

Nov. 14, 1939.

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2,179,974

SIGNAL RECEIVING SYSTEM

Filed Aug. 15, 1930

Fig. 1.

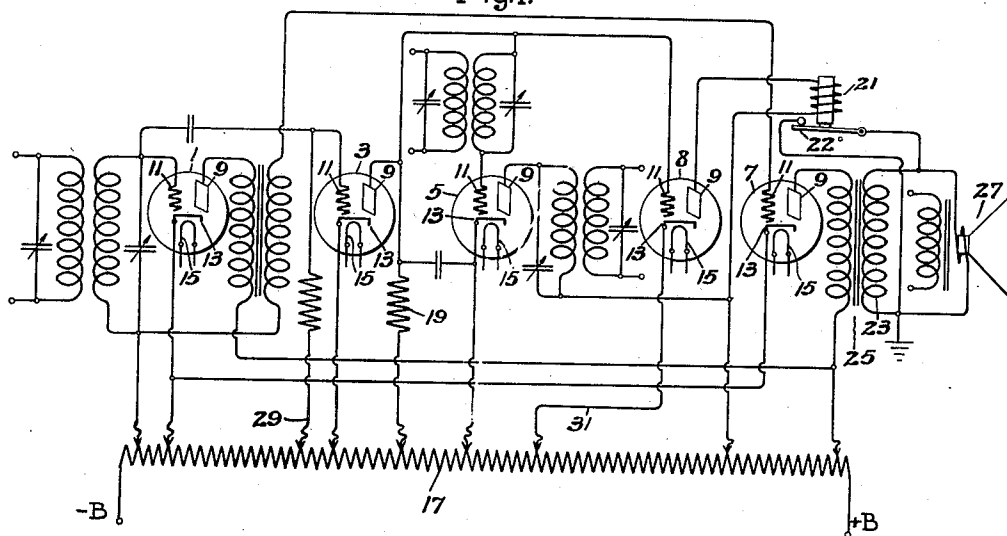
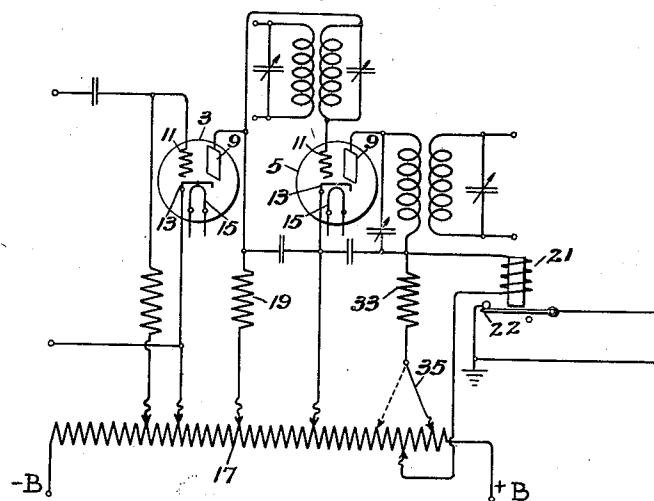


Fig. 2.



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2,179,974

SIGNAL RECEIVING SYSTEM

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Application August 15, 1930, Serial No. 475,474

12 Claims. (Cl. 250—20)

My invention relates to signal receiving systems and it has particular relation to systems of the type wherein means are provided for automatic volume control.

5 In each of my co-pending applications, Serial Nos. 212,791 and 404,012, filed August 13, 1927, and November 1, 1929, respectively, and assigned to the Westinghouse Electric & Manufacturing Company, I have disclosed a radio receiving system comprising an automatic volume-control device constituted by a signal responsive thermionic tube, the output current of which is utilized to control the bias potential applied to the grid of a single amplifying tube or to the grids of a plurality of amplifying tubes.

15 By reason of the fact that the radio receiving systems disclosed in my co-pending applications are designed to maintain constant output volume, the operation of tuning them from one station to another is usually accompanied by a certain amount of background-noise, that varies in intensity according to the season of the year and the specific location of the system. The background-noise can, of course, be manually controlled during the tuning operation by adjusting a manual volume-control device, but such adjustment is undesirable.

It is, accordingly, an object of my present invention to provide, in a radio receiving system of the type described, means whereby background-noise is suppressed during the tuning operation.

Another object of my invention is to provide, in a radio receiving system of the type described, means whereby a loud speaker shall automatically be connected in circuit only during such time as a desired signal is being received.

Another object of my invention is to provide, in a radio receiving system, means whereby a loud speaker is prevented from being energized during the tuning operation.

40 A still further, and more specific, object of my invention is to provide means whereby the range of operation of a background suppressor may be definitely pre-determined according to local conditions.

45 In accordance with my invention, I provide a radio receiving system with a signal responsive volume-control tube, the output current from which is utilized to control the bias potential applied to the grids of one or more amplifier tubes and to also control the grid-bias applied to a "suppressor tube", the output circuit of the latter comprising a relay device having contacts that are included in a circuit which controls the application of power to a loud speaker. The nor-

mal bias on the suppressor tube grid is so chosen that, when it changes in response to the presence of current in the output circuit of the volume-control tube, the relay will function, and the loud speaker will be energized or de-energized as desired.

According to a modification of my invention, the suppressor tube per se may be dispensed with and the relay device may, instead, be included in the common plate-potential supply for the usual amplifier tubes of a radio receiving system.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of certain specific embodiments when read in connection with the accompanying drawing, in which:

Fig. 1 is a diagrammatic view of a portion of a radio receiving system of the super-heterodyne type comprising an embodiment of my invention, and

Fig. 2 is a diagrammatic view of a portion of a signal receiving system comprising an alternative embodiment of my invention.

Referring specifically to Fig. 1 of the drawing, a super-heterodyne receiving system constructed according to my invention includes, in addition to other tubes well known to those skilled in the art, a second detector tube 1, a volume-control tube 3, a high frequency amplifier tube 5, a power amplifier tube 7, and a "suppressor tube 8".

All of the tubes are preferably of the equipotential cathode type, each having an anode 9, a grid 11, a cathode 13 and a heater 15. The source of potential for the heaters 15 is not illustrated.

A common supply of anode and negative grid-biasing potential is provided, the said supply preferably being constituted by a voltage dividing device 17, or potentiometer, connected across the positive and negative terminals of any convenient source of unidirectional potential (not shown.)

As explained in my co-pending applications, the output from the intermediate frequency amplifier, in addition to being impressed upon the input circuit of the second detector tube 1, is also impressed upon the input circuit of the volume control tube 3, with the result that an increase in signal-amplitude causes an increase in plate current flowing through a resistor 19, included in the output circuit of the volume-control tube. The consequent increased drop in potential

across the resistor causes a more negative potential to be applied to the grid of the high frequency amplifier tube 5, which reduces the amplification of the signal therein.

In accordance with my present invention, I also connect the plate of the volume-control tube 3 to the grid of the suppressor tube 8, the output circuit of which includes the winding of a relay device 21 having a plurality of contacts 22 that are disposed in shunt relation to the secondary winding 23 of a transformer 25 which energizes a signal indicating or output device such as a loud speaker 27.

The contacts 22, without departing from the spirit of my invention, may be included serially in the circuit between the transformer 25 and the voice-coil of the loud speaker, they may be interposed in the field-winding potential-supply circuit thereof, or in any one of the circuits providing cathode-heating or plate-potentials to the audio-frequency amplifying stages exemplified by the tube 7 in Fig. 1.

The volume-control tube, normally, is biased negatively, with respect to the cathode thereof, by proper adjustment of a contact 29 engaging the potentiometer 17, to substantially the cut-off point, with the result that no current flows in the output resistor 19. In such event, the grid of the suppressor tube 8 assumes a potential, with respect to its cathode, that is determined solely by the relative position on the potentiometer of the connection thereto of the output resistor 19, in the output circuit of the volume-control tube, and a connection 31 extending from the potentiometer to the cathode of the suppressor tube.

The normal bias applied to the suppressor tube, in the absence of an incoming signal from a desired station, is so adjusted that the output current therefrom is just sufficient to maintain the relay 21 energized and the contacts thereof closed.

It will thus be apparent that the disturbances incidental to the turning operation, if of less amplitude than the signals from the desired radio stations will not cause the relay (21) to be de-energized and consequently they will not be manifested as sound from the loud speaker.

As hereinbefore mentioned, the noise, or disturbance, level varies according to the season of the year and the location of the receiving system. Furthermore, irrespective of season and location, a daily or hourly variation of noise-to-signal ratio occurs. It is, accordingly, desirable to be able to control the sensitivity of the background-noise suppressor independently of the automatic signal-volume control, whereby the system may be adjusted for silence during the tuning operation despite fluctuations in the noise-level.

An alternative embodiment of my invention is, therefore, illustrated in Fig. 2 of the drawing, wherein the elements analogous to those in Fig. 1 are similarly designated, it being, of course, understood that the said Fig. 2 is illustrative only of a minor portion of a radio receiving system.

The modified form of my invention differs from the form described in Fig. 1 by reason of the fact that the suppressor tube per se is omitted and the relay device 21 is included in the plate circuit of one of the intermediate frequency amplifier tubes 5 or in the common plate-potential supply lead for all of the said amplifier tubes.

In addition to the inclusion of the winding of the relay device 21 in the plate potential supply lead for the amplifier tube, a resistor 33 and a

variable contact device 35 are also connected in parallel to the said relay device. By adjusting the position of the contact device along the potentiometer 17 the amount of current taken by the relay device, during the operation of tuning the radio receiver, may be accurately determined, and the amount of current decrease necessary to cause de-energization of the relay may be adjusted to correspond to the amplitude of signals from desired transmitting stations.

It will be perceived that I have, by my invention, provided means whereby the background noise accompanying the tuning operation in a signal receiver of the automatic volume control type may be suppressed. Furthermore, I have provided means whereby the background suppressor may be so adjusted that it will respond only to signals of a definite amplitude, thus preventing the tuning operation from being accompanied by unpleasant noises.

Although I have illustrated certain specific embodiments of my invention, many modifications thereof will at once be apparent to those skilled in the art to which it pertains. My invention, therefore, is not to be limited, except insofar as is necessitated by the prior art or by the spirit of the appended claims.

I claim as my invention:

1. In a radio receiving system, the combination with an automatic volume control device and an amplifier controlled thereby, of a second control device directly 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.

2. In a radio receiving system, the combination with automatic volume control means including an automatic volume control tube, and a signal circuit arranged to supply controlling potentials thereto, of means for suppressing background noises incident to the operation of the system, said means including a second tube having an input circuit connected with said automatic volume control tube to receive controlling potentials therefrom, a relay in the output circuit of the second tube, and a signal transmission circuit for said system connected with and controlled by said relay.

3. In a radio receiving system, the combination with an automatic volume control means including an automatic volume control tube and a signal circuit arranged to supply controlling potentials thereto, of means in circuit in said system for suppressing background noises incident to the operation of the system, said means including a second tube connected with said automatic volume control tube to receive controlling potentials therefrom, a relay in the output circuit of said tube, a signal transmission circuit for said system connected with and controlled by said relay, and means included in circuit with said suppressor means for independently controlling the sensitivity of said suppressor means with respect to said automatic volume control means.

4. In a radio signal receiving system, a signal detector, an audio frequency amplifier, a signal output circuit for said amplifier, a signal amplifier for supplying signals to said detector, automatic volume control means for said signal amplifier, and noise suppressor means connected with and controlling said output circuit, said noise sup-

pressor means being directly controlled by said automatic volume control means jointly with said signal amplifier.

5 5. In a radio receiving system having automatic volume control means, the combination of means for suppressing background noise during the tuning operation, and means whereby the last named means may be adjusted to be insensitive to signals of less than a predetermined amplitude, said last
10 named means including an electronic amplifier device having an output circuit connected with said noise suppressing means and an input grid circuit providing signal variable and adjustable biasing potentials.

15 6. In a radio receiving system having automatic volume control means, the combination of an electronic amplifier device having an input grid circuit and an output anode circuit, means for supplying to said grid circuit solely signal-derived controlling potentials from said control means, means connected with said output circuit for suppressing background noise during tuning operation of said system, and means for electrically biasing said electronic amplifier device to
20 predetermine a signal level at which said background noise suppressor means will operate.

25 7. In a radio receiving system, the combination with automatic volume control means and audio frequency amplifying means, of background noise suppression means connected with the audio frequency amplifying means to control the signal transmission efficiency thereof and including a control electronic amplifier tube having a control grid connected solely with the automatic
30 volume control means to receive controlling potentials therefrom in response to signal variations, and means for electrically biasing said control grid to predetermine the signal level at which said background suppressor means operates.

40 8. 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
45 auxiliary electronic device responsive solely to the carrier energy in rectified form from said regulating means, 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.

50 9. In a system for the reception of energy, a receiver, an amplifier tube adapted to vary the

gain of said receiver and having a control electrode, a transmission path associated with said receiver and normally maintained in a condition of disability, a switch for removing the disability from said path, an auxiliary tube for governing
5 the said switch having a control electrode, a resistance in circuit with said control electrode, with the control electrode of the amplifier tube and with a local source of potential, and means responsive to the received carrier energy for
10 regulating the potential drop through said resistance.

10. In a signal receiving system of the type comprising means responsive to change in the strength of a received signal for automatic volume control, tuning means, a signal amplifier
15 controlled by the volume control means, and an audio network coupled to the controlled amplifier, background noise suppressing means including an electron discharge tube independent of
20 said controlled amplifier, connections between the output electrodes of the last tube and the audio network, connections between the input electrodes of the said tube and the volume control means whereby the suppressing means is
25 controlled from the volume control means, and additional means for adjusting the potential of an electrode of said tube so that the suppressing means may be rendered insensitive to signals of less than a predetermined amplitude.

30 11. In a signal receiving system, a circuit for receiving signalling energy, a sound reproducing circuit, an auxiliary control circuit connected with first mentioned circuit, a relay tube, independent of the receiving circuit, operated by said
35 auxiliary control circuit, and means controlled by said relay for electrically connecting or disconnecting said sound reproducing circuit with respect to said signal receiving circuit according to the character of the received signaling energy.

40 12. In a signal receiving system, a circuit for receiving signaling energy, a sound reproducing system connected with said circuit, an auxiliary control circuit connected with said receiving circuit, a relay operated by said auxiliary control
45 circuit, an electron tube circuit, independent of the receiving circuit, and connected with said relay and controllable according to the bias potential impressed thereon, and switching means controlled by said relay and operating to open or
50 close the electrical circuit through said sound reproducing system according to the character of the received signaling energy for correspondingly controlling the operation of said sound reproducing system.

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