

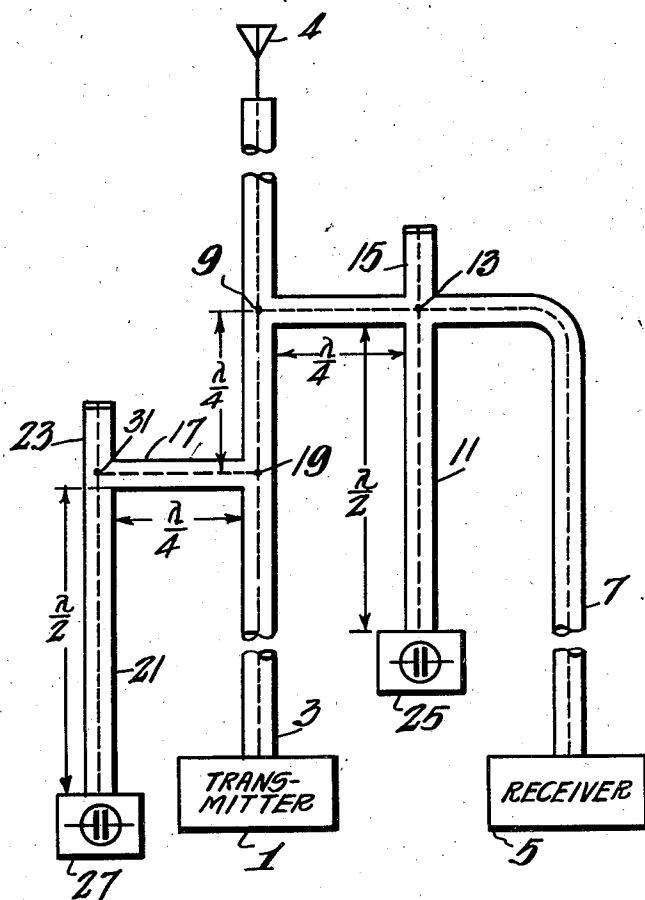
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RADIO TRANSMITTER-RECEIVER AUTOMATIC SWITCHING SYSTEM

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RADIO TRANSMITTER-RECEIVER AUTOMATIC SWITCHING SYSTEM

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3 Claims. (Cl. 250-13)

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The invention covered herein may be manufactured and used by or for the Government of the United States for governmental, military, naval and national defense purposes without payment to me or assigns of any royalty thereon.

This invention relates to radio frequency distribution systems, and more particularly to networks for operating a radio transmitter and a receiver with a common antenna system. In certain applications, particularly those in which signals comprising short pulses are radiated, reflected by a remote object and picked up at or near the location of the transmitter, it is desirable to use a single antenna system rather than provide separate antennas for reception and transmission. In order to prevent damage to the receiver during the periods of transmission, as well as dissipation of power, it is necessary to provide means for isolating electrically the receiver from the transmitter.

Prior art systems for this purpose have been somewhat uncertain in operation, extremely critical of adjustment, and relatively inefficient in that a compromise must be effected between the degree of isolation of the receiver and the amount of transmitter power dissipated in the network.

It is the principal object of the present invention to provide an improved radio frequency network for operating a transmitter and a receiver with a common antenna system.

Another object is to provide an improved network of the described type which incorporates no moving parts and provides substantially instantaneous switching of the antenna from transmitter to receiver.

A further object is to provide an improved network of the described type which is efficient, not critical of adjustment, and capable of providing substantially complete isolation of the receiver from the transmitter without absorbing appreciable power.

These and other objects will become apparent to those skilled in the art upon consideration of the following description, with reference to the accompanying drawing, which is a schematic diagram of a transmission network embodying the invention.

A typical automatic transmit-receive switching system according to prior practice involves the use of a parallel-resonant transmission line connected to the input of the receiver. The line is short circuited at one end, and a glow discharge tube is connected across the other end. When the tube is not discharging, the parallel resonant impedance of the line has no effect on the flow

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of signal energy to the receiver. When the transmitter is operating, the tube discharges, substantially short circuiting the open end of the line, so that the inductive reactance of the line is effectively connected across the receiver input. In order to present a sufficiently low impedance at this point, an intermediate point on the line, rather than the open end, is connected to the receiver. Thus, by "tapping down" on the line, the minimum impedance is lowered, at the expense of lowering the maximum impedance by the same ratio. This in itself is not a particularly serious defect. However, the adjustment of the line length becomes more and more critical as the tapping point is moved toward the short circuited end. In a typical installation, an error of one percent in the adjustment may render the system inoperative, owing to failure to protect the receiver or because of improper loading of the transmitter, or both.

According to the present invention, a radio transmitter 1 is connected through a coaxial line 3 to an antenna system 4. A receiver 5 is connected through a coaxial line 7 to a point 9 on the transmitter line 3. A section 11 of coaxial line is connected to the receiver line 7 at a point 13, $\frac{1}{4}$ wave length distant from the junction point 9. The line 11 is $\frac{1}{2}$ wave length long. A short circuited stub line 15 is also connected to the point 13. A line 17, $\frac{1}{4}$ wave length long, is connected to the transmitter line 3 at a point 19, $\frac{1}{4}$ wave length nearer the transmitter than the point 9. A half wave open-circuited line 21 is connected to the end of the line 17. A short circuited stub 23 is also connected to the end of the line 17. Non-linear impedance devices, such as gaseous discharge tubes 25 and 27, are connected across the open circuited ends of the lines 11 and 21 respectively.

The operation of the above described system is as follows:

When the transmitter 1 is operating, relatively high peak voltages are impressed on the gas tubes 25 and 27, causing the gas to ionize so that the tubes present relatively low impedances across the open ends of the lines 11 and 21. The low impedance of the tube 21 is reflected through the half wave line 11 as substantially a short circuit across the line 7 at the point 13. The low impedance at the point 13 is reflected through the quarter wave section on the line 7 as a high impedance at the point 9. Thus the major portion of the energy reaching the point 9 from the transmitter 1 flows past the point 9 to the antenna. Similarly, the low impedance presented

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by the tube 27 is reflected as an open circuit to the point 19.

During the periods when the transmitter 1 is not operating, the tubes 25 and 27 are non-conductive, presenting very high impedances at the open ends of the lines 11 and 21. The stubs 15 and 23 are adjusted to parallel resonate the reactances presented by the tubes 25 and 27 through the lines 11 and 21 at the points 13 and 31. The open circuit point 31 is reflected as a short circuit at the point 19 through the quarter wave line 17. The short circuit at the point 19 is reflected as an open circuit at the point 9. Energy traveling down the line 3 from the antenna flows into the line 7 to the receiver 5. The open circuit presented by the line 11 at the point 13 has no effect upon the flow of energy through the line 7. The lengths of the various line sections are not unduly critical and adjustments may be made by actual measurements of length, without causing substantial departure from ideal performance.

Thus the invention has been described as an improved distribution network for radio frequency systems employing a common antenna for transmission and reception. Gaseous discharge tubes are connected through line sections of resonant lengths to lines connecting the antenna with the receiver and the transmitter. During transmission, the gas in the tubes is ionized, rendering the tubes conductive and thereby providing relatively low impedances which are reflected in the transmission line circuit to divert the flow of energy from the receiver to the transmitter. During reception, the gas tubes are non-conductive, presenting relatively high impedances which are reflected to the transmission line circuit to effectively connect the receiver to the antenna system and disconnect the transmitter.

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I claim as my invention:

1. A radio frequency switching system including a first transmission line for connection between a transmitter and an antenna system, a second transmission line connected to a point intermediate the ends of said first transmission line for connection to a receiver, a third transmission line $\frac{1}{4}$ wave length long connected to said first transmission line at a point $\frac{1}{4}$ wave length distant from the point of connection of said second transmission line thereto, a fourth transmission line $\frac{1}{2}$ wave length long connected to the end of said third transmission line, a fifth transmission line $\frac{1}{2}$ wave length long connected to said second transmission line at a point $\frac{1}{4}$ wave length distant from the point of connection between said first and second lines, and gaseous discharge tubes connected to the ends of said fourth and fifth transmission lines.
2. A radio system including a transmitter, a receiver and an antenna system, a main transmission line connected between said transmitter and said antenna system, a branch transmission line connected between said receiver and a point on said main transmission line, a quarter wave transmission line connected to a point on said main line $\frac{1}{4}$ wave length nearer said transmitter than the point of connection of said branch line thereto, half wave open-ended line sections connected to the end of said quarter wave line and to a point on said branch line $\frac{1}{4}$ wave length distant from the point of connection of said branch line to said main line respectively, and gaseous discharge tubes connected to the open ends of said half wave line.
3. The invention as set forth in claim 2, including short-circuited stub lines connected to the points of connection of said half wave lines to said branch line and said quarter wave line.

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