

Gleber's Gear Teeth Pattern Replication Method for Repairing Wooded Gears

This method is intended to make it easy to draw sections of gear teeth by hand using a template for creating patches for wooden gears. It is designed to be simple to use, accurate and repeatable, but without requiring CAD tools or expensive equipment. This method can also be used to draw an entire replacement gear if desired.

Supplies Required

1. Original wheel
2. Donor wood for new teeth
3. Sheet of 5-10 mil clear plastic at least as large as the wheel. Something like a report cover works fine.
4. Sharp pencil
5. Fine point marker
6. Dividers or compass
7. Scissors
8. Double stick tape
9. Push pin



As usual, the quality of your results will depend on the care exercised while working. When marking and cutting, be as precise as possible. The photos here were done on a sample in a hurry for the sake of writing this document and a fine point marker was not available, so the marks are larger than typical. If you take your time and mark and cut carefully, I think this method will work very well.

Procedure to Create the Marking Template

1. Measure the outer diameter of the gear teeth tips (measure across several directions to get an average across several teeth tips)



2. Measure the inner diameter gear teeth roots (measure across several directions to get an average across several teeth roots)



- Using the dividers, scribe two concentric circles on the plastic sheet at the corresponding diameters.



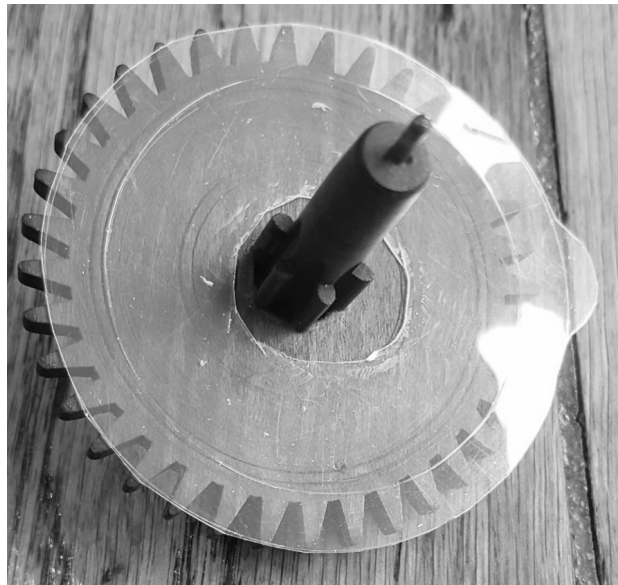
- Create a hole in the center of the circles using the push pin. See photo below.
- Create a hole on the inner diameter using the push pin. Make the hole big enough for the pencil point. It doesn't matter where the hole is. See photo below.
- Create a hole on the outer diameter using the push pin. Make the hole big enough for the pencil point. This hole should be located in a radial line with the inner hole.



7. Cut out the circle on the outer diameter to create a disk, but leave a small tab around the hole on the outer diameter.



8. If you can remove the wheel from its arbor, **skip this step**.
 - a. If you cannot remove the wheel from its arbor, cut a second disk of the same diameter and make a hole in the center large enough for it to slip over the arbor and lie flat on the wheel. Use this disk for the next steps and then transfer the marks to the original disk before cutting the gear profile lines on the original disk.



9. Center the disk over the wheel with the tab over the clockwise side (right end) of the section of broken teeth and use double stick tape to hold it in place.



10. Use the marker to mark the location of the tip of each tooth on the outer edge of the disk. Working clockwise, start at the tab and mark the tooth locations all the way around to the section of broken teeth. Be as precise as possible.



11. You might want to label the disk so you can reuse it in the future.



12. With the disk centered over the wheel and the tab near the 3 O'clock position check to make sure that the teeth tip marks are aligned with the teeth tips. Then, scribe a line indicating the profile of the counter clockwise side of a tooth near the 11:30 O'clock position. If this position is too near to the section of missing teeth, you may need to move counter clockwise to work in the area to the left of the missing section of teeth.

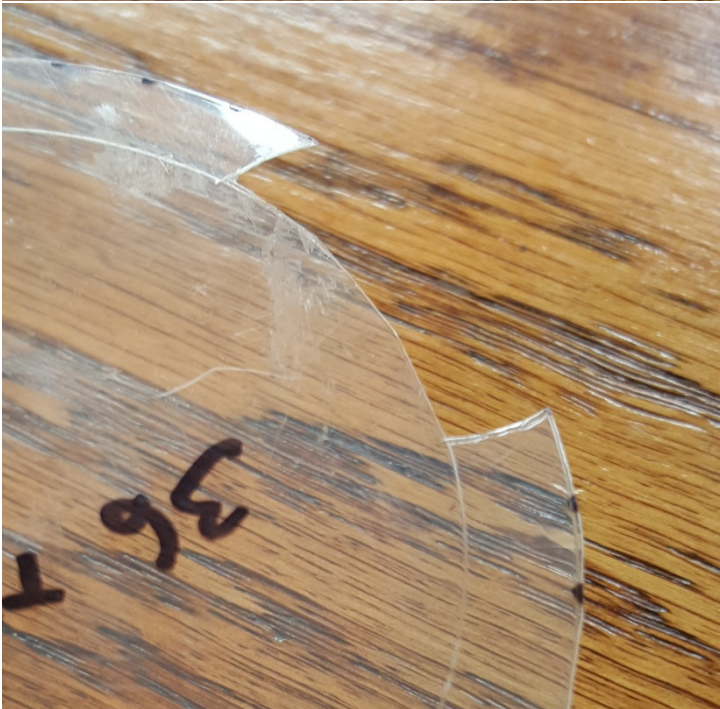


13. With the disk centered over the wheel and the tab near the 3 O'clock position check to make sure that the teeth tip marks are aligned with the teeth tips. Then, scribe a line indicating the profile of the clockwise side of a tooth near the 12:30 O'clock position. If this position is too near to the section of missing teeth, you may need to move counter clockwise to work in the area to the left of the missing section of teeth.



14. If you can remove the wheel from its arbor, **skip this step**. If you cannot remove the wheel from its arbor, transfer all of the marks from this second disk to the original disk.

15. Cut out the area between the two lines and the inner teeth root radius.



16. You are now ready to use this template to draw the teeth for the patch.

Procedure to Use the Marking Template to Draw the Teeth

1. Place the template on the piece of wood from which you plan to cut the teeth.
2. Align the template so that the edge with the tooth profiles is close to the edge where you plan to cut the teeth.
3. Use the push pin to secure the template to the wood.



4. Place the pencil in the hole for the outer diameter of the teeth tips and mark an arc for where you plan to cut the teeth. See photo below. If creating a replacement gear, draw the entire circle.

5. Place the pencil in the hole for the inner diameter of the teeth roots and mark an arc for where you plan to cut the teeth. If creating a replacement gear, draw the entire circle.



6. Turn the template until the tooth profile for the counter clockwise side is where you want to start the first tooth.



7. Holding the template in this position, place an index mark on the wood opposite from where you plan to cut the teeth and in line with one of the tooth tip marks on the disk.



8. Keeping the template in this position, use the pencil to mark the tooth profile for the counter clockwise side of a tooth from the inner diameter to the outer diameter.



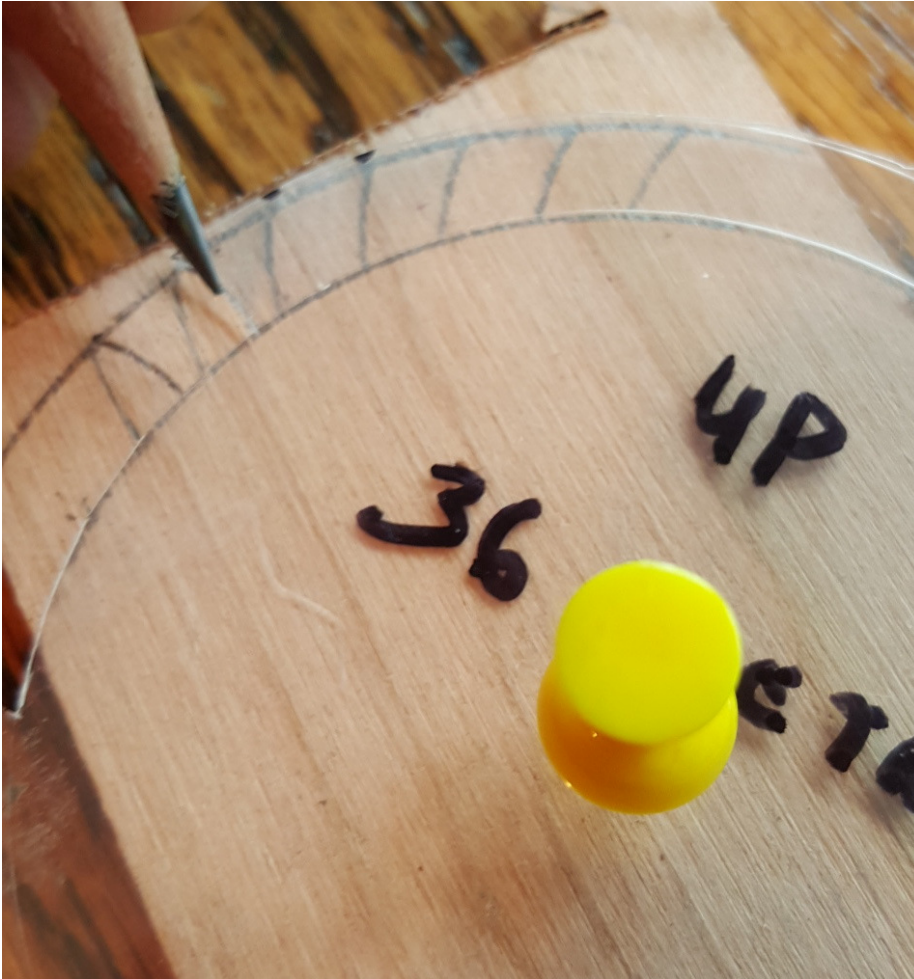
9. Rotate the template to align the next tooth tip mark with the index and use the pencil to mark the tooth profile for the counter clockwise side of a tooth from the outer diameter to the inner

diameter. Be as precise as possible when aligning the mark with the index.



10. Repeat the previous step for as many teeth as desired, but it is recommended to draw two more teeth than need. This will allow you to align the patch with the existing teeth on each side of the broken section and lay out a dovetail to insert the patch with the proper tooth pitch at each end of the patch. If you are creating a replacement gear, you will need to add a second index mark in order to draw the teeth all the way around.
11. For the tooth profile for the clockwise side of the tooth, turn the template and align the profile with the line drawn for the counter clockwise side of the tooth and draw the profile. You don't

need to use the teeth tip and index marks. Repeat this step for each tooth.



12. Once you have drawn your teeth, you can use the divider to check to make sure the spacing is equal. You can also lay the original gear over your pattern and compare to make sure the pattern matches. You might find a tooth a little off for several possible reasons. It could be because the original gear tooth spacing was off or a tooth was worn, or you might not have marked the tips precisely or lined up the index mark precisely, or you might have drawn your lines poorly. Even the grain of the wood can shift the path of the pencil. Anyway, there are lots of reasons that a tooth might not be just right, but usually, you can make adjustments to fix the spacing. One nice thing about this method is that the errors are not cumulative. If you tried to rotate the template a fixed number of degrees, but your angle was off by just a little, that small amount would add up and the teeth would get progressively closer together or farther apart, which could be a problem by the fourth or fifth tooth. That shouldn't happen with this method, which means if a tooth is a little off, the teeth on each side are probably okay and you just need

to adjust that one tooth. Here is the final drawing ready for cutting.



13. You are now ready to cut the teeth. See the recommendations below.

Procedure to Cut the Teeth

1. When the lines are drawn, they should be just inside the actual profile due to the offset of the pencil from the cut edge of the template.
2. You should cut the teeth leaving the lines on and then do any final shaping as necessary.