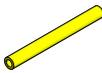


You're about to create an amazing, remote control, hydraulic claw. When it is done, it will pick up objects similar to the "Claw" arcade games.

This is a real engineering project (not a toy). What does that mean? You get to design and build your own unique claw, rather than just following directions. You'll also get to cut, screw and maybe even pound. Experiment and try different ideas. Keep improving and changing your design.

## 1<sup>st</sup> Gather Tools & Components to Make a Claw

Component	Picture	In a 10 Pack	For a Single
Strips		40	4
Dowel		30	3
38cm (15in) Tubing		10	1
Blocks		40	4
Slide Stop 3in Section		10	1
#10 1in Screw		80	8
Cylinder Screws		20	2
#10 Nut		40	4
Cable Ties		40	4
4.5ml Cylinder		20	2

### Other Materials:



What other materials can you find to make your (materials not supplied in the TeacherGeek pack). Other materials could be tape, craft supplies, from a recycling bin, wood, metal, cardboard, or anything else

you may have. These materials can be used to help you create your own unique designs.



### Tools Required:

This activity allows you to really build, so you are going to need a few simple tools. The TeacherGeek tool set has them all:

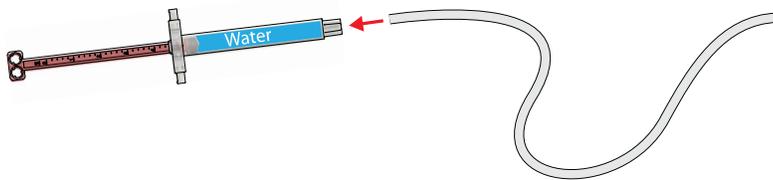
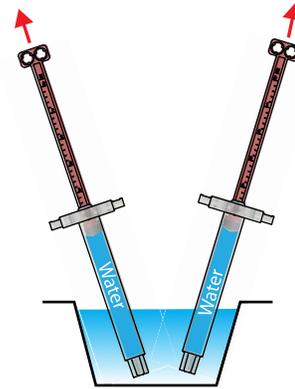
- Reamer -Changes holes to allow dowels to spin and slide
- Cutter -Cuts dowels, strips and other parts
- Hammer & Block -Tap dowels into holes, instead of pushing
- Screwdriver -Turn Screws
- Pliers -Hold nuts, bend wire, pull out parts

## 2<sup>nd</sup> Create the Hydraulic System

**A.** Fill each cylinder with water:

- 1) Push the cylinder piston in.
- 2) Place the cylinder tip under water.
- 3) Pull the piston back to completely fill the cylinder with water.

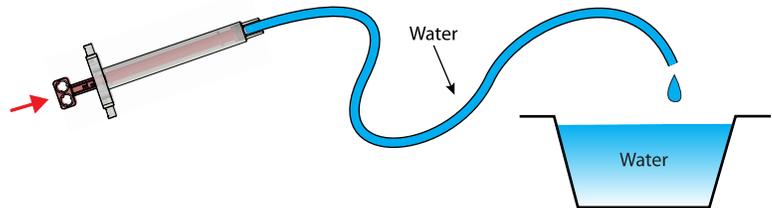
Note: You do not want air bubbles in the water filled cylinders. Food coloring can be used in the water.



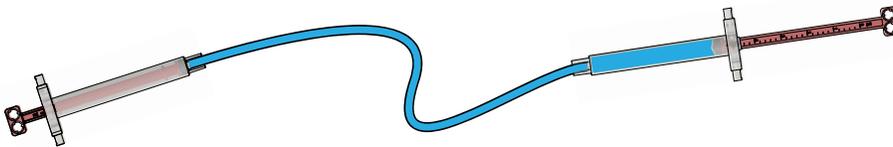
**B.** Attach the tubing to a water filled cylinder. Make sure the tubing is pushed fully onto the cylinder tip.



**C.** Push in the cylinder piston to fill the tubing with water. The cylinder and tubing should have no air in them.



**D.** Attach the water filled tubing (from step C) onto the second water filled cylinder.



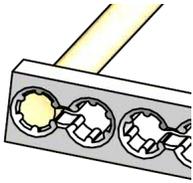
**E.** Use a cylinder screw to keep the tubing from slipping off. Gently turn the screw into the hole aside the tubing. Your hydraulic system is now done. Experiment and play with it.



No Bubbles

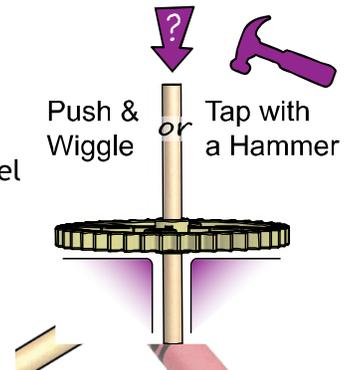
Your hydraulic system will work better without air in the cylinders or tubing. You will periodically have to remove tubing from a cylinder to bleed the lines (remove the air).

## 3<sup>rd</sup> Learn How the TeacherGeek System Works



### Dowels & Holes

TeacherGeek components have holes that wooden dowels press securely into. If you are having trouble pushing a dowel into a hole, add some crayon or tap it with a hammer.

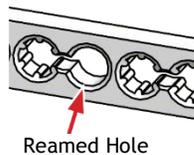
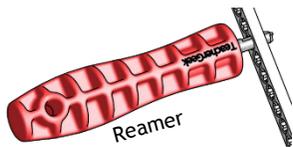


Tip: Rub a crayon or wax on the end of a dowel to make it slide easier into a hole. The crayon wax reduces friction.

### Reaming

Do you need a dowel to rotate or slide in a hole? Turn a reamer through the hole to enlarge it.

**Caution:** Dowels fall out of reamed holes. Do not ream holes that dowels should stay pressed into.



### Cutting

Use a TeacherGeek multi-cutter (best), pruning shears, or a saw to cut dowels and connector strips. Do not use multi-cutters to cut metal, and do not forget to wear safety glasses.



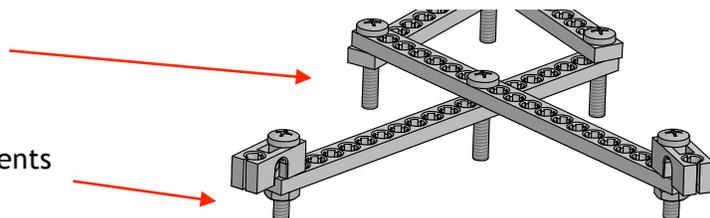
### Slide Stop

Slide stop can be cut into sections. Slide it onto dowels as a spacer, or to prevent dowels from sliding.

### Screws & Nuts

Use a screw (with no nut) to connect components and allow them to rotate.

Use a screw and nut to connect components and keep them from rotating.



## 4<sup>th</sup> It's time to make your claw gripper. How will you do it?

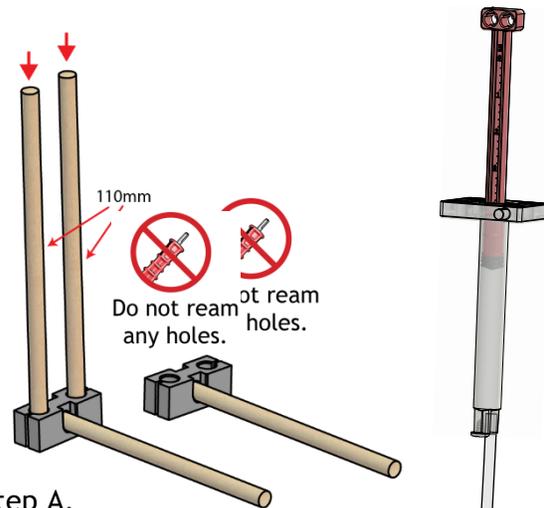
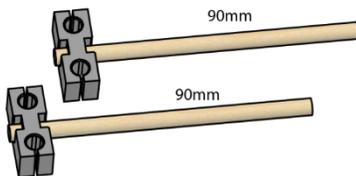
Option #1: Create an example gripper, then change it into your own design.

Option #2: Create your own design.

## Example Gripper #1

### A. Make the Fingers

- 1) Cut two 90mm (~3.5in) dowels.
- 2) Push/tap the dowels into two perpendicular blocks.

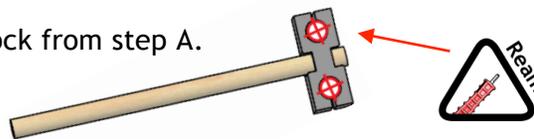


### B. Add Dowels

- a) Cut two 110mm (~4 3/8in) dowels.
- b) Push/tap the dowels into one of the blocks from step A.

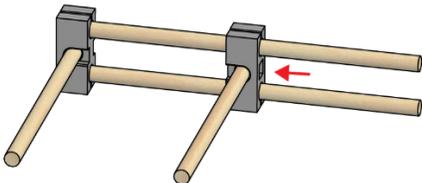
### C. Ream Holes

Ream the holes marked  in the 2<sup>nd</sup> block from step A.



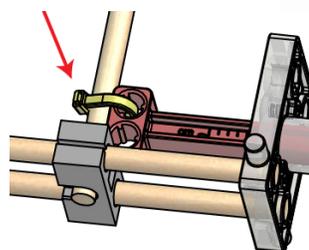
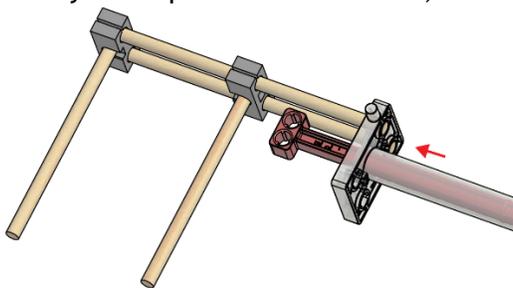
### D. Assemble the Slide

Assemble the components as shown. If the block from step C does not slide easily, ream the holes more.



### E. Attach a Cylinder

Push/tap the 3.5ml cylinder from your hydraulic system onto the assembly from step D. Use a cable tie to attach the cylinder piston to the dowel, as shown.

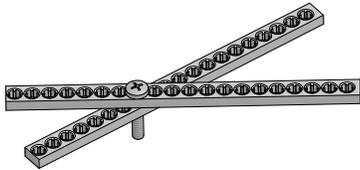
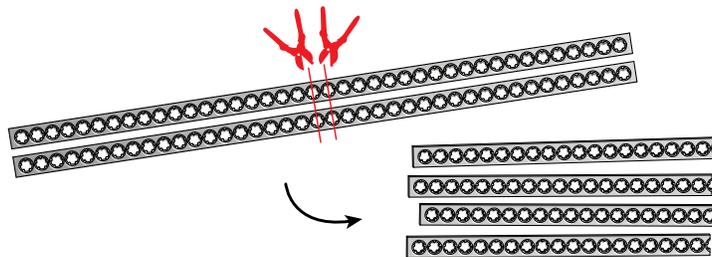


### F. Keep Working

These directions helped get you started. It is now your job to finish the claw, and make it your own unique design.

## Example Gripper #2

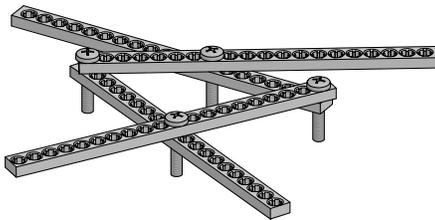
**A.** Cut two strips in in half.



**B.** Put a screw into the center of two cut connector strips to make them pivot like scissors. The screw does not have to be in the same place as the picture. Keep the strips together. The strips will hold them so they will not move. Do not ream any holes.

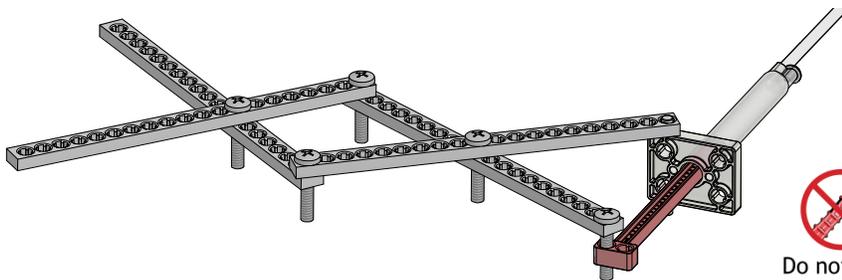


**C.** Attach more strips, with screws, to make an accordion mechanism. Why is this called an accordion mechanism? See if you can figure it out.



Do not ream any holes.

**D.** Attach your accordion mechanism to a hydraulic cylinder using one screw.



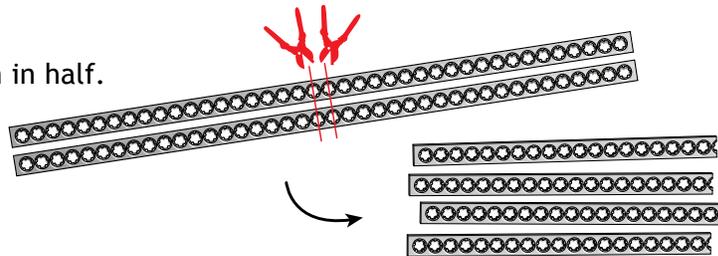
Do not ream any holes.

**E.** Keep working on it... Experiment by changing where screws are placed. Can you make it hang straight down from the tubing? Try to make it open wider and close tighter. Add other materials to help it grip. Make it your own design.

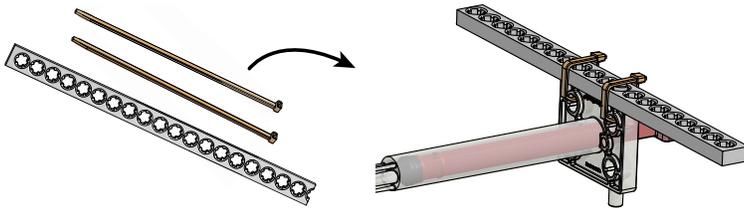


## Example Gripper #3

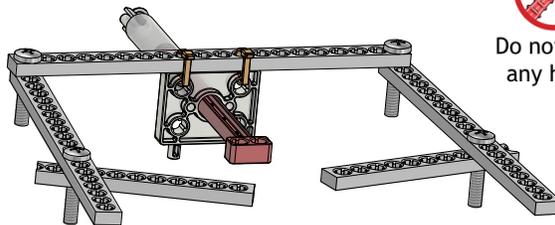
**A.** Cut two strips in in half.



**B.** Attach one half strip to a cylinder as shown, using cable ties or tape.

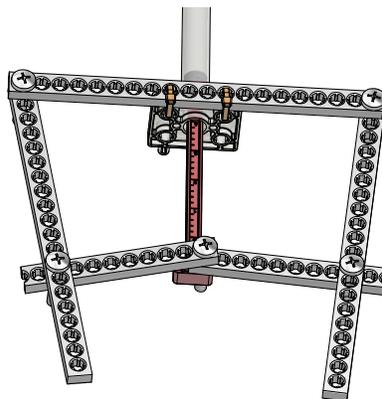


**C.** Use screws to attach more connector strips. The screws do not have to be in the same place as the picture. Keep the screws loose. The strips will hold the screws, so they will not need nuts



Do not ream any holes.

**D.** Use one more screw to attach the connector strips shown to the red cylinder piston. Move the piston in and out. The gripper should open and close. Adjust the position of the screws and strips to make the gripper open wide and close completely.



Do not ream any holes.

**E.** Keep working on it... Experiment by changing where screws are placed. Try to make it open wider and grip tighter. Add other materials to help it grip. Make it your own design.

