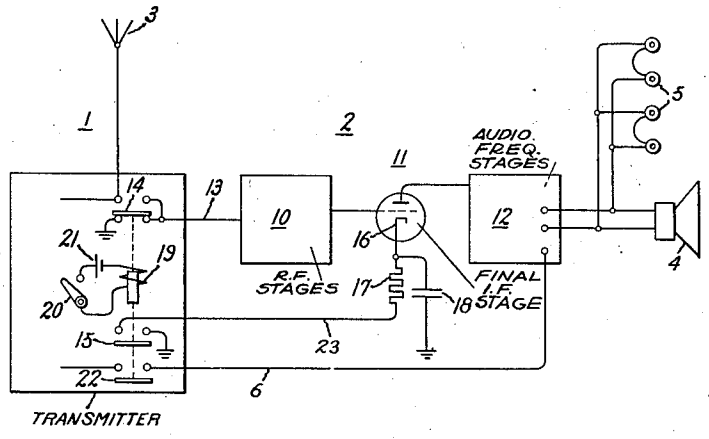
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RECEIVER DESENSITIZING CIRCUIT

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RECEIVER DESENSITIZING CIRCUIT

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My invention relates to short-wave radio circuits of the type used in two-way communication systems and it has for an object to provide an improved circuit for desensitizing the receiver of such a system from the high voltages of the transmitter.

In signalling systems where a receiver employs the same antenna as the transmitter, necessary precaution must be taken to keep the high intensity transmitter radio frequency voltages out of the receiver. In such systems, it is customary to short-circuit the receiver antenna connection during a transmitting period. In mobile two-way signalling systems, the transmitter and the receiver are usually located closely together in a unitary structure and the proximity of the receiver to the transmitter permits sufficient signal from the transmitter to be picked up by the receiver to overload the receiver equipment even though there is no antenna connected to it. Particularly in systems where a plurality of loud speakers or head sets are connected to the equipment and a portion of the transmitted signal is supplied to these speakers or other receiving devices in order that the transmitted, as well as received, messages may be communicated to all of these receivers, it is increasingly difficult, because a portion of the receiving equipment is utilized for such communication, to isolate effectively the receiving equipment from the transmitter voltages. It is customary in desensitizing circuits for such receivers to open the voltage supply or to short-circuit the high potential side of a signalling circuit. The first of these methods causes severe clicks in the output of the receiver which are particularly annoying in this type of communication circuit. On the other hand, short-circuiting the high potential side of a radio frequency circuit causes noise pick-up and sometimes regeneration or oscillation due to added switch connections, producing objectionable noise in the loud speakers and head sets. Short-circuiting the high potential side of an audio circuit produces similar objectionable disturbances.

It is an object of my invention, therefore, to provide a desensitizing circuit for a receiver of such equipment which both isolates the receiver from the antenna and isolates the audio circuits of the receiver from the radio frequency circuits.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, however, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing, in which the single figure of the drawing illustrates the features of my invention.

Referring to the drawing, the transmitter 1 and the receiver 2 of a signalling system are both connected to an antenna 3 for transmitting and receiving messages. Both the transmitted and the received messages are supplied to a plurality of utilization means, such as loud speaker 4 and head sets 5. The loud speaker and head sets 5 are directly connected to the output circuit of the receiver 2, which in turn is connected by means of conductor 6 to the transmitter 1 to receive a sidetone signal from the transmitter during sending periods for the purpose of auditing transmitted messages.

The receiver 2 preferably is of the superheterodyne type and comprises the radio frequency and intermediate frequency stages 10, a final intermediate frequency stage 11 and the audio frequency stages 12, the output of the audio stages being supplied directly to the speaker 4 and the head sets 5. Preferably, both the transmitter 1 and the receiver 2 are completely shielded and are connected only by the conductor 13 supplying signals from antenna 3 to the receiver 10, conductor 6 supplying the sidetone signal from the transmitter to the output circuit of the receiver, and conductor 23 supplying ground potential to the cathode of amplifier 11 for a purpose to be explained later.

In mobile two-way signalling systems, it is desirable to have the apparatus as compact as possible; hence, it is customary in such apparatus to mount the antenna 3 on the transmitter 1 and to include in the transmitter, at the antenna post, means for short-circuiting the connection to the receiver 10. Such a short-circuiting means is indicated in my apparatus by the switch 14 which in one position connects the conductor 13 to the antenna 3 and in its other position connects the conductor 13 directly to ground, short-circuiting the input of the radio frequency receiver 10. Because of the proximity of the receiver 2 to the transmitter 1 and the antenna 3, complete shielding of the receiver from radio frequency voltages is difficult to obtain. Minute radio frequency voltages introduced into the radio frequency stages through inductive linking of the conductor 13 are amplified in the radio frequency and intermediate frequency stages so that they reach objectionable magnitudes in the output stages of the receiver. Thus, in the presence of an antenna 3 radiating signals that have intensities of as high as 10,000 volts, it has been found that it is

physically impossible to prevent the introduction of these signals into the receiver circuit despite short-circuiting by the switch 14 and complete shielding of the receiver. As a result, the transmitted signals appear in the receiver with intensities that overload the receiver circuits.

In order to provide a more effective desensitizing circuit for the receiver 2, in accordance with my invention, the radio frequency circuits of the receiver 2 are isolated from the audio frequency circuits of the receiver during transmitting periods by means of the switch 15 in the cathode circuit of the final intermediate frequency amplifier 11. As shown in the drawing, the circuit of the cathode 16 comprises the resistor 17 connected to ground through conductor 23 and switch 15 and the by-pass capacitor 18 connected across resistor 17 and switch 15. Preferably, the position of the switch 15 is controlled by relay 19 operated by the switch 20 located in the transmitter 1 and used for energizing the transmitter. Voltage for the operation of relay 19 may be supplied from any suitable source, such as the battery 21. Likewise, preferably, the relay 19 controls simultaneously the operation of switch 14 for short-circuiting the input to receiver 2, switch 15 for isolating the radio frequency and audio frequency circuits of receiver 2, and switch 22 for supplying a sidetone signal from transmitter 1 to the output circuits of receiver 2.

The desensitizing circuit described above thus completely isolates the radio frequency and audio frequency circuits of receiver 2 by opening the cathode circuit of the last intermediate frequency amplifying tube between the bias resistor 17 and ground. This is a circuit for unidirectional currents of very small value and of low potential. When the switch 15 is open, anode current cannot flow through amplifier 11 and signals, consequently, cannot be transferred to the audio stages 12. As a result, the receiver output circuit is made completely insensitive to transmitter signals impressed on the preceding stages of the receiver. It is desirable that interruption of the translating circuit through receiver 2 be made in the final stage of radio frequency circuits. Should the cathode circuit of some previous stage be interrupted, due to the presence of the intense signals of the transmitter 1 and their linkage with the tuned circuits of subsequent stages of radio frequency amplification, a certain amount of transmitter signal is picked up in the subsequent stages and, after amplification, introduced into the detector and audio stages 12.

Further in accordance with my invention, capacitor 18 is made sufficiently large to prevent quick variation of the voltage of cathode 16 with respect to ground when switch 15 is opened and closed. Thus, the time constant of the circuit comprising resistor 17 and capacitor 18 is sufficiently large that no noticeable disturbances are introduced into the circuit of receiver 2 by operation of switch 15. In this manner, all objectionable clicks and similar disturbances are eliminated. It is desirable, moreover, that cathode 16 be maintained at ground potential for radio frequency voltages by means of capacitor 18 permanently connected to ground. If cathode 16 is isolated from ground during periods of operation of the transmitter 1, the cathode floats at an indeterminate radio frequency potential and, in the presence of strong signals produced by the preceding stages of the receiver, amplifier 11 acts to transmit a certain amount of signal to the subsequent stages, introducing distortions which interfere with the sidetone signal being supplied directly from the transmitter.

It will thus be seen that my invention provides an improved desensitizing circuit for the receiving apparatus of a two-way signalling system which is particularly adapted to overcome the difficulties encountered in mobile systems employing a plurality of loud speakers and head sets.

While I have shown a particular embodiment of my invention, it will of course be understood that I do not wish to be limited thereto since various modifications may be made, and I contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a signalling system comprising a transmitter and a receiver both connected to a single antenna, said receiver including a final stage high frequency amplifier, an audio frequency circuit, and a plurality of utilization means connected to said circuit, means for connecting said utilization means to said transmitter for auditing transmitted signals, and means for desensitizing said receiver during operation of said transmitter, said desensitizing means comprising means for disconnecting said receiver from said antenna, and means for isolating said amplifier from said circuit.

2. In combination, a signalling system comprising a transmitter and a receiver both connected to a single antenna, said receiver including a high frequency circuit, an audio frequency circuit, and a plurality of utilization means connected to said audio circuit, means for connecting said utilization means to said transmitter for auditing transmitted signals, and means for desensitizing said receiver during operation of said transmitter, said desensitizing means comprising means for disconnecting said receiver from said antenna, and means for isolating said high frequency circuit from said audio frequency circuit.

3. In combination, a signalling system comprising a transmitter and a receiver both connected to a single antenna, said receiver including a final stage high frequency amplifier having a cathode, and means for desensitizing said receiver during energization of said transmitter, said desensitizing means comprising a resistor and a switch connected in series between said cathode and a point of fixed potential, a capacitor connected in shunt thereto between said cathode and said point of fixed potential, and means for opening said switch when said transmitter is energized, said resistance and capacitor having a time constant of sufficient length to prevent the occurrence of objectionable noise.

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