Nov. 24, 1953 H. E. LAUCKNER 2,660,697

SELENIUM RECTIFIER WITH VARNISH INTERMEDIATE LAYERS

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FIG. 1.

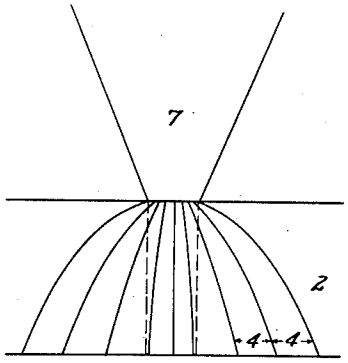

FIG. 2.

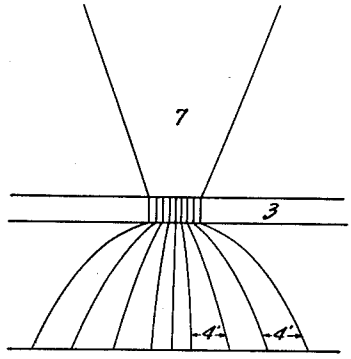

FIG. 3.

FIG. 4.

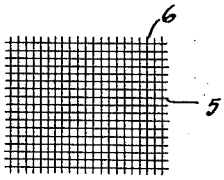

FIG. 5.

FIG. 6.

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SELENIUM RECTIFIER WITH VARNISH INTERMEDIATE LAYERS

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6 Claims. (Cl. 317—241)

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It is known practice to increase the blocking voltage of selenium dry plate rectifiers by applying a thin intermediate layer of insulating material such as varnish to the semi-conducting layer. It is relatively difficult, of course, to produce this intermediary layer in equal quality. Accordingly, the electric values of such rectifiers varies. In particular there are differences in the forming qualities which take effect in the finished rectifier discs since in the case of a great number of discs it is not possible to form each disc by itself.

It has been proved that according to the invention rectifiers with extremely uniform qualities are obtained, especially rectifiers with a reproduceable blocking characteristic, if the varnish is applied as a screen or raster instead of an evenly distributed varnish intermediate layer. After application of the varnish the back electrode is then applied. It will be of advantage to apply a screen composed of lines or dots to the selenium surface by a printing process.

Tests showed that the cover should not exceed a certain part of the selenium layer. E. g. a too great cover is applied in case of a line shaped screen wherein stripes of the free selenium surface of 0.15 mm. width alternate with varnish stripes of 0.25 mm. width; in this case the effect of an evenly distributed varnish layer results again. The covering of the selenium surface, therefore, must not reach these proportions. It has to be noted, however, that the proportions are dependent on the geometric structure of the layer system, and also on the fineness of the varnish screen.

The resistance of the rectifier in the forward direction is reduced by the arrangement of the present invention without impairing the blocking voltage. To explain such behavior it can presumably be pointed out that the arrangement may concern an approximation to the conditions of the point detector and that different current lines may be more decisive for the blocking phase of the rectifier than for the passing phase.

The behaviour of the system may be understood from the conditions of point-shaped contacts (see "Electric Contacts," a book by Ragnar Holm) and shall be explained with respect to the accompanying drawings in which Fig. 1 shows a scheme of the current distribution in a system in which a homogeneous body is contacted by another body of a sharp form along a small area (point contact). In Fig. 2 the homogeneous body is subdivided into two regions of different resistivity. The schemes corresponding to Figs.

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3–5 show interrupted coats of lacquer, varnish, or the like, applied to the semiconducting layer before depositing the counterelectrode. Fig. 1 is a sectional view of a complete cell including base element, semi-conductor, insulating screen layer, and counterelectrode.

Supposing in Fig. 1 a circular contact area of point 1, which is small in comparison with the thickness of the homogeneous body 2, the current distribution is indicated by the lines 4. It is obvious that the swelling out of the lines will be decreased when substituting a given body of a certain resistivity by another one of the same shape or size but having a comparatively higher resistivity. This case has been realised in Fig. 2 in such a manner that a point-shaped contact touches a layer of a high resistivity contacting a body of low resistivity in the entire extension of the touching surface of these two bodies. In this case the current distribution is indicated by lines 4'.

Whilst the scheme of Fig. 1 corresponds to point contact rectifiers in which the current is flowing in the open or forward direction, the scheme of Fig. 2 is an image of the current flow in the inverse direction, where a blocking layer 3 has to be provided. Within the range of high resistivity the lines may be supposed to run almost parallelly and to swell out when entering the material of better conductivity.

When regarding the relation between the direct resistance and the blocking resistance as a function of the diameter or the shape of the contact area, the resistance in the blocked direction will increase to a higher percentage than in the opposite direction when decreasing the contact area. Thus the advantage of the invention may be seen in the process to replace a contact area, given by occasional perforations in a normal blocking layer (artificial or not), by a greater number of smaller contact areas of an arbitrary defined shape. It should be understood that this explanation of the advantageous effect of the invention should not exclude another theory of the function of the device according to the invention.

Examples of the distribution of the insulating material have been drawn in the further figures. Corresponding to Fig. 3 fine parallel lines 5 of insulating material have been provided. In Fig. 4 two systems of rectangular crossed lines 5 and 6 have been shown.

Another embodiment of the invention is represented in Fig. 5, where fine points 7 in regular distribution may be produced by a printing proc-

ess. All figures have not been drawn in true scale. In at least one direction—lines in the width, points in the diameter—the size of the intermediate lacquer coating should be of the order of thickness of the semi-conducting layer and less.

A complete cell is shown in Fig. 1 having a base element 8, a semi-conductor 9, insulating screen layer 10 and counter-electrode 11. The insulating screen layer 10 shown in Fig. 6 is of the form shown in Fig. 3.

The thickness of semi-conducting layers usually lies between 0.03 and 0.10 mm. Thus the width of the lacquer stripes in Figure 3 or the diameter of the lacquer dots in Figure 5 should approximately have these values. On the other hand, the area covered with lacquer shall amount to 30–70%, preferably 40–60% of the total area. Hereby the higher percentages are to be applied in case of fine rasters only, i. e. for instance in case of narrow lacquer stripes. In the above example of a raster with lacquer stripes of 0.25 mm. width alternating with uncovered stripes of 0.15 mm. width, however, the lacquer stripes are covering only 62.5% of the total area, but due to their great width they are taking equal effect as an uninterrupted lacquer layer and therefore are not suitable for the reduction to practice of the invention.

While I have described above the principles of my invention in connection with specific methods, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention.

What is claimed is:

1. Selenium rectifier, in which an intermediate layer of insulating material is placed between the semi-conducting layer and the back electrode for an improvement in the blocking voltage, characterized in that this intermediate layer takes the form of a screen (raster).

2. Selenium rectifier as claimed in claim 1, and in which the insulating screen is made from some varnish.

3. Selenium rectifier as claimed in claim 1, and in which the screen is composed of lines.

4. Selenium rectifier as claimed in claim 3 in which the width of the lines going in one direction are of the order of the thickness of the semi-conducting layer or less.

5. Selenium rectifier as claimed in claim 1 in which the screen is composed of dots.

6. Selenium rectifier as claimed in claim 5 in which the dots have a diameter of the same order as the thickness of the semi-conducting layer or less.

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