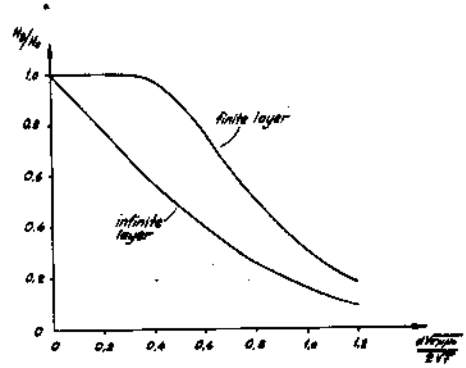


Fig. 16. The magnetic field in the transient case.

where $\sigma_1$ and $\sigma_2$ represent the conductivity on each side of the boundary. If the conductivity $\sigma_1$ of the layer is zero (spinel material) compared with the drum material (usually brass) we have the Laplace transform

$$h = H_0 \frac{e^{-(y-d)k\sqrt{s}}}{\cosh k d \sqrt{s}}$$

and the time function

$$H(d, t) = 2 H_0 \sum_{n=0}^{\infty} (-1)^n \operatorname{erfc}\left[(2n+1) d \sqrt{\frac{\sigma \mu \mu_0}{4t}}\right]$$

Fig. 16 shows the two cases, infinite layer and finite layer, from which one can compute the transient time for a given material.

## 10. Summary

The magnetic field in the ferromagnetic layer on a magnetic drum is calculated having finite airgaps and finite permeability in the layer. The layer is assumed to be a spinel material for which the permeability is low. The special cases when the permeability is one and infinite is treated by conformal mapping. The results from this investigation suggest a linear potential distribution between the corners of the recording head. This approximation gives explicit expressions for the field, and the method is generalized to finite permeability. Expressions are given for the field on each side of the

layer, and asymptotic expressions are given for the field at a large distance from the pole gap of the recording head. The inductance of the head is calculated, and measurements of the inductance change have been made when the permeability is increased from 1 to $\mu$. The transient field is computed for the one-dimensional case, assuming the resistivity of the layer to be very large. The results can be used to analyze the influence on the field from permeability and geometric shape of the head.