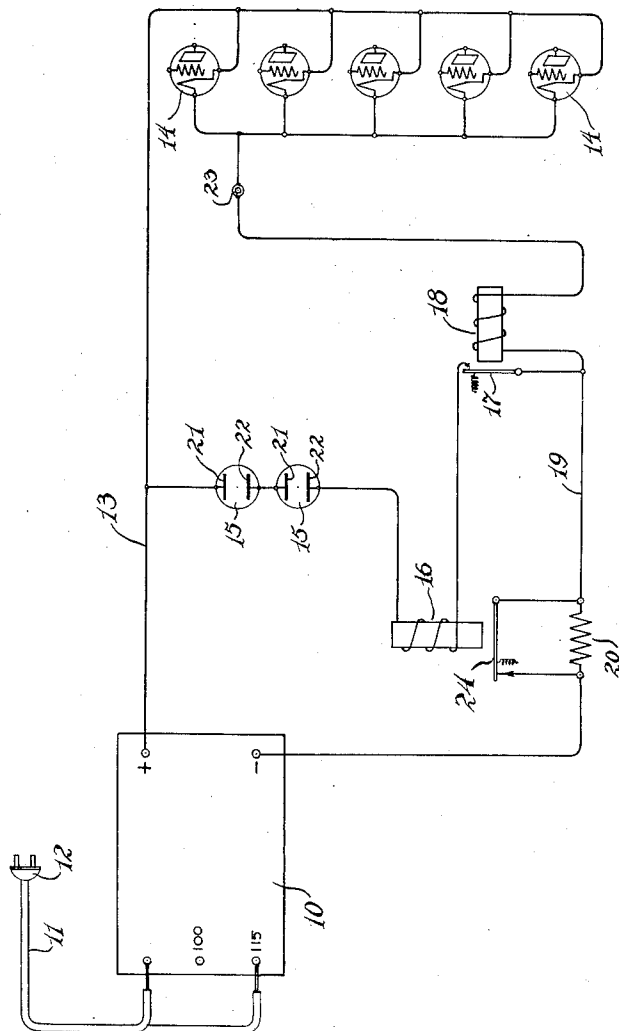


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E. W. ENGLE ET AL
FILAMENT VOLTAGE REGULATOR

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FILAMENT-VOLTAGE REGULATOR.

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Our invention relates to means for regulating the filament voltage of radio receiving instruments.

It is an object of our invention to provide improved means for regulating the voltage of the current supplied to the filament of the tube of radio receiving sets in which an A-battery eliminator is used as a source of current.

A further object of our invention is to provide improved means whereby the regulating devices are disconnected when the receiving set is not in use.

Other objects will appear from the following description reference being had to the accompanying drawing showing a circuit diagram of our improved regulating device.

An A-battery eliminator which usually consists of a transformer, rectifier cells, choke coils and condensers is diagrammatically shown at 10 as being adapted to be connected to a source of alternating current supply by means of the double conductor cord 11 and plug 12. A conductor 13 connects the positive terminal of the A-battery eliminator with the A-circuit of the receiving set which circuit comprises a plurality of filaments of tubes 14 connected in parallel. Two electrolytic valve cells 15 are connected in series with the winding of an electromagnet 16 which circuit is arranged to be completed through the armature 17 of an electromagnet 18. One end of the winding of the electromagnet 18 is connected by a conductor 19 with a resistance 20 which in turn is connected to the negative terminal of the A-battery eliminator. The other end of the winding of the electromagnet 18 is connected to the filaments of the tubes 14. Each of the electrolytic valve cells 15 comprises a lead electrode 21 and a tantalum electrode 22. These electrodes are preferably immersed in a dilute solution of sulphuric acid and iron sulphate.

A switch 23 is shown as adapted to complete or break the circuit to the filaments of the tubes 14. The resistance 20 is normally shunted through the armature 24 of the electromagnet 16 which is constructed so as to attract its armature when the current passing through its winding exceeds a predeter-

mined value. When one or more of the tubes are cut out of the circuit by means of individual controls or by removing the tubes from their sockets, the A-eliminator has a tendency to supply a current at a higher voltage to the remaining tubes. This tendency of the voltage to increase as the load decreases is counteracted by the passage of current through the shunt circuit of the electrolytic valve cells. These valve cells have the peculiar characteristic of acting as a relatively high resistance at low voltages but have a relatively low resistance when the potential difference exceeds a certain voltage. The valve cells are preferably connected so that they will begin to conduct a relatively large current when the voltage rises slightly above the normal filament voltage. When the switch 23 is closed and one or more filaments are in the circuit, current will flow through the winding of the electromagnet 18 and swing its armature 17 so as to close the shunt circuit through the valve cells 15 and the winding of the electromagnet 16, thus conditioning this circuit to shunt a portion of the current when the voltage increases to a value above which the valves 15 act as conductors, thereby maintaining the voltage at the desired value. If the voltage at the output side of the eliminator rises above a predetermined value due to the fact that most of the tubes have been cut out and the eliminator is supplying a current of low amperage, a sufficient amount of current will pass through the electrolytic valves 15 and the electromagnet 16 to cause the latter to draw its armature towards it and thus break the shunt circuit which normally is bridged about the resistance 20. The insertion of this additional resistance 20 in the tube circuit is an added means for cutting down the voltage at the tube and is sufficient to prevent burning out of the tubes due to excessive voltage.

The electromagnet 18 and its associated armature 17 acts as a relay so that the electrolytic valve cells will not be connected across the output terminals of the eliminator unless the set is being used, that is, unless current is flowing through the filaments of the tube 14. It will be apparent that slight increases

in voltage will be offset by the shunting of current through the valve cells 15, and that greater rises in the voltage will be prevented not only by the shunting of the current
5 through the valve cells but also by the insertion of the resistance 20 in the circuit. An effective check is thus provided to counteract the tendency of the voltage to become excessive when the resistance of tube filament circuit is increased as tubes are removed.

The device of our invention eliminates the possibility of subjecting the filaments of the receiving set tubes to excessive voltages which under ordinary circumstances would shorten
15 the life of the tubes and frequently burn out their filaments. Since the relay 18 is energized only when the current is passing through one or more of the tube filaments, there will be no wastage of current through
20 the valve cells when the receiving set is not in use.

While we have shown and described the invention as adapted to a particular use, it will be apparent that changes may be made in its
25 construction to adapt it for other uses without departing from the broad principles of our invention. We therefore do not wish to restrict ourselves in any unessential particulars, but what we claim and desire to secure by
30 Letters Patent is:

We claim:

1. In an "A" current supply system for radio receivers, the combination of a source of direct current supply, a plurality of thermionic tube filaments, means for connecting
35 said filaments to said source, a relay in said means connected to be energized when said tubes are being supplied with current, a plurality of electrolytic valve cells, connections
40 for bridging them across the terminals of said source of supply upon the energization of said relay.

2. In an "A" current supply system for radio receivers, a source of direct current, a
45 plurality of thermionic tubes, means for connecting said tubes to said source, a relay in said means operable upon the flow of current to said tubes, a circuit in parallel with said tubes, said circuit being open when the relay
50 is not energized and closed when said relay is energized, a plurality of electrolytic valve cells in said circuit, an electromagnet in series with said valve cells, and means for increasing the resistance in the tube circuit, said
55 means being actuated by said electromagnet when the current through said valve cells exceeds a predetermined value.

3. In an "A" current supply system for radio receivers a source of direct current supply, filaments of thermionic tubes, connections between said filaments and said source,
60 a series of electrolytic valve cells in parallel with said filaments and means including an electromagnet for inserting a resistance in

said filament circuit when the current flowing through said cells exceeds a predetermined maximum. 65

4. In an "A" current supply system for radio receivers, an "A" battery eliminator, filaments of thermionic tubes, connections between said eliminator and said filaments, an electrolytic valve cell and an electromagnet connected in series with each other and in parallel with said filaments, a resistance in series with said filaments, a low resistance
75 shunt circuit around said resistance, and means including said electromagnet whereby said shunt circuit is broken by said electromagnet upon the flow of a predetermined current through said valve cell and electro-
80 magnet.

5. In an "A" current supply system for radio receivers, the combination of an "A" battery eliminator, thermionic tube filaments connected so as to be heated by current from
85 said eliminator, a series of electrolytic valve cells, and means for connecting said valve cells in parallel with said filaments upon the flow of current through said filaments.

6. In an "A" current supply system for radio receivers, the combination of an "A" battery eliminator, thermionic tube filaments connected so as to be heated by current from said eliminator, a series of electrolytic valve cells, means to connect said valve cells
95 in parallel with said filaments upon the flow of current through said filaments, a normally shunted resistance in circuit with said filaments, and automatic means to break the shunt around said resistance upon the passage of a predetermined current through said
100 valve cells.

7. In an "A" current supply system for radio receivers, the combination of an "A" battery eliminator, thermionic tube filaments connected so as to be heated by current from said eliminator, a series of electrolytic valve cells, a relay in said filament circuit, a switch actuated by said relay to connect said cells in parallel with said filaments upon the flow
105 of current through any of said filaments, and electrical means for inserting a resistance in series with said filaments upon the flow of a predetermined current through said cells. 110

8. In combination, a direct current source, variable load terminals, connections between said source and said terminals, a circuit including an electrolytic cell bridged across said terminals, means actuated by load current for closing said circuit, a switch in said connections, a resistance bridged across said switch, and means actuated by current in said circuit for opening said switch whereby resistance is introduced in series with said
120 load terminals. 125

9. In combination, conductors for connecting direct current source with variable load

terminals, a circuit including a tantalum-sulphuric-acid electrolytic cell bridged across said conductors, means actuated by load current for closing said circuit, a switch in one
5 of said conductors, a resistance bridged across said switch, and means actuated by current in said circuit for opening said switch

whereby resistance is introduced in series with said load terminals.

In witness whereof, we hereunto subscribe 10
our names this 4 day of September, 1926.

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