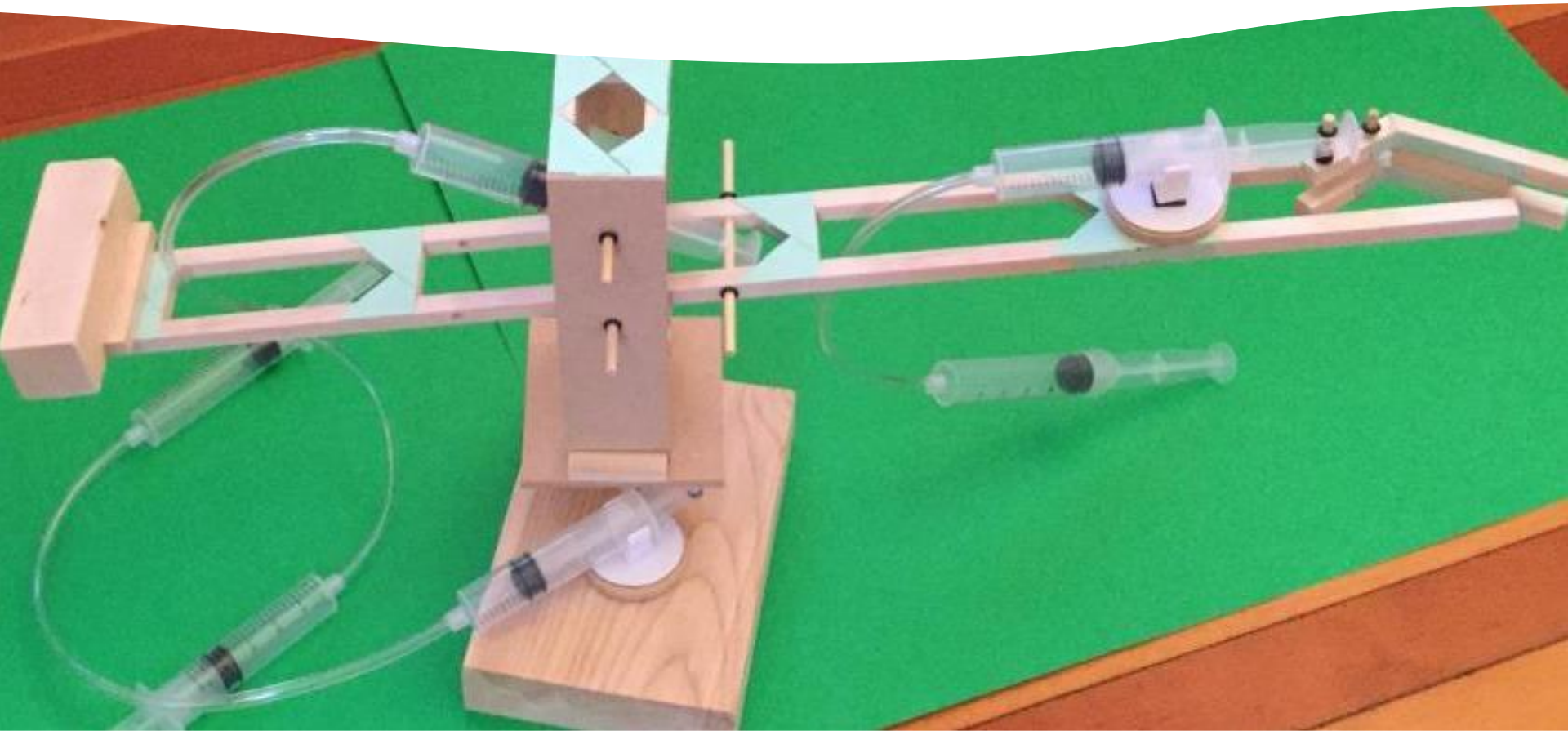
REBOOT Hydraulic Arm Assembly Instructions

A construction kit to make a hydraulic robot arm. Uses a cardboard triangle system and wood glue to join wooden pieces together to make a frame into which pistons are mounted. Three movements: lift, 90° turn and grab using a variety of positions for the arm.

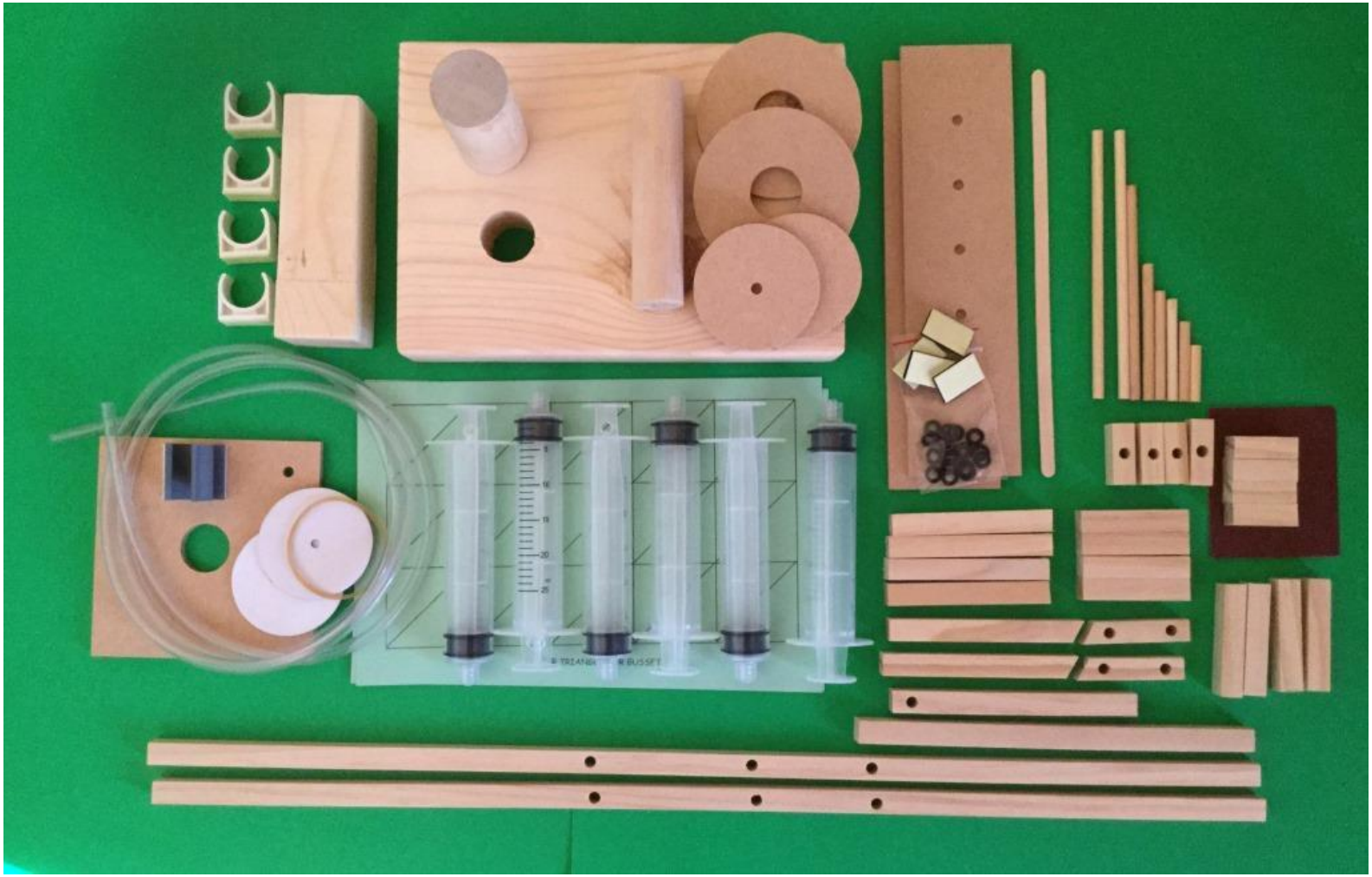
Recommend: Carpenter's Wood Glue (e.g. Elmers)



Contents of Reboot Arm Kit

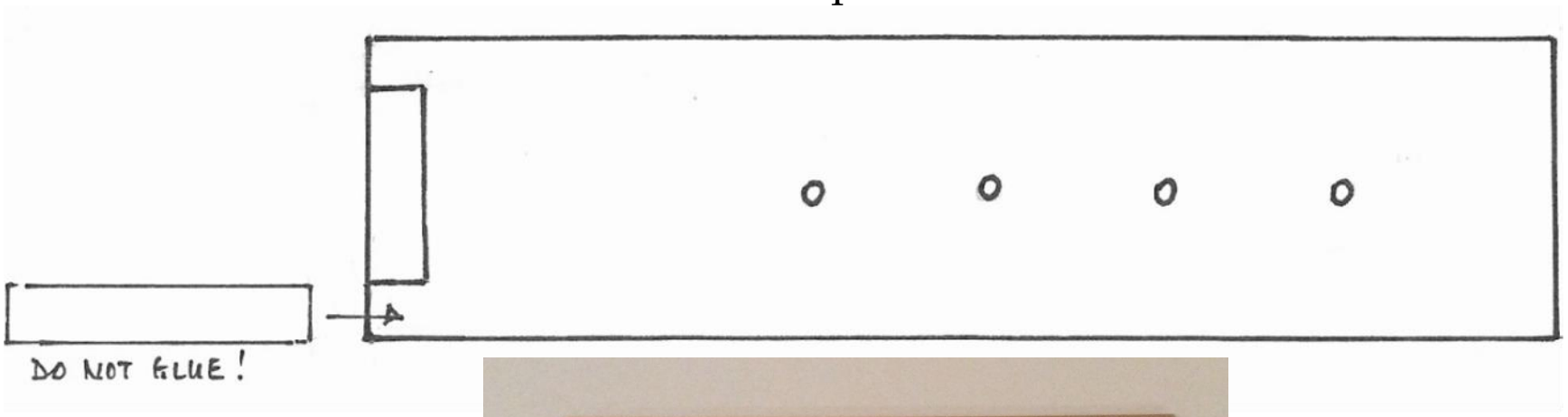
Wooden pieces (⅜″ cross-section):
2 X 19⅝″; 1 X 7″; 2 X 4¼ at angle″; 4 X 2⅞″; 4 X <2″; 4 X 1⅞″; 6 X >1¼″; 4 X 1⅛″(drilled)
Wooden pieces for Claw: 3 (2 with two holes, cut offset), 1 X 4¼" with one hole
Green corner gussets: 2 cards
Pistons, 20cc: 6 (3 have holes in the plunger and one has a cut plunger);
Piston Holders: 5 (1 gray, 4 white); Thick sticky pads: 4
Plastic Tubing: 1 length - 4ft.
Wooden dowel, 3/16″ diam.: 2 X 5″; 1 X 3″; 1 X 2½"; 1 X 2″; 1 X 1⅞"; 1 X 1½″; 1 X 1 ″
Wooden dowel, 7/8″ diam.: 1 X 3⅞″
Mini-washers: 18; Rubber bands: 1
Platform 4″ square X 1
Wooden base with holes
Thin m.d.f. walls X 2 with 4 holes in each
Larger wheel with 7/8″ hole X 2; Smaller wheels X 2; White disk X 2
Objects: 1 round >2¾″, 1 square approx. 3⅞″
Plus a piece of sandpaper; Stirring Sticks: 2

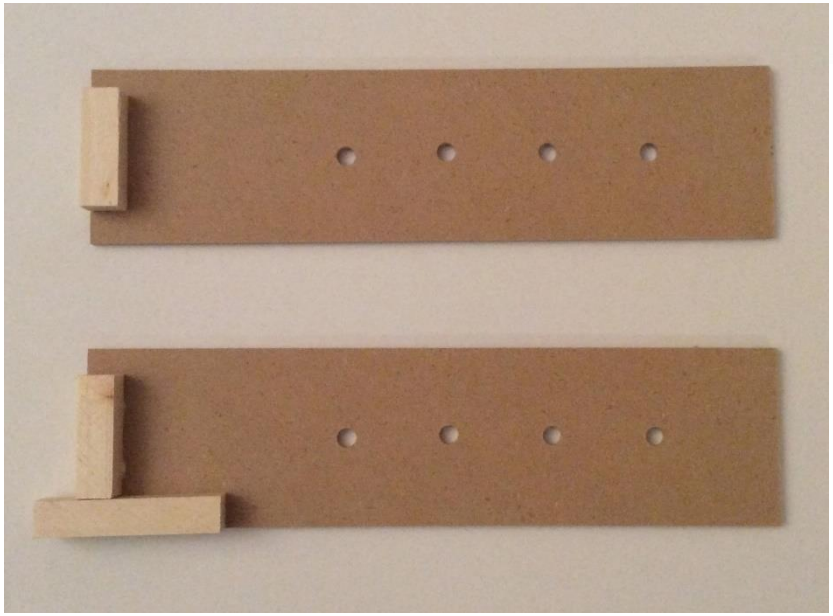
Kit Contents



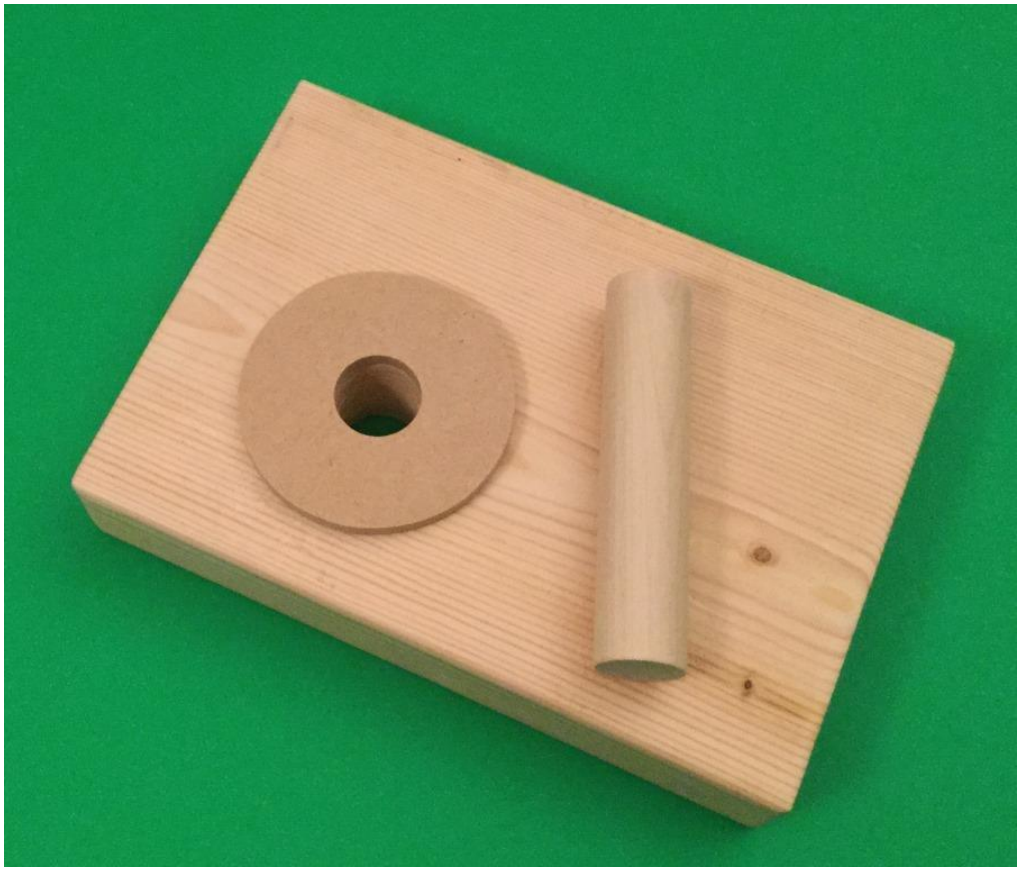
Part 1: Building the structure

Glue a (slightly less than) 1¼″ piece to each m.d.f. rectangle. A small amount of glue is best applied by the wooden stirrer.
Make sure that another wooden piece would fit on each end

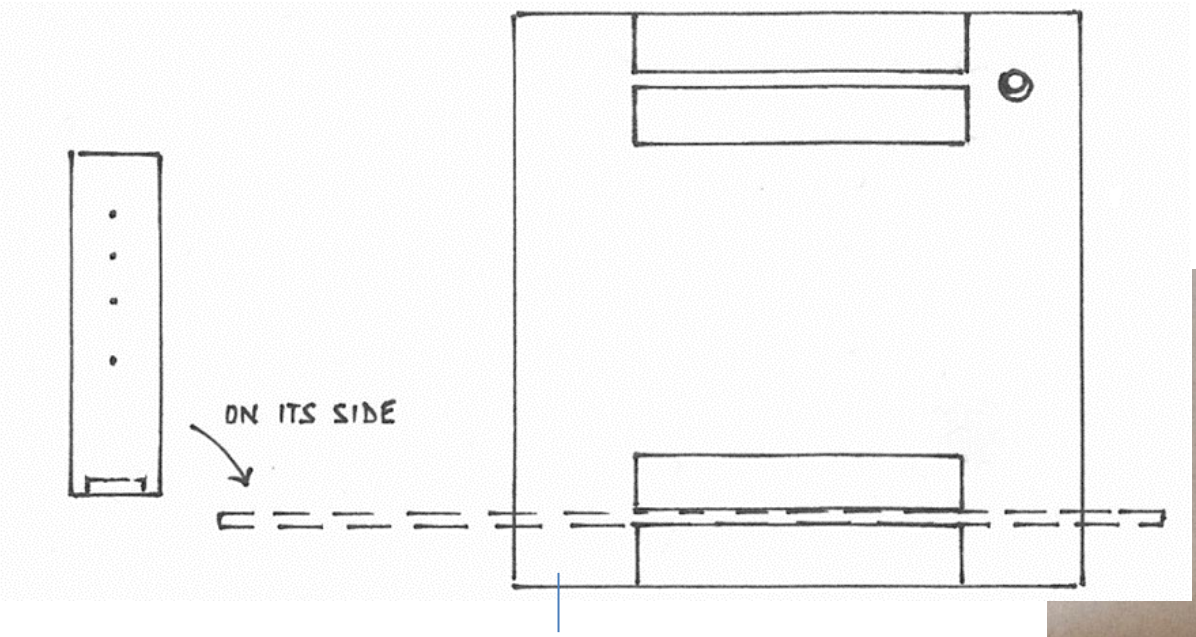


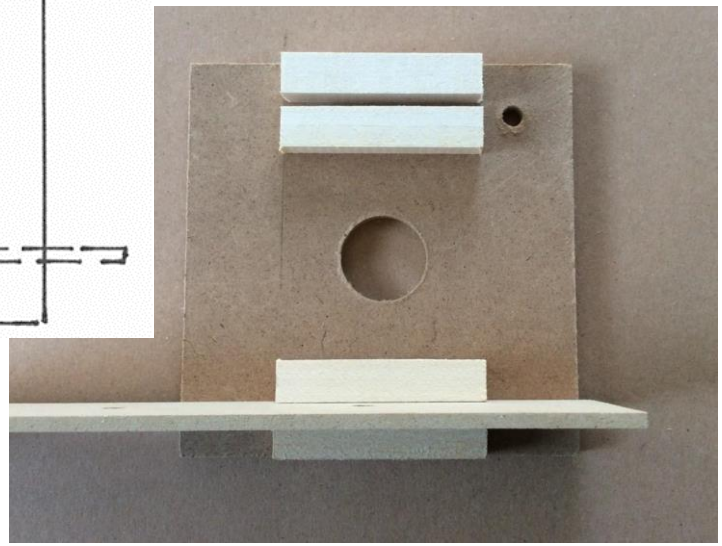


To reduce the large hole in the block so that the ⅞″ diameter dowel fits snuggly and still rotates freely, glue a large wheel with the ⅞″ hole onto the block in the desired position. Place on one side to dry.

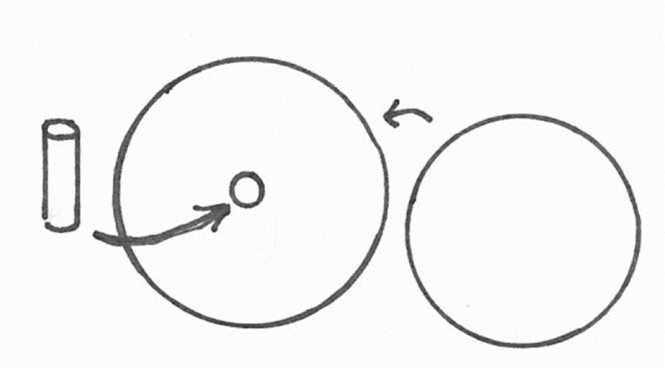


Glue four 1⅞” long pieces onto the 4” square, 1” from the sides, as shown. There should be a gap between the pieces so that the m.d.f. rectangles will fit





Piston clips are used to hold the pistons in place on platforms for the claw and the base and for the arm.

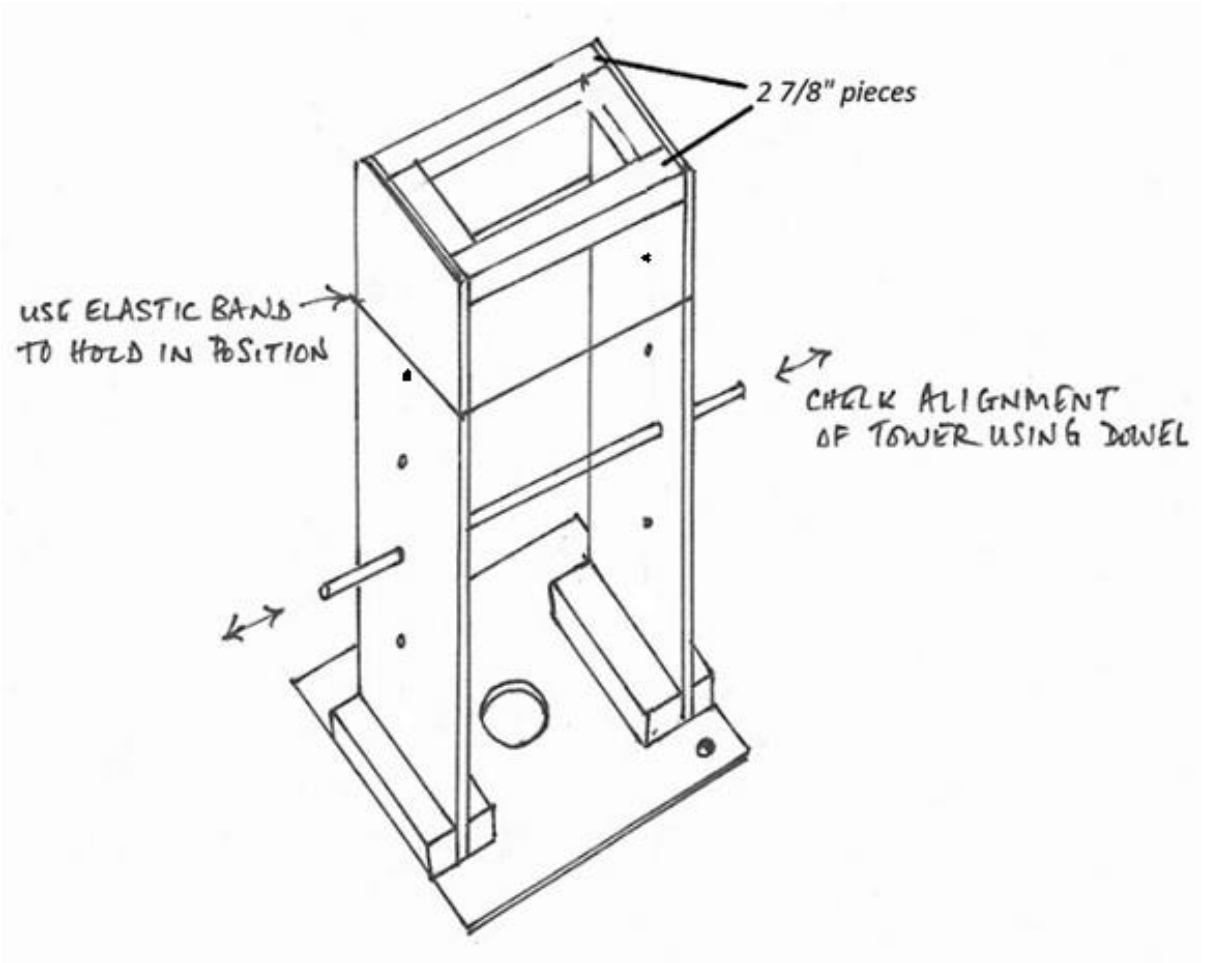


Glue the 2 disks onto the 2 small wheels so white side is up. The holes in each disk will need to be slightly enlarged

Then glue the 1″ dowel rod into one of the wheels and the 1½″ dowel rod into the other from below. Make sure the dowel rod is flushed with the disk and the topside of both wheels.

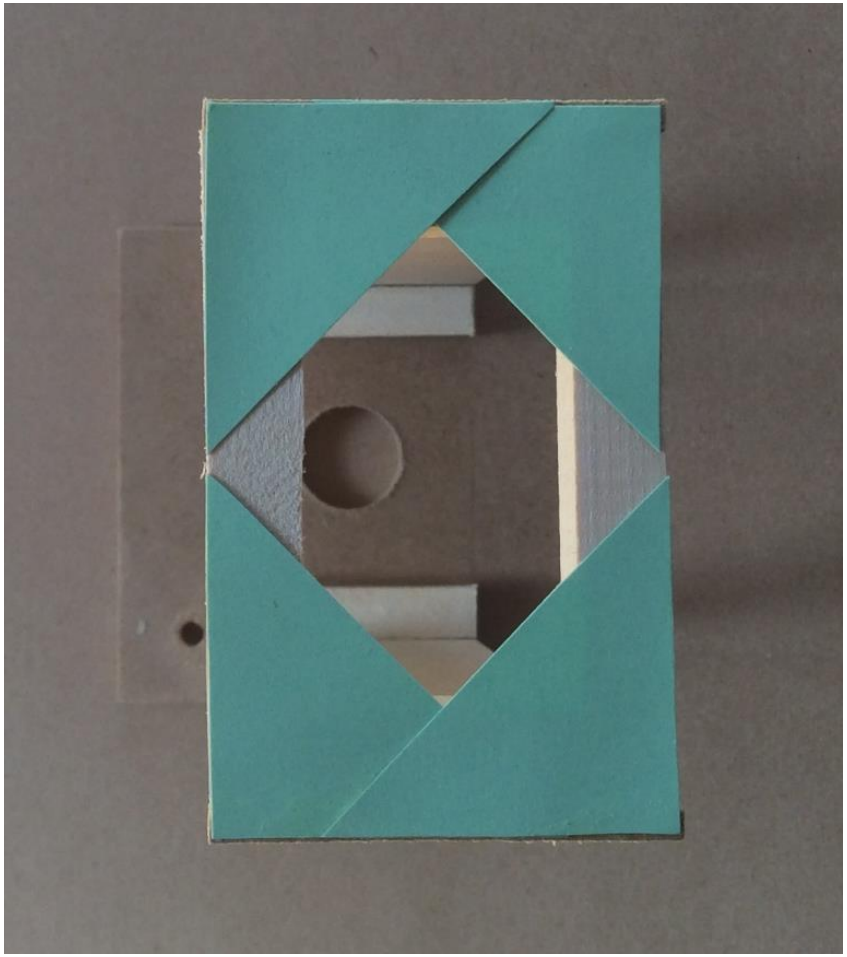
<u>Place on one side to dry.</u>

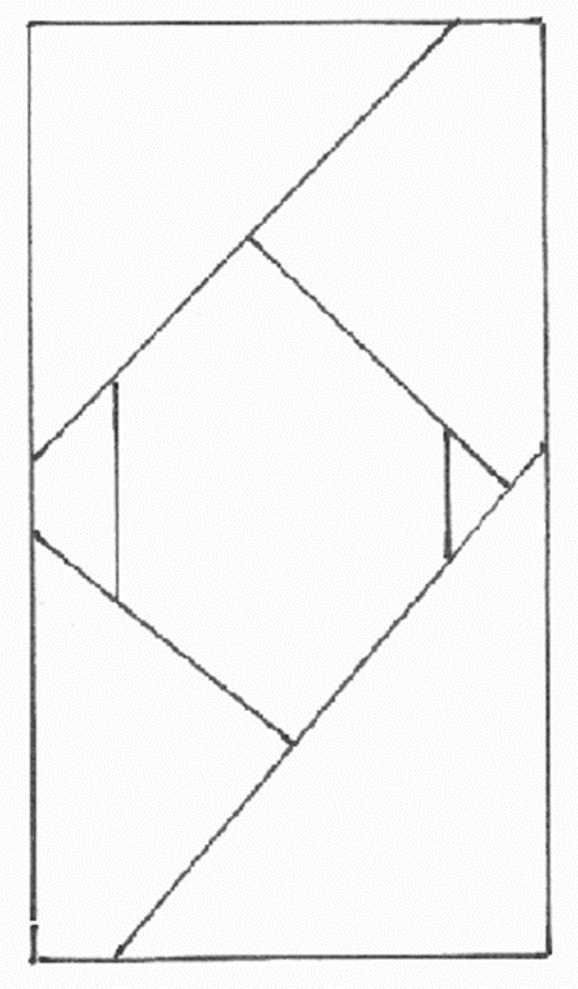
Glue the m.d.f. rectangles with four holes into position on the 4″ square platform by carefully placing a small amount of glue in the ⅛″ gap between the 1⅞″ pieces on the square platform. To make sure the sides of the tower are vertical glue the two 2⅞″ pieces into the top section as shown below using a small amount of glue applied to the ends of the 2⅞″ pieces. Use the elastic to hold in place while drying. The Tower will be slightly larger at the top



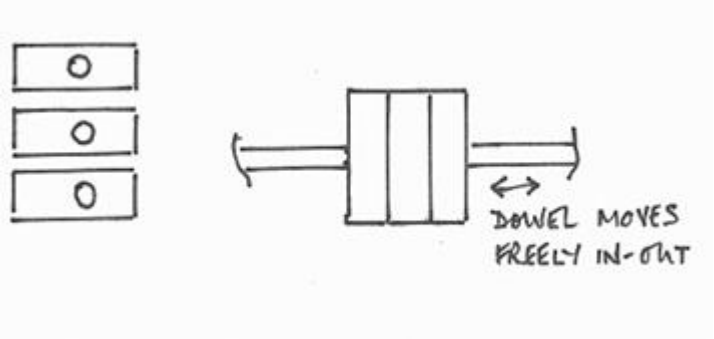
Glue 4 green triangles onto the top of the tower to secure the frame

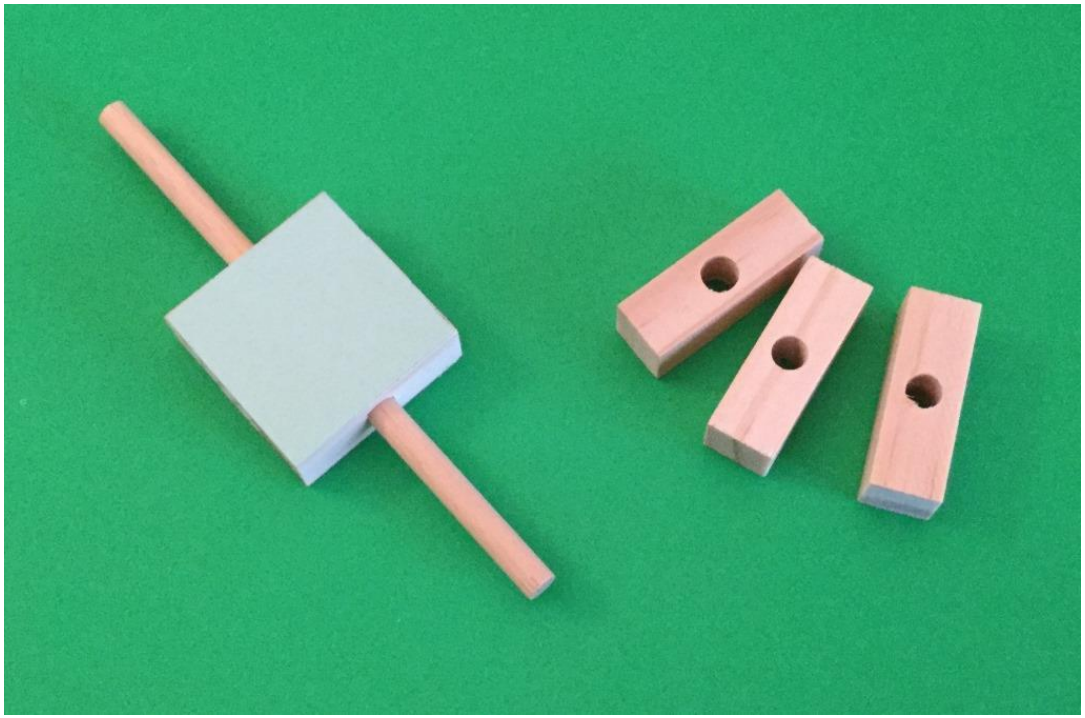
<u>Place on one side to dry</u>





Glue together three 1¼" pieces with holes using a small amount of glue. Male sure a dowel can rotate through the aligned holes



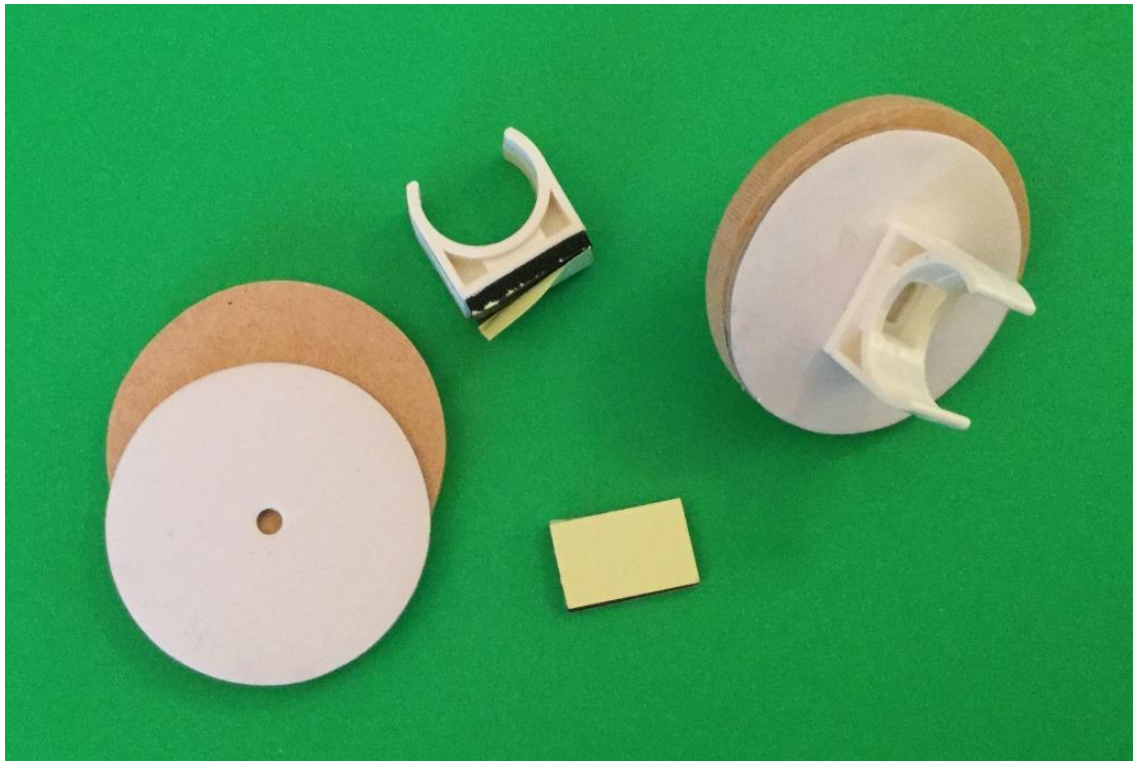


Glue a piece of green card to the platform and place on one side to allow to dry

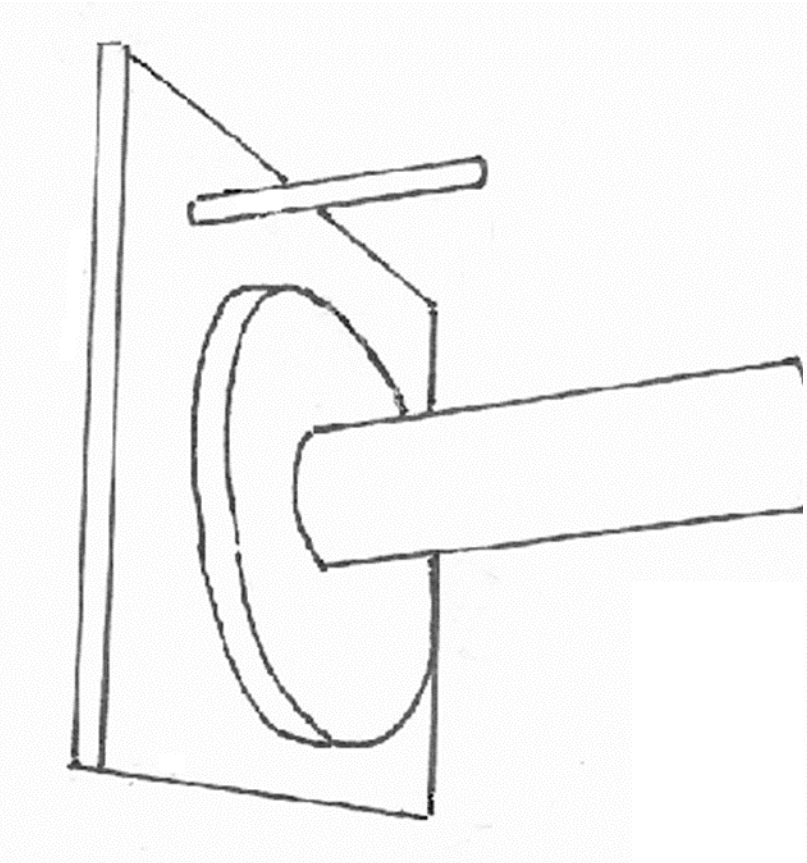
Note: The white plastic holders have a thin yellow double-sided sticky pad. This will hold if <u>cardboard is glued onto the platform **and allowed to dry**</u>. Otherwise the yellow pad can be removed and replace by a black thick one

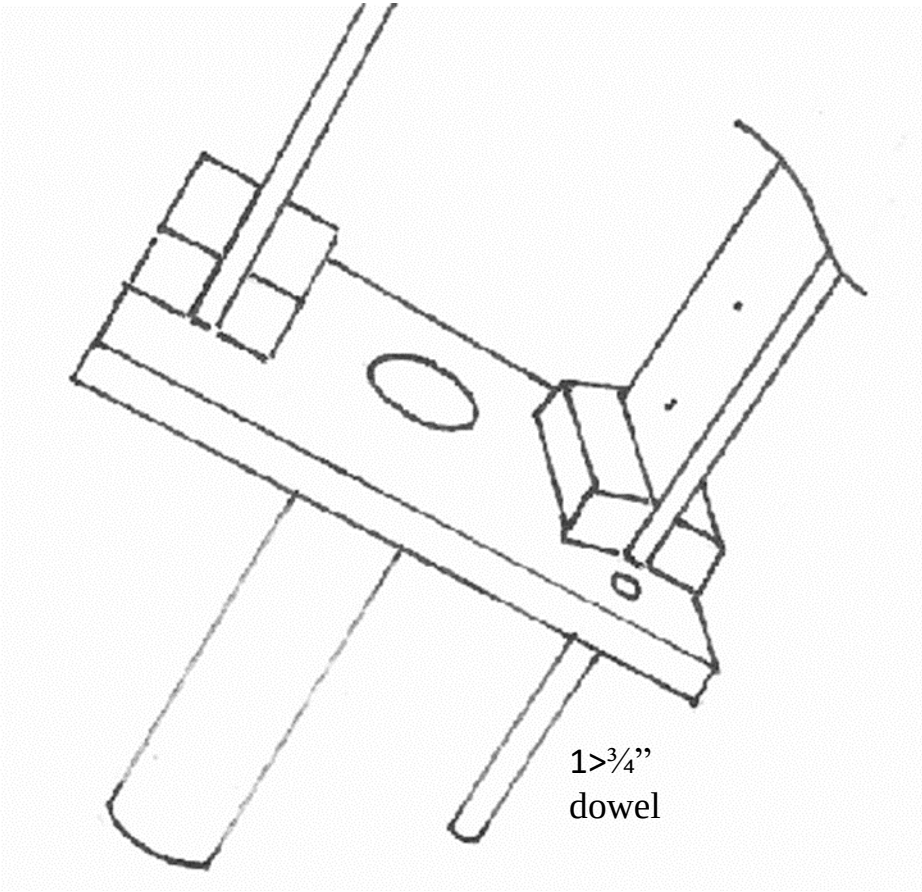
If the wheel platforms are dry firmly place clips on the two white disks.
Make sure they are in the center of each.
Place completed platforms on one side for later.

Alternatively, peel off the thin yellow sticky pads and replace with thicker ones

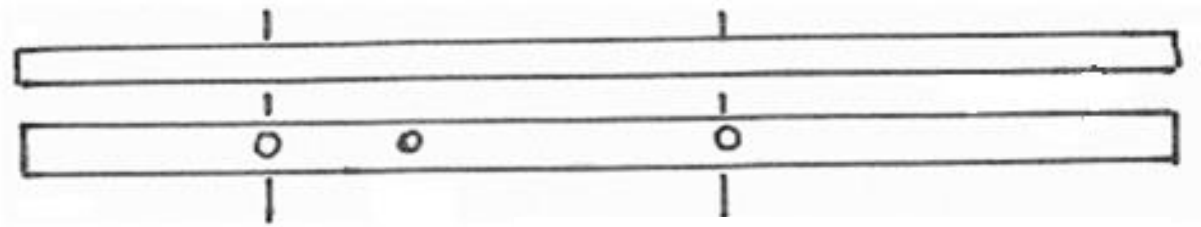


Glue the second large wheel with the ⅞" hole under the 4" square and the ⅞" dowel through the hole of the wheel and the platform so it is flush with the top surface of the 4" square. Finally glue the 1⅞" dowel into the hole in the corner of the platform so it is flush with the top of it. Place on one side to dry.

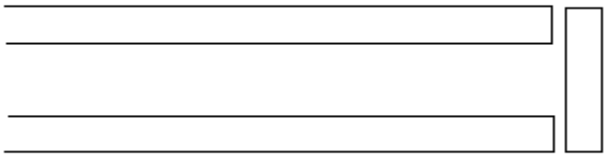




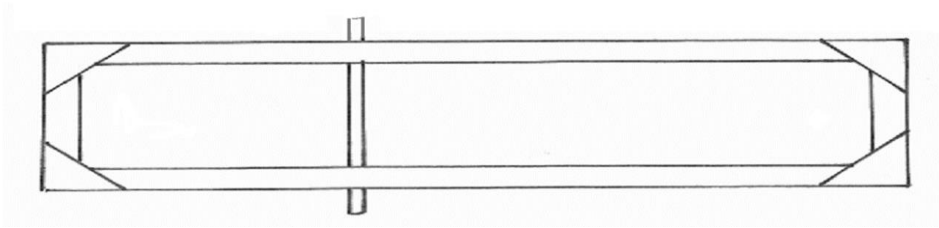
To join the 19⅝" pieces together using two <2" pieces at each end,
First, set the rectangle so that the two holes closest together on each are on the left side as in the picture below.



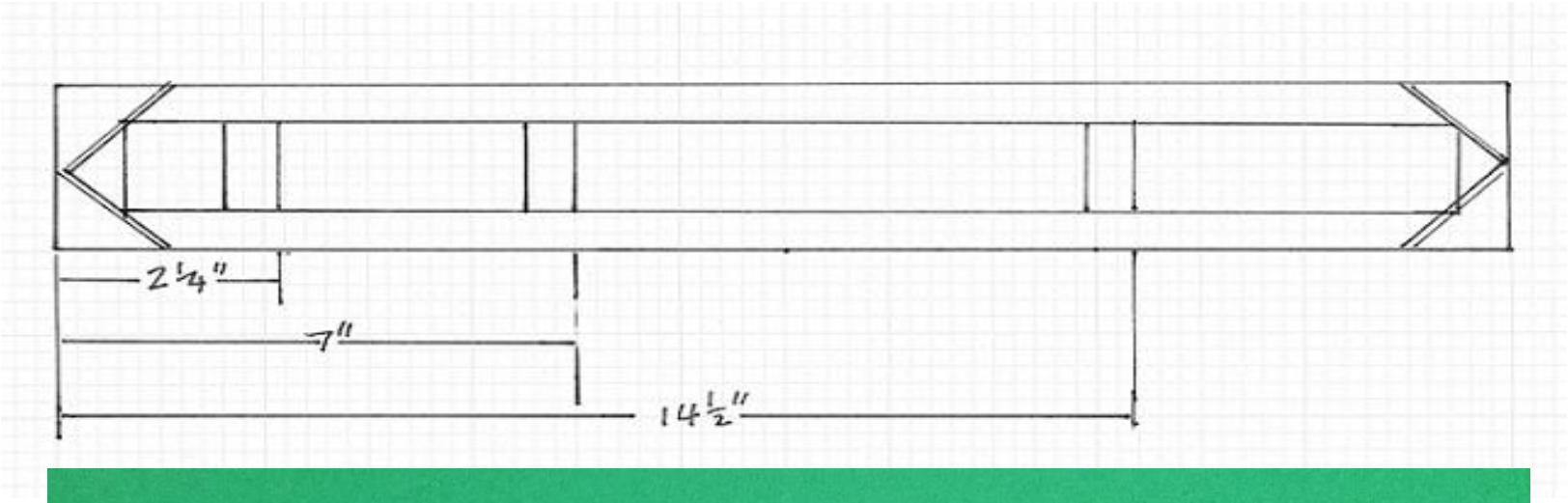
Note: Make sure the <2" pieces are aligned as shown to the right

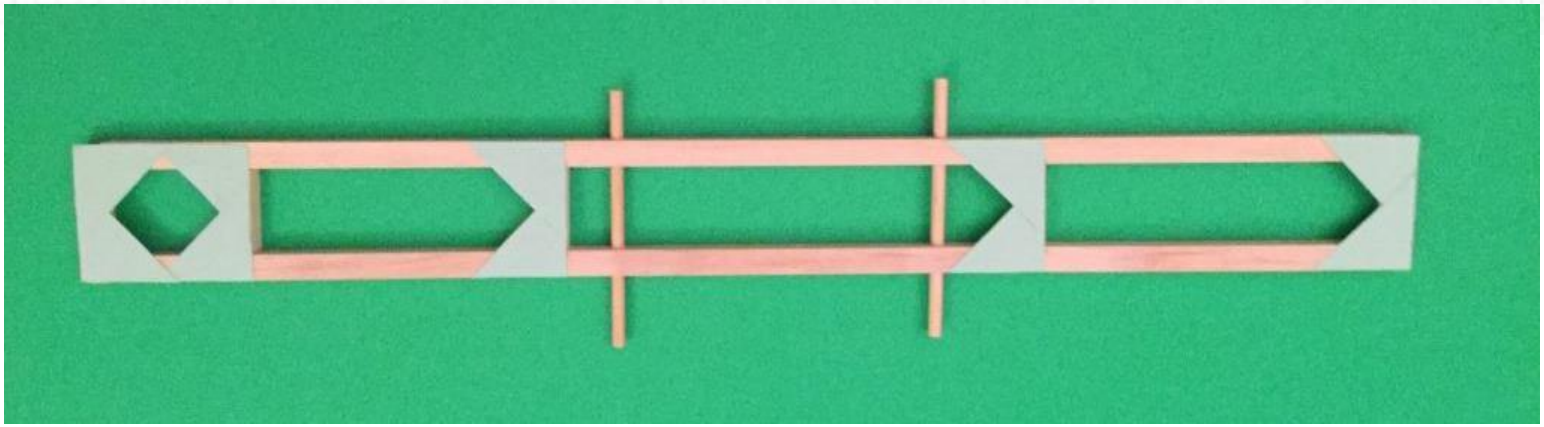


Second, Turn the 19⅝" pieces inward so the holes face each other. Glue green gusset corners to the ends. Glue one side to start with. Check the position of the holes by making sure a dowel through matching holes is at right-angles (90°) to the longer sides.

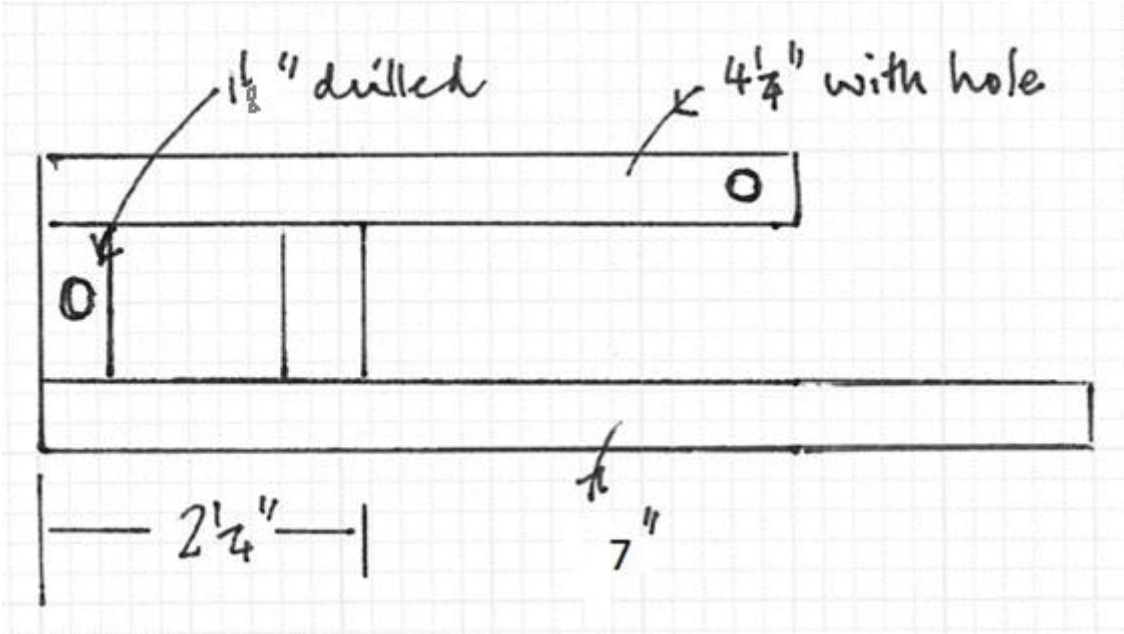


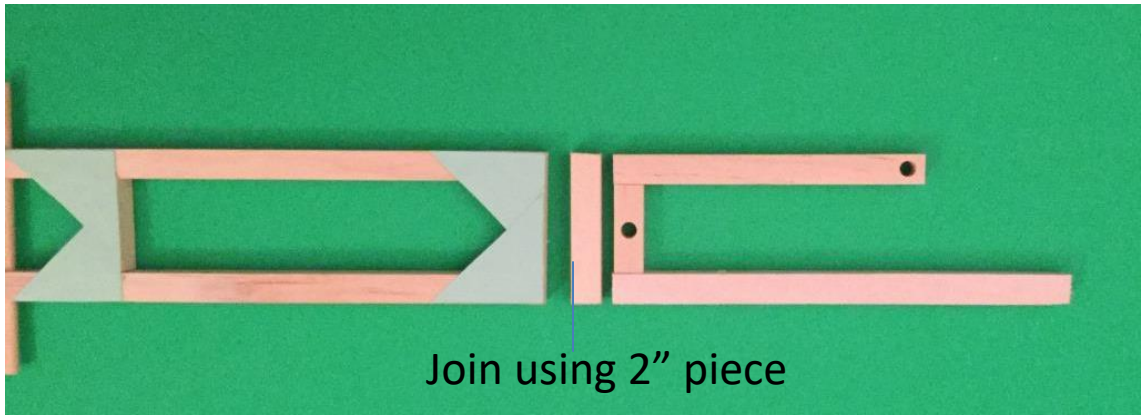
Turn the arm over carefully and glue green corners on the ends. Then glue three (slightly greater than) 1¼″ pieces into the frame of the arm using gusset corners – in the positions indicated below. Once in place, glue green gusset corners to secure the pieces on both sides.



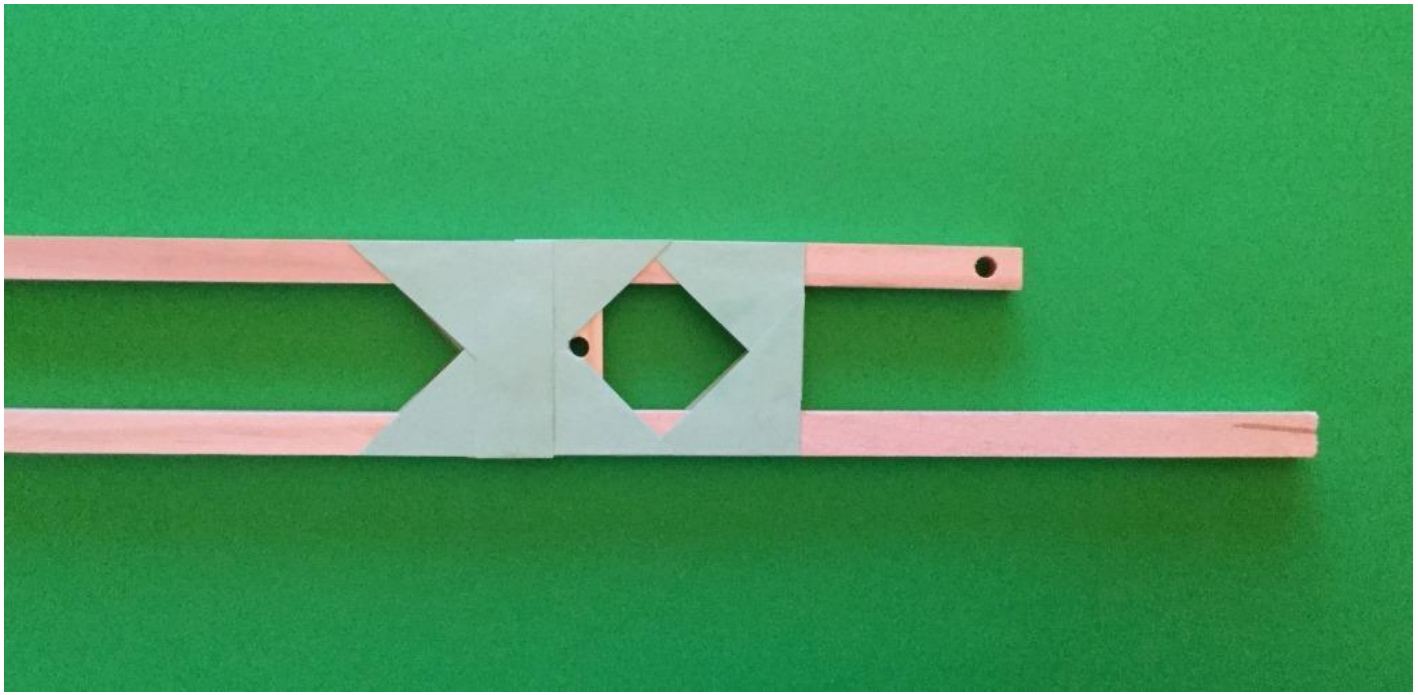


To make the claw frame lay out the following (as shown below): 4¼″ piece with hole, 1⅛″ with hole, >1¼″ without hole and the 7″ piece.

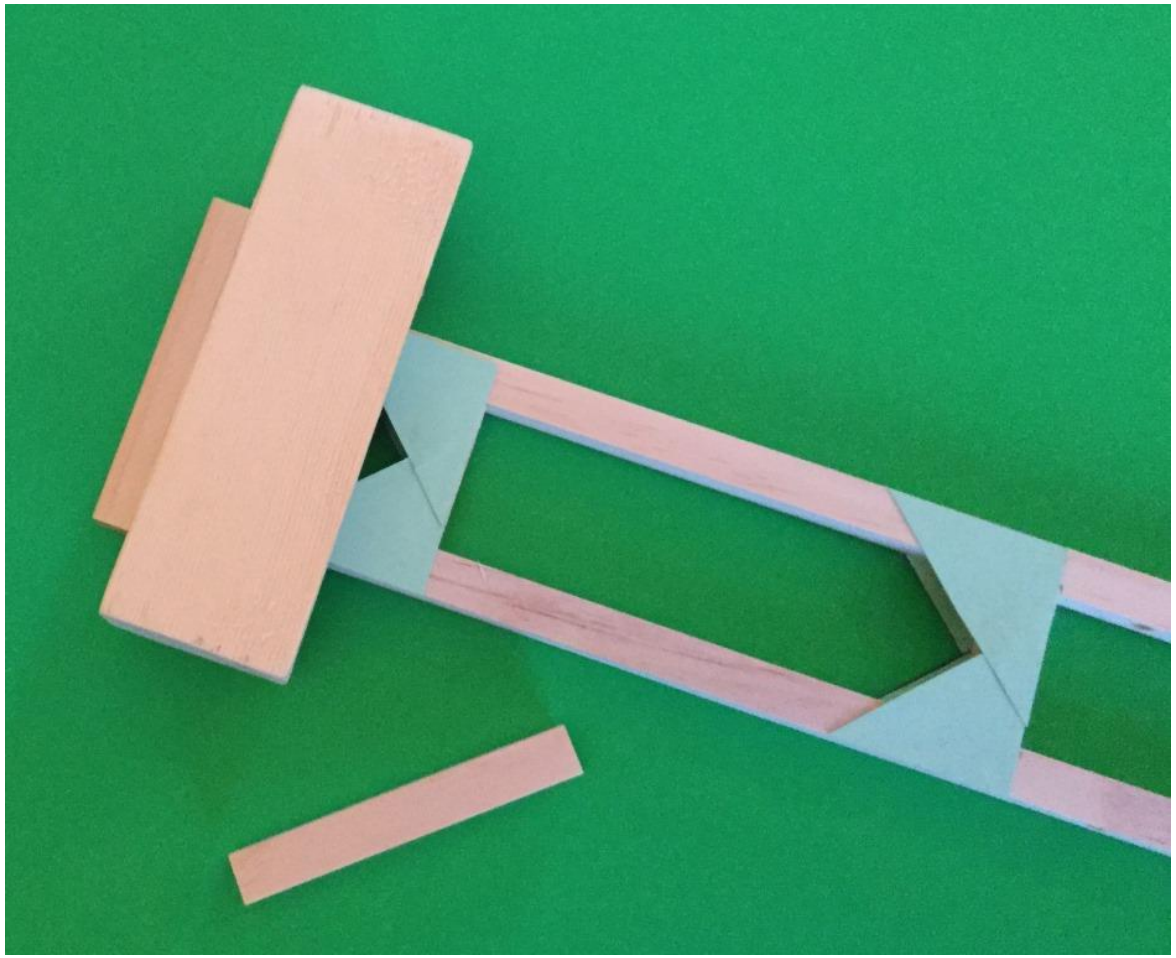




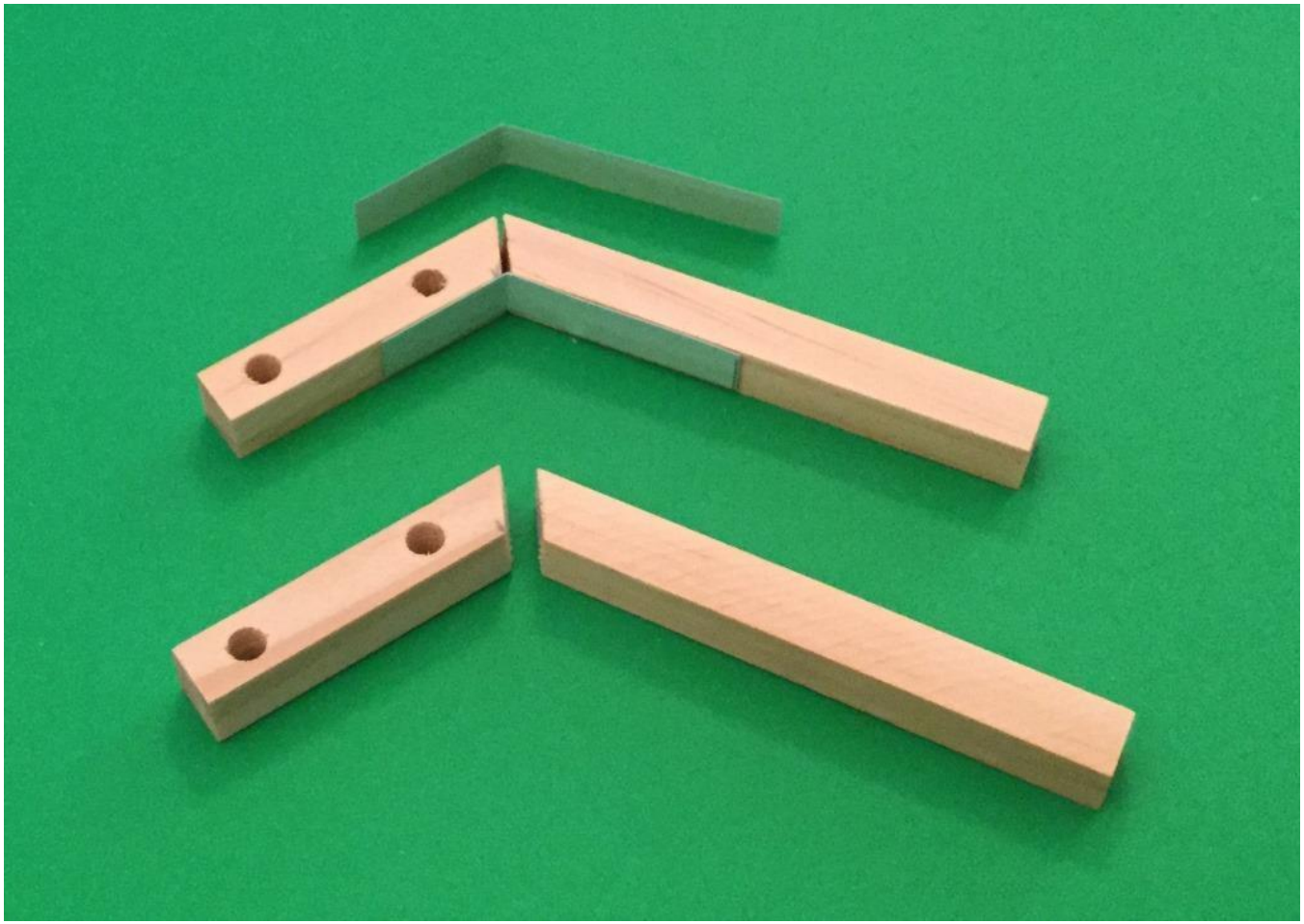
Carefully glue a <2″ piece to the frame of the arm and to the claw framework and then glue the 1⅛″ piece with a hole into position. Glue the >1¼″ piece without a hole into the claw frame 2¼″ from the 2″ piece as shown on the preceding slide. Secure by gluing 4 green triangular gussets and a rectangular strip of card 2″ X ¾”, on each side, as shown below



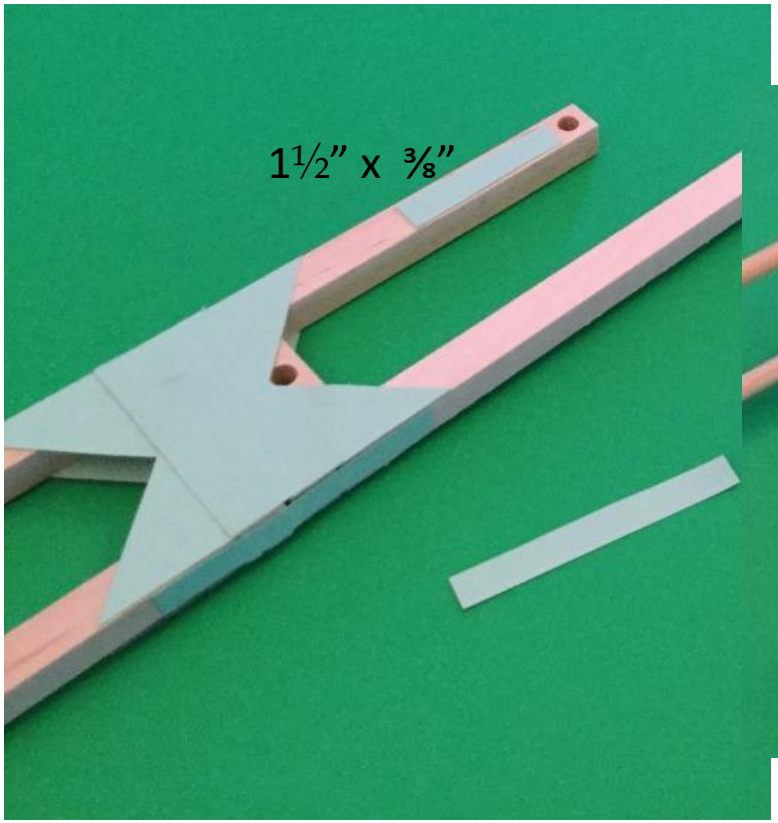
Glue the remaining two 2⅞″ pieces in place at the other end of the arm framework to hold the cuboid wooden block firmly so it can be removed. This will act as a counterweight

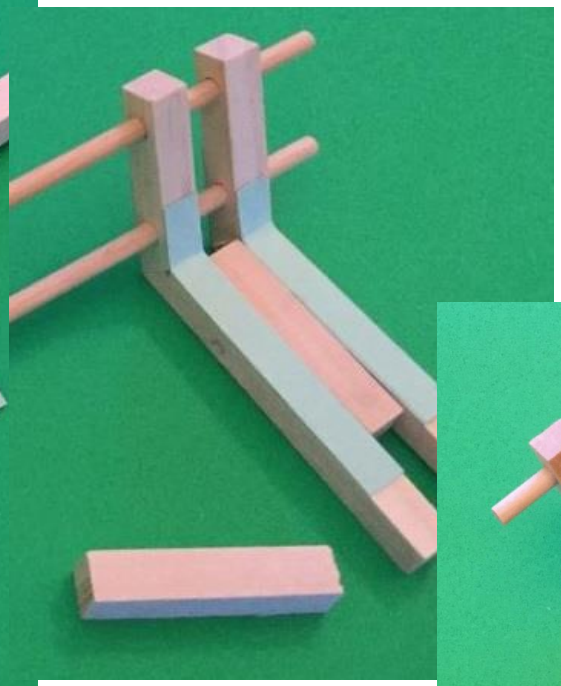


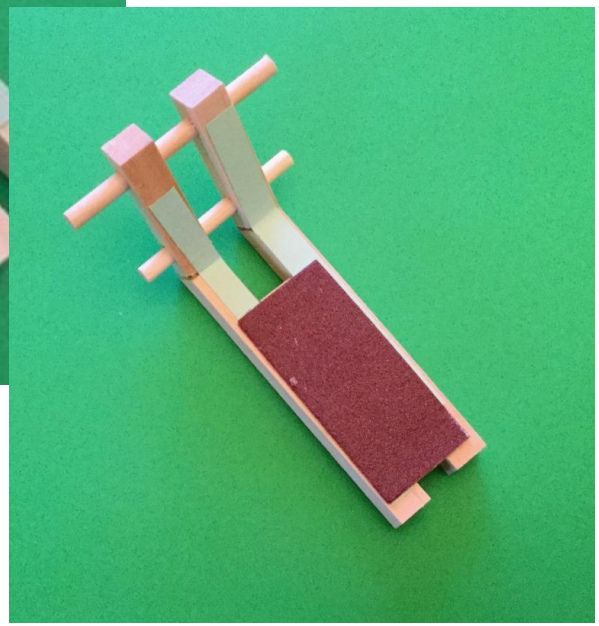
Join the four pieces with 60º cuts together to form the two fingers of the claw. Use a small amount of glue between the pieces and secure with strips of card ⅜” wide and 4” long.



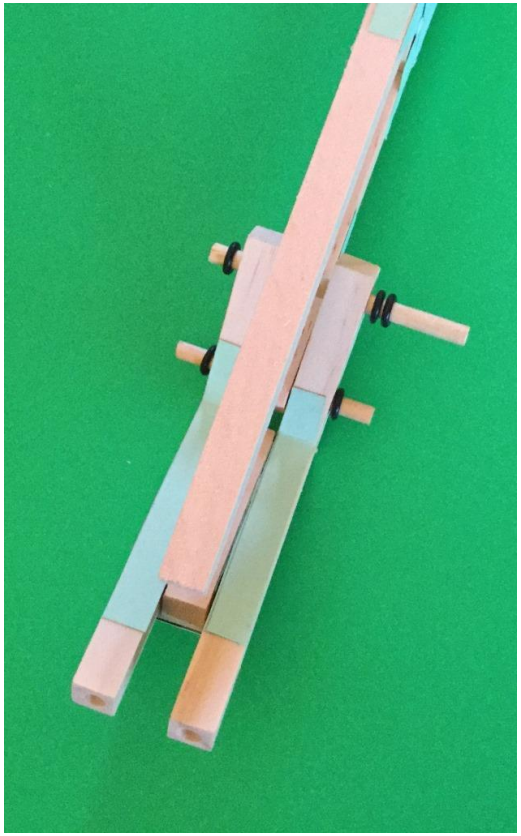
Connect the two fingers together using a <2″ piece. Make sure the holes are aligned by testing with dowel rod as shown. Also glue another strip of card ⅜″ wide and 1½″ long onto the claw frame near as possible to the hole in the 4¼″ piece. Add two pieces of sandpaper - 2¼″ X 1″ long for a gripper and ⅜″ wide X 1½″ for inside the "thumb"

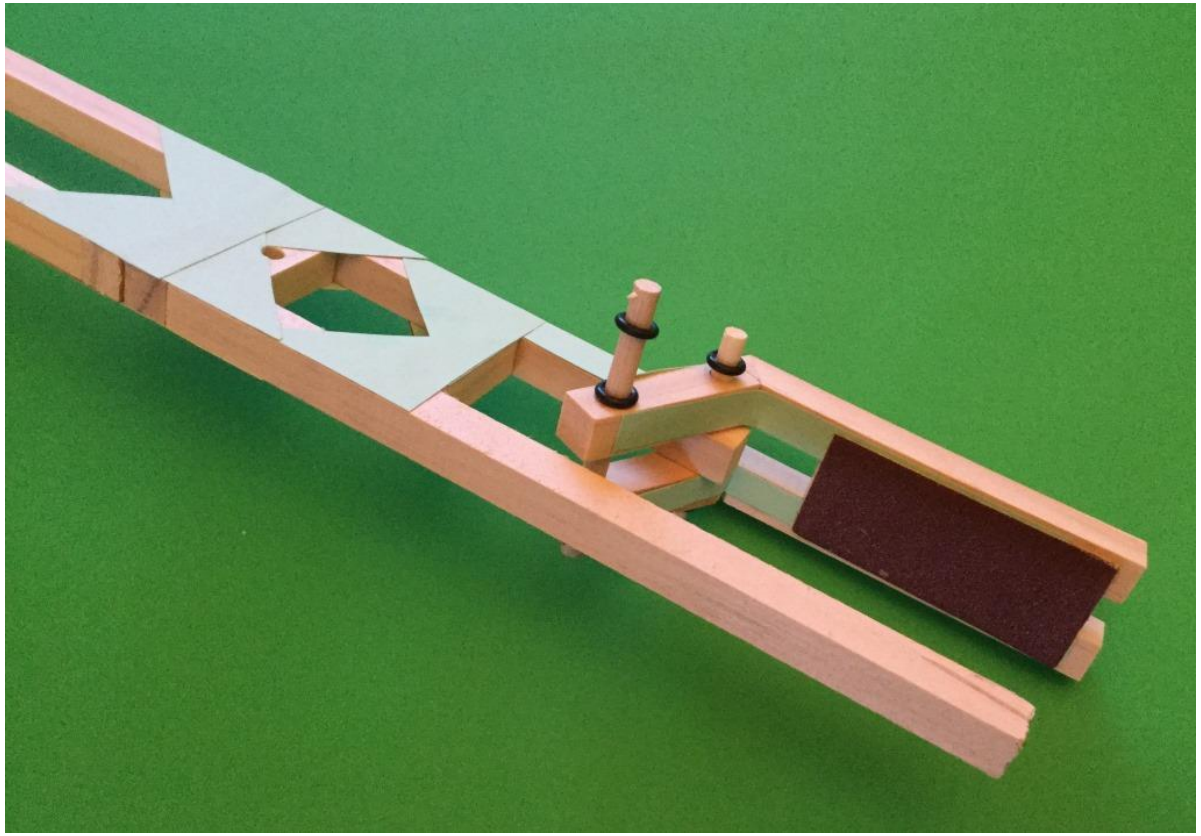






Use mini-washers and the 2½” and 2” dowels to secure the claw fingers to the claw frame. Notice there are 2 mini-washers on the top of the longer dowel

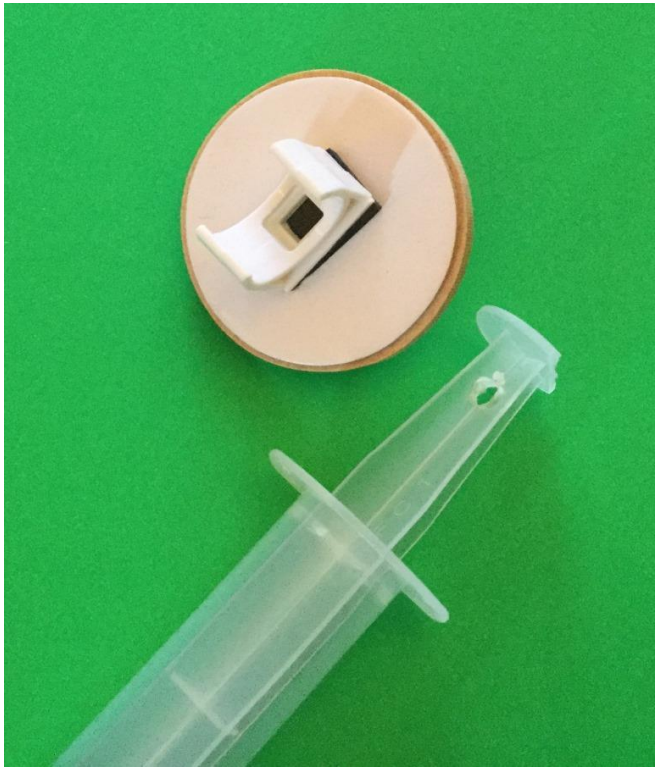




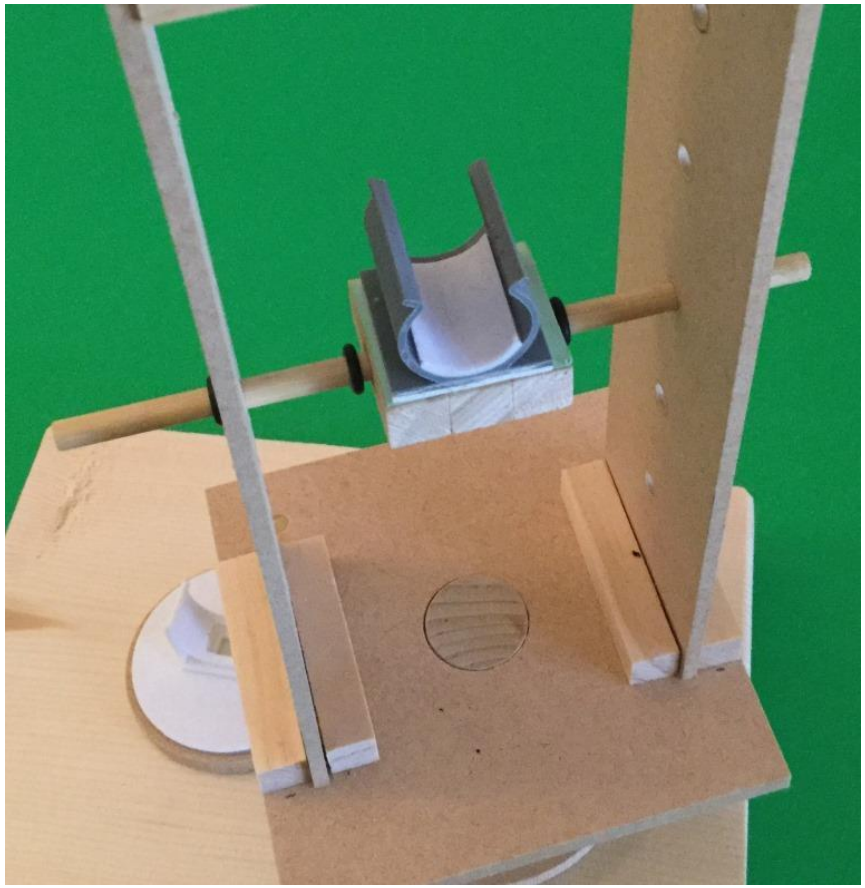
Using Syringes

Prior to using the syringes extract the plunger from barrel of the syringe and wipe your finger around the black rubber connector. The grease on your finger is sufficient to lubricate it.

To install the piston-syringe to turn the fingers select the piston with a hole and the end cut, and the platform with the 1½″ dowel. Position the plunger so it is at 8cc. and then place the platform and holder into the holes. Snap the syringe in place as shown while carefully guiding the 2½″ dowel through the hole in the plunger. Note the cut end is down.



Position the platform and holder for the lifting piston



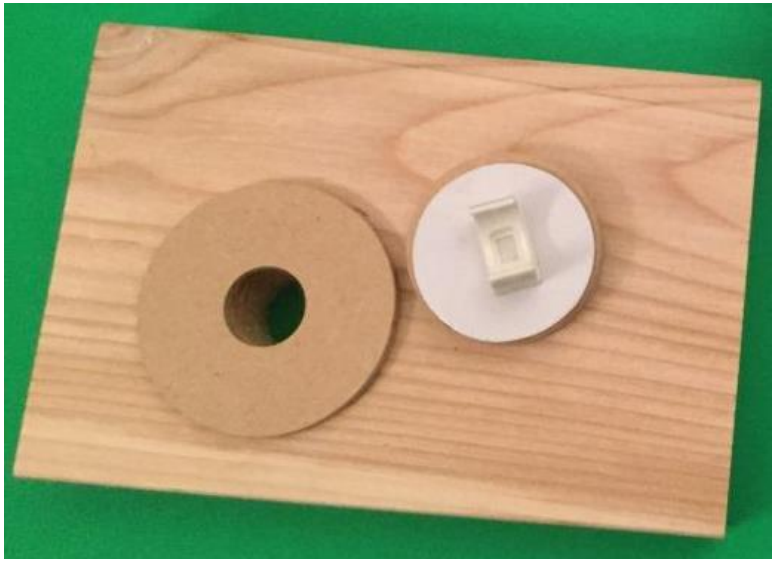
Remove the backing from the gray syringe holder and firmly press the gray holder onto the platform.

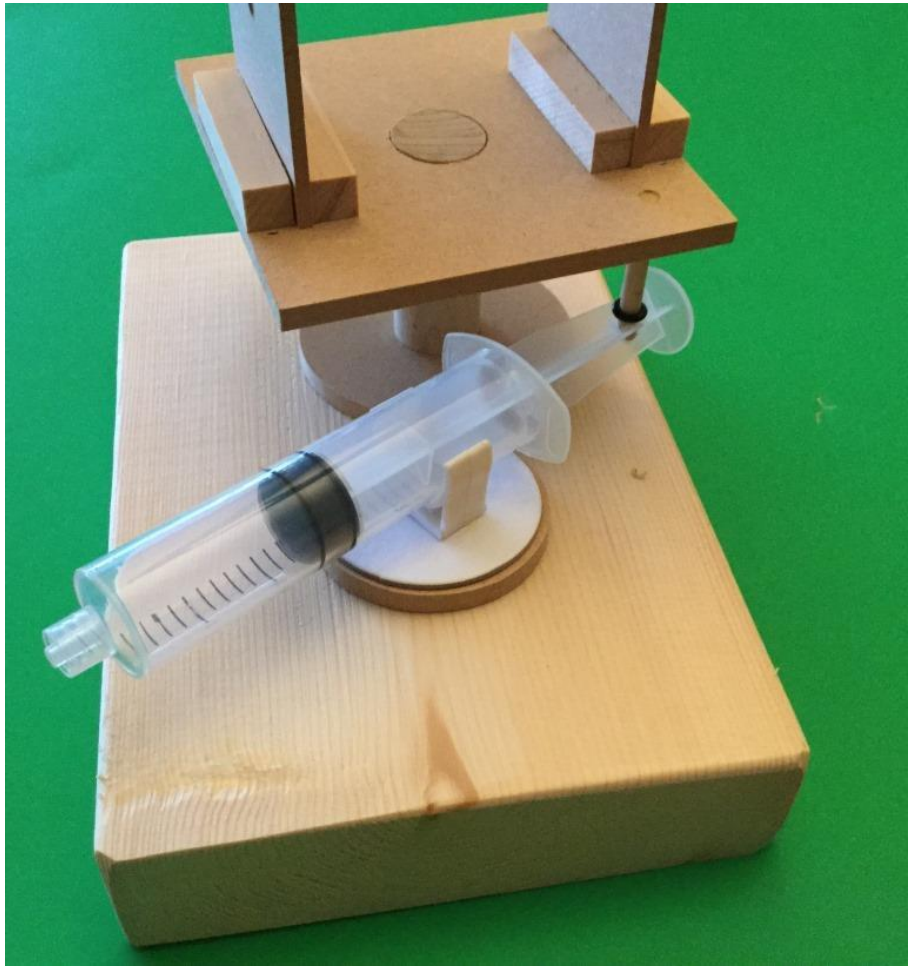
Push a 5″ dowel into position two holes below the top holes. Then push one mini-washer, then the platform and then another mini-washer onto the dowel so it is positioned in the center. Use 2 mini-washers to secure this 5″ dowel on the outside of the arm tower.

Also, push a mini-washer onto the 1⅞” dowel in the corner of the 4”platform

To install the piston-syringe to turn the tower select a piston with a hole and the platform with the 1” dowel

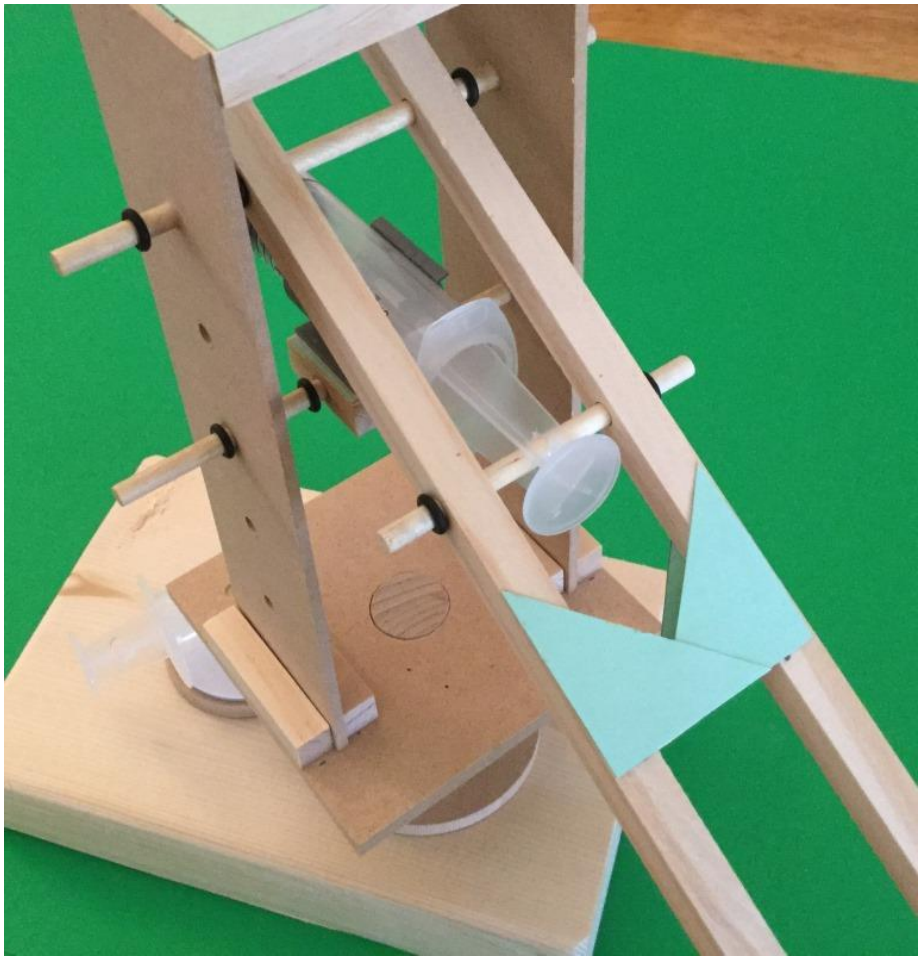
Place the platform for rotating the tower into the hole furthest from the ⅞″ hole *(if there are two (2) holes, -otherwise in the smaller hole).* Use a piston with a hole in its plunger, push the plunger half-way and snap the piston into the white holder. Place the tower into the ⅞″ hole while carefully guiding the 1½″ dowel through the hole in the plunger while pushing the mini-washer up.





https://youtu.be/j1GvDNXbiNk

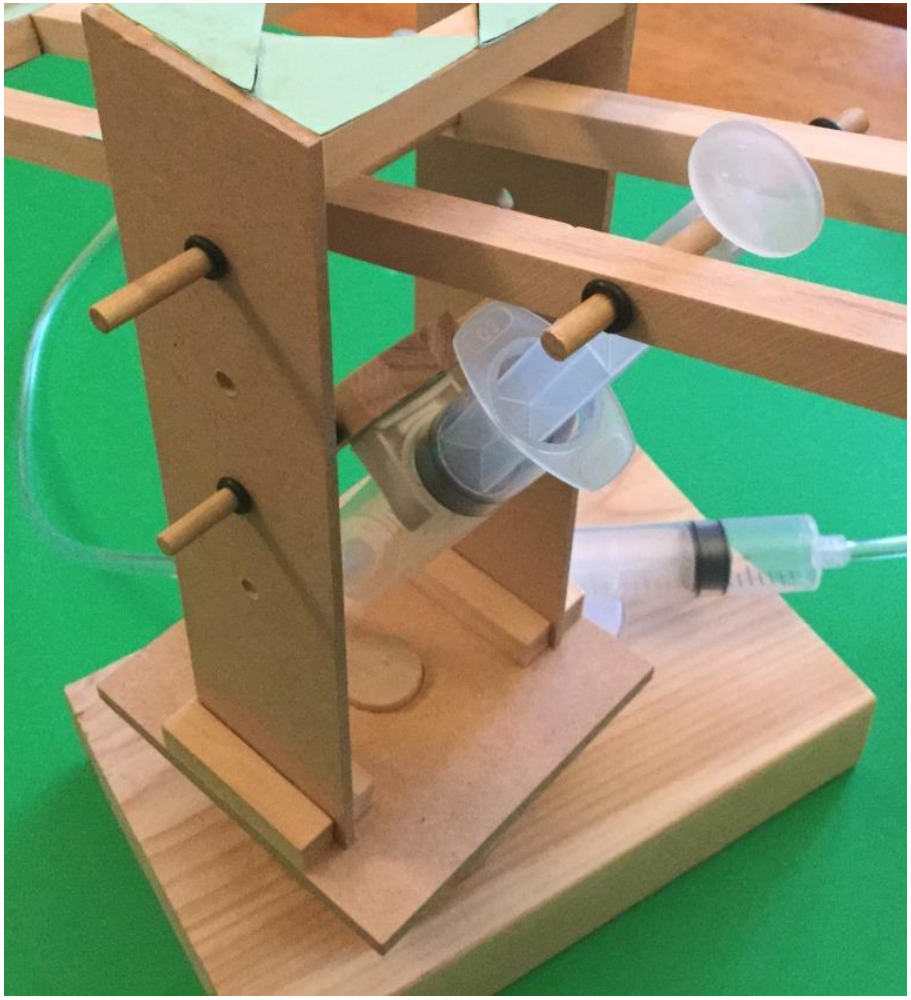
Use a 5″ dowel in the top position of the tower to secure the arm.

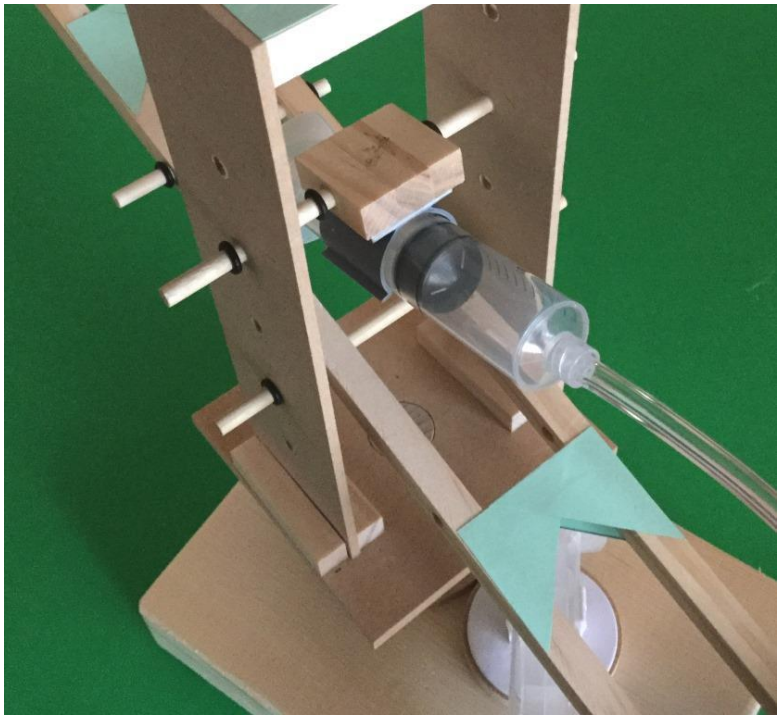


Use a 5″ dowel in the top position of the tower to secure the arm with mini-washers inside and outside of the tower

Use the 3″ dowel to secure the plunger of the lifting piston-syringe to the holes on the arm nearest the claw mechanism.

Then mount the syringe, with its plunger pushed in half-way, into the holder.

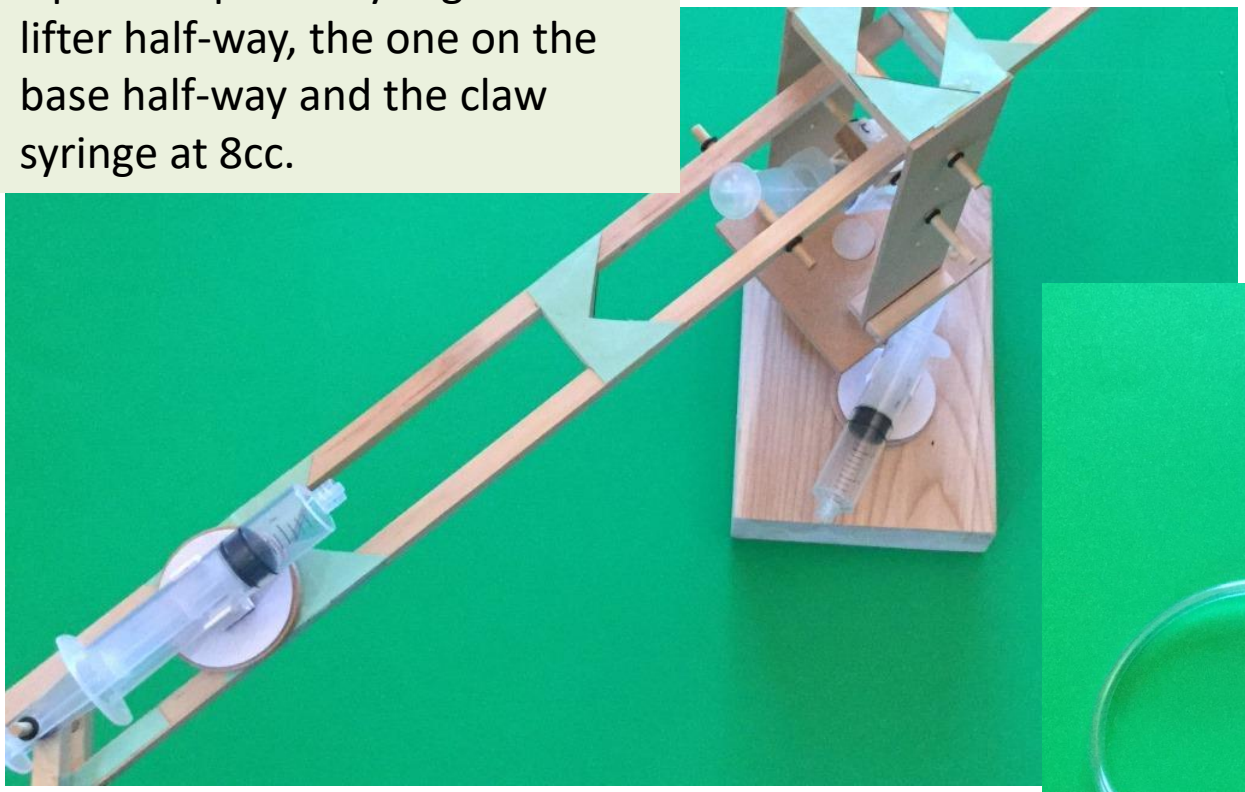


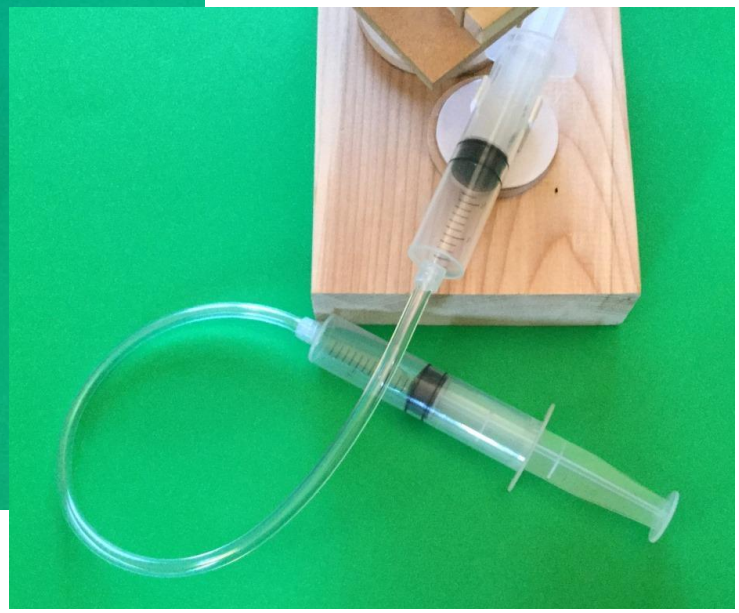


https://youtu.be/9Ar4FD14v1U

To use the arm pneumatically connect syringes to the others using a 15” length of tubing for each. Arrange the piston-syringes so they are complimentary at least halfway open, as below.

Open the piston-syringe on the lifter half-way, the one on the base half-way and the claw syringe at 8cc.





https://youtu.be/biI3fXTgDjo

Using Pneumatics – air – to move the device.
Air is a “spongy” fluid with a relatively large amount of space between its particles compared to water.

Once you have used the arm pneumatically a few times you will realize that air, the fluid in the piston-syringes, is “spongy” and there are significant delays in the action of the plungers.

Spongey fluid: https://youtu.be/ey5GqpDFl8U

Perhaps at this point you may wish to try a different fluid – water – and the question arises “How do I get the water into the syringes?”

Hydraulics - base: https://youtu.be/QtcOBgM9lgM