Bending of a leaf spring

Physics | Mechanics | Forces, work, power & energy

Difficulty level	Group size	Preparation time	Execution time
easy	-	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/6474821e21530f000293d572

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General information

Application

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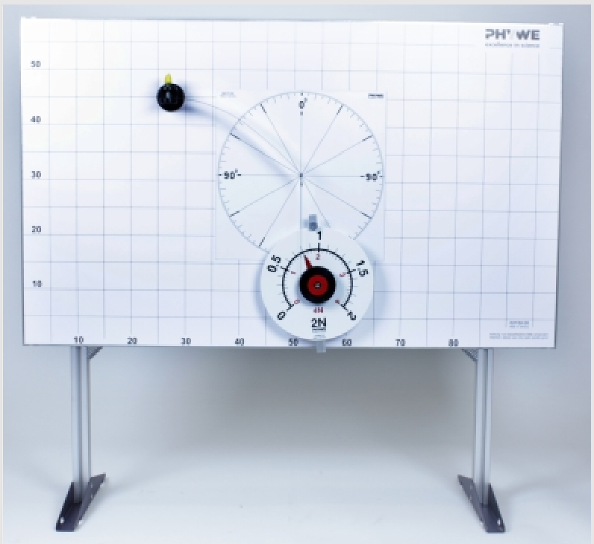

Leaf spring Experimental setup example

The leaf spring is a spring that is clamped on one side and can be found in many areas of electrical engineering.

In this experiment, the variation of the force required for the elastic deformation of the leaf spring becomes clear at different points and angles of application.

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Other information (1/2)

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Prior knowledge

No prior knowledge is required for this experiment.

Principle

The bending behaviour of a leaf spring is to be investigated under the conditions that the point of application and the direction of the force remain the same.

Furthermore, it is to be demonstrated that the force effect is greatest when the force acts vertically on the leaf spring.

Other information (2/2)

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Learning objective

The experiment will demonstrate the behaviour of leaf springs under load and explain how the spring constant of a leaf spring can be determined.

Tasks

1. The students should investigate the behaviour of a leaf spring under load and determine its spring constant D.
2. In the same experimental set-up, the tensile force at different angles is to be determined at constant deflection and an interpretation of the result is to be attempted.

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Safety instructions

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The general instructions for safe experimentation in science lessons apply to this experiment.

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Equipment

Position	Material	Item No.	Quantity
1	PHYWE Demo Physics board with stand	02150-00	1
2	Clamp on fixing magnet	02151-01	1
3	Torsion dynamometer	03069-03	1
4	Scale for demonstration board	02153-00	1
5	Pointers f. Demonst.Board, 4 pcs	02154-01	1
6	Optical disk, magnet held	08270-09	1
7	Leaf spring	02228-00	1
8	Marker, black	46402-01	1
9	G-clamp	02014-01	2

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Set-up and Procedure

Set-up

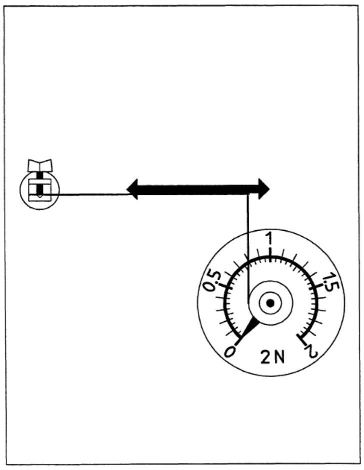

Figure 1

- Place the sleeve with magnet on the demo panel and clamp the leaf spring.
- Place two pointers so that their side edges are at the same height as the horizontal leaf spring (fig. 1).
- Position and adjust the dynamometer so that the pull cord is vertical.

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Procedure (1/2)

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- Move the force gauge vertically downwards until it indicates a force of 0.1 N; mark the point on the board above which the end of the leaf spring is located with the pen
- Move the dynamometer further down and sideways (so that the pull cord always remains vertical) and proceed as before for steps of 0.1 N.
- Remove the dynamometer and determine the (vertical) distances s of the points marked with the pen to the lower edge of the scale with the help of the scale; enter values for s in Table 1.

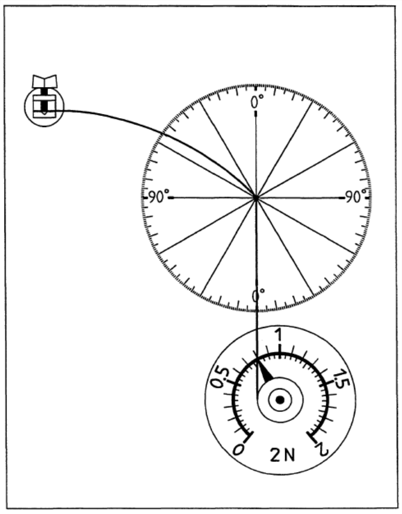

Figure 2

Procedure (2/2)

- Place the force gauge in the lower part of the panel so that the pull cord is vertical and a force of 0.8 N is indicated (Fig. 2).
- Place the angle disc so that the centre is under the end of the leaf spring.
- Now gradually move the dynamometer horizontally (to the right and left) and, if necessary, slightly vertically so that the pull cord forms angles of about 30°,45°, ... with the vertical. and the end of the leaf spring always remains above the centre point (5 = constant); measure the forces required in each case and note the values for the horizontal pull cord and the pull cord perpendicular to the bent spring.

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Evaluation (1/3)

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The force required for constant deformation of the spring is smallest when it acts perpendicular to the leaf spring.

Tabelle 1

F/N	s/cm
0,1	2,3
0,2	4,5
0,3	6,3
0,4	7,9
0,5	9,4
0,6	10,9
0,7	12,1
0,8	13,0

Tabelle 2

Zugschnur	F/N
Senkrecht nach unten	0,8
waagerecht	1,2
Senkrecht zur Blattfeder	0,65

Evaluation (2/3)

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The graphical representation of the measured values in Table 1 shows a curve that is almost linear in the lower part, but then becomes increasingly curved (Fig. 3).

The elastic deformation also depends on the direction of the force. The force required for a desired deflection is smallest when it acts perpendicular to the spring. For other tensile directions, only the force acting perpendicularly to the spring is effective.

This explains why the curve in Fig. 3 deviates more and more from a straight line with larger forces. If we take into account the measured value for the force acting perpendicular to the spring in Fig. 3, as noted in Table 2, this point lies on a straight line on which the points with the values for small deflections lie.

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Evaluation (3/3)

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The experimental setup can also be used to demonstrate the dependence of the effect of the force on the position of the point of application of the force. A constant force is applied at different points on the leaf spring.

Then the experimental set-up as a whole can be used to make the students aware that forces are characterised by magnitude, direction and point of application.

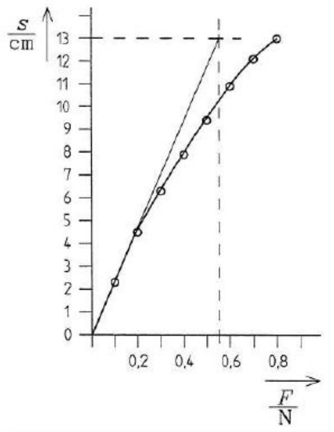

Figure 3

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