

Galvanic cell

The invention relates to a galvanic cell, having a strip-shaped positive electrode, a strip-shaped negative electrode and disposed therebetween a strip-shaped separator which are rolled up in the manner of a spiral to form an electrode winding, having a cylindrical housing for receiving the electrode winding, having a cell pole which is insulated and sealed off with respect to the housing, and having a connection element which bridges the space between the cell pole and the edge of the one electrode strip in conductive manner.

A preferable application of the invention is in lithium winding cells, but also in Ni/Cd accumulators in the round cell form with wound sintered foil electrodes.

In the case of winding cells of this type, the electrode strip of the one polarity is always somewhat longer than the electrode strip of the other polarity, so that the first mentioned forms the outermost end of the spiral winding and can be brought into direct contact with the inner wall of the housing cup. Generally, the outermost spiral winding is formed by the negative electrode, and the housing cup is consequently also the negative cell pole.

The electrode strip of the other polarity must, in contrast, be connected, in a rather inconvenient manner, to the corresponding cell pole which is either a metal button made in the cell cover and insulated with respect thereto, a flange cap or a metal cell cover itself. Contact in this case always requires a connection element for bridging the space between the cell pole leading to the outside and the electrode concerned.

According to DE-PS 30 14 435, a spiral spring has the role of such a connection element, in that it brings a collector rod connected to a lithium winding electrode in contact with a metal housing cover as the negative cell pole.

In other cases, a vane is welded to one of the strip electrodes at its edge kept free of active mass. This vane, in the later stages of cell assembly, must be positioned in order to connect it by means of a resistance welding to the pole piece

leading to the outside. However, even with the shortest distance between cell pole and vane current collector a flexible intermediate connection cannot be avoided for reasons relating to welding or assembly techniques. The sealed alkaline cell according to US-PS 3 579 387 is an example of this.

Moreover, the current collector vane mounted on the electrode strip is already disruptive during winding of the electrode and reduces the capacity of the winding machine. Subsequently, the current collector vane projecting upwardly out of the cell cup is disruptive during doping of the electrolyte with vacuum, since the cell can only be sealed with difficulty. The instability of the current collector vane results, moreover, in disruptions in automated production.

There is the problem, specifically in connection with the production of lithium winding cells, that welding current collector vanes, which for the reasons indicated can also be of long dimension in order to make a zig-zag folding possible, has to be carried out in a box filled with argon.

The object of the invention is to specify a galvanic cell of the winding cell type, in which the electrical connection between the contact leading to the outside and the electrode strip of the corresponding polarity is of simpler construction, is at least easier to assemble than previously, and whereof the manufacture can easily be integrated into the production flow.

According to the invention, the object is achieved by a galvanic cell as defined in Claim 1.

The particular advantage of the invention resides in the fact that for the electrical connection of the one winding electrode - preferably the positive electrode - to its outer pole there is provided a connection element which is pre-assembled from parts outside the cell and the final positioning of which connection element is effected without a welding procedure. Even the electrode strip to be contacted needs neither to have a collector rod nor a vane-type current collector, so that none of the obstacles already mentioned are in the way either of the winding procedure or of the electrolyte doping.

The construction and function of the connection element

according to the invention can best be described by way of the production steps thereof with reference to figurative illustrations.

Fig. 1 shows the stages of pre-assembly of the novel connection element.

Fig. 2 shows a winding cell equipped with the novel connection element.

According to Fig. 1, a fork-shaped contact clip 2 is first welded centrally onto a contact plate 1 of V2A steel.

An injection moulded, centrally apertured insulating plate of polypropylene is then pressed onto the contact plate. Secure holding is produced by the press stud-like construction of the mutually engaging parts of the insulating plate and the contact clip.

In corresponding manner, a spiral conical spring 5 is then pressed onto the collar 4 which surrounds the aperture of the insulating plate, the collar 4 being constructed such that the conical spring is securely held by a resilient undercut 4a. The collar 4 at the same time serves as an insulation means between the fork-shaped contact clip 2 and the conical spring 5.

Pre-assembly of the connection element, which is effected separately from the cell, is thus complete.

The connection element is now pushed into the cell cup, which is already equipped with the electrode winding comprising anode strip, cathode strip and separator. The electrode winding is here arranged such that at least at its upper end side facing the cover the edge of the one electrode strip which is to be contacted by the pole leading to the outside and generally forms the inner side of the spiral winding projects beyond the edge of the other electrode strip.

The complete connection element, the contact plate at the very bottom, is pressed onto the projecting edge, which is for example the edge of the cathode strip, by means of a beaded mandrel, entering the open cup from above, a cylindrical die whereof the diameter is somewhat smaller than the inner diameter of the cup, while at the same time the spiral conical spring is compressed. The beaded mandrel forms the counterbearing for a

beaded wheel running around the outer side of the cup and impressing a peripheral bead into the cup wall at a point directly above the compressed spring. The spring, which is supported in the interior of the cell against the bead, remains constantly tensioned as a result of this measure, of which a pictorial representation has been dispensed with here.

The last steps of final assembly can easily be understood with reference to Figure 2, which shows the finished cell.

Already located in the cell cup 6, whereof the base is provided with an insulating mat 7, is the electrode winding, comprising the positive electrode 8, the negative electrode 9 and disposed therebetween the separator 10.

The connection element according to the invention, pre-assembled from the contact plate 1 with welded-on contact clip 2, the insulating plate 3 with collar 4 and the spiral conical spring 5, is also inserted and tensioned by way of the bead 11.

During the filling with electrolyte which now follows, a vacuum metering head is used which seals off the cell by means of its sealing element on the bead.

If the present galvanic cell is a lithium cell, then it and all further steps must be carried out in a box filled with argon or another inert gas.

The next and also last steps are placing on the cell cover and closing the cell, preferably by laser welding.

As can be seen in Fig. 2, the cover is an element which may also be pre-assembled in normal atmospheric conditions, which element comprises the metal flange cap 12 provided with a central opening, the end pole or contact 13, guided through the opening, and the seal 14. During placing on of the lid, the contact 13 is pushed in the manner of a plug into the fork-shaped contact clip 2 and the electrical connection to the (positive) electrode 8 by way of the connection element according to the invention is thus produced.

Since all the parts to be assembled have rotational symmetry, positioning of current collector elements is dispensed with, which is conducive to automated production at high cycle speeds.

No welding operation is necessary during the actual assembly of the cell. By means of the electrolyte doping procedure, the zone which is subsequently to be welded by laser is not wetted with electrolyte.

If production steps are to be carried out in an inert gas atmosphere, then they are restricted to cells having air-sensitive active components, such as lithium winding cells.



Claims

1. Galvanic cell, having a strip-shaped positive electrode, a strip-shaped negative electrode and disposed therebetween a strip-shaped separator which are rolled up in the manner of a spiral to form an electrode winding, having a cylindrical housing for receiving the electrode winding, having a cell pole which is insulated and sealed off with respect to the housing, and having a connection element which bridges the space between the cell pole and the edge of the one electrode strip in conductive manner, characterized in that the connection element is a combination of a contact plate (1) having a centrally welded-on fork-shaped contact clip (2) and a pressure spring (5) placed on the contact plate with the interposition of a centrally apertured insulating plate (3), the contact plate being pressed by the force of the tensioned pressure spring onto the edge of the one electrode strip (8) projecting at the end side of the winding, and in that the terminal pole (14) is inserted into the fork-shaped contact clip.
2. Galvanic cell according to Claim 1, characterized in that the tensioned pressure spring is supported against a bead (12) running around the cell housing (6).
3. Galvanic cell according to Claim 2, characterized in that the one electrode strip which is contacted by the pole current collector is the positive electrode.
4. Galvanic cell according to one of Claims 1 to 3, characterized in that it is a lithium winding cell.