the same purpose. This cell was opened and a groove cut down the centre of the disc. Lead fuse wires were then inserted to make contact with the faces of the two halves. These lead wires were joined to terminals by which the cell was connected to a Kipp micro-galvanometer of period 0.2 sec. With this a five to tenfold amplification can be obtained, of a galvanometer of 1.5-5 sec. period, without introducing any measurable lag into its movements. A Moll galvanometer of 1.25 sec. period used, in place of the microgalvanometer, as a secondary would give a further fourfold multiplication, an amplification of at least twenty times. It would still introduce little lag into the movements of the primary one.

By this means any galvanometer of sufficient steadiness can have its 'figure of merit' increased many times. For those who can go to the trouble and expense of using a second galvanometer of short period and a photo-cell, the problem of sensitive galvanometers is reduced largely to one of steadiness and zero stability; given these, amplification with a photo-cell can supply the required sensitivity—to the limit of course set by Brownian movements of the primary galvanometer.

A. V. HILL.

University College,
Gower Street, W.C.1.
March 23.

J. Sci. Instr., 8, 262.

Diffraction of Cathode Beam by Simultaneous Reflection from two Different Specimens

FROM the first investigations of G. P. Thomson¹ dealing with the structure of surface layers up to the present time, the method of using a specimen ground flat has remained apparently without change², though the construction of a crystal holder for this method is comparatively complicated and the results obtained in such a way cannot apparently be of high

FIG. 1.

degree of accuracy. The investigation of the surface structure by reflection is, however, of great interest. We have recently succeeded in obtaining very exact results by means of a simultaneous reflection of a cathode beam from two specimens; one of them was a substance the lattice constants of which were very exactly known, such as sodium chloride.

As has been shown by H. de Laszlo and V. Cosslet³, the cathode beam is hollow. The results

of our study confirm this. Therefore for obtaining a sharply outlined diffraction pattern, it is evidently not necessary to use the entire cross-section of the cathode beam, but only one side of it, and this can be done only with a convex specimen. From Fig. 1 it can be seen that this method not only gives a sharp diffraction pattern, but also simultaneously a very sharp spot from the cathode beam may appear in the photographic plate, so that the centre of the rings can be found at once. If a cathode beam is passing between two such convex specimens (Fig. 2) a double diffraction pattern appears as is shown (Fig. 1).

Fig. 2.

When compared with the method of taking successive photographs one after the other⁴, we believe our method has the advantage that the possible change of high voltages is with simultaneous exposures of no importance. Moreover, the mounting of such a double specimen and its setting in the beam is exceedingly simple.

A fuller account of this method will be published shortly.

N. A. SHISHACOW.
L. I. TATARINOWA.

Cement Institute,
Moscow, 17.
March 9.

¹ G. P. Thomson, *Proc. Roy. Soc.*, A, 128, 641, 649; 1930.

² See for example: J. Cates, *Trans. Farad. Soc.*, 29, 817; 1933. G. D. Preston, *Phil. Mag.*, 17, 466; 1934. R. O. Jenkins, *Phil. Mag.*, 17, 457; 1934. A. G. Emsli, *Phys. Rev.*, 45, 43; 1934.

³ *NATURE*, 130, 59, July 9, 1932.

⁴ G. I. Finch and A. G. Quarrel, *NATURE*, 131, 842, June 10, 1933.

The Polarity of the Co-ordinate Link

It has already been shown that organic sulphides and tertiary arsines differ markedly in their reaction with chloramine-T. The former give rise to sulphilimines, of formula $R_2S \rightarrow NSO_2C_6H_5$, in which the co-ordinate link is apparently devoid of polar properties: the arsines, however, do not give stable arsinimines, of formula $R_3As \rightarrow NSO_2C_6H_5$, because the co-ordinate link in such compounds apparently possesses sufficient polarity to combine with water, producing thus the corresponding hydroxy-sulphonamides, $R_3As(OH).NH_2SO_2C_6H_5$. This behaviour is similar to that of the tertiary arsine-oxides,

$R_3As \xrightarrow{+} O$, where the strongly polar link induces ready combination with water to give the dihydroxides, $R_3As(OH)_2$.

We are undertaking a systematic study of the action of chloramine-T on the organic derivatives of the elements of Groups 5 and 6, and the tertiary phosphines in this respect come midway between the sulphides and the arsines, the final product depending primarily on the nature of the tertiary phosphine. Thus tri-*o*-tolylphosphine gives a true phosphinimine, $(C_6H_5)_3P \rightarrow NSO_2C_6H_5$, (A), and no other product has been detected: tri-*p*-tolylphosphine gives a mixture of the phosphinimine isomeric