I, Eric Vance, hereby declare:

That I possess advanced knowledge of the Japanese and English languages. I have 5 years of professional translation experience and I hold a Bachelor of Arts degree in Japanese and a Bachelor of Science degree in Physiology. I have 2.5 years of professional translation experience and training with a dedicated patent translation firm that specializes in chemical, electrical, optical, mechanical, and other technical fields. I hold a JLPT N1 Certification in Japanese linguistics.

The attached Japanese into English translation has been translated by me and to the best of my knowledge and belief, it is a true and accurate translation of JP2007-294111A, with publication date November 8, 2007.

I declare that all statements made above of my own knowledge are true and that all statements made on information and belief are believed to be true. I have been warned and understand that willful false statements and the like are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on June 12, 2020 in South Jordan, Utah.

Eric Vance

State of UT County of Salt Lake county
Subscribed and sworn to (or affirmed) before me on this
12th day of June, 2020 by
Eric Vance proved to me on the basis
of satisfactory evidence to be the person(s) who appeared before me.
Notary Signature

Notary Public

May 26th 2024
Notary Commission Expiry

MERCEDES ANNTIONETTE KELLEY
Notary Public - State of Utah
Comm. No. 712186
My Commission Expires on
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(19) **Japan Patent Office (JP)** (12) **JAPANESE UNEXAMINED PATENT APPLICATION PUBLICATION (A)** (11) Patent Application
Publication No. JP 2007-294111
(P2007-294111A)
(43) Publication Date: **November 8, 2007 (Heisei 11)**

(51) Int. Cl.			FI			Theme Code (Reference)
H01M	10/04	(2006.01)	H01M	10/04	W	5H011
H01M	2/34	(2006.01)	H01M	2/34	B	5H028
H01M	2/02	(2006.01)	H01M	2/02	G	5H043

Examination Request: Not Yet Total No. of Claims: 6 OL (Total 13 pages)

(21) Application No. JP 2006-116981
(22) Date of Filing April 20, 2008 (Heisei 18)

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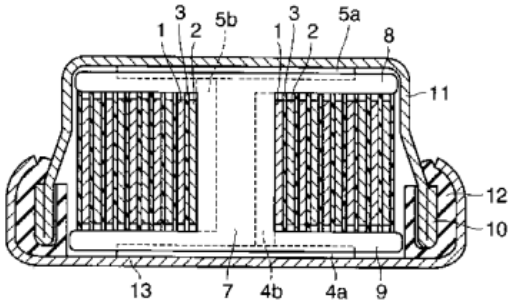
(54) [Title of Invention] SMALL BATTERY

(57) [Abstract]
[Problem] To provide a small battery capable of improving heavy load characteristics without impairing productivity.
[Solution] A small battery provided with a container and a flat electrode group in which a laminate containing a positive electrode 1 and a negative electrode 2 is spirally wound, the flat electrode group being stored in the container, wherein the flat electrode group is integrated with a winding axis core 7 by spirally winding the laminate while at least one of the positive electrode 1 and the negative electrode 2 is fixed to the winding axis core 7.
[Selected Drawing] FIG. 1

FIG. 1



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[Scope of Patent Claims]
[Claim 1]
A small battery comprising a container and a flat electrode group in which a laminate containing a positive electrode and a negative electrode is spirally wound, the flat electrode group being stored in the container,
wherein the flat electrode group is integrated with a winding axis core by spirally winding the laminate while at least one of the positive electrode and the negative electrode is fixed to the winding axis core.
[Claim 2
The small battery according to claim 1, wherein the container comprises a positive electrode case doubling as a positive electrode terminal, a negative electrode case doubling as a negative electrode terminal, and an insulation gasket interposed between the positive electrode case and the negative electrode case, and a seal of the container is created by caulking performed on the positive electrode case or the negative electrode case.
[Claim 3]
The small battery according to claim 2, further comprising:
a positive electrode terminal part disposed between the positive electrode case and one end face of the electrode group;
a negative electrode terminal part disposed between the negative electrode case and another end face of the electrode group;
a positive electrode lead part for ensuring continuity between the positive electrode terminal part and the positive electrode, the positive electrode lead part being integrated with the winding axis core; and
a negative electrode lead part for ensuring continuity between the negative electrode terminal part and the negative electrode, the negative electrode lead part being integrated with the winding axis core.
[Claim 4]
The small battery according to claim 3, wherein an insulating member is disposed between the positive electrode case and the one end face of the electrode group, between the negative electrode case and the other end face of the electrode group, or both.
[Claim 5]
The small battery according to claim 2, further comprising:
a first insulating member fixed to one end of the winding axis core so as to cover one end face of the electrode group;
a second insulating member fixed to another end of the winding axis core so as to cover another end face of the electrode group;
a positive electrode terminal part disposed between an inner face of the positive electrode case and the first insulating member;
a negative electrode terminal part disposed between an inner face of the negative electrode case and the second insulating member;
a positive electrode lead part for ensuring continuity between the positive electrode terminal part and the positive electrode, the positive electrode lead part being integrated with the winding axis core; and
a negative electrode lead part for ensuring continuity between the negative electrode terminal part and the negative electrode, the negative electrode lead part being integrated with the winding axis core.
[Claim 6]
The small battery according to any one of claims 1 to 5, being a coin or button cell.
[Detailed Description of the Invention]
[Technical Field]
[0001]
The present invention relates to a small battery provided with a winding electrode group (for example, a button cell or a coin cell).
[Background Art]
[0002]
The spread of mobile electronic/communication devices such as small video cameras, mobile phones, PDAs, and laptops is remarkable, rechargeable batteries such as lithium-ion rechargeable batteries and nickel-metal hydride rechargeable batteries have been applied thereto as power sources, and development for size reduction and capacity increase has been performed to a great extent.
[0003]

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In addition to the trend of further size reduction of mobile devices, rechargeable batteries are required as power sources for devices for which size reduction as wristwatches is necessary, and small rechargeable batteries such as button cells and coin cells have come to be applied to uses of backup power supplies for SRAM and RTC, for which discharge is performed at a light load wherein the discharge current is about a few μA to a few dozen μA, and main power supplies for wristwatches not requiring battery replacement.

[0004]

That illustrated in FIG. 10 is a typical structure for these small rechargeable batteries such as button cells and coin cells. That is, an object wherein a positive electrode case 21 doubling as a positive electrode terminal and a metal negative electrode case 22 doubling as a negative electrode are caulked together via an insulation gasket 23 is used as a hermetically sealed container. One each of a tablet-shaped positive electrode 24 and negative electrode 25 having diameters smaller than the diameter of an opening of the insulation gasket 23 are stored within this hermetically sealed container. A separator 26 impregnated with an electrolytic solution is interposed between the positive electrode 24 and the negative electrode 25.

[0005]

Because such small rechargeable batteries such as button cells and coin cells have simple structures, they have excellent mass producibility and the characteristic of being capable of size reduction.

[0006]

However, small rechargeable batteries such as button cells and coin cells that have the structure indicated above have insufficient properties when discharging at high current, which is required for the main power sources of small mobile devices, and they are not suited as main power sources of small mobile devices.

[0007]

Meanwhile, due to size reduction of mobile devices such as small video cameras, mobile phones, PDAs, and laptops, size reduction is also necessary for lithium-ion rechargeable batteries, nickel-hydride rechargeable batteries, and the like, which have been used as main power sources (for example cited documents 1 and 2). A method for manufacturing lithium-ion rechargeable batteries and nickel-metal hydride rechargeable batteries will be briefly described. First, an active material layer is applied or filled on a current collector composed of a metal foil or a metal net to form electrodes. After welding current-collecting tab terminals to the formed electrodes, these electrodes are wound or laminated to form an electrode group. Additionally, the current collecting tab terminals taken out from the electrode group are bent in a complicated manner and welded to a safety element, an electrode pin, an electrode can, and the like to manufacture a battery. Manufacture of these rechargeable batteries requires such complicated manufacturing steps, and the work is complicated. Furthermore, in order to prevent short-circuiting of the tab terminals, it is necessary to provide a space or part within the battery or to incorporate many parts such as safety elements within the battery. Therefore, size reduction is extremely difficult for these rechargeable batteries, and the limit has currently substantially been reached.

[Cited Document 1] JP H11-345626 A

[Cited Document 2] JP H11-354150 A

[Disclosure of Invention]

[Problem to Be Solved by Invention]

[0008]

An object of the present invention is to improve heavy load characteristics of small batteries such as button cells and coin cells without impairing productivity.

[Means for Solving Problem]

[0009]

The small battery according to the present invention is a small battery provided with a container and a flat electrode group in which a laminate containing a positive electrode and a negative electrode is spirally wound, the flat electrode group being stored in the container,

wherein the flat electrode group is integrated with a winding axis core by spirally winding the laminate while at least one of the positive electrode and the negative electrode is fixed to the winding axis core.

[0010]

Here, flat electrode group means an electrode group having a structure wherein the height of the electrode group in the winding axis core direction is smaller than the size in the direction perpendicular to the winding axis.

[Effect of Invention]

[0011]

According to the present invention, it is possible to provide a small battery capable of improving

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heavy load characteristics without impairing productivity.

[Best Mode for Carrying out Invention]

[0012]

As a result of repeated research relating to improvement of heavy load characteristics of small batteries, the present inventors have discovered a method for safely, and with high productivity, storing a wound electrode group within a case of a small battery such as a button cell or a coin cell. Thereby, heavy load characteristics have been dramatically improved compared to conventional small batteries.

[0013]

That is, it was found that by using a container having a sealed structure in which a metal negative electrode case doubling as a negative electrode terminal and a positive electrode case doubling as a positive electrode terminal are fitted via an insulation gasket, and furthermore which is caulked by caulking the positive electrode case or negative electrode case, and by storing in the container an electrode group having a laminate including a positive electrode and a negative electrode wound in a spiral, it is possible to provide a small battery having excellent heavy load characteristics.

[0014]

Winding a thin positive electrode and negative electrode via a separator in lithium-ion rechargeable batteries and nickel-metal hydride rechargeable batteries, which are used as main power sources for small mobile devices, enables enlargement of the counter-electrode area of the negative electrode and the positive electrode and extraction of high current. However, as described above, the manufacturing process is complicated, and the number of parts is extremely high for the sake of ensuring safety and the like. Thus, it was thought that it was impossible to store the electrode group structure within a small battery such as a button cell or a coin cell.

[0015]

Therefore, the present inventors attempted to change the approach away from conventional art, and by incorporating at least a winding axis core into the electrode group structure, and as needed, an insulation plate and contacting terminals between electrodes and external terminals, enabled efficient storage of an electrode group in which a positive electrode, a negative electrode, and a separator are wound in a few layers to a few dozen layers within a case of a small battery such as a button cell or a coin cell while preserving the benefits of safety and excellent productivity.

[0016]

The present inventors will describe below how the present invention was realized.

[0017]

First, when winding a positive electrode and a negative electrode in a spiral via a separator, by incorporating the winding axis core into the electrode group while being integrated with the negative electrode and/or the positive electrode, it was possible to manufacture a wound electrode group capable of being housed in a case of a small battery such as a button cell or a coin cell. It is desirable that the winding axis core or a part of a base part thereof be formed from an insulating material such as polyethylene, polypropylene resin, glass, or ceramic.

[0018]

Next, connection between the electrode group and the metal cases doubling as external terminals will be described. For comparatively large lithium-ion rechargeable batteries such as cylindrical or prismatic, the tab terminals are welded to a center part of the electrode group or the winding member, and after bending this, it is welded to a safety element or sealing pin, and current collection is performed. However, productivity is poor because the bending process is complicated. Thus, it was possible to simplify the structure by installing a terminal on the winding axis core to be incorporated into the electrode group to connect the electrode and the metal case doubling as an external terminal. The method for connecting the electrode to this terminal includes crimping, welding such as resistance welding and ultrasonic welding, bonding such as with a conductive adhesive, and the like, but it is not particularly limited. Additionally, the method of connecting this terminal to the metal case doubling as an external terminal includes welding such as resistance welding and ultrasonic welding, bonding such as with a conductive adhesive, contact between the terminal and the battery case, and the like, but it is not particularly limited. However, for current collection by contact, it is desirable to improve current collection properties using a metal net, metal powder, carbon filler, conductive paint, or the like.

[0019]

Next, it is desirable to establish an insulating member between the electrode group and the battery case to prevent short-circuiting. The insulating member is not particularly limited insofar as the insulating properties are maintained, but an insulating plate made of polyethylene or polypropylene resin, a film made of PET or polyimide, or the like can be used. The insulating member may be disposed between the positive electrode case and the electrode

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