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BLOCKING LAYER CELL

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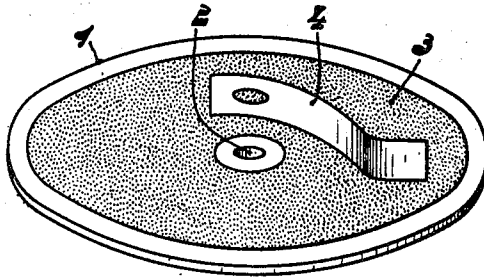


Fig. 1.

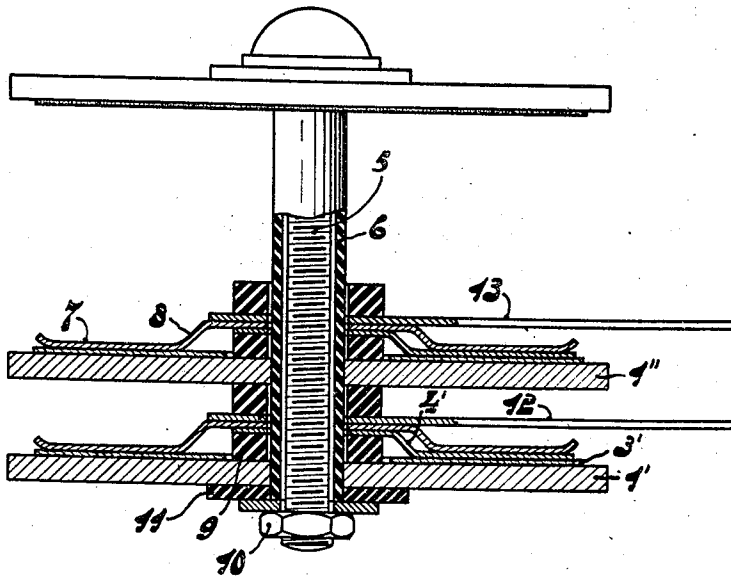


Fig. 2.

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BLOCKING-LAYER CELL

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6 Claims. (Cl. 175-366)

This invention relates to a blocking layer cell, wherein one of the electrodes consists of a thin layer of a material having a low melting point and which in itself is not sufficiently strong to act as a supporting plate.

Such blocking layer cells are used, for instance, as rectifiers or detectors. Various methods of supplying current to the electrode-layer or of taking current from them are known.

In rectifiers a number of these cells is often provided on a central bolt. One electrode usually consists of a metal layer applied by spraying. In this case a spring contact is in each instance used as a supply conductor for this electrode.

Experiments have revealed that by making use of a new method of supplying current to the thin layer of material having a low melting point important advantages can be obtained.

The invention is characterized in that the current collector of the layer made from material having a low melting point consists of a thin flexible foil which is metallically connected to the layer and bears thereon.

The advantages obtained by means of the construction according to the present invention appear from the fact that the temperature during continuous operation is lower than in a system comprising spring contacts. Moreover the yield, which in the case of spring contacts decreases after a definite number of working hours, increases in a cell according to the invention. In a cell with spring contact the blocking voltage at a constant current decreases with increasing contact pressure, so that the yield of the cell decreases, but in a cell according to the invention there is no dependency whatsoever of the contact pressure.

Only after elaborate researches it was found that the improvement obtained in this respect by means of the contact according to the invention probably results from the fact that due to oxidation extra contact resistances ensue at the contact points of the spring contacts, i. e., oxide of the applied layer of material having a low melting point, also under the influence of the higher temperature prevailing at the contact.

When it is desired to avoid this drawback by more strongly pressing the spring contacts, in which case the contact point is slightly displaced, new drawbacks arise; in this case there is a risk of pressing through the metal layer at the contact point. At any rate oxidation will occur again after some time.

The construction according to the invention yields advantages also in a mechanical respect.

Since the connecting strip is thin it may be easily bent, for instance to connect it on another plate to some circuit. The mechanical efforts occurring in bending are not transmitted to the metal layer of the cell at the point of adherence of the foil, so that this point is not subject to mechanical efforts.

It is known per se to provide on the blocking layer a drop of an alloy having a low melting point into which drop a wire is stuck during its liquid state. After coagulation of the drop it adheres itself to the insulating coating and serves as one electrode in the cell, whereas the wire clamped as a result of the coagulation serves as a supply conductor for this electrode. However, such a construction is not always practicable, for instance when a number of cells are arranged on a central bolt such as is often the case in rectifiers, or if a number of cells are directly stacked in a cylinder such as is often effected in detectors. In fact, the drop forms a protuberance on the cell due to which too much space would be occupied upon arranging a number of cells against each other. Another drawback is that due to the wire being fairly thick it is stiff so that efforts exerted on the wire are transmitted to the drop-shaped electrode due to which there is a risk of it being entirely lifted from the blocking layer.

By making use of an alloy having a low melting point, for instance, an alloy consisting of bismuth, tin and cadmium as a material of the layer to which is secured the current collector the metallic joint can be established by a melting joint between the electrode material and the material of the foil.

Thus the layer may be melted before its attachment as result of which the foil is, so to say, soldered without the temperature required therefore having to be raised to such a degree that other materials of the cell are affected due to the strong heating.

In order to ensure firm adherence between the foil and the thin metal layer, the foil consisting, for instance, of copper may previously be thinned.

It has been found that such a good and durable contact is formed that not the whole surface of the metal layer need be covered with the foil, but that a single strip is sufficient which contributes in its turn to the flexibility so that mechanical efforts are not transmitted to the joint.

For operation in moist atmospheres it is advantageous to design the cell in such manner that it is not affected by moisture. An excellent moisture seal is obtained when at least the surface of the layer of a material having a low melting point

together with the connecting foil is coated with a lacquer layer. This lacquer layer increases at the same time the mechanical strength of the joint between the foil and the metal layer.

During normal operation of the cell according to the invention, i. e., when the maximum load prescribed of the cell is not exceeded, the temperature is such that it is still materially lower than the melting temperature of the material having a low melting point. However, it may occur that due to unwise treatment of the cell or disturbance in the circuit including the cell the load of the cell increases to such a degree that the temperature exceeds the melting point of the said material. This may have various detrimental consequences. In fact, the contact between the current collector and the layer may be interrupted, for instance due to the resilient force which is always available in a curved strip or in a curved foil. Furthermore, the electrode material contracts into the form of a drop due to melting. Since the electrode bears on the blocking layer all drops are insulated from each other. If the current collector would still be electrically connected to the cell this would consequently apply only for a very limited surface of the electrode layer, in other words the load highly increases per unit surface area of the layer due to which, however, still more heat is produced. Due to this the current collector will become detached from the alloy by melting.

To avoid that in the case of excessive heating the current collector becomes detached from the electrode and the alloy contracts to form drops insulated from one another the blocking layer cell, in a suitable form of construction of the invention, is designed in such manner that the layer of a material having a low melting point is at least partly covered with a conductive member which engages this layer under pressure, the foil metalically connected to the layer being also under pressure below said member where it is not connected to this layer.

If due to excessive heating the alloy layer would nevertheless be caused to melt the current collector cannot become detached from the alloy layer since this movement is prevented by the pressure exerted by the member.

If contraction of the material into the form of separate drops would occur at other points of the alloy layer, i. e., where there is no direct contact with the current collector—only the parts below the current collector have a direct contact—this would not constitute an obstacle to the conductivity. In fact, all or nearly all drops are electrically interconnected through the said member.

When providing such a member it should be considered that excessive pressure through the electrode layer on the blocking layer may affect the blocking voltage of the cell. In order to avoid even the possibility of this risk the blocking layer cell, in a suitable form of construction, is so constructed that the conductive member exhibits a cavity at its centre which is engaged by a disk of insulating material which on its other side engages the blocking layer; to this end the layer of a material having a low melting point exhibits a cleared spot at this point.

When making use of a disc of insulating material it is ensured that the pressure at which the contact member engages the electrode layer is only determined by the preliminary tension of the resilient ends of the member, whereas the pressure ensuing, for instance, when screwing down a central bolt is entirely taken up by the

insulating discs and is not transmitted to the contact surfaces.

When these contact surfaces are made as large as possible one obtains on the one hand the advantage of a low current load and on the other hand that the mechanical surface pressure is kept low. These circumstances also permit the efficiency of the blocking layer cell to be greatly increased without involving the drawbacks involved by excessive production of heat.

The process of manufacture of a cell according to the invention will be more fully described by reference to the accompanying drawing.

In the drawing Fig. 1 is a perspective view of a blocking layer cell, whereas Fig. 2 shows part of a unit which may be used, for instance, in the Grätz circuit.

In Fig. 1 the reference number 1 denotes a supporting plate to which is applied a semi-conductive material; the plate may consist of aluminium and the semi-conductor or selenium. On the electrode is provided a blocking layer. A central hole 2 serves as a guide for positioning the plate 1 during the coating thereof with selenium and for mounting the finished blocking layer cell. Since the selenium- and the blocking layer are very thin they have been omitted in the drawing.

By means of a templet the material of the counter electrode 3 is applied by spraying which material may consist of the alloy of bismuth, tin and cadmium having a low melting point of 103° (the so-called "alloy 103"). By making use of the templet the electrode 3 acquires the outline shown in the drawing. An advantage is secured in the extension of the leakage path of the current along the edge of the plate over the blocking layer to the electrode 3. Hereinafter the inner demarcation will be more clearly set out.

A thin strip 4 of conductive material is metalically connected to the alloy. The cell can now be used without additional means as a rectifier.

When it is desired to use the cell in a circuit with a current load higher than that for which a cell is designed a plurality of cells must be connected in parallel. Likewise, a corresponding number of cells may be connected in series for higher voltages. If the maximum operating voltage in a circuit is 100% higher than the admissible maximum voltage per cell it is possible, however, to use the Grätz-circuit which comprises four cells. In this case both phases of the alternating current are rectified.

For such application the construction shown in Fig. 2 may be chosen wherein the cells whose parts bear the same reference numbers as the corresponding parts shown in Fig. 1, are slipped on a central bolt 5 which is covered with an insulating tube 6, for instance of a synthetic varnished paper.

On the layer 3' and on the strip 4' of each cell there bears a contact member 7 shaped as a cap. Owing to the preliminary tension of the parts 8 the cap exerts a definite pressure on the layer 3', which pressure solely depends on this preliminary tension. In fact, the alloy electrode has a central spot left clear through which the layer 9 of insulating material bears on the blocking layer. If the bolt is tightened by means of a nut 10 which is prevented by a ring 11 from contacting with the outer cell a force is made to act on the blocking layer through the insulating disc. However, this has no detrimental consequences even

if the blocking layer would be defective at this point.

To permit the connection to an outer circuit a soldering tag 12 is provided on which bears again a disc by which at the same time the next plate 1' is kept at the desired distance from the first-mentioned plate 1' and so on until the required number of plates together with current collectors are arranged on the bolt 5.

This bolt may at the same time serve for fastening the unit to a chassis plate.

It is advantageous to choose for the layer of a material having a low melting point a material which in itself is eminently adapted as soldering material. In this case it is not necessary to use special solder and means used for facilitating the normal soldering operation which often involve chemical attack, for instance due to the presence of acids may be omitted. For the electrode material, which is at the same time a suitable soldering material, it is advantageous to use the said alloy 103.

In establishing the metallic joint one may proceed in such manner that the foil to be attached is previously coated with a layer consisting of the electrode material as a result of which adherence of the foil to the electrode is facilitated.

What we claim is:

1. A blocking layer cell comprising a supporting plate, an electrode and blocking layer system carried by said plate and including an outer layer of a metallic material having a low melting point, and a thin substantially-unstressed strip of metal serving as a current conductor and having one end metallicity-connected and united to said outer layer.

2. A blocking layer cell comprising a supporting plate, an electrode and blocking layer system carried by said plate and including an outer layer of a metallic material having a low melting point, and a thin substantially-unstressed strip of metal

serving as a current conductor and having one end united to said outer layer by a soldered joint.

3. A blocking layer cell comprising a supporting plate, an electrode and blocking layer system carried by said plate and including an outer layer of a material having a low melting point, and a current conductor in the form of a thin substantially-unstressed strip of metal serving as a current conductor and having one end thermally-connected and united to the material of said outer layer.

4. A blocking layer cell comprising a supporting plate, an electrode and blocking layer system carried by said plate and including an outer layer of a metallic material having a low melting point, and a thin substantially-unstressed copper strip provided with a layer of tin and having one end metallicity connected and united to said outer layer.

5. A blocking layer cell comprising a supporting plate, an electrode and blocking layer system carried by said plate and including an outer electrode layer of a metallic material having a low melting point, a thin substantially-unstressed strip of metal serving as a current conductor and having one end metallicity-connected and united to said outer layer, and a protective layer of lacquer on said electrode layer and current conductor.

6. A blocking layer cell comprising a supporting plate, an electrode and blocking layer system carried by said plate and including an outer layer of a metallic material having a low melting point, a thin substantially-unstressed current conductor having one end metallicity connected and united to said outer layer, and a resilient member pressing said conductor against said outer layer with a constant and predetermined pressure.

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