DATA OPTICS, INC.
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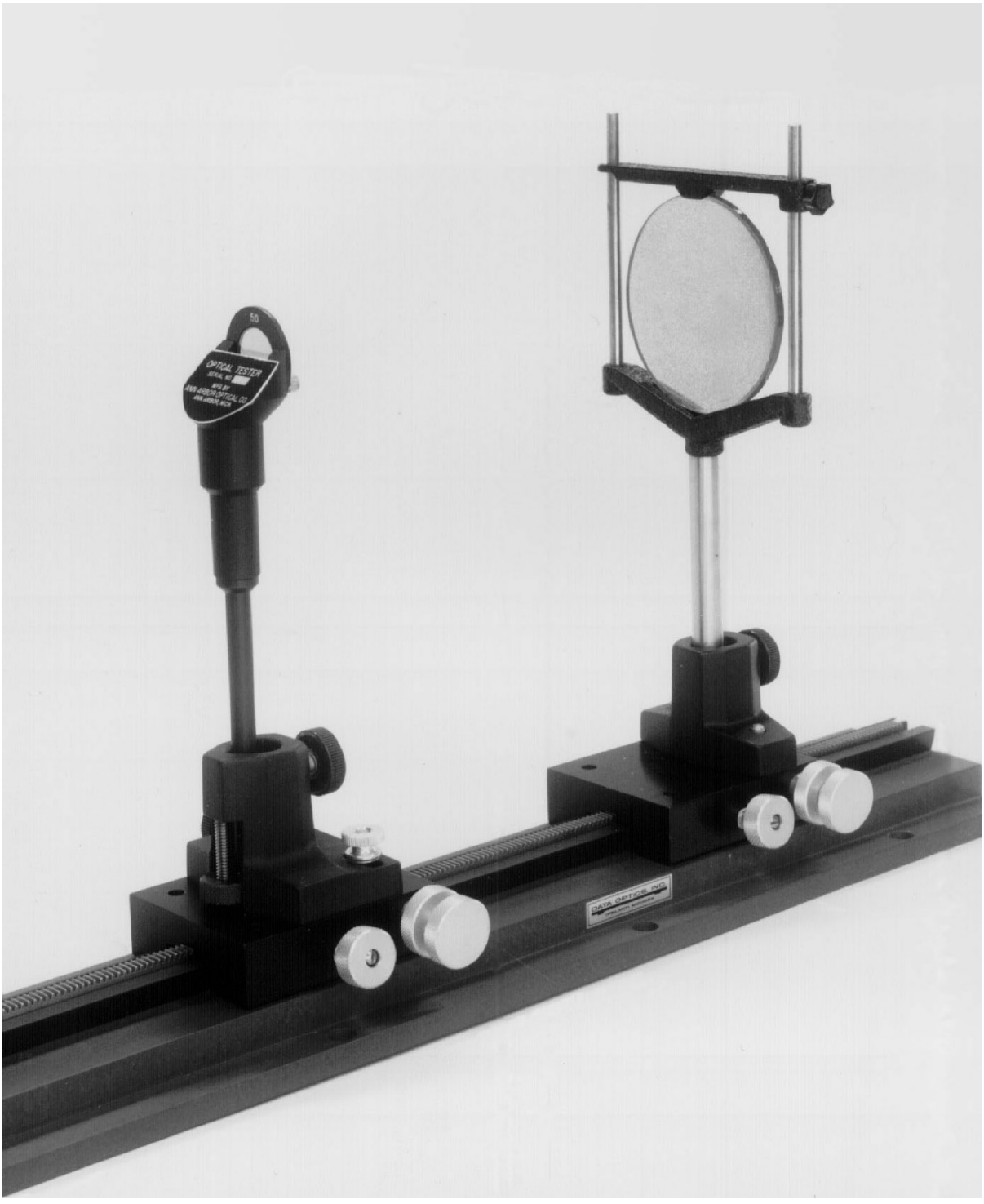
Model C Optical Tester



For Testing the Quality of Lenses, Mirrors and Optical Windows

PRINCIPLE

The Model C Optical Tester is based on the method introduced by V. Ronchi and M. Lenouvel. When a lens, mirror or optical window is illuminated through a grating of equally spaced transparent and opaque bands, as in Figure 1, with the grating near the focal plane F, then the eye, placed at P in the returning beam of light sees a number of dark lines which appear localized on the lens.

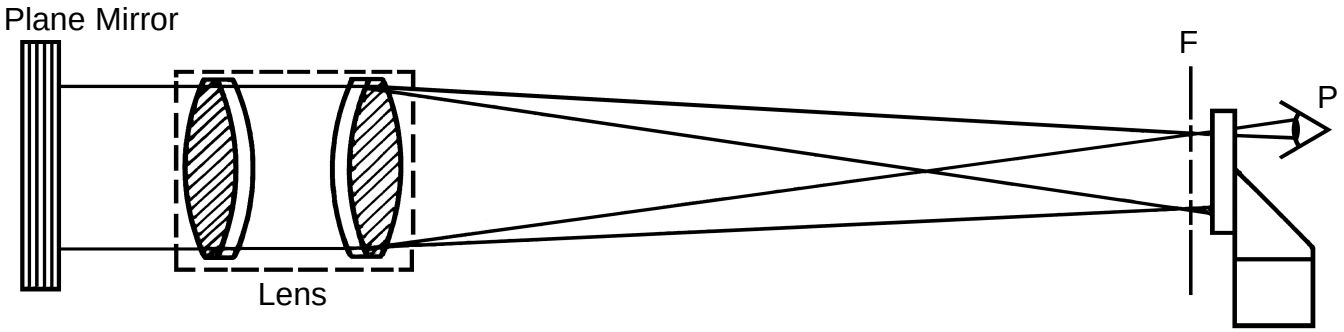


Figure 1

In Figure 1, if the grating is behind the focal plane, then its image is an equal distance in front. Upon looking at the lens through the grating, all the rays passing through the grating image cannot reach the eye, as they are stopped by the opaque parts of the grating. As a result, a pattern of light and dark lines is seen.

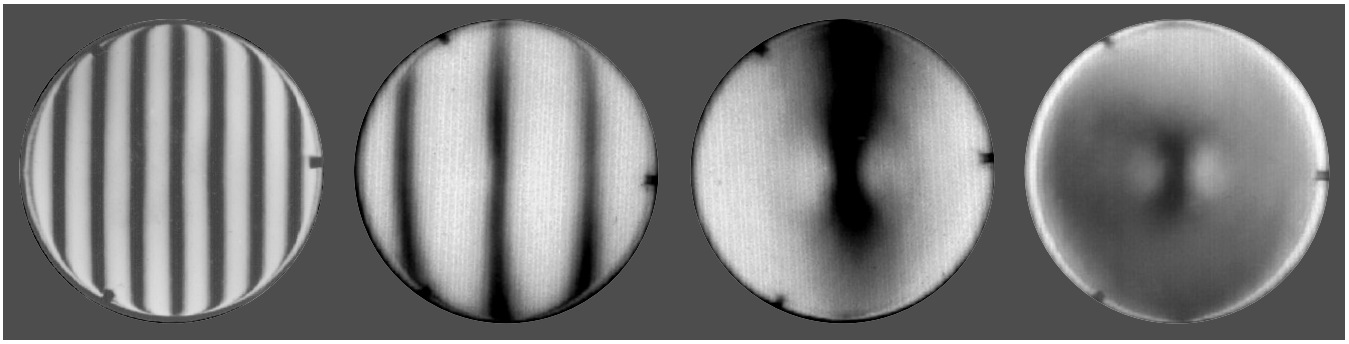
If the lens is well corrected, the shadow lines or fringes are straight, parallel, and equidistant. The distance separating them increases as the grating is moved nearer to the focal plane, at which point they disappear completely. In the case of a poor lens or mirror the fringes have a complex form, varying according to the position of the grating. The pattern covers the entire lens (or mirror) when testing optics having focal lengths greater than 3 to 4 inches. For shorter focal lengths, the examination is limited to proportionally smaller portions of the lens.

METHOD OF USE

The Optical Tester can be hand-held for a casual inspection of mirrors and lenses. However, for an accurate measurement of focal length or a critical analysis, it should be clamped in position, preferably with some mechanical adjustment for movement toward and away from the optical component being inspected. For this purpose, an adjustable laboratory stand of any kind can be used. Also good for this purpose is an inexpensive type of optical bench such as those used for instructional use. The particular optical arrangement depends on the type of lens or mirror being inspected, and the laboratory facilities available. A dark room is not necessary. A photographic record of the pattern can be made by mounting the Optical Tester before a suitable camera.

APPLICATIONS

LENSES: Both single lenses and lens systems can be tested for focal length. The location of focal planes can be determined to exacting accuracy. Figure 2 shows the patterns obtained at the distances indicated inside the focal plane of an 8'' objective. A defect at the center of this lens is evident from these patterns. Aberrations (spherical, coma, chromatic) can be detected and measured.



(a) -0.063" (b) -0.031" (c) -0.006" (d) 0.000"

Figure 2

MIRRORS: Spherical and parabolic mirrors can be tested both for focal length and accuracy of optical figure. In addition, the Optical Tester can be used to determine the position of the optic axis of off-axis parabolic mirrors. Figure 3 shows patterns observed when examining two spherical mirrors with the Optical Tester. A visual analysis of the fringes in the patterns shows the contours of the mirror surfaces to be as illustrated. The variations in the contour at the right have been exaggerated for illustrative purposes; the variation in the radius of curvature is really less than 0.4% over the entire surface of this mirror.

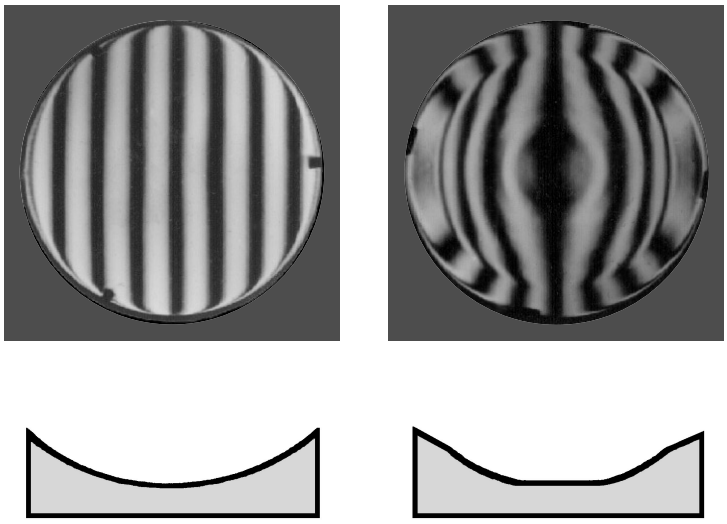


Figure 3

OTHER USES: The Optical Tester can be used for the detection or observation of a local distortion in an optical path, due to a change in surface or index of refraction. An example of this is the examination of plastic and glass windows for distortion. Another example is the observation of local temperature variations in small bodies of water and other fluids. Temperature gradients of less than 0.1°C. have been observed by this method.