

Gas liquefier

5 Series of pins 3 Driving rod 4 Knurled nut 1 Glass cylinder

Operating Instructions

Fig. 1

1 PURPOSE AND CHARACTERISTIC FEATURES

With the gas liquefier, the phase conversion from gas to liquid and back which results from a change in volume (liquefaction on decreasing volume, vapourization on increasing it) can be shown, using butane as example. It can be further demonstrated that the conversion pressure is reduced when the temperature of the butane is decreased.

2 FUNCTION AND OPERATING ELEMENTS

The most important parts of the gas liquefier are:

- 1 Duran glass cylinder, closed at one end, with explosionprotective plastic coating.
- 2 Piston with sealing gasket.
- 3 Driving rod with handle
- 4 Knurled nut which screws onto the thread on the cylinder and through which the driving rod slides.
- 5 Series of pins. These pass through a slit in the knurled nut, so that the driving rod it can be locked in several different compression positions by turning it.

3 HANDLING

3.1 Filling the gas liquefier

Before carrying out experiments, the gas liquefier must be filled with butane.

Important: Ensure that the following safety precautions are taken during filling:

 Because of the high flammability of a butane-air mixture, ensure that during the filling process, and as long as gas can flow, no open flames and no lighted cigarettes etc are within a distance of several meters from the filling area.

- 2.) Filling should preferably be carried out in a fume cupboard. If not, care must be taken that any gas which flows out can flow to the open air (butane has a higher specific weight than air), i.e. the filling process should be carried out in the open air if possible, or at an open window.
- 3.) Do not work in rooms which are below earth level.
- 4.) To avoid pressures above those admissible, do not expose the gas liquefier to ambient temperatures above 50°C or to direct sunlight.

For filling, it is purposeful to hold the gas liquefier vertically with a universal clamp and stand. The butane is taken from a burner with butane cartridge (see List of Equipment). To do this, screw off only the burner head from the burner attachment. Inset the gas outlet opening of the burner attachment in the glass cylinder, open the burner valve and carefully spray in butane until the cup-shaped end of the cylinder is about half-filled (filling volume about 1 cm³). Allow the butane to vapourize and insert the piston as soon as all liquid has vapourized. The butane vapour drives out all of the residual air, which would otherwise interfere with the experiment. After introducing the piston, screw on the knurled nut. The gas liquefier is now ready for use.

When the experiment has been completed, empty the butane out of the gas liquefier under observation of the necessary safety precautions.

3.2 Experimental procedure

Press the piston of the butane gas filled gas liquefier slowly into the cylinder. When doing this, we recommend you rest the liquefier on a soft and non-slipping surface. When the gas volume has been decreased by a certain amount, a smeary liquid begins to deposit on the wall of the cylinder and flow down to the bottom of the cylinder. On further compression.the volume of the liquid formed by condensation increases. When the piston has been completely inserted, lock it in position. The end status of the liquefaction remains as it is.

To demonstrate the evaporation of the butane on increasing the volume, release the lock on the driving rod. The piston slides back up under the pressure of the butane vapour. As this occurs, the liquid volume continually decreases until it has finally all disappeared.

The process of liquefaction and subsequent evaporation can be repated as often as required.

The phase conversion which can be caused using the gas liquefier is only isothermic to a certain approximation. This is particularly noticeable when the change in volume is relatively quickly carried out. The temperature constancy is improved when the working volume of the gas liquefier is immersed in a water bath (not above 50°C). The lower the water temperature, the less force which must be exerted on the piston to decrease the volume. When the change in volume is not carried out too quickly, the force required remains almost constant right up to liquefaction.

4 SPECIFICATIONS

Outer diameter of cylinder Inner diameter of cylinder Length of cylinder 27 mm 20 mm 270 mm

5 LITERATURE

Physik in Demonstrationsversuchen	
Ausgabe A/B-Mechanik	01141.21
Versuchseinheiten Energie	
Sonnenenergie u. Umgebungswärme	
Wärmepumpe	16630.21
Versuchseinheiten Physik	
Thermodynamik 2, Reale Gase	16300.11
Aliphatische Kohlenwasserstoffe	16801.01

6 LIST OF EQUIPMENT

Butane burner LABOGAZ 206 type	32178.00
Butane cartridge C206	47535.00

7 NOTE ON THE GUARANTEE

We guarantee the instrument supplied by us for a period of 6 months. This guarantee does not cover natural wear nor damage resulting from improper handling.

The manufacturer can only be held responsible for the function and safety characteristics of the instrument, when maintenance, repairs and changes to the instrument are only carried out by the manufacturer or by personnel who have been explicitly authorized by him to do so.