Jan. 12, 1954 F. J. OCNASCHEK 2,666,183

VARIABLE ATTENUATOR

Filed Oct. 15, 1952

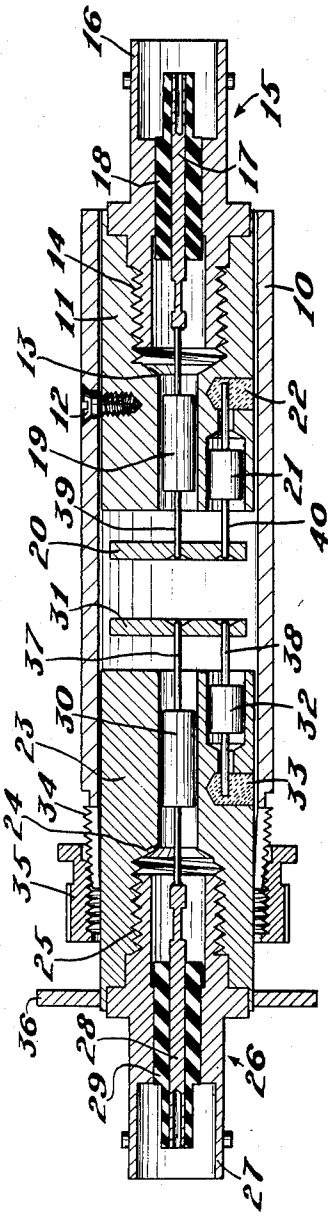


Fig. 1

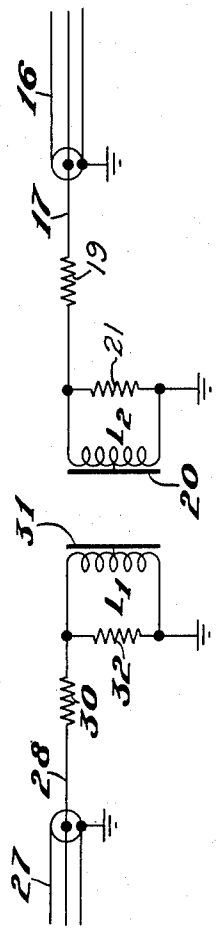


Fig. 2

INVENTOR.
FRANK OCNASCHEK
BY Mann Moody
ATTORNEY

Patented Jan. 12, 1954

2,666,183

UNITED STATES PATENT OFFICE

2,666,183

VARIABLE ATTENUATOR

Frank J. Ocnaschek, Dallas, Tex., assignor to Collins Radio Company, Cedar Rapids, Iowa, a corporation of Iowa

Application October 15, 1952, Serial No. 314,804

4 Claims. (Cl. 333—81)

1

This invention relates to a variable attenuator wherein the impedance may be varied to provide a change in coupling.

It is oftentimes desirable to attenuate a high, ultra high, or very high frequency signal to a fraction of its value. At other times it is desirable to match impedances so that the most efficient utilization of power may be obtained.

It is an object of this invention, therefore, to provide a variable attenuator and coupling device wherein the amount of coupling and impedance may be varied at will.

A feature of this invention is found in the provision for a generally cylindrical cavity resonator which has mounted at opposite ends input lines connected to capacitor plates by a pair of leads so as to form an inductive coupling.

Further features, objects and advantages will become apparent from the following description and claims when read in view of the drawings, in which;

Figure 1 is a sectional view of the variable attenuator of this invention, and

Figure 2 is a schematic view illustrating the electrical equivalents of the circuit.

Figure 1 illustrates a hollow conducting cylinder 10 which has mounted in one end thereof an internal conducting plug 11. It is fastened to the member 10 by set screws 12 or other holding means.

A central opening 13 is formed through the member 11 and a portion 14 is enlarged and threaded. A coaxial cable connector 15 is threadedly received in the portion 14 and terminates in an outer conductor 16 and an inner conductor 17. The inner and outer conductors are insulated from each other by insulation material 18. The outer conductor 16 is electrically connected to the conducting portion 11 but the inner conductor 17 is insulated therefrom.

A resistor 19 has one side electrically connected to one end of the inner conductor 17 and its opposite end is connected to a lead 39 which is connected to a first capacitive plate 20. A second resistor 21 is connected to a lead 40 which is connected to the plate 20. The other side of resistor 21 is connected to the plate 11 by solder material.

The opposite end of the cylinder 10 receives therein a second plug 23 of conducting material which is formed with a central opening 24 and which has a threaded portion 25 in which a second coaxial connector 26 is received.

The outer conductor 27 of the connector 26 is connected to the member 23, whereas the inner conductor 28 is insulated from it by insulation

2

material 29. A resistor 30 has one side connected to the inner conductor 28. A lead 37 is connected to the other side of resistor 30 and to a second capacitor disc 31.

A fourth resistor 32 has one end connected to the disc 31 by a lead 38 and its opposite end attached to the member 23 by solder material 33.

A tapered threaded portion 34 is attached to the cylinder 10 and a tapered threaded collar 35 is received thereon so as to clamp the member 23 to the member 34. The internal threads of the collar 35 are tapered opposite to the taper of the threads of member 34. When the collar 35 is loosened the member 23 may be rotated or slid relative to cylinder 10 by suitable levers 36.

When the collar 35 is tightened, the member 23 is rigidly held and cannot be rotated.

Figure 2 illustrates schematically the apparatus of this invention wherein it is seen that the capacitor plates 20 and 31 are capacitively coupled to each other and inductances L_1 and L_2 are inductively coupled to each other. The inductance L_1 is the loop comprising the leads 37 and 38 and plate 31. The inductance L_2 is the loop formed by the leads 39 and 40 and the plate 20.

The coupling between the capacitive plates 20 and 31 may be varied by moving them longitudinally relative to each other. This may be accomplished by loosening the sleeve 35 and manually moving the plates apart with the levers 36. This allows coarse adjustment of the coupling between the input and output sides. Minor adjustments may be made by rotating the member 23 relative to the member 11 so that the coupling loops comprising L_1 and L_2 rotate relative to each other so that the coupling is varied from a maximum to a minimum value. This allows fine adjustments to be made at these frequencies.

Other advantages that are obtainable with this structure are:

1. Can be used over a large frequency range, high frequency, very high frequency and ultra high frequency.
2. Very low standing wave ratio.
3. Provides same attenuation over wide frequency ranges.
4. Will withstand severe conditions of shock and vibration.
5. Longitudinal movement provides coarse control, and rotational movement provides fine control.
6. Can be used as an impedance transformer as well as an attenuator by changing the values of resistance in either end of attenuator.

7. Can be inserted anywhere in transmission line.

8. Has no tuned elements, therefore does not require tuning and is very stable with respect to frequency temperature and humidity changes.

9. Provides a common conductor.

10. Can be used in a balanced circuit by suitable changes in circuit arrangement.

It is seen that this invention provides a variable attenuator or impedance transformer which may be very accurately adjusted.

Although this invention has been described with respect to a particular embodiment thereof, it is not to be so limited as changes and modifications may be made therein which are within the full intended scope of the invention, as defined by the appended claims.

I claim:

1. A variable impedance and coupling device comprising, a hollow conducting cylindrical member, a first internal conducting plug received within one end of said cylinder, said first plug formed with an axial opening, a first coaxial connector connected to said first plug, a first resistor mounted within the axial opening of said first plug and connected to the center conductor of said coaxial cable connector, a first capacitive plate attached to the opposite side of said first resistor, a second resistor with one end attached to said first plug and the opposite end connected to said first capacitive plate, a second plug rotatably and slidably supported in said cylinder and formed with an axial opening, a third resistor mounted within the axial opening of said second plug, a second capacitive plate attached to one side of the third resistor, a second coaxial connector connected to said second plug, and a fourth resistor connected between said second plug and said second capacitive plate.

2. A variable coupling and impedance matching device comprising, a hollow cylindrical member, a first plug formed with a central longitudinal opening mounted in one end of said cylindrical member, a first resistor mounted in said longitudinal opening, a coaxial connector connected to said first plug and its center conductor connected to one side of said resistor, a first capacitive disc connected to the other side of the first resistor, a second resistor connected between said first capacitive disc and said first plug, a second plug slidably and rotatably received in said cylindrical member, a second coaxial connector connected to said second plug, said second plug formed with a longitudinal

opening, a third resistor mounted in said longitudinal opening with one lead connected to the center conductor of said coaxial connector, a second capacitive plate attached to the other lead of said third resistor, a fourth resistor connected between the second plug and the second capacitive plate, and a lever attached to said second plug for rotating and moving it longitudinally relative to said cylindrical member.

3. A variable attentuator and coupling device comprising, a hollow conducting cylindrical member, a pair of plugs mounted in opposite ends of said cylindrical member, said plugs formed with longitudinal openings therethrough, a pair of coaxial connectors mounted, respectively, to said plugs, a first resistor formed with a pair of relatively rigid leads extending from opposite ends thereof, one of the leads of said first resistor connected to a first capacitive disc, said first resistor mounted in the longitudinal opening of the first plug and the opposite lead of said first resistor connected to the center conductor of the first coaxial connector, a second resistor formed with a pair of relatively rigid leads with one of the leads connected to the first plug and the other lead connected to said first capacitive disc, a third resistor mounted in the longitudinal opening of the second plug and having a pair of relatively rigid leads, a second capacitive plate connected to one of said leads of the third resistor, the other of said leads of the third resistor attached to the center conductor of the second coaxial connector, a fourth resistor with relatively rigid leads, one of its leads connected to the second plug and the other lead connected to the second capacitive plate, and fastening means for loosening and tightening the second plug relative to said cylindrical member.

4. Apparatus according to claim 3 wherein said fastening means comprises a tapered threaded portion on one end of said cylindrical member, and an internally threaded tapered collar receivable on said first tapered portion.

FRANK J. OCNASCHEK.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,888,278	MacDonald	Nov. 22, 1932
2,422,601	Tashjian	June 17, 1947
2,494,722	Rosen	Jan. 17, 1950
2,514,544	Hansen	July 11, 1950
2,561,184	Dehn	July 17, 1951