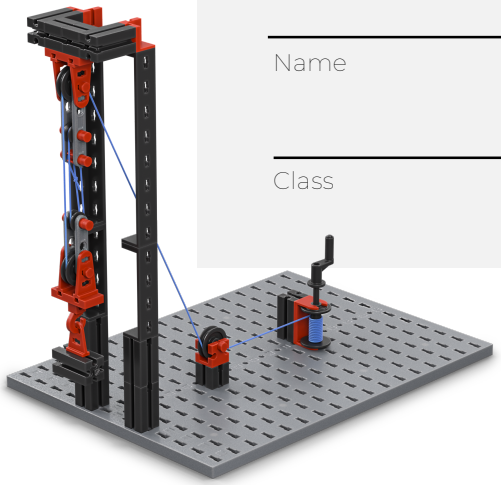
Model 2
Pulley block

Date

Name

Class

One of the oldest mechanisms in existence is the pulley. Without it, the impressive stone buildings of antiquity would never have been built. A pulley increases force by distributing the load across several rope loops. The work performed—lifting a weight—remains the same, but it takes longer to pull (with less force).



DESIGN TASK

Build the simple pulley block shown here.

THEMATIC TASK

Fig. 2 shows three different rope guides, each using two, three, and four pulleys of the pulley block. Implement them one after the other and answer the questions below.

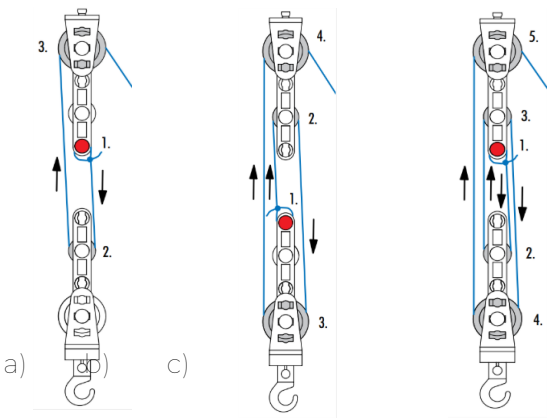
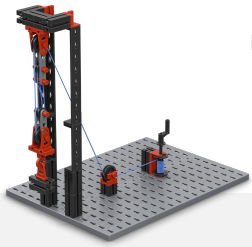


Fig. 2: Three different rope guides with a) two, b) three, and c) four pulleys



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1. How many turns of the crank does the rope winch need without a pulley, and how many in cases a), b), and c) to lift an object 10 cm? pulley block and how many in cases a), b), and c) to lift an object 10 cm?

2. What force amplification do the three pulley versions a), b), and c) provide compared to a rope pull without pulley block?

3. Why is this type of pulley block also called a "factor pulley block"?

EXPERIMENT

Now add a cogwheel to the pulley block, as shown in Fig. 3.

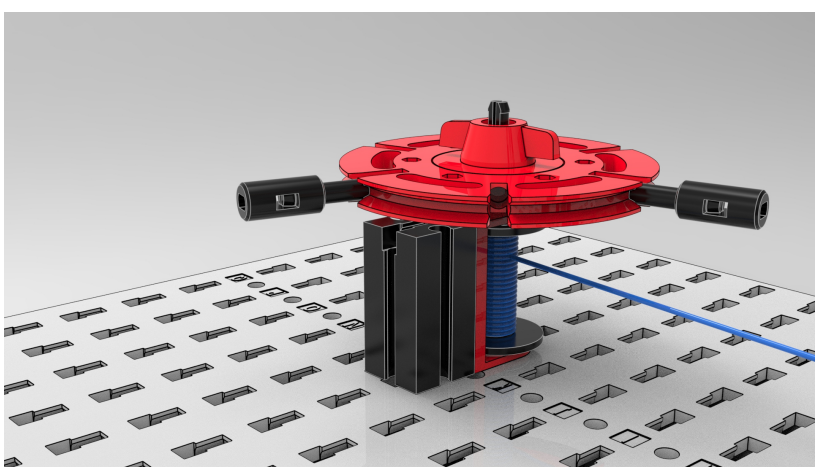
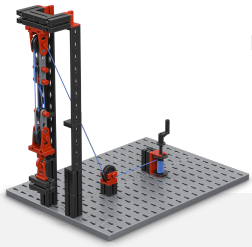


Fig. 3: Wave wheel for pulley



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Explanation of the corrugated wheel as a lever:

The wave wheel works on the principle of a lever. The locking adapter is the center of the lever, i.e., the pivot point (the axis). The forces act on different lever arms:

Force on the locking adapter:

The force acting on the locking adapter in the center represents the input variable.

Force on the rope drum:

This force is transmitted to the rope drum via the lever mechanism and ultimately acts on the rope.

1. What force amplification does the wave wheel achieve with a) a locking axis of 30 and b) a locking axis of 45 as a lever?

_____

_____

2. What is the "price" you pay for the force amplification with the corrugated wheel?

_____

_____

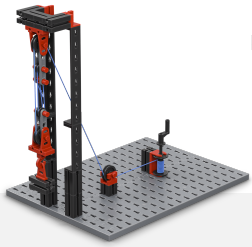
3. Which force amplification is easier to achieve—that of the corrugated wheel or that of the pulley? Name various advantages and disadvantages of the two force amplifiers.

_____

_____

ADDITIONAL TASK

Build the simple pulley block with motor shown in Fig. 3 and test the model.



ADDITIONAL TASK

Build the simple pulley block with motor shown in Fig. 4 and test the model.

Date

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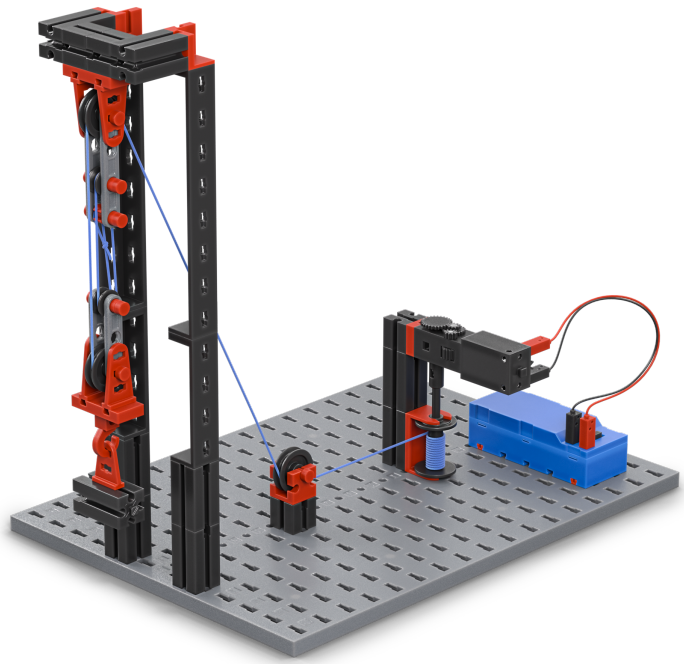

Fig. 3: Pulley block with motor