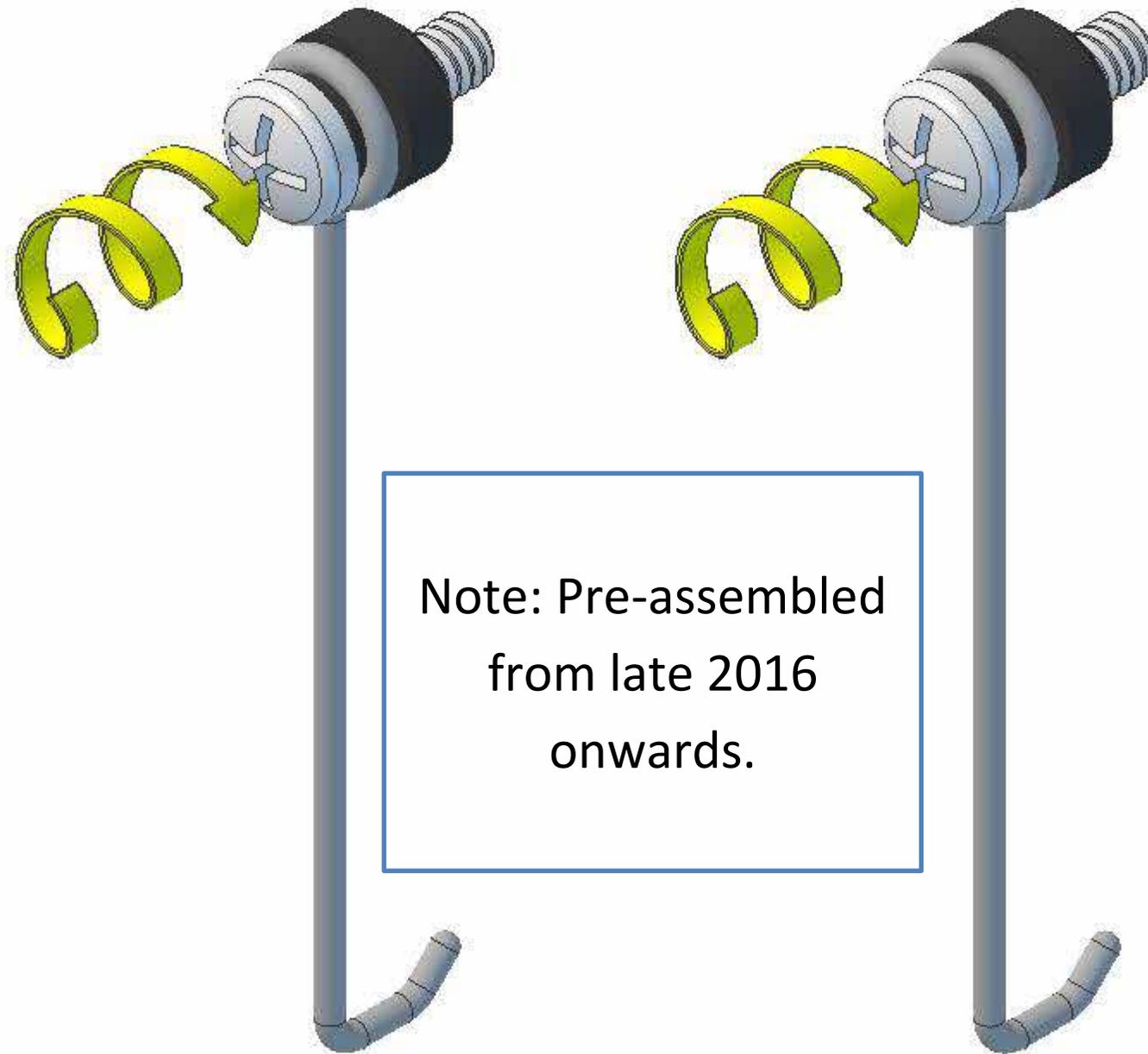
Fully tighten the screw.



Fit one conrod onto one conrod bush and secure with one M2x6mm roundhead screw. The screw only needs screwing in a couple of turns at this stage. Note, the hook on the bottom of the conrod should be aligned as shown in the diagram. Repeat for the second conrod.



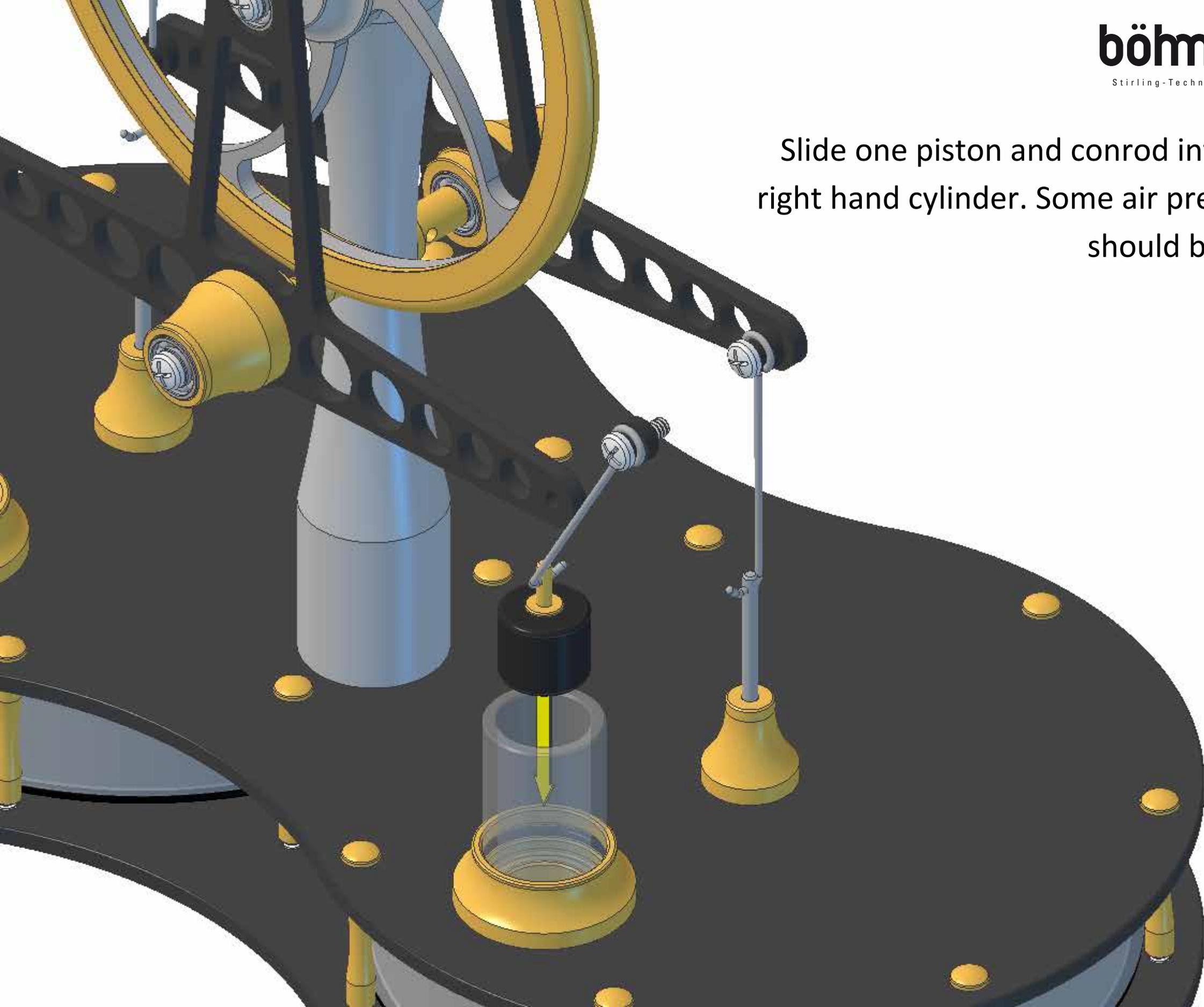
Screw the screws in until they just touch the bushes. Do not over-tighten or you could cause the bushes to expand and pinch the conrod eyes, which could prevent your engine from running.

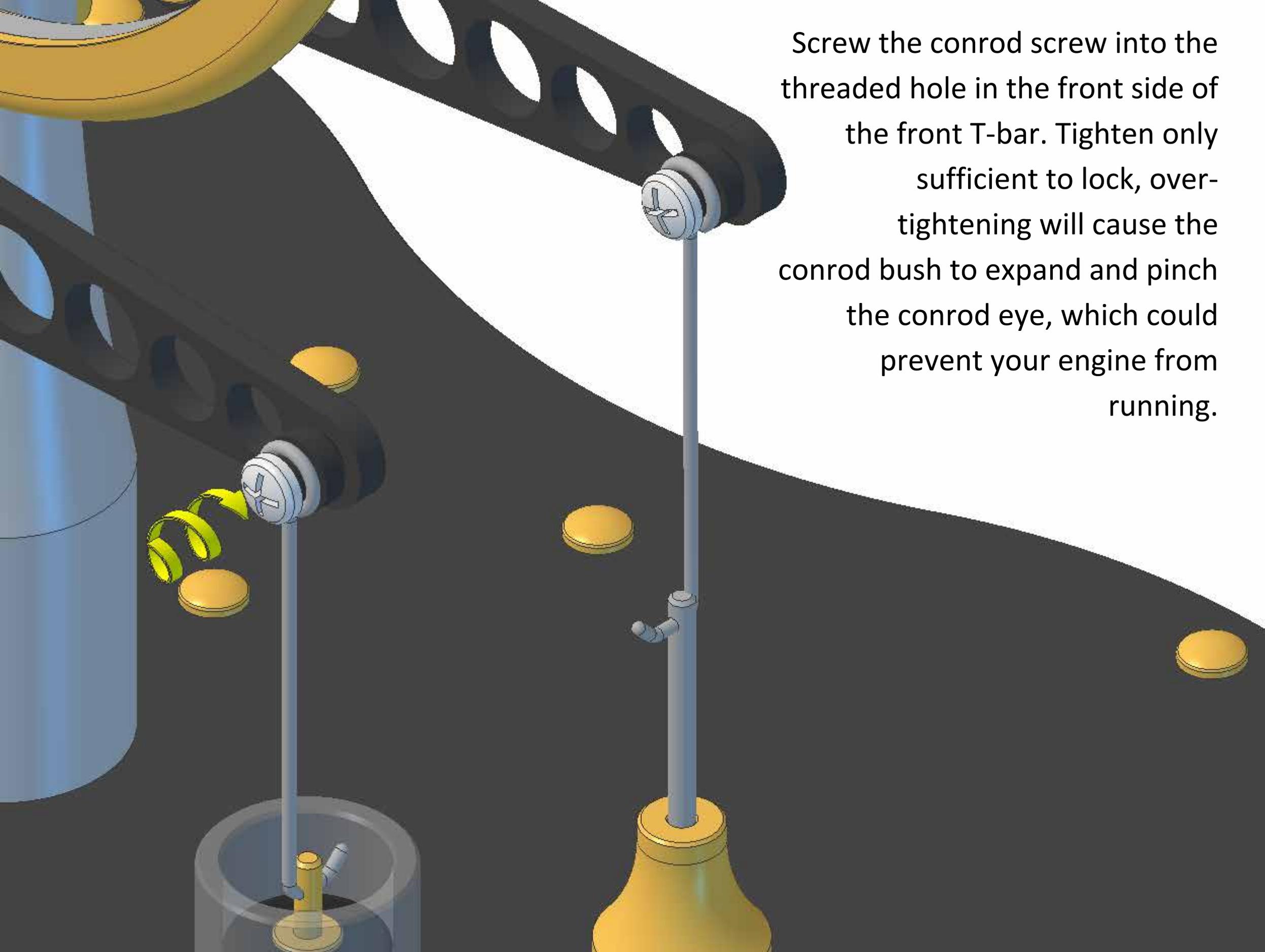


Fit the hook on the first conrod through the hole in the top of the first piston. Repeat for the second conrod and piston.



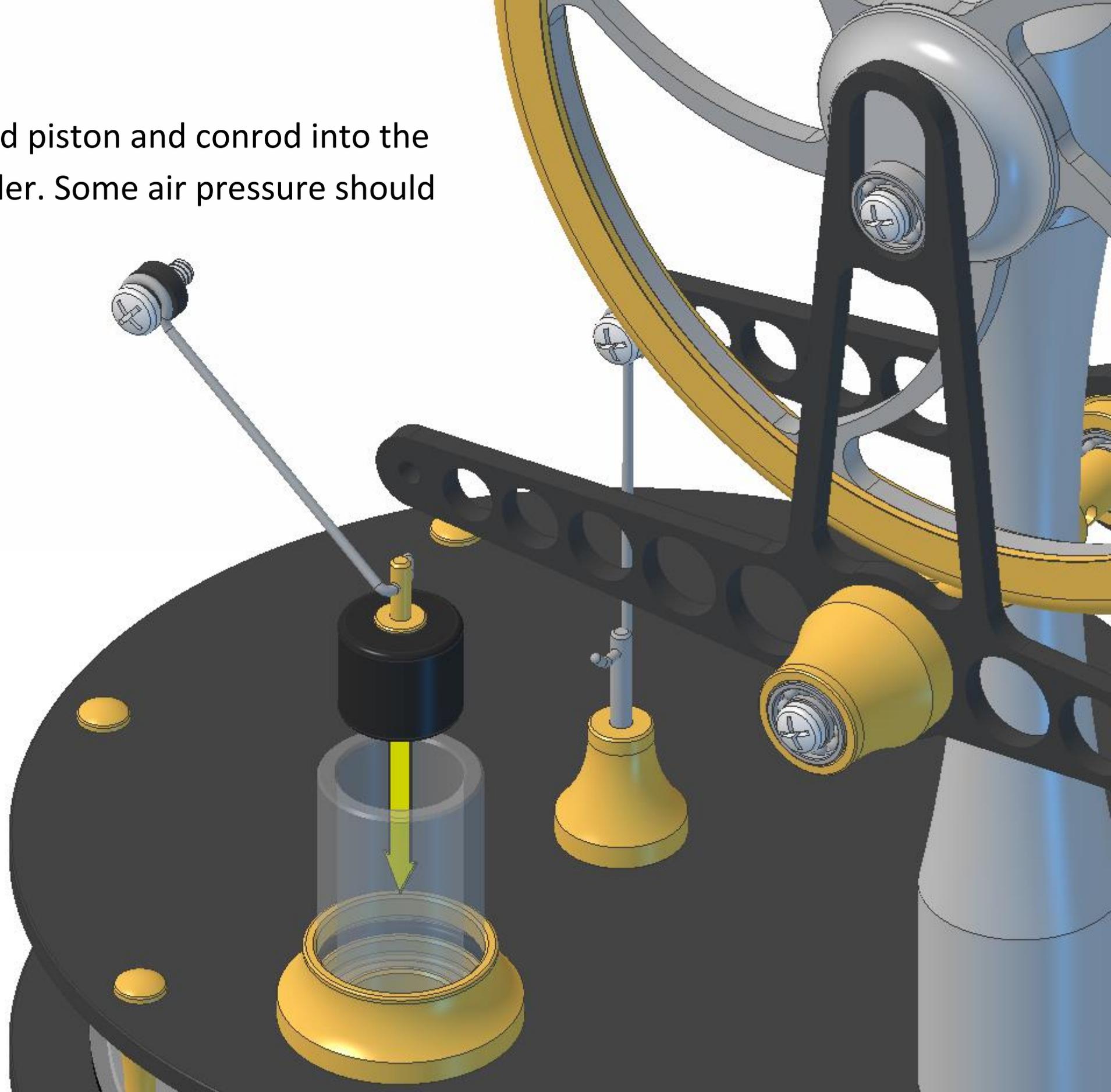
Slide one piston and conrod into the right hand cylinder. Some air pressure should be felt.



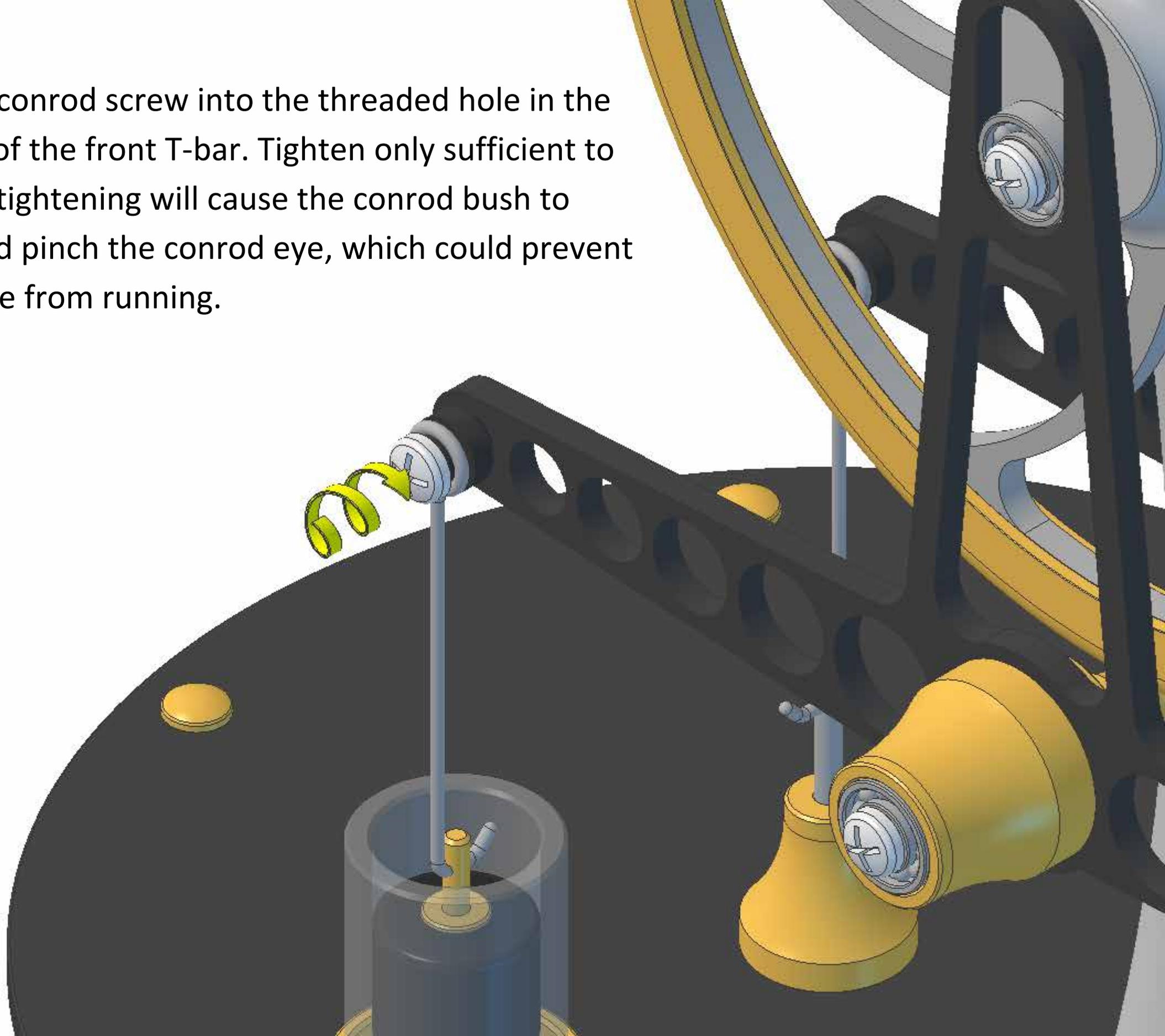


Screw the conrod screw into the threaded hole in the front side of the front T-bar. Tighten only sufficient to lock, over-tightening will cause the conrod bush to expand and pinch the conrod eye, which could prevent your engine from running.

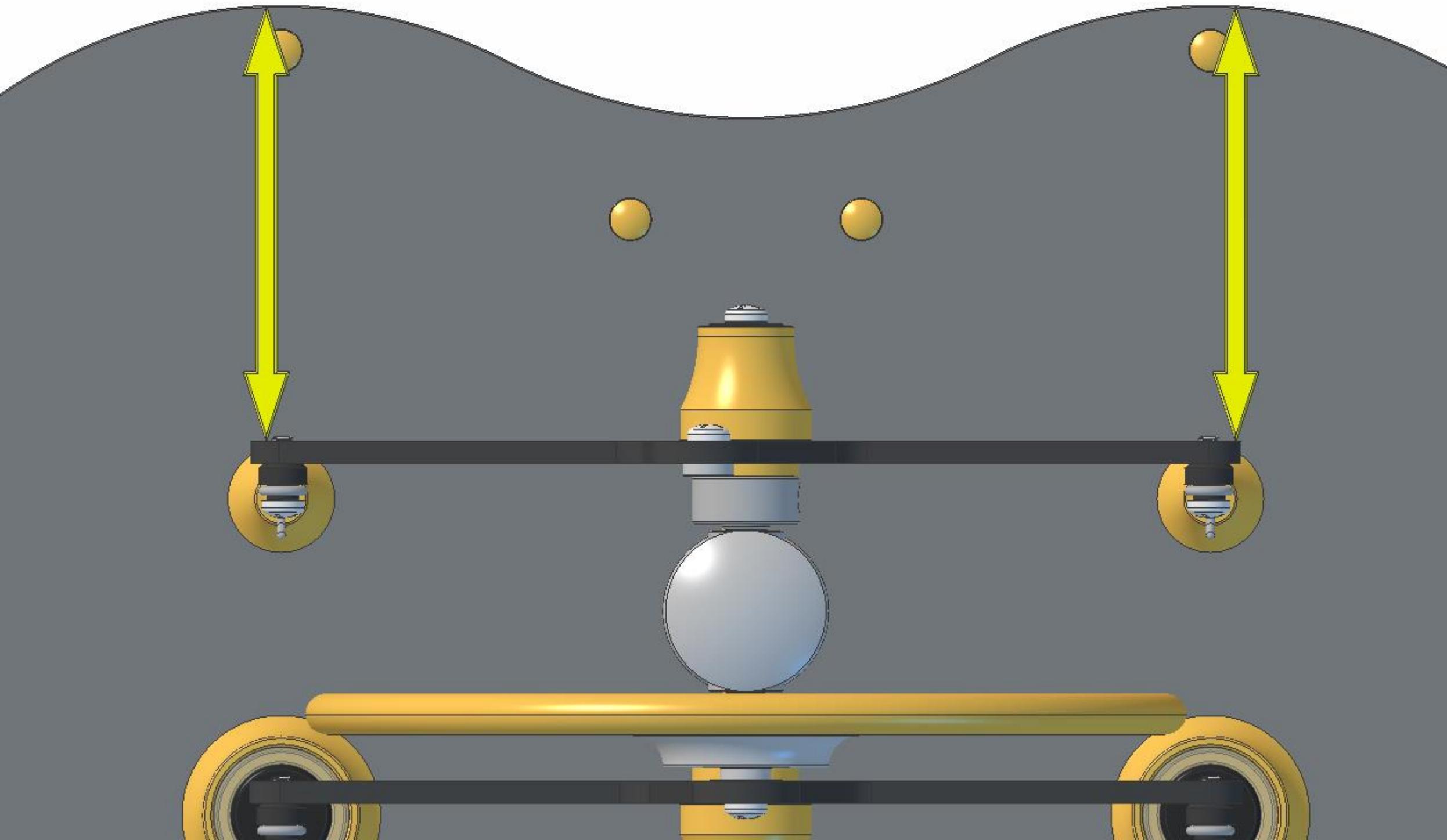
Slide the second piston and conrod into the left hand cylinder. Some air pressure should be felt.



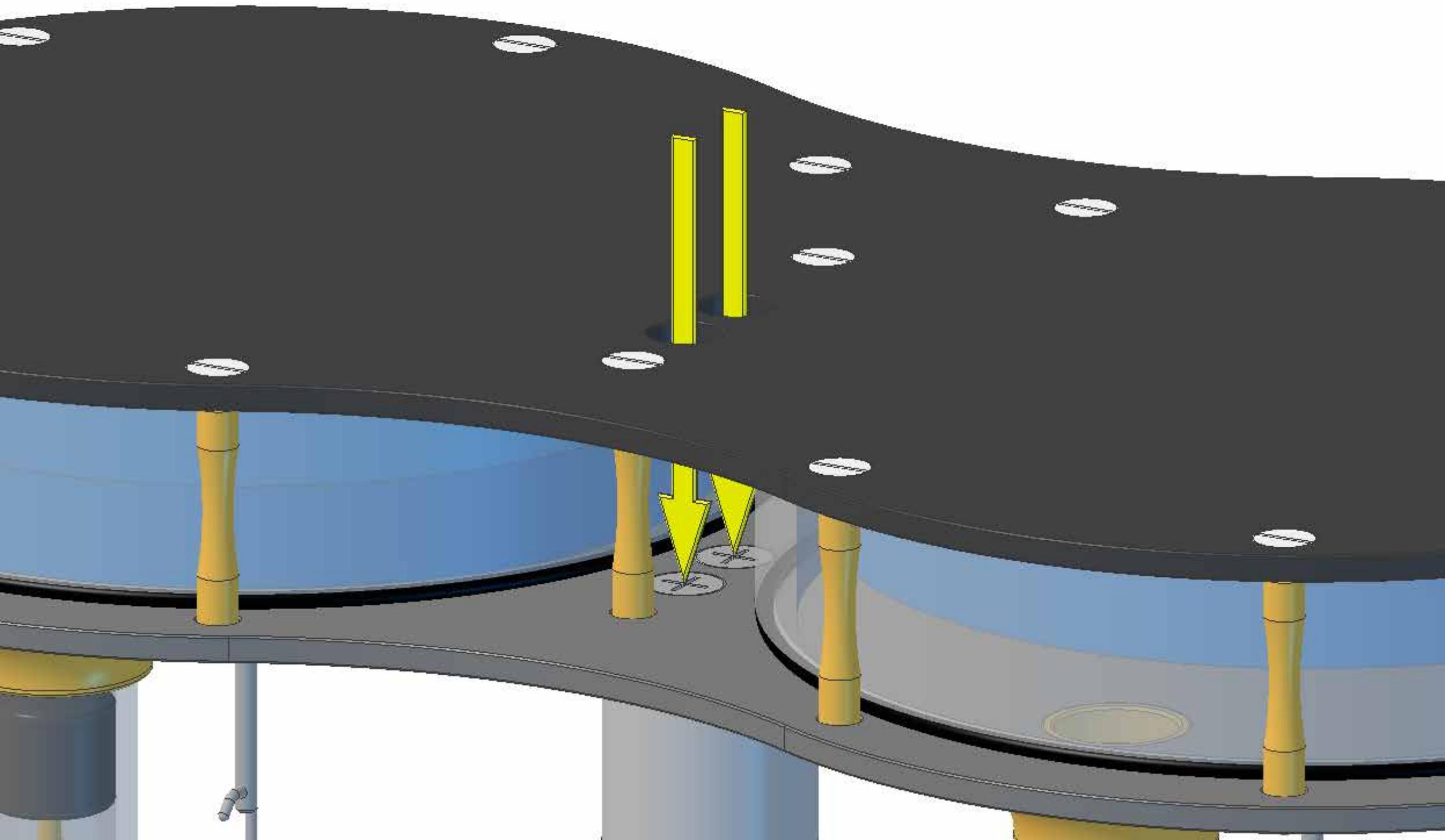
Screw the conrod screw into the threaded hole in the front side of the front T-bar. Tighten only sufficient to lock, over-tightening will cause the conrod bush to expand and pinch the conrod eye, which could prevent your engine from running.



Check that the each end of the rear T-bar is the same distance from the back edge of the top plate. Also check that the rear conrods hang vertically. If the T-bar is not parallel then the conrods will not hang vertically, one will lean forwards and one will lean backwards, which could prevent your engine from running.



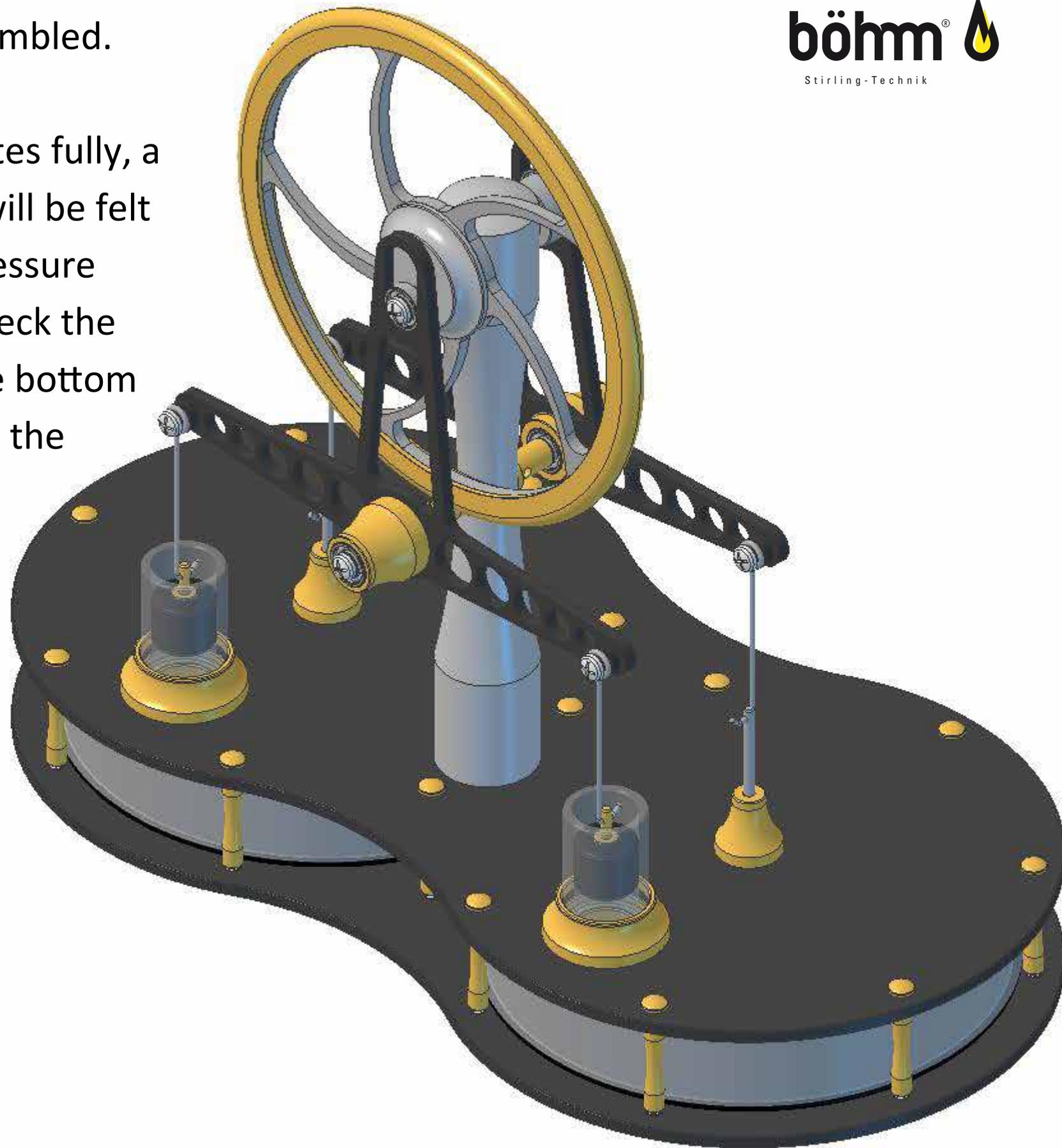
To adjust the alignment of the T-bar you will need to slacken the main pillar screws, adjust the T-bar and re-tighten the screws. Re-check and adjust until the T-bar is parallel.



Your engine is now fully assembled.

Check that the flywheel rotates fully, a small amount of resistance will be felt on rotation due to the air pressure inside the main chamber. Check the pistons do not bump into the bottom of the cylinders and re-check the displacers do not bump into either plate.

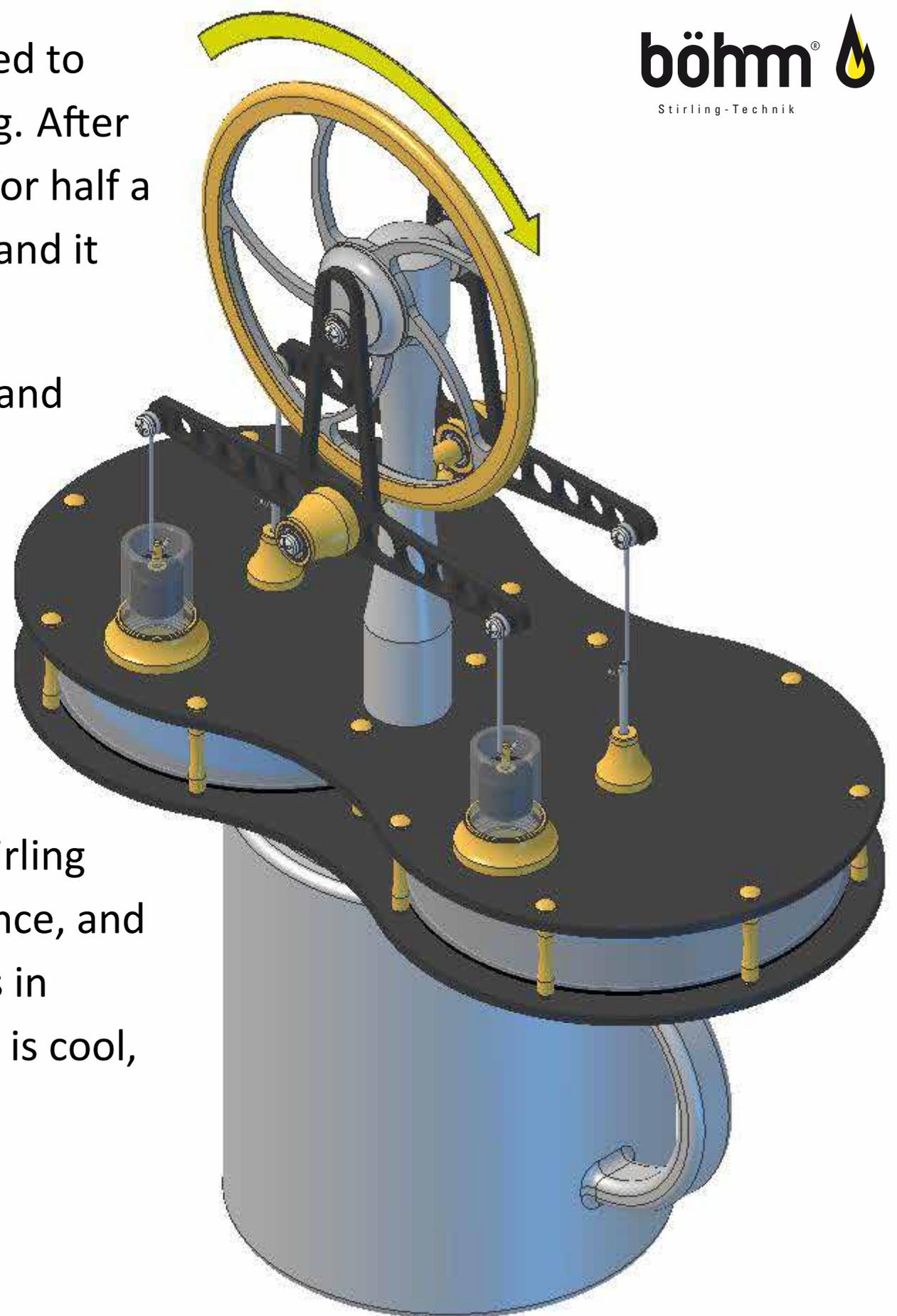
Once you have made these final checks you are ready to operate your engine.



The engine is not self-starting; you will need to give the flywheel a little spin to get it going. After the engine has been on your heat source for half a minute to a minute gently spin the wheel and it should carry on running.

The engine has been designed to run on hand heat, but will run equally as well from a wide variety of heat sources, including Digital TV box, adsl modem, table lamp, hot water - tea or coffee, warm sunlight.

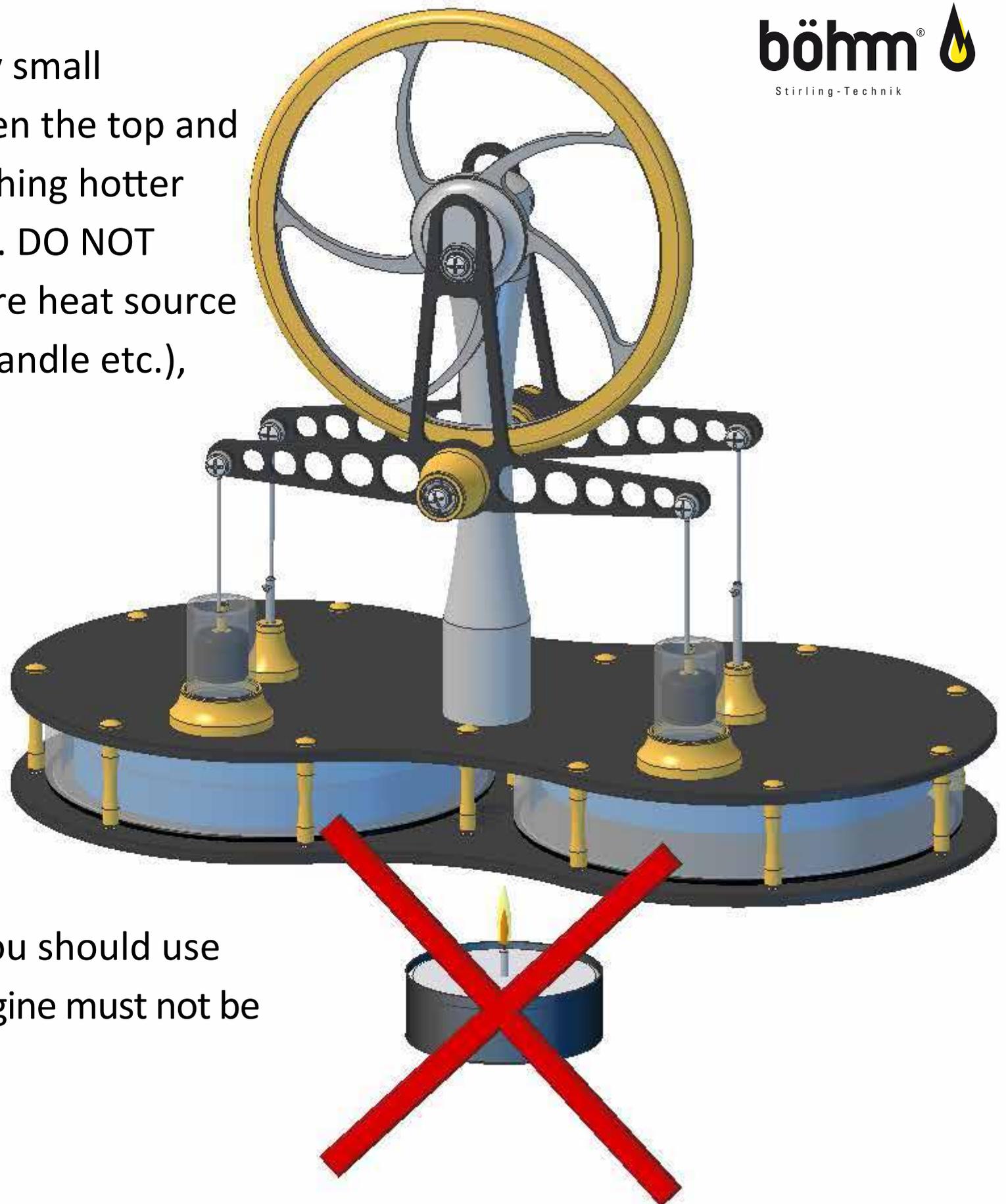
The engine will operate in reverse if you place it on a bowl of ice, this is because Stirling engines operate on a temperature difference, and it doesn't matter if the top plate is cool, as in conventional running, or the bottom plate is cool, as in ice running.



The engine only requires a very small temperature difference between the top and bottom plates to operate, anything hotter than hot water WILL damage it. DO NOT place it on any high temperature heat source (cooker, wood burning stove, candle etc.), this will melt a number of parts on the engine.

If you wish to operate your engine on hot coffee or tea you must allow the liquid to cool for a couple of minutes first.

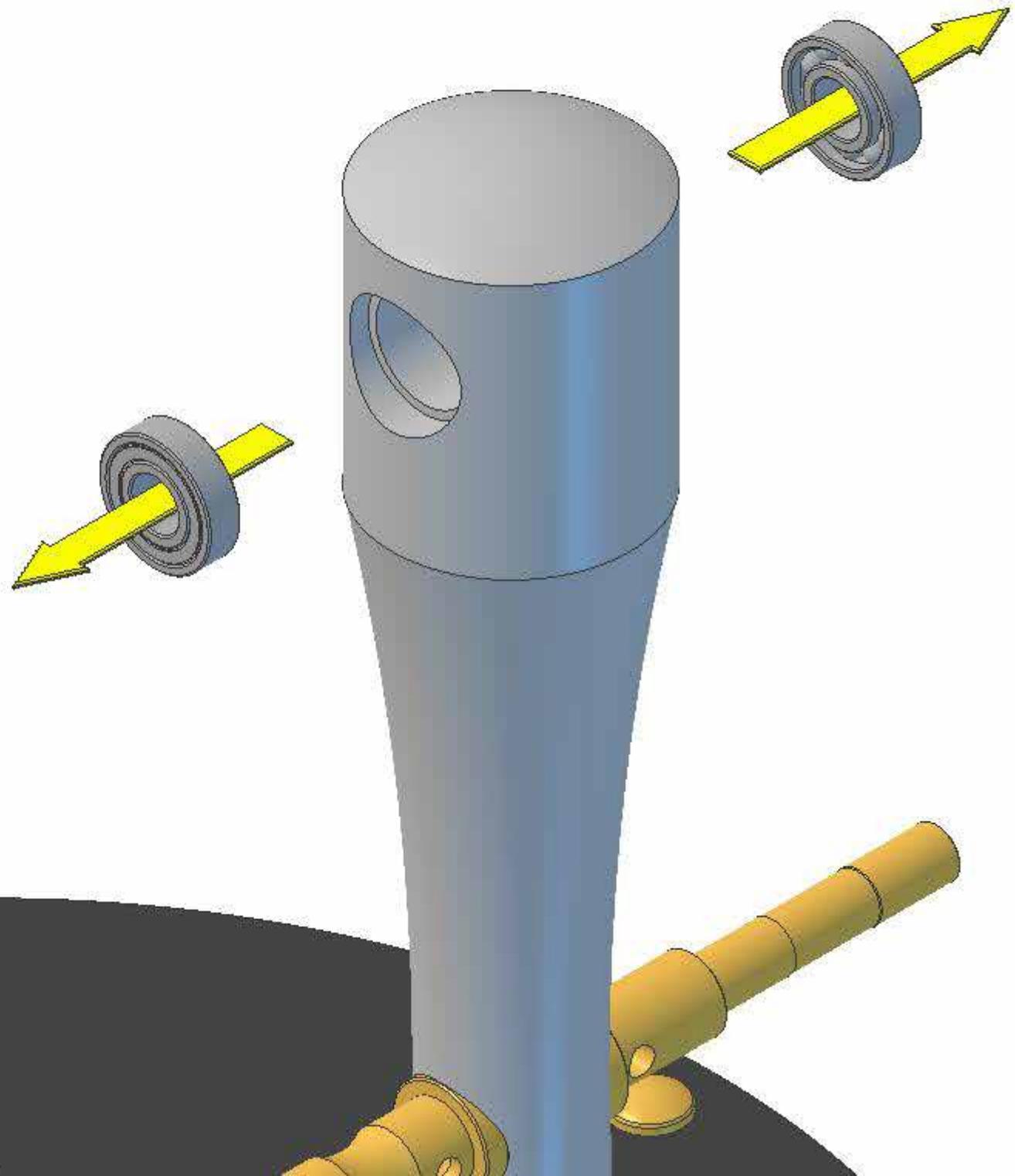
The hottest heat source that you should use for your HB6 Double Teatime engine must not be hotter than 75°C (167°F)



If your engine stops suddenly after a few revolutions the main axle ball-race bearings might need cleaning.

Disassemble your engine (by following the assembly instructions backwards) until you gain access to the bearings. Remove them and rinse in Methylated spirit or denatured alcohol. Then either blow dry with compressed air or allow to dry naturally on an absorbent cloth or paper towel.

Follow the assembly instructions to reassemble your engine.



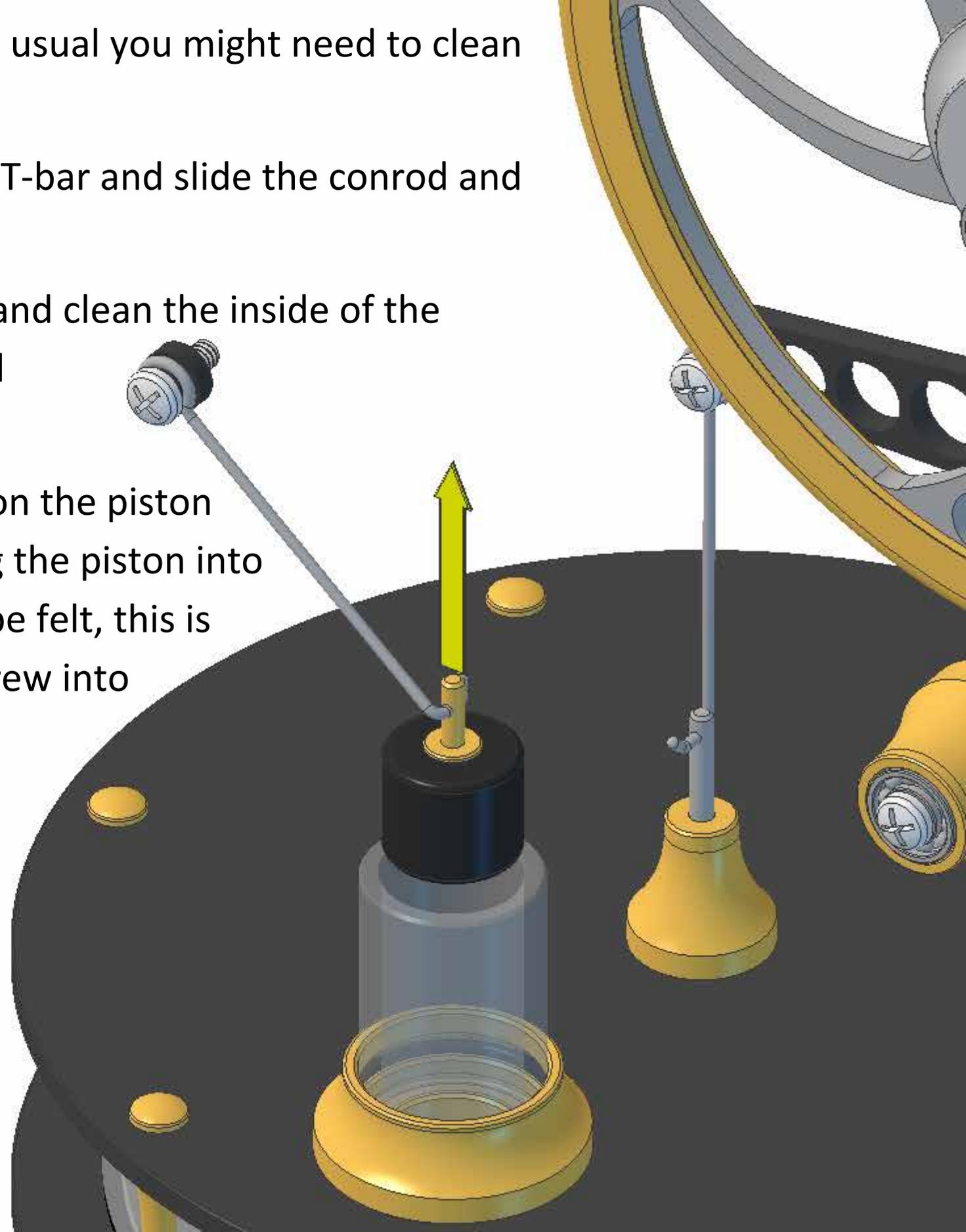
If your engine is running slower than usual you might need to clean the pistons and cylinders.

Unscrew the conrod screw from the T-bar and slide the conrod and piston out of the cylinder.

Wipe the piston with a paper towel and clean the inside of the cylinder with a rolled up paper towel or cotton bud.

Make sure there are no stray fibres on the piston or in the cylinder and re-fit by sliding the piston into the cylinder (some air pressure will be felt, this is normal) and screwing the conrod screw into the hole in the T-bar.

Repeat for the second piston and cylinder.



If your engine is running slower than usual you might need to clean the gland stem.

Rotate the flywheel until the displacer stem is at its highest point, and wipe the stem with a cloth.

Repeat for the second gland stem.

