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Tool Tip...

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The Ultimate Star Roller

by ***Kyle Kepley***

Figure 1: The Passfire Star Roller, also known as the "NASCAR Roller"

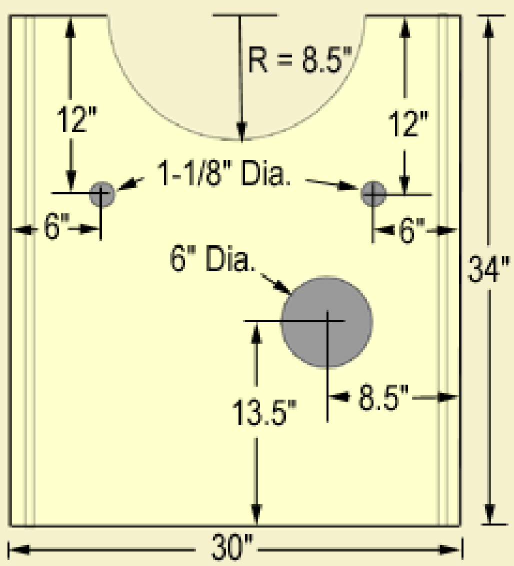
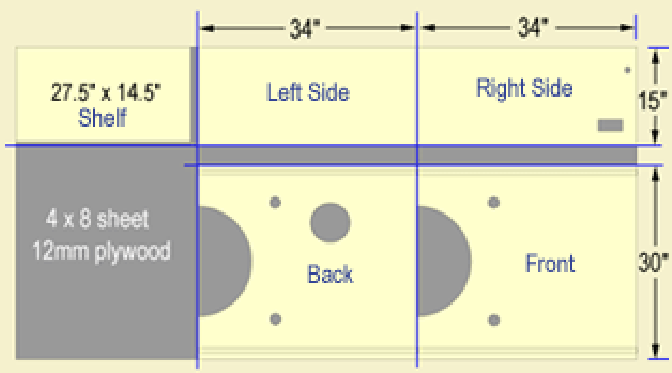


Figure 2: Measurements for front and back panel.

Materials:

- (1) 4'x8' sheet 12mm plywood
- (4) 18" long x 1.5" square pine
- (1) 15-1/2" long 5/8" steel rod
- (1) 17" long 5/8" steel rod
- (4) 5/8" ball bearings (stamped)
- (4) 5/8" shaft collars
- (2) 11" segment 5/8" I.D. heater hose
- (1) 6" v-belt pulley (5/8" I.D.)
- (1) 3" v-belt pulley (1/2" I.D.)
- (1) V-belt 4L-300
- (4) 1-1/2" long 1/4" bolts
- (4) 1/4" wing nuts
- (32) 1-1/4" long #8 wood screws
- (2) 3" gate hinges
- (4) 1" swivel casters
- (1) Switch box w/switch and cover plate
- (1) grounded extension cord
- (1) 1/6 HP 1725 RPM AC motor
- (1) roughly 26" diameter x 10" wide car tire



Introduction:

I recently took this star roller on "tour" this month and, as all agreed who saw it in action, rolling stars in a tire is the future of star rolling. As explained in this months star roller design article, a typical car tire provides a rolling geometry that makes the job considerably easier than a conventional bucket type roller. The surface texture inside a tire provides excellent traction to eliminate slippage that would otherwise be a problem with such a large diameter roller, and also helps circulate stars from the bottom of the pile to reduce the size consistency problem that plagues star rolling. Star clumping is also reduced in the early stages of rolling, and problems

Figure 3: Starting with a basic box.

Figure 4: Using a home-made compass to mark the circular cutouts.

Figure 5: Holding box together with clamps while fitting-out internal components.

with composition sticking to the tire wall is surprisingly minimal. During use there is no need to apply composition to certain areas among the stars, mix up the stars by hand, wet the container wall or any of the other tricks of the trade required to coax good size consistency out of a bucket type roller. The reduced technique not only makes star rolling easier to learn for a beginner, it also speeds up the process as well!

Other than the concept of rolling stars in a tire, there is nothing all that special about the design shown here. It is simply a box with two rollers, similar to what a large ball mill might look like. You may be tempted to shorten the box walls around the tire to save wood and expand the range of tire sizes the box can accommodate. There are two potential problems with doing this: the taller box walls insure that the tire can never topple off the rollers if it ever gets bumped or becomes unbalanced during use. The taller box walls also allow the standoff-casters to be located higher up the tire wall and off to the sides as seen in Figure 13, keeping them away from the powder drop zone directly under the tire. Using short box walls would force you to place the caster as seen in Figure 14, which would be subjected to falling powder. This would not only clog up the bearings, but also subject the powder to a friction point between the caster and the tire wall, resulting in a possible ignition hazard.

One important thing to remember if altering this design is that the tire will drop more composition than a bucket type roller, due to having two open sides instead of one. Thus the motor must be completely insulated from falling powder, and something needs to be placed under the roller to catch the spilled dust.

Building the Roller:
Due to the escalating cost of good 3/4" sanded plywood, I have opted to use a thinner multi-ply "Guatambu" hardwood that can now be found in most lumber yards. This imported wood comes in various metric thicknesses, and is very smooth and defect free. The 12mm board used here is about 7/16 inches thick, which is a little on the thin side for a machine cabinet but will work due to the reinforced corners used here.

The easiest way to cut the sheet into the pieces shown above is to use a panel saw. Since most people don't have one of these at home, you can have the lumberyard cut it up for you (even Home Depot will do this). First cross-cut the two 34" wide pieces, then rip a 30" and 15" piece from each of the 34" panels. The remaining scrap will be used for the shelf, but it is better to measure and cut this piece after the cabinet has been assembled just in case

Figure 6: Idler roller installed. Note the caster to prevent the tire from contacting the cabinet.

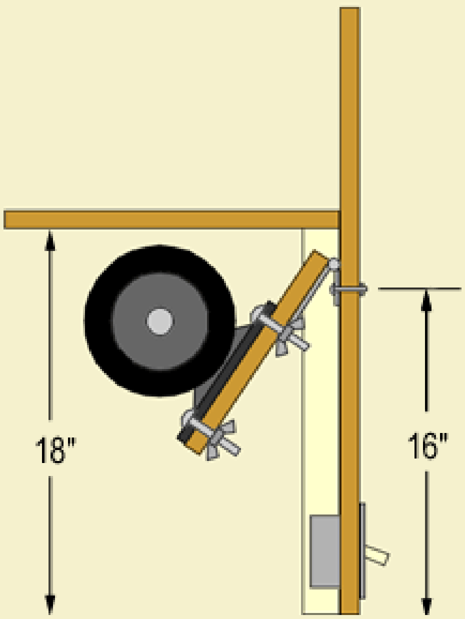


Figure 7: Details of right panel hardware.

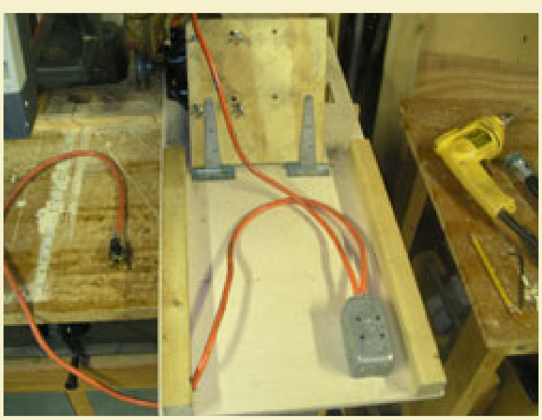


Figure 8: Motor and switch wiring.

your dimensions are slightly different. The shelf needs to have a good fit so that powder can not leak around the edges.

Figure 2 shows the layout of the front and back panels, which are identical with the exception of the 6" diameter motor access hole in the rear panel. This cabinet uses dado joints, which is a type of joint where one piece of wood fits half way into an adjoining piece. This requires a channel to be cut half way through the inside faces of the front and back panels, located 3/4" from the left and right edges and running the full height of the panel. The width of this channel is just a hair wider than the plywood thickness so that the side panels can slide into it and lock in place. A router or dado blade can be used to do this, but if you don't have the tools then you can probably get away with just butting the pieces up against each other and using the corner blocks shown in Figure 13 to hold them together.

If you decide not to use dado joints on the box, you will need to either subtract 1/2" off the side panel width or add 1/2" to the length of both steel roller bars. It would also be a good idea to fasten a 3/4" square strip of pine along both inside edges of the front and back panels, which will help you align the pieces when assembling the box.

Figure 3 shows the box pieces locked together for a trial fit. No glue is used to fasten the pieces together, since you will occasionally have to disassemble at least one panel to service the rollers and motor. Only four #8 wood screws are used on each edge of the front and back to hold the panels together.

Figure 4 shows a make-shift compass used to mark the semi-circle cutouts, which consists of a piece of wood with a hole that holds a pencil. A small nail hammered through the pivot point is held against the edge of the board as the line is drawn. This is easier to do before the panels are assembled and Figure 4 is just for illustration. A jig saw is required to cut out the half circles.

The 5/8" bearings used in this project will fit snugly into a 1-1/8" hole. Stamped bearings are not only cheaper than other types of ball bearings, but the metal flange around the rim of the bearing is ideal for holding the bearing in place. The bearings will be inserted from the inside of the panels and locking collars on the roller shaft will butt up against the bearing and hold the whole assembly in place (see Figure 12). Thus all you need to do is drill two 1-1/8" holes in the front and back panel, as marked in Figure 2. The 6" motor access hole should not be cut until after the internal parts are fitted out so that you

Figure 9: Closeup of junction box wiring.

will be able to know exactly where to center it. The placement shown in Figure 2 will only be right if you use the exact same motor and belt size as I used, which is unlikely.

Once the front and back panels are cut and finished, stand them up and fasten them to the left side panel and right side panels, using bar clamps to hold them together while you drill and drive the screws as seen in Figure 5. Next you will square up the box and attach the 1.5" square corner braces into each corner, securing them with screws running through the panel and into the braces on both sides.

Next you will need to remove the right side panel so that you can install the motor and switch hardware. Remove the screws that hold the corner braces to the front and back panel so that they will remain attached to the side panel when you remove it. The motor and switch hardware are now mounted to the inside of the right panel as seen in Figures 7 and 8. The switch is mounted low to the ground so that it can be operated by your foot.

Begin by drilling a 1/2" hole in the lower left corner as seen in Figure 7. Feed your extension cord through this hole first, then wire it to the switch box as seen in Figure 9. Cut a 1-3/8" x 2-5/8" square hole in the lower right corner to accommodate the switch. Your switch box will have mounting holes that are probably about 3-1/2" on centers, so you will need to drill holes below and above your square cutout for the mounting screws to pass through from the outside.

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Figure 10: Closeup of motor mounted on hinge plate.

A segment of the extention cord is cut off prior to wiring up the switch, which will run from the switchbox to the motor. The motor used here can be wired to allow both clockwise and counterclockwise rotation. For right handed people, a star roller should rotate in a clockwise direction, which means the motor should also be wired for a clockwise rotation in this case. A clockwise rotation puts the star pile on the left side of the roller, making it easier to spray with your right hand. Left handed people will want a counter clockwise rotation instead.

The motor for this project is a 1/6 HP AC surplus motor running at 1725 RPMs. This motor, which was purchased at www.meci.com, has a nice mounting bracket on the bottom for attaching it to the hinge plate. The hinge plate is a 9-3/4" long x 9" wide piece of plywood with four holes dilled to match the motor mount plate. Four 1/4" bolts with wing nuts are used to fasten the motor to this plate. Two gate hinges are used to attach the motor assembly to the panel wall, as seen in Figure 10. Note that the motor is installed as far to the left edge of the panel as possible without it rubbing against the back panel when installed. The motor shaft needs to extend far enough out the back of the box for you to get a pulley wheel on it.

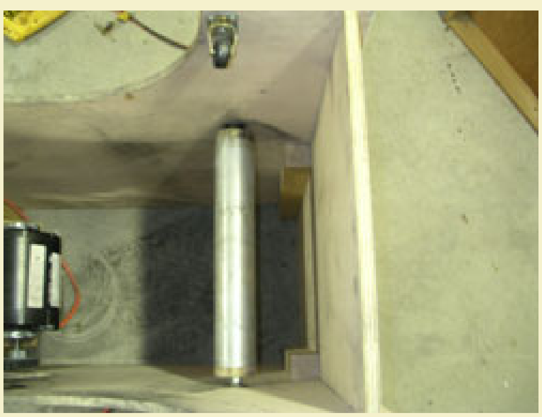

Figure 11: Shelf supports fastend into corners.

The panel is now fitted in place so that you can figure out where to cut your access hole in the rear panel. Attach the front panel first, leaving the rear panel unattached. You will need to insert the drive shaft into the front panel and hold up the pulley end so that you can hang the motor from it and see where the center point of the motor shaft will be on the rear panel. The location doesn't have to be exact, since the 6" diameter hole leaves some room for error.

Once you know where your motor shaft will need to exit the rear panel, detach the rear panel and cut the 6" access hole at the point you marked. The rear panel is then re-attached and all screws holding the edges and corner braces of all panels are now firmly secured.

At this point you are ready to fit out the inner shelf board. Figures 12 and 13 shows this board installed. The inside dimensions of the box are now measured and a piece of leftover plywood is cut to exactly fit this hole. The shelf can be dropped in place without any need to fasten it to the corner supports, or you can drive a screw into each corner to hold it down.

The idler roller shown in the pictures here is actually a leftover from the Maltese shell roller project and not necessary. This kind of roller

Figure 12: Drive shaft ready for installation after shelf is dropped in place.

is actually more difficult to work with because you can not install it after the box is closed up. It must be installed at the same time the box is being closed, while the drive shaft type rollers can be installed or removed without having to open the walls.

Both the idler roller and the drive roller are constructed from 5/8" steel rods with 11" segments of rubber heater hose slipped over them. It is important not to make the heater hose segments longer than this or you may not be able to install the rollers without opening the box. The trick to pushing the tight-fitting heater hose down onto the middle of the roller bars is to use a tube that just fits over the shaft but does not fit over the heater hose. The hose is pressed onto the shaft by hand until it is flush with the edge, then the pipe is placed over the end and a mallet is used to drive it the rest of the way onto the shaft. An alternate method is to drill a 3/4" hole in a piece of wood, place the shaft on end with the heater hose side down, then hammer the shaft down through the hole until the hose is in the right place.

Figure 13: Shelf and rollers installed. Note the swivel casters on each side of the cutout.

Install each roller as follows: Take the roller shaft and slip a shaft collar on each end, followed by a bearing. The flange end of the bearings should be facing each other, as seen in Figure 12. The collar on one end is locked down so that it holds the bearing at the end of the shaft. The bearing and collar are left loose on the other end, and this end is slipped into the mounting hole from inside the box. There should be enough room to slide the other end of the shaft into the hole on the opposite side. The loose bearing is now slid down the shaft and pressed into its hole, then held in place by tightening down the remaining shaft collar.

Because a tire has the ability to travel back and forth on the rollers, you will need to put swivel casters on the inside wall of both ends. These casters will provide a low-friction stand-off to keep the tire from rubbing the front edge. For reasons already discussed, do not be tempted to use a single caster as seen in Figure 14 as an alternative to the caster arrangement shown in Figure 13.

Figure 14: A single central caster is tempting but should be avoided as a potential hazard.

The roller box is finished out by adding the pulleys to the drive shaft and motor as seen in Figure 15. The pulleys shown here are a 6" and a 3", but any combination that results in a 2:1 ratio can be used. In fact, a 4" and a 2" would be more desirable, since it would be cheaper and also gives more space between the pulleys to allow larger diameter motor pulleys to be used when dropping the RPMs for larger stars. For example, you could cut the rolling speed in half by using a 4" pulley on both shafts, while two 6" pulleys would not be possible with the dimensions shown. Smaller pulleys also result in less position change in the hanging motor when changing speeds, allowing the motor to stay in the cutout hole area without having to change belt sizes when pulley sizes change.

While this cabinet was designed specifically for a Goodyear Eagle GT tire that is about 26" Diameter and 10" wide (P255/60R15), it will work with any type of tire that is right around this size. One drawback to partially closing in the tire with the cabinet is that you can't use a bigger tire than this, but you can certainly use smaller tires. If you plan to use smaller tires, you may need to build your rollers closer together or drop the shelf height to keep the smaller tires from

Figure 15: External pulleys linked up.

Figure 16: Home-made milk jug scoop for removing finished stars.

Figure 17: High volume and star uniformity achieved with the tire roller.

coming into contact with the dust collection shelf. It is best to obtain the tire or range of tires you want to use first, then alter this design to work with your tires.

A trip to your local city dump should allow you to choose from a very large range of tires to use for your roller. I prefer a tire with a deep, rounded inner volume for holding lots of stars. The inner surface should have small ridges, but avoid too aggressive or pitted of a surface and look out for defects as well. The nice thing is that your roller drum is free, so if it doesn't work out then pitch it and try another one. You can also keep one tire for chlorates and a separate tire for non chlorate mixes.

Usage Notes:

This roller is about as easy as it gets for making round stars. The size shown here can take a cup of cores and turn it into 15 lbs of stars within about 20 minutes, with a minimal amount of screening and futzing with the stars as they roll. The tire rotates at 30 RPM, which is pretty fast for a star roller of this size (larger size rolling containers usually need lower RPMs). The high speed combined with the ribbed surface texture help keep stars moving and separated when starting from small cores.

One advantage to the hollow center of the rolling container is that you can force a draft through the container such that all airborne dust is carried out away from the operator. A properly placed fan can virtually eliminate the need for a dust mask when using this roller.

The only disadvantage of a tire roller is the excess powder leakage that can happen due to powder being carried up the tire wall and released from the top, where it drifts down and often falls out along the sides of the tire. This can be minimized by not adding too much powder at once between wetting the stars. Even so, it is a good idea to line the shelf under the roller with paper so that the dust that does collect there can be easily removed.

One question you might have had up to this point is "how do I remove the stars when they're done?" The simple answer to this problem is the large scoop made from a one gallon milk jug seen in Figure 17. With the roller running, simply insert the scoop and let the stars roll into it. Even a large batch of stars can be cleared out in only 3 or 4 scoop fulls.

Cleaning the roller is equally easy: simply yank out the tire, roll it over to your garden hose and spray it down. No bolts to unscrew and no water to bail out of a stationary container. Just spray the inside as you roll it across your yard, rock the water out of it (a rather tricky skill at first), towel dry the inside and slap it back on its cradle for the next batch!

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