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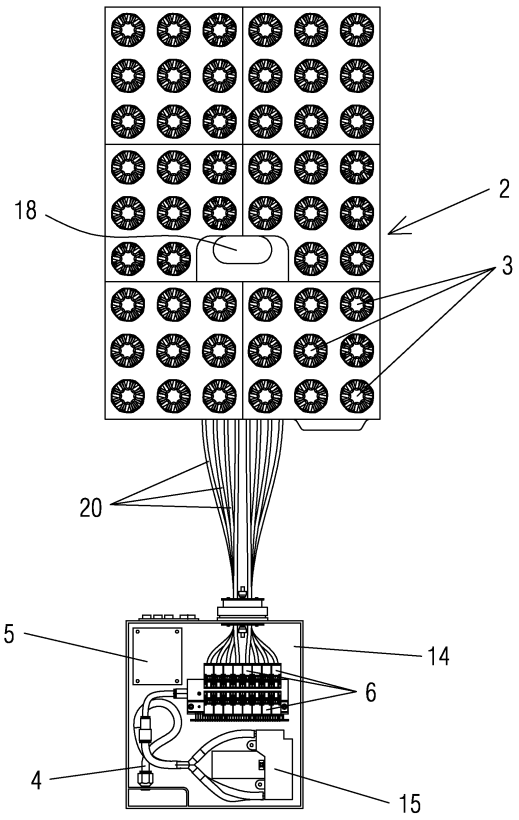
(54) Adaptive inflatable cushion

(57) Adaptive inflatable cushion (1), in particular designed to be located at the base of a seat or seating area, comprising a flexible main base (2) having a plurality of inflatable cells (3), arranged in a matrix that protrudes in an upward direction, and inflating means, including pressure regulating means operated by a programmable control unit that is associated with inflating means, such that a plurality of separate regions each defined by one or more inflatable cells having pressure values equal to or different from each other are defined in the flexible main base (2). In this way, this element can prevent the formation of pressure ulcers in users with spinal cord injuries, limited mobility and/or professionals who must spend long periods of time in a static seated position.

FIG.1



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Description

OBJECT OF THE INVENTION

[0001] The object of the present invention relates to an adaptive inflatable cushion with a "massage" effect that incorporates significant innovations and advantages.

[0002] More specifically, the invention proposes the development of an adaptive inflatable cushion, in particular designed to be located at the base of a seat or seating area, such as for example, a vehicle seat in order to prevent the formation of pressure ulcers in users with spinal cord injuries, limited mobility and/or professionals who have to spend long periods of time in a static seated position.

BACKGROUND OF THE INVENTION

[0003] It is well known in the medical field that pressure ulcers, also known as decubitus ulcers or bedsores, are a serious secondary complication to a spinal cord injury that noticeably affect the user in respect of their physical and psychological state and social well-being, thereby affecting their quality of life. Changes occur after a spinal cord injury, notably the lack of voluntary mobility, muscle atrophy in paralysed limbs, changes in muscle fibres, as well as a lower resistance to fatigue, contributing to the development of complications, such as pressure ulcers, as previously mentioned. The formation of these ulcers may be caused by pressure, in other words, the strain generated on the tissue as a result of compression, shearing, rubbing, etc. the time the user sits in the same position, and environmental factors such as ambient humidity and temperature.

[0004] Therefore, preventing this type of ulcer is an important objective in the rehabilitation of people with spinal cord injuries.

[0005] The cushions that are usually fitted to wheelchairs are initially designed to relieve pressure and reduce the risk of pressure ulcers. However, in practice there is evidence to show that there are not entirely efficient as they are not intended to deliver different pressure to different regions of the same cushion, such that the patient or user ends up suffering from ulcer formation, especially those persons who due to reduced mobility of the lower extremities must spend extended periods in a wheelchair. Therefore, there is still a need to resolve this problem in a satisfactory manner.

DESCRIPTION OF THE INVENTION

[0006] The invention herein has been developed with the aim of providing an adaptive inflatable cushion that is considered a novelty within the field of application and resolves the aforementioned drawbacks, further providing other additional advantages that will be apparent from the description detailed hereinafter.

[0007] It is therefore an object of the present invention to provide an adaptive inflatable cushion, in particular designed to be located at the base of a seat or seating area comprising a flexible main base provided with a plurality of inflatable cells arranged in a matrix that protrude in an ascending direction and inflating means.

[0008] More specifically, the invention is **characterised in that** it includes a pressure regulating means operated by a programmable control unit that is associated with inflating means, such that a plurality of separate regions defined by one or more inflatable cells having pressure values equal to or different from each other are defined in the main base.

[0009] Thanks to said features, a cushion that successfully prevents the occurrence of pressure ulcers in persons with spinal cord injury or serious physical limitation of movement (e.g., the elderly) is obtained, as a "massage" effect is achieved, avoiding damage to the capillaries and improving blood flow. The cushion described above is particularly suitable for fitting into a vehicle seat or a wheelchair, enabling a person with a spinal cord injury, for example, to drive competition racing vehicles that require the individual to remain inside the driver compartment for a considerable period of time, being a very effective solution that can further be easily fitted and removed.

[0010] It should be noted that the arrangement of the programmable control unit (CPU) enables the pressure value of the cells or groups of cells to be adjusted in a completely automated and continuous manner without the user having to be concerned about controlling and adjusting the pressure or different pressures present in the main base.

[0011] In a particularly preferred embodiment of the invention, the pressure regulating means comprises a plurality of secondary conduits relative to the various separate regions that branch from a main conduit coupled to the inflating means, each one of the secondary conduits associated with at least one solenoid valve and a pressure sensor being electrically connected with the programmable control unit.

[0012] Advantageously, the flexible main base comprises a sheet layer of flexible material having a plurality of primary grooves that define multiple paths, wherein each entry zone of the grooves is coupled to a secondary conduit through which air from the inflating means passes.

[0013] Preferably, the flexible material of the sheet layer mentioned above is neoprene.

[0014] According to another aspect of the invention, a second sheet layer of flexible material is provided, having a plurality of holes, wherein each hole is associated with an inflatable cell, said sheet being interposed between the flexible main base and the sheet layer. If the height of the grooves is equal to the height of the sheet layer, a third flat sheet layer attached and arranged inferiorly to the sheet layer is included. In this manner, a simply manufactured structure is achieved in order to obtain a high degree of flexibility which facilitates handling during

fitting and removal of the cushion, in a wheelchair, for example.

[0015] In this manner, the flexible base is formed by a laminated structure provided comprising different sheet layers bonded to each other underneath to facilitate the construction process by reducing the number of required components, such as hoses, joints, couplings and the like, and at the same time making the overall weight of the cushion lighter.

[0016] Advantageously, the regulating means is arranged inside a housing separate from the flexible main base, such that the elements forming part of the regulating means can be adequately protected against bumps and dirt in the enclosing means, thereby increasing the service life of the various components.

[0017] Advantageously, the programmable control unit includes an interface for data transmission and exchange. In this manner, a medical specialist may adjust or use the operating parameters of the control unit involved in inflating and deflating the cells of the main base in a quick and simple manner in order to adapt them to meet the needs of the individual using the cushion.

[0018] In a preferred embodiment, the interface consists of a USB input port and/or at least one pushbutton having ON/OFF functions.

[0019] Additionally, the programmable control unit includes a connection for wireless data exchange.

[0020] In a preferred embodiment, the inflating means comprises a compressor that communicates data with a programmable control unit, such that inflating and deflating can be carried out evenly, easily and quickly.

[0021] Advantageously, it further includes autonomous power supply means such as a rechargeable battery, which supplies electric current to the programmable control unit, the pressure regulating means and the inflating means, therefore making it easy to use in any location where the user so requires.

[0022] In addition, indicators warning on the charge status of the rechargeable battery are included, which can include acoustic and/or light indicators, such that the user is informed of the battery status at all times.

[0023] Preferably, the cushion of the invention may have a removable cover surrounding the flexible main base such that there is no direct contact between the main base and the user.

[0024] Other characteristics and advantages of the adaptive cushion, object of the invention herein, will become apparent from the description of a preferred, although not exclusive embodiment, which is illustrated by way of non-limiting example in the drawings appended, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

Figure 1.- Schematic plan view of the adaptive inflatable cushion according to the present invention;

Figure 2.- Exploded perspective view of the various sheet layers that form part of the flexible main base provided with the cells;

Figures 3a and 3b.- Detailed plan view and a cross section along the A-A line of Figure 3a;

Figure 4.- Schematic perspective view of the housing including the pressure regulating means where an upper lid has been omitted for clarity; and

Figure 5.- A pressure map of a cushion according to the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

[0026] In view of the mentioned figures and according to the adopted numbering, an example of a preferred embodiment of the invention can be seen therein, which comprises the parts and elements indicated and described in detail below.

[0027] Hence, as seen in the figures, a preferred embodiment of the adaptive inflatable cushion is shown, having a substantially rectangular base, indicated generally by the reference (1), which is specially provided to be fitted on a wheelchair, on the base of a seat or seating area in order to create a "massage" effect continuously while being used, being formed from a plurality of layers or overlapping sheet bodies fixed on each other, as set out in the following explanation.

[0028] Hence, as can been seen the adaptive inflatable cushion comprises a flexible main base indicated generally by the reference (2) and is shown in greater detail in Figure 2, having a plurality of inflatable cells (3) arranged in a matrix that protrude in a substantially vertical and upward direction, a number of inflating means and pressure regulating means being controlled by a programmable control unit (5) associated with inflating means. In this manner, a plurality of separate regions defined by inflatable cells having pressure values equal to or different from each other are defined in the main base (2).

[0029] Making particular reference to the pressure regulating means, they comprise a plurality of secondary conduits (20) relative to the various separate regions that branch from a main conduit (4) coupled to the inflating means, each one of the secondary conduits (3) associated with two solenoid valves (6), one of the solenoid valves associated with an air passage and the other solenoid valve associated with air extraction. In addition, pressure sensors (7) associated with the various secondary conduits (20) that are electrically connected to the programmable control unit (5) are further provided.

[0030] As shown in Figure 2, the flexible main base (2) comprises a sheet layer (8) of flexible material having a plurality of primary grooves (9) that define multiple paths, wherein each entry zone of the grooves is coupled to a secondary conduit (20) through which air from the inflating means passes, which will be explained herein below.

[0031] A second sheet layer (10) of flexible material is provided, having a plurality of through holes (11) arranged in a matrix, wherein each through hole (11) is

associated with an inflatable cell (3), said second sheet layer (10) being interposed between the flexible main base (2) and the sheet layer. To ensure tightness inferiorly, a third flat sheet layer (12) attached and arranged inferiorly to the second sheet layer (10) is included.

[0032] It should be noted that the flexible material used in the various abovementioned sheet layers is neoprene.

[0033] The aforementioned regulating means is arranged inside a housing (13) separate from the flexible main base (2), which may be made of a rigid material. This housing may include a closable lid (not shown) that enables access to the interior thereof in the event of having to replace any components. To ensure good sealing in the lid area, sealing gaskets that prevent water or dirt from getting into the housing (13) may be arranged.

[0034] The programmable control unit (5) includes an interface for data transmission and exchange. The interface consists of a USB input port (not shown) as well as a plurality of pushbuttons (14), one of the pushbuttons having an ON/OFF function.

[0035] The programmable control unit (5) includes a connection for wireless data exchange, such as Bluetooth®, such that the programme or operating parameters may be modified via a mobile or portable device such as a mobile phone, laptop tablet etc.

[0036] The inflating means comprises a compressor (15) of reduced dimensions located inside the housing (13) that communicate data with a programmable control unit (5) and in fluid communication through the main conduit (4) to enable the flow of pressurized air.

[0037] In addition, autonomous power supply means is provided, such as a rechargeable battery supplying electric current to the programmable control unit, the pressure regulating means and the inflating means.

[0038] For the user to be informed of the battery status, a number of light indicators (16) warning on the charge status of the rechargeable battery have been included, although it can further be complemented with acoustic indicators.

[0039] Additionally, the flexible main base (2) can be wrapped and protected by a cover, for example, using a woven or non-woven fabric (not shown) that prevents dirt or wear on contact with the flexible main base (2).

[0040] It should be noted that the flexible main base can have fastening means for attaching the cushion firmly over the area where it is to be fitted. Thus, in a possible embodiment, the flexible main base (2) can have a through hole (18) to allow the passage of a belt while alternatively, there may be additional elements such as VELCRO® straps, buttons, clipping elements or the like.

[0041] Figure 5 shows a particular embodiment of a pressure map wherein there are eight different areas or regions with different pressure that have been indicated by the letters A,B,C,D,E,F,G and H. Obviously, there may be many other configurations for pressure maps, making it possible to adapt this cushion according to the needs of each user.

[0042] It should be noted that the control unit can warn the user if a malfunction occurs in any of the main parts that form part of the cushion described herein.

[0043] The details, shapes and dimensions and other accessory elements as well as the materials used in the manufacture of the cushion of the invention may be conveniently replaced by others which are technically equivalent and do not depart from the essential nature of the invention or from the scope defined by the claims provided hereinafter.

Claims

1. Adaptive inflatable cushion (1), in particular designed to be located at the base of a seat or seating area comprising a flexible main base (2), having a plurality of inflatable cells (3), arranged in a matrix that protrudes in an upward direction, and inflating means, **characterised in that** it includes pressure regulating means operated by a programmable control unit that is associated with inflating means, such that a plurality of separate regions each defined by one or more inflatable cells having pressure values equal to or different from each other are defined in the flexible main base (2).

2. Adaptive inflatable cushion (1) according to claim 1, **characterised in that** the pressure regulating means comprises a plurality of secondary conduits relative to the various separate regions that branch from a main conduit coupled to the inflating means, each one of the secondary conduits associated with at least one solenoid valve and a pressure sensor being electrically connected with the programmable control unit.

3. Adaptive inflatable cushion (1) according to claims 1 and 2, **characterised in that** the flexible main base comprises a sheet layer of flexible material having a plurality of primary grooves that define multiple paths, wherein each entry zone of the grooves is coupled to a secondary conduit through which air from the inflating means passes.

4. Adaptive inflatable cushion (1) according to claim 3, **characterised in that** the flexible material of the sheet layer is neoprene.

5. Adaptive inflatable cushion (1) according to claim 3, **characterised in that** a second sheet layer of flexible material is provided, having a plurality of through holes, wherein each through hole is associated with an inflatable cell, said second sheet layer being interposed between the flexible main base and the sheet layer.

6. Adaptive inflatable cushion (1) according to claim 3, **characterised in that** the height of the grooves is

equal to the height of the sheet layer such that it includes a third flat sheet layer attached and arranged inferiorly to the second sheet layer.

7. Adaptive inflatable cushion (1) according to claim 1, **characterised in that** the regulating means are arranged inside a housing separate from the flexible main base.

8. Adaptive inflatable cushion (1) according to claim 1, **characterised in that** the programmable control unit includes an interface for data transmission and exchange.

9. Adaptive inflatable cushion (1) according to claim 8, **characterised in that** the interface comprises a USB input port.

10. Adaptive inflatable cushion (1) according to claim 8, **characterised in that** the interface comprises at least one pushbutton.

11. Adaptive inflatable cushion (1) according to claim 1, **characterised in that** the programmable control unit includes a connection for wireless data exchange.

12. Adaptive inflatable cushion (1) according to claim 1, **characterised in that** the inflating means comprises a compressor that communicates data with a programmable control unit.

13. Adaptive inflatable cushion (1) according to claim 2, **characterised in that** each of the secondary conduits is linked to two solenoid valves, one of the solenoid valves being associated with an air passage and the other solenoid valve associated with air extraction.

14. Adaptive inflatable cushion (1) according to claim 1, **characterised in that** it comprises autonomous power supply means supplying electric current to the programmable control unit, the pressure regulating means and the inflating means.

15. Adaptive inflatable cushion (1) according to claim 14, **characterised in that** the autonomous power supply means comprises a rechargeable battery.

16. Adaptive inflatable cushion (1) according to claim 15, **characterised in that** it includes indicators warning on the charge status of the rechargeable battery.

17. Adaptive inflatable cushion (1) according to claim 16, **characterised in that** the warning indicators consist of acoustic and/or light indicators.

18. Adaptive inflatable cushion (1) according to claim 1, **characterised in that** it has a detachable cover that surrounds the flexible main base (2).

FIG. 1

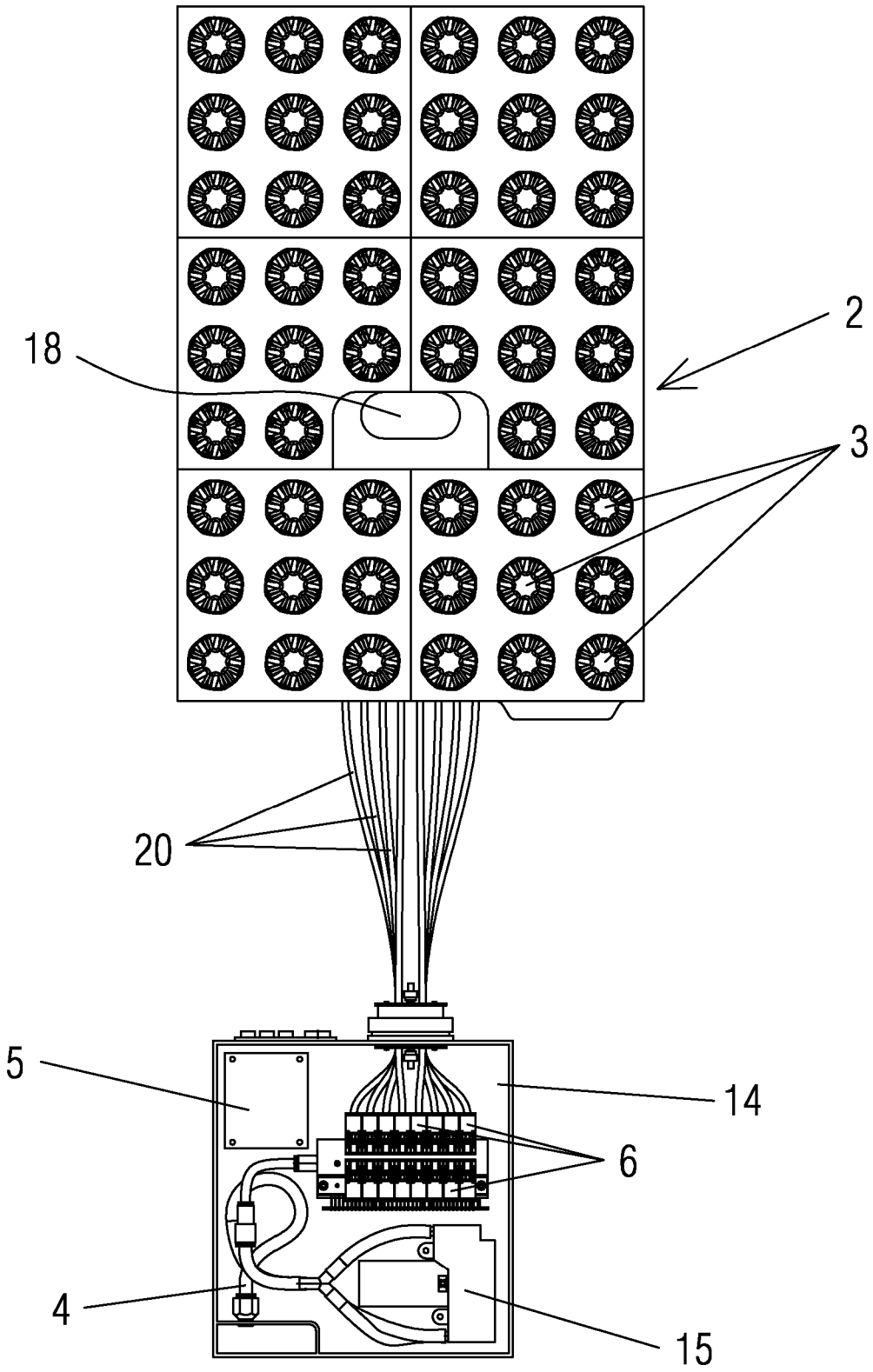


FIG.2

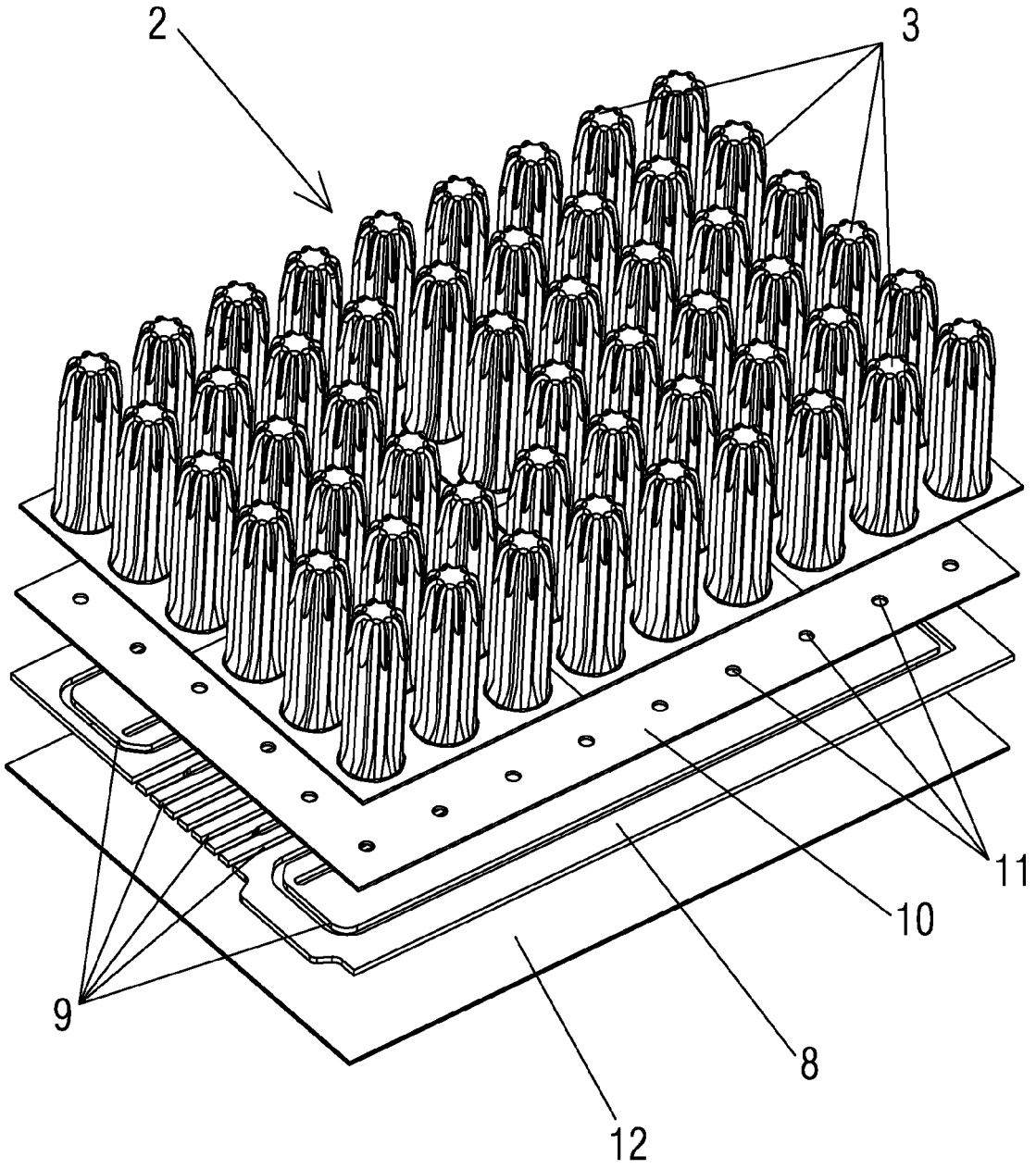
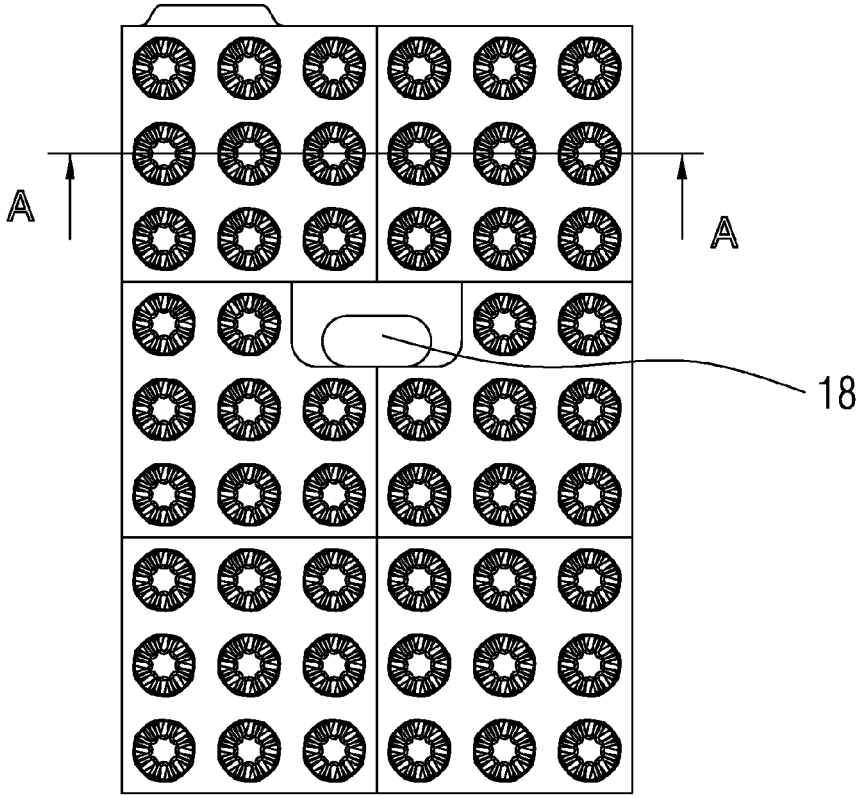


FIG.3A



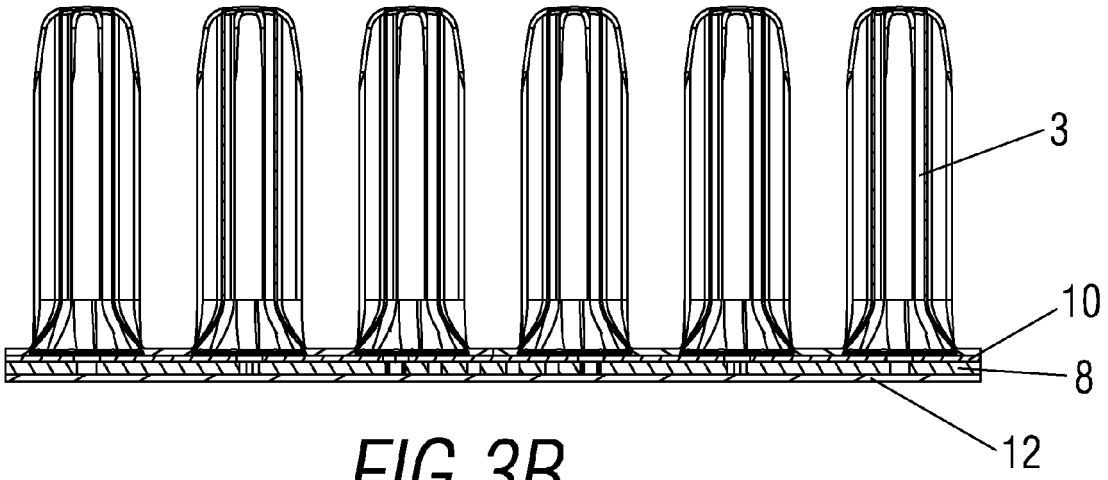


FIG.3B

FIG.4

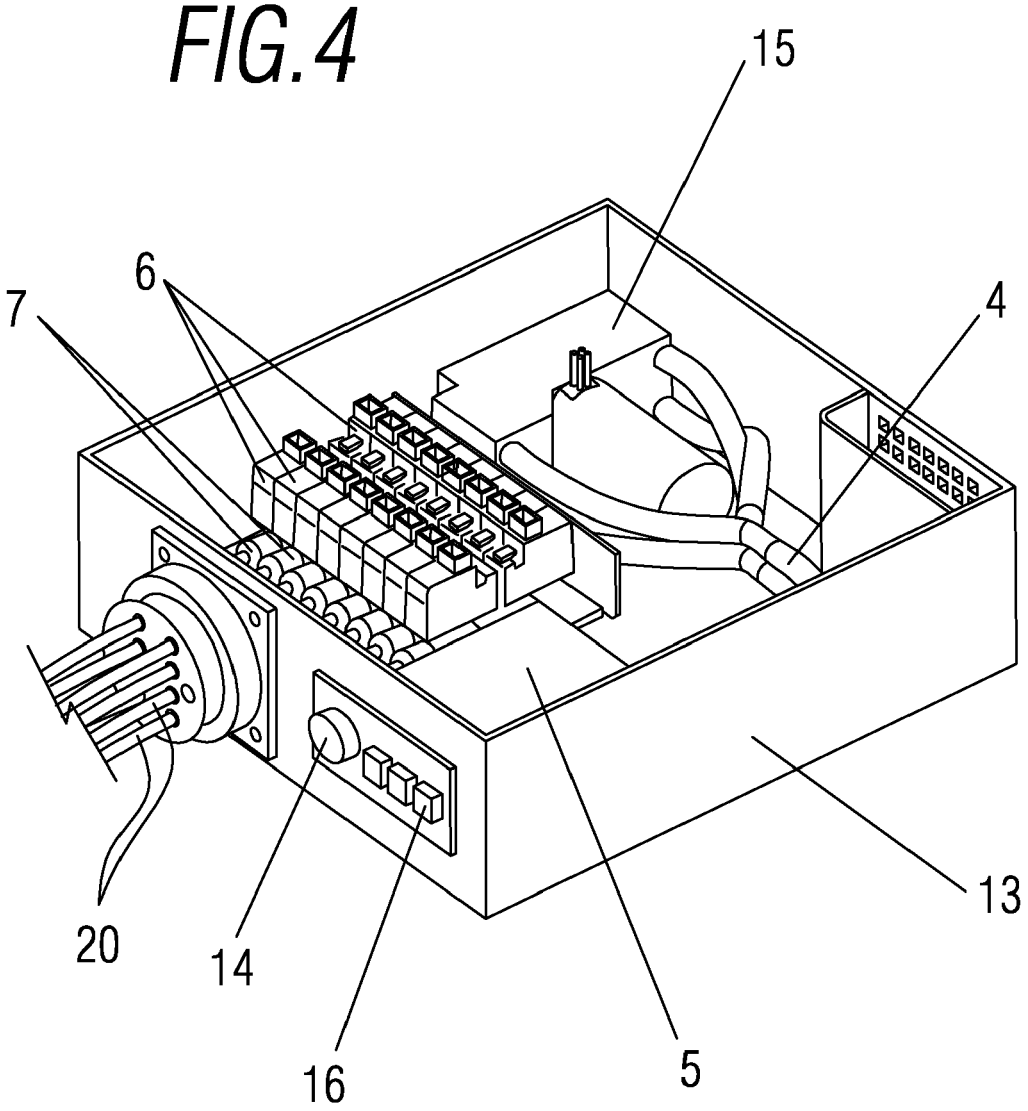
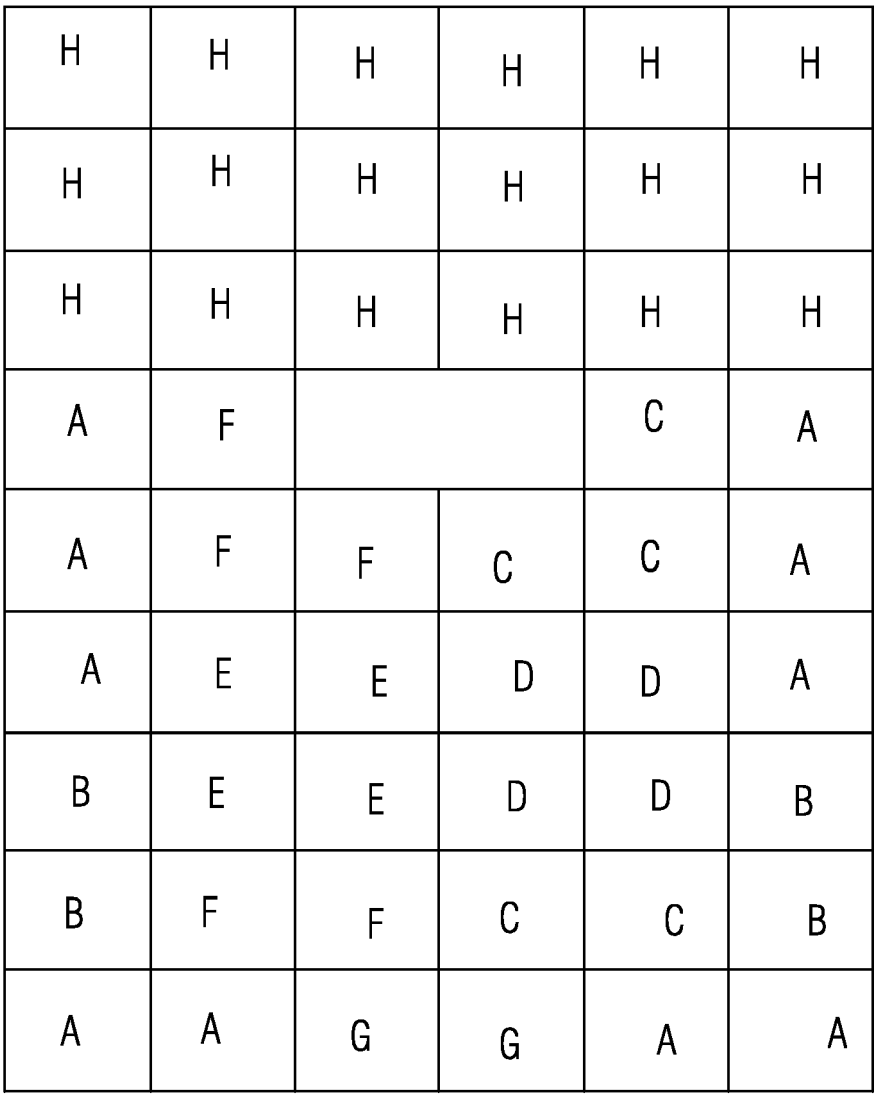


FIG.5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EUROPEAN SEARCH REPORT

Application Number
EP 13 38 2447

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 March 2014	Knoflacher, Nikolaus

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