# Checking tapers

*By GEOMETER*

**TAPERS** are used on many components to hold parts securely together. Examples are crankshafts, spindles, mandrels and axle-shafts carrying flywheels, pulleys, gears and hubs. Well-fitting tapers transmit considerable power (torque) by themselves; but keys are often used for additional security.

Machining accurate tapers is a test of skill on the lathe, for the angles must be precise and the finish good. We can correct small errors of angle and faults in the surface by lapping two tapers together with fine grinding paste. But this is essentially a finishing process, and we must not rely on it to correct large errors.

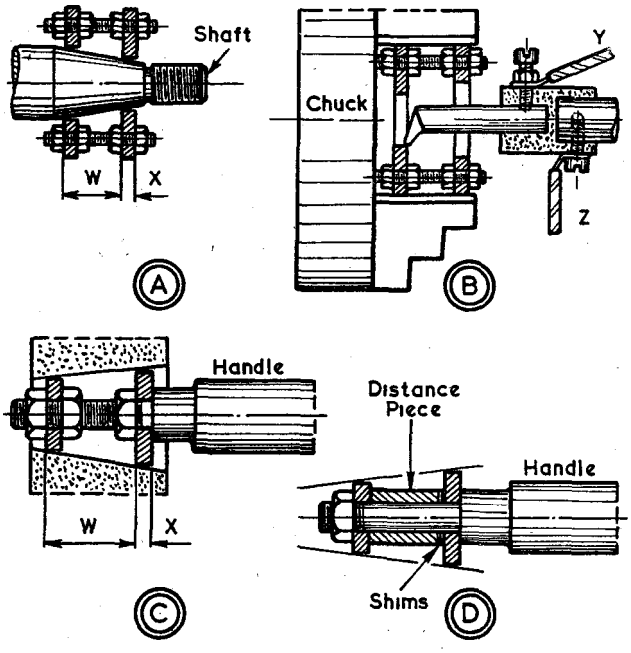
For accuracy in machining, the first essential is a sharp tool at centre height and the second a precise setting for the topslide. It happens that the degree markings of topslides are not accurate enough for this setting, and so other methods must be used. Several' which I have evolved over the years have had their merits. Those described here can be used for production work and for ***one-off*** jobs.

The gadget shown at A is a taper gauge built up' from steel washers and studding with nuts. Both washers should have the same outside diameter, so that they can be chucked to set the taper on the topslide. Three or four pieces of studding, or' screwrod, can be used, each with four locknuts for adjusting. the washers. These are bored parallel in the chuck, to fit near the larger and the smaller ends of the taper on the shaft. When joined by studding, they make a lattice gauge, which has the advantage of being adjustable to different angles. Each bore should be machined to a definite size and with a square edge; then the extreme corner should be removed with fine emerycloth.

To take a taper from a shaft, the washers are set to fit snugly on the taper and parallel to one another. This you can check with calipers or micrometer, measuring over the length ***W*** plus X. The tangent of the half-angle is found by taking the length ***W*** as the base of a right-angle triangle and the difference in the radii of the two bores as the vertical. From this relationship, the taper can be found in degrees and minutes'in trigonometrical tables.

Hold the gauge in the three-jaw or four-jaw chuck, as at ***B,*** with both bores spuming truly, to set the topslide for the inside taper. If the bore is large enough, the cutting edge of the tool should be at centre height. Adjust the slide until the edge of the tool just touches both bores as it is traversed. A dial indicator with a probe attachment can also be used.

The sketch shows a special dummy electric tool which simplifies the setting. Use a sleeve of insulating material, such as Tufnbl, to mount the too1 in its holder. Two wires Y-Z are connected in circuit with a low-voltage battery and **bulb** flashlight). When the tip of the tool makes contact




with the bore of one of the washers, the bulb lights up. By noting the light, or lack of it, as the tool is moved in the washers, you know how to set the slide. To make a check of concentric spinning, turn the chuck with the tool inside one of the washers.

On the same principle of two spaced washers, a plug taper gauge can be made as at C, again with the advantage of adjustment. A handle can be machined in mild steel and threaded for the nuts, or a piece of studding can be screwed into a handle. The washers can be mounted and machined in place, their corners being removed with a Swiss file or emerycloth. The effective length for calculating the angle of the taper is like that of the other gauge: total length minus X, to give ***W.***

A plug gauge of the same type can be made as at ***D,*** with a turned handle, a distance piece, and a single nut at the end. Thin shims to one face of the distance piece give an accurate setting. With the handle chucked and the washers true, you can set the topslide to angle, using an ordinary turning tool. Instead, a dial indicator can be employed, or an electric device similar to that for the inside setting. ❑

## TO BLACKEN BRASS

**HERE** is a formula for blackening brass. I learned it in England when I was over last year from Canada and I have found it very satisfactory.

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|---|---|
| Copper Carbonate . . . | . . . 87.5 Grains |
| 0.880 Ammonia ... | ... f Ounce |
| Rainwater . . . ... | ... I 1/2 Ounce |

Heat solution to **175** degrees F and immerse the brass for 30 seconds (or longer).

The formula gives a beautiful black brass. It will not take on solder. Rub a soldered joint with stannic chloride using an iron wire brush. The joint will then be brass-plated.

For a larger quantity of solution use **I** lb. Copper Carbonate, **I** quart 0.880 Ammonia and 3 quarts rainwater.

A. H. **JONES.**