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Fig. 1: Inclined plane, equipment set complete, 11301-10

Operating instructions

CE The unit complies with the applicable EU-guidelines

TABLE OF CONTENT

1 SAEFTY PRECAUTIONS

Caution

- Carefully read these operating instructions completely before operating this instrument. This is necessary to avoid damage to it, as well as for user-safety.

2 PURPOSE AND CHARACTERISTIC

With the aid of the compact device, forces that keep a body in equilibrium on this plane can be investigated for different angles of inclination of an inclined plane without time-consuming setup and adjustment work. The basic relationship between force, displacement, stroke and work for simple machines can be worked out.

A rolling body used as a measuring object has the advantage that the lines of attack of all acting forces intersect at one point, the center of gravity. On the one hand, this avoids undesirable torques, and on the other hand, the physical facts can be presented more simply and transparently.

For the direct determination of the test geometry, the device is equipped with two scales and an angle scale, so that the continuously adjustable inclination angle of the plane can be read off directly, but also the angle function sin, which is relevant for the inclined plane, can be determined as a quotient of final height to path length by direct reading off the two scales.

With the aid of the two force gauges, the corresponding force components parallel and perpendicular to the rolling plane can be taken.

3 FUNCTIONAL AND OPERATING ELEMENTS

The inclined plane has the following parts or functional elements (see Figs. 2, 3).

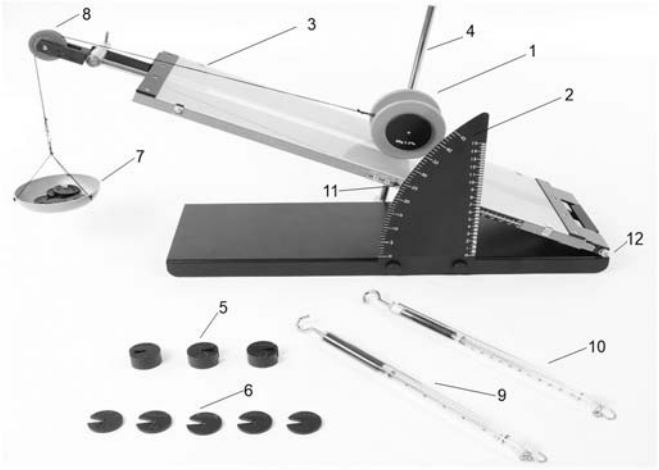

Fig. 2

1. Rolling body (11301-01)

2. vertical plate with angle scale. Two knurled screws with angle scale. The knurled screws are used for fastening to the base plate.

3. inclinable track with demonstration cm graduation for realization of inclined plane. The track can be rotated around a hinge *(12)* and can be adjusted in height by means of a sleeve with locking screw on the threaded stem *(4).*

5. slotted weights, 50g

6. slotted weights, 100g

7. bowl for slotted weights

8. pulley with guide slot for a thread, which can be attached to the pulley body *(1)* and the shell.

9. Spring balance 5N

10. Spring balance 5N

11. pointer for indication of the angle of inclination

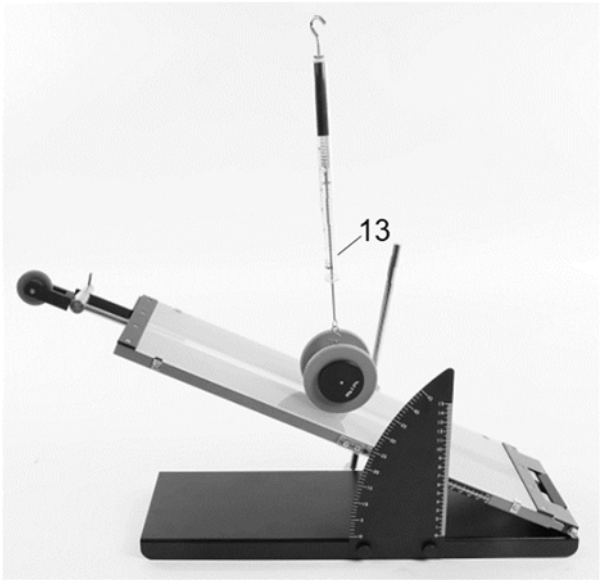

Fig. 3

13. The second spring balance 5N can be attached directly to the roller body to measure the vertical force component.

4 HANDLING

The inclined plane can be disassembled if necessary and stored in a space-saving manner. Proceed as follows to assemble the inclined plane:

- Loosen the track *(3)* at the threaded stem *(4)* and fold it down. If necessary, unscrew the threaded stem.
- Attach the supplied thread to the shell. Select the length of the second thread so that the rolling element is centered on the roller track.
- to measure the force components, two spring balances can be attached directly to the rolling element.

5 EXPERIMENTS

5.1 Measurement of the path component F_s (slope down force)

First, the weight force *F* of the rolling element with and without additional masses is determined (spring balance 5 N). Then the force can be measured by hand parallel to the roller track. The component Fs is determined for different angles of inclination or heights h, so that the relationships

$$F_s = F \cdot \sin\alpha \quad bzw. \quad F_s = F \cdot \frac{h}{l} \quad (l = Bahnlänge)$$

can also be verified by graphical application, if necessary.

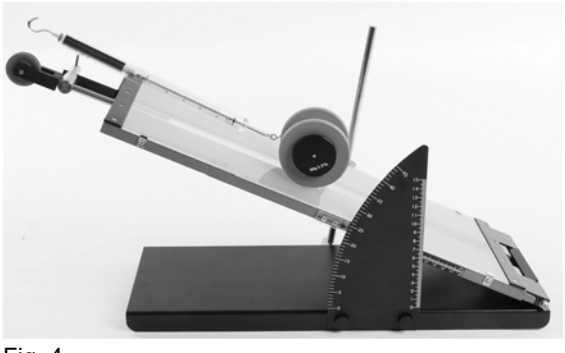

Fig. 4

5.2 Decomposition of the weight force of a body on the inclined plane (slope force Fs and normal force Fn)

The rolling element *(1)* has two fastening hooks at the center of gravity. Here it is possible to attach both force gauges in order to measure the corresponding force component in each case.

It must also be ensured that the direction of application of the tensile force is exactly perpendicular to the path. With correct adjustment, the force component Fs must have the same values for corresponding inclination angles of the plane as in the case of the overlying rolling element (Experiment 5.1). For different angles of inclination or heights h, the rolling element can now be given the relations

$$F_n = F \cdot \cos\alpha \quad bzw. \quad F_n = F \cdot \frac{x}{l}$$

can be verified. Here x is the projection of the path length l onto the horizontal.

Since the rolling body is kept in equilibrium in this case by two forces perpendicular to each other, the experiment also results in the decomposition of the weight force F into two perpendicular components whose direction varies by changing the angle of inclination.

6 TECHNICAL DATA

Base plate	(520 x 155) mm
Vertical plate	(100 x 215) mm
Scale range	0° - 45°
Plane length	440 mm
Mass of rolling body	50 g ± 2%
Mass of additional weight	200 g ± 2%

7 LIST OF EQUIPMENT

Inclined plane equipment set complete	11301-10
Inclined plane	11301-02
Rolling element	11301-01
Spring balance 5 N	03065-04
Slotted weights 10g	02205-03
Slotted weights 50g	02206-03
Fishing line 5m	02089-01

8 WASTE DISPOSAL

The packaging mainly consists of environmentally-friendly materials that should be returned to the local recycling stations.

Do not dispose of this product with normal household waste. If this unit needs to be disposed of, please return it to the address that is stated below for proper disposal.

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