(1) the amplitude has been multiplied by a factor,
(2) there is an advance in phase, and
(3) the angle of flow is now θ' instead of θ.

Neither the difference in amplitude nor the difference in phase will have any bearing on the effective ac diode resistance under the assumptions of linear forward and back conductance. Therefore,

$$\frac{G_0 + G_B}{G_F - G_B} = \frac{\tan\theta' - \theta'}{\pi},$$

$$R_1' = \frac{2\pi}{(G_F - G_B)(2\theta' - \sin 2\theta') + 2\pi G_B}.$$

A comparison of these equations with (4) and (5) shows that R_1', the effective ac resistance of the diode, is equivalent to the input resistance R_1 in the case of a completely by-passed load. Thus, for the case in point, once R_1 is known, the input resistance and input capacitance are easily calculated by standard ac methods. The rectification efficiency then becomes,

$$\rho = \cos\theta' \sqrt{1 + \left(\frac{V_f}{V_1}\right)^2 - 2\left(\frac{V_f}{V_1}\right)\cos\phi} \qquad (1)'$$

where V_f/V_1 is the ac voltage transfer characteristic and ϕ is the phase angle of the load.

D. *Figure of Merit Tank Circuit Loading Not Purely Resistive*

If the detector circuit represents capacitive loading on the tank circuit, the figure of merit given above must be modified. Once the detector-circuit input resistance R_1 and the input capacitance C_1 have been determined, then:

$$\frac{n^2R_1}{X_{L0}} = Q = \frac{\omega_0}{\Delta\omega},$$

$$L\left(C_0 + \frac{C_1}{n^2}\right) = \frac{1}{\omega_0^2},$$

where C_1 is the input capacitance of the detector circuit. Thus the turns ratio is given by

$$n_c = \sqrt{\frac{1 - \Delta\omega R_1C_1}{\Delta\omega R_1C_0}} = n\sqrt{1 - \Delta\omega R_1C_1}.$$

Substituting in (6), as above,

$$\text{grid-grid gain} = \frac{\left(\frac{G_m}{\sqrt{C_0}}\right)(\rho\sqrt{R_1}\sqrt{1 - \Delta\omega R_1C_1})}{\sqrt{\Delta\omega}}.$$

Thus the crystal figure of merit with a capacitive detector input circuit is $\phi_c = \phi(1 - \Delta\omega R_1C_1)$. Therefore, under normal circuit operation, we cannot develop as high a voltage at the detector-circuit input in the presence of input capacitance as in its absence.

Conclusion

A number of experimental methods have been described for measuring the basic crystal-diode parameters. In addition, methods were described for measuring the detector-circuit input parameters which may be of interest in television receiver engineering.

Also, it was found that for a constant input signal level, the shape of the IF response characteristic will not depend on the back resistance of the crystal if the latter is above a certain minimum value. If the signal level changes, the effective ac resistance of the crystal will change because of the curvature of the diode characteristic. As a result of this change in resistance the detector-circuit input impedance will vary, and may detune the last IF stage and change its bandwidth.

A crystal figure of merit was developed for the specific application of video detection. Universal curves were presented which define germanium diode performance under the assumptions of constant forward and back conductance, zero-impedance driving voltage generator and high susceptance load.

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Correction

Aaron D. Bresler, author of the paper, "On the Approximation Problem in Network Synthesis," which appeared on pages 1724–1728 of the December, 1952 issue of the Proceedings of the I.R.E., has brought the following correction to the attention of the editors:

Equation (6), which appears in column one on page 1725 and which reads

$$\beta_1^2 = \beta_2\beta_3 = (\alpha^2 - \tfrac{1}{4})\,\frac{\beta_3}{\beta_2} = \left[\frac{\alpha + \frac{1}{2}}{\alpha - \frac{1}{2}}\right]^{2\alpha}, \qquad (6)$$

should be replaced by (6a) and (6b) as follows:

$$\beta_1^2 = \beta_2\beta_3 = (\alpha^2 - \tfrac{1}{4}) \qquad (6a)$$

$$\frac{\beta_3}{\beta_2} = \left[\frac{\alpha + \frac{1}{2}}{\alpha - \frac{1}{2}}\right]^{2\alpha}. \qquad (6b)$$