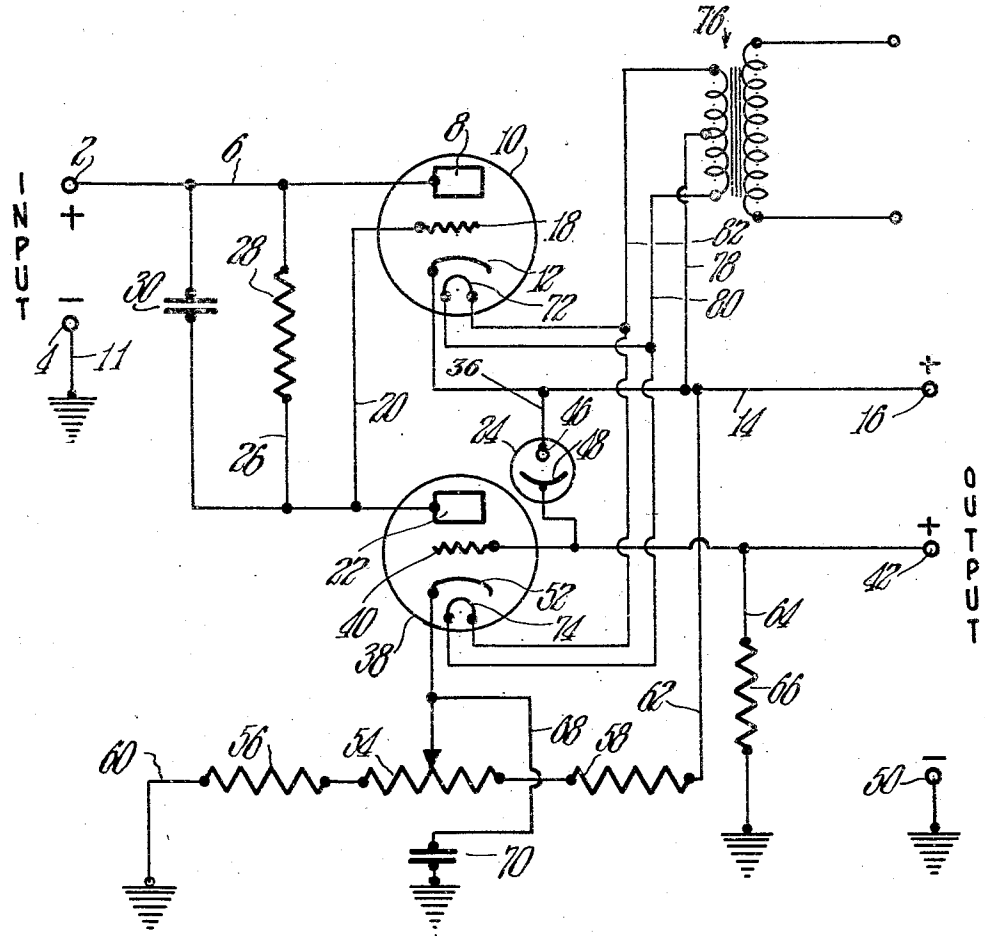
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POWER SUPPLY REGULATING APPARATUS

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POWER SUPPLY REGULATING APPARATUS

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6 Claims. (Cl. 171—312)

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This invention relates to power supply apparatus and is directed more particularly to direct-current power supply regulating apparatus.

The principal objects of the invention are directed to direct-current power supply regulating apparatus characterized by means to facilitate regulating over wider ranges than heretofore known under various conditions of input, output and load.

The novel features of the invention are adapted for use in connection with radio apparatus but the invention is not to be considered as so limited since various changes and modifications may be made to adapt the novel features of the invention to various uses.

In the drawing:

The figure is a diagrammatic figure showing the novel features of the invention.

Referring now to the drawing more in detail, the invention will be fully described.

Input terminals 2 and 4 at the input of the apparatus are adapted for connection to a D. C. rectifier or other means for supplying direct current which, as is well known, is likely to fluctuate in voltage. Such fluctuations are very objectionable in connection with radio apparatus.

Terminal 2 is connected by 6 to a plate 8 of a vacuum tube 10. Terminal 4 is connected by 11 to ground. A cathode 12 of tube 10 is connected by 14 to a high voltage terminal 16 of the output of the apparatus.

Grid 18 of tube 10 is connected by 20 to a plate 22 of a vacuum tube 38. A connection 26 which includes a resistance 28 extends from plate 22 to line 6. A fixed condenser 30 is connected to 6 and 26 by-passing resistance 28.

A connection 36, including a constant drop voltage device 24, extends from 14 to a grid 40 of tube 38 and said grid is connected to terminal 42 at the output side of the apparatus, as shown. The constant voltage drop device 24 may take various forms but in the form of the invention shown represents a gas diode with the anode and cathode thereof indicated by 46 and 48. A negative terminal at the output of the apparatus is represented at 50 and is connected to ground.

A cathode 52 of tube 38 is connected to the movable arm of a resistance unit 54 as shown. Resistances 56 and 58 are connected to resistance 54 and ground by 60 and to said resistance 54 and line 14 by 62. A connection 64 between grid 40 of tube 38 and ground includes resistance 66. Cathode 52 of tube 24 is connected by 68 to ground through a fixed condenser 70.

Heaters or filaments 72 and 74 of tubes 10 and

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38 are connected to the secondary of a transformer 76 by lines 78, 80 and 82. Said transformer may be connected to an A. C. line.

The apparatus may be used as the direct-current power supply regulator for radio apparatus in which case the input may be connected to rectified direct current and the output may be connected to those components to which power is to be supplied.

The voltage at the input is likely to vary or increase or decrease due to fluctuations in the line or other causes. The tube 10 may be termed the regulator tube, in effect a controlled variable resistor component in series with the load while tube 38 operates as an amplifier directly connected to the input grid 18 of tube 10 controlling its plate resistance.

Tube 24 provides a constant voltage drop between cathode 12 and grid 40 and it acts to maintain a voltage on said grid well below that on plate 8 of tube 10 allowing greater amplification through tube 38 than is ordinarily possible. The device 24 faithfully reproduces voltage variations at grid 40 as they occur in line 14 thereby to provide improved regulation. Condenser 70 with resistances 54 and 56 have a time factor greater than any other part of the apparatus and provides a relatively constant voltage drop from cathode 52 to ground.

As voltage changes occur either at the input or with load variations, the voltage at the output of tube 10 tends to simultaneously change. Changes are carried to grid 40 of tube 38 where the flow of electrons changes directly and proportionally. This electron flow is carried through resistance 28 and causes inversion of and amplification of the rate of voltage changes occurring at grid 40 of tube 38 to, roughly, mu times the rate of grid voltage change.

This inverted amplifier voltage is applied to the grid 18 of tube 10 and causes the electron flow from the cathode 12 to plate 8 of tube 10 thereby to vary proportionally.

This change is in opposition to the original tendency for the output voltage to change, occurs instantly and therefore prevents any but an entirely minute variation to occur.

A second, lower, output voltage is made available at grid 40 of tube 38 through the constant voltage device 24. This output carries the same absolute regulation present at the cathode of tube 10, since the device 24 is made to have a constant voltage drop.

The invention may be embodied in other specific forms without departing from the essential char-

acteristics thereof. Hence, the present embodiments are therefore to be considered in all respects merely as being illustrative and not as being restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all modifications and variations as fall within the meaning and purview and range of equivalency of the appended claims are therefore intended to be embraced therein.

What it is desired to claim and secure by Letters Patent of the United States is:

1. Direct-current power supply voltage regulating apparatus having an input and both high and low voltage outputs comprising in combination, regulating and amplifying tubes having plates, grids, and cathodes, a constant voltage drop device, a connection between the cathode of the first-named tube, said device and high voltage output, a connection between the grid of the second-named tube, low voltage output and said device, a connection between the input and plate of the regulating tube and between the plates of the amplifying and regulating tubes including a resistance, a ground in said input and outputs forming the neutral or negative side thereof resistance means connected between the high voltage output and ground and a connection between the cathode of said amplifying tube and resistance adapted for various positions on said resistance.

2. Direct-current power supply voltage regulating apparatus having an input and both high and low voltage outputs comprising in combination, regulating and amplifying tubes having plates, grids, and cathodes, a constant voltage drop device, a connection between the cathode of the first-named tube, said device and high voltage output, a connection between the grid of the second-named tube, low voltage output and device, a connection between the input and plate of the regulation tube and between the plates of the amplifying and regulating tubes including a resistance, a ground in said input and outputs forming the neutral or negative side thereof resistance means connected between the high voltage output and ground and a connection between the cathode of said amplifying tube and resistance adapted for various positions on said resistance, and connections including a condenser by-passing said first-named resistance.

3. Direct-current power supply voltage regulating apparatus having an input and both high and low voltage outputs comprising in combination, regulating and amplifying tubes having plates, grids, and cathodes, a constant voltage drop device, a connection between the cathode of the first-named tube, said device and high voltage output, a connection between the grid of the second-named tube, low voltage output and device, a connection between the input and plate of the regulation tube and between the plates of the amplifying and regulating tubes including a resistance, a ground in said input and outputs forming the neutral or negative side thereof resistance means connected between the cathode of said amplifying tube and ground and including an arm adapted for various positions on said resistance, and connections including a condenser by-passing said first-named resistance, a second low voltage output being made available by the circuit arrangement through the said constant voltage drop device.

4. Direct-current power supply voltage regulating apparatus having input and high and low voltage outputs comprising in combination, regulating and amplifying tubes having plates, grids, and cathodes, a constant voltage drop device, a connection between the cathode of the first-named tube, one side of said device and high voltage output, a connection between the grid of the second-named tube, low voltage output, and the low voltage side of the device, a connection between the plate of the amplifier tube and the grid of the regulating tube, and a connection between the plates of the amplifier and regulating tubes, including a resistance, a ground in said input and outputs forming the neutral or negative side thereof resistance means between the high voltage output and ground and connection between the cathode of said amplifying tube and a tap on said resistance with a means for varying the tap on said resistance, and connections between the aforementioned cathode and a condenser by-passing the lower portion of the resistance between the tap and the low potential end of the circuit, a second voltage output being available by this circuit arrangement through the constant voltage device, and either output being adjustable over a range determined by the limiting currents permissible through the regulating and amplifying tubes and the constant voltage device.

5. Direct-current power supply voltage regulating apparatus having an input and high and low voltage outputs comprising in combination, regulating and amplifying tubes having plates, grids, and cathodes, a constant voltage device, a connection between the cathode of the first-named tube, one side of said device and high voltage output, a connection between the grid of the second-named tube, low voltage output, and the low voltage side of said device, a connection between the plate of the amplifier tube and the grid of the regulating tube and a connection between the plates of the amplifier and regulating tubes including a resistance means, a ground in said input and outputs forming the neutral or negative side thereof connections between the high voltage output and ground and connections between said amplifying tube and resistance with a means for varying a tap on said resistance, adjustment of said tap being equivalent to an adjustable reference voltage, and connections including a condenser to by-pass the cathode of the said amplifier tube to ground, a second ouput being available by this circuit arrangement through the constant voltage device, either output being adjustable over a range determined by the limiting currents permissible through the regulating and amplifying tubes and the constant voltage device.

6. Direct current power supply voltage regulating apparatus having an input and high and low voltage cutputs comprising in combination, regulating and amplifying tubes having plates, grids, and cathodes, a constant voltage device, a connection between the cathode of the first-named tube, one side of said device and high voltage output, a connection between the grid of the second-named tube, low voltage output, and the low voltage side of said device, a connection between the plate of the amplifier tube and the grid of the regulating tube and a connection between the plates of the amplifier and regulating tubes including a resistance, a ground in said input and outputs forming the neutral or negative side thereof resistance means connected between the high voltage output and a ground and connection between said amplifying tube and

resistance including a means for varying a tap on said resistance, adjustment of said tap being equivalent to an adjustable reference voltage, and connections including a condenser to by-pass the cathode of said amplifier tube to ground, the combination of said condenser and said associated tapped resistor to provide a time factor longer than that of any other portion or portions of the regulating device and thereby stabilizing the aforementioned reference voltage, a second output being available by this circuit arrangement, either output being adjustable over a range determined by the limiting currents permissible through the regulating and amplifying tubes and the constant voltage device.

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