$$T_B(x',y') = \begin{cases} 0, & 0 \le \frac{1}{2}[1+\cos\Psi(x',y')] \le b, \\ 1, & b \le \frac{1}{2}[1+\cos\Psi(x',y')] \le 1, \end{cases} \tag{3}$$

where $b = 1-(1/\pi)\arcsin a(x',y')$. In this case, the desired output field is a plane wave with a cosine amplitude taper and the plane wave is designed to leave the hologram in an angle of 33°. In binary-amplitude coding, the phase is stored in the locations of the slots and the amplitude information is recorded in the variations of slot widths. The main effect of the binarization is the redistribution of energy between the various diffraction orders of the hologram [5]. Figure 2 shows an example of a binary amplitude hologram.

The field in the quiet-zone is calculated by using an exact near-field aperture integration (physical optics). The formula for the quiet-zone field is [6,7]

$$\mathbf{E}(x,y,z) = \iint_S E_a \frac{1+jkR}{2\pi R^3} e^{-jkR}\left[\mathbf{u}_y(z-z') - \mathbf{u}_z(y-y')\right] dS', \tag{4}$$

where $R = \sqrt{(x-x')^2+(y-y')^2+(z-z')^2}$ is the distance from a point in the aperture (hologram) to a point in the quiet-zone. In this case, the aperture field is $E_a(x',y') = T_B(x',y')E_{feed}(x',y')$, where $E_{feed}(x',y')$ is the complex field of the feed horn in the plane of the hologram. In this analysis, the aperture field is assumed to be linearly polarised in $\mathbf{u}_y$-direction. However, the polarization effects of a hologram structure are not included in these analyses, i.e., the incoming wave is only modulated by a scalar T_B function.

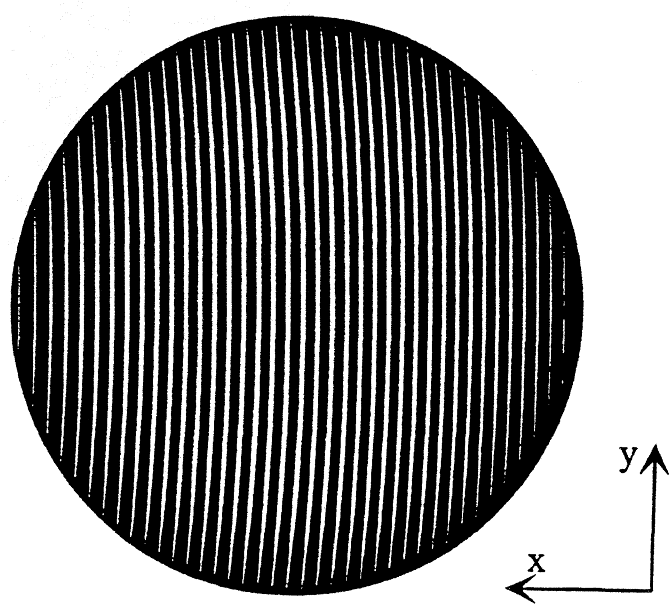

Figure 2. An example of a binary amplitude hologram.