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AUDIO AMPLIFIER RESPONSE CONTROL

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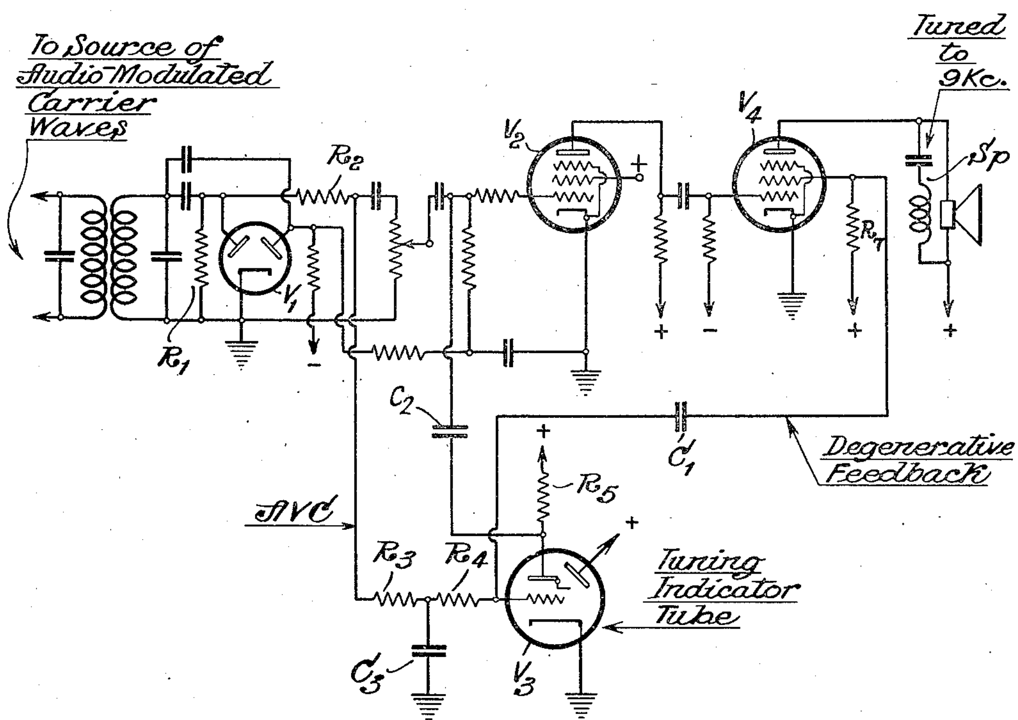

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AUDIO AMPLIFIER RESPONSE CONTROL

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9 Claims. (Cl. 250—20)

The object of the invention is to regulate, or vary, the audio band width of a receiver apparatus as a function of the incoming carrier field intensity. The basic purpose of such regulation, known in the prior art, is to suppress or lessen, in receiving long-distance stations with a feeble signal, the disturbing noises included in the band of high audio frequencies.

It has been suggested previously to provide an audio amplifier tube subject to "forward" volume control potential action with negative feedback which is operative only for the high audio frequencies so that, in a positively acting manner, the higher audio frequencies are suppressed more markedly than in local reception as a result of higher amplification, or gain, of the controlled audio tube in distant signal reception.

Now, according to this invention a particularly effective regulation is secured by feeding the audio potential to the control grid of a tube serving to amplify a regulation potential, especially the amplifier system of a tuning indicator tube, and by deriving the said potential from the plate circuit of the regulator potential amplifier tube and using it for negative feedback. In this manner, on the one hand, the influence of the regulator potential on the band width is made more intense, while, on the other hand, there result particularly high maximum negative feedback potentials.

In the appended drawing, showing such a circuit scheme by way of example, there is shown a double diode tube V_1 and the regulated audio tube V_2. The latter is controlled by means of the regulator potential obtained in the right-hand diode. The tuning indicator tube is V_3, and the screen grid type of power tube is V_4. The indicator tube V_3 is fed through the resistances R_2, R_3 with an AVC. potential taken off across R_1, and the potential is smoothed by condenser C_3 so as to act as an indicator control quantity. The tube V_3 may be of the 6E5 type. The voltage across R_1 is proportional to the carrier amplitude. R_7 is a high-ohm resistance included in the screen grid circuit of the power tube V_4 across which an audio alternating potential arises. This alternating potential is applied through condenser C_1 to the regulator grid of the indicator tube V_3. This alternating potential, which also arises across the resistance R_5 after amplification in the indicator tube, results in a potential across resistance R_5. The amplified potential is transferred to the grid circuit of the audio tube V_2 through condenser C_2. C_1 and C_2 are so proportioned that the negative feed-back will be operative predominantly for the highest audio frequencies, particularly in the range of 9 kilocycles (kc.). So far as the other circuit elements are concerned, the problem of constants is immaterial and they have no new significance. Hence, these elements in so far as they appear in the drawing are devoid of notations or symbols.

The negative feedback potential is intentionally taken from the screen grid circuit of tube V_4 rather than from the plate circuit. For it will be understood that the plate circuit contains a 9 kc. trap, or stopper circuit, Sp which, if the negative feedback potential were derived from the plate, would have the effect that, for these frequencies, also the negative feedback potential is of a minimum value, not to mention this further difficulty that, if the said potential were taken from the plate circuit, undesirable phase shifts might be occasioned under certain circumstances because of the inductive load thereof. By the way, the attempt or plan to take the negative feedback potential from the plate of the preceding tube V_2, if V_3 is employed at the same time, is impracticable on the ground that this would mean the production of regeneration rather than negative feedback. In other words, it is not merely for the sake of amplification, but also to insure the proper phase angle, that tube V_4 is also included in the scheme.

In lieu of the resistance R_7 shown in the drawing, it is possible also to use a resistance with frequency effect, more particularly a choke-coil or a resonance circuit tuned to the high frequencies. In fact, this offers an advantage, first, because this restricts the negative or reverse feedback still more to the high frequencies. In other words, the slope of the band width curve is made steeper. In the second place, an appreciable frequency-dependent resistance in the screen grid lead inheres action on the amplification factor of the tube under conditions being a function of the frequency seeing that such screen grid alternating potentials as will arise produce a negative feedback effect. In other words, the frequencies used for the reverse feedback are taken from the end or power tube in such a way that the gain of the power tube for these frequencies is at the same time reduced. It will thus be seen that a circuit element which is a function of the frequency instead of resistance R_7 results in a multiplicative action upon the frequency characteristic or response. However, the use of this effect is of practical sense only if a parallel resonance circuit tuned to 9 kc.

is included in the screen grid lead, since the 9 kc. stopper circuit may be operative both for long distance as well as in local signal reception, whereas general suppression of the high frequencies by direct screen grid reverse feedback is not desirable; for this is not subject to automatic volume control action and is therefore constantly operable. If the resonance circuit connected in lieu of resistance R_7 should happen to exhibit a tendency towards phase shift, this would have to be offset by a counteracting phase shift in the next reverse feedback path.

What is claimed is:

1. In a radio receiver of the type provided with a source of audio-modulated carrier waves, a detector for producing audio voltage from the waves, an audio amplifier for the audio voltage and a visual current indicator tube the improvement which comprises means for impressing amplified audio voltage upon said indicator tube, means impressing the audio voltage output of the indicator tube upon the input of said amplifier in degenerative sense, and means responsive to carrier amplitude variation for varying the gain of the indicator tube.

2. In the receiver of the type provided with a demodulator of sound modulated carrier waves, an audio amplifier network having input terminals coupled to said demodulator, a tuning indicator tube of the type having a control electrode, an output electrode and a fluorcescent target; the improvement which comprises means responsive to the amplified audio output of said audio amplifier for varying said indicator tube control electrode potential, means for feeding amplified audio potential, developed in the output electrode circuit of said indicator tube, to the input terminals of the audio amplifier and carrier-responsive means for regulating the magnitude of said amplified audio potential.

3. In the receiver of the type provided with a detector of modulated carrier waves, an audio amplifier network having input terminals coupled to said demodulator, a resonance indicator tube of the type having a control electrode controlled by carrier-responsive voltage, an output electrode and a fluorescent target; the improvement which comprises means utilizing the amplified audio output of said audio amplifier for varying said indicator tube control electrode potential, and means for feeding amplified audio potential developed at the output electrode of said indicator tube to the input terminals of the audio amplifier.

4. In an audio amplifier system comprising at least two audio amplifier tubes arranged in cascade, the last tube including a positive output element and an auxiliary control element, a resistive element in circuit with the auxiliary element for developing amplified audio voltage thereacross, audio utilizing means in circuit with the output element of the last tube, means including an amplifier tube to feed the audio voltage developed across said resistive element to the input electrode of the first audio tube in degenerative phase, and automatic volume control means to vary the control electrode voltage of said amplifier tube.

5. In the radio receiver of the type provided with a demodulator of sound modulated carrier waves, an audio amplifier network having input terminals coupled to said demodulator, a tuning indicator tube of the type having a control electrode, an output electrode and a fluorescent target; the improvement which comprises means responsive to the amplified audio output of said audio amplifier for controlling said indicator tube control electrode potential, automatic volume control means to vary the said control electrode voltage, and means for degeneratively feeding amplified audio potential developed in the output electrode circuit of said indicator tube to the input terminals of the audio amplifier.

6. In the receiver of the type provided with a demodulator of sound modulated carrier waves, an audio amplifier network having input terminals coupled to said demodulator, a tuning indicator tube of the type having a control electrode, an output electrode and a fluorescent target; the improvement which comprises means responsive to the amplified audio output of said audio amplifier for controlling said indicator tube control electrod potential, means for degeneratively feeding amplified audio potential developed in the output electrode circuit of said indicator tube to the input terminals of the audio amplifier, and carrier-responsive means for regulating the intensity of the degenerative potential.

7. In an audio amplifier system comprising at least two audio amplifier tubes arranged in cascade, the last tube including a positive screen grid element, an impedance in circuit with the screen grid element for developing amplified audio voltage thereacross, means in circuit with the output electrode of the last tube tuned substantially to nine kilocycles, means to feed the audio voltage developed across said impedance to the input electrode of the first audio tube in degenerative phase, and means for controlling the magnitude of the degenerative voltage in a sense to minimize response at frequencies above said nine kilocycles.

8. In the receiver of the type provided with a demodulator of sound modulated carrier waves, an audio amplifier network having input terminals coupled to said demodulator, a second audio tube provided with a screen circuit, a tuning indicator tube of the type having a control electrode, an output electrode and a fluorescent target; the improvement which comprises means, responsive to the amplified audio output developed across the screen circuit of said second audio tube for controlling said indicator tube control electrode potential, means for degeneratively feeding amplified audio potential developed in the output electrode circuit of said indicator tube to the input terminals of the audio amplifier, and means responsive to said carrier waves for controlling the magnitude of said degenerative potential.

9. An audio amplifier system as described in claim 4 wherein said audio utilizing means includes a nine kilocycle trap and wherein said resistive element is tuned to substantially nine kilocycles.

WERNER HEPP.