

wheel as near as possible to the proper figure. For roughing, use the rear knob control. For finishing, use the front table feed control, and set the table dogs. Holes up to 3" long can be ground with this attachment.

The best results will be obtained when the grinding wheelhead has been adjusted vertically to center the attachment spindle with the work. This may be done with the aid of the centering gage, as shown in Figure 23A. The wheel should grind on the side of the hole towards the front of the machine. To obtain accurate work, align the workhead spindle parallel to the top of the table and parallel to the table traverse, using an aligning bar and an indicator gage on a stand. The best finish will be produced by taking light cuts of about .0005" per pass.

Gear Cutter Grinding Attachment. Since gear cutters are form relieved, the only correct way they can be sharpened is to grind the *faces* of the teeth. (Figures 38A and 38B). To accomplish this result, it is necessary that the feed or adjustment of the cutter to the grinding wheel should be a *rotary or circular adjustment*, as provided for in the Cincinnati Gear Cutter Sharpening Attachment.

When grinding a new cutter for the first time, it is necessary to grind the *backs* of the teeth before grinding the cutting edge. This extra operation need only be done once, but it is necessary because the pawl locates from the back of the teeth, and if they are all ground uniformly, more accurate results can be obtained.

To set up for the first grinding of an ordinary gear cutter, proceed as follows: (See Figure 38C).

1. Fasten the extension on the left end of the wheel spindle.
2. Place wheel shape No. 12Y-155 in position.
3. Set the wheelhead to 90° and clamp in place.
4. Clamp the attachment on the table, to the left of the wheel, with the pawl side *away* from the wheel. See that the upper swiveling part of the attachment is set to zero on the degree readings.

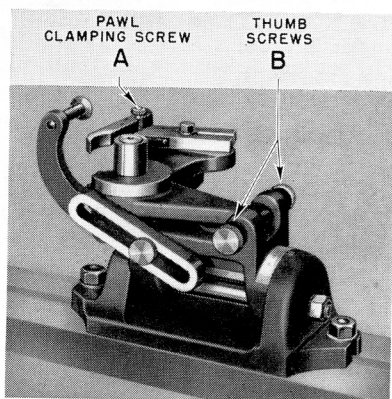
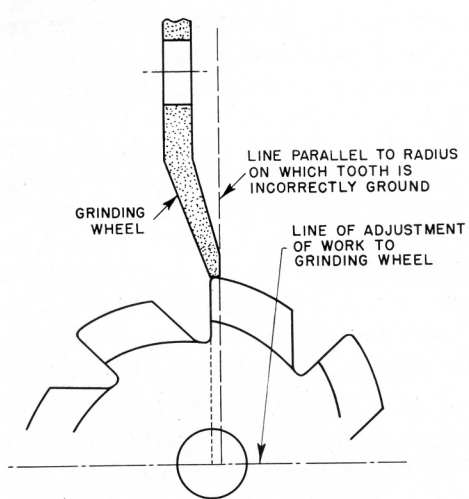


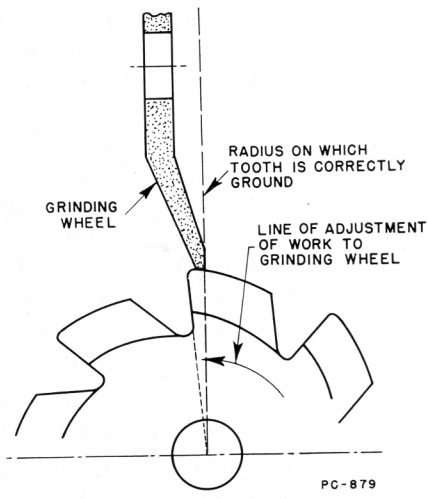
Figure 37A
Gear Cutter Grinding Attachment



WRONG

Figure 38A

The Wrong Way to Grind a Radial Tooth Gear Cutter. The face of the tooth is ground in a plane parallel to the radius, deforming the tooth profile



RIGHT

Figure 38B

The Correct Way to Grind a Radial Tooth Gear Cutter. The face of the tooth is ground in a radial plane

5. Place the cutter on the stud in the reverse position, so that the back of the tooth can be ground.
6. Set the centering gage on top of the wheelhead and adjust the head vertically until the cutter and gage are about central. Remove the gage and adjust the saddle in or out, and at the same time rotate the cutter by hand on the stud to bring the back of the tooth in the same plane with the face of the wheel.

7. Place the edge of the pawl on the *outside diameter* of the tooth being ground, and clamp in place by tightening knob "A". (Figure 37A).

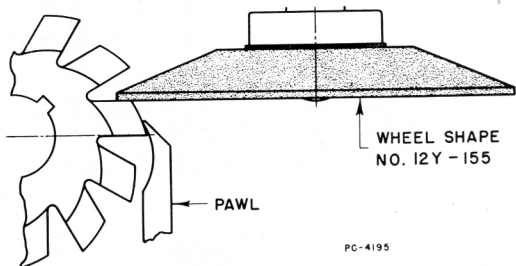


Figure 38C

Grinding the Backs of the Teeth of a New Gear Cutter

8. To index for grinding the back of the next tooth, traverse the table to the left, moving the cutter away from the wheel. Lift the cutter off the stud by hand. Hold it lightly against the solid pawl with one hand while grinding.

Due to deformations set up in hardening, the amount ground off one tooth may be greater than the next tooth, but there will then be a uniformity between the back of the teeth (the locating side for grinding) and the outside diameter. Notice that during the first grinding operation the pawl is fixed, while for the second or sharpening operation, the pawl swivels and acts as a stop when indexing to the next tooth. To continue with the sharpening operation (radial tooth cutters only):

9. Swivel the attachment centering gage up to the top of the attachment, and rotate the cutter by hand on the stud to bring the face of one tooth against the gage. Loosen knob "A" and contact the back of the tooth with the pawl, and then swing the gage out of the way. (Figure 37A).
10. Adjust the saddle to bring the face of a tooth in line with the face of the grinding wheel. Do not re-adjust the saddle while the cutter is being ground, except to compensate for wheel wear.
11. Loosen one thumb screw "B" and tighten the other one to rotate the face of the tooth towards the grinding wheel. (Figure 37A).
12. Grind one tooth, move the attachment away from the wheel by means of the table motion, index to the next tooth, grind, and so on.
13. If the cutter is not ground enough, re-set screws "B" and repeat the grinding operation.

If the teeth are provided with rake or undercut, of course they can not be ground radially, but must be ground in a plane tangent to the base circle, as shown in Figure 39A. Line up the point of one cutter tooth with the attachment gage, as before, swivel the table to the degree of undercut, adjust the saddle to bring the face of the tooth in line with the face of the wheel, and grind. (Also see discussion on page 30.). If the cutter is not ground enough, adjust the saddle towards the wheel to compensate for wheel wear, and repeat the operation.

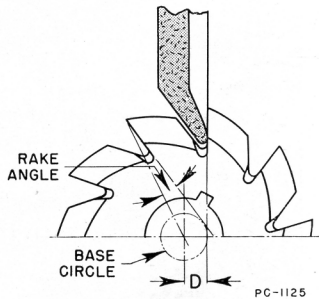


Figure 39A
Gear Cutter with
Undercut Teeth

Roughing gear cutters are sometimes made with alternate right and left side rake on the teeth to produce a better cutting action. These stagger tooth cutters can be ground by using the standard gear cutter grinding attachment. When setting up, proceed as for the regular cutter, then tilt the upper part of the attachment the amount of the side rake, which is usually seven to ten

degrees. Set the gage to the outer edge of the tooth and clamp the pawl in position to rest on the back of the tooth. Adjust the saddle until the edge of the wheel just touches the outer edge of the tooth, then proceed to grind every other tooth. For the second operation, tilt the upper part of the attachment the same amount in the opposite direction, touch up the outer edge of the tooth with the wheel, and proceed to grind.

The cutter stud on the attachment is $\frac{7}{8}$ " diameter, but adapter bushings of 1", $1\frac{1}{4}$ ", $1\frac{1}{2}$ ", $1\frac{3}{4}$ ", and 2" outside diameter are supplied for cutters with these hole diameters. (Metric sizes are: stud 22 mm and bushings 27 mm, 32 mm, 40 mm, 45 mm, and 50 mm. O. D.) Gear cutters or any cutter of similar design up to $5\frac{1}{2}$ " outside diameter and up to 2" hole diameter can be ground on this attachment.

Small End Mill Grinding Attachment. Small end mills up to $4\frac{1}{2}$ " cutter length and 1" maximum cutter diameter can be conveniently ground with this attachment. Small end mills and plain milling cutters with helical teeth are similar in sharpening procedure.

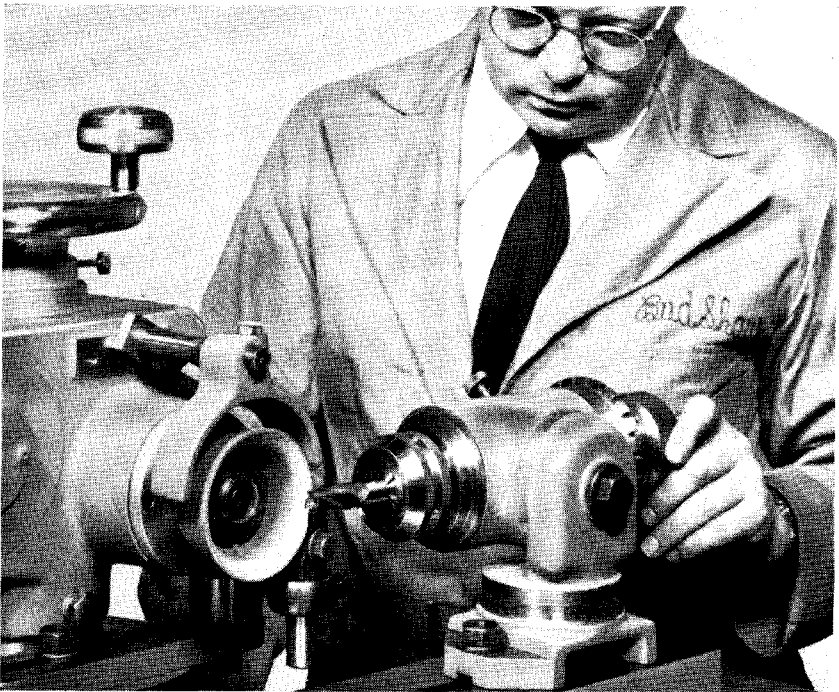


Figure 40A
Small End Mill Grinding Attachment