



Curiosity Guide #707

Fluid Power

Accompanies Curious Crew, Season 7, Episode 7 (#707)

Liquid Lift

Investigation #2

Description

Let's do some heavy lifting!

Materials

- Hot water bottle
- Threaded cap with open valve
- 5/16 plastic tubing
- 60-milliliter syringe
- Board
- Water
- A friend
- You may need a funnel and a chair to get enough water from a height to raise the student on the hot water bottle.

Procedure

- 1) Fill the syringe and 10 feet of tubing with water.
- 2) Put the threaded cap into the empty water bottle and attach the tubing to the valve.
- 3) Place the board on the water bottle. Invite a friend to stand on the board.
- 4) Slowly begin to press on the syringe.
- 5) What do you notice?

Results

Explanation

You may have noticed that your friend begins to lift off the floor. This is an example of hydraulics, in which liquid in a closed system is used to transmit power from one part of the system to the other. Pushing the 60-milliliter plunger is easy because the diameter of the plunger is small compared to the area of the water bottle. Total force is calculated by the pressure multiplied by the area. The pressure of the water is the same throughout the system, so the only difference is the area of the syringe compared to the water bottle. This means that the force in the larger water bottle is multiplied. There is a mechanical advantage going from a small cylinder to a larger area, so the lifting power is multiplied. French scientist Pascal in the 1600s realized that fluids under pressure in a closed container transmit the force equally throughout the container. This is referred to as Pascal's Law.

I bet you've noticed... Have you ever driven by a construction site and seen a large backhoe lifting heavy loads of dirt or rocks? Or have you visited an auto mechanics and seen a car lift in the air so the technician could work on it? Designing ways to move such heavy things seems impossible, but this is when fluid power can be really useful. Fluids include gases and liquids. When force is applied to these gases and liquids, they can transmit power from one place to another. Going up!

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