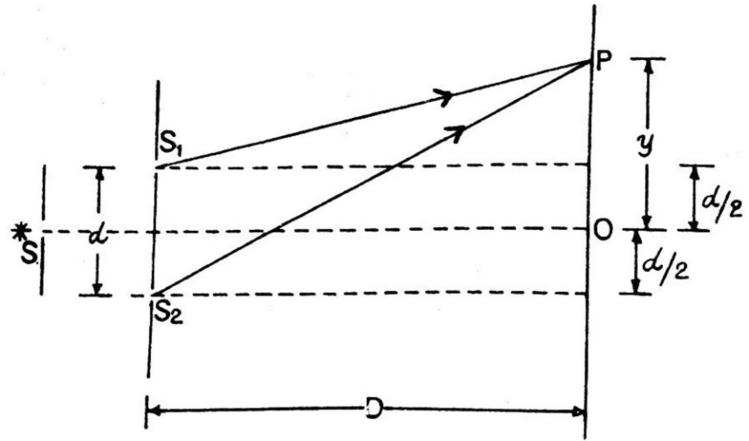At any point P on the screen, the geometric path difference between the wavelets

$$\Delta x_g = S_2P - S_1P \qquad .....(1)$$

And the corresponding phase difference is

$$\phi = \frac{2\pi}{\lambda} \Delta x_o \qquad ..........(2)$$



Where $\Delta x_o$ is optical path difference, $\Delta x_o = \mu.\Delta x_g$ ; $\Delta x_g$ being the geometrical path difference.

$$(S_2P)^2 - (S_1P)^2 = \left[ D^2 + \left( y + \frac{d}{2} \right)^2 \right] - \left[ D^2 + \left( y - \frac{d}{2} \right)^2 \right]$$

$$= 2yd$$

$$(S_2P - S_2P)(S_2P + S_2P) = 2yd$$

Since, D>>d, $(S_2P + S_1P) \approx 2D$