

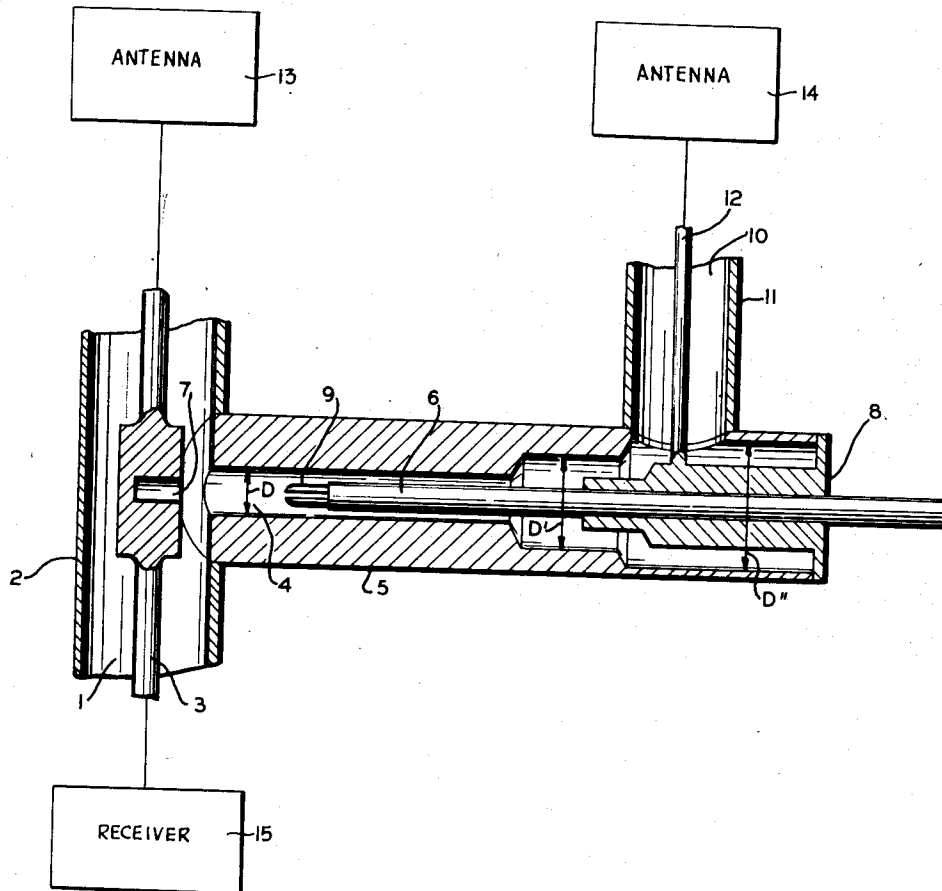
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POWER DIVIDER

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POWER DIVIDER

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2. Claims. (Cl. 333-7)

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My present invention relates in general to apparatus for controlling the intensity of guided electromagnetic energy and more particularly to the provision of a combined voltage divider, variable attenuator and switch in a transmission line system.

This invention is an improvement upon the invention disclosed in my copending application Serial No. 613,511, filed August 30, 1945.

In my present invention I provide a simple mechanism for varying the intensity of the signal in a coaxial line and for switching that signal on and off. My present invention further provides a means for dividing the power in a coaxial transmission system so that power may be fed from one generator to two output lines, or conversely, from two input lines to a common receiver. Further, my present invention provides that one of the two output or input lines may be switched on and off or the signal therein may be attenuated.

It is accordingly an object of my invention to provide in a single apparatus a variable attenuator, switch and power divider for dividing the power in a coaxial line system and for switching on and off the power in one branch of the apparatus.

It is a further object of my invention to provide such a combined variable attenuator, switch and power divider that will be light in weight, simple to manufacture and simple to adjust and operate.

It is a still further object of my invention to provide such an attenuator, switch and power divider that will control positively the switching on and off of the power in one branch thereof.

Other objects and features of my present invention will become apparent upon a careful consideration of the following detailed description when taken together with the accompanying drawing the figure of which illustrates a typical embodiment of the invention.

In the drawing, a first coaxial line 1 having an outer conductor 2 and an inner conductor 3 has joined thereto in a T-junction a second coaxial line 4 having an outer conductor 5, an inner conductor 6 and an end closure 8 for the far end thereof. The inner conductor 3 of the first coaxial line 1 has a hole 7 cut transversely therein opposite to the open portion of the second coaxial line 4. The inner conductor 6 of the second coaxial line 4 is slidably mounted therein, being held slidably by a portion of the end closure 8. The end closure 8 is inwardly elongated along the axis of the second coaxial line 4 and progressive-

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ly reduced in diameter. The end of the inner conductor 6 directed toward the first coaxial line 1 has spring-fingered contactors 9 therein. These contactors 9 make contact with the hole 7 in the inner conductor 3 of the first coaxial line 1 when the slidable inner conductor 6 of the second coaxial line 4 is pushed toward and into the hole 7. The inner diameter D of the outer conductor 5 of the second coaxial line 4 is substantially smaller than the inner diameter of the first coaxial line. This is made smaller so that when the slidable inner conductor 6 is retracted from the hole 7, the section of the line 4 that has no inner conductor therein will form a section of hollow wave guide operated beyond cut off frequency. The inner diameter D is progressively increased in sloped steps D' and D'' toward the closed end of the second coaxial line 4. Correspondingly, the end closure 8 is as aforementioned progressively reduced in its cross sectional diameter along its inwardly elongated portion to match the increases in internal diameter of the outer conductor 5. A third coaxial line 10, having an outer conductor 11 and an inner conductor 12, is joined in T-junction fashion to the second coaxial line 4 near the closed end thereof. The closed end of the second coaxial line 4 may then become a short circuited coaxial line stub having a depth substantially equal to one-quarter the length of a wave of energy therein at the operative frequency to form effectively an impedance matching stub and support for the inner conductor 6. This stub preferably has a low Q.

In explaining the operation of the apparatus of my invention, it will be convenient to assume that the device is in use in a transmission line system connecting two radio antennas 13 and 14 in parallel to a radio receiver 15. Accordingly, one end of the first coaxial line 1, the lower end on the drawing, is connected to a radio receiver 15, and the upper end of the coaxial line 1 is connected to a first radio antenna 13 and the free end of the third coaxial line 10 is connected to a second radio antenna 14. If now, the slidable inner conductor 6 of the second coaxial line 4 is pushed into the hole 7 and engaged into contact with the inner conductor 3 of the first coaxial line 1, signals from both antennas will be fed simultaneously into the receiver 15. Now if the slidable inner conductor 6 be retracted from the hole 7, the second antenna 14, namely the one connected to the third coaxial line 10, will no longer be effectively connected to the receiver, and signals from only one antenna 13,

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namely the one directly connected to the first wave guide 1, will be brought to the receiver. As aforementioned, the portion of the second coaxial line 4 which is now without an inner conductor operates as a section of hollow wave guide beyond its cut off frequency and is therefore effectively a high impedance in the path of the signal coming from the second antenna 14. Such signals will be quickly attenuated to an insignificant value by this section of wave guide operated beyond cut off. The small size of the diameter D near the first line 1 is desirable to prevent large changes in the impedance of the first line 1 when the slidable inner conductor 6 is inserted in the hole 7 or withdrawn therefrom. This is so because the hole 7 may be made relatively small when the diameter D is small.

The apparatus of my invention may also be used in a system in which electric power is being fed to two different users of that power. Thus, if a generator of power be connected to the lower end of the first coaxial line 1, and a first user of this power be connected to the upper end of the same coaxial line 1, and a second user of this power be connected to the free end of the third coaxial line 10, power will be fed in parallel to both users when the slidable inner conductor 6 is engaged electrically in the hole 7 in the inner conductor 3. When this slidable inner conductor 6 is retracted from the hole 7, power will no longer be fed to the second user connected to the third coaxial line 10, but will be fed solely to the first user.

The increasing inner diameter D, D', and D'' of the outer conductor 5 and that of the projection of the end closure 8 of the second coaxial line 4 provides broad-banding characteristics in this coaxial line. The impedance matching stub end of the second coaxial line 4 aids in matching impedances to power being interchanged between the second coaxial line 4 and the third coaxial line 10. This stub is proportioned to have a low Q, in order further to enhance the broad-band characteristics. Obviously, if the inner conductor 6 be placed near but not firmly in contact with the opening 7 in the inner conductor 3, there will be attenuation of signals passing between these two conductors but not complete elimination, since electrical lines of force will pass from the slidable conductor 6 to the inner conductor 3 of the first coaxial line 1. It is only when the slidable inner conductor 6 is retracted a sufficient distance from the hole 7 in the inner conductor 3 to break all electrostatic lines of force between these two inner conductors that a switching action takes

place and that the portion of the second coaxial line 4 left without an inner conductor operates as a wave guide beyond cut off.

Although I have shown and described only a certain specific embodiment of my invention, I am fully aware of the many modifications possible thereof. Therefore this invention is not to be limited except insofar as is necessitated by the prior art and the spirit of the appended claims.

I claim:

1. A combined power divider, attenuator and switch for use in transmission lines comprising, a first coaxial line having first inner and outer conductors and two open ends, a second coaxial line of relatively smaller inner diameter than said first line having second inner and outer conductors, and one open and one closed end, means for connecting said open end of said second line to said first line through a side thereof between said two open ends, said second inner conductor being axially slidably mounted in said second line and adapted to make slidable electrical contact with said first inner conductor, said inner conductor having a substantially transverse hole therein to receive the thereunto directed end of said second conductor in said slidable electrical contact, said second line becoming a wave guide operated beyond its cut off frequency at normal operative frequencies when said second inner conductor is retracted from said first inner conductor, a third coaxial line having third inner and outer conductors and two open ends, and means for connecting one end of said third line to said second line through a side thereof near said closed end.

2. The apparatus of claim 1 in which the inner diameter of said second coaxial line is progressively increased in steps toward said closed end and the portion of said closed end beyond the junction between said second and third lines is a short circuited stub of relatively low Q having a length substantially equal to one quarter of a wave length therein of energy at the operative frequency.

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