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

(11) **EP 4 566 583 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
11.06.2025 Bulletin 2025/24

(21) Application number: **22954102.4**

(22) Date of filing: **04.08.2022**

(51) International Patent Classification (IPC):
A61H 31/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A61H 31/00

(86) International application number:
PCT/KR2022/011547

(87) International publication number:
WO 2024/029647 (08.02.2024 Gazette 2024/06)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **02.08.2022 KR 20220096252**

(71) Applicant: **CU Medical Systems Inc.**
Wonju-si, Gangwon-do 26365 (KR)

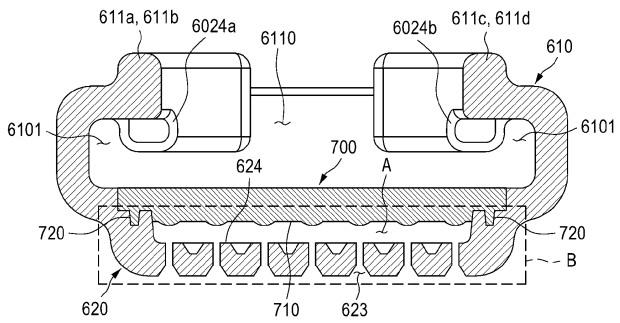
(72) Inventors:
- **SONG, In-ho**
Seoul 02799 (KR)
- **SHIN, Ji-hye**
Seoul 08708 (KR)

(74) Representative: **Schiweck Weinzierl Koch Patentanwälte Partnerschaft mbB**
Ganghoferstraße 68 B
80339 München (DE)

(54) PISTON COVER OF CARDIOPULMONARY RESUSCITATION DEVICE

(57) **In** a cover fit-coupled to a piston (310) for compressing a chest of a patient provided in a cardiopulmonary resuscitation device according to one exemplary embodiment of the present invention, the cover may include a first pad (600) in which a first pad upper portion (610) and a first pad lower portion (620) are integrally formed with each other, the first pad upper portion including a pair of grooves (6024a and 6024b) formed between a first piston fitting portion (611a) and a second piston fitting portion (611b), and between a third piston fitting portion (611c) and a fourth piston fitting portion (611d) forming a piston fitting hole (6110) and a piston fitting portion (611) in which a fastening member formed in a part of an outer peripheral surface of the piston (310) is inserted into the pair of grooves (6024a and 6024b) when the piston (310) is fit-coupled to the piston fitting hole (6110), and the first pad lower portion compressing a chest compression point of the patient with a lower surface of the first pad lower portion while generating a negative pressure when the piston (310) is expanded and pulling the chest of the patient with the lower surface and moving the chest upward through the negative pressure when the piston (310) is contracted, and a first plate (700) including a protruding member (720) fit-coupled to the first pad lower portion (620) and fit-coupled to the first pad lower portion (620) to form an interspace (A).

FIG 4.



EP 4 566 583 A1

Description

[Technical Field]

[0001] The present invention relates to a piston cover of a cardiopulmonary resuscitation device, and more specifically, to a piston cover of a cardiopulmonary resuscitation device capable of continuously providing a cushioning effect that relieves and distributes pressure applied to a chest of a patient during an emergency treatment process for the patient.

[Background Art]

[0002] In the related art, various types of cardiopulmonary resuscitation (CPR) devices are known. One of the devices is driven by compressed air or breathing gas (Jolife AB, Lund, Sweden; LucasTM). A unique advantage of the cardiopulmonary resuscitation device is light weight thereof, which makes it portable. Another advantage is the elastic properties of compressed air, which makes gas-driven cardiopulmonary resuscitation devices less likely to cause damage to a chest of a patient than devices with rigid compression means. The known device may be used as an emergency device in life-saving situations. Furthermore, in a known device, the motive gas may be supplied from a hospital air supply line which may be desirable for uninterrupted bursts of cardiopulmonary resuscitation when a patient is admitted.

[0003] However, even when elastic properties of compressed air are used, since a material of a compression means itself is hard, when the compression means compresses a chest of a patient, strong pressure is applied to the chest of the patient, which may cause rib fractures and hemothorax during cardiopulmonary resuscitation.

[Disclosure]

[Technical Problem]

[0004] Accordingly, an object of the present invention is to provide a piston cover of a cardiopulmonary resuscitation device capable of continuously providing a cushioning effect for relieving and distributing pressure applied to a chest of a patient during a chest compression process of the patient in order to improve the conventional compression means.

[0005] However, the technical problems to be achieved in the present invention are not limited to the technical problems mentioned above, and other technical problems not mentioned can be clearly understood by a person having ordinary knowledge in the technical field to which the present invention belongs from the description below.

[Technical Solution]

[0006] In order to achieve the above purpose, in a cover fit-coupled to a piston 310 for compressing a chest of a patient provided in a cardiopulmonary resuscitation device according to one exemplary embodiment of the present invention, the cover may include: a first pad 600 in which a first pad upper portion 610 and a first pad lower portion 620 are integrally formed with each other, the first pad upper portion including a pair of grooves 6024a and 6024b formed between a first piston fitting portion 611a and a second piston fitting portion 611b, and between a third piston fitting portion 611c and a fourth piston fitting portion 611d forming a piston fitting hole 6110 and a piston fitting portion 611 in which a fastening member formed in a part of an outer peripheral surface of the piston 310 is inserted into the pair of grooves 6024a and 6024b when the piston 310 is fit-coupled to the piston fitting hole 6110, and the first pad lower portion compressing a chest compression point of the patient with a lower surface of the first pad lower portion while generating a negative pressure when the piston 310 is expanded and pulling the chest of the patient with the lower surface and moving the chest upward through the negative pressure when the piston 310 is contracted; and a first plate 700 including a protruding member 720 fit-coupled to the first pad lower portion 620 and fit-coupled to the first pad lower portion 620 to form an interspace A.

[0007] In addition, in a cover fit-coupled to a piston 310 for compressing a chest of a patient provided in a cardiopulmonary resuscitation device according to another exemplary embodiment of the present invention, the cover may include: a second pad 800 in which a second pad upper portion 810 and a second pad lower portion 820 are integrally formed with each other, the second pad upper portion including a pair of grooves 8024a and 8024b formed between a first piston fitting portion 811a and a second piston fitting portion 811b, and between a third piston fitting portion 811c and a fourth piston fitting portion 811d forming a piston fitting hole 8110 and a piston fitting portion 811 in which a fastening member formed in a part of an outer peripheral surface of the piston 310 is inserted into the pair of grooves 8024a and 8024b when the piston 310 is fit-coupled to the piston fitting hole 8110, and the second pad lower portion compressing a chest compression point of the patient with a lower surface of the second pad lower portion while generating a negative pressure when the piston 310 is expanded and pulling the chest of the patient with the lower surface and moving the chest upward through the negative pressure when the piston 310 is contracted; and a second plate 900 including a first protruding member 920 and a second protruding member 930 fit-coupled to the second pad lower portion 820 and fit-coupled to the second pad lower portion 820 to form interspaces A and B.

[Advantageous Effects]

[0008] The cover of the present invention has the effect of preventing rib fractures and hemothorax from occur-

ring during a chest compression process by continuously providing a cushioning effect of relieving and distributing the pressure applied to a chest of a patient during the chest compression process of the patient, to the patient.

[0009] However, the effects obtainable from the present invention are not limited to the effects mentioned above, and other effects not mentioned will be clearly understood by those skilled in the art to which the present invention belongs from the description below.

[Description of Drawings]

[0010]

FIG. 1 is a perspective view of a cardiopulmonary resuscitation device according to one exemplary embodiment of the present invention.

FIG. 2 is a schematic view of the cardiopulmonary resuscitation device illustrated in FIG. 1.

FIG. 3 is a perspective view of a first pad constituting a cover according to one exemplary embodiment of the present invention.

FIG. 4 is a cross-sectional view taken along line A-A of FIG. 3.

FIG. 5 is a perspective view of a first pad lower portion included in an area B illustrated in FIG. 4.

FIG. 6 is a plan view of the first pad lower portion included in the area B illustrated in FIG. 4.

FIG. 7 is a perspective view of a second pad constituting a cover according to another exemplary embodiment of the present invention.

FIG. 8 is a cross-sectional view taken along line C-C of FIG. 7.

FIG. 9 is a perspective view of a second pad lower portion included in an area D illustrated in FIG. 8.

FIG. 10 is a plan view of the second pad lower portion included in the area D illustrated in FIG. 8.

[Best Mode]

[0011] Hereinafter, with reference to the attached drawings, exemplary embodiments of the present invention will be described in detail so that those skilled in the art can easily implement the present invention. However, since the description of the present invention is merely an exemplary embodiment for structural and functional explanation, the scope of the rights of the present invention should not be construed as being limited by the exemplary embodiments described in the text. That is, since the exemplary embodiments can be variously modified and can have various forms, the scope of the rights of the present invention should be understood to include equivalents that can realize the technical idea. In addition, the purpose or effect presented in the present invention does not mean that a specific exemplary embodiment must include all of them or only such effects, and therefore the scope of the rights of the present invention should not be understood as being limited thereby.

[0012] The meanings of terms described in the present invention should be understood as follows.

[0013] The terms "first", "second", or the like are intended to distinguish one component from another, and the scope of the right should not be limited by these terms. For example, the first component may be referred to as the second component, and similarly, the second component may also be referred to as the first component. When a component is referred to as being "connected" to another component, it should be understood that it may be directly connected to the other component, but there may also be another component therebetween. Meanwhile, when a component is referred to as being "directly connected" to another component, it should be understood that there is no other component in between. Moreover, other expressions that describe the relationship between components, such as "between" and "directly between" or "adjacent to" and "directly adjacent to", should be interpreted in the same way.

[0014] A singular expression should be understood to include the plural expression unless the context clearly indicates otherwise, and the terms "include" or "have" should be understood to specify the presence of a stated feature, number, step, operation, component, part, or combination thereof, but not to exclude the possibility of the presence or addition of one or more other features, numbers, steps, operations, components, parts, or combinations thereof.

[0015] All terms used herein, unless otherwise defined, have the same meaning as commonly understood by a person of ordinary skill in the art to which the present invention belongs. Terms defined in commonly used dictionaries should be interpreted as having a meaning consistent with the contextual meaning of the relevant art, and shall not be interpreted as having an ideal or overly formal meaning unless explicitly defined in the present invention.

[0016] FIG. 1 is a perspective view of a cardiopulmonary resuscitation device according to one exemplary embodiment of the present invention, and FIG. 2 is a schematic view of the cardiopulmonary resuscitation device illustrated in FIG. 1.

[0017] Referring to FIG. 1 and FIG. 2, the cardiopulmonary resuscitation device of the present invention includes a base plate 100, a support 200, and a hood 300 for compressing a chest of a patient.

[0018] The base plate 100 is formed in a shape to support a back of a patient requiring cardiopulmonary resuscitation, and includes a sliding guide 110 for sliding the support 200 and the hood 300 and a stopper 120 for fixing the positions of the support 200 and the hood 300.

[0019] In the base plate 100, an internal space into which a frame 115 provided in the sliding guide 110 can be inserted to adjust the height of a piston 310 is formed on a side portion of the base plate 100.

[0020] The sliding guides 110 are provided on both sides of the base plate 100, and one end and the other end of the support 200 are coupled to be slidable, allow-

ing the support 200 to slide forward or backward.

[0021] As illustrated in (b) of FIG. 2, which is an enlarged view of an area A illustrated in (a) of FIG. 2, the sliding guide 110 is provided with the frame 115 that is inserted into or withdrawn from the inside of the base plate 100, thereby allowing the distance between both ends of the support 200 to be adjusted, thereby adjusting the height of the piston 310.

[0022] In this case, the reason why the height of the piston 310 is adjusted is to prevent a situation in which a chest of a specific patient cannot be compressed by the piston 310 because each patient has a different body shape.

[0023] The stopper 120 is provided in the sliding guide 110 and is formed in a form that can be connected to one end and the other end of the support 200 to connect one end and the other end of the support 200, and fixes the positions of the support 200 and the hood 300 through connection to one end and the other end of the support 200.

[0024] The support 200 is coupled to the sliding guide 110 to move a lower end of the piston 310 to a position where the lower end compresses the chest of the patient, and in one exemplary embodiment of the present invention, the shape for supporting the hood 300 may be arched, but is not limited thereto.

[0025] One end and the other end of the support 200 are movably coupled to the pair of sliding guides 110, and thus, the support may slide forward or backward with the sliding guide 110 as an axis, or a distance between both ends of the support may be adjusted by inserting and withdrawing the frame 115.

[0026] It is preferable that the forward and backward sliding movement of the support 200 and the distance adjustment between both ends are performed before the piston 310 compresses the chest of the patient, and when the support 200 moves to a position for the piston 310 to compress and relax the chest of the patient, one end and the other end are fastened by the pair of stoppers 120.

[0027] The support 200 is configured in a form in which one end and the other end are attached to and detached from the pair of sliding guides 110, and can be attached to and detached from the pair of sliding guides 110. Through attachment and detachment, the support is attached to and detached from the base plate 100 together with the hood 300 and may be used as a separate device.

[0028] The hood 300 is coupled to one side of the support 200, more specifically, to the center portion (arch crown) of the arch-shaped support 200, and includes the piston 310 for compressing the chest of the patient and a control unit 320 for contracting or expanding the piston 310.

[0029] **In** the hood 300, the control unit 320 may be exposed to the outside or installed inside.

[0030] The piston 310 is separated from the chest of the patient before compressing the chest of the patient, and may repeat a process of being operated by the control unit 320 to compress the chest of the patient and then being separated to relax the chest of the patient.

[0031] The piston 310 may be operated based on a compression continuous mode that continuously compresses the chest of the patient according to a chest compression mode set through the control unit 320, or a compression 30 : 2 mode that performs chest compression and artificial respiration of the patient simultaneously by performing 2 artificial respirations after performing 30 chest compressions of the patient, and thus, the chest compressionbased emergency treatment can be provided to the patient.

[0032] The control unit 320 may control the operation of the cardiopulmonary resuscitation device as well as the operation of the piston 310, and may be provided with a plurality of buttons for this purpose.

[0033] The plurality of buttons is not illustrated in the drawings, but as a specific example, the plurality of buttons may include a power button for turning the cardiopulmonary resuscitation device on/off, a stop button for stopping the operation of the piston 310, a compression mode setting button for causing the piston 310 to perform chest compression (CPR) of a patient or for setting the chest compression mode of the piston 310, a compression depth setting button for setting the chest compression depth of the piston 310, and a compression speed setting button for setting the chest compression speed (number of times) of the piston 310.

[0034] The above control unit 320 performs a self-test to determine whether the settings are initialized and normal operation is possible when an input signal is input to the power button and the cardiopulmonary resuscitation device is turned on. When the cardiopulmonary resuscitation device is on, in a case where the input signal is input to the power button again, the settings are initialized and the cardiopulmonary resuscitation device is turned off.

[0035] The control unit 320 controls the operation of the piston 310 so that the chest of the patient is repeatedly compressed and relaxed when the chest compression mode set through the compression mode setting button is the compression continuous mode. Meanwhile, when the chest compression mode set through the compression mode setting button is the compression 30 : 2 mode, the operation of the piston 310 may be controlled so that two artificial respirations are performed after the chest of the patient is compressed 30 times.

[0036] The control unit 320 may control the operation of the piston 310 so that the chest of the patient is compressed to at least one depth of 4 cm, 4.5 cm, 5 cm, and 5.5 cm when the input signal is input to the compression depth setting button, and further, may control the operation of the piston 310 so that the chest of the patient is compressed to 5 cm when the input signal is input to the compression depth setting button in an initialization state, thereafter, the chest of the patient is compressed to 5.5 cm when the signal is input, the chest of the patient is compressed to 4 cm when the signal is input again, and the chest of the patient is compressed to 4.5 cm when the

signal is input again.

[0037] The control unit 320 may control the operation of the piston 310 so that the chest of the patient is compressed at least one of 100, 110, and 120 times when the input signal is input to the compression speed setting button, and further, may control the operation of the piston 310 so that the chest of the patient is compressed 110 times when the input signal is input to the compression speed setting button in the initialization state, the chest of the patient is compressed 120 times when the signal is input again, and the chest of the patient is compressed 100 times when the signal is input again.

[0038] The cardiopulmonary resuscitation device may include a cover that is mounted on the lower end of the piston 310, is made of a material having a different hardness from that of the piston 310 of a hard material, and can continuously provide a cushioning effect that relieves and distributes the pressure applied to the chest of the patient.

[0039] According to one exemplary embodiment of the present invention, as illustrated in FIGS. 3 to 6, the cover may include a first pad 600 to which the lower end of a piston 310 is fit-coupled to directly compress the chest of the patient, and a first plate 700 which is fit-coupled to the first pad 600 to form the interspace A and disposed inside the first pad 600.

[0040] FIG. 3 is a perspective view of a first pad constituting a cover according to one exemplary embodiment of the present invention, FIG. 4 is a cross-sectional view taken along line A-A of FIG. 3, FIG. 5 is a perspective view of a first pad lower portion included in an area B illustrated in FIG. 4, and FIG. 6 is a plan view of the first pad lower portion included in the area B illustrated in FIG. 4.

[0041] Referring to FIGS. 3 to 6, the first pad 600 has an outer shape including a first pad upper portion 610 to which the lower end of the piston 310 is fit-coupled and a first pad lower portion 620 for compressing the chest of the patient with the lower surface of the first pad lower portion, and the first pad upper portion 610 may have a piston fitting portion 611 formed therein.

[0042] The first pad upper portion 610 forms a piston fitting hole 6110 by the piston fitting portion 611 that is integrally formed in a shape bent from the first pad lower portion 620, and the piston 310 may be fastened to the first pad upper portion 610 when the lower end portion of the piston comes into contact with the first plate 700, and then a fastening member (not illustrated) formed in a part of the outer peripheral surface is inserted into the piston fitting hole 6110 through rotation of the cover.

[0043] The piston fitting portion 611 forms the piston fitting hole 6110, and the lower end of the piston 310 may be fit-coupled to the first pad upper portion 610 through the piston fitting hole 6110.

[0044] Moreover, the piston fitting portion 611 is a part formed by being bent from the first pad upper portion 610 to form the piston fitting hole 6110 into which the piston 310 can be inserted, and may include a first piston fitting portion 611a, a second piston fitting portion 611b, a third piston fitting portion 611c, and a fourth piston fitting portion 611d.

[0045] **In** addition, the piston fitting portion 611 has a pair of grooves 6024a and 6024b formed between the first piston fitting portion 611a and the second piston fitting portion 611b and between the third piston fitting portion 611c and the fourth piston fitting portion 611d, and when the piston 310 is fit-coupled to the piston fitting hole 6110, the fastening member formed in a part of the outer peripheral surface of the piston 310 may be inserted into the pair of grooves 6024a and 6024b.

[0046] That is, the piston 310 may be fastened to the first pad 600 by the fastening member being inserted into the pair of grooves 6024a and 6024b while the lower end portion of the piston comes into contact with the first plate 700.

[0047] Moreover, the piston fitting portion 711 may have a lower portion that may expand (or flow) toward the outside of the first pad upper portion 610 so that the fastening member of the piston 310 may be inserted into or withdrawn from the pair of grooves 6024a and 6024b during the process of engaging and disengaging the fastening member of the piston 310 and the pair of grooves 6024a and 6024b, and for this purpose, an expansion space 7101 may be formed in the interspace between the piston fitting portion and the first pad upper portion 610.

[0048] The first pad upper portion 610 may be made of at least one of polyurethane, polypropylene, and biocompatible silicone, which are materials with high hardness, so that the contraction and expansion of the piston 310 and the force therefor can be transmitted to the cap regardless of various external forces that may be applied from the outside.

[0049] In addition, the first pad upper portion 610 may have a hardness of 40 to 60 shore A in the case of biocompatible silicone, and a hardness of 25 to 30 asker C in the case of other materials. In one exemplary embodiment of the present invention, the asker C hardness may be measured by an asker hardness tester that applies a predetermined shape of indenter to the surface of a sample with the force of a spring and measures the hardness based on the depth into which the indenter is indented into the sample in a state where the resistance of the sample and the force of the spring are balanced, and the shore hardness measures the height of the rebound when an object with a small diamond fixed to the end of the object is dropped from a certain height.

[0050] The first pad lower portion 620 is the part of the area B of FIG. 4, may be formed integrally with the first pad upper portion 610, and may directly contact the chest compression point of the patient and compress the chest of the patient when the piston 310 is extended toward the chest of the patient.

[0051] The first pad lower portion 620 has an outer shape formed by a housing 621, and the housing 621 may be provided with a plurality of air flow holes 623 and a seating portion 624.

[0052] In addition, the housing 621 includes an outer housing 621a and an inner housing 621b integrally formed with each other, and the lower surface of the housing comes into contact with the chest of the patient.

[0053] Moreover, the housing 621 has a protruding member insertion hole 622 formed at the boundary between the outer housing 621a and the inner housing 621b to enable the fit-coupling of the protruding member 720 provided in the first plate 700.

[0054] The protruding member insertion hole 622 may be formed in a circular shape at the boundary between the outer housing 621a and the inner housing 621b to enable the fit-coupling of the protruding member 720.

[0055] The outer housing 621a and inner housing 621b may be implemented in a bellows shape to allow for a change in the volume of the interspace A.

[0056] In addition, the upper portions of the outer housing 621a and the inner housing 621b are fit-coupled to the bottom portion 710 of the first plate 700, and an adhesive means (for example, an adhesive) may be provided (or applied) to the upper portions of the outer housing 621a and the inner housing 621b so that the fit-coupling structure of the first pad 600 and the first plate 700 is maintained. However, the adhesive means is not limited to being provided on the upper portions of the outer housing 621a and the inner housing 621b, and may be provided on the bottom portion 710.

[0057] In addition, the outer housing 621a and the inner housing 621b have side walls that form the protruding member insertion hole 622 protruding upward, thereby generating the interspace A between the inner housing 621b and the first plate 700 in the fit-coupling structure of the first pad 600 and the first plate 700.

[0058] The inner housing 621b has a plurality of air flow holes 623 formed on the lower surface so that when pressure is transmitted from the chest of the patient to the lower surface during the chest compression process of the patient, a change in volume occurs through the air flow in the interspace A.

[0059] The volume of the interspace A between the upper side of the inner housing 621b and the first plate 700 may decrease when air flows outward along the air flow hole 623 by the piston 310 that expands during the chest compression process of the patient, and in contrast, when the piston is separated from the chest of the patient after the compressing the chest of the patient is completed, the volume of the interspace may increase according to the air introduced through the air flow hole 623.

[0060] The inner housing 621b has the lower surface that comes into contact with the chest of the patient during the chest compression process of the patient, and as the piston 310 expands, air flows outward from the interspace A, and thus, the volume of the interspace A decreases. Therefore, when the seating portion 624 provided in the interspace A comes into contact with the bottom portion 710 of the first plate 700, a negative pressure is generated in the interspace A, and when the piston 310 is contracted after the negative pressure is generated in the interspace A, the lower surface that comes into contact with the chest compression point of the patient may move upward while pulling the chest of the patient.

[0061] As such, the first pad lower portion 620 is made of at least one of ethylene-vinyl acetate, polyethylene, polyethylene-polypropylene blend, polystyrene, neoprene, chloroprene, polyurethane, and biocompatible silicone, and due to the characteristics of these materials, the first pad lower portion may be implemented as a shape that conforms to the shape of the chest of the patient.

[0062] Moreover, in the first pad lower portion 620, the biocompatible silicone may have a hardness of 10 to 30 shore A, and other materials may have a hardness of 10 to 20 asker C.

[0063] Meanwhile, the first pad lower portion 620 needs to conform to the chest of the patient when compressing the chest of the patient, and accordingly, the lower surface of the inner housing 621b that comes into contact with the chest compression point of the patient is preferably made of biocompatible silicone that easily conforms to the chest of the patient among applicable materials, thereby continuously providing a cushioning effect that relieves and distributes the pressure applied to the chest of the patient, thereby preventing rib fractures and hemothorax from occurring during the chest compression process of the patient.

[0064] When the first plate 700 is fit-coupled to the first pad lower portion 620, the bottom portion 710 faces the seating portion 624 with the interspace A therebetween.

[0065] The lower surface of the bottom portion 710 may come into contact with the seating portion 624 when the volume of the interspace A decreases during the process of compressing the chest of the patient.

[0066] The protruding member 720 that can be fit-coupled to a protruding member insertion hole 622 to be fit-coupled to the first pad lower portion 620 protrudes from the bottom portion 710 of the first plate 700.

[0067] The protruding member 720 may protrude in a circular shape to be fit-coupled into the protruding member insertion hole 622.

[0068] As such, the cover of the present invention is not limited to being implemented only through the fit-coupling of the first pad 600 and the first plate 700, and may also be implemented by fit-coupling of a second pad 800 that is a modified version of the first pad 600 and a second plate 900 that is a modified version of the first plate 700.

[0069] Hereinafter, a cover according to another exemplary embodiment of the present invention implemented through the fit-coupling of the second pad 800 and the second plate 900 will be described in detail.

[0070] FIG. 7 is a perspective view of a second pad constituting the cover according to another exemplary embodiment of the present invention, FIG. 8 is a cross-sectional view taken along line C-C of FIG. 7, FIG. 9 is a perspective view of a second pad lower portion included

in an area D illustrated in FIG. 8, and FIG. 10 is a plan view of the second pad lower portion included in the area D illustrated in FIG. 8.

[0071] Referring to FIGS. 7 to 10, the second pad 800 has an outer shape including a second pad upper portion 810 to which the lower end of the piston 310 is fit-coupled and a second pad lower portion 820 for compressing the chest of the patient with the lower surface of the second pad lower portion, and the second pad upper portion 810 may have a piston fitting portion 811 formed therein.

[0072] The second pad upper portion 810 forms a piston fitting hole 8110 by the piston fitting portion 811 that is integrally formed in a shape bent from the second pad lower portion 820, and the piston 310 may be fastened to the second pad upper portion 810 when the lower end portion of the piston comes into contact with the second plate 900, and then a fastening member (not illustrated) formed in a part of the outer peripheral surface is inserted into the piston fitting hole 8110 through rotation of the cover.

[0073] The piston fitting portion 811 forms the piston fitting hole 8110, and the lower end of the piston 310 may be fit-coupled to the second pad upper portion 810 through the piston fitting hole 8110.

[0074] Moreover, the piston fitting portion 811 is a part formed by being bent from the second pad upper portion 810 to form the piston fitting hole 8110 into which the piston 310 can be inserted, and may include a first piston fitting portion 811a, a second piston fitting portion 811b, a third piston fitting portion 811c, and a fourth piston fitting portion 811d.

[0075] **In** addition, the piston fitting portion 811 has a pair of grooves 8024a and 8024b formed between the first piston fitting portion 811a and the second piston fitting portion 811b and between the third piston fitting portion 811c and the fourth piston fitting portion 811d, and when the piston 310 is fit-coupled to the piston fitting hole 8110, the fastening member formed in a part of the outer peripheral surface of the piston 310 may be inserted into the pair of grooves 8024a and 8024b.

[0076] That is, the piston 310 may be fastened to the second pad 800 by the fastening member being inserted into the pair of grooves 8024a and 8024b while the lower end portion of the piston comes into contact with the second plate 900.

[0077] Moreover, the piston fitting portion 811 may have a lower portion that may expand (or flow) toward the outside of the second pad upper portion 810 so that the fastening member of the piston 310 may be inserted into or withdrawn from the pair of grooves 8024a and 8024b during the process of engaging and disengaging the fastening member of the piston 310 and the pair of grooves 8024a and 8024b, and for this purpose, an expansion space 8101 may be formed in the interspace between the piston fitting portion and the second pad upper portion 810.

[0078] The second pad upper portion 810 may be made of at least one of polyurethane, polypropylene, and biocompatible silicone, which are materials with high hardness, so that the contraction and expansion of the piston 310 and the force therefor can be transmitted to the cap regardless of various external forces that may be applied from the outside.

[0079] **In** addition, the second pad upper portion 810 may have a hardness of 40 to 60 shore A in the case of biocompatible silicone, and a hardness of 25 to 30 asker C in the case of other materials. **In** one exemplary embodiment of the present invention, the asker C hardness may be measured by an Asker hardness tester that applies a predetermined shape of indenter to the surface of a sample with the force of a spring and measures the hardness based on the depth into which the indenter is indented into the sample in a state where the resistance of the sample and the force of the spring are balanced, and the shore hardness measures the height of the rebound when an object with a small diamond fixed to the end of the object is dropped from a certain height.

[0080] The second pad lower portion 820 is the part of the area D of FIG. 8, may be formed integrally with the second pad upper portion 810, and may directly contact the chest compression point of the patient and compress the chest of the patient when the piston 310 is extended toward the chest of the patient.

[0081] The second pad lower portion 820 has an outer shape formed by a housing 821, and the housing 821 may be divided into a first housing 821a and a second housing 821b formed integrally with each other, and may include a plurality of air flow holes 823, a first seating portion 824, a second seating portion 825, and a partition 826.

[0082] The first housing 821a includes a first protruding member insertion hole 822a into which the first protruding member 920 of the second plate 900 is to be fit-coupled, thereby enabling the fit-coupling of the second pad 800 and the second plate 900.

[0083] The first housing 821a may be divided into a plurality of interspaces A in which negative pressure is generated through a plurality of partitions 826. Therefore, when the volume of the interspaces A is reduced by receiving pressure from the chest of the patient, not only may all of the plurality of lower surfaces move toward the bottom portion 910 of the second plate 900, but also only some of the lower surfaces that come into contact with the chest compression point of the patient and receives a pressure of a certain strength or greater from the chest of the patient among the plurality of lower surfaces may move toward the bottom portion 712.

[0084] It is preferable that the first protruding member insertion hole 822a is formed in a circular shape on the first housing 821a so that the first protruding member 920 can be fit-coupled to the first protruding member insertion hole.

[0085] The second housing 821b is connected to the first housing 821a through the plurality of partitions 826 in the structure of the housing 821, and includes a second protruding member insertion hole 822b into which the

second protruding member 930 of the second plate 900 is to be fit-coupled, so that the fit-coupling of the second pad 800 and the second plate 900 are implemented together with the first housing 821a.

[0086] It is preferable that the second protruding member insertion hole 822b is formed in a circular shape on the second housing 821b so that the second protruding member 930 can be fit-coupled to the second protruding member insertion hole.

[0087] The side walls of the first housing 821a and the second housing 821b may protrude upward so that the interspaces A and B are generated between the bottom portion 910 of the second plate 900 and the first housing and the second housing in the fit-coupling structure of the second pad 800 and the second plate 900.

[0088] **In** addition, the first housing 821a and the second housing 821b may be implemented in a bellows shape so that the volumes of the interspaces A and B can be changed.

[0089] **In** addition, the upper portions of the first housing 821a and the second housing 821b are coupled to the bottom portion 910 of the second plate 900, and an adhesive means (for example, an adhesive) may be provided (or applied) to the upper portions of the first housing 821a and the second housing 821b so that the fit-coupling structure of the second pad 800 and the second plate 900 is maintained. However, the adhesive means is not limited to being provided on the upper portions of the first housing 821a and the second housing 821b, and may be provided on the bottom portion 910.

[0090] The plurality of air flow holes 823 is formed on the lower surfaces of the first housing 821a and the second housing 821b, respectively, and may include a plurality of first air flow holes 823a formed on the lower surface of the first housing 821a and a plurality of second air flow holes 823b formed on the lower surface of the second housing 821b.

[0091] The first and second air flow holes 823a and 823b may reduce the volumes of the interspaces A and B by causing the air in the interspace A between the bottom portion 910 of the second plate 900 and the first housing 821a and the interspace B between the bottom portion 910 and the second housing 821b to flow outward during the process of compressing the chest of the patient through the expansion of the piston 310.

[0092] A plurality of first seating portions 824 may be formed to be provided in the interspaces A of the first housing 821a divided into a plurality of portions through the plurality of partitions 826, and when the air in the interspace A flows outward from the plurality of first air flow holes 823a and the volume of the interspace A decreases, the first seating portions come into contact with the bottom portion 910 of the second plate 900 so that the interspace A may be in a negative pressure state.

[0093] As a specific example, when a peripheral portion of the lower surface of the bottom portion 910 which surrounds the center portion of the lower surface of the bottom portion 910 of the second plate 900 and is parallel to the first seating portion 824 in a vertical direction moves downward due to downward pressure applied from the fastening member provided on the piston 310 through the expansion of the piston 310, the first seating portion 824 comes into contact with the peripheral portion of the lower surface of the bottom portion 910. Accordingly, the partitioned interspace A may be in a negative pressure state.

[0094] The second seating portion 825 may be provided in the interspace B of the second housing 821b, and when the air in the interspace B partitioned by the plurality of second air flow holes 823b flows to the outside and the volume of the interspace B decreases, the second seating portion comes into contact with the bottom portion 910 of the second plate 900 so that the interspace B may be in a negative pressure state.

[0095] As a specific example, when the center portion of the lower surface of the bottom portion 910 that is parallel to the second seating portion 825 in the vertical direction in the bottom portion 910 of the second plate 900 is moved downward due to the downward pressure applied through the expansion of the piston 310, the second seating portion 825 comes into contact with the center portion of the lower surface of the bottom portion 910. Accordingly, the interspace B may be in a negative pressure state.

[0096] It is preferable that the plurality of partitions 826 is provided to partition the interspace A of the first housing 821a into a plurality of portions, and each partition 826 may be provided in a shape that connects the first housing 821a and the second housing 821b.

[0097] As such, the second pad lower portion 820 is made of at least one of ethylene-vinyl acetate, polyethylene, polyethylene-polypropylene blend, polystyrene, neoprene, chloroprene, polyurethane, and biocompatible silicone, and due to the characteristics of these materials, the second pad lower portion 820 may be implemented as a shape that conforms to the shape of the chest of the patient.

[0098] Moreover, in the second pad lower portion 820, the biocompatible silicone may have a hardness of 10 to 30 shore A, and other materials may have a hardness of 10 to 20 asker C.

[0099] Meanwhile, the second pad lower portion 820 needs to conform to the chest of the patient when compressing the chest of the patient, and accordingly, the lower surfaces of the first and second housings 821a and 821b that come into contact with the chest compression point of the patient are preferably made of biocompatible silicone that easily conforms to the chest of the patient among applicable materials, thereby continuously providing a cushioning effect that relieves and distributes the pressure applied to the chest of the patient, thereby preventing rib fractures and hemothorax from occurring during the chest compression process of the patient.

[0100] When the second plate 900 is fit-coupled to the second pad lower portion 820, the bottom portion 910 faces the first seating portion 824 and the second seating

portion 825 with the interspaces A and B therebetween.

[0101] The lower surface of the bottom portion 910 may come into contact with the seating portion 624 when the volumes of the interspaces A and B decrease during the process of compressing the chest of the patient.

[0102] The second plate 900 includes the first protruding member 920 that can be fit-coupled to the first protruding member insertion hole 822a so as to be fit-coupled to the second pad lower portion 820, and the second protruding member 930 that is positioned closer to the center portion of the bottom portion 910 than the first protruding member 920 and can be fit-coupled to the second protruding member insertion hole 822b.

[0103] The first protruding member 920 may protrude in a circular shape from the bottom portion 910 so as to be fit-coupled into the first protruding member insertion hole 822a.

[0104] The second protruding member 930 may protrude in a circular shape from the bottom portion 910 so as to be fit-coupled into the second protruding member insertion hole 822b.

[0105] The cover according to another exemplary embodiment of the present invention has an advantage in that the fit-coupling structure between the pad and the plate is reinforced by implementing the fit-coupling between the second pad 800 and the second plate 900 through a relatively large number of protruding members 920 and 930 compared to the cover according to one exemplary embodiment of the present invention.

[0106] The detailed description of the preferred exemplary embodiments of the present invention disclosed above has been provided to enable those skilled in the art to implement and practice the present invention. While the above has been described with reference to preferred exemplary embodiments of the present invention, it will be understood by those skilled in the art that various modifications and changes can be made to the present invention without departing from the scope of the present invention. For example, those skilled in the art can utilize each of the configurations described in the above-described exemplary embodiments in a manner that combines them. Accordingly, the present invention is not intended to be limited to the exemplary embodiments illustrated herein, but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

[0107] The present invention can be embodied in other specific forms without departing from the technical spirit and essential characteristics of the present invention. Therefore, the above detailed description should not be construed as restrictive in all aspects but should be considered as illustrative. The scope of the present invention should be determined by reasonable interpretation of the appended claims, and all changes coming within the equivalent scope of the present invention are intended to be included in the scope of the present invention. The present invention is not intended to be limited to the exemplary embodiments set forth herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein. In addition, claims that do not have an explicit citation relationship in the claims may be combined to constitute an exemplary embodiment or may be included as a new claim by post-application amendment.

[0108] The piston cover of the cardiopulmonary resuscitation device of the present invention can continuously provide a cushioning effect to the patient to relieve and distribute the pressure applied to the chest of the patient during the chest compression process of the patient, thereby preventing rib fractures and hemothorax from occurring during the chest compression process. Therefore, the present invention has industrial applicability.

Claims

1. A piston cover fit-coupled to a piston (310) for compressing a chest of a patient provided in a cardiopulmonary resuscitation device, the piston cover comprising:

   a first pad (600) in which a first pad upper portion (610) and a first pad lower portion (620) are integrally formed with each other, the first pad upper portion including a pair of grooves (6024a and 6024b) formed between a first piston fitting portion (611a) and a second piston fitting portion (611b), and between a third piston fitting portion (611c) and a fourth piston fitting portion (611d) forming a piston fitting hole (6110) and a piston fitting portion (611) in which a fastening member formed in a part of an outer peripheral surface of the piston (310) is inserted into the pair of grooves (6024a and 6024b) when the piston (310) is fit-coupled to the piston fitting hole (6110), and the first pad lower portion compressing a chest compression point of the patient with a lower surface of the first pad lower portion while generating a negative pressure when the piston (310) is expanded and pulling the chest of the patient with the lower surface and moving the chest upward through the negative pressure when the piston (310) is contracted; and
   a first plate (700) including a protruding member (720) fit-coupled to the first pad lower portion (620) and fit-coupled to the first pad lower portion (620) to form an interspace (A).

2. The piston cover of claim 1, wherein the first pad lower portion (620) includes

   a housing (621) including an outer housing (621a) and an inner housing (621b) of which upper portions are coupled to a bottom portion (710) of the first plate (700) and which are integrally formed with each other,

a plurality of air flow holes (623) formed on a lower surface of the inner housing (621b) so that air in an interspace (A) between the inner housing (621b) and the bottom portion (710) flows, and

a seating portion (624) provided in the interspace (A) to comes into contact with the bottom portion (710) when the air in the interspace (A) flows outward through the air flow holes (623) and volume of the interspace (A) decreases.

3. The piston cover of claim 2, wherein the first pad lower portion (620) includes a protruding member insertion hole (622) to which the protruding member (720) is fit-coupled at a boundary between the outer housing (621a) and the inner housing (621b).

4. The piston cover of claim 3, wherein in the outer housing (621a) and the inner housing (621b), side walls forming the protruding member insertion hole (622) protrude upward so that the interspace (A) is generated between the bottom portion (710) and the outer housing and inner housing in a fit-coupling structure of the first pad (600) and the first plate (700).

5. The piston cover of claim 4, wherein the inner housing (621b) generates a negative pressure in the interspace (A) when the volume of the interspace (A) is reduced so that the bottom portion (710) and the seating portion (624) provided in the interspace (A) come into contact with each other and pulls the chest of the patient with a lower surface of the inner housing when the piston (310) is contracted after the negative pressure is generated in the interspace (A) to move the chest upward.

6. The piston cover of claim 1, wherein the first pad lower portion (620) is made of at least one of ethylene-vinyl acetate, polyethylene, polyethylene-polypropylene blend, polystyrene, neoprene, chloroprene, polyurethane, and biocompatible silicone, and

the biocompatible silicone has a hardness of 10 to 30 shore A, and at least one of ethylene-vinyl acetate, polyethylene, polyethylene-polypropylene blend, polystyrene, neoprene, chloroprene, and polyurethane has a hardness of 10 to 20 asker C.

7. The piston cover of claim 6, wherein in the first pad lower portion (620), a lower surface that compresses the chest compression point of the patient is made of the biocompatible silicone.

8. The piston cover of claim 1, wherein the first pad (600) is made of at least one of polyurethane, polypropylene, and biocompatible silicone.

9. A piston cover fit-coupled to a piston (310) for compressing a chest of a patient provided in a cardiopulmonary resuscitation device, the piston cover comprising:

a second pad (800) in which a second pad upper portion (810) and a second pad lower portion (820) are integrally formed with each other, the second pad upper portion including a pair of grooves (8024a and 8024b) formed between a first piston fitting portion (811a) and a second piston fitting portion (811b), and between a third piston fitting portion (811c) and a fourth piston fitting portion (811d) forming a piston fitting hole (8110) and a piston fitting portion (811) in which a fastening member formed in a part of an outer peripheral surface of the piston (310) is inserted into the pair of grooves (8024a and 8024b) when the piston (310) is fit-coupled to the piston fitting hole (8110), and the second pad lower portion compressing a chest compression point of the patient with a lower surface of the second pad lower portion while generating a negative pressure when the piston (310) is expanded and pulling the chest of the patient with the lower surface and moving the chest upward through the negative pressure when the piston (310) is contracted; and

a second plate (900) including a first protruding member (920) and a second protruding member (930) fit-coupled to the second pad lower portion (820) and fit-coupled to the second pad lower portion (820) to form interspaces (A and B).

10. The piston cover of claim 9, wherein the second pad lower portion (820) includes

a first housing (821a) of which an upper portion is coupled to a bottom portion (910) of the second plate (900) and which forms a first protruding member insertion hole (822a) to which the first protruding member (920) is to be fit-coupled,

a second housing (821b) of which an upper portion is coupled to the bottom portion (910) of the second plate (900) and which forms a second protruding member insertion hole (822b) to which the second protruding member (930) is to be fit-coupled,

a plurality of air flow holes (823) in which a plurality of first air flow holes (823a) that allow air in the interspace (A) between the first housing (821a) and the bottom portion (910) to flow, and a plurality of second air flow holes (823b) that allow air in the interspace (B) between the second housing (821b) and the bottom portion (910) to flow are formed on lower surfaces of the first housing (821a) and the second housing

821b,
a plurality of partitions (826) configured to partition the interspace (A) of the first housing (821a) into a plurality of portions,
a plurality of first seating portions (824) provided in each of the interspaces (A) partitioned into the plurality of portions by the partitions (826) to come into contact with the bottom portion (910) when the air in the interspace (A) flows outward through the first air flow hole (823a) and volume of the interspace (A) decreases, and
a second seating portion (825) provided in an interspace (B) to come into contact with the bottom portion (910) when the air in the interspace (B) flows outward through the second air flow hole (823b) and volume of the interspace (B) decreases.

11. The piston cover of claim 10, wherein in the first housing (821a) and the second housing (821b), side walls forming the first protruding member insertion hole (822a) and the second protruding member insertion hole (822b) protrude upward so that the interspaces (A and B) are generated between the bottom portion (910) and the first housing and second housing in a fit-coupling structure of the second pad (800) and the second plate (900).

12. The piston cover of claim 11, wherein the first housing (821a) and the second housing (821b) generate a negative pressure in the interspaces (A and B) when volumes of the interspaces (A and B) are reduced so that the bottom portion (910), the first seating portion (824), and the second seating portion (825) come into contact with each other and pulls the chest of the patient with lower surfaces of the first housing and the second housing when the piston (310) is contracted after the negative pressure is generated in the interspaces (A and B) to move the chest upward.

13. The piston cover of claim 9, wherein the second pad lower portion (820) is made of at least one of ethylene-vinyl acetate, polyethylene, polyethylene-polypropylene blend, polystyrene, neoprene, chloroprene, polyurethane, and biocompatible silicone, and
the biocompatible silicone has a hardness of 10 to 30 shore A, and at least one of ethylene-vinyl acetate, polyethylene, polyethylene-polypropylene blend, polystyrene, neoprene, chloroprene, and polyurethane has a hardness of 10 to 20 asker C.

14. The piston cover of claim 13, wherein in the second pad lower portion (820), a lower surface that compresses the chest compression point of the patient is made of the biocompatible silicone.

15. The piston cover of claim 9, wherein the second pad (800) is made of at least one of polyurethane, polypropylene, and biocompatible silicone.

FIG 1.

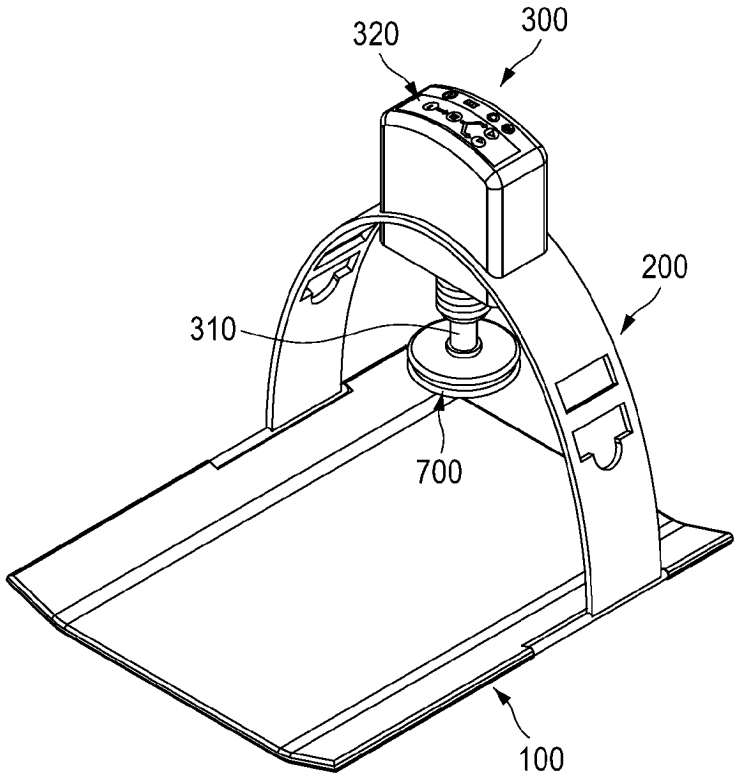


FIG 2.

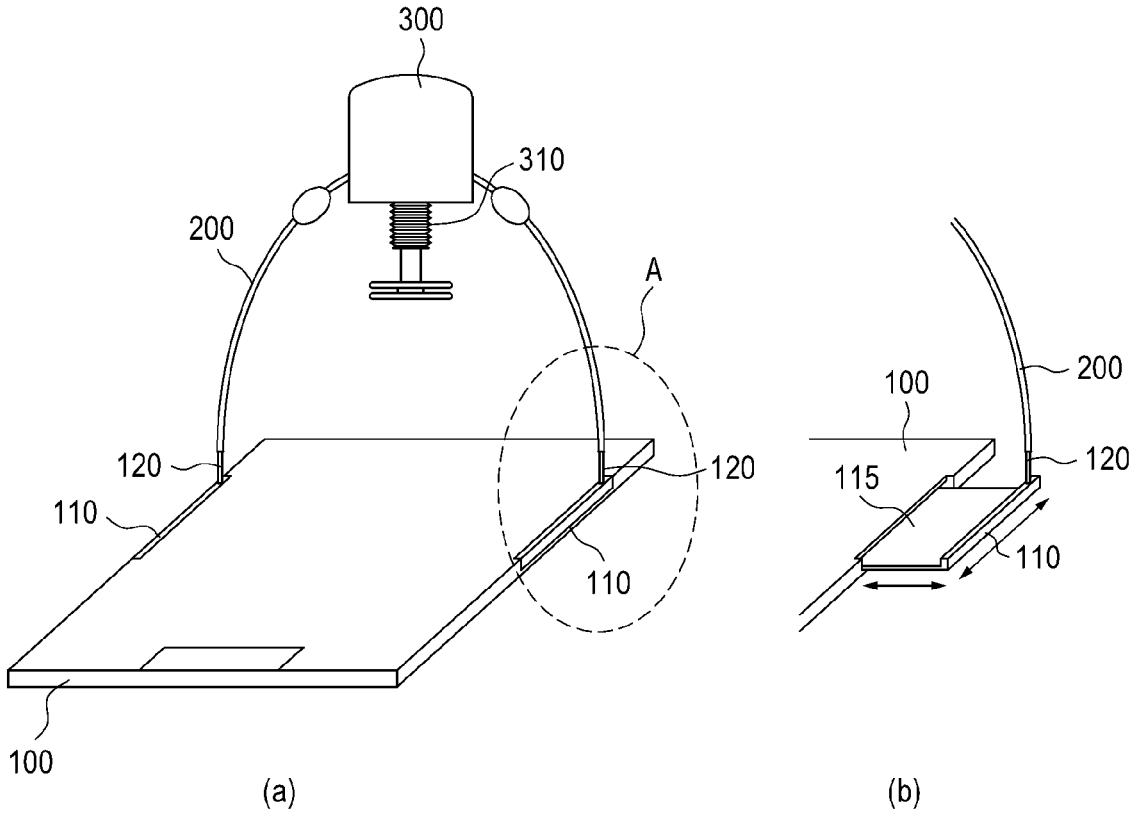


FIG 3.

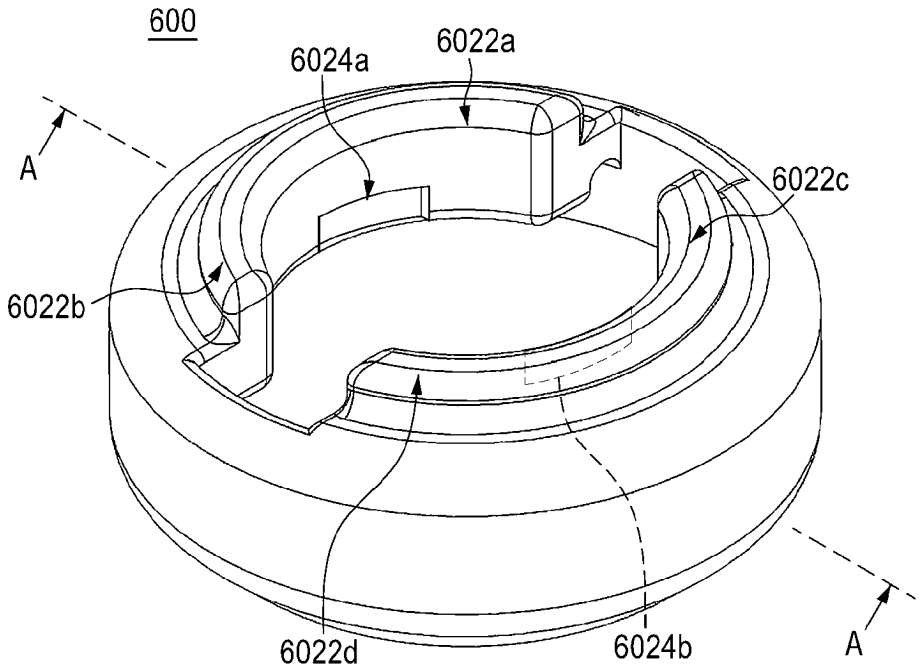

600
6024a
6022a
A
6022c
6022b
6022d
6024b
A

FIG 4.

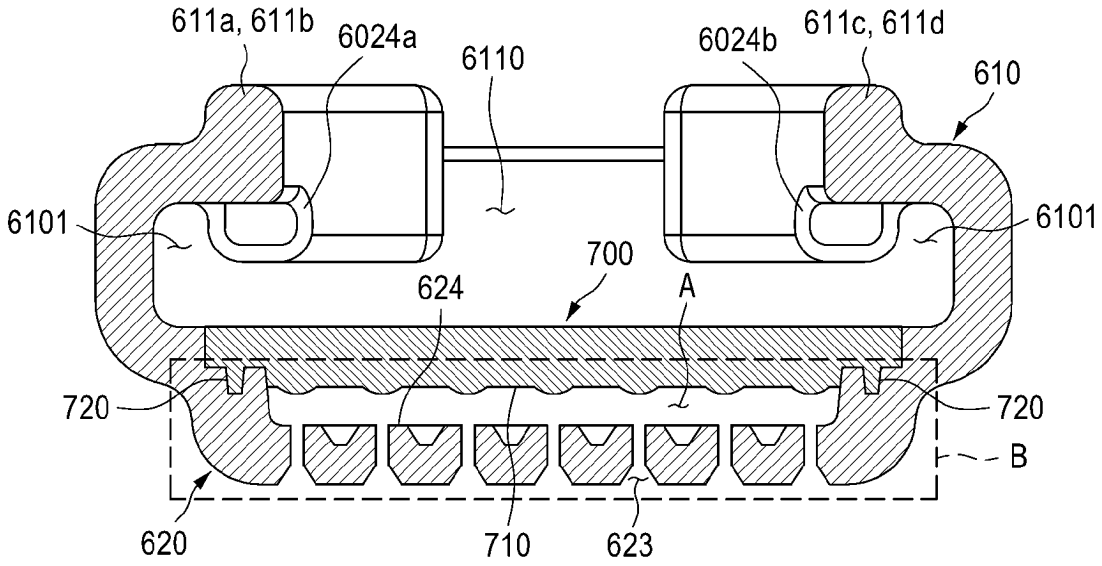

611a, 611b
6024a
6110
6024b
611c, 611d
610
6101
6101
700
624
A
720
720
B
620
710
623

FIG 5.

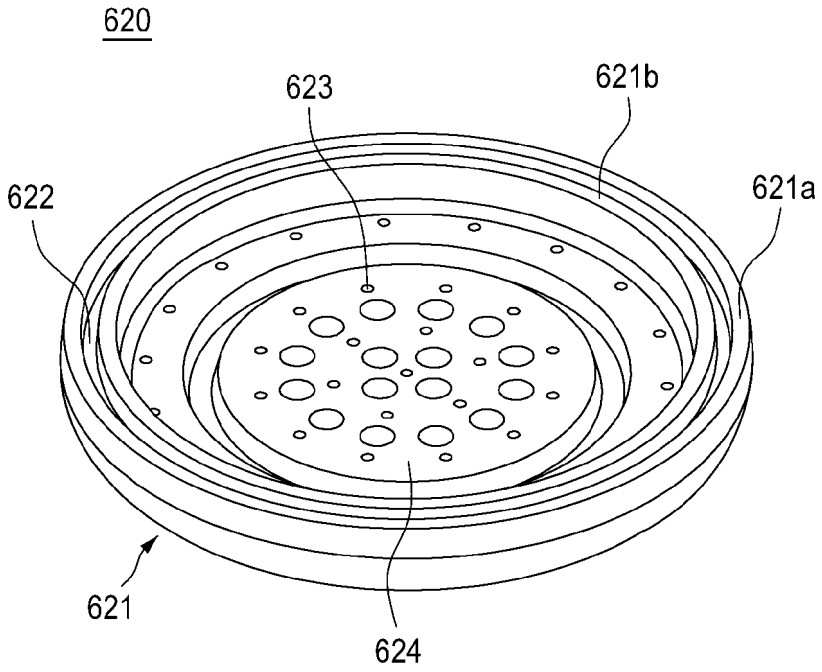


FIG 6.

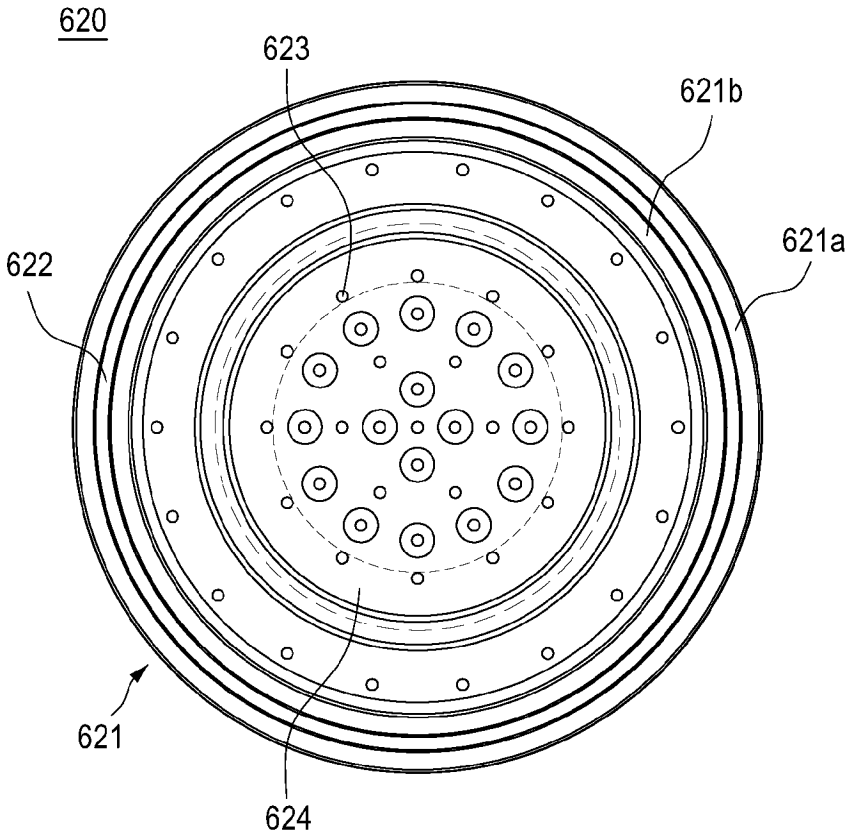


FIG 7.

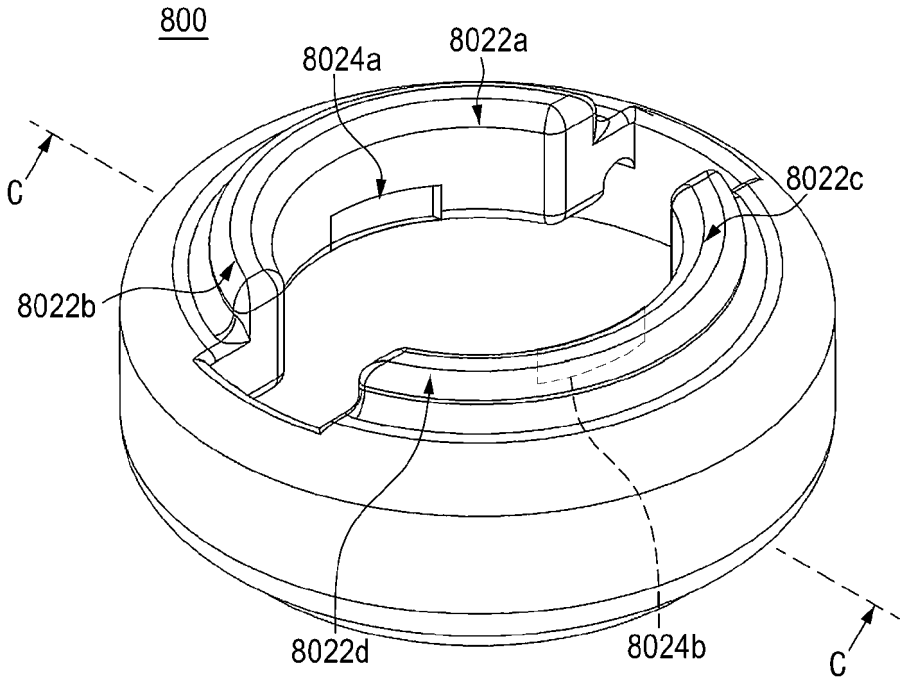

800
8024a
8022a
C
8022c
8022b
8022d
8024b
C

FIG 8.

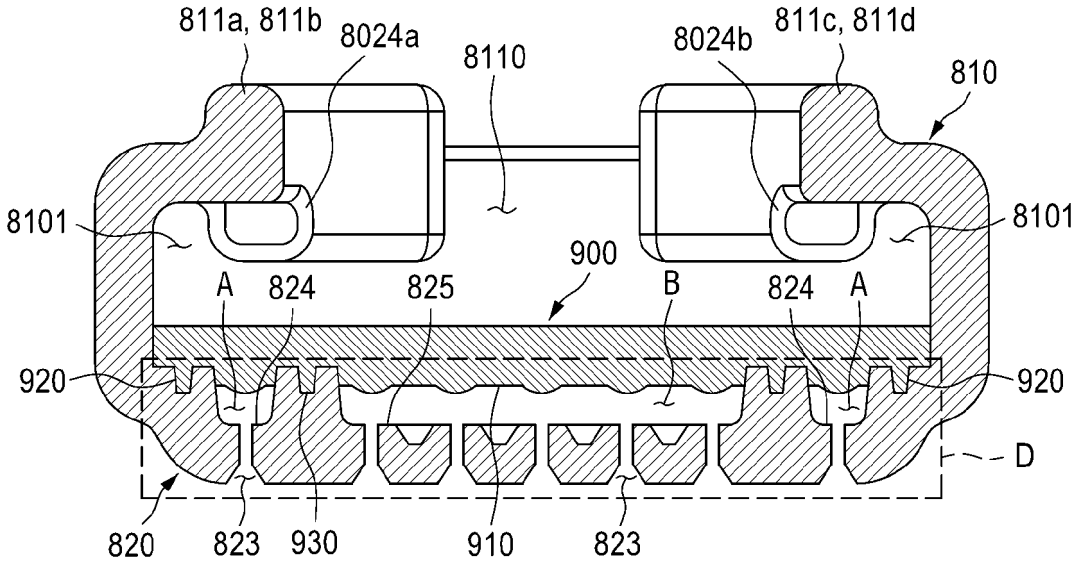

811a, 811b
8024a
8110
8024b
811c, 811d
810
8101
8101
900
A
824
825
B
824
A
920
920
D
820
823
930
910
823

FIG 9.

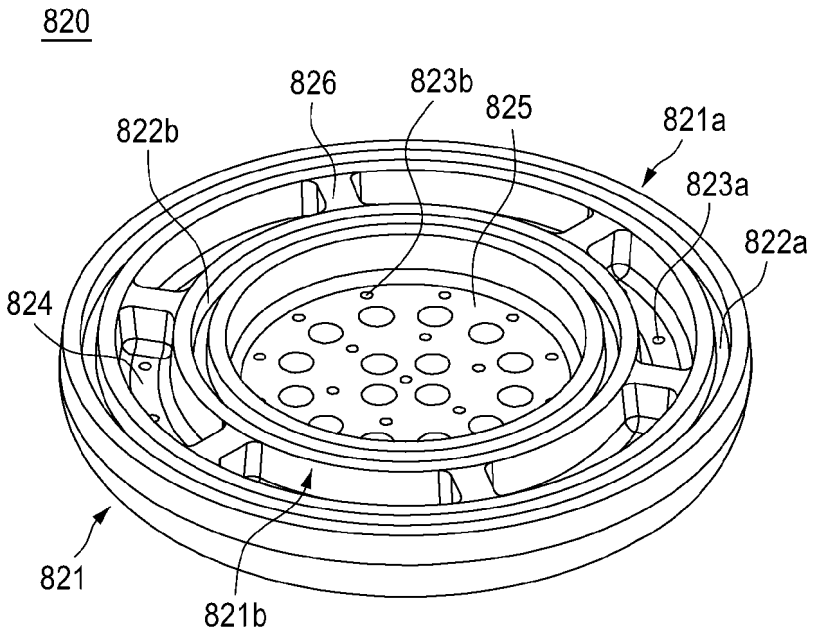
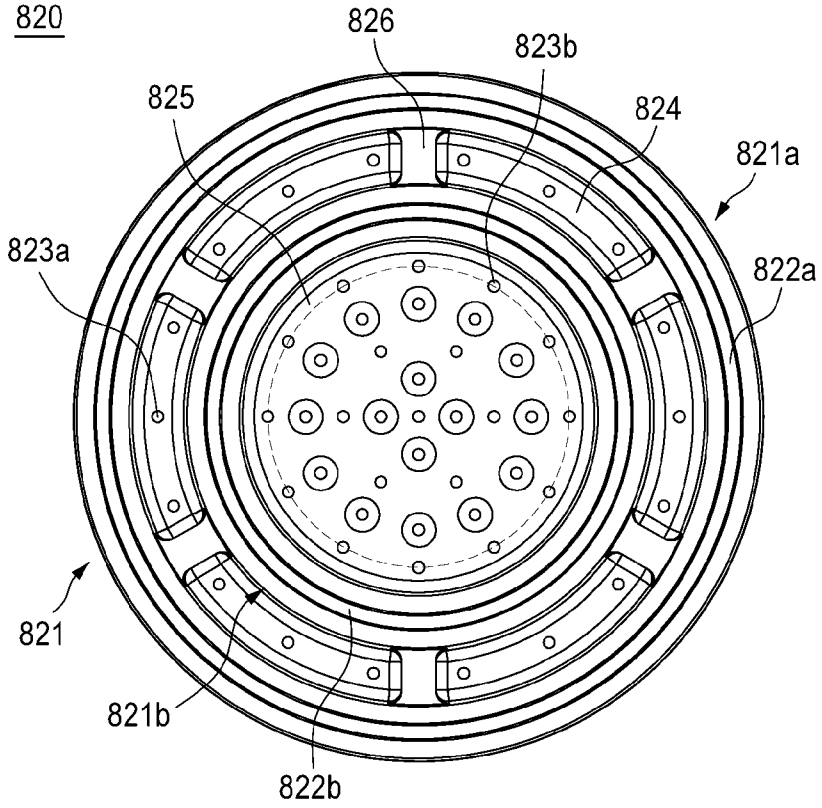


FIG 10.



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2022/011547

A. CLASSIFICATION OF SUBJECT MATTER

A61H 31/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61H 31/00(2006.01); B29C 45/00(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & keywords: 심폐소생(cardiopulmonary resuscitation), 피스톤(piston), 흡입(suction)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2019-0021943 A1 (PHYSIO-CONTROL, INC.) 24 January 2019 (2019-01-24) See paragraphs [0010]-[0011] and [0070]-[0072]; and figures 9-14B.	1-15
A	US 2022-0175614 A1 (PHYSIO-CONTROL, INC.) 09 June 2022 (2022-06-09) See entire document.	1-15
A	KR 10-0499870 B1 (LIMSTECH. CO., LTD.) 05 July 2005 (2005-07-05) See entire document.	1-15
A	JP 2015-530187 A (ZOLL MEDICAL CORPORATION) 15 October 2015 (2015-10-15) See entire document.	1-15
A	JP 2015-533552 A (ZOLL MEDICAL CORPORATION) 26 November 2015 (2015-11-26) See entire document.	1-15

☐ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 April 2023	**19 April 2023**
Name and mailing address of the ISA/KR **Korean Intellectual Property Office** **Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208** Facsimile No. **+82-42-481-8578**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2022/011547

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
US 2019-0021943 A1	24 January 2019	US 11246796 B2	15 February 2022
US 2022-0175614 A1	09 June 2022	None	
KR 10-0499870 B1	05 July 2005	KR 10-2004-0019651 A	06 March 2004
JP 2015-530187 A	15 October 2015	CN 104755057 A	01 July 2015
		EP 2900196 A1	05 August 2015
		EP 2900196 A4	20 April 2016
		US 2014-0088467 A1	27 March 2014
		US 2015-0073314 A1	12 March 2015
		US 8888725 B2	18 November 2014
		WO 2014-051933 A1	03 April 2014
JP 2015-533552 A	26 November 2015	CN 104755058 A	01 July 2015
		EP 2900195 A1	05 August 2015
		EP 2900195 A4	20 April 2016
		US 2014-0094724 A1	03 April 2014
		US 2015-0105705 A1	16 April 2015
		US 8920348 B2	30 December 2014
		US 9655809 B2	23 May 2017
		WO 2014-051934 A1	03 April 2014

Form PCT/ISA/210 (patent family annex) (July 2022)