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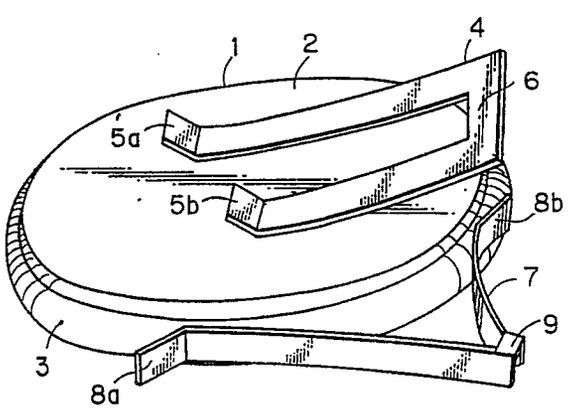
(54) Electrode construction of battery in electrical equipment.

(57) The present invention is directed to an electrode construction of a battery (1) in an electrical equipment. According to the present invention, at least two contacts (8a, 8b; 5a, 5b) in an electrode (4, 7) have a different shape from each other, so that the characteristic frequencies of these contacts are different from each other. As a result, when a contact is resonating by the frequency of an oscillation applied to the electrical equipment, the other contact keeps in contact with the battery (1) without resonating.

FIG. 4



EP 0 390 070 A2

ELECTRODE CONSTRUCTION OF BATTERY IN ELECTRICAL EQUIPMENT

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an electrode construction of a battery in an electrical equipment, such as an IC card.

Description of the Prior Art

Fig. 7 is a perspective view showing a conventional electrode construction of a battery in an IC card.

A battery 1 has a minus pole 2 and a plus pole 3. A minus electrode 4 has two minus-pole contacts 5a and 5b to be connected with the minus pole 2 of the battery 1 respectively, and a fixing part 6 fixed in a battery chamber (not shown) of an IC card. The fixing part 6 is electrically connected with an electric circuit (not shown) of the IC card, the electric circuit having semiconductor elements to store storage data. Both of the minus-pole contacts 5a and 5b are formed so as to have the same shape (in length, width, thickness and so on) with each other.

A plus electrode 7 has two plus-pole contacts 8a and 8b to be connected with the plus pole 3 of the battery 1 respectively, 80 and a fixing part 9 fixed in the battery chamber of the IC card. The fixing part 9 is electrically connected with the electric circuit of the IC card. Both of the plus-pole contacts 8a and 8b are formed so as to have the same shape with each other.

When the battery 1 is detachably installed in the battery chamber of the IC card, the minus pole 2 is electrically connected with the minus electrode 4 through the minus-pole con tacts 5a and 5b, while the plus pole 3 is electrically connected with the plus electrode 7 through the plus-pole contacts 8a and 8b. Thus, an electrical power of the battery 1 is nected with the plus electrode 7 through the plus-pole contacts 8a and 8b. Thus, an electrical power of the battery 1 is supplied to the electric circuit of the IC card through the minus and plus electrodes 4 and 7.

Now, the minus-pole contacts 5a and 5b of the minus electrode 4 have a characteristic frequency ω, respectively. The characteristic frequency ω is given by the following definition:

$\omega = F(\ell, E, I, m)$

where ℓ is a length of the minus-pole contact, E is a longitudinal section modulus, I is a moment of inertia, and m is a linear density.

As is apparent from the definition (1), the minus-pole contacts 5a and 5b have the same characteristic frequency with each other since they have the same shape, and the plus-pole contacts 8a and 8b have the same characteristic frequency with each other by the same reason.

Therefore, when an oscillation having a frequency resonating with respect to the characteristic frequency of the minus-pole contacts 5a and 5b is applied to the IC card, both of the minus-pole contacts 5a and 5b simultaneously oscillate and move away from the minus pole 2 of the battery 1, whereby the power supply from the battery 1 to the electric circuit of the IC card is cut off eliminating the storage data stored in the semiconductor elements of the electric circuit.

Accordingly, a principal object of the present invention is to provide an electrode construction of a battery in an electrical equipment which can maintain a power supply from the battery through the minus and plus electrodes in a reliable manner, even if an oscillation with any frequency is applied to the electrical equipment and the respective electrodes.

SUMMARY OF THE INVENTION

The present invention is directed to an electrode construction of a battery in an electrical equipment, wherein the electrical equipment comprises a battery chamber, a plus electrode and minus electrode provided in the battery chamber, respectively, and a battery having a plus pole to be connected with the plus electrode and a minus pole to be connected with the minus electrode in a state so that the battery is detachably installed in the battery chamber. The inventive electrode construction is characterized in that the plus electrode and/or the minus electrode comprise a plurality of contacts to be connected with the battery, at least two contacts out of the plurality of contacts having a different shape from each other.

According to the present invention, since at least two contacts out of a plurality of contacts in an electrode have a different shape from each other, the characteristic frequencies of these contacts are different from each other. As a result, when a contact is resonating by the frequency of an oscillation applied to the electrical equipment, the other contact keeps in contact with the battery without resonating.

These and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed descrip-

tion of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing an IC card to which an embodiment of the present invention is applied;

Fig. 2 is a horizontal sectional view of a main part of the IC card;

Fig. 3 is a vertical sectional view of the main part of the IC card;

Fig. 4 is a perspective view showing an embodiment of an electrode construction according to the present invention;

Figs. 5 and 6 are perspective views showing modified examples of an electrode, respectively; and

Fig. 7 is a perspective view showing a conventional electrode construction of a battery in an IC card.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a perspective view showing an IC card to which an embodiment of the present invention is applied, Fig. 2 is a horizontal sectional view of a main part of the IC card, Fig. 3 is a vertical sectional view of the main part of the IC card. Fig. 4 is a perspective view showing an embodiment of an electrode construction according to the present invention.

An IC card 10 has a body 11 in which an electric circuit 12 is formed. The electric circuit 12 has semiconductor elements to store storage data. A battery chamber 13 is formed in the body 11, and the battery 1 having a minus pole 2 and a plus pole 3 is detachably installed in the battery chamber 13 through a battery holder 14. The battery holder 14 has a supporting part 15 for supporting the battery 1 and convex parts 16 for detachably engaging with recessed parts 17 formed in the battery chamber 13, respectively.

A minus electrode 4 has two minus-pole contacts 5a and 5b to be connected with the minus pole 2 of the battery 1, respectively, and a fixing part 6 fixed in the battery chamber 13. The fixing part 6 is electrically connected with the electric circuit 12. Both of the minus-pole contacts 5a and 5b are formed in a strip-shape. respectively, and having a different length from each other.

A plus electrode 7 has two plus-pole contacts 8a and 8b to be connected with the plus pole 3 of the battery 1, respectively, and a fixing part 9 is fixed in the battery chamber 13. The fixing part 9 is electrically connected with the electric circuit 12. Both of the plus-pole contacts 8a and 8b are formed so as to have the same shape with each other.

When the battery 1 is detachably installed in the battery chamber 13 of the IC card 10 through the battery holder 14, the minus pole 2 of the battery 1 is electrically connected with the minus electrode 4 through the minus-pole contacts 5a and 5b, while the plus pole 3 is electrically connected with the plus electrode 7 through the plus-pole contacts 8a and 8b. Thus, an electrical power of the battery 1 is supplied to the electric circuit 12 through the minus and plus electrodes 4 and 7.

According to the electrode construction, since the minus-pole contacts 5a and 5b have a different length from each other, the characteristic frequencies of the minus-pole contacts 5a and 5b are different from each other. Therefore, when an oscillation having a frequency resonating with respect to the characteristic frequency of the minus-pole contact 5a is applied to the IC card 10, the minus-pole contact 5a will oscillate and move away or depart from the minus pole 2 of the battery 1. However, the minus-pole contact 5b will neither oscillate nor depart from the minus pole 2 at this very frequency which is different from its characteristic frequency, so that the electric power of the battery 1 will be applied to the electric circuit 12 through the minus pole contact 5b.

On the other hand, when an oscillation having a frequency resonating with respect to the characteristic frequency of the minus-pole contact 5b is applied to the IC card 10, the minus-pole contact 5b will oscillate and move away or aepart from the minus pole 2 while the minus-pole contact 5a will neither oscillate nor depart from the minus pole 2 at this very frequency which is different from its characteristic frequency, so that the electric power of the battery 1 will be applied to the electric circuit 12 through the minus-pole contact 5a. Thus, it is possible to prevent the storage data stored in the semiconductor elements of the electric circuit 12 from being eliminated.

In the above embodiment, although the minus-pole contacts 5a and 5b are formed so as to have a different length from each other, the minus-pole contacts 5a and 5b may also be formed so as to have a different width from each other as shown in Fig. 5 or to have a different thickness from each other as shown in Fig. 6.

In the above embodiments, although only the minus-pole contacts 5a and 5b are formed so as to have a different shape from each other , it is also possible according to the invention that only the plus-pole contacts 8a and 8b are formed so as to have a different shape from each other, or that alternatively both of the minus-pole contacts 5a and 5b and the plus-pole contacts 8a and 8b are

formed so as to have a different shape from each other, respectively.

In the above embodiment, although the minus and plus electrodes 4 and 7 have two contacts respectively, the number of the contacts may also be three or more. In a case where three or more contacts are formed at the electrode, at least two contacts out of these contacts may be formed so as to have a different shape from each other.

In the above embodiment, although the present invention has been described with reference to an electrode construction of a battery in an IC card, it can be broadly employed to an electrode construction of a battery in an electrical equipment.

Although the present invention has been described and illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the spirit and the scope of the present invention being limited only by the terms of the appended claims.

Claims

1. An electrode construction of a battery (1) in an electrical equipment comprising a battery chamber (13), a plus electrode (7) and a minus electrode (4) respectively provided in the battery chamber (13), and a battery (1) having a plus pole (3) to be connected with the plus electrode (7) and a minus pole (2) to be connected with the minus electrode (4) in a state of that the battery (1) is detachably installed in the battery chamber (13), wherein the plus electrode (7) and/or the minus electrode (4) comprises a plurality of contacts (8a, 8b; 5a, 5b) to be connected with the battery (1), at least two contacts out of the plurality of contacts (8a, 8b; 5a, 5b) having a different shape from each other.

2. The electrode construction of a battery in an electrical equipment in accordance with claim 1, wherein the contacts (8a, 8b; 5a, 5b) are formed in a strip-shape, respectiveley, and have a different length from each other.

3. The electrode construction of a battery in an electrical equipment in accordance with claim 1 or 2, wherein the contacts (8a, 8b; 5a, 5b) are formed in a strip-shape, respectively, and have a different width from each other.

4. The electrode construction of a battery in an electrical equipment in accordance with any of claims 1 to 3, wherein the contacts (8a, 8b; 5a, 5b) are formed in a strip-shape, respectively, and have a different thickness from each other.

5. The electrode construction of a battery in an electrical equipment in accordance with any of claims 1 to 4, wherein the electrical equipment is an IC card (10) which further comprises an electric circuit (12) having semiconductor elements to store storage data, the battery (1) supplying an electric power to the electric circuit (12) to cause the electric circuit (12) to hold the storage data.

FIG. 1

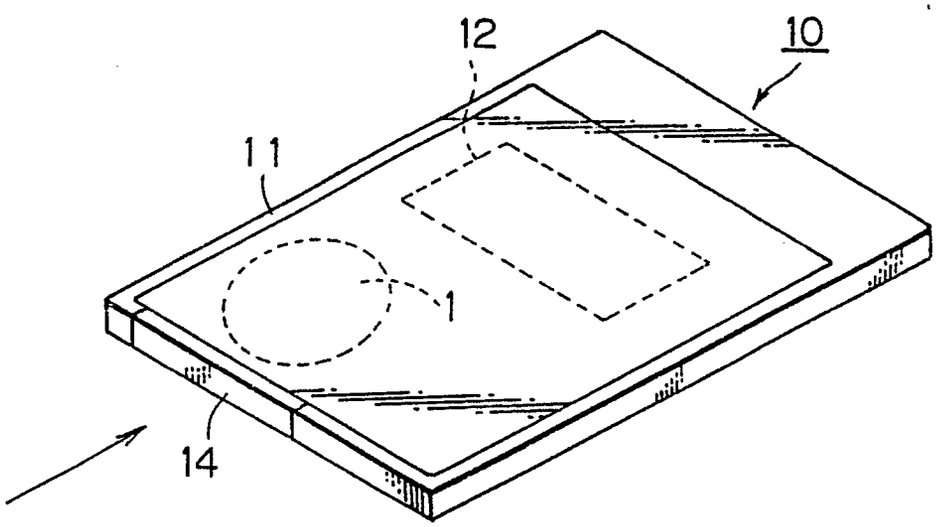


FIG. 2

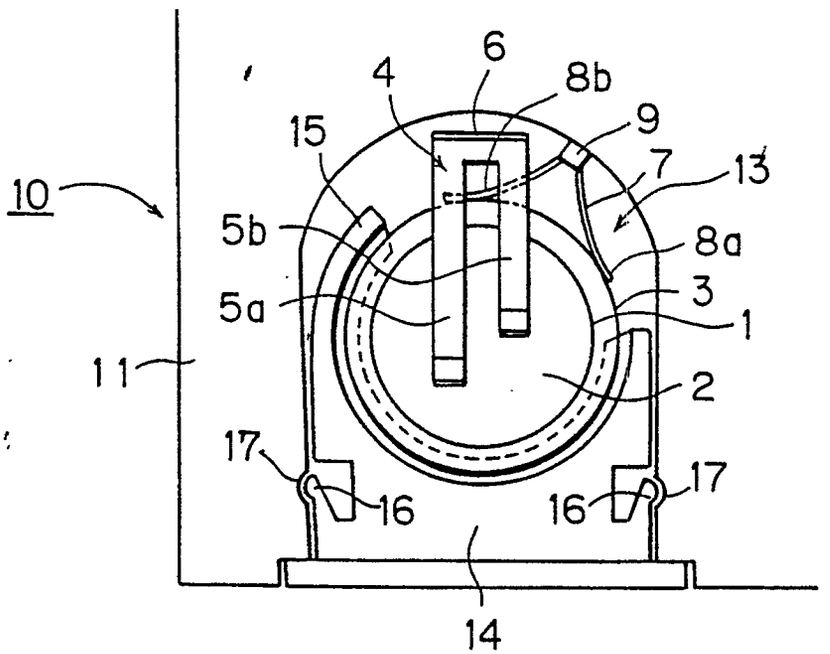

10
11
4
6
8b
9
15
7
13
5b
8a
5a
3
1
2
17
16
16
17
14

FIG. 3

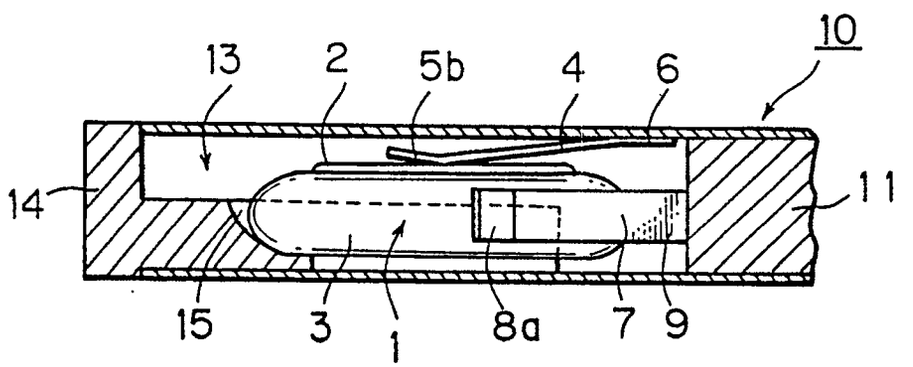

10
13
2
5b
4
6
14
11
15
3
1
8a
7
9

FIG. 4

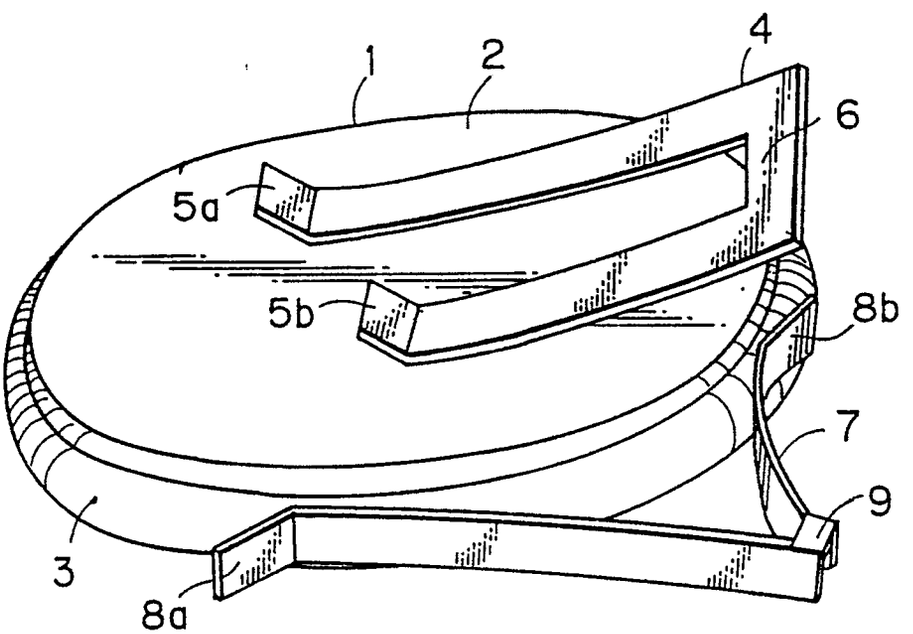


FIG. 5

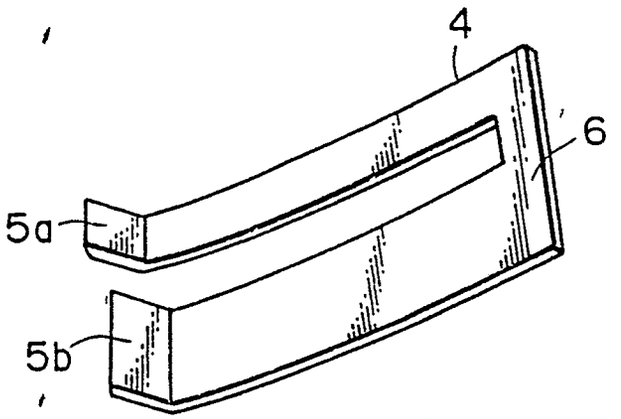


FIG. 6

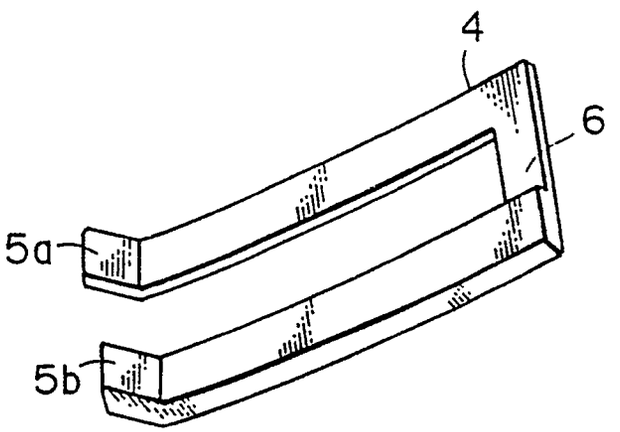


FIG. 7