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Instruction Sheet **346 00/01**

Torsion Pendulum after Pohl

Power Supply Unit for Torsion Pendulum

The torsion pendulum after Pohl (346 00) is an oscillatory system where low-frequency free and forced oscillations (via built-in motor) can be demonstrated and an eddy current brake allows for damping of the oscillations.

The power supply unit (346 01) for the torsion pendulum provides suitable supply voltage for motor and electromagnet of the eddy current brake.

Examples of experiments:

- Static measurement of restoring torque
- Dynamic measurement of the moment of inertia J of a pendulum (from $T = 2\pi\sqrt{\frac{J}{D}}$)
- Free oscillations: curves for oscillating motion, aperiodic and creeping adjustment, decay constant, logarithmic decrement
- Forced oscillations: amplitude of a forced oscillation as a function of frequency and amplitude of the exciting oscillation, resonance curves for different dampings, comparison of the phase relationship between exciting and forced oscillation.

1 Safety Note

- **The power supply unit for the torsion pendulum (346 01) may be converted for mains voltages other than 220 V a. c., see chapter 4.2.**
- **The supply voltage for the motor (24 V d. c.) and the coil current (max. 2 A d. c.) should be checked with measuring instruments when using power supply units other than the recommended power supply unit (346 01).**

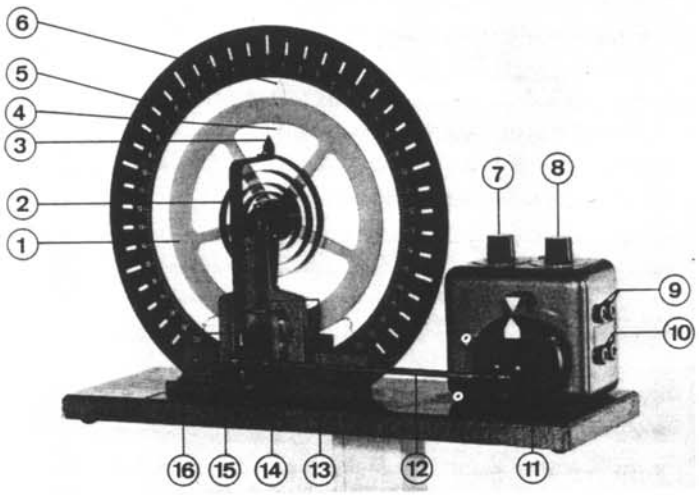

Fig. 1

⑨ *Sockets* for motor supply voltage.

⑩ *Sockets* for measuring the exciter voltage.

⑪ *Drive wheel* and eccentric.

⑫ *Driving rod.*

⑬ *Transmission lever* to which spiral spring ② of the torsion pendulum is connected.

⑭ *Guide slot* for amplitude adjustment of the transmission lever by adjusting driving rod ⑫ on the transmission lever ⑬.

⑮ *Screw* for fixing of driving rod ⑫ in ⑭.

⑯ *Electromagnet* acting as an eddy current brake for damping of torsional oscillations; 4-mm sockets for the coil current are provided on the rear.

2 Description, Technical Data

2.1 Torsion pendulum after Pohl (346 00)

①, ② *Torsion pendulum,* consisting of *oscillatory system* ① made of copper and *spiral spring* ②. One end of the spring is connected to the transmission lever ⑬.

③, ④ *Pointers* for accurate display of the phase relationship between the transmission lever (pointer ③) and the torsion pendulum (pointer ④).

⑤ *Scale* for amplitude measurement of the oscillation. Slits are provided every 5 divs. for projection purposes.

⑥ *Amplitude pointer.*

⑦, ⑧ *Controls* for the exciter voltage which is proportional to the rotational speed of the motor:
⑦ *Fine adjustment.*
⑧ *Coarse adjustment.*

Technical Data:

Natural frequency:	0.5 Hz approx.
Exciter frequency:	0 to 1.2 Hz approx.
Motor:	
Supply voltage:	24 V d. c.
Exciter voltage:	0 to 24 V d. c., continuously adjustable
Current consumption:	max. 0.6 A d. c.
Electromagnet:	
Supply voltage:	0 to approx. 24 V d. c.
Current:	nominal 1 A, for short periods 2 A
Dimensions:	40 cm x 14 cm x 27 cm approx.
Weight:	6 kg approx.

2.2 Power supply unit for torsion pendulum after Pohl (346 01)

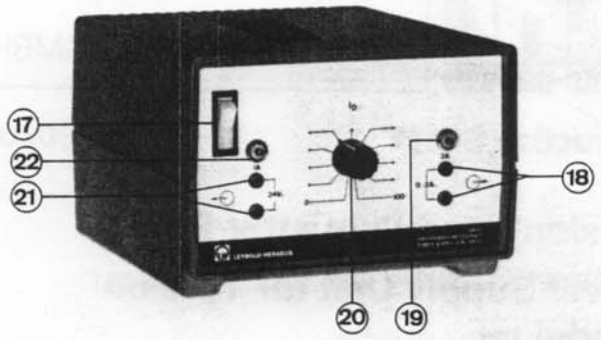

Fig. 2

⑰ *On/off switch* with pilot lamp.
⑱ *Output sockets* for electromagnet ⑯.
⑲ *Circuit breaker* for protection of output ⑱.
⑳ *Adjusting knob* for continuous adjustment of current (0 to 2 A) for the electromagnet ⑯
㉑ *Output* 24 V d. c., for supplying the motor (sockets ⑨).
㉒ *Circuit breaker* for protection of output ㉑.

Primary fuse (fuse holder is integral to the connector on the rear): T 1.0 B (Ref. No. 69 815) for 220 V/240 V
T 2.0 D (Ref. No. 69 818) for 110 V/130 V

Mains voltage: 220 V, 50/60 Hz (can also be converted to 110 V, 130 V, 240 V; see chapter 4)

Dimensions: 20 cm x 21 cm x 23 cm

Weight: 6 kg approx.

Included with the unit are: Mains lead, spare fuse T 1.0 B (contained in a fuse holder), fuse T 2.0 D (for conversion to 110 V/130 V).

3 Operation

If the power supply unit for the torsion pendulum (346 01) is not used, other power supply units are required:

one capable of a fixed voltage of 24 V d. c., 1 A and a second source of d. c. which is variable between 0 and approx. 24 V with a current rating of 2 A, e. g.
Variable low-voltage transformer S 591 09
Variable low-voltage transformer SE 522 20

The amplitude of the transmission lever ⑬ can be varied by adjusting driving rod ⑫ to different positions along the guide slot ⑭ (bottom position gives maximum amplitude).

For experiments with forced oscillations, it is advisable to use a magnetic voltage stabilizer (522 60) in front of the power supply unit which supplies the motor in order to avoid frequency changes caused by mains voltage variations.

To reduce beat frequencies which might occur with forced oscillations, slightly dempen the system by eddy current brake (load electromagnet ⑯ with 0.1 A to 0.3 A).

For undistorted shadow projection, halogen lamp housing 12 V, 50/100 W (450 64), with halogen lamp 12 V/100 W (450 63) can be used placed at the same height as the axis of the rotational pendulum.

4 Changing Fuses, Mains Voltage Conversion

4.1 Changing the primary fuse on the power supply unit for the torsion pendumum (346 01)

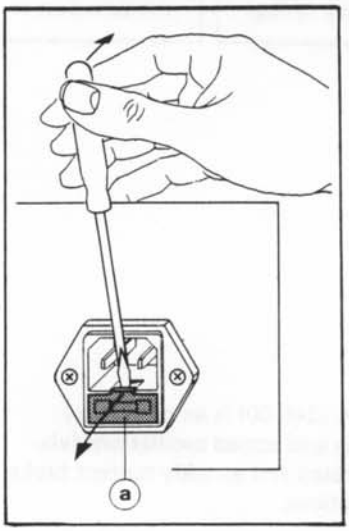

Fig. 3.1

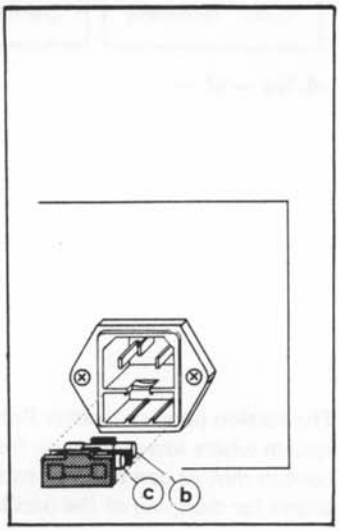

Fig. 3.2

To exchange the primary fuse, the insert ⓐ containing the primary fuse ⓑ and the replacement fuse ⓒ is taken out using a screw-driver or another suitable tool, as indicated in Fig. 3.1.

The primary fuse ⓑ can then be taken out and be replaced by a new fuse or by the replacement fuse ⓒ. Check fuse rating before doing so! (Fig. 3.2).

In order to keep the unit continuously operative, a replacement fuse should always be stored in the insert.
Now the insert is placed back into the unit.

4.2 Conversion to mains voltages other than 220 V a. c.

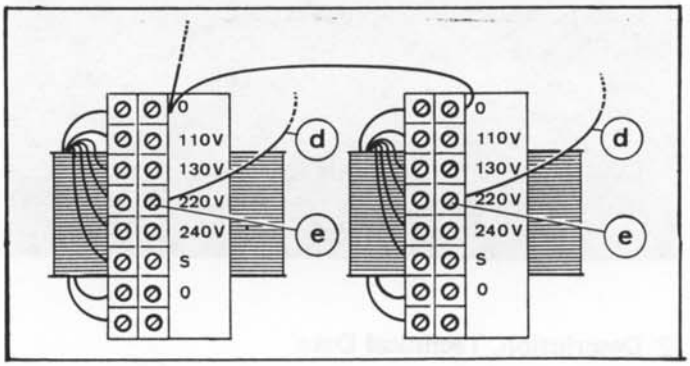

Fig. 4

Important: Disconnect the mains cable from the unit!

Use a cross-head screw-driver size 2 to remove the four screws on the bottom of the unit and remove the top part of the enclosure. An ordinary 3 mm screw-driver can be used to remove (see Fig. 4) the wires on the transformer and to reattach rhem to the appropriate points according to the required mains voltage.

Attention! Both transformers must be converted.