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FIG. 9. Curve illustrating the percentage intensity ratio (ordinates) between the two components, normal and parallel to the plane of incidence, of light transmitted through a tilted glass plate for different angles of rotation (abscissæ).

*New Method.*—For this method use is made of a cleavage plate of calcite of such thickness and an aperture of such width that the two fields from the two rays just touch (Fig. 10); better fields are obtained by use of a small Koenig-Martens portable photometer[9] (Fig. 11).

[9] *Verhandlungen d. deutsch. Physikal. Gesellschaft, 1*, 204–208, 1899; *Physikalische Zeitschrift, 1*, 299–303, 1900.

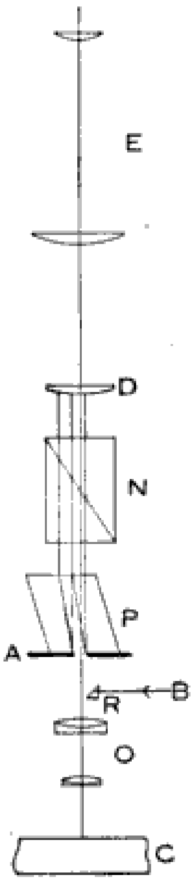


FIG. 10. New method for the detection and measurement of the degree of anisotropism of a crystal plate. In this method the cleavage plate of calcite serves to produce two adjacent fields whose planes of polarization are normal to each other. The intensity of the illumination of the two fields is made equal by rotation of the nicol *N*.

In Fig. 10 the non-polarized incident light is reflected by the prism *R* to the plate *C* whence it passes on reflection through the calcite plate aperture *A* to the nicol *N*, the weak lens *D* and the microscope eyepiece *E*. In the writer's microscope the upper nicol can be rotated and the angle of rotation read off to 6′ on the stage of the microscope. The function of the low-power lens *D* is to image the aperture *A* in the focal plane of the weak eye lens *E*.

In Fig. 11 the calcite plate is replaced by the Koenig-Martens arrangement of aperture *A*, field lens *D* (to render rays from aperture *A* to Wollaston prism *W* parallel), and the twin prism *F*. This gives a better photometric field than the calcite cleavage plate. In both methods artificial light, non-polarized, and either monochromatic or white is used and rendered diffuse either by the interposition of a ground glass or opal glass plate. The fields should be equally illuminated and no junction line between them should be visible. In case polarized light be present the intensity of illumination of the two fields is different; but it can be made equal by rotating the nicol *N*

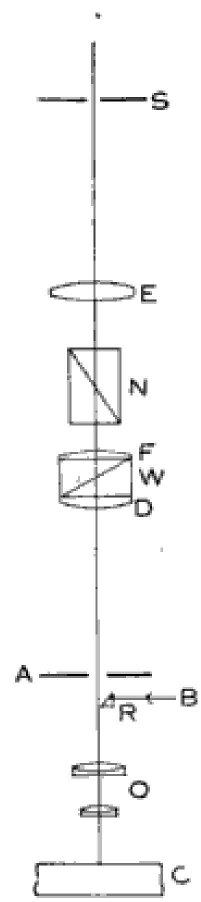


FIG. 11. In this method the Koenig-Martens arrangement of wollaston prism and twin glass prism is substituted for the calcite cleavage plate of Fig. 10. The intensity of the illumination of the two adjacent fields is rendered equal by rotation of the nicol *N*.

Of the two devices the Koenig-Martens photometer is the better because it gives a better photometric field and is an attachment complete in itself which may be used on any microscope in place of the eyepiece. The only additional accessory required is the reflecting prism or mirror with which every metallographic microscope is equipped.

These methods are superior to the Koenigsberger method, not only because of increased sensitiveness, but also because the particular plate under investigation can be viewed directly (at high or low magnifications) and the test made directly on the plate in full view. In the Koenigsberger method the Savart bands are not readily distinguished unless the plate is brought out of sharp focus and even then the irregularities of the image tend to render indistinct and uncertain the faint Savart bands.

31. *The Nutting Reflectometer.* — In the study of color it is sometimes desirable to ascertain the reflection coefficients of colored media. This can be done if the object is diffusely reflecting by means of an ordinary brightness photometer, although the uncertainties of color photometry will be present in any case. However, Nutting[15] has devised a simple instru-



ment shown in Fig. 60 that is very useful for determining the reflection coefficients of any colored media for light incident from all possible directions simultaneously. Two crown glass prisms of 21 deg. angle are fastened over the two apertures in the end of a Köenig-Martens polarization photometer and the latter is inserted into a metal ring which is nickel-plated and polished inside. The light enters the apertures of the instrument along the dotted lines shown and is divided into two plane-polarized beams by a Wollaston prism. These beams can be balanced in intensity by

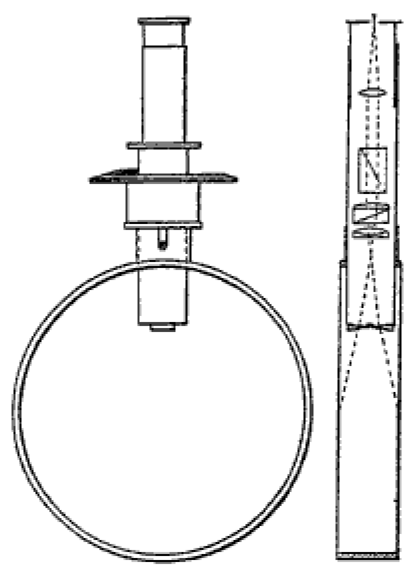

Fig. 60. — The Nutting reflectometer.

rotating the Nicol prism. The surface whose reflection coefficient is desired is placed on one side of the ring completely covering it and this is illuminated by a non-selective ground opal glass on the other side of the ring. The instrument is placed upon a wooden frame for convenience. The light is reflected back and forth between two planes of 'infinite' extent made practically so by the polished ring. Simple theory shows that the ratio of the brightness of the unknown to that of the ground opal glass is a direct measure of the reflection coefficient of the former for the character of the illumination it receives. Certain precautions must be taken into consideration as explained by Nutting.

32. *Methods of Altering Brightness of Colors Non-selectively.* — It is often desirable to alter the