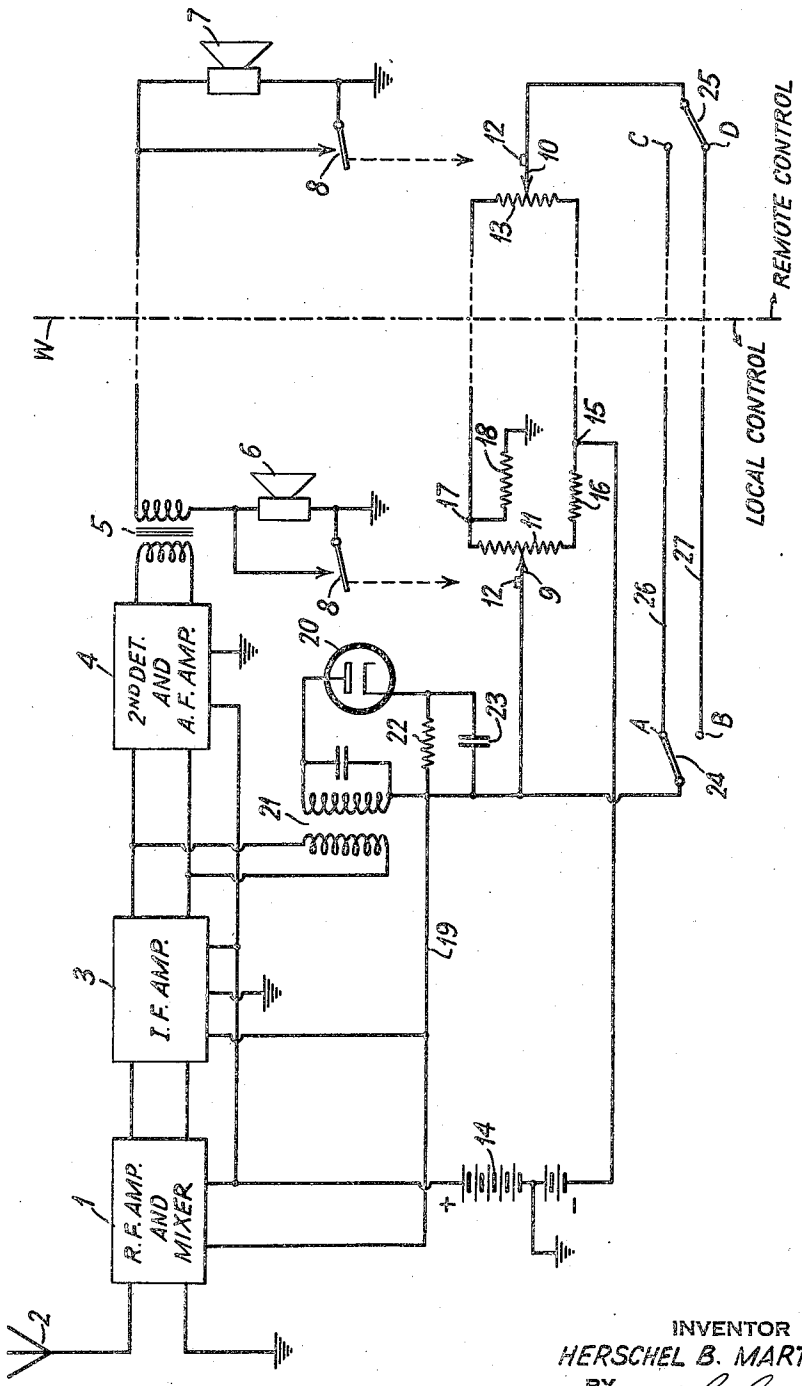
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DUAL VOLUME CONTROL SYSTEM FOR RADIO RECEIVERS

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DUAL VOLUME CONTROL SYSTEM FOR RADIO RECEIVERS

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This invention relates to a volume control system for a radio receiver and has particularly to do with the provision of a dual control system whereby the loud speaker volume may be controlled from either of two points remote from one another.

Situations frequently arise where a single radio receiver may be employed to operate two loud speakers, one in one room and one in a different room. In order that an occupant of either room may control the volume to suit his own taste, it is, of course, a matter of great convenience to have a volume control device within easy reach. To be able to control the volume from either of two points is somewhat like being able to light and extinguish a stairway lamp from either an upstairs or a downstairs switch. However, the problem of controlling the volume of a radio receiver is more complicated than the lighting switch system just mentioned.

It is an object of my invention to provide a volume control device operable from either a local or a remote point.

It is another object of my invention to provide a dual control for a volume device in combination with an automatic volume control device, such that a desirable sound level may be obtained in a given loud speaker connected with a radio receiver.

It is another object of my invention to provide a radio receiver circuit arrangement including a sensitivity control device operable from either of two separated positions.

Other objects and advantages of my invention will be made apparent in the description to follow.

The invention is best illustrated by a single circuit diagram as shown in the accompanying drawing.

The drawing shows a radio receiver comprising a radio frequency amplifier and mixer 1 fed with incoming modulated carrier frequency energy as collected on the antenna 2. The output from the RF amplifier and mixer 1 is preferably delivered to an intermediate frequency amplifier 3 the output from which is then passed to a second detector and audio frequency amplifier 4, a portion of the energy being diverted, however, for use in an automatic gain control device.

The output from the last stage in the audio frequency amplifier 4 may be impressed across the primary of a transformer 5 the secondary of this transformer being in circuit between the voice coils of two loud speakers 6 and 7. One of these loud speakers 6 may conveniently be located adjacent the receiver, while the other loud speaker 7 is located at any suitable remote point, say, in a different room as indicated by the dot and dash line W which might represent a wall between the two rooms.

By grounding one terminal of each of the voice coils in the loud speakers 6 and 7 respectively, the other terminals of these loud speakers may be connected to the two terminals of the secondary in the transformer 5. A series circuit is, therefore, normally closed through the transformer secondary and the two loud speaker coils. However, it is possible to short-circuit either of the loud speaker coils and to use the other loud speaker, if so desired. Each of the loud speakers is, therefore, provided with a short-circuiting switch 8 for by-passing the loud speaker circuit to ground. It is convenient to operate the switch 8 in conjunction with the movable tap (9 or 10, as the case may be) of a potentiometer. Combination controls of a type similar to this are well known, as, for instance, where an on-and-off switch is operable from a volume control knob on a radio receiver. In this case the movable element 9 on potentiometer 11 is provided with an insulation lug 12 which, when moved to the uppermost position, causes the local switch 8 to close for short-circuiting the loud speaker 6. A similar lug 12 is provided on the movable element 10 of the remote poteniometer for actuating the remote switch 8 to close the same when the lug 12 is raised to its uppermost position.

Potentiometer 11 has its two terminals respectively connected to corresponding terminals of the potentiometer 13. Potentiometer 11 is preferably one of high ohmic value, whereas potentiometer 13 has a relatively low ohmic value. The positions of these potentiometers might be reversed; but if so, the operating procedure will be slightly different from that which will now be described.

The purpose of potentiometers 11 and 13 is to enable an operator at either the local control point or the remote control point to adjust the bias voltage which is to be applied to the grids of the super-control tubes in the radio frequency amplifier and in the intermediate frequency amplifier respectively. The adjustment of the grid bias voltage influences the sensitivity of the amplifiers in such manner that, in the absence of a carrier wave to which the receiver is tuned, substantially all low level noise effects may be suppressed and will not reach the loud speakers.

An operating potential source 14 is provided having a plate voltage section and a negative grid biasing section, the connection between the two sections being grounded. From the negative terminal of the source 14 a conductor is taken to a point 15 in a circuit connection between the lower terminals of the potentiometers 11 and 13. A resistor 16 is interposed between point 15 and potentiometer 11. The upper terminals of potentiometers 11 and 13 are interconnected and they also have a resistive ground connection through resistor 18. The purpose of resistors 16 and 18 will be hereinafter explained.

The potentiometer tap 9 is connected to the grid biasing circuit 19 which feeds a bias voltage to the various grids of the tubes whose gain and sensitivity is to be controlled.

In addition to the manual volume control device I preferably employ an automatic gain control system of any well known type. For the sake of simplicity, I have shown such an AVC system as including a diode rectifier 20 the electrodes of which are in circuit with the secondary of a transformer 21. This transformer is supplied with a portion of the output energy from the intermediate frequency amplifier 3. Other means of diversion of this energy are, of course, well known in the art as by capacitive coupling means, for example. In response to variations in the carrier energy from the I. F. amplifier the diode rectifier 20 is caused to supply the necessary negative bias for maintaining a desired output level from the amplifiers. Such a level is preferably one which will suppress background noises when no signal is present. A suitable time constant device consisting of resistor 22 and capacitor 23 is provided for slowing up the action of the AVC system. The grid bias lead 19 is connected to one terminal of the resistor 22 remote from the cathode of the diode rectifier 20.

Two single-pole double-throw switches 24 and 25 respectively are provided, one at the local control point and the other at the remote control point. The switch blade of switch 24 is connected to the movable tap 9. The switch blade of switch 25 is connected to the movable tap 10 at the remote station. Conductor 26 interconnects switch points A and C of the respective switches; likewise conductor 27 interconnects switch points B and D.

The mode of operation of my invention is as follows:

Consider first that the listener is stationed at the local control point and desires to receive a communication by listening to the loud speaker 6. Being unable to reach the remote volume control potentiometer 10, he throws the switch 24 into whichever position will produce an open circuit between the switch blades 24 and 25. That is to say, both conductors 26 and 27 will be dead-ended. Under this condition the position of the potentiometer tap 10 is of no concern to the operator. He then adjusts the volume level of the receiver by means of the adjustable tap 9 which is within easy reach. This tap supplies a more negative biasing voltage if it is in a lower position and a more positive biasing voltage if it is raised to an upper position.

Assume now that it is desired to listen to a communication as received on the loud speaker 7 at a remote point. The operator stationed at the remote control point is then able to adjust the volume of his speaker by manipulating the adjustable tap 10 after setting switch 25 to that one of its positions which will cause a closed circuit to be established across one or the other of the conductors 26 and 27. If, therefore, switch 24 happens to rest on its contact A, switch 25 will be moved to contact C. On the other hand, if switch 24 happens to be resting on contact B, then switch 25 must be set to contact D. Under these conditions the lower resistance value of the potentiometer 13 predominates in its control effect over the control effect of the high resistance potentiometer 11, no matter what the setting of the latter may be. It will thus be seen that the operator at either the local point or the remote point is able to adjust the volume of the incoming signals to suit his own taste. When, however, it is desired that the loud speaker near the operator should be shut off, it is only necessary to move the potentiometer tap to the extreme upper position, when the insulation lug 12 presses against the contact spring 8 for short-circuiting the associated loud speaker coil. This operation does not appreciably affect reception on the other loud speaker, which, of course, may be kept going for standby reception requirements.

The function of resistors 16 and 18 is to limit the current flow through potentiometer taps 9 and 10 when they are interconnected by one or the other of conductors 26 and 27 and when one tap is moved to a position of extreme negative voltage value while the other tap is moved to a position approximating ground potential. Short-circuiting of the potentiometer connections is thus avoided.

Various modifications of the circuit arrangement may be made by those skilled in the art without departing from the spirit of the invention. For example, it is quite possible to employ dynamic loud speakers having field coils which are energized by the main power supply source. Furthermore, it is possible to combine the diode detector tube 20 as used for automatic volume control with components of a detector tube serving to supply the audio frequency amplifiers. This variation has not been shown since it was thought desirable to indicate clearly a typical AVC device per se in connection with the grid biasing circuit 19.

My invention has been found particularly useful in connection with marine radio systems where, for example, the radio apparatus is located in one cabin, say, the radio operator's cabin, a remote loud speaker being provided in the wheel house. On small vessels, however, it will be understood that the radio apparatus may be installed in the wheel house and the remote loud speaker may be placed in the captain's cabin. In fact, any suitable arrangement of the local and remote control stations on board the vessel may, of course, be provided.

I claim:

1. A dual volume control system for a radio receiver comprising means including a direct current grid biasing source for establishing a normal gain ratio in certain amplifier stages of said receiver, a voltage divider of relatively high ohmic value having its terminals resistively connected across the terminals of said source and having a movable tap connected to the grids of said amplifier stages, a voltage divider of relatively low ohmic value having its terminals connected to corresponding terminals of the first said voltage divider and having a movable tap, the two said voltage dividers being respectively located at separate control stations, a single-pole-double-throw switch at each control station, each said switch having a movable contact

member connected to an adjacent one of said movable taps on the voltage dividers, and conductors interconnecting corresponding stationary contact members of the two said switches, said switches constituting means for at times interconnecting the movable taps of said voltage dividers.

2. A system in accordance with claim 1 and having an automatic volume control device fed with energy from said amplifier stages and arranged to vary the bias potential applied to said grids.

3. In a dual volume control system for a radio receiver, the method of adjusting the normal gain and sensitivity of its amplifier stages from either of two separated control stations which comprises adjustably dividing a grid bias voltage through a path of relatively high ohmic value at one of said control stations, at times controlling the gain in said amplifier stages in accordance with said voltage division, and at other times adjustably dividing said grid bias voltage through a path of relatively low ohmic value at the other of said control stations while simultaneously controlling the gain in said amplifier stages substantially in accordance with the last said voltage division.

4. In a dual volume control system for a radio receiver, the method according to claim 3 and including the step of additionally controlling the gain in said amplifier stages in dependence upon variations in the output level of said stages.

5. In a radio receiving system an audio-output circuit comprising two series-connected loud speakers located at separated stations, short-circuiting means for silencing either of said speakers, a volume control device having a relatively wide range of ohmic values located at one of said stations, a volume control device having a relatively narrow range of ohmic values located at the other of said stations, means for selectively rendering either of said volume control devices effective to adjust the normal gain and sensitivity of certain amplifiers in said receiving system, and manipulative means at each station common to the short-circuiting means and the volume control device thereat.

6. A local-and-remote volume control device for adjusting the gain in certain radio frequency and intermediate frequency amplifier stages of a radio receiver, said device comprising a constant current source arranged to supply a suitable negative bias potential to the grids with respect to the cathodes of the discharge tubes in said stages, two separated potentiometers each having an adjustable tap arranged to feed said bias potential to said grids and having terminals resistively connected across said constant current source, one of said potentiometers being of higher ohmic value than the other, and switching means adjacent each of said potentiometers for rendering the tap on the adjacent potentiometer effective to adjust the value of the bias potential applied to said grids, and for effectively disabling the other potentiometer.

7. A device in accordance with claim 6 and in combination with two separated loud speakers, the same being series-connected in the output circuit of said radio receiver, and means including two short circuiting switches each appropriately operable in conjunction with a respective one of said potentiometer taps, when the latter is moved to an extreme position, whereby a selected one of said loud speakers is silenced.

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