

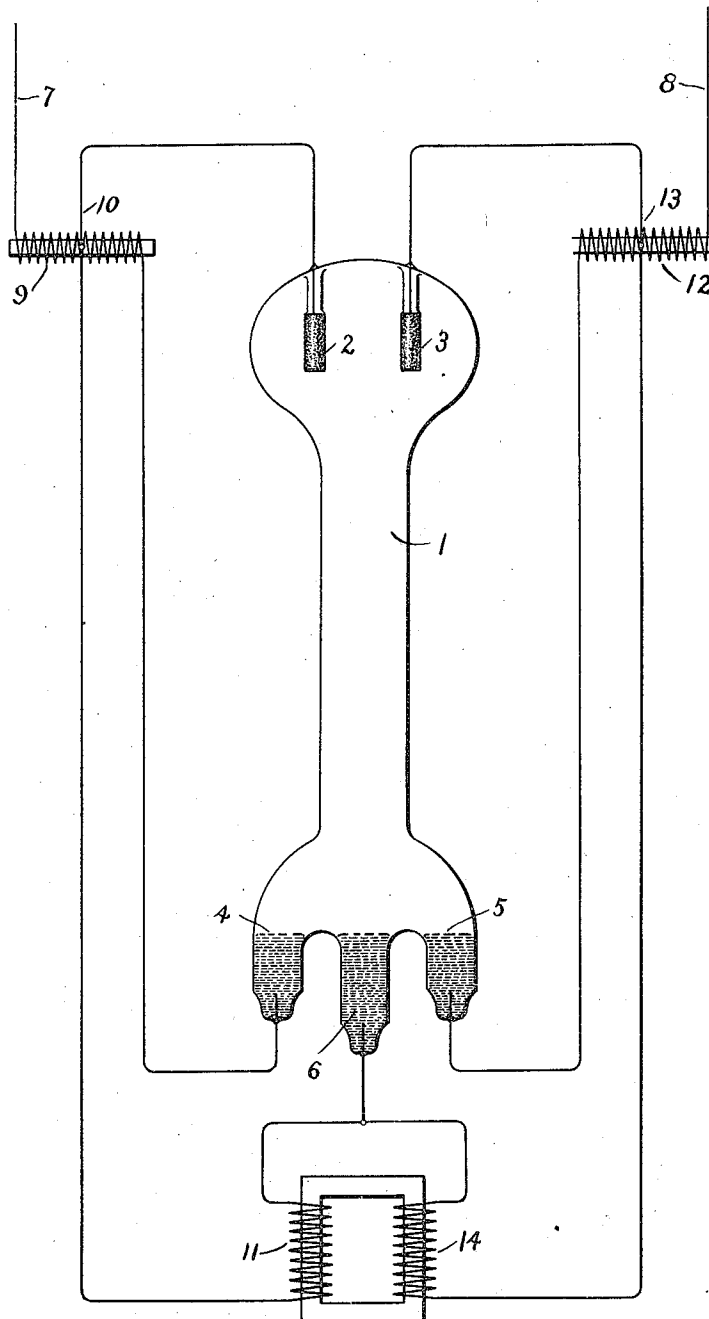
C. P. STEINMETZ.
VAPOR ELECTRIC SYSTEM.
APPLICATION FILED JUNE 21, 1907.

945,991.

Patented Jan. 11, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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J. Ellis Allen

INVENTOR

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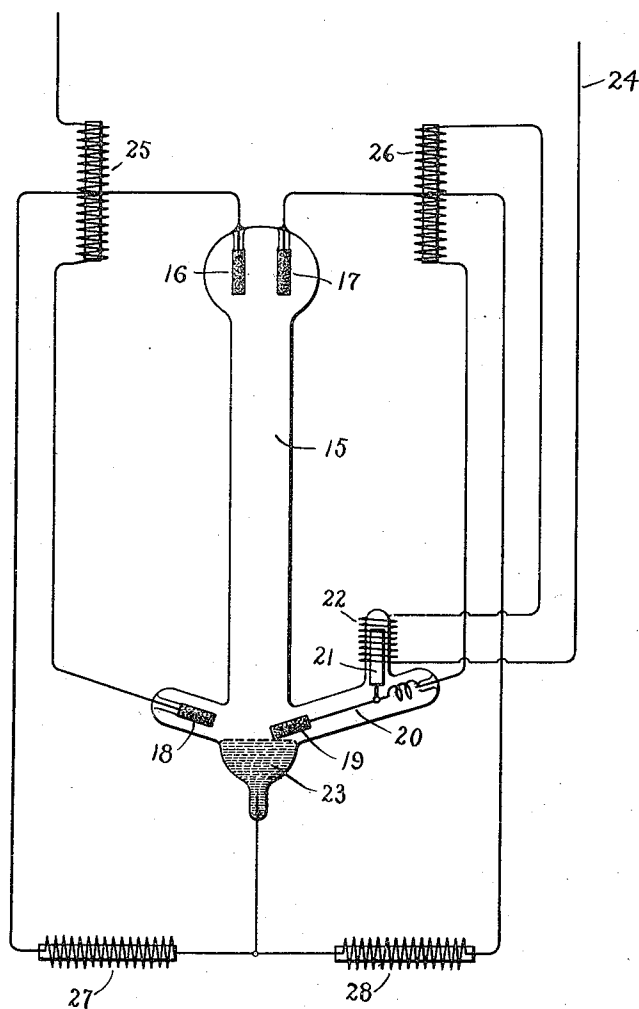
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Fig. 2.



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INVENTOR

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UNITED STATES PATENT OFFICE.

CHARLES P. STEINMETZ, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

VAPOR ELECTRIC SYSTEM.

945,991.

Specification of Letters Patent.

Patented Jan. 11, 1910.

Application filed June 21, 1907. Serial No. 380,002.

To all whom it may concern:

Be it known that I, CHARLES P. STEINMETZ, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Vapor Electric Systems, of which the following is a specification.

My present invention relates to the operation of vapor electric devices such as mercury vapor lamps, and more particularly to the operation of such devices on alternating current circuits.

According to my invention, the lamp or other vapor device is provided with auxiliary anodes to act as starting means, and is also provided with inductive means for rendering these auxiliary anodes inactive after the main anodes have gone into action.

The system hereinafter described comprises other special features as hereinafter set forth in detail; the novel features are particularly pointed out in the appended claims.

The drawings accompanying this specification and forming a part thereof, illustrate in Figure 1 a mercury vapor lamp of ordinary type, equipped with reactances for cutting the auxiliary anodes out of circuit; Fig. 2 illustrates similar reactances applied to a lamp in which one auxiliary anode is movable to start an arc within the vapor device.

Referring to Fig. 1, the vapor device 1 comprises main anodes 2 and 3, auxiliary anodes 4 and 5, and a mercury cathode 6. The device is supplied with electrical energy from a source of alternating current by means of mains 7 and 8. The main 7 is connected with auxiliary anode 4 through a reactance 9, and the latter has a tap 10 connected directly with main anode 2 and connected indirectly with cathode 6 through reactance 11. The main 8 is connected to anode 3 and auxiliary anode 5 through a similar tapped reactance coil 12, and the tap 13 is connected to cathode 6 through reactance 14.

To start the tube in operation it must be shaken or tilted until an auxiliary anode 4 or 5 contacts momentarily with the mer-

cury cathode 6 and establishes an arc to the electrode 6 as cathode. During this starting operation current can flow from main 7 through reactance 9 to auxiliary anode 4 and then through the arc to cathode 6 and back to main 8 by way of reactance 14, and half of reactance 12. Simultaneously current may flow from main 7 through half of reactance 9 and then from tap 10 through reactances 11 and 14 and back to main 8 through half of reactance 12. Reactances 11 and 14 serve to store energy which is later given up to maintain a continuous flow of current to cathode 6 from anodes 4 and 5.

Almost immediately after the establishment of the auxiliary arcs at the bottom of the tube, current begins to flow to the cathode from main anodes 2 and 3. This action takes place because of the lower impedances offered by the path including the main anodes. After the main arcs start, energy from lead 7 passes through half of reactance 9 and then out through tap 10 to main anode 2 and through the arc to cathode 6, returning to main 8 by way of reactance 14 and half of reactance 12. The passage of this current through the left hand half of reactance 9 develops an electromotive force in the remaining half of the coil having a direction such that it tends to put out and does put out, the starting arc of anode 4. So long as the arc continues to play to the main anodes 2 and 3, the auxiliary anodes 4 and 5 will be under the influence of the counter E. M. F. of the coils 9 and 12 and will not send current through the short paths at the bottom of the vapor device.

It will be noted that the auxiliary anodes 4 and 5 are by the above described means cut out of circuit purely by the inductive action of the reactance coils and without recourse to switches, resistance, or other automatic devices which might be proposed for use in this relation. The reactances 9 and 12 offer little impedance to the starting current, but they offer a high impedance in the starting path after the starting operation has been completed.

The system illustrated in Fig. 2 comprises a vapor tube 15 having main anodes 16 and

17 and auxiliary anodes 18 and 19. The latter is mounted on the flexible lead-wire 20 which engages with a magnetizable plunger 21 arranged vertically in a branch of the tube and controlled by a solenoid 22 suitably disposed outside the envelop. At starting, the movable electrode 19 is in contact with the mercury cathode 23 and completes the circuit through the device so that current may flow from the alternating current main 24 through the solenoid 22 and then through other circuits of the system to anode 19. The passage of this current through the solenoid 22 lifts anode 19 and starts an auxiliary arc at the surface of the mercury cathode 23.

The system shown in Fig. 2, like that of Fig. 1, is provided with reactance coils 25 and 26 connected between the alternating current mains and the auxiliary anodes and having taps connected with the main anodes and also with the mercury cathode of the tube. Maintaining reactances 27 and 28 are inserted in the cathode connections.

After anode 19 has been lifted to establish the starting arc to cathode 23, the arc flashes up to the main anodes 16 and 17 and the reactances 25 and 26 act automatically to suppress the starting arcs, as explained more in detail in connection with Fig. 1. So long as current is supplied from the alternating current source, the arcs will continue to play to the main anodes in preference to the starting anodes; but if for any reason the source of power fails, the auxiliary anode 19 will drop back in contact with the cathode and will be in position to repeat the starting action as soon as the source again becomes operative. The system has the advantage of the side branch start, also of the automatic shift of the starting arc to the main anodes and complete extinction of the side branch without the use of cut-outs or similar devices in the anode leads.

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

1. The combination of a vapor electric device having a cathode and a plurality of anodes, an auxiliary anode therefor, means for supplying energy to said auxiliary anode during starting, and means in circuit with said auxiliary anode for developing a counter electromotive force through the starting path after the starting operation is completed.

2. The combination of a vapor electric device having main anodes and a cathode, auxiliary anodes for said device, alternating current supply mains having reactances connected respectively between said mains and said auxiliary anodes, said reactances having taps connected respectively to said main anodes, and means for returning current from said cathode to said mains.

3. The combination of a vapor electric de-

vice having anodes and a cathode, alternating current mains for supplying energy to said device, auxiliary anodes continuously connected to said mains, and reactances in circuit with said auxiliary anodes and each having a portion in circuit with one of said main anodes.

4. The combination of a vapor electric device having anodes and a cathode, auxiliary anodes therefor, alternating current supply mains continuously connected to said auxiliary anodes, and reactive means for automatically decreasing the voltage on said auxiliary anodes when current flows through said device by way of said main anodes.

5. The combination of a vapor electric device having main anodes and a cathode, auxiliary anodes therefor, alternating current mains each of which is continuously connected to a main anode and to an auxiliary anode, and automatic means for developing a counter electromotive force in circuit with an auxiliary anode when current flows through the device by way of a main anode.

6. The combination of a vapor electric device having anodes and a cathode, auxiliary anodes therefor, supply mains each of which is continuously connected with an auxiliary anode through a path of low ohmic resistance, and means for limiting the flow of current through an auxiliary anode by the inductive action of current flowing through a main anode.

7. The combination of a vapor electric device having main anodes and a cathode, auxiliary anodes in proximity to said cathode, means for establishing an arc from said auxiliary anodes to said cathode to start the flow of current from said main anodes to said cathode, and reactive means energized by current passing through an auxiliary anode and also by current passing to a main anode.

8. The combination of a vapor electric device having a starting anode, and means in circuit with said anode for developing a counter electromotive force through the starting path after the starting operation is completed.

9. The combination of a vapor electric device having main anodes and a cathode, an auxiliary anode for said device, an alternating current supply main, and a reactance connected between said main and said auxiliary anode and having a tap connected to a main anode.

10. The combination of a vapor electric device having anodes and a cathode, an auxiliary anode therefor, a supply main continuously connected to said auxiliary anode, and reactive means for automatically decreasing the voltage on said auxiliary anode when current flows through said device by way of a main anode.

11. The combination with a vapor electric

device having a cathode, an auxiliary anode,
and means for passing current to said cath-
ode, of an alternating current main continu-
ously connected to said auxiliary anode, and
5 automatic means for developing a counter-
electromotive force in circuit with said aux-
iliary anode after said device is started.

In witness whereof, I have hereunto set
my hand this 19th day of June, 1907.

CHARLES P. STEINMETZ.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.