**Problem 4 (Optics)**

A thin lens plane-convex with the diameter 2r, the curvature radius R and the refractive index $n_o$ is positioned so that on its left side is air ($n_1 = 1$), and on its right side there is a transparent medium with the refractive index $n_2 \neq 1$. The convex face of the lens is directed towards air. In the air, at the distance $s_1$from the lens, measured on the principal optic ax, there is a punctual source of monochromatic light.

a) Demonstrate, using Gauss approximation, that between the position of the image, given by the distance $s_2$ from the lens, and the position of the light source, exists the relation:

$$\frac{f_1}{s_1} + \frac{f_2}{s_2} = 1$$

where $f_1$ and $f_2$ are the focal distances of the lens, in air, respectively in the medium with the refractive index $n_2$.

Observation: All the refractive indexes are absolute indexes.

b) The lens is cut perpendicular on its plane face in two equal parts. These parts are moved away at a distance $\delta \ll r$ (Billet lens). On the symmetry axis of the system obtained is led a punctual source of light at the distance $s_1$ ($s_1 > f_1$) (fig. 4.1). On the right side of the lens there is a screen E at the distance d. The screen is parallel with the plane face of the lens. On this screen there are N interference fringes, if on the right side of the lens is air.

Determine N function of the wave length.

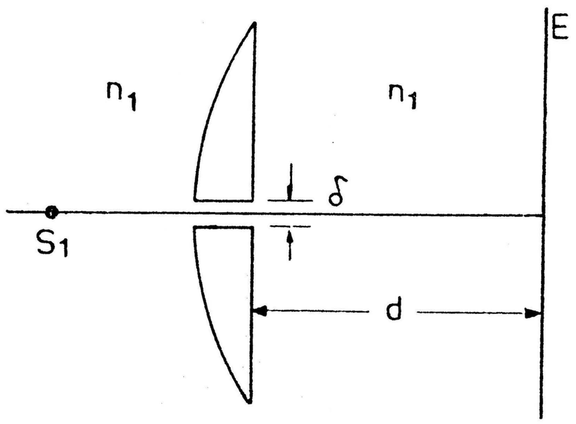


Fig. 4.1