FINAL PROJECT
TECH 4880
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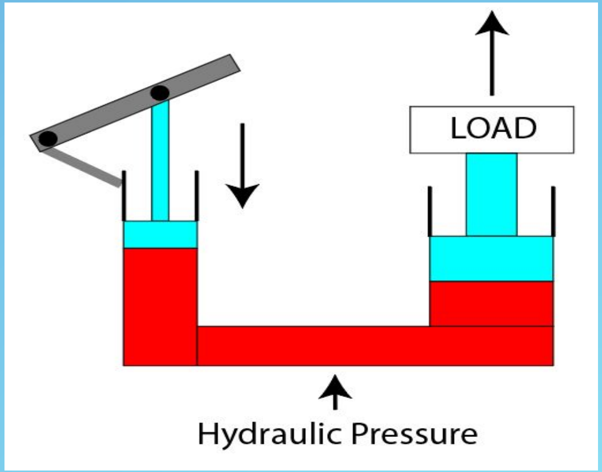
INTRODUCTIONS

Fluid power is just another word for describing hydraulics and pneumatics technologies. Both of these technologies use liquid or gas to transmit power from one location to another. For hydraulics, the fluid is mostly oil, therefore pneumatics uses compressed air.

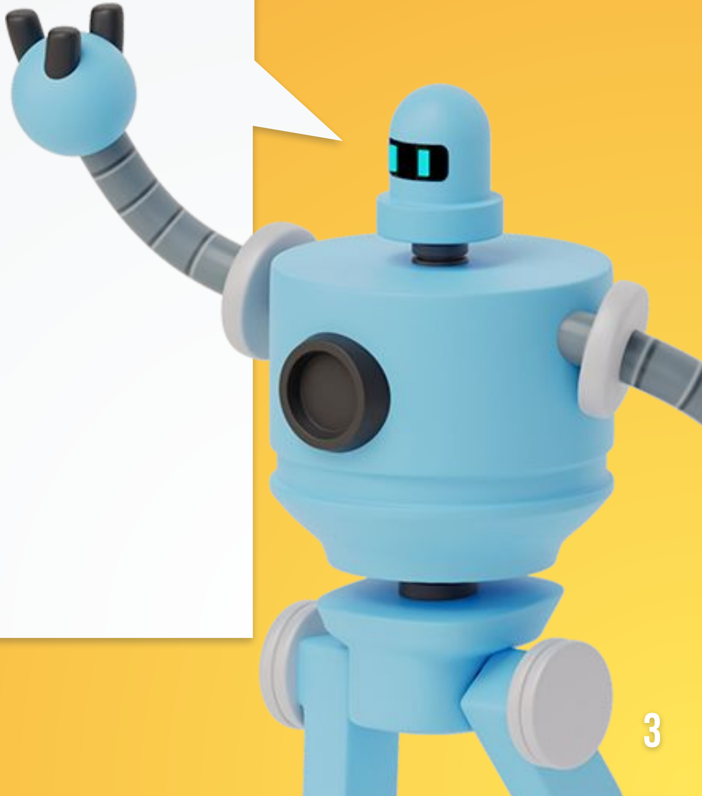
The technology of fluid power is used in many industries in today's world like automotive assembly lines, passenger airlines, packaging equipment, cranes, forklifts, and many more. Fluid power can be used for many tough tasks like creating a tunnel or even lifting or stacking containers. Within the fluid power system, it can push, lift, pull, grip, or rotate almost any load.

Fluid power systems contain four important components which are valve, actuator, pump, and reservoir tank. However, there are some components that are extremely necessary but cylinders, hoses, fittings, gauges, sensors, filters, or seals could be used to refine the system for either accurate operation or to increase the lifespan of the system or the parts themselves.

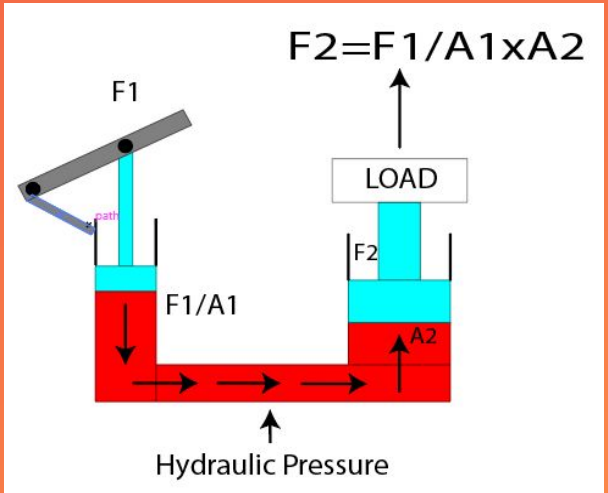


OBJECTIVES

1. *The objective of this project is to build a Hydraulic Powered Simple Machine System that you can use to explore fluid power fundamentals.*
2. *By the end of this project, we should be able to know*
   a. *how to calculate and understand each of the class levers*
   b. *how to construct a simple hydraulic system,*
   c. *how to draw diagrams of different kinds of hydraulic systems*
   d. *apply mathematical connection to the fluid system within a working model.*



APPLIED SCIENTIFIC CONCEPTS AND PRINCIPLES



Some concepts that are mainly used in fluid power are **Pascal's Law, Flow rate,** and **area.** In Pascal's Law, the pressure is equal to the force that is divided by the area. It stated that within a hydraulic system the pressure is exerted onto a piston that produces an equal increase of pressure onto another piston in the system.

The formula that is used for **Pascal's Law** would be

$$p = F/A$$

p = Pressure

F = Force

A = Area

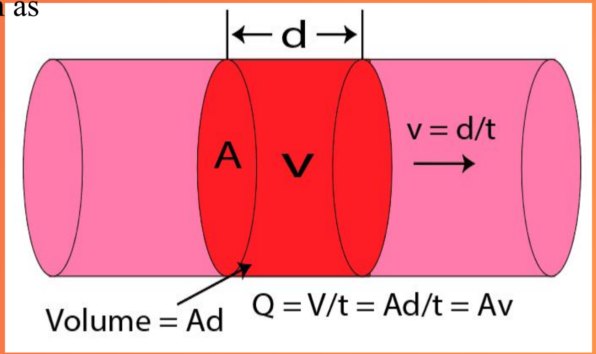
The next concept is called the **Flow Rate.** Flow rate is the amount of fluid that passes through a given cross-sectional area per unit of time. The SI unit for flow rate would be m3/s. The volume part of the fluid in the pipe is written as *V= Ad* where *A* is the cross sectional area of the fluid and *d* is the width of the portion of the fluid. The symbol for this formula would be

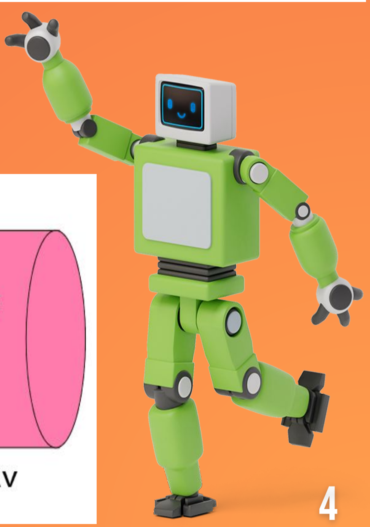
$$Q = vA$$

Q = Volumetric flow rate

V = flow velocity v

A = cross-sectional vector area





GOVERNING EQUATIONS

Pascal's Law	$p = F/A$
Area of a cylinder	$Ac = \pi(\text{diameter})24$
Volume of the cylinder	$v = Qt$
Flow rate	$Q = vA$ or $Q = vt$

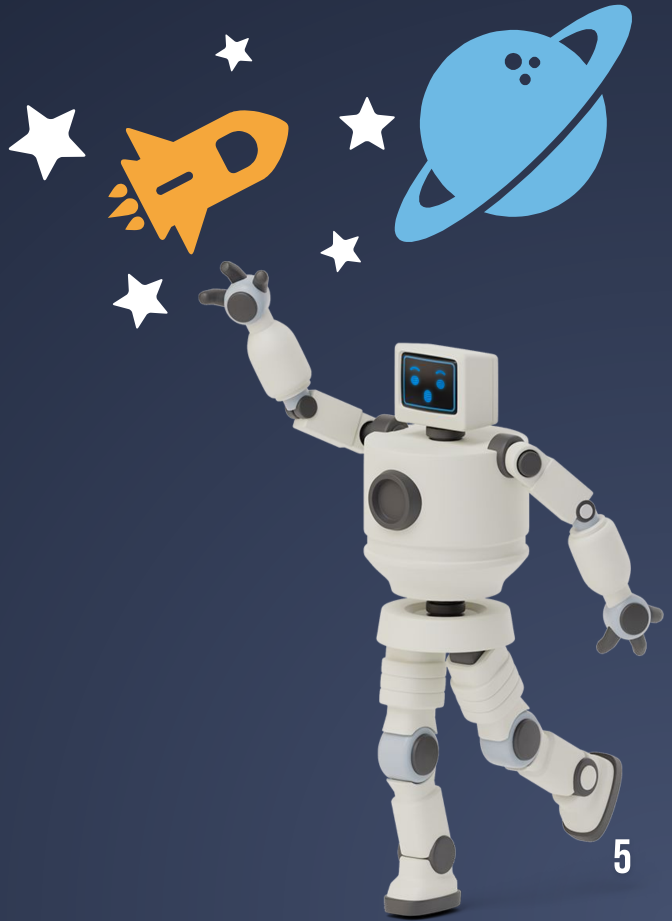
p = Pressure (psi or lbf/in2)

F =Force (lbf)

A = Area (in2)

d = diameter (in)

Q = Flow rate (gpm or gal/min)



DATA COLLECTION AND ANALYSIS

1.97 in diameter syringe

10.04 in height of syringe

height = 10.04

radius = 0.985 in

Ac = π(1.97in)/210.04 = 1.21436 in2

v = 10.04 in/12 sec=0.837 in/sec

Q = 1.21436 in2 x 0.83 in/sec = 1.01601 in/sec x 0.26 = 0.264 gal/min

Volume of cylinder = 1.21436 in2 x 10.04 in = 12.19217 in2

l = (10.04in)2+ (0.985in)2 = 101.771825 in2

Ac = π (0.985in)2+ π(0.985in)(101.771825 in)= 317.9777852 in2

1st Class Lever

F1 = (0.66 lbf)(6 in)/6 in = 0.66 lbf

p = 0.66 lbf/317.9777852 in2 = 0.002075616696 psi

HP = (0.002075616696 psi)(0.195 gal/min)/1714 = 2.4 × 10-7HP

2nd Class Lever

F1 = (0.66 lbf)(12 in - 6 in)/12 in = 0.30 lbf

p = 0.33 lbf/317.9777852 in2 = 0.001037808348 psi

HP = (0.001037808348 psi)(0.195 gal/min)/1714 = 1.2 × 10-7HP

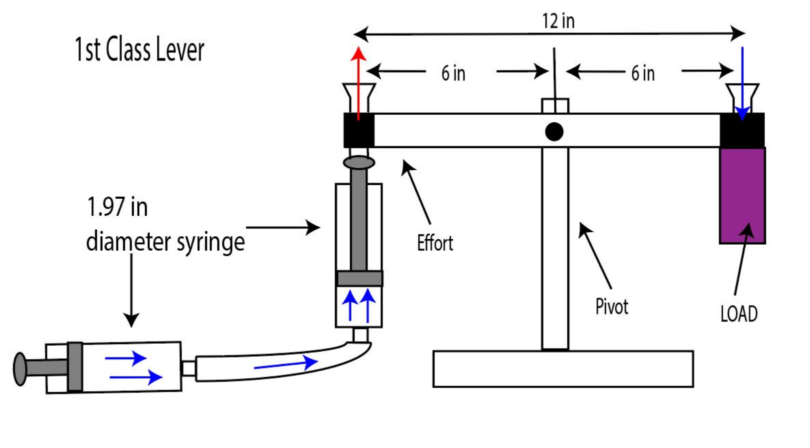
3rd Class Lever

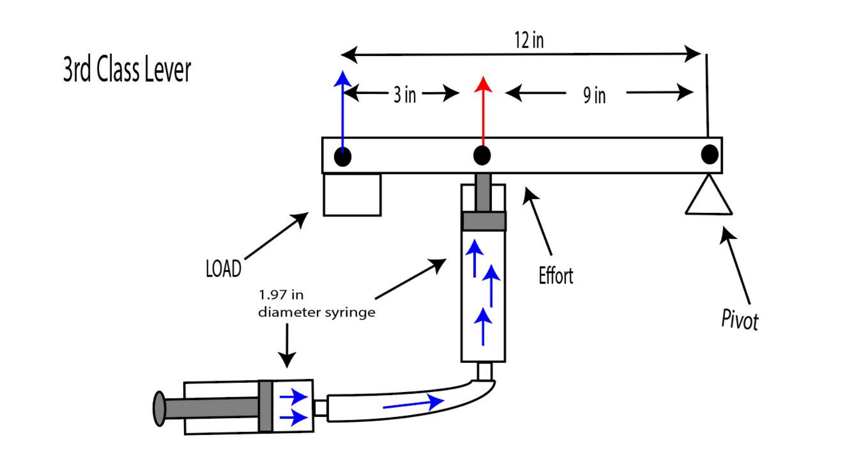
F1 = (0.66 lbf)(12 in)/6 in = 1.32 lbf

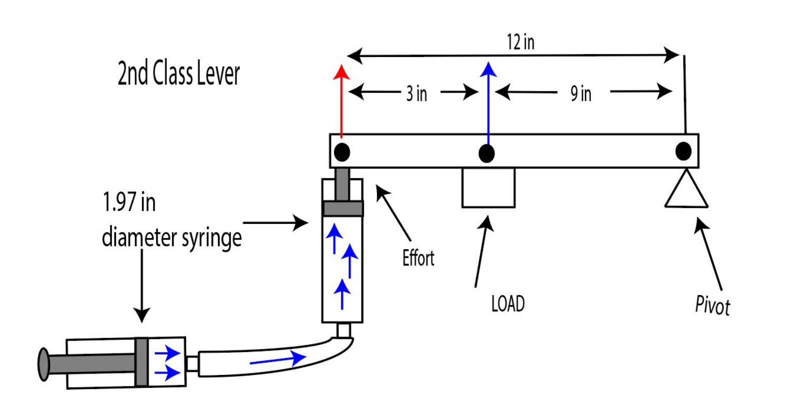
p = 1.32 lbf/317.9777852 in2 = 0.004151233393 psi

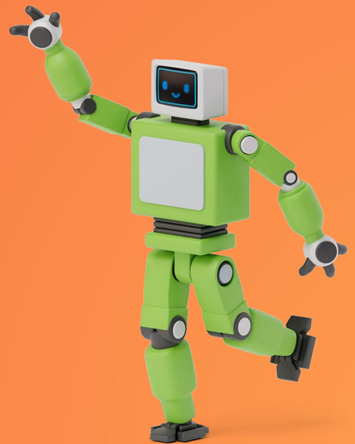
HP = (0.004151233393 psi)(0.195 gal/min)/1714 = 4.7 × 10-7HP

WORKING SKETCHES

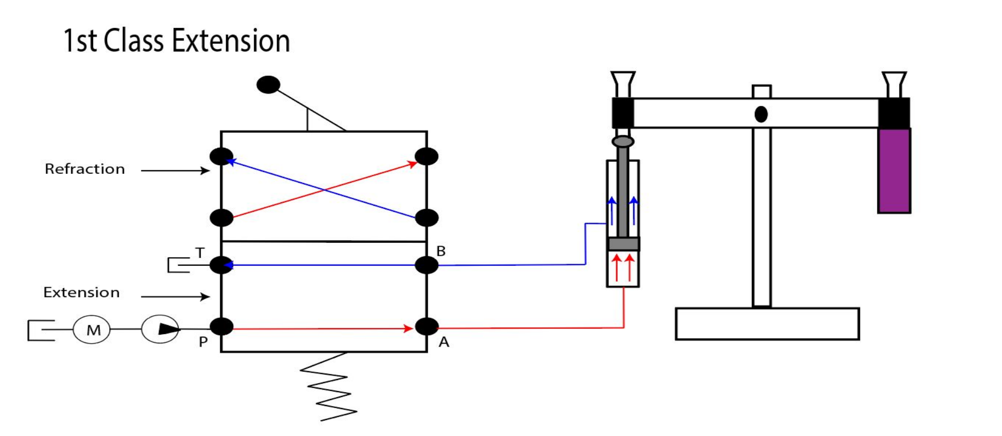


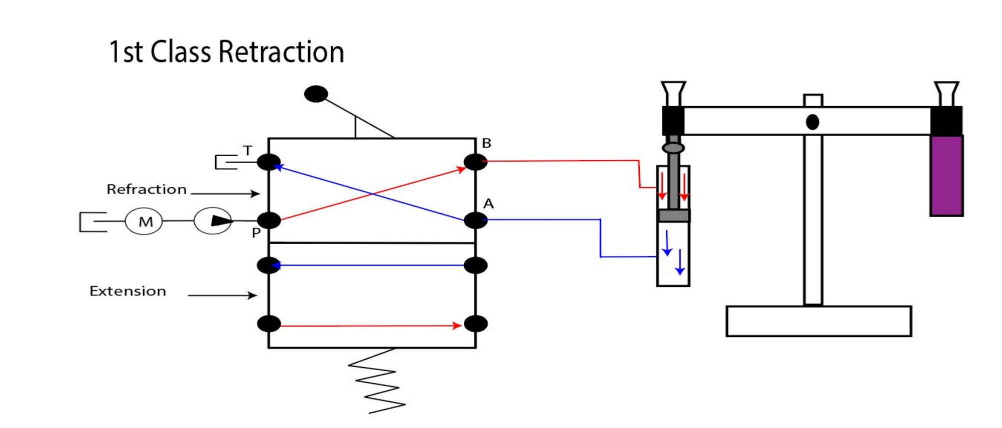




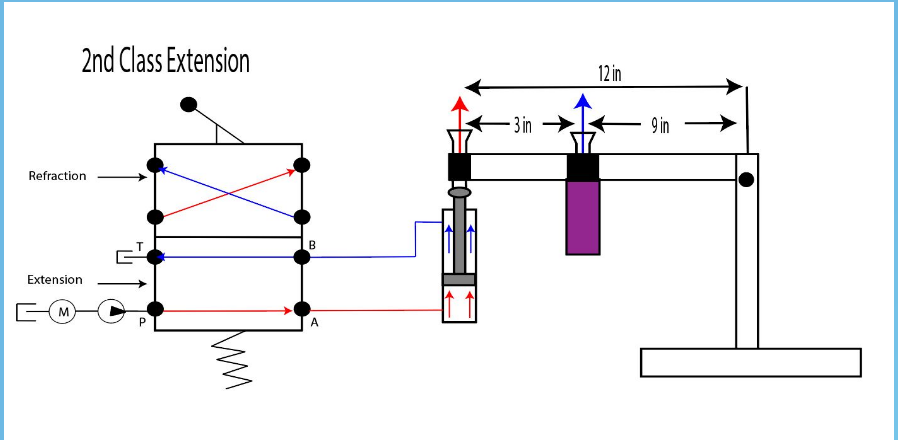


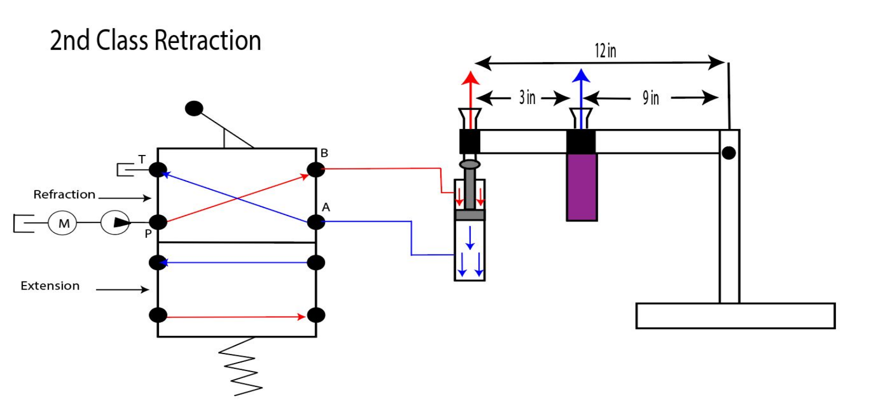
CIRCUIT DRAWINGS OF FULL-SCALE DESIGN

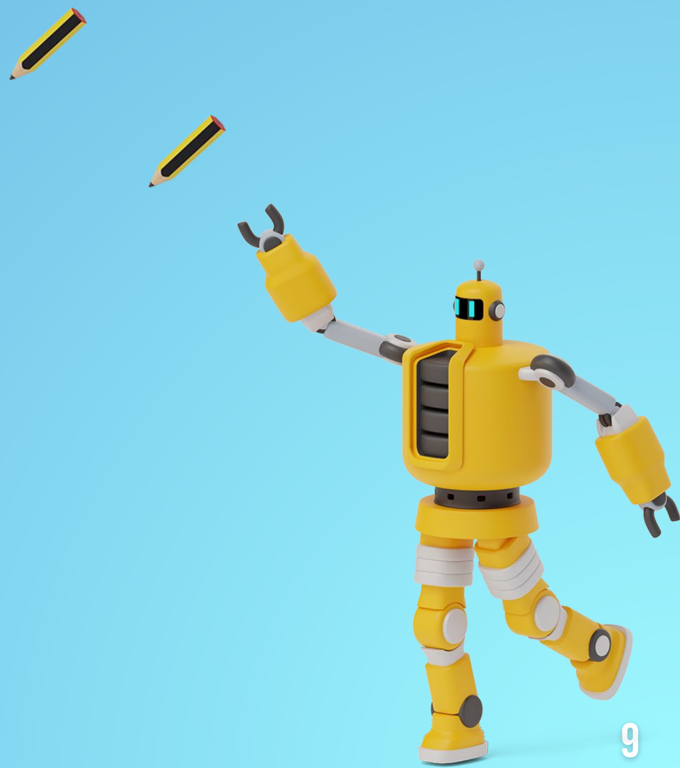




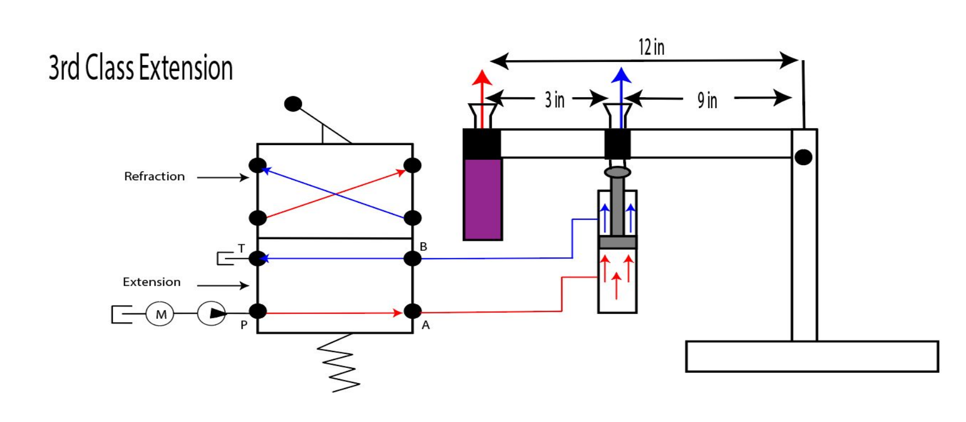
CIRCUIT DRAWINGS OF FULL-SCALE DESIGN PART 2

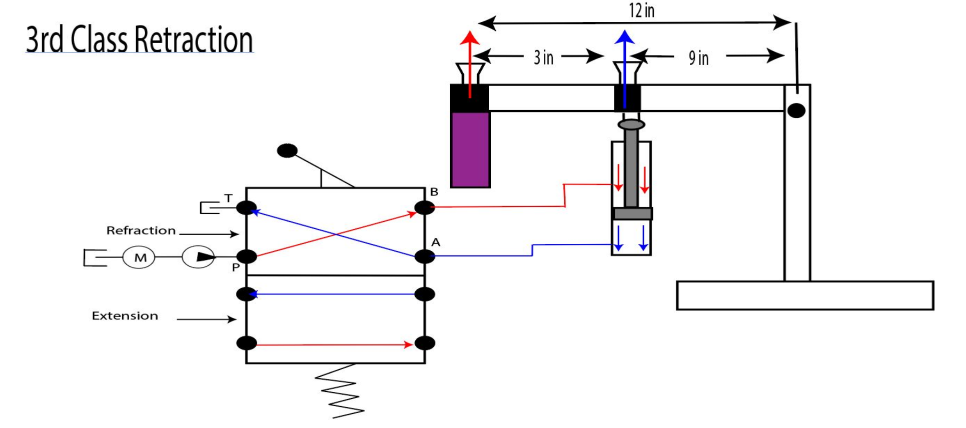




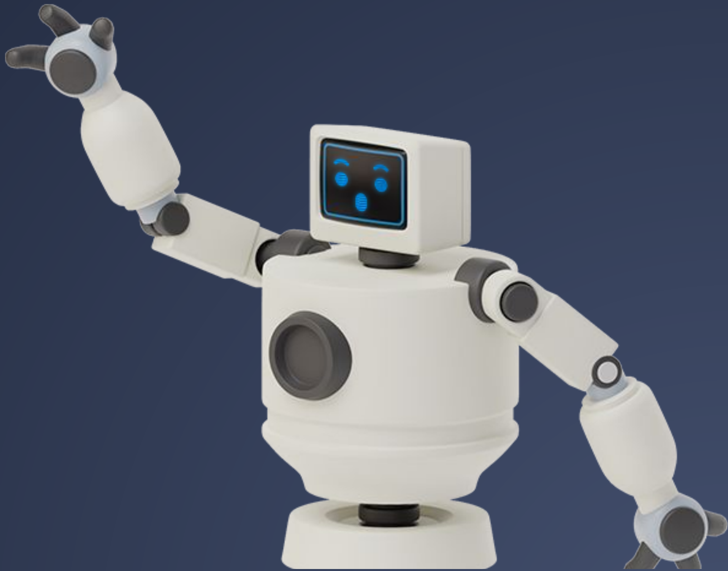


CIRCUIT DRAWINGS OF FULL-SCALE DESIGN PART 3





Working model (brief video recording)



FINAL FULL-SCALE DRAWING