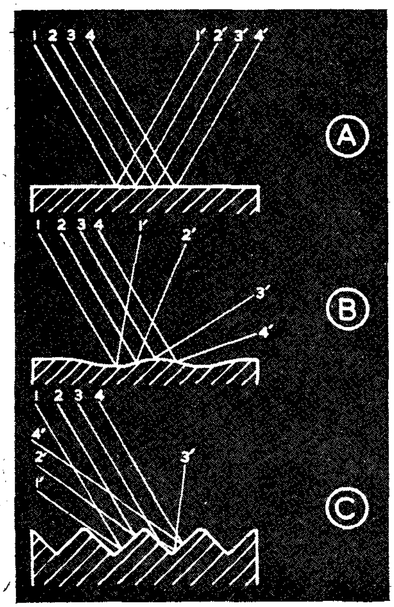
Polishing metal surfaces

GEOMETER explains the theory and practice of obtaining highly polished surfaces and mentions some of the snags

PRECISION COUPLED to good quality of surface finish is the object of beginner and expert alike in metal work, and often the one fails less from lack of skill than from lack of knowledge of what to attempt. Even the practical expert's knowledge may be limited to workshop procedure and not reinforced by the elementary laws of reflection of light.

For purpose of explanation, light rays are regarded as proceeding in parallel straight lines to a' surface, upon striking which they are reflected. The rays striking the surface are the *incident* rays, and those leaving are the *reflected* rays. In regard to the surface, the angle of the *reflected* rays is always exactly the same as that of the *incident* rays.

The " surface " for individual or small numbers of "rays is very small and if a large area, generally flat, consists of numerous facets or small surfaces tilted at different angles, the parallel *incident* rays are scattered. as *reflected* rays. Thus, on observation, such a surface will not appear " bright " or polished.



In diagrams *A, B* and C are three types of surface, and the *incident* rays are 1, 2, 3, 4 and the reflected rays 1', 2', 3', 4'.

At *A,* the surface is both flat and smooth and polished so that light striking it is reflected towards the observer. At *B,* the surface is not flat, but has been polished so that although it is smooth (to the touch) the light is scattered, and some areas appear brighter than others. At C, there is a series of uniform ridges, such as might be produced in a machining process, say, on a lathe, and the light is scattered according to the formation of the ridges.

Where the depth of such ridging can be kept small by fine machining, grinding or draw-filing, a surface such as C, generally flat though not polished, is superior to an uneven polished surface such as *B*.

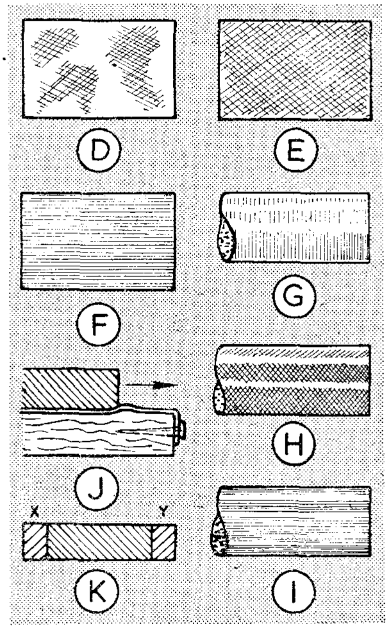
Smoothing and polishing

Before a surface can be polished, it must be reduced below the level of the deepest scratch or pit mark,. or this will remain to mar the finish. Work can then proceed by hand with abrasive cloth in descending fineness to the stage where, using worn cloth, no further improvement is possible. Then cloths or felt and liquid metal polish can be used.

On a polishing spindle, work can be finished with emery bobs and polishing mops. In either case, a result as at *B* would follow from the formation of hills and hollows.

Eliminating **waviness**

For best results, large geometrical errors or waviness must be eliminated as well as pitting. Careful diagonal filing, *D,* reveals high spots, and continued produces a surface as at E-which is attractive when fine files are used. Uni-directional filing or draw-filing produces a finish as *F,* as is often done on tools.



Round work revolved in a lathe can be polished with abrasive cloth, but the waviness is perpetuated in a series of rings, G. Rapidly oscillating the cloth results in a criss-cross pattern, *H,* tending to show waviness and eventually reduce it. Maximum effect in this respect follows, however, from using a fine file, 'or abrasive cloth wrapped over a file. Abrasive cloth used lengthwise on a rod produces a longitudinal pattern, I, revealing machining or grinding marks.

Flat surfaces on a component can be smoothed and polished by laying a sheet of abrasive cloth on a flat metal surface (surface plate or lathe bed), or a piece of thick glass, and rubbing the component on it.

Care is necessary not to round the edges of component polishing in this manner, through the cloth pushing up slightly, J. This effect is commonly avoided as at *K,* through a block or strip of metal, x. and Y, being each end of, the component, all faces level. ❑