

# LocoGear

John D.L. Johnson  
9 River Oaks Drive  
Chico, CA 95973-1089  
jjohnson@LocoGear.com  
www.LocoGear.com  
Fax: (530) 898-6824

## Technical Bulletin - 01

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### Turning Instructions for Wheel Casting Lima Card Number 953-A-5014

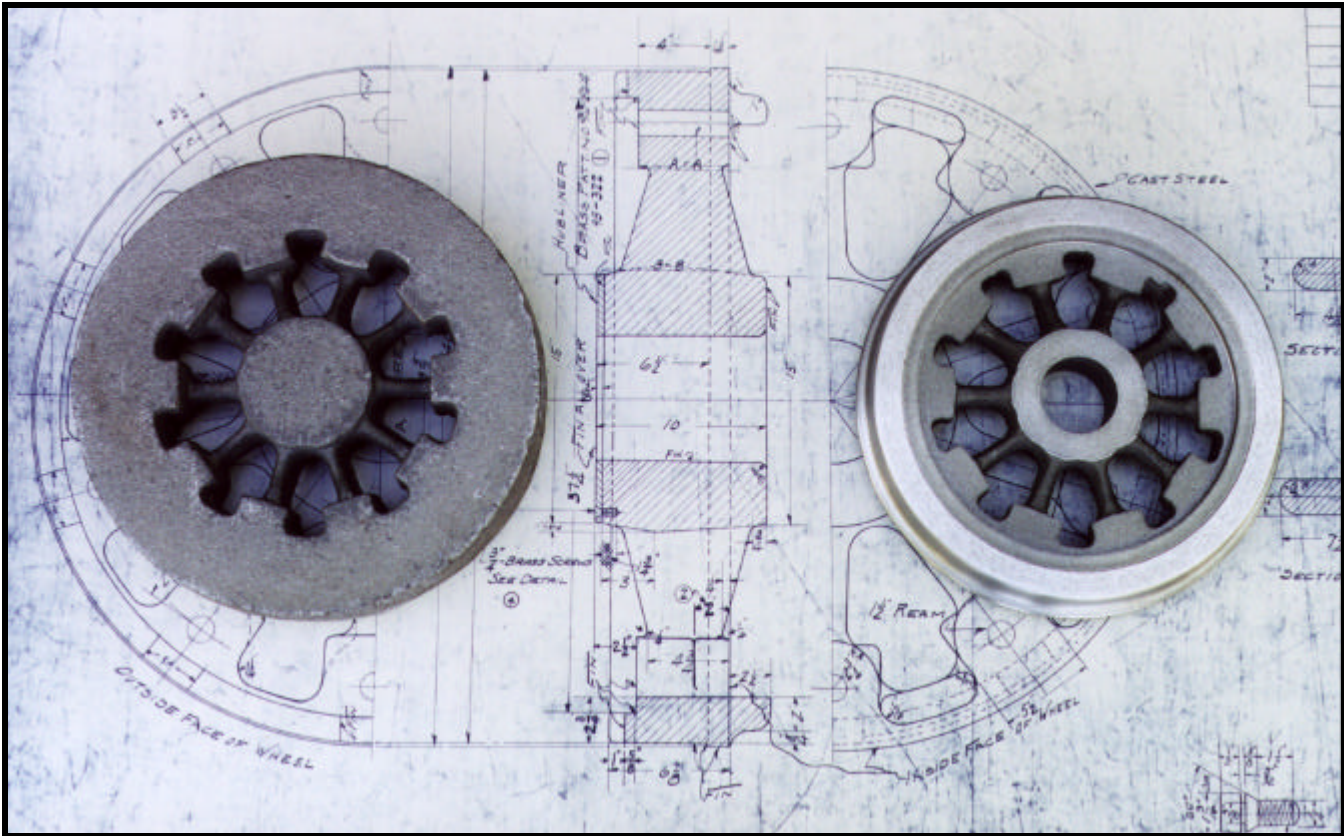
The following instructions are a step by step description of the process for turning the wheel castings (Lima Card Number 953-A-5014). These wheels were used on both the **Western Maryland Railway #6** and the **Greenbrier, Cheat and Elk Railroad #12**. The prototype is a 48" ten spoke driver. Lima made both wheels in each set exactly the same so that the set could be turned end-for-end at any time. Although bolt holes and brass hub bearings were standard on each wheel only one wheel would have a gear rim bolted to it.

The wheel casting has been made with enough material around the rim to make a one piece wheel and tire. Although the ductile cast iron is expected to wear well for many years, steel tires can be made and pressed on to the wheel centers. The instructions below will indicate when this should be considered during the turning process.

1. To start, place wheel casting in a 4-jaw lathe chuck with the square spoke bottoms facing out. This is the front or outside face of the wheel. The jaws should not hold more than about 3/8" of the casting. If the jaws extend over the casting beyond this, there will not be enough room to cut the tire flange. Center the casting making the gaps between the spoke bottoms as concentric as

possible. Setup the tool post with either HSS or carbide cutter to make facing cut. Remove approx. 0.025" and check for concentric alignment of spaces between spoke bottoms. Reposition casting if necessary. Note that wheel hub may not appear to be concentric.

2. Once the wheel casting is in its final position, continue facing off the casting until the center hub face is approximately 1/32" above the top of the spokes. This is the finished face of the hub. Set the lathe carriage dial indicator or DRO to 0.562". This is the distance from the wheel hub bearing to the wheel's vertical center, which is also approximately at the casting's central part line. Turn face of wheel rim to 0.531". This is the finished face of what would be the rim tire. Note that this assumes that the wheel casting will be used as a one piece wheel and tire tread. If steel tires are to be applied to the cast iron wheel center, then this surface should be faced off to 0.516".
3. The next step for the one piece wheel is to face off the surface of the wheel rim out to where the tire would be. Reposition cutting tool to face wheel center by cutting away from center. Reset lathe carriage dial indi-

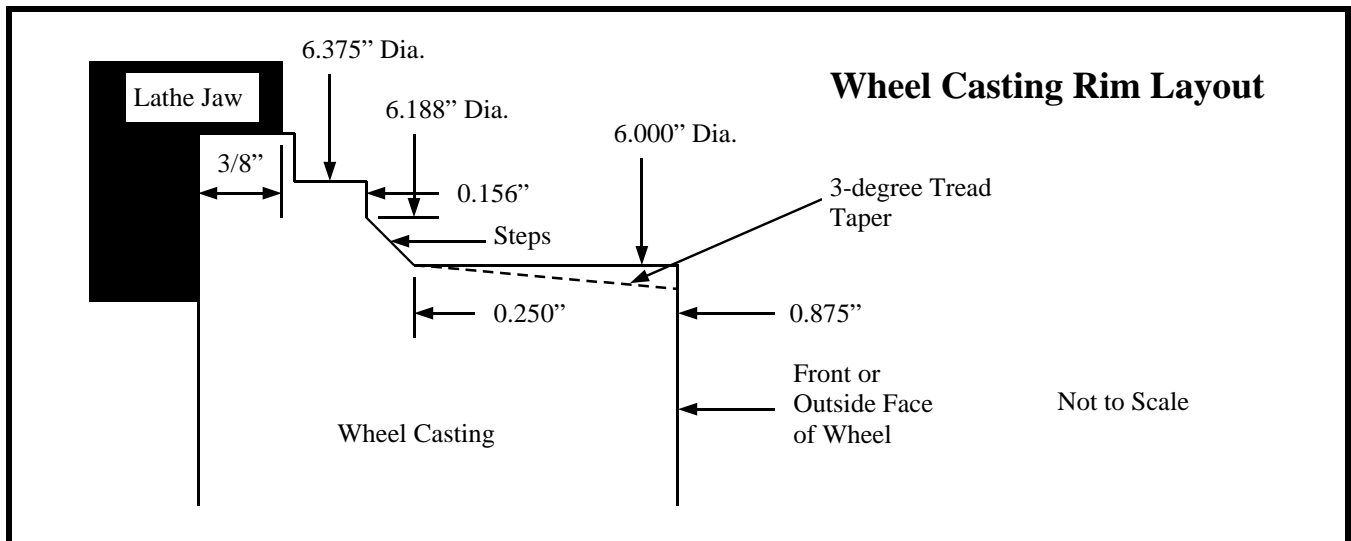


cator or DRO at 0.531" with tool contacting face of wheel rim. Advance carriage with tool over spokes to 0.516" from the vertical center of the wheel. Make a facing cut out to 5.130" diameter. This is the finished face of the wheel rim and the resulting shoulder is at the point where the tire would extend beyond the wheel center.

4. The Shay wheel has a shoulder where the ring gear will be bolted to the wheel on the line shaft side of the locomotive. This shoulder is on each wheel of the wheel set. This step makes a series of interrupted cuts as the tool cuts through the square spoke bottoms. Continue to make a series of facing cuts out to 4.656" diameter and down to 0.313" from the wheel's vertical center.
5. If a steel tire is to be applied to the wheel center casting, the rim of the wheel can be machined down to 5.330" diameter. Go as close to the chuck jaws as is safe. A small 0.100" lip will be made like the prototype as indicated on the Lima drawing. Reduce the wheel diameter to 5.130" and over 0.702"

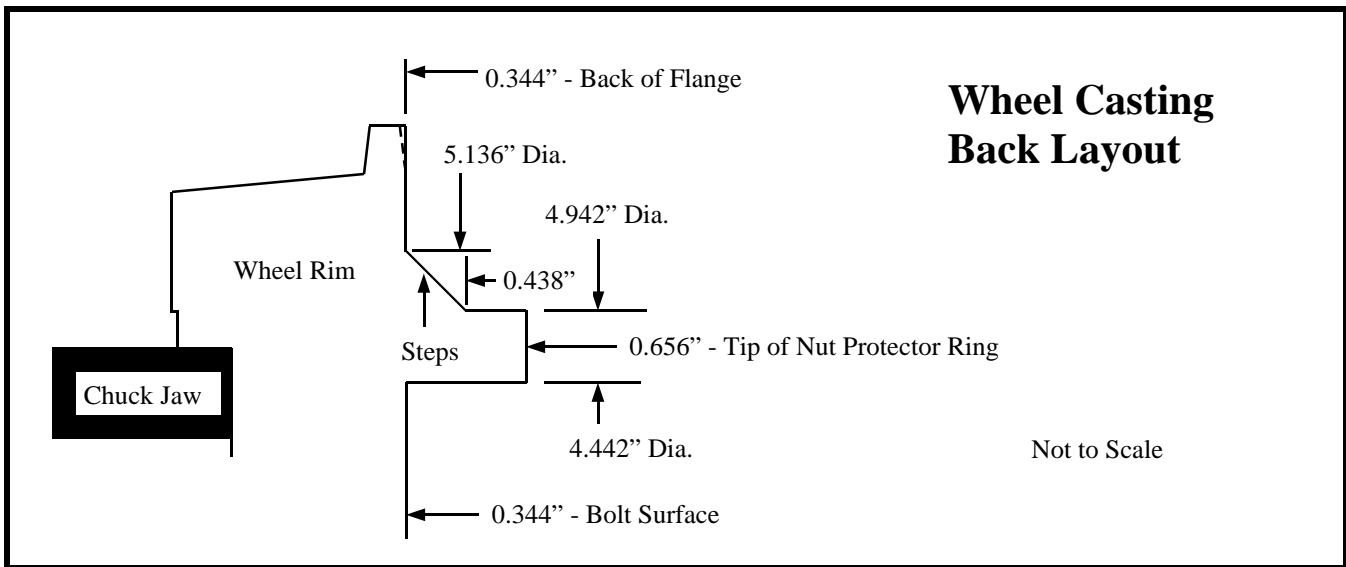
from the face of the wheel rim leaving a shoulder for the steel tire to be pressed against. If a steel tire is used, skip steps 7 through 11 as this completes the front or outside of the wheel. The steel tire should follow much the same instructions as steps 7 through 11 to make its contour. The inside contour of the steel tire should conform to the dimensions mentioned previously in this step.

6. To begin turning the wheel tread for the one piece wheel, turn down the outside edge of the wheel rim to 6.375" diameter and as close to the chuck jaws as is safe. This should be at least 7/8" across the edge of the wheel rim from the wheel rim face. This surface is just the tips of the flange.
7. Next set the compound to 87-degrees. Extend the compound so that an approximately 3/4" long, 3-degree tapered cut can later be made. Position tool post cutter to just touch the face of wheel rim and set the carriage dial indicator or DRO to 0.875", which is the width of the wheel rim. Begin rough turning the wheel rim to 6.188" diameter and across



to 0.156" as shown on the dial indicator or DRO.

8. A 0.094" radius contour will be made later at the base of the flange which will transition onto the tapered rim of the wheel. Therefore a series of steps should be made while turning the wheel rim down to 6.000" diameter and over to 0.250" as shown on the dial indicator or DRO leaving enough material to make this radius.
9. To cut the wheel tread taper, position the tool post cutter at 6.000" diameter and at 0.250" as shown on the dial indicator or DRO. Retract the compound and drawing the cutter toward the outside face of the wheel rim giving the wheel tread a 3-degree taper.
10. The flange has a 10-degree taper. Spin compound to 10-degrees and position tool post cutter next to flange at the top of the steps at 6.186" diameter and at 0.156" as shown on the dial indicator or DRO. Move compound toward the tip of the flange cutting the flange taper.
11. To make the radius contour at the base of the flange, use a 0.094" radius ground cutting tool to finish off the contour.
12. The wheel is press fit onto the axle. To make this hole, center drill a starter hole in the hub with a drill chuck in the lathe tail stock. Make successively larger holes through the casting until an appropriate boring bar can take over cutting the axle hole. Continue boring until the hole is 1.124" diameter. This will give a 0.002" press fit. A plug gauge would be a good idea to have at this time to check for size.
13. This completes the turning of the front of the one piece wheel and tread. Use a file to round over the corner between the rim face and wheel tread. Use Emory paper to remove any burrs and smooth all machined surfaces. Remove casting from the lathe.
14. The back or inside of the wheel can be machined using either a 4-jaw or 3-jaw chuck since all of the precision turning is now completed. Mount the wheel front facing the lathe chuck with the jaws pressing outward against the gear rim shoulder.
15. To begin on the back of the wheel, rough turn down the outer edge of the rim to just above the tip of the flange. Stay back from the flange as the wheel may still be moved to get a better alignment with the front.
16. A facing cut across the entire back of the wheel will give a better surface to measure the thickness of the wheel and to check for alignment adjustments. Measure the distance from the front face of the wheel to the back of the wheel at several places around the rim. Adjust clamping in the chuck to even out any misalignment of the wheel. Take one or more



## Wheel Casting Back Layout

Not to Scale

facing cuts until the wheel is properly aligned. Make a measurement of the thickness of the rim and subtract 0.531" for the one piece wheel, subtract 0.516" for the wheel center for a steel tire. Reset the dial indicator or DRO to this calculated dimension. This is now the distance to the vertical center of the wheel.

17. Begin facing off the back of the wheel casting. Reduce the face of the rim to 0.656" from the vertical center of the wheel. This is the tip of the nut protector ring. Reduce the face of the hub to 0.625" which is the finish face of the hub.
18. To finish the inside of the flange, make a series of cuts over to 0.344" from the vertical center of the wheel and down to 5.136" diameter. This is the top of a radius from the back of the wheel rim to the nut protector ring. Finish making a series of cuts stepping down to 4.942" diameter and 0.438" from vertical center leaving enough material to make the 0.094" radius.
19. To make the 10-degree taper on the back side of the flange, rotate the compound to 10-degrees and cut the taper.
20. Use the 0.094" radius cutter tool to finish the radius from the back of the wheel flange to the nut protector ring.
21. On the inside of the nut protection ring are the round spoke bottoms where the bolt holes open out to the inside of the wheel for the rim gear bolts. This surface is the same as the back side of the flange at 0.344" from the vertical center of the wheel. Reposition the cutting tool to cut from the center out. Touch the cutting tool to the tip of the nut protector ring and reset the dial indicator or DRO to 0.656". Begin a series of cuts from above the spokes out to 4.442" diameter. This will be a series of interrupted cuts machining the round spoke. This diameter should be approximately at the edge of the spaces between the spoke bottoms. The nut protector ring will later be milled out near the bolt holes resulting in ten nut protectors, one between each gear rim bolt.
22. The final finishing cuts to the back of the wheel are made with a 1/16" round over tool on each side of the tip of nut protector ring, the inside of the axle hole, and the outside of the hub.
23. Contour the tip of the flange with a file and Emory paper all machined surfaces.

This concludes the turning instructions for the wheel casting. The machining of the nut protectors and drilling of the gear rim bolt holes will be included on a further **LocoGear** Technical Bulletin.