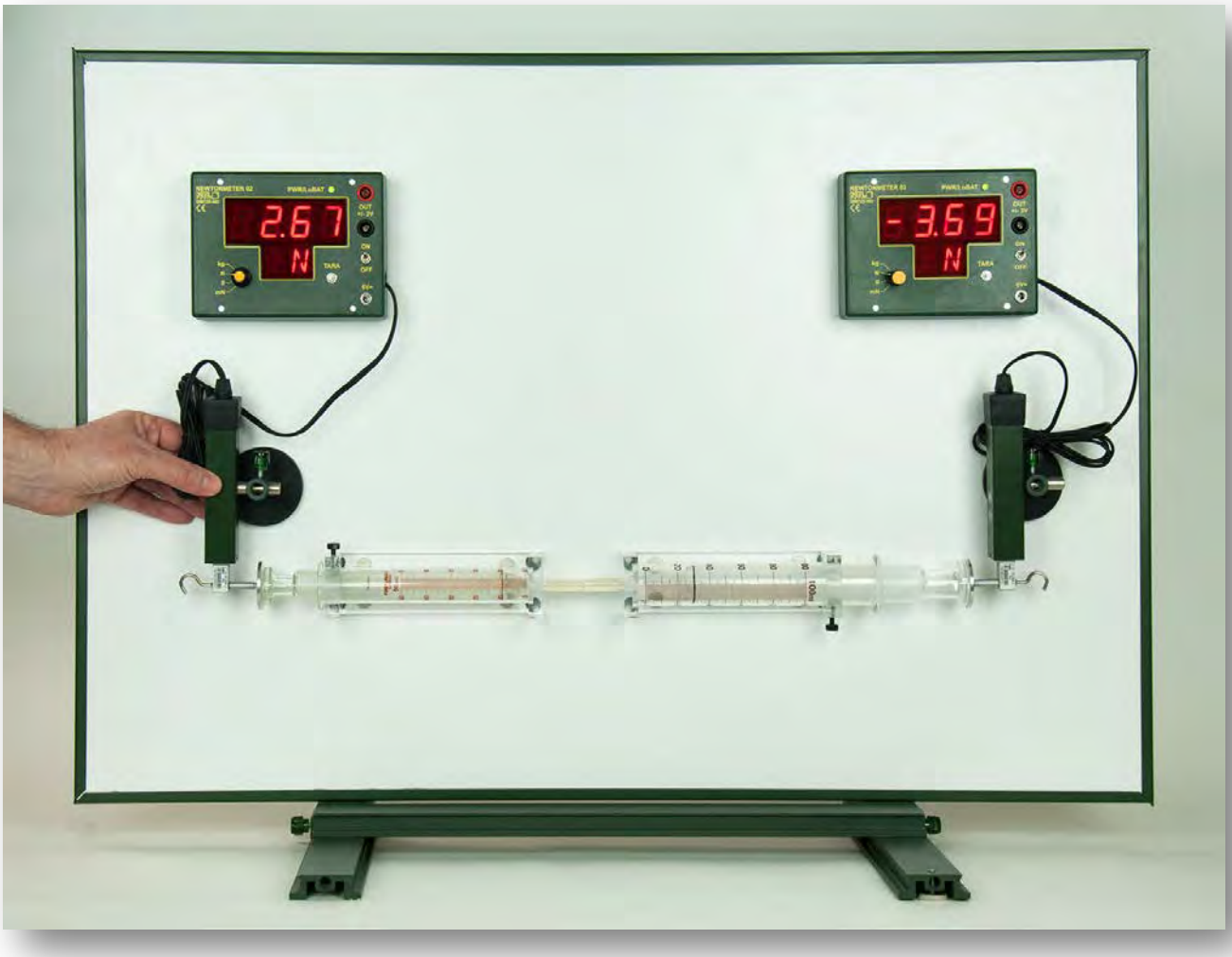
PNEUMATIC PRESS

MED 16.01d



Material:

Item-no.	Qty.	Description
DS101-1G	1	Support base, large, L=500 mm
DS600-6G	1	Board holders, pair, magnetic
DS103-1P	1	Panel, green/white, 900x610mm
C6100-1A	1	Syringe, 50 ml, glass
C6100-1B	1	Syringe, 100 ml, glass
C6100-5F	1	Holder for syringe 50ml, "inno"
C6100-5H	1	Holder for syringe 100ml, "inno"
C7445-5S	1	Hose, silicone, D=5/8 mm, L=100 cm
DS110-66	2	Magnetic base, d=66 mm, with tube and pin
DM725-ND	2	Newtonmeter "inno" 20 N / 2000 g

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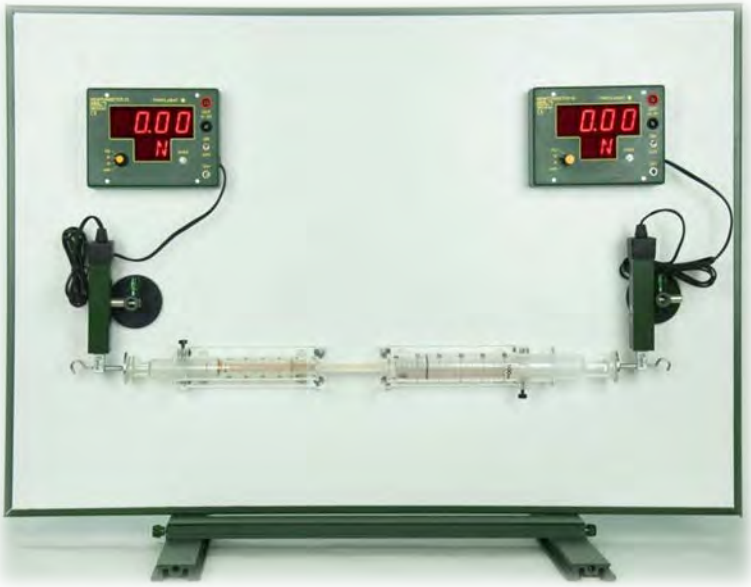
Purpose
Comparison of the pressure force on two different-sized areas.

Preparation

- Pull out the pistons of the syringes and measure the diameter with the calliper, afterwards the area (pressure area) can be calculated and noted the chart below.

- Place the two glass syringes in the respective “inno” holders and fix them carefully with the plastic screw.



- The pistons of both syringes are pulled 3 cm out. We connect the two tips of the syringes with a 7 cm silicone hose.

- Place both holders (with the syringes) horizontally on the magnetic panel.

- Place both Newtonmeter on the magnetic panel. The small capacitor plates are plugged in into the openings of the weighing bars.

- Fix the rod of the weighing bars to the magnetic base. The weighing bar of the left Newtonmeter should be fixed at the end of its rod.

- The magnetic bases are positioned so that the small capacitor plates are aligned with the pressure plates of the syringes centrally.

- The small capacitor plates should touch the pressure plates of the syringes slightly.

A_1 (Syringe 50 ml): D = ……. cm A = ……. cm²

A_2 (Syringe 100 ml): D = ……. cm A = ……. cm²

The relation $\frac{A1}{A2}$ of the pressure plates is therefore 1: …… .

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Experiment
Turn on both Newtonmeter and tare (set to 0).

Loosen the screw on the left magnetic base so that the weighing bar can be moved.

Push the left weighing bar slowly to the right – a pressure force is acting on the piston of the left syringe.

Wir ermitteln zwei verschiedene Druckkraft – Werte an der linken Spritze und lesen gleichzeitig die Kräfte am linken und am rechten Newtonmeter ab. Die Werte werden in folgende Tabelle eingetragen:

	Measuring 1	Measuring 2	Measuring 3
Pressure force F_1 at the 50 ml syringe	..... N	..... N	..... N
Pressure force F_2 at the 100 ml syringe	..... N	..... N	..... N
Relation of pressure forces	1 :	1 :	1 : .....

Wir determine the relation of $\frac{F1}{F2}$ and note this in the 3rd row of the chart.

Now we compare these values with the relation of the pressure areas of the pistons.

Result

Both ratios are nearly identical: $\frac{F1}{F2} = \frac{A1}{A2}$

Note
Hydraulic presses or lifting platforms for example are working according to this principle. The bigger the size ratio between pump piston and plunger, the smaller is the required to lift an object.

However instead of air, a liquid (such as oil) is usually used in these cases.

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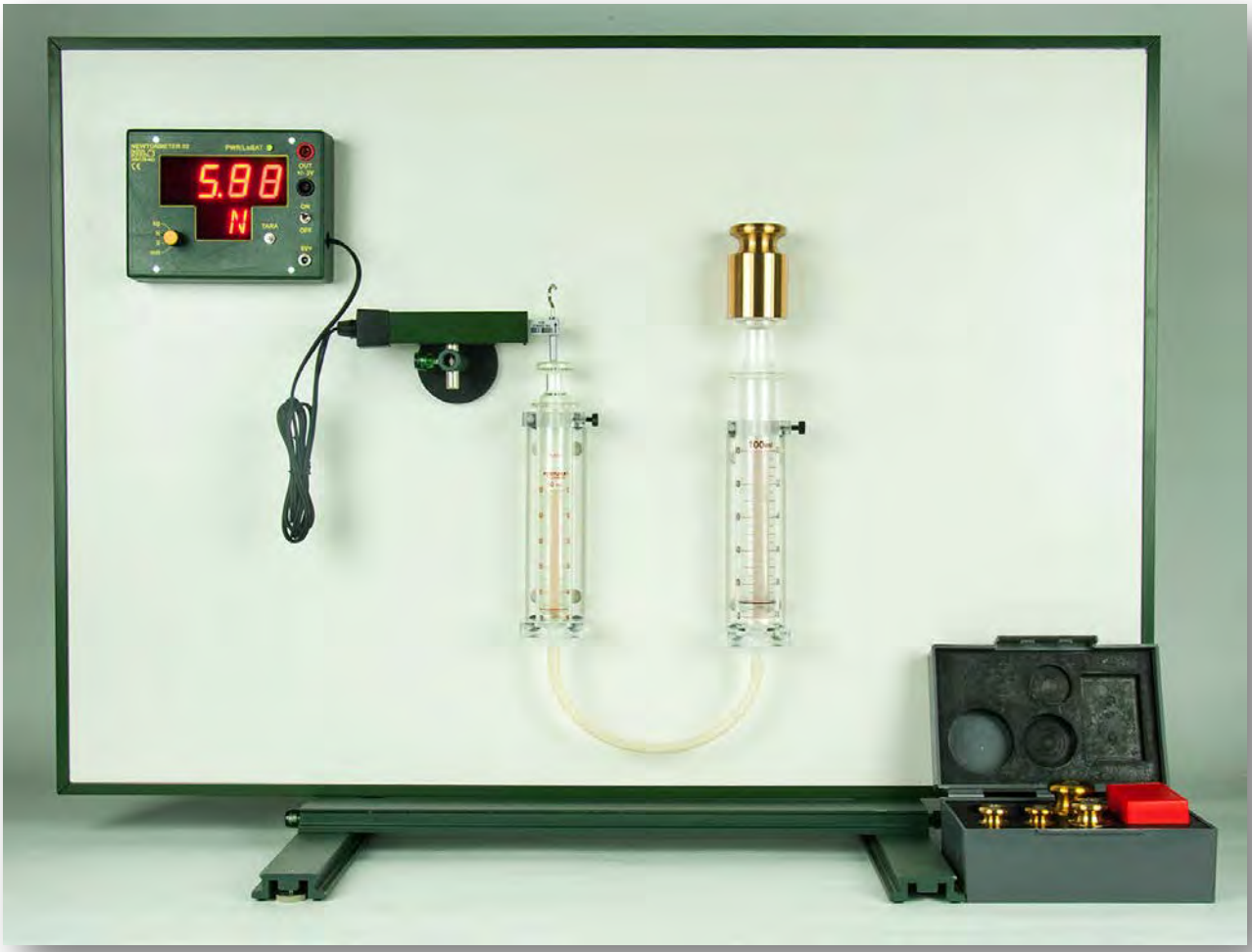
Alternative experiment setup
The following setup is mostly shown in the teaching books:



The mass used in this setup is 1000 g, the ration can easily be determined.

Note
Piston manometers (pressure compensators) also work according to this principle.