CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Beck T. Pedersen

Project Number
J0322

Project Title
Pneumatics vs. Hydraulics

Abstract

Objectives/Goals
Pneumatic/hydraulic systems are used in a wide variety of applications such as toys, construction equipment, and robotics. The goal of my project was to determine whether a hydraulic or pneumatic system could generate more force. The amount of force a pneumatic/hydraulic system can generate determines the type of uses the system would be most appropriate for.

Methods/Materials
I made a crane-like arm with an Erector set, and a pneumatic/hydraulic system using two 60 mL syringes connected with plastic tubing. The arm was operated by depressing the plunger of one syringe, which forced the plunger of the other syringe (connected to the arm) to expand, and made the arm push down on a scale. I filled the pneumatic/hydraulic system with different substances, and with each substance measured the maximum force of the arm pressing down on the scale. I tested the force of air (pneumatics), water (hydraulics), and canola oil (hydraulics).

Results
The hydraulic force generated with water was greater than the pneumatic force generated with air. I was not able to successfully measure the hydraulic force generated with canola oil because it was too thick to work in my system properly. Measurements of hydraulic force generated with water was approximately 60% stronger than the pneumatic force generated with air.

Conclusions/Discussion
My experiment indicated that the hydraulic system generated more force than the pneumatic system, and suggests that hydraulics should be used for projects requiring more force such as moving heavy objects. I think the hydraulic system generated more fluid power because water is not compressible and air is highly compressible.

Summary Statement
I made a mechanical arm operated by a pneumatic/hydraulic system filled with various substances to test which system and substance generated more force.

Help Received
I designed and built the mechanical arm and hydraulic system myself. I performed measurements with some assistance from my father.