

CASING STRUCTURE FOR AN APPARATUS USING A PNEUMATIC BATTERY

The present invention relates to the structure of a casing for an apparatus of the type using a pneumatic battery and, more particularly, to a casing structure for a radio pager or similar communication apparatus powered by a pneumatic battery.

Modern miniature apparatuses including radio pagers are powered by various kinds of batteries, e.g., manganese battery, lithium battery, nickel-cadmium battery, and pneumatic battery. A pneumatic battery with which the present invention is concerned has a disk configuration and is formed with perforations on one side thereof. Air is introduced in the pneumatic battery via the perforations to generate a voltage by a chemical reaction. While the apparatus is not used, the perforations of the battery are sealed to prevent the reaction from occurring in the battery. To use the battery, after the perforations have been unsealed, the battery is put in a battery holder. Then, the battery holder is inserted into a bore or battery containing section formed in part of the casing of the

apparatus. Of course, the battery is brought into electrical connection with circuitry including a power switch as soon as the battery holder is set in the bore of the casing.

5 The problem with the conventional casing structure stated above is that when the pneumatic battery is received in the casing, the perforations thereof are constantly open, i.e., air continuously enters the battery via the perforations even when the apparatus is not used. As a result, the reaction continues in the battery to reduce the battery capacity due to natural
10 discharge. The battery, therefore, becomes unable to generate a voltage high enough to power the apparatus in about six weeks, making the apparatus practically inoperable. Such a life is shorter than the life of, for example a manganese battery which is as long as a few months, preventing the apparatus from being
15 efficiently used.

A feature of a casing structure to be described below, by way of
20 example, is that it reduces the natural discharge of a pneumatic battery in an apparatus and thereby promotes the efficient use of the apparatus.

A casing structure for an apparatus using a pneumatic battery to be described below, as an example, includes a casing body, a bore formed in the casing body for accommodating the pneumatic
25 battery, and a switch mechanism for selectively covering or

uncovering perforations formed in the pneumatic battery when the battery is received in the bore.

There will be described below, with reference to the accompanying
5 drawings, a conventional casing, and arrangements illustrative of the present invention.

In the drawings:-

FIG.1 is a perspective view of a pneumatic battery and a
10 conventional casing structure for a radio pager to be powered by the battery;

FIG. 2 is a graph indicative of the natural discharge of a pneumatic battery in a sealed condition;

FIG. 3 is a graph indicative of the natural discharge of a
15 pneumatic battery in an unsealed condition;

FIG. 4A is a perspective view of an apparatus with a casing structure in an operative condition;

FIG. 4B is a plan view of part of the apparatus of Fig. 4A including a pneumatic battery;

FIG. 4C is a sectional side elevation associated with
20 FIG. 4B;

FIG. 5A is a perspective view showing the apparatus of FIG. 4A in an inoperative condition;

FIGS. 5B and 5C are respectively a plan view and a side elevation associated with FIG. 5A;

FIG. 6 is a side elevation showing an electrical power switch;

5 FIG. 7A is a perspective view of an apparatus forming an embodiment of the present invention in an operative condition;

FIG. 7B is a plan view of part of the apparatus shown in FIG. 7A;

10 FIG. 7C is an exploded perspective view of the embodiment; and

FIG. 8 is a perspective view showing the apparatus of FIG. 7A in an inoperative condition.

15 To better understand the present invention, a brief reference will be made to a pneumatic battery and an apparatus to which it is applicable, shown in FIG. 1. The apparatus shown in FIG. 1 is implemented as a radio pager having a casing 1. A pneumatic battery 10 is provided with a disk configuration and
20 formed with perforations 11 on one side thereof. Before the battery 10 is used, the perforations 11 are closed by a seal 12. To use the battery 10, the seal 12 is removed from the battery 10 to uncover the openings 11, and then the battery 10 is put in a battery holder 2. Subsequently, the battery holder 2 with the
25 battery 10 is inserted into a bore 1a formed in the casing 1. A

power switch 3 is provided on the casing 1. Once the seal 12 is removed, the perforations are constantly exposed to the atmosphere despite that the battery 10 is accommodated in the casing. Hence, air is introduced in the battery 10 even when the radio pager is not operated, causing a mechanical reaction to continue in the battery 10.

Assume that the perforations 11 are closed by the seal 12 to intercept air, i.e., to prevent a mechanical reaction from occurring in the battery 10. Then, the battery capacity changes due to natural discharge, as shown in FIG. 2. On the other hand, when the seal 12 is removed, the natural discharge of the battery capacity occurs as shown in FIG. 3. As the two graphs indicate, while the battery 10 with the seal 12 discharges little even in about one year, the battery 10 without the seal 12 discharges to a voltage too low to power the radio pager in about six weeks due to natural discharge. The life of such a battery is, therefore, shorter than that of a manganese battery or similar battery which is about a few months.

As stated above, with the conventional casing, it is impossible to protect the battery 10 from natural discharge after the seal 12 has been removed.

Referring to FIGS. 4A-4C, 5A-5C and 6, a casing structure is shown which is also applied _____ to a radio pager by way of example. FIG. 4A shows the radio pager in an operative condition while FIG. 5A shows it in an

inoperative condition. As shown, a casing 1, like the casing 1 of FIG. 1, is provided with a removable battery holder 2. When the battery holder 2 is loaded with a pneumatic battery 10 and inserted into the casing, the battery 10 is brought into electrical connection with circuitry built in the casing 1.

A power switch 3 is provided on the casing 1 and representative of a switch for operating the pager. In the illustrative embodiment, another switch 4 is provided on the casing 1 in close proximity to the battery holder 2. As best shown in FIG. 6, the switch 4 has a slide block 41 and a packing member 42 made of rubber or similar elastic material and affixed to the underside of the slide block 41. When the battery 10 is received in the casing 1, the slide block 41 is movable in the radial direction of the battery 10 when operated by hand. The packing member 42 is sufficiently larger than perforations 11 formed in the battery and held in close contact with the upper surface of the battery 10. Lugs 43 protrude from the packing member 42 and are made of rubber or similar contractile material. While the pager is not operated (FIGS. 5B and 5C), the slide block 41 is moved toward the center of the battery 10 to close the perforations 11 with the lugs 43. This, coupled with the fact that the packing member 42 isolates the portion of the battery 10 surrounding the perforations from the outside, sets up a hermetic sealing structure. When the pager is to be used (FIGS. 4B and 4C), the slide block 41 is moved away from the center of the battery 10.

As a result, the lugs 43 are removed from the perforations 11 while contracting, and the packing 42 is also moved away from the perforations 11, whereby the perforations 11 are fully uncovered.

5 As stated above, even after the battery 10 has been inserted into the casing 1 with a seal thereof removed, the packing 42 plugs the perforations 11 of the battery 10 only if the slide block 41 of the switch 4 is moved toward the center of the battery 10. In this condition, the natural discharge of
10 the battery 10 is minimized as shown in FIG. 2, preserving the battery capacity over a long time. When the slide block 41 is moved away from the center of the battery 10, the packing 42 uncovers the perforations 11 of the battery to allow the pager to be operated by a required voltage.

15 FIGS. 7A-7C and 8 show an embodiment of the _____ present invention. In these figures, the same or similar constituents to those of the previous apparatus are designated by like reference numerals, and a redundant description will be avoided for simplicity. As shown, the power
20 switch 3 provided on the casing 1 has a slide block 31. An arm 32 extends from the slide block 31 to the vicinity of the pneumatic battery 10. A packing 33 has lugs 44 and is affixed to the end of the arm 32 adjoining the battery 10. The packing 33 is held in close contact with the upper surface of the

battery 10 to selectively cover or uncover the perforations 11, as in the previous embodiment.

5 The power switch 3 and members associated therewith are configured as follows. A slider 46 is mounted on a printed circuit board 45 and received in a groove formed in the slide block 31 to be movable integrally with the slide block 31. With this configuration, the switch 3 selectively turns on or off the power supply while allowing the arm 32 to move. When the slide block 31 of the power switch 3 is moved toward an ON position, it moves the packing member 33 away from the battery 10 to open the perforations 11. When the slide block 31 is moved toward an OFF position, it moves the packing member 33 toward the center of the battery 10 via the arm 32 to thereby close the perforations. Hence, while the pager is not used, i.e., when the power switch 3 is held in the OFF position, the perforations 11 of the battery 10 are covered to minimize the decrease of the battery capacity. This is successful in increasing the life of the battery 10.

20 While an embodiment of the present invention has been shown and described in relation to a radio pager, it is, of course, applicable to any other miniature communication equipment of the type using a pneumatic battery.

25 In summary, it will be seen that there has been described a casing structure which reduces the natural discharge of a pneumatic battery received in a communication apparatus

by covering perforations formed in the battery when the apparatus is not used. As a result, the life of the battery is increased to promote effective use of the apparatus.

5 Various modifications will become possible for those skilled in the art after receiving the teachings of the present disclosure without departing from the scope thereof.

10 Although particular embodiments have been described in illustration of the invention, it will be appreciated that variations and modifications thereof, as well as other embodiments, may be made, without departing from the scope of the protection sought by the appended claims.



CLAIMS

1. A casing structure for an apparatus for using a pneumatic battery, including a casing body, a bore formed in the casing body for accommodating the pneumatic battery, a mechanism for selectively covering or uncovering perforations formed in the pneumatic battery when the pneumatic battery is received in the bore, the mechanism including a slide block provided on the casing body, and a packing member interlocked with the slide block for selectively covering or uncovering the perforations of the pneumatic battery, and an electrical power switch on the casing body, the packing member being interlocked with the electrical power switch for selectively covering and uncovering the perforations of the pneumatic battery when the electrical power switch is respectively OFF and ON.

2 A casing structure as claimed in claim 1, wherein the apparatus is a radio pager.

3. A casing structure as claimed in claim 1 substantially as described herein with reference to Figs. 7A, 7B, 7C, and 8 of the accompanying drawings.