Marconi Broadcasting Transmitter Systems

'Rotamode' U.H.F Filter B8152

Features

Mechanically simple
Low drift
Good isolation
Versatile in application

Description

The Rotamode

The Rotamode is a unique type of u.h.f filter introduced by Marconi Communication Systems Ltd, initially for use in u.h.f television systems.

In the Rotamode, the properties of a directional coupler and a cylindrical resonator are combined in order to form a constant-resistance network having properties which make it especially useful in three distinct television roles:

1) For combining vision and sound transmissions
2) As a band-pass filter
3) For combining two or more different television channels into a common transmission line.

The basic Rotamode consists of a cylindrical resonator with two internal couplers. Each coupler consists of a short length of conductor running parallel to the circumference of the cylinder and having both ends brought through the surface of the cylinder to coaxial connectors. The positions of the couplers around the circumference of the resonator are not critical and may be varied to some extent for practical reasons.

Principle of operation

A Rotamode cross-section is shown diagrammatically in Fig. 2, AB and CD being the two coupling loops, matched under resistive terminating conditions.

At frequencies corresponding to cavity resonance, current in the loop AB excites the cavity in such a way that the magnetic field passes through AB. The associated electric field is as shown in Fig. 3 and is in *time* quadrature with the current giving rise to it. The potential difference between the loop and the cavity wall also excites the cavity producing an 'electric' field as shown in Fig. 4, *in phase* with the exciting voltage.

Since the exciting voltage and current are in phase the two electric fields are in time as well as space quadrature. The resultant vector therefore represents a circularly polarized, or rotating, field. Coupling therefore occurs with the second loop. It can be shown that, at resonance, all the energy fed into port A appears at port D, ports B and C being effectively decoupled. At frequencies remote from cavity resonance, power fed into port A is delivered to port B, ports C and D being totally decoupled since there is then no field excitation. The network behaves as a frequency-conscious directional coupler, the magnitude of the coupling being determined by the characteristics of the resonant cavity.

Fig. 1 Vision and Sound Combiner Type B8152. Total assembly includes harmonic attenuators and monitoring probes. Actual height 1·32m (4ft 4in).

The Rotamode as a Vision and Sound Combining Unit

The network described above satisfies the requirements of a constant-resistance type combining filter. The cavity is adjusted to resonate at the sound carrier frequency so that power fed into port A is transferred to port D. Vision power fed into port C goes straight through to port D. Sound and vision power therefore appear combined at port D. Port B is connected to a matched load which serves to absorb the very slight residual sound and vision power arising from the finite bandwidth involved, thus maintaining the correct input match.

When attenuation is required at the colour subcarrier image frequency (as in the Marconi B8152) this is achieved by adding (see Fig. 5) a second resonator, synchronously tuned, having an inductive coupling aperture in the common wall. This produces an additional resonance below sound carrier, and the degree of coupling is adjusted to place this at the

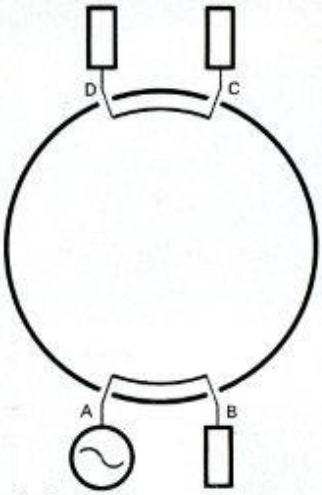


Fig. 2

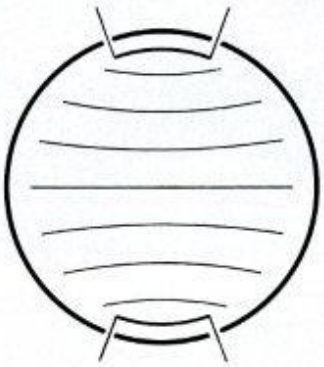


Fig. 3

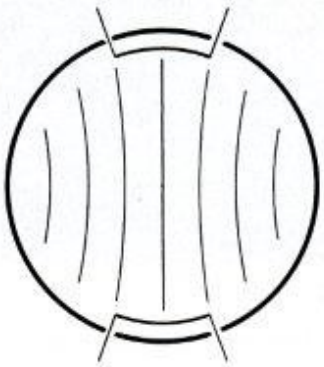


Fig. 4

image frequency. The energy at the image frequency is diverted to port B and thence into the absorber load.

A practical example of a vision-sound combiner with sub-carrier image attenuation (the B8152), is shown in the assembly of Fig. 1, which also includes power monitoring equipment and harmonic attenuators.

The Rotamode used as a band-pass filter

If the output coupler is introduced into the second cavity a band-pass response is obtained. The shape of the response in the pass-band is determined by the input, output and mutual couplings. Further resonators can be added in order to achieve the required cut-off characteristics. Such a filter can be designed for use in filtering out-of-band intermodulation products, and can be used to replace two or more individual notch-filters.

Typically such a filter comprises four resonant cavities synchronously-tuned and coupled by circular apertures in the common walls as illustrated in Fig. 6. The input is fed to port A and the filtered output appears at port D.

The Rotamode used to combine television channels

If, in Fig. 6, a second television channel, remote in frequency from the Rotamode pass-band, were fed into port C it would appear unchanged at port D no power being transferred to coupler AB. By this means an input at A, in the Rotamode pass-band, can be combined with a second channel to appear at D. With normal channel spacing only two resonators would be required.

The process can be repeated with further channels using other Rotamode filters.

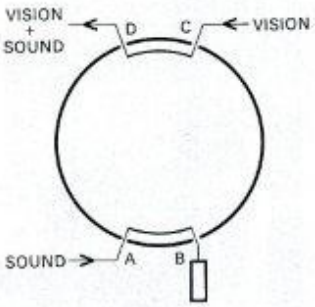
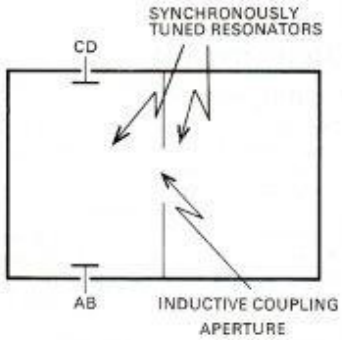


Fig. 5



Practical designs

The Rotamode is now the standard vision-sound combiner supplied with Marconi u.h.f transmitters requiring a combining unit. The performance specified for the transmitter includes that of the Rotamode.

In addition the standard Marconi u.h.f t.v channel combiner is also the Rotamode and MCSL would be pleased to submit proposals upon receipt of customer's requirements. In particular we require to know vision and sound powers and carrier frequencies, the television system in use, the colour system adopted, and the type and size of transmission line and connectors required.

Physically the Rotamode is smaller in most cases than the conventional hybrid ring combining units. It is also mechanically simpler, thus reducing differential heating and tuning effects.

Many r.f filtering requirements can be most satisfactorily met by using the Rotamode, the use of which is by no means confined to either u.h.f or television. It is especially applicable to higher frequencies when it becomes very compact but provided that size is not a problem can also be useful on lower bands.

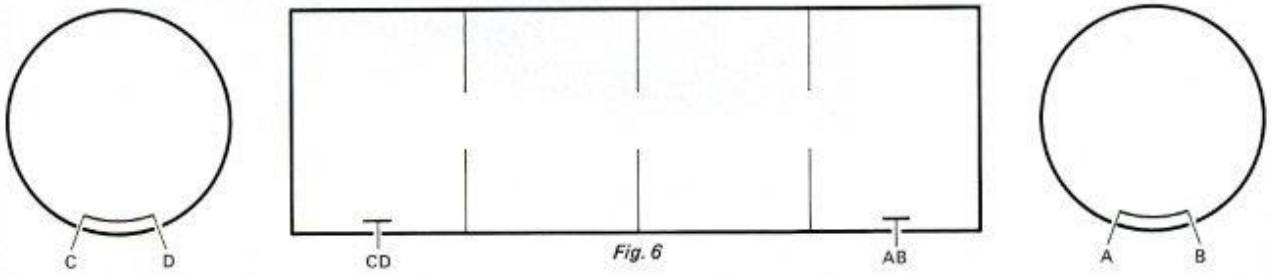


Fig. 6

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