Name:

Class Period:

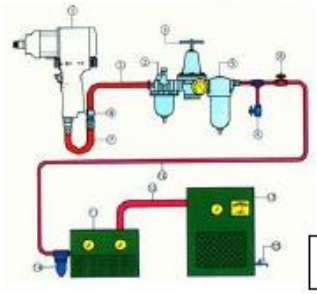
Date:

Energy Storage

Needed Supplies: Air compressor, valve, cylinder, piping/tubing, weight, pressure gauge, ruler, stopwatch

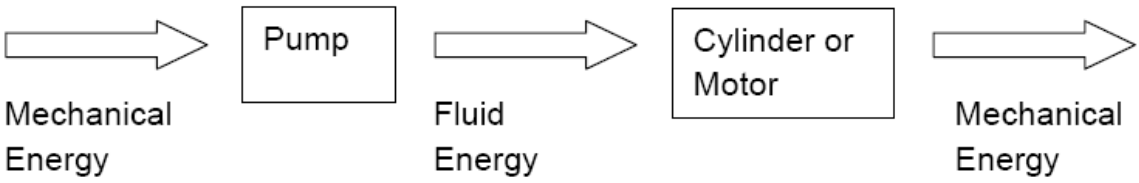
Background

www.toolmonger.com



http://www.cartool.com.cn

- Air compressors are used every day to do jobs that would otherwise be difficult to do with ordinary hand tools.
- Air compressors use an air pump to convert mechanical energy to fluid energy, store that energy in a tank, and then expel it through a cylinder or motor, converting it back to mechanical energy.



- Asdf
  - Work
    - Work is defined as force times distance
    - **W = FD**
      - **F** in lbs
      - **D** in inches

- Power
  - Power is defined as work per unit time
    - **Power = Work / t**
  - Hydraulic power is the product of Pressure and Flow Rate
    - **Power = PQ**
      - **P** in psi
      - **Q** in in^3/sec
- Efficiency
  - Efficiency is the ratio of power input to power output
    - **e = Output power / Input power**

Experiment

- In this experiment you will follow the path of compressed air from a tank to a cylinder attached to a weight
- The air within the air compressor tank is stored energy, and creates power when released at a certain pressure (**P**) and a flow rate (**Q**).
  - Refer to the specifications of the air compressor model that you are using, specifically what flow rate (in CFM, cubic feet per minute) it can deliver at a certain pressure.
- When the air reaches the cylinder, work is done by the cylinder (a force is applied over a distance)
  - Power is produced during the extension of the cylinder as well (Work/time)
- Between the air tank and the cylinder, power is lost through friction in the pipes as well any leaks in the system
  - It is possible to determine how efficient the system is by dividing the output power at the cylinder by the input power from the compressor tank

Procedure

1. Plumb a basic air circuit with 1 valve and 1 cylinder and connect to an air compressor
2. Make sure that air compressor has a pressure gauge.

3. Attach an object of known weight to the extended cylinder
4. Retract the cylinder and record the following:
    a. How long it takes to lift the weight
    b. The pressure reading from the gauge
    c. The distance that the weight travels

Data

Calculations

Power produced by air compressor:

P		psi
Q		ft^3/min
Q		in^3/sec
Input Power		lb-in/sec

Efficiency:

Input Power	
Output Power	
e	

Power produced by cylinder:

F(weight of object)		lbf
D(distance travelled)		in
W(work)		lb-in
t (time)		sec
Output Power		lb-in/sec

Discussion

1. What generally increases with the size of an air compressor tank? (Consult your instructor or online resources if necessary)

2. Would decreasing the length of tubing between the tank and cylinder increase or decrease the efficiency of the system? Explain your answer.

3. What does an efficiency of 1 mean? Why is the generally not possible in the real world?