United States Patent Office 2,718,688 Patented Sept. 27, 1955

2,718,688

METHOD OF MANUFACTURING DRY RECTIFIERS

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No Drawing. Application July 24, 1950, Serial No. 175,663

Claims priority, application Germany July 30, 1949

4 Claims. (Cl. 29—25.3)

The invention relates to a method of manufacturing of dry rectifiers especially of selenium rectifiers.

It is an object of the invention to improve the qualities of rectifiers.

A further object of the invention is to simplify the process of manufacturing.

As it is well known in the art, a dry rectifier comprises as main parts a thin semi-conducting layer, e. g. a selenium layer, and one electrode each on both sides of this semi-conducting layer. The one electrode is called the base-plate. The second electrode is called the counterelectrode.

On the base-plate the semi-conducting layer, e. g. the selenium layer, is melted on or applied by vapourizing on or in any other way. In case of copper oxyde rectifiers, the semi-conducting layer is formed by oxidizing the base-plate consisting of copper.

It is well known that the second or counter-electrode is applied to the surface of the semi-conducting layer by spraying or vapourizing on. Furthermore it is known that in case of copper oxide rectifiers the counterelectrode is formed by graphite in such a way that it is applied to the surface of the copper oxide layer in form of a colloidal solution.

All these known methods do not allow or if, only incompletely, to form a counterelectrode of a definite layer thickness.

I have found a method that allows to manufacture dry rectifiers with a counterelectrode of definite thickness.

For a more complete understanding of the nature and scope of my invention reference may be had to the following detailed description. By the new method the counterelectrode is applied to the surface of the semi-conducting layer as an extra unit in form of a prefabricated metal-plate preferably of a metal-foil, while by the known processes the counterelectrode is formed while applying the material of the counterelectrode. By the new process the counterelectrode is prefabricated as an extra unit and then applied to the semi-conducting layer. In this way a very definite thickness of the counterelectrode is obtained. This has the advantage of saving material the counterelectrode consists of. Furthermore, the new method allows to improve the qualities of the rectifiers. Usually a component is added to the metal (or metal-alloy), the counterelectrode is formed of, which essentially improves the quality of the rectifiers i. e. increasing the high resistance in the reverse direction. In case of selenium rectifiers that component generally consists of thallium. Hereby it cannot be avoided, that the resistance in the direction of the rectified current is increased. However, the increasing of the resistance in the direction of the rectified current, is at first by far smaller than the increasing of the resistance in the reverse current direction. By increasing the amount of said component beyond a certain value, the resistance in the reverse current direction increases relatively less than before, while the resistance in the direction of the rectified current increases much more than before. To obtain the best results it is therefore highly important to accurately dose the said component. However the new method allows such an accurately dosing, which is an important advantage of the new method.

Furthermore, in dry contact rectifiers, manufactured by the known processes, the counterelectrode itself is not absolutely equal in thickness throughout its extension and frequently porous, which latter disadvantage arises, if the counterelectrode is applied by spraying. Consequently the amount of the component, e. g. thallium, is unequal on the different spots of the rectifier, which leads to different values of resistance on the different spots of the rectifier. The counterelectrodes applied by the new method are equal in all rectifiers of a series, as well as in each counterelectrode itself. Furthermore, the counterelectrodes have non-porous surfaces. Therefore, the aforementioned disadvantages are avoided in the rectifiers manufactured by the new method. It has already been mentioned that the new method leads to counterelectrodes with strictly dosed amounts of components e. g. of thallium.

If the counterelectrodes are as usual applied by vapourizing on, the counterelectrodes may have a definite thickness. But it is difficult to apply counterelectrodes by vapourizing on as an alloy of a definite composition. The new method avoids such difficulty.

The new process has further advantages above those mentioned before. There is e. g. the possibility of concentrating the said component in that zone of the counterelectrode which adjoins immediately the semi-conducting layer. This concentration may go up to 100%. This can be easily carried out by using a counterelectrode consisting of several layers, which differ from each other by the concentration of the component e. g. from 100% to 0%. E. g. this can be performed by using thallium or other components only in that layer or that layer group which adjoins directly the semi-conducting layer.

There are no difficulties to fix the counterelectrode applied as a separate unit to the semi-conducting layer. E. g. with selenium rectifiers it was found, that there will exist a chemical combination or amalgamation between the counterelectrode and the semi-conducting layer, which will give a good contact between those two elements. I prefer to apply or press the counterelectrode on the semi-conducting layer, coating the base-plate, and then to heat the unit formed by these elements, and/or to compress this unit. The connection between the counterelectrode and the semi-conducting layer will be very favourable by heating both elements beyond the melting-point for a short period. As I have found, it is not necessary in all cases, that in the contacting zone of the two elements a chemical combination or amalgamation will become visible. That method of manufacturing will be preferably applied, if the counterelectrode, according to the other steps of the complete process of manufacturing the dry rectifier, is to be heated together with the semi-conducting layer beyond the melting-point of one of these two elements. If a heat treating up to a high temperature is not possible on account of the semi-conducting layer or for other reasons, a suitable connection can be obtained by forming the counterelectrode out of metal or a metal-alloy having a suitable lower melting-point. Consequently, the counterelectrode applied to the semi-conducting layer may be heated up to its melting-point or some degrees beyond this melting-point without doing any harm to the semi-conducting layer. In case of a heat treating up to a relatively low temperature, the time of the treating may be prolongated.

Since different embodiments of the invention may be made and certain changes may be made in the description without departing from the spirit and scope of the invention, it is intended that all the matter contained in

the above description shall be construed as illustrative and not in a limiting sense.

I claim:

1. The method of manufacturing a selenium rectifier composed of a base electrode, a counter electrode and an intermediate selenium layer, which comprises the steps of depositing the selenium layer onto the base electrode, separately producing a counter electrode and applying thereto a given dose of thallium of a concentration increasingly graduated toward one surface of the counter electrode, and thereafter fusing the counter electrode at said surface together with said selenium layer.

2. The method of manufacturing a selenium rectifier composed of a base electrode, an adherent counter electrode and an intermediate selenium layer, which comprises the steps of depositing the selenium layer onto the base electrode, separately producing a counter electrode and adding a definite uniformly distributed dosage of additional barrier-promoting substance to the bulk of the counter electrode material, firmly joining the dosed counter electrode with the bare surface of the selenium layer, and finally forming said rectifier by the application of heat and pressure, said dosage being of such amount that after formation of said rectifier substantially complete diffusion of said substance into said selenium layer will have taken place, whereby variation in the characteristics of the rectifier due to subsequent ageing during use will be minimized.

3. The method of manufacturing a selenium rectifier composed of a base electrode, an adherent counter electrode and an intermediate selenium layer, which comprises the steps of depositing the selenium layer onto the base electrode, separately producing a counter electrode and adding to the bulk of the counter electrode material a definite uniformly distributed dosage of thallium, firmly joining the dosed counter electrode with the bare surface of the selenium layer, and finally forming said rectifier by the application of heat and pressure, said dosage being of such amount that after formation of said rectifier substantially complete diffusion of said thallium into said selenium layer will have taken place, whereby variation in the characteristics of the rectifier due to subsequent ageing during use will be minimized.

4. The method of manufacturing a selenium rectifier composed of a base electrode, an adherent counter electrode and an intermediate selenium layer, which comprises the steps of depositing the selenium layer onto the base electrode, separately producing a counter electrode and adding to the bulk of the counter electrode material a definite uniformly distributed dosage of thallium having on one surface of the counter electrode a larger thallium concentration than elsewhere in said counter electrode, placing the counter electrode with its said surface into contact with the bare surface of the selenium layer, applying heat and pressure to fuse the counter electrode to the selenium layer, said dosage being of such amount that after said heat and pressure treatment substantially complete diffusion of said thallium into said selenium will have taken place, whereby variation in the characteristics of the rectifier due to subsequent ageing during use will be minimized.

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