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TONE CONTROL DEVICE

Filed April 16, 1935

Fig. 1

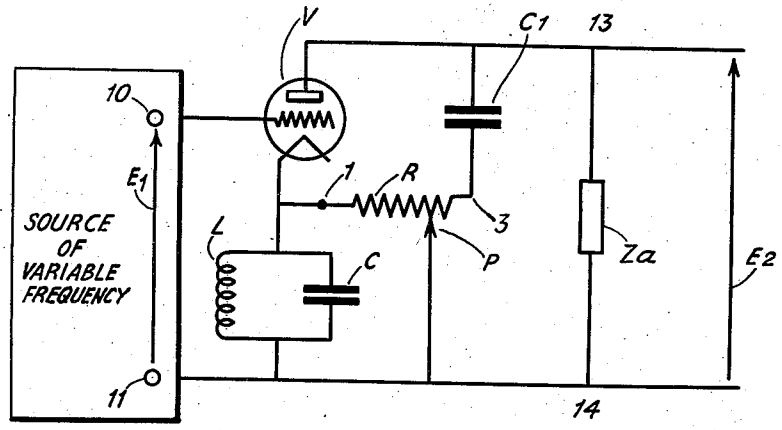
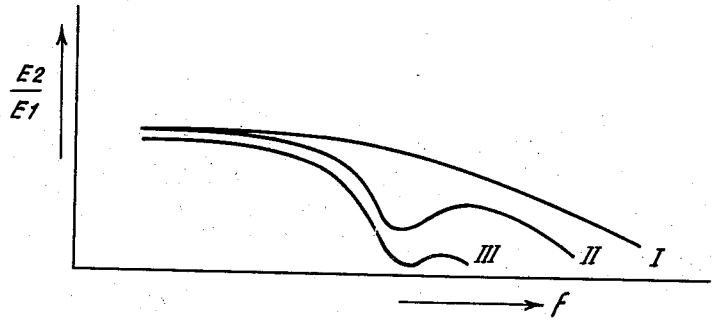


Fig. 2



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TONE CONTROL DEVICE

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3 Claims. (Cl. 179—171)

This invention relates to circuit arrangements for regulating the frequency characteristic curves of low frequency amplifiers, more particularly of those employed in wireless receiving sets.

It is frequently desirable to be able to vary the frequency characteristic curve of a low frequency amplifier in such manner that, deviating from an ideal faithfulness, certain frequencies are amplified more or less than other frequencies and, in addition, to give the characteristic curve a course such that for frequencies higher than a certain limit frequency the amplification rapidly decreases. In wireless receiving sets, for example, it is important to be able to adjust the low frequency amplifier in such manner that the higher tone frequencies are amplified less than the lower frequencies in order to be able to act upon the timbre of the speech or music reproduced by the receiver, and furthermore to cause the amplification to decrease rapidly on the upper end of the transmission range in order to suppress disturbances, for example those produced due to interference of transmitters of nearly the same frequency.

According to the invention, the requirements are met with by a circuit arrangement in which that portion of the cathode lead of a low frequency amplifying tube which is common to the control grid circuit and the anode circuit, contains a tuned circuit whose end located near the cathode is connected through a resistance in series with a condenser to the anode of the amplifying tube whereas that end of the tuned circuit which is remote from the cathode is connected to an adjustable point on the resistance.

Figure 1 is a schematic circuit diagram of an audio amplifier arranged according to my invention and

Figure 2 shows characteristic curves of the amplifier of Figure 1.

Figure 1 represents a low frequency amplifying tube V which may constitute the first, the last or an intermediate amplification stage of the amplifier. The input terminals are denoted by 10, 11 and the output terminals to which a load impedance Z_a is connected by 13, 14.

The input or control grid circuit is coupled to the output or anode or tuned circuit by means of an oscillatory circuit consisting of an inductance L and a condenser C and located in the cathode lead of the amplifying tube. Furthermore, the anode and the cathode of the amplifying tube are connected to one another through a condenser C_1 in series with a resistance R. The resistance R has an adjustable contact P which is connected to that end of the oscillatory circuit LC which is remote from the cathode.

If the contact P is in position 1, the circuit LC is short circuited, as appears from the drawing, so that there is no coupling between the control grid circuit and the anode circuit. The frequency characteristic curve of the amplifier is determined in this case by the relative values of the impedance Z_a and of the series connection of the resistance R and the condenser C_1 which series connection is connected in parallel with the impedance Z_a. If the impedance Z_a behaves essentially as an ohmic resistance, the amplification remains nearly constant for all the low audio or tone frequencies whereas for the higher tone frequencies the amplification decreases due to the presence of the condenser C_1. However, this decrease is slight if the resistance R has a sufficiently high value so that the frequency characteristic curve has the characteristic shown in curve I of Figure 2. When contact P is in position 1 it is seen that the circuit LC is short circuited and therefore no anode current passing therethrough, it has no degenerative effect.

If now the contact P is moved from position 1 towards position 3, the short circuit of the circuit LC is removed and the larger that portion of the resistance R which is connected in parallel with said circuit, the smaller is the damping of the circuit and the tighter is the coupling between the anode and the control grid circuits. This coupling is such that for frequencies located in the neighborhood of the frequency to which the circuit LC is tuned, the amplification decreases. At the resonant frequency of LC, this circuit behaves as a large resistance common to the grid and anode circuits and the anode current therethrough causes a voltage drop which is applied to the control grid of the tube in an out of phase relation with the applied signal voltage thereby causing substantial degeneration. At frequencies not far different from the resonant frequency of circuit LC, this circuit acts similar to a smaller resistance, so that the voltage drop therein is less and the amount of degeneration is correspondingly less. This becomes perceptible in the frequency characteristic curve in the form of a sag as shown by curve II in Figure 1.

The larger the value of that portion of the resistance R which is located in parallel with the circuit LC, the higher is the degree to which the amplification decreases in the neighborhood of the natural frequency of the circuit. The depth of the sag of the frequency characteristic curve increases in this case and attains a maximum

value when the contact P reaches position 3. That portion of the resistance R which is located in series with the condenser C_1, becomes smaller and smaller with the result that the influence of the condenser C_1 increases, which becomes manifest by a decrease of the amplification for the higher tone frequencies. In position 3 the frequency characteristic curve has the shape represented by curve III in Figure 2, from which it results that for frequencies higher than the natural frequency of the circuit LC amplification substantially no longer occurs, which is very advantageous for the suppression of disturbances.

When the contact P is adjusted from position 1 to position 3, the curve I of Figure 2 merges without interruption into curve III so that at will the higher tone frequencies are suppressed more and more with respect to the lower tone frequencies and, in accordance therewith, the timbre of the speech or music reproduced may be varied.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. In an amplifier device, the combination of an electron discharge tube having a cathode, a control grid and a plate, an input circuit connected to said cathode and control grid, an output circuit connected to said cathode and plate, a coil common to said input and output circuits, a condenser shunting said coil, and the series connection of a condenser and resistor, one side of said condenser being directly connected to said plate and the outer end of said resistor being directly connected to said cathode.

2. A device for amplifying a broad band of audio frequency currents comprising, the combination of a single electron discharge tube having a cathode, a control grid and a plate, an input circuit connected to said cathode and control grid, an output circuit connected to said cathode and plate, an inductance coil common to said input and output circuits, the series connection of a resistor and a condenser connecting said plate and cathode, one side of said condenser being directly connected to said plate and a contact connected to the low potential end of said coil and adjustable along said resistor whereby the attenuation of currents in the upper end of said band may be variably controlled by adjustment of said contact.

3. A circuit arrangement for regulating the frequency characteristic curve of low frequency amplifiers, wherein that portion of the cathode lead which is common to the control grid circuit and the anode circuit comprises a tuned circuit whose end located near the cathode is connected to the anode of the amplifying tube through a resistance in series with a condenser, whereas that end of the tuned circuit which is remote from the cathode is adjustably connected to said resistance.

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