

Low Temperature Stirling Engine

Equipment:

Stirling engine
cup or mug
electric water kettle (or the like)
(optional: small bowl)

“Chemicals”:

water
(optional: crushed ice)

Safety:

The precautions usual in everyday life for handling hot water have to be observed.

Procedure:

Hot water ($< 100\text{ }^{\circ}\text{C}$) is filled in a cup. Subsequently, the Stirling engine is placed on top of the cup. After waiting for about 2 minutes in order for the bottom plate to warm up, the flywheel is gently pushed.

Alternatively, the engine can be put on a small bowl filled to the brim with ice.

Observation:

The Stirling engine runs as long as the water in the cup is warm enough. If one takes it off the cup, it will stop after a short while.

Explanation:

Stirling engines such as the beta type with only one cylinder presented here operate with a temperature difference between the plates. While the bottom plate is heated by the hot water in the cup, the top plate remains at room temperature. With the large displacer disk (made of Styrodur etc.) at the top, most of the air inside the main chamber is at the bottom, where it is heated by the warm bottom plate. Due to the heating, the gas expands and pushes the small power piston upwards, which drives the flywheel via a connecting rod and a crankshaft. This movement acts in turn on the displacer disk via a second connecting rod with a 90 degree offset between the piston and the displacer disk. The displacer disk moves down to the bottom of the chamber while the air flows around the outside of the displacer disk to the top of the chamber where it is cooled by the top plate. Due to the cooling down, the gas contracts thereby causing the power piston to move downwards. This movement drives the flywheel a bit further. The cycle is closed.

The Stirling engine can also be operated by cooling the bottom plate. This can be done by placing it on a small bowl filled to the brim with ice. In this case, the flywheel rotates in the opposite direction.

Disposal:

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