

LA VERNE R. PHILPOTT

CONSTANT POTENTIAL SUPPLY FOR ELECTRIC DISCHARGE DEVICES

WITNESSES:

P. J. Fitzgerald
Esq.

INVENTOR

LaVerne R. Philpott.

BY *F. W. Syle.*
ATTORNEY

UNITED STATES PATENT OFFICE

1,966,216

CONSTANT POTENTIAL SUPPLY FOR
ELECTRIC-DISCHARGE DEVICES

La Verne R. Philpott, Wilkinsburg, Pa., assignor
to Westinghouse Electric & Manufacturing
Company, East Pittsburgh, Pa., a corporation
of Pennsylvania

Application July 30, 1932, Serial No. 626,852

3 Claims. (Cl. 250—27)

My invention relates to improvements in circuits of the radio or facsimile type or more particularly, as relates to amplifiers employed in such circuits.

5 In certain systems, the successful operation depends to a large extent upon the application and maintenance of uniform constant potentials to the various electrodes of an electric discharge device. Such conditions exist in systems de-
10 signed for the transmission of facsimiles wherein direct-current amplifiers are employed to key a transmitter in response to predetermined variations in signal strength, as determined by the variations in light density of the subject matter
15 which is to be transmitted. Should the applied potentials to the amplifier tubes undesirably vary from any of the many possible causes, it is apparent that the operation of the system will become faulty and irregular.

20 It is the main object of my invention to provide improvements in systems of the above character wherein potential fluctuations, particularly those occurring at the supply source, will not be permitted to reach the electric-discharge
25 devices which may be employed in the amplifiers of the system. To maintain the operation of these amplifiers uniform and constant necessitates that the filament supply potential shall be maintained substantially constant as well as
30 the potential applied to the plate or anode of the devices.

In the accompanying drawing, I have illustrated, in circuit form, an embodiment of my invention. In lieu of illustrating a complete fac-
35 simile system or any other system employing a plurality of amplifiers, I have shown merely one amplifier tube, as this will be sufficient to illustrate the manner in which my invention may be applied. This amplifier tube I have designated
40 by the reference numeral 1 and is of the indirectly heated cathode type comprising anode, grid and cathode electrodes 3, 5 and 7, respectively, together with a heater element 9 for the cathode. The input circuit through the device
45 may constitute a resistor 11 connected between the grid and cathode, this resistor comprising also an element in the output circuit of a preceding amplifier tube (not shown). The output
50 circuit of the device 1 also may include a resistor 13 which may, in turn, comprise an element in the grid circuit of a succeeding amplifier or similar device (not shown) and in systems for the transmission of facsimiles, this resistor might be employed for blocking or un-

blocking a transmitter in response to picture signals from a scanning device.

Potentials for the anode of the amplifier may be obtained from a voltage divider 15 which is connected across the output of a rectifier and filter circuit of any type well known in the art, broadly indicated by reference numeral 17. This rectifying and filtering circuit may be inductively coupled to any alternating-current voltage supply suitable for the purpose. To assure constant potentials across this voltage divider 15, I provide in series therewith an electric discharge device 19 comprising an anode, grid and cathode electrodes 21, 23 and 25, respectively, this device constituting an impedance which may automatically be varied in a predetermined manner in response to changes in the voltage or potential, to compensate for such changes.

In the lead to the filament 25 of the series tube, I may provide a resistor 26, preferably of the variable type, which resistor when employed will put a bias on the grid 23, which may be manually adjusted to determine the desired normal operating impedance of the tube 19.

In order to obtain the above referred to compensating reaction, I provide a control tube 27 preferably of the screen-grid type, although this is not essential to the successful operation of my invention, and connect the anode 29 of this control tube directly to the grid 23 of the series connected device 19 and to the anode 21 through a resistor 22. The screen grid 31 is connected to the filament 33 through a battery 35 of any suitable operating potential, the filament being connected to the negative lead of the supply source. The grid 37 of the control tube 27 is connected to the positive lead of the supply source and its circuit continues through the voltage divider 15 to the filament 33. In the grid circuit, I provide a source of potential 39 which shall be equal to or preferably slightly greater in value than the potential which exists across the voltage divider.

The potential for supplying the filament of the amplifier is obtained from the same voltage supply source as the supply for the anodes and by reason of the fact that the amplifier 1 is of the heater type, the supply potential need not be filtered but may be alternating in character. In parallel with the heater 9 of the amplifier, I connect the filament 41 of a thermionic device 43 of the two element type having an anode 45 in addition to the filament 41. In the filament circuit of this tube I provide a variable resistor 47 and in the common return lead from the heater

9 of the amplifier 1 and the filament 41 of the device 43, I provide another resistor 49, one end of which is connected to the armature 51 of a relay 53 which in the inoperative condition of the relay is adapted to make contact, causing a shunting conductor to short out the resistor 49 which is common to both filament circuits. The operation of this relay is controlled by the plate current flowing through the two element tube 43, the coil of the relay being connected in this circuit. The filament of this tube 43 is very critical to temperature changes. With the tube 43 operating along the saturation portion of its characteristic curve, the resistors 47 and 49 are so adjusted that with the relay 53 in a magnetized condition, that is, with the shunt disconnected from the resistor 49, the temperature of the filament 41 will drop so that insufficient plate current will flow to hold the armature 51 away from the shunting conductor, thus permitting the armature to make contact with the shunt thereby effectively removing the resistor 49 from the filament supply circuit. Under these conditions, the temperature of this filament will rise to produce a heavier plate current and reenergize the relay 53 to place the resistor 49 into the circuit again. Since the filament is so critical to temperature changes, the relay will operate repeatedly and rapidly, thus maintaining a substantially constant mean temperature of the filament, whereby substantially the same condition will be caused to exist in the filament heater 9 of the indirectly heated tube 1, and by reason of the fact that the amplifier is of the indirectly heated cathode type, the slight and rapid changes produced by the action of the relay will produce no noticeable effect in the operation of the amplifier 1 with the result that the cathode will emit a constant and uniform supply of electrons regardless of high changes which might occur in the potential of the filament supply source.

Referring to the plate supply system, as described heretofore, since the potential on the grid 37 of the control tube 27 is determined by the difference between that of the battery or supply source 39 and that across the voltage divider 15, it is apparent that this grid potential will vary in response to changes in potential across the voltage divider. This variation will be in a positive or negative direction depending on the direction in which the potential of the voltage divider tends to shift. Changes of the grid potential thus caused will, accordingly, vary the impedance of the control tube 27 and, accordingly, vary the current in the plate circuit of the control tube. Since the plate circuit of this tube includes the resistor 22, a change in the voltage drop across this element will occur, which will cause the grid potential of the tube to shift with regard to the potential on the plate. Thus the impedance of this series connected tube 19

will be increased or decreased to produce, respectively, a decrease or increase of the voltage across the divider depending on whether the potential across the divider had tended to decrease or increase. The regulation in a system of this type is of the order of 1000-1 and has been found to operate very satisfactorily in practice.

From the above description, it will be apparent that I have provided a system wherein the potentials applied to a device of the electric discharge type may be maintained constant to assure constant and uniform results therefrom.

Various changes might be made in the components of my system, and I, therefore, do not desire to be limited to the specific details disclosed except as is necessitated by the prior art and the appended claims.

I claim as my invention:

1. An electrical circuit comprising an electric discharge device of the indirectly heated cathode type having anode, grid and cathode elements with a filament heater for said cathode, a common source of potential for said anode and said heater and means deriving energy from said source of potential for controlling the constancy of the potentials applied to said anode and heater, said means comprising a self-adjusting impedance in the anode potential supply circuit to said discharge device responsive to changes in said potential supply and heater control means for the heater of said device.

2. An electrical circuit comprising an electric discharge device of the indirectly heated cathode type having anode, grid and cathode elements with a filament heater for said cathode, a common source of potential for said anode and said heater and means deriving energy from said source of potential for controlling the constancy of the potentials applied to said anode and heater, said means including a heater regulator comprising a two element discharge device operated at saturation and having a filament reactive to current changes and means in the output circuit of said two element device responsive to said filament reactions for maintaining a mean potential across the heater of said indirectly heated tube.

3. In combination, an electric discharge device having an anode circuit including a voltage divider, means for supplying potential to said voltage divider and means for maintaining said potential constant said means comprising an impedance between said potential supply means and said voltage divider, and means for comparing the instantaneous potential across said divider with a potential of fixed value, said means comprising an electric discharge device having a grid circuit, the source of said fixed potential and said voltage divider being included in said grid circuit.

LA VERNE R. PHILPOTT.