

## Some facts about TAPERS

By GEOMETER

A PART from many other uses a taper is often the means of securing a flywheel, a sprocket, a gear or pulley to a shaft—either with or without a key. For such purposes, a taper is usually mechanically more satisfactory than a plain interference fit between shaft and bore, a sliding fit with a drive-in key, or a sliding fit with a locating shoulder and, a nut for holding.

The angle of a taper has a considerable influence on the grip exerted when components are pulled together; and the smaller the angle, or the less the change in diameter for unit length, the more powerful the hold.

A taper may be dimensioned or designated in two common ways, A. The angle, *P*, may be given irrespective of the size of the shaft, which may be convenient when the angle is a whole degree, such as 5 deg., or whole degree and a simple fraction, such as 6) deg. Alternatively, the smaller and larger diameters, *Q* and *R*, may be given and the distance, *S*, between them. In such an event, the taper may also be given as so much per foot or per inch as the case may be.

On a lathe, a fairly-quick taper is machined by setting the topslide at an angle and using this for machining; while a slow or gradual taper longer than can be machined from the topslide is produced by setting over the tailstock, or using a set-over centre

when the work is mounted between centres. Again, on lathes so equipped, a taper turning attachment may be used to control movement of the cross-slide, leaving the work in longitudinal alignment with the lathe bed.

Some experiments are virtually always necessary in setting up for machining a taper, since no graduation—particularly of the topslide—is sufficiently accurate. Moreover, it is important for the tool to be at centre height, otherwise, variations in shape and angle occur, *B*. When the tool is at centre height it lies on the horizontal centre line of the shaft, where the slide angle is the same as the taper. If the tool is dropped, however, to plane, *T*, the effect on the larger diameter, *U*, is much less than on the smaller diameter, *V*.

### GOOD-FITTING TAPERS

In obtaining well-fitting tapers, size, angle and finish, both externally and internally, are extremely important. If one has the choice when fitting two parts on a "one-off" job the shaft is better finished last, as it is the more easily adjusted for size to secure longitudinal location, and the simpler to provide with a good finish, or on which to correct small inaccuracies, from careful use of a fine (Swiss) file and/or abrasive cloth.

Variations in longitudinal location with size are shown at C, where the component moves from *W* to *X* as the bore is increased.

If there is no choice in procedure, as when fitting a new sprocket to an existing shaft, the taper is picked up on the topslide with the shaft in the lathe and a mandrel turned to the same taper, but smaller. This is used for preliminary testing, though the final testing should be with the shaft itself.

Illustrations, *D*, show some ways in which an internal taper can be faulty. The bore may be large on the outside or inside, when on entering the mandrel and "feeling" slackness can be noticed. Pushing in the mandrel and twisting also shows where the taper is touching.

When the taper is faulty, the topslide requires m-adjustment. Finish is important, since if the mandrel rides on ridges the fitting will be poor though the angle may be correct. Slight correction and improvement follows from grinding the parts together, but too much reliance should not be placed on this.

For small bores, silver-steel tools, *E*, can be made by bending as *Y* or turning to leave a diameter, *Z*, both of which can be filed to shape, then hardened and tempered.

Of course, with a taper reamer available, or made from silver steel, sizing and finishing are simplified. □

