

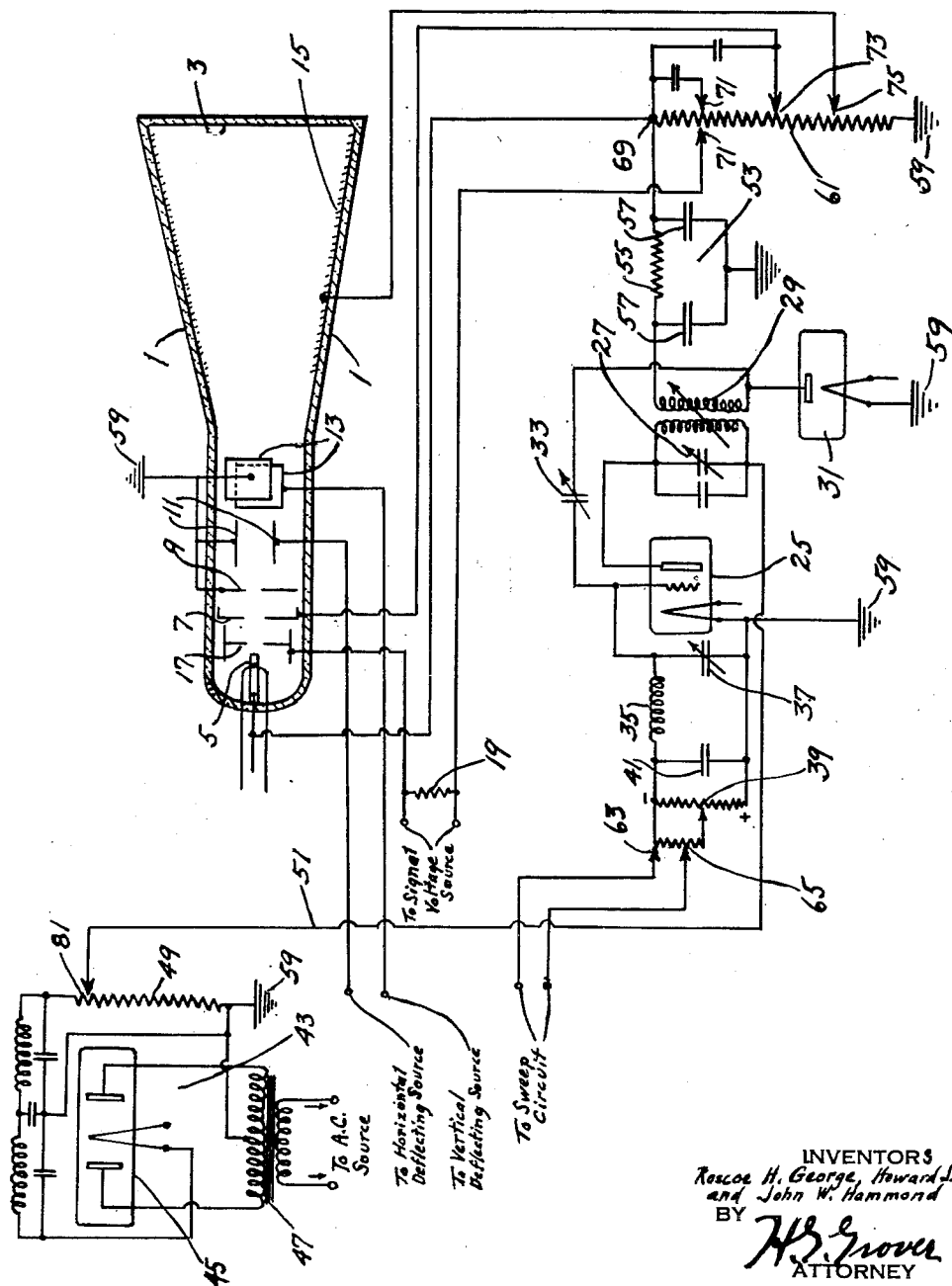
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POWER SUPPLY SYSTEM

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## POWER SUPPLY SYSTEM

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The present invention relates to systems for developing suitable voltages for operating electronic apparatus. In one form of the invention a particular application for use in connection with cathode ray oscillographic apparatus is found.

It is one of the principal objects of this invention to provide a simplified power supply circuit for cathode ray oscillographic apparatus.

Another object is to provide a power supply system wherein a substantially fixed relationship exists between the relative magnitudes of voltages to control the deflection and velocity of an electron ray developed in a cathode ray oscillograph tube.

A further object of the invention is to provide means to transform a direct current voltage to a direct current voltage of higher potential.

Other objects of the invention are to provide a power supply system which is of simplified construction and arrangement; a system wherein a minimum of apparatus is required; a system which is easily and cheaply assembled; and a system providing satisfactory and efficient operation.

A further object is to provide a power supply system wherein the energy storing elements are of small capacity so that upon disconnecting the energizing power source the accumulated charge in such elements will drop to substantially a zero value almost instantly. This provides for safety of operation because excessive changes are not stored in condenser elements and an operator who may accidentally short any condenser will not be subjected to serious shock, and further the shorting of a condenser will render the oscillator substantially inoperative so that the individual will not be subjected to burning from continued feeding in of energy to the storage elements.

Still other objects and advantages will become apparent to those skilled in the art from a reading of the following specification in connection with the accompanying drawing which shows one suitable embodiment.

In the art to which this invention relates distinct ranges of operating voltages are required. Such voltages are those necessary for operating and heating the electron emitting elements; those voltages necessary to develop the electron ray and to supply the usual amplifying tubes and oscillators; those voltages required for causing scanning or movement of the developed electron ray; and those voltages necessary for producing ray focusing and acceleration. According to a

simplified analysis the invention includes an oscillating circuit wherein the required unidirectional voltages are produced by rectification in order to provide especially the last two ranges of voltages above specified. In this connection it should be understood that suitable ranges of voltages for controlling the beam sweep or deflection may be of the order of 500 volts when the beam focusing and accelerating voltage is of the order of 4000 volts. And that these voltages are derived from a direct current voltage source whose magnitude is of the order of 300 volts.

Referring now to the drawing for a further understanding of the invention it will be appreciated that whenever there is a variance in the ratio of the voltages producing acceleration and focusing of the electron beam within a tube 1 and that voltage which deflects the beam to cause it to traverse the screen 3 the length of "sweep" or screen traversed will vary. Under normal operating conditions this effect is undesirable and is overcome with the apparatus herein disclosed. Nevertheless, varying the connections after optimum operating conditions have once been obtained will still permit changing the sweep path where desirable to vary the size of the area of the screen 3 illuminated by the beam.

Within the cathode ray tube 1 there is developed between the cathode 5 (preferably so arranged as to be heated either by conduction or radiation or both due to applied currents) and an anode 7 an electron ray or beam. After the electron ray is developed it is focused by passing the same through a second anode 9 to which a voltage substantially higher than applied to the first anode 7 is supplied. The high voltage on the second anode 9 relative to the first anode 7 causes a converging electrostatic field such as has been explained in the patent of R. H. George, No. 2,086,546, issued July 13, 1937, to be developed. The second anode 9 is an apertured element which, for convenience, is assumed to operate at ground potential with the cathode operating at a voltage of the order of 4000 volts below ground potential and the first anode operating at a voltage of the order of 500 volts positive relative to the cathode.

Electrostatic deflection plate pairs (or electromagnetic coils with suitable modifications) 11 and 13 are arranged within or without the tube 1 to deflect the ray across the screen 3. One plate of each pair 11 and 13 also connects to ground and the other plate of each pair connects with a source of sweep frequency voltage (not shown) which may be of any desired character.

The inner conical wall of the tube 1 is provided with a conducting coating 15 which may be operated at the same voltage as the second anode 9 or at a value 20 to 50 volts negative with respect thereto where desired. In the latter case there is provided a return path for the beam electrons after they strike the screen 3 and at the same time the stability of operation, the sharpness of the beam and focusing of the spot is improved.

Voltages to control the beam intensity are supplied from a signal source (such as any suitable amplifier or signal receiver amplifier not shown) to a grid or central electrode 17 by connecting the signal source across a suitable resistor 19.

Referring now to the oscillator for developing the operating voltages above referred to there has been shown a thermionic tube 25. This has been shown as being of the tuned grid-tuned plate type, but it is obvious that any other type oscillator such as the well known Hartley, Colpitts, Miessner or other types may be substituted where desired. The oscillator tube 25 includes in its plate circuit the tank circuit 27 comprising parallel connected inductance and capacity elements. Coupled to the tank circuit 27 is a pick-up coil 29 to feed output energy from the oscillator 25 to a rectifying device, such for example as a diode 31 having the positive terminal grounded and also to supply feed-back energy by way of capacity coupling 33 to the oscillator input circuit. In the oscillator in-put circuit there is a second tuned circuit comprising the inductance 35 and capacity 37 and the grid leak resistor 39 which is shunted by a relatively large condenser 41 serving to by-pass any developed a-c potentials.

As is well known the flow of grid current during the positive half cycles causes a voltage drop through the leak resistor 39, and the condenser 41 serves to maintain, by virtue of its previously acquired charge, a suitable magnitude voltage drop during the negative half cycle.

Voltages of the order of 300 volts for operating the oscillator tube 25 are developed in the rectifier unit 43, which unit includes the full wave rectifying tube 45 connected, as shown, in well known manner with an alternating current source through the transformer 47. In this way from the high side of the resistor 49 plate voltage for tube 25 is obtained and supplied thereto by way of conductor 51.

The output from the oscillator 25 transferred into coupling coil 29 (which output is of a frequency of the order of 100 K. C. preferably) after being rectified by the rectifier 31 is filtered by the filter circuit 53 comprising a resistor 55 shunted by condensers 57 connected to ground 59 and having an a-c impedance relatively low compared to the resistor 55. It is of course possible to substitute a choke for resistor 55 but good efficiency is obtained by the simple construction illustrated.

A voltage divider resistance 61 is connected at one end of the filter circuit 53 and at the other end to ground which leaves the positive end toward ground. As will be seen from what has been described the sweep circuit voltages may be obtained by way of terminals 63 and 65 connected with the grid leak resistor 39 or resistor 67 in parallel therewith. Similarly, the high voltages may be obtained by suitable connections 69, 71, 73 and 75, for example, on the voltage divider 61, which connections lead respectively

to the cathode 5, the grid 17, the anode 7 and the conductive coating 15.

From the foregoing it will also be appreciated that by varying the capacity 33 so as to increase the same, for example, an increase in the voltage drop across leak resistor 39 will result and at the same time in a decrease in the voltage drop through resistor 61 because an increasing amount of the output circuit energy from the oscillator 25 is fed back to the grid circuit. In operation capacity 33 is adjusted to provide the desired ratio of voltage drop across resistors 61 and 39. Where variations in voltage drop from such optimum condition are desired it is possible to move the variable tap 81 upon the voltage divider 49 to vary thereby the plate voltage on the oscillator tube 25. When the plate voltage on oscillator 25 is changed it will be appreciated that the magnitude of the voltage drop across resistors 61 and 39 remain in substantially the same ratio as for the assumed optimum condition.

Having now described the invention, what is claimed and desired to be secured by Letters Patent is the following:

1. In a direct current voltage generating system, an electron tube having a cathode, a control electrode and at least another electrode, means comprising the two electrodes for developing sustained oscillations, means for deriving a unidirectional undulating voltage from said cathode and control electrode, means for filtering the derived voltage so as to produce direct current voltage, deriving an alternating current voltage from first named means, means for rectifying the derived alternating current voltage, filtering means for the resultant rectified voltage so as to produce a second direct current voltage, and means to maintain constant ratio between both of said produced direct current voltages.

2. In a direct current voltage generating system wherein an oscillating electron tube generator and a single rectifier is provided, the method of producing two related direct current voltages which comprises the steps of deriving a unidirectional undulating current from the generator, filtering the derived voltage, simultaneously deriving an alternating current voltage from the generator, rectifying the derived alternating current voltage, and filtering the resultant rectified voltage.

3. In a direct current voltage generating system wherein an oscillating electron tube generator and a single rectifier is provided, the method of producing two related direct current voltages which comprises the steps of deriving a unidirectional undulating current from the generator, filtering the derived voltage, deriving an alternating current voltage from the generator, rectifying the derived alternating current voltage, filtering the resultant rectified voltage, and controlling the amplitudes of the filtered derived voltage and the filtered rectified voltage by the derived alternating current voltage.

4. A system for producing direct current voltages comprising an electron tube having a cathode, a control electrode and an auxiliary electrode, means including said electrodes for producing sustained oscillations, means including said control electrode for deriving a unidirectional undulating voltage, means for producing an alternating current from said first named means, means for rectifying the alternating current so produced, and means for filtering the unidirectional voltage and the rectified voltage.

5. A system for producing direct current voltages comprising an electron tube having a cathode, a control electrode and an auxiliary electrode, means including said electrodes for producing sustained oscillations, means including said control electrode for deriving a unidirectional undulating voltage, means for producing an alternating current from said first named means, means for rectifying the alternating current so produced, and means for filtering the unidirectional voltage and the rectified voltage, said first named means including means to maintain a fixed ratio between the two filtered voltages.

6. A system for producing direct current voltages comprising an electron tube having a cathode, a control electrode and an anode, means including said control electrode and anode for producing sustained oscillations, means for deriving a unidirectional undulating voltage from said control electrode and said cathode, means for filtering said voltage to produce a first direct current voltage, means for producing an alternating current from the produced oscillations, means for rectifying the alternating current, and means to filter the rectified current to produce a second direct current voltage.

7. A system for producing direct current voltages comprising an electron tube having a cathode, a control electrode and an anode, means including said control electrode and anode for producing sustained oscillations, means for deriving a unidirectional undulating voltage from

said control electrode and said cathode, means for filtering said voltage to produce a first direct current voltage, means for producing an alternating current from the produced oscillations, means for rectifying the alternating current, and means to filter the rectified current to produce a second direct current voltage, said oscillation producing means including means whereby a predetermined ratio between the first and second direct current voltages may be maintained.

8. A system for producing direct current voltages comprising an electron tube having a cathode, a control electrode and an anode, means including said control electrode and anode for producing sustained oscillations, means for deriving a unidirectional undulating voltage from said control electrode and said cathode, means for filtering said voltage to produce a first direct current voltage, means for producing an alternating current from the produced oscillations, means for rectifying the alternating current, means to filter the rectified current to produce a second direct current voltage, said oscillation producing means including means whereby a predetermined ratio between the first and second direct current voltages may be maintained, and means whereby the amount of the voltages may be varied, the ratio between the voltages being maintained.

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