Crank as a handle

You have probably seen different cranks on a variety of devices: from the old style pencil sharpener, the simple kitchen meat grinder to a boat winch that winds up the rope to lift the sails. But, how does a crank actually work and what can it offer us? Discover all these by following the instructions below.

Discover:
- What is a crank mechanism?
- What is the relationship between the handle position, the force applied and the lifting speed?

Level Of Difficulty ★ ★ ★ ★ ★

Materials Needed:
- Engino® Simple Machines (STEM40) or Cams & Cranks (STEM04).

Procedure:

1. Find the instructions in **pages 21-24** and build the **fishing crane** model.

2. You will need to tie and wrap the string on the pulley a few times so it works properly.

3. For each case we are going to change the position of the handle (as indicated in the picture below). For **case 1** the handle is already positioned in the first hole. Turn the crank and feel the force applied in order for the load to be lifted and also observe the lifting speed.

4. Move the handle one hole closer to the axis (**case 2**). Turn the crank, making sure that you keep the same rotating pace with your hand as before. Feel the force and observe the lifting speed again.

5. Finally repeat the same procedure for **case 3** and complete the table on the right.
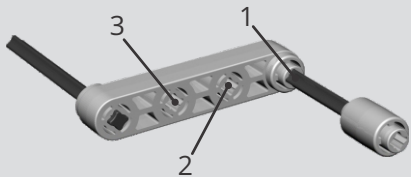
Engino® "fishing crane" model

1. Tick the correct boxes in the following table comparing the force applied on the crank in order for the load to be totally lifted, as well as the lifting speed.

Case	Handle's Position	Force (difficulty in rotation)			Lifting Speed		
		Easy	Medium	Difficult	Slow	Medium	Fast
1.		✓			✓		
2.			✓			✓	
3.				✓			✓

2. Look carefully at the "handle's position" column, the "FORCE" column and the "LIFTING SPEED" column. Write down your conclusions about the relationship between the position of the axle on the crank, the difficulty in rotation and the speed by which the load is lifted.

The further away the handle is placed from the axle, the easier it gets to turn the crank. However, the load is lifted slower because the covered distance becomes longer (bigger circle).

3. Complete the following sentence using the words in the box.

When we ....*manually*.... turn a ....*crank*.... using our hand, the further away the handle is from the ....*axle*.... the ....*easier*.... it is for the crank to turn, but the load is lifted in ....*slower*.... pace.


Relation of force and speed

The use of a crank as a handle, even though it has many applications, it does not take advantage of the full potential of the mechanism. However, the oil drilling machine (pumpjack) uses cranks not as handles, but as parts of the entire drilling mechanism. How? Let's build the next model and find out!

Discover:
- What is the relationship between a crank's position and the difficulty in rotation?
- What is the relationship between the force (difficulty in rotation) and the speed?

Level Of Difficulty ★ ★ ★ ★ ★

Materials Needed:
- Engino® Simple Machines (STEM40) or Cams & Cranks (STEM04).
- Ruler.

Procedure:

1. Find the instructions online and build the **oil drill** model.

2. In this model, there are two cranks: the input and the output. Identify them and write their names in the picture at the bottom.

3. For **case 1**, the middle axle is inserted in the first hole of both the output and the supporting cranks (see number 1 in the picture below). Turn the input crank, feeling the force applied and observing the speed of the piston pump. Then, with the help of a ruler, measure the maximum distance which the piston pump is moving along the vertical axis (simulated by the extendable rod).
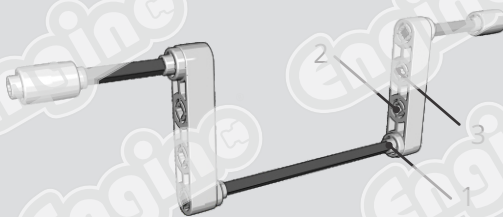
4. For **case 2**, insert the middle axle in the second hole of the cranks (indicated with number 2) and turn the input crank. Repeat the same observations (speed, force and distance). Note that the extendable rod is not fully inserted in now, so measure the maximum travel distance accordingly.

5. For **case 3**, remove the middle axle and insert it in the third hole of the cranks (indicated with number 3) and follow the same procedure as before. Again, be careful when taking your measurement, by placing your ruler at the appropriate point.

1. Complete the following table with your measurements and compare the force and speed for each case.

Case	Handle's Position	Piston's pump distance	Force (difficulty in rotation)			Piston's Pump Speed		
			Easy	Medium	Difficult	Slow	Medium	Fast
1.			✓			✓		
2.				✓			✓	
3.					✓			✓

2. Look carefully at the "Handle's position" column and the "Piston's pump distance" column and write down your conclusions about the relationship between the position of the handle and the distance the piston pump travels.

The further away the handle is from the axle, the longer the distance travelled by the piston pump (and vice versa).

3. Now, write down your conclusions about the relationship between the difficulty in turning the crank ("FORCE") and the speed of the piston pump.

The further away the handle is from the axle, the easier the crank turns and the faster the piston pump moves (and vice versa).

output crank
input crank
piston pump
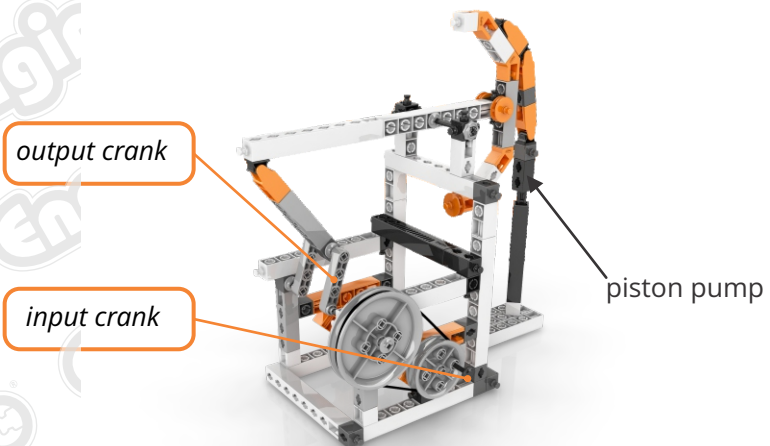
Engino® "oil drill" model

Thank you for accessing our free version of this resource.

To continue reading and gain access to the full version, please login and register your product.

We appreciate your interest and hope you find our resources valuable.

Login or Register