(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 610 401 B9

(12) CORRECTED EUROPEAN PATENT SPECIFICATION

(15) Correction information:
Corrected version no 1 (W1 B1)
Corrections, see
Claims EN 1

(48) Corrigendum issued on:
26.08.2009 Bulletin 2009/35

(45) Date of publication and mention of the grant of the patent:
06.05.2009 Bulletin 2009/19

(21) Application number: **05076328.3**

(22) Date of filing: **12.03.2001**

(51) Int Cl.:
H01M 2/26 *(2006.01)* ***H01M 2/20*** *(2006.01)*

(54) Nonaqueous electrolyte secondary cells

Nichtwässrige elektrolytische Sekundärzellen

Cellules électrolytiques secondaires non-aqueuses

(84) Designated Contracting States:
DE FR GB

(30) Priority: **14.03.2000 JP 2000070927**
26.09.2000 JP 2000292306
29.11.2000 JP 2000362515

(43) Date of publication of application:
28.12.2005 Bulletin 2005/52

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
01302226.4 / 1 134 819

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- **PATENT ABSTRACTS OF JAPAN vol. 1998, no. 14, 31 December 1998 (1998-12-31) & JP 10 261399 A (SANYO ELECTRIC CO LTD), 29 September 1998 (1998-09-29)**

Description

FIELD OF THE INVENTION

[0001] The present invention relates to nonaqueous electrolyte secondary cells which comprise a can and a rolled-up electrode unit accommodated in the can and serving as a secondary cell element and which are adapted to deliver electric power generated by the electrode unit from a pair of electrode terminals provided on the can.

BACKGROUND OF THE INVENTION

[0002] In recent years, attention has been directed to lithium secondary cells or batteries having a high energy density for use as power sources for portable electronic devices, electric motor vehicles, etc. Cylindrical lithium secondary cells of relatively large capacity, for example, for use in electric motor vehicles comprise, as shown in FIGS. 1 and 2, a cylindrical cell can 1 having a cylinder 11 and lids 12, 12 welded to the respective ends of the cylinder, and a rolled-up electrode unit 4 encased in the can 1. A pair of positive and negative electrode terminal assemblies 9, 9 are attached to the lids 12, 12, respectively. The two electrodes of the rolled-up electrode unit 4 are connected to the terminal assemblies 9, 9, whereby the electric power generated by the electrode unit 4 can be delivered to an external device from the pair of terminal assemblies 9, 9. Each lid 12 is provided with a gas vent valve 13.

[0003] As shown in FIG. 3, the rolled-up electrode unit 4 comprises a positive electrode 41 and a negative electrode 43 which are each in the form of a strip and which are rolled up into a spiral form with a striplike separator 42 interposed between the electrodes. The positive electrode 41 comprises a striplike current collector foil 45 in the form of aluminum foil and coated over opposite surfaces thereof with a positive electrode active substance 44 comprising a lithium containing composite oxide. The negative electrode 43 comprises a striplike current collector foil 47 in the form of copper foil and coated over opposite surfaces thereof with a negative electrode active substance 46 containing a carbon material. The separator 42 is impregnated with a nonaqueous electrolyte.

[0004] The positive electrode 41 and the negative electrode 43 are each superposed on the respective separators 42, as displaced from the separator widthwise thereof, and the assembly is rolled up into a spiral form, whereby the edge 48 of the current collector foil 45 of the positive electrode 41 is positioned as projected outward beyond the edge of the separator 42 at one of the axially opposite ends of the electrode unit 4, and the edge 48 of the current collector foil 47 of the negative electrode 43 is positioned as projected outward beyond the edge of the separator 42 at the other end of the unit 4. A current collecting plate 32 in the form of a disk is joined to each of the opposite ends of the electrode unit 4 by resistance welding and connected by a lead member 33 to the base end of the electrode terminal assembly 9 shown in FIG. 2.

[0005] The electrode terminal assembly 9 comprises an electrode terminal 91 extending through a hole in the lid 12 of the can 1 and mounted on the lid 12. The electrode terminal 91 has a flange 92 at its base end. An insulating packing 93 is fitted in the hole of the lid 12 for electrically insulating the electrode terminal 91 from the lid 12 and providing a seal therebetween. The electrode terminal 91 has a washer 94 fitted therearound from outside the lid 12, and a first nut 95 and a second nut 96 screwed thereon. The first nut 95 is tightened up to clamp the insulating packing 93 between the flange 92 of the terminal 91 and the washer 94 and thereby seal off the hole more effectively. The outer end of the lead member 33 is fixedly joined to the flange 92 of the terminal 91 by spot welding or ultrasonic welding.

[0006] The lithium secondary cell having the current collecting structure shown in FIG. 2 nevertheless has the problem that the edges 48, 48 of the current collector foils 45, 47 forming the positive electrode 41 and the negative electrode 43 of the rolled-up electrode unit 4 have a small area, which results in a small area of contact between each edge of the current collector foil and the corresponding current collecting plate 32, consequently increasing the internal resistance of the cell. Further when the outermost peripheral portion of the current collecting plate 32 is joined to the electrode edge positioned radially most outwardly of the electrode unit 4 by laser welding, the laser beam is likely to leak out from the collecting plate 32 to irradiate the electrode or separator, causing damage to the electrode or separator.

[0007] A cylindrical secondary cell of improved power characteristics has been proposed which, as seen in FIG. 7, comprises a positive electrode 81 having an uncoated portion which extends upward beyond a portion thereof coated with an active substance 84 and varies in width longitudinally of the electrode, and a negative electrode 82 having an uncoated portion which extends downward beyond a portion thereof coated with an active substance 85 and varies in width longitudinally of the electrode. The positive and negative electrodes 81, 82 are rolled up into a spiral form with a separator 83 interposed between the electrodes to obtain a rolled-up electrode unit 8 having conical projections 86 as seen in FIG. 8. The electrode unit 8 is encased in a cell can 1. Each of the electrode projections 86 is connected to an electrode terminal 90 by a current collecting lead 80 (JP-A No. 329398/1998).

[0008] Although improved to some extent in power characteristics, the secondary cell described requires the step of obliquely cutting an edge of each of the positive and negative electrodes 81, 82 as shown in FIG. 7. This not only makes the fabrication process complex but also presents difficulty in giving an accurately finished conical surface to the projection 86 of the rolled-up electrode unit 8 was shown in FIG. 8 by rolling up the assembly of the two electrodes, consequently entailing the problem of an impaired yield and variations in the properties of cells.

Especially in the case of lithium secondary cells for use as power sources in electric motor vehicles, there is a need to reduce the internal resistance to the greatest possible extent so as to obtain a high capacity and a high power. Furthermore, a manufacturing cost reduction requires a current collecting structure of high productivity.

[0009] Accordingly, a nonaqueous electrolyte secondary cell having low resistance and excellent in productivity is proposed which has a current collecting plate 7 of the shape shown in FIG. 9 (JP-B No. 4102/1990). The collecting plate 7 has a central hole 74 and a lead portion 75 extending from the outer periphery thereof. The collecting plate 7 further has a plurality of ridges 72 V-shaped in cross section and extending radially from its center. As shown in FIG. 10, these ridges 72 are pressed against and weld to edge portions 48 of electrode of a rolled-up electrode unit 4.

[0010] With this cell, the ridges 72 of the collecting plate 7 bite in the edge portions 48 of electrode of,the electrode unit 4. The collecting plate is therefore in contact with the edge 48 of the electrode over a greater area than the conventional collecting plate which is in the form of a flat plate. This results in an increase in the quantity of current collected to afford an increased cell power.

[0011] However, since the ridges of the collecting plate have a V-shaped cross section with an acute angle, the area of contact of the ridges with the edge of the current collector foil is not sufficiently great. Accordingly, the collecting plate not only has great contact resistance at the weld but is also poor in the state of contact at the portions other than the weld. Thus, the structure described has the problem of low current collecting performance. Moreover, the junction between the V-shaped ridge and the edge of the current collector foil to be irradiated with a laser beam makes an acute angle with the direction of projection of the beam, so that the laser beam fails to act effectively on the junction for welding and is likely to produce a faulty weld joint.

[0012] Further for the nonaqueous electrolyte secondary cell to give an improved power, it is effective to reduce the electric resistance of the path through which the electric power produced by the rolled-up electrode unit 4 is delivered to the outside, i.e., the internal resistance, whereas the current collecting plate 7 shown in FIG. 9 is greater in the average distance over which the current collected by the plate 7 flows before flowing into the lead portion 75 because the lead portion 75 extends from the outer periphery of the plate 7. For this reason, the secondary cell incorporating the collecting plate 7 still has great internal resistance.

[0013] A cell including the features of the preamble of claim 1 is disclosed in DE-B-1 233 040.

SUMMARY OF THE INVENTION

[0014] An object of the present invention is to provide a cylindrical secondary cell of the tabless type wherein a current collecting plate can be welded to the end of a rolled-up electrode unit without the likelihood of causing damage to the electrode or the separator and which can be fabricated by a simple process, the cell further exhibiting excellent power characteristics.

[0015] According to the present invention there is provided A cylindrical secondary cell comprising a positive electrode and a negative electrode each in the form of a strip and rolled up into a spiral form with a separator interposed between the electrodes and impregnated with a nonaqueous electrolyte to obtain a rolled-up electrode unit, and a cylindrical cell can having rolled-up electrode unit, and a cylindrical cell can therein, the cell being adapted to deliver electric power generated by the rolled-up electrode unit to the outside via a pair of electrode terminal portions, wherein the positive electrode and the negative electrode each comprise a striplike current collector and an active substance coating the current collector, each of the electrodes having a portion coated with the active substance and extending longitudinally of the current collector, and an uncoated portion not coated with the active substance and formed along an edge of the current collector, the uncoated portion projecting from at least one of axially opposite ends of the rolled-up electrode unit to provide a cylindrical projection, the cylindrical projection being covered with a current collecting plate made of metal, the current collecting plate comprising a top plate in contrast with an end face of the cylindrical projection and a skirt portion in contact with at least a portion of an outer peripheral surface of the cylindrical projection, characterised in that the skirt portion comprises two circular arc piece, the top plate of the current collecting plate being joined to the end face of the cylindrical projection of the rolled up electrode unit by laser welding with radial laser beam paths, the skirt portion of the current collecting plate being joined to the outer peripheral surface of this cylindrical projection of the rolled-up electrode unit by laser welding, the current collecting plate being connected to one of the electrode terminal portions by a lead member.

[0016] With the cylindrical secondary cell of the invention described, the end face of the cylindrical projection of the rolled-up electrode unit and the inner surface of the top plate of the current collecting plate are in contact with each other, and the outer peripheral surface of the cylindrical projection and the inner peripheral surface of the skirt portion of the collecting plate are also in contact with each other, with the result that the contact resistance between the electrode of the unit and the collecting plate is low, consequently giving reduced internal resistance to the cell and permitting the cell to exhibit high power characteristics.

[0017] In joining the outermost peripheral portion of top plate of the collecting plate to the portion of electrode edge positioned at the outermost peripheral portion of the electrode unit in the step of laser welding of the collecting plate as fitted over the cylindrical projection of the electrode unit, the outer peripheral surface of the cylindrical projection is covered with the skirt portion of the collecting plate. The skirt portion therefore obviates the likelihood that the electrode or separator will be exposed directly to the laser beam, preventing damage to the electrode or separator.

[0018] Furthermore, the positive electrode and the negative electrode forming the electrode unit need only to be made each in the form of a strip having a specified width. This simplifies the fabrication process, further making it possible to give the cylindrical projection of the unit with an accurately finished cylindrical surface and consequently eliminating a reduction in the yield and variations in the cell performance.

[0019] Stated specifically, the top plate 61 and the skirt portion 62 of the current collecting plate 6 are joined respectively to the end face and the outer peripheral surface of the cylindrical projection 40 of the rolled-up electrode unit by laser welding. This fully reduces the contact resistance between the electrode unit and the collecting plate.

[0020] Thus, the current collecting plate can be welded to the rolled-up electrode unit without the likelihood of causing damage to the electrode or separator, so that the cylindrical secondary cell of the invention is easy to fabricate. Moreover, the reduced internal resistance of the cell assures outstanding power characteristics.

FIG. 1 is a perspective view showing the appearance of a cylindrical lithium secondary cell;

FIG. 2 is a fragmentary front view partly broken away and showing a conventional lithium secondary cell;

FIG. 3 is a perspective view partly in development of a rolled-up electrode unit for use in the cell;

FIG. 4 is a front view partly broken away of a cylindrical lithium secondary cell embodying the invention;

FIG. 5 is an exploded perspective view of a rolled-up electrode unit and current collecting plates including same but not all features of the invention incorporated into the cell;

FIG. 6 is a perspective view of an example of current collecting plate according to the invention;

FIG. 7 is a development showing the positive electrode, separator and negative electrode of another conventional secondary cell;

FIG. 8 is a fragmentary front view partly broken away and showing the secondary cell;

FIG. 9 is a plan view of a conventional current collecting plate; and

FIG. 10 is a view showing the step of joining a ridge of the conventional collecting plate to an edge of electrode of the rolled-up electrode unit.

DETAILED DESCRIPTION OF EMBODIMENTS

[0021] A cylindrical lithium secondary cell embodying the invention will be described below in detail with reference to the drawings concerned.

[0022] With reference to FIGS. 4, the cylindrical lithium secondary cell of the invention comprises a cylindrical can 1 having a cylinder 11 and lids 12, 12 welded to the respective ends thereof, and a rolled-up electrode unit 4 encased in the can 1. A pair of positive and negative electrode terminal assemblies 9, 9 are attached to the lids 12, 12, respectively. The terminal assembly 9 has the same construction as in the prior art. Each lid 12 is provided with a gas vent valve 13.

[0023] A current collecting plate 6 is provided at each end of the electrode unit 4 and joined to a cylindrical projection 40 by laser welding. A lead member 63 has a base end joined to the upper surface of the collecting plate 6 by spot welding, and an outer end joined by spot welding to the rear face of a flange 92 of an electrode terminal 91 constituting the electrode terminal assembly 9.

[0024] As shown in FIG. 5, the rolled-up electrode unit 4 comprises a positive electrode 41 and a negative electrode 43 which are each in the form of a strip and which are rolled up into a spiral form with a striplike separator 42 interposed between the electrodes. The positive electrode 41 comprises a striplike current collector foil 45 in the form of aluminum foil and coated over opposite surfaces thereof with a positive electrode active substance 44 comprising a lithium containing composite oxides. The negative electrode 43 comprises a striplike current collector foil 47 in the form of copper foil and coated over opposite surfaces thereof with a negative electrode active substance 46 containing a carbon material. The separator 42 is impregnated with a nonaqueous electrolyte.

[0025] The positive electrode 41 has a portion A coated with the positive electrode active substance 44 and a portion B not coated with the substance and extending along an edge 48 of a current collector foil. The negative electrode 43 has a portion A coated with the negative electrode active substance 46 and a portion B not coated with the substance and extending along an edge 48 of a current collector foil.

[0026] The positive electrode 41 and the negative electrode 43 are superposed on respective separators 42, as displaced from the separators widthwise thereof, and the uncoated portions of the positive electrode 41 and the negative electrode 43 are caused to project outward beyond the opposite edges of the separator 42. The assembly is then rolled up into a spiral form, whereby the electrode unit 4 is fabricated. The edge 48 of the current collector foil of the uncoated portion of the positive electrode 41 extends outward beyond one edge of the separator 42 at one of the axially opposite ends of the electrode unit 4, providing the cylindrical projection 40 at the positive electrode side. The edge 48 of the current collector foil of the uncoated portion of the negative electrode 43 extends outward beyond the other edge of the separator 42 at the other end of the unit 4, providing the cylindrical projection 40 at the negative electrode side.

[0027] As shown in FIGS. 4 and 5, the current collecting plate 6 comprises a dislike top plate 61 and a cylindrical skirt portion 62 which does not have the inventive circular are pieces 64 (described below). The inner surface of the top plate 61 is in intimate contact with the outer end face of the cylindrical projection 40 and is joined thereto by laser welding, and the inner peripheral surface of the skirt portion 62 is in intimate contact with the outer peripheral surface of the projection 40 and is joined thereto by laser welding. The outer surface of the collecting plate 6 is connected by the lead member 63 to the flange 92 of the electrode terminal assembly 92.

[0028] In fabricating the cylindrical lithium secondary cell of the present invention a separator 42, negative electrode 43, separator 42 and positive electrode 41 are placed over one another in superposed layers first, and wound up into a spiral form to obtain the rolled-up electrode unit 4 as shown in FIG. 5. A current collecting plate 6 for the positive electrode is prepared from aluminum, while a negative electrode current collecting plate 6 is made from nickel.

[0029] Next, the cylindrical projections 40, 40 of the rolled-up electrode unit 4 are joined to the respective collecting plates 6 by laser welding. For laser welding, a laser beam is projected along radial paths on the surface of the top plate 61 of each collecting plate 6 as fitted over the projection 40 of the electrode unit 4, and on the outer peripheral surface of the skirt portion 62 of the plate 6 while making one turn around the periphery. A lead member 63 is joined at its base end to the surface of each collecting plate 6 by spot welding.

[0030] The rolled-up electrode unit 4 is thereafter placed into the cylinder 11 of a cell can 1, and the outer end of the lead member 63 extending from each collecting plate 6 is spot-welded to the rear face of a flange 92 of an electrode terminal 91. An electrode terminal assembly 9 is attached to each of lids 12, and the first nut 95 is tightened up to give satisfactory liquid-tightness to the insulating packing 93.

[0031] Each lid 12 is then joined to the opening f the cylinder 11 by laser welding, an electrolyte is poured into the can 1, and a gas vent valve 13 is thereafter screwed into each lid 12 as shown in FIG. 4 for fixing, whereby a cylindrical lithium secondary cell of the invention is completed. Alternatively, a plurality of circular-arc pieces 64 may be provided on a disklike top plate 61 to form a skirt portion 62 as shown in FIG. 6 to obtain a current collecting plate 6.

Preparation of Positive Electrode

[0032] A positive electrode composition was prepared by mixing together a powder of $LiCoO_2$ serving as a positive electrode active substance and having a mean particle size of 5 μm and artificial graphite serving as an electrically conductive agent in a ratio by weight of 9:1. Next, polyvinylidene fluoride serving as a binder was dissolved in N-methyl-2-pyrrolidone (NMP) to prepare an NMP solution. The composition and the NMP solution were then mixed together so that the ratio of the composition to the polyvinylidene fluoride would be 95:5 by weight to prepare a slurry, which was then applied to opposite surfaces of aluminum foil serving as a positive electrode current collector foil and having a thickness of 20 μm with a doctor blade method, followed by drying in a vacuum at 150° C for 2 hours to prepare a positive electrode 41 shown in FIG. 5.

Preparation of Negative Electrode

[0033] Carbon lumps (d002=3.356A; Lc>1000) were pulverized by forcing an air stream thereagainst to obtain a carbon powder. Polyvinylidene fluoride serving as a binder was dissolved in NMP to prepare an NMP solution. The carbon powder and the NMP solution were then kneaded so that the ratio of the powder to the polyvinylidene fluoride would be 85:15 by weight to prepare a slurry, which was then applied to opposite surfaces of copper foil serving as a negative electrode current collector foil and having a thickness of 20 μm with a doctor blade method, followed by drying in a vacuum at 150° C for 2 hours to prepare a negative electrode 43 shown in FIG. 5.

Preparation of Electrolyte

[0034] An electrolyte was prepared by dissolving $LiPF_6$ in an amount of 1 mol/L in a solvent obtained by mixing together ethylene carbonate and diethyl carbonate in a ratio by volume of 1:1.

Assembly of Invention Cells

[0035] An ion-permeable finely porous membrane of polypropylene serving as a separator was wound around a spool with a diameter of 10 mm several turns, four sheets, i.e., a sheet of the separator, the positive electrode, a sheet of the separator and the negative electrode, as place one over another in superposed layers were wound up many turns into a spiral form so as to interpose the separator between the positive and negative electrodes, and the spool was finally remove to prepare a rolled-up electrode unit 4. shown in FIG. 5. A cylindrical lithium secondary cell of the invention was assembled using the electrode unit 4. The cell was 57 mm in outside diameter and 220 mm in length.

[0036] Two kinds of current collecting plates 6 were prepared for use over the cylindrical projections 40 of the electrode unit 4: i.e., collecting plates 6 in accordance with the invention having a skirt portion 62 comprising two separate circular-arc pieces 64, 64 as shown in FIG. 6, and collecting plates 6 having a cylindrical skirt portion 62 as shown in FIG. 5. Fabricated in the manner described above were invention cell 1 having the collecting plates 6 of FIG. 6, and cell 2 having the collecting plates 6 of FIG. 5. In invention cell 1, the skirt portion 62 of the plate 6 covered 30% of the entire area of the outer peripheral surface of the cylindrical projection 40. In cell 2, the skirt portion 62 of the collecting plate 6 covered 90% of the entire area of the outer peripheral surface of the cylindrical projection 40.

Assembly of Comparative Cell

[0037] A comparative cell was fabricated in the same manner as the invention cell described except that the disklike current collecting plates 32 shown in FIG. 3 were joined to the respective ends of the rolled-up electrode unit 4. Evaluation of Cells

[0038] Invention cells 1 and 2, and the comparative cell were checked for power characteristics (power density when discharged for 15 seconds at a depth of discharge of 50%). Table 1 shows the results.

Table 1

Cell	Power density [W/kg]
Invention cell 1	645
Cell 2	665
Comparative cell	590

[0039] Table 1 indicates that invention cells 1 and 2 are higher than the comparative cell in power density presumably because the current collecting plates 6 of the invention cells have the skirt portion 62 and are therefore improved in current collecting performance and reduced in internal resistance.

[0040] A comparison between invention cell 1 and cell 2 indicates that a greater power density is available when the skirt portion 62 of the current collecting plate 6 is in contact with the cylindrical projection 40 over a larger area. Thus, it is apparent that the skirt portion 62 of the collecting plate 6 contributes to an improvement in current collecting performance.

[0041] The cylindrical lithium secondary cell of the invention is reduced in the contact resistance between each electrode of the rolled-up electrode unit 4 and the current collecting plate 6 to exhibit excellent power characteristics. Further in the laser welding step of joining the collecting plate 6 as fitted over the cylindrical projection 40 of the unit 4 in fabricating the secondary cell of the invention, the cylindrical projection 40 is almost entirely covered with the collecting plate 6, consequently eliminating the likelihood that the electrodes or separator will be exposed directly to the laser beam, whereby the damage to the electrodes or separator is avoidable.

[0042] The positive electrode 41 and the negative electrode 43 constituting the rolled-up electrode unit 4 are each prepared in the form of a strip having a specified width, hence a simplified fabrication process. The cylindrical projection 40 of the electrode unit 4 can be given an accurately finished cylindrical surface by rolling up the two electrodes. This obviates the reduction of the yield or variations in the cell properties.

[0043] The cells of the present invention are not limited to the foregoing embodiments in construction but can be modified variously by one skilled in the art without departing from the invention as set forth in the appended claims.

Claims

1. A cylindrical secondary cell comprising a positive electrode (41) and a negative electrode (43) each in the form of a strip and rolled up into a spiral form with a separator (42) interposed between the electrodes and impregnated with a nonaqueous electrolyte to obtain a rolled-up electrode unit (4), and a cylindrical cell can (1) having rolled-up electrode unit (4), therein, the cell being adapted to deliver electric power generated by the rolled-up electrode unit (4) to the outside via a pair of electrode terminal portions (9), wherein the positive electrode (41) and the negative electrode (43) each comprise a striplike current collector (45, 47) and an active substance (44, 46) coating the current collector (45, 47), each of the electrodes (41, 43) having a portion coated with the active substance and extending longitudinally of the current collector (45, 47), and an uncoated portion not coated with the active substance and formed along an edge (48) of the current collector (45, 47), the uncoated portion projecting from at least one of axially opposite ends of the rolled-up electrode unit (4) to provide a cylindrical projection (40), the cylindrical projection (40) being covered with a current collecting plate (6) made of metal, the current collecting plate (6) comprising a top plate (61) in contact with an end face of the cylindrical projection (40) and a skirt portion (62) in contact with at least a portion of an outer peripheral surface of the cylindrical projection (40), **characterised in that** the skirt portion (62) comprises two circular arc pieces (64, 65), the top plate (61) of the current collecting plate (6) being joined to the end face of the cylindrical projection (40) of the rolled up electrode unit (4) by laser welding with radial laser beam paths, the skirt portion (62) of the current collecting plate (6) being joined to the outer peripheral surface of this cylindrical projection (40) of the rolled-up electrode unit (4) by laser welding, the current collecting plate (6) being connected to one of the electrode terminal portions (9) by a lead member (63).

2. A cylindrical secondary cell according to claim 1, wherein the cylindrical projection (40) projecting from each of the axially opposite ends of the rolled-up electrode unit (4) is covered with the current collecting plate (6) of the metal, the current collecting plate (6) for the positive electrode (41) being made from substantially the same material as the current collector of the positive electrode (41), the current collecting plate (6) for the negative electrode (43) being made from substantially the same material as the current collector of the negative electrode (43),

the two current collecting plates (6), (6) being connected to the pair of electrode terminal portions respectively.

Patentansprüche

1. Zylindrische Sekundärzelle, umfassend eine Positivelektrode (41) und eine Negativelektrode (43), jede in der Form eines Bandes und aufgerollt zu einer Spiralform mit einem Separator (42), der sich zwischen den Elektroden befindet und mit einem nicht wässrigen Elektrolyten imprägniert ist, um eine aufgerollte Etektrodeneinheit (4) zu erhalten, und ein zylindrisches Zellgefäß (1) mit der aufgerollten Eloktrodeneinhcit (4) darin, wobei die Zelle angepasst ist, um den von der aufgerollten Elektrodeneinheit (4) erzeugten elektrischen Strom über ein Paar Elektroden-Anschlussklemmenteile (9) an die Außenseite abzugeben, worin die Positivelektrode (41) und die Negativelektrode (43) jeweils einen bandähnlichen Stromabnehmer (45, 47) und eine aktive Substanz (44, 46), mit welcher der Stromabnehmer (45, 47) geschichtet ist, umfassen, wobei jede der Elektroden (41,43) einen mit der aktiven Substanz beschichteten Abschnitt aufweist und längs zum Stromabnehmer (45,47) verläuft, und einen unbeschichteten Abschnitt, der nicht mit der aktiven Substanz beschichtet ist und entlang einer Kante (48) des Stromabnehmers (45,47) gebildet ist, wobei der unbeschichtete Abschnitt von mindestens einem von axial gegenüberliegenden Enden der aufgerollten Elektrodeneinheit (4) vorspringt, um einen zylindrischen Vorsprung (40) bereitzustellen, wobei der zylindrische Versprung (40) mit einer Stromabnahmeplatte (6) aus Metall abgedeckt ist, wobei die Stromabnahmeplatte (6) eine obere Platte (61) in Kontakt mit einer Stirnseite des zylindrischen Vorsprungs (40) und einem Kragenteil (62) in Kontakt mit mindestens einem Abschnitt einer äußeren peripheren Oberfläche des zylindrischen Vorsprungs (40) umfasst, **dadurch gekennzeichnet, dass** das Kragenteil (62) zwei Kreisbogenstücke (64, 65) umfasst, wobei die obere Platte (61) der Stromabnahmeplatte (6) mit der Stirnseite des zylindrischen Vorsprungs (40) der aufgerollten Elektrodeneinheit (4) durch Laserschweißen mit radialen Lascrstrahlpfaden verbunden ist, wobei das Kragenteil (62) der Stromabnahmeplatte (6) mit der äußeren peripheren Oberfläche dieses zylindrischen Vorsprungs (40) der aufgerollten Elektrodeneinheit (4) durch Laserschweißen verbunden ist, wobei die Stromabnahmeplatte (6) an eines der Elektroden-Anschlussklemmcuteile (9) durch ein Leitungsglied (63) angeschlossen ist.

2. Zylindrische Sekundärzelle nach Anspruch 1, worin der zylindrische Vorsprung (40), der von jedem der axial gegenüberliegenden Enden der aufgerollten Elektrodeneinheit vorsteht (4), mit der Stromabnahmeplatte (8) aus dem Metall abgedeckt ist, wobei die Stromabnahmeplatte (6) für die Positivelektrode (41) aus dem im Wesentlichen gleichen Material gefertigt ist wie der Stromabnehmer der Positivelektrode (41), wobei die Stromabnahmeplatte (6) für die Negativelektrode (43) aus im Wesentlichen dem gleichen Material gefertigt ist wie der Stromabnehmer der Negativelektrode (43), wobei die beiden Stromabnahmeplatten (6),(6) jeweilig an das Paar von Elektroden-Anschlussklemmenteilen angeschlossen sind.

Revendications

1. Pile secondaire cylindrique comprenant une électrode positive (41) et une électrode négative (43), chacune sous la forme d'une bande et enroulée en une forme de spirale avec un séparateur (42) interposé entre les électrodes et imprégné avec un électrolyte non aqueux pour obtenir une unité d'électrodes enroulées (4), et un boîtier de pile cylindrique (1) possédant l'unité d'électrodes enroulées (4) à l'intérieur, la pile étant adaptée pour délivrer une énergie électrique générée par l'unité d'électrodes enroulées (4) vers l'extérieur via une paire de portions terminales d'électrode (9), où l'électrode positive (41) et l'électrode négative (43) comprennent chacune un collecteur de courant de type bande (45, 47) et une substance active (44, 46) revêtant le collecteur de courant (45, 47), chacune des électrodes (41, 43) possédant une portion revêtue avec la substance active et s'étendant longitudinalement au collecteur de courant (45, 47) et une portion non revêtue qui n'est pas revêtue avec la substance active et formée le long d'un bord (48) du collecteur de courant (45, 47), la portion non revêtue se prolongeant à partir d'au moins une des extrémités opposées axialement de l'unité d'électrodes enroulées (4) pour donner un prolongement cylindrique (40), le prolongement cylindrique (40) étant couvert avec une plaque collectant le courant (6) composée de métal, la plaque collectant le courant (6) comprenant une plaque supérieure (61) en contact avec une face d'extrémité du prolongement cylindrique (40) et une portion de jupe (62) en contact avec au moins une portion d'une surface périphérique externe du prolongement cylindrique (40), **caractérisée en ce que** la portion de jupe (62) comprend deux pièces en arc circulaires (64, 65), la plaque supérieure (61) de la plaque collectant le courant (6) étant jointe à la face d'extrémité du prolongement cylindrique (40) de l'unité d'électrodes enroulées (4) par un soudage au laser avec des trajectoires radiales de faisceau laser, la portion de jupe (62) de la plaque collectant le courant (6) étant jointe à la surface périphérique externe de ce prolongement cylindrique (40) de l'unité d'électrodes

enroulées (4) par un soudage au laser, la plaque collectant le courant (6) étant reliée à une des portions terminales d'électrode (9) par un élément de plomb (63).

2. Pile secondaire cylindrique selon la revendication 1, dans laquelle le prolongement cylindrique (40) se prolongent à partir de chacune des extrémités opposées axialement de l'unité d'électrodes enroulées (4) est couvert avec la plaque collectant le courant (6) du métal, la plaque collectant le courant (6) pour l'électrode positive (41) étant composée de substantiellement le même matériau que le collecteur de courant de l'électrode positive (41), la plaque collectant le courant (6) pour l'électrode négative (43) étant composée de substantiellement le même matériau que le collecteur de courant de l'électrode négative (43), les deux plaques collectant le courant (6), (6) étant reliées à la paire de portions terminales d'électrode, respectivement.

FIG 1

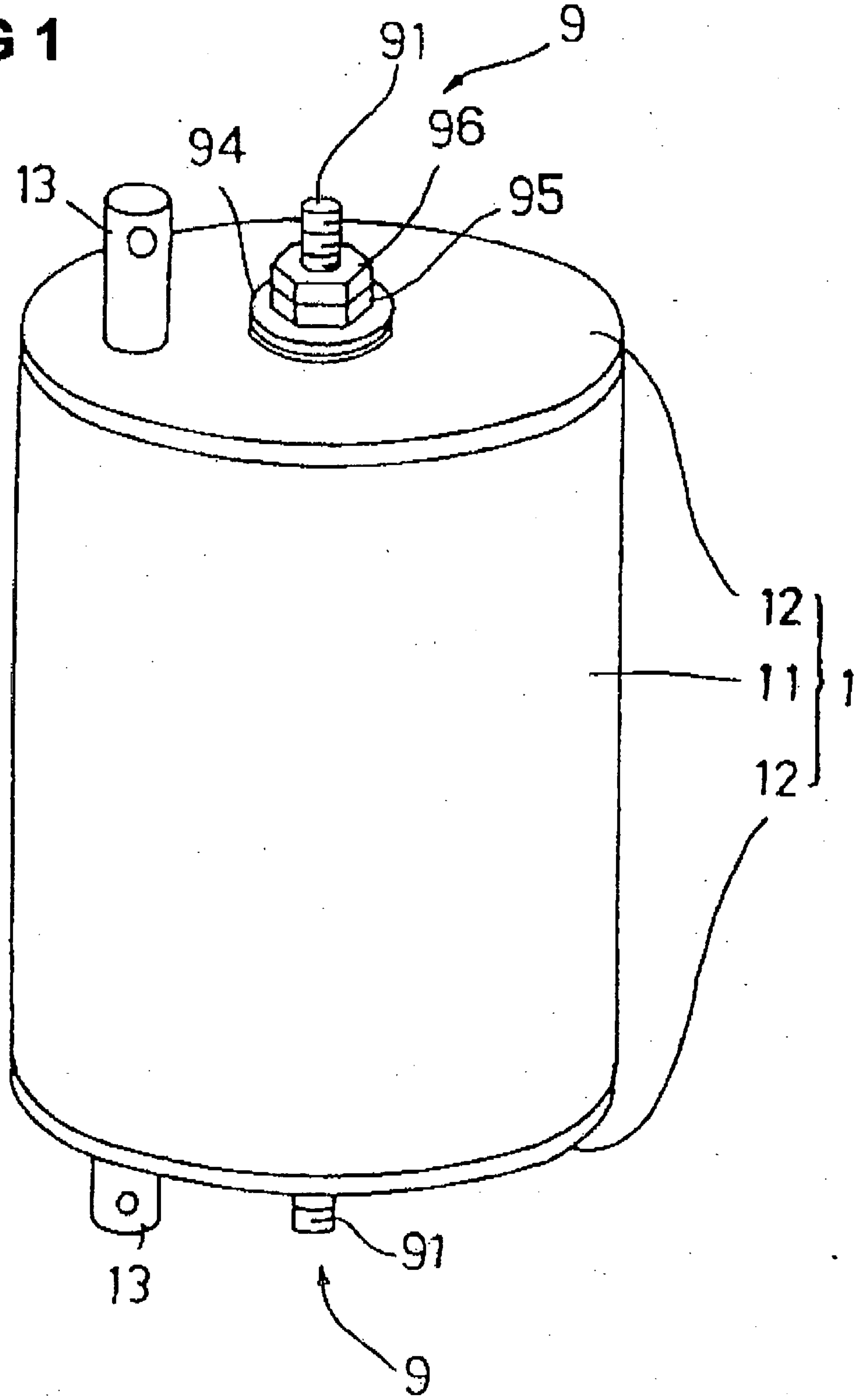


FIG 2

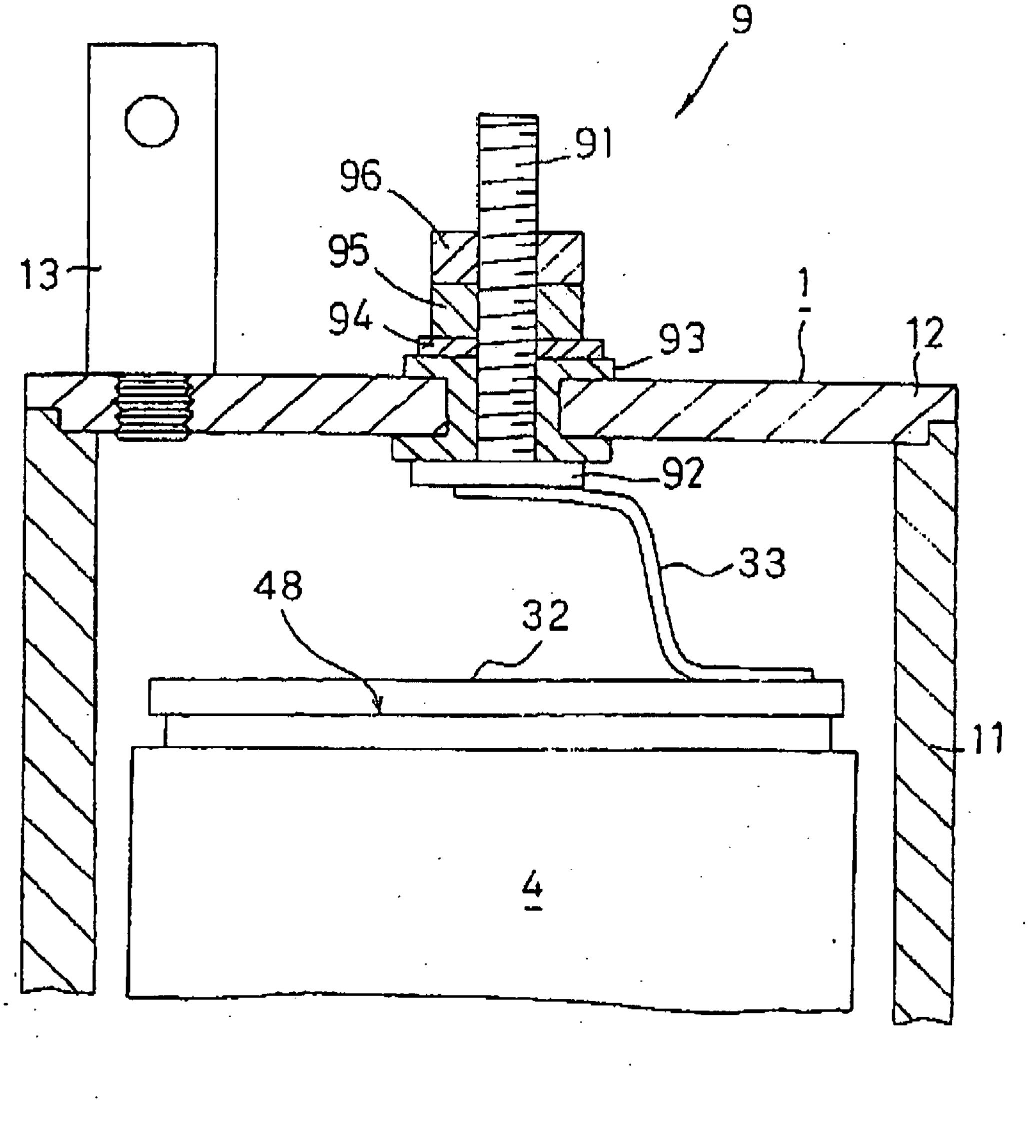


FIG 3

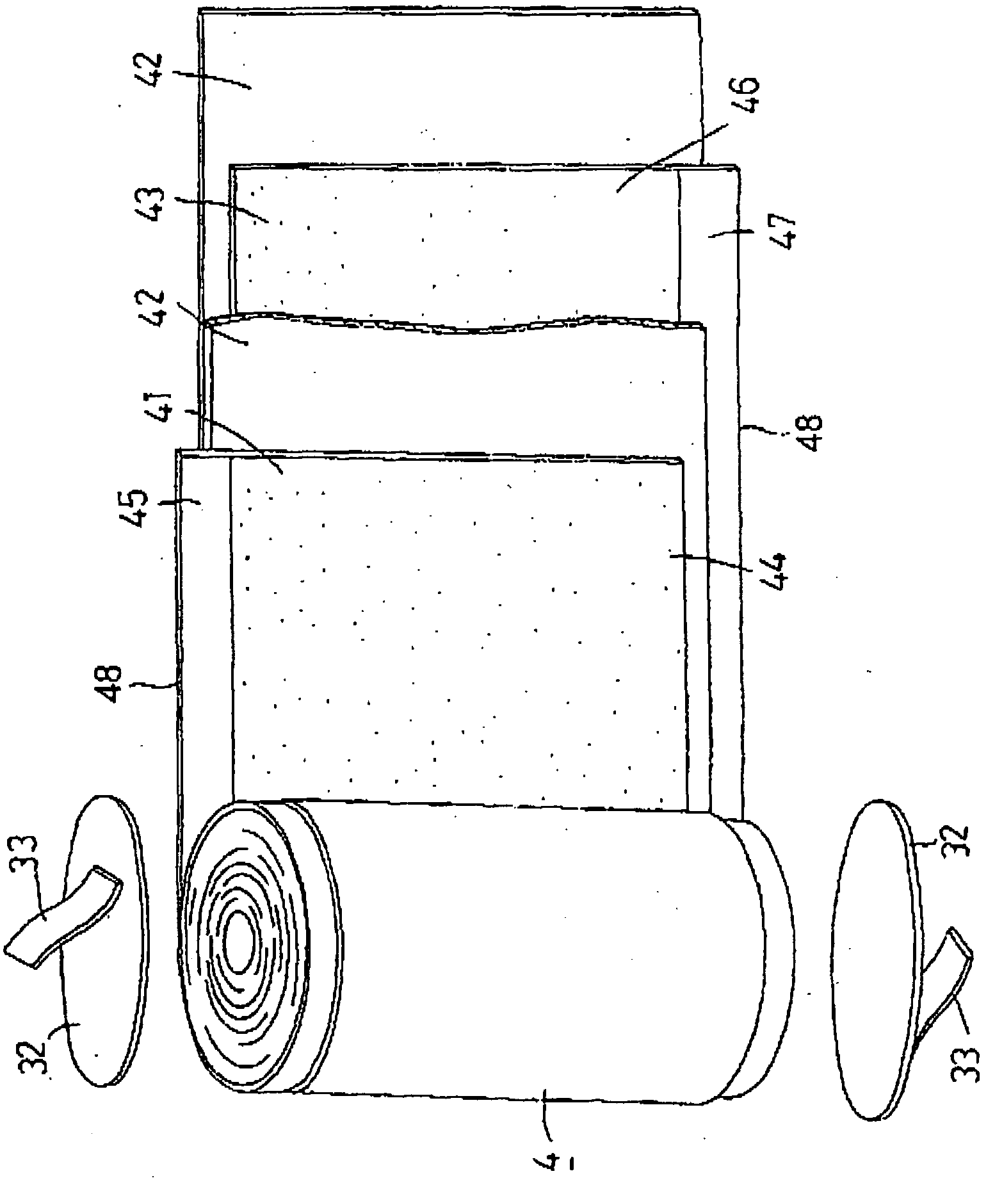


FIG 4

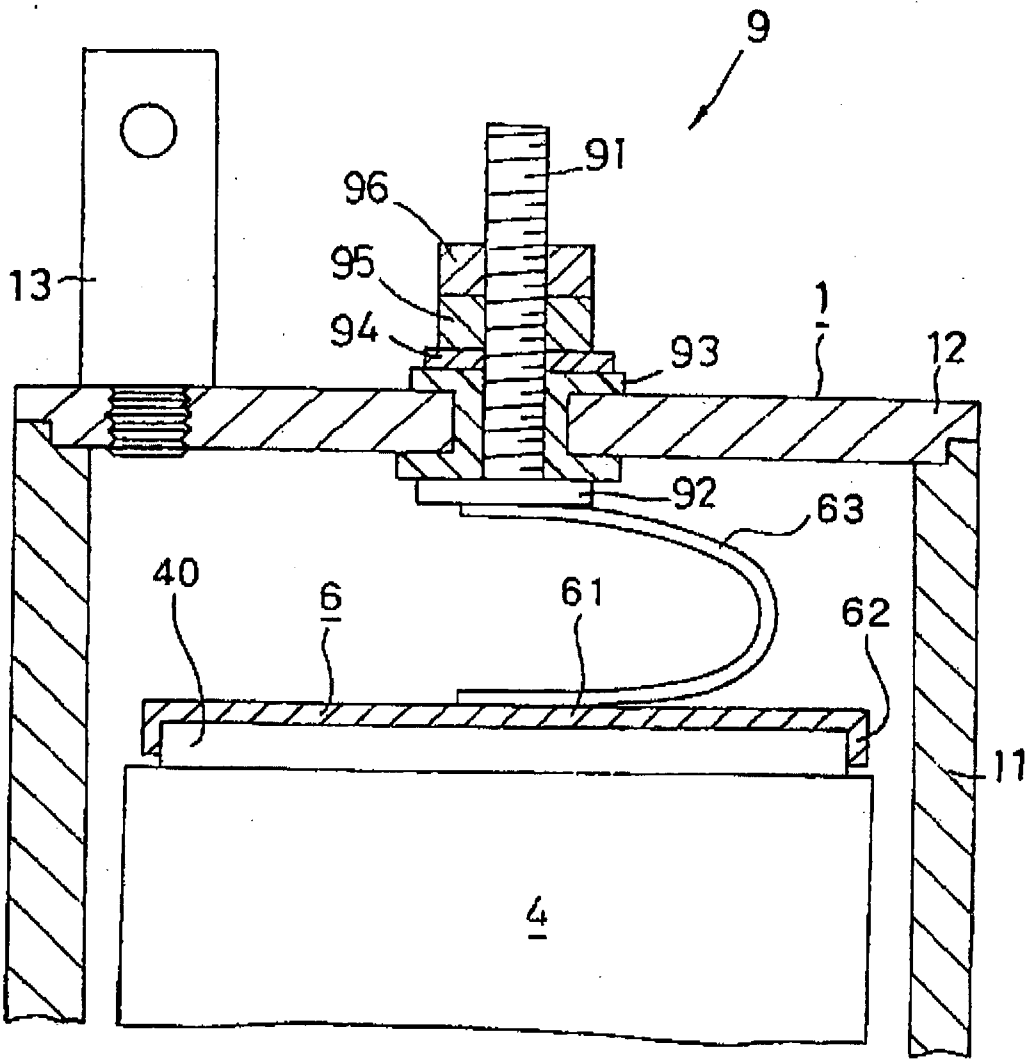


FIG 5

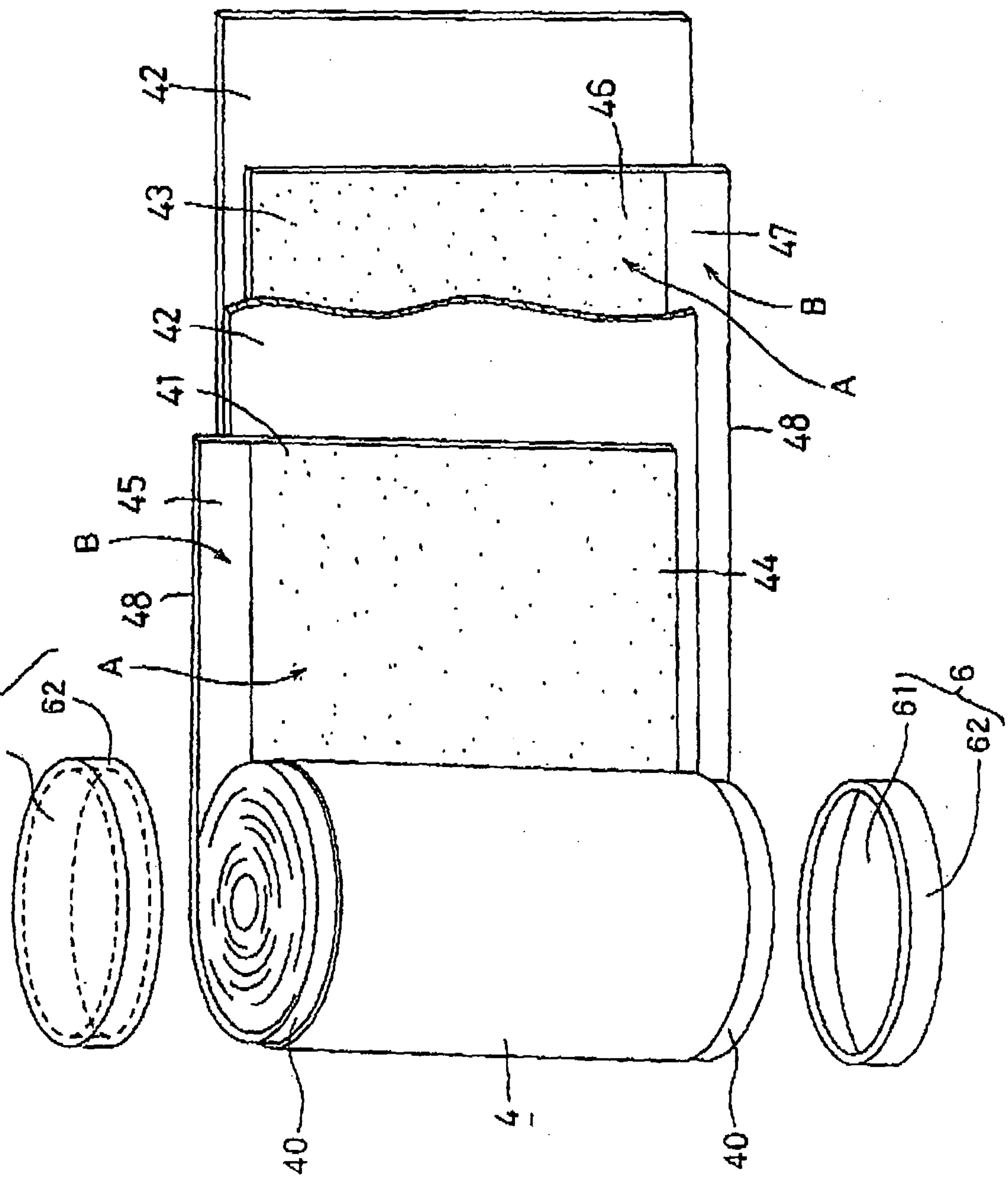


FIG 6

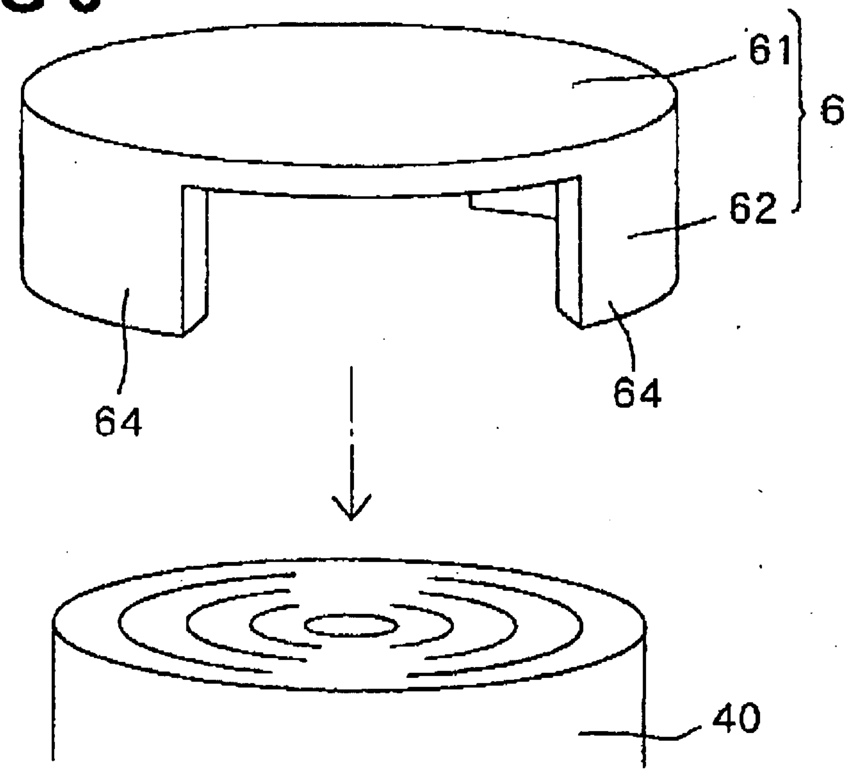


FIG 7

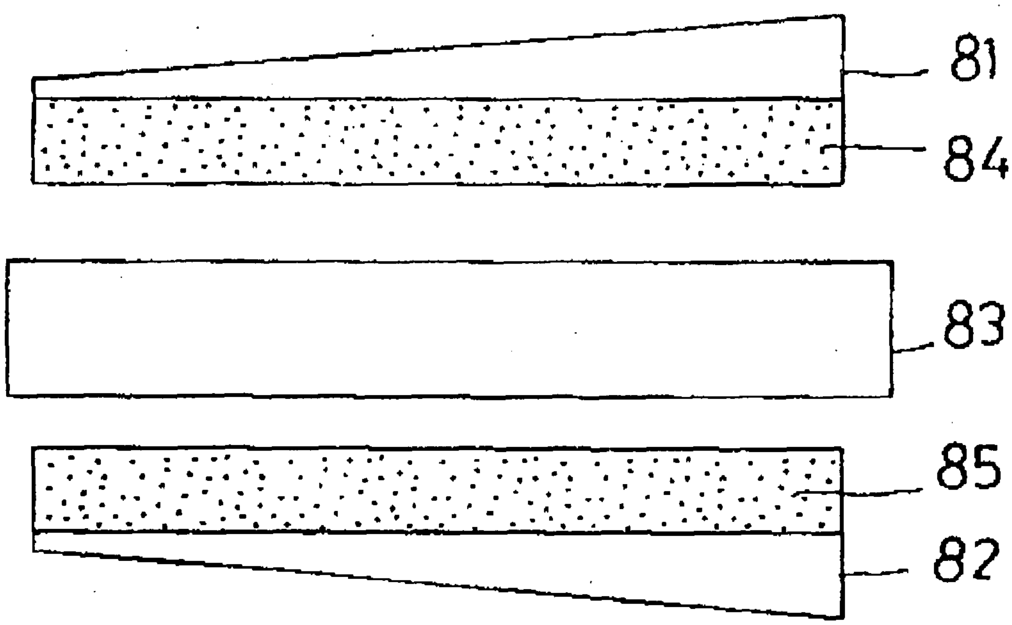


FIG 8

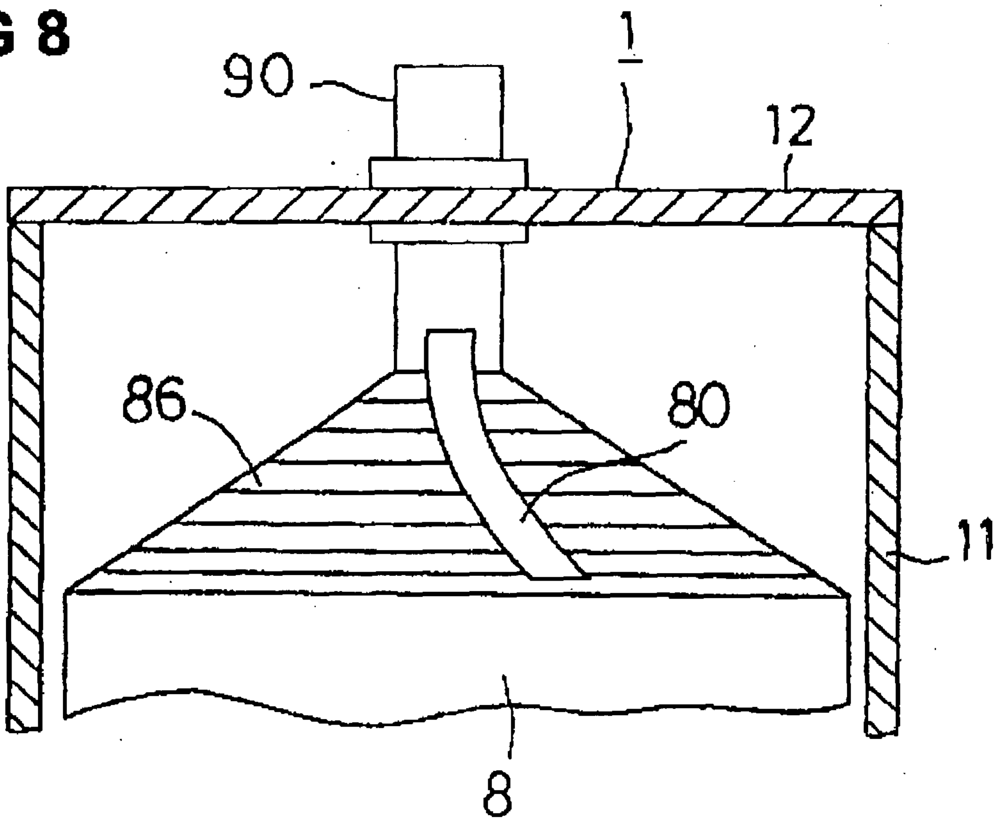


FIG 9

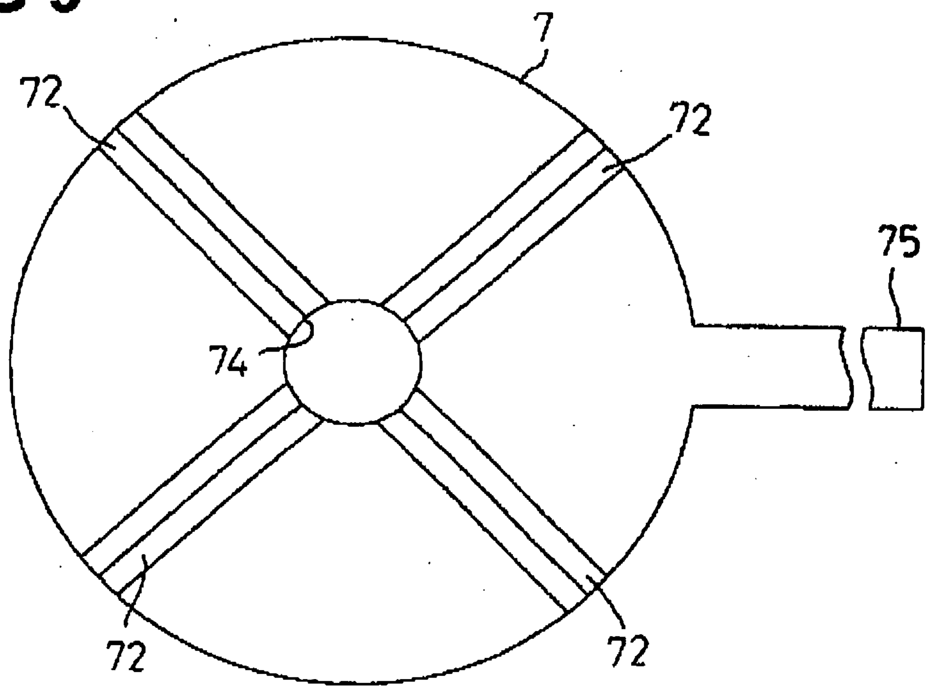
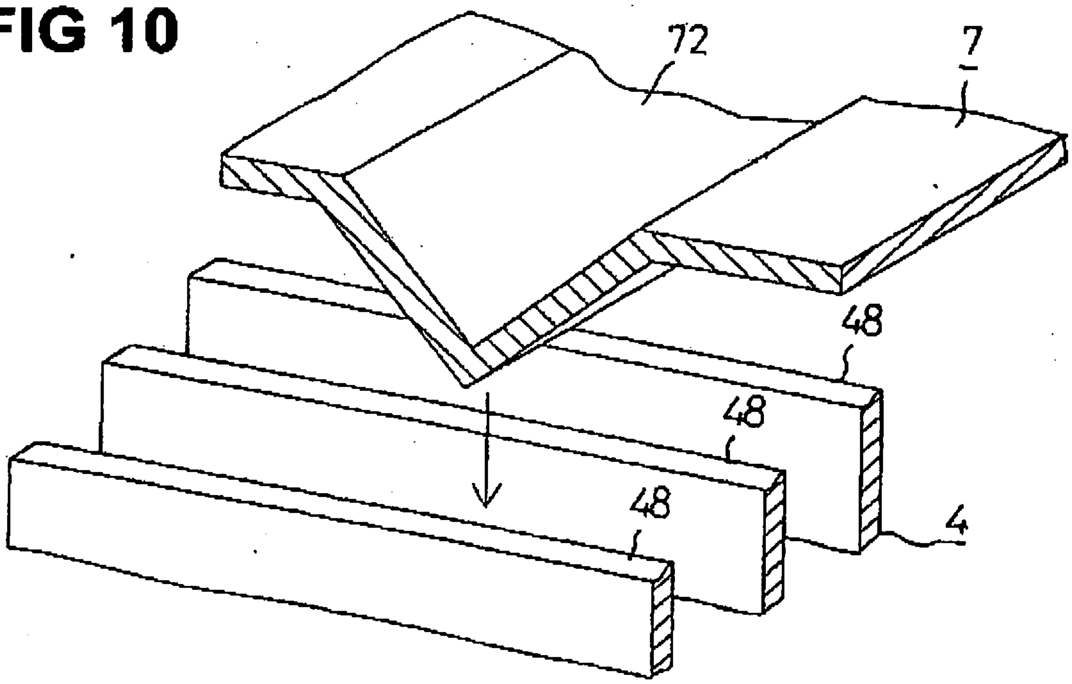


FIG 10



REFERENCES CITED IN THE DESCRIPTION

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- JP 2004102 B **[0009]**
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