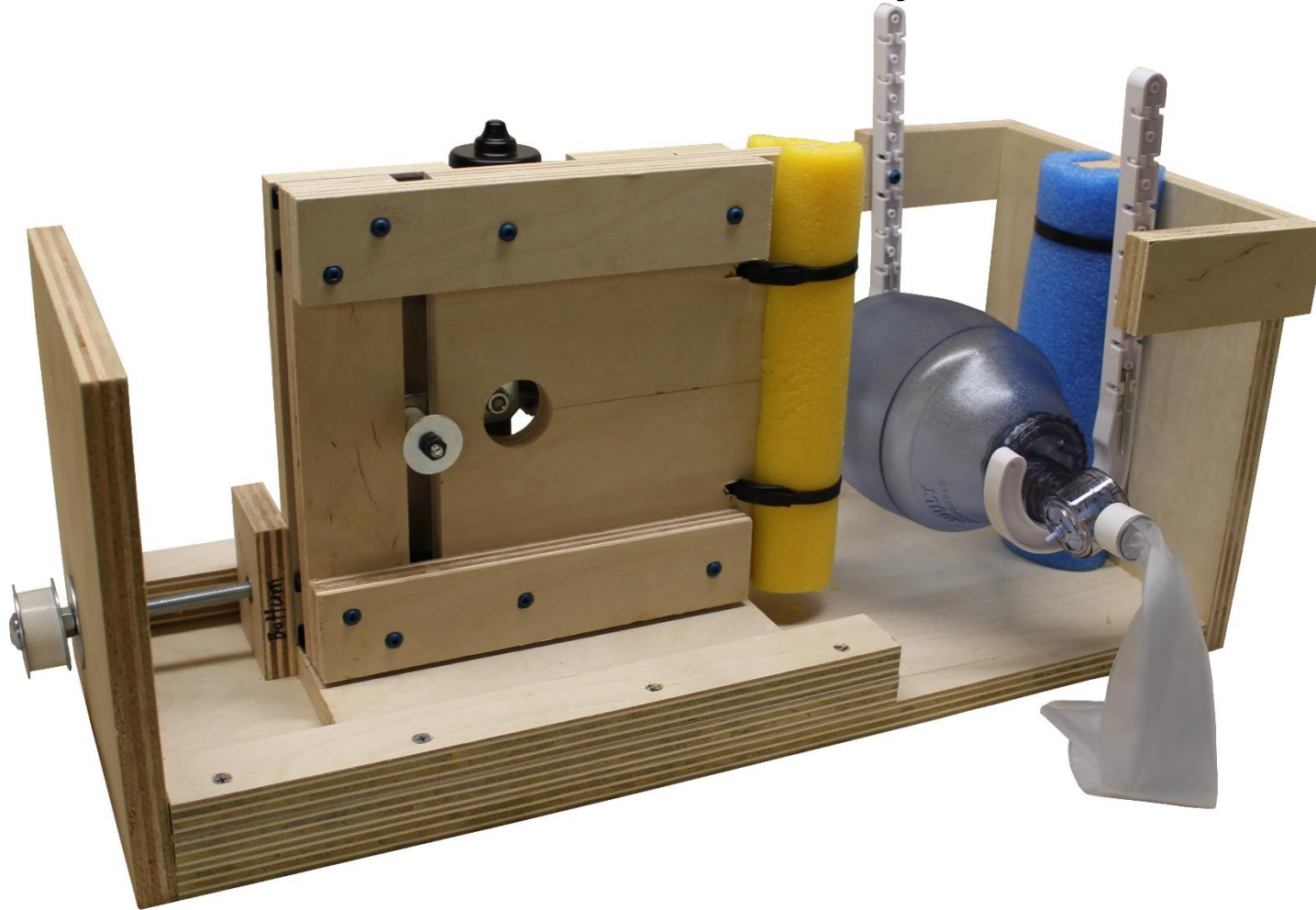


Commodore Open-source Ventilator (COV)

Mechanical Fabrication and Assembly Instructions v1.0



Disclaimer

- This device has not been tested on a live human and does not currently have FDA approval.
- This device is currently only intended for patients who are sedated, intubated, and chemically paralyzed, and should only be operated under the care of an experienced physician.
- No material on this site is intended to provide medical advice. All designs are intended for investigational use only.
- This site does not represent any official policies or procedures of Vanderbilt University.
- The material on this site is provided with no warranties explicit or implied.

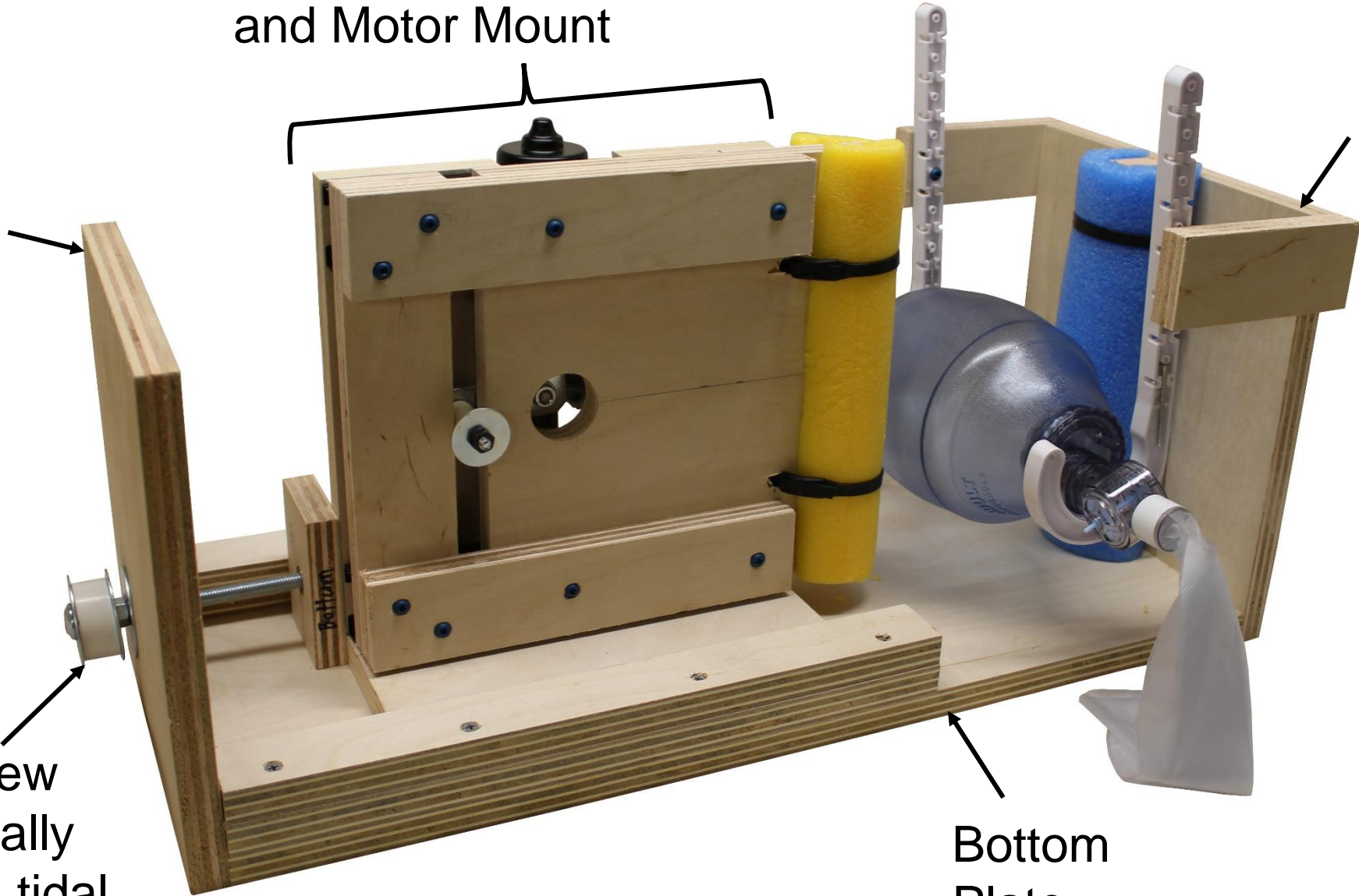
Scotch Yoke Mechanism
and Motor Mount

Rear
Plate

Front
Plate

Lead screw
for manually
adjusting tidal
volume

Bottom
Plate

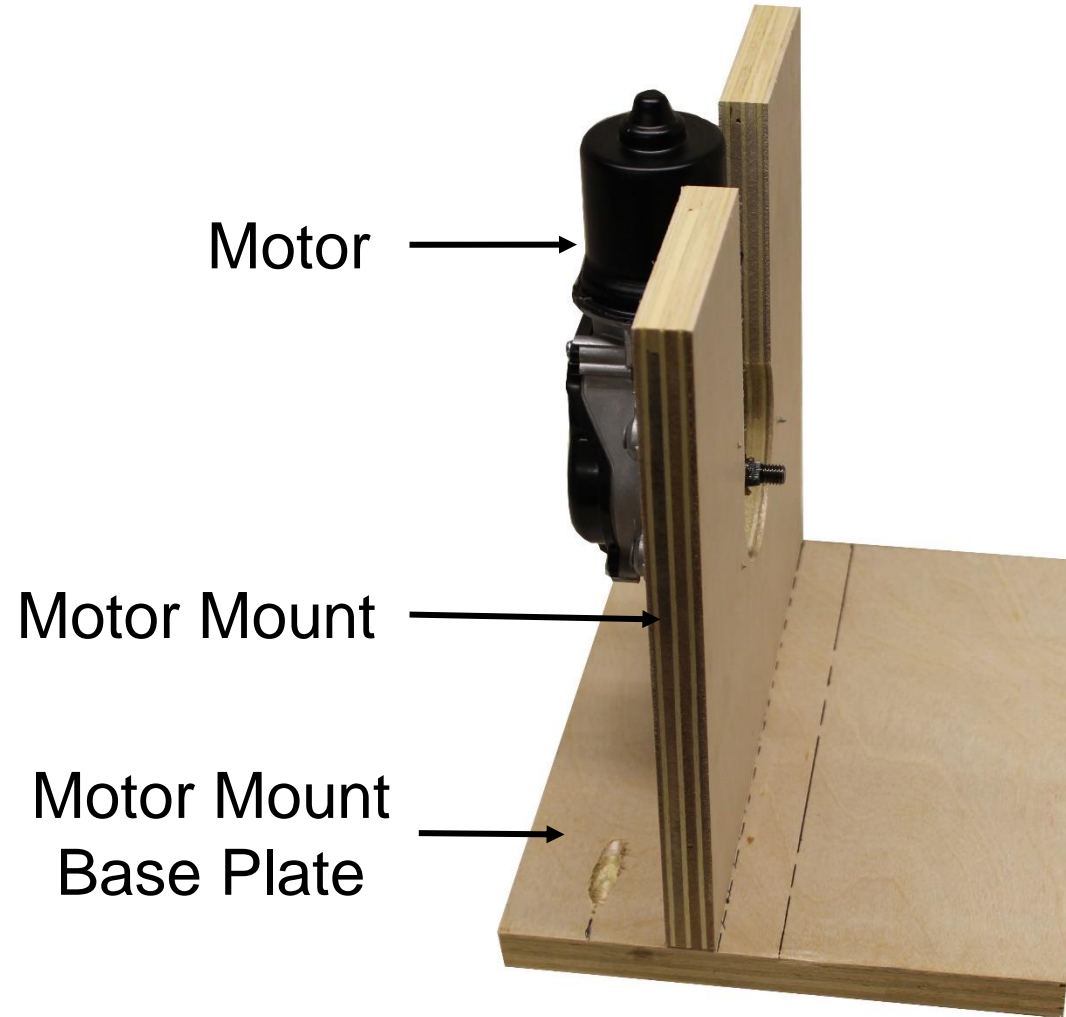


Main Steps

1. Motor Mount
2. Scotch Yoke Mechanism
 1. Mechanism Fabrication
 2. Drawer Glides
3. Linear Slide Mechanism

Tools
Table Saw
Hand Drill
Drill Bit Set
3" diameter hole saw
Pocket Hole Jig
Clamps
Drill Press or Mill (optional depending on sourced motor)
File
1/4" Wrench

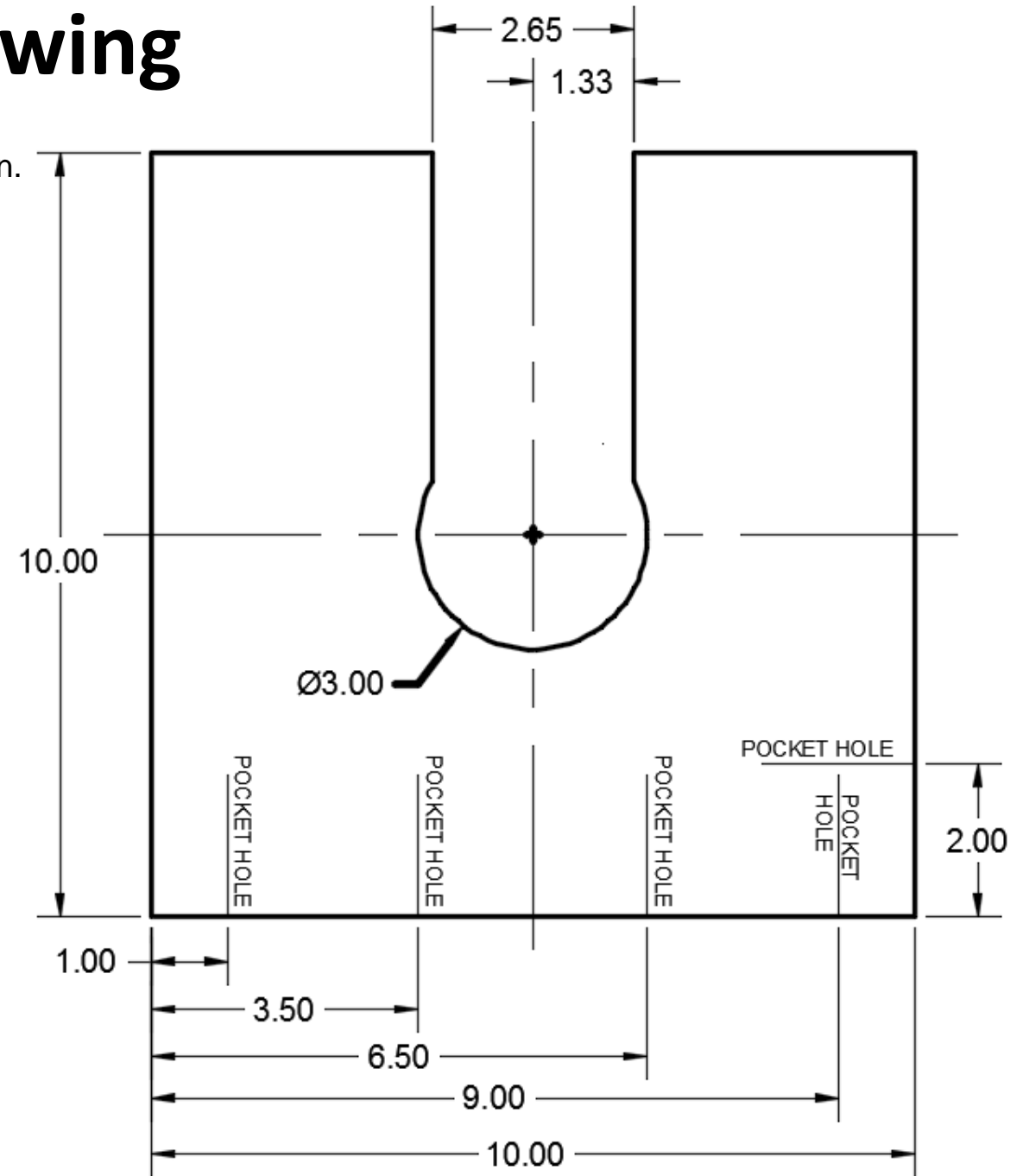
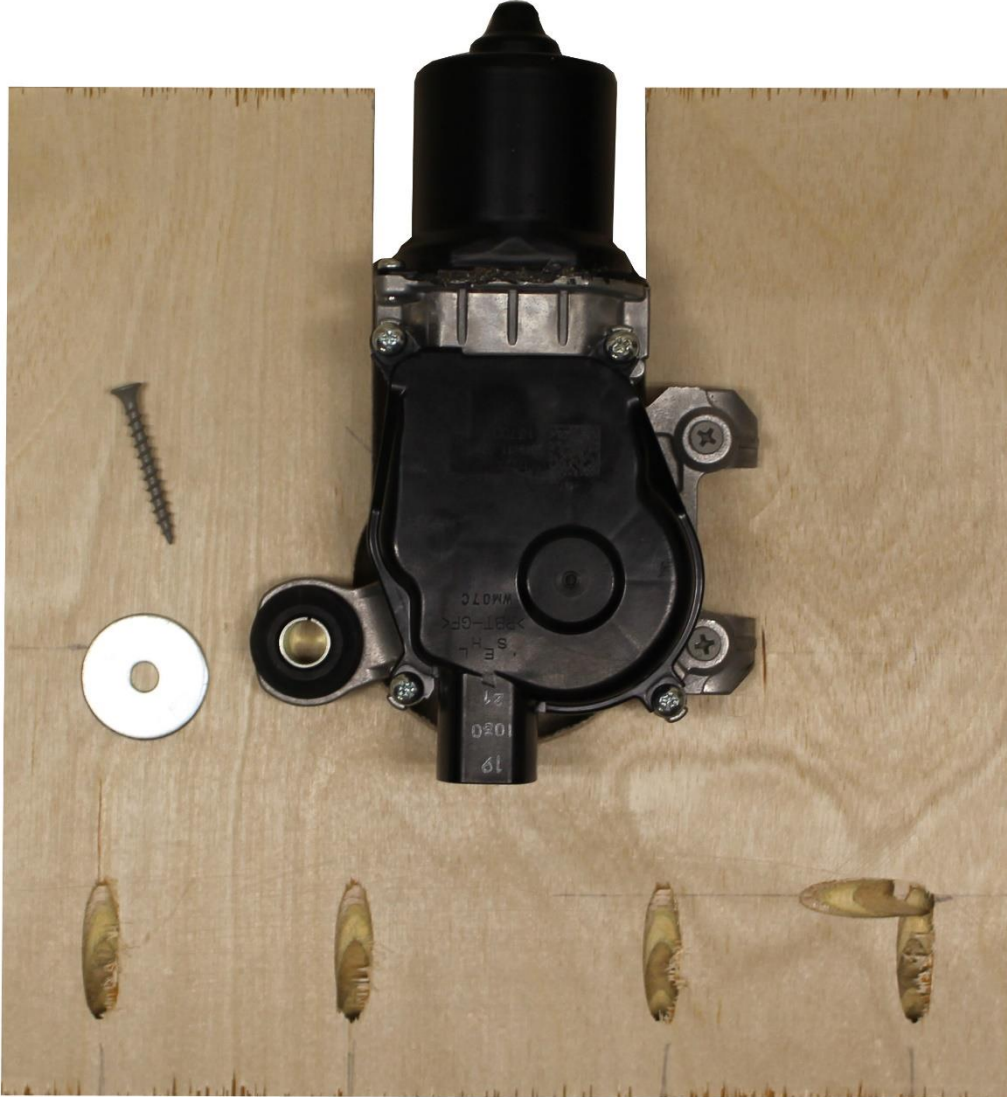
Step 1: Motor Mount



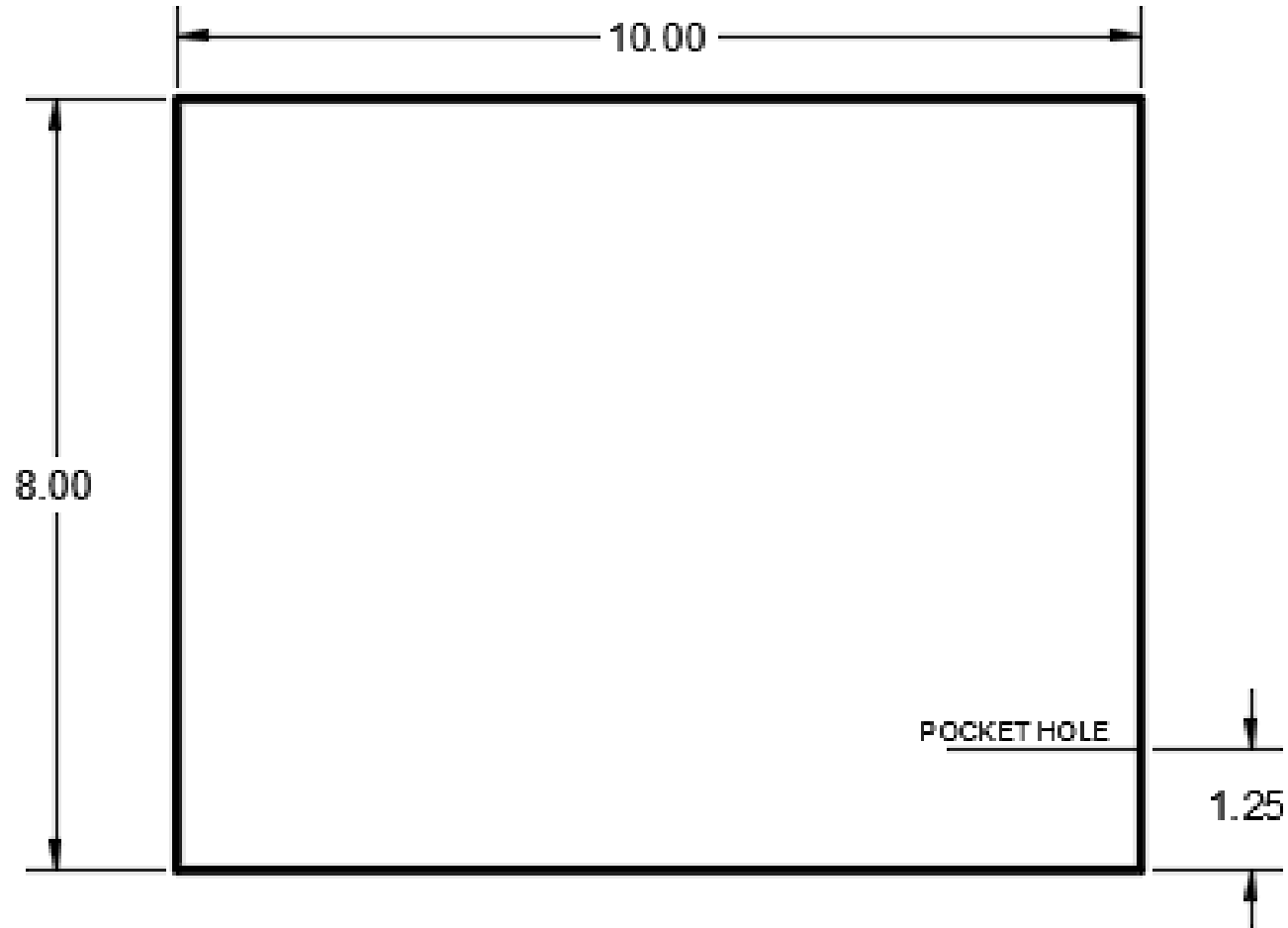
Motor Mount Hardware	Qty
Windshield Wiper Motor (or equivalent)	1
~20" x ~20" Plywood	1
1-5/8" wood screw	3
1-1/4" Kreg course thread screw	12
Large retaining washer	1

1. Motor Mount- Main Drawing

Please Note: This design is for a Nissan Altima windshield wiper motor. Depending on the wiper motor you have, you will have to alter this design.

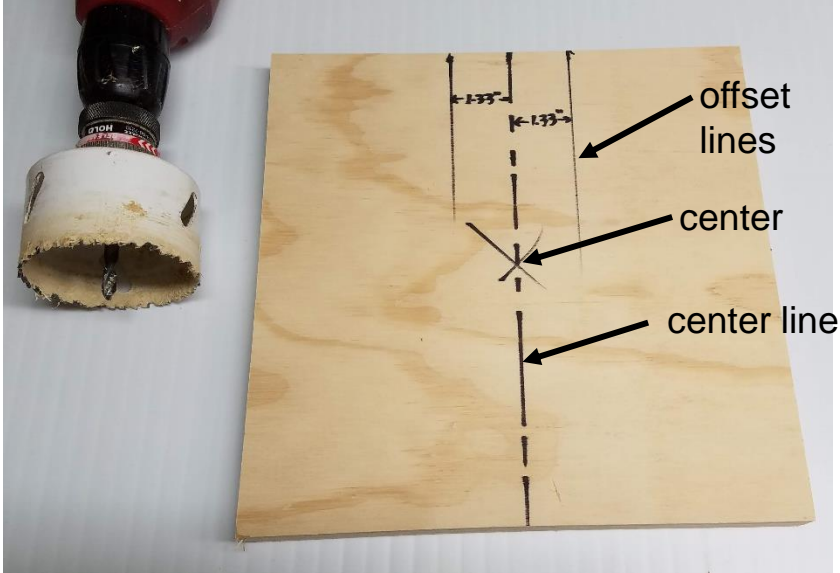


1. Motor Mount- Base Plate Drawing



1. Motor Mount- Fabrication Process

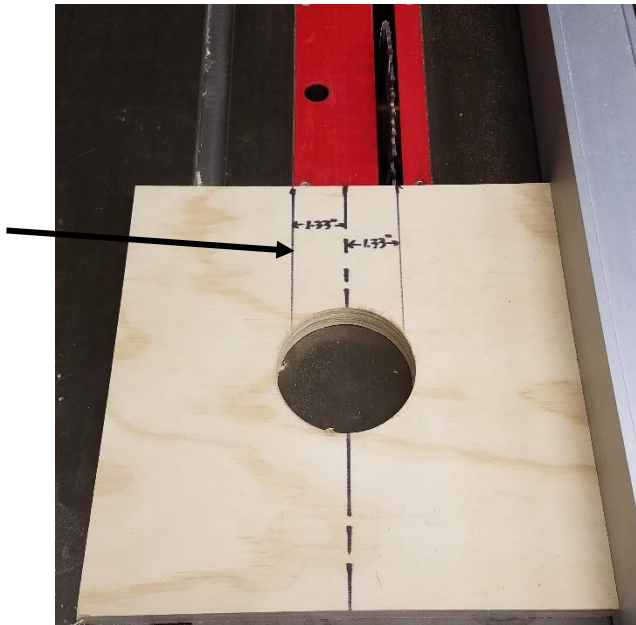
Step 1: Mark the center of your 10"x10" part. Draw a center line and create offset lines 1.33" on either side of the center line



Step 2: Drill a 3" diameter hole in the center of the part with a 3" diameter hole saw.

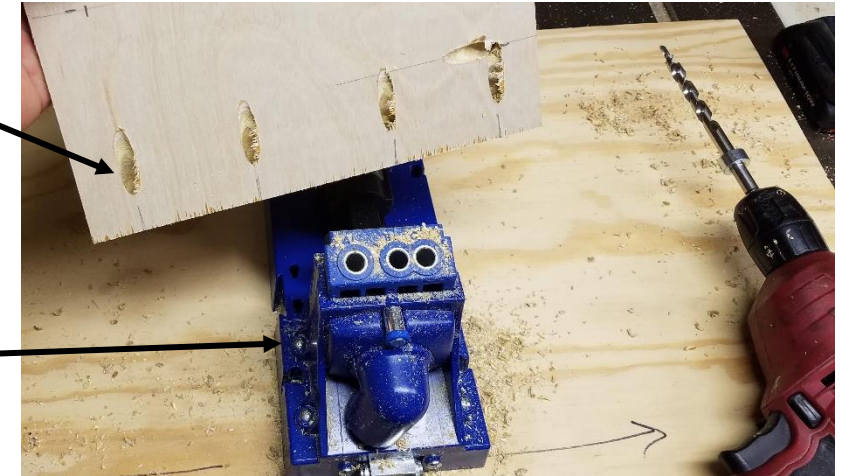


Step 3: Use a table saw to cut the two offset lines.



Step 4: Using a pocket-hole jig, drill pocket holes at the specified locations in the dimensioned drawing.

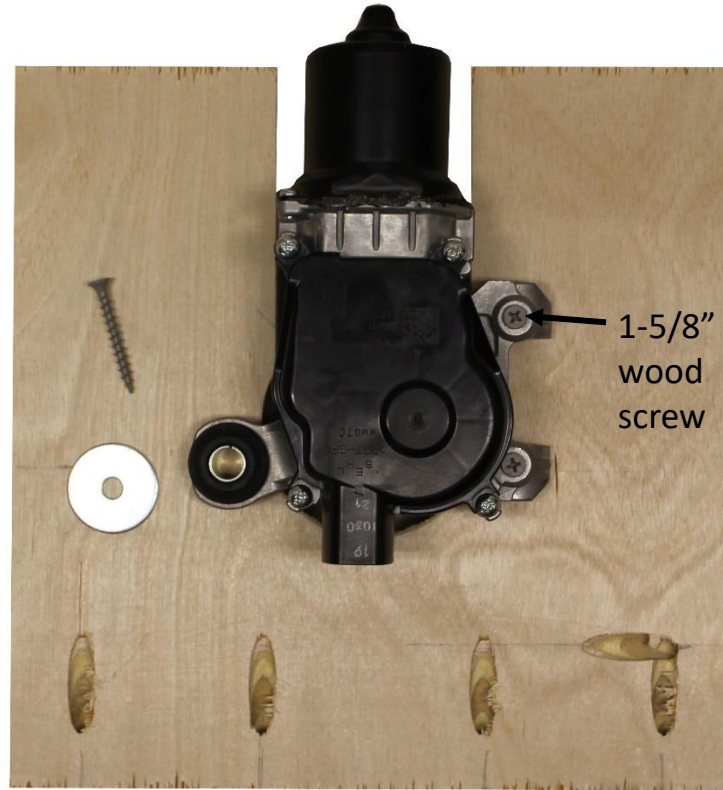
Note: the pocket-hole jig pictured is the Kreg Jig K5, one made by Kreg, but the same results can be achieved with the Kreg Pocket-Hole Jig 320.



1. Motor Mount- Assembly Process



Step 5: Check the placement of the motor from both sides. The motor shaft doesn't need to be at the center of the board, but you want to confirm that the crank arm will not rub against the wood as it rotates. You may have to get creative and add spacers.

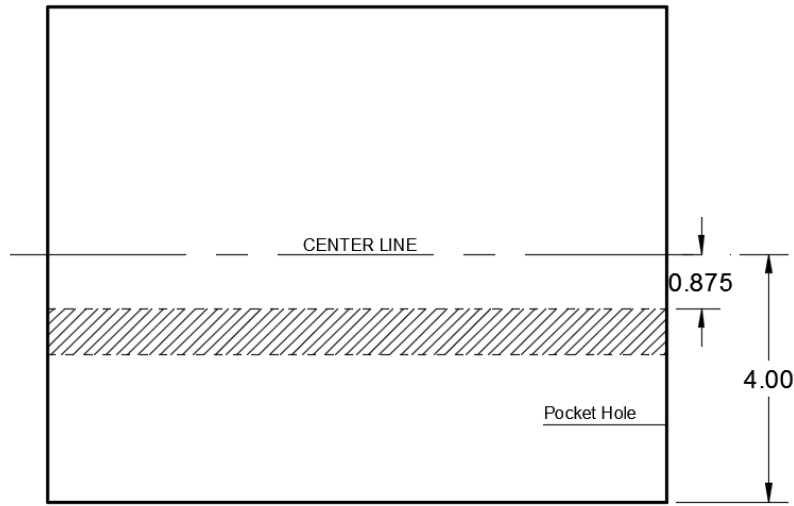


Step 6: Attach the motor to the motor mount plate. This design uses 1-5/8" wood screws. A large washer was used to anchor one of the corners, which had a much larger diameter anchor point.



Motor attached!

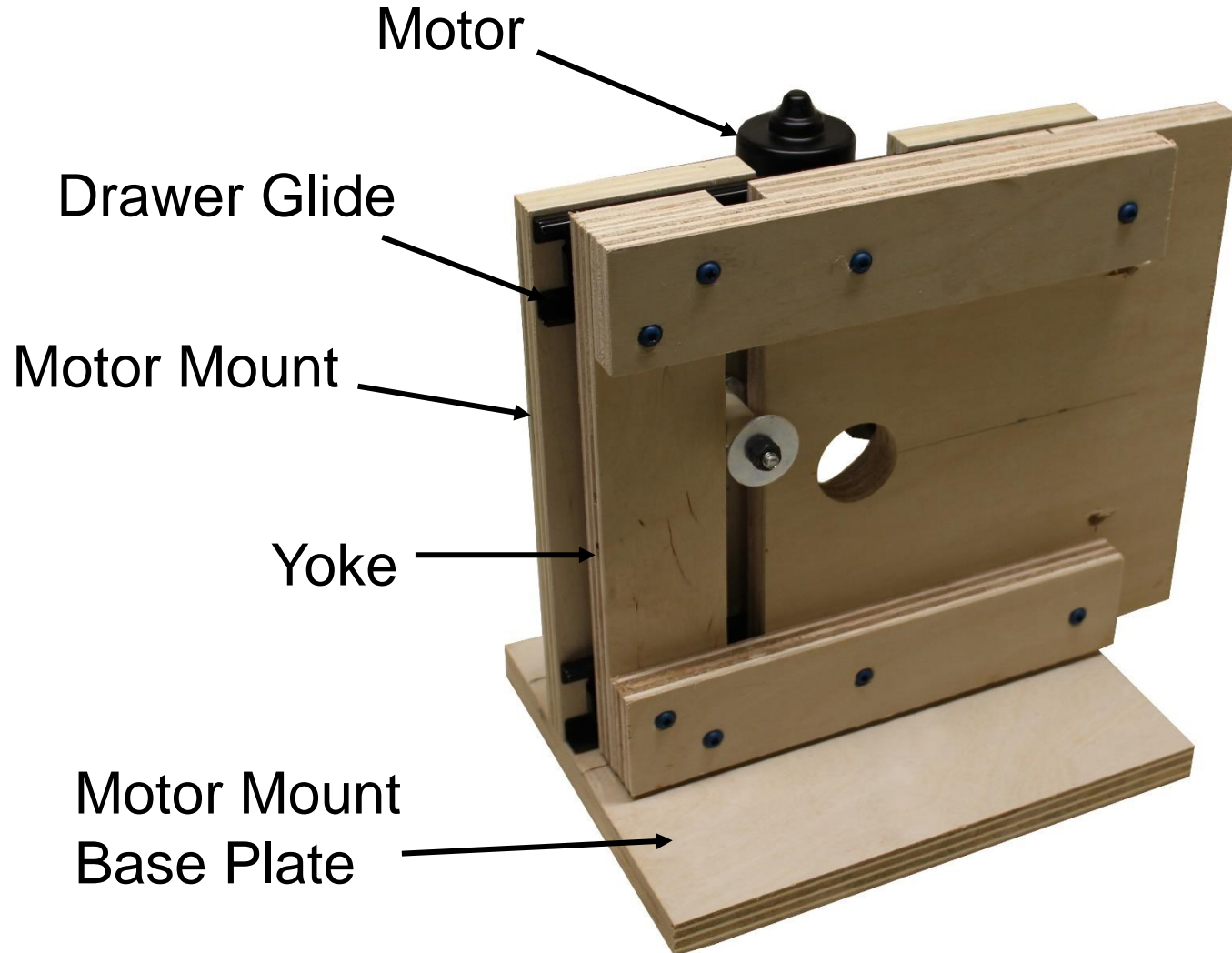
1. Motor Mount – Assembly Process



Step 7: When attaching the motor mount to the base plate, its needs to be about 7/8" (0.875 inches) offset from the center line. This offset is so that when the drawer glides are added, the yoke will move back and forth along the center line and push on the center of the Ambu Bag.

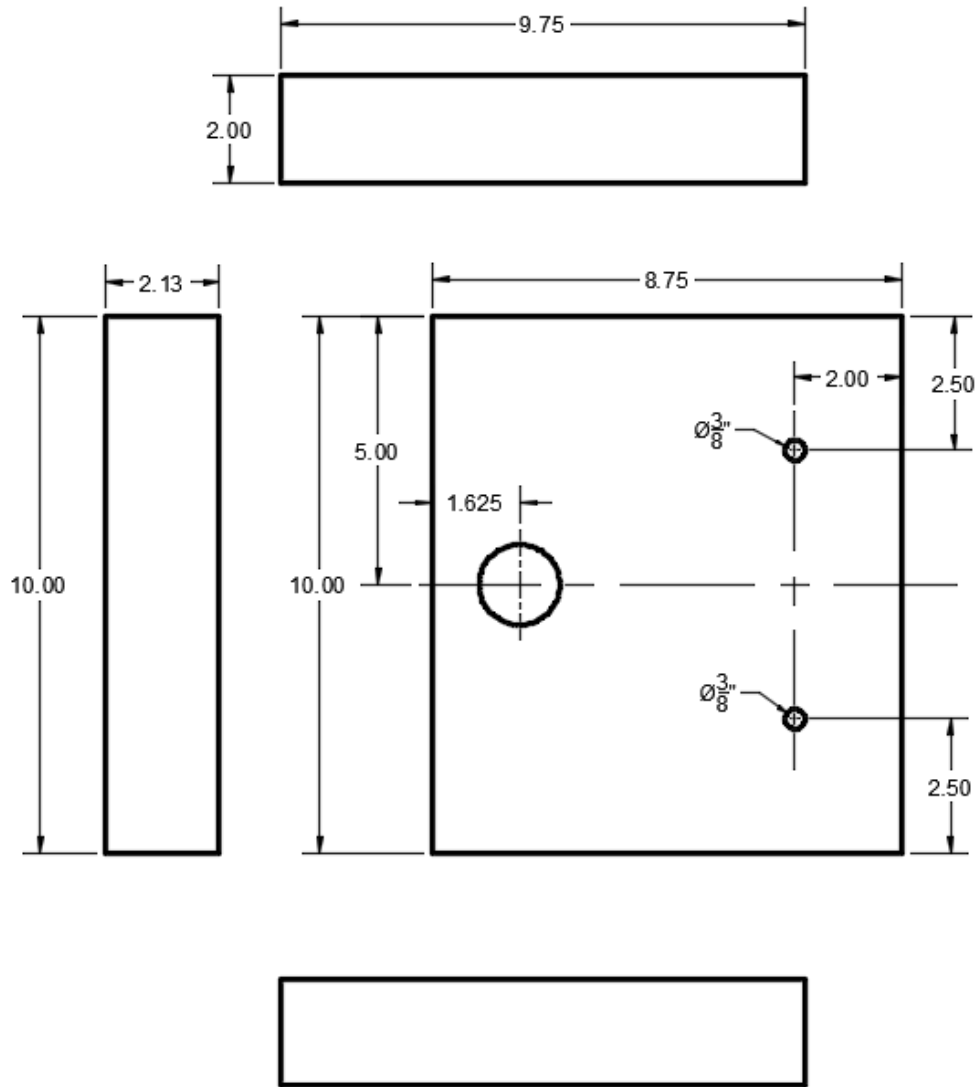


Step 2: Scotch Yoke Mechanism

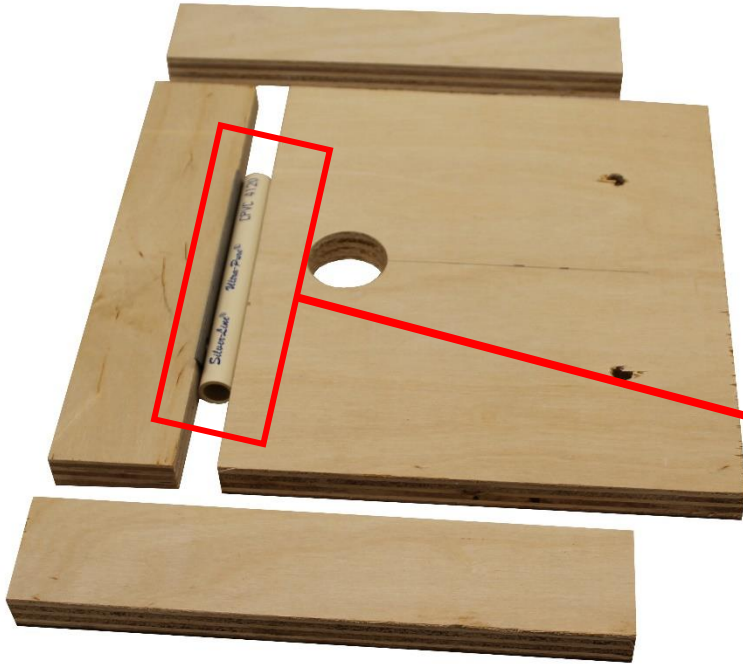


Scotch Yoke Mechanism Hardware	Qty
1-1/4" wood screw	8
2" long 1/4 -20 fully threaded screw	1
#6 – 5/8" Wood Screws	8
1/4-20 nuts	3
Retaining Washer	1
1/2" CPVC pipe @ 1.25" - 1.375" long	1
~15" x ~15" Plywood	1
8" or 10" Drawer Glides	2
Superglue (if not using lock nuts)	1
Hot Glue	1

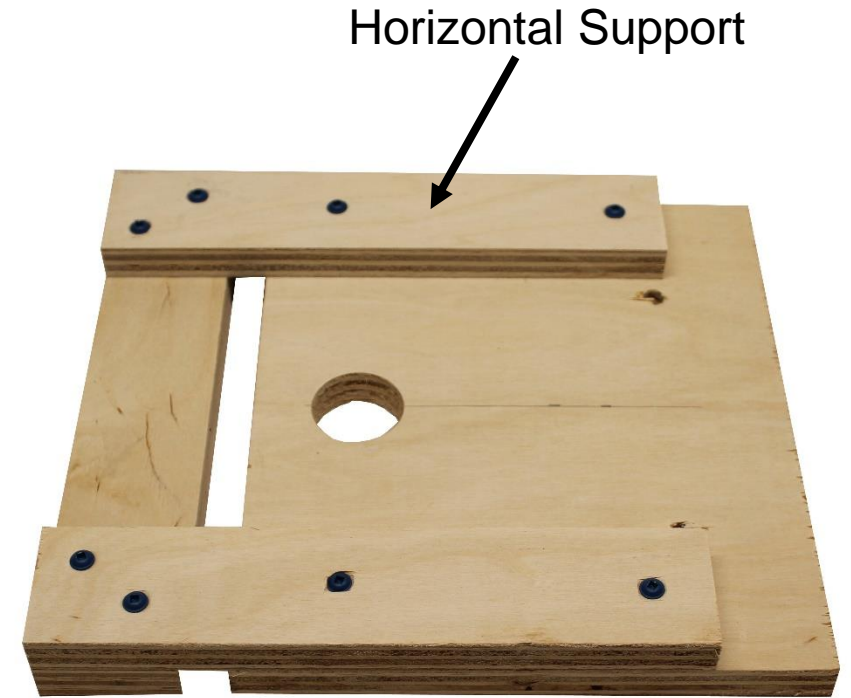
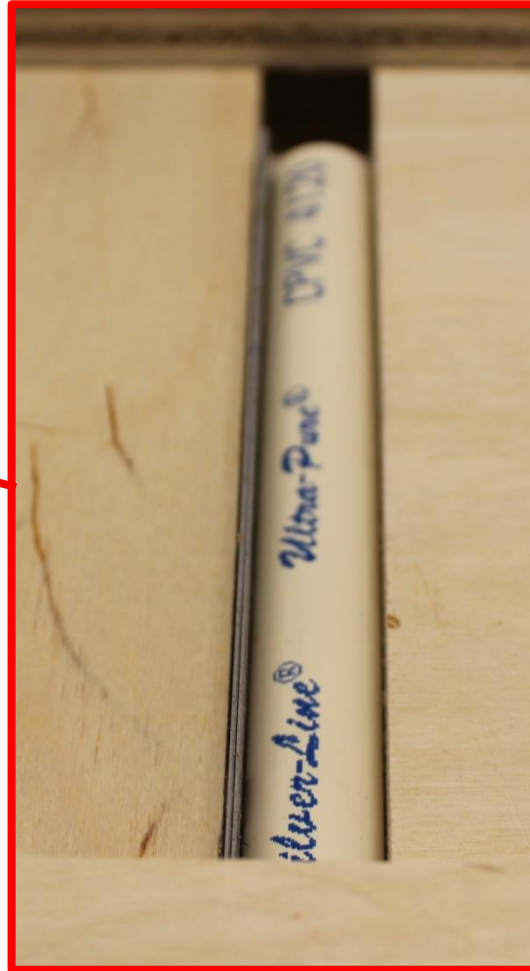
2. Scotch Yoke Mechanism - Main Drawing



2.1 Scotch Yoke Mechanism Fabrication - Yoke



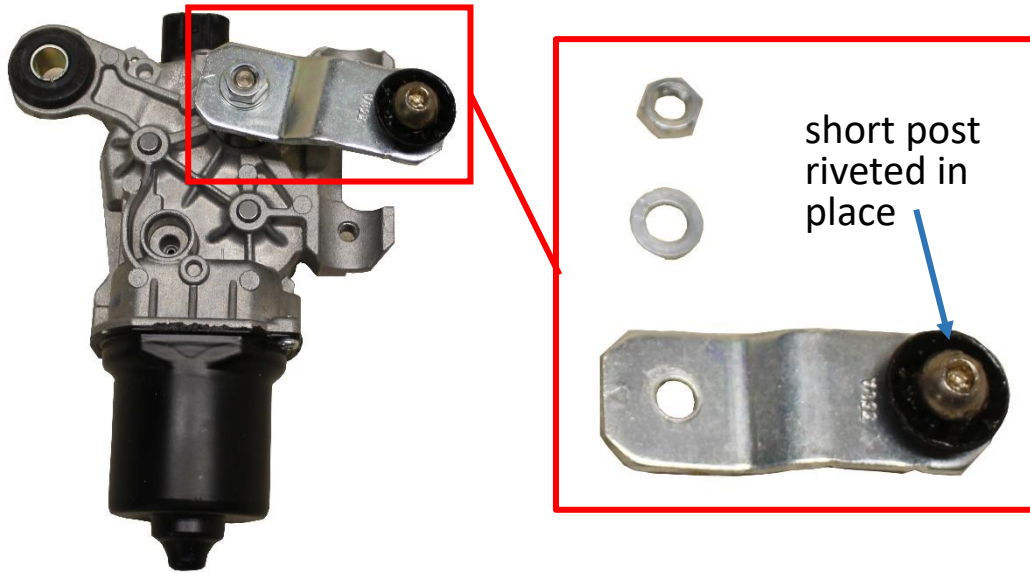
Step 1: The 1/2" CVPC will be rolling up and down the inside of the channel. Add a couple metal shims to give the tube clearance to roll.



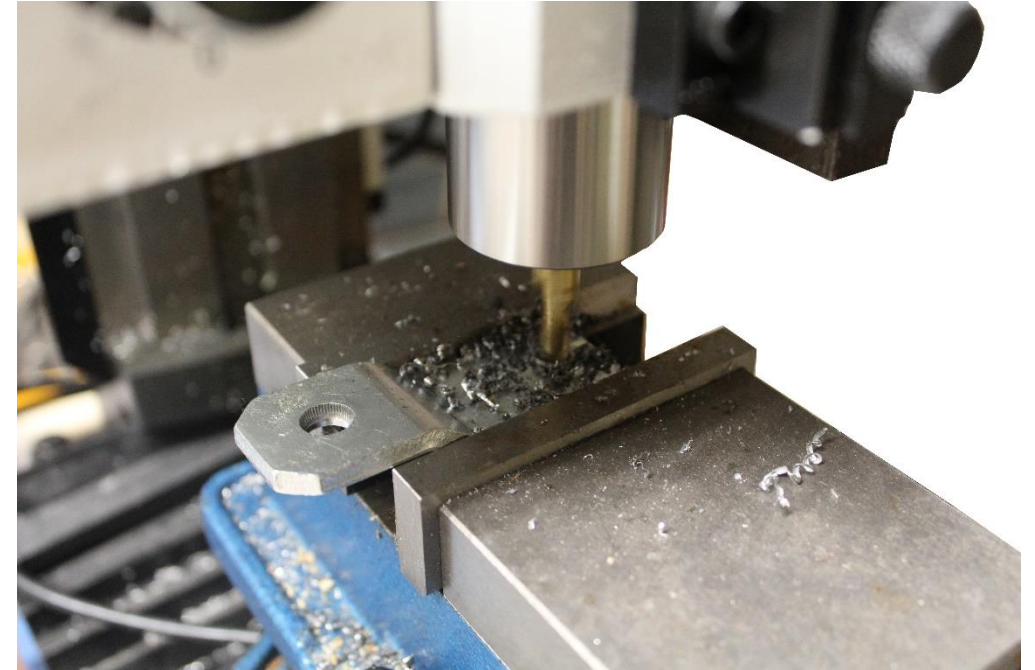
Step 2: Screw the horizontal supports in place with 1-1/4" wood screws and then remove the pipe and spacers.

2.1 Scotch Yoke Mechanism Fabrication - Crank Arm

Please Note: this process is specific to this wind shield wiper motor. Certain wiper motor models may require more or less work. These instructions serve to demonstrate one method.



Step 1: Remove the crank arm from the motor shaft.

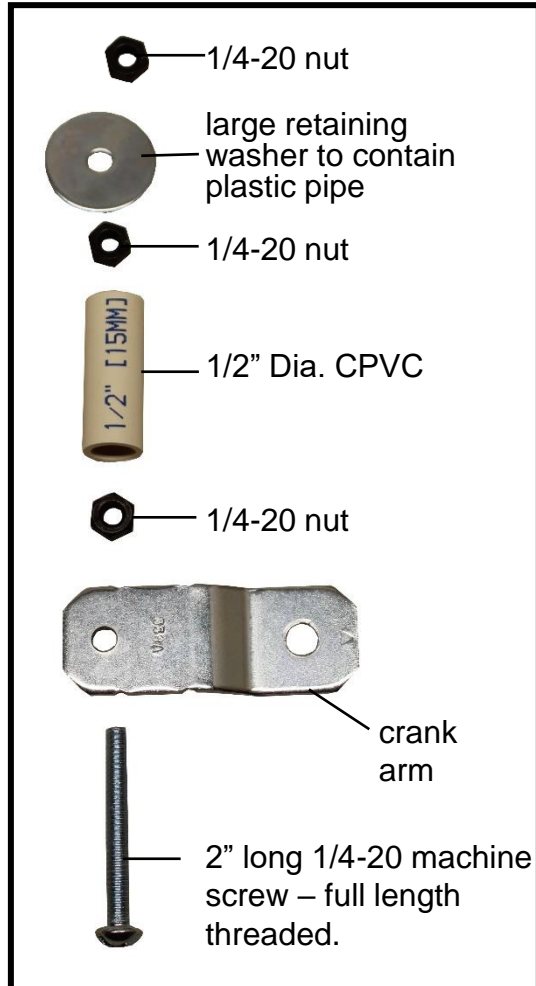


Step 2: Drill or machine out the post. Here we demonstrate a 1/4" diameter end-mill machining out the post.

2.1 Scotch Yoke Mechanism Fabrication - Crank Arm

Please Note: this process is specific to this wind shield wiper motor. Certain wiper motor models may require more or less work. These instructions serve to demonstrate one method.

New Post Assembly



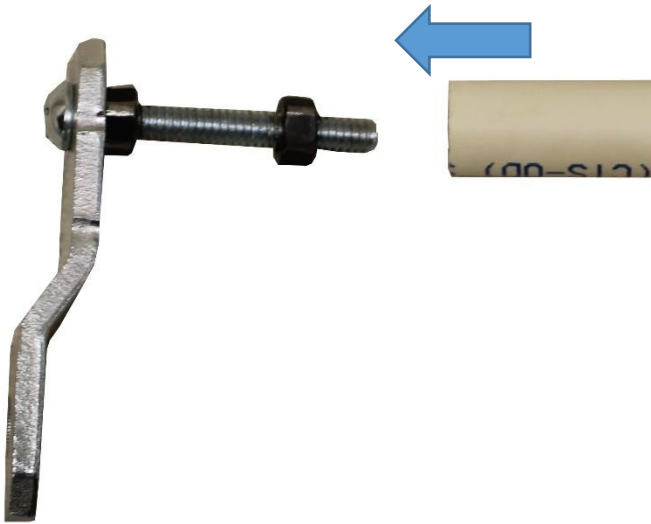
Step 3: Anchor the screw to the crank arm with the 1/4-20 nut. You may have to lightly file the corners of the nut to allow the nut to fit inside CPVC pipe. If you don't have access to lock nuts which would be preferred, use super glue, epoxy or even plumbers tape to minimize the potential for it to loosen.



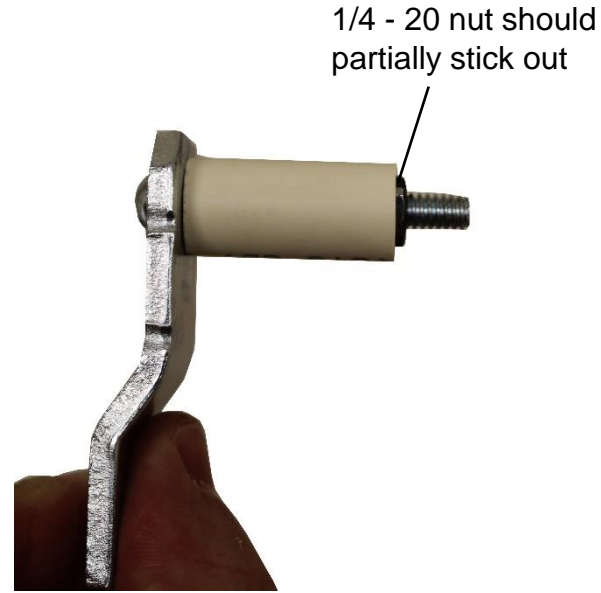
Step 4: Cut the CPVC pipe to length. This may vary depending on your wiper motor, but for this design 1-1/4" to 1-3/8" is an acceptable length.

2.1 Scotch Yoke Mechanism Fabrication - Crank Arm

Please Note: this process is specific to this wind shield wiper motor. Certain models may require more or less work. These instructions serve to demonstrate one method of what is possible.



Step 5: Thread the second 1/4-20 nut partway onto the screw. Again you may have to file the corners. A lock nut is preferred, but if you don't have any apply an adhesive or plumbers tape to anchor it in place.



Step 6: Slide the plastic pipe over the screw. Make sure the 1/4-20 nut partially sticks out the end so the pipe can freely rotate once assembled.



Step 7: Add the large retaining washer and the last 1/4-20 nut and tighten. **If you're using glue, don't glue this last nut in yet.**

2.2 Scotch Yoke Mechanism - Drawer Glides

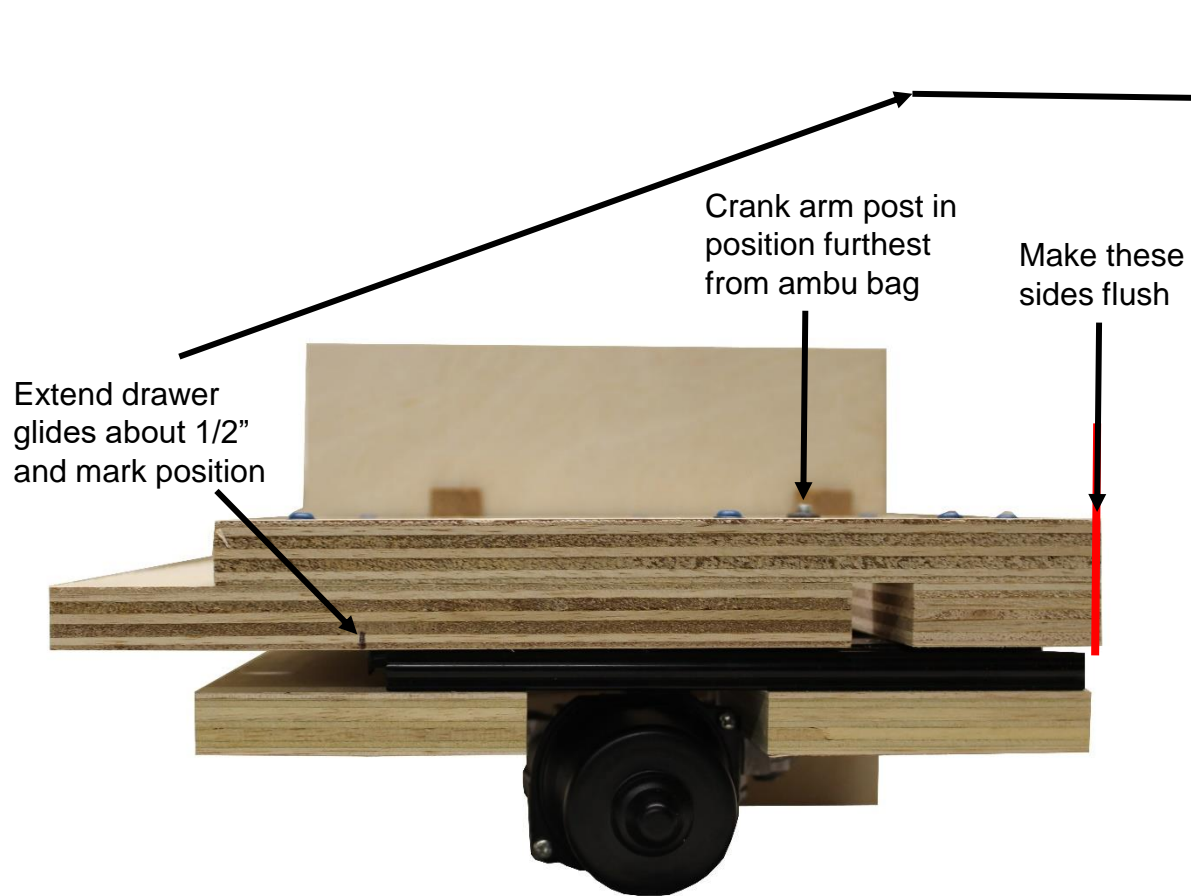


Step 1: Align the drawer glides along the top and bottom of the motor mount plate. Screw them in place with #6 – 5/8" long wood screws. This design can accommodate 8" and 10" long drawer glides. You can use longer glides, but you will have to make changes to parts of this design.

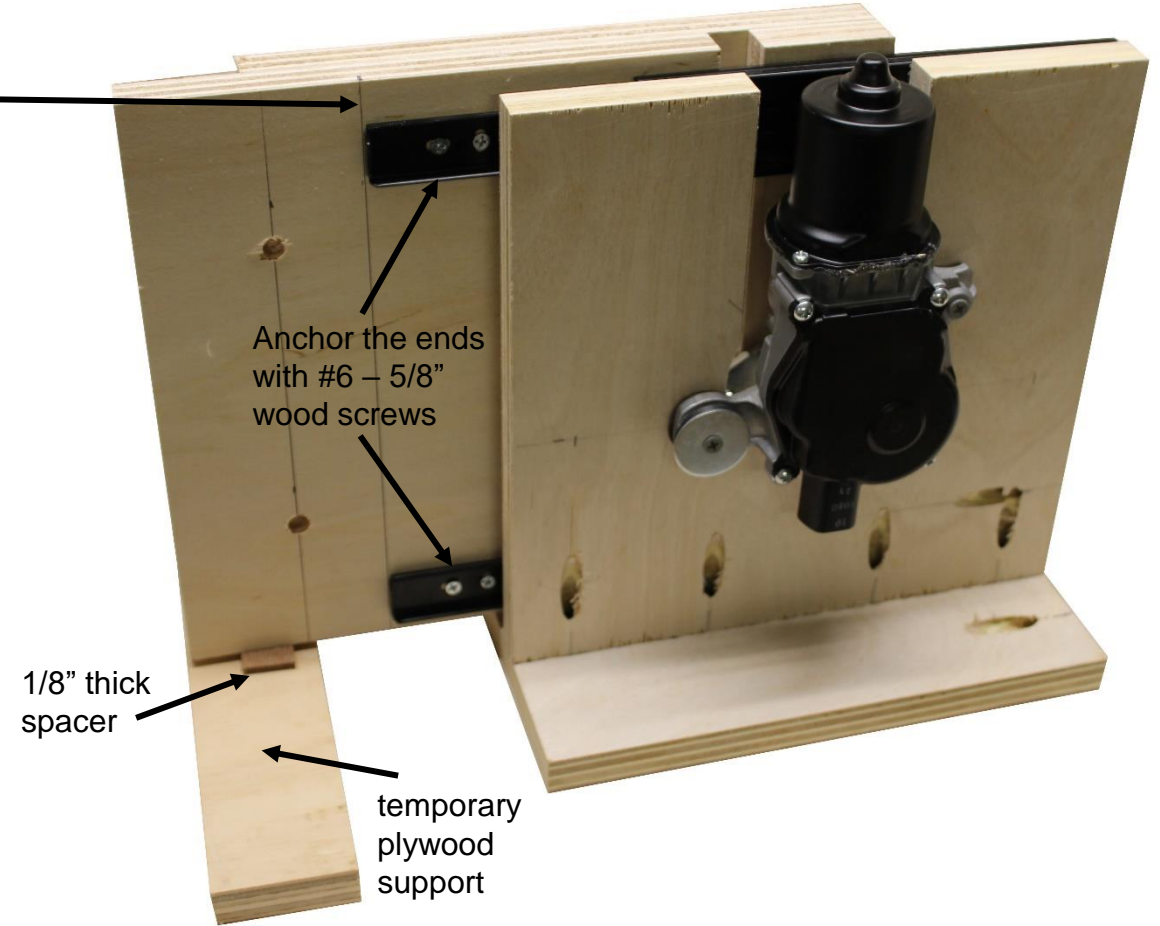


Step 2: Close drawer glides. **Note:** With 8" drawer glides, you will want the drawer glides to be flush with the rear of the motor mount plate to be able to screw into the narrow portion of the yoke.

2.2 Scotch Yoke Mechanism - Drawer Glides



Step 3: Extend the drawer glides about 1/2" and then place the yoke on top with the back of the yoke flush with the back of the motor mount.



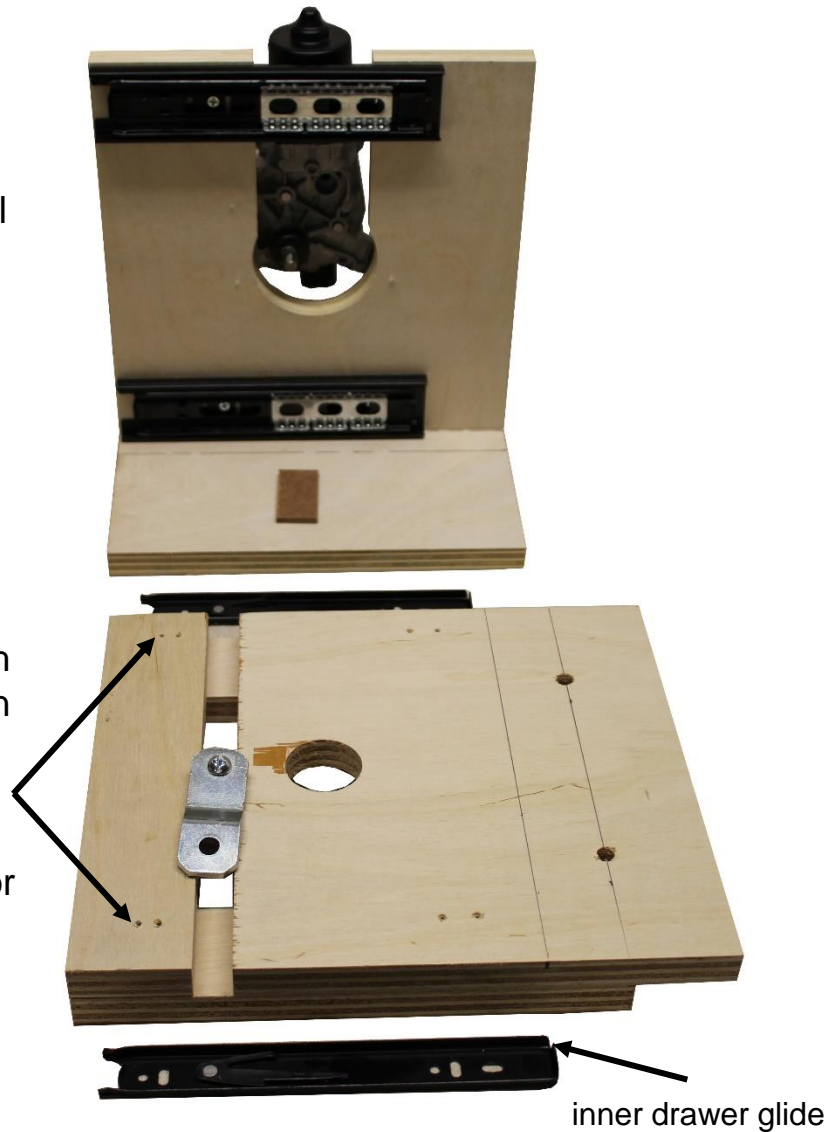
Step 4: Extend the drawer glides about 1/2" and then place the yoke on top with the back of the yoke flush with the back of the motor mount.

2.2 Scotch Yoke Mechanism - Drawer Glides

Step 5: If you are making large numbers of this design you will want to create jigs to avoid this step. If you are making a small batch this one way to complete this assembly.

Start by disassembling everything including removing the inner drawer glide, the crank arm and even the motor. With this design it's very difficult to slide the yoke back on with the motor and crank arm in place.

Use this opportunity to locate the anchor points for the other end of the inner drawer glide on the yoke.



Step 6: For this design the yoke doesn't sit far enough away from the crank arm to keep it from rubbing on the inside surface of the yoke. To get around this, hot glue a 1/4-20 washer at as many of the anchor points of the inner drawer glide. This adds about 1/16" offset which is just enough clearance.

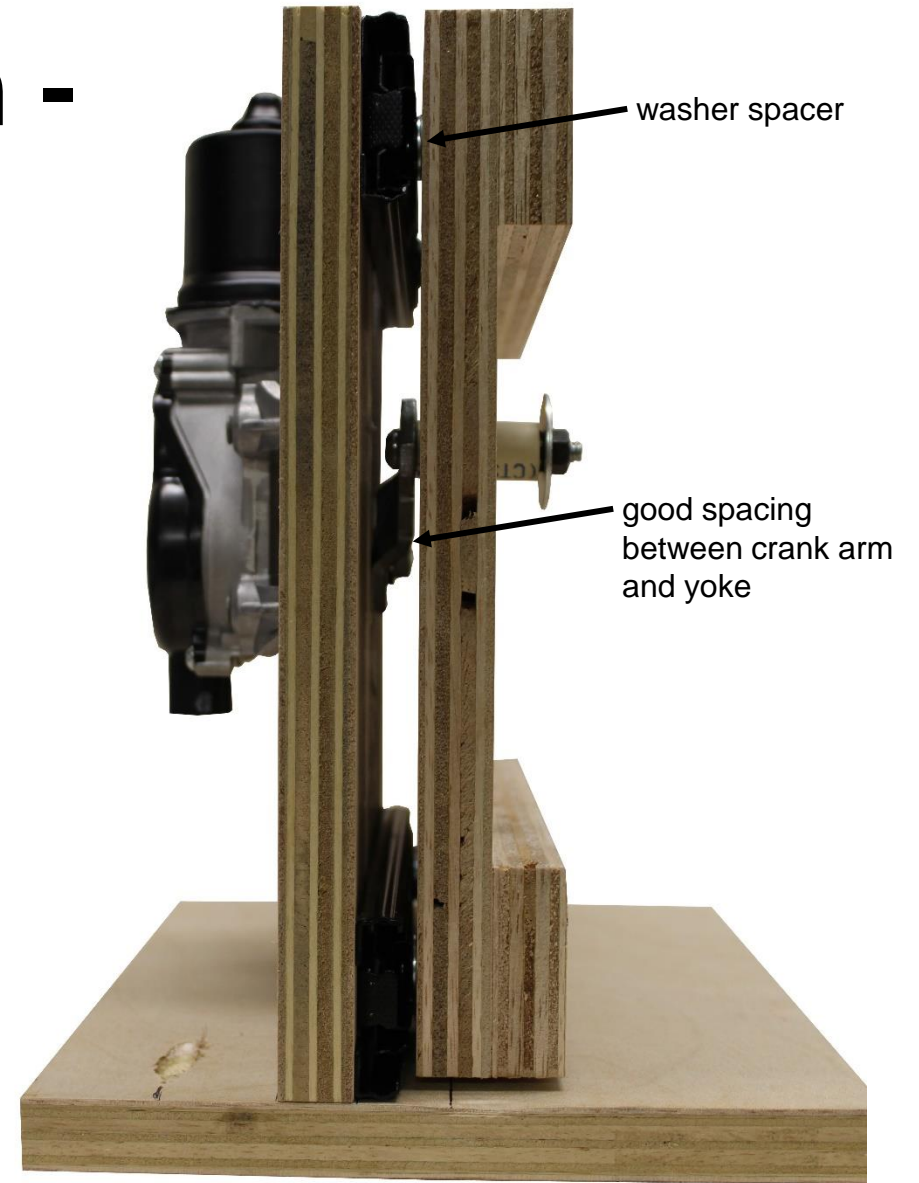
Step 7: Reattach the inner drawer glides and slide the drawer glide assembly back together.

2.2 Scotch Yoke Mechanism - Drawer Glides



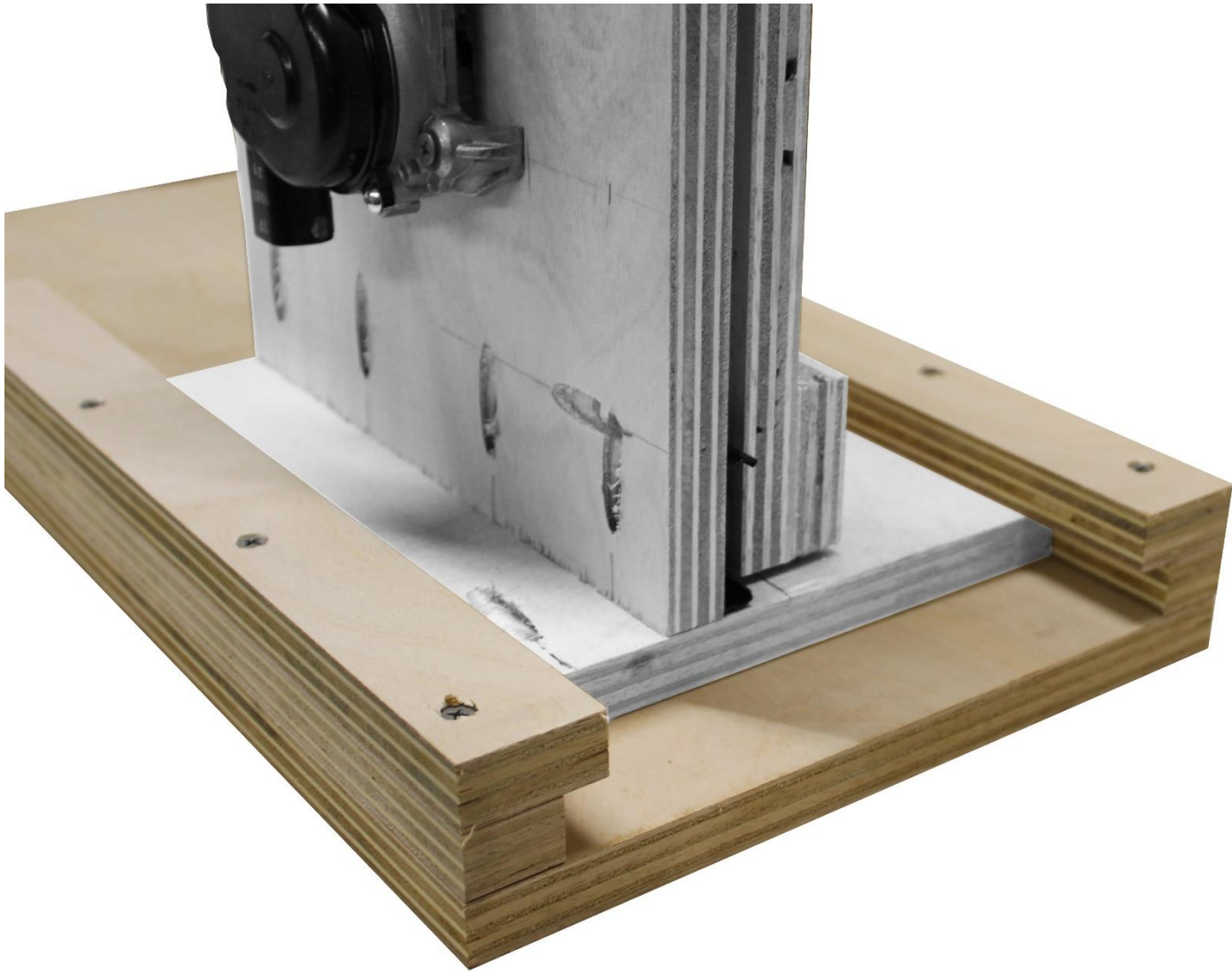
Step 8: Attach the crank arm to the motor shaft.

Step 9: Reattach the retaining washer to the crank arm post.



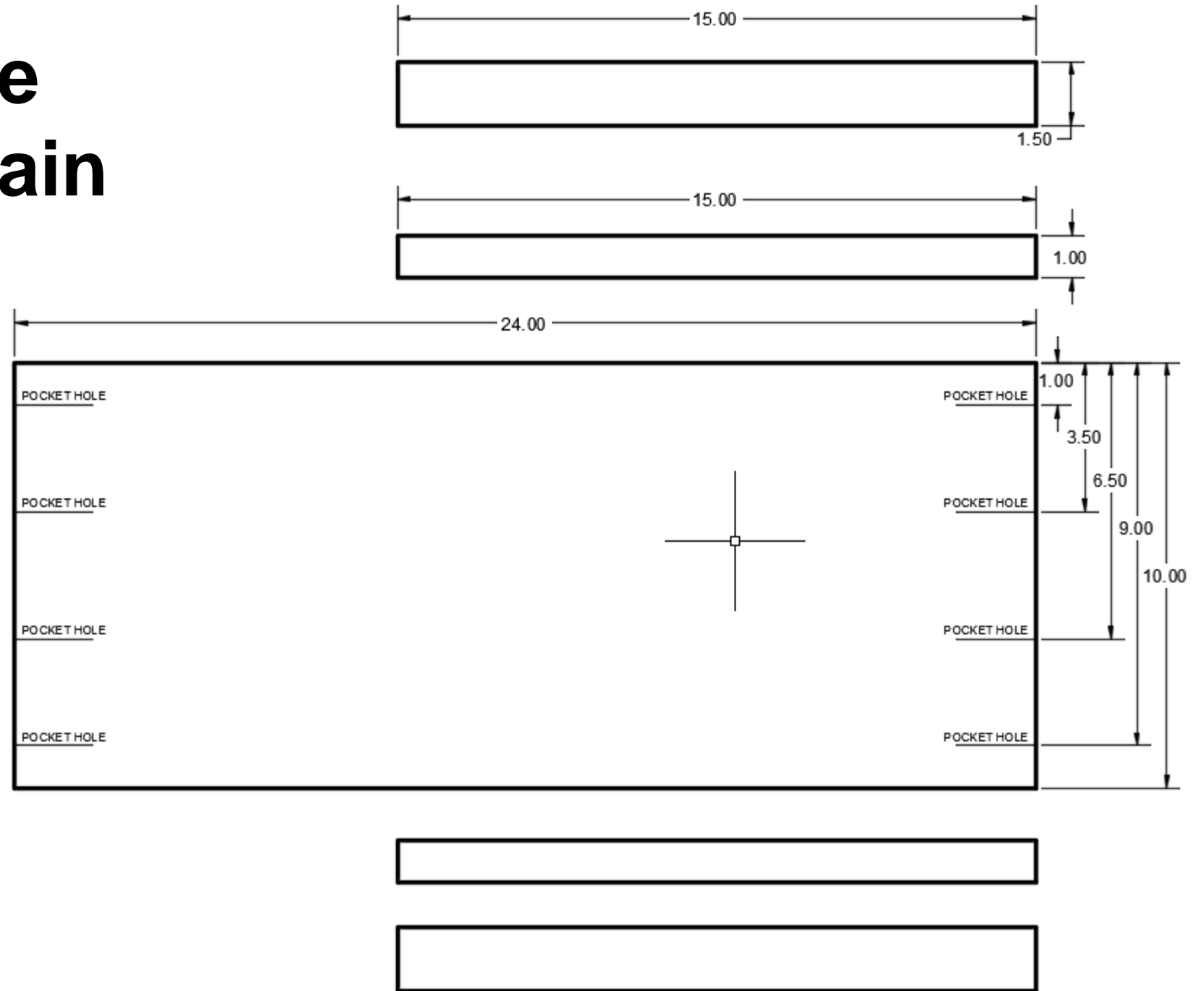
Side view of the finished assembly. Notice the good spacing between the yoke and the crank arm, which was created by adding the washer spacers.

Step 3: Linear Guide Assembly



Linear Guide Hardware	Qty
2-1/2" wood screw	8
~24" x ~24" Plywood	1

3. Linear Guide Assembly – Main Drawing

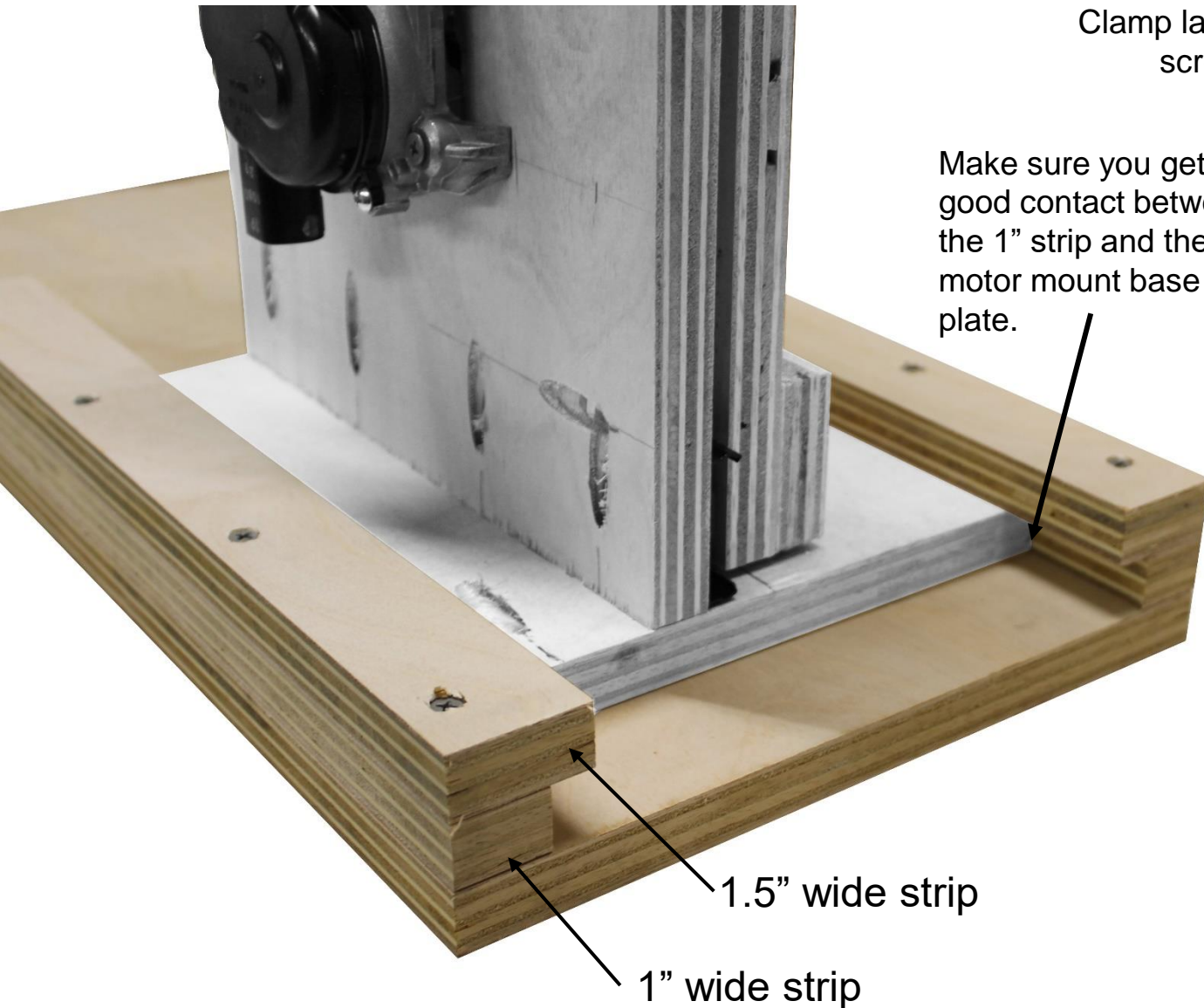


3. Linear Guide Assembly – Main Drawing Pieces

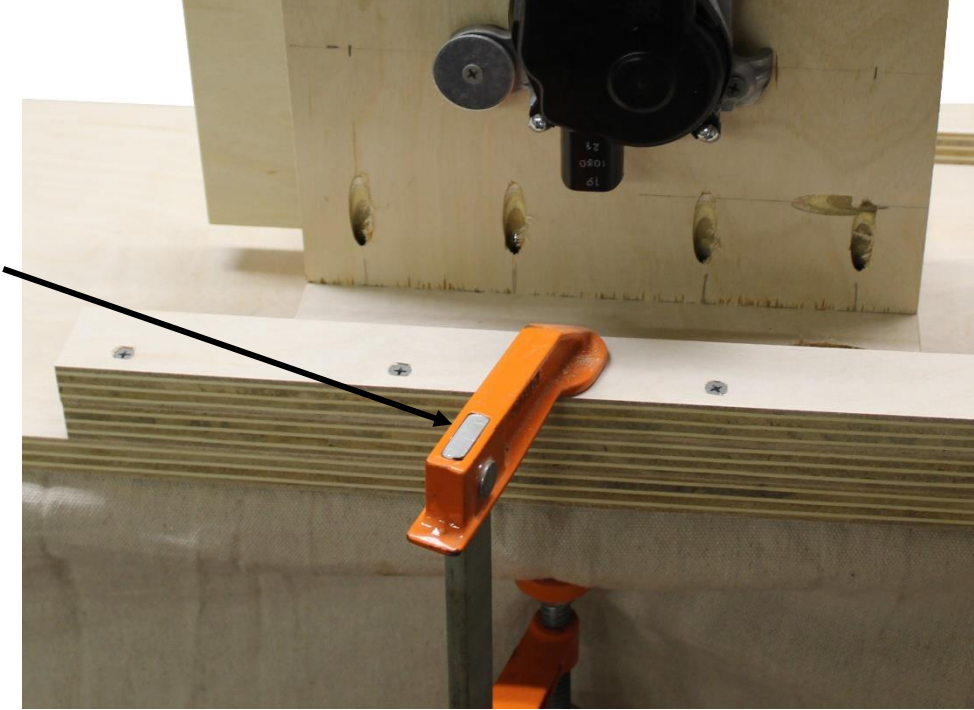
Pocket holes
are on the
other side



3. Linear Guide Assembly



Clamp layers before screwing them together



Step 1: Layer the 1" and 1.5" wide strips as show. Leave the Scotch Yoke mechanism assembly in place to make sure you have snug contact between the 1" wide strips and the motor mount base plate to minimize wiggle when the motor is running.

Step 2: Clamp the layers of plywood together before screwing them together with 2-1/2" wood screws.