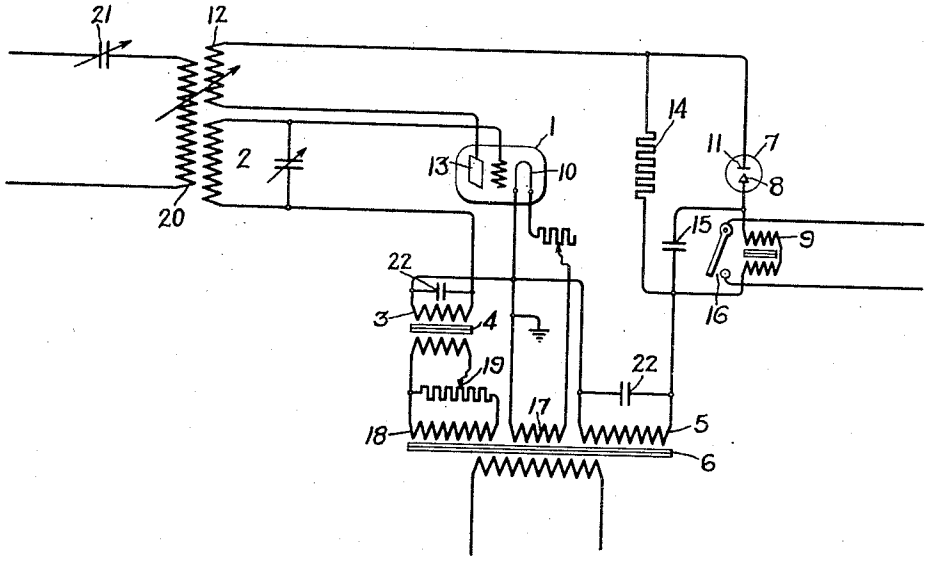
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L. J. PERKINS

AMPLIFYING SYSTEM

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# UNITED STATES PATENT OFFICE.

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## AMPLIFYING SYSTEM.

Application filed November 10, 1924. Serial No. 748,874.

My present invention relates to an apparatus for amplifying comparatively feeble electrical variations and rendering such variations capable of controlling the operation of any desired form of electro-responsive apparatus for producing an indication of the received signals or serving other desired functions. Such an apparatus has been disclosed broadly and claimed in my copending application Serial No. 716,521, filed May 28, 1924.

The object of my invention is to provide an apparatus which will be positive in its operation and capable of producing a high degree of amplification of signaling currents impressed thereon whereby comparatively weak signaling impulses will be capable of producing a positive action of some desired form of electro-responsive apparatus.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation will best be understood by reference to the following description taken in connection with the accompanying drawing in which I have indicated diagrammatically a circuit organization which may be employed in carrying my invention into effect.

I have indicated in the drawing an amplifying device 1 having input and output circuits. This device is shown as of the conventional three-electrode thermionic type although other forms of amplifying device may be employed in carrying my invention into effect.

The grid or input circuit of device 1 includes the usual tuned input 2 and the secondary 3 of a transformer 4, whereby an alternating biasing potential may be impressed upon the grid. The output or plate circuit of device 1 may be supplied from any convenient source. In the present case I have shown in the output circuit the secondary winding 5 of a transformer 6, whereby an alternating potential is impressed upon the plate or output circuit. The output circuit also includes the rectifying device 7 having an anode 8 connected through the windings of a relay 9 to the cathode 10 of the device 1, and a cathode 11 connected through a feed-back coil 12 to the anode 13 of device 1. The device 7 is preferably of the type which is non-conducting until the potential impressed at its terminals exceeds a predetermined value. One suitable form of device which may be used for this purpose comprises two dissimilar electrodes enclosed in a receptacle which is filled with a suitable gas such as neon or other inert gas at a definite pressure. It is possible by choice of the particular gas and the pressure of the gas to so construct such a device that a discharge will take place between the electrodes whenever the potential thereto exceeds a certain definite value. The device 7 is shunted by high resistance 14. The windings of the relay 9 are preferably shunted by a by-pass condenser 15 and the contacts 16 of this relay may be used to close any desired circuit for producing an indication or performing other desired functions. Current for the operation of the cathode 10 of the device 1 may be supplied by a secondary winding 17 of the transformer 6. The biasing potential of the grid is also supplied by another secondary winding 18 of the transformer 6, the value of the biasing potential being regulated by the variable resistance 19. The signaling potential which is to be amplified is impressed upon the input circuit from the primary winding 20. The circuit including the winding 20 may, if desired, be tuned to the frequency of the impulses to be amplified by means of a tuning condenser 21. Transformer windings 3 and 5 are preferably shunted by the by-pass condensers 22 for by-passing the high frequency components of the currents flowing in the input and output circuits.

In the operation of the system the circuits are so adjusted that the potential drop across resistance 14, due to the normal current in the plate circuit, is of a value slightly below that required to cause the device 7 to become conducting. The use of an alternating potential in the plate circuit is preferable because of the fact that the on and off potentials of the device 7, such as that described, are substantially the same with alternating current, whereas with direct current the potential at which the device ceases to be conducting after it once becomes conducting is usually somewhat less than the potential required to render the device conducting.

When a high frequency signaling impulse is impressed upon the input circuit the plate current is increased and hence the drop in

potential across resistance 14 is increased. A comparatively weak signaling impulse impressed upon the grid circuit is capable of increasing the potential drop across the resistance 14 to such a value that device 7 will become conducting. The windings of relay 9 will then be energized and contacts closed at 16. By the use of rectifying device 7 it is possible to employ a direct current type of circuit closing relay.

The biasing potential applied to the grid of device 1 is preferably 180° out of phase with the potential applied to the plate circuit. This arrangement compensates to some extent for changes in the plate current due to the use of an alternating current source of potential. The regenerative coil 12 is ineffective in amplifying the low frequency current supplied by the transformer 6, but as soon as the high frequency signaling impulse is impressed upon the system the feed-back coil 12 comes into play and the amplification produced by the system is increased by reason of this feed-back.

While I have shown and described only a single embodiment of my invention, it will be apparent that many modifications in the form and connections used in the apparatus may be made without departing from the scope of my invention as set forth in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, means for supplying an alternating potential to both of said circuits, a rectifying device included in the plate circuit which is non-conducting until the voltage supplied thereto exceeds a predetermined value, and means for automatically varying said voltage to render the rectifier conducting.

2. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, means for supplying an alternating potential to the plate circuit, means for supplying to the grid circuit an alternating potential which is out of phase with the potential supplied to the plate circuit, and a rectifying device included in the plate circuit which is non-conducting until the voltage applied thereto exceeds a predetermined value.

3. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, means for supplying an alternating potential to the plate circuit, means for supplying to the grid circuit an alternating potential whose phase is displaced 180° from that of the potential supplied to the plate circuit, and a rectifying device included in the plate circuit which is non-conducting until the voltage applied thereto exceeds a predetermined value.

4. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, means for supplying an alternating potential to both of said circuits, a rectifying device included in the plate circuit which is non-conducting until the voltage applied thereto exceeds a predetermined value, and a circuit closing relay in series with said device.

5. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, means for supplying an alternating potential to both of said circuits, and a rectifying device included in the plate circuit which is non-conducting until the voltage applied thereto exceeds a predetermined value, said rectifying device being shunted by a high resistance.

6. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, means for supplying an alternating potential to both of said circuits, a rectifying device included in the plate circuit which is non-conducting until the voltage applied thereto exceeds a predetermined value, and a circuit closing relay in series with said device, said rectifying device being shunted by a high resistance.

7. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, means for supplying alternating potential to both of said circuits, a rectifying device included in the plate circuit which is non-conducting until the voltage applied thereto exceeds a predetermined value, means for supplying a signaling current to the grid circuit, and a circuit closing relay in series with said rectifying device and which is responsive to the signaling current supplied to the grid circuit.

8. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, means for supplying alternating potentials to both of said circuits, a rectifying device associated with the plate circuit which is non-conducting until the voltage applied thereto exceeds a predetermined value, and means for supplying signaling currents to the grid circuit, the system being so adjusted that when a signaling current is supplied to the grid circuit the rectifying device will be rendered conducting.

9. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, a rectifying device associated with the plate circuit which is non-conducting until the voltage applied thereto exceeds a predetermined value, means for supplying to the plate circuit an alternating potential of such value that said rectifying device is normally non-conducting, and means for supplying

a signaling current to the grid circuit, the system being so adjusted that the rectifying device will be rendered conducting by the application of signaling current to the grid circuit.

10. The combination in an amplifying system of an electron discharge device having plate and grid circuits, a rectifying device associated with the plate circuit which is non-conducting until the voltage applied thereto exceeds a predetermined value, a high resistance in shunt to said discharge device, means for supplying to the plate circuit an alternating potential of such value that the potential normally applied therefrom to the rectifying device is slightly below that required to render it conducting, and means for supplying a signaling current to the grid circuit.

11. The combination in an amplifying system of an amplifying device having input and output circuits, a rectifying device associated with the output circuit which is non-conducting until the voltage supplied thereto exceeds a predetermined value, and means for supplying a signaling impulse to said input circuit and thereby rendering the rectifier conducting.

12. The combination in an amplifying system of an amplifying device having input and output circuits, a rectifying device included in the output circuit which is non-conducting until the voltage supplied thereto exceeds a predetermined value, means for supplying to said device from the output circuit a potential of a value slightly below that required to render it conducting, and means for automatically increasing said potential.

13. The combination in an amplifying system of an amplifying device having input and output circuits, a rectifying device included in the output circuit which is non-conducting until the voltage supplied thereto exceeds a predetermined value, means for supplying to said device from the output circuit a potential of a value slightly below that required to render it conducting, and means for supplying a signaling current to the input circuit and thereby increasing the potential supplied to the rectifying device to a value high enough to render it conducting.

14. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, a rectifying device included in the plate circuit which is non-conducting until the voltage supplied thereto exceeds a predetermined value, and means for supplying a signaling impulse to the grid circuit and thereby rendering the rectifying device conducting.

15. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, a rectifying device included in the plate circuit which is non-conducting until the voltage supplied thereto exceeds a predetermined value, an electro-responsive device connected in the plate circuit and in series with said rectifying device, and means for supplying a signaling impulse to the grid circuit and thereby rendering the rectifying device conducting.

16. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, a rectifying device included in the plate circuit which is non-conducting until the voltage supplied thereto exceeds a predetermined value, means for supplying a signaling current to the grid circuit, and an electro-responsive device connected in the plate circuit and in series with said rectifying device, said rectifier being responsive to signaling current supplied to the grid circuit.

17. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, a rectifying device associated with the plate circuit which is non-conducting until the voltage supplied thereto exceeds a predetermned value, means for supplying to the device a potential of a value slightly below that at which it is rendered conducting, and means for supplying a signaling current to the grid circuit, the system being so adjusted that the rectifying device will be rendered conducting by the application of signaling current to the grid circuit.

18. The combination in an amplifying system of a three-electrode electron discharge device having plate and grid circuits, means for supplying an alternating potential to both of said circuits, a rectifying device included in the plate circuit which is non-conducting until the voltage supplied thereto exceeds a predetermined value, said device comprising a pair of separated electrodes surrounded by an attenuated gaseous medium, and means for supplying a signaling impulse to the grid circuit and thereby rendering the rectifying device conducting.

In witness whereof, I have hereunto set my hand this 3rd day of November, 1924.

LUCIUS J. PERKINS.