April 20, 1937. P. F. G. HOLST 2,077,566

RADIO-PHONOGRAPH APPARATUS

Filed Nov. 30, 1934

Fig. 1.

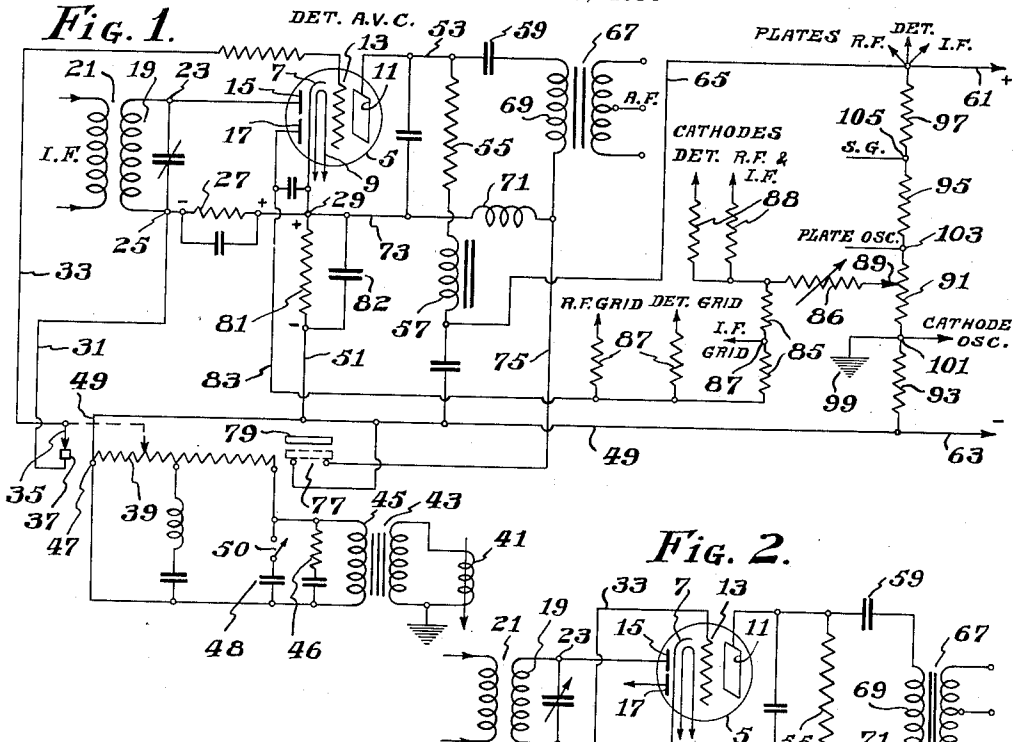


Fig. 2.

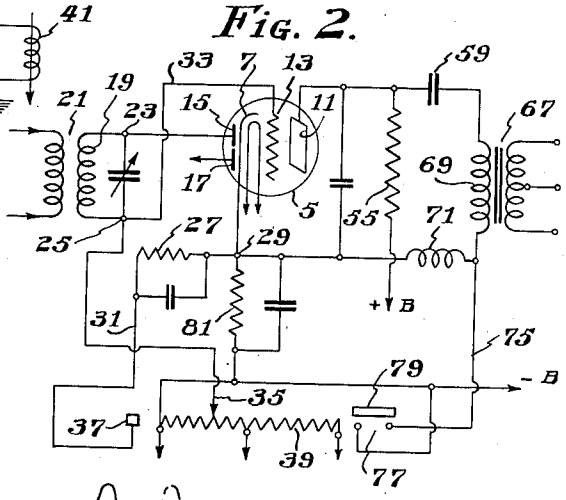
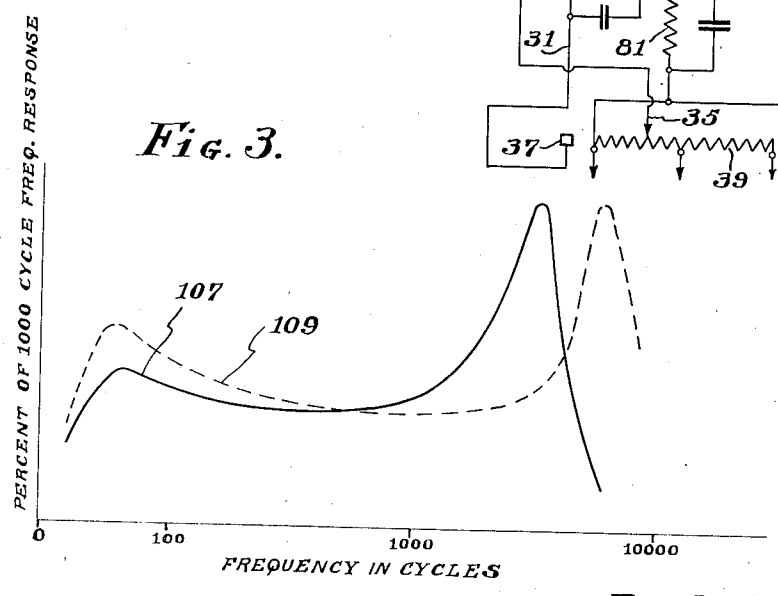


Fig. 3.



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Patented Apr. 20, 1937 2,077,566

UNITED STATES PATENT OFFICE

2,077,566

RADIO-PHONOGRAPH APPARATUS

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Application November 30, 1934, Serial No. 755,474

14 Claims. (Cl. 179—100.11)

The present invention relates to radio phonograph combination apparatus and the like, wherein a single electric discharge device, such as an amplifier or detector tube, may selectively be utilized in two signals circuits, such as a radio signal receiving circuit and a phonograph pickup circuit for phonograph record amplification. More particularly, the present invention relates to apparatus of the above character wherein the electric discharge device is the second or audio frequency detector of a superheterodyne receiving circuit and is of the type comprising an amplifier portion having a cathode, grid and anode elements, and a diode rectifier portion comprising two or more diode anodes associated with the cathode of the amplifier portion in a common envelope. Such devices may be referred to as multiple diode amplifiers and are known commercially as duplex diode triodes and pentodes, specific types being represented by RCA—85 and RCA—6B7 tubes, for example.

It is an object of the present invention to provide an improved system wherein a multiple diode amplifier device of the type above referred to, may be operated selectively as a radio signal detector and as a signal amplifier.

It is a further object of the present invention to provide a selective switching system for operation of a multiple diode amplifier as a detector and as a signal amplifier wherein a minimum number of switching operations are required.

It is also an object of the invention to provide for operation of automatic volume control means in connection with a device of the above character whereby radio signals are automatically suppressed when amplifying signals from other sources.

It is an object of the present invention to provide an improved radio phonograph switching system in connection with a detector tube of the character above referred to, which involves a minimum of circuit changes and switching operations whereby the apparatus is converted from a condition of adjustment for amplifying radio signals to a condition of adjustment for amplifying phonograph signals and the like, and vice versa.

It is also a further object of the present invention to provide a selective radio-phonograph switching system, for the second or audio frequency detector of a superheterodyne receiver of the type including in a common envelope audio frequency amplifier elements and a double diode rectifier, and circuits in connection with the switching means adapted for automatically suppressing radio signals through the amplifying portion of the receiver when the switching means is adjusted for phonograph signal amplification.

It is still a further object of the present invention to provide a switching system of the type herein referred to, whereby a single diode detector and electric discharge amplifier having a common enevolpe and a common cathode may be operated as a diode or signal biased detector and as a self-biased amplifier.

It is also an object of the present invention to provide, in a selective radio-phonograph switching system for a double diode amplifier device, means for simultaneously changing the audio frequency response characteristic and the bias potential for the signal amplifier.

It may also be considered as a further object of the present invention to provide in connection with a double diode rectifier and second detector of a superheterodyne receiver, selective switching means for changing said detector from radio signal detection and amplification to phonograph signal amplification with a minimum of switching changes for the circuits connected therewith and means of automatically suppressing the radio signal portion of the receiver whereby it is rendered ineffective to amplify radio signals when said detector is adjusted for phonograph signal amplification.

In carrying out the above and other objects of the invention, a double diode amplifier tube, such as a type known at present commercially as an RCA—85 radio tube and hereinbefore referred to, is provided as the second or audio frequency detector in a superheterodyne receiver in such a manner that one of the diode anodes thereof provides signal rectification or detection while another diode anode provides automatic volume control for the radio signals. The amplifier portion is adapted to amplify both detected radio signals and signals of other origin, such as phonograph signals, applied thereto under control of simplified selective switching means, including, in a preferred embodiment, volume control means for the signals of other origin.

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

Fig. 2 is a similar circuit diagram showing a modification of the circuit of Fig. 1, and

Fig. 3 is a curve diagram illustrating certain operating characteristics shown in Fig. 1.

Referring to Fig. 1, 5 is an electric discharge device comprising a cathode 7, a heater 9 therefor, an output anode 11, a control grid 13 and two diode anodes 15 and 17 associated with the cathode 7. The tube 5 may be a commercial type known as an RCA—85 radio tube or the like, and includes an amplifier portion comprising the cathode 7, the grid 13 and the output anode 11. It further includes a double diode rectifier means in the same envelope, comprising the diode anodes 15 and 17 associated with the common cathode 7.

In the present example, the tube 5 is arranged in circuit to function as a diode rectifier type of detector, as a first audio frequency amplifier, and as automatic volume control means for the receiver. The automatic volume control means being shown schematically, together with suitable legends indicating the circuit connections, for the purpose of simplifying the drawing, since the invention does not include the same.

The tube 5 represents any multiple diode amplifier device for a radio signal amplifying system, wherein it is required to utilize said device for amplifying signals of other origin outside the normal signal channel of the apparatus, and for suppressing signals through the latter while amplifying said signals of another origin.

In the present example, signals to be rectified or detected are supplied to the first diode anode 15 through a tuned signal input circuit 19, including the secondary of an input coupling transformer 21. This may be the final intermediate frequency amplifier coupling transformer of a superheterodyne radio receiving system. The high potential terminal 23 of the tuned input circuit 19 is connected with the diode anode 15 while the low potential terminal 25 is connected through a suitable potential drop producing means, such as a resistor 27, to the cathode at 29, whereby a rectifier or detector circuit is provided between the diode anode and the cathode.

The audio frequency component of rectified signals in the detector circuit are applied between the cathode 7 and the control grid 13 through a connection lead 31 from the terminal 25 and a grid lead 33 connected with the grid 13, the connection between the leads 31 and 33 being controlled by and completed through a movable contact 35 connected with the lead 33 and a fixed contact 37 connected with the lead 31.

The movable contact 35 is associated with and forms part of a volume control potentiometer device 39 for signals of other origin, such as provided by a phonograph pickup device indicated at 41. The pickup device is connected through a suitable input transformer 43 with the potentiometer device 39, the latter being in shunt relation to the secondary 45 of the transformer, as indicated. Suitable tone compensating circuit means 46 and 48 are also provided in shunt with the input circuit, the latter being controlled by a switch 50 to remove high frequency response or needle scratch.

The contact 35 is movable from the position 37 to positions of adjustment along the potentiometer device 39, as indicated by the dotted lines, and serves to connect the grid 13 with the source of signals 41 and the cathode connection is completed from a low potential terminal 47 on the potentiometer device 39 through a lead 49 and a cathode lead 51 whereby the signals from the device 41 are applied between the cathode and control grid 13.

Signals from either the tuned input circuit 19 or the device 41 are amplified in the device 5 and appear in the output anode circuit indicated at 53. The output circuit comprises suitable output coupling means, represented in the present example by a coupling resistor 55, a filter choke coil 57 and an output coupling condenser 59. Anode potential from a source 61—63 of unidirectional current is supplied through a lead 65.

The output circuit per se is isolated from the anode potential by the condenser 59 and further includes coupling transformer 67, the primary 69 of which is connected in series with the anode coupling condenser 59 through a tuning or peaking choke coil 71, directly back to the cathode connection 29 through a return lead 73. One terminal of the choke coil 71 is thereby connected directly with the cathode in the low potential side of the anode output circuit. The lead 49 is connected with the negative lead 63 of the plate supply circuit and is also connected to the opposite terminal of the choke coil 71 through a lead 75 and a switch 77 which is normally open for radio reception, as shown by the position of the shorting or bridging means indicated at 79.

When receiving radio signals through the input transformer 21 and the tuned circuit 19, the control grid 13 of the amplifier portion of the tube 5 receives not only the rectified or detected signals from the impedance 27 through the leads 31 and 33 and the switch means 35—37, but also receives a direct current component of the rectified signal from the same impedance, as a biasing potential which increases with increases in signal strength. It will be seen, therefore, that the biasing potential with no signal will be zero, whereupon the anode current to the tube 5 through the anode 11 will tend to increase to a relatively high value. However, the impedance of the output coupling means 55 and an impedance 81 in the cathode lead 51 serve to limit the anode current with no signal impressed upon the detector and with no biasing potential on the grid 13.

It will be noted that in the anode circuit, and, specifically, in the cathode return lead 51, the resistor 81 is located in the position of the usual self-bias resistor. However, in the present example, it is of a relatively higher value than normally employed. For example, with the type of tube indicated, it may be of a value as high as 20,000 ohms. The output coupling resistor 55 may be of the same resistance value.

With this arrangement, the voltage drop with no signal is substantially 90 volts across the resistor 81. The voltage then applied to the second diode anode 17 is adjusted to a value of substantially 80 volts through a lead indicated at 83, from the same potential source as is used to supply the cathode with the 90 volt drop through the resistor 81.

The diode anode 17, therefore, may be utilized to provide automatic volume control of the receiving circuits since with increase in signal strength, the negative bias on the grid 13 increases as supplied by the impedance 27 causing a reduction in the flow of anode current through the resistor 81 and a reduction in the potential drop therethrough.

When the potential drop through the resistor 81 is less than 80 volts, the diode anode 17 begins to draw current from the supply lead 83 and this current is arranged to cause a potential drop

through resistors indicated at 85 and 86 connected with the grids of tubes in the receiver, the gain of which it is desired to control. Such grids may be those of the detector, radio frequency and intermediate frequency amplifier as indicated by the connections 87. The cathode connections to the said tubes are also indicated at 88, and the connection for both the cathode and grids is made with the potential supply means through a variable volume control contact 89 in connection with a section 91 of a potentiometer or bleeder resistor comprising additional sections in series therewith, as indicated at 93, 95, and 97, the connection between the sections 93 and 91 being grounded as indicated at 99. Suitable oscillator cathode, plate and screen grid connections for the receiver are indicated at 101, 103, and 105, respectively.

The automatic volume control system per se and the connections for the various tubes controlled thereby does not concern the present invention except that the radio phonograph selective switching circuit is adapted for use in connection with a tube having or providing the automatic volume control means as described above and including the controlling resistor 81 in the cathode lead, the potential drop across which is controlled by an amplifier grid which is variably biased in response to variations in received signal strength or a diode biased amplifier, as it will hereinafter be referred to. The term "diode bias" is intended to distinguish from self-bias as provided in an amplifier which receives a biasing potential from a resistor or impedance in the cathode return lead.

The present amplifier is intended to be both a diode biased and a self-biased amplifier, being diode biased for amplifying the detected signals, and being self-biased for amplifying the signals of other origin, such as supplied from the phonograph pickup 41.

The change from diode bias operation to self-bias is made simultaneously with the change from radio signal amplification to amplification of the phonograph pickup signals. This is effected, it will be noted, by movement of the movable contact 35 from the contact 37 to the potentiometer resistor 39.

It will be seen thus that the grid 13 is switched from connection with the negative end of the diode bias resistor 27 to the negative end of the self-bias resistor 81, to receive a fixed bias potential from the latter. In this case, however, the potential is too high for normal amplification and, accordingly, a shunting resistor to lower the drop is connected across the resistor 81. This is effected in the present example by closure of the switch 77—79 which places the choke coil 71 in parallel with the resistor 81, the choke coil having a resistance of 3,000 ohms in the present example. This causes a biasing potential to be applied to the grid 13 at a fixed, normal value for signal amplification from the pickup device 41. The volume of signals received therefrom may be increased or decreased, as is obvious, by movement of the contact 35 along the potentiometer resistor 39 without changing the fixed bias provided by the choke coil 71 and the resistor 81 in parallel. A condenser 82, preferably of several microfarads capacity, connected in shunt to the cathode resistor 81 causes a low alternating current or signal potential drop thereacross.

It has been noted hereinbefore, that reduction of the voltage drop across the cathode resistor 81, as by an increase in the radio signal strength, causes the voltage on the second or automatic volume control diode 17 to exceed that on the cathode, whereupon current flows therefrom to the cathode to reduce the gain of the receiver.

This automatic volume control action is also put into effect when the resistor 81 is shunted by the choke coil 71. It will be seen that the automatic volume control action of the second diode 17 becomes effective in reducing the gain of the radio receiving channel and is caused by the shunt connection of the coil 71 with the resistor 81. The voltage across the coil and resistor is sufficiently low to cause the automatic volume control action to entirely cut off the radio signal by reducing the gain to a minimum through the radio receiving circuit. The change of connection whereby the cathode resistor 81 is shunted by the choke coil 71 through closure of the switch means 77—79, automatically causes cut off in the radio receiving circuit by lowering the voltage drop across the cathode resistor to permit the automatic volume control to function. The switch is preferably operated in conjunction with and in response to operation of the phonograph volume control means. This is effected by including the switch 77—79 with the volume control means as indicated in the drawing, whereby the switch 77—79 is closed when the movable arm 35 leaves the contact 37 and engages with the potentiometer 39, thereby making it unnecessary for providing means for cutting off the radio receiver operation.

In the circuit shown and described, the lead 31 may be regarded as supplying signal variable biasing potentials for the control grid 13 while resistor 81 and shunt connected choke coil 71 provide, through the lead 49, self biasing potentials for the control grid 13 and such potentials are made selectively available through movement of the contact 35 from the contact 37 to the potentiometer resistor 39. The potentiometer 39 is therefore connected with a source of self bias potential while the adjacent contact 37 is connected with a source of biasing potential from a diode rectifier in the signal circuit.

The automatic volume control system is such that an auxiliary diode associated with the cathode is adapted to feed the current through the cathode when the potential on the latter is lowered below that supplied to the diode anode and such potential will be lowered by increasing the signal strength or by shunting the cathode return circuit resistor by suitable means such as the tuning choke coil in the output anode circuit, which, for that purpose, is connected adjacent to the cathode in said circuit.

The choke coil 71 has also a further function in the circuit for radio reception but is effectively short circuited for phonograph or auxiliary signal input as indicated by the curves shown in Fig. 3 to which, along with Fig. 1, attention is now directed.

For phonograph operation it is desirable to increase the range of response for better fidelity than for radio reception because usually the selectivity limits the possibilities of wide frequency range, and in particular to move the high frequency peak to a higher frequency point. This is accomplished by inserting the choke coil 71 in the output anode circuit of the detector-amplifier 5 so that the choke coil has the same effect as leakage reactance in the transformer for lowering the point at which the frequency peak occurs in the frequency response characteristic as indicated by the solid line curve 107, while the

curve 109 indicates the frequency response characteristic of the output anode circuit and coupling transformer with the choke coil short circuited. It will be noted that for phonograph operation the high and low frequency response is extended and accentuated whereby improved fidelity on phonograph operation is obtained.

The choke coil 71 is therefore made to perform two functions, that of tuning the amplifier output anode circuit for a desired response characteristic, and for operating as a shunt connection for the cathode resistor of the combined diode detector-amplifier thereby to lower the voltage on the cathode and to a value such that the tube may operate as an amplifier and the associated automatic volume control system may be caused to function on phonograph operation to reduce the radio signal gain to a predetermined low value whereat radio reception is substantially cut off.

In addition to the control of the radio receiving circuit through the automatic volume control anode for cutting off the radio signal reception, additional or alternative means may be provided for cutting off the radio signal when operating in response to phonograph signals by causing a negative biasing potential to be placed upon the detector diode anode when operating the detector-amplifier as an amplifier for the auxiliary signals. A modification of the circuit in Fig. 1 to provide this control arrangement is shown in Fig. 2 to which attention is now directed, and in which the same reference numerals for like parts are used throughout.

Referring to Fig. 2, it will be noted that while the contact 37 is connected with the source of signal variable potential, the grid lead 33 and the contact 35 are connected at the low potential point 25 with the tuned circuit 19 and with the signal diode 15 so that when the contact 35 is moved into connection with the potentiometer 39, the diode 15 receives the same biasing potential as the grid 13 which is sufficiently negative to prevent the diode 15 from functioning in response to signals normally received whereby reception through the radio signal channel is prevented automatically when the phonograph or auxiliary input circuit is brought into operation.

The circuit according to Fig. 2 therefore provides a signal input circuit having a diode anode connected to one terminal thereof and the amplifier control grid connected to another terminal thereof, with the movable contact of the potentiometer device connected with both the diode anode and the control grid, whereby signal controlled or self bias potentials may be applied to both of said electrodes for selective phonograph or radio operation in a signal receiving circuit. Since the remaining connections are otherwise the same as in Fig. 1, further description is believed to be unnecessary.

From the foregoing description it will be seen that an improved control circuit is provided for a multiple diode amplifier device of the electric discharge type. Means are provided for operating the amplifier portion as a signal or diode biased amplifier for radio signals and as a fixed biased amplifier for phonograph signals. Furthermore it will be seen that the circuit control means is particularly adapted for use in connection with the second or audio frequency detector circuit of a superheterodyne receiver having one of the diode anodes employed for automatic volume control in a balanced circuit arrangement involving operating the cathode above ground potential whereby the radio reception is automatically suppressed when the circuit is adjusted for phonograph operation, and that control is effected by simple switching means associated with and jointly operable with the volume control means for the phonograph circuit.

I claim as my invention:

1. The combination with an electric discharge device having a cathode, an anode, a control grid and a pair of diode anodes associated with the cathode, of a signal rectifier circuit connected between one of said diode anodes and the cathode providing a signal variable biasing potential for said control grid, a potential drop producing impedance in circuit with the cathode separately from said rectifier circuit and having a positive terminal connected to the cathode, the potential drop being variable with biasing potential, means for impressing a fixed potential between the negative end of said potential drop producing means and the other diode anode normally lower and in opposition to the potential drop in said last named means, a signal input circuit connected with the negative end of said potential drop producing means, an anode output circuit tuning choke coil connected in circuit with the anode adjacent to the cathode, and selective switching means for simultaneously connecting said choke coil in parallel with said potential drop producing impedance and connecting said control grid with said signal input circuit, to the exclusion of said signal rectifier circuit.

2. In a radio receiving system, the combination with a signal amplifier having a control grid, a cathode and two diode anodes associated with the cathode, of a signal rectifier circuit including a diode output resistor connected between the cathode and one of said anodes, means providing a biasing potential and signal supply connection for said control grid with said resistor, an automatic volume control circuit including means for impressing upon said cathode and the second diode anode opposing direct current potentials, one of which is variable in accordance with variations in signal strength to effect automatic volume control of received signals, an input circuit for additional signals, means for impressing a fixed biasing potential on said circuit of a value corresponding to the biasing potential provided by received signals through said rectifier circuit, and means for selectively connecting said control grid with said last named signal input circuit to the exclusion of the rectifier circuit.

3. In a radio receiving system, the combination with a signal amplifier having a control grid, a cathode and two diode anodes associated with the cathode, of a radio signal rectifier circuit connected with one of said anodes, means for impressing upon said cathode and the second diode anode opposing direct current potentials, one of which is variable in accordance with variations of grid potential, means providing for said control grid a conductive connection with the rectifier circuit whereby said grid is varied in biasing potential in accordance with variations in signal strength, a signal input circuit, means for impressing a fixed biasing potential thereon of a value equal to a predetermined value of said variable biasing potential, and means for selectively connecting said control grid with said last named signal input circuit.

4. In a radio signaling system, the combination with an electric discharge amplifier device having a cathode, rectifier anodes associated

therewith, a control grid and a signal output anode, of a signal rectifier circuit connected with one of said rectifier anodes providing a signal variable direct current biasing potential for said control grid, an automatic volume control circuit connected with the other of said rectifier anodes, and comprising means for deriving control potentials responsive to variations in said biasing potential, means for applying to said grid a fixed biasing potential substantially equal to said first named biasing potential for controlling said automatic volume control circuit, and means for applying signals to said grid when so connected.

5. In a radio signaling system, the combination with an electric discharge amplifier device having a cathode, rectifier anodes associated therewith, a control grid and a signal output anode, of a signal rectifier circuit connected with one of said rectifier anodes providing diode bias potentials for said control grid, an automatic volume control circuit connected with the other of said rectifier anodes, means for varying the potential of said other anode with respect to the cathode, means for operating said amplifier with diode bias potential derived from said rectifier circuit, means for connecting said grid with a differing source of biasing potentials, means for applying signals to said grid when so connected, and means for causing said automatic volume control circuit to function in response to said change in connection to reduce the signal input on said rectifier circuit.

6. In a radio receiving system, the combination with a second detector of the electric discharge type including an amplifier portion and a double diode rectifier portion associated with a common cathode, of means including a switch connection for supplying to said amplifier portion diode rectified signals through at least one diode of said rectifier portion, a signal input circuit, means associated with said switch connection for variably connecting said amplifier with said input circuit, means for impressing a fixed biasing potential on said input circuit whereby said amplifier portion is biased at a fixed potential in connection therewith, and means for causing potentials on said cathode and a diode anode in said rectifier portion to vary relatively in response to connection of said amplifier portion with the signal input circuit, and an automatic volume control circuit connected with said last named diode anode to receive controlling potentials in response to said relative variation.

7. In a radio-phonograph signal amplifying system having automatic volume control means including an amplifier tube responsive to variations in signal strength to control the radio signal gain therethrough, the combination of a phonograph signal input circuit for said amplifier tube including a fixed bias potential supply means for causing said automatic volume control means to function in response to phonograph operation thereby to suppress radio signals, means for connecting said input circuit with said amplifier tube to apply phonograph signals thereto to be amplified, and means for controlling the volume level of said signals.

8. In a radio signaling system, the combination with a diode biased signal amplifier, of means for supplying additional signals thereto, means for supplying a fixed biasing potential to said amplifier, and means for connecting the control grid of said amplifier with said signal supply means and said last named source of biasing potential, said last named means including a volume control potentiometer device having a potentiometer resistor connected with said biasing potential supply means, a movable contact connected with said amplifier, and a fixed contact to which said first named contact is movable from the potentiometer resistor, for supplying diode bias potentials and signal potentials thereto.

9. In a radio-phonograph combination apparatus, the combination of an electric discharge amplifier device having a cathode, a control grid, an output anode and an additional anode associated with the cathode to provide a diode rectifier, a radio signal input circuit connected between said diode anode and the cathode, a diode output resistor connected in said circuit adjacent to the cathode, a self bias resistor connected separately in circuit with said cathode from said signal input circuit, a phonograph signal input circuit connected with the negative end of said self-bias resistor, a potentiometer resistor conductively connected across said phonograph input circuit having a contact connected with said control grid and movable along said resistor, a second contact adjacent to the low volume end of said resistor to which said first named contact may be moved from said resistor, the second named contact being connected wtih the anode end of said diode output resistor, whereby said control grid may be changed from self-bias operation to diode bias operation responsive to signal variations, automatic volume control means for radio operation of said apparatus controllable by potential variations in said self-bias resistor in response to variations in biasing potential on the control grid from said diode rectifier, and means operable by said volume control potentiometer when said movable contact is moved into contact with said potentiometer resistor to adjust the self-bias potential on said control grid to a value at which the automatic volume control means is effective to cut off the radio signals.

10. In a radio-phonograph combination apparatus, an electric discharge amplifier device having a cathode, a control grid, an output anode and a diode anode associated with said cathode to provide a diode rectifier, a signal input circuit connected with said diode anode, a self-bias resistor in circuit with the cathode, means for connecting the control grid and the diode anode through said input circuit to the negative end of said self-bias resistor and selectively to the cathode end of said resistor, a diode output resistor in said last named connection and a phonograph volume control device in said first named connection.

11. In a radio-phonograph combination apparatus, an audio frequency amplifier device common to the radio and phonograph circuits thereof, having a cathode, a control grid, an output anode and a diode anode associated with said cathode to provide a diode rectifier, a radio signal input circuit connected with said diode anode and the cathode, a potential drop producing impedance device in circuit with the cathode, circuit means for causing anode current to flow therethrough from the cathode, means for connecting the control grid to the negative end of said potential drop producing impedance device and selectively to the cathode and positive end thereof, an output resistor for said diode rectifier in said last named selective connection, and a phonograph signal input circuit in said first named selective connection.

12. In a radio-phonograph combination apparatus, an audio frequency amplifier device com-

mon to the radio and phonograph circuits thereof, having a cathode, a control grid, an output anode and a diode anode associated with said cathode to provide a diode rectifier, a radio signal input circuit connected with said diode anode and the cathode, a potential drop producing impedance device in circuit with the cathode, circuit means for causing anode current to flow therethrough from the cathode, means for connecting the control grid to the negative end of said potential drop producing impedance device and selectively to the cathode and positive end thereof, an output resistor for said diode rectifier in said last named selective connection, a phonograph signal input circuit in said first named selective connection, and automatic volume control means responsive to the potential drop in said impedance device for suppressing radio signals on said radio signal input circuit.

13. Radio-phonograph apparatus in accordance with claim 10, further characterized by the fact that automatic volume control for radio operation is controlled by a potential drop producing impedance device to suppress radio signals for phonograph operation.

14. In a radio and phonograph signal amplifying system, the combination with an electric discharge amplifier device having a cathode, rectifier anodes associated therewith, a control grid and a signal output anode, of a radio signal rectifier circuit connected with one of said rectifier anodes providing a signal variable diode bias potential for said control grid, an automatic volume control circuit connected with the other of said rectifier anodes and including means for varying the potential of said other anode with respect to the cathode in response to said variable bias potential, means for operating said amplifier with diode bias potential derived from said rectifier circuit, means for connecting said grid with a differing source of biasing potentials, means for applying phonograph signals to said grid when so connected, and means for causing said automatic volume control circuit to function in response to said change in connection to reduce the signal input on said rectifier circuit.

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