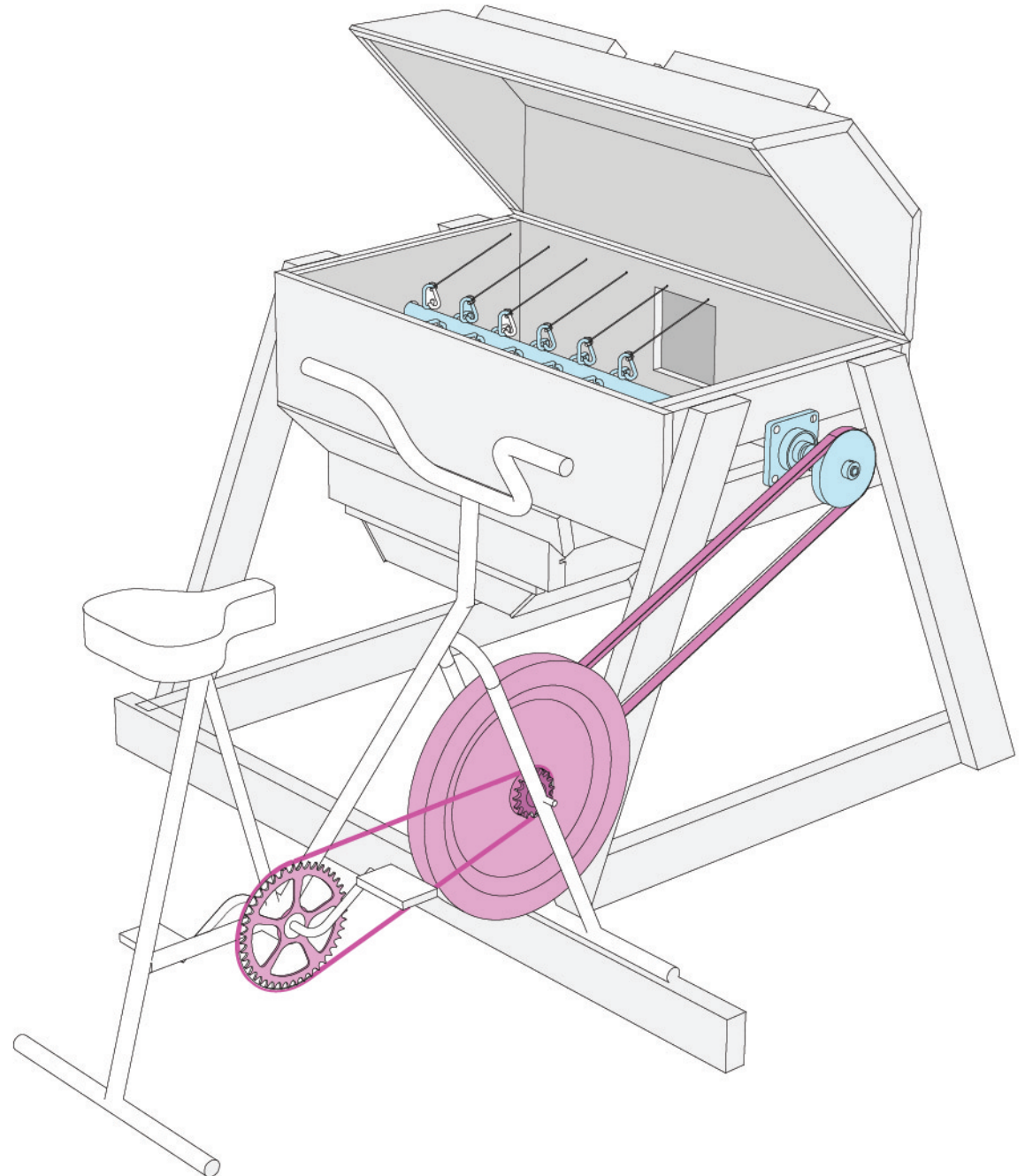


# THRESHER

The Thresher is a bike powered gang of swipples (the part of a flail that hits the seeds) inside a drum. The swipples hit the seed heads or pods and break them apart so the seeds fall out. The design is based around using 1x10 finished lumber to construct the drum and also using about all the power a person can supply while biking. The swipples can be easily changed and are made from wire, bike spokes, wood, and plastic or metal chain depending on the crop. The size of the scalping screen (through which the threshed material falls) is also easily changed.

The Thresher can be used three ways: One, as a batch process where the whole drum is filled with plant material, processed, and then the fibrous remains are removed. Two, as a pass-through process where seed heads are fed in through the right top window, get processed as they move to the left, and the empty seed heads are tossed out the left side window. And Three, as a sheaf process, where sheaves of cut and aligned grain are held by their stalks with the heads thrust through a window on the side of the drum to be processed, after which the straw bundle is withdrawn, and a new sheaf introduced.



# OVERVIEW OF STEPS



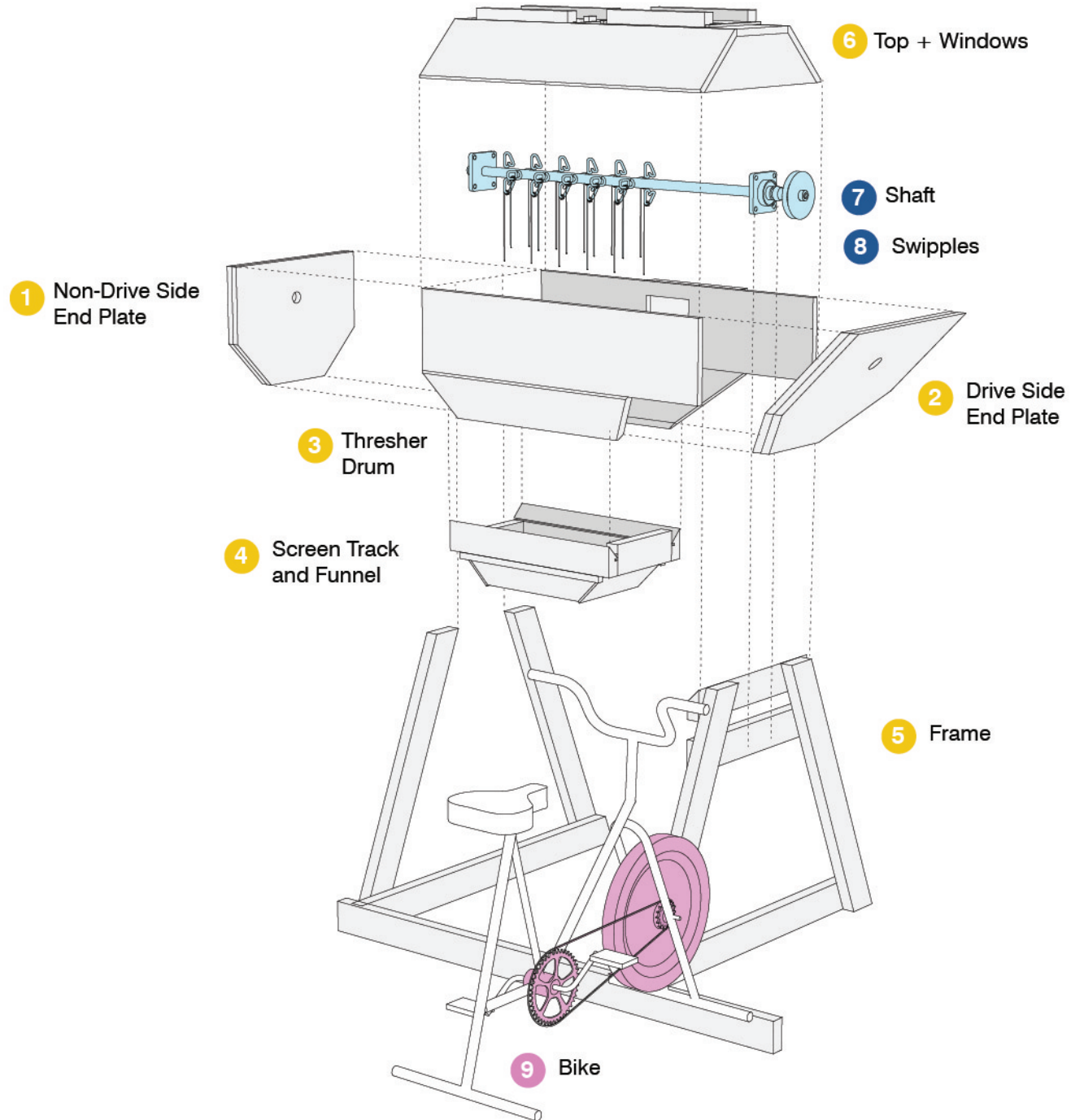
WOOD WORK



METAL WORK



BIKE WORK

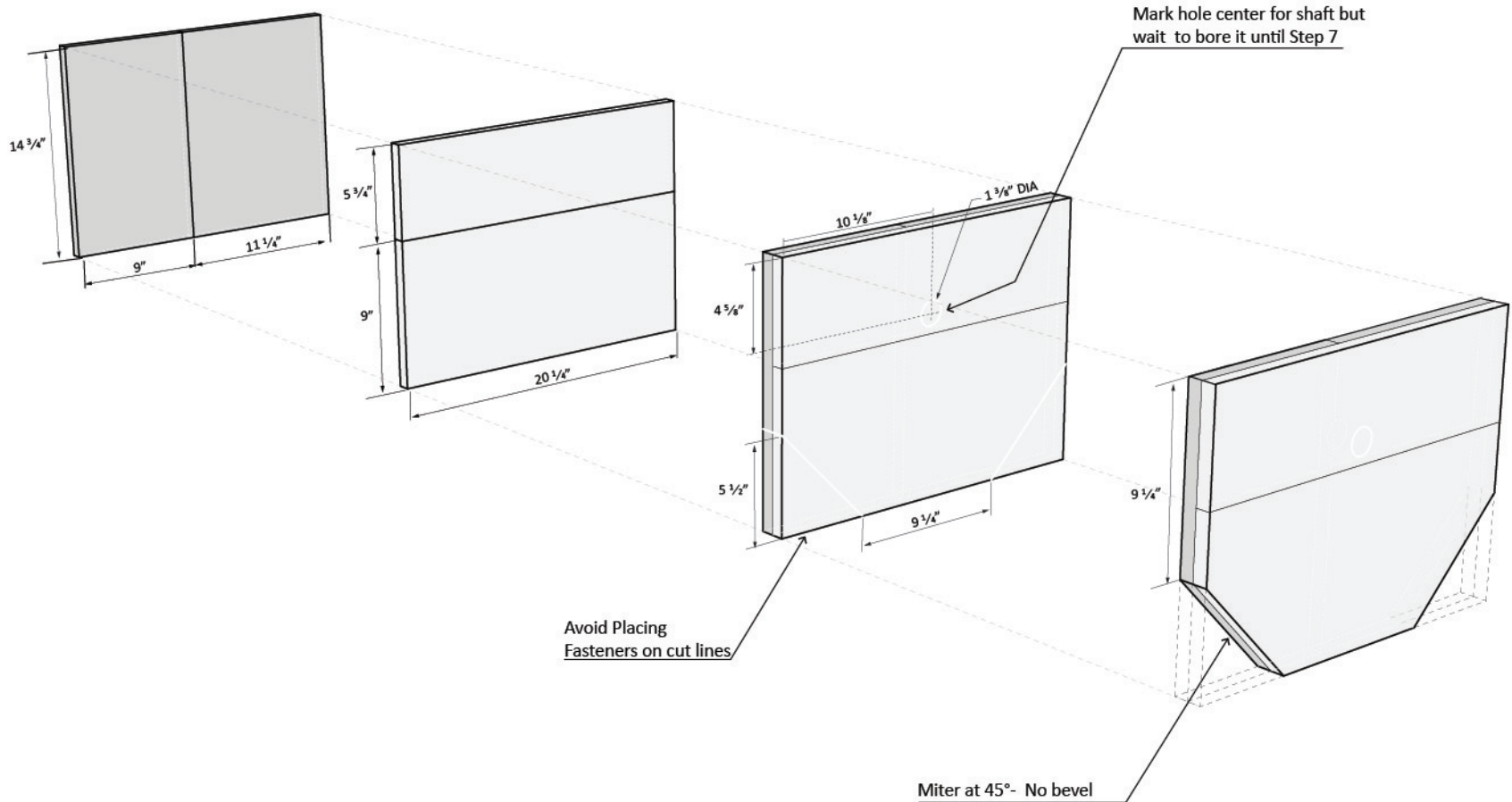


STEP  
1

# NON-DRIVE SIDE END PLATE



The end plates of the thresher drum are built up from two thicknesses of 1x lumber, cut out of 1x12. Since the end plates are too wide to be cut from a single 1x12 board, each thickness must be two boards joined together. One of the end plates of the thresher drum is oriented square to the staves (on the non-drive side) and the other is oriented at 45° degrees to the staves (on the drive side). The square end plate is relatively easy to build, so build it first.

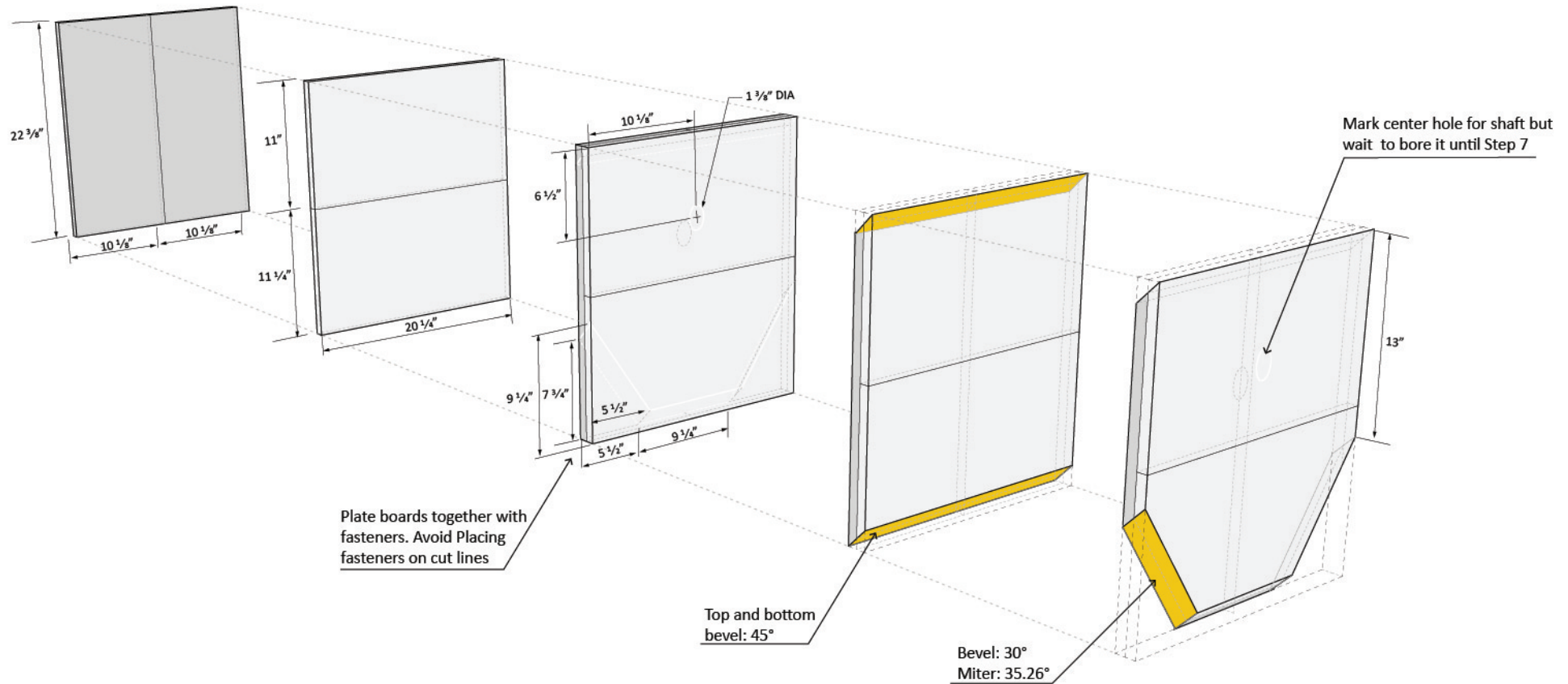


**STEP  
2**

# DRIVE SIDE END PLATE



The angled end plate requires careful measuring and cutting. One trick for getting the angled endplate to turn out correctly is to plate up the shape as a rectangle with square cuts (avoid putting fasteners where cuts will occur). Then bevel the top and the bottom. Finally, cut the miters + bevels on the flared side

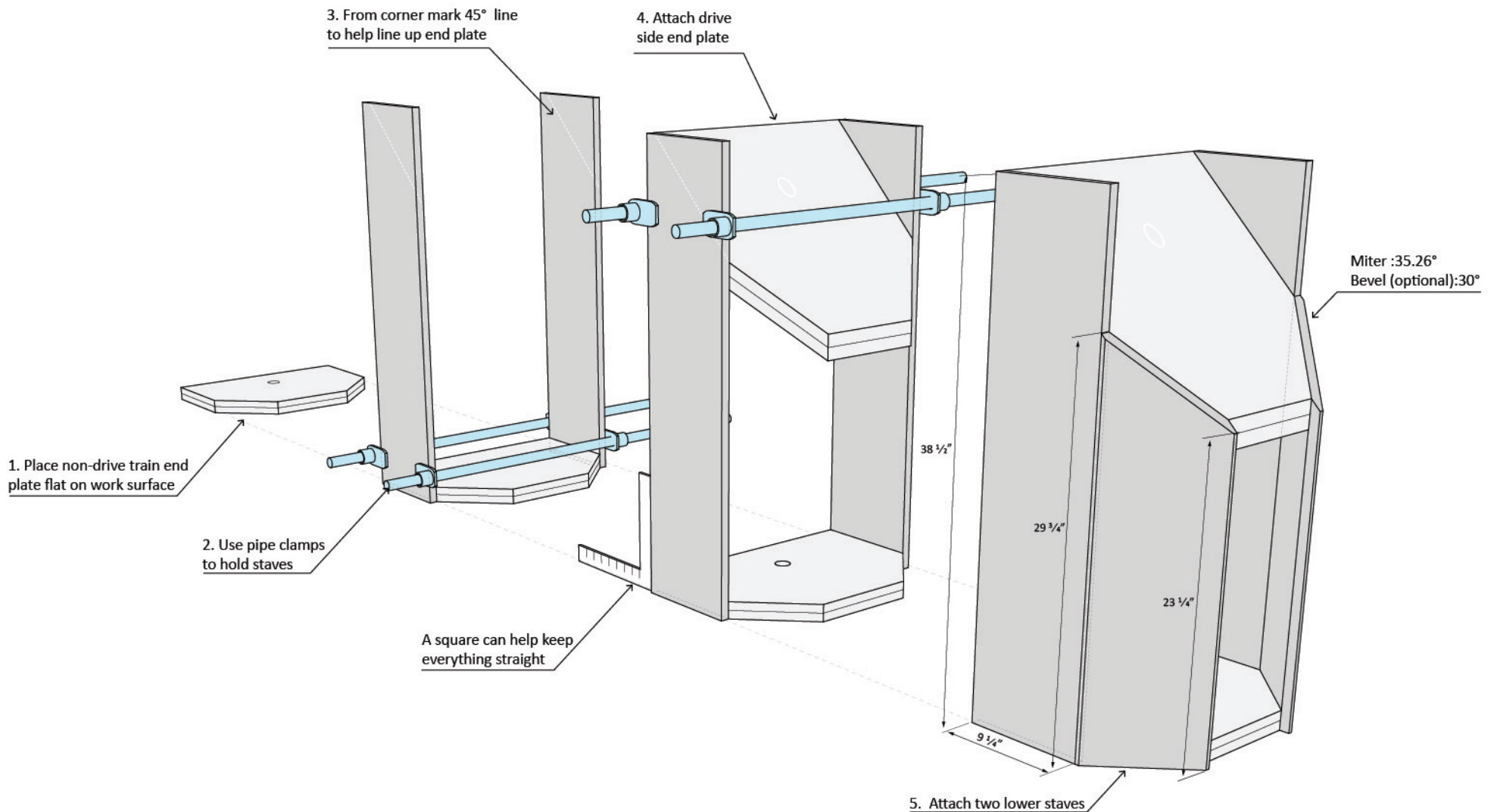
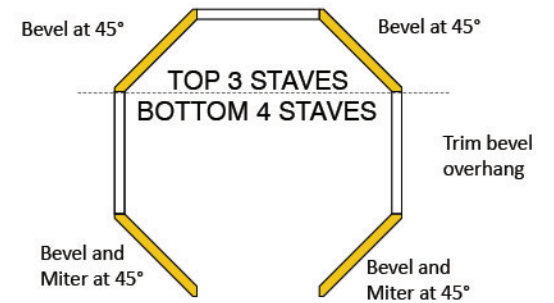


STEP 3

# THRESHER DRUM



The shape of the thresher drum is almost octagonal. It is designed to be built with 1x10 finished lumber. The bevelled edges can be cut on the boards with a table saw or a skillsaw. If a skillsaw is used to cut the bevels, then a straight piece of wood should be clamped or nailed to the stave to guide the skillsaw. Make the 4 staves for the drum and the 3 staves for the top (see step 6) all at once. Then set aside the 3 top staves for step 6.



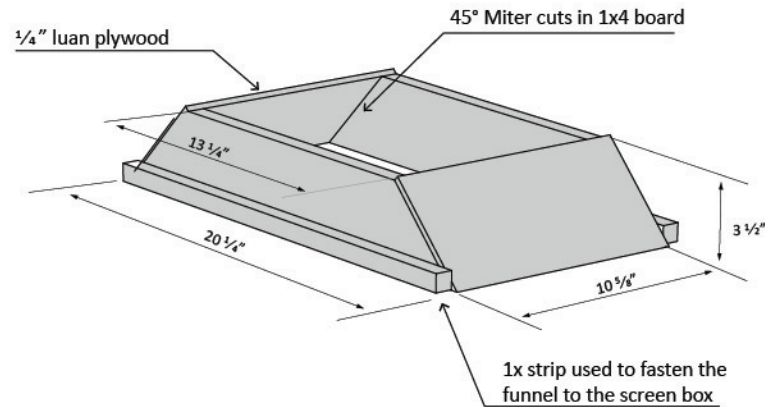
# STEP 4

# SCREEN TRACK + FUNNEL

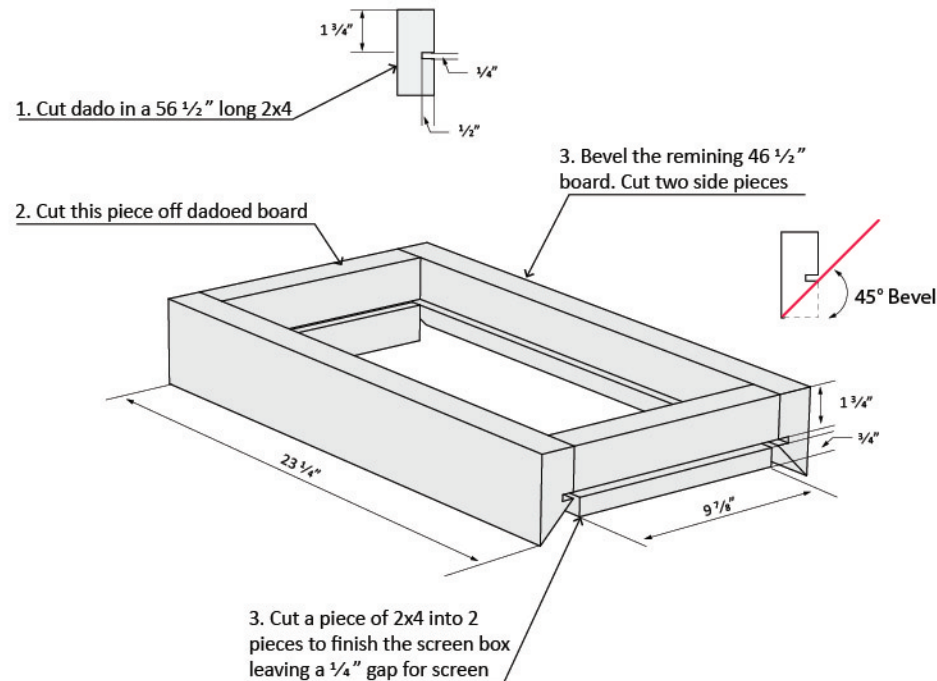


The bottom is made up of 2 parts, the screen box and the funnel. It is easiest to construct it upside down. The screen should be cut to fit into the slot. In general the smallest screen that will pass the seeds is used.

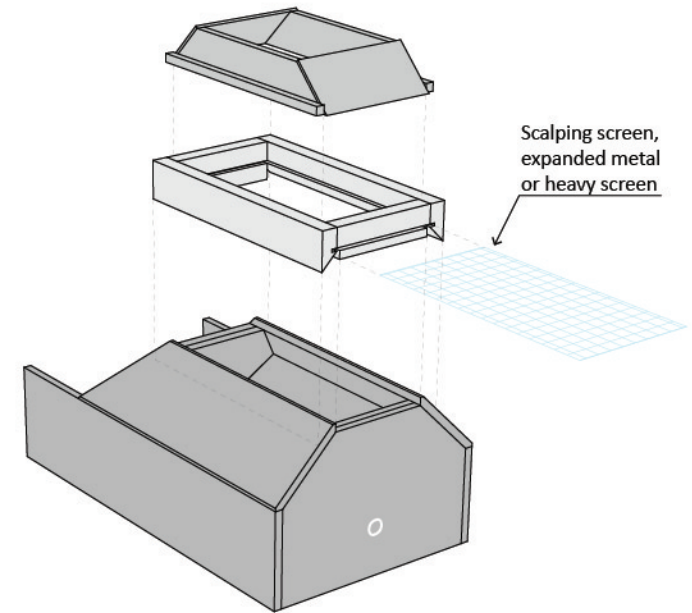
## FUNNEL



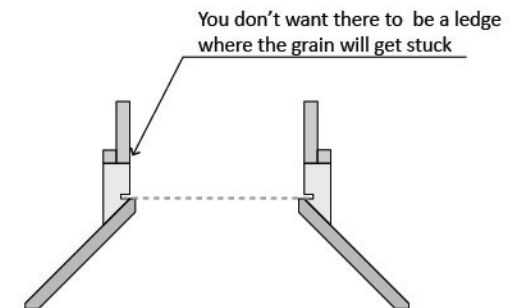
## SCREEN TRACK



## ASSEMBLE



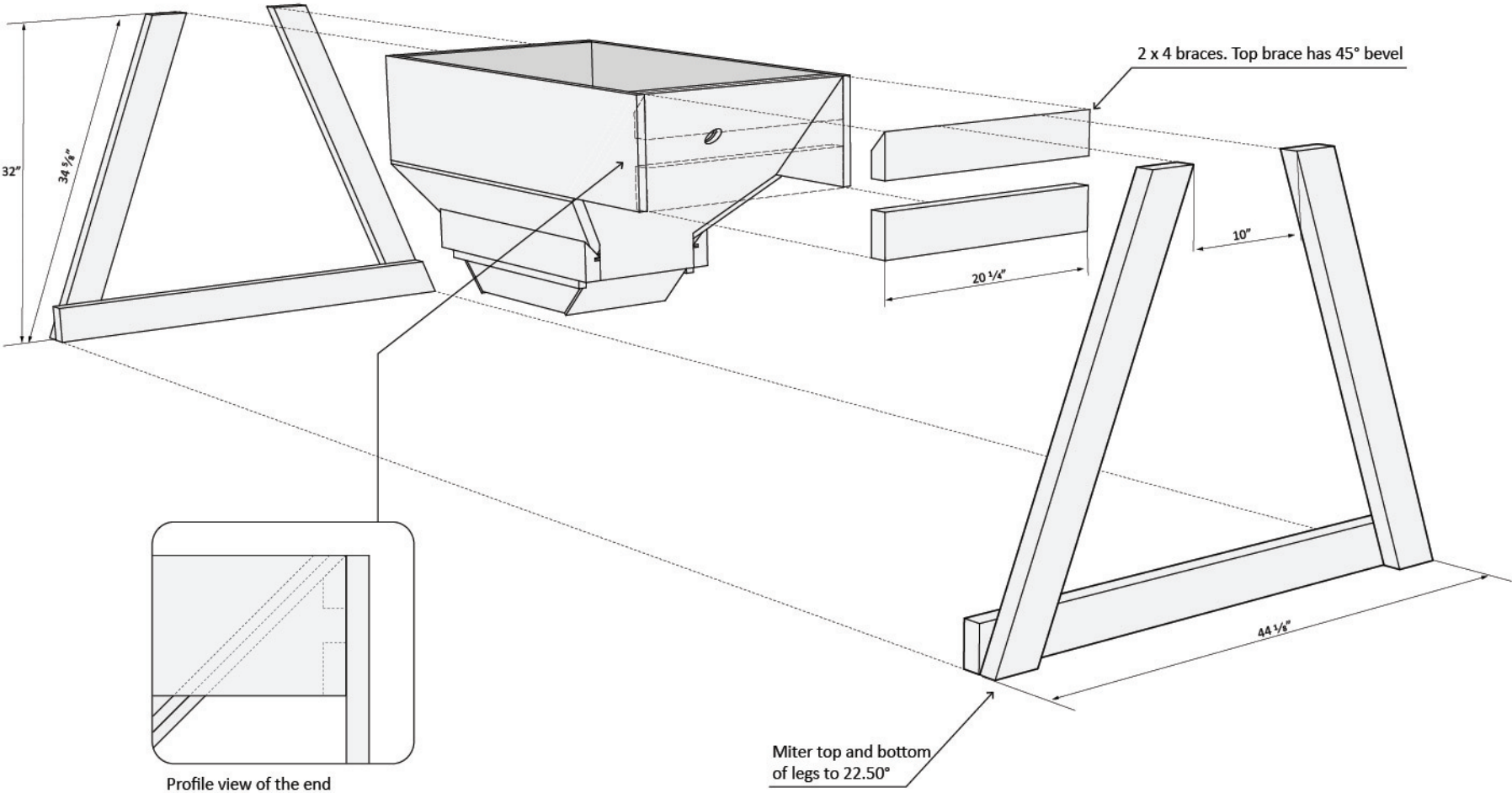
## CROSS-SECTION



**STEP 5**

# FRAME

Once the thresher drum is assembled the 2x4 legs and bracing can be fastened to the drum so it will stand up.

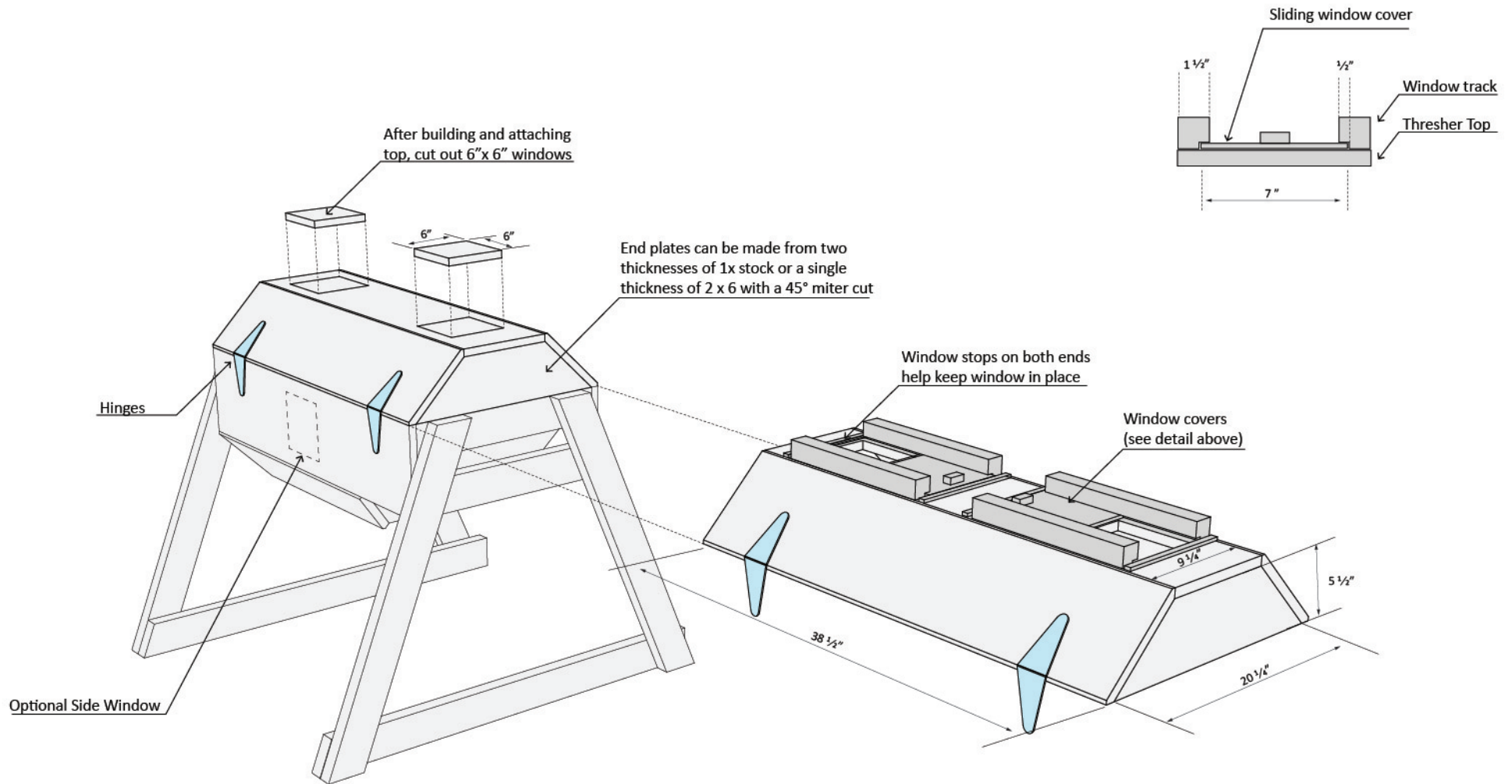


STEP  
6

# TOP + WINDOWS



The top is made out of 3 staves prepared in Step 3. The two windows on the top of the thresher make it possible to feed unthreshed grain heads (such as rye harvested with a sickle) through the right hand window and have them travel to the left through the thresher and be thrown out of the left hand window. The optional window on the side of the thresher can be built the same as the top windows and allows bundles of stalks (such as rye harvested with a scythe and grain cradle) to be fed into the spining thresher and then withdrawn once threshed.





**STEP  
7****SHAFT**

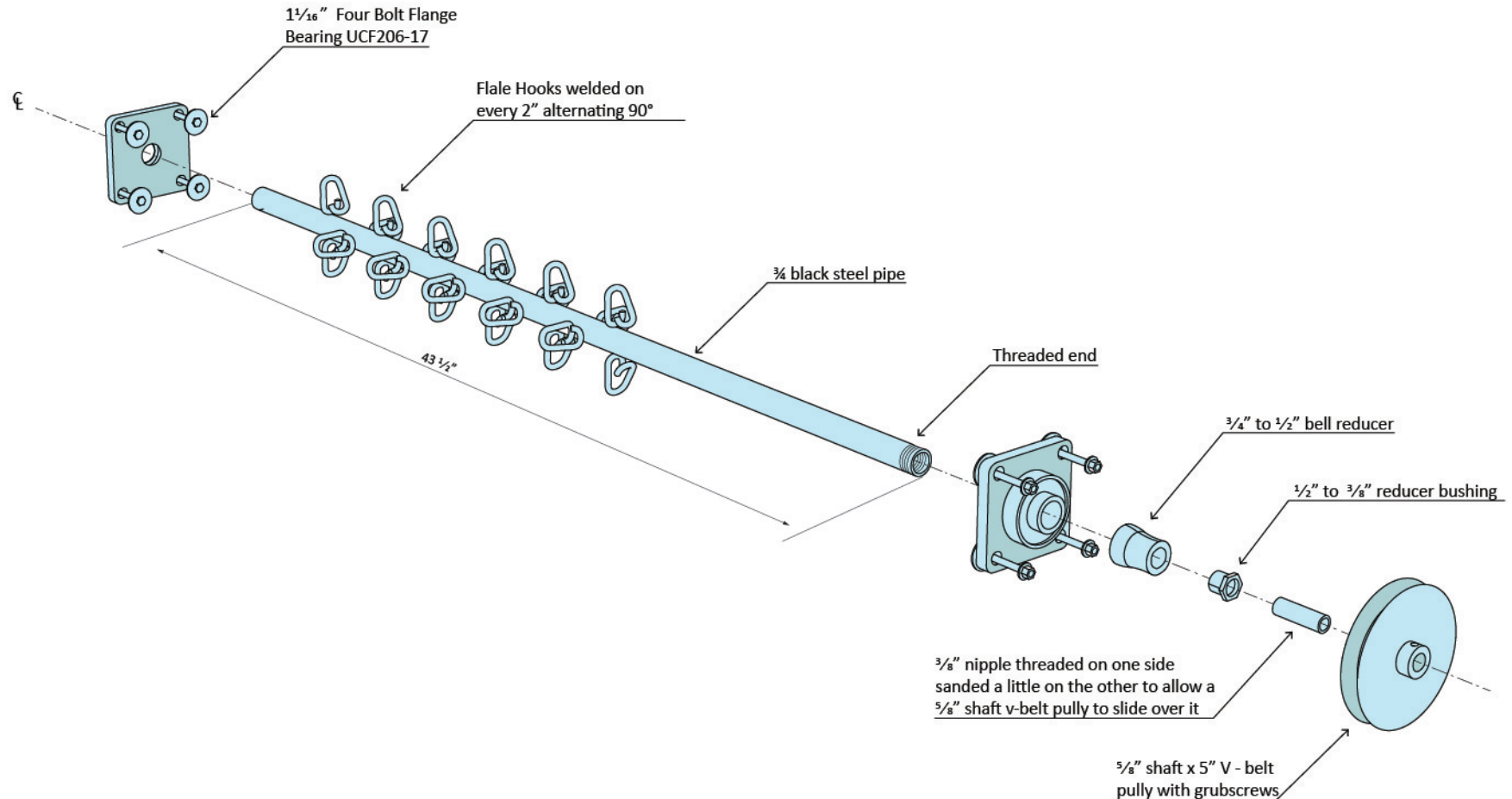
The shaft for the thresher is just a piece of  $\frac{3}{4}$ " schedule 40 black steel pipe. Select a piece that looks straight to the eye. The small imperfections in the straightness of the shaft will cause the whole thresher to shake and wobble a little, which helps the thresher work properly.

Bore the holes for the shaft in the end plates. With the thresher assembled and standing upright, the hole on the drive-side is made at a  $45^\circ$  angle to the end plate by holding the drill horizontal. Then cut the shaft to length. Since the shaft must be installed after it is made, it will need a mark where the first flail hook is welded to the shaft. The mark should be the farthest point on the shaft toward the drive side that still allows the shaft to be installed ("zig zagged" into place) in the thresher drum. The mark can be found by simply installing and uninstalling the shaft a couple times, and marking the point with a sharpie. The goal is to populate as

much of the shaft as possible with flail hooks, so that the entire interior volume of the thresher drum is visited by a swipple. The area of the shaft that is left bare of flail hooks is over the angled endplate of the thresher drum. Grain heads in that area tend to fall down the incline into the path of the first set of flails.

Once the shaft is marked for flail hooks, the flail hooks can all be welded to the shaft. The flail hooks should be welded so as to minimize heat distortion (tacked and then back-step welded). The shaft with the flail hooks is installed, and then the bearings are slid over the pipe and bolted to the thresher drum.  $1\frac{1}{4}$ " fender washers are used against the wood. The shaft end might have to be sanded a little to get the bearing to slide over it.

Finally, the bell reducer, bushing, and nipple are threaded on tightly. The nipple may need to be filed a little for the v-belt pulley to slide on to it.



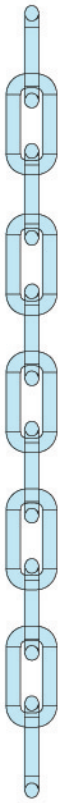
STEP  
8

# SWIPPLES



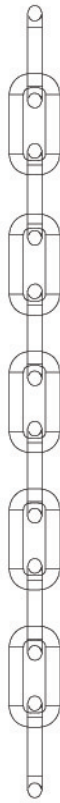
A swipple is the part of the flail that strikes the grain head or seed pod and knocks the seeds out of it. The Thresher is designed so the swipples can be easily changed. A very simple and inexpensive swipple can be made from a piece of wood and a length of wire. Or, a piece of chain, plastic chain, or wire can be used. The swipples mount on the flail hooks which are welded to the shaft. Below are the swipples we have tested and the crop they worked best on:

Deciding which swipples to use is easy. If the thresher fails to completely remove the seeds from the grain heads or pods, select a harder, heavier swipple. If the thresher breaks the seeds, select a softer, lighter swipple. If the grain heads are being fed continuously in to the thresher, the swipples can vary along the length of the thresher, beginning with lighter swipples at the entrance end and using heavier swipples at the exit end.



**METAL CHAIN:**

Worked OK on harder beans and rye but not as well



**PLASTIC CHAIN:**

Worked well on larger beans that weren't as dry



**STAINLESS STEEL BICYCLE SPOKES (14G)**

Worked well on dry black beans



**HARDWOOD WITH WIRE LOOP:**

Worked great on rye, wheat, rice, and lupine.

STEP  
9

## BIKE UNIT



Virtually any exercycle made with bicycle parts can be used to power the Thresher. Preferable is an exercycle with a large gear ratio (4:1 or larger), and a “fixed gear” (which means you can pedal backwards as well as forwards). A freewheel can be converted to a fixed gear by welding the freewheel shut or by removing the freewheel and installing a fixed cog and lock ring. A flywheel is optional. Some exercycles may need structural reinforcement.

The Thresher uses a v-belt transmission from the exercycle to the thresher shaft. The v-belt will slip if the shaft jams, and this is safer for both the machine and the operator. The v-belt pulleys can be purchased or made from wood.

First, remove the flywheel from the exercycle. On the non-drive side of the flywheel (or wheel) hub mount a ~4” v-belt pulley. The center bore on the pulley has to be large enough to clear the bearing race covers on the

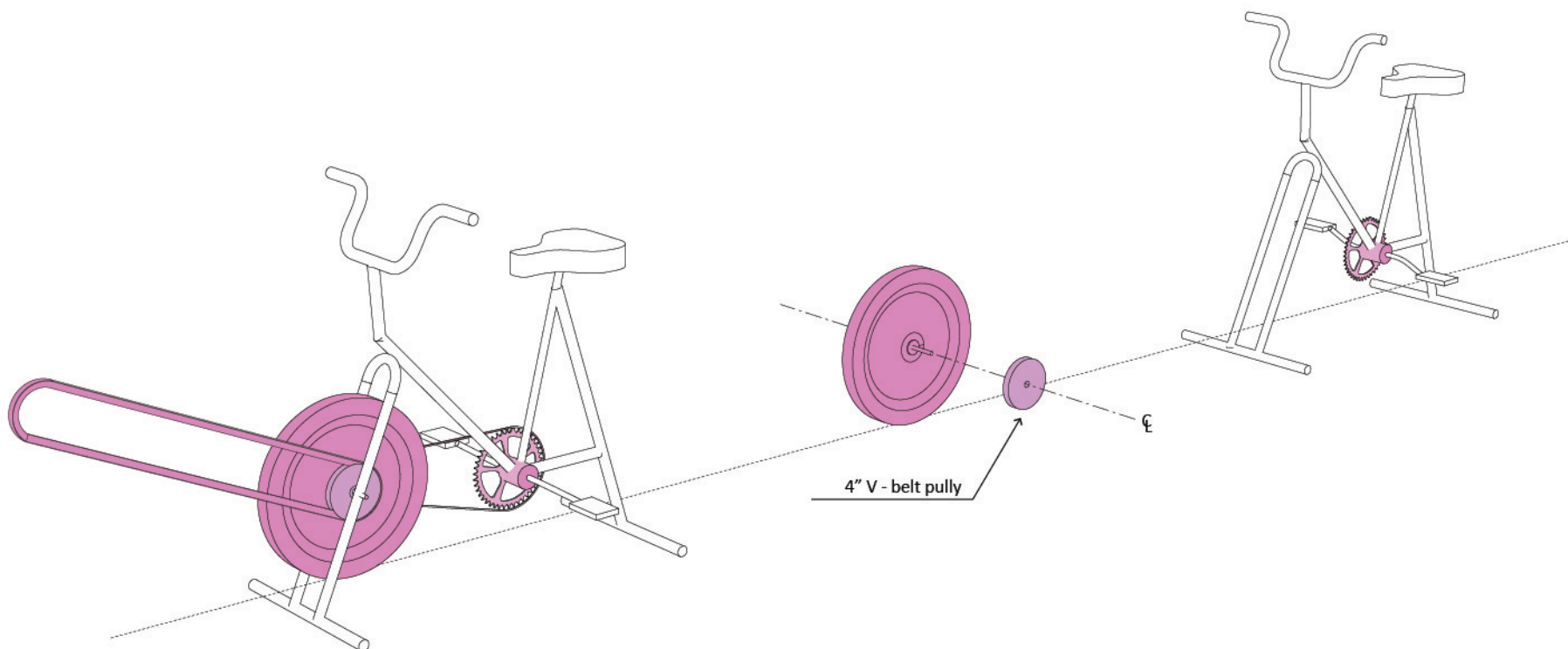
exercycle's hub. If you use a metal v-belt pulley it will either need to be intended for a very large shaft (~1.5”), or you will need to modify the hole in the one you have. If the pulley is made from wood then drilling out the center to the correct inside diameter is easy.

The next challenge is locating, drilling, and tapping holes in the exercycle hub that allow you to mount the v-belt pulley precisely centered on the axle of the flywheel or hub. A compass divider helps.

For ease of future maintenance, the bottom bracket of the exercycle can be outfitted with a zerk fitting. Add structural elements to the exercycle if it needs it.

Drill quarter inch holes in the legs of the exercycle so that it can be screwed to the wood frame of the Thresher.

Reassemble the exercycle and mount it to the Thresher with the v-belt tensioned and aligned. Then screw down the legs of the exercycle.





**Questions + Comments + Donations -**  
Contact Lu Yoder - [bravelittleship@gmail.com](mailto:bravelittleship@gmail.com)

This project was supported in part by the Northeast Sustainable Agriculture Research and Education (SARE) program ([www.nesare.org](http://www.nesare.org)). SARE is a program of the National Institute of Food and Agriculture, U.S. Department of Agriculture.