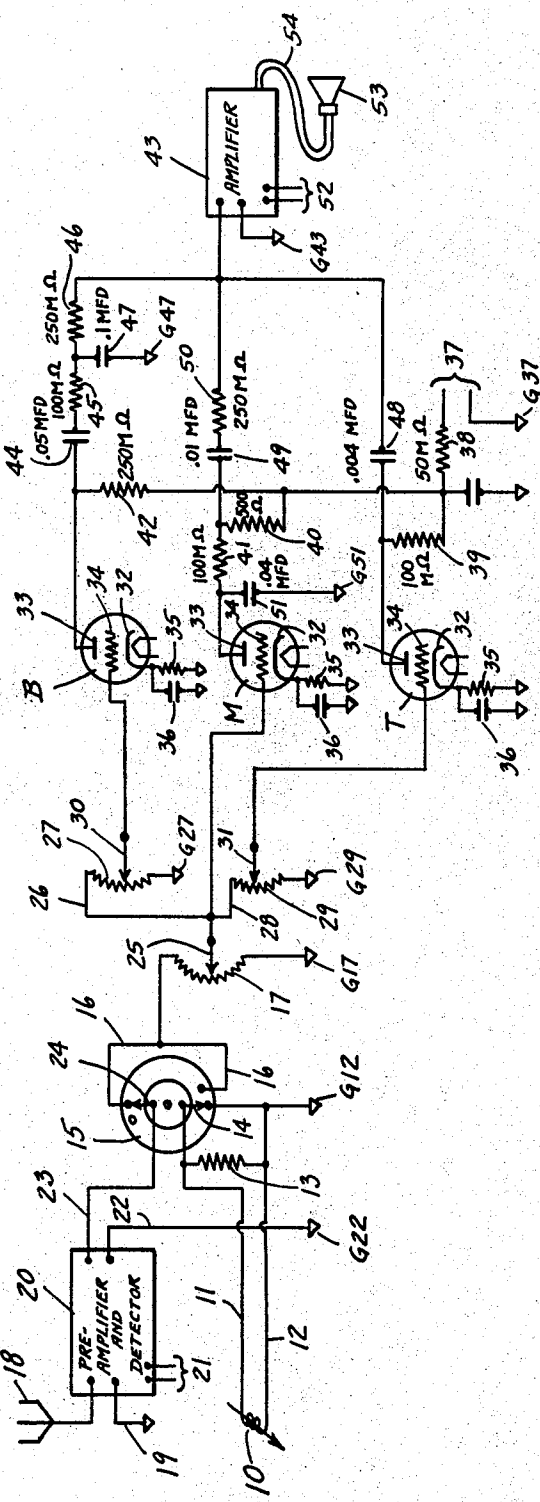
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METHOD AND APPARATUS FOR TONE CONTROL OF SOUND REPRODUCING SYSTEMS

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METHOD AND APPARATUS FOR TONE CONTROL OF SOUND REPRODUCING SYSTEMS

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This invention relates to a method and apparatus for tone control of electric sound reproducing systems such as are found in radio receivers, phonographs and sound film apparatus.

In tone control apparatus heretofore commonly employed for differentiating the amplification of the upper and lower registers of sound, it has been the usual practice when it is desired to accentuate the bass register to first partially suppress the treble register and then increase the entire volume level of the output. Thus two operations are necessary each time the accentuation of the bass register is adjusted, and the final result of the adjustment cannot be determined until the second operation is completed. The two operations often must be repeated several times before a satisfactory adjustment is obtained. Other tone control adjustments require similar manipulation.

One object of the present invention is to provide a tone control by means of which either the upper or lower register may be accentuated or suppressed without the necessity of altering the general volume level at the same time.

Another object of the invention is to provide a tone control in which the middle register may also be accentuated or suppressed in relation to the bass and tenor registers.

Other objects and features of the invention will be understood from the accompanying drawing and the following description and claims:

The drawing is a diagram of electrical connections by means of which the invention may be practiced.

In the drawing the invention is shown applied by way of example to a combined phonograph and radio. The phonograph portion includes a pickup 10 which may be of the common magnetic type and is connected to a load circuit consisting of conductors 11 and 12 with a load resistance 13 connected therebetween. The conductor 11 is connected to a movable finger 14 of a program switch 15 and the conductor 12 is grounded at G12. In the position of the program switch 15 shown in the drawing, the finger 14 engages a branch of conductor 12 and thus short-circuits the load circuit of the pickup and renders the same inoperative. When the program switch is turned to the position for phonograph operation, the finger 14 connects the conductor 11 to a conductor 16 which is connected through a potentiometer 17 to ground at G17.

The radio portion of the apparatus includes an input circuit consisting of antenna 18 and grounded conductor 19 which are connected to a preamplifier and detector unit 20 supplied with power from any suitable source by conductors 21. The unit 20 may be of any suitable type adapted to receive the energy from the input circuit and to amplify and change the characteristics thereof to approximately those of energy received in the phonograph circuit. The output of the unit 20 is delivered to a circuit including a conductor 22 grounded at G22 and a conductor 23 connected to a finger 24 of the program switch 15. In the position of the switch shown in the drawing, the finger 24 connects the conductor 23 to the conductor 16 and thus delivers the output of the radio apparatus to the potentiometer 17. When the program switch is turned to the phonograph position this connection is broken and the radio portion of the apparatus becomes inoperative.

A movable finger 25 engages the potentiometer 17 and is connected by a conductor 26 to a potentiometer 27 grounded at G27. This finger is also connected by a conductor 28 to a potentiometer 29 grounded at G29. The potentiometer 27 is provided with a contact finger 30 and the potentiometer 29 is provided with a similar finger 31.

Three electron discharge tubes, indicated respectively by B, M and T, are provided. These tubes may be of any suitable type for amplification and are herein shown as provided with the usual heated cathodes 32, anodes 33 and control grids 34. The cathodes are grounded through the usual biasing resistors 35 shunted by condensers 36. The control grid of the tube B is connected to the potentiometer finger 30. The control grid of the tube M is connected to the potentiometer finger 25 and that of the tube T is connected to the potentiometer finger 31. It will be apparent from the foregoing that the adjustment of the potentiometer finger 25 controls the input to all three of the tubes B, M and T. The adjustment of the finger 30 controls the input to the tube B only, and that of the finger 31 controls the input to the tube T only.

Power for maintaining the proper anode voltages is obtained by impressing on a pair of conductors 37 a unidirectional voltage from any suitable source. One of said conductors is grounded at G37 and the other is connected to the several anodes 33 through resistors 38, 39, 40, 41 and 42 connected as shown in the drawing and proportioned to provide each of the anodes with the proper operating potential.

The anode circuits of the tubes B, M and T are all coupled to an amplifier 43, but each of

said connections is provided with suitable filtering means to limit the output of the tubes to the bass, middle and treble registers of the band of audio frequencies, respectively. Thus, the anode of the tube B is connected to the amplifier 43 through a condenser 44, a resistor 45 and a resistor 46. A condenser 47 shunts the circuit to ground at G47 from a point between the resistors 45 and 46. In the drawing the ohmic values of the resistors and the capacitances of the condensers are given by way of example for one preferred form of the invention. These condensers and resistors together constitute a low-pass filter which suppresses the audio-frequency band above a predetermined arbitrary point selected to define the upper limit of the bass register. Similarly, the tube T has its anode coupled to the amplifier 43 through a condenser 48. This condenser is of relatively low capacitance as indicated in the example of the drawing and thus substantially confines the output of the tube T to the treble register. By suitably proportioning the condenser, the lower limit of the treble register may be arbitrarily chosen as desired. The output of the tube M is fed to the amplifier 43 through the resistor 41, a condenser 49 and a resistor 50. A condenser 51 shunts the anode to ground at G51. These resistors and condensers when proportioned as indicated in the drawing constitute a broad band-pass filter which suppresses parts of the upper and lower registers of the output of the tube M and passes a band of frequencies overlapping those passed by the bass and treble circuits.

The amplifier 43 has its second input terminal grounded at G43 and may be supplied with operating power by conductors 52 connected to any suitable source of power. A loud speaker 53 is connected to the amplifier in the usual manner by a cable connection 54. The amplifier 43 may be of any well-known form adapted to receive the output of the tubes B, M and T and to amplify the same to speaker level. If desired, separate amplifiers may be used for each of these circuits.

From the foregoing description, it will be apparent that the bass register may be accentuated or decreased by adjustment of the potentiometer 27 to increase or decrease the input to the tube B without thereby changing the general volume level of the output. Similarly, the treble register may be accentuated or suppressed by adjustment of the potentiometer 29 without changing the general volume level. An adjustment of the entire volume level may be made by means of the potentiometer 17 without altering the relative proportioning of the several registers. The adjustment of either the bass register or the treble register may thus be made with a single operation without the necessity for the cut-and-try method otherwise required.

If it is desired to accentuate the middle register, both the bass and treble may be suppressed and the general volume level raised. In this respect the method of adjustment is similar to the prior practice in requiring more than one operation. However, it is obvious that a fourth potentiometer inserted in the middle register circuit will provide independent adjustment of that circuit as well.

The foregoing specification describes the invention in one of its preferred forms, the details of which may be varied without departing from the scope of the invention as defined by the appended claims. It is thought that the application of the invention to sound film apparatus will be obvious.

The invention claimed is:

1. A method of tone control for an electronic sound reproducing system consisting in dividing the energy input to the system into bass, middle and treble channels, controlling the amplitude of the input to all of said channels in common, independently controlling the amplitude of the input to the bass and treble channels, filtering the energy in the several channels to suppress frequencies above the bass register in the bass channel, to suppress frequencies below the treble register in the treble channel and to suppress at least a part of the bass and treble frequencies in the middle channel, and then uniting the output of all of said channels in a single channel and translating the output thereof into sound.

2. A method of tone control for an electronic sound reproducing system consisting of dividing the energy input to the system into a plurality of separate channels, filtering the energy in each of said channels to suppress certain portions of the audio-frequency band in each channel, independently controlling the amplitude of the output of some of said channels, and uniting the output of all of said channels in a single channel and translating the output thereof into sound.

3. A method of tone control for an electronic sound reproducing system consisting in dividing the energy input to the system into bass, middle and treble channels, controlling the amplitude of the input to all of said channels in common, independently controlling the amplitude of the input to the bass and treble channels, filtering the energy in the several channels to suppress frequencies above the bass register in the bass channel, to suppress frequencies below the treble register in the treble channel and to suppress at least a part of the bass and treble frequencies in the middle channel, independently amplifying the energy in each of said channels, and then uniting the output of all of said channels in a single channel and translating the output thereof into sound.

4. Apparatus for tone control of an electronic sound reproducing system including a plurality of energy transmitting circuits each connected to receive a part of the input energy of said system, filtering means in each circuit adapted to suppress certain portions of the audio-frequency band, a separate volume control unit associated with certain of said circuits, a further volume control unit connected to control the general volume level of all of said circuits, and means receiving the combined output energy of all of said circuits and converting the same into sound.

5. Apparatus for tone control of an electronic sound reproducing system including a plurality of energy transmitting circuits each connected to receive a part of the input energy of said system, filtering means in each circuit adapted to suppress certain portions of the audio-frequency band, a separate volume control unit associated with certain of said circuits, a further volume control unit connected to control the general volume level of all of said circuits, a separate amplifying means in each of said circuits, and means receiving the combined output energy of all of said circuits and converting the same into sound.

6. Apparatus for tone control of an electronic sound reproducing system including a plurality of energy transmitting circuits each connected to receive a part of the input energy of said system, a filter in one of said circuits adapted to confine

the output thereof substantially to the bass register of the audio-frequency band, a filter in another of said circuits adapted to confine the output thereof substantially to the treble register, filters in a third of said circuits adapted to suppress at least a part of the bass and treble registers therein, separate volume control units in the bass and treble circuits, a third volume control unit connected to control the volume level in all of said circuits, and means receiving the combined output energy of all of said circuits and converting the same into sound.

7. Apparatus for tone control of an electronic sound reproducing system including a plurality of energy transmitting circuits each connected to receive a part of the input energy of said system, a filter in one of said circuits adapted to confine the output thereof substantially to the bass register of the audio frequency band, a filter in another of said circuits adapted to confine the output thereof substantially to the treble register, filters in a third of said circuits adapted to suppress at least a part of the bass and treble register therein, separate volume control units in the bass and treble circuits, a third volume control unit connected to control the volume level in all of said circuits, a separate amplifying means in each of said circuits, and means receiving the combined output energy of all of said circuits and converting the same into sound.

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