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DEVICE MORE PARTICULARLY FOR CONTROLLING THE SOUND INTENSITY IN LOW FREQUENCY DISTRIBUTION SYSTEMS

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Fig. 1

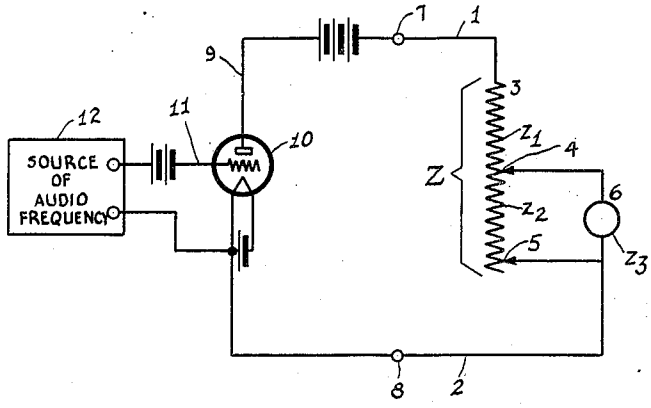
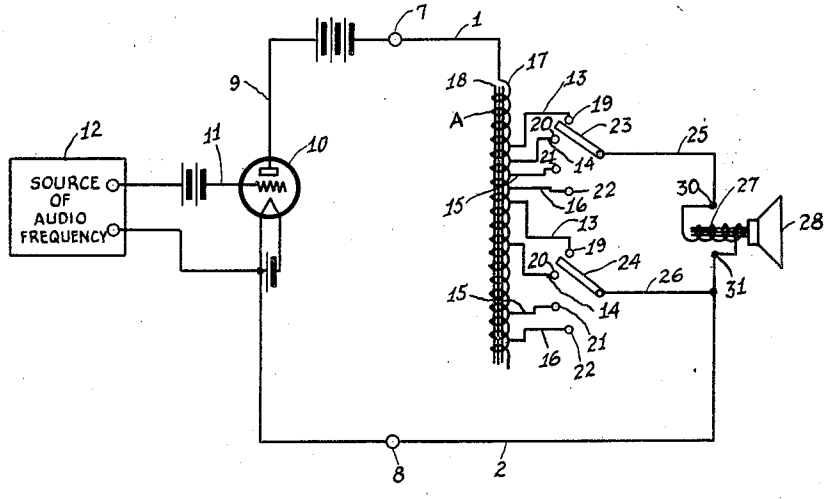


Fig. 2



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DEVICE MORE PARTICULARLY FOR CONTROLLING THE SOUND INTENSITY IN LOW-FREQUENCY DISTRIBUTION SYSTEMS

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6 Claims. (Cl. 179—1)

An object of my invention is an improved type of volume control arrangement and more particularly such a device as will maintain a substantially constant load on the line to which the device is connected.

A further object is to provide a volume control device which has substantially the same frequency characteristic as the loudspeaker or other sound converting device controlled.

A still further object of the invention is to maintain substantially constant the external plate circuit impedance of a vacuum tube audio amplifier to which my volume control device is connected. Other objects of the invention will become apparent to those skilled in the art as a description thereof proceeds.

A preferred embodiment of my invention is shown in the attached diagrammatic drawing in which;

Fig. 1 shows a diagrammatic circuit arrangement; and,

Fig. 2 shows a second circuit arrangement using a tapped coil.

With electric networks for the distribution of music and with low-frequency currents corresponding thereto it is often needed to be capable of controlling the sound intensity. For this purpose the loudspeaker may be tapped from a potentiometer with ohmic resistances.

It is found that this method deteriorates the quality of the music and that if the potentiometer resistance is high, in particular the intensity of the low tones is altered. The total sound volume is altered thereby, it is true, but the timbre is equally altered in a high measure.

If the potentiometer resistance is low, the control is satisfactory but in this case the energy consumption becomes much too high.

This invention provides a method of control whereby the said inconveniences are obviated and it consists in connecting in series with the loudspeaker an adjustable impedance having about the same frequency characteristic curve as the loudspeaker itself. It is evident that the frequency dependency need not be mathematically the same as that of the loudspeaker. The tolerances are determined by the sensitiveness of the perceiving instrument, in the present case the ear. In this manner the intensity of the different tones is varied in about the same measure so that with this new method the variation of the quality with respect to the high and low tones is considerably smaller than with the known ones.

A very simple method of obtaining an impedance which varies with the desired frequency consists, according to the invention, in utilizing a coil having a solid iron core.

The solid iron core results in that due to Foucault losses the ohmic resistance increases with the frequency and the impedance has been found to vary with the frequency in substantially the same manner as that of a loudspeaker.

The coil may be provided with a plurality of a tappings in order to control the intensity.

The circuit-arrangement should preferably be such that part of the series impedance always remains connected in the circuit. It is thus prevented that when the loudspeaker is short-circuited, short-circuiting of the whole network also occurs.

For the coil use may advantageously be made of a coil having a shape similar to that of the loudspeaker coil. It is only advisable to take a larger number of turns than used on the speaker coil in order to be enabled to bring about a considerable variation of intensity.

According to the invention, by a core of solid iron is also meant a core consisting of sub-divided iron if the sub-division is such that in spite of the sub-division an increase of the ohmic resistance is obtained which has approximately the same curve as with a loudspeaker.

The described form of embodiment of the invention is based on the observation that the resistance caused by the Foucault losses in an iron core which is not or only roughly sub-divided, varies with the frequency in a similar manner as that of a loudspeaker.

According to the invention, use may also be made of parallel connection instead of series connection. However, in this case it is also desired to take care that when the loudspeaker should be short-circuited, there occurs no short-circuiting of the whole network. This is possible when a safety resistance precedes. This safety resistance, too, should preferably have the same frequency characteristic curve as the telephone or loudspeaker. With the systems described the load varies when the sound intensity is adjusted.

When applied to audio frequency amplifiers in which the loudspeaker is coupled either directly or via a transformer with the anode circuit of an amplifier valve, the drawback may occur that the quality of the sound is altered due to the fact that the external plate impedance varies with change of volume.

In distribution systems, too, there may be circumstances in which variation of the load on the circuit due to the adjustment of the sound intensity is undesirable. In these cases use may be

made of the controlling method according to the drawing which represents an embodiment of my invention.

In the drawing, 1 and 2 denote supply leads. The impedance denoted by Z has the same frequency characteristic curve as a telephone 6 whose impedance is denoted by Z_3.

If the impedance Z is homogeneous throughout its length, an arbitrarily tapped part thereof, in the present case the part comprised between the points 3 and 4 and that comprised between the points 4 and 5 will have, independently of the place of these points 4 and 5, about the same frequency characteristic curve as the telephone. According to the invention, when the total load remains constant the intensity can be regulated by shifting the points 4 and 5 in such manner that the impedance of the portion comprised between 3 and 4 (Z_1) increased with the impedance between the points 4 and 5 shunted by the telephone

$$\frac{(Z_2 \quad Z_3)}{Z_2+Z_3}$$

remains constant.

In this case the load does not vary when the sound intensity varies and the external plate circuit impedance remains the same.

In both Figs. 1 and 2, modulated audio frequency currents, such for example as used in music and speech, may be supplied to the input terminals 7 and 8 of my volume control arrangement by the output or plate circuit 9 of a 3 element vacuum tube power amplifier 10. The audio frequencies may be impressed on the grid or control circuit 11 of said tube from any desired audio frequency source, shown diagrammatically at 12.

In Fig. 2 series of tappings 13, 14, 15, 16 are taken out from the winding or coil 17 having an iron core 18 as above described. An end portion A of the coil and having a substantial impedance is left untapped. These tappings are connected to contact points 19, 20, 21 and 22 with which switch arms 23 and 24 contact. Leads 25 and 26 connect arms 23 and 24 with the terminals 30, 31 of the operating coil 27 of a loudspeaker or telephone 28. Supply lead 2 is connected to lead 26 as shown. While only four tappings of coil 17 are shown for clearness of illustration, it will be understood that a larger number may be provided, if desired. Switch arms 23 and 24 are mounted for independent control and they may be operated without any definite relation to the net amount of impedance in circuit. I prefer, however, to operate them to control the volume in such manner that the external plate circuit impedance remains substantially constant over the range of volume control.

I claim as my invention:

1. Apparatus for controlling sound intensity comprising an acoustic device, means for energizing said device, an impedance having the same frequency characteristic curve as said acoustic device, said impedance consisting of a coil having an iron core, and connections from said acoustic device connecting at least a portion of said impedance in parallel with said acoustic device.

2. Apparatus according to claim 1 in which said impedance consists of a coil having a core of roughly subdivided iron.

3. Apparatus for reproducing sound comprising a loudspeaker, an impedance having the same frequency characteristic as the loudspeaker, means for connecting a portion only of said impedance in parallel with said loudspeaker and leads for energizing said loudspeaker through the portion of said impedance not connected in parallel with said loudspeaker, said impedance consisting of an iron core coil.

4. Apparatus for reproducing sound comprising a loudspeaker, an impedance having the same frequency characteristic as the loudspeaker, means for connecting a portion only of said impedance in parallel with said loudspeaker and leads for energizing said loudspeaker through the portion of said impedance not connected in parallel with said loudspeaker, said means for connecting a portion only of the impedance in parallel with the loudspeaker are adjustable in such a manner that the total impedance of the circuit is maintained constant when the sound intensity is varied.

5. In combination, a source of current, an output device adapted to be energized with current from said source, a series impedance element connected in series with said source, and a shunt impedance element in shunt to said output device, said impedance elements each varying in impedance value with frequency in the same fashion as the impedance of said output device varies in frequency, and means for increasing the magnitude of one of the impedance elements while decreasing the magnitude of the other impedance element each of said impedances comprising an iron core inductance.

6. In combination, a source of energy, a load, coupling elements having similar frequency characteristics to that of the load connected between said source and said load, and means for varying said coupling elements to vary the amount of energy transferred to said load without varying the effective load on said source.

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