

A Continuously Variable Diaphragm for Use in Spherical Aberration Studies

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IN the theory of geometrical optics, the amount of longitudinal spherical aberration suffered by a ray of light on passing through a thin lens is commonly expressed as a function of the height h of the ray above the principal axis of the lens. In order to facilitate the study of the aberration the diaphragm shown in Fig. 1 was devised.

A V-shaped slot is cut in a rectangular piece of sheet metal and a straight slot of length equal to the diameter of the lens to be studied is cut in an approximately square piece of the same material. Parallel ways are then provided in the latter piece and spaced so that the piece containing the V-shaped slot will slide into them. When the two slots are opposite each other the effect is to form two diamond-shaped apertures at a distance $2h$ apart. The lens is mounted immediately behind the slots so that the two apertures will be situated symmetrically with respect to the principal axis of the lens. The height of the rays above the principal axis may be varied continuously by sliding the rectangular piece in its ways, and when the diaphragm is mounted with the lens on an optical bench provided with a source and screen the amount of longitudinal spherical aberration may be studied as a function of h . If desired a scale and index may be ruled on the sheet metal which will read the height h in convenient units.

Fig. 2 shows typical results for a plano-convex lens which has a radius of curvature of

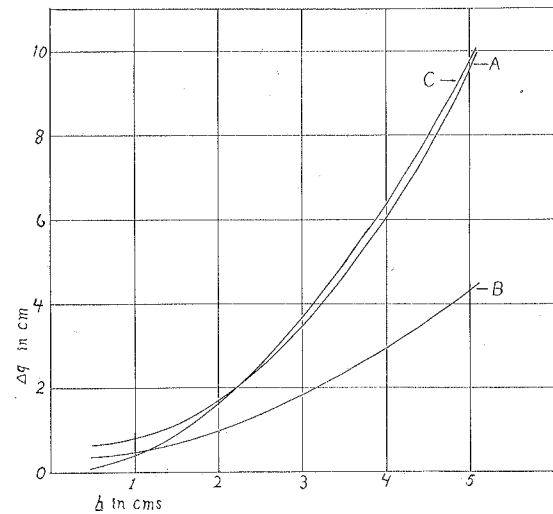


FIG. 2. Longitudinal spherical aberration Δq as a function of the height h of the ray above the central axis. Curve *A*, plotted from data taken with the plane side of the lens facing source; curve *B*, with convex side facing source; curve *C*, theoretical curve corresponding to *A*.

8.93 cm, index of refraction of 1.54, and diameter of 11.3 cm. The values of Δq for the theoretical curve *C* were calculated by substituting the constants of the lens into the thin-lens relation given by T. T. Smith,¹ modified to give the aberration Δq and not the reciprocal aberration $\Delta(1/q)$. In each case the object distance was 69 cm.

¹ National Bur. of Standards Sci. Paper No. 461 (1922), p. 561.

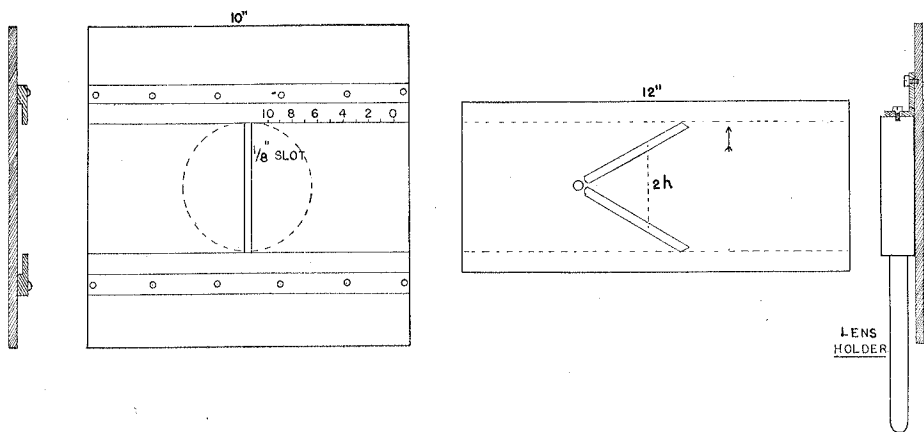


FIG. 1. Details of variable diaphragm.