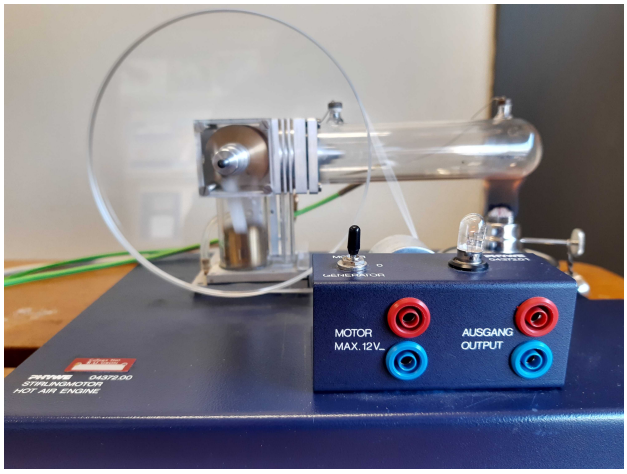
4F30.10 - Stirling Engine

Key words: Stirling Engine, Thermal Physics, Thermodynamics, Carnot



Equipment List:

1. Stirling engine
2. Spirit burner and spirit
3. p-V-n-T measurement unit
4. Thermal probes

How to assemble and operate:

- Hook up all the cables, the gray one from the stirling engine in the p-V-n socket, and the thermal probes in the T1 and T2 sockets (mind the polarity!)
- Calibrate the thermal probes by pressing the ΔT button and then pressing the V button
- Place the thermal probes in the holes on either side of the cylinder. The temperature on each end of the cylinder can now be shown on the measurement unit. Alternatively, the temperature difference can be shown instead of T1 by pressing the display button
- Place a small amount of fuel in the burner, close it back up, and put it under the end of the cylinder
- Light the burner, the flame can be adjusted with the knob on the side
- The stirling engine will be ready to run once the temperature difference reaches about 80-90 degrees, start it by giving the wheel a good twist
- Adjusting the flame height will (after a while) change the temperature difference and through that the rpm of the engine
- If the engine is connected to the generator, you can switch the switch to generator mode to show the light bulb lighting up.

Description/Theory:

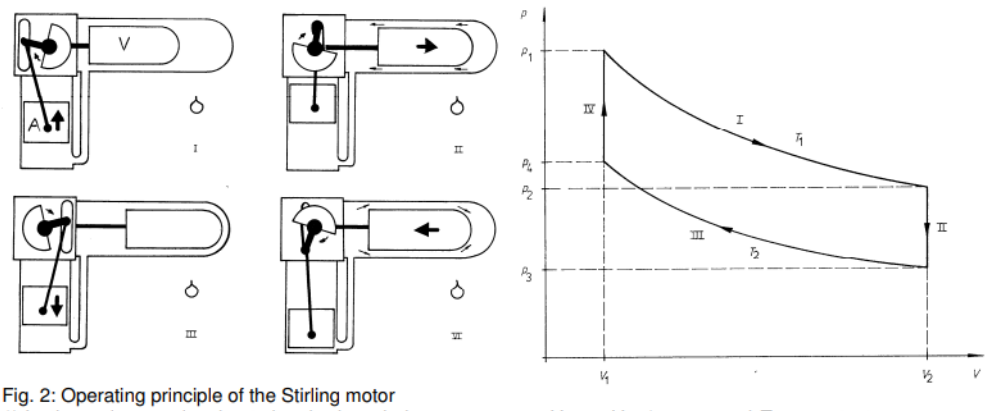


Fig. 2: Operating principle of the Stirling motor
1) Isothermal expansion, heat absorbed, work done
2) Isochoric heat emission, no work transferred
3) Isothermal compression, heat emission, work absorbed
4) Isochoric heat absorption, no work transferred

$V_1 \longrightarrow V_2$ $p1 \longrightarrow p_2$ and T_1 = constant.
$T_1 \longrightarrow T_2$ $p2 \longrightarrow p_3$ and V_2 = constant.
$V_2 \longrightarrow V_1$ $p3 \longrightarrow p_4$ and T_2 = constant.
$T_2 \longrightarrow T_1$ $p4 \longrightarrow p_1$ and V_1 = constant.

This demonstration shows energy conversion from heat to electrical in the Carnot cycle. Through varying the flame intensity, it can show that the work done by the system varies with the temperature difference and thus the heat input. Through the generator, it also shows that useful work can be extracted from the system.

Comments/Notes:

Care should be taken when using due to the open flame. This demonstration should be used in a well ventilated room and away from flammable objects. Maximum output is at around 6-700 RPM. Operating manual is available. Possible experiments include Conversion: heat - Mech. Energy, Operation as heat pump or refrigeration machine, Mech. power in relation to speed, Electr. power in relation to speed, Temperature measurement, Recording of the pV curve