

"COMPACT ELECTRONIC EQUIPMENT"

The present invention relates to compact electronic equipment which uses a thin battery cell as a power source.

5 Various types of compact card- or sheet-like electronic equipment such as electronic calculators having a very small thickness of up to about 1 mm have been recently developed. Compact electronic equipment of this type generally has a solar cell having a
10 thickness of about 0.2 mm as a power source cell.

 However, with compact electronic equipment having a memory and/or timepiece function, if a solar cell is
x used as a power source cell, the solar cell cannot receive a sufficient amount of light at times such as at
15 nighttime. The power source voltage cannot then be supplied, and the stored memory contents are lost or the timepiece function cannot be obtained. In view of this problem, compact electronic equipment of this type must have a primary cell.

20 Such primary cells include button-shaped cells such as a mercury cell, a silver oxide cell, or a lithium cell. A button-shaped cell has a considerably large thickness as compared with a solar cell. For example, the thinnest button-shaped lithium cell available on the
25 market today has a thickness of 1.6 mm. Compact electronic equipment having a memory and/or timepiece function must use such a button-shaped cell and

therefore has a considerably larger thickness than compact electronic equipment using a solar cell.

It is an object of the present invention to provide compact electronic equipment which allows the use of an extremely thin power source cell, is compact in size and thin, and can have a memory and/or timepiece function.

The present invention provides electronic equipment comprising a substantially flat upper case member, a substantially flat lower case member having an outer periphery substantially corresponding with that of the upper case member, and a frame portion disposed between the upper and lower case members and defining two storing sections, and an adhesive means securing together the upper and lower case members:

an integrated circuit chip disposed in one of the storing sections and a thin battery cell disposed in the other of the storing sections, the battery cell comprising a power generating unit disposed between upper and lower flat electrode members, and conductive lead means for electrically connecting the electrode members of the battery cell to the integrated circuit chip;

said frame portion having an opening therein communicating with said other storing section and with the exterior of the equipment, and a battery cell receiving member for supporting at least a peripheral edge of the battery cell and being mounted within the other storing section for removal together with the battery cell from the other storing section via said opening.

With this structure, the electronic equipment can be rendered very thin and compact in size. The compact electronic equipment can also have a memory and/or timepiece function, thereby providing multifunction equipment.

The compact electronic equipment according to this

invention can simply and easily receive the battery cell and allows easy replacement thereof.

According to a preferred embodiment of the present invention, the conductive lead means comprises
5 two film-like connecting members each having a conductor formed on a plastic film. The film-like connecting members are adhered to the surface of the thin battery cell with an adhesive.

With the above-mentioned structure, the compact
10 electronic equipment is rendered thinner and smaller. In particular, a good connection is made between the battery cell and a flexible substrate by means of very thin film-like connecting members.

According to another embodiment of the present
15 invention, the conductive lead means comprises two connecting members with conductors which are respectively fixed on the inner surfaces of the upper and lower case members. Each electrode member of the battery cell is in contact with a conductor of the corresponding connect-
20 ing member.

According to still another embodiment of the present invention, the conductive lead means comprises extended portions of the pair of electrode members of the battery cell. The extended portions are in contact
25 with the inner surfaces of the upper and lower case members, respectively.

The compact electronic equipment having the above-mentioned structure can be manufactured with ease.

This invention can be more fully understood from
30 the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view schematically showing compact card-like electronic calculator shown for the purposes of explanation;

35 Fig. 2 is a partially enlarged sectional view of



the compact electronic calculator shown in Fig. 1 along the line II-II therein;

Fig. 3 is an exploded perspective view of the compact electronic calculator shown in Fig. 1;

5 Fig. 4 is an enlarged sectional view of a battery cell (hereinafter referred to as cell) received in the compact electronic calculator shown in Fig. 1;

Fig. 5 is a perspective view showing a cell and film-like connecting members which are received
10 in the compact electronic calculator shown in Fig. 1;

Fig. 6 is a partially enlarged sectional view showing a card-like electronic calculator according to the present invention;

Fig. 7 is an exploded perspective view of the
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compact electronic calculator shown in Fig. 6;

Figs. 8 and 9 are perspective views showing modifications of a cell receiving member;

Fig. 10 is a perspective view showing a
5 modification of the cell; and

Fig. 11 is a sectional view showing the cell shown in Fig. 10 along the line XI-XI therein.

Fig. 1 shows the outer appearance of the compact card-like electronic calculator. The calculator is of
10 the type which has a calculating function with a memory,

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and a timepiece function.

Fig. 2 is a sectional view of the calculator of Fig. 1 along the line II - II therein, and

Fig. 3 is an exploded perspective view thereof.

5 The structure of this calculator will be described with reference to Figs. 1 to 3.

The calculator has a case 10. As shown in Fig. 3, the case 10 has a multilayer structure wherein an upper panel 12 and an upper sheet 13, which together form an
10 upper case member, are laminated on the upper surface of a frame portion 11, and a lower case member comprising a lower panel 14 and a lower sheet 15 are laminated on the lower surface of the frame portion or frame 11. As shown in Fig. 3, a flexible film-like substrate 20, a
15 very thin display panel 30 (e.g. a liquid crystal display panel), and a cell 40 are further arranged inside the case 10. A spacer 50 having the same outer shape as that of the flexible substrate 20 and made of a plastic film is placed on the upper surface of the flexible substrate
20 20. The flexible substrate 20 has through holes for receiving an LSI chip 21 and chip parts 22 such as chip capacitors. The LSI chip 21 and the chip parts 22 are fitted in the holes in the flexible substrate 20 to be mounted thereon. A number of sets of stationary contacts
25 23 including a pair of contacts 23A and 23B are formed at regular intervals on the upper surface of the flexible substrate 20. The spacer 50 has a number of openings 51 which correspond to each stationary contact 23 on the flexible substrate 20. The spacer 50 has through holes
30 52 and 53. The through hole 52 corresponds to the LSI chip 21, and the through holes 53 correspond to the chip parts 22. The spacer 50 having the LSI chip 21 and the chip parts 22 fitted therein is adhered to the flexible substrate 20. The flexible substrate 20 and the spacer
35 50 are fitted within the frame 11 of the case 10. The

frame 11 is formed by punching a thin metal sheet of stainless steel or the like into a corresponding shape. The inside space of the frame 11 is divided into a space or storing section A for receiving the flexible substrate 20, a space or storing section B for receiving the display panel 30, and a space or storing section C for receiving the cell 40 to be described later. The display panel 30 is fitted in the space B of the frame 11 and is arranged at one side of the flexible substrate 20. Connecting terminals 24 for the display panel are regularly arranged at one edge of the lower surface of the flexible substrate 20. As a hot-melt type electrically conductive adhesive is applied on the connecting terminals 24, a film-like connector 31 is fixed to the connecting terminals 24 by means of heating. Thus, the film-like connector 31 is electrically connected to the connecting terminals 24. The cell 40 is fitted in the space C and is arranged at the side opposite to the side of the flexible substrate 20. The upper and lower electrodes of the cell 40 are connected to cell connecting terminals 25A and 25B by means of a pair of film-like connecting members 60. The cell connecting terminals 25A and 25B are formed at one edge of the upper and lower surfaces of the flexible substrate 20.

Special care is taken to render the overall cell 40 thin. Fig. 4 shows the structure of the cell 40.

Referring to Fig. 4, the cell 40 has negative and positive electrode sheets 41A and 41B on its upper and lower surfaces. The electrode sheets 41A and 41B are made of thin metal sheets such as aluminum or stainless steel sheets. The electrode sheets 41A and 41B overlap each other through a holding frame 42. A power generating unit 40A is arranged in a space defined by the electrode sheets 41A and 41B and the holding frame 42.



The surface area of generating unit 40A is less than that of sheets 41A and 41B. The power generating unit 40A has a metal lithium layer 43, a manganese dioxide layer 44, and a separator 45 interposed there-
5 between as a partition wall. The separator 45 is a nonwoven fabric made of polypropylene and impregnated with an organic electrolyte. The electrode sheets 41A and 41B are adhered to each other at the periphery of the holding frame 42 by an adhesive 46 as a sealing
10 member, which is made of a composite material containing both organic and inorganic materials. The cell 40 has a sealed structure. With this sealed structure, the cell 40 has considerable strength against damage. The features of the structure of the cell 40 are that the
15 entire outer surfaces of the electrode sheets 41A and 41B serve as electrodes, and that the electrode sheets 41A and 41B function as flat housing sheets. The power generation of the cell 40 is the same as that of a button-shaped lithium cell.

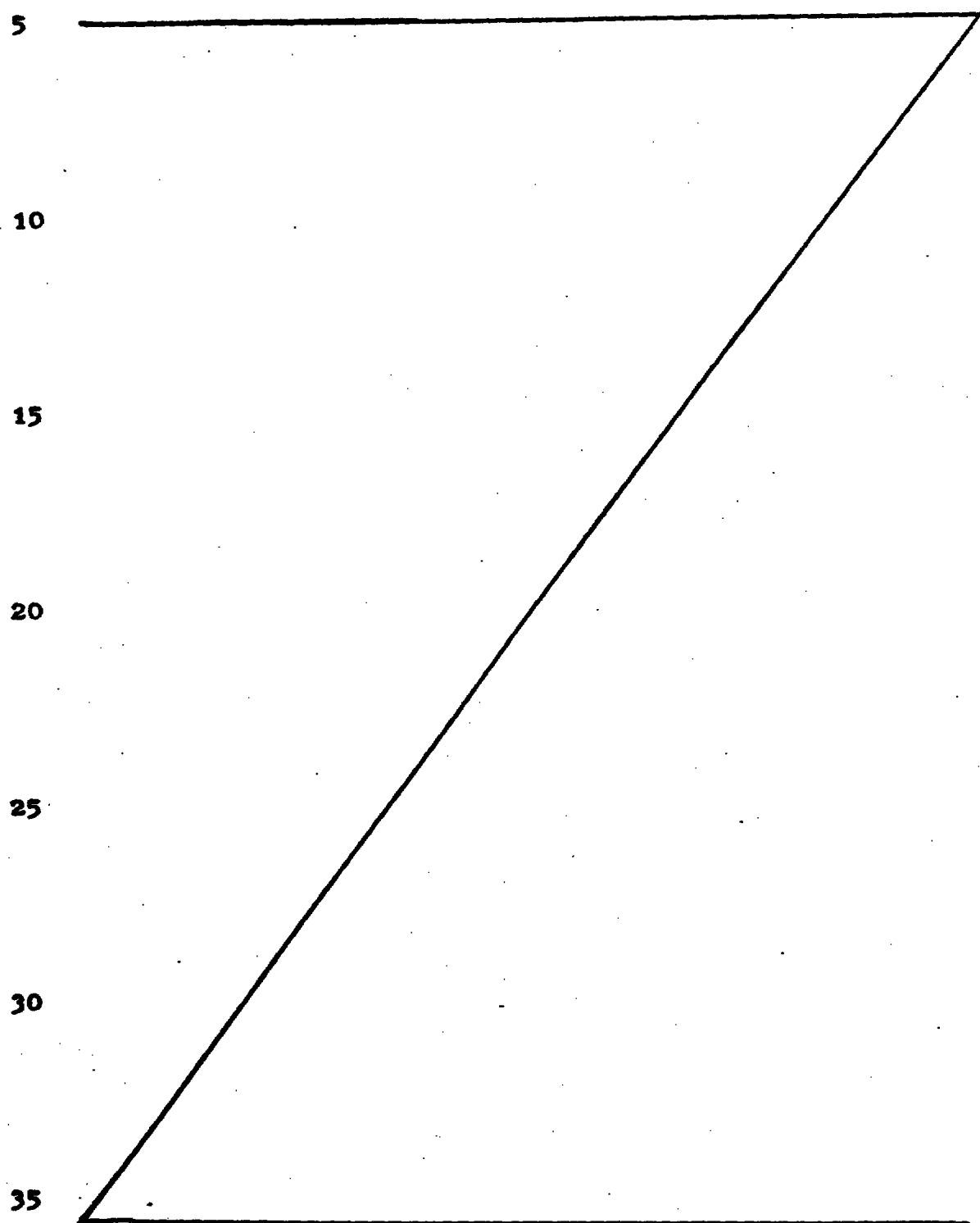
20 The thickness of the cell 40 will be described below. The negative and positive electrode sheets 41A and 41B respectively have a thickness of 50 μ , and the metal lithium layer 43 also has a thickness of 50 μ . The manganese dioxide layer 44 and the separator 45
25 both have a thickness of 150 μ . The cell as a whole has a thickness of 450 μ . In this case, the cell 40 is a rectangle having dimensions of about 45 X 25 mm. The average life of the cell 40 is about 2 years when it is used in a compact card-like electronic calculator
30 having both memory and timepiece functions. When the electronic circuit or display panel is improved in a calculator of this type, the life of the cell 40 can be prolonged further.

The connecting structure between the cell 40
35 and conductive lead means formed by film-like connecting

(6A)

members 60 for connecting it to the flexible substrate 40 will be described with reference to Fig. 5.

Each film-like connecting member 60 has a cell



adhering portion 60A having a slightly larger area than that of the cell 40, and a projection 60B projecting from one side of the cell adhering portion 60A. The film-like connecting member 60 has a plastic film as a base film. A conductor 61 extends on the base film from a position substantially at the center of each cell adhering portion 60A toward the end of the projection 60B. An electrically insulated adhesive is applied on the inner surface of the film-like connecting members 60 except for the conductor 61, and a hot-melt type electrically conductive adhesive is applied on the inner surfaces of the conductor 62. The hot-melt type adhesive is molten at relatively low temperatures such as about 130°C and is solidified at room temperature. The conductor 61 has a double-layer structure consisting of a metal-coated layer and a carbon-coated layer. The metal-coated layer is formed by coating a conductive metal such as gold, silver or copper on a corresponding surface of a base film by means of deposition or printing such as screen printing. The carbon-coated layer is formed from a conductive suspension obtained by mixing a conductive powder such as carbon, a thermoplastic high polymeric material, and a solvent, screen-printing the resultant mixture on the metal-coated layer, and heating the suspension at a low temperature (about 100°C). The film-like connecting member 60 has a thickness of 50 to 100 μ .

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Connection between the film-like connecting member 60 and the cell 40 will be described below. The entire upper and lower surfaces of the cell 40, that is, the overall outer surfaces of the negative and positive electrode sheets 41A and 41B are flashed with a conductive metal such as nickel. Then, the outer surfaces of the electrode sheets 41A and 41B are smoothened and rendered dense. The cell adhering portions 60A of the film-like connecting members 60 are placed on the outer surfaces of the electrode sheets 41A and 41B. After bending the peripheral portions of the cell adhering portions 60A on the side surfaces of the cell 40, the cell adhering portions 60A are heated and pressed. Then, the film-like connecting members 60 are adhered on the upper and lower surfaces of the cell 40, thereby connecting the film-like connecting members 60 to the cell 40.

With this connecting structure between the cell 40 and the film-like connecting members 60, no current leakage from the cell 40 to the frame 11 will occur. This is because the side, upper and lower surfaces of the cell 40 are completely covered with the base films of the film-like connecting members 60. When the film-like connecting members 60 are adhered to the cell 40, no thermal damage to the cell 40 will occur. This is

because the film-like connecting members 60 can be adhered to the cell 40 by a hot-melt type adhesive which can be used at low temperatures. Due to the smoothness of the upper and lower surfaces of the

5 cell 40 which is obtained by flashing, adhesion between the film-like connecting members 60 and the cell 40 is strong. Although the upper and lower surfaces of the cell 40 are flashed in the above embodiment, this is not essential to the present invention. Furthermore, in this embodiment, in order to allow contact with the electrode sheets 41A and 41B of the cell 40, the conductors 61 of the film-like connecting member 60 are formed only at portions of the base films. However, if a conductive adhesive is applied to the entire surfaces of the base films, the film-like connecting members 60 may be rendered conductive over the entire surfaces which are respectively brought into contact with the entire surfaces of the electrode sheets 41A and 41B of the cell 40.

20 The film-like connecting members 60 are adhered to the flexible substrate 20 by heating and pressing the projections 60B onto the terminals 25A and 25B of the flexible substrate 20. Thus, electrical connection between the electrodes of the cell 40 and the terminals 25A and 25B of the flexible substrate 20 is accomplished.

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Referring again to Figs. 2 and 3, the upper and lower panels 12 and 14 of the case 10 are made of metal sheets such as stainless steel or beryllium steel sheets. The upper panel 12 has openings 121
5 respectively corresponding to the openings 51 of the spacer 50, and a hole 122 for receiving the upper portion of the display panel 30. The upper panel 12 also has recesses 123, 124 and 125 formed by etching in its lower surface. The recesses 123 and 124 receive the
10 upper portions of the LSI chip 21 and the chip parts 22 which project above the spacer 50. The recess 125 receives the upper portions of the film-like connecting member 60 adhered to the upper surface of the cell 40. The lower surface of the upper panel 12 is
15 adhered to the upper surface of the frame 11, so that the upper panel 12 is formed integrally with the frame 11. The spacer 50 is adhered to the lower surface of the upper panel 12.

The lower panel 14 has in its upper surface a
20 recess 141 formed by etching. The recess 141 receives the lower film-like connecting member 60 adhered to the lower surface of the cell 40. The lower panel 14 is adhered to the lower surface of the frame 11. Adhesion between the lower panel 14 and the frame
25 11 is performed after a filler 16 is filled. More specifically, after the flexible substrate 20 having the display panel 30 and the cell 40 connected



thereto is adhered to the lower surface of the spacer 50, and the display panel 30 and the cell 40 are fitted in the frame 11, the filler 16 is applied inside the frame 11 from the lower surface of the flexible substrate 20. The lower panel 14 is adhered not only to the frame 11 but also to the flexible substrate 20 through the filler 16. The filler 16 serves to fix in position the LSI chip 21 and the chip parts 22 mounted on the flexible substrate 20, the display panel 30 and the cell 40. The filler 16 can be a quick-dry liquid adhesive which can be hardened at room temperature such as an acrylic- or epoxy-based two-part adhesive. The adhesive is dripped onto the lower surface of the flexible substrate 20 having its upper surface facing downward.

The outer surface of the case 10 obtained by adhering the frame 11 and the upper and lower panels 12 and 14 is covered with an outer member 17 so as to guarantee a complete hermetic seal of the case. The outer member 17 is formed by applying a liquid adhesive of the same type as that used for the filler 16, hardening the adhesive, and cutting any excess portion of the hardened adhesive layer.

The upper and lower sheets 13 and 15 of the case 10 are made of a plastic film and are respectively adhered to the surfaces of the upper and lower panels 12 and 14. In the upper sheet 13, keyboard sections 131 designating

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ten keys, character keys or function keys are printed on a lower surface of a transparent plastic film, and the overall portion except for a display portion 132 is printed with a non-transparent paint. The display panel 30 is adhered to the lower surface of the display portion 132 of the upper sheet 13 by a transparent adhesive. Contact bases 133 to be inserted in the respective openings 121 of the upper panel 12 are formed on the lower surfaces of the keyboard sections 131 by screen printing or the like. Movable contacts 134 are mounted on the lower surfaces of the contact bases 133 by printing carbon ink or the like. The movable contacts 134 are pressed onto the stationary contacts 23 of the flexible substrate 20 when the operator depresses the keyboard sections 131 of the upper sheet 13 downward so as to elastically deform them. The operation switches therefore are constituted by the movable contacts 134 and the stationary contacts 23.

The compact card-like electronic calculator having the above-mentioned structure can be rendered very thin for the following reasons. That is, a very thin

cell 40 is used, the cell 40 is arranged at the side opposite to that of of the flexible substrate 20, and connection between the cell 40 and the flexible substrate 20 is achieved through the film-like connecting members 60, so that not much height is required for connecting the cell 40 to the



flexible substrate 40.

A total thickness of the calculator of this embodiment will be described. The flexible substrate 20, the spacer 50 and the filler 16 respectively have thickness of 200 μ , 100 μ , and 130 μ . The upper panel 12, the upper sheet 13, the lower panel 14, and the lower sheet 15 respectively have thickness of 150 μ , 70 μ , 150 μ , and 50 μ . Therefore, the calculator has a total thickness of 850 μ which is substantially equivalent to that of a compact card-like electronic calculator using a solar cell. The thickness of the frame 11 of the case 10 is defined by a space between the upper and lower panels 12 and 14. The width of the space has a size corresponding to the sum of the thickness of the flexible substrate 20, the spacer 50, and the filler 16, i.e., 430 μ . In this embodiment, the cell 40 having a thickness of 450 μ is used. In this case, the overall thickness of the cell portion including the thickness of the upper and lower film-like connecting members 60 is 550 to 590 μ . This thickness is greater than the width of the space between the upper and lower panels 12 and 14, i.e., 430 μ . However, as has been described above, the recesses 125 and 141 are formed in the lower and upper surfaces of the upper and lower panels 12 and 14, respectively. These recesses 125 and 141 receive therein the upper and lower portions of the film-like connecting members 60 and the

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cell 40. Therefore, the cell 40
can be received between the upper and lower panels 12
and 14 without increasing the thickness of the
equipment.

5 In this embodiment, the case 10 comprises a
multilayer structure constituted by the frame 11, the
upper and lower sheets 13 and 15, and the upper and
lower panels 12 and 14. The upper sheet 13 may be
formed integrally with the upper panel 12. The lower
10 sheet 15 need not be used.

A compact card-like electronic calculator which
allows replacement of the cell 40 according
to a ~~second~~ embodiment of the present invention will now
be described.

15 Figs. 6 and 7 respectively are a sectional view and
an exploded perspective view of this calculator, which
are similar to that in Figs. 2 and 3. As in the case of
the calculator shown in Figs. 1 to 3, the calculator
shown in Figs. 6 and 7 has a calculation function with a
20 memory, and a timepiece function. Like the calculator
shown in Figs. 1 to 3, this calculator uses a thin
cell and is therefore thin. The same
reference numerals as in Figs. 2 and 3 denote the same
parts in Figs. 6 and 7.

A press portion 126 for pressing a first connecting member 70 to be described later is formed at the left portion of the upper panel 12 in Fig. 7. The press portion 126 has a pair of parallel slits 126A formed in the upper panel 12, and a bent portion 126B formed by slightly bending downward the portion between the slits 126A. At the press portion 126, the central portion of the bent portion 126B is elastically projected downward from the lower surface of the upper panel 12, and the projecting portion presses the connecting portion 70 downward.

This first connecting member 70 is adhered to that portion of the lower surface of the upper panel 12 which corresponds to the press portion 126 of the upper panel 12. The first connecting member 70 has an insulating sheet 70A and a conductor 70B formed on the lower surface of the insulating sheet 70A. The conductor 70B electrically connects the negative electrode sheet 41A of the cell 40 to the connecting terminal 25A on the flexible substrate 20.

A press portion 142 of the lower panel 14 is formed at that portion of the lower panel 14 which is opposed to the press portion 126 of the upper panel 12. As in the case of the press portion 126 of the upper panel 12, the press portion 142 has a pair of parallel slits 142A and a bent portion 142B and elastically presses a second connecting member 72 downward. The second connecting

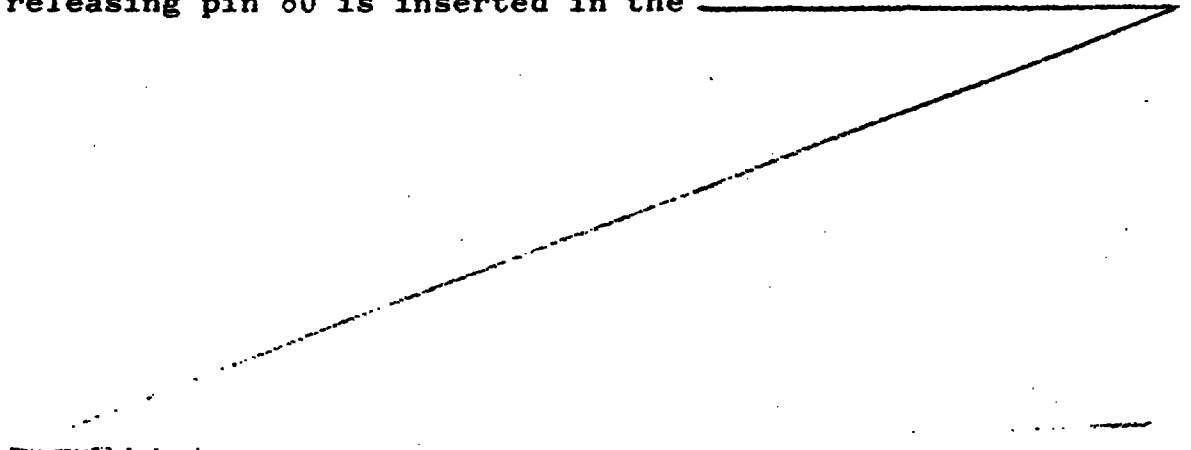


member 72 is adhered to that portion of the upper surface of the lower panel 14 which corresponds to the press portion 142 of the lower panel 14. As in the case of the first connecting member 70, the second connecting member 72 has an insulating sheet 72A and a conductor 72B formed on the upper surface of the insulating sheet 72A. The conductor 70B electrically connects a positive electrode sheet 41B of the cell 40 to the connecting terminal 25B on the lower surface of the flexible substrate 20.

The arrangement shown in figures 6 and 7 is different from the arrangement shown in figures 1 to 5 in the structure of frame 11. As shown in Fig. 7, the frame 11 has one open side which corresponds to space C for receiving the cell 40. The frame 11 has a recess 112 extending near one partitioning projection 111, and a through hole 113 extending in the recess 112. A release pin 80 can be detached from the through hole 113.

A cell receiving member 90 is detachably mounted in the space C from the open side of the frame 11. The cell receiving member 90 for receiving the cell 40 is made of stainless steel and has a rectangular shape. The cell receiving member 90 has a projection 91 at a portion corresponding to the recess 112. When the cell receiving member 90 is mounted in the space C, the projection 91 is detachably engaged in the recess 112. When the releasing pin 80 is inserted in the

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through hole 113, the projection 91 is disengaged from the recess 112. An insulating coating 92 covers at least the portion of the cell receiving member 90 which is brought into contact with the cell 40 when the cell

5 40 is received in the cell receiving member 90. It is preferable that the insulating coating 92 covers the all-over surfaces of the cell receiving member 90. The insulating coating 92 serves to insulate the upper and lower electrode sheets 41A and 41B from each other.

10 Insulating coatings (not shown) are respectively formed on the portions of the lower surface of the upper panel 12 and the upper surface of the lower panel 14 corresponding to the upper and lower surfaces of the cell 40, except for the first connecting member 70.

15 Since the cell 40 is received in the cell receiving member 90, the size of the cell 40 is smaller than that of Figs. 1-5, and is 40 x 20 mm.

Mounting of the cell 40 in the card-like electronic calculator will be described with reference

20 to Fig. 7.

The cell 40 is placed inside the cell receiving member 90. Thereafter, the cell receiving member 90 is inserted into the space C of the frame 11 from the open side of the frame 11. At this time, the

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projection 91 of the cell receiving member 90 is engaged in the recess 112 of the frame 11, and the cell receiving member 90 is held in the space C of the frame 11. At the same time, the upper and lower electrode sheets 41A and 41B of the cell 40 are respectively brought into contact with the conductors 70B and 72B of the first and second connecting members 70 and 72 which are adhered on the lower and upper surfaces of the upper and lower panels 12 and 14. The electrical connection between the cell 40 and the flexible substrate 20 is achieved by the connecting members 70 and 72.

In order to replace the cell 40 with a new one, the release pin 80 is inserted into the through hole 113 from the side of the compact card-like electronic calculator, that is, from the side of the frame 11, so as to press inward the projection 91 of the cell receiving member 90. Then, the projection 91 is disengaged from the recess 112. The cell receiving member 90 can then be pulled out from the space C of the frame 11, thereby allowing replacement of the cell 40.

In the embodiment described above, the cell receiving member 90 for receiving the cell 40 has a rectangular shape. However, the present invention is not limited to this. A different cell receiving member from the cell receiving member 90 shown in Fig. 7



is shown in Figs. 8 and 9.

A cell receiving member 190 shown in Fig. 8 has a frame portion 191 different in shape from that of the cell receiving member 90 shown in Fig. 7, and a bottom plate 192 mounted below the frame portion 191. An extension 193 of the bottom plate 192 extends from an end thereof. An insulating coating (not shown) covers the upper surface of the bottom plate 192 and on the inner wall surface of the frame portion 191. A conductor 194 is formed on the insulating coating. One end of the conductor 194 is in contact with the positive electrode sheet 41B of the cell 40 received in the cell receiving member 190, and the other end thereof is in contact with the connecting terminal 25B on the lower surface of the flexible substrate 20 when the cell receiving member 190 is inserted in the space C. In this manner, the cell 40 and the flexible substrate 20 are electrically connected with each other. In this case, a press portion 195 similar to the press portion 141 of the above embodiment is formed at the extension 193 of the bottom plate 192 so as to be in contact with the terminal 25B of the flexible substrate 20. A projection 196 similar to the projection 91 of the above embodiment is formed on one side of the frame portion 191.

In the cell receiving member 190 according to the modification described above, the conductor 194 is

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formed on the bottom plate 192 through the insulating coating. Therefore, the second connecting member 72 and the press portion 141 of the lower panel 14 need not be used. As compared with the calculator of the embodiment shown in Figs. 6 and 7, the detachable reception and electrical connection of the cell 40 can be reliably performed.

Fig. 9 shows a cell receiving member 290 according to another modification. The cell receiving member 290 is formed by bending a single stainless plate so as to sandwich the cell 40 therebetween. The cell receiving member 290 has upper and lower portions 291 and 292. Clamp portions 293 for clamping the cell 40 are formed in the upper and lower portions 291 and 292 so as to oppose each other. Extensions 294 and 295 respectively extend from the sides of the upper and lower portions 291 and 292. A pair of clamp portions 296 are formed in the projections 294 and 295 so as to be in contact with the terminals 25A and 25B of the flexible substrate 20. Insulating coating (not shown) covers the inner surfaces of the upper and lower portions 291 and 292. Conductors (not shown) similar to the conductors 61 of the film-like connecting members 60 as shown in Fig. 5 are formed on these insulating coatings. A projection 297 corresponding to the recess 112 of the frame 11 is formed in the cell receiving member 290.



When the cell receiving member 290 of this modification is used, the press portions 126 and 141 of the upper and lower panels 12 and 14 and the first and second connecting members 70 and 72 need not be used.

5 Still another modification of a cell for a compact electronic equipment according to the present invention will now be described with reference to Figs. 10 and 11.

10 A cell 240 shown in Figs. 10 and 11 has a power generating unit similar to that in the cell 40 shown in Fig. 4. The power generating unit 240A of the cell 240 has a pair of electrode sheets 241A and 241B. It also has a metal lithium layer 243 and 241B, a manganese dioxide layer 244 and a separator 245 which are formed between
15 the electrode sheets 241A.

However, the cell 240 shown in Figs. 10 and 11 is different from the cell 40 shown in Fig. 4 in the following respects. First, in the
20 embodiment shown in Figs. 10 and 11, the electrode sheets 241A and 241B have extensions 241C and 241D which extend sideways from the corners of the rectangles of the sheets 241A and 241B. These extensions 241C and 241D connect the cell 240 to the terminals
25 25A and 25B of the flexible substrate 20 and therefore serve the same purpose as the film-like connecting member 60 in the first embodiment.

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Second, in this embodiment, a sealing member 246 corresponding to the adhesive 46 in Figs. 4 and 5 extends outward from the peripheries of the electrode sheets 241A and 241B so as to seal the space therebetween. The sealing member 246 is made of a composite material containing both organic and inorganic materials. When the frame 11 made of a metal surrounds the side surfaces of the cell 240, this sealing member 246 serves to prevent short-circuiting of the electrode sheets 241A and 241B.

When this cell 240 is used, the first and second connecting members 70 and 72 and the receiving member 90, 190 or 290 are not required and the cell 240 can be easily mounted inside the space C of the calculator. In addition, this modification of the cell 240 may be applied to either of the first and second embodiments.

The present invention is not limited to the card-like electronic calculators as described above, and can be applied to a wide variety of compact electronic equipment.



CLAIMS:

1. Electronic equipment comprising:
a substantially flat upper case member, a substantially
flat lower case member having an outer periphery
substantially corresponding with that of the upper case
5 member, and a frame portion disposed between the upper
and lower case members and defining two storing sections,
and an adhesive means securing together the upper and
lower case members:
an integrated circuit chip disposed in one of
10 the storing sections and a thin battery cell disposed
in the other of the storing sections, the battery cell
comprising a power generating unit disposed between
upper and lower flat electrode members, and conductive
lead means for electrically connecting the electrode
15 members of the battery cell to the integrated circuit
chip;
said frame portion having an opening therein
communicating with said other storing section and with
the exterior of the equipment, and a battery cell
20 receiving member for supporting at least a peripheral
edge of the battery cell and being mounted within
the other storing section for removal together with the
battery cell from the other storing section via said opening.
2. Electronic equipment according to claim 1,
25 wherein said battery cell receiving member comprises a
rectangular frame surrounding the battery cell.
3. Electronic equipment according to claim 1, wherein
said battery cell receiving member includes a projection
resiliently biased into engagement with a recess in said
30 frame portion in order to releasably lock the battery
cell receiving member in said other storing section.



4. Electronic equipment according to any preceding claim, wherein said battery cell receiving member includes a bottom plate member for supporting the battery cell.
5. Electronic equipment according to claim 4, wherein said bottom plate member includes an electrical conductor contacting an electrode of the battery cell.
- 10 6. Electronic equipment according to any preceding claim, wherein the battery cell has a three-layer structure of uniform thickness comprising positive and negative electrode sheets with a generating unit disposed therebetween having an area smaller than the sheets, and a
15 sealing member for sealing together the peripheries of the electrode sheets.
7. Electronic equipment according to any preceding claim, wherein said conductive lead means comprises two
20 film-like connecting members each of which has a conductor formed on a plastic film.
8. Electronic equipment according to claim 7, wherein each of said connecting members is adhered on a surface of
25 said battery cell with an adhesive.
9. Electronic equipment according to any of claims 1 to 6, wherein said conductive lead means comprises two film-like connecting members with conductors, which are
30 respectively fixed on inner surfaces of said upper and lower case members, and the electrode sheets of said battery cell are respectively in contact with said conductors of said connecting members.
- 35 10. Electronic equipment according to claim 5, wherein



said conductive lead means comprises a single film-like connecting member having a first conductor, said connecting member being fixed to an inner surface of one of said upper and lower case members, the electrode members of
5 said battery cell being in contact with said first conductor and one end of said conductor of the battery cell receiving member, respectively, and the other end of said conductor of the battery cell receiving member being in contact with an inner surface of the other of said upper
10 and lower case members.

11. Electronic equipment according to claim 1, wherein said conductive lead means are comprised in the battery cell receiving member for receiving said battery cell, the
15 battery cell receiving member having portions sandwiching the battery cell.

12. Electronic equipment according to claim 1, wherein said conductive lead means comprises extending portions
20 extending from the flat electrode members of the battery cell, said extending portions being in contact with inner surfaces of said upper and lower case members.

13. Electronic equipment according to claim 6, wherein
25 said sealing member has a shape extending outward from the peripheries of said electrode sheets.

14. Electronic equipment, substantially as hereinbefore described with reference to the accompanying drawings.