Making a Hydraulic Machine

STEM Challenge

Description
Harness the power of water while creating a fun machine!

Materials
- 10-milliliter syringes
- Plastic tubing
- Cardboard
- Wooden skewers
- Zip ties
- Scratch awl
- Exacto knives
- Scissors
- Hot glue
- Popsicle sticks
- Drill
- Drill bits
- Wire
- Needle-nose pliers
- Snips
- Paper clips
- Foam board
- Small objects
- Water
- Food coloring
Procedure
1) Use the available materials to design and build a hydraulic machine that can do work using liquid power.
2) Decide how many joints will be in the machine.
3) Determine if the base will rotate or not.
4) Plan how the system will move, in order to decide where and how to place and mount the syringes.
5) Fill the syringes with colored water, mount them to cardboard joints, and connect them to plastic tubing.
6) Test and redesign, as necessary.
7) Does your machine function the way you intended?

Results
Explanation

The idea of hydraulics is to apply a force on a liquid in a closed system to transfer the energy to another part of the system. Applying pressure to one of the plungers causes the syringe on the other end of the system either to extend out or to pull in. If the second plunger is connected to one part of the machine, and the joints can freely move, the parts can bend one way or another. The more joints there are in the system, the more complex and precise the motion of the machine.

Let's learn more! For both hydraulic and pneumatic power systems, there are four parts in the design. First, there is a place to store the fluid. This storage space is called a reservoir or receiver. Second, there is a pump for liquids or compressor for gases to convert mechanical energy into fluid power. Third, there is a valve that can control the direction the fluids go and how large a flow to send. Finally, there are actuators like cylinders and pistons that transfer the energy from fluid power back to mechanical power. Each of the parts is connected by hoses or piping to carry the fluids. Great engineering!

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