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H. WERRMANN

2,233,759

AMPLIFIER WITH NEGATIVE FEEDBACK

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Fig. 1

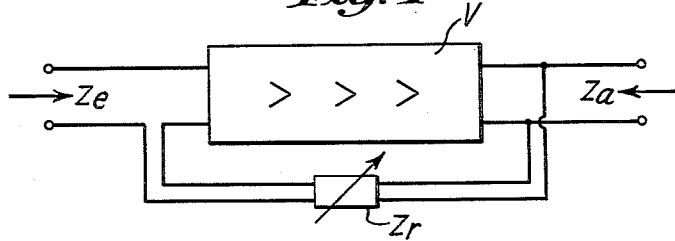


Fig. 2

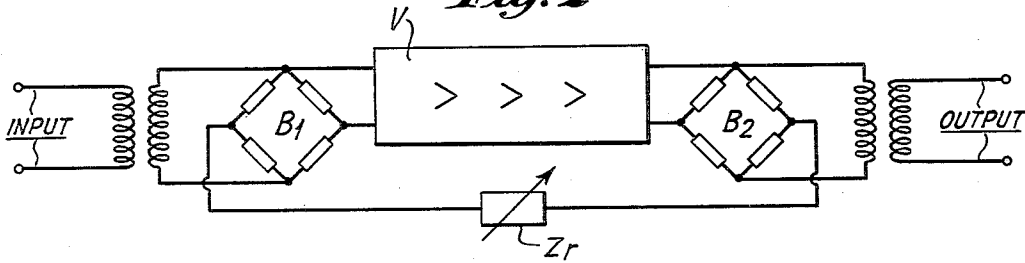


Fig. 3

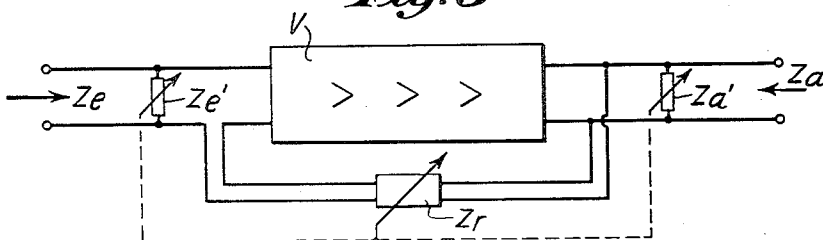
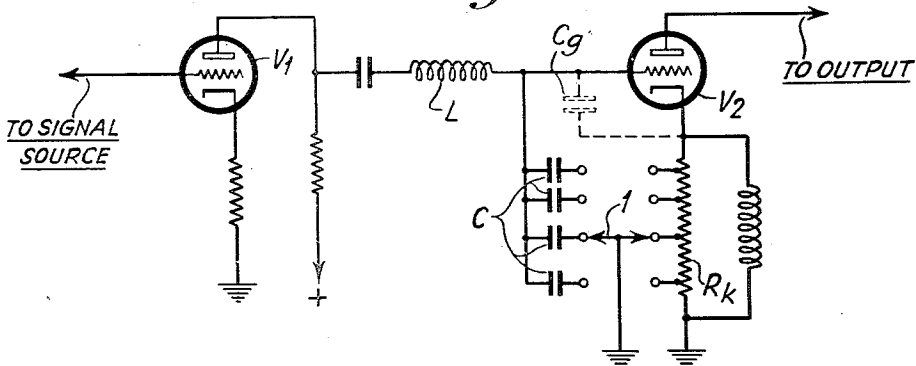


Fig. 4



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4 Claims. (Cl. 179—171)

The apparent input resistance and output resistance of a multiple stage amplifier depend, as is known, on the feedback value. In the drawing Figs. 1 and 2 each show schematically feedback circuits known in the prior art; Fig. 3 schematically shows a feedback circuit embodying one form of the present invention, and Fig. 4 shows a circuit arrangement embodying a modification of the invention. In a circuit according to Figure 1 in which the output of amplifier V is fed back across a feedback impedance Z_r , the apparent input resistance Z_e and the apparent output resistance Z_a vary if the feedback is controlled for instance by varying the impedance Z_r . In a great many cases of employing amplifiers with negative feedback an absolute constancy of the apparent input resistance and apparent output resistance is necessary, for instance, in order to maintain certain conditions of matching. As is known, the dependence of the apparent input and output resistances on the feedback can be eliminated by employing the bridge circuits B_1 and B_2 in accordance with the circuit shown in Figure 2. However, such bridge circuits require considerable means such as is not always permissible.

In accordance with the present invention, the difficulties encountered in varying the feedback are overcome in that the input circuits and/or output circuits of one or several tubes have variable impedances assigned thereto which are set in common with the negative feedback so that the resultant impedance of the input circuits and/or output circuits remains constant irrespective of the respectively set value of the negative feedback. It is advisable mechanically to couple the additional impedances in the input circuit and output circuit with the adjustable feedback impedance so that there takes place an automatic setting of the additional impedances to the respectively required value.

Figure 3 shows schematically an illustrative construction in accordance with the invention. The additional impedances are designated by Z_e' and Z_a' . The adjustment means thereof are coupled with the adjustment means of the impedance Z_r placed in the feedback path, as indicated by the dash lines. Obviously the invention is also applicable if instead of having a quadripole placed in the feedback path for setting the negative feedback as shown in Figure 3, any other variable circuit element is used to this end. The application of the invention is particularly essential if in an amplifier, such as for instance a television amplifier with distortion reducing means in

series, a control of the amplification is to be provided between individual stages through a controllable negative feedback of one of the stages.

Figure 4 shows such an amplifier with distortion-reducing means in series. The inductance L for reducing the distortion is placed between the two amplifier tubes V_1 and V_2 . The negative feedback at the tube V_2 takes place across the cathode feedback resistor R_k . The latter is adjustable for the purpose of controlling the degree of amplification. In displacing the feedback control means, the input capacity C_g of the controlled tube varies. However, the series distortion reduction obtained through series resonance between the inductance L and the input capacity C_g likewise changes so that the amplification control will depend on the frequency, which is not desirable. In accordance with the present invention this dependence is eliminated in that the amplification control has a switch arrangement I connected therewith which inserts the various capacities C into the input circuit of the tube. The capacities are so chosen that at each position of the feedback resistance R_k the input capacity of the tube remains constant. It is obvious that in place of the partial capacity adjustable in steps, a controllable capacity may be employed.

What I claim is:

1. In combination with a source of high frequency waves and a tube having input and output electrodes, a coupling path between the source and said input electrodes including a distortion reduction means which comprises the inherent capacity existing between said input electrodes and a coil arranged in series resonance therewith, means providing negative feedback of high frequency voltage from the output electrodes to said input electrodes, said feedback means including an adjustable element for regulating the magnitude of the feedback voltage, and adjustable capacity means simultaneously operable with said adjustable element for maintaining the value of said inherent capacity substantially independent of the feedback voltage magnitude.

2. In combination with a source of high frequency waves and a tube having input and output electrodes, a coupling path between the source and said input electrodes including a distortion reduction means which comprises the inherent capacity existing between said input electrodes and a coil arranged in series resonance therewith, means providing negative feedback of high frequency voltage from the output electrodes to said input electrodes, said feedback means including

an adjustable element for regulating the magnitude of the feedback voltage, adjustable capacity means simultaneously operable with said adjustable element for maintaining the value of said inherent capacity substantially independent of the feedback voltage magnitude, said feedback means consisting of a resistor located in the space current path of said tube, and said adjustable element varying the value of resistance in the space current path.

3. In combination with a source of high frequency waves and a tube having input and output electrodes, a coupling path between the source and said input electrodes including a distortion reduction means which comprises the inherent capacity existing between said input electrodes and a coil arranged in series resonance therewith, means providing negative feedback of high frequency voltage from the output electrodes to said input electrodes, said feedback means including an adjustable element for regulating the magnitude of the feedback voltage, adjustable

capacity means simultaneously operable with said adjustable element for maintaining the value of said inherent capacity substantially independent of the feedback voltage magnitude, said source comprising a prior high frequency transmission tube, and said adjustable capacity means being arranged in shunt with said inherent capacity.

4. In an amplifier, a tube having at least a grid, cathode and plate, an alternating voltage input circuit connected to said grid, a resistor in the space current path of the tube, said resistor being unbypassed for alternating current whereby alternating voltage is developed thereacross, and an alternating current path between said resistor and said grid, said path including a slidable tap which is adjustable along said resistor for varying the value of the alternating voltage impressed on the grid, and means operatively associated with said tap to compensate for capacity changes between the grid and cathode caused by adjustment of the tap.

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