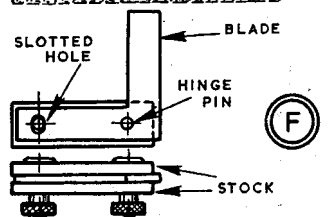
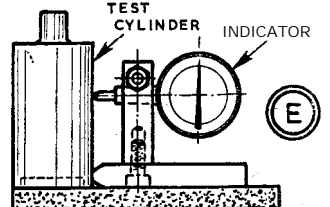
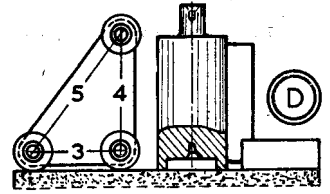
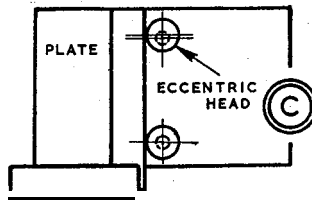
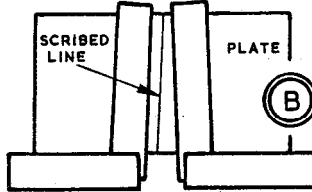
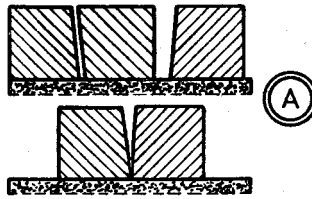


Basic SQUARENESS

By GEOMETER



LIKE other fundamental features, right-angular accuracy—the basic squareness of edges and faces—is an element without which nothing can be accomplished in engineering. Often it is taken for granted, and regarded as inherent in tools, instruments and machines and the work produced with them, though a close check may reveal that what was thought to be absolute is, in fact, only relative. It so, error has occurred at some time.

If not there originally, it may have occurred as a result of wear, strain or accident. For example, a square may be dropped and the blade knocked slightly out of alignment with the stock; or an angle plate may be accurately machined from an unweathered “green” casting, then alter in ageing a considerable time afterwards.

Errors multiply

In such cases, errors will be transferred to work and components, causing complications in fitting; and to avoid this, constant scrutiny of work and components is advisable—and occasional verification of tools and equipment, by methods which establish squareness from first principles.

On a flat surface like that of a surface plate, any three tools, such as squares, or components with right-angle faces, can be proved for accuracy one with another on the principle as at **A**. On the faces of two components, there could be complementary errors, matching to leave no gap. In that case, the face of the third component reveals the error on one or the other, as it cannot agree with both. Only when three faces are right-angles will they match together without error

in any or all of three combinations—a test, if one likes, of skill in fitting, filing, scraping and lapping.

Self-checking a square

Alternatively, a square of any type can be checked by itself from a straight edge. For a small hand-square, as used for metal, it can be done as at **B** on a piece of plate, holding the square one way, scribing a line, then turning the square over and again presenting it to the line. Any error from a right-angle is doubled in this way, and even when quite small can be clearly seen. The celluloid square of a draughtsman can be similarly checked; held to the T-square to draw a thin pencil line, then turned over with the edge again to the line.

Greater accuracy in checking on this principle is obtained as at **C**. The plate is provided with a pair of reference diameters, both the same size which can be the plain heads of special screws their shanks passing through holes in the plate, and held by nuts on the opposite side. One head is fixed and the other adjustable, either from eccentricity with its shank, or from an oversize hole in the plate.

With the blade of the square held to the fixed head, the other is adjusted to it and tightened. Then turning the square over, the blade should again touch both heads, strips of paper or shimstock being used for testing.

With both heads accurately located, the device can be used for speedily resetting the blade of an adjustable square.

On a surface plate, basic squareness can be checked using a device on the principle of the elementary triangle, or a cylinder machined in the lathe. Both are as at **D**. On the one, three rollers have clearance holes for bolts through the sideplates, in which the holes are spaced at 3, 4 and 5 units. The rollers are set by micrometer, with the diameter of one added to each dimension. On the cylinder, there should be a parallel diameter with a relieved base machined at the same setting, preferably between centres.

Using a cylinder

Such a cylinder can be used as at **E**, to set a square incorporating an indicator, which can be presented to other squares or components with right-angle faces. Accuracy is then instantly revealed, or error shown in thous. The base of the square should have a straight edge against which the cylinder can be rolled. The pillar can be arranged to suit the indicator.

A small square for setting true (or angling for pattern work) can be, as at **F**. Two pieces of plate are used for the stock, and two well-fitting plain shank screws to secure them, with the blade of thinner material hinged in between. El