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H. WITTKKE

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METHOD OF TREATING DRY PLATE ELEMENTS

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FIG. 1.

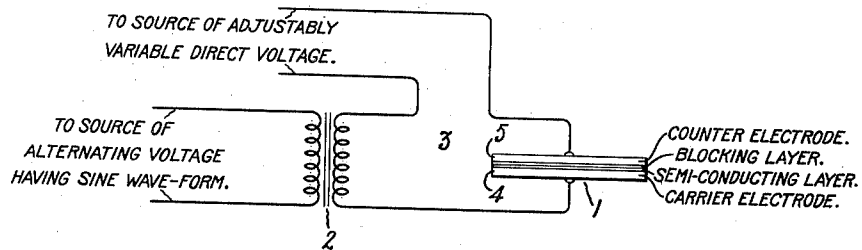
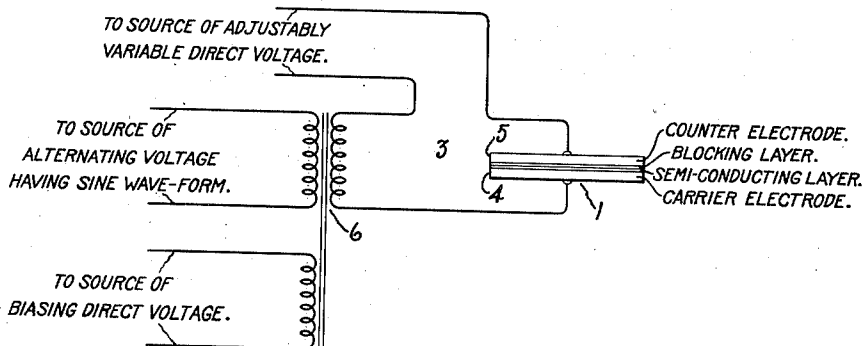


FIG. 2.



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UNITED STATES PATENT OFFICE

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METHOD OF TREATING DRY PLATE
ELEMENTS

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pany, a corporation of New York

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4 Claims. (Cl. 175-366)

My invention relates to electrode systems of non-symmetrical conductivity such as dry plate cells for rectifiers or the like, and particularly to methods of treating dry plate elements subsequent to their manufacture for the purpose of artificial aging of the elements, or for obviating the danger of short circuits. One of its objects is to provide improved methods of such subsequent electrical treatment.

It is well known that electrode systems of non-symmetrical conductivity such as dry plate elements, for example selenium rectifier cells comprising a carrier electrode, a semi-conducting layer, a blocking layer, and a counter-electrode, require after their production by chemical means and by heat treatment a subsequent electrical treatment which accomplishes the artificial aging of the element and removes the danger of damage in service from internal short circuits which are either already present in the element or which would originate in service by reason of the sparking over of the current at the weakest points of the blocking layer. The heat produced upon the passage of the current during the above mentioned subsequent electrical treatment burns out the points subject to short circuit. Prior methods have employed for this purpose either direct current or alternating current with or without limiting resistance in the circuit.

These prior methods have been found to entail considerable disadvantages. In case the dry plate element is loaded with direct current without limiting resistance, the danger exists that if the short circuit which occurs when the current is applied is a severe one the heat developed thereat becomes so great that the burning out of the short circuit area takes place with sufficient violence to fuse the counter-electrode in the region spreading out from the short circuit area. The fusion also penetrates deeply into the semi-conductor layer thereby causing the short circuit to become still more violent, the dry plate element being finally destroyed. In selenium rectifiers, for example, under such circumstances externally visible craters appear having slightly raised edges produced by the molten metal.

On the other hand in case the dry plate element is loaded with direct current or alternating current through a limiting resistance the danger exists that certain points or areas or a given dry plate element may be so defective as to be liable to short circuit in service but that, by reason of the limiting resistance, a current intensity sufficient to burn out these defective points or incipient short circuits cannot develop. There-

fore upon testing such dry plate elements with service current they become short circuited and damaged, and are consequently rejected.

Further, in case the dry plate element is loaded with alternating current but without limiting resistance in the circuit, then, since the arc originating at the short circuit points is extinguished during each half period of the alternating current, damage to the plates of the element is avoided during these half periods. However, in the half periods corresponding to the current conducting or flow direction of the element a current originates which is so intense that owing to the heat developed by this current the counter electrode fuses entirely or in part and thereby the element is finally destroyed. In selenium rectifiers under these circumstances externally visible blisters occur in the counter electrode.

In accordance with the present invention the foregoing disadvantages are overcome, the method of subsequent treatment of dry plate elements after production being carried out in such manner that the salvaging of elements having defective points or areas tending to cause short circuit in service is successfully accomplished without danger of destruction of the elements during the salvaging operation.

Specifically, in accordance with the present invention the dry plate elements are treated, subsequent to production, in such manner that an alternating voltage is applied thereto the maximum instantaneous values of which are greater in the blocking direction of the elements than in their current conducting or flow direction.

The novel features which are considered to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation together with further objects and advantages thereof may best be understood by reference to the following description taken in connection with the accompanying drawing wherein Fig. 1 is a circuit diagram illustrating a method whereby my invention may be practiced, and Fig. 2 is a circuit diagram illustrating a modification of the method illustrated in Fig. 1.

Referring to Fig. 1, the dry plate element 1 which is to be electrically treated subsequently to being formed is connected, as through a transformer 2, to a source of alternating voltage having a sine wave-form. A suitable direct voltage is superimposed on the alternating voltage, for example by connecting in series in the trans-

former and dry plate element circuit 3 a source of adjustably variable direct voltage. The polarity of the latter source is so arranged that the instantaneous values of the resultant voltage in circuit 3 impressed on element 1 are substantially greater in the blocking direction of the element, in the present case from carrier electrode 4 to counter-electrode 5, than in the current conducting or flow direction of the element.

In the circuit illustrated in Fig. 2 instead of impressing an alternating voltage of pure sine wave form on the element 1, an alternating voltage deviating from this form is employed which is impressed on the element 1 through a transformer 6. Such distorted alternating voltages may be generated, for example, as shown in Fig. 2 by applying in a usual manner a direct current bias to the transformer 6 from a suitable source of direct voltage. The polarity of the direct biasing voltage source is so arranged that from the resulting distorted alternating voltage impressed on the element 1, a substantially higher effective voltage is impressed thereon in the blocking direction than in the current conducting or flow direction. Further, in the circuit of Fig. 2 employing an alternating voltage deviating from the sine wave-form, it is advantageous to provide in series with this alternating voltage impressed on the element 1, an appropriately variable direct voltage as in Fig. 1, in order, for example, to control the time periods of the positive and negative portions or voltage pulses of the distorted voltage waves at a given ratio of the maximum values of these positive and negative portions. In this manner the current, and the heat produced thereby in the element, during the flow direction periods thereof remain within moderate limits, whereas during the blocking direction periods such a high voltage is applied to the element that at any defective points in the blocking layer, arcs are caused to occur. Thus the short circuits originating by reason of the high applied voltage, as well as short circuits already existing in the element, are burned out by the heating current due to the high voltage.

The arcs cannot produce the disturbing results referred to hereinbefore in connection with the employment of direct current, since in the use of the present method, the arc is extinguished at the end of each half period in the blocking direction. In the use of the present method destruction of the element by fusion of the counter-electrode, which occurs when alternating current is employed without limiting resistance, is likewise prevented since, for the flow direction in the element, the instantaneous values of the alternating voltage are selected so small that they remain below the voltage values occurring, in the flow direction, in actual service.

Nothing in the present method prevents the use therewith of limiting resistances, but the use of such resistances is not necessary since the values of the instantaneous voltages applied to the element may be so selected that the desired current intensities are obtained in both the blocking direction and in the flow direction.

The method in accordance with the present invention is of importance primarily in connection with dry plate rectifiers, but it is also applicable in connection with blocking layer photo cells or

resistance cells. Further, the method may be utilized in connection with several dry plate systems connected in series or in parallel.

My invention has been described herein in particular embodiments for purposes of illustration. It is to be understood, however, that the invention is susceptible of various changes and modifications and that by the appended claims I intend to cover any such modifications as fall within the true spirit and scope of my invention.

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

1. The method of treating a dry plate element of non-symmetrical conductivity which includes subjecting said element to an alternating voltage the maximum instantaneous values of which in the blocking direction of said element are sufficiently high to burn out short-circuit areas of said element and in the current conducting direction of said element are substantially lower than the maximum instantaneous values of the voltage impressed upon said element in the current conducting direction in normal use of said element for rectification.

2. The method of treating a dry plate element of non-symmetrical conductivity which includes providing an alternating voltage having a sine wave-form, impressing a direct voltage upon said alternating voltage to produce a resultant voltage, and impressing said resultant voltage upon said element, the peak value of said alternating voltage and the value of said direct voltage being each relatively high to cause the peak value of the resultant sum voltage in the blocking direction to be sufficiently high to burn out short-circuit areas of said element and said peak value of the alternating voltage exceeding the value of the direct voltage by only a relatively small amount to cause the peak value of the resultant difference voltage in the current conducting direction to be substantially less than the peak value of alternating voltage impressed upon said element in the current conducting direction in normal use of said element for rectification.

3. The method of treating a dry plate element of non-symmetrical conductivity which includes impressing a distorted alternating voltage upon said element in such manner that the maximum instantaneous values of the voltage pulses of said resultant voltage are substantially greater in the blocking direction of said element than in the current conducting direction thereof, and impressing a direct voltage upon said resultant voltage to determine the time periods of said pulses of resultant voltage.

4. The method of treating a dry plate element of non-symmetrical conductivity which includes providing an alternating voltage having a sine wave-form, providing a biasing direct voltage to produce a distorted alternating voltage from said first named voltage, impressing said distorted voltage upon said element in such manner that the maximum instantaneous values of the voltage pulses of said distorted voltage are substantially greater in the blocking direction of said element than in the current conducting direction thereof, and impressing a direct voltage upon said distorted voltage to determine the time periods of said pulses of said distorted voltage.

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