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(54) **HANDHELD PUSH-BUTTON DEVICE**

TRAGBARE DRUCKKNOPFVORRICHTUNG

DISPOSITIF DE BOUTON-POUSOIR MANUEL

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Description

Field of Invention

[0001] The present invention relates to a handheld push-button device which is preferably intended to be used as a service-call unit in the medical, healthcare and geriatric field.

Background of Invention

[0002] Basically, handheld push-button devices used as a service-call unit in the medical, healthcare and geriatric field are necessary for patients in order to call for help in case of emergencies. Normally, patients are provided with a handheld push-button device comprising a single call button. This call button is a common feature for handheld push-button devices. It is advantageous for patients to operate the call button in any position - especially in case of emergencies, when the patients normally have to focus on finding as well as precisely and accurately pushing the call button.

[0003] In this regard, the exact location and position of the call button of common handheld push-button devices may not be well determinable by the patients and may vary considerably from one handheld push-button device to the other, from one site to the other at which the handheld push-button device is installed, from one patient to the other who operates the handheld push-button device along other influences which are not predictable.

[0004] Figs. 1A and 1B are schematic diagrams of a handheld push-button device 1 according to the state of the art.

[0005] As illustrated in Figs. 1A and 1B, the known handheld push-button device 1 comprises a housing 11 and a call button 12. Fig. 1A illustrating the front side of the housing 11 shows that the call button 12 is embedded in the front side of the housing 11. Thereby, the call button 12 is accessible on the front side of the housing 11. Fig. 1B illustrating the back side of the housing 11 shows that the call button 12 is not present on the back side of the housing 11. Thereby, the call button 12 is not accessible on the back side of the housing 11.

[0006] In this regard, the call button 12 is not visible to the patients when the handheld push-button device 1 lies on its front side with its back side turned towards the patients, or when the handheld push-button device 1 hangs at a cable from above and turns into an unfavorable position regarding the patients' view. Therefore, the patients need to turn the handheld push-button device 1 prior to be able to operate the call button 12. Often, this action is required to be performed single-handedly which makes precise and accurate operation of the call button 12 even more complicated and cumbersome.

[0007] Therefore, solutions are known where the call button is integrated at a top edge or a side edge of the handheld push-button device.

[0008] Figs. 2A and 2B are schematic diagrams of oth-

er handheld push-button devices 2a, 2b according to the state of the art.

[0009] As illustrated in Figs. 2A and 2B, the other known handheld push-button devices 2a, 2b comprise a housing 21a, 21b and a call button 22a, 22b. With respect to Fig. 2A, the call button 22a is integrated at the top edge of the housing 21a. With respect to Fig. 2B, the call button 22b is integrated at the side edge of the housing 21b.

[0010] However, these solutions suffer from being disadvantageous regarding haptic usability.

[0011] DE 43 09 670 A1 discloses an actuator having two buttons arranged on opposite sides of a housing. The buttons are thus positioned so that they can be pressed by the finger and thumb of one hand. Also, or alternatively, the housing can be formed as a grippable handle with at least one button. In that case, the actuator is in the form of a movable release button whose housing is connected to a cable. The end of the housing furthest from the buttons is in the shape of a hook.

[0012] EP 0 589 171 A2 discloses a pear-type and multiple touch-contact switch having at least one function key, which is arranged on a touch-contact switch housing, and a connecting lead which is passed out of an outlet opening in the touch-contact switch housing. The touch-contact switch housing is provided with a clamping holder for holding a section of the connecting lead, which is laid from the outlet opening as far as a loop which extends to the holder.

Summary of Invention

[0013] In view of the above, the object of the present invention consists in providing an improved handheld push-button device, by means of which help can be called in an easier, faster and more reliable manner without demanding the patients to focus on finding as well as precisely and accurately pushing the call button in case of emergencies.

[0014] The object of the present invention is accomplished by the handheld push-button device as set out in independent claim 1. Advantageous developments are defined in the dependent claims.

[0015] According to an aspect of the present invention, there is provided a handheld push-button device, preferably intended to be used as a service-call unit in the medical, healthcare and geriatric field, comprising: a housing accommodating an electric switch element; and a force-transmitting element including an activation region arranged such that it is accessible for a user, wherein said force transmitting element is supported by the housing so as to be able to transmit an actuation force applied to it by the user to a movement that can act on the electric switch element; wherein the force-transmitting element has plural activation regions arranged such that they are accessible for a user from at least two opposite sides of the housing.

[0016] Advantageously, the force-transmitting element is structured so as to transmit the activation force

applied to it: by its resilient deformation and a mechanical transmission of the deformation to the electric switch element to act on it; by its deformation combined with a pneumatic or hydraulic transmission of the force to the electric switch element to act on it; or by a sliding movement in the housing towards the electric switch element and a mechanical transmission of the movement to the electric switch element to act on it.

[0017] Advantageously, the force transmitting element is at least partially translucent at both sides having the activation regions, and the device includes a light source arranged to transmit light through the translucent portions.

[0018] Advantageously, the light source is arranged inside the force transmitting element and/or inside the housing.

[0019] Advantageously, the light source can be activated in at least two illuminated states differing from each other in one or more of the following: a light color, a light intensity, a flashing pattern; and the device is arranged such that one of the states is activated when the electric switch element is operated. According to the invention, the force-transmitting element is a ring or a disc-like element that has the activation regions on opposite sides and that is supported in the housing so as to be movable to act on the electric switch element upon application of the activation force on any one of the activation regions. And, the ring-like element has a central hole/opening extending through the device between the two opposite sides.

[0020] Advantageously, the ring-like element has the activation regions recessed from the opposite sides of the housing.

[0021] Advantageously, the interior of the housing is fluid-tightly sealed to the environment.

[0022] Advantageously, the interior of the housing is fluid-tightly sealed to the force-transmitting element.

[0023] Advantageously, a single electric switch element is provided in the device to be acted on and operated by the force transmitting element, and the electric switch element is preferably a micro-switch or includes a sensor arranged to detect the presence/absence of a member functionally linked to the force transmitting element.

Brief Description of Drawings

[0024]

Figs. 1A and 1B are schematic diagrams of a handheld push-button device according to the state of the art.

Figs. 2A and 2B are schematic diagrams of other handheld push-button devices according to the state of the art.

Fig. 3 is a block diagram of a handheld push-button device according to one or more embodiments of the present invention.

Figs. 4A and 4B are schematic diagrams of a handheld push-button device according to one or more embodiments of the present invention.

5 Detailed Description of Embodiments

[0025] Fig. 3 is a block diagram of a handheld push-button device according to one or more embodiments of the present invention.

10 **[0026]** As illustrated in Fig. 3, the handheld push-button device 3 comprises a force-transmitting element 31 and an electric switch element 32. The electric switch element 32 is accommodated in a housing (not shown). The force-transmitting element 31 includes plural (i.e. at least two) activation regions 311, 312. The plural activation regions 311, 312 are arranged such that they are accessible for a user from at least two opposite sides of the housing, such as e.g. the front side and the back side of the housing. The force-transmitting element 31 is supported by the housing so as to be able to transmit an actuation force applied to it by the user to a movement that can act on the electric switch element 32.

15 **[0027]** The force-transmitting element 31 is structured so as to transmit the activation force applied to it by pushing at least one of the plural activation regions 311, 312 to the electric switch element 32 to act on it. That is to say, the electric switch element 32 is operated by the force transmitting element 31.

20 **[0028]** According to one or more embodiments of the present invention, the force-transmitting element 31 transmits the activation force applied to it by its resilient deformation and a mechanical transmission of the deformation to the electric switch element 32 to act on it.

25 **[0029]** Alternatively, according to one or more embodiments of the present invention, the force-transmitting element 31 transmits the activation force applied to it by its deformation combined with a pneumatic or hydraulic transmission of the force to the electric switch element 32 to act on it.

30 **[0030]** Alternatively, according to one or more embodiments of the present invention, the force-transmitting element 31 transmits the activation force applied to it by a sliding movement in the housing towards the electric switch element 32 and a mechanical transmission of the movement to the electric switch element 32 to act on it.

35 **[0031]** According to one or more embodiments of the present invention, the handheld push-button device 3 further comprises a light source 313. The light source 313 is arranged inside the housing. The light source may even be arranged inside the force-transmitting element 31. The light source 313 can be activated in at least two illuminated states differing from each other in one or more of a light color, a light intensity and a flashing pattern. Specifically, the handheld push-button device 3 is arranged such that one of the states is activated when the electric switch element 32 is operated. The force transmitting element 31 is at least partially translucent at both sides having the activation regions 311, 312 so that light

from the light source 313 may be transmitted through the translucent portions.

[0032] According to one or more embodiments of the present invention, the force-transmitting element 31 is a ring or a disc-like element that has the activation regions 311, 312 on opposite sides and that is supported in the housing so as to be movable to act on the electric switch element 32 upon application of the activation force on any one of the activation regions 311, 312. The ring-like element may have a central hole/opening extending through the handheld push-button device 3 between the two opposite sides. The ring-like element may also have the activation regions 311, 312 recessed from the opposite sides of the housing.

[0033] According to one or more embodiments of the present invention, the force-transmitting element 31 is a cushion-like element supported by the housing so as to be accessible from the two opposite sides such that application of the activation force on the activation regions 311, 312 of the cushion from any one of the two opposite sides causes a deformation of the cushion that is either directly or via an intermediate member acting on the electric switch element, or causes a fluid inside the cushion to be transmitted to a fluid-activated member that can act on the electric switch element.

[0034] According to one or more embodiments of the present invention, the force-transmitting element 31 is a spring-like element arranged in the housing so as to be accessible from the two opposite sides such that application of the activation force on the activation regions 311, 312 of the spring-like element from any one of the two opposite sides causes a resilient deformation of the spring-like element that is directly or via an intermediate member acting on the electric switch element 32.

[0035] In this regard, according to one or more embodiments of the present invention, the activation areas 311, 312 may be linked to the electric switch element 32 by mechanical elements acting onto the electric switch element 32. The mechanical link may be manufactured from any kind of suitable material, such as e.g. metal or plastic. The mechanical elements may be manufactured as individual parts or a single part.

[0036] Specifically, according to one or more embodiments of the present invention, the mechanical link may be e.g. a blade spring of a dedicated shape. A blade spring being initially straight comprises two limbs. They are bent as arcs in the same direction and folded in the center point so as to form a barrel like shape. The joint of the limbs and the electric switch element 32 are fixed at a certain position inside the handheld push-button device 3 while the ends of the limbs are positioned in front of the activation point of the electric switch element 32. When the activation force is applied on the activation regions 311, 312, any bent area of any limb is pressed so that it is levelled to a flat arc. This results in a linear displacement of the ends of the limbs. While the joint of the blade spring is fixed, the limbs only move into the direction of the electric switch element 32 which is there-

by activated. Furthermore, the blade spring is built symmetrically. Hence, any end of the limbs activates the electric switch element 32 individually or collectively resulting in the very same state change of the electric switch element 32.

[0037] According to one or more embodiments of the present invention, the interior of the housing is fluid-tightly sealed to the environment. The interior of the housing is fluid-tightly sealed to the force-transmitting element 31.

[0038] According to one or more embodiments of the present invention, the electric switch element 32 may be a micro-switch. Alternatively, it may include a sensor arranged to detect the presence/absence of a member functionally linked to the force transmitting element 31.

[0039] According to one or more embodiments of the present invention, each of the plural activation regions 311, 312 represents a call button of the handheld push-button device 3.

[0040] Figs. 4A and 4B are schematic diagrams of a handheld push-button device according to one or more embodiments of the present invention.

[0041] As illustrated in Figs. 4A and 4B, the handheld push-button device 3 comprises a housing 33 and the call buttons 311, 312. Fig. 4A illustrating the front side of the housing 33 shows that the call button 311 is embedded in the front side of the housing 33. Thereby, the call button 311 is accessible on the front side of the housing 33. Fig. 4B illustrating the back side of the housing 33 shows that the call button 312 is embedded in the back side of the housing 33. Thereby, the call button 312 is accessible on the back side of the housing 33. The operation of the handheld push-button device 3 may be performed by either pushing the call button 311 on the front side of the housing 33 or the call button 312 on the back side of the housing 33. Also, the operation of the handheld push-button device 3 may be performed by simultaneously pushing the call button 311 on the front side of the housing 33 and the call button 312 on the back side of the housing 33.

[0042] Since the call button 311 is accessible on the front side of the housing 33 and the call button 312 is accessible on the back side of the housing 33, at least one call button 311, 312 is visible to the patient in nearly every position of the handheld push-button device 3. Furthermore, in case the handheld push-button device 3 lies on a solid or semi solid surface (e.g. night table, mattress etc.), one of the call buttons 311, 312 may be intuitively and directly operated with a single-finger operation. In case the handheld push-button device 3 hangs at a cable from above, both of the call buttons 311, 312 may be intuitively and directly operated with a two-finger operation. Since the light source is arranged in the handheld push-button device 3 and since the call buttons 311, 312 are at least partially translucent, the call buttons 311, 312 are also visible to the patient independent of the ambient light, i.e. whether it is dark or not. That is to say, the call buttons 311, 312 may be intuitively and directly operated during day and night time.

[0043] According to the present invention, there is provided an improved handheld push-button device, by means of which help can be called in an easier, faster and more reliable manner without demanding the patient to focus on finding as well as precisely and accurately pushing the call button in case of emergencies.

Claims

1. A handheld push-button device (3), preferably intended to be used as a service-call unit in the medical, healthcare and geriatric field, comprising:

a housing accommodating an electric switch element (32); and
 a force-transmitting element (31) including an activation region arranged such that it is accessible for a user, wherein said force-transmitting element (31) is supported by the housing so as to be able to transmit an actuation force applied to it by the user to a movement that can act on the electric switch element (32),
 wherein the force-transmitting element (31) has plural activation regions (311, 312) arranged such that they are accessible for a user from at least two opposite sides of the housing,
characterized in that
 the force-transmitting element (31) is a ring-like element that has the activation regions (311, 312) on opposite sides and that is supported in the housing so as to be movable to act on the electric switch element (32) upon application of the activation force on any one of the activation regions (311, 312), and
 the ring-like element has a central hole/opening extending through the device between the two opposite sides.

2. The handheld push-button device (3) according to claim 1, wherein the force-transmitting element (31) is structured so as to transmit the activation force applied to it:

by its resilient deformation and a mechanical transmission of the deformation to the electric switch element (32) to act on it;
 by its deformation combined with a pneumatic or hydraulic transmission of the force to the electric switch element (32) to act on it; or
 by a sliding movement in the housing towards the electric switch element (32) and a mechanical transmission of the movement to the electric switch element (32) to act on it.

3. The handheld push-button device (3) according to claim 1 or 2, wherein the force-transmitting element (31) is at least partially translucent at both sides hav-

ing the activation regions (311, 312), and the device includes a light source (313) arranged to transmit light through the translucent portions.

4. The handheld push-button device (3) according to claim 3, wherein the light source (313) is arranged inside the force-transmitting element (31) and/or inside the housing.
5. The handheld push-button device (3) according to claim 3 or 4, wherein the light source (313) can be activated in at least two illuminated states differing from each other in one or more of the following: a light color, a light intensity, a flashing pattern; and the device is arranged such that one of the states is activated when the electric switch element (32) is operated.
6. The handheld push-button device (3) according to claim 1, wherein the ring-like element has the activation regions (311, 312) recessed from the opposite sides of the housing.
7. The handheld push-button device (3) according to any one of the preceding claims, wherein the interior of the housing is fluid-tightly sealed to the environment.
8. The handheld push-button device (3) according to any one of the preceding claims, wherein the interior of the housing is fluid-tightly sealed to the force-transmitting element (31).
9. The handheld push-button device (3) according to any one of the preceding claims, wherein a single electric switch element is provided in the device to be acted on and operated by the force-transmitting element (31), and the electric switch element (32) is a micro-switch or includes a sensor arranged to detect the presence/absence of a member functionally linked to the force-transmitting element (31).

Patentansprüche

1. Tragbare Druckknopfvorrichtung (3), die vorzugsweise dazu bestimmt ist, als eine Service-Call-Einheit im medizinischen, Gesundheitspflege- und geriatrischen Feld verwendet zu werden, aufweisend:

ein Gehäuse, das ein elektrisches Umschalt-element (32) aufnimmt; und
 ein Kraftübertragungselement (31) mit einem Aktivierungsgebiet, das derart angeordnet ist, dass es für einen Nutzer erreichbar ist, wobei das Kraftübertragungselement (31) durch das Gehäuse gelagert ist, um in der Lage zu sein,

eine durch den Nutzer darauf ausgeübte Betätigungskraft in eine Bewegung zu übertragen, die auf das elektrische Umschaltelement (32) wirken kann,

wobei das Kraftübertragungselement (31) eine Vielzahl von Aktivierungsgebieten (311, 312) aufweist, die derart angeordnet sind, dass sie für einen Nutzer von zumindest zwei gegenüberliegenden Seiten des Gehäuses erreichbar sind,

dadurch gekennzeichnet, dass

das Kraftübertragungselement (31) ein ringartiges Element ist, das die Aktivierungsgebiete (311, 312) an gegenüberliegenden Seiten aufweist, und das in dem Gehäuse bewegbar gelagert ist, um auf das elektrische Umschaltelement (32) auf eine Anwendung der Aktivierungskraft auf irgendeine der Aktivierungsgebiete (311, 312) hin zu wirken, und

das ringartige Element ein zentrales Loch/Öffnung aufweist, das/die sich durch die Vorrichtung zwischen den beiden gegenüberliegenden Seiten erstreckt.

2. Tragbare Druckknopfvorrichtung (3) nach Anspruch 1, wobei das Kraftübertragungselement (31) strukturiert ist, um die darauf ausgeübte Aktivierungskraft zu übertragen:

durch seine elastische Verformung und eine mechanische Übertragung der Verformung zu dem elektrischen Umschaltelement (32), um darauf zu wirken;

durch seine Verformung kombiniert mit einer pneumatischen oder hydraulischen Übertragung der Kraft zu dem elektrischen Umschaltelement (32), um darauf zu wirken; oder

durch eine Schiebebewegung in dem Gehäuse zu dem elektrischen Umschaltelement (32) und eine mechanische Übertragung der Bewegung zu dem elektrischen Umschaltelement (32), um darauf zu wirken.

3. Tragbare Druckknopfvorrichtung (3) nach Anspruch 1 oder 2, wobei das Kraftübertragungselement (31) zumindest teilweise lichtdurchlässig an beiden Seiten mit den Aktivierungsgebieten (311, 312) ist, und die Vorrichtung eine Lichtquelle (313) umfasst, die angeordnet ist, um Licht durch die lichtdurchlässigen Abschnitte zu übertragen.
4. Tragbare Druckknopfvorrichtung (3) nach Anspruch 3, wobei die Lichtquelle (313) im Inneren des Kraftübertragungselements (31) und/oder im Inneren des Gehäuses angeordnet ist.
5. Tragbare Druckknopfvorrichtung (3) nach Anspruch 3 oder 4, wobei

die Lichtquelle (313) in zumindest zwei beleuchteten Zuständen aktiviert werden kann, die sich voneinander in einem oder mehreren der folgenden unterscheiden: einer Lichtfarbe, einer Lichtintensität, einem Blinkmuster; und

die Vorrichtung derart angeordnet ist, dass einer der Zustände aktiviert wird, wenn das elektrische Umschaltelement (32) betrieben wird.

6. Tragbare Druckknopfvorrichtung (3) nach Anspruch 1, wobei bei dem ringähnlichen Element die Aktivierungsgebiete (311, 312) von den gegenüberliegenden Seiten des Gehäuses eingelassen sind.
7. Tragbare Druckknopfvorrichtung (3) nach einem der vorstehenden Ansprüche, wobei das Innere des Gehäuses zu der Umgebung fluiddicht abgedichtet ist.
8. Tragbare Druckknopfvorrichtung (3) nach einem der vorstehenden Ansprüche, wobei das Innere des Gehäuses zu dem Kraftübertragungselement (31) fluiddicht abgedichtet ist.
9. Tragbare Druckknopfvorrichtung (3) nach einem der vorstehenden Ansprüche, wobei ein einzelnes elektrisches Umschaltelement in der Vorrichtung vorgesehen ist, um darauf zu wirken und durch das Kraftübertragungselement (31) betrieben zu werden, und das elektrische Umschaltelement (32) ein Mikroschalter ist oder einen Sensor umfasst, der angeordnet ist, um das Vorhandensein/Fehlen eines Elements, das mit dem Kraftübertragungselement (31) funktional verbunden ist, zu erfassen.

Revendications

1. Dispositif (3) de bouton-poussoir tenu à la main, destiné de préférence à être utilisé comme unité d'appel du service dans le domaine médical, du soin de la santé et gériatrique, comprenant :

un boîtier dans lequel est logé un élément (32) d'interrupteur électrique et

un élément (31) de transmission de force, comprenant une région d'activation, disposée de manière à être accessible à un utilisateur, l'élément (31) de transmission de force étant supporté par le boîtier, de manière à pouvoir transformer une force d'actionnement, qui lui est appliquée par l'utilisateur, en un déplacement, qui peut agir sur l'élément (32) d'interrupteur électrique,

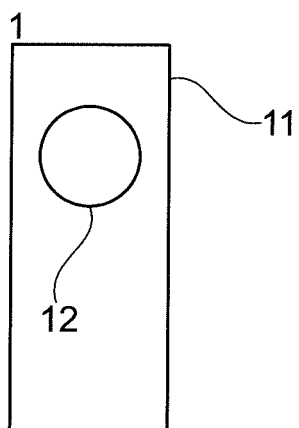
dans lequel l'élément (31) de transmission de force a plusieurs régions (311, 312) d'activation, disposées de manière à être accessibles à un utilisateur, à partir d'au moins deux côtés opposés du boîtier,

caractérisé en ce que

l'élément (31) de transmission de force est un élément annulaire, qui a les régions (311, 312) d'activation sur des côtés opposés et qui est supporté dans le boîtier de manière à être mobile pour agir sur l'élément (32) d'interrupteur électrique par application de la force d'activation sur l'une quelconque des régions (311, 312) d'activation et l'élément annulaire a un trou/ouverture centrale traversant le dispositif entre les deux côtés opposés.

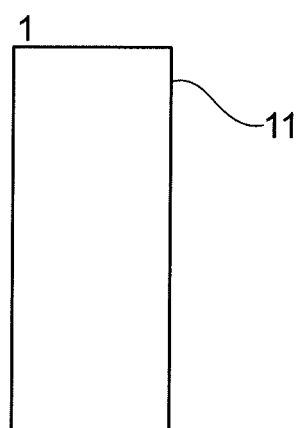
2. Dispositif (3) de bouton-poussoir tenu à la main suivant la revendication 1, dans lequel l'élément (31) de transmission de force est structuré de manière à transmettre la force d'application, qui lui est appliquée :
 - par sa déformation élastique et par une transmission mécanique de la déformation à l'élément (32) d'interrupteur électrique pour agir sur lui;
 - par sa déformation combinée à une transmission pneumatique ou hydraulique de la force à l'élément (32) d'interrupteur électrique pour agir sur lui ou
 - par un déplacement de translation dans le boîtier en direction de l'élément (32) d'interrupteur électrique et par une transmission mécanique du déplacement à l'élément (32) d'interrupteur électrique pour agir sur lui.
3. Dispositif (3) de bouton-poussoir tenu à la main suivant la revendication 1 ou 2, dans lequel l'élément (31) de transmission de force est translucide, au moins en partie des deux côtés ayant les régions (311, 312) d'activation et le dispositif comprend une source (313) lumineuse, disposée de manière à transmettre de la lumière à travers les parties translucides.
4. Dispositif (3) de bouton-poussoir tenu à la main suivant la revendication 3, dans lequel la source (313) lumineuse est disposée à l'intérieur de l'élément (31) de transmission de force et/ou à l'intérieur du boîtier.
5. Dispositif (3) de bouton-poussoir tenu à la main suivant la revendication 3 ou 4, dans lequel la source (313) lumineuse peut être activée dans au moins deux états d'éclairage, différents l'un de l'autre, par l'un ou plusieurs de ce qui suit : une couleur de la lumière, une intensité de la lumière, une configuration de clignotement et le dispositif est agencé de manière à activer l'un des états lorsque l'on fait fonctionner l'élément (32) d'interrupteur électrique.

6. Dispositif (3) de bouton-poussoir tenu à la main suivant la revendication 1, dans lequel l'élément annulaire a les régions (311, 312) d'activation en retrait des côtés opposés du boîtier.
7. Dispositif (3) de bouton-poussoir tenu à la main suivant l'une quelconque des revendications précédentes, dans lequel l'intérieur du boîtier est rendu étanche au fluide par rapport à l'atmosphère.
8. Dispositif (3) de bouton-poussoir tenu à la main suivant l'une quelconque des revendications précédentes, dans lequel l'intérieur du boîtier est rendu étanche au fluide par rapport à l'élément (31) de transmission de force.
9. Dispositif (3) de bouton-poussoir tenu à la main suivant l'une quelconque des revendications précédentes, dans lequel il est prévu un seul élément d'interrupteur électrique dans le dispositif, sur lequel agit et opère l'élément (31) de transmission de force, et l'élément (32) d'interrupteur électrique est un micro-interrupteur ou comprend un capteur disposé de manière à détecter la présence/l'absence d'un élément relié fonctionnellement à l'élément (31) de transmission de force.



FRONT SIDE

Fig. 1A



BACK SIDE

Fig. 1B

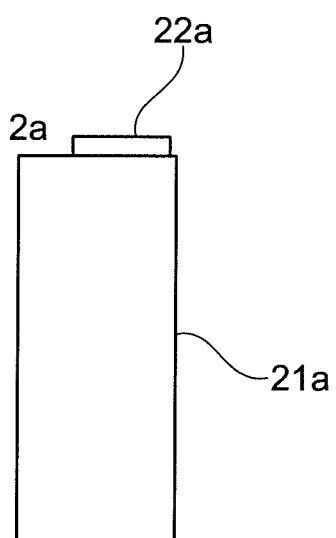


Fig. 2A

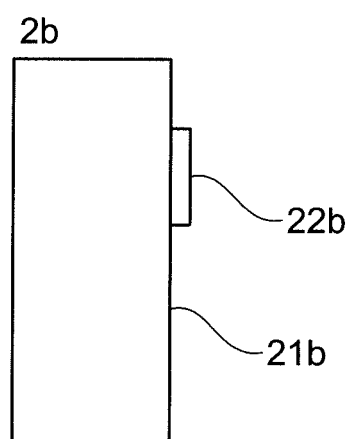


Fig. 2B

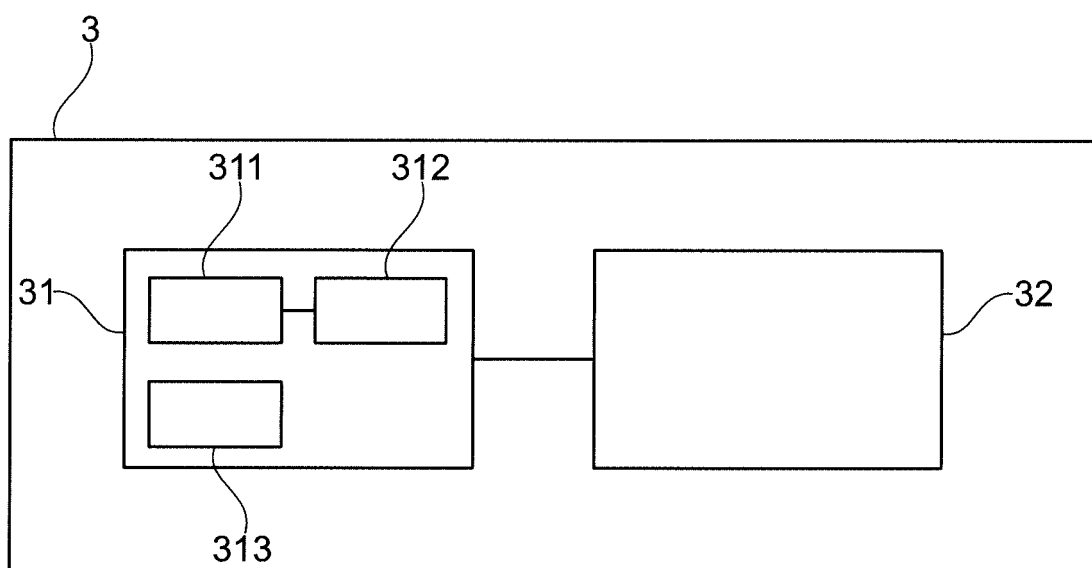


Fig. 3

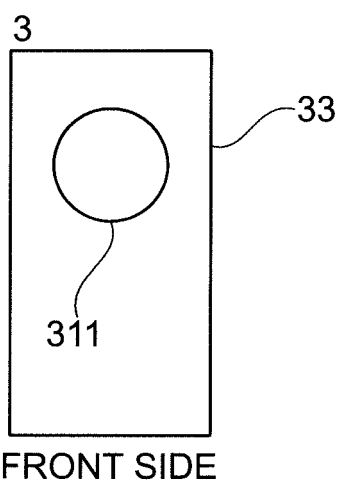


Fig. 4A

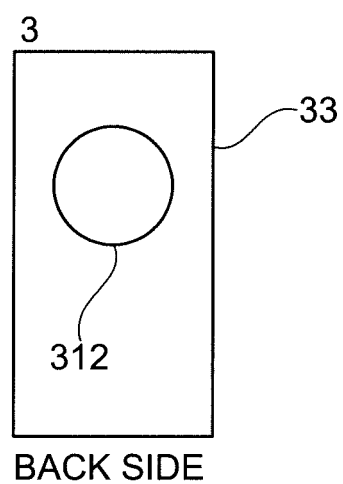


Fig. 4B

REFERENCES CITED IN THE DESCRIPTION

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