

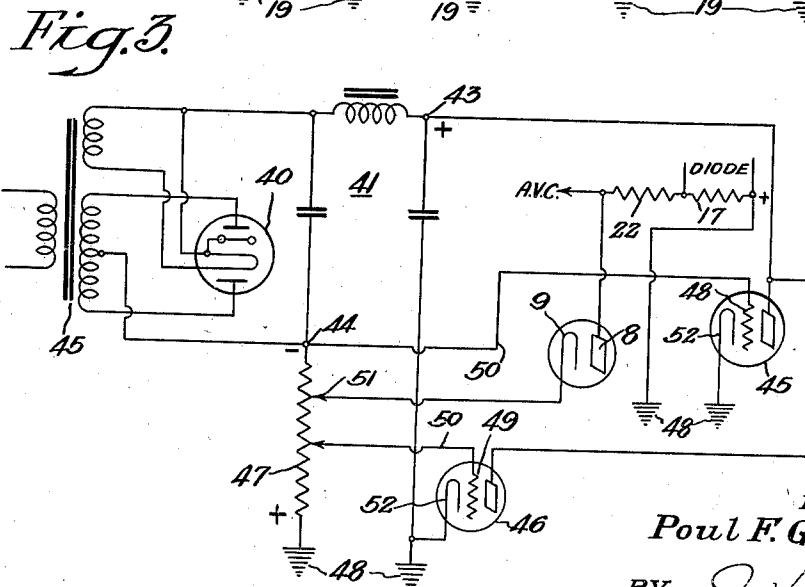
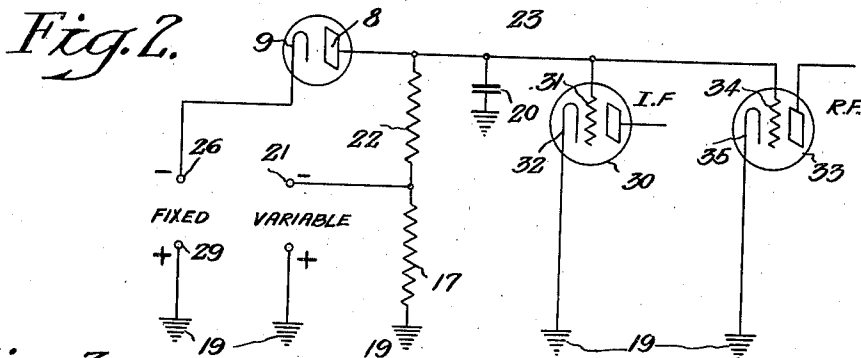
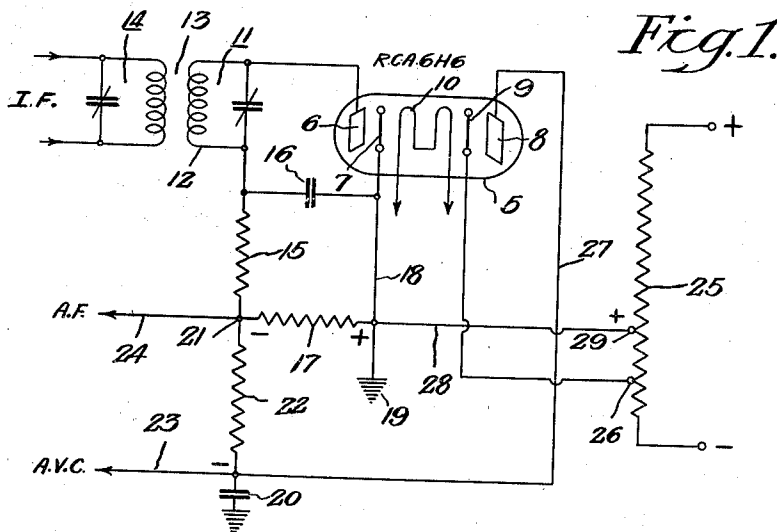
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BIAS POTENTIAL SUPPLY SYSTEM

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BIAS POTENTIAL SUPPLY SYSTEM

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The present invention relates to a bias potential supply system for radio receiving apparatus and the like, and has for its object to provide a bias supply system in connection with a diode signal rectifier for a radio receiving system, wherein a fixed initial biasing potential and a signal variable automatic volume control potential may be applied to certain amplifier tubes.

It is a further object of the present invention to provide a bias potential supply system for radio receiving systems which provides an automatic volume control potential and a fixed biasing potential in a conductive supply circuit, and in which a transition from automatic bias control to fixed bias control may be accomplished automatically without adversely affecting the operation of the system.

The invention has for its further object to provide an automatic bias supply system responsive to signals which permits a main signal rectifier, diode cathode and controlled amplifier cathodes to be connected together by a common circuit lead or chassis ground connection, whereby more stable operation is effected in the radio receiving system.

The invention will, however, be better understood from the following description, when considered in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing,

Figure 1 is a schematic circuit diagram of a portion of a radio receiving system embodying the invention.

Fig. 2 is a simplified circuit diagram illustrating the operation of the circuit of Fig. 1, and

Fig. 3 is a further schematic circuit diagram showing the bias supply circuit for certain of the other tubes of the receiver and is a modification of the circuit of Fig. 1.

Referring to Fig. 1, a diode type second detector is indicated by the electric discharge device 5. This device is preferably of the double diode type, although the two diodes may be inclosed in separate envelopes. In the present example, however, the device is an RCA 6H6 tube having two diode rectifiers with separate cathodes, one of which comprises an anode 6, and a cathode 7, and the other of which comprises an anode 8 and a cathode 9, with the series connected cathode heaters indicated at 10.

The diode rectifier provided by the anode 6 and the cathode 7 is utilized as a second detector, and is connected with a tuned input circuit 11 provided in connection with the secondary 12 of

an intermediate frequency output transformer 13 to which signals are supplied from the preceding intermediate frequency amplifier (not shown) through the tuned primary circuit 14.

In series between the tuned input circuit 11 and the anode 6, there is connected a suitable filter resistor 15 provided with a by-pass for intermediate frequency currents to the cathode, as indicated by the capacitor 16, and a diode output resistor 17, connected in series with the filter resistor 15, to the cathode lead, indicated at 18. The latter may be grounded, as indicated at 19, to the chassis or other suitable return circuit for the receiving system.

The junction point 21 or negative terminal of the output resistor 17 is connected through a filter resistor 22 with an automatic volume control supply lead 23, which leads to the preceding circuits to be controlled in any well known manner for automatic volume control purposes, and, likewise, the audio frequency component of the rectified signal appearing in the output resistor 17 may be taken therefrom for further amplification in any well known manner through an output lead 24. The bias supply or automatic volume control circuit 23 is suitably by-passed to ground at high and audio frequencies by the by-pass capacitor 20.

In order to establish a fixed biasing potential on the automatic volume control circuit and on the tubes controlled thereby, in the absence of signals, a fixed source of biasing potential is provided in connection with a fixed potential source represented by the bleeder resistor 25 of the receiving system and the remaining diode rectifier provided by the electrodes 8 and 9. For this purpose, the cathode 9 is connected to a more negative potential tap-point 26 on the source 25 than the connection for the anode 8, which is provided through a lead 27, the resistor 22, the output resistor 17, and a lead 28, connected with a more positive tap-point 29.

With the arrangement shown, and with a negative potential of substantially three volts between the points 26 and 29, a current is caused to flow thereby from the positive terminal 29 through the resistors 17 and 22 and the lead 27 to the anode 8 from which the current flows from the cathode 9 and returns to the negative terminal 26. The cathode 7 and the positive end of the resistor 17 are grounded, and, therefore, because of the direction of current flow in the resistors a potential proportional to the relative values of the resistors 17 and 22 is placed upon the diode anode 6, the audio frequency lead 24

and the automatic volume control lead 23 with respect to ground, this being in each case of a lesser value than the bias potential difference between the terminals 29 and 26, and is sufficient to maintain the circuit 23 at a predetermined desired negative potential with respect to ground or the common cathode circuit for the receiving system.

As signals are received, the current through the main diode or detector output resistor 17 is caused to increase because of rectification of the carrier wave or signal and this tends to raise the potential in a negative direction at the terminal 21 and at the anode 8 through its connection therewith until the potential of the anode 8 equals the potential of the cathode 9, when no further current flow takes place through the control diode 8—9 since the cathode and anode are of the same negative potential. The automatic volume control circuit then takes over the control and the potential applied to the circuit leads 23 and 24 is proportional to the strength of the carrier wave or signal and serves to properly bias the circuits in the usual manner to effect the usual automatic volume control of the preceding portion of the receiver.

The manner in which the system operates to control the preceding amplifier tubes of the receiver is shown more clearly in Fig. 2 to which attention is now directed and in which the same reference numerals are applied to like circuit elements, as in Fig. 1.

As will be seen in Fig. 2, the intermediate frequency amplifier tubes indicated at 30, are provided with a control grid 31 and a cathode 32, connected respectively with the automatic volume control lead 23 and the common circuit return or ground 19, and in a similar manner the radio frequency amplifier tubes, represented by the tube 40, are provided with a control grid 34 and a cathode 35 connected in a similar manner for automatic volume control between the lead 23 and ground 19.

The fixed source of biasing potential between the terminals 26 and 29 is applied between the ground 19 and the cathode 9, and the anode 8 is connected with the lead 23, whereby current is caused to flow through the connection with the output resistor 17 and the series filter resistor 22, which potential drop through both elements is applied between the grids and cathodes of the amplifier tubes 30 and 33. This initial bias is determined by the value of the potential between the terminals 26 and 29 and it will be noted that the polarity is such that the flow of current through the diode output resistor is in the same direction as when a variable potential resulting from signal rectification is derived between ground 19 and the terminal 21 and applied through the resistor 17, the drop and potential being transferred through the output filter resistor 22 to the automatic volume control lead 23.

From the diagrammatic representation, it will be seen that when the terminal 21 becomes as negative as the terminal 26, both the anode 8 and the cathode 9 will be at the same negative potential and further operation of the rectifier will be discontinued. The control of the tubes 30 and 33 representing any of the preceding amplifier tubes of the receiver will then be entirely under control of the variable source or rectified signal potential.

Viewed in one of its aspects, the rectifier device 8—9 is a check-valve preventing the flow of current through the fixed source from the automatic

volume control circuit when the latter provides a higher than a predetermined potential. In other words, the controlling diode 8—9 serves to disconnect the fixed source of biasing potential as soon as the variable source or automatic volume control means reaches a predetermined value. Furthermore, use is made of both the filter resistor and the diode output resistor for providing the initial biasing potential while for automatic volume control operation, the filter resistor functions only as a filter.

The relative resistance values of the filter resistor and the diode output resistor in series determines the relative amount of delay potential or negative bias which is applied to the detector diode anode 6. In the present example, where the resistor 17 may have a value of 220,000 ohms, for example, and the resistor 22 may have a resistance of 2.2 megohms, the negative biasing potential on the diode anode 6 may be of the order of less than .3 volt, thus causing no appreciable delay in the response to signals, the major portion of the drop in potential being through the series resistor 22.

Referring to Fig. 3, a rectifier device 40 is arranged to provide, through a filter 41, rectified alternating current at positive and negative output terminals 43 and 44, respectively, from a usual alternating current step-up transformer 45.

Without the use of the usual bleeder or output resistor, the anode-cathode space paths of the audio frequency amplifier tubes, represented by the tubes 45—46 are parallel connected in series with a resistor 47 in the negative supply lead, and the circuit return thereto is made through ground or common circuit return connections 48. This avoids the shunt load of the usual output resistor, while at the same time providing fixed biasing potentials in connection with the resistor 47 to which the control grids 48 and 49 may be returned through suitable circuits represented by the connections 50. The coupling elements have been omitted for the sake of simplifying the drawing and permitting the circuits to be traced more readily. The control diode comprising the electrodes 9 and 8 are connected as in the preceding figures with the diode output resistor 17 and the series resistor 22 between the ground and a negative tap 51, for example, on the resistor 47.

It will be seen from a consideration of Figs. 2 and 3, that the high frequency and low frequency amplifier tubes are separately biased by different means and that by the system of Fig. 3 the voltage divider resistor 25 may be omitted, while at the same time the control diode is permitted to operate in connection with the detector diode to provide an initial bias potential across both the series resistor and the diode output resistor with the same polarity to ground as the diode, when operating to supply a potential across the diode output resistor and that this connection serves to raise the diode anode negatively to a value equal to the cathode to reduce its operation to zero. As in the case of the radio frequency and intermediate frequency amplifier tubes, the audio frequency amplifier tubes are by this means also permitted to have the cathodes 52 thereof connected directly to the common return circuit or ground.

I claim as my invention:

1. A bias control system for radio receiving apparatus and the like having a common cathode return circuit, comprising in combination a diode rectifier, means providing a source of fixed poten-

tial, means providing a source of variable potential, and means for causing said last named potential to vary in response to signal strength variations, said potential sources having positive terminals directly connected with said common cathode return circuit for said apparatus and having negative terminals interconnected through said diode rectifier.

2. A bias control system for radio receiving apparatus and the like having a common cathode return circuit, comprising in combination a diode rectifier, means providing a source of fixed potential, means providing a source of variable potential, means for controlling the value of the last named potential in response to signal strength variations, said potential sources having positive terminals directly connected with said common cathode return circuit for said apparatus and having negative terminals interconnected through said diode rectifier, and the cathode of said rectifier being connected with the negative terminal of the fixed source and the anode being connected with the negative terminal of the variable source through a series filter resistor.

3. A bias control system for radio receiving apparatus and the like having a common cathode return circuit, comprising in combination a diode rectifier, means providing a source of fixed potential, means providing a source of variable potential, means for controlling the value of the last named potential in response to signal strength variations, said potential sources having positive terminals directly connected with said common cathode return circuit for said apparatus and having negative terminals interconnected through said diode rectifier, the cathode of said rectifier being connected with the negative terminal of the fixed source and the anode being connected with the negative terminal of the variable source through a series filter resistor, a bias control circuit connected with said anode, and an output resistor for the variable source connected between said common circuit connection and the negative terminal of said variable source.

4. In a bias potential supply system for amplifying apparatus embodying a plurality of electric discharge amplifier devices, the combination of a diode rectifier device, means providing a common cathode return circuit for said amplifier devices to which the cathodes of said devices are directly connected, a bias potential supply lead for said amplifier devices, means providing a fixed biasing potential for said amplifier devices having a negative terminal and having a positive terminal connected with said supply lead through said diode rectifier device, the anode electrode of said rectifier device being connected with said negative terminal, means including a rectifier output resistor providing a potential proportional to the strength of a received signal, said last named means having a positive terminal provided with a direct connection with said common return circuit and a negative terminal connected with the anode of said rectifier device, a filter resistor in circuit with and having a relatively higher resistance than said last named means.

5. In a radio receiving system, the combination with a second detector comprising a diode rectifier, of a diode output resistor having the cathode end thereof connected directly with a common circuit return element of said receiving system and with the diode cathode, means for deriving automatic volume control potentials from said resistor, including a series resistor and output lead connected with a negative terminal

thereof with respect to the cathode end, means adapted to provide a fixed biasing potential, a control diode rectifier device having an anode connected with said last named lead and having a cathode connected to the cathode of the first named rectifier through said source of fixed biasing potential, the positive terminal of which is connected with the cathode of the first named diode rectifier and the negative terminal of which is connected with the cathode of the control diode rectifier.

6. In a bias potential supply system for radio receiving apparatus and the like, including in combination a plurality of amplifier tubes, the cathodes of which are connected with a common circuit return element, means providing a source of biasing potential having a positive terminal connected with said common circuit return element, means providing a bias potential supply connection for certain of the amplifier tubes directly with said last named means, means providing a bias potential supply connection for certain others of said amplifier tubes with said bias potential source including a diode rectifier device in said connection, means providing a conductive resistance path between the anode of said device and the common circuit return element, and means providing automatic volume control potentials in connection with a portion of said resistance path and of a polarity such that the positive terminal thereof is connected with the common circuit return element.

7. The combination with a direct current bias potential supply circuit for radio receiving systems and the like, of a diode rectifier device in said circuit having a cathode and an anode, means for maintaining said cathode at a negative potential with respect to the cathode return circuit of said system, a negative bias supply circuit connected with said anode, and means for raising the negative potential on said anode with respect to the negative potential on the cathode in response to an increase in signal strength, said last named means having a positive terminal connected with the cathode return circuit of said system by a direct connection.

8. In a radio receiving system, having a plurality of high frequency and low frequency amplifier tubes, the combination of means providing a common cathode circuit connection therefor through said system, potential supply means having a positive terminal connected with said common cathode circuit connection, a signal rectifier device including a cathode and an anode, a diode output resistor therefor having a connection with the anode, the cathode of the rectifier device being directly connected with said common circuit connection and directly with said diode output resistor, a bias control circuit for the high frequency amplifier tubes connected to the negative terminal of said output resistor, a filter resistor in series therewith, having a relatively high resistance with respect to said diode output resistor, and an auxiliary diode rectifier device having a cathode connected with a negative terminal of said potential supply means and having an anode connected with said bias control circuit whereby it is connected in series with said diode output resistor and filter resistor in series, whereby the potential of the signal rectifier device cathode is not less than the potential of the controlled amplifier cathodes.

9. In a radio receiving system, the combination with a plurality of high frequency amplifiers having the cathodes thereof connected to ground,

of a diode signal detector having a cathode connected to ground, a diode output resistor connected with said detector to receive the rectified signal output therefrom and having the positive end connected to ground, a series filter resistor through which automatic volume control potentials are supplied from said diode output resistor to the control grids of said high frequency amplifiers, means providing an auxiliary diode rectifier, means for raising the cathode thereof above ground by a predetermined negative potential, means for applying said automatic volume control potentials to the rectifier anode to raise said anode to a higher negative potential than the rectifier cathode in response to received signals and providing a connection whereby the potential of the detector diode cathode is not less negative than the potential of the controlled amplifier cathodes.

10. A bias control system for radio receiving apparatus and the like including a common cathode return circuit, comprising in combination a diode rectifier, means providing a source of fixed potential, means providing a source of variable potential, means for causing said last named potential to vary in response to signal strength variations, said potential sources having positive terminals directly connected with said common cathode return circuit for said apparatus and having negative terminals interconnected through said diode rectifier, and a circuit for

deriving a biasing potential therefrom, connected with said diode rectifier and said cathode return circuit.

11. In a radio receiving system, the combination with an amplifier gain control circuit comprising a common cathode return circuit element and a bias supply lead normally negative with respect thereto, of a diode signal rectifier having an output resistor connected in circuit therewith to receive the rectified signal output therefrom, said output resistor having a positive terminal connected directly to the common cathode return circuit element, a filter resistor connected between a negative terminal of said output resistor and said negative bias supply lead, and a direct current residual bias supply circuit connected between said negative bias supply lead and the common cathode return circuit element, said last named circuit including a second diode rectifier device having an anode electrode connected with said negative bias supply lead, and having a cathode, and said circuit further including means providing substantially fixed biasing potential in series with said second diode rectifier device, the negative terminal of said last named biasing means being connected with the cathode of the second diode rectifier device, and said last named bias means having a positive terminal connected to said common cathode return circuit element.

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