If you have a metal lathe, making your own wheelsets from steel is a straightforward and satisfying job.

Turn your own WHEELSETS

A good introduction to lathe work

by Mike Lafond | Woodstock, Ontario | PHOTOS AND ILLUSTRATION BY THE AUTHOR

Back in the days when we fixed things instead of throwing them out, there was a time when having a lathe in the basement was a common thing. The ability to machine parts from a solid bar has been lost to the general public and, as a consequence, our children are not even aware that such a thing is possible. Anyone can buy wheels, so why machine your own? It's for the same reason I made a career of being a machinist. It's fun and you get the pride of knowing you made those wheels to an exact size.

If you don't have a lathe or know the first thing about machining, many larger towns have Maker clubs. There is usually a monthly membership fee and people are there who can help you get started. If you're not put off by self learning, there are small hobby lathes available for as little as $400 USD. You can buy a school-sized lathe for $2,500.

This article is aimed at those who already have a lathe, or access to one, and have a working knowledge of how to use it. For the rest of you, there are many websites and online resources where, if you found this interesting, you will have no trouble finding what you need.

Getting started

The wheels described here are 26" wheels to replace the plastic wheels on my Bachmann freight cars (**figure 1**). To start, you will need 1½" cold-rolled steel (CRS) bar stock. This can be purchased in whatever length you need from Metal Supermarket (*www.metalsupermarkets.com*) or a similar company. Most industrial suppliers will not sell less than 12' lengths. CRS is more expensive than hot-rolled steel but it has a much better surface on the bar and is more cylindrical then HRS.

Let's talk safety. The amount of the material held in the chuck should be no less then the diameter of the work piece, no more than about 1.25 times the diameter sticking out of the chuck unsupported (**photo 1**). There can be much more sticking out of the chuck if the end of the piece is center drilled and the tailstock center is pushed into it or you have a steady rest positioned near the end. Cut a piece of material to the length that will meet the above parameters.

Set the speed of the lathe and the feed rate at which the carriage will move. See the sidebar for a discussion of RPM. Set the cutter to the center height of the work

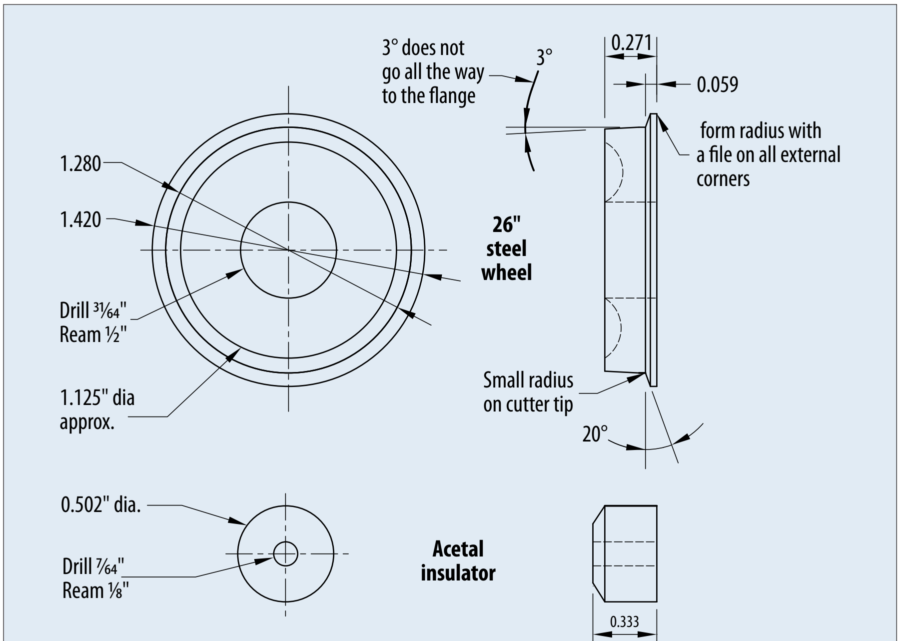
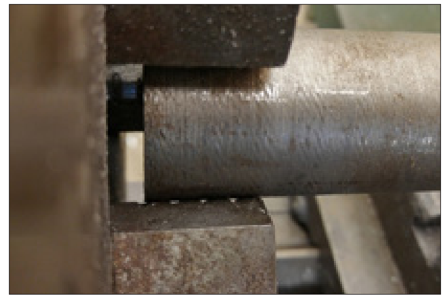


Figure 1—26" steel with with acetal insulator



1. This photo illustrates what *not* to do—the piece is not gripped properly. No matter how tight you make the chuck, if you take too heavy a cut with your piece like this, it is going to go flying.

2. The compound rest is turned 20° to the vertical. Note how close the carriage is to the chuck jaws. Always check for clearance when working close to the chuck.

3. The round-end cutter has been ground for this job from 5/16" high-speed steel. Tools are cheap and you can regrind them again and again when they wear. Push the cutter into the face of the part until you are happy with the look.

4. When you reverse the wheel to end-face the saw cut, it is important that the wheel spins true before cutting. Close the chuck on the wheel, back it off a little, then push with two fingers while gently tightening the chuck. Turn on the lathe and check that it is visually running true. Take a cut and measure in a couple of places. If you are within .002", it is good.

piece and the correct angle for end facing. End face the work until the end is smooth.

Depending on the angle ground into your cutter, you may have to change the angle of the tool for parallel turning. Turn the outside diameter to the flange diameter of 1.420". Then turn the tread. The tread diameter is 1.280"; its length is .212".

The tread and flange are not square and parallel. After the diameter and length have been achieved, loosen the compound-rest clamps and rotate the compound rest 3°, then cut the angle on the tread. Rotate the compound rest 20° from 90°, as shown in **photo 2**, and turn the flange angle.

The center hole

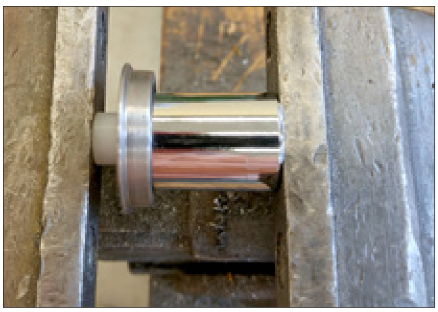
The hole in the middle of the wheel can be created for just an insulator, a roller bearing and an insulator, or just a straight-to-the-axle hole if you are running dead rail. I make my wheels with insulators because I like to take my rolling stock to other people's railroads.

Put a #5 center drill in a drill chuck, put the chuck in the tail stock, slide the tail stock up to the work piece, and clamp it down. Change the RPM, then center-drill the part. Slow the RPM down from the center-drilling speed to the rpm needed for the 31/64" drill. Drill about ⅜" deep. Change to a ½" reamer, slow the RPM down to about a quarter of the drilling speed, and ream the hole. Drills do not actually make round holes; they are usually egg shaped and larger than the size of the drill. A brand-new drill will be closer to round than one that has been reground, but the multiple cutting edges of a reamer will ensure the correct diameter and roundness of the hole.

The next step is decorative. Use a cutter that has been ground to a rounded shape as shown in **photo 3**. A quarter of the turning RPM should be about right. Push the cutter into the face of the wheel, leaving an outer rim and just touching the edge of the hole, as shown in the picture. My machine is old and worn, so the cutter vibrates when put under this much pressure; that's why the slow speed.

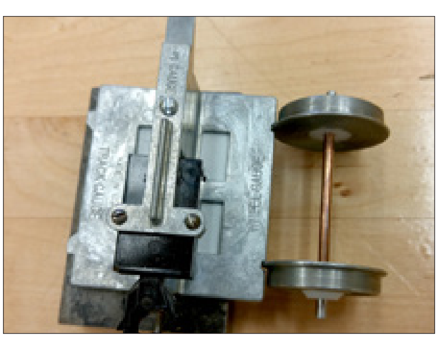
You are now ready to cut off the wheel. Here you have two choices. You can set up the lathe for parting and part the wheel off or you can take the piece out of the lathe and cut it off, preferably by using a power saw. Parting is a touchy operation. The cutter must be sharp, it must be exactly 90° to the work piece, the chuck must be *tight*, the spot where you are cutting must be as close to the chuck as you can get it, and you must keep it lubricated as you go *very* slowly—a quarter of the RPM used for turning. I find it faster and less stressful to cut the wheel off with a saw, then turn it around in the chuck and end face it. This requires you to gently tighten the chuck as you press the wheel against it (**photo 4**). Turn on the lathe and

5. The correct setup for parting when using this type of tool post. Set the compound slide parallel to the lathe axis. To get the .333" length, turn the compound-rest dial .458". This will account for the thickness of the cutting tool.



6. The socket seats nicely in the recessed area, pushing the wheel on squarely.

7. Line everything up as straight as you can and push the axle in. It will straighten itself. Once the wheelset is assembled, roll it on a table to check that it rolls straight. If not, the insulator is likely a little out of square. Press it back out and try again. If the insulator won't stay in on the second try, make another one.



8. A completed wheelset. The flanges should have a little play in the gauge. If one flange is tight to the right, the other flange should also be tight to the right.

Calculating RPM

THERE ARE THREE FACTORS that affect the RPM setting for operating your lathe. The first is the cutter material, the most common being high-speed steel (HSS) or carbide. For this article I am assuming the use of HSS. The second is the diameter of the work piece. The larger the piece, the slower it will turn or, in the case of drilling, the drill size determines the RPM. The third is the material being cut. The harder the material the slower you will go.

CS is cutting speed, given in surface feet per minute (SFM). The numbers in the following list indicate that many feet of diameter must past the cutter every minute for optimal cutting and productivity. If you are running slower than the calculated number, that's okay; it will just take you longer. However, increasing the speed will lead to burned work pieces and damaged cutters. Most older lathes have set, specific RPM selections and seldom will the calculated number fall right on one of your choices. It's always better to go slower.

The RPM formula is:

RPM = (4 x CS)/ diameter

Remember, brackets first, then divide.

Regular low-carbon steel	100 SFM
Brass	90 SFM
Tool steel	70 SFM
Aluminum	200 SFM
Most plastics	50 SFM

see if the wheel is running true. When it is, end-face it to a thickness of .271". Break all sharp edges with a file and you have a complete wheel.

The insulator

I use ½" acetal for the insulator. While it may look round and ½" in diameter, it's not. Put a piece in the chuck with about ⅝" sticking out. Set the speed to about 400 RPM. End-face the part. Color the surface with a black marker, then parallel turn a light cut of .005". You are aiming for a finished diameter about 0.502". This will give the acetal enough grip in the hole of the wheel to not come loose. Use a #2 center drill to start the hole, then drill with a 7/64" drill about ½" deep. Use a ⅛" reamer to finish the hole.

This piece is quick and easy to part off. Set up the parting tool and cut it off at a length of 0.333" (**photo 5**). Use a hobby blade to cut off the excess left when the piece breaks off. Shave around the cut-off end to clean off the burr created by parting.

The wheel and insulator are ready to be pressed together. The trick here is to ensure that the insulator is entering the hole as squarely as possible. I use an arbor press but you could press it together in a vise (**photo 6**). Use a ¾" socket to push the wheel onto the insulator.

Making the axle

The axle is the easiest part. I use ⅛" fusion-welding rod, but you could also use drill rod from any machine-tool supplier. With a hacksaw, cut the piece off longer than 2.75". End-face both ends and measure it to determine how much to remove to achieve 2.75", then end-face it to 2.75". Round the ends a little with a file.

Use a ⅜"- or 5/16"-deep socket on the insulator and press the axle into the hole (**photo 7**). Using the socket ensures that the pressure of inserting the axle is taken by the socket, not the hole in the wheel, which might cause the insulator to push out. Press on the second wheel. Use a flange gauge to set the wheel distance (**photo 8**) and use a caliper to check that the axle stubs are approximately the same length. Adjust as necessary by holding the axle with pliers and twisting, while pushing or pulling on the wheel. Clean the assembly with acetone, mask the bearing surfaces, prime, and paint. Install the wheelset in place of the old plastic wheels, and you're finished.

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