It is interesting to consider what results might have been obtained if Z_{02} had been used as the characteristic impedance. In this case, the new values are $M=-j0.231$, $N=j4.321$, $Z_{A1}=4.087\underline{/70^\circ}$, $Z_{B1}^*=2.452\underline{/30^\circ}$, $K=j1.635$, $R_3=0.264$, $R_4=3.776$, $Z_{SC}=-j0.162$, and $Z_{OC}=-j2.309$. The same values of Z_{SC} and Z_{OC} are obtained in either case. In this case, all points lie on a conventional chart.

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A Unique Solid-State Diplexer*

A diplexer is a familiar device which readily combines two separate radio-frequency signals to permit simultaneous transmission through a single transmission line or separates a composite signal into its constituent parts to permit each part to be transmitted or proceed individually. This correspondence describes a unique method of deriving diplexing action in a simple Y-junction circulator, and suggests a method of diplexing in other devices which depend upon the phase shift properties of ferrimagnetic material for their operation.

The general properties of symmetrical junction circulators are well known. At most frequencies of interest a circulator can be made to operate in a condition such that the applied dc biasing field is either above or below ferrimagnetic resonance. The direction of signal flow from port to port around a circulator changes when the applied field is shifted from one side of resonance to the other.

Experiments were performed in our laboratory to determine the optimum frequency of operation and the dc biasing field required for operation at the optimum frequency in a circulator, both below and above resonance, for a series of aluminum substituted yttrium-iron garnets. Figs. 1 and 2 show how the frequency and field change as a function of $4\pi M_s$. Note that at a $4\pi M_s$ of 320 the same field is required for operation at the optimum frequency above resonance (5.5 Gc) as is required below resonance (7.4 Gc). Typical loss and isolation characteristics as a function of frequency are shown in Fig. 3. Fig. 4 depicts the operation of the device and how it can be used in the separation or combination of two signals. The isolation between channels was approximately 30 db and the loss was approximately 1 db. It seems likely that by using the same principle, that is simultaneous operation above and below resonance, a four-port phase shift type of duplexer (assuming broad-band microwave components) could be adapted, by the proper choice of geometry and ferrimagnetic material, to perform as a diplexer.

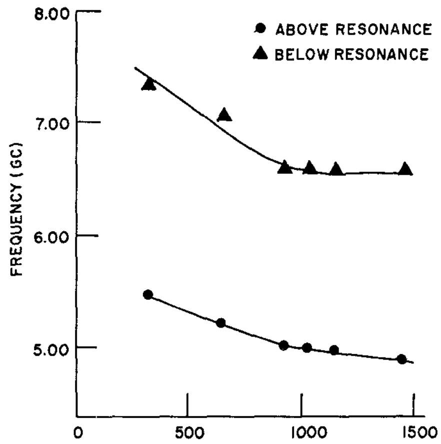

Fig. 1—Optimum frequency of operation for a series of aluminum substituted garnets.

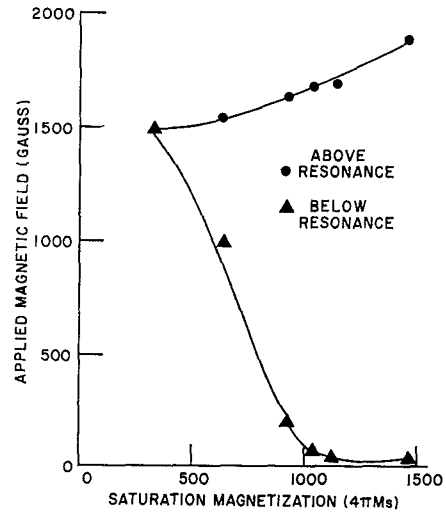

Fig. 2—Field required for operation at optimum frequency.

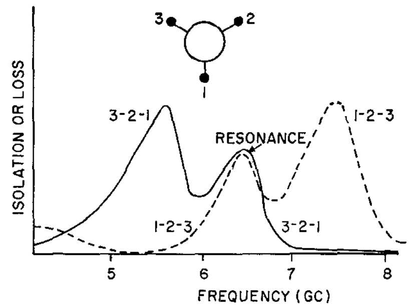

Fig. 3—Typical loss and isolation as a function of frequency.

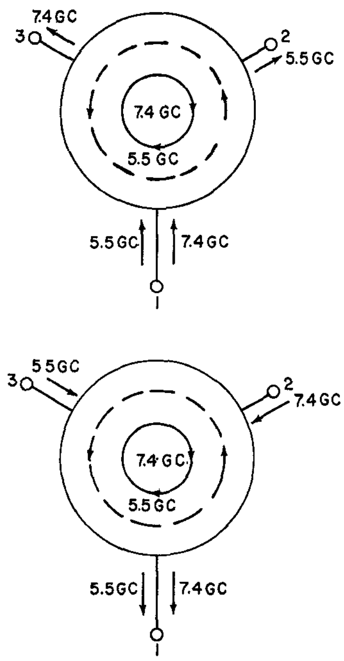

Fig. 4—Operation of a three-port circulator as a diplexer.

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