$$V_1 = \frac{1}{a}\int_0^a V(x)\, e^{i K_1 x}\, dx$$

i.e., the Fourier component of the potential with period $1/a$.

To find E, we must eliminate A_0 and A_1 from equations (22) and (23). In this way, we obtain:

$$(E - T_0)(E - T_1) - V_1 V_1^* = 0 \qquad (24)$$

which gives:

$$E = \frac{1}{2}\left[T_0 + T_1 \pm \sqrt{\{(T_0 - T_1)^2 + 4V_1 V_1^*\}}\right] \qquad (25)$$

The resultant E–k curve is plotted in Fig. 7; it is of the familiar form with energy gaps whenever the wavenumber of the electron coincides with, or is a multiple of, the periodicity of the reciprocal lattice. When $k = k_1$ so that $T_0 = T_1$, it follows from equation (25) that:

$$E = T_1 \pm |V_1| \qquad (26)$$

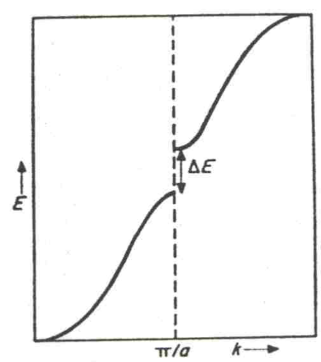

FIG. 7. E–k relation for nearly-free-electrons.

This specifies the range of forbidden values of E and the width of the energy gap is thus:

$$\Delta E = 2|V_1| \qquad (27)$$

Consequently the energy gap is determined by twice the corresponding Fourier component of the potential.