TUTORIALS FOR BRACCIO IDRAULICO

OVERVIEW

A hydraulic arm is a practical method for analysing the way hydraulic fluids transfer energy from one point to the next. Here you have to make a hydraulic actuated arm to primarily accomplish following tasks:

The device arm must be able to lift and extend, requiring the use of two separate hydraulic systems. When force is applied to one point it is transmitted to another point using a fluid. This will allow for the simultaneous operation of both arm movements.

In order to complete the given task, the device will have to rotate a full 90°. To do so, we will require another hydraulic system, placed at a strategic angle to the base. The base for the hydraulic arm will be ingeniously and simply designed. To allow one hydraulic to move the entire 90°, the base will consist of the large device base and a smaller shaft of rectangular pieces. Similar to principles used in the mousetrap car, the large device base will act as the wheel, and the smaller shaft will be the axel, the larger the axel to wheel ratio, the more distance it will travel.

Basically,

1. The hydraulic powered arm must turn 90 degrees in order to complete the course.
2. It must be able to pick up and drop a predetermined number of canisters.

The Hydraulic Control System

The hydraulic arm operators will be in control of three syringes. One will control the rotation of the device, while the other lifts and extends it in an attempt to pick up a canister. Much practice is needed to efficiently work as a group. When one person pushes on a syringe, the liquid then extends the syringe placed on the device, which is attached to the initial syringe by a small plastic tube. The liquid used in the syringes will also determine the efficiency of the hydraulics system.

The Liquid

Due to the fact that oil is almost incompressible, it is the ideal liquid for a hydraulic system. Yet it was found to corrode the rubber material inside a common syringe. When water was tested, it was deemed acceptable, since it didn't compress an excessive amount.

What is Compression?

Compression is when the spaces between molecules are reduced due to an external force. This causes less of the energy applied on the first syringe to transfer to the second syringe.

THE DIMENSIONS IN THE TOTORIAL ARE PROVIDED JUST TO GIVE AN OVERVIEW ABOUT THE MANUFACTURING PROCESS. ACTUAL LENGTHS REQUIRED MAY BE DIFFERENT FROM THOSE SPECIFIED HERE.

You can also visit following links to get visual ads with the manufacturing, obviously minus the gripper. Also you have to attach an electromagnet in the arm. You are more than welcome to make innovative and mind-blowing models. Good luck……

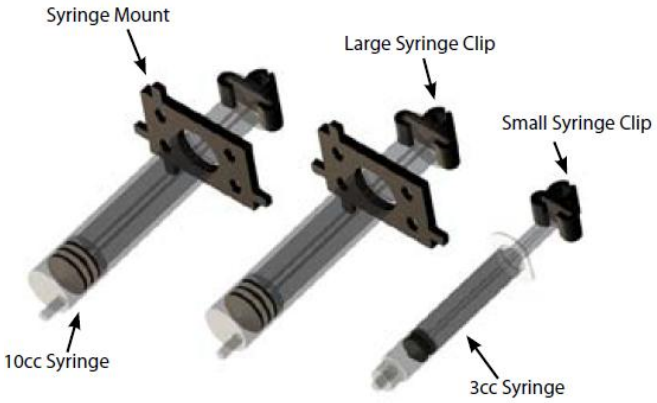
http://www.youtube.com/watch?v=vsF95qA1x7I&feature=related

http://www.youtube.com/watch?v=HPp1u4NMwMY&feature=related

http://www.youtube.com/watch?v=Qeg0y5AAmtI&feature=related

THE HYDRAULICS

STEP I : Assemble The Hydraulic Cylinders



STEP II: Cut the Hydraulic Lines

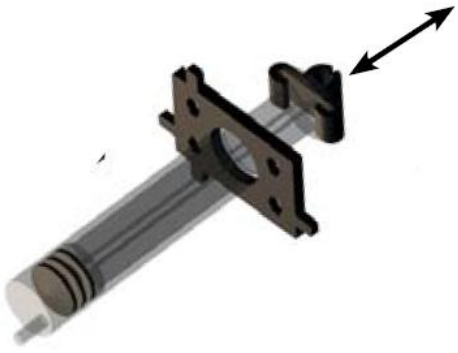
Cut the tubing into parts of desired lengths.

STEP III: Put the Tubing and Cylinders into a Tub of Water

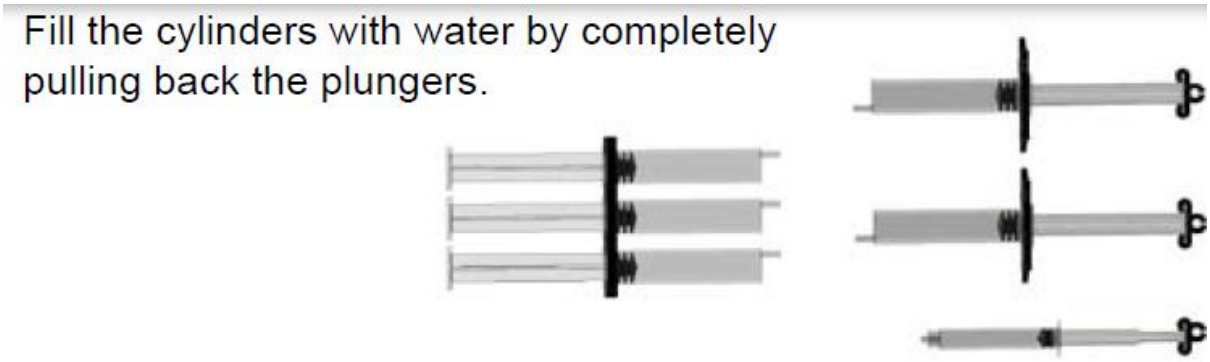
Food coloring can be added to better see the fluid flow through the hydraulic system.

STEP IV: Purge The Air from the Cylinders (Perform this process under water)

Push and pull the plungers to purge all air from the cylinders.

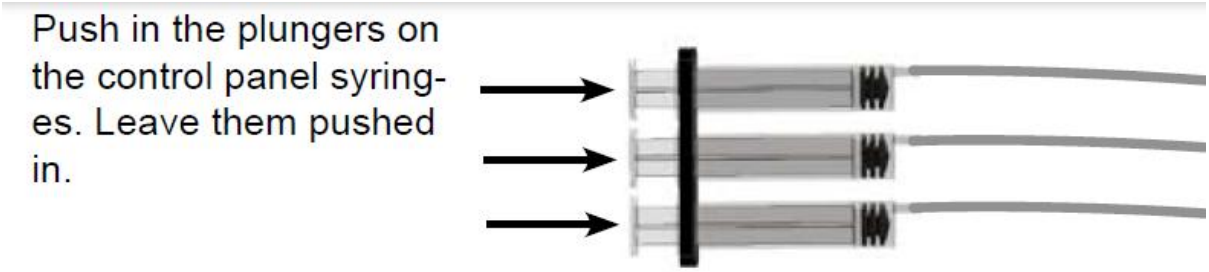


STEP V: Fill Cylinders with Water (Perform this process under water)

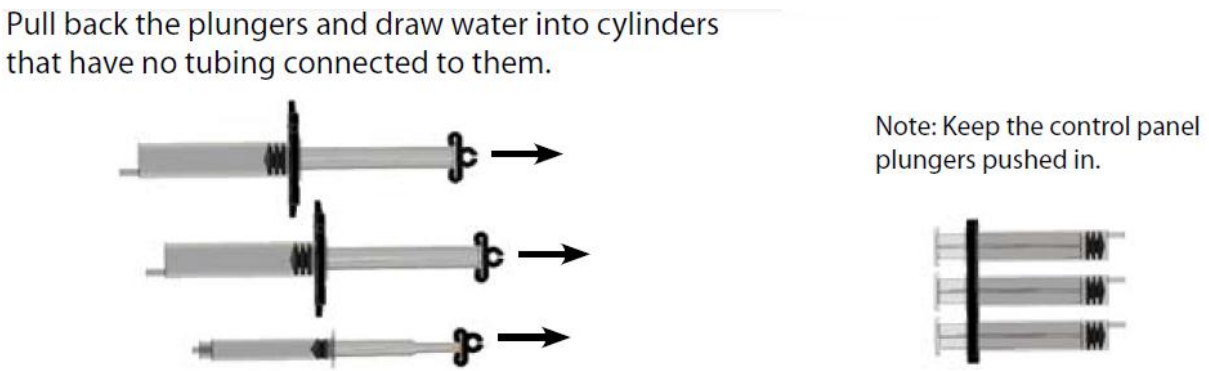


STEP VI: Attach Tubing (To The Control Panel) Perform this process under water.

STEP VII : Purge Air From The Tubing (Perform this process under water)



STEP VIII: unattached Cylinders Should be Full of Water Perform this process under water.



STEP IX: Connect The Unattached Cylinders (Perform this process under water)

STEP X: One Last Check

Move the plungers on the hydraulic cylinders. Do they have enough throw (travel)? If not, you may need to place the hydraulic system back under water where you can pull the tubing from a cylinder to add or remove water from the system.

TIPS AND TRICKS

1. Adding a small amount of glycerine to the water in your hydraulic lines can keep cylinders from sticking after sitting without use.

2. Bleeding the hose

Air in the hydraulic lines will degrade the performance of your hydraulic arm. Following is a basic way to easily bleed the lines (get rid of the air).

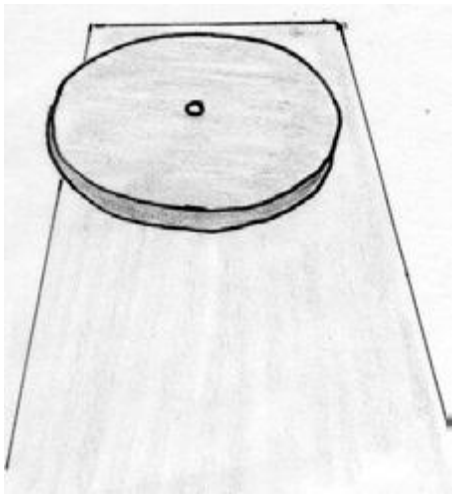
1. Pull the air (from the lines) into a cylinder.
2. Turn the cylinder so its tip is its highest point.
3. Remove the hydraulic line (tubing) from the cylinder.

4. Push the plunger so the air is forced from the cylinder. Stop pushing when the water level reaches the top of the cylinder tip.
5. Re-attach the hydraulic line to the cylinder. *You may need to push air from the hydraulic line before attaching it to the cylinder.

Building the arm 1

Building the arm 2

Rotation of base



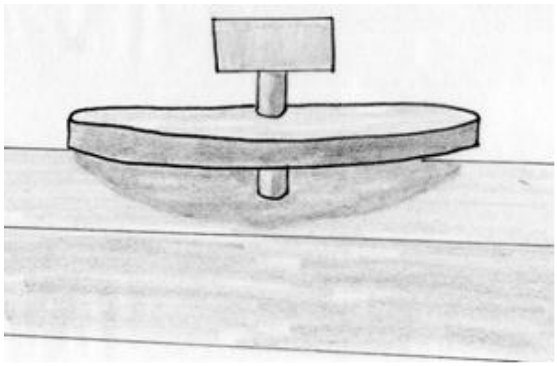
Drill a hole in the base at its centre or near to it but leaving some room for the piston that moves it on the other side so as to facilitate rotation of the disk (on which the hydraulic arm would be mounted).

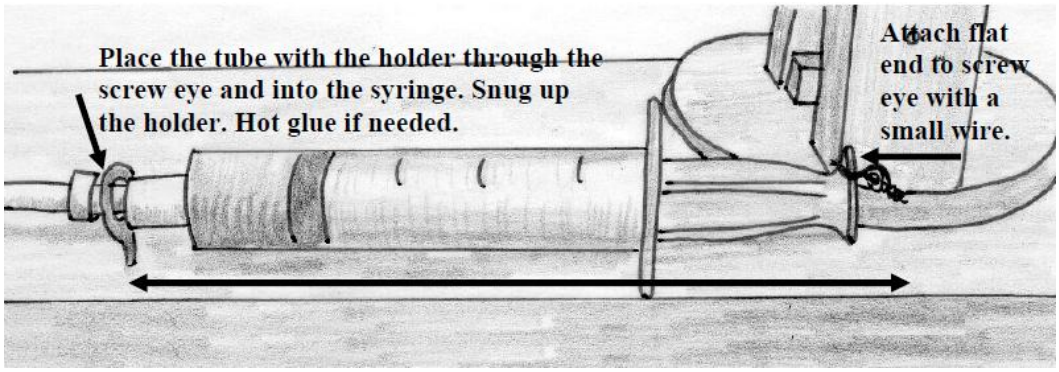
For this :-

Cut a small length dowel and glue it in the base. Slide the disk over the dowel in such a fashion that disc should be able to rotate about the dowel. Do ensure that the disc does not come out.

Glue peg in base and to wood, but not to the disk (it has to turn).

The piston of the syringe is attached to the side of the support structure (body) thus imparting tangential push or pull providing a couple moment necessary for the whole structure to rotate about the dowel stick.

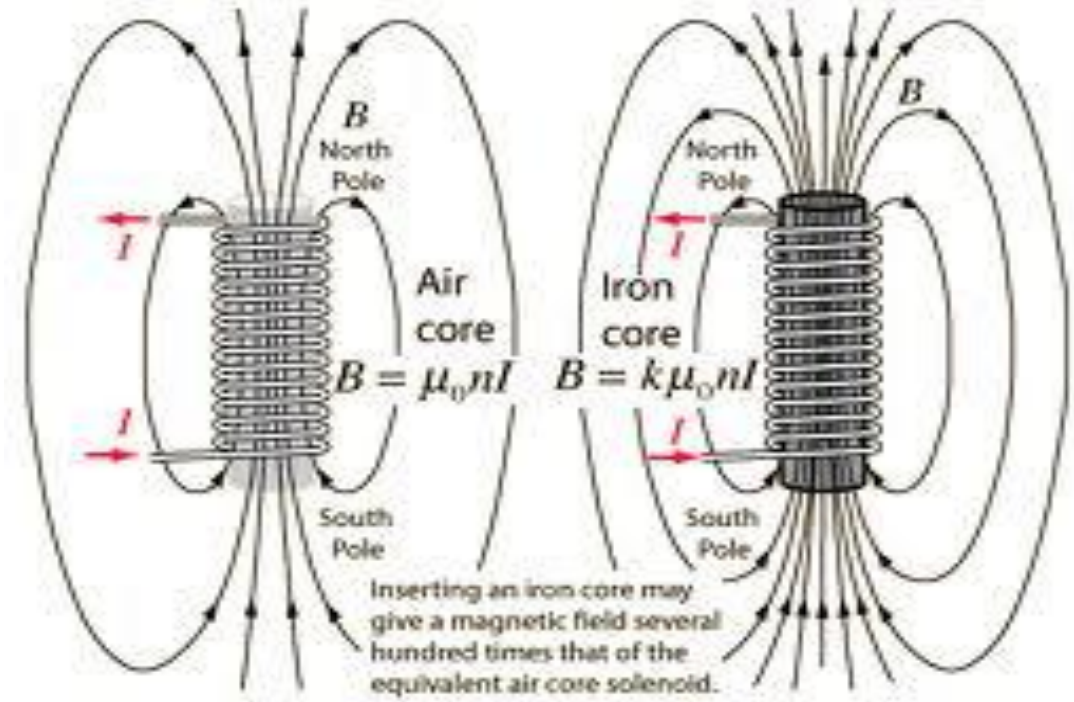


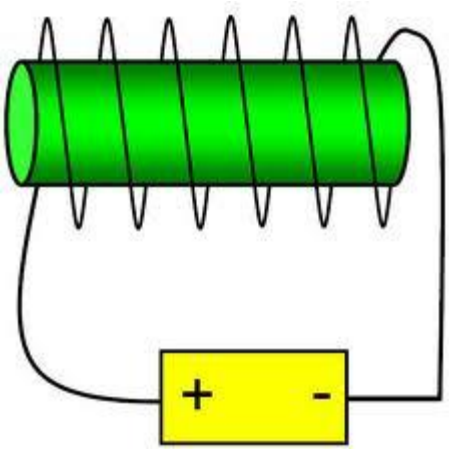


ELECTROMAGNET

Electromagnets are coils of wire wrapped around air or a metal core. Solenoids are electromagnets with an air core. Increasing the number of coils or the electric flow increases the magnetic strength. To make a simple electromagnet, wrap wire around an iron or steel nail, and connect the wire to a battery. DC electromagnets are principally used to pick up or hold objects.

An 'air core coil' does not depend upon a ferromagnetic material to achieve its specified inductance. This covers the cases where there really is just air inside as well as windings upon a different insulator such as bakelite, glass or PTFE etc. Its inductance is unaffected by the current it carries. This contrasts with the situation with coils using ferromagnetic cores whose inductance tends to reach a peak at moderate field strengths before dropping towards zero as saturation approaches. Air coils are also free of the 'iron losses' which affect ferromagnetic cores.





Solenoid air core electromagnet

Iron core electromagnet

Winding a strong electromagnet:

The strength of an electromagnet at its simplest boils down to amp-turns: N*I (# turns x amps).

Parameters

1) CORE

a) Material: a soft iron core, or electrical steel or laminated core are good options.

b) Length: 3"

c) Width: 1/4"

d) surface: surface area is of huge importance. The more the better. And round is better.

2) WINDINGS

wire size: the smaller the wire, the more turns, the stronger the EM. But the more resistance, requiring more voltage push the same amps through it.

Power: use adapter of range 9-18 V.

How Are Electromagnets Made?

http://www.youtube.com/watch?v=icUGUViSsHc

Select a Core

O The core of the electromagnet must be made of a magnetic substance, such as iron, cobalt or nickel. An iron or iron-containing steel nail can be used to make a small electromagnet.

Wrap Insulated Wire Around the Core

O A single strand of insulated wire should next be wrapped around the core as many times as possible in a helical fashion. The more times the wire goes around the core, the stronger the electromagnet will be.

The wire must be insulated so electrical current will travel through the wire only and not the core.

Run Electric Current Through the Wire

O Connect the ends of the wire to a source of electric current, such as a battery. Be careful not to run too much current through the wire, as additional current can make the wire exceedingly hot.

Three Ways to Make an Electromagnet Stronger

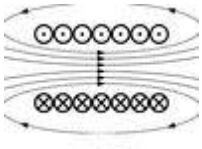
An electromagnet is a current-induced magnet. The basic setup is an electrical current circulating around some magnetizable material, such as an iron rod. The current and number of times the current circulates around determine the magnetic strength. Therefore, the same things that strengthen a current are the same things that strengthen an electromagnet.

Law of Induction

• As current runs through a straight wire, a circular magnetic field is generated around it. When a wire is made into a circle, the current generates a magnetic field parallel to its axis.

If you pile loops on top of each other, as in a coil or solenoid, you increase the magnetic field strength.

The formula for the magnetic field inside a coil is the current multiplied by the loop-count density multiplied by a constant.



Increase Winding Count

• By the magnetic field equation inside a solenoid, increasing the number of turns per unit length (n) of the wire around the magnetizable material will increase the magnetic field applied to the magnetizable material. Increasing the magnetic field applied to the magnetizable material in turn makes its own magnetic field stronger.

Similarly, wrapping with thicker wire has the same effect, but by increasing the current. Like a widening river, a thicker conductor allows more current through.

Reduce Resistance

O Another way of increasing the current is to reduce the resistance. A more conductive wire could be used, or the circuit can be shortened between the electrical source and the magnet.

Increase Voltage

O Another way of increasing the current is to use a higher electromotive force, or voltage. The relevant formula is V=IR, the definition of resistance. If V is the drop in electric potential over the entire circuit, and R is the resistance over the entire circuit, the current (I) through any point of the circuit can be increased by an increase in the applied voltage.

Switch From AC to DC

O If the circuit is powered by alternating current, another possibility is to switch to direct current of the same voltage. The reason that a direct current is superior is because an alternating current switches the magnetic polarity of the magnet before it has time to build full strength.