These results are plotted in the diagram below (Fig. 1).

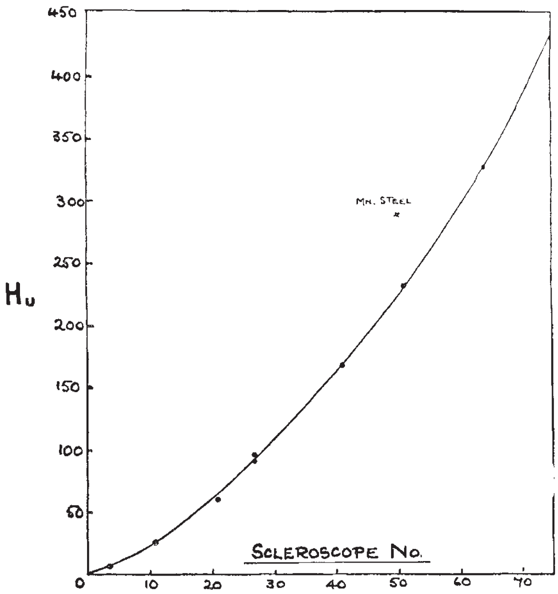

FIG. 1.

The relation between H_u and scleroscope number is quite good. The equation for the curve is:

$$H_u = 0{\cdot}79S^{1{\cdot}44}.$$

It is of interest that the ultimate hardness of manganese steel is higher than the scleroscope figure indicates.

If, as is believed, the value of H_u is independent of the ball diameter (D), then

$$kH_u = a_1 . D_1^{n_1-2} = a_2 . D_2^{n_2-2}.$$

k varies for different metals. Also, since with the 10 mm. ball

$$H_u = \frac{2a}{\pi} \times 10^{n-2},$$

then

$$0{\cdot}79S^{1{\cdot}44} = \frac{2a}{\pi} \times 10^{n-2},$$

$$S^{1{\cdot}44} = 0{\cdot}806a \times 10^{n-2}.$$

HUGH O'NEILL.

The Victoria University of Manchester.
March 5.

Metallic Crystals and Polarised Light.

DURING a research, not yet completed, on the optical properties of crystals, certain observations made in the case of metals appear to justify publication, from their importance in metallurgy.

If an etched metal specimen is examined under the microscope with the usual mode of illumination, but with plane-polarised light, and the reflected light is viewed through a "crossed" analyser, the different crystals in the field of view are sharply distinguished by differences of brightness. Rotation of the stage causes the brightest to grow dark and the darkest to light up, each crystal passing through four maxima and four minima in a complete revolution. The portions thus marked off often form parts of a crystal which appears of uniform structure under ordinary illumination; some structural difference which is indistinguishable, or with difficulty distinguishable without polarised light, produces marked differences with the crossed Nicol arrangement, which thus promises to be an effective new weapon in the metallurgist's armoury.

Curiously enough, these phenomena were observed quite independently by Miss Olwen Jones, who is engaged on the above-mentioned research in this laboratory, and by my colleague, Mr. C. Handford, of the Department of Metallurgy, who was working on a quite different problem. It was only on consulting him on the metallurgical aspects of the matter that I learned that he had noticed the effects a few days before. Her work suggests to Miss Jones that the cause may very possibly be a fine striated or laminated structure of the crystals, producing a sort of serration of their surfaces, the direction of the striation differing from crystal to crystal. When the vertical plane containing the serrations is parallel or perpendicular to the plane of polarisation in the incident beam the reflected light is plane-polarised, and is therefore extinguished by the analyser; when the angle between those planes is 45° or 135° the ellipticity, and therefore the brightness, is maximum.

Further investigations are being made both to test this theory and to develop the metallographic technique of the method.

J. H. SHAXBY.

Viriamu Jones Physical Laboratory,
University College, Cardiff, March 12.

Easy Method of observing the Stark Effect.

IN the course of our investigations on the pole effect of the iron arc, we used a special device to keep the arc steady in the vertical position, and photographed the spectrum by means of a large quartz prism on a Littrow mounting. The lines originating in the electrode, extending from the visible part of the spectrum down to the ultra-violet, showed distinct separation, which was identical with the Stark effect observed with vacuum tubes. The separated lines show polarisations parallel and perpendicular to the field, which at the maximum amounts to about 20,000 volts per cm., and is confined to a very thin layer at the electrode, indicating a steep gradient. We found it convenient to work with a 500 volts arc, although the same phenomenon can be observed with a 100 volts arc. The effect is observed at the lower electrode, whether this be anode or cathode. Other metals can be used instead of iron.

The observation of the Stark effect is thus rendered extremely easy, as the only process involved is the production of a steady arc and the use of a spectroscope sufficiently powerful to resolve the lines into components.

H. NAGAOKA.
Y. SUGIURA.

Institute of Physical and Chemical Research,
Hongo, Tokyo, February 13.

Volcanic Dust and Climatic Change.

ON page 20 of his very interesting book, "The Evolution of Climate," Mr. C. E. P. Brooks says that I have "attributed glaciation to the presence of great quantities of volcanic dust in the atmosphere." This is too generous. I only insist that volcanic dust is one of the factors that control climate, and that at times it may (not must) have been an important factor, especially when mountains were high and continents extensive.

W. J. HUMPHREYS.

U.S. Department of Agriculture,
Weather Bureau, Washington,
February 17.