

## SPECIFICATION

### Battery

5 Conventional batteries in which a plurality of positive and negative electrodes are alternately superposed with separator layers therebetween, have been constructed in such a manner that two electrodes having a same polarity are connected to each other by a current collector member, and one of the pair of negative electrodes is superposed on one of the pair of positive electrodes with a separator layer therebetween and the other one of the pair of positive electrodes is then turned to be superposed on said one of the pair of negative electrodes with a separator layer therebetween and the other one of the pair of negative electrodes is then turned to be superposed on said other one of the pair of positive electrodes with a separator layer therebetween.

20 Therefore, there has been a possibility of internal short-circuit due to positional shifting of the electrodes or separator layers during the assembling, thereby to require a highly accurate assembling work. In addition, the assembling itself has been extremely complicated.

25 According to the present invention in one aspect there is provided a battery comprising a pair of electrodes having one polarity, an electrode having the other polarity interposed between said pair of electrodes, separator layers between said electrodes, central bores provided in said separator layers and said electrode having said other polarity, an electrical contact member extending through said central bores whereby said pair of electrodes having said one polarity are electrically connected to each other by means of said electrical contact member, and an insulating member disposed between said electrical contact member and said electrode having said other polarity.

40 According to the present invention in another aspect there is provided a battery comprising a circular electrode having one polarity interposed between two circular electrodes having the other polarity and of larger diameter, separator layers between said electrodes, the superposed small and larger diameter electrodes being disposed in a cylindrical conductive case such that said larger diameter electrodes are closely fitted into said cylindrical conductive case thereby to be electrically connected to said cylindrical conductive case, an electrode having said one polarity being superposed on the upper electrode of said larger diameter electrode, with a separator layer therebetween, central bores formed in said upper larger diameter electrode and said separator layers sandwiching said upper larger diameter electrode, an electrical contact member extending through said central bores whereby said electrode having said one polarity is electrically connected to said smaller diameter electrode disposed in said cylindrical conductive case, by means of said electrical contact member, and an insulating member is disposed between said electrical contact member and said upper larger diameter electrode.

65 According to the present invention in yet another aspect there is provided a battery comprising a circu-

lar electrode having one polarity interposed between two larger diameter electrodes having the other polarity, with separator layers between said electrodes, said superposed electrodes being disposed in a cylindrical conductive case such that said larger diameter electrodes are closely fitted into said cylindrical conductive case, thereby to be electrically connected to said cylindrical conductive case, a concave space defined by an insulating packing disposed at the periphery of a closure cover of a battery vessel, within said concave space an electrode having said other polarity at the lower portion of said concave space and an electrode having said one polarity at the upper portion of said concave space, with a separator layer therebetween, said upper large diameter electrode disposed in said cylindrical conductive case being electrically connected to said electrode having said other polarity disposed within said concave space of said closure cover, central bores provided in said electrodes having said other polarity to be thus electrically connected and in said separator layers disposed at the both sides of said electrodes having said other polarity to be thus electrically connected, and an electrical contact member extending through said central bores whereby said smaller diameter electrode disposed in said cylindrical conductive case is electrically connected to said electrode having said one polarity disposed in said closure cover, by means of said electrical contact member.

Some embodiments of the invention will now be described, by way of examples, with reference to the accompanying drawings, in which:—

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

Figure 2 is a disassembled perspective view of the battery constituting elements of Figure 1;

Figure 3 is a section view of a second embodiment of the present invention;

Figure 4 is a disassembled perspective view of the battery constituting elements of Figure 2;

Figure 5 is a section view of a third embodiment of the present invention;

Figure 6 is a section view, illustrating the assembling process of the battery shown in Figure 5;

Figure 7 is a section view of a fourth embodiment of the present invention;

Figure 8 is a perspective view of a conductive case;

Figure 9 is a perspective view of another form of a conductive case;

Figure 9 is a section view of a fifth embodiment of the present invention;

Figure 11 is a disassembled perspective view of an electrical contact member used in the battery shown in Figure 10;

Figure 12 is a section view of a sixth embodiment of the present invention;

Figure 13 is a section view of a seventh embodiment of the present invention;

Figure 14 is an enlarged section view of portions of the battery shown in Figure 13; and

Figure 15 is a section view of an eighth embodiment of the present invention.

Similar reference numerals denote similar parts in

the different views.

A first embodiment will be described with reference to Figures 1 and 2 illustrating a flat lithium battery.

- 5 Through an insulating packing 3, a closure cover 1 which simultaneously forms the terminal of a positive pole, is sealed to a battery vessel 2 by turning in to the C-shape the edge 2' of the opening of the battery vessel 2, which simultaneously forms the terminal of a negative pole. Thus, an element housing space is provided between the closure cover 1 and the vessel 2. A first negative electrode collector member 4A made of a stainless steel net is spot-welded to the inner surface of the bottom of the vessel 2. Superposed on this negative electrode collector member 4A are a first negative electrode 5A, a separator layer 6A, a first positive electrode 7A and a separator layer 6B.

- 10 Central bores 8 of the same shape are provided in the separator layers 6A and 6B, and the first positive electrode 7A. Extending through these central bores 8 is an electrical contact member 10 made of a bar of conductive material, of which at least the portion in contact with the first positive electrode 7A is covered by a cylindrical insulating member 9.

- 25 Further superposed on the separator layer 6B are a second negative electrode 5B, a second negative electrode collector member 4B, a separator layer 6C, and a second positive electrode 7B, and a positive electrode collector tab 7' is connected to and projects from the first positive electrode 7A and is placed onto the second positive electrode 7B. At the time of closing the opening of the vessel 2, this positive electrode collector tab 7' is contact-pressed to the inner surface of the closure cover 1, whereby electrical contact is provided between the closure cover 1 and the positive electrode 7A. The separator layers 6A, 6B and 6C are impregnated with a predetermined amount of an electrolyte during the assembling.

- 40 The first and second negative electrodes 5A and 5B are made by being stamped out from a rolled lithium plate. The first and second positive electrodes 7A and 7B are made in such a way that a conductive agent and a viscous liquid are added to active material of manganese dioxide so as to form paste, which is subsequently applied to the positive electrode collector member 11, which is then finally dried.

- 50 The insulating member 9 may be made of polypropylene resin or polyethylene resin.

- According to the battery of the first embodiment, the central bores 8 are formed in a pair of separator layers 6A and 6B and the positive electrode 7A and these are interposed between a pair of negative electrodes 5A and 5B, and the electrical contact member 10 of which at least the portion in contact with the positive electrode 7A is covered with the insulating member 9, is passed through these central bores 8, whereby this electrical contact member 10 prevents a plurality of electrodes from being positionally shifted thereby to prevent internal short-circuit, and permits a pair of negative electrodes 5A and 5B to be electrically connected to each other.

- 65 It is to be noted that the negative electrodes 5A and 5B may also be made of soft and light metal

such as magnesium or sodium, besides lithium.

A second embodiment of the present invention will now be described with reference to Figures 3 and 4.

- 70 A battery vessel 12 simultaneously forming the terminal of a positive pole may be made of stainless steel. A cylindrical conductive case 13 simultaneously forming a positive electrode collector member, is provided at one end thereof with an inwardly turned flange 14.

- 75 Disposed in the conductive case 13 are a pair of first and second positive electrodes 15A and 15B having such a diameter as to closely contact with the inner wall surface of the conductive case 13 and a first negative electrode 17A having a diameter smaller than that of the positive electrodes 15A and 15B, this first negative electrode 17A being sandwiched between the separator layers 16A and 16B. The pair of the positive electrodes 15A and 15B are electrically contacted to each other by means of the conductive case 13, which is fitted into the battery vessel 12, whereby electrical contact is provided between the conductive case 13 and the battery vessel 12 by the contact thereof. It is to be noted that the first negative electrode 17A has such a diameter as not to come in contact with the conductive case 13.

- 90 An insulating packing 19 is integrally disposed at the peripheral edge of a closure cover 18 which simultaneously forms the terminal of a negative pole. A negative electrode collector net 20 made of stainless steel is securely fixed to the inner surface of the closure cover 18 by spot-welding. A second negative electrode 17B is contact-pressed to the negative electrode collector net 20 in the concave space defined by the plane portion of the closure cover 18 and the insulating packing 19. This second negative electrode 17B is superposed on the first positive electrode 15A with a separator layer 16C therebetween.

- 105 Central bores 21 are provided in the first positive electrode 15A and the separator layers 16A and 16C. Extending through these central bores 21 is an electrical contact member 22, of which at least the portion in contact with the positive electrode 15A is covered by an insulating member 23. Both ends 22' and 22'' of the electrical contact member 22 terminate in the first and second negative electrodes 17A and 17B, respectively.

- 115 With the conductive case 13 fitted into the battery vessel 12, the insulating packing 19 disposed at the periphery of the closure cover 18 is placed onto the flange 14 of the conductive case 13. The battery vessel 12 is then closed by turning inwardly the opening edge thereof. The other end 22'' of the electrical contact member 22 of which one end 22' terminates in the first negative electrode 17A, is then forcibly entered into the second negative electrode 17B, whereby a pair of negative electrodes 17A and 17B are electrically connected to each other by means of the electrical contact member 22.

- 125 According to the battery of the second embodiment of the present invention, the positive electrodes 15A and 15B have such a diameter as to closely contact the inner wall surface of the cylindrical conductive case 13, and are electrically con-

5 nected to each other by means of the conductive case 13, and the negative electrodes 17A and 17B have a smaller diameter than that of the positive electrode 15A and 15B and are electrically connected to each other by means of the electrical contact member 22 which is passed through the central bores 21 formed in the large diameter positive electrode 15A and the separator layers 16A and 16C. Such construction is therefore very simple as compared with a conventional battery in which the assembling has been made after a pair of electrodes having a same polarity were electrically connected to each other in advance by a conductive member. Namely, according to the present invention electrical contact between the electrodes having a same polarity may be provided only by superposing in succession each of individually formed positive and negative electrodes, thereby to simplify the assembling work to a great extent.

20 The electrical contact member 22 disposed at the centre positions of the electrodes prevents such electrodes from positionally shifting, thereby to prevent internal short-circuit.

25 A battery vessel simultaneously forming the terminal of one pole may also be used as a cylindrical conductive case, although the cylindrical conductive case 13 has been shown as fitted into the battery vessel 12 in the second embodiment above-mentioned.

30 It is to be noted that the present invention may also be applied to alkaline batteries as well as non-aqueous batteries as shown in the first and second embodiments.

35 A third embodiment of the present invention will be described with reference to Figures 5 and 6.

This third embodiment differs from the second embodiment shown in Figures 3 and 4, in the following respects.

40 This third embodiment is constructed similar to that of the second embodiment in which the negative electrode collector net 20 is securely spot-welded to the inner surface of the closure cover 18, and the second negative electrode 17B and the separator layer 16C are contact-pressed to the negative electrode collector net 20 within the concave space defined by the plane portion of the closure cover 18 and the insulating packing 19. In the third embodiment, however, a third positive electrode 15C is contact-pressed to the separator layer 16C and housed in said concave space. This third positive electrode 15C is contact-pressed to the first positive electrode 15A in the conductive case 13 through a resilient conductive plate 24, whereby electrical contact is provided between the first positive electrode 15A and the third positive electrode 15C. Central bores 21 are also formed in the third positive electrode 15C and the conductive plate 24. The electrical contact member 22 is passed through these central bores 21 and the ends 22' and 22'' of the electrical contact member 22 are in contact with or terminate in the pair of negative electrodes 17A and 17B, respectively.

A battery of the third embodiment is assembled as described in the following.

65 As shown in Figure 6, the first negative electrode

17A sandwiched between the separator layers 16A and 16B is held by and between the first and second positive electrodes 15A and 15B, which is subsequently fitted into the conductive case 13. The electrical contact member 22 is passed through the central bore 21 in the first positive electrode 15A and is then contact-pressed to the first negative electrode 17A. Thus assembled elements are then fitted into the battery vessel 12. The conductive plate 24 is then placed on the first positive electrode 15A. On the other hand, the second negative electrode 17B and the third positive electrode 15C with the separator layer 16C therebetween are housed in the concave space defined by the plane portion of the closure cover 18 and the insulating packing 19. Thus assembled closure cover 18 is then placed on the flange 14 of the conductive case 13. Finally, the peripheral edge of the opening of the battery vessel 12 is inwardly turned to securely close the closure cover 18, whereby a completed battery is produced.

85 In the batteries of the type using a rolled lithium plate for the negative electrodes 17A and 17B as in the third embodiment discussed hereinbefore, the negative electrodes 17A and 17B are very thin, but the insulating packing 19 may not be formed so thinly, because the closing structure has to be sufficiently rigid so as to be put into practice. Accordingly, when only the negative electrode 17B made of a rolled lithium plate is disposed in the concave space defined by the closure cover 18 and the insulating packing 19 at the periphery thereof, a large vacant space is then formed, which is disadvantageous in view of the volumetric efficiency. In the battery constructed according to the third embodiment, however, the negative electrode 17B is disposed together with the positive electrode 15C, thereby to improve the volumetric efficiency.

Where lithium is used as negative electrode active material and manganese dioxide is used as positive electrode active material as shown in the third embodiment, a state of their electrical chemical equilibrium is provided when the ratio by volume of the lithium pole to the manganese dioxide pole is about 1:2. Accordingly, the ratio of the thickness of the positive electrode interposed between the pair of negative electrodes to that of the positive electrode located at the end of the laminated electrode group, will be about 2:1, if this pair of positive electrodes have a same diameter. However, it requires extremely complicated operations to manufacture positive electrodes having different thicknesses, since the positive electrodes are made, as mentioned earlier, according to the powder-pressed method or the pasted method.

120 In this third embodiment, however, it may be sufficient only to adjust the ratio of the thickness of the first negative electrode 17A to the second negative electrode 17B, to about 2:1, if the first, second and third positive electrodes 15A, 15B and 15C have a same thickness as shown in Figure 5. Namely the negative electrodes 17A and 17B are made of a rolled lithium plate, and the adjustment of the thickness of such negative electrodes is therefore made much easier than that for positive electrodes, thereby to improve the battery manufacturing effi-

ciency to a great extent.

A fourth embodiment of the present invention will now be described with reference to Figures 7 to 9.

This fourth embodiment differs from the third embodiment shown in Figure 5, in the following points.

In the third embodiment above-mentioned, the conductive case 13 is provided with the flange 14 the width of which is formed rather narrow, and the conductive plate 24 is used for providing electrical contact between the first and third positive electrodes 15A and 15C. In this fourth embodiment, however, a relatively wide flange 25 is disposed at the periphery of one end of the conductive case 13 and a central bore 26 is provided in the flange 25, and the cylindrical insulating member 23 above-mentioned is pressingly inserted into and fixed to this central bore 26. This insulating member 23 is also passed through the central bores 21 in the third positive electrode 15C and the separator 16C at the upper portion of the insulating member 23, and the central bores 21 in the first positive electrode 15A and the separator 16A at the lower portion of the insulating member 23. It is to be noted that the electrical contact member 22 is pressingly inserted into this insulating member 23.

As shown in Figure 9, projections 27 may be formed on both surfaces of the flange 25. These projections 27 are forcibly entered into the positive electrodes 15C and 15A disposed on and under the flange 25, whereby the current collecting effect is improved.

Provision of such a wide flange 25 at the edge of one end of the conductive case 13 may therefore cause two electrodes disposed on and under the flange 25, to be electrically connected to each other. In addition, press-insertion of the insulating member 23 into the central bore 26 in the flange 25 of the conductive case 13 may improve the battery assembling efficiency. Furthermore, the projections 27 on both surfaces of the flange 25 provide good electrical contact between the electrodes 15A and 15C having a same polarity which are disposed on and under the flange 25.

A fifth embodiment of the present invention will now be described with reference to Figures 10 and 11.

This fifth embodiment differs from the second embodiment shown in Figure 3, in the following respects.

In the second embodiment, the electrical contact member 22 is formed of a single rod. In the fifth embodiment, however, as shown in Figure 11 an electrical contact member 28 comprises a conductive plate 30 provided with a plurality of bores 29 and a thumbtack-shape conductive pin 31, which is connectingly inserted into the central bore 29' in the conductive plate 30, this conductive pin 31 being provided at the external circumferential surface thereof with the insulating member 23.

When the conductive plate 30 is press-contacted to the first negative electrode 17A so that the conductive plate 30 be pressingly entered into the first negative electrode 17A, the conductive plate 30 constituting the electrical contact member 28 comes in con-

tact with the first negative electrode 17A in a large area, thereby to reduce the contact resistance and to enhance the current collecting effect.

Furthermore, in this fifth embodiment the positioning of the electrical contact member 28 may be made in an easier way, whereby the assembling efficiency is improved.

A sixth embodiment of the present invention will now be described with reference to Figure 12.

This sixth embodiment differs from the fifth embodiment shown in Figure 10, in the following respects.

In the fifth embodiment, the upper end of the conductive pin 31 of the electrical contact member 28 is press-contacted to the second negative electrode 17B. In this sixth embodiment, however, as shown in Figure 12 the central bore 21 is defined also in the second negative electrode 17B which is contact-pressed to the inner surface of the closure cover 18 through the negative electrode collector net 30, and the conductive pin 31 is passed also through this central bore 21 in the second negative electrode 17B. The tip 32 of the conductive pin 31 is then spot-welded to the negative electrode collector net 20. Such spot-welding may reduce the contact resistance to enhance the current collecting effect.

A seventh embodiment of the present invention will now be described with reference to Figures 13 and 14.

This seventh embodiment differs from the sixth embodiment shown in Figure 12, in the following respects.

In the sixth embodiment, the tip 32 of the conductive pin 31 of the electrical contact member 28 is spot-welded to the negative electrode collector net 20. In this seventh embodiment, however, a second conductive pin 31' having a shape substantially similar as that of the conductive pin 31, is securely fixed to the inner surface of the closure cover 18 together with the negative electrode collector net 20 by a spot-welding. The second conductive pin 31' is passed through the second negative electrode 17B, which is press-contacted to the concave space of the closure cover 18, so that the lower end of the second conductive pin 31' is projected from the second negative electrode 17B.

As shown in Figure 14 the inner diameter L of the cylindrical insulating member 23' is slightly smaller than the total of the outer diameters / of the conductive pins 31 and 31'. The conductive pins 31 and 31' are inserted into the insulating member 23' from each of the openings thereof, respectively, and within the insulating member 23' the conductive pins 31 and 31' are overlapped and press-contacted to each other, whereby electrical contact is provided between the conductive pins 31 and 31'.

In such arrangement, the conductive pins 31 and 31' projected from the first and second negative electrodes 17A and 17B are presscontacted to each other within the insulating member 23', whereby more secure electrical contact is provided between the conductive pins 31 and 31'.

An eighth embodiment of the present invention will now be described with reference to Figure 15.

This eighth embodiment is one in which the

seventh embodiment shown in Figure 13 is being applied to the third embodiment shown in Figure 5. Namely, in this eighth embodiment, as shown in Figure 15, a third positive electrode 15C is disposed on the first positive electrode 15A through a conductive plate 24', thereby to provide more secure electrical contact between the first and second negative electrodes 17A and 17B, like the seventh embodiment.

#### 10 CLAIMS

1. A battery comprising a pair of electrodes having one polarity, an electrode having the other polarity interposed between said pair of electrodes, separator layers between said electrodes, central bores provided in said separator layers and said electrode having said other polarity, an electrical contact member extending through said central bores whereby said pair of electrodes having said one polarity are electrically connected to each other by means of said electrical contact member, and an insulating member disposed between said electrical contact member and said electrode having said other polarity.

2. A battery comprising a circular electrode having one polarity interposed between two circular electrodes having the other polarity and of larger diameter, separator layers between said electrodes, the superposed small and larger diameter electrodes being disposed in a cylindrical conductive case such that said larger diameter electrodes are closely fitted into said cylindrical conductive case thereby to be electrically connected to said cylindrical conductive case, an electrode having said one polarity being superposed on the upper electrode of said larger diameter electrode, with a separator layer therebetween, central bores formed in said upper larger diameter electrode and said separator layers sandwiching said upper larger diameter electrode, an electrical contact member extending through said central bores whereby said electrode having said one polarity is electrically connected to said smaller diameter electrode disposed in said cylindrical conductive case, by means of said electrical contact member, and an insulating member is disposed between said electrical contact member and said upper larger diameter electrode.

3. A battery as claimed in claim 2, in which said cylindrical conductive case simultaneously forms a collector member having said other polarity and is fitted into a battery vessel simultaneously forms a collector member having said other polarity and is fitted into a battery vessel simultaneously forming the terminal of said other polarity, and said battery vessel is closed by a closure cover simultaneously forming the terminal of said one polarity, through an insulating packing.

4. A battery comprising a circular electrode having one polarity interposed between two larger diameter electrodes having the other polarity, with separator layers between said electrodes, said superposed electrodes being disposed in a cylindrical conductive case such that said larger diameter electrodes are closely fitted into said cylindrical conductive case, thereby to be electrically connected to said cylindrical conductive case, a concave space

defined by an insulating packing disposed at the periphery of a closure cover of a battery vessel, within said concave space an electrode having said other polarity at the lower portion of said concave space and an electrode having said one polarity at the upper portion of said concave space, with a separator layer therebetween, said upper large diameter electrode disposed in said cylindrical conductive case being electrically connected to said electrode having said other polarity disposed within said concave space of said closure cover, central bores provided in said electrodes having said other polarity to be thus electrically connected and in said separator layers disposed at the both sides of said electrodes having said other polarity to be thus electrically connected, and an electrical contact member extending through said central bores whereby said smaller diameter electrode disposed in said cylindrical conductive case is electrically connected to said electrode having said one polarity disposed in said closure cover, by means of said electrical contact member.

5. A battery as claimed in claim 4, in which said cylindrical conductive case simultaneously forms a collector member having said other polarity and is fitted into said battery vessel and forms the terminal of said other polarity, and said battery vessel is closed by said closure cover and forms the terminal of said one polarity, through said insulating packing.

6. A battery as claimed in any of claims 1, 2 and 4, in which said electrodes having said one polarity to be electrically connected to each other by means of said electrical contact member are made of soft and light metal plate, and the ends of said electrical contact member are forcibly entered into said electrodes having said one polarity, respectively, whereby said electrodes having said one polarity are electrically connected to each other by means of said electrical contact member.

7. A battery as claimed in claim 6, in which each plate is formed of lithium, magnesium or sodium.

8. A battery as claimed in claim 4, in which said smaller diameter electrode is formed with lithium used as active material, and said larger diameter electrodes are formed with manganese dioxide used as active material.

9. A battery as claimed in claim 4, in which a flange is provided on said cylindrical conductive case, and the electrodes having said other polarity are disposed on and under said flange whereby said electrodes having said other polarity are electrically connected to each other by said flange.

10. A battery as claimed in claim 9, in which projections are provided on both surfaces of said flange of said cylindrical conductive case.

11. A battery as claimed in any of claims 1, 2 and 4, in which said electrical contact member comprises a conductive plate in contact with at least one of said electrodes having said one polarity, and a conductive pin for electrically connecting said electrodes having said one polarity to each other.

12. A battery as claimed in any of claims 1, 2 and 4, in which said electrical contact member comprises a pair of conductive pins, each projecting into each of the facing surfaces of said electrodes having said



seventh embodiment shown in Figure 13 is being applied to the third embodiment shown in Figure 5. Namely, in this eighth embodiment, as shown in Figure 15, a third positive electrode 15C is disposed on the first positive electrode 15A through a conductive plate 24', thereby to provide more secure electrical contact between the first and second negative electrodes 17A and 17B, like the seventh embodiment.

#### 10 CLAIMS

1. A battery comprising a pair of electrodes having one polarity, an electrode having the other polarity interposed between said pair of electrodes, separator layers between said electrodes, central bores provided in said separator layers and said electrode having said other polarity, an electrical contact member extending through said central bores whereby said pair of electrodes having said one polarity are electrically connected to each other by means of said electrical contact member, and an insulating member disposed between said electrical contact member and said electrode having said other polarity.

2. A battery comprising a circular electrode having one polarity interposed between two circular electrodes having the other polarity and of larger diameter, separator layers between said electrodes, the superposed small and larger diameter electrodes being disposed in a cylindrical conductive case such that said larger diameter electrodes are closely fitted into said cylindrical conductive case thereby to be electrically connected to said cylindrical conductive case, an electrode having said one polarity being superposed on the upper electrode of said larger diameter electrode, with a separator layer therebetween, central bores formed in said upper larger diameter electrode and said separator layers sandwiching said upper larger diameter electrode, an electrical contact member extending through said central bores whereby said electrode having said one polarity is electrically connected to said smaller diameter electrode disposed in said cylindrical conductive case, by means of said electrical contact member, and an insulating member is disposed between said electrical contact member and said upper larger diameter electrode.

3. A battery as claimed in claim 2, in which said cylindrical conductive case simultaneously forms a collector member having said other polarity and is fitted into a battery vessel simultaneously forms a collector member having said other polarity and is fitted into a battery vessel simultaneously forming the terminal of said other polarity, and said battery vessel is closed by a closure cover simultaneously forming the terminal of said one polarity, through an insulating packing.

4. A battery comprising a circular electrode having one polarity interposed between two larger diameter electrodes having the other polarity, with separator layers between said electrodes, said superposed electrodes being disposed in a cylindrical conductive case such that said larger diameter electrodes are closely fitted into said cylindrical conductive case, thereby to be electrically connected to said cylindrical conductive case, a concave space

defined by an insulating packing disposed at the periphery of a closure cover of a battery vessel, within said concave space an electrode having said other polarity at the lower portion of said concave space and an electrode having said one polarity at the upper portion of said concave space, with a separator layer therebetween, said upper large diameter electrode disposed in said cylindrical conductive case being electrically connected to said electrode having said other polarity disposed within said concave space of said closure cover, central bores provided in said electrodes having said other polarity to be thus electrically connected and in said separator layers disposed at the both sides of said electrodes having said other polarity to be thus electrically connected, and an electrical contact member extending through said central bores whereby said smaller diameter electrode disposed in said cylindrical conductive case is electrically connected to said electrode having said one polarity disposed in said closure cover, by means of said electrical contact member.

5. A battery as claimed in claim 4, in which said cylindrical conductive case simultaneously forms a collector member having said other polarity and is fitted into said battery vessel and forms the terminal of said other polarity, and said battery vessel is closed by said closure cover and forms the terminal of said one polarity, through said insulating packing.

6. A battery as claimed in any of claims 1, 2 and 4, in which said electrodes having said one polarity to be electrically connected to each other by means of said electrical contact member are made of soft and light metal plate, and the ends of said electrical contact member are forcibly entered into said electrodes having said one polarity, respectively, whereby said electrodes having said one polarity are electrically connected to each other by means of said electrical contact member.

7. A battery as claimed in claim 6, in which each plate is formed of lithium, magnesium or sodium.

8. A battery as claimed in claim 4, in which said smaller diameter electrode is formed with lithium used as active material, and said larger diameter electrodes are formed with manganese dioxide used as active material.

9. A battery as claimed in claim 4, in which a flange is provided on said cylindrical conductive case, and the electrodes having said other polarity are disposed on and under said flange whereby said electrodes having said other polarity are electrically connected to each other by said flange.

10. A battery as claimed in claim 9, in which projections are provided on both surfaces of said flange of said cylindrical conductive case.

11. A battery as claimed in any of claims 1, 2 and 4, in which said electrical contact member comprises a conductive plate in contact with at least one of said electrodes having said one polarity, and a conductive pin for electrically connecting said electrodes having said one polarity to each other.

12. A battery as claimed in any of claims 1, 2 and 4, in which said electrical contact member comprises a pair of conductive pins, each projecting into each of the facing surfaces of said electrodes having said

one polarity, central bores are defined in said electrode having said other polarity and said separator layers which are interposed between said electrodes having said one polarity, a cylindrical insulating member is inserted into said central bores, and within the inner space of said insulating member said pair of conductive pins are press-contacted with and electrically connected to each other.

13. A battery substantially as hereinbefore  
10 described with reference to and as illustrated in the accompanying drawings.

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