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C. W. HEWLETT

2,349,622

MANUFACTURE OF RECTIFIERS OF THE BLOCKING LAYER TYPE

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Fig. 1.

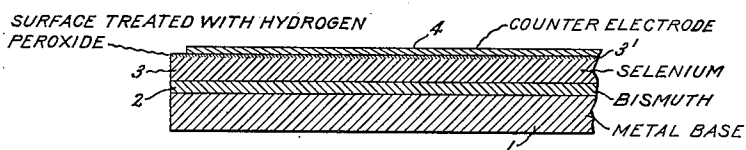


Fig. 2

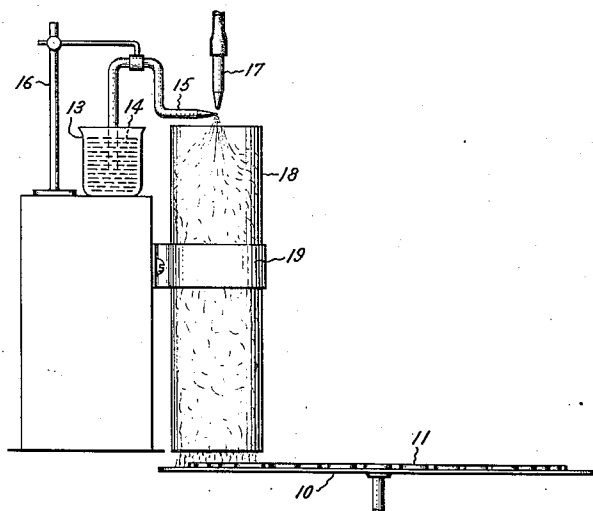
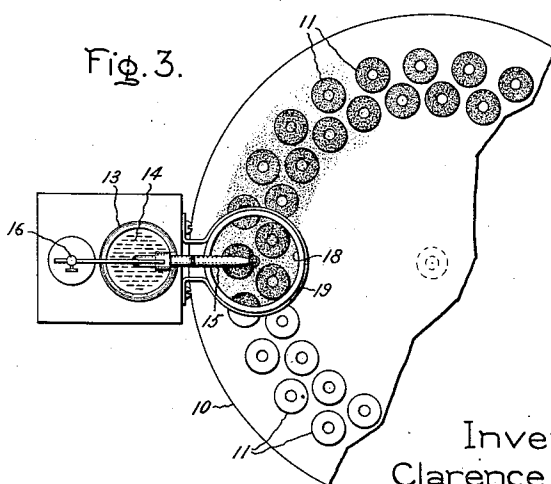


Fig. 3.



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UNITED STATES PATENT OFFICE

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MANUFACTURE OF RECTIFIERS OF THE
BLOCKING LAYER TYPEClarence W. Hewlett, Schenectady, N. Y., assign-
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2 Claims. (Cl. 175—366)

The present invention relates to the manufacture of alternating current rectifiers of the so-called "blocking layer" type. It has as its primary object the provision of a fabricating method which is adapted to produce rectifiers of good electrical properties and uniform quality.

The invention is directly applicable to the manufacture of rectifiers of the type which comprises a layer of selenium sandwiched between a metallic base member and a counter-electrode. The rectifying properties of such a construction depend upon the existence between the selenium and the counter-electrode of a so-called "blocking layer" which has a much higher electrical resistance in one direction than in the other. The present invention is concerned with an improved procedure for producing the blocking layer.

In accordance with the invention, the selenium surface on which the blocking layer is to be produced is subjected to the action of a dilute solution of hydrogen peroxide by spraying an appropriate quantity of the peroxide solution on the selenium. The hydrogen peroxide apparently has the effect of producing on the selenium a thin layer of selenium dioxide which is intimately bound to the underlying selenium and which has advantageous properties which are easily reproducible from one cell to another.

The aspects of the invention which I desire to protect herein are pointed out with particularity in the appended claims. The invention itself, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing, in which Fig. 1 represents an enlarged section of a fragmentary portion of a rectifier cell suitably embodying the invention, Fig. 2 is a schematic representation of apparatus for practicing the invention, and Fig. 3 is a plan view of a portion of the apparatus of Fig. 2.

In fabricating rectifier cells of the type under consideration, it is expedient to start with a metal base member (corresponding to the part 1 of Fig. 1) which has a shape corresponding to that desired for the finished rectifier. For many purposes it is convenient to form the base member as a relatively thin disk having a central opening for permitting a number of cells to be assembled upon a central arbor or frame. The base member may suitably be constituted of aluminum or of an aluminum alloy.

According to the preferred procedure, one surface of the shaped base member is provided with a thin layer 2 of bismuth, this material having

the function of assuring a better contact between the base member and a selenium layer 3 which is subsequently to be added. The bismuth may be applied in one way by depositing it in vapor form in vacuum, for example, by use of the method and apparatus described in my prior U. S. Patent 2,327,329, patented December 21, 1943.

As a next step, selenium is deposited by vaporization on the bismuth layer, the deposition of selenium also being preferably carried out by vaporization in vacuum. It has been found advantageous in a particular case to apply the selenium in three layers, the third layer being constituted of pure selenium and the first and second layers comprising selenium which contains from .01 to .05 per cent of a halogen, preferably chlorine. (The addition of the halogen improves the conductivity of the selenium and thus decreases the operating resistance of the cell as a whole.) After the deposition of each of the selenium layers, the cell is subjected to heat in order further to improve its electrical characteristics.

After the last layer of selenium has been laid down and following the desired heat treatment of this layer, the surface of the selenium is next subjected to the action of hydrogen peroxide for the purpose of producing a blocking layer on the selenium (i. e. at 3' in Fig. 1). This may be done in one way by means of the apparatus shown in Fig. 2, in which there is shown a rotating table 10 having mounted on it near its periphery a plurality of disk-like rectifier cells 11. The table 10 is assumed to be slowly rotated (e. g. in a clockwise direction) by means of an electric motor or the like (not shown).

Above the table and in proximity to its outer edge there is supported a vessel 13 which contains a solution 14 of hydrogen peroxide in distilled water. This solution may suitably have a concentration between about 0.1 per cent and about 1.0 per cent, the optimum concentration being somewhat variable with different groups of cells. In order to bring the hydrogen peroxide solution into contact with the rectifier cells 11 in a suitable manner, there is provided in connection with the vessel 13 an atomizing nozzle 15 which is shown as being supported by a standard 16. A compressed air nozzle 17 which discharges in a downward direction in proximity to the opening of the nozzle 15 causes the hydrogen peroxide solution to be discharged from the latter nozzle in the form of a downwardly directed spray. A cylinder 18 supported by a

clamping ring 19, tends to confine this spray and to prevent its being dissipated by transverse drafts or other disturbing influences.

In the specified arrangement, each of the cells 11 is subjected to a certain amount of the hydrogen peroxide spray as it passes under the nozzle 15. The amount of spray received by any one cell is, of course, a function of the rate of discharge of the hydrogen peroxide and of the speed of rotation of the table 10. When using a hydrogen peroxide solution having a concentration of 0.3 per cent, it has been found desirable in a particular case to regulate the motion of the table in such fashion that the amount of solution sprayed on the selenium surface is approximately .1 to .2 cubic millimeter per square centimeter of surface. After the hydrogen peroxide is deposited on a given cell, the continued motion of the table 10 removes the cell from the action of the spray, and the cell is thereafter allowed to dry in air. If desired, each cell may be subjected to the spray several times (e. g. from two to six times) before being removed from the rotary table and dried.

It is believed that the action of the hydrogen peroxide is to form a layer of selenium dioxide on the selenium surface. It is probable that this selenium dioxide deposit extends to some extent into the crystal boundaries of the selenium-surface and that this accounts for the superior results obtained by this method. Regardless of what the proper explanation may be, it is a fact that cells produced in the manner specified are characterized by a very high degree of uniformity and by excellent electrical properties.

When the hydrogen peroxide treated cell is thoroughly dry, the treated selenium surface is covered with an appropriate counter-electrode (4 in Fig. 1). Such a counter-electrode may be formed, for example, by spraying the surface in question with a metal such as a soft solder applied by a Schoop gun or the like. Finally the cell is "formed" by subjecting it to a relatively prolonged passage of current in the blocking direction (i. e. with the counter-electrode at a positive potential with respect to the base member).

The details of procedure given herein are, of course, exemplary rather than limiting, and I aim in the appended claims to cover all variations of the procedure which come within the true spirit and scope of the foregoing disclosure.

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

1. In the process of fabricating a selenium rectifier the step which comprises subjecting the surface of the selenium component of the rectifier to the action of a spray of an aqueous solution containing about 0.1 to 1.0 per cent of hydrogen peroxide.

2. In the process of fabricating a selenium rectifier which comprises subjecting the surface of the selenium component of the rectifier to a spray of a dilute solution of hydrogen peroxide, thereby to develop a blocking layer on the said surface, and discontinuing said treatment when about .1 to .2 cubic millimeter of said solution per square inch of surface has been deposited.

CLARENCE W. HEWLETT.

CERTIFICATE OF CORRECTION.

Patent No. 2,349,622.

May 23, 1944.

CLARENCE W. HEWLETT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 9, for "selenium" read --selenium--; and second column, line 7, for "Patent 2,327,329" read --Patent 2,337,329--; same column, line 19, for "selenium" read --selenium--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of July, A. D. 1944.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.