

Step 1: Gather your materials



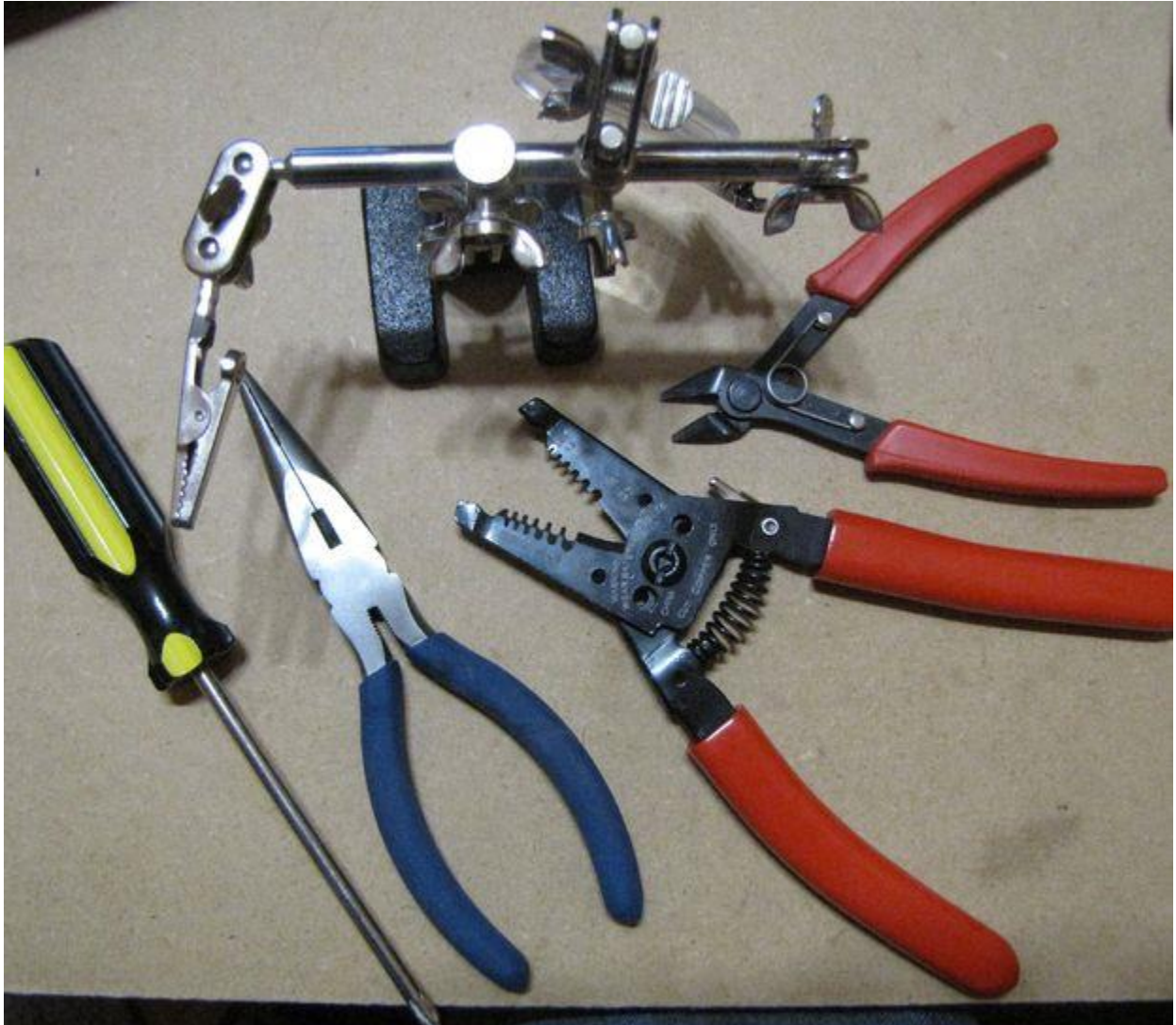


You will need the following items:

- (1) DPDT On/On toggle switch. [We like these from Jameco.](#) Though you can use another size or style if you prefer. Just be sure get one with a 1/4 inch mounting hole or adjust the files that you will be cutting out later to compensate.
- (1) Micro switch. [This needs to be this item](#) to match the mounting holes and cam assembly in our file that you will be cutting out later. If you get another switch, you will need to edit the file and potentially spend time to get the measurements setup for alignment.
- (1) 2xAA battery holder. Any brand or kind should do. [We prefer this one from Jameco.](#)
- (1) Solarbotics GM-9 Geared Motor. These are available from many sources including [Solarbotics.com](#) and [Hobby Engineering.com](#).
- A short piece (about 3") of 3/64" brass rod (for the hinge mechanism). Available at many local hardware stores and big-box stores.
- The laser cut enclosure, mounting and cam mechanism.
- About 10" of black 22 gauge solid core wire
- About 10" of red 22 gauge solid core wire
- About 2" of green 22 gauge solid core wire
- (1) small zip tie (for a strain relief)
- (1) 1" of velcro
- (2) AA batteries
- (2) #4 x 1/2" screws
- (2) #4 x 3/8" screws

- (3) #2 x 3/8" screw

Step 2: Gather your tools and supplies



To assemble the Useless Machine, gather the following tools and supplies:

- Wood glue
- 3 large elastic bands (will be used to clamp the box after glue up)
- Small brush (for applying glue) An acid brush or small hobby size paint brush will work perfectly for this.
- Screwdriver - No 1 Phillips
- Needle nose pliers
- Wire cutters / Strippers

- Soldering iron
- Solder

Optional

- A set of helping hands to hold the pieces while soldering

Step 3: Cut your useless machine



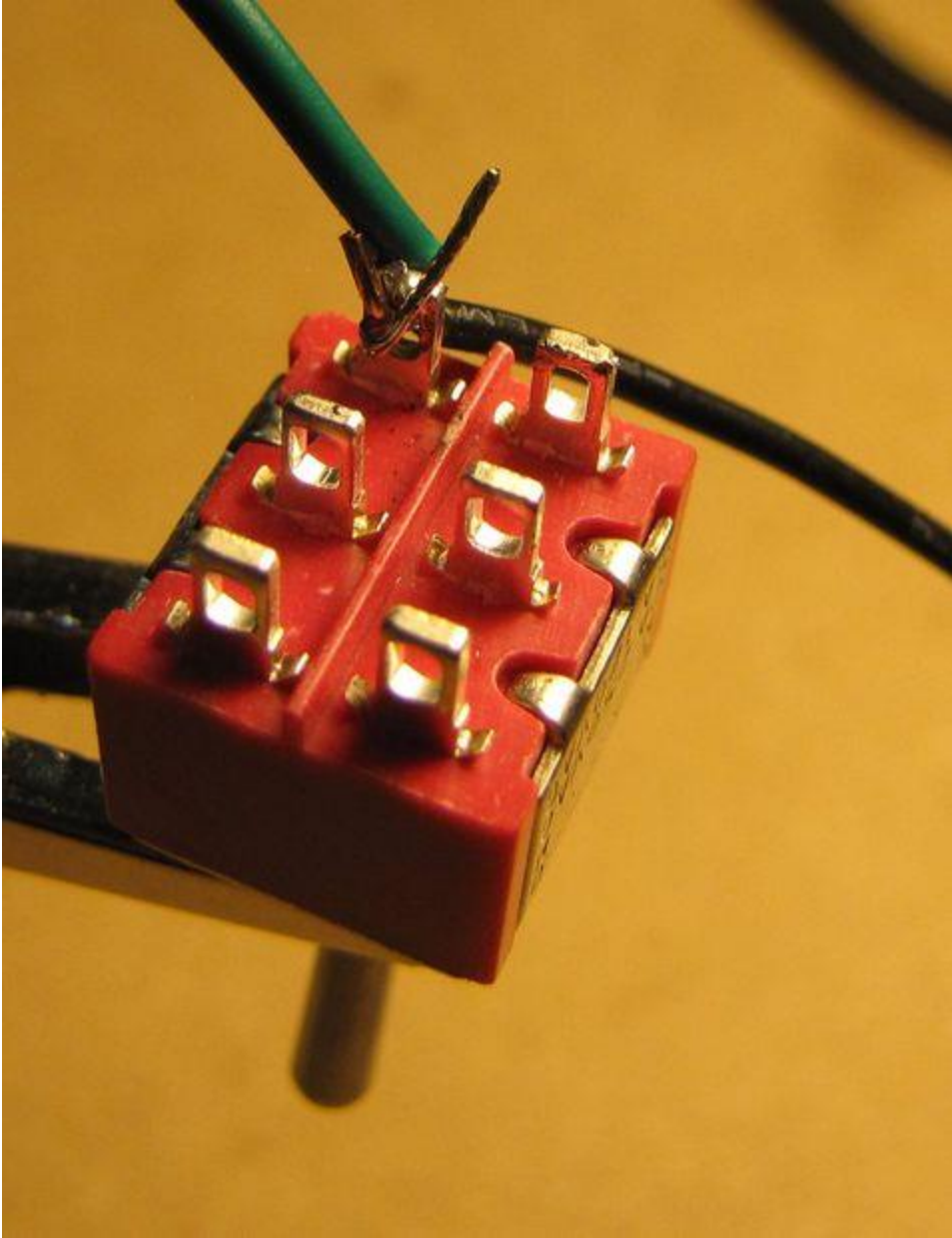


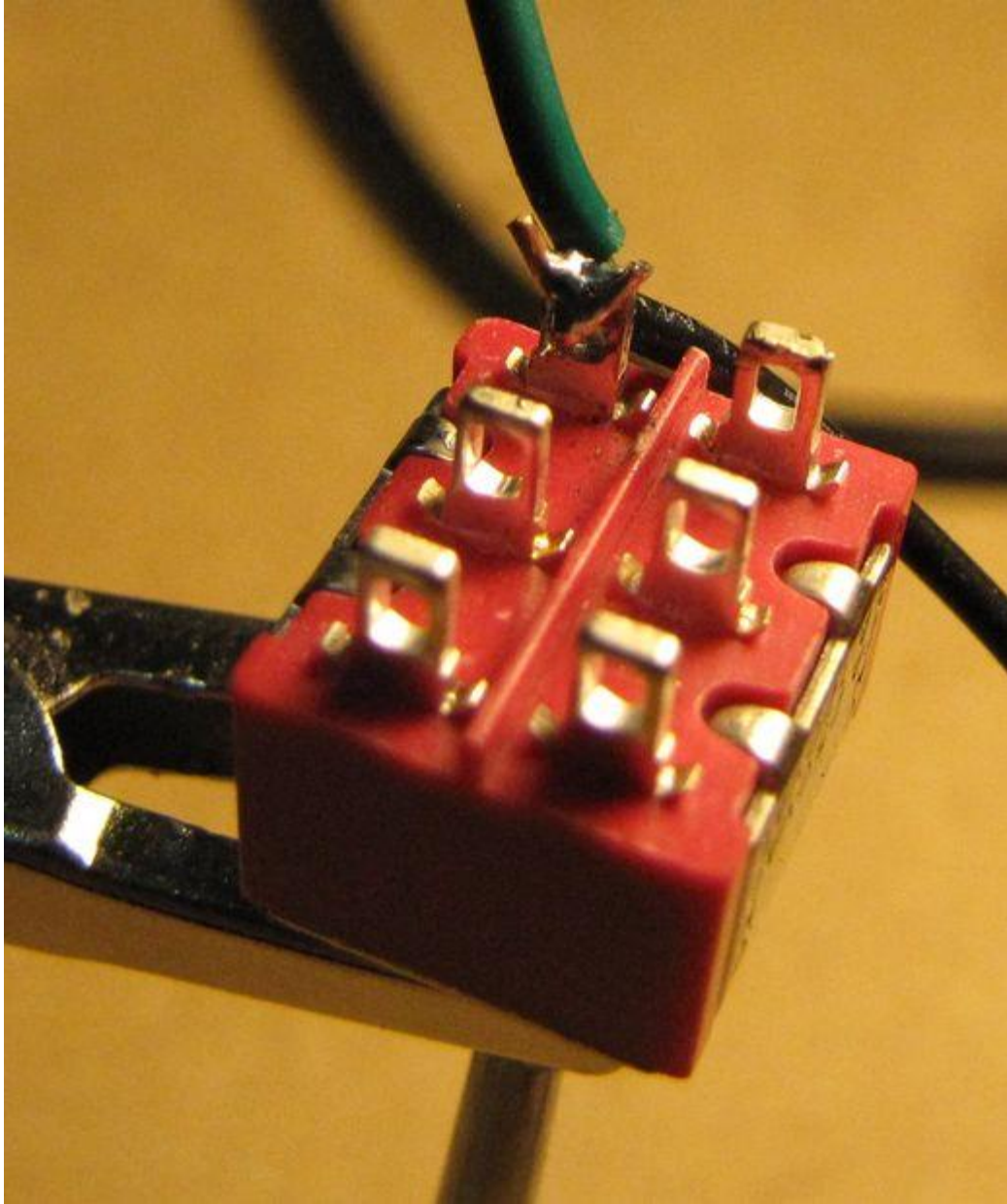
Use the attached plans to laser cut your useless machine in 1/8 material. We used Baltic Birch for this instructable. You will end up with the pieces shown in the attached images. There are essentially 3 sub-assemblies that will make up your Useless machine. The box base, the box lid and the internal mechanisms which consist of a cam assembly and the mounting brackets.

The attached plans use color mapping so that the resulting file has both engraved areas (raster) and cut areas (vector). The red lines in the plan are set to a lower power and higher speed so that the result is a line that is marked (rastered) instead of being cut. This speeds up the process considerably.

In our shop, for production items, we often finish our material prior to running them through the laser. We use a Golden Oak finish. the benefit of this finish is that it closely matches the smoke residue color so that, once cut, our pieces can be immediately assembled. Feel free to assemble this however you want, though.

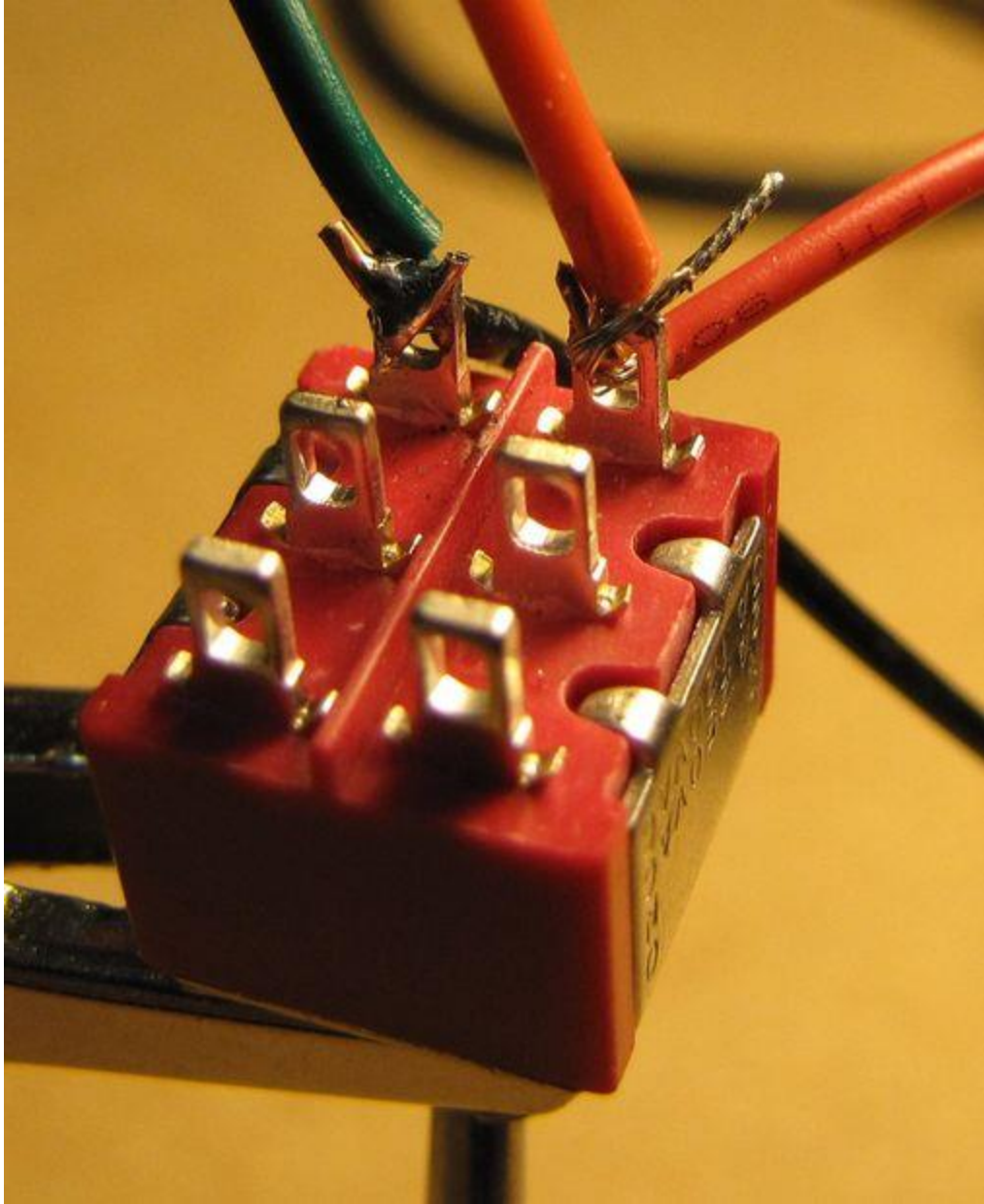
Step 4: Solder your first wires

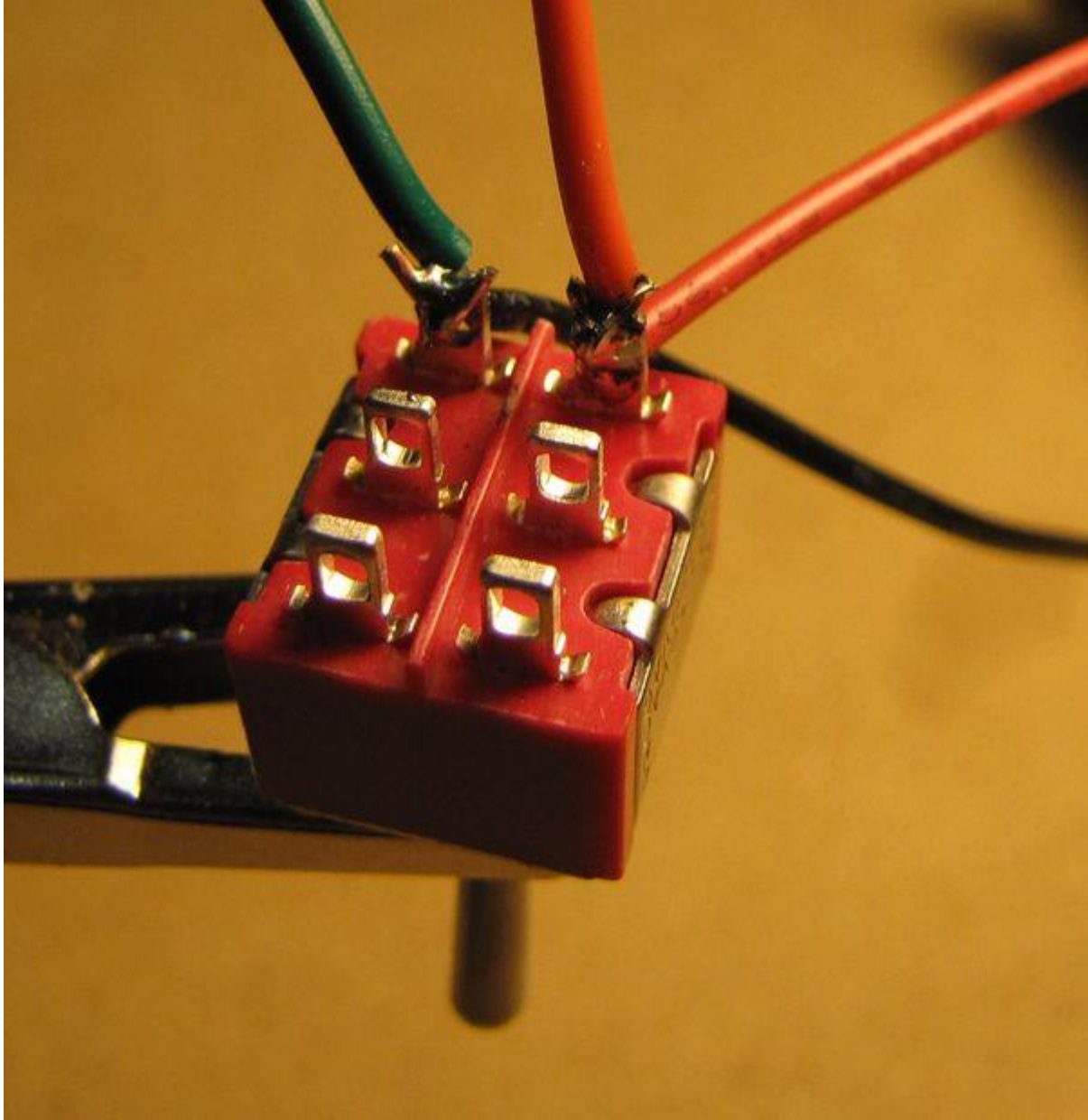




Cut and strip about 1/4" off of both ends of your 2" green wire. When looking at the bottom of the DPDT switch, you are going to solder one end of the green wire and the black wire from your 2xAA battery pack to the top right lug as show in the image. Trim any extra wire tag ends after soldering to ensure that you do not accidentally short out your toggle switch terminals later.

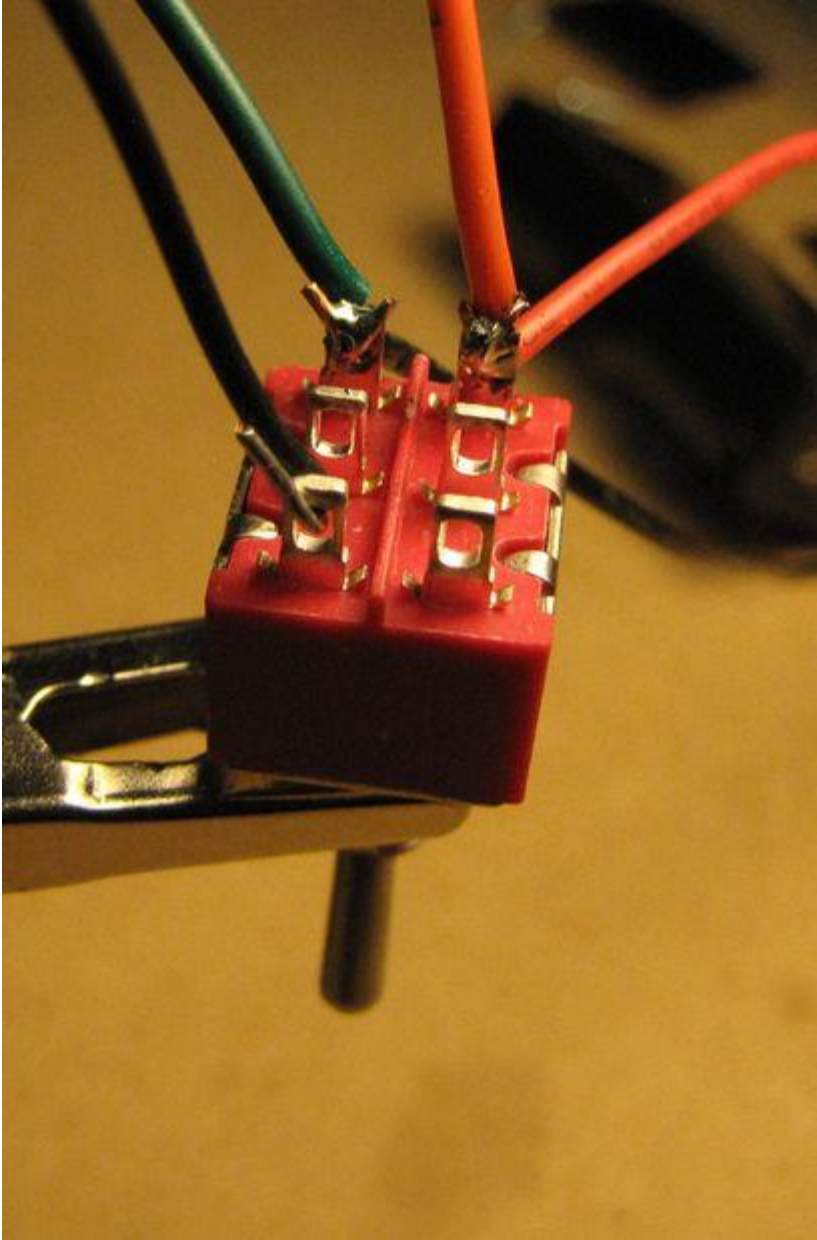
Step 5: Soldering part 2

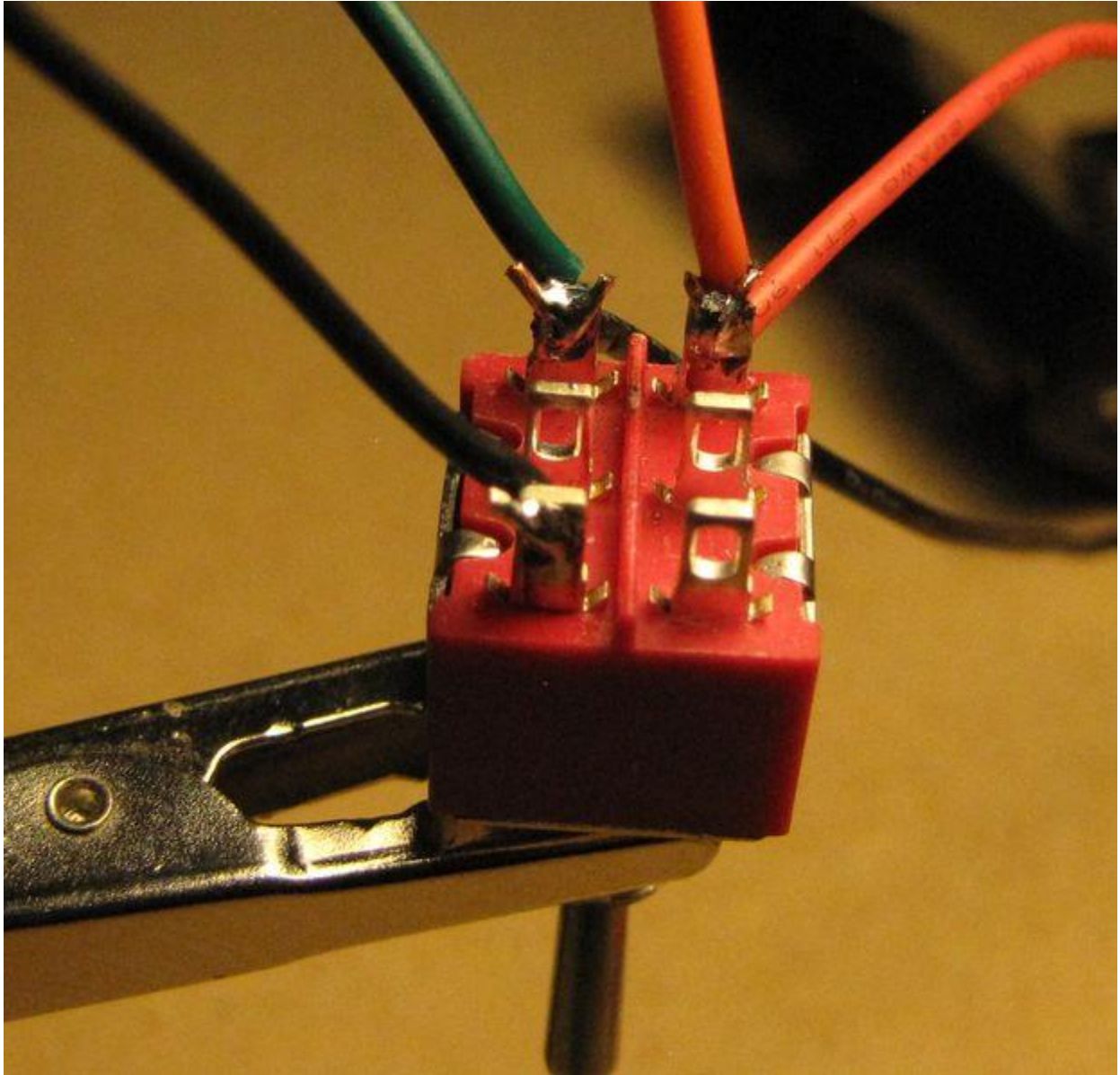




Now cut about 3 inches from your red wire and strip about 1/4" from both ends. Solder one end of the red wire and the red wire from your 2xAA battery holder to the lower right lug of the terminal. Once the solder has cooled, trim any tag ends to prevent a short circuit later.

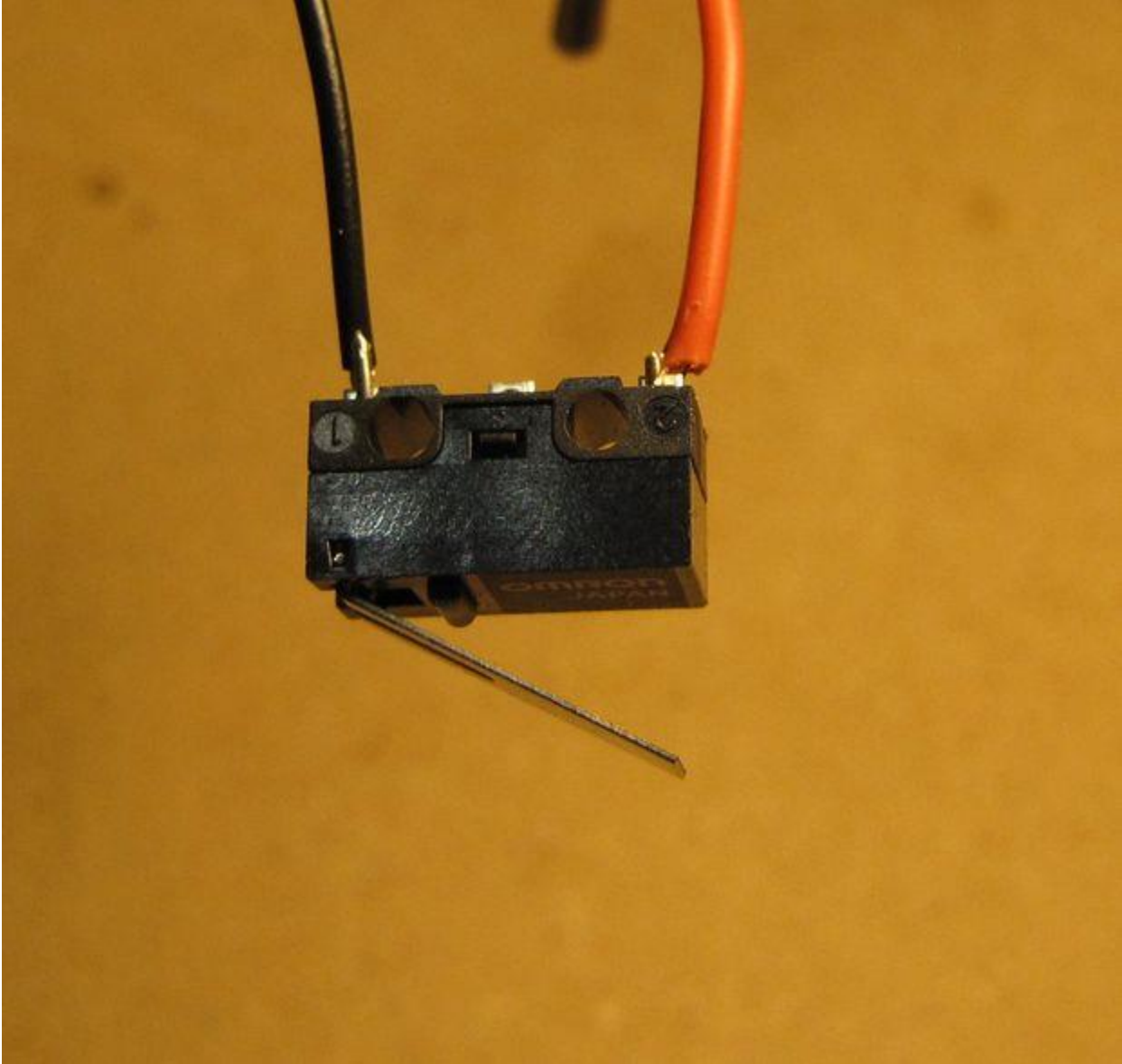
Step 6: Soldering step 3

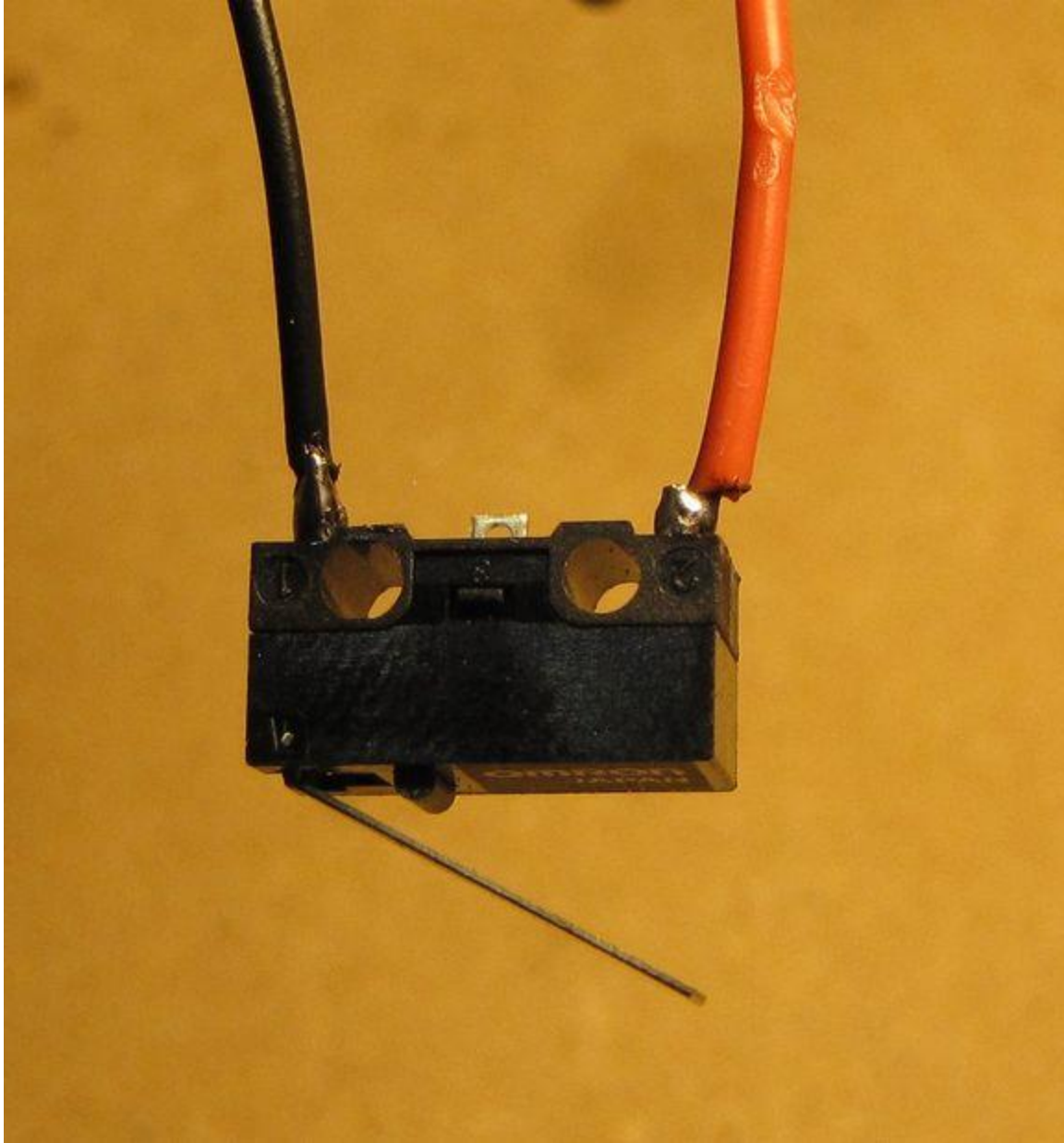




Cut about 3 inches from your black wire and trim 1/4" of insulation from both ends. Attach one of the wire to the top left lug of the toggle switch.

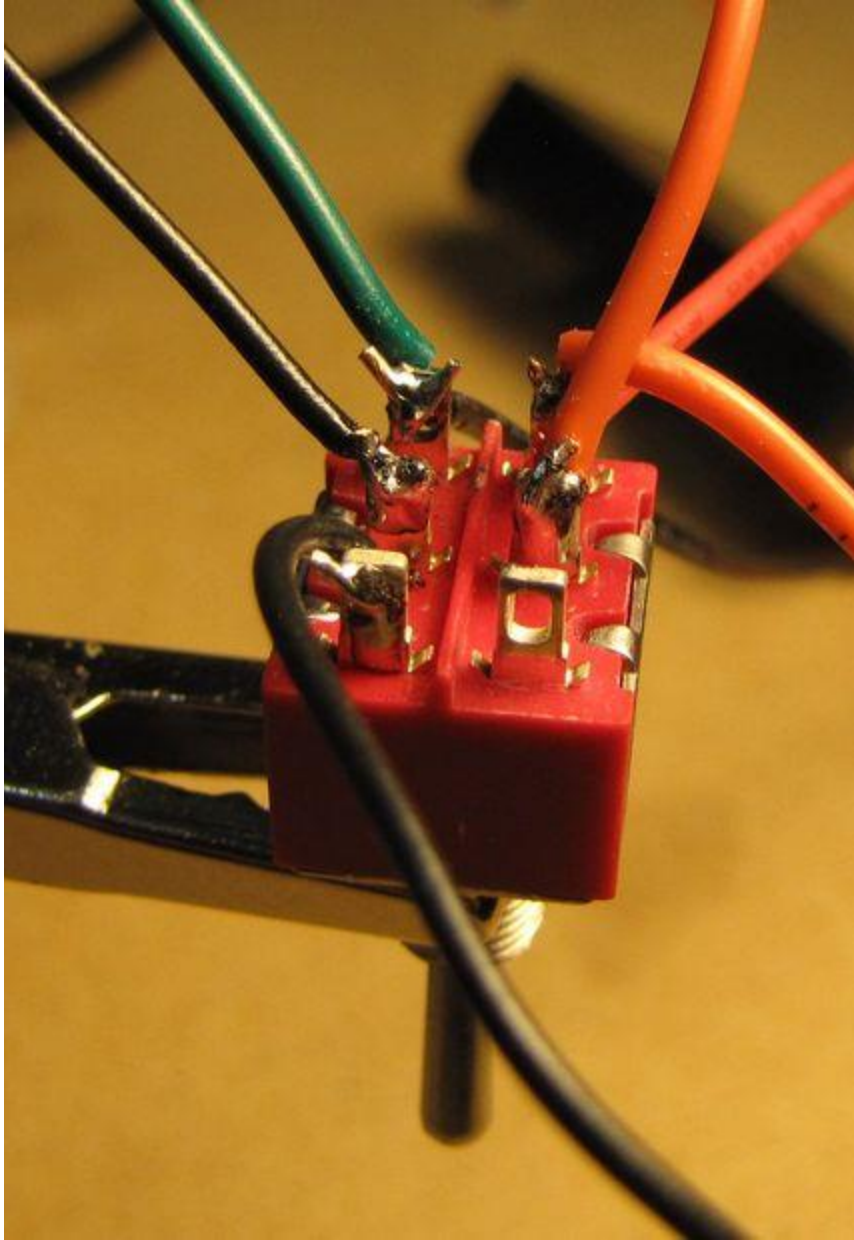
Step 7: Soldering step 4





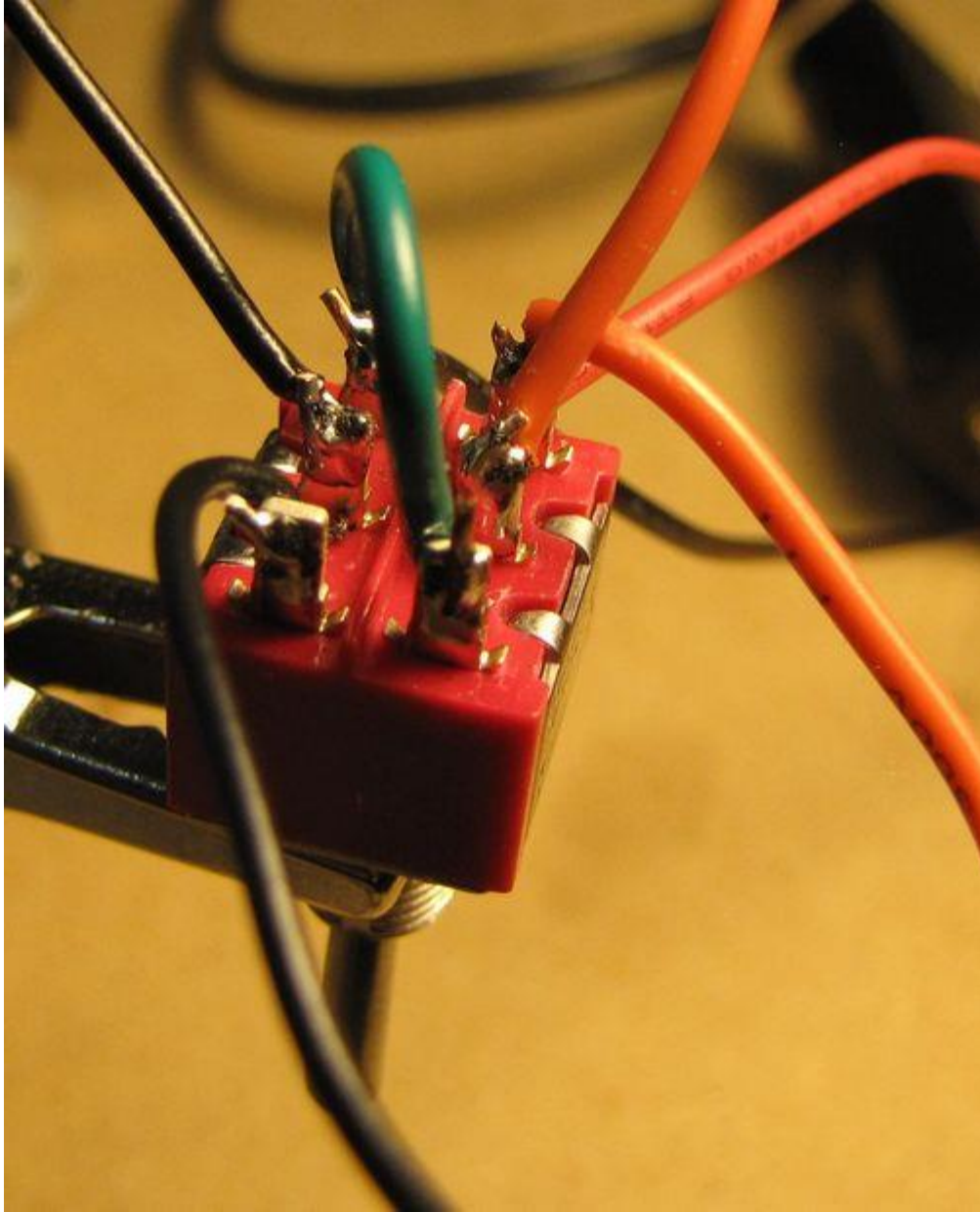
Solder the other ends of the red and black wires you soldered in the previous step and attach them to the two outside terminals of the micro switch. The polarity does not matter. You can attach either wire to either of the terminals. Just make sure you do NOT use the center terminal.

Step 8: Solder Step 5



Take the remaining red and black wires and strip 1/4" from each of the ends. These wires are soldered onto the toggle switch. The black wire to the top center terminal and the red wire to the bottom center terminal.

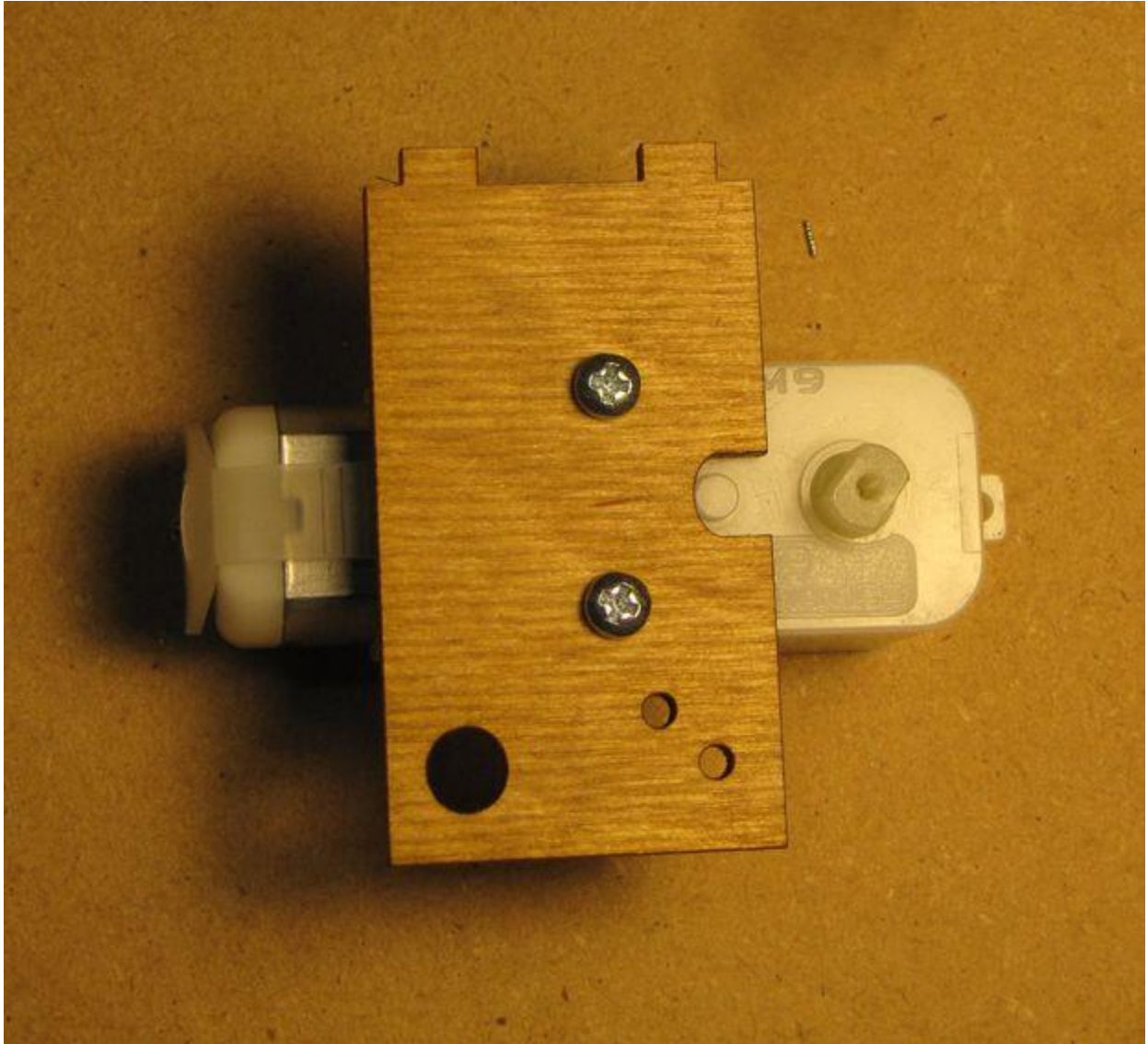
Step 9: Solder step 6



Take the remaining end of the green wire and solder it to the lower left terminal.

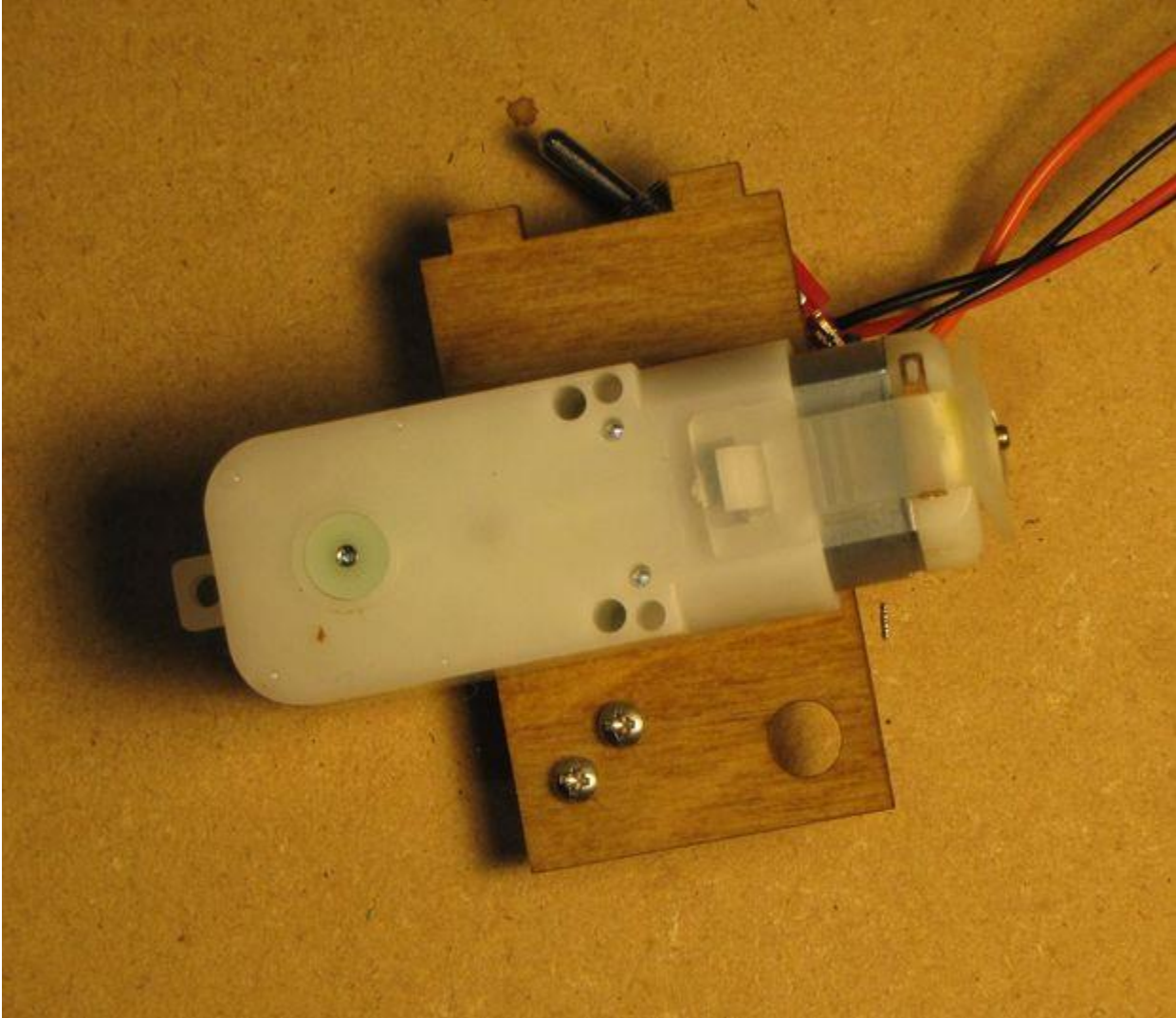
Now turn off your soldering iron for a few minutes while we assemble the mounting brackets and cam assembly.

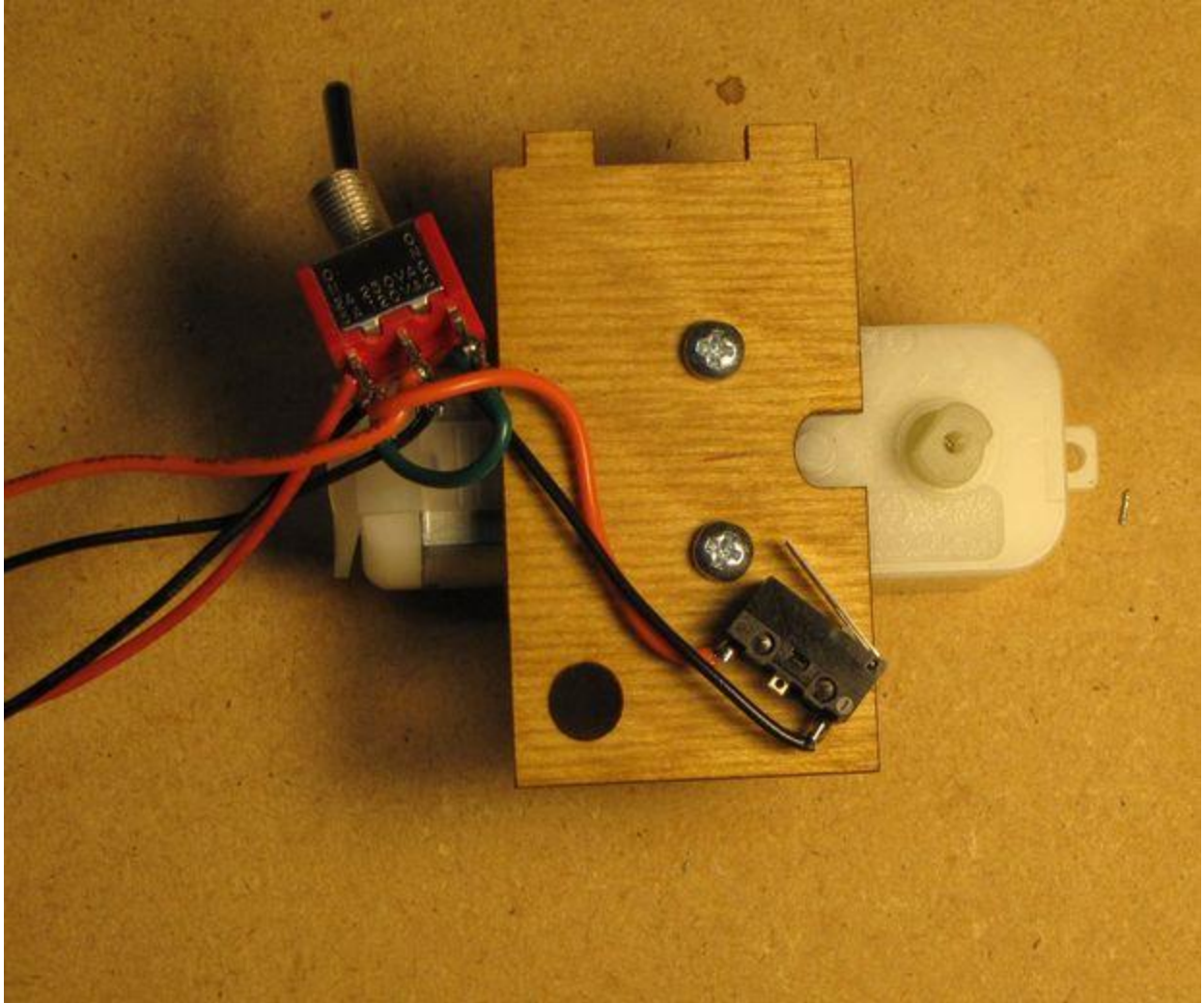
Step 10: Attach large mount to gear motor



Using the 2 #4 by 1/2" screws, attach the large mounting plate to the gear motor

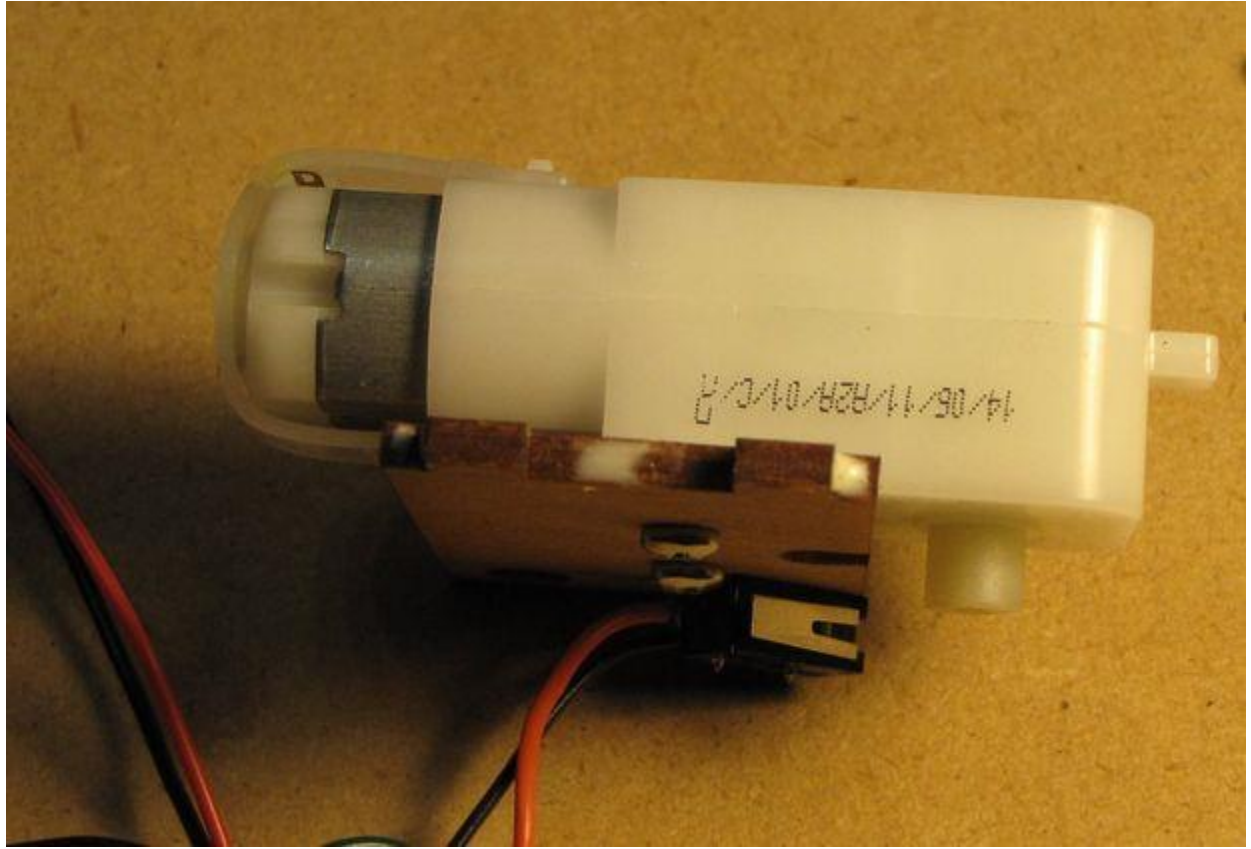
Step 11: Attach micro switch to large plate

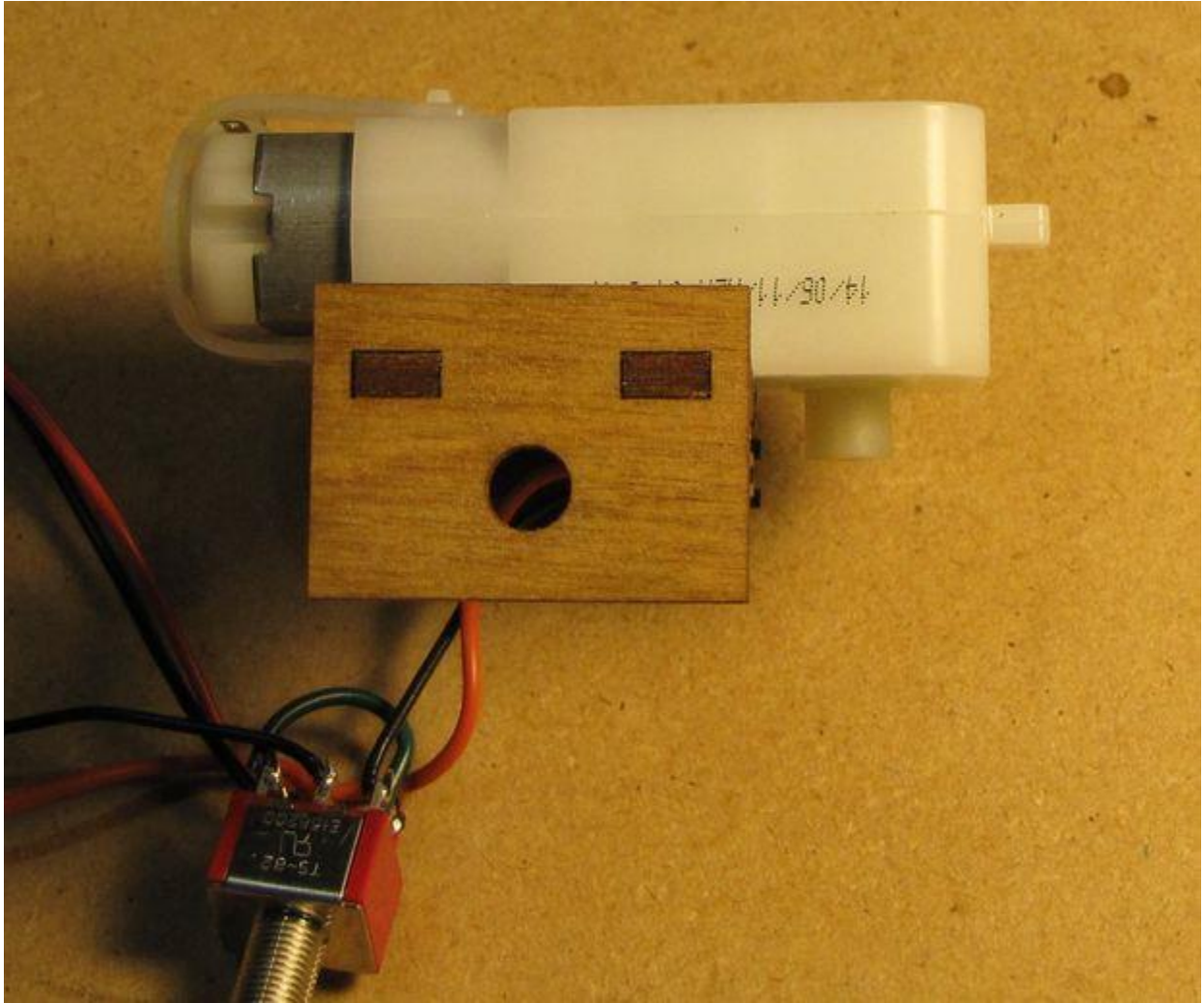




Using the 2 of the #2 x 3/8 screws attach the micro switch to the large mounting plate. The screws attach from the back side of the plate. Be sure to note the orientation of the switch so that the lever is pointed towards the top of the plate.

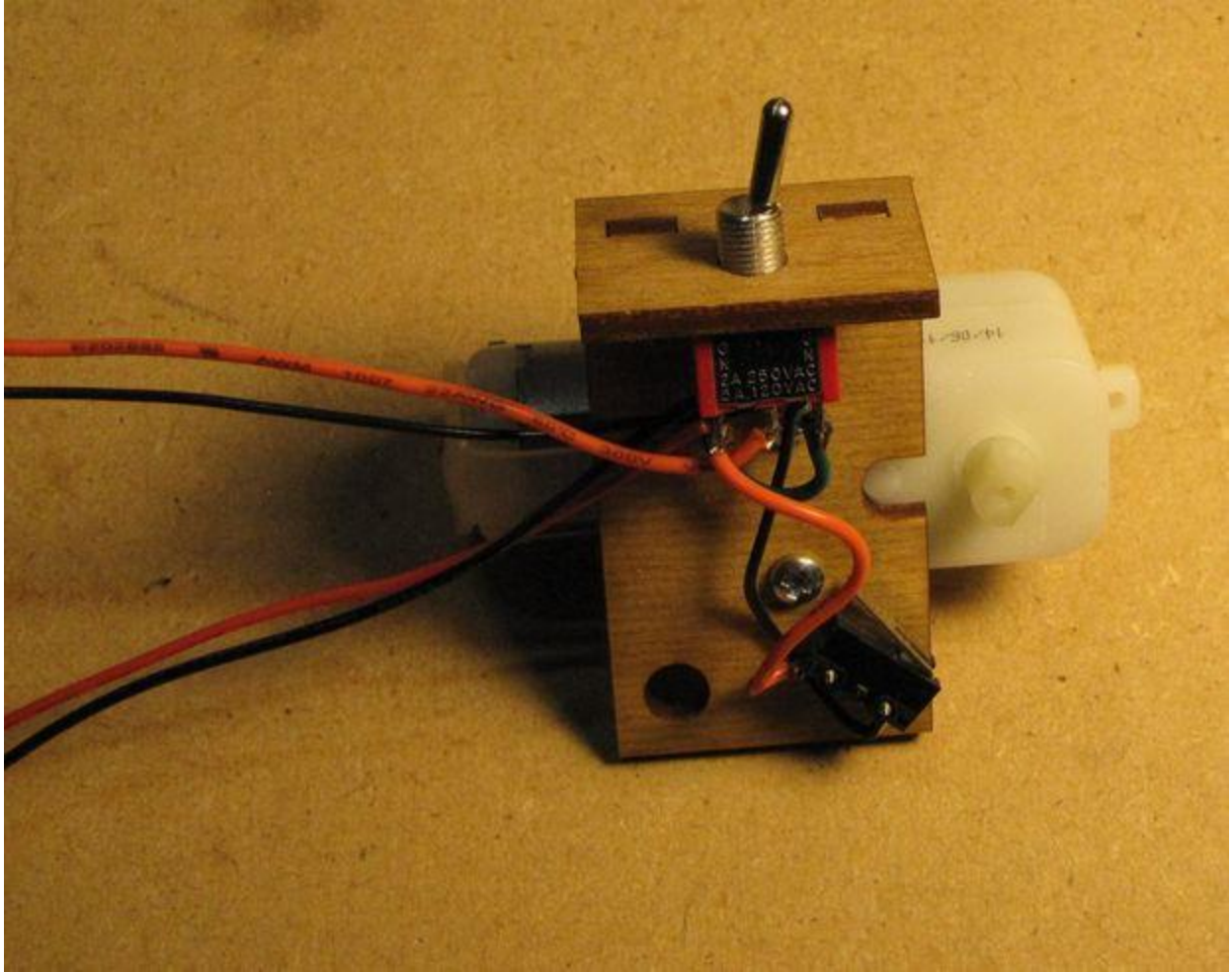
Step 12: Attach the top mounting plate





Apply a few small dabs of glue between the tenons on the large mounting plate and attach the small mounting plate. Be sure to note the orientation of the small mounting plate. Let the assembly dry for 15-20 minutes. You can use an elastic band to apply pressure to the plate if it is necessary.

Step 13: Mount the toggle switch



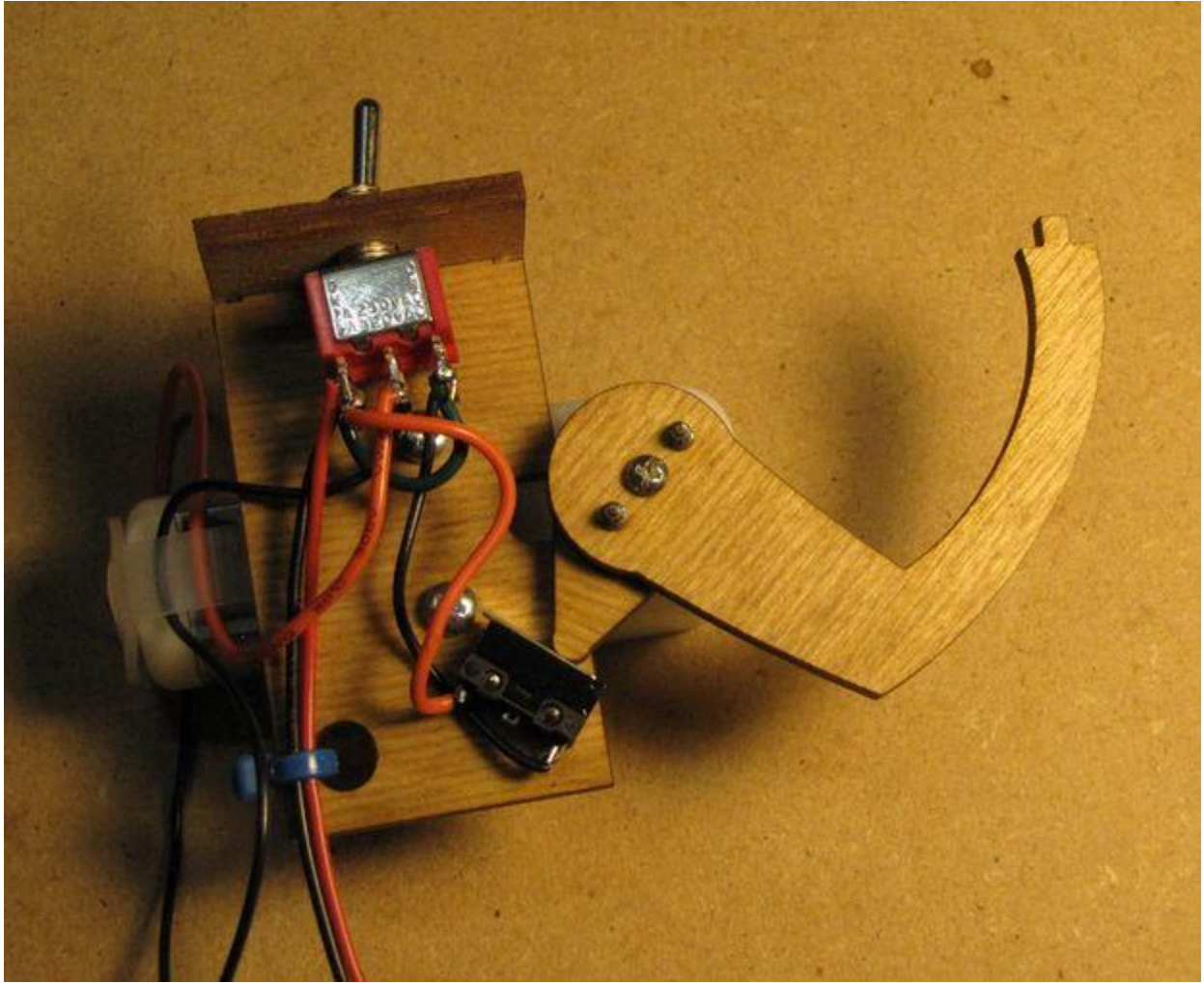
Push the toggle switch through the hole in the small mounting plate. The switch needs to be mounted so that the wires for the battery tray are towards the back (farthest from the axle on the motor). This is important for your Useless Machine to operate correctly.

Step 14: Build the arm and cam assembly



Layout the arm and cam as shown. Use the 2 #4 x 3/8 screws to mount the cam. The orientation of the cam is important. Make sure that the angle between the arm and the cam matches as shown in the picture. If your cam is mounted the wrong way, the arm will not fall below the cover of the useless machine.

Step 15: Attach arm assembly to motor axle



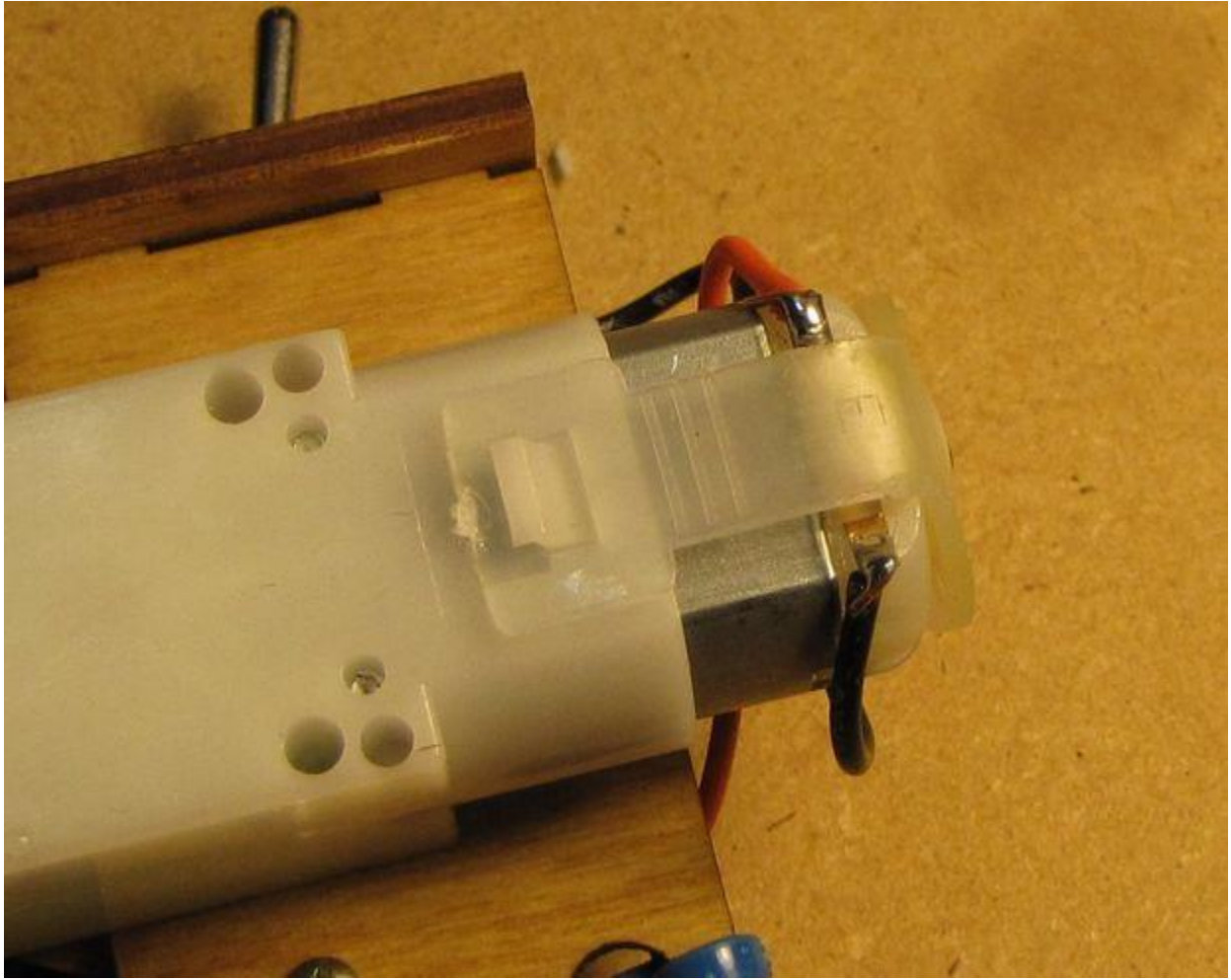
Using the remaining #2 x 3/8 screw, mount the arm assembly to the motor axle. Now is a good time to attach the zip tie through the hole in the lower left of the large mounting bracket to hold the battery wires. This will provide strain relief for when you need to replace your batteries.

Step 16: Attach the "hand"



Use a few dabs of glue to attach the hand to the arm. The hand gives us a slightly larger contact area so the the arm make solid contact with the toggle switch.

Step 17: Solder the motor



Solder the red wire to the upper tab on the motor (closest to the toggle switch) and the black wire to the lower tab.

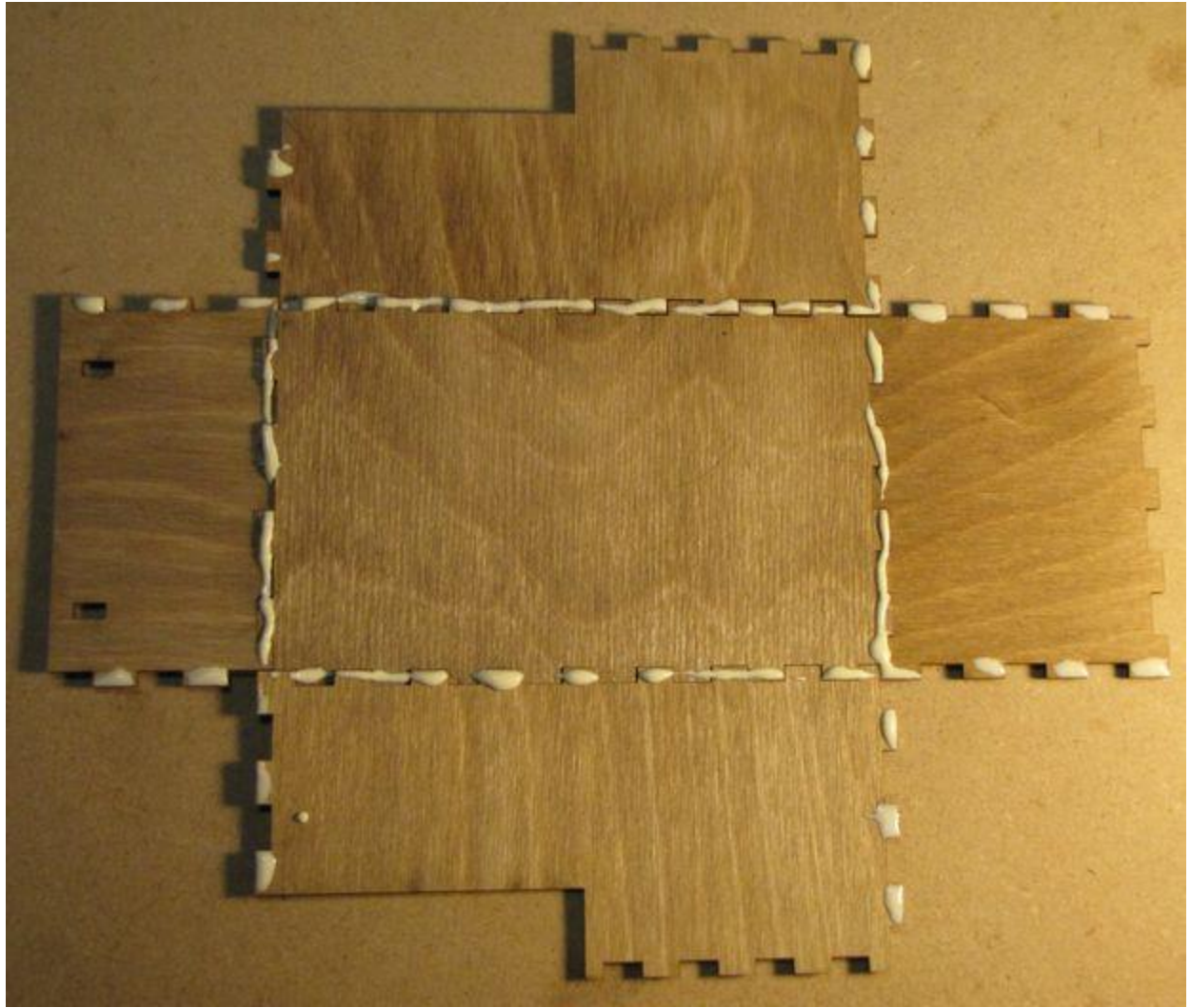
Step 18: Test the motor assembly

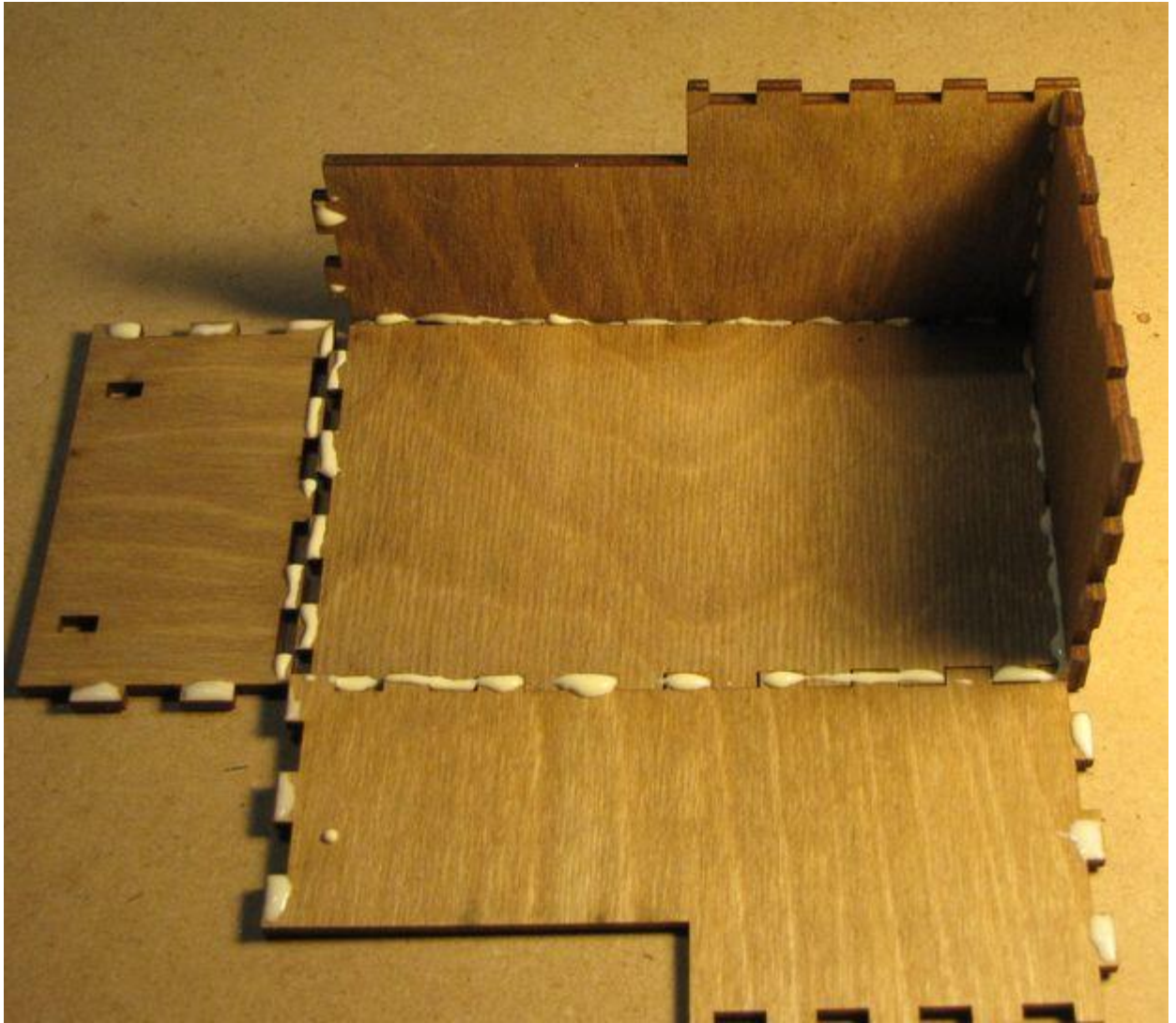


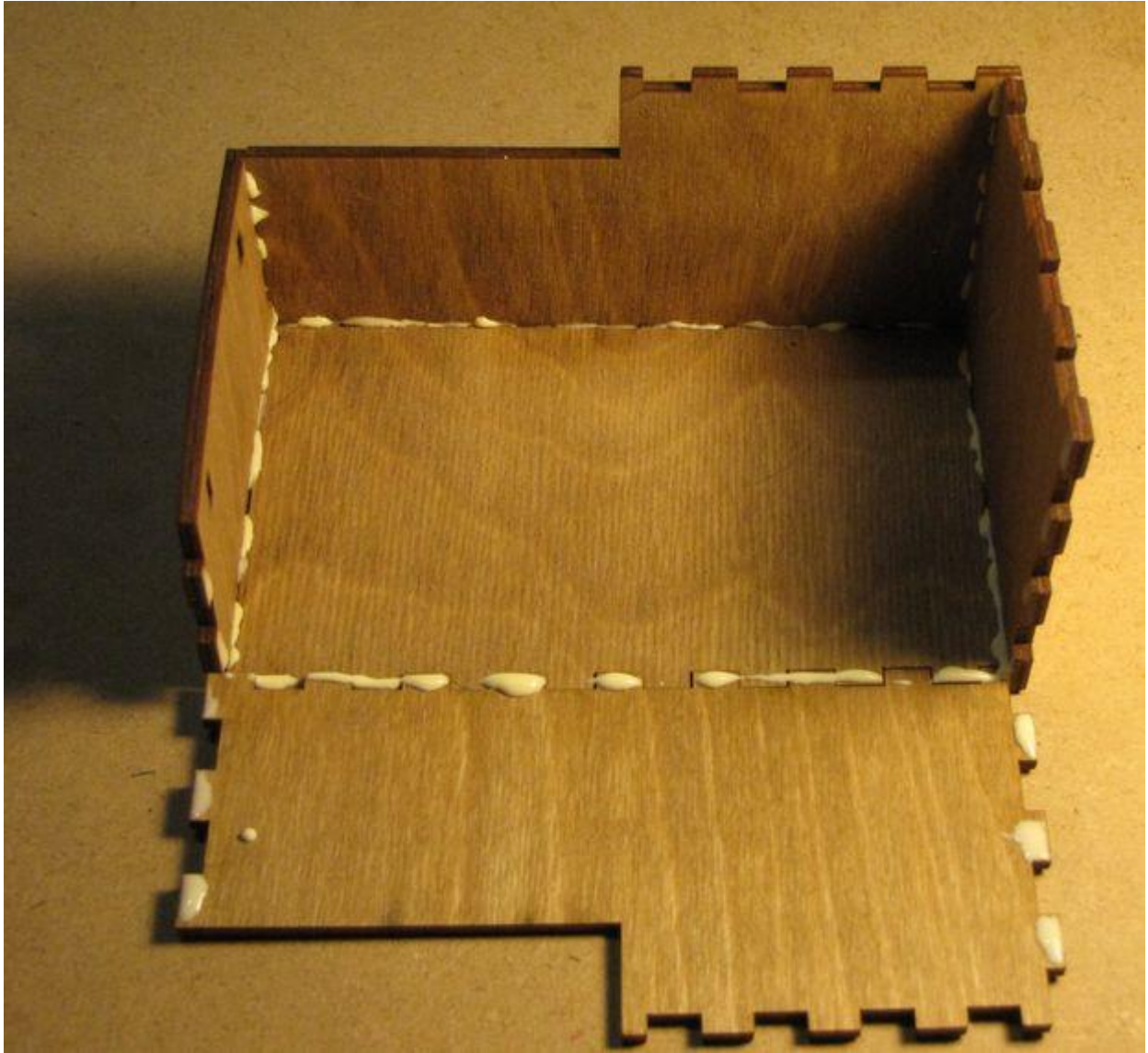
Now is a perfect time to test our motor assembly. Hold the assembly upright with the large mounting plate flat on your work table. Make sure the toggle switch is pulled into position furthest away from the arm assembly and insert 2 AA batteries. Toggle the switch on. The arm should rise and push the switch into the off position and then return to closed. If this does not occur, check all of your wiring and for short circuits. If you did not hold the assembly against a flat surface, it is possible that the cam pushed past the lever of the micro switch. If this happened, remove the batteries and carefully push the arm back over the lever. Be sure not to bend the lever.

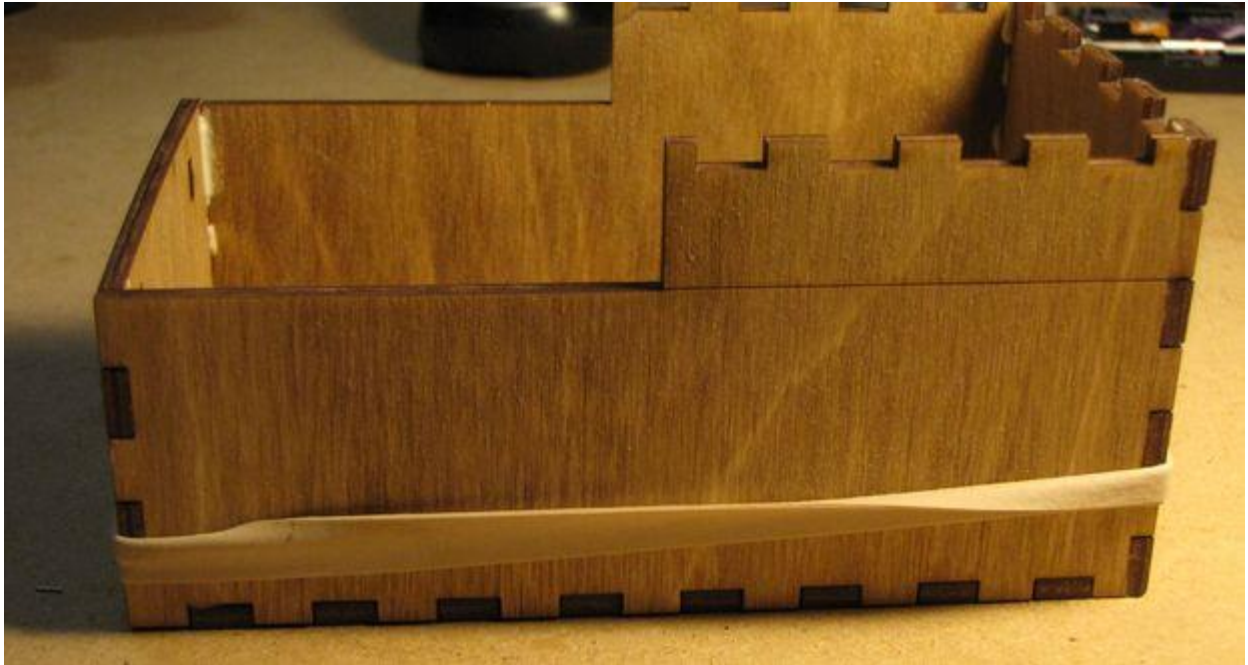
When you are finished playing with the assembly, set it aside for a few minutes and we will begin building the enclosure.

Step 19: Layout, glue and assemble the lower box





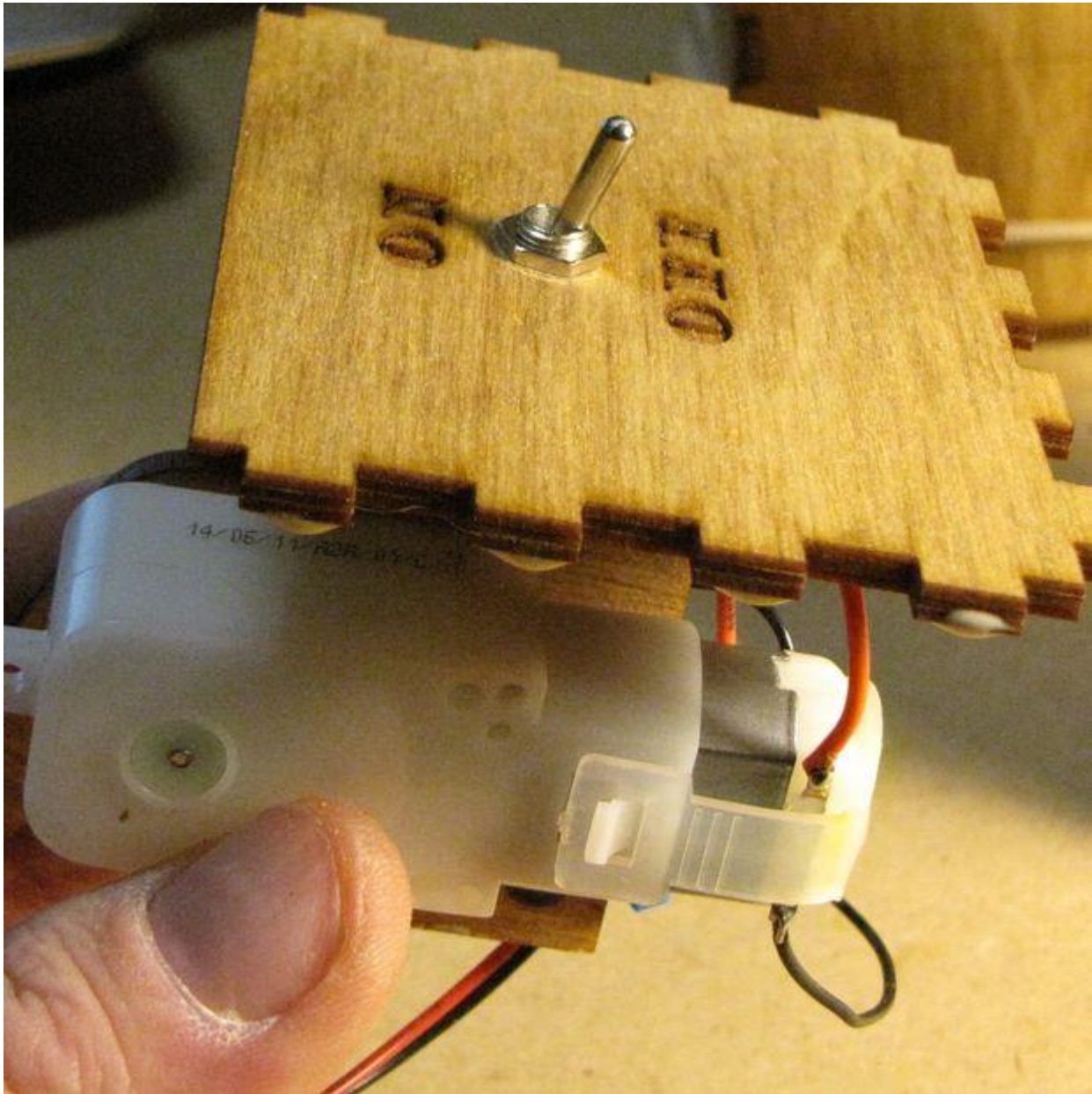




Grab a paper towel to have handy for cleanup and layout the lower box bottom and sides as shown and apply a small bead of glue to all the meeting tabs as well as the tabs on the inside portion of the sides where the side pieces will meet. It is sometimes helpful to use a small brush to help with this step. You will be "folding" the box together so make sure the the lines and markings are all face down. Start by folding up two meeting sides. Then a third and finally the last. Use an elastic band to hold the entire assembly together. Quickly grab your paper towel and clean up and glue overflow.

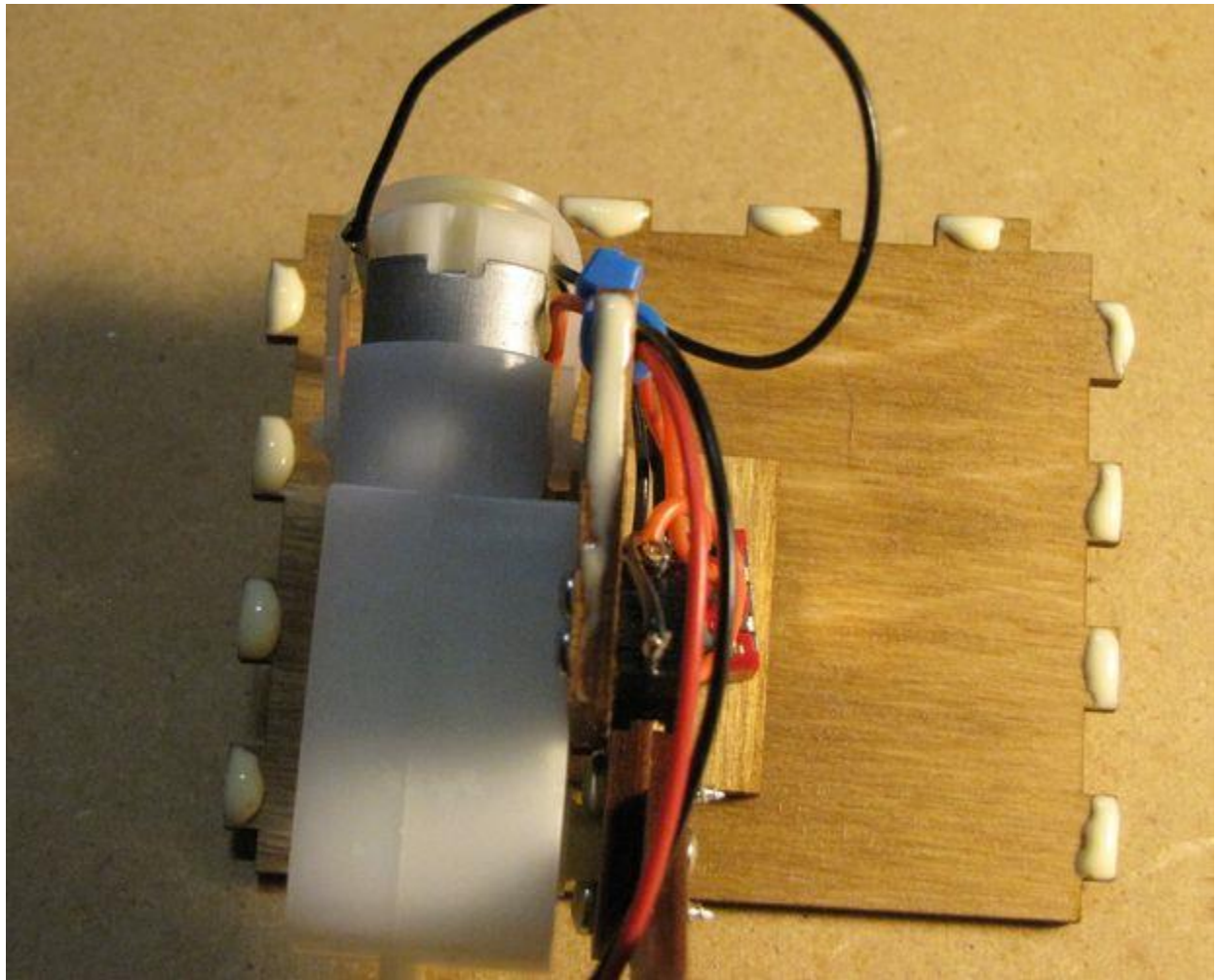
Step 20: Add the arm assembly to the top

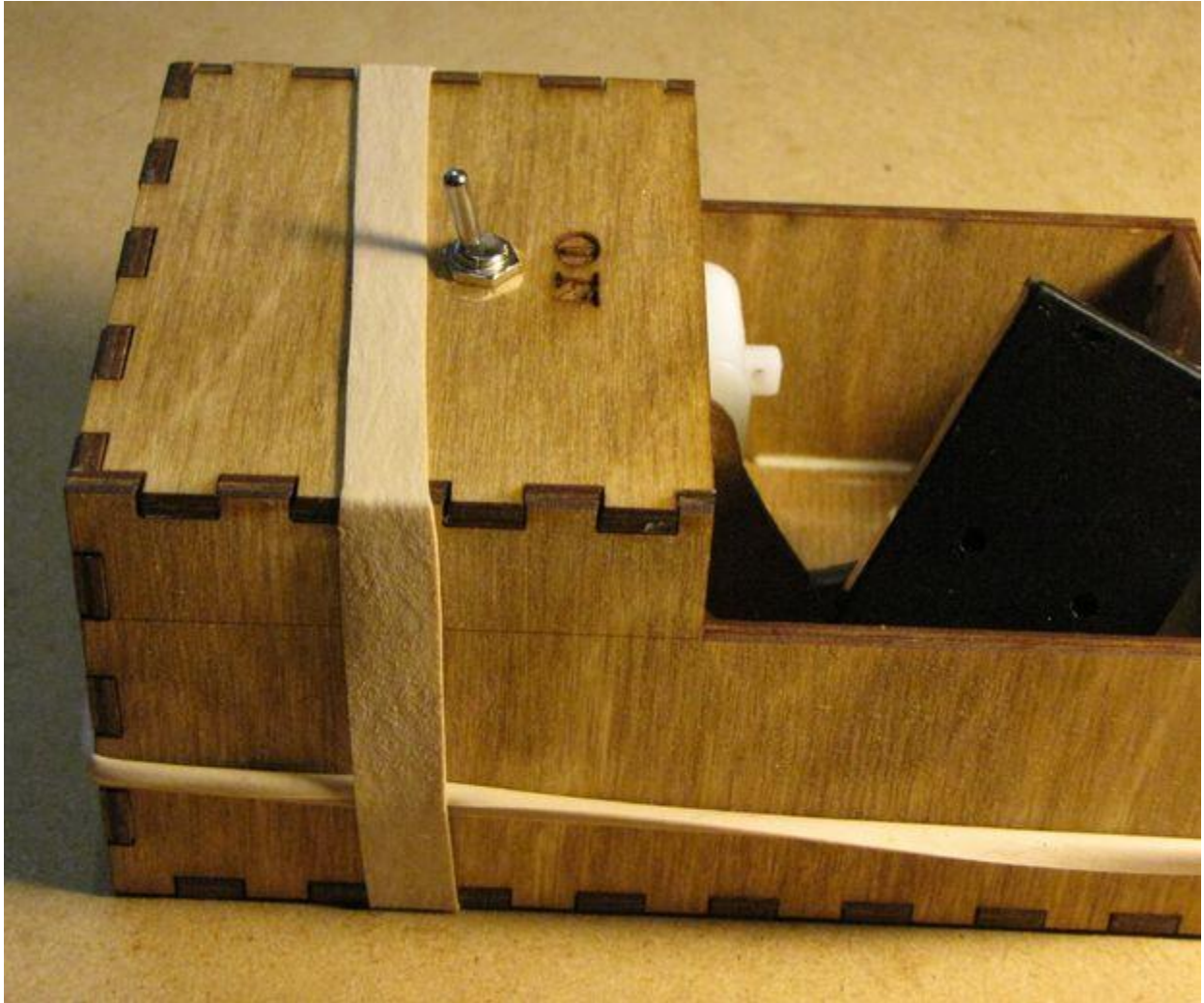




Apply a small dab of glue to the upper bracket and insert the arm assembly into the top cover. Tighten the nut. Make sure the arm assembly is pointed in the proper orientation as show in the pictures.

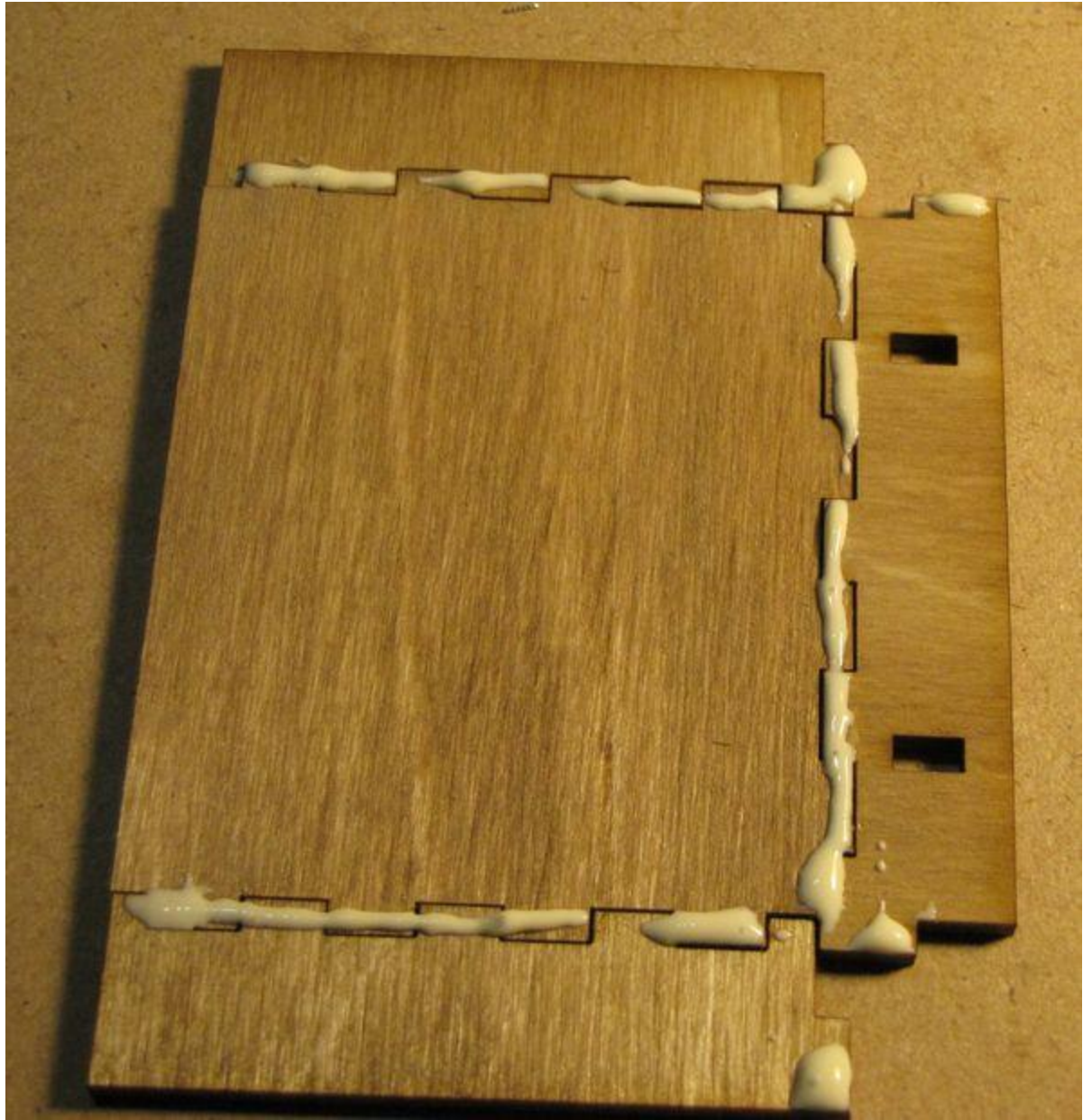
Step 21: Glue the top into place





Apply glue to all of the tabs on the top as well as to the thin bottom portion of the large mounting plate. Insert the top into the bottom assembly and apply a rubber band while the glue dries.

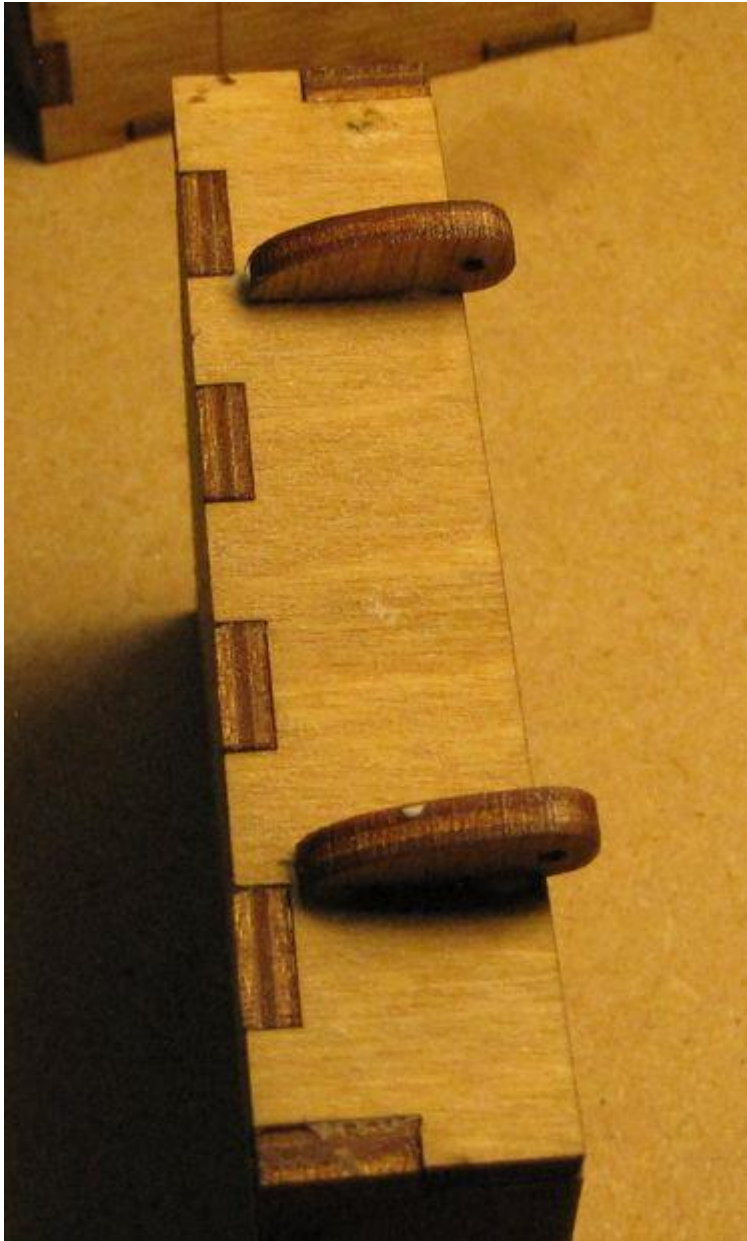
Step 22: Glue up the lid





Layout the pieces for the lid as show. Apply a small bead of glue to all the overlapping tabs and fold up similar to how you did the box bottom. Wipe off any glue spill and clean up any squeeze out. Place the lid onto the box assembly and add an elastic band as shown to temporarily hold in place. Set the entire box aside to dry and let the glue setup.

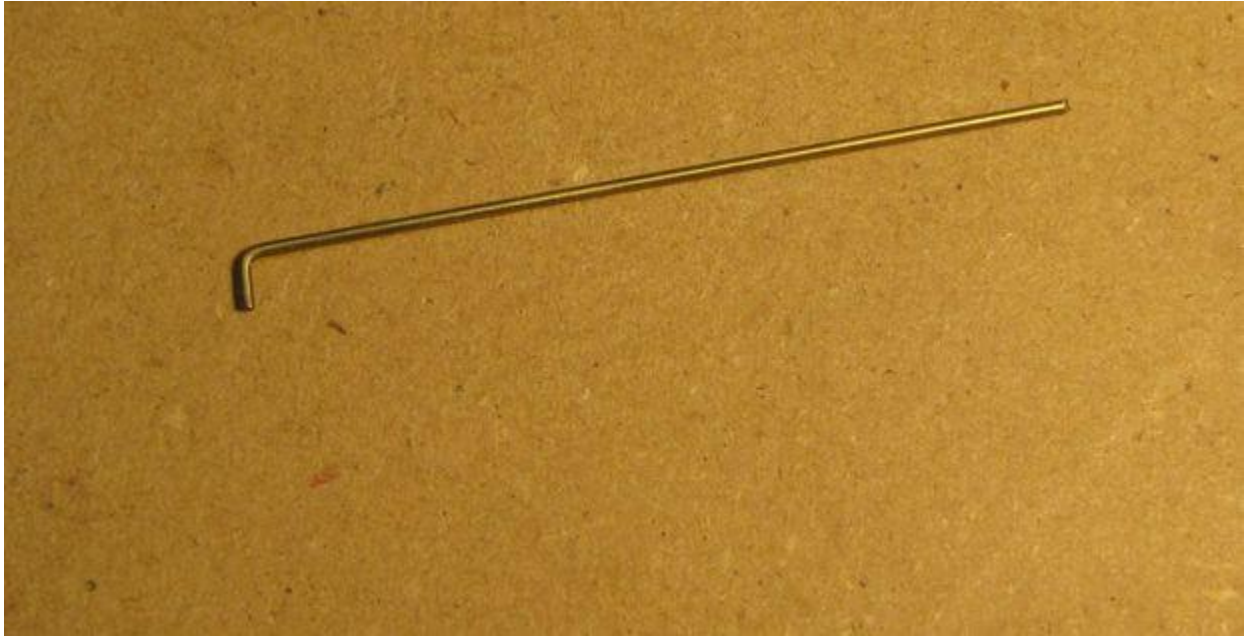
Step 23: Add the hinge brackets





Place a few small dabs of glue on the hinge brackets where the hinges will meet the box and lid. Place the lid back onto the box to check alignment of the hinge brackets and then set aside and allow the glue to dry thoroughly.

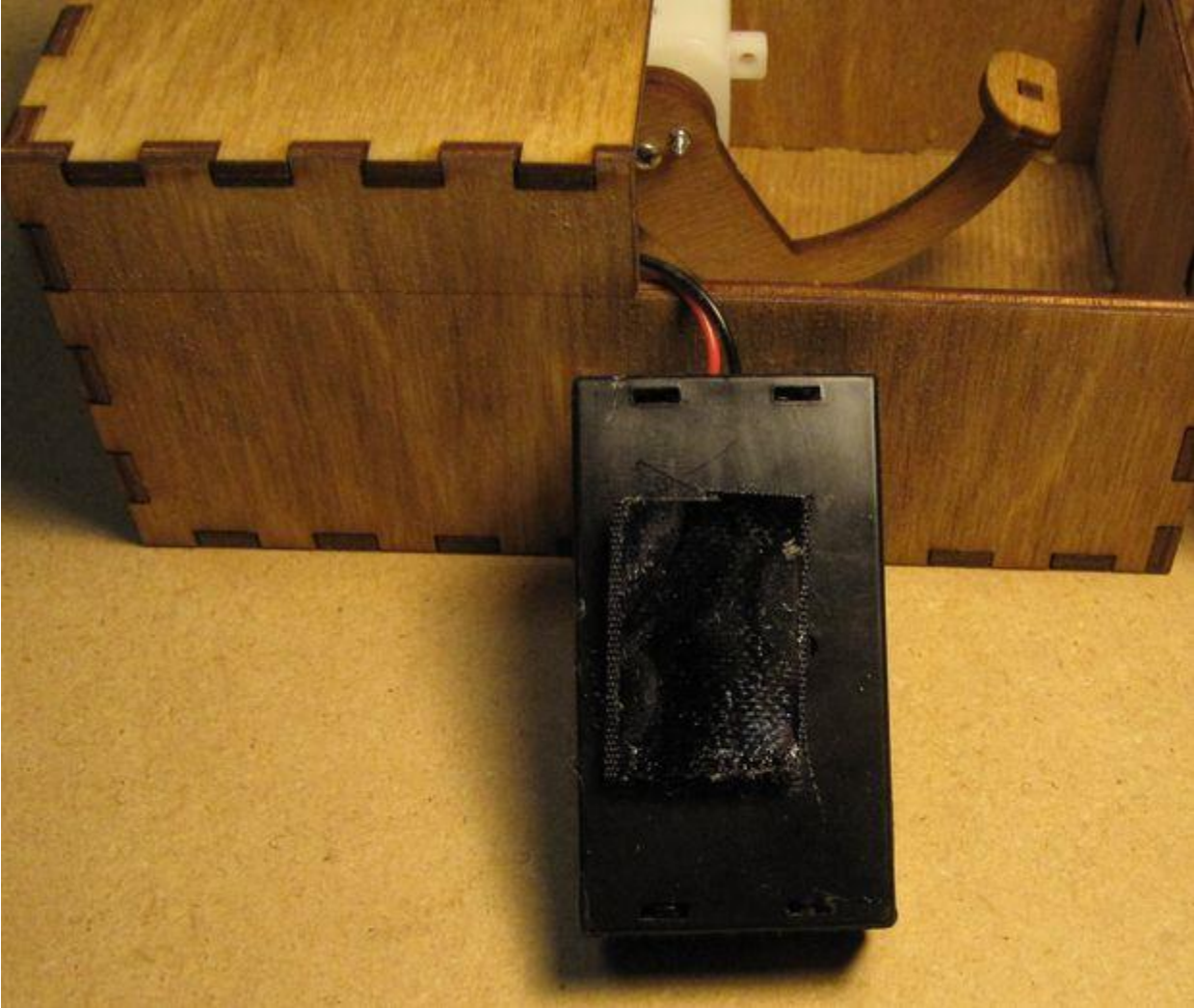
Step 24: Add the hinge pin

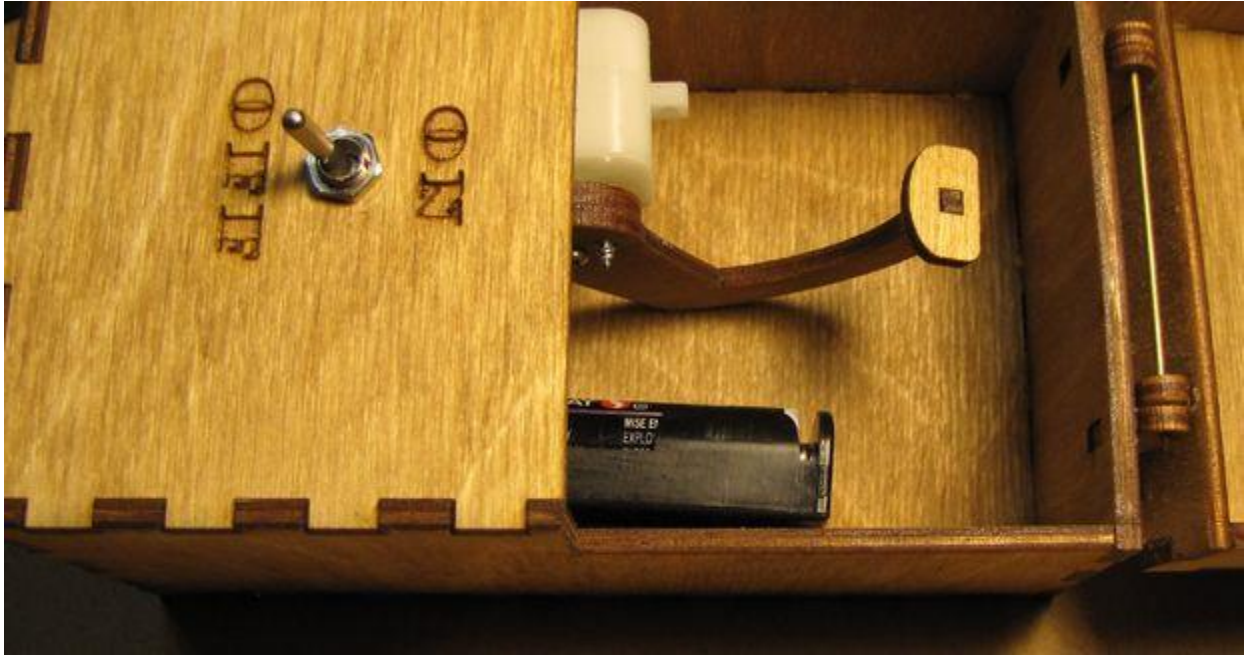




Using your pliers, bend about 1/4" of your brass rod to a 90 degree angle. Slide the hinge pin through the hinge brackets and then CAREFULLY bend the other end. Do not apply much pressure to the hinge brackets as this can cause the bracket to split. Trim the end of the hinge pin you just bent to match the size of the other side.

Step 25: Add velcro to keep battery box in place





Attach the velcro to the battery box and then the battery box to the side of your Useless Machine. This will keep the battery box in place

Step 26: Enjoy

Have fun and enjoy your new Useless Machine. We get a giggle from almost everyone who tries it. We think you will too!