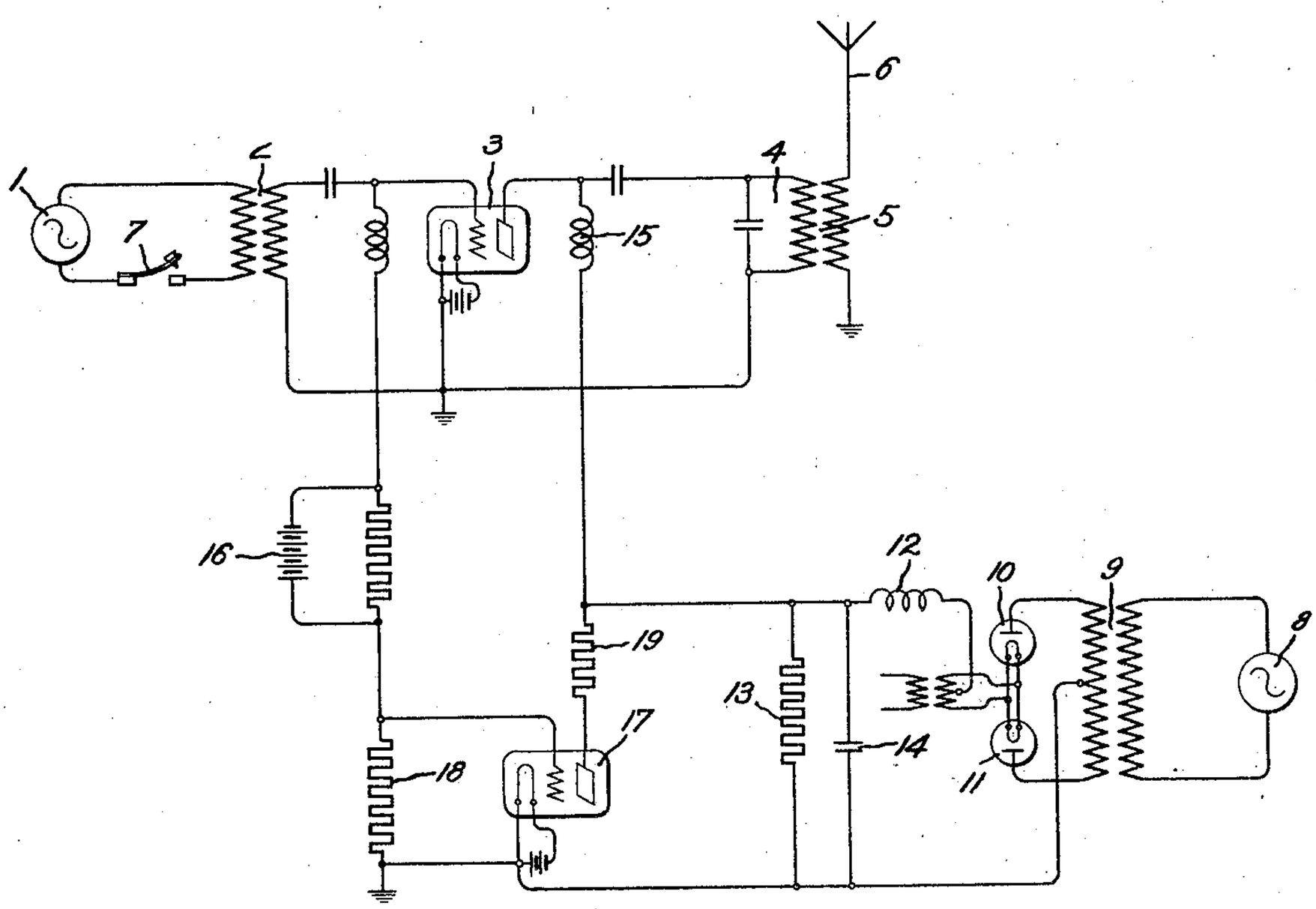
May 9, 1933. I. J. KAAR 1,908,254

SIGNAL SYSTEM

Filed Sept. 20, 1929



Inventor:
Ira J. Kaar,
by Charles D. Mullen
His Attorney

Patented May 9, 1933

1,908,254

UNITED STATES PATENT OFFICE

IRA J. KAAR, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

SIGNAL SYSTEM

Application filed September 20, 1929. Serial No. 394,074.

My invention relates to signal systems employing electron discharge devices, and more particularly to means for eliminating the effect of voltage regulation in the sources from which potential is impressed upon the operating circuits of the discharge devices.

It frequently occurs, and particularly where the operating potential of the discharge device, or devices, of a signal system is supplied from an alternating current source through an electron discharge rectifier, that considerable voltage variation occurs between full load and no load conditions. These variations in voltage of the source of course occur when the impedance of the discharge device, to which energy from the source is supplied, is changed as due to keying, or impulsing the signal system. Thus, for example, when high frequency oscillations are supplied to the grid of an electron discharge amplifier, which is normally biased negatively, the anode impedance will be reduced, thereby causing an increased load, and a corresponding reduction in the voltage, of the anode supply source. When the high frequency oscillations are supplied in rapid impulses, as in accordance with signals of the telegraphic code, the variation in anode potential may seriously distort or destroy the form of the impulses as they are reproduced in the output circuit of the amplifier.

One of the objects of my invention is to provide means whereby these voltage variations are reduced or eliminated. Another object of the invention is to provide means whereby the load on the anode supply source is maintained constant throughout the operation of the system. Still another object of the invention is to provide means which will assume the load when the discharge devices of the signal system are of increased impedance as during interruptions between impulses of the telegraphic code, whereby the load on the source is rapidly shifted back and forth between said means and the discharge devices of the system at the speed of the signaling operation.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claim. My invention itself, however, both as to its organization and method of operation together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompaniyng drawing in which the single figure represents an embodiment of my invention.

Referring to the drawing, I have shown a high frequency signaling system in which high frequency oscillations from a source 1 are supplied through a transformer 2 to the grid of an electron discharge amplifier 3. Oscillations from the anode circuit of this amplifier are then supplied through a tuned output circuit 4 including a transformer 5 to an antenna or other suitable load circuit 6. These oscillations may be interrupted and controlled in accordance with the desired signals by means of a key 7 which may be connected in series with the circuit 1, or in any of the operating circuits of the amplifier 3, in any manner well known in the art.

The anode potential for the discharge device 3 is supplied from an alternating current source 8 through a transformer 9 to a pair of oppositely connected electron discharge devices 10 and 11. These devices comprise a full wave rectifier by means of which a unidirectional current is caused to flow from the cathodes of these discharge devices through inductance 12 and resistance 13 back to the mid-point of the secondary winding of the transformer 9, the opposite terminals of which are connected respectively to the anodes of the discharge devices 10 and 11. A suitable smoothing and storage condenser 14 is connected in parallel with the resistance 13 for the purpose of smoothing the potential appearing across the resistance. The potential across the resistance 13 is connected between the anode and cathode of the discharge device 3, a suitable high frequency choke 15 being connected in circuit between the anode and the resistance for the purpose of preventing high frequency oscillations from entering the circuits of the rectifier.

The grid of the discharge device 3 is biased negatively with respect to the cathode thereof by means of a source of unidirectional po-

tential 16. This source may be similar to that described in connection with the anode supply source, or it may comprise a suitable generator, or storage battery, as desired. Due to this negative potential little or no anode current flows normally in the discharge device and, accordingly, the load upon the rectifiers 10 and 11 normally consists principally of the resistance 13. When the key 7 is operated to its circuit closing position, however, and oscillations are supplied to the grid of the discharge device 3, the impedance between the anode and cathode is reduced and the current, through the anode circuit, will be increased to its normal operating value, thereby causing an increase in load upon the anode supply system. Due to the regulation of this system a reduction in voltage on the resistance 13 and hence upon the anode of the discharge device 3 will result from this increased load. This variation in potential between no load and full load conditions of the rectifier system detrimentally affects the form of the output signals. This of course results from the fact that the magnitude of oscillations supplied in the load is dependent upon the anode voltage and from the fact that when the key 7 is first operated the anode potential has the value of the no load voltage of the rectifier system, whereas an instant later it has the lesser value of the full load voltage of the rectifier system.

To obviate this difficulty means are provided in accordance with my invention whereby these voltage variations may be greatly reduced or substantially eliminated. This means comprises an electron discharge device 17 so connected and arranged in the circuit that it constitutes a load upon the rectifier system during those periods when the anode circuit of the discharge device 3 is of increased impedance. Thus, in this way the load upon the rectifier system is maintained more nearly constant throughout the transmission of signals. The anode of device 17 is connected through resistance 19 to one side of resistance 13 and through choke coil 15 to the anode of device 3. The cathodes of both of the discharge devices 17 and 3 are connected together as indicated by the ground connections, as shown in the drawing. The resistance 18 is connected between the grid and cathode of the device 17, this resistance being also included in the grid circuit of the device 3.

Thus, the operation of the device is as follows: When the key 7 is operated to its circuit-closing position the anode circuit of the device 3 tends to increase the load upon the rectifier system. A rectified current will then be caused to flow in the grid circuit of the discharge device 3 through the resistance 18. This current causes a negative potential to be impressed upon the grid of the discharge device 17, and the impedance of its anode circuit to be increased whereby this device constitutes a reduced load upon the rectifying system. When the key is released the rectified current in the grid circuit is interrupted and the grid of the discharge device 17 assumes the potential of the cathode in which case the device 17 again constitutes an increased load upon the rectifier system.

In this way it will be apparent that the load upon the rectifier system or the necessary portion of the load to effect complete compensation, is shifted from the device 3 to the device 17, and vice versa, at the speed of and in response to operation of the key, the device 17 thus serving to compensate for variations in load upon the rectifier system produced by variations in impedance of the device 3. This transfer of energy from one discharge device to the other occurs without time lag, as might be occasioned by the use of inductance or capacity in the circuits, and accordingly may take place at practically any keying speeds, such for example, as at the high keying speeds used in television transmission.

A resistance 19 is included in the anode circuit of the device 17 for the purpose of regulating the amount of current flowing in the anode circuit of this device whereby a more complete compensation of the load variations may be effected. This resistance also serves the purpose of limiting the anode dissipation in the tube 17.

While I have shown a particular embodiment of my invention, it will of course be understood that I do not wish to be limited thereto since many modifications, both in the circuit arrangement and in the instrumentalities employed may be made, and I therefore contemplate by the appended claim to cover any such modifications as fall within the true spirit and scope of my invention.

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

In combination, an electron discharge device, having an anode, a cathode and a grid, a source of radio frequency oscillations to be amplified connected between said grid and cathode, means to interrupt said oscillations in accordance with signal impulses, a second electron discharge device having a cathode, anode and grid, a resistance having one terminal connected to both of said grids and another terminal connected to both of said cathodes, a second resistance connected between said anodes, a source of energizing potential connected between said cathodes and a point between the anode of said first discharge device and said resistance, said discharge devices being so adjusted that a substantial part of the load on said source is normally assumed by said second resistance and discharge device whereas when signal impulses are supplied to said grid of said first discharge device a negative potential

is supplied to the grid of said second device to reduce the losses therein and in said second resistance sufficiently to maintain a constant load on said source, and a radio frequency choke coil in series with said second resistance and discharge device having substantially no impedance to changes in direct current occurring therein whereby the signal impulses are faithfully amplified by said first discharge device.

In witness whereof, I have hereunto set my hand this 19th day of September, 1929.

IRA J. KAAR.