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(b) the shift of the interference pattern on the screen when the slit is displaced by $\delta l = 1.0$ mm along the arc of radius r with centre at the point O;

(c) at what maximum width δ_{max} of the slit the interference fringes on the screen are still observed sufficiently sharp.

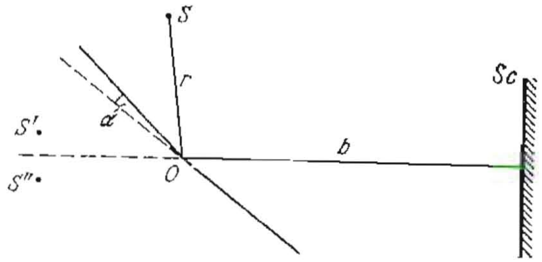

Fig. 5.14.

5.72. A plane light wave falls on Fresnel mirrors with an angle $\alpha = 2.0'$ between them. Determine the wavelength of light if the width of the fringe on the screen $\Delta x = 0.55$ mm.

5.73. A lens of diameter 5.0 cm and focal length $f = 25.0$ cm was cut along the diameter into two identical halves. In the process, the layer of the lens $a = 1.00$ mm in thickness was lost. Then the halves were put together to form a composite lens. In this focal plane a narrow slit was placed, emitting monochromatic light with wavelength $\lambda = 0.60$ µm. Behind the lens a screen was located at a distance $b = 50$ cm from it. Find:

(a) the width of a fringe on the screen and the number of possible maxima;

(b) the maximum width of the slit δ_{max} at which the fringes on the screen will be still observed sufficiently sharp.

5.74. The distances from a Fresnel biprism to a narrow slit and a screen are equal to $a = 25$ cm and $b = 100$ cm respectively. The refracting angle of the glass biprism is equal to $\theta = 20'$. Find the wavelength of light if the width of the fringe on the screen is $\Delta x = 0.55$ mm.

5.75. A plane light wave with wavelength $\lambda = 0.70$ µm falls normally on the base of a biprism made of glass ($n = 1.520$) with refracting angle $\theta = 5.0°$. Behind the biprism (Fig. 5.15) there is a plane-parallel plate, with the space between them filled up with benzene ($n' = 1.500$). Find the width of a fringe on the screen Sc placed behind this system.

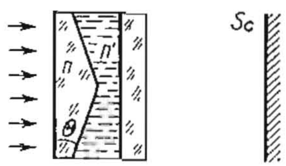

Fig. 5.15.

5.76. A plane monochromatic light wave falls normally on a diaphragm with two narrow slits separated by a distance $d = 2.5$ mm.

$2d\sqrt{n^2 - \sin^2\theta_1} = (k + \tfrac{1}{2})\lambda$, $k = 0, 1, 2, \ldots$ for a thin film

A fringe pattern is formed on a screen placed at a distance $l = 100$ cm behind the diaphragm. By what distance and in which direction will these fringes be displaced when one of the slits is covered by a glass plate of thickness $h = 10$ µm?

5.77. Figure 5.16 illustrates an interferometer used in measurements of refractive indices of transparent substances. Here S is

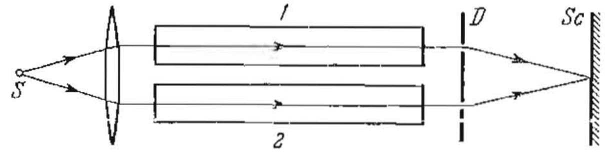

Fig. 5.16.

a narrow slit illuminated by monochromatic light with wavelength $\lambda = 589$ nm, *1* and *2* are identical tubes with air of length $l = 10.0$ cm each, D is a diaphragm with two slits. After the air in tube *1* was replaced with ammonia gas, the interference pattern on the screen Sc was displaced upward by $N = 17$ fringes. The refractive index of air is equal to $n = 1.000277$. Determine the refractive index of ammonia gas.

5.78. An electromagnetic wave falls normally on the boundary between two isotropic dielectrics with refractive indices n_1 and n_2. Making use of the continuity condition for the tangential components, **E** and **H** across the boundary, demonstrate that at the interface the electric field vector **E**

(a) of the transmitted wave experiences no phase jump;

(b) of the reflected wave is subjected to the phase jump equal to π if it is reflected from a medium of higher optical density.

5.79. A parallel beam of white light falls on a thin film whose refractive index is equal to $n = 1.33$. The angle of indices is $\theta_1 = 52°$. What must the film thickness be equal to for the reflected light to be coloured yellow ($\lambda = 0.60$ µm) most intensively?

5.80. Find the minimum thickness of a film with refractive index 1.33 at which light with wavelength 0.64 µm experiences maximum reflection while light with wavelength 0.40 µm is not reflected at all. The incidence angle of light is equal to 30°.

5.81. To decrease light losses due to reflection from the glass surface the latter is coated with a thin layer of substance whose refractive index $n' = \sqrt{n}$, where n is the refractive index of the glass. In this case the amplitudes of electromagnetic oscillations reflected from both coated surfaces are equal. At what thickness of that coating is the glass reflectivity in the direction of the normal equal to zero for light with wavelength λ?

5.82. Diffused monochromatic light with wavelength $\lambda = 0.60$ µm falls on a thin film with refractive index $n = 1.5$. Determine the