REMOTE LOUDNESS CONTROL
16 Claims, 3 Drawing Figs.

ABSTRACT: A remote loudness control for a jukebox or the like in which the audio signal passes through two parallel channels, one of which is resistive and the other of which presents a high impedance to low frequencies and a relatively lower impedance to high frequencies. As the loudness control is operated to reduce loudness from a maximum, means including a direct current rheostat differentially varies the gains of the respective channels to cause the higher frequencies to be more greatly attenuated than are the lower frequencies. The control does not require shielding and necessitates only two wires from the control to the jukebox.
REMOTE LOUDNESS CONTROL

BACKGROUND OF THE INVENTION

My invention relates to a loudness control providing bass boost and more particularly to a remote loudness control which needs no shielding and which requires only two wires from the system to the remote control.

In systems of the prior art for controlling the volume of a jukebox or the like from a remote location, a dual potentiometer at the remote location necessitates the use of five leads to the jukebox. Since the audio signal being controlled passes through the potentiometer, the leads must be shielded. The complexity and expense of such a system is obvious. In operation of such a control to reduce volume, the signal strength is reduced by the same amount throughout the entire spectrum of frequencies present in the signal.

I have invented an improved remote loudness control which overcomes the defects of volume controls of the prior art. My control is relatively simple in that it operates entirely on direct current and requires only two unshielded leads from the control element to the system being controlled. It is less expensive to construct than are the volume control systems of the prior art. I so arrange my control as to provide a system wherein higher frequencies are more severely attenuated than are lower frequencies effectively to provide “bass boost.”

SUMMARY OF THE INVENTION

One object of my invention is to provide a remote loudness control for a sound system such as that of a jukebox or the like.

Another object of my invention is to provide a remote loudness control which is simpler and less expensive to construct than are remote volume control systems of the prior art.

A further object of my invention is to provide a remote loudness control requiring only two unshielded leads from the device being controlled to the actuable control element.

Still another object of my invention is to provide a remote loudness control giving bass boost.

Other and further objects of my invention will appear from the following description.

In general my invention contemplates the provision of a remote loudness control for a jukebox or the like in which the audio signal passes through two parallel channels to the speaker amplifier. One of the channels is resistive while the other channel more readily passes higher frequencies than lower frequencies. I provide a direct current system for differentially varying the gains of the two channels in response to operation of a rheostat to cause the system to attenuate higher frequencies more severely than lower frequencies to provide bass boost.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings which form part of the instant specification and which are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views:

FIG. 1 is a schematic view of one form of my remote loudness control.

FIG. 2 is a diagram illustrating the frequency characteristic of my system for various settings of the loudness control.

FIG. 3 is a schematic view of an alternate form of my remote loudness control.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1 of the drawings, my remote loudness control, indicated generally by the reference character 10, includes respective amplifier channels, indicated generally by the reference characters 12 and 14, each of which is connected between a terminal 16 carrying the audio signal from a jukebox pickup or the like and the coupling capacitor 18 of the speaker amplifier 20.

The channel 12 includes an input capacitor 22, a resistor 24, a coupling capacitor 26, an amplifier 28 and a filter resistor 30. Channel 14 includes input capacitor 32, resistor 34, coupling capacitor 36, amplifier 38 and a frequency-sensitive filter capacitor 40.

The direct current control section, indicated generally by the reference character 42, of my system includes a string of four diodes 44, 46, 48 and 50, each of which in the absence of a forward biasing potential has a resistance of about 2 megohms. I connect the string of diodes 44, 46, 48 and 50 between ground and one terminal of a biasing resistor 52, the other terminal of which is connected to a suitable source 54 of potential. It will be appreciated that resistor 52 normally provides a predetermined biasing potential at its terminal 56. I connect the resistance winding 58 of a rheostat having a brush 60 in parallel with the string of diodes between ground and the terminal 56. Respective capacitors 62 and 64 between terminal 56 and ground and between the common terminal of diodes 46 and 48 and ground provide AC short circuits for the direct current control section 42 of my remote loudness control.

With the brush 60 at the top of winding 58 the potential at terminal 56 is short-circuited and all of the diodes 44, 46, 48 and 50 are nonconductive. Under these conditions the effective resistance at the common terminal of diodes 44 and 46 and at the common terminal of diodes 48 and 50 is about one megohm so that substantially no biasing current passes through resistors 24 and 34. Under these conditions, and assuming that the amplifiers 28 and 38 have the same gain, the gain of each of the channels 12 and 14 is the same. Moreover, as will be apparent from the explanation hereinbelow, the system loudness is at a maximum value and all frequencies of the signal at terminal 16 are amplified the same amount.

If now brush 60 is moved downwardly along the winding 58 so that sufficient bias is provided at terminal 56 to cause the diodes of the string to conduct each pair effectively forms a voltage divider with its associated channel resistor 24 or 34. In this state, my system so operates as to attenuate higher frequencies of the signal at terminal 16 more greatly than lower frequencies. In the particular embodiment of my invention shown in FIG. 1, in order to accomplish this result I select resistor 24 to have a value of about 40 K. and I select resistor 34 to have a value of about 160 K. Moreover, I select the values of resistor 30 and of capacitor 40 to form a device having a crossover frequency which may, for example, be at 200 cycles at which the reactance of capacitor 40 is equal to the impedance of resistor 30. Particularly, I may choose a resistor 30 having a value of about 8 K. and a capacitor 40 having a value of about 0.1 uf. From the foregoing it will be apparent that branch 14, including the capacitor 40, more readily passes higher frequencies than lower frequencies.

Referring now to FIGS. 1 and 2, in FIG. 1 I have shown the frequency response of my system for various settings of brush 60. Considering the case wherein the brush 60 is set for maximum loudness so that the bias at terminal 56 is grounded and the diodes 44, 46, 48 and 50 are effective open circuits, the gain of the system will be constant over the entire frequency spectrum of the signal at terminal 16. This is indicated by the uppermost line in FIG. 2. It is to be noted that the diodes require about one-half a volt for conduction, thus to provide sufficient swing at the common terminals of the two pairs to prevent conduction therethrough at the maximum setting of brush 60.

Assuming now that brush 60 is moved downwardly along line 58 to a point at which the effective resistance at the common terminals of the two pairs of diodes is about 40 K., the input circuit for the upper channel 12 in effect includes two series-connected 40 K. resistors. As a result, half the input signal appears across each and the gain of this channel is reduced by a factor of two to reduce the loudness level 6 db. At the same time the input circuit of the lower channel 14 is made up of a 160 K. resistor and a 40 K. resistor in series. Thus the gain of this channel is reduced to one-fifth for a loud-
ness reduction of 12 db. Under these conditions, over the first or lower frequency portion of the response curve, most of the signal going to amplifier 20 passes through the upper channel 12 with a loudness reduction of about 6 db. At a frequency of around 100 cycles, the lower channel begins to pass the higher frequency components of the signal and these signals are more greatly attenuated than are the lower frequency signals. At the center frequency of about 200 cycles, the upper and lower channels 12 and 14 carry approximately the same portions of the signal therethrough. This action continues until at about approximately 450 cycles and above all components of these frequencies going to amplifier 20 pass through the lower channel 14 with an attenuation of about 12 db. This will readily be apparent from the center curve of FIG. 2.

It will thus be apparent that with the arrangement 1 have shown in FIG. 1, higher frequency signals are attenuated to a greater degree than are lower frequency signals to provide the bass boost effect. If the brush 60 is moved still further downwardly along winding 58 until, for example, the effective resistance at the common terminals of the two pairs of diodes 44 and 46 and 48 and 50 is about 10 K., the gain through the channel 12 is reduced to one-fifth to provide a loudness level reduction of about 12 db and the gain through channel 14 is reduced to one-seventieth, or a loudness level reduction of about 25 db. The resultant loudness reduction versus frequency characteristic is illustrated by the lower curve in FIG. 2.

It is to be noted further that the remote portion of the control includes only the rheostat winding 58 and its associated brush and only two leads 66 and 68 are required to connect this element to the jukebox or the like at which the remainder of the circuitry is located. Not only is that true but the two conductors 66 and 68 carry only direct current and no shielding need be employed.

Referring now to FIG. 3. I have shown an alternate form of my remote loudness control indicated generally by the reference character 70. This form of my system includes an upper channel indicated generally by the reference character 72 comprising a resistor 74, the amplifier 28 and the resistor 30 connected in series between terminal 16 and capacitor 18. The lower channel, indicated generally by the reference character 76, of the form of my invention shown in FIG. 3 includes a resistor 78, the amplifier 38 and the capacitor 40 connected in series between terminal 16 and capacitor 18. In this form of my invention, instead of using the string of diodes 44, 46, 48 and 50 to vary the gain through the upper and lower channels, I employ a pair of series-connected light-sensitive resistors 80 and 82. By way of example, I select resistors 74 and 78 each having a value of 160 K. Resistors 80 and 82 are so chosen as to have respective values of 4 megohms and 1 megohm when not illuminated. I connect the common terminal of resistors 80 and 82 to ground.

I place resistors 80 and 82 and an illuminable light source 84 in a lightweight housing 86. I connect the source 84 between terminal 56 and ground. From the structure just described, it will be apparent that with brush 60 at the maximum setting wherein it shorts out the potential at terminal 56, light 84 will be extinguished. Under these conditions the resistors 80 and 82 are effectively open circuits and no differential frequency attenuation is provided. However, if the brush 60 is moved downwardly along winding 58 to a point at which lamp 84 is illuminated sufficiently to reduce the resistances of resistors 80 and 82 to respective values of 160 K. and 40 K., the gain through the upper channel 72 will be reduced by one-half to attenuate signals passing therethrough by about 6 db and the gain through the lower channel 76 is reduced to one-fifth to reduce the level of signals passing therethrough by about 12 db. The remainder of the operation of the circuit is similar to that of FIG. 1 and the resultant loudness frequency characteristic is represented by the center curve of FIG. 2. Similarly, if brush 60 is moved further downwardly along winding 58 until, for example, resistor 80 has a value of 40 K., while resistor 82 has a value of 10 K., then the gain through the upper channel is reduced by about one-fifth of the maximum resulting in a loudness level reduction of 12 db. At the same time the gain through the lower channel 76 is reduced to about one-seventeenth providing a loudness level reduction of 24 db. This condition is represented by the lowest curve in FIG. 2.

In operation of the form of my invention shown in FIG. 1, with brush 60 at the maximum terminal, the upper channel 12 is short-circuited, the effective resistance at the common terminals of the two sets of diodes 44 and 46 and 48 and 50 is one megohm so that these points are effectively open-circuited. Under these conditions, the gains of the upper and lower channels 12 and 14 are the same and no differential attenuation of higher frequencies occurs as indicated by the uppermost curve in FIG. 2. When the brush 60 is moved to a point at which the effective resistance at the common terminals of the pairs of diodes is about 40 k., the gain of upper channel 12 is reduced by about one-half, resulting in a loudness level reduction of about 6 db. therethrough and the gain of the lower channel 14 is reduced to about one-fifth, resulting in a loudness level reduction therethrough of about 12 db. Over the lower frequency portion of the response curve, channel 12 is effective. Over the central portion of the curve, from about 100 cycles to about 400 cycles, both channels are effective, and above 400 cycles channel 14 alone is effective. Activation of the brush 60 further to reduce the effective resistance at the common terminals of the pairs of diodes will result in a response indicated by the lowermost curve in FIG. 2.

Operation of the form of my invention shown in FIG. 3 is substantially the same as that of the form of the invention shown in FIG. 1. With brush 60 at the maximum setting, source 84 is extinguished and resistors 80 and 82 provide effective open circuits between channels 72 and 76 and ground. When the brush 60 is moved downwardly along winding 58, the values of resistors 80 and 82 are so reduced as to provide differential gains in the two channels so as to attenuate higher frequencies more than lower frequencies.

It is to be noted that in each form of my invention, not only is bass boost provided but only two conductors 66 and 68 are required to connect the control rheostat to the device, such as a jukebox, being controlled. These conductors carry only direct current. They need not be shielded.

It will be seen that I have accomplished the objects of my invention. I have provided a remote loudness control which is simpler and less expensive than are volume controls of the prior art. My system does not require shielded leads to the remote station. It provides bass boost.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

I claim:

1. A loudness control for a sound system including in combination, a first signal transmission channel providing a gain, a second signal transmission channel providing a gain, the respective gains of said channels adapted to be varied, an input terminal, an output terminal, means connecting said channels in parallel between said input terminal and said output terminal, and control means for varying the respective overall gains of said channels in the same direction by different amounts.

2. A loudness control as in claim 1 in which one of said channels passes higher frequencies more readily than lower frequencies.

3. A loudness control as in claim 1 in which one of said channels passes higher frequencies more readily than lower frequencies, and in which said control means comprises means for concomitantly reducing the gain of the other channel by a certain amount and reducing the gain of said one channel by a greater amount.
4. A loudness control as in claim 1 in which said first channel comprises a resistor connected to said output terminal and in which said second channel comprises a capacitor connected to said output terminal.

5. A loudness control as in claim 1 in which said control means comprises a source of direct current potential and a rheostat connected to said source.

6. A loudness control as in claim 1 in which said control means comprises first and second voltage dividers associated respectively with said channels, said first voltage divider comprising a first resistance element and first resistive means having a variable resistance, said second voltage divider comprising a second resistance element and second resistive means having a variable resistance, and means responsive to actuation of said control means for varying the resistance of said first and second resistive means.

7. A loudness control as in claim 1 in which said control means comprises first and second voltage dividers associated respectively with said channels, said first voltage divider comprising a first resistance element and first resistive means having a variable resistance, said second voltage divider comprising a second resistance element and second resistive means having a variable resistance, and means responsive to actuation of said control means for varying the resistance of said first and second resistive means, said first resistance element having a resistance which is less than the resistance of said second resistance element.

8. A loudness control as in claim 1 in which said control means comprises first and second voltage dividers associated respectively with said channels, said first voltage divider comprising a first resistance element and first resistive means having a variable resistance, said second voltage divider comprising a second resistance element and second resistive means having a variable resistance, and means responsive to actuation of said control means for varying the resistance of said first and second resistive means, said first resistive means having a resistance greater than the resistance of said second resistive means.

9. A loudness control as in claim 1 in which said control means comprises first and second voltage dividers associated respectively with said channels, said first voltage divider comprising a first resistance element and first resistive means having a variable resistance, said second voltage divider comprising a second resistance element and second resistive means having a variable resistance, and means responsive to actuation of said control means for varying the resistance of said first and second resistive means comprising a pair of series-connected diodes, a source of biasing potential, means for applying said biasing potential to said diodes, and means for varying said biasing potential.

10. A loudness control as in claim 1 in which said control means comprises first and second voltage dividers associated respectively with said channels, said first voltage divider comprising a first resistance element and first resistive means having a variable resistance, said second voltage divider comprising a second resistance element and second resistive means having a variable resistance, and means responsive to actuation of said control means for varying the resistance of said first and second resistive means comprising a light-sensitive resistor, a light source positioned adjacent said light-sensitive resistor, and means for varying the resistance of said light source.

11. A loudness control for a sound system including in combination, a first signal transmission channel providing a gain, a second transmission channel providing a gain, the respective gains of said channels adapted to be varied, said first channel having a series-connected output resistor, said second channel having a series-connected output capacitor, an input terminal, an output terminal, means connecting said channels in parallel between said input terminal and said output terminal, a first voltage divider comprising a second resistor connected in series in said first channel and first variable resistive means connected between said second resistor and ground, a second voltage divider comprising a third resistor connected in series in said second channel and second variable resistive means connected between said third resistor and ground, and control means for varying the resistances of said variable resistive means in the same direction.

12. A control as in claim 11 in which said control means comprises a source of direct current potential and a rheostat connected to said source.

13. A control as in claim 11 in which said third resistor has a resistance greater than the resistance of said second resistor, each of said first and second resistive means comprising a diode, said control means comprising a source of biasing potential, means for applying said biasing potential to said diodes, and means for varying said biasing potential.

14. A control as in claim 11 in which said first and second resistive means comprise first and second light-sensitive resistors, said first light-sensitive resistor having a resistance value greater than that of said second light-sensitive resistor, said control means comprising a light source positioned adjacent said light-sensitive resistors and means for varying the output of said light source.

15. A remote manually operated system for controlling the loudness of a sound system supplied with an input audio signal including in combination, a signal transmission channel having a signal input terminal to which said audio signal is applied and having a gain control input terminal, a source of direct current potential having a magnitude greater than ground potential, a first resistor, a manually operated variable second resistor at a location remote from said channel, means including a common terminal connecting said first and second resistors across said source, and means connecting said common terminal to said gain control input terminal to control the gain of said channel in response to actuation of said second resistor.

16. A system as in claim 15 in which said potential varying means is a rheostat.