Instructions for Building a

Parallel Axle Derby Pumpkin Racer

Building a Pumpkin Derby racer may seem like a difficult task, but it really is fairly easy. The goal is to put two axles through a relatively small pumpkin and attach wheels. For the Great Pumpkin Festival's Pumpkin Derby Race, there are a few rules to follow in order to ensure that your racer is not disqualified:

i. The ***total weight*** of the pumpkin racer (including axles, wheels, decorations, etc.) *cannot exceed twenty pounds.* ***There will be a weigh-in the morning of the race.***

ii. The pumpkin racer must have ***at least two axles.***

iii. Using a solid base with affixed wheels is *NOT permitted.* (This means no skateboards, roller skates, Tonka trucks, etc.) The axles on which the wheels are affixed must penetrate the pumpkin and support it.

iv. If desired, the pumpkin may be hollowed out to reduce its weight, but the pumpkin shape must remain. (*No, you cannot cut the pumpkin in half.)*

The challenge is to build the fastest racing pumpkin with two or more independent axles. Here's a little tip…In order for your Derby pumpkin to go straight down the track, *the axles MUST be perfectly parallel!*

For the race, you will simply place your pumpkin racer in the starting block and let it fly!

LIST OF POSSIBLE MATERIALS

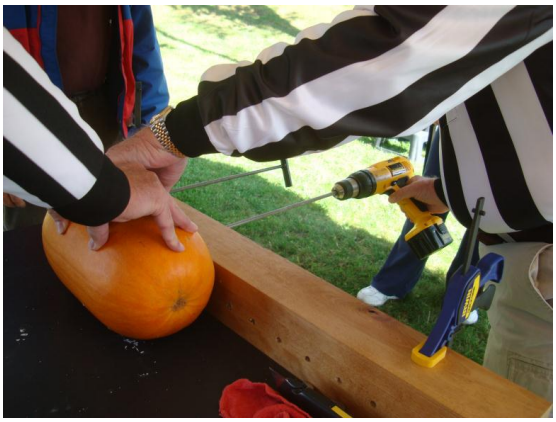
In these instructions, five (5) inch rubber wheels with a 5/16" axle opening are used; however, you may use any size wheel that will fit your racer. (Roller blade wheels, lawnmower wheels, etc.)

Below is a list of recommended materials to help build your pumpkin racer. This list assumes that 5" wheels and/or axles with 5/16" diameter axles are used. If other axle diameters are used, associated hardware must be adjusted accordingly.

- 1 Medium pumpkin (14-18 lbs)
- 2 Eighteen inch long pieces of 5/16" threaded rod
- 4 Five inch rubber wheels
- 20 Hex nuts 5/16"
- 8 Flat washers 5/16"
- 4 Fender washers 5/16"
- 4 Acorn nuts 5/16"
- 2 Wrenches ½"

INSTRUCTIONS

Step 1—Punching Axle Holes



To drill parallel holes for the axles, place the pumpkin next to a sturdy jig. Hold the pumpkin firmly in place and punch the first axle hole by pushing in a steel rod or by drilling with a long 5/16" bit. Insert a 5/16" rod through the jig into the pumpkin to stabilize it while drilling the second hole. Repeat the punching/drilling process.

TIP: It is easier to decorate your pumpkin ***AFTER* installing the wheels. When you decorate, make sure the wheels stay clear of all hanging or dangling decorations to ensure they won't get tangled up in the wheels during the race.

Step 2---Inserting the Axles

Carefully feed the axles through the path you've created with the axle punch jig. If the threaded rod gets stuck, poke the steel rod through again to clear the path.

You need to be careful with the threaded rod. The threads can easily bend, thus making it impossible to get a hex nut to go on smoothly. Don't hammer the threaded rod through the pumpkin or knock it on the ground to help feed it through. If you absolutely have to give the rods a tap, first screw an acorn nut on the end.

Step 3---Centering the Pumpkin

After a few trips down the racetrack, your pumpkin may slip on the axle and become off-center. This might happen during a crash, either with another pumpkin racer or the curb.

To avoid this issue, on each axle, thread one fender snug up against the pumpkin with a hex nut anchoring the washer in place on the axle, as shown in the photo.

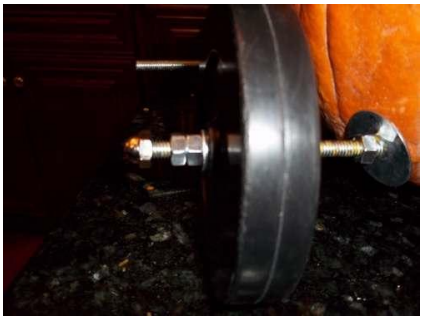
HELPFUL TIP: **After repeated use, axles may bend or warp, especially if your racer has crashed. Do a check of the axles before each race to make sure they are straight.**

Step 4---Attaching the wheels

The nuts and washers should be put on the threaded rod in the following order:

-Hex Nuts (2)
-Flat washer (1)
-Wheel (1)
-Flat Washer (1)
-Hex Nuts (2)
-Acorn Nut (1)

Make sure the acorn nut has enough room to be fully screwed onto the threaded rod. See the sequence of washers, wheels and nuts depicted in the photo.

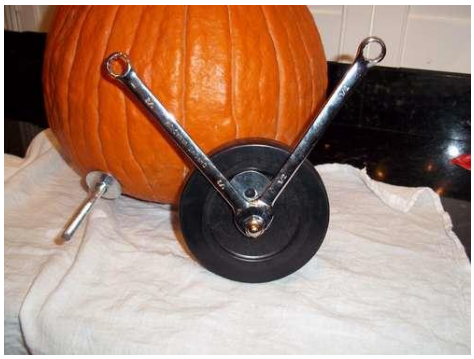


****The purpose of the acorn nut is simply to protect you from scratches or cuts from the threaded rod. A small piece of duct tape or something similar will do the trick at less expense.**

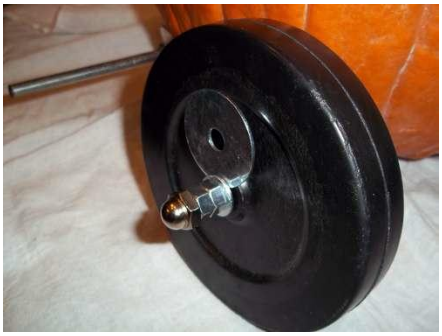
Repeat this step for the remaining three wheels.

Once all the pieces have been put onto the threaded rod, it is time to secure the hex nuts. You will need to create a LOCK NUT. If you skip this part, the hex nuts will continue to rotate on the threaded rod as your pumpkin goes down the track, causing your wheels to lock up. When that happens, your Derby Racer won't move, and you may lose.

Step 5---Securing the Lock Nuts



To create the LOCK NUT, simply rotate two hex nuts onto each other. For this step, you will use the two ½ inch wrenches. You will have EIGHT points on the four axles where you will need to make LOCK NUTS; one on each side of each wheel.



Place one wrench over one hex nut and the other wrench over the second hex nut. Rotate one hex nut to the right and the other to the left. This will give you a tight joint that you will not be able to move by hand.

It is important that after the lock nuts are tightened there is enough room for the wheels to rotate freely, but not so much that they wobble. To avoid this problem, insert a fender washer between the wheel and lock nut as

shown in the photo. Then rotate the two hex nuts back onto the flat washer and make the LOCK NUT joint. When you pull out the fender washer, you will have just enough room for the wheels to spin unobstructed without wobbling.

Step 6---Test Run and Troubleshooting

Make sure to test run your Derby racer to see what adjustments you may need to make. A sloped driveway is a great place to practice. The following are common problems:

- **Derby Racer Rubs on the Ground:**
  - **If the pumpkin hangs too low and is rubbing on the ground, shave off some of the pumpkin or any low-hanging decorations. Bumps and imperfections in the roadway may also cause a pumpkin to hit the ground as it races, so make sure you have good clearance.**
- **Derby Racer Runs Slow or Does Not Move:**
  - **Check to make sure all wheels are spinning freely and not wobbling.**
- **Derby Racer Veers Off-Course:**
  - **Your racer may tend to veer either left or right. For a racer that veers off-course, determine the following:**
    - **Are all wheels spinning freely?**
      - **Check to make sure that all wheels are spinning freely and equally. If a left side wheel is stuck, the rotation of the right side wheels will cause the pumpkin to sharply veer to the left.**
    - **Is the pumpkin centered on the axles?**
      - **If your pumpkin appears to be heavier on one side, you may need to adjust its placement on the axles, or hollow out the heavier side of the pumpkin.**
    - **Are the axles really parallel?**
      - **The most likely cause of veering is that your axles are not parallel. If your axles are off even slightly, your racer may not go straight. (*In Step 7, CUSTOM ADJUSTMENTS, below, there are ideas for getting your axles parallel, but when it comes to this problem,***

don't underestimate the value of a strategically placed piece of duct tape to pull your axles in slightly or to push them slightly out.)

Step 7---Custom Adjustments and Specialty Hardware

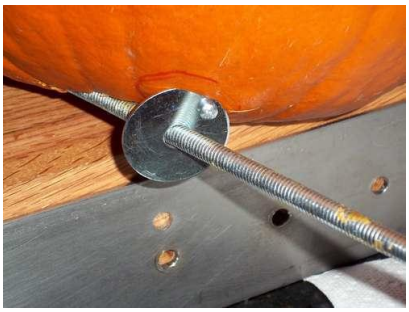
To keep the axles parallel, you might want to install an OUTBOARD STABILIZER BAR on each side of the racer. The bars can be made from two identical pieces of wood. The length of the bars should be 2" longer than the distance between your axles. That dimension must be identical for both sides of the pumpkin. Stack and clamp one bar on top of the other and drill two 5/16" holes through the sides of both bars at a distance corresponding to the distance between the axles. Insert the axles through the holes and affix a lock nut between the bar and the pumpkin. Then attach the wheels outside the stabilizer bar as described in steps 4 & 5 above.

Note the outboard stabilizer bar attached to the axle.

If you don't have the right size wood available at home, there are several other techniques you can use that are described below:

- **An item called a FREE-SPINNING WASHERED NUT can be handy. This little item has the washer pre-attached to the nut. The washer is free-spinning. This particular nut may save you from some of these problems. Try it out and see how it works.**
- **Another favorite is called the TEE NUTS PRONGED. This little nut has teeth to it and could be used to help stabilize an axle or keep an axle in parallel. Once you find the perfect position, just jam it into the pumpkin.**

- **There is also a nut called a MILLED EDGE COUPLING NUT. It's like a wedge.**
- **You could use washers with holes in them; however, it would be easy to create this for less money by simply drilling a hole through a fender washer. You can also use a screw through one of the holes to bring an axle into parallel.**
- **A hole drilled through a fender washer can accomplish the same thing. First, secure the front axle with the custom fender washer. Then, measure the pumpkin on both sides to achieve truly parallel axles. If measurements are not the same, adjust the front or back axle by pulling it forward until the distances on both sides are the same. When parallel, secure the fender washer. The picture to the right shows how this is done.**



FINAL THOUGHTS

Remember, you're working with a pumpkin—a product of nature that will not be perfect in terms of weight distribution or dimensions. Despite your best efforts, it may not go straight. Yes, it can be challenging to get the axles on parallel, and it is precisely that fact that makes the race fun. On race day, pumpkins will zig and zag down the track. Some may end up on the grass. Some will zoom through the finish line leaving everyone else in the dust. Some may never get off the starting line. But for everyone, the Pumpkin Derby is a unique event and one not to be missed!