Nov. 3, 1936. R. S. HOLMES 2,059,870

PROTECTIVE MEANS FOR RADIO RECEIVING APPARATUS

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Fig. 1

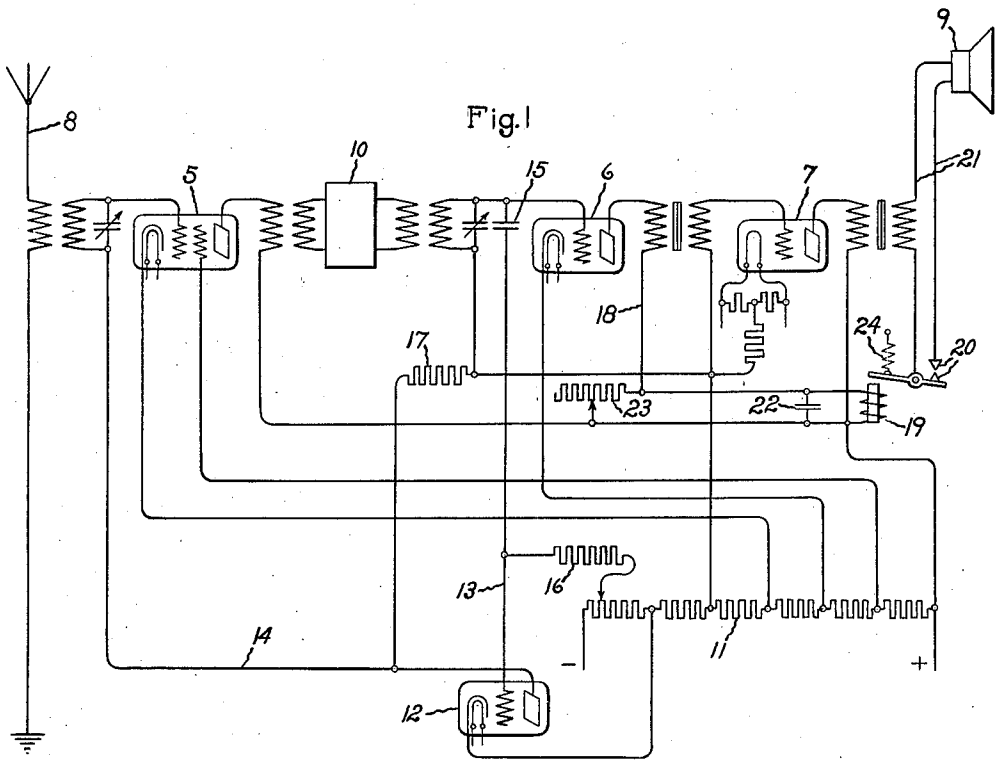
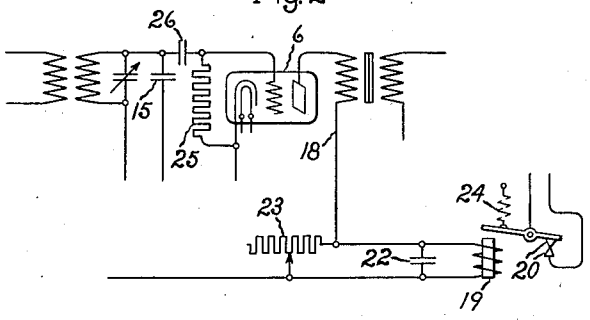


Fig. 2



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PROTECTIVE MEANS FOR RADIO RECEIVING APPARATUS

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24 Claims. (Cl. 250—20)

The present invention relates to radio receiving apparatus, and more particularly to a protective means therefor.

When a sensitive radio receiver is operated in a location where there is considerable induction noise, static and other radio interference, the interference picked up by the receiver while tuning between stations is often sufficient to set up a very objectionable noise in the loud-speaker or sound producing device. This is especially true when the receiver or receiving apparatus is provided with an automatic volume control means, in which case the amplification of the receiver is greatly increased when no signals are being received, that is, when tuning between stations.

As is well known, an automatic volume control means usually operates in connection with the amplifier of a radio receiving apparatus to vary the sensitivity of the amplifier in accordance with the signal strength applied to some portion of the receiving channel such as the detector. As the signal strength decreases to a minimum value when tuning between stations the sensitivity of the set is by the automatic volume control means increased to substantially a maximum value, thereby tending to bring in interference at a maximum strength and to cause the loud-speaker to deliver a maximum of objectionable noise.

In addition to the noise set up by interference in connection with a radio receiving apparatus embodying an amplifier and an automatic volume control means, the various circuits receive unusual signal stresses, which is undesirable.

It is therefore the object of the present invention to provide a protective means in connection with a radio receiving apparatus embodying an automatic volume control means in connection with its signal amplifying and detecting channel for causing said apparatus to deliver substantially a constant carrier level to the detector which protective means is arranged to cut off the signal output to the sound producing device in the absence of received signals of or above a predetermined carrier strength.

The invention will be better understood from the following description when taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the drawing, Fig. 1 is a schematic wiring diagram of a radio receiving apparatus connected with a sound producing device and provided with an automatic volume control means and a protective means embodying the invention, and Fig. 2 is a similar wiring diagram of a portion of the circuit of Fig. 1 provided with a modification of the invention.

Referring to the drawing, 5, 6 and 7 are electric discharge devices representing a radio frequency amplifier, a detector and an audio frequency amplifier respectively for a radio receiving apparatus providing a signal channel between an antenna or source of signals 8 and an output or sound producing device 9. Additional amplifying apparatus which may be provided between amplifier 5 and the detector 6 is indicated at 10.

The amplifying and detector devices may be of any suitable type and in the present example are of the hot-cathode, grid-controlled type connected in cascade in the usual manner between the antenna and the output device and provided with suitable operating potential from a supply resistor 11.

The receiving apparatus is provided with an automatic volume control means which in the present example includes an electric discharge device 12 connected with the signal channel through a lead 13 and with radio amplifier 5 through a lead 14. As indicated in the drawing the volume control device 12 is a grid controlled tube having its grid connected with the signal channel through a suitable coupling condenser 15 and receiving its bias potential through a resistor or a grid leak 16. Lead 14, for the amplifier 5, is connected with the output or anode circuit of device 12 in which is located a coupling or anode resistor 17. This circuit arrangement represents any suitable automatic volume control means for radio receiving apparatus and in the present example operates in response to increased signal strength applied to the detector 6 to increase the negative bias on the amplifier 5, thereby reducing its amplification and thereby automatically maintaining substantially a constant output volume from the sound producing device 9. As the detail arrangement of the receiving apparatus and the automatic volume control means does not concern the present invention, further description thereof is believed to be unnecessary.

In the output or anode circuit 18 of one of the electric discharge devices provided in the receiving apparatus in which output circuit a current variation is set up in response to changes in the signal strength applied to said device through the signal channel is connected a current responsive device or relay 19 having contacts 20 arranged to open and close an output circuit 21 connected between the receiving apparatus and the output or sound producing device 9. The

relay is provided with a suitable radio frequency bypass condenser 22 and means for controlling its sensitivity whereby it may be adjusted to operate in response to a predetermined current flow. In the present example the means for adjusting its sensitivity is a simple variable resistor 23 connected in shunt with it.

The anode or output circuit 18 in which the relay is connected in the present example is as indicated the output or anode circuit of the detector 6. It will be noted that this detector is arranged for grid bias or anode circuit detection and as is well known the anode or output current for such a detector increases in response to increased signal strength or increased signal potential applied to its grid. Accordingly the detector output circuit provides a suitable circuit for connecting the relay 19 and as indicated in the present example the relay is arranged to operate to close contacts 20 and to connect the output device 9 with the receiving apparatus through circuit 21 in response to an increase in the current flow through it. When the current is reduced to a set value as determined by the adjustment of resistor 23 the contacts are opened by suitable means such as a spring 24.

With the above described arrangement in connection with a radio receiving apparatus having automatic volume control means and a sound producing device the latter is normally disconnected from the apparatus and is connected to receive the signal output therefrom only when a station or signal of a certain predetermined strength is being received, thereby permitting the apparatus to be tuned between signal channels or stations without objectionable noise from the sound producing device from sources of interference.

The relay arrangement for the output circuit of the apparatus may be actuated in connection with any suitable controlling circuit provided in connection with the apparatus. In certain applications it may be connected in a circuit in which the current flow is reduced in response to increased signal strength or in response to a signal. A circuit of this character is shown in Fig. 2 to which attention is now directed.

As is indicated in Fig. 2, the detector 6 is arranged for grid leak detection through the medium of a suitable grid leak 25 and grid condenser 26 whereby the current in its anode or output circuit 18 decreases in response to increased signal strength. Relay 19 in its output circuit is then arranged to have its contacts 20 normally closed as indicated, the contacts 20 being thereby opened in response to a decreased signal strength or in the absence of signals the resistor 23 is adjusted to set the sensitivity of the relay to a desired value in the same manner as in connection with the arrangement of Fig. 1.

It will be seen that in the absence of received signal or signals of low value the anode or output current of the detector will increase and cause the relay to open contacts 20, thereby cutting off the sound producing device from the receiving apparatus.

While the invention has been shown and described in what I believe at present to be its best embodiments, it should be understood that it is not limited thereto and may be carried out in connection with other receiving apparatus having automatic volume control means and a sound producing device.

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

1. The combination, in a radio receiving apparatus, of a sound producing device, means for automatically controlling the volume of sound produced whereby the maximum volume is determined, and means for automatically rendering said sound producing device inoperative when the sound produced thereby drops below a predetermined low value, said low value being sufficiently above zero to prevent the production of objectionable noise by said sound producing device during periods of little or no received signal.

2. The combination, in a radio receiving apparatus, of a sound reproducing device, means for controlling the maximum and minimum volume levels of the sound reproduced by said device, said means including an automatic volume control device for determining the maximum volume level, and automatic means for determining the minimum volume level by rendering said sound reproducing device inoperative in response to a volume level less than a predetermined amount, said amount being sufficiently above zero to prevent production of objectionable noise by said sound producing device during periods of little or no received signal.

3. In a radio receiving apparatus, the combination of a radio signal amplifying and detecting means providing a signal channel, a sound producing device connected with said signal channel to receive the signal output therefrom, means responsive to changes in the signal strength applied to said channel for automatically maintaining substantially a constant output volume from said sound producing device, and means including a current responsive relay for automatically disconnecting the signal channel of the apparatus from said sound producing device in the absence of received signal of a predetermined strength.

4. In a radio receiving apparatus, the combination of a radio signal amplifying and detecting means providing a signal channel, a sound producing device connected with said signal channel to receive the signal output therefrom, means responsive to changes in the signal strength applied to said channel for automatically maintaining substantially constant output volume from said sound producing device, and means for disconnecting the signal channel of the apparatus from said sound producing device in the absence of received signal of a predetermined strength, said means including an electric discharge device connected with the signal channel of said apparatus and having an output circuit, and a current responsive relay in said circuit for disconnecting said sound producing device from said apparatus.

5. The combination, in a radio receiving apparatus having an electron discharge detector, of a sound producing device, means for automatically controlling the volume of sound produced by said device whereby the maximum volume is determined, and means responsive to currents of said detector for automatically rendering said sound producing device inoperative whereby the minimum volume produced by said device is determined.

6. The combination, in a radio receiving apparatus having an electron discharge detector, of a sound producing device, means for controlling the maximum and minimum volume levels of the sound produced by said device, said means including an automatic volume control device for determining the maximum volume level, and au-

tomatic means responsive to currents of said detector for determining the minimum volume level by rendering said sound producing device inoperative in response to a volume level less than a predetermined amount.

7. The combination, in a radio receiving apparatus, of a radio frequency amplifier, a detector, an audio frequency amplifier, a sound producing device, means responsive to currents of said detector for automatically controlling the amplification of said radio frequency amplifier whereby the maximum volume of sound produced by the currents of said audio frequency amplifier is determined, and means responsive to currents of said detector for rendering said sound producing device unresponsive to the currents of said audio frequency amplifier whereby the minimum sound volume is determined.

8. In a signal receiving system, volume control means responsive to an incoming signal, a thermionic device responsive to said volume control means, a signal indicating device, circuit connections between said devices and means connected with and controlled by said thermionic device for rendering said signal indicating device inoperative.

9. In a signal receiving system, signal indicating means, signal amplifying means having an output circuit providing a signal controlled potential means responsive to said potential for de-energizing said signal indicating means, and means associated with said de-energizing means whereby it is rendered responsive only to signals having a definite minimum amplitude.

10. In a signal receiving system of the type having automatic volume control means, signal indicating means, signal amplifying means adapted to provide an output potential responsive to changes in the amplitude of a signal wave, means responsive to said potential for rendering said signal indicating means inoperative, said potential responsive means having a certain range of sensitivity and means for adjusting the range of sensitivity of said potential responsive means.

11. In a radio receiving system, a signal receiving circuit, a control device having an input circuit connected with said signal receiving circuit and an output circuit, a second control device connected with the output circuit of the first named device, a relay connected with said last named device whereby it is responsive to changes in current flow therethrough, said relay having control contacts, a signal output circuit for said system, a sound producing device connected therewith, and circuit means connecting said relay contacts and said output circuit, whereby operation of the relay controls the output to said sound producing device.

12. In a radio receiving system, the combination with an automatic volume control device and an amplifier controlled thereby, of a second control device connected with said volume control device whereby it is controlled jointly with the amplifier, and means controlled by the second named device for preventing the transmission of audible signals through said system in response to received signals of an amplitude lower than a predetermined value.

13. A signalling system comprising a high frequency amplifier circuit, means for tuning said circuit through a range of frequencies, a gain control device for regulating the sensitivity of said amplifier, means for utilizing the amplifier output, and additional means for automatically decreasing the utilizing efficiency of said last means when said amplifier is adjusted to substantially maximum sensitivity by said gain control device but is tuned through a point of said range where less than a predetermined amount of high frequency energy is received.

14. In a system for the reception of signal energy, a receiver having a detector normally in operative condition and a demodulated signal output path normally maintained in a condition of disability, means responsive to carrier energy transmitted to the receiver for adjusting the gain of said receiver, and means responsive to said carrier energy for removing the disability from said demodulated signal output path.

15. In a signal receiving system of the type having automatic volume control means, signal indicating means, signal amplifying means adapted to provide an output current responsive to changes in amplitude of a signal wave, means responsive to said current for rendering said signal indicating means inoperative, said current responsive means having a certain range of sensitivity, and means for adjusting the range of sensitivity of said current responsive means.

16. A receiving system comprising a signal translating device, a radio frequency amplifier connected to the device, means for regulating the sensitivity of said amplifier inversely with received signal energy level, and means, operative to disable said device, when said amplifier is adjusted to substantially maximum sensitivity by said regulating means and no signal energy is received.

17. In combination, in a radio receiver, a radio frequency amplifier, a frequency changing means, a low frequency amplifier, means for controlling the gain of the radio frequency amplifier, and an electrical relay, responsive to variations in the output of said frequency changing means, for reducing the transmission efficiency of the low frequency amplifier when the gain of the radio frequency amplifier is increased by said controlling means and no carrier wave is received.

18. In combination, in a radio receiver, a radio frequency amplifier, a frequency changing means, a low frequency amplifier, means for controlling the gain of the radio frequency amplifier, and an electrical relay, responsive to variations in the output of said frequency changing means, for reducing the transmission efficiency of the low frequency amplifier when the gain of the radio frequency amplifier is increased and no carrier wave is received, said low frequency amplifier including an output transformer, and said relay being connected to control the circuit of the transformer secondary.

19. A signaling system comprising a high frequency amplifier circuit, means for tuning said circuit to a desired frequency, a gain control device for regulating the sensitivity of said amplifier, means for utilizing the amplifier output, and additional means for automatically decreasing the utilizing efficiency of said last means when said amplifier is adjusted to maximum sensitivity by said gain control device but less than a predetermined amount of high frequency energy is received.

20. A signaling system comprising a high frequency amplifier circuit, means for tuning said circuit to a desired frequency, a gain control device for regulating the sensitivity of said amplifier, means for changing the frequencies amplified at high frequency to a low frequency, a low frequency amplifier, and additional means for automatically impairing the transmision effi-

ciency of the low frequency amplifier when the high frequency amplifier is adjusted to substantially maximum sensitivity by said gain control device but no high frequency energy is received.

21. In a system for the transmission of modulated signals, the combination with an amplifier for amplifying said signals, and means automatically controlling the gain of said amplifier in accordance with the strength of received signals, of a demodulator, a reproducer for the demodulated signals, and means, operative simultaneously with said gain control means during periods of operation of the latter, to substantially prevent the reproduction of all output from said demodulator when said signals decrease below a predetermined intensity value.

22. In a radio receiver, means for automatically regulating the amplification with inverse relation to the strength of the received carrier energy and means for preventing the occurrence of interfering noise in the output of the receiver during periods when the carrier energy is not received, said last-stated means comprising an auxiliary device responsive to the carrier energy in rectified form and means associated with the signal output circuit of the receiver and controlled by said auxiliary device for suppressing the signal output of the receiver when no carrier energy is being received.

23. In a system for the reception of energy including a receiver having a detector normally in operative condition, a demodulated signal output path therefor and means for automatically regulating the gain of the receiver with relation to the strength of the received carrier energy, the method of transmission control which consists in normally maintaining said demodulated signal output path in a condition of disability and applying the received carrier energy to perform the double function of regulating the gain of the receiver and removing the disability from said demodulated signal output path.

24. In a system for the reception of signals, including a receiver, a demodulated signal path therefor and means for automatically regulating the gain of the receiver with relation to the strength of the received carrier energy, the method of transmission control which consists in normally maintaining said demodulated signal path in a condition of disability, rectifying received carrier energy and applying the rectified carrier energy to perform the double function of regulating the gain of the receiver and removing the disability from said demodulated signal path.

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