

sample

Important:

McMaster Carr, a supplier whose part numbers are referenced throughout this document, can only ship within the United States. Builders outside of the U.S. must find an alternate supplier for the required hardware.

Hardware part numbers and availability are subject to change. Verify that all hardware or equivalents are obtainable prior to purchasing these plans.

Merlot

a kinetic sculpture

design by Derek Hugger

The Basics

Contents

These plans include all the information required to build Merlot. They provide an outline of the build process, tips for an accurate and successful build, lists of required tools and off-the-shelf components, a complete parts list, full scale patterns for all plywood parts, and step-by-step assembly instructions.

Before Building

Read and understand all instructions before building. Failure to do so will lead to increased frustration levels, lengthened build times, wasted material, and other vexing occurrences.

Build Process

Always wear eye protection and any other necessary personal protective gear. Read, understand, and abide by all manufacturer instructions and warnings for all tools used.

1. Use a light duty/general purpose spray adhesive to temporarily bond the patterns to plywood. Apply the adhesive evenly and sparingly.
2. Drill the holes first, and then cut out the parts. Hole alignment between parts is critical to proper function, so care must be taken to drill the holes accurately. Take time to cut out the parts accurately. An accurately cut part will require less sanding and less modification later.
3. Remove the patterns from the cut plywood parts, and then sand the parts to remove rough edges and any residual adhesive.
4. Cut and tap all aluminum tubes, and cut all brass tubes and stainless steel rods.
5. Following the assembly instructions, build all subassemblies as well as Merlot Upper and Lower Assemblies. Then, following the Upper + Lower Connection instructions, connect the two completed assemblies.
6. If desired, fully disassemble Merlot to finish its components. Stain and a thin layer of polyurethane may affect the balance of some parts and may also effect friction levels in the Speed Limiter Asm. See Balance Adjustments and Speed Limiter Weights in Tips + Tactics if any readjustments is needed.

Notes

When printing the patterns, always print at 100% scale. Do not use the “scale to fit page” option.

Using a quality, flat Baltic birch plywood is important. Cheaper, lower quality plywood, such as types often found at stores like Home Depot, can be warped and knotted. This can affect both clearance between moving parts as well as assembly balance.

Changing humidity levels can cause wood parts to swell and move. Some binding or changes in performance may occur with changes in humidity. As humidity levels return to normal, so too should the system’s performance.

The Fine Print

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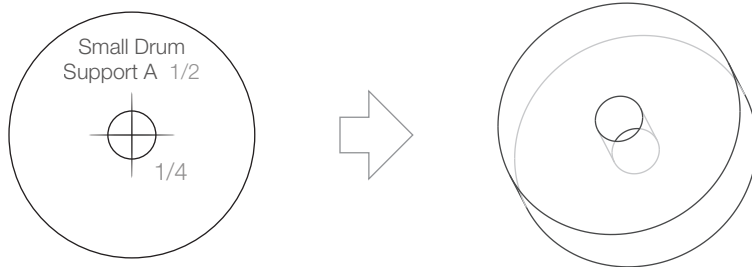
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Tips + Tactics

Pattern Syntax

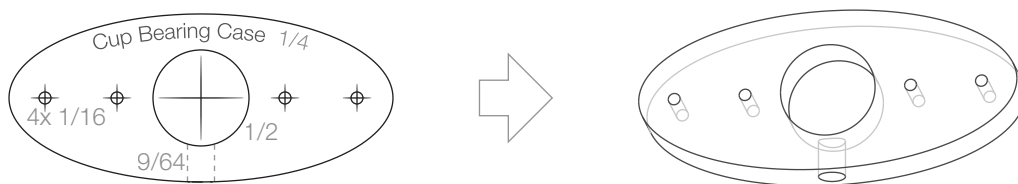
Patterns are labeled with a part name followed by a thickness dimension.

Example: Small Drum Support A is cut from 1/2" plywood. It also has a hole to be drilled with a 1/4" bit.



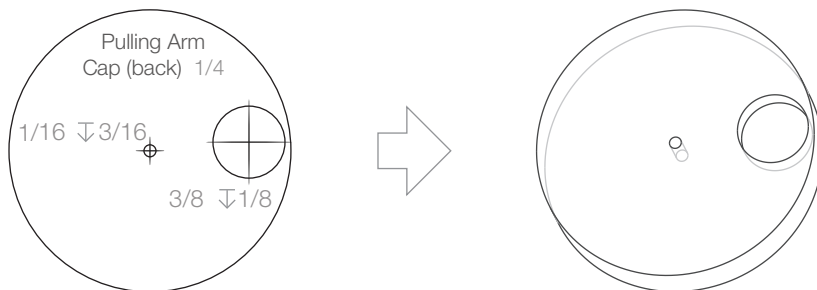
Dashed lines indicate a hole drilled from the side.

Example: Cup Bearing Case has a 9/64" hole drilled from the side. It also has four 1/16" holes and a 1/2" hole drilled from the front.



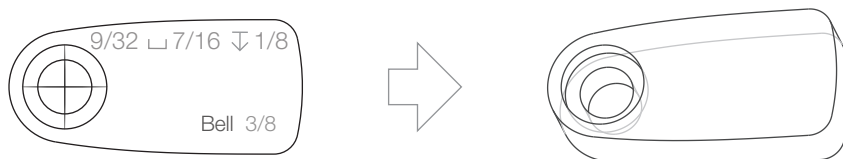
A \Downarrow symbol indicates drilling to a certain depth, not thru.

Example: Pulling Arm Cap has a 1/16" hole drilled 3/16" deep and a 3/8" hole drilled 1/8" deep. As indicated by "(back)", this pattern shows the back side of the part.



Two concentric circles indicate a hole with a counterbore.

Example: Bell has a 9/32" hole with a 7/16" counterbore drilled 1/8" deep.

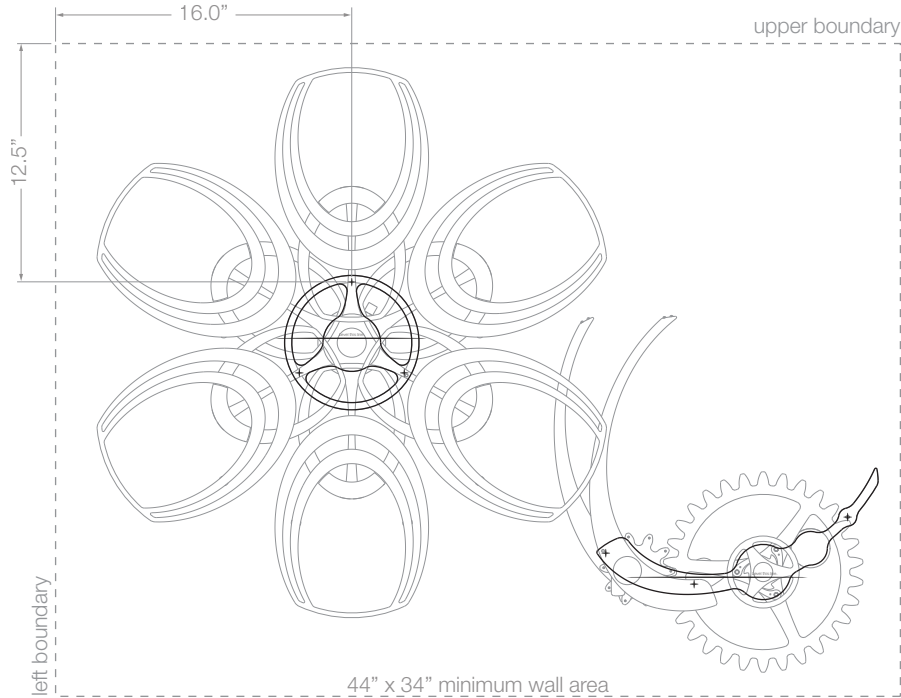


Tips + Tactics

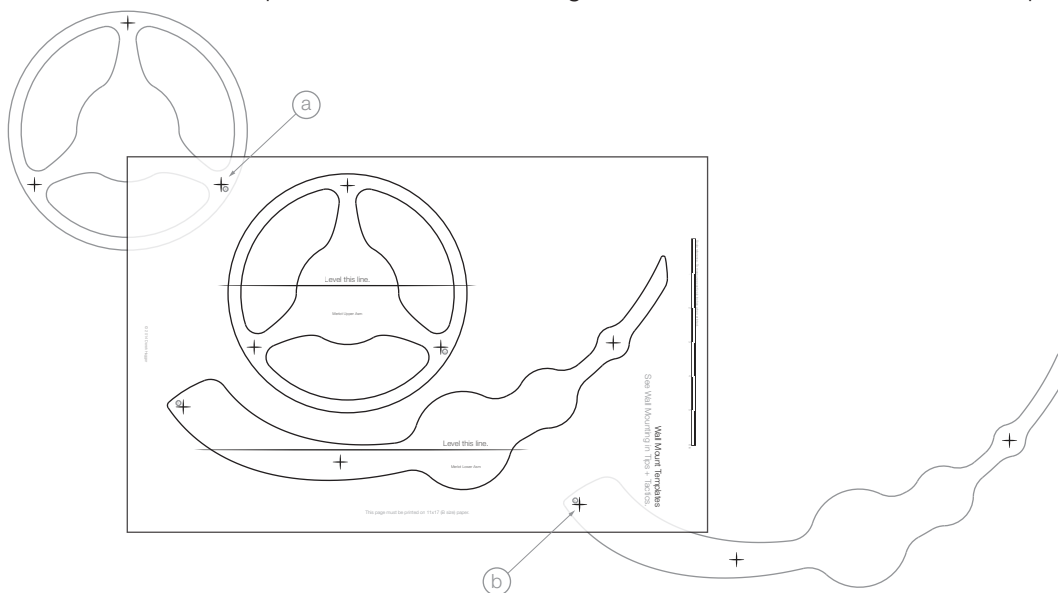
Wall Mounting

Use the Wall Mount Template as a guide for drilling the holes required to mount Merlot. Mark all holes on the wall before drilling. The minimum wall area required to mount Merlot is 44" wide x 34" high. This will leave roughly a 1" clearance around Merlot. Mount into studs or use appropriate anchors to ensure that Merlot will not fall or otherwise separate from the wall.

To center Merlot in a 44" x 34" space, the top hole of the Merlot Upper Asm pattern must be 12.5" down from the upper boundary and 16.0" over from the left boundary.



Once the three holes for the Merlot Upper Asm are marked on the wall, align the bottom right hole mark on the wall with the "a" mark on the top left of the Wall Mount Template. With these points aligned, level the lines on the page, and then mark the wall at the "b" mark on the bottom right of the Wall Mount Template. Next, align this new mark on the wall with the left most hole location on the Merlot Lower Asm pattern. Mark the remaining two holes from the Merlot Lower Asm pattern.



Tips + Tactics

Spring Alternative

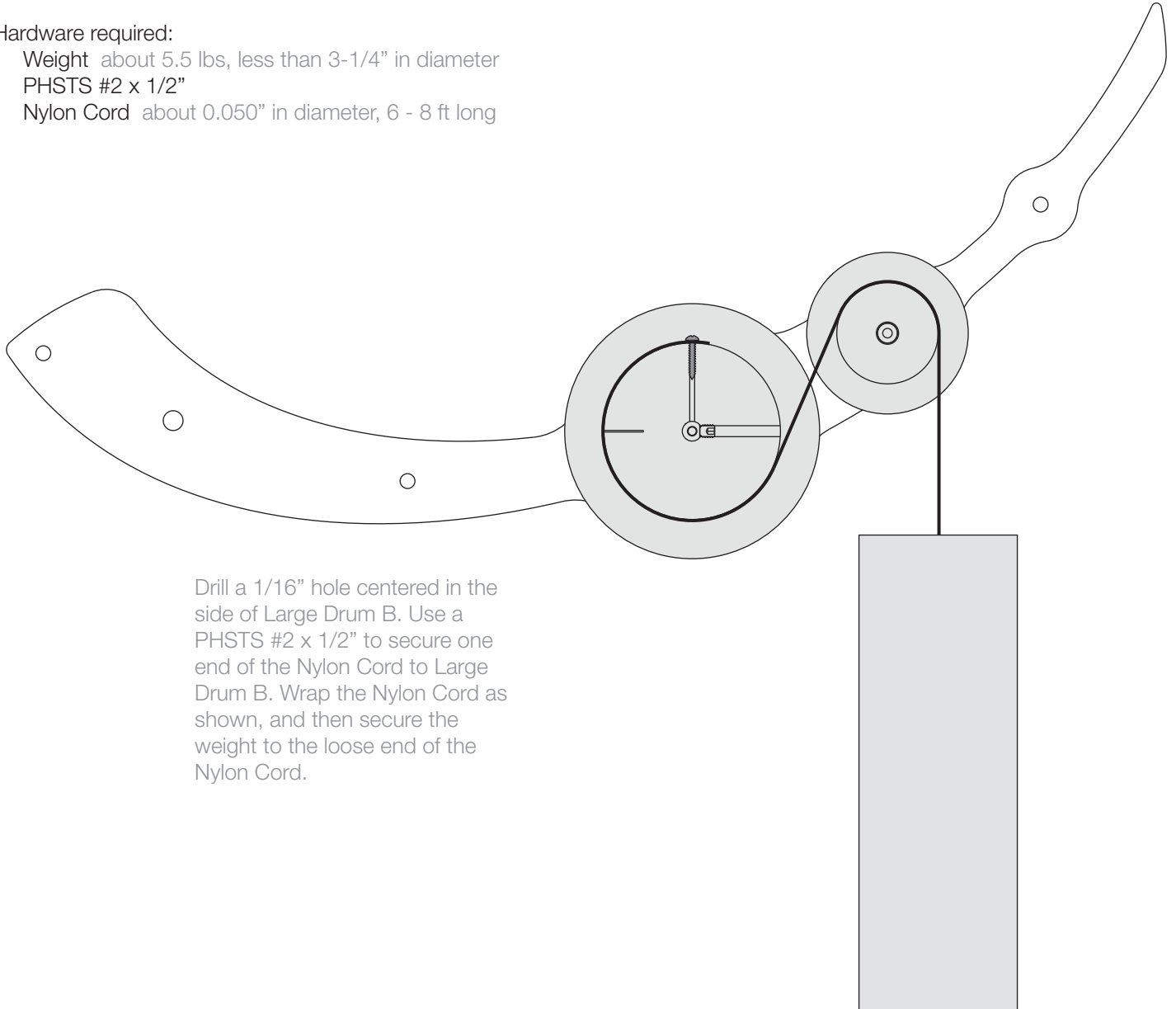
If a Spring cannot be obtained, a Weight can be used instead. The weight can be made from virtually any object meeting the requirements below.

Hardware required:

Weight about 5.5 lbs, less than 3-1/4" in diameter

PHSTS #2 x 1/2"

Nylon Cord about 0.050" in diameter, 6 - 8 ft long



Drill a 1/16" hole centered in the side of Large Drum B. Use a PHSTS #2 x 1/2" to secure one end of the Nylon Cord to Large Drum B. Wrap the Nylon Cord as shown, and then secure the weight to the loose end of the Nylon Cord.

Using a weight, Merlot's run time is dependent on its distance from the floor. The higher up on the wall it is mounted, the longer it will run.

Along with the brass 1/2" Weights that mount on the Speed Limiter, the Weight that replaces the Spring can also help govern Merlot's speed. A heavier weight will cause Merlot to spin faster, and a lighter weight will cause it to spin more slowly. Start with a weight that is a bit heavier than the requirement, test it, and remove material from the Weight until Merlot reaches a desired speed.

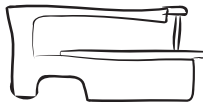
Tools

Required

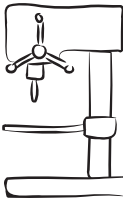
Power Tools



bandsaw



scroll saw



drill press

General



brad point drill index
1/16" to 1/2"
in 1/64" increments



drill bit #29



tap 8-32



hacksaw



clamp

Drivers



phillips #1



hex 5/64"

Supplies



sandpaper

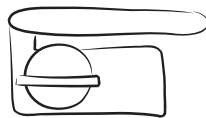


wood glue

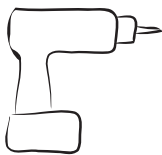


spray adhesive

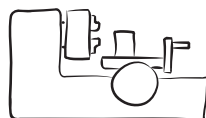
Recommended



belt/disc sander



drill



metal lathe



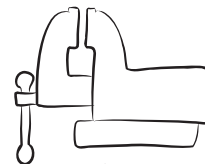
cnc router*



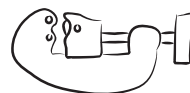
calipers



precision files



vice



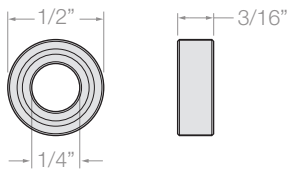
tube cutter

* A CNC router is an optional replacement for the bandsaw and scroll saw for cutting the plywood parts.

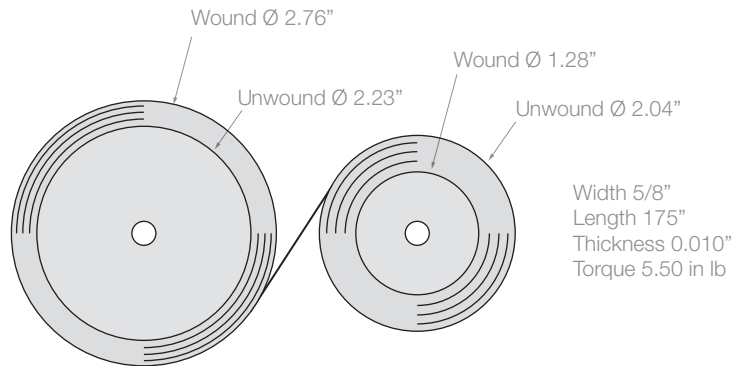
Hardware

Description	Qty	McMaster Carr P/N *
Bearing (see image below)	10	57155K376
LSHCS, 8-32 x 1/2"	19*	93615A320
Magnet Neodymium, 0.7 lbs max pull, Ø1/8" x 1/8"	3	5862K61
String approx. Ø 0.030 - 0.040	-	
PHSTS, #2 x 1/4"	6	92470A095
PHSTS, #2 x 5/16"	12	92470A099
PHSTS, #2 x 3/8"	32	92470A097
PHSTS, #2 x 1/2"	44	92470A098
PHSTS, #6 x 1/2"	10*	92470A148
PHSTS, #6 x 3/4"	8	92470A151
Set Screw, 8-32 x 3/16"	9	92313A189
Set Screw, 8-32 x 3/8"	1	92313A192
1/4" Weight (see image below)	10*	90309A312
1/2" Weight (see image below)	9*	90309A315
Spring (see image below)	1	A 3X51-20010**
Washer #8	13*	90107A010

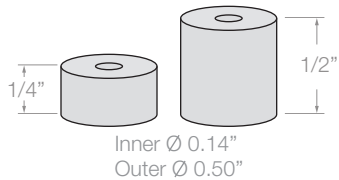
Bearing Double Shielded, ABEC-5



Spring NEGATOR Spring Motor (aka Constant Torque Spring)



Weights Unthreaded Brass Spacers for #6 Screws



LSHCS low socket head cap screw
PHSTS pan head self tapping screw

* Quantities may vary. Additional fasteners, washers, and/or weights may be required to balance Merlot's assemblies.

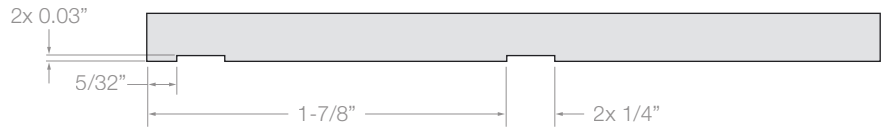
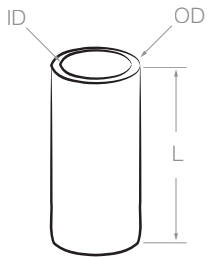
* Part numbers referenced are from www.mcmaster.com.

** Part number referenced is from Stock Drive Products: www.sdp-si.com/eStore

Metal

Description	Material	OD x L *	ID	Qty	Tap**	McMaster Carr P/N ***
Brass Tube	Brass	7/32" x 5/16"	0.191"	3	-	8859K23
Brass Tube	Brass	9/32" x 1/8"	0.253"	1	-	8859K25
Brass Tube	Brass	9/32" x 1/4"	0.253"	1	-	
Brass Tube	Brass	9/32" x 0.30"	0.253"	2	-	
Brass Tube	Brass	9/32" x 0.38"	0.253"	1	-	
Brass Tube	Brass	9/32" x 1/2"	0.253"	2	-	
Brass Tube	Brass	9/32" x 0.68"	0.253"	3	-	
Brass Tube	Brass	9/32" x 0.86"	0.253"	2	-	
Brass Tube	Brass	9/32" x 7/8"	0.253"	1	-	
Brass Tube	Brass	9/32" x 1-1/8"	0.253"	1	-	
Brass Tube	Brass	9/32" x 2.30"	0.253"	3	-	
SS Rod	Stainless Steel	1/16" x 1/2"	-	15	-	88915k37
SS Rod	Stainless Steel	1/16" x 1"	-	2	-	
SS Rod	Stainless Steel	1/16" x 1-3/4"	-	2	-	
SS Rod	Stainless Steel	1/16" x 2-5/8"	-	4	-	
SS Rod	Stainless Steel	3/32" x 15/16"	-	12	-	8984K1
SS Rod	Stainless Steel	3/16" x 11/16"	-	3	-	89535K24
Long Cup Tube	Aluminum	1/4" x 2-7/8"	0.120"	3	both sides	4568T11
Pulling Arm Tube	Aluminum	1/4" x 0.68"	0.120"	2	thru	
Short Cup Tube	Aluminum	1/4" x 1-1/4"	0.120"	3	both sides	
Small Drum Tube	Aluminum	1/4" x 2.4"	0.120"	1	-	
Small Gear Tube	Aluminum	1/4" x 4"	0.120"	1	one side	
Speed Limiter Tube	Aluminum	1/4" x 1-1/2"	0.120"	1	one side	
Spinner Tube	Aluminum	1/4" x 4-7/8"	0.120"	1	one side	
Winding Tube	Aluminum	1/4" x 3.82"	0.120"	1	both sides	

Winding Tube
Cut or file the flats shown below.



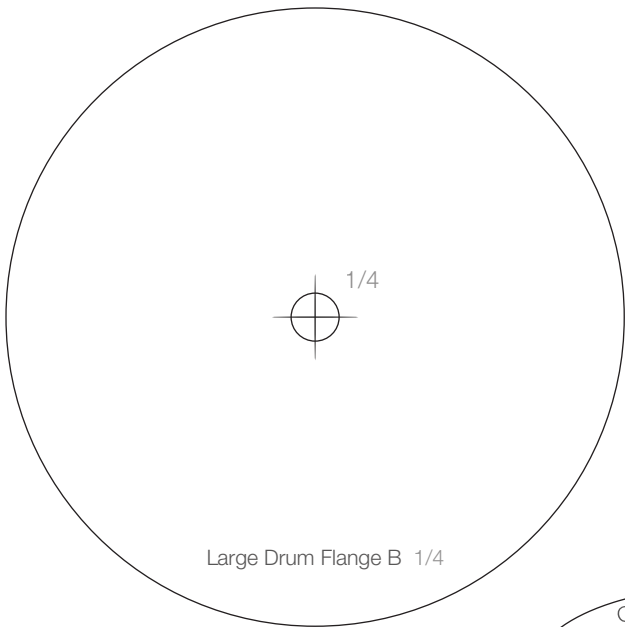
OD outer diameter
ID inner diameter
L length

* Due to variations in plywood thicknesses, required tube lengths may vary slightly.

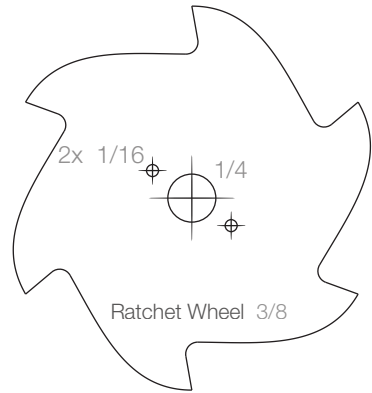
** Expand 0.120" tube ID with a #29 drill bit and then tap for 8-32 thread. Minimum thread depth: 1/2".

*** Part numbers referenced are from www.mcmaster.com.

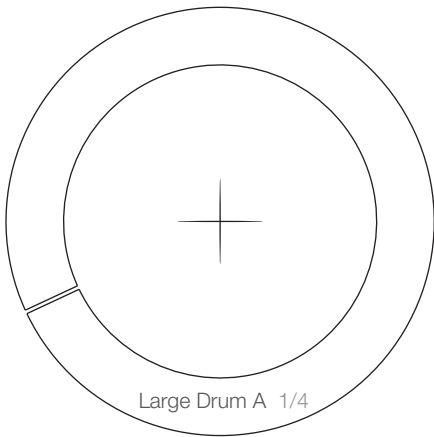
Scale reference. To measure exactly six inches when printed.



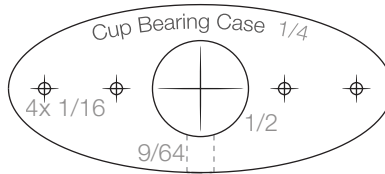
Large Drum Flange B 1/4



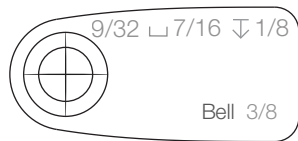
Ratchet Wheel 3/8



Large Drum A 1/4



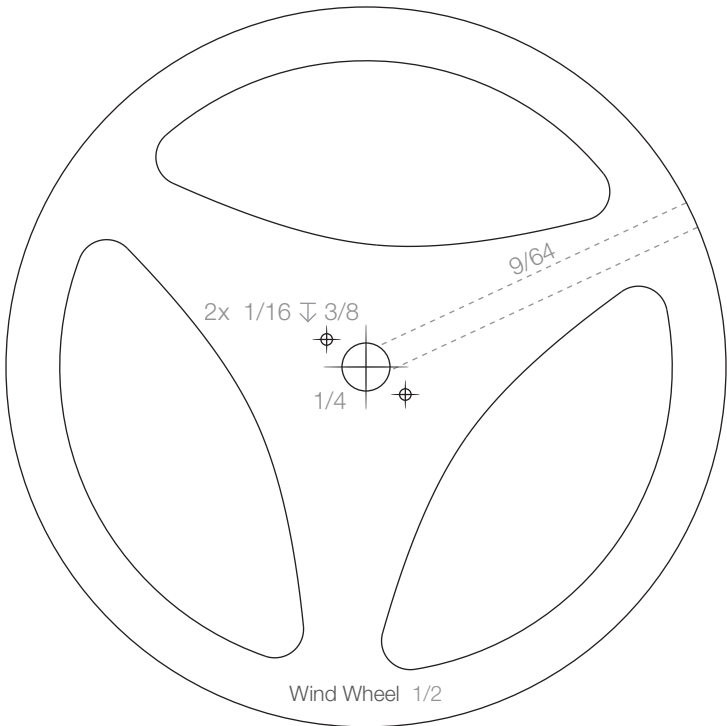
Cup Bearing Case 1/4



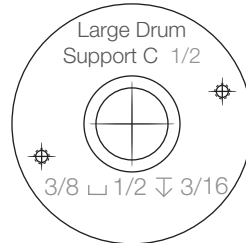
Bell 3/8



Small Drum Flange B 1/8

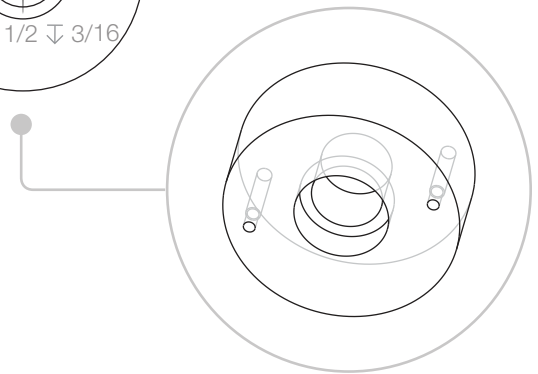


Wind Wheel 1/2



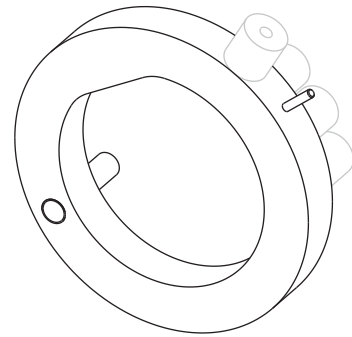
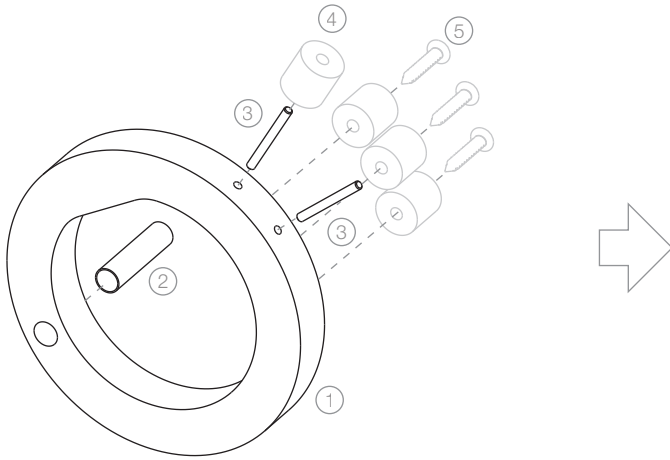
Large Drum Support C 1/2

2x 1/16 \sqsubset 5/64 ∇ 3/8 (from back)



Upper Subassemblies

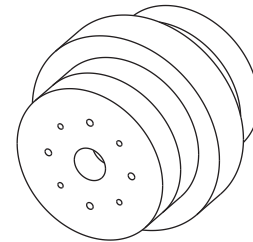
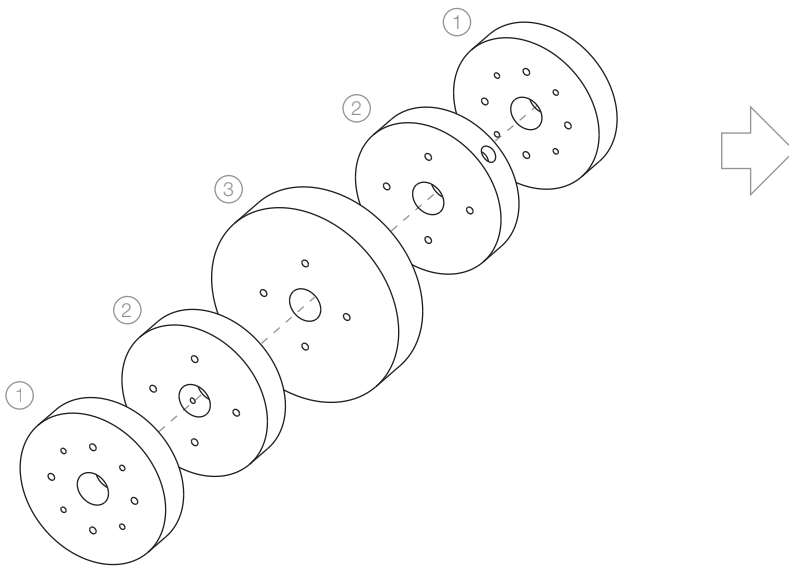
Steps 1, 2



Speed Limiter Asm

#	Required Parts	Qty
1	Speed Limiter	1
2	Brass Tube, 9/32" x 1-1/8"	1
3	SS Rod, 3/32" x 15/16"	2
4	1/2" Weight	X
5	PHSTS, #6 x 3/4"	X

The number of required 1/2" Weights and PHSTS, #6 x 3/4" will vary. See Speed Limiter Weight in Tips + Tactics.



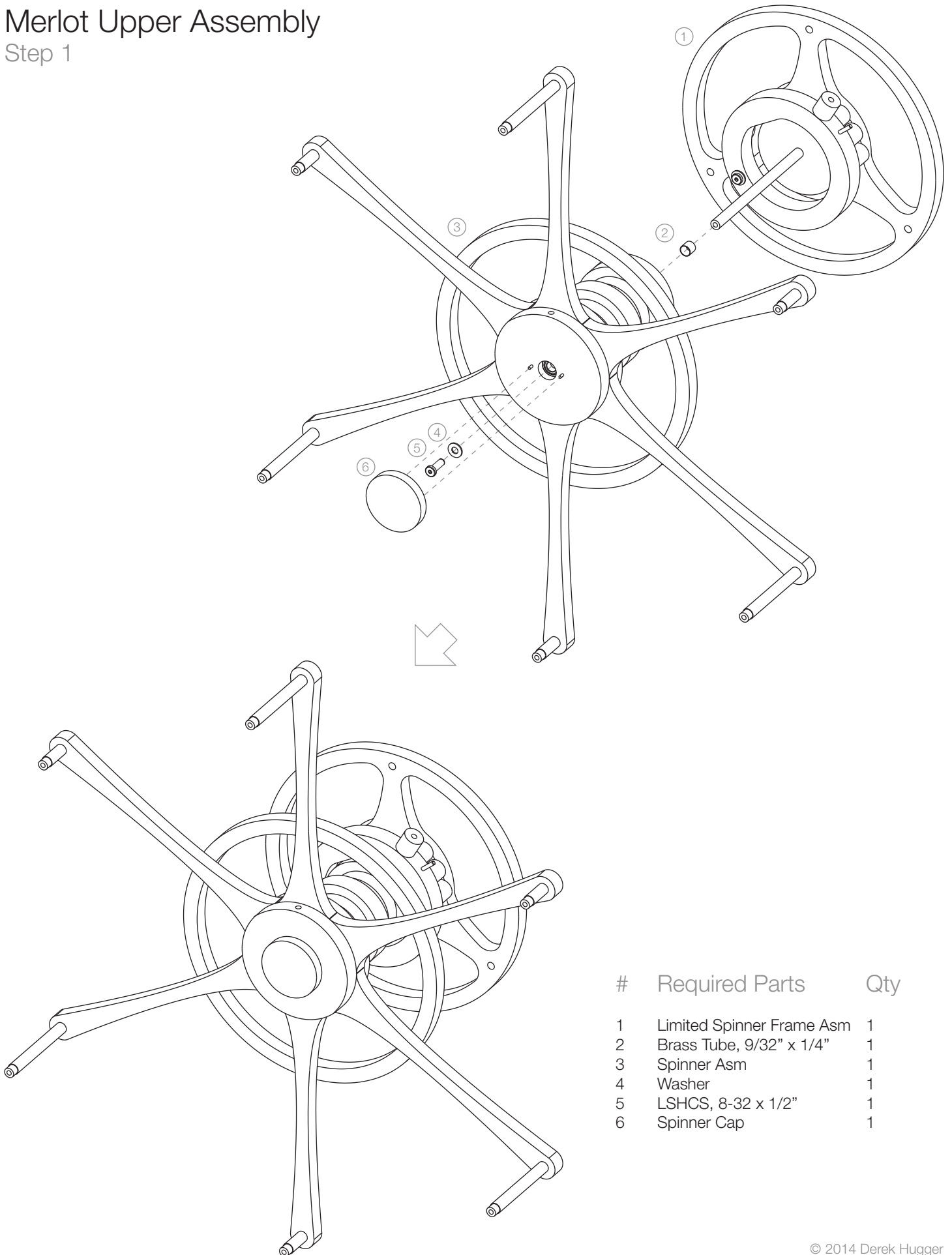
Puller Asm

#	Required Parts	Qty
1	Spool Drum End	2
2	Spool Drum	2
3	Spool Flange	1

Glue together all items. Insert 4x 1/16" rods in the 5/64" holes while gluing to ensure all parts remain concentric and aligned.

Merlot Upper Assembly

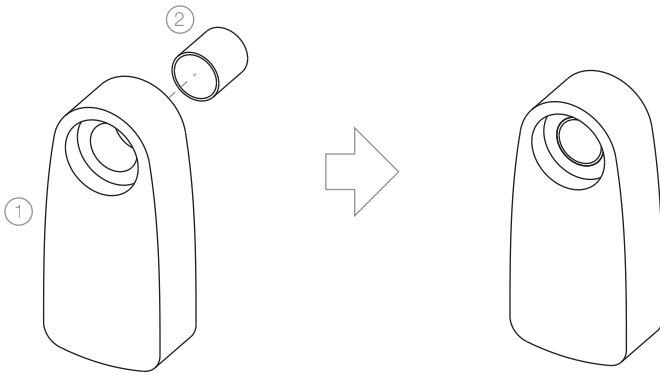
Step 1



#	Required Parts	Qty
1	Limited Spinner Frame Asm	1
2	Brass Tube, 9/32" x 1/4"	1
3	Spinner Asm	1
4	Washer	1
5	LSHCS, 8-32 x 1/2"	1
6	Spinner Cap	1

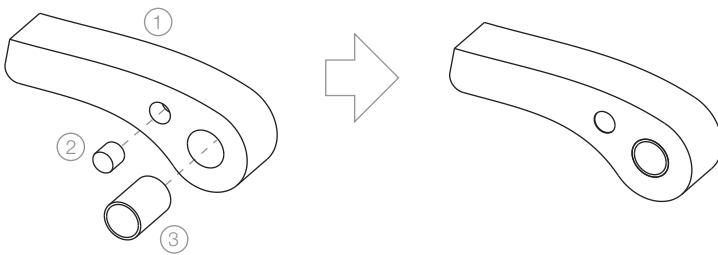
Lower Subassemblies

Steps 1, 2, 3



Bell Asm (2x)

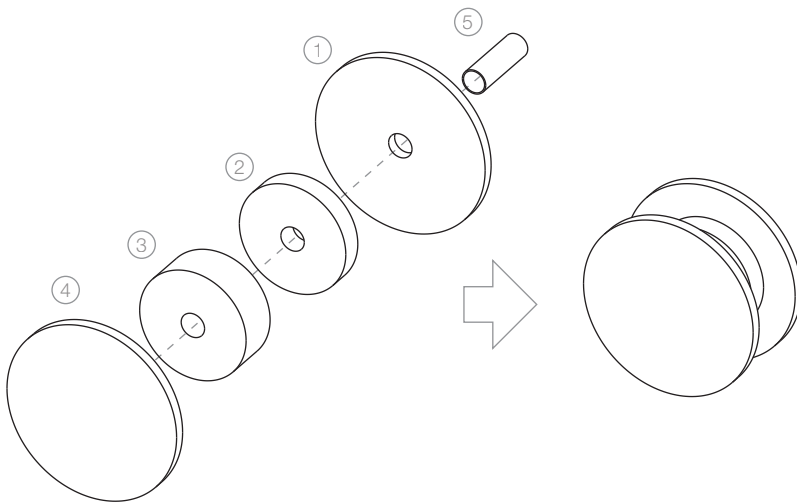
#	Required Parts	Qty
1	Bell	1
2	Brass Tube, 9/32" x 0.3"	1



Ratchet Arm Asm (3x)

#	Required Parts	Qty
1	Ratchet Arm	1
2	Magnet	1
3	Brass Tube, 7/32" x 5/16"	1

Magnet polarity must be the same on all three assemblies.



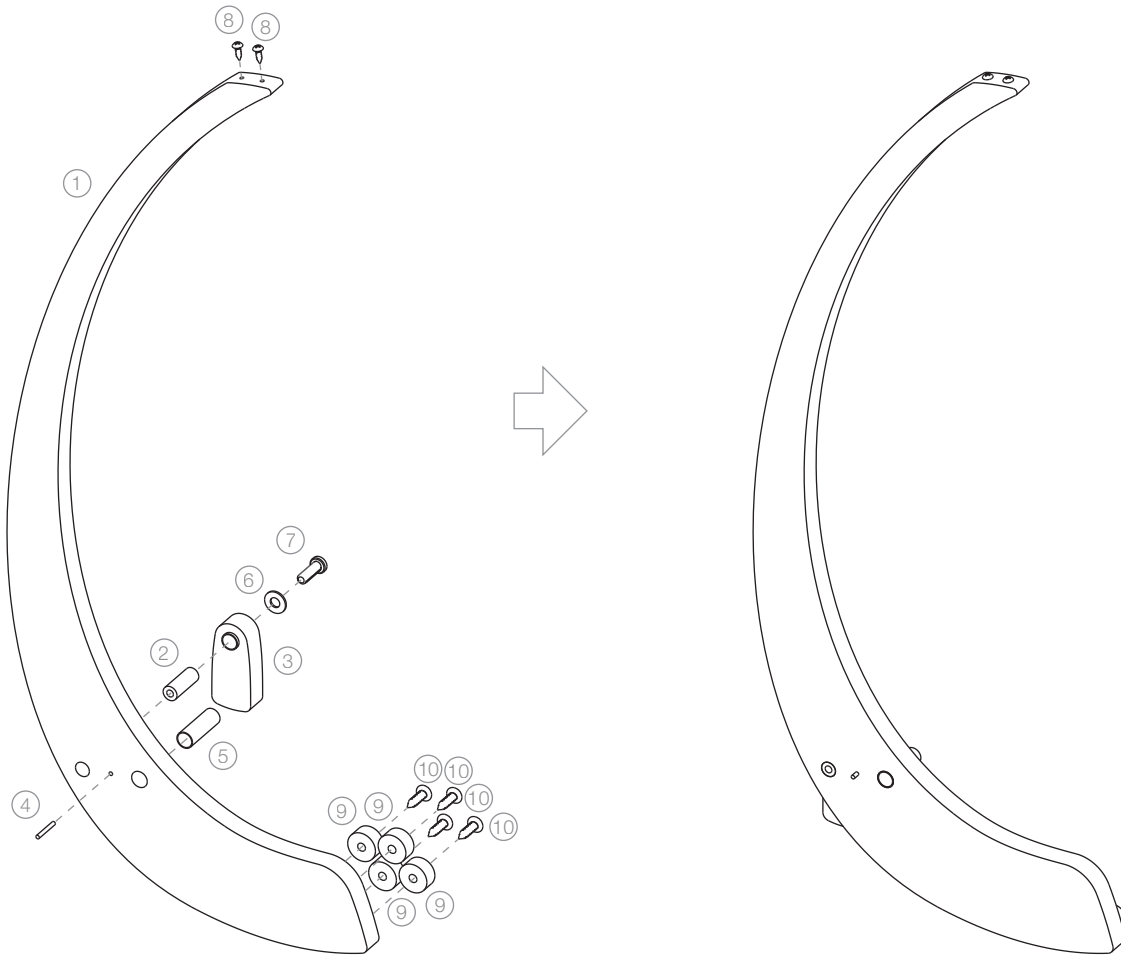
Small Drum Asm

#	Required Parts	Qty
1	Small Drum Flange A	1
2	Small Drum A	1
3	Small Drum B	1
4	Small Drum Flange B	1
5	Brass Tube, 9/32" x 7/8"	1

Glue together items # 1, 2, 3, and 4, ensuring they remain concentric.

Lower Subassemblies

Step 10



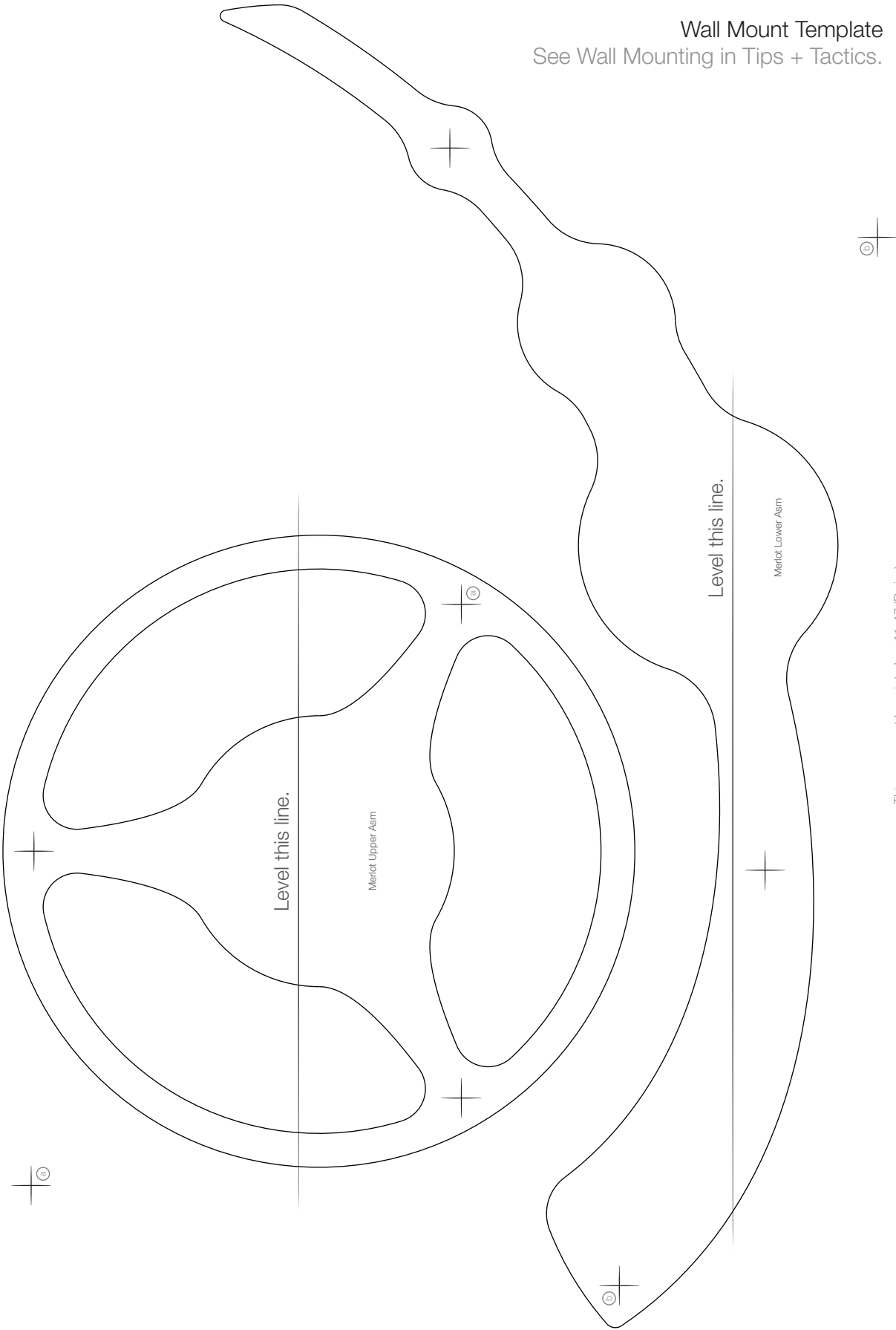
Front Pulling Arm Asm

#	Required Parts	Qty
1	Pulling Arm	1
2	Pulling Arm Tube	1
3	Bell Asm	1
4	SS Rod, 1/16" x 1/2"	1
5	Brass Tube, 9/32" x 0.86"	1
6	Washer	1
7	LSHCS, 8-32 x 1/2"	1
8	PHSTS, #2 x 1/4"	2
9	1/4" Weight	4
10	PHSTS, #6 x 1/2"	4



Wall Mount Template

See Wall Mounting in Tips + Tactics.



This page must be printed on 11x17 (B size) paper.

Note: For the Sample, this page is not to scale.