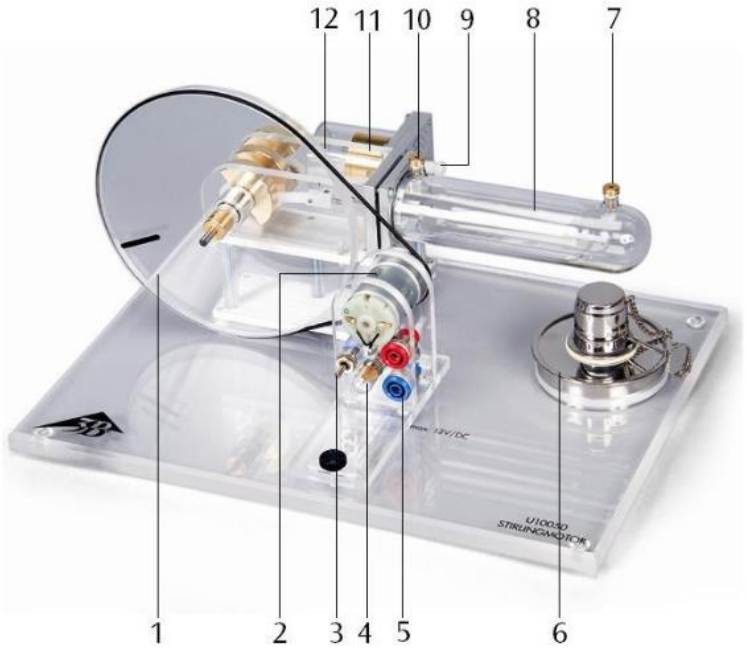
Product name - 266910

2020-01-07 / MRA

Product manual - AE 266910



1 Flywheel with marking for speed determination
2 Motor-generator unit with 2-stage pulley
3 Switch
4 Bulb
5 4-mm safety plugs
6 Alcohol burner
7 Temperature measurement connector 1
8 Displacement piston
9 Capped hose connection for pressure measurements
10 Temperature measurement connector 2
11 Working piston
12 Threaded rod M3 (connected with the working piston)

Start instructions

- Pour the fuel alcohol carefully into the alcohol burner, making sure that none of it is spilt.
- Never fill the alcohol burner as long the wick is still smoldering, or another open flame is in close proximity.
- Immediately close the fuel container after use.
- Keep away from the open flame.
- Caution! Only extinguish the flame by fitting the cover provided for this purpose. The Stirling engine becomes hot when it is operated with an open flame.
- Do not touch the displacement cylinder during or immediately after operation of the Stir-ling motor.
- Allow the Stirling engine to cool before putting it away.

Technical data

Motor-generator unit:

Max. 12 V DC

2-stage pulley: 30 mm dia., 19 mm dia.

Working piston: 25 mm dia.

Path of working piston: 24 mm

Volumetric change: 12 cm^3.

Minimum volume: 32 cm^3.

Maximum volume: 44 cm^3

Power of the Stirling motor: 1W

Dimensions: 300x220x160 mm^3.

Weight: 1.65 kg

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Purpose of the set-up

The Stirling engine can be used for qualitative and quantitative investigations of the Stirling cycle, and can be operated in three different modes: heat engine, heat pump and refrigerator. The displacement cylinder and piston are made of heat-resistant glass; the working cylinder, flywheel and transmission covers are made of acrylic glass. This allows a very clear observation of the individual motion sequences at all times. The crankshafts are equipped with ball bearings and made of hardened steel. The connecting rods consist of wear-resistant plastic. The integrated motor-generator unit with a 2-stage pulley allows the generated mechanical energy to be converted into electrical energy. A switchover mechanism permits operation of an integrated lamp or external loads, as well as a feeding of electrical energy in order to simulate a heat pump or refrigerator. By attaching the thin cord supplied with the apparatus to the threaded rod on the work piston, the stroke length can be measured.

Theory:

An ideal Stirling cycle has 4 phases (refer to Fig. 1):
Phase 1: Isothermal change of state, during which the air expands at constant temperature.

Phase 2: Isochoric change of state, during which the air cools at constant volume in the regenerator.

Phase 3: Isothermal change of state, during which the air is compressed at constant temperature.

Phase 4: Isochoric change of state, during which the air in the regenerator is heated back to its initial temperature. The process that takes place in the Stirling Engine only approximates to such an ideal cycle because in fact the four phases overlap. Gas changes from hot to cold while the expansion is still taking place and not all the air will yet being the colder part of the engine while the compression phase is occurring.

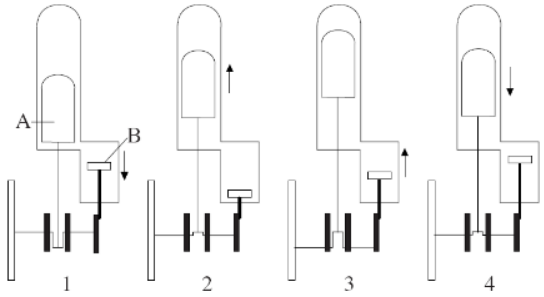

Fig. 1 Functioning principle
(A: Displacement piston, B: Working piston)

Functionality

The Stirling Engine as a heat engine:

- Fill the methylated-spirit burner, place it in the recess in the base plate, twist out about 1-2 mm of the wick, and ignite it.
- Move the displacer piston to its farthest-back position, and after a short heating-up time (about 1-2 minutes) push the flywheel gently in the clockwise direction (as seen from the motor-generator unit) to set it turning (see Fig. 2).
- If necessary, adjust the tension of the drive belt by moving the motor-generator unit.
- Turn on the filament lamp by moving the switch to the “up” position.
- Alternatively, connect an external load through the 4 mm sockets and drive it by moving the switch to the “down” position.

Speed without a load: 1000 rpm.

Speed with a generator as load: 650 rpm. Generator voltage: 6V DC.

Pressure difference: +250 hPa / -150 hPa.