

SPECIFICATION

Electric batteries having spirally wound electrodes

5 The present invention relates to a battery in which a spiral electrode is formed by band-shaped positive and negative electrode plates with a separator layer therebetween wound upon a collector rod serving also as a winding core and the thus formed spiral

10 electrode is housed in a battery casing whose opening is closed by a lid through an insulating packing, with the battery casing and the lid simultaneously forming the terminals of the battery, respectively.

15 In a conventional battery in which a spiral electrode has been formed by band-shaped positive and negative electrode plates with a separator layer therebetween wound upon a collector rod serving also as a winding core and thus formed spiral

20 electrode has been housed in a casing, a fine round pin has been used as such collector rod. Accordingly, when these positive and negative electrode plates with a separator layer therebetween have been wound upon the collector rod, such

25 collector rod comprising a round pin has been apt to be rotated idle and subsequently it has been necessary to fix fairly strongly one end of the collector rod to a winding machine. The working efficiency has therefore been lowered.

30 Furthermore, in a viewpoint of electrical connection means, when conductive resilient means of a coil spring has been merely disposed between the collector rod and the battery vessel, it has been feared that such conductive resilient means has

35 easily come off from the desired position due to vibration or the like since the end area of the collector rod comprising a round pin has been small. It has therefore been necessary to spot-weld one end of the conductive resilient means to the collector

40 rod. The working efficiency has therefore been lowered.

According to the present invention there is provided a battery comprising a collector rod serving also as a winding core and having at one end

45 thereof a flange of non-circular shape, positioning means formed on said flange, a spiral electrode formed by band-shaped positive and negative electrode plates with a separator layer therebetween wound upon said collector rod with one of said

50 electrode plates electrically connected to said collector rod, a battery casing housing said spiral electrode and to which the other of said electrode plates is electrically connected, a lid hermetically closing said battery casing and separated from the

55 casing by an electrically insulating packing, said lid forming a terminal of said one electrode plate, and conductive resilient means having one end positioned by said positioning means and the other end in contact with said lid, said conductive resilient

60 means being compressed between said flange and said lid to electrically connect said collector rod to said lid.

Two embodiments of the present invention will now be described, by way of examples, with

65 reference to the accompanying drawings, in which:-

Figure 1 is a longitudinal section view of a first embodiment of a battery in accordance with the present invention,

Figure 2 is an enlarged longitudinal section view of the upper portion of *Figure 1*,

Figure 3 is a perspective view of a collector rod used in the first embodiment shown in *Figure 1*,

Figure 4 is an enlarged longitudinal section view of main portions of a second embodiment of a battery in accordance with the present invention, and

Figure 5 is a perspective view of a collector rod used in the second embodiment shown in *Figure 4*.

The description hereinafter will describe a cylindrical lithium battery to which the present invention is applied.

The battery shown in *Figures 1* to *3* has a negative electrode collector rod 1 which serves also as a winding core and has at one end thereof a square-shaped flange 2. A rod-shaped projection 3 serving as a positioning means is formed on the upper surface of the flange 2 and is in a unitary construction therewith.

A spiral electrode 4 is formed in such a way that a band-shaped negative electrode plate 5 formed from a lithium rolled plate is electrically connected and secured at one end thereof to the collector rod 1, and a band-shaped positive electrode plate 7 formed from, for example manganese dioxide as active material, is superposed on the negative electrode plate 5 with a separator layer 6 therebetween, and the negative electrode plate 5, separator layer 6 and positive electrode plate 7 are wound upon the collector rod 1 with the flange 2 attached to a fixing jig means (not shown).

An insulating sheet 9 is disposed on the inner bottom surface of a battery casing 8 simultaneously forming a terminal of the positive electrode. The spiral electrode 4 is housed in the battery casing 8, and the positive electrode plate 7 located at the outermost circumference of the spiral electrode 4 is electrically connected to the battery casing 8 by means of contact pressure.

A lid 10 hermetically closes the opening of the battery casing 8 through insulating packing 11. Conductive resilient means 12 comprising for example a coil spring has one end positioned by being fitted to the projection 3 on the upper surface of the flange 2 and the other end is in contact with the lower surface of the lid 10. The mounting of the lid 10 to the battery vessel 8 causes the conductive resilient means 12 to be compressed and such compressed conductive resilient means 12 causes the negative electrode plate 5 to be electrically connected, through the collector rod 1 and the conductive resilient means 12, to the lid 10 simultaneously forming a negative electrode terminal.

The description hereinafter will discuss a second embodiment of the present invention with reference to *Figures 4* and *5*.

It is to be noted that like parts are designated by like numerals used in describing the first embodiment shown in *Figures 1* to *3*.

The second embodiment is different from the first

embodiment in the form of positioning means formed on the upper surface of a non-circular shape flange 14 disposed at one end of a negative electrode collector rod 13.

- 5 In the second embodiment, as the positinging means a concave portion 15 is formed in the upper surface of the flange 14. One end of the conductive resilient means 12 is fitted into this concave portion 15, so that the conductive resilient means 12 may be positioned at a predetermined position.

10 According to the battery of the present invention, the non-circular shape flange formed at one end of the collector rod serving also as a winding core prevents the collector rod 1, 13 from being rotated when the band-shaped positive and negative electrode plates 4 are wound upon the collector rod 1, 13. Therefore, the winding operation may readily be performed, thereby to enhance the working efficiency.

- 20 Furthermore, according to the present invention, the provision of positioning means on the flange 2, 14 eliminates the necessity of weldingly connecting one end of the conductive resilient means 12 to the collector rod 1, 13, and permits the conductive resilient means 12 to be positioned at a predetermined position all the time, whereby electrical connection means may be improved.

CLAIMS

- 30 1. A battery comprising a collector rod serving also as a winding core and having at one end thereof a flange of non-circular shape, positioning means formed on said flange, a spiral electrode formed by band-shaped positive and negative electrode plates with a separator layer therebetween wound upon said collector rod with one of said electrode plates electrically connected to said collector rod, a battery casing housing said spiral electrode and to which the other of said electrode plates is electrically connected, a lid hermetically closing said battery casing and separated from the casing by an electrically insulating packing, said lid forming a terminal of said one electrode plate, and conductive resilient means having one end positioned by said positioning means and the other end in contact with said lid, said conductive resilient means being compressed between said flange and said lid to electrically connect said collector rod to said lid.
- 45 2. A battery as claimed in claim 1, in which the positioning means comprises a projection provided on the upper surface of the flange of the collector rod.
- 50 3. A battery as claimed in claim 1, in which the positioning means comprises a concave portion formed in the upper surface of the flange of the collector rod.
- 55 4. A battery as claimed in any preceding claim, in which the conductive resilient means is a coil spring.
- 60 5. A battery as claimed in any preceding claim, in which the positive and negative electrode plates constituting the spiral electrode are a band-shaped negative electrode plate formed from a lithium rolled plate, and a band-shaped positive electrode plate formed by manganese dioxide as active material,
- 65

respectively.

6. A battery substantially as hereinbefore described with reference to and as illustrated in Figures 1 to 3 or Figures 4 and 5 of the accompanying drawings.
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- 5 In the second embodiment, as the positinging means a concave portion 15 is formed in the upper surface of the flange 14. One end of the conductive resilient means 12 is fitted into this concave portion 15, so that the conductive resilient means 12 may be positioned at a predetermined position.

10 According to the battery of the present invention, the non-circular shape flange formed at one end of the collector rod serving also as a winding core prevents the collector rod 1, 13 from being rotated 15 when the band-shaped positive and negative electrode plates 4 are wound upon the collector rod 1, 13. Therefore, the winding operation may readily be performed, thereby to enhance the working efficiency.

- 20 Furthermore, according to the present invention, the provision of positioning means on the flange 2, 14 eliminates the necessity of weldingly connecting one end of the conductive resilient means 12 to the collector rod 1, 13, and permits the conductive 25 resilient means 12 to be positioned at a predetermined position all the time, whereby electrical connection means may be improved.

CLAIMS

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1. A battery comprising a collector rod serving also as a winding core and having at one end thereof a flange of non-circular shape, positioning means formed on said flange, a spiral electrode formed by 35 band-shaped positive and negative electrode plates with a separator layer therebetween wound upon said collector rod with one of said electrode plates electrically connected to said collector rod, a battery casing housing said spiral electrode and to which the 40 other of said electrode plates is electrically connected, a lid hermetically closing said battery casing and separated from the casing by an electrically insulating packing, said lid forming a terminal of said one electrode plate, and conductive 45 resilient means having one end positioned by said positioning means and the other end in contact with said lid, said conductive resilient means being compressed between said flange and said lid to electrically connect said collector rod to said lid.
- 50 2. A battery as claimed in claim 1, in which the positioning means comprises a projection provided on the upper surface of the flange of the collector rod.

3. A battery as claimed in claim 1, in which the 55 positioning means comprises a concave portion formed in the upper surface of the flange of the collector rod.

4. A battery as claimed in any preceding claim, in which the conductive resilient means is a coil spring.

- 60 5. A battery as claimed in any preceding claim, in which the positive and negative electrode plates constituting the spiral electrode are a band-shaped negative electrode plate formed from a lithium rolled plate, and a band-shaped positive electrode plate 65 formed by manganese dioxide as active material,

respectively.

6. A battery substantially as hereinbefore described with reference to and as illustrated in Figures 1 to 3 or Figures 4 and 5 of the 70 accompanying drawings.

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