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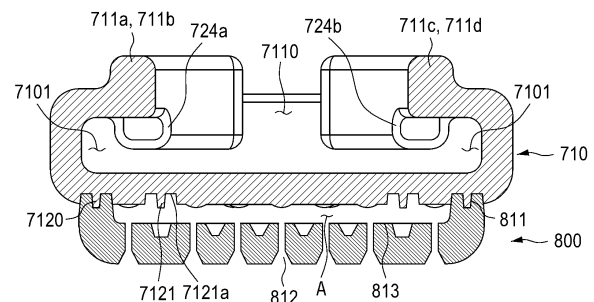
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(54) **PISTON CAP OF CARDIOPULMONARY RESUSCITATION DEVICE**

(57) In a cap 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 cap may include a pad (700) including a pair of grooves (724a and 724b) formed between a first piston fitting portion (711a) and a second piston fitting portion (711b), and between a third piston fitting portion (711c) and a fourth piston fitting portion (711d) forming a piston fitting hole (7110), a piston fitting portion (711) 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 (724a and 724b) when the piston (310) is fit-coupled to the piston fitting hole (7110), a bottom portion (712) having a first protruding member (7120), a second protruding member (7121), a first fit-coupling hole (7120a), and a second fit-coupling hole (7121a) formed on a lower surface, and a pad main body (710) in which the piston fitting portion (711) and the bottom portion (712) are integrally formed with each other, and a first vacuum (800) having a housing (810) which is fit-coupled to the pad (700) through the first protruding member (7120) and the first fit-coupling hole (7120a), generates a negative pressure when the piston (310) is expanded to compress a chest compression point of the patient with a lower surface of the housing, and pulls the chest of the patient with the lower surface

and moves the chest upward through the negative pressure when the piston (310) is contracted.

FIG 9.



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Description

[Technical Field]

[0001] The present invention relates to a piston cap of a cardiopulmonary resuscitation device, and more specifically, to a piston cap 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 a chest compression process of 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 cap 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-described ob-

jects, in a cap 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 cap may include: a pad 700 including a pair of grooves 724a and 724b formed between a first piston fitting portion 711a and a second piston fitting portion 711b, and between a third piston fitting portion 711c and a fourth piston fitting portion 711d forming a piston fitting hole 7110, a piston fitting portion 711 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 724a and 724b when the piston 310 is fit-coupled to the piston fitting hole 7110, a bottom portion 712 having a first protruding member 7120, a second protruding member 7121, a first fit-coupling hole 7120a, and a second fit-coupling hole 7121a formed on a lower surface, and a pad main body 710 in which the piston fitting portion 711 and the bottom portion 712 are integrally formed with each other; and a first vacuum 800 having a housing 810 which is fit-coupled to the pad 700 through the first protruding member 7120 and the first fit-coupling hole 7120a, generates a negative pressure when the piston 310 is expanded to compress a chest compression point of the patient with a lower surface of the housing, and pulls the chest of the patient with the lower surface and moves the chest upward through the negative pressure when the piston 310 is contracted.

[0007] In addition, in a cap 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 cap may include: a pad 700 including a pair of grooves 724a and 724b formed between a first piston fitting portion 711a and a second piston fitting portion 711b, and between a third piston fitting portion 711c and a fourth piston fitting portion 711d forming a piston fitting hole 7110, a piston fitting portion 711 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 724a and 724b when the piston 310 is fit-coupled to the piston fitting hole 7110, a bottom portion 712 having a first protruding member 7120, a second protruding member 7121, a first fit-coupling hole 7120a, and a second fit-coupling hole 7121a formed on a lower surface, and a pad main body 710 in which the piston fitting portion 711 and the bottom portion 712 are integrally formed with each other; and a second vacuum 900 having a housing 910 which is fit-coupled to the pad 700 through the first protruding member 7120, the second protruding member 7121, the first fit-coupling hole 7120a, and the second fit-coupling hole 7121a, generates a negative pressure when the piston 310 is expanded to compress a chest compression point of the patient with a lower surface of the housing, and pulls the chest of the patient with the lower surface and moves the chest upward through the negative pressure when the piston 310 is contracted.

[Advantageous Effects]

[0008] The cap of the present invention has the effect of preventing rib fractures and hemothorax from occurring 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 pad constituting a cap according to one exemplary embodiment of the present invention.

FIG. 4 is a front view of the pad constituting the cap according to one exemplary embodiment of the present invention.

FIG. 5 is a cross-sectional view taken along line A-A of FIG. 3.

FIG. 6 is a perspective view of a vacuum constituting the cap according to one exemplary embodiment of the present invention.

FIG. 7 is a plan view of the vacuum constituting the cap according to one exemplary embodiment of the present invention.

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

FIG. 9 is a cross-sectional view of a cap according to one exemplary embodiment of the present invention.

FIG. 10 is a perspective view of a vacuum according to another exemplary embodiment of the present invention.

FIG. 11 is a plan view of the vacuum according to another exemplary embodiment of the present invention.

FIG. 12 is a cross-sectional view taken along line B-B of FIG. 11.

FIG. 13 is a cross-sectional view of a cap according to another exemplary embodiment of the present invention.

[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. 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.

[0017] 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.

[0018] 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.

[0019] 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, allowing the support 200 to slide forward or backward.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] 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.

[0025] 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.

[0026] 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.

[0027] 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.

[0028] In the hood (300), the control unit 320 may be exposed to the outside or installed inside.

[0029] 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.

[0030] 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 compression-based emergency treatment can be provided to the patient.

[0031] 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.

[0032] 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.

[0033] 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.

[0034] 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.

[0035] 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.

[0036] 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.

[0037] The cardiopulmonary resuscitation device may include a cap 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.

[0038] According to one exemplary embodiment of the present invention, as illustrated in FIGS. 3 to 9, the cap may include a pad 700 which is a portion to which the lower end of a piston 310 is fit-coupled, and a first vacuum 800 which is a portion fit-coupled to the pad 700 and directly compresses the chest of the patient according to the movement of the piston 310.

[0039] FIG. 3 is a perspective view of the pad constituting the cap according to one exemplary embodiment of the present invention, FIG. 4 is a front view of the pad constituting the cap according to one exemplary embodiment of the present invention, FIG. 5 is a cross-sectional view taken along line A-A of FIG. 3, FIG. 6 is a perspective view of the vacuum constituting the cap according to one exemplary embodiment of the present invention, FIG. 7 is a plan view of the vacuum constituting the cap according to one exemplary embodiment of the present invention, FIG. 8 is a cross-sectional view taken along line B-B of FIG. 7, and FIG. 9 is a cross-sectional view of the cap according to one exemplary embodiment of the present invention.

[0040] Referring to FIGS. 3 to 5, the pad 700 has an outer shape formed through a pad main body 710 so that the lower end of the piston 310 can be fit-coupled, and the pad main body 710 may be formed integrally with a piston

fitting portion 711 and a bottom portion 712.

[0041] The pad main body 710 forms a piston fitting hole 7110 by the piston fitting portion 711 that is integrally formed in a shape bent from the bottom portion 712, and the piston 310 may be fastened to the pad main body 710 when the lower end portion of the piston 310 comes into contact with the bottom portion 712, and then a fastening member (not illustrated) formed in a part of the outer peripheral surface is inserted into the piston fitting hole 7110.

[0042] The piston fitting portion 711 forms the piston fitting hole 7110, and the lower end of the piston 310 may be fit-coupled into the pad main body 710 through the piston fitting hole 7110.

[0043] Moreover, the piston fitting portion 711 is a part formed by being bent from the pad main body 710 to form the piston fitting hole 7110 into which the piston 310 can be inserted, and may include a first piston fitting portion 711a, a second piston fitting portion 711b, a third piston fitting portion 711c, and a fourth piston fitting portion 711d.

[0044] In addition, the piston fitting portion 711 has a pair of grooves 724a and 724b formed between the first piston fitting portion 711a and the second piston fitting portion 711b and between the third piston fitting portion 711c and the fourth piston fitting portion 711d, and when the piston 310 is fit-coupled to the piston fitting hole 7110, the fastening member formed in a part of the outer peripheral surface of the piston 310 may be inserted into the pair of grooves 724a and 724b.

[0045] That is, the piston 310 may be fastened to the pad 700 by the fastening member being inserted into the pair of grooves 724a and 724b while the lower end portion of the piston comes into contact with the bottom portion 712.

[0046] Moreover, the piston fitting portion 711 may have a lower portion that may expand (or flow) toward the outside of the pad main body 710 so that the fastening member of the piston 310 may be inserted into or withdrawn from the pair of grooves 724a and 724b during the process of engaging and disengaging the fastening member of the piston 310 and the pair of grooves 724a and 724b, and for this purpose, an expansion space 7101 may be formed in the interspace between the piston fitting portion and the pad main body 710.

[0047] The bottom portion 712 is the lower surface of the pad main body 710, and when the piston 310 is fit-coupled to the piston fitting hole 7110, the upper surface of the bottom portion comes into contact with the lower end portion of the piston 310, and a protruding member and a fit-coupling hole may be each formed on the lower surface of the bottom portion to implement fit-coupling with the first vacuum 800.

[0048] As a specific example, the lower surface of the bottom portion 712 may include a first protruding member 7120, a first fit-coupling hole 7120a having the first protruding member 7120 provided therein, a second protruding member 7121 positioned closer to the center portion of the bottom portion 712 than the first protruding

member 7120, and a second fit-coupling hole 7121a having the second protruding member 7121 provided therein.

[0049] The first protruding member 7120 may be protruded in a circular shape from the lower surface of the bottom portion 712 so as to be fit-coupled to the protruding member insertion hole 811 or the first protruding member insertion hole 911a to be described later.

[0050] The second protruding member 7121 may be protruded in a circular shape from the lower surface of the bottom portion 712 so as to be fit-coupled to the second protruding member insertion hole 911b to be described later.

[0051] The first fit-coupling hole 7120a may be formed in a circular shape so as to fitcouple the upper portion of an outer housing 810a and the upper portion of an inner housing 810b to be described later, or so as to be fit-coupled to the upper portion of the first housing 910a.

[0052] The second fit-coupling hole 7121a may be formed in a circular shape so as to be fit-coupled to the upper portion of the second housing 910b to be described later.

[0053] In addition, the bottom portion 712 is in contact with the lower end portion of the piston 310, thereby having the effect of preventing the lower end portion of the piston 310 from directly contacting the chest of the patient.

[0054] The pad 700 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.

[0055] In addition, the pad 700 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.

[0056] Referring to FIGS. 6 to 8, the first vacuum 800 may compress the chest of the patient by directly contacting the chest compression point of the patient when the piston 310 is extended toward the chest of the patient after being fit-coupled to the pad 700.

[0057] The first vacuum 800 has an outer shape formed by a housing 810, and the housing 810 may be provided with a plurality of air flow holes 812 and a seating portion 813.

[0058] In addition, the housing 810 includes an outer

housing 810a and an inner housing 810b integrally formed with each other, and the lower surface of the housing comes into contact with the chest of the patient.

[0059] Moreover, the housing 810 has a protruding member insertion hole 811 formed at the boundary between the outer housing 810a and the inner housing 810b to enable the fit-coupling of the first protruding member 7120 provided in the pad 700.

[0060] The protruding member insertion hole 811 may be formed in a circular shape at the boundary between the outer housing 810a and the inner housing 810b to enable the fit-coupling of the first protruding member 7120.

[0061] The outer housing 810a and inner housing 810b may be implemented in a bellows shape to allow for a change in the volume of the interspace A.

[0062] In addition, the upper portions of the outer housing 810a and the inner housing 810b are fit-coupled to the first fit-coupling hole 7120a of the pad 700, and an adhesive means (for example, an adhesive) may be provided (or applied) to the upper portions of the outer housing 810a and the inner housing 810b so that the fit-coupling structure of the pad 700 and the first vacuum 800 is maintained. However, the adhesive means is not limited to being provided on the upper portions of the outer housing 810a and the inner housing 810b, and may be provided on the first protruding member 7120 or the first fit-coupling hole 7120a.

[0063] Moreover, the outer housing 810a and the inner housing 810b have side walls that form the protruding member insertion hole 811 protruding upward, thereby generating the interspace A between the inner housing 810b and the bottom portion 712 in the fit-coupling structure of the pad 700 and the first vacuum 800.

[0064] The inner housing 810b has a plurality of air flow holes 812 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.

[0065] The volume of the interspace A between the upper side of the inner housing 810b and the bottom portion 712 may decrease when air flows outward along the air flow hole 812 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 812.

[0066] The inner housing 810b has the lower surface that comes into contact with the chest 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 813 provided in the interspace A comes into contact with the bottom portion 712, 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.

[0067] As such, the first vacuum 800 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 vacuum 800 may be implemented as a shape that conforms to the shape of the chest of the patient.

[0068] Moreover, in the first vacuum 800, the biocompatible silicone may have a hardness of 10 to 30 shore A, and other materials may have a hardness of 10 to 20 shore C.

[0069] Meanwhile, the housing 810 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 810b 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.

[0070] The cap according to one exemplary embodiment of the present invention may be implemented when the first protruding member 7120 of the pad 700 is inserted into the protruding member insertion hole 811 of the first vacuum 800 as illustrated in FIG. 9, and may be included in the cardiopulmonary resuscitation device of the present invention to compress the chest of the patient.

[0071] As such, the cap of the present invention is not limited to being implemented only through the fit-coupling of the pad 700 and the first vacuum 800, and may also be implemented by fit-coupling a second vacuum 900 that is a modified version of the first vacuum 800 to the pad 700.

[0072] Below, a cap according to another exemplary embodiment of the present invention implemented through the fit-coupling between the pad 700 and the second vacuum 900 will be described in detail.

[0073] FIG. 10 is a perspective view of a vacuum according to another exemplary embodiment of the present invention, FIG. 11 is a plan view of the vacuum according to another exemplary embodiment of the present invention, FIG. 12 is a cross-sectional view taken along line B-B of FIG. 11, and FIG. 13 is a cross-sectional view of a cap according to another exemplary embodiment of the present invention.

[0074] Referring to FIGS. 10 to 12, the second vacuum 900 has an outer shape formed by a housing 910, and the housing 910 may be divided into a first housing 910a and a second housing 910b that are formed integrally, and the second vacuum may include a plurality of air flow holes

912, a first seating portion 913, a second seating portion 914, and a partition 915.

[0075] The first housing 910a includes a first protruding member insertion hole 911a into which the first protruding member 7120 is to be fit-coupled, thereby enabling the fit-coupling of the pad 700 and the second vacuum 900.

[0076] The first housing 910a may be partitioned into a plurality of interspaces A in which negative pressure is generated through the plurality of partitions 915. Therefore, when the volume of the interspace 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 712, but also only some of the lower surfaces that come into contact with the chest compression point of the patient and receive 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.

[0077] It is preferable that the first protruding member insertion hole 911a is formed in a circular shape on the first housing 910a so that the first protruding member 7120 can be fit-coupled to the first protruding member insertion hole.

[0078] The second housing 910b is connected to the first housing 910a through the plurality of partitions 915 in the structure of the housing 910, and includes the second protruding member insertion hole 911b to which the second protruding member 7121 is to be fit-coupled, so that the fit-coupling of the pad 700 and the second vacuum 900 is implemented together with the first housing 910a.

[0079] It is preferable that the second protruding member insertion hole 911b is formed in a circular shape on the second housing 910b so that the second protruding member 7121 can be fit-coupled to the second protruding member insertion hole.

[0080] The side walls of the first housing 910a and the second housing 910b may protrude upward so that the interspaces A and B are generated between the bottom portion 712 and the first housing and the second housing in the fit-coupling structure of the pad 700 and the second vacuum 900.

[0081] In addition, the first housing 910a and the second housing 910b may be implemented in a bellows shape so that the volumes of the interspaces A and B can be changed.

[0082] The upper portions of the first housing 910a and the second housing 910b are fit-coupled to the first fit-coupling hole 7120a and the second fit-coupling hole 7121a, and an adhesive means (for example, an adhesive) may be provided (or applied) to the upper portions of the first housing 910a and the second housing 910b so that the fit-coupling structure of the pad 700 and the second vacuum 900 is maintained. However, the adhesive means is not limited to being provided on the upper portions of the first housing 910a and the second housing 910b, and may be provided in at least one of the first protruding member 7120 and the first fit-coupling hole

7120a and at least one of the second protruding member 7121 and the second fit-coupling hole 7121a, respectively.

[0083] The plurality of air flow holes 912 is formed on the lower surfaces of the first housing 910a and the second housing 910b, respectively, and may include a plurality of first air flow holes 912a formed on the lower surface of the first housing 910a and a plurality of second air flow holes 912b formed on the lower surface of the second housing 910b.

[0084] The first and second air flow holes 912a and 912b may reduce the volumes of the interspaces A and B by causing the air in the interspace A between the bottom portion 712 and the first housing 910a and the interspace B between the bottom portion 712 and the second housing 910b to flow outward during the process of compressing the chest of the patient through the expansion of the piston 310.

[0085] A plurality of first seating portions 913 may be formed to be provided in the interspaces A of the first housing 910a divided into a plurality of portions through the plurality of partitions 915, and when the air in the interspace A flows outward from the plurality of first air flow holes 912a and the volume of the interspace A decreases, the first seating portions come into contact with the bottom portion 712 so that the interspace A may be in a negative pressure state.

[0086] As a specific example, when a peripheral portion of the lower surface of the bottom portion 712 which surrounds the center portion of the lower surface of the bottom portion 712 and is parallel to the first seating portion 913 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 913 comes into contact with the peripheral portion of the lower surface of the bottom portion 712. Accordingly, the partitioned interspace A may be in a negative pressure state.

[0087] The second seating portion 914 may be provided in the interspace B of the second housing 910b, and when the air in the interspace B partitioned by the plurality of second air flow holes 912b flows to the outside and the volume of the interspace B decreases, the second seating portion comes into contact with the bottom portion 712 so that the interspace B may be in a negative pressure state.

[0088] As a specific example, when the center portion of the lower surface of the bottom portion 712 that is parallel to the second seating portion 914 in the vertical direction in the lower surfaces of the bottom portion 712 is moved downward due to the downward pressure applied through the expansion of the piston 310, the second seating portion 914 comes into contact with the center portion of the lower surface of the bottom portion 712. Accordingly, the interspace B may be in a negative pressure state.

[0089] It is preferable that the plurality of partitions 915 is provided to partition the interspace A of the first housing

910a into a plurality of portions, and each partition 915 may be provided in a shape that connects the first housing 910a and the second housing 910b.

[0090] The second vacuum 900 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 vacuum 900 may be implemented as a shape that conforms to the shape of the chest of the patient.

[0091] Moreover, in the second vacuum 900, 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.

[0092] Meanwhile, the housing 910 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 910a and 910b 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.

[0093] As illustrated in FIG. 13, the cap according to another exemplary embodiment of the present invention may be implemented when the first protruding member 7120 and the second protruding member 7121 of the pad 700 are fit-coupled to the first protruding member insertion hole 911a and the second protruding member insertion hole 911b of the second vacuum 900 and the upper portions of the first and second housings 910a and 910b are fit-coupled to the first fit-coupling hole 7120a and the second fit-coupling hole 7121a, respectively, and may be used in the process of compressing a chest of the patient by being included in the cardiopulmonary resuscitation device of the present invention.

[0094] In this way, the cap according to another exemplary embodiment of the present invention has the advantage of reinforcing the fit-coupling structure between the pad and the vacuum by implementing the fit-coupling between the pad 700 and the second vacuum 900 through a relatively large number of protruding members 7120 and 7121 compared to the cap according to one exemplary embodiment.

[0095] 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-de-

scribed exemplary embodiments in a manner that combines them. Accordingly, the present invention is not intended to be limited to the embodiments illustrated herein, but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

[0096] 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 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 postapplication amendment.

[0097] The piston cap 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 cap fit-coupled to a piston (310) for compressing a chest of a patient provided in a cardiopulmonary resuscitation device, the piston cap comprising:

a pad (700) including a pair of grooves (724a and 724b) formed between a first piston fitting portion (711a) and a second piston fitting portion (711b), and between a third piston fitting portion (711c) and a fourth piston fitting portion (711d) forming a piston fitting hole (7110), a piston fitting portion (711) 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 (724a and 724b) when the piston (310) is fit-coupled to the piston fitting hole (7110), a bottom portion (712) having a first protruding member (7120) and a first fit-coupling hole (7120a) formed on a lower surface, and a pad main body (710) in which the piston fitting portion (711) and the bottom portion (712) are integrally formed with each other; and a first vacuum (800) having a housing (810)

which is fit-coupled to the pad (700) through the first protruding member (7120) and the first fit-coupling hole (7120a), generates a negative pressure when the piston (310) is expanded to compress a chest compression point of the patient with a lower surface of the housing, and pulls the chest of the patient with the lower surface and moves the chest upward through the negative pressure when the piston (310) is contracted.

2. The piston cap of claim 1, wherein the housing (810) includes

an outer housing (810a) and an inner housing (810b) of which upper portions are inserted into the first fit-coupling hole (7120a) and which are integrally formed with each other, a plurality of air flow holes (812) formed on a lower surface of the inner housing (810b) so that air in an interspace (A) between the inner housing (810b) and the bottom portion (712) flows, and a seating portion (813) provided in the interspace (A) to come into contact with the bottom portion (712) when the air in the interspace (A) flows outward through the air flow holes (812) and volume of the interspace (A) decreases.

3. The piston cap of claim 2, wherein the housing (810) includes a protruding member insertion hole (811) to which the first protruding member (7120) is fit-coupled at a boundary between the outer housing (810a) and the inner housing (810b).

4. The piston cap of claim 3, wherein the bottom portion (712) includes

the first protruding member (7120) inserted into the protruding member insertion hole (811), and the first fit-coupling hole (7120a) in which the first protruding member (7120) is provided inside and which is fit-coupled to the upper portion of the outer housing (810a) and the upper portion of the inner housing (810b).

5. The piston cap of claim 3, wherein in the outer housing (810a) and the inner housing (810b), side walls forming the protruding member insertion hole (811) protrude upward so that the interspace (A) is generated between the bottom portion (712) and the outer housing and inner housing in a fit-coupling structure of the pad (700) and the first vacuum (800).

6. The piston cap of claim 5, wherein the inner housing (810b) generates a negative pressure in the interspace (A) when the volume of the interspace (A) is reduced so that the bottom portion (712) and the

seating portion (813) 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. 5

7. The piston cap of claim 1, wherein the first vacuum (800) 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. 10
8. The piston cap of claim 7, wherein in the first vacuum (800), a lower surface that compresses the chest compression point of the patient is made of the biocompatible silicone. 15
9. The piston cap of claim 1, wherein the pad (700) is made of at least one of polyurethane, polypropylene, and biocompatible silicone. 20
10. A piston cap fit-coupled to a piston (310) for compressing a chest of a patient provided in a cardiopulmonary resuscitation device, the piston cap comprising: 25
a pad (700) including a pair of grooves (724a and 724b) formed between a first piston fitting portion (711a) and a second piston fitting portion (711b), and between a third piston fitting portion (711c) and a fourth piston fitting portion (711d) forming a piston fitting hole (7110), a piston fitting portion (711) 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 (724a and 724b) when the piston (310) is fit-coupled to the piston fitting hole (7110), a bottom portion (712) having a first protruding member (7120), a second protruding member (7121), a first fit-coupling hole (7120a), and a second fit-coupling hole (7121a) formed on a lower surface, and a pad main body (710) in which the piston fitting portion (711) and the bottom portion (712) are integrally formed with each other; and 30
a second vacuum (900) having a housing (910) which is fit-coupled to the pad (700) through the first protruding member (7120), the second protruding member (7121), the first fit-coupling hole (7120a), and the second fit-coupling hole (7121a), generates a negative pressure when the piston (310) is expanded to compress a 35
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chest compression point of the patient with a lower surface of the housing, and pulls the chest of the patient with the lower surface and moves the chest upward through the negative pressure when the piston (310) is contracted.

11. The piston cap of claim 10, wherein the housing (910) includes

a first housing (910a) having an upper portion inserted into the first fit-coupling hole (7120a) and forming a first protruding member insertion hole (911a) to which the first protruding member (7120) is to be fit-coupled,
a second housing (910b) having an upper portion inserted into the second fit-coupling hole (7121a) and forming a second protruding member insertion hole (911b) into which the second protruding member (7121) is to be fit-coupled,
an air flow hole (912) in which a plurality of first air flow holes (912a) that allow air in an interspace (A) between the first housing (910a) and the bottom portion (712) to flow, and a plurality of second air flow holes (912b) that allow air in an interspace (B) between the second housing (910b) and the bottom portion (712) to flow are formed on lower surfaces of the first housing (910a) and the second housing (910b),
a plurality of partitions (915) configured to partition the interspace (A) of the first housing (910a) into a plurality of portions,
a plurality of first seating portions (913) provided in each of the interspaces (A) partitioned into the plurality of portions by the partitions (915) to come into contact with the bottom portion (712) when the air in the interspace (A) flows outward through the first air flow hole (912a) and volume of the interspace (A) decreases, and
a second seating portion (914) provided in an interspace (B) to come into contact with the bottom portion (712) when the air in the interspace (B) flows outward through the second air flow hole (912b) and volume of the interspace (B) decreases.

12. The piston cap of claim 11, wherein the bottom portion (712) includes

the first protruding member (7120) inserted into the first protruding member insertion hole (911a),
the first fit-coupling hole (7120a) in which the first protruding member (7120) is provided inside and to which the upper portion of the first housing (910a) is fit-coupled,
the second protruding member (7121) inserted into the second protruding member insertion hole (911b), and

the second fit-coupling hole (7121a) in which the second protruding member (7121) is provided inside and to which the upper portion of the second housing (910b) is fit-coupled.

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- 13.** The piston cap of claim 11, wherein in the first housing (910a) and the second housing (910b), side walls forming the first protruding member insertion hole (911a) and the second protruding member insertion hole (911b) protrude upward so that the interspaces (A and B) are generated between the bottom portion (712) and the first housing and second housing in a fit-coupling structure of the pad (700) and the second vacuum (900).

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- 14.** The piston cap of claim 13, wherein the first housing (910a) and the second housing (910b) generate a negative pressure in the interspaces (A and B) when the volumes of the interspaces (A and B) are reduced so that the bottom portion (712), the first seating portion (913), and the second seating portion (914) 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.

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- 15.** The piston cap of claim 10, wherein the second vacuum (900) 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.

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- 16.** The piston cap of claim 15, wherein in the second vacuum (900), a lower surface that compresses the chest compression point of the patient is made of the biocompatible silicone.

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- 17.** The piston cap of claim 10, wherein the pad (700) is made of at least one of polyurethane, polypropylene, and biocompatible silicone.

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FIG 1.

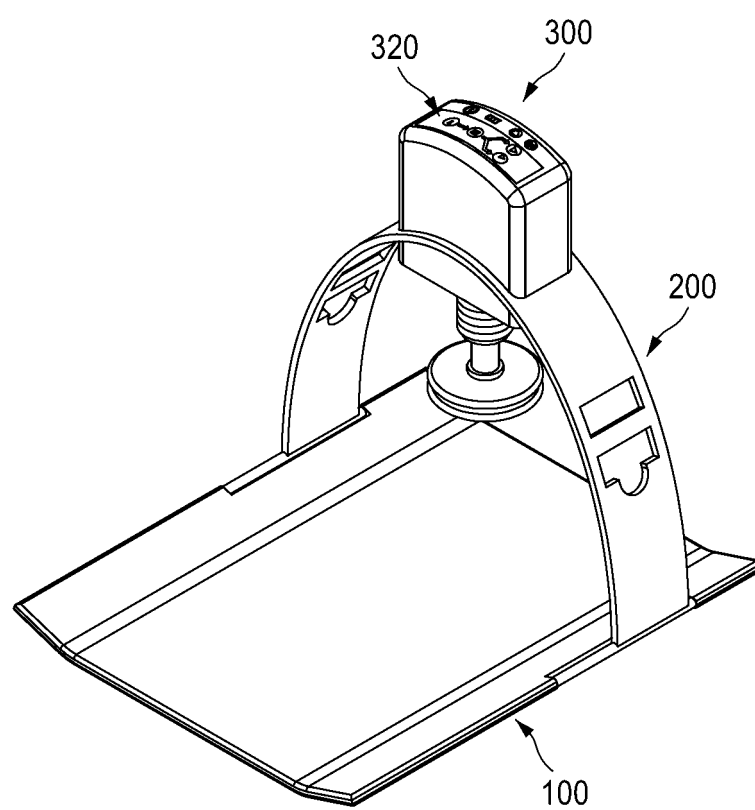


FIG 2.

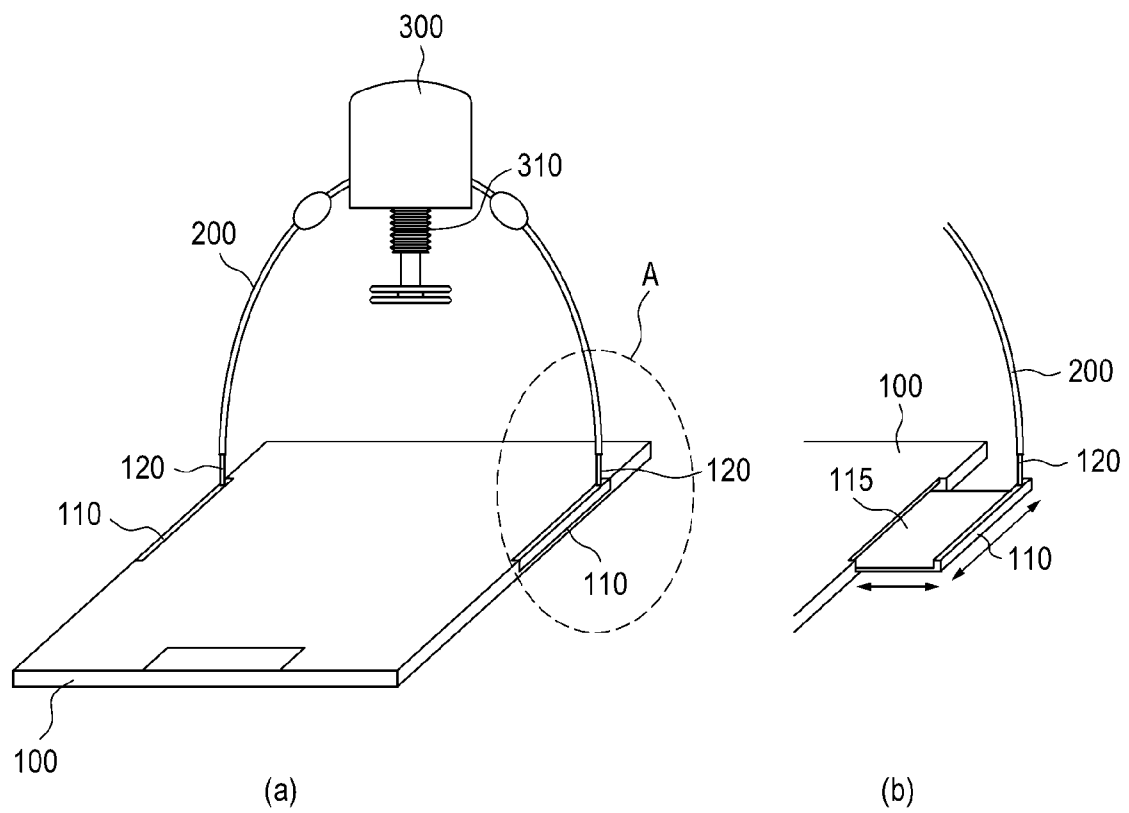


FIG 3.

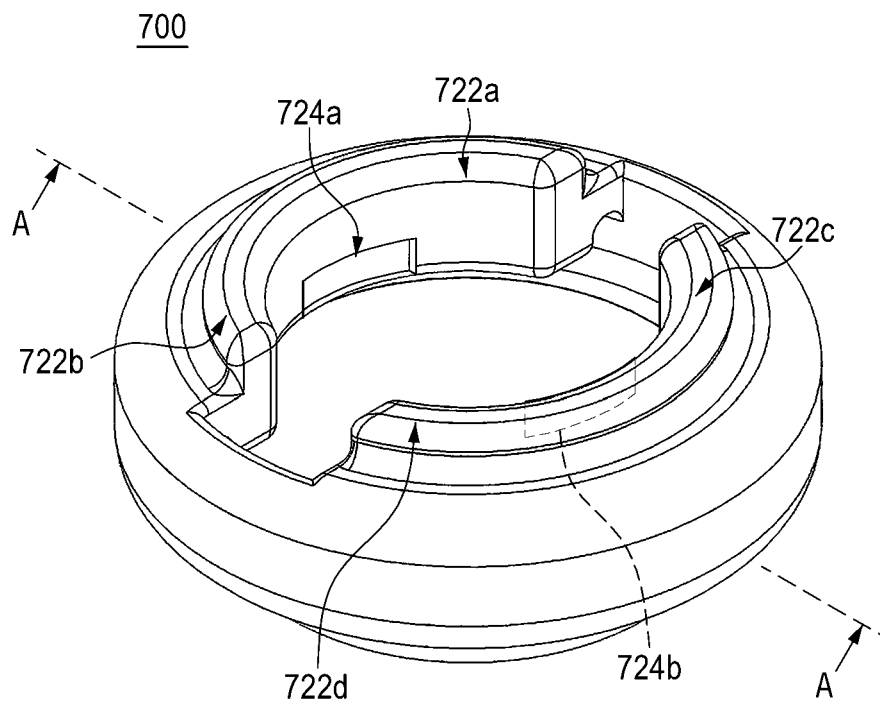


FIG 4.

700

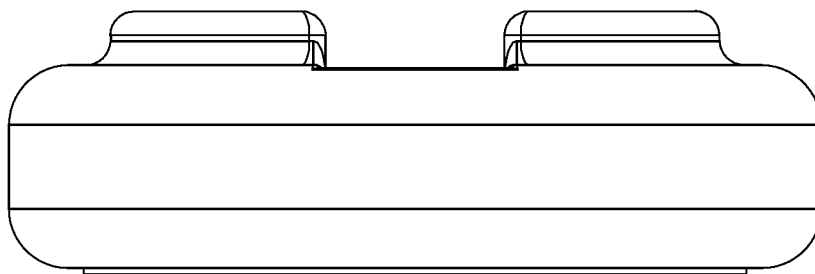


FIG 5.

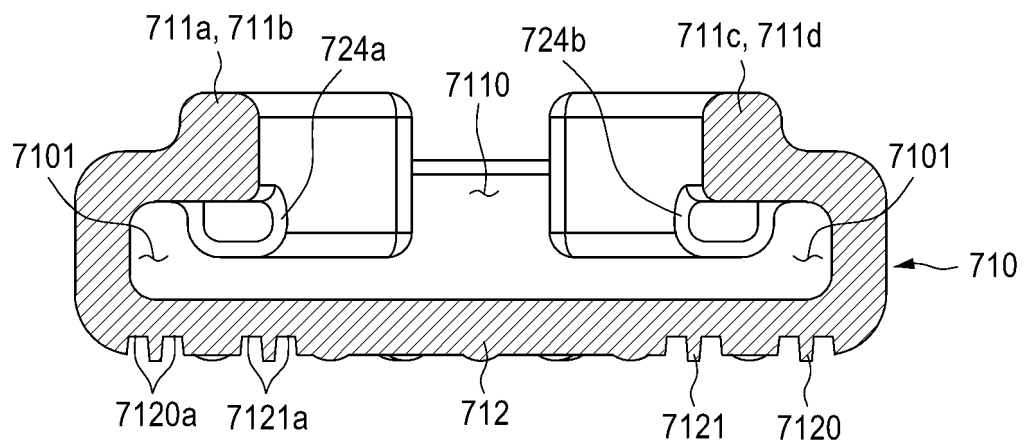


FIG 6.

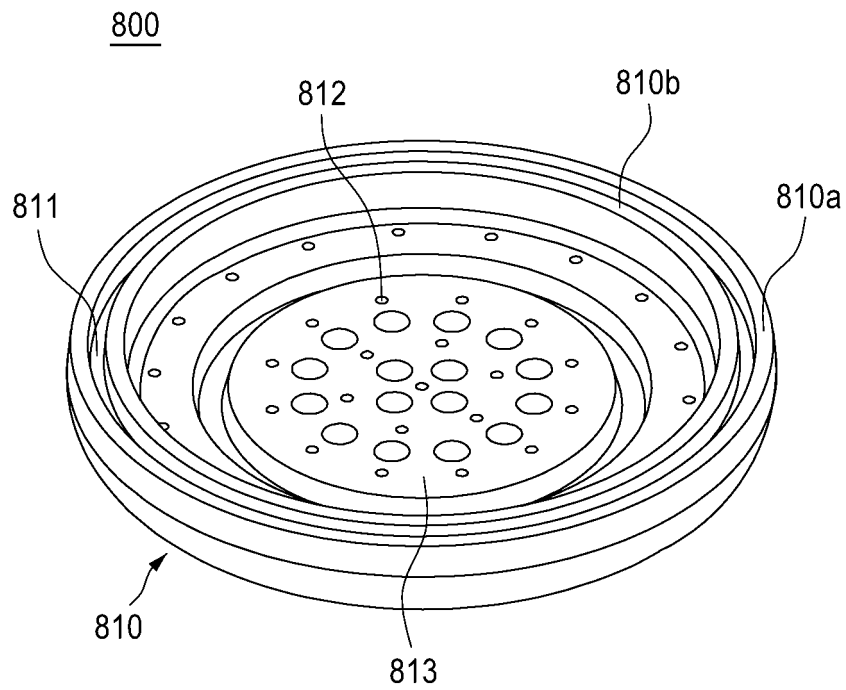


FIG 7.

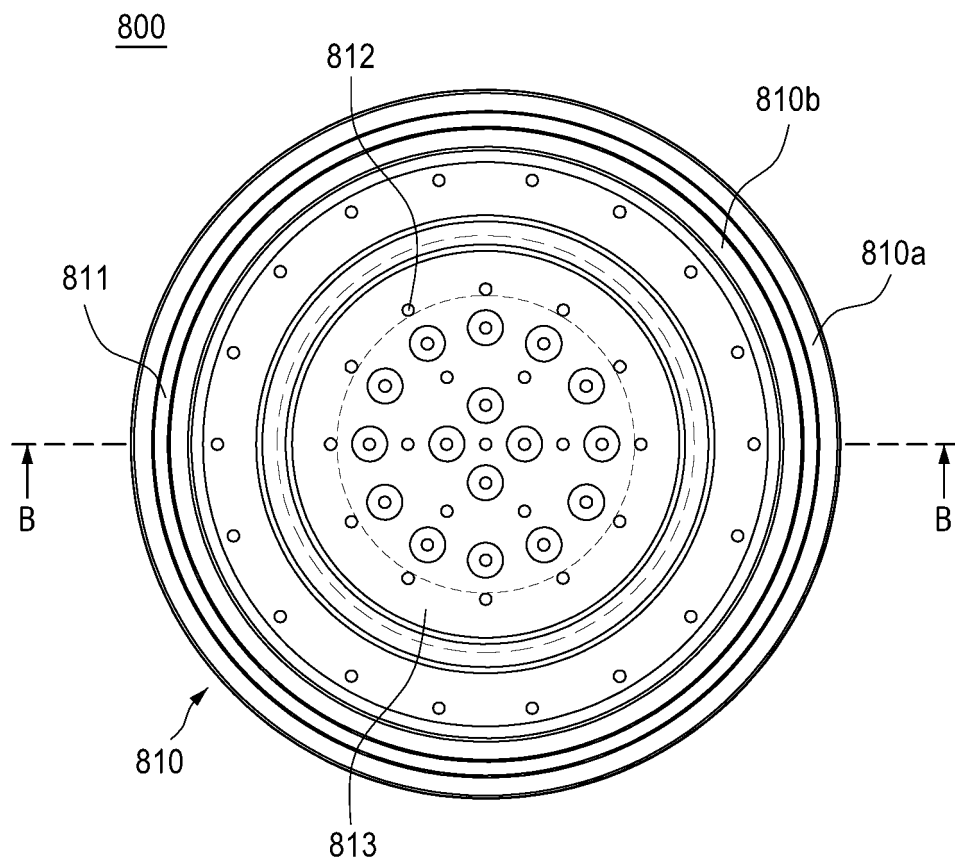


FIG 8.

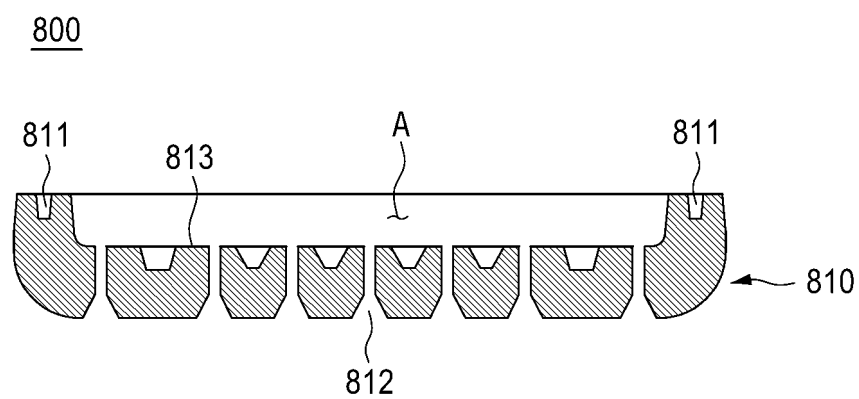


FIG 9.

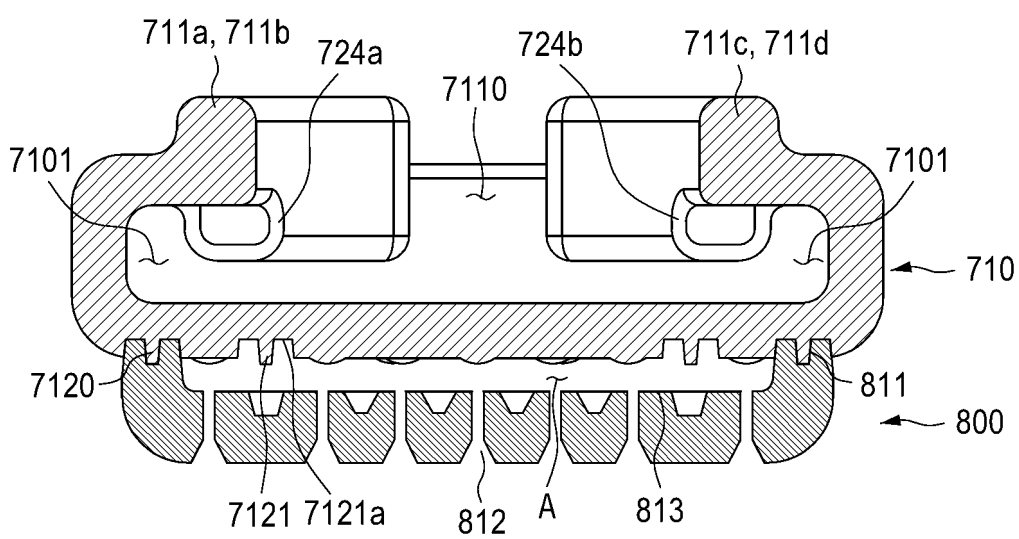


FIG 10.

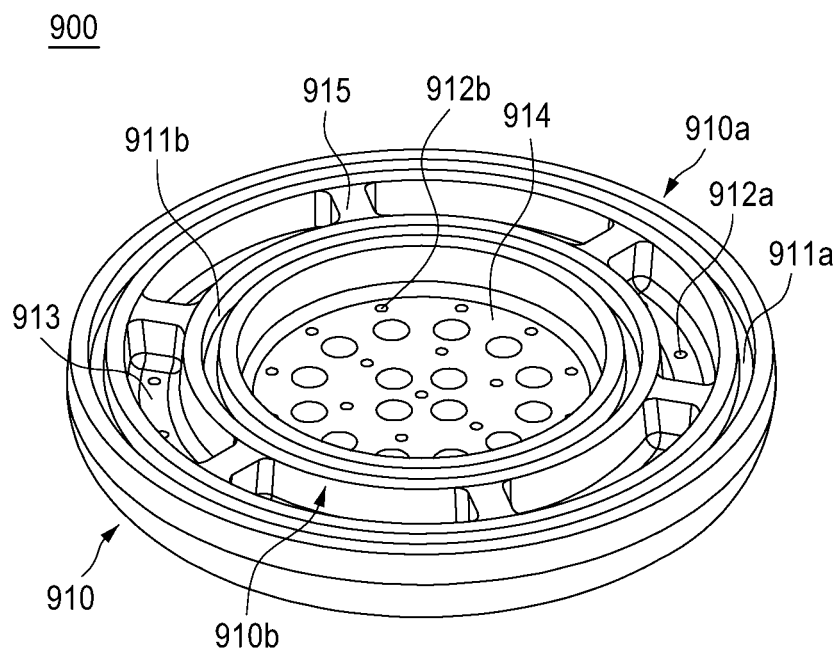


FIG 11.

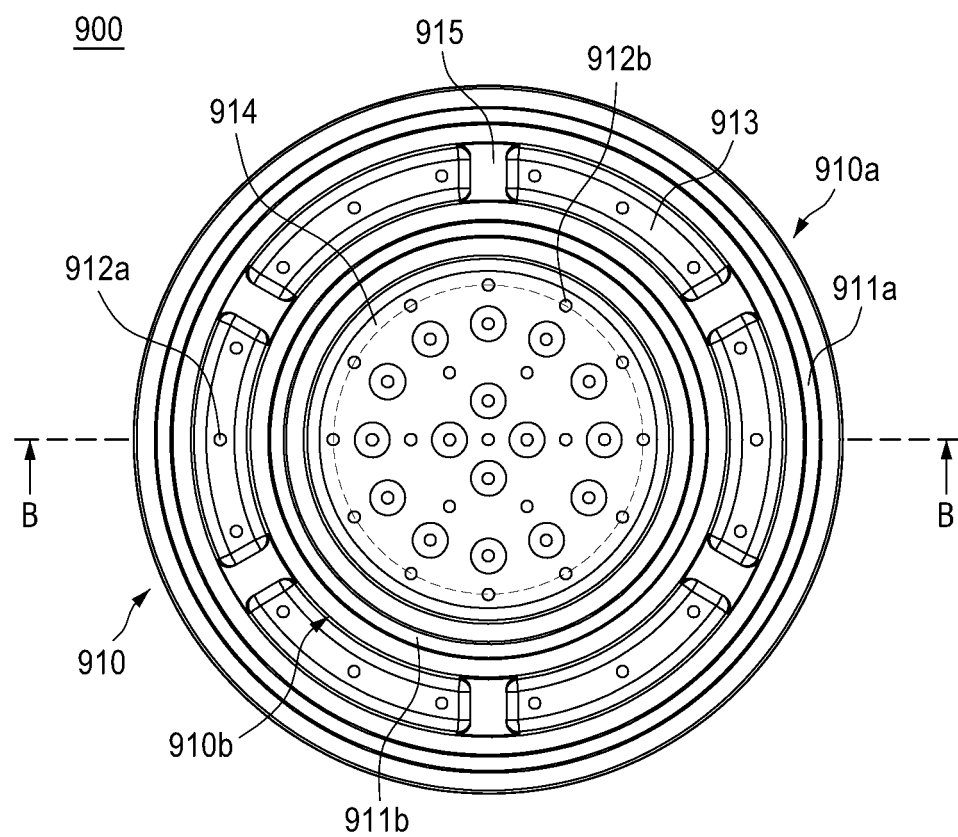


FIG 12.

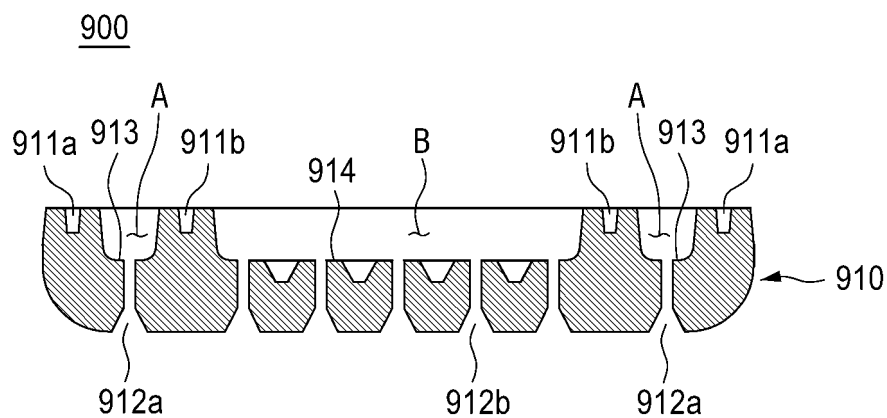
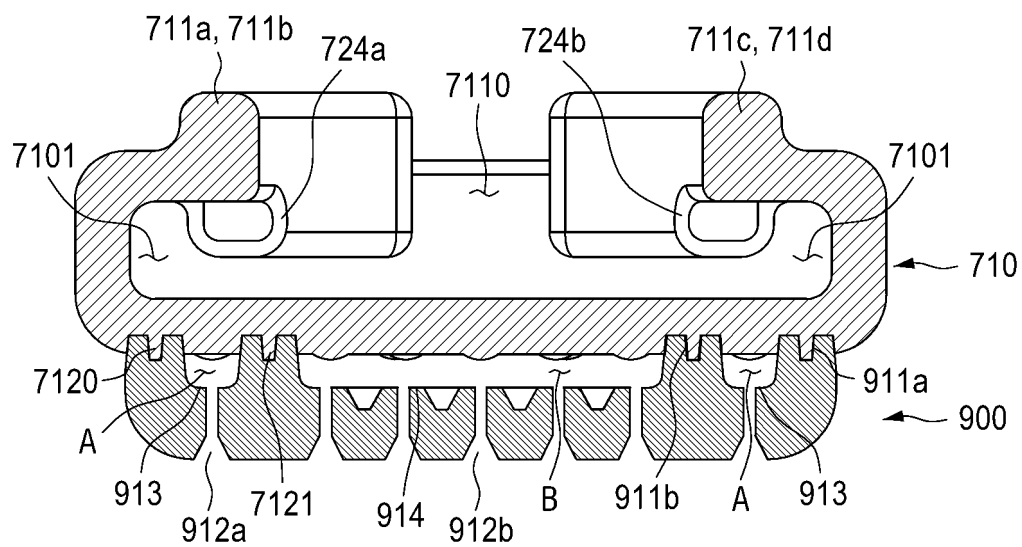


FIG 13.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2022/011542

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.
X	US 2019-0021943 A1 (PHYSIO-CONTROL, INC.) 24 January 2019 (2019-01-24) See paragraphs [0010]-[0011] and [0070]-[0072]; and figures 9-14B.	1,7-10,15-17
A		2-6,11-14
A	US 2022-0175614 A1 (PHYSIO-CONTROL, INC.) 09 June 2022 (2022-06-09) See entire document.	1-17
A	KR 10-0499870 B1 (LIMSTECH. CO., LTD.) 05 July 2005 (2005-07-05) See entire document.	1-17
A	JP 2015-530187 A (ZOLL MEDICAL CORPORATION) 15 October 2015 (2015-10-15) See entire document.	1-17
A	JP 2015-533552 A (ZOLL MEDICAL CORPORATION) 26 November 2015 (2015-11-26) See entire document.	1-17

☐ 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

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“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

18 April 2023

Date of mailing of the international search report

19 April 2023

Name and mailing address of the ISA/KR

Korean Intellectual Property Office

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Authorized officer

Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2022/011542

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		EP 2900195 A4	20 April 2016
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