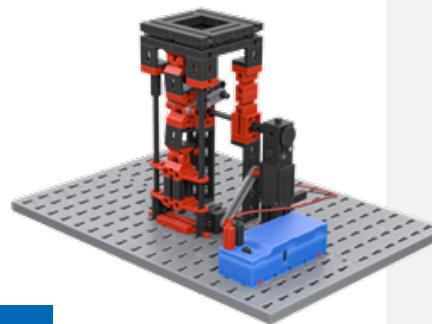


Model 18

Toggle press



DESIGN TASK

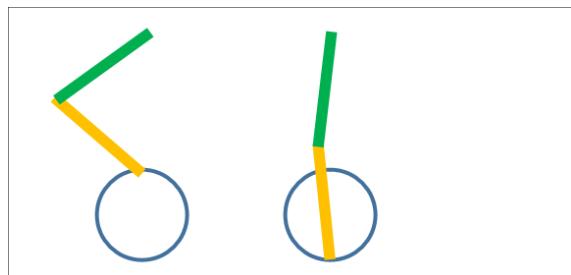


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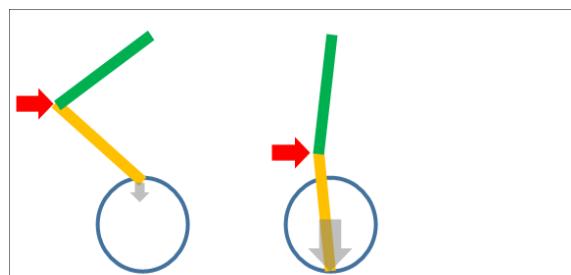
A knee lever works like the human knee joint. Let's take a simplified look at a cyclist's leg and pedal:



The thigh is green, the lower leg is orange, and the pedal path is shown as a blue circle. On the left, we see the bent leg when the pedal is at the top. On the right, the leg is almost fully extended—and for good reason: in this position, it can exert the greatest force on the pedal.

Now let's replace the leg with two articulated levers. The joints at the top and bottom correspond to the hip and foot, while the middle joint is the knee. Instead of muscle power, pressure is applied directly to the knee to move the levers.

The red arrow in the second drawing shows how the force acts directly on the knee and moves the levers:



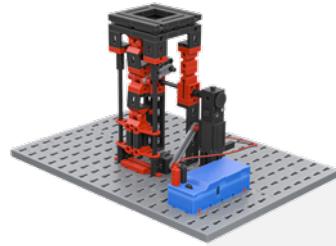
The model shows how a small force can be converted into a large force through a clever lever design. The articulated connection of the levers allows a relatively small force (red arrows) at a specific point to generate a significantly greater force (gray arrows) – albeit with a slower movement.

This mechanical force amplification is based on the principle of the lever and occurs in many technical applications, such as presses, toggle lever mechanisms, and even human joint movements.

Task: Construct the model according to the instructions. When assembling the model, make sure that all axes are well aligned so that the press head can move without resistance and the force transmission works optimally.



THEMATIC TASK



1. Name the three components (assemblies) of the model through which the torque of the motor is transmitted to the pressing force in the press head.



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2. Compare a) the effect of the combination of the eccentric crank and the lever attached to it (the I-strut 30) with b) the effect of the two levers in the toggle lever mechanism. What is the difference, what is the same?



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EXPERIMENTAL TASK



Place objects of different thicknesses under the press, such as paper, modeling clay, or thin pieces of wood, and compare the model with the eccentric press.

Is the maximum force of this toggle lever press model smaller, equal, or greater?

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APPENDICES

Further information

- [1] Wikipedia: [Toggle lever](#).
- [2] Wikipedia: [Toggle lever press](#).



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