C. M. GREEN.

VAPOR RECTIFIER SYSTEM.

APPLICATION FILED AUG. 11, 1905.

958,391. Patented May 17, 1910.

Fig. 2.

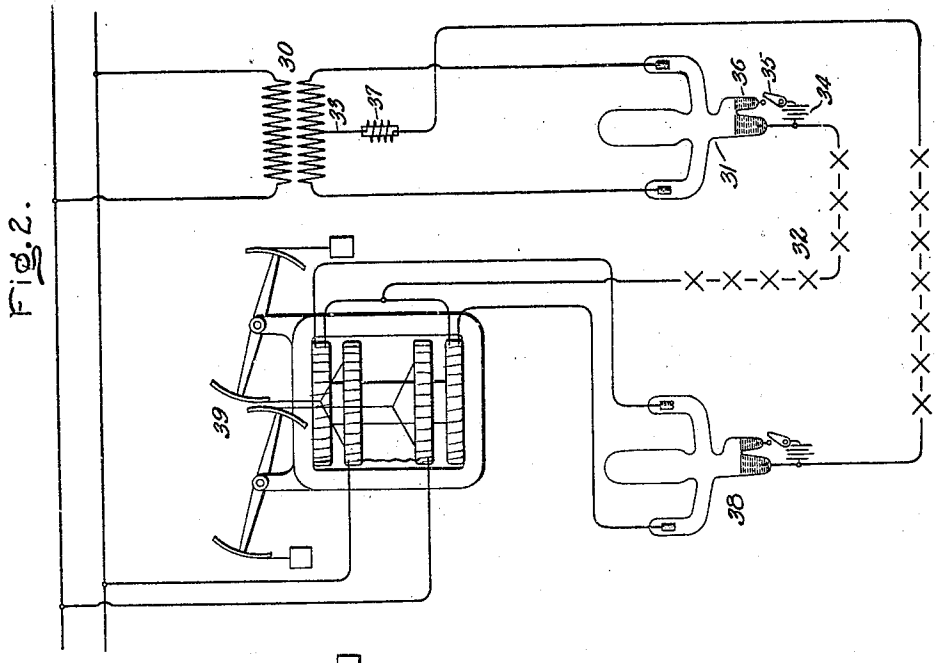
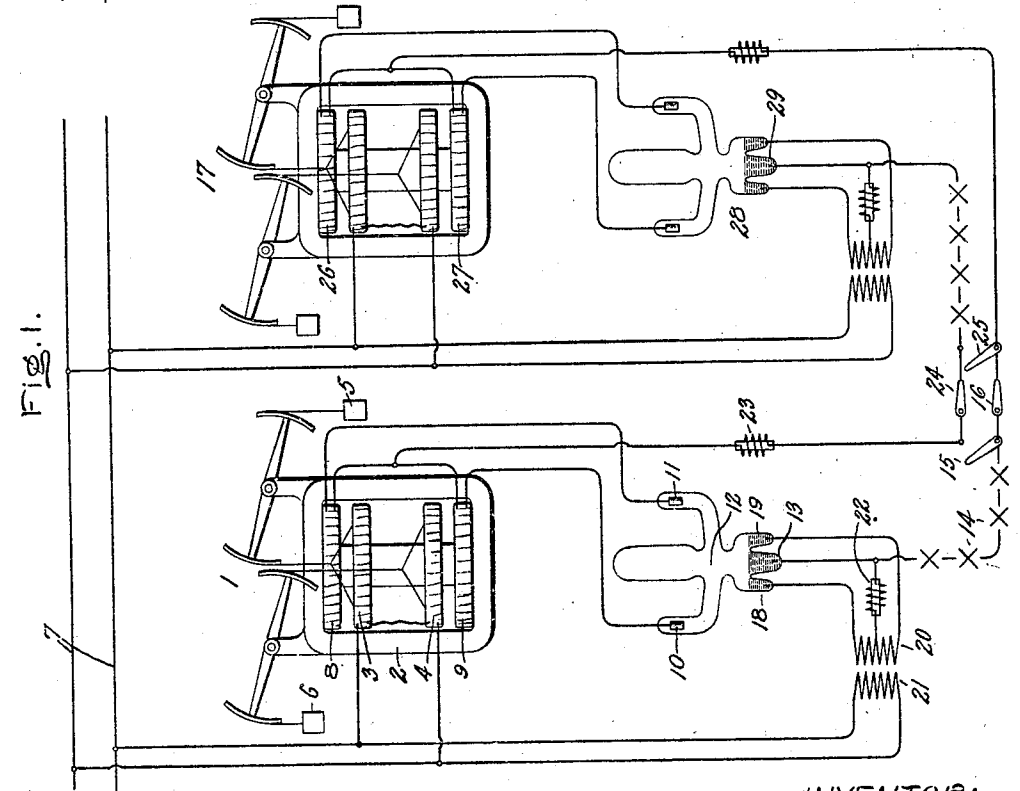


Fig. 1.



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VAPOR-RECTIFIER SYSTEM.

958,391. Specification of Letters Patent. Patented May 17, 1910.

Application filed August 11, 1905. Serial No. 273,806.

To all whom it may concern:

Be it known that I, CHARLES M. GREEN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Vapor-Rectifier Systems, of which the following is a specification.

This invention relates to a system of electrical distribution in which mercury rectifiers are used to transform alternating current into direct current. It contemplates the use of a constant current transformer having two stationary coils, and two floating coils movable toward and from the stationary coils to automatically maintain a constant current in the consumption circuit supplied by the transformer. Such a transformer, when provided with a mercury vapor rectifier, may be used for operating a constant current series circuit containing a plurality of translating devices such as arc lamps or motors, and it is possible to introduce a second constant current transformer and rectifier into the circuit to compensate for an increase in the series load, or to shift the load from one transformer to another as occasion may require. Such a transformer and rectifier may also be introduced in series with a rectifier operating on constant potential to act as a booster and regulator, and thus serve to compensate for changes in the resistance of the series circuit supplied by the constant potential rectifier.

My invention will be better understood by reference to the following description taken in connection with the drawing forming a part of this specification.

Figure 1 shows a plurality of rectifiers each of which is connected to a constant current transformer of the floating coil type and a series consumption circuit receiving energy from both of the transformers; Fig. 2 shows a constant potential rectifier of ordinary form operating on a series circuit and provided with a constant current transformer to boost the voltage and maintain substantially constant current in the series load.

The constant current transformer 1 consists of a suitable magnet frame 2 within which two movable primary coils 3 and 4 are mounted. These coils may be coupled together in any suitable and usual manner to insure simultaneous movement and are counter-balanced by the weights 5 and 6, and supplied with energy from an alternating current source 7. The transformer is also provided with stationary secondary coils 8 and 9 inductively related to the movable primary coils and connected in series to the anodes 10 and 11 of the mercury rectifier 12. By this arrangement each secondary supplies current of a definite polarity to a single anode and the two primaries constitute separate means for regulating current waves of each polarity.

The rectifier 12 is provided with a mercury cathode 13 from which current passes through the translating devices 14, and then, either through a switch 15 to the conductor connecting the two transformer secondaries, or through a switch 16 to a second transformer 17 similar in all respects to transformer 1. The mercury rectifier is provided with two auxiliary anodes 18 and 19 which I utilize in starting the flow of current through the rectifier but which may thereafter be left in circuit to insure a flow of current through the tube at all times and thereby prevent possible disturbances in the consumption circuit from putting out the rectifier arcs. To start the rectifier it is shaken so that a momentary contact is formed between one of the auxiliary anodes and the mercury cathode 13 thereby permitting current to flow from a transformer secondary 20. The corresponding primary 21 of this transformer receives current from the constant potential source 7. When the mercury electrodes separate, a small arc is formed between the mercury surfaces, and this renders the rectifier tube conductive for current from the anodes 10 and 11. A small reactance 22 may be inserted in series with the mercury cathode 13 to smooth out the rectified current delivered to the secondary 20 and to assist in maintaining an arc from one auxiliary anode during the small interval of time necessary for the potential at the other anode to rise to a value sufficient to start a second arc through the tube. A similar reactance 23 may be inserted in series with the consumption circuit to prevent fluctuations in the line resistance from putting out the rectifier.

In case of an overload on the rectifier 12, or in case it is desirable for any other reason to relieve the load on the transformer 1 the switches 15, 16, 24 and 25 may be thrown as

shown in the drawing, so that the current from rectifier 12 passes through the translating devices 14 to the secondaries 26 and 27 of the transformer 17. The outer terminals of these secondaries are connected to the anodes of the second rectifier 28, similar in all respects to the rectifier previously described and operating to deliver unidirectional current from its cathode 29 through the switch 24 to the secondaries of transformer 1.

In Fig. 2, a constant potential transformer 30 supplies current to the anodes of a mercury rectifier 31 which delivers unidirectional current to a series consumption circuit 32. The secondary of the transformer 30 is provided with a central tap 33 to which the rectified current from the consumption circuit may return. To start the rectifier, I make use of a storage battery 34, which may be connected through a switch 35 with the auxiliary anode 36, so that when the rectifier is shaken, an incipient arc is produced in the lower end of the tube which renders it conductive for pulsations of proper direction from the transformer 30. A reactance coil 37 is connected in series with the consumption circuit, and this coil in combination with the high internal reactance of the transformer secondary operates to maintain a continuous discharge from the rectifier anodes even after the battery 34 has been disconnected from the auxiliary anode, so that the rectifier after having once been started will maintain itself in a conductive condition.

A constant potential rectifier system such as I have just described may be properly adjusted to give normal current to a definite number of series translating devices, but it does not permit the addition of more load without a decrease in the current delivered. To overcome this lack of regulation I introduce a second rectifier 38 supplied with energy from a movable coil transformer 39. This rectifier and its coöperating transformer may be suitably compounded to maintain constant current in the consumption circuit 32 irrespective of the number of translating devices in circuit.

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

1. The combination of a transformer having a plurality of separate secondary coils and primaries coöperating therewith, and having a rectifier connected to one terminal of each of said secondary coils, a consumption circuit supplied with current from said rectifier, means for connecting said consumption circuit to one terminal of each of said coils, said means including a second rectifier, and means for maintaining a substantially constant current in said consumption circuit, said maintaining means including said primaries.

2. The combination of an alternating current source, a mercury rectifier receiving current waves of both polarities from said source, a consumption circuit connected to said rectifier, and separate means for independently regulating the current waves of the two polarities from said source to maintain substantially constant current in said consumption circuit.

3. The combination of a mercury rectifier, a series consumption circuit connected to said rectifier and a transformer for supplying energy to said consumption circuit, said transformer having windings of relatively high reactance which carry uni-directional current, and a plurality of movable coils for automatically maintaining substantially constant current in said consumption circuit.

4. The combination of a mercury rectifier, a series consumption circuit connected to said rectifier, a source of current for said rectifier and a transformer operatively connected to said consumption circuit and having windings traversed by uni-directional current, said windings being separated sufficiently to offer material reactance to said uni-directional current, said transformer having a plurality of coils automatically movable to maintain substantially constant current in said consumption circuit.

5. A constant current transformer having a plurality of secondary coils separated by an air gap, means for automatically varying the voltage of each of said coils, an asymmetric vapor path for current from each of said coils, a consumption circuit, and means for connecting said consumption circuit to one terminal of each of said coils.

6. The combination of a source of constant potential current, a mercury rectifier receiving energy therefrom and supplying current to a series consumption circuit, a second rectifier in series therewith and also delivering energy to said consumption circuit, and automatic means for regulating the energy delivered by said second rectifier to maintain substantially constant current in said consumption circuit.

7. The combination of a single phase source of alternating current, a consumption circuit, a vapor rectifier supplying energy to said consumption circuit at substantially constant potential, a second rectifier connected in series with said consumption circuit, and automatic means co-acting with one of said rectifiers for maintaining a substantially constant current in said consumption circuit.

8. The combination of a consumption circuit, means for supplying energy thereto at substantially constant potential, a vapor rectifier in series with said consumption circuit and supplying energy thereto, and automatic means for maintaining a substantially

constant current in said consumption circuit by regulating the energy supplied by said vapor rectifier.

9. The combination with a transformer comprising two series-connected secondary coils, two series-connected primary coils relatively movable with respect to and between the secondary coils, and a magnetizable core surrounded by the said coils having a leakage path between the primary and also between the secondary coils, of a rectifying device having its alternating current terminals connected to the terminals of the said secondary coils and a direct current circuit having one conductor connected between the direct current terminal of the rectifying device and the connection between the secondary coils.

10. The combination with a transformer comprising two series-connected secondary coils, two series-connected primary coils relatively movable with respect to the secondary coils, and a magnetizable core surrounded by the said coils having a leakage path between the primary and also between the secondary coils, of a rectifying device having its alternating current terminals connected to the terminals of the said secondary coils, and a direct current circuit having one conductor connected between the direct current terminal of the rectifying device and the connection between the secondary coils.

In witness whereof, I have hereunto set my hand this fifth day of August, 1905.

CHARLES M. GREEN.

Witnesses:

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HENRY O. WESTENDARP.