Beginner's Workshop **By Geometer**

Hand fitting methods

for flat and right-angle faces

GIVEN ACQUAINTANCE with the principles involved, and the necessary time and care, hand fitting methods as applied to basic equipment such as faceplates, straightedges and squares, can attain the highest standards of precision. Contrary to what might be thought, the methods employed are for the most part extremely simple-and, moreover, have applications in optics, where the highest machine precision falls short of requirements.

In possession of a faceplate, straightedge (such as a good steel rule) and a square, it is possible to undertake various tests of work and components.

A part with a flat surface can be placed on a faceplate and tested for " rock " with the fingers. Lightly oiling the faceplate, or using a smear of red lead and oil mixed together or marking blue, the component when lifted from the faceplate will reveal where it has touched-on the high spots. Applying a straightedge to narrow surfaces will likewise reveal if they are straight-by placing a bright light behind and observing if there are gaps anywhere. A square will show if two faces or edges are at right angles, either when applied direct to the component, or when used on the surface plate with the component.

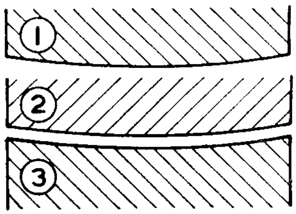
Minimum three surfaces

In all these tests, however, reliance is placed on the accuracy of the equipment — faceplate, straightedge and square. And obviously there must be some methods of verification of these-which are not too involved, or engineering could never have developed.

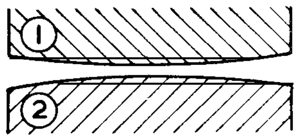
There are two ways of bringing surfaces into agreement so that they make contact over a large area or as completely as possible. They are : 1, by removing the high spots when revealed, by some abrading or scraping means (files or scrapers in hand fitting, when the equipment must not be altered or damaged) and 2, by rubbing the surfaces together with a suitable abrasive between them (lapping), as is always done in finishing optical surfaces, and also in hand fitting, but using other surfaces than those of the test equipment.

Two surfaces, however, may be in close contact but not as required-which is flat, to bring about which condition there must be a minimum of three surfaces, A. Either convex surface 1 or 2 placed on the concave surface 3 would fit closely. But when,

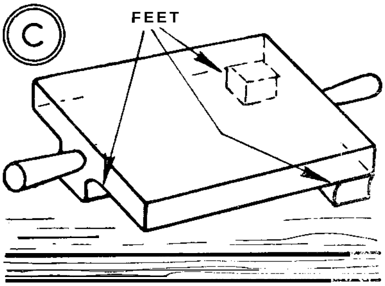
A



B



C



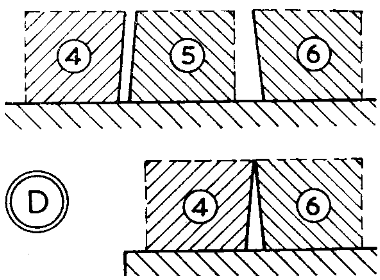
as at B, 1 and 2 are brought together, they are obviously defective.

So it is, three surfaces fitted together by. filing, scraping or lapping are inevitably flat. The same is true of straightedges ; two might have complementary curvature, but three in agreement must be straight.

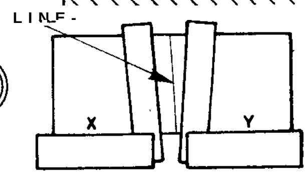
The principle is applicable to right-angle faces, using a standard surface plate, C. Two blocks, D, 4 and 5, might have faces in agreement but not at right-angles, while a third, 6, could also be defective. Trying all together, however, such as 4 and 6, errors are revealed. Only when the faces are at right-angles will all pair properly. For a test such as this, red lead and oil or marking blue, can be smeared on one face, the blocks kept in contact with the faceplate and rubbed sideways, revealing areas of contact. If the blocks are cubes, only two are necessary since they can be turned about on different faces to discover errors.

Squares can be tested on a faceplate, three together; but the usual workshop test for a single square is as E. It is laid on a straight-edged piece of material in position X and a line scribed, then turned over to position Y and the alignment of the blade checked against the line.

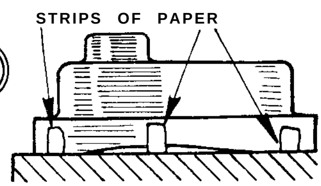
In checking straightedges or components on the faceplate, F, strips of paper can be situated at various positions, and where errors are discovered by the paper pulling out, the thickness then increased until the paper grips. Alternatively, thin metal foil-shimstock-can be used. ❑



D



E



F