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

(11) **EP 2 474 292 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
11.07.2012 Bulletin 2012/28

(51) Int Cl.:
A61G 7/057 *(2006.01)*

(21) Application number: **11193503.7**

(22) Date of filing: **14.12.2011**

(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

(30) Priority: **14.12.2010 IT VR20100236**

(71) Applicant: **MKS Innovatech S.r.l.**
20135 Milano (IT)

(72) Inventors:
- **Gelmetti, Nicola**
  37017 Lazise (VR) (IT)
- **Martinelli, Fabio**
  37029 San Pietro in Cariano (VR) (IT)

(74) Representative: **Fisauli, Beatrice A. M.**
Con Lor S.p.A
Via Renato Fucini, 5
20133 Milano (IT)

(54) **Apparatus with inflatable mattress**

(57) An apparatus (10) is proposed for the sustenance of a patient, comprising:
- at least one compressor (12);
- at least one inflatable mattress (28, 30) comprising a first series (32, 36) of cells and a second series (34, 38) of cells;
- at least one valve (16, 18) having a discharge connection for the discharge in the outer ambient, and connected through a first conduit (42, 50) with the first series of cells (32, 36), through a second conduit (46, 54) with the second series of cells (34, 38), and through a feed conduit (14) with the compressor (12);
- at least one small mattress-sensor (24; 80), put under said at least one mattress (28), comprising at least one conduit-sensor (56; 82) and detecting means (20; 90) to detect the air pressure in said at least one conduit (64; 82);
- management and control means (66), connected with the detecting means (20; 90), with the at least one valve (16, 18) and with the at least one compressor (12).

EP 2 474 292 A1

Description

[0001] The present invention refers in general to an apparatus with an inflatable mattress and a method for the inflation of said mattress. More particularly, this invention relates to an apparatus with a bedsore mattress, inflatable with air, and a method for the inflation of said bedsore mattress.

[0002] As is known, there exist many types of bedsore mattresses that are usually provided with at least two series of cells which are inflated and deflated alternately according to predetermined cycles of time in order to have the patient lying on the mattress change his/her position and to change the supporting sectors of the mattress for the patient.

[0003] The bedsore mattresses are, therefore, inflated by one or more compressors. The operation of said compressors is controlled by a suitable management and control system that adjusts the inflation and the deflation of each of the two series of cells in the mattress.

[0004] In particular, said management and control systems must guarantee the maintenance of a correct pressure to be applied on the body of a patient by the mattress.

[0005] A typology of inflation systems according to the known art provides that the air that goes out of the mattress, in particular out of each of the two series of cells, flows in a sensing small mattress put under the mattress so as to detect the pressure of the patient on the mattress.

[0006] Said typology of systems does not allow an efficient control of the mattress pressure. In addition, the mattress must be fed continuously since the air in a variable quantity flows to the outside of the mattress toward the small mattress and from here to the outside.

[0007] Another typology of inflation systems according to the known art provides that the feeding of the sensing small mattress, put under the mattress, is done directly from the compressor that feeds the mattress. A sensor detects the pressure of the air that goes out of the small mattress and regulates the power of the compressor.

[0008] Also in this case, the system provides a continuous feed of the mattress and consequently, the compressor is operating continuously, which gives rise to problems in the consumes, outputs and lifetime of the compressor itself.

[0009] The aim of the invention is, therefore, to carry out an inflating system for a mattress in order to overcome the problems of the known art.

[0010] Another aim of the invention is to propose an inflating system for a mattress with low consumption and easy operation.

[0011] Another aim of the invention is to allow the compressor not to be continuously operating.

[0012] Said aims and advantages are reached according to the invention with an apparatus for the sustenance of a patient, characterized by the fact of comprising:

- at least one compressor;
- at least one inflatable mattress comprising a first series of cells and a second series of cells, the cells of the first series being possibly alternated with the cells of the second series;
- at least one valve having a discharge connection for the discharge in the outer ambient, and connected through a first conduit with the first series of cells, through a second conduit with the second series of cells, and through a feed conduit with the compressor;
- at least one small mattress-sensor, put under said at least one mattress, comprising at least one conduit-sensor and detecting means to detect the air pressure in said at least one conduit;
- management and control means, connected with the detecting means, with the at least one valve and with the at least one compressor;

said management and control means being adapted to switch on or switch off the at least one compressor according to the pressure detected by the detecting means, and adapted to vary the setting up of the at least one valve in order to inflate and deflate alternately the first series of cells and the second series of cells.

[0013] In the apparatus according to the invention, it is no more necessary that the compressor is always operating since the air that flows from the compressor to the small mattress-sensor does not go out directly but it is kept in the inside of the small mattress-sensor unless a suitable order is sent by the management and control means.

[0014] In this way, the energy consumption is reduced by the compressor. In addition, the employed amount of air, which is sucked in from the outside and is blown into the mattress, is considerably lower than that employed by the known systems.

[0015] As an advantage, in the apparatus according to the invention, the small mattress-sensor can be connected by means of a control valve; in particular, said control valve can have a discharge connection for the discharge in the outer ambient, and can be connected through a first conduit with an end of the conduit-sensor, through a second conduit with the other end of the conduit-sensor, and through a feed conduit with the compressor; at least one pressure sensor being comprised in the second conduit to sense the pressure going out of the small mattress-sensor.

[0016] In this way, the inlet and the outlet of air in the conduit-sensor is regulated by the control valve through which it is possible to stop the air flow in the same conduit-sensor, to blow the air in the same or to discharge the air from the same. Besides, it is possible to measure the pressure of the air in the conduit-sensor.

[0017] As an advantage, the apparatus according to the invention can provide that the conduit-sensor, put in the small mattress-sensor, is closed at both ends and comprises a pressure sensor connected with the management and control means. In this way, it is not necessary to feed the small mattress-sensor and only a pres-

sure sensor is sufficient. For instance, the pressure sensor is positioned at an end of the conduit-sensor, in case outside the small mattress, to measure the change of pressure of the air and understand the situation of the mattress, positioned on the small mattress-sensor, and the situation of the patient.

[0018] In addition, the apparatus can comprise:

- a first mattress with a first series of cells and a second series of cells;
- a second mattress with a first series of cells and a second series of cells;
- a first valve having a discharge connection for the discharge in the outer ambient, connected through a first conduit with the first series of cells of the first mattress, through a second conduit with the second series of cells of the first mattress, and through a feed conduit with the compressor; said first valve being connected with the management and control means ;
- a second valve having a discharge connection for the discharge in the outer ambient, connected through a first conduit with the first series of cells of the second mattress, through a second conduit with the second series of cells of the second mattress, and through a feed conduit with the compressor, said second valve being connected with the management and control means;

[0019] in particular, said first mattress being arranged at the trunk of the patient, said second mattress being arranged at the feet of the patient and said small mattress-sensor being arranged under said first mattress and/or said second mattress.

[0020] Accordingly, the apparatus according to the invention, can comprise more inflatable subunits, each of them being independent from each other. In this way, it is possible to control the pressure of the cells in a more flexible way. Advantageously, a head mattress is put under the head of the patient and can be connected with the first series of cells of the first mattress with a nonreturn valve and with the second series of cells of the first mattress with a nonreturn valve. In this way, the head mattress has always the maximum pressure, reached by the first mattress.

[0021] In addition, at least one of said first mattress and second mattress can comprises a lower chamber connected through nonreturn valves with the first series of cells and second series of cells so that said lower chamber has always the maximum pressure, reached by said first series of cells and said second series of cells.

[0022] Further features and details of the invention will be better understood from the following specification which is set forth as an example, not limited, as well as from the accompanying drawings wherein:

Fig. 1 is a diagram of an apparatus with inflatable mattress, according to the invention;

Fig. 2 is a detail of the diagram in Fig. 1;

Fig. 3 is a component of an apparatus with inflatable mattress, according to a variant of the invention.

[0023] With reference to the accompanying drawings, in particular Figures 1 and 2, number 10 denotes an apparatus with inflatable mattress which comprises a compressor 12 which is connected through a feed conduit 14 to a trunk valve 16, a feet valve 18 and a mat valve 20.

[0024] The above three valves have the same constructive features, each of them being provided with four connections with the outside, namely, one connection is connected to the feed conduit 14, two connections are provided with a pressure gauge and one last connection is for the discharge (not visible in the figures). Besides, the valves comprise an inner mechanism which allows to put two or more of the four connections with the outside in communication with each other so that a continuous regulation of the valve is allowed as well as a continuous regulation of the passage of air in the inside. Both the trunk valve 16 and the feet valve 18 are connected to a bedsore mattress 22 while the mat valve 20 is connected to a sensor mat 24 which is put under the bedsore mattress 22.

[0025] The bedsore mattress 20 comprises a head sector 26, a trunk sector 28 and a feet sector 30.

[0026] The trunk sector 28 comprises a first series of cells 32 and a second series of cells 34, which are fed regardless of the trunk valve 16. Each cell of the first series of cells 32 is alternated with a cell of the second series of cells 34 in the inside of the trunk sector 28.

[0027] The first series of cells 32 is connected through a first conduit 42 to a first connection 40 of the trunk valve 16 while the second series of cells 34 is connected through a second conduit 46 to a second connection 44 of the trunk valve 16.

[0028] Besides, the trunk sector 28 comprises a lower chamber (not visible in the figure) which is connected through nonreturn valves to the first series of cells 32 and second series of cells 34 so as to keep it at the maximum pressure reached in the inside of the cells, unless leakage is controlled or not. In addition, the lower chamber of the trunk sector 28 communicates with the head sector 26 so that the head sector 26 is allowed to keep a suitable support pressure.

[0029] Likewise, the feet sector 30 comprises a first series of cells 36 and a second series of cells 38 which are fed by the feet valve 18 regardless of the feeding of the trunk sector 28. Each cell of the first series of cells 36 is alternated with a cell of the second series of cells 38 in the inside of the feet sector 30.

[0030] The first series of cells 36 is connected through a first conduit 50 to a first connection 48 of the feet valve 18 while the second series of cells 38 is connected through a second conduit 54 to a second connection 52 of the feet valve 18.

[0031] The sensor mat 24 comprises a conduit sensor 56 which is arranged like a coil. An end of the conduit

sensor 56 is connected through a first conduit 60 to a first connection 58 of the mat valve 20 and the opposite end is connected through a second conduit 64 to a second connection 62 of the mat valve 20. The coil arrangement allows to cover a wide surface of the mat sensor 24. The inflation system 10 comprises also a control centre 66, visible in Fig. 2, which includes a multifunction display 68, a plurality of push-buttons 70 and an electronic central unit 72. A plurality of connections 74 connects the control centre to the three valves 16, 18, 20 and the compressor 12.

[0032] The electronic central unit 72 manages the visualization in the multifunction display 68 of all the functional parameters of the apparatus with inflatable mattress 10 and processes, at the same time, the data coming from the three valves 16, 18, 20 and compressor 12 so as to control the working and feeding thereof.

[0033] The working of the apparatus 10 with inflatable mattress is described below.

[0034] The first operation which the apparatus 10 with inflatable mattress performs by switching it on is a calibration of the electric feeding of the compressor 12 by disposing the apparatus in a configuration of calibration. In this phase, the bedsore mattress 22 is isolated from the compressor.

[0035] The configuration of calibration of the apparatus 10 with inflatable mattress is such that the trunk valve 16 and the feet valve 18 block the air flow from the compressor 12 to the bedsore mattress 22 and that the mat valve 20 is arranged in a bypass configuration in which its discharge connection is put in a direct communication with the feed conduit 14.

[0036] In this way, the whole quantity of air that has been treated by the compressor 12 passes only through the mat valve 20 which detects the forward pressure of the compressor, compares the same with a valve pressure which has been predetermined during the projecting phase and varies the feed current of the compressor 12 so that the two pressures are equal. In this way, some common working problems are overcome such as the presence of dirty filters or other, and the necessary maintenance interventions are reduced.

[0037] Once the calibration phase is concluded, it is possible to proceed with the inflation of the bedsore mattress 22 according to an alternate mode or a continuous mode when it is selected by an operator by means of the group of push-buttons 70. The continuous mode allows the inflation of the first series of cells 32, 36 and second series of cells 34, 38 of the trunk sector 28 and feet sector 30 at the same pressure so that a bedsore mattress 22 is obtained and allows the same support/sustenance of the body of a patient in every point of the mattress 22.

[0038] On the contrary, in the alternate mode, the inflation system 10 performs a working cycle which alternates the support/sustenance of the body of the patient between the first series of cells 32, 36 and the second series of cells 34, 38 of the trunk sector 28 and feet sector 30 so that the support/sustenance pressure is changed in each point of the mattress 22 in time.

[0039] The working according to the alternate mode is described below.

[0040] Beginning from a condition of unloaded bedsore mattress 22, the mat sensor 24, which is put under the trunk sector 28, is squashed by the weight of the patient who blocks the air passage in the conduit sensor 56 in at least one point of the conduit sensor 56.

[0041] The central electronic unit 72 orders the trunk valve 16, the feet valve 18 and the mat valve 20 to put the feed conduit 14 in communication with the first conduits 42, 50 and second conduits 46, 54 of the trunk sector 28, feet sector 30 and first conduit 60 of the mat sensor 24 in order to inflate all the cells of the mattress 22. In this phase, the weight of the patient prevents the air to pass in the second conduit 64 of the mat valve 20 which does not detect any pressure at its second connection 62 which, in this working phase, is put in communication with the exhaust of the mat valve 20.

[0042] In the feet sector, when the feet valve 18 detects a predetermined pressure, called average pressure hereinafter, at both connections 48, 52, the feet valve 18 changes its operation mode and blocks its first connection 48 so that it prevents a further inflating of the first series of cells 36 of the feet sector 30 and puts the second connection 52 in communication with the exhaust of the feet valve 18 itself in order to bring the second series of cells 38 of the feet sector 30 to the wished pressure, called minimum pressure hereinafter, on blocking then any exchange of air in the feet sector 30.

[0043] In the trunk sector 28, once the minimum pressure has been reached and detected by both connections 40, 44 of the trunk valve 16, the trunk valve 16 blocks its second connection 44 and prevents consequently a further inflation of the second series of cells 34 of the trunk sector 28 so that only the first series of cells 32 is still inflated until a slight air pressure is detected in the connection 62 of the mat valve 20. When this fact occurs means that the trunk sector 28 has reached a pressure that is called sustenance pressure below so that the patient is sufficiently raised from the bedsore mattress 22 and the air is allowed to flow in the whole conduit sensor 56 which is not pressed in any point by the weight of the patient.

[0044] Once the sustenance pressure has been reached by means of inflation in the first series of cells 32 of the trunk sector 28, the electronic central unit 72 orders the compressor 12 to switch off and the trunk valve 16 to close its first connection 40 on blocking the inflation of the first series of cells 32 of the trunk sector 28 and to put the second connection 44 in communication with the exhaust of the trunk valve 16 itself until the second series of cells 34 reaches the above mentioned minimum pressure, which can be much lower than the pressure obtained in the first series of cells 32 of the trunk sector 28. This pressure may depend on the medical specifications of the country in question.

[0045] In this operation phase, in the bedsore mattress

22 the first series of cells 36 in the feet sector 30 is inflated at the average pressure while the second series of cells 38 in the feet sector 30 is inflated at the minimum pressure and the first series of cells 32 in the trunk sector 28 is inflated at the sustenance pressure which the second series of cells 34 in the trunk sector 28 is inflated at the minimum pressure. The head sector 26 is inflated at the sustenance pressure, namely, the maximum pressure reached in the trunk sector 28. The electronic central unit 72 maintains this distribution of pressures in the inside of the bedsore mattress 22 for a predetermined period of time, for instance five minutes, during which the compressor 12 remains switched off, which does not occur in the prior art.

[0046] When the predetermined period of time has elapsed and the compressor 12 is kept switched off, the electronic central unit 72 orders the trunk valve 16 and the feet valve 18 to put the respective first connections 40, 48 in communication with the respective second connections 44, 52 so that it is possible to obtain a rebalance of the pressures in the bedsore mattress 22 and to make such pressures uniform.

[0047] The so-described inflation cycle can be repeated by alternating later the first series of cells and the second series of cells in both the trunk sector 28 and the feet sector 30.

[0048] More particularly, in the following inflation cycle, the electronic central unit 72 verifies whether in the trunk sector 28 or in the feet sector 30 there is an equal pressure or a pressure higher than the average pressure in order to avoid a further inflation phase by the compressor 12 in that sector.

[0049] In other terms, if, for instance, after the rebalance of the pressures in the feet sector 30, the pressure is higher than the average pressure while the pressure in the trunk sector 28 is lower than the average pressure, the electronic central unit 72 orders the trunk valve 16 to allow the first series of cells 32 and the second series of cells 34 to be inflated until both series of cells reach the average pressure while the electronic central unit 72 orders the feet valve 18 only to deflate that series of cells which in the preceding cycle had been maintained at the average pressure.

[0050] In this way, the previously described inflation cycle will be repeated by inverting the pressures obtained in the series of cells of the sectors of the bedsore mattress 22.

[0051] In a different operation mode of the apparatus with inflatable mattress according to the invention, the operator can inflate all the cells of the bedsore mattress of both the trunk sector and the feet sector at a predetermined pressure in the shortest time possible, for instance by utilizing the maximum power of the compressor. This function allows the mattress to remain inflated for a certain period of time and deactivates automatically and restores thus the operative conditions that were present before selecting this different operation mode.

[0052] According to a different construction of the apparatus with inflatable mattress according to the invention, the feet sector of a bedsore mattress can comprise two nonreturn valves, each of them being connected to the first series of cells 36 and second series of cells 38, respectively and communicating with the head sector. The nonreturn valves can be arranged in such a way as to allow the inlet of compressed air toward the head sector only when the pressure in the head sector itself is lower than the pressure in one of the first series of cells and second series of cells in the feet sector. According to this construction it is possible to control more accurately the pressure in the head sector since it depends on the management of the feet sector but it is independent from the variations in the trunk sector, caused by the working of the mat sensor.

[0053] According to a variant of the invention, an apparatus with inflatable mattress can comprise an independent mat sensor 80 showing a substantially rectangular shape, as visible in Figure 3, which in turn comprises a tube sensor 82 arranged like a spiral or according to a different shape beginning from the centre of the independent mat sensor 80 itself and in such a way as to cover most part of its surface.

[0054] The spiral of the tube sensor 82 ends on the edge of the independent mat sensor 80 and is connected through a conduit 84 to a valve 86.

[0055] In turn, the valve 86 is connected through a conduit 88 to a pressure sensor 90 which transmits the detected pressure through a connection 92 to the management and control system.

[0056] The valve 86 can comprise appropriately a device which stops the passage of air in case the conduit 88 is disconnected in order to prevent air from going out of the conduit 84 and tube sensor 82.

[0057] The independent mat sensor 80 can substitute the mat sensor 24 if necessary, which involves the advantage of obtaining a measurement of the pressure variation in relation to the weight/position of the patient without utilizing compressed air coming from the management and control system and guaranteeing thus reduced consumes and a greater autonomy in respect to the management and control system without inserting elements to be interested by electricity in the bedsore mattress.

[0058] In case of a crushing of the tube-sensor 82, the pressure of the air contained in the tube-sensor 82 and conduit 84, which air is initially at the atmospheric pressure, increases proportionally so that this increase of the air pressure is detected by the pressure sensor 90.

[0059] The detected variation of pressure can be utilized, for instance, to estimate the weight/position of the patient and to value the inflation pressure required to inflate the cells of the bedsore mattress in order to safely support the patient.

[0060] The particular construction of the independent mat-sensor 80 and tube-sensor 82 allows to detect an inclination of the bed, as well, for instance an inclination of the bed-back, because the different distribution of the weight/position of the patient on the tube-sensor 82 in-

volves a different pressure, which is detected by the pressure sensor 90, and consequently, a different estimate of the weight/position of the patient. This different estimate of the weight of the patient will involve, for instance, an increase of the inflation pressure for the inflation of the cells of the bedsore mattress in case of an inclination of the bed-back.

[0061] According to a variant of the invention, an independent mat-sensor can comprise a tube-sensor which is produced entirely or partially in an elastic material to avoid an excessive crushing and to avoid that a part of the tube-sensor remains separate from the remaining part with the risk of misrepresenting the pressure detected by the pressure sensor.

[0062] The apparatus with inflatable mattress according to the invention has several advantages in comparison with the prior art, for instance a remarkable saving in energy since the compressor is utilized only when the inflation is necessary while in the known compressor, the compressor must be always operating to maintain the inflation of the mattress, which involves not only a greater consumption of energy but also a greater noise and wear of mechanical parts. A further advantage is the possibility of a self-calibration of the apparatus with inflatable mattress according to the invention which compensates for any malfunctions of the compressor which could reduce the quantity of inflated air so that many maintenance interventions are avoided.

[0063] Another advantage is to remarkably reduce the quantity of the air treated by the apparatus with inflatable mattress on the whole in order to improve the conditions of the air of the ambient in which it operates while in the known systems, the compressor is always operating and consequently, it is necessary to treat much more air which is then exhausted in the ambient in which it operates.

[0064] Besides, the electronic management of the components of the apparatus with inflatable mattress allows a full customization of the operating cycle since all the functional parameters of the control centre 66 can be varied.

[0065] The different operation mode allows to keep the mattress completely inflated with a rigid, uniform surface so that it is possible to guarantee the necessary care for the patient when the care requires such a support surface.

[0066] In addition, further variants and constructions are possible which are to be considered as included in the scope of protection as set forth in the following claims.

Claims

1. Apparatus (10) for the sustenance of a patient, comprising:

- at least one compressor (12);
- at least one inflatable mattress (28, 30) comprising a first series (32, 36) of cells and a second series (34, 38) of cells;
- at least one valve (16, 18) having a discharge connection for the discharge in the outer ambient, and connected through a first conduit (42, 50) with the first series of cells (32, 36), through a second conduit (46, 54) with the second series of cells (34, 38), and through a feed conduit (14) with the compressor (12);
- at least one small mattress-sensor (24; 80), put under said at least one mattress (28, 30), comprising at least one conduit-sensor (56; 82) and detecting means (20; 90) to detect the air pressure in said at least one conduit-sensor (56; 82);
- management and control means (66), connected with the detecting means (20; 90), with the at least one valve (16, 18) and with the at least one compressor (12);

said management and control means (66) being adapted to switch on or switch off the at least one compressor (12) according to the pressure detected by the detecting means (20; 90), and adapted to vary the setting up of the at least one valve (16, 18) in order to inflate and deflate alternately the first series of cells (32, 36) and the second series of cells (34, 38).

2. Apparatus (10) according to claim 1, wherein a control valve (20) is comprised and has a discharge connection for the discharge in the outer ambient, and connected through a first conduit (60) with an end of the conduit-sensor (56), through a second conduit (64) with the other end of the conduit-sensor (56), and through a feed conduit (14) with the compressor (12); at least one pressure sensor being comprised in the second conduit (64) to sense the pressure going out of the small mattress-sensor (24).

3. Apparatus (10) according to claim 1, wherein the conduit-sensor (82), put in the small mattress-sensor (80), is closed at both ends and comprises a pressure sensor (90) connected with the management and control means (66).

4. Apparatus (10) according to any of the preceding claims, comprising:

- a first mattress (28) with a first series of cells (32) and a second series of cells (38);
- a second mattress (30) with a first series of cells (36) and a second series of cells (38);
- a first valve (16) having a discharge connection for the discharge in the outer ambient, connected through a first conduit (42) with the first series of cells (32) of the first mattress (28), through a second conduit (46) with the second series of cells (34) of the first mattress (28), and through a feed conduit (14) with the compressor (12);

said first valve (16) being connected with the management and control means (66);
- a second valve (18) having a discharge connection for the discharge in the outer ambient, connected through a first conduit (50) with the first series of cells (36) of the second mattress (30), through a second conduit (54) with the second series of cells (38) of the second mattress (30), and through a feed conduit (14) with the compressor (12); said second valve (18) being connected with the management and control means (66);
said first mattress (28) being arranged at the trunk of the patient, said second mattress (30) being arranged at the feet of the patient; said small mattress-sensor (24; 80) being arranged under said first mattress (28) and/or said second mattress (30).

5. Apparatus (10) according to any of the preceding claims, wherein a head mattress (26) is connected with the first series of cells (32) of the first mattress (28) with a nonreturn valve and with the second series of cells (34) of the first mattress (28) with a nonreturn valve so that the head mattress (26) has always the maximum pressure, reached by the first mattress (28); said head mattress (26) being arranged at the head of the patient.

6. Apparatus (10) according to any of the preceding claims, wherein at least one of said first mattress (28) and second mattress (30) comprises a lower chamber connected through nonreturn valves with the first series of cells (32, 36) and second series of cells (34, 38) so that said lower chamber has always the maximum pressure, reached by said first series of cells (32, 36) and said second series of cells (34, 38).

7. Apparatus (10) according to any of the preceding claims, wherein the cells of the first series (32, 36) are alternated with the cells of the second series (34, 38).

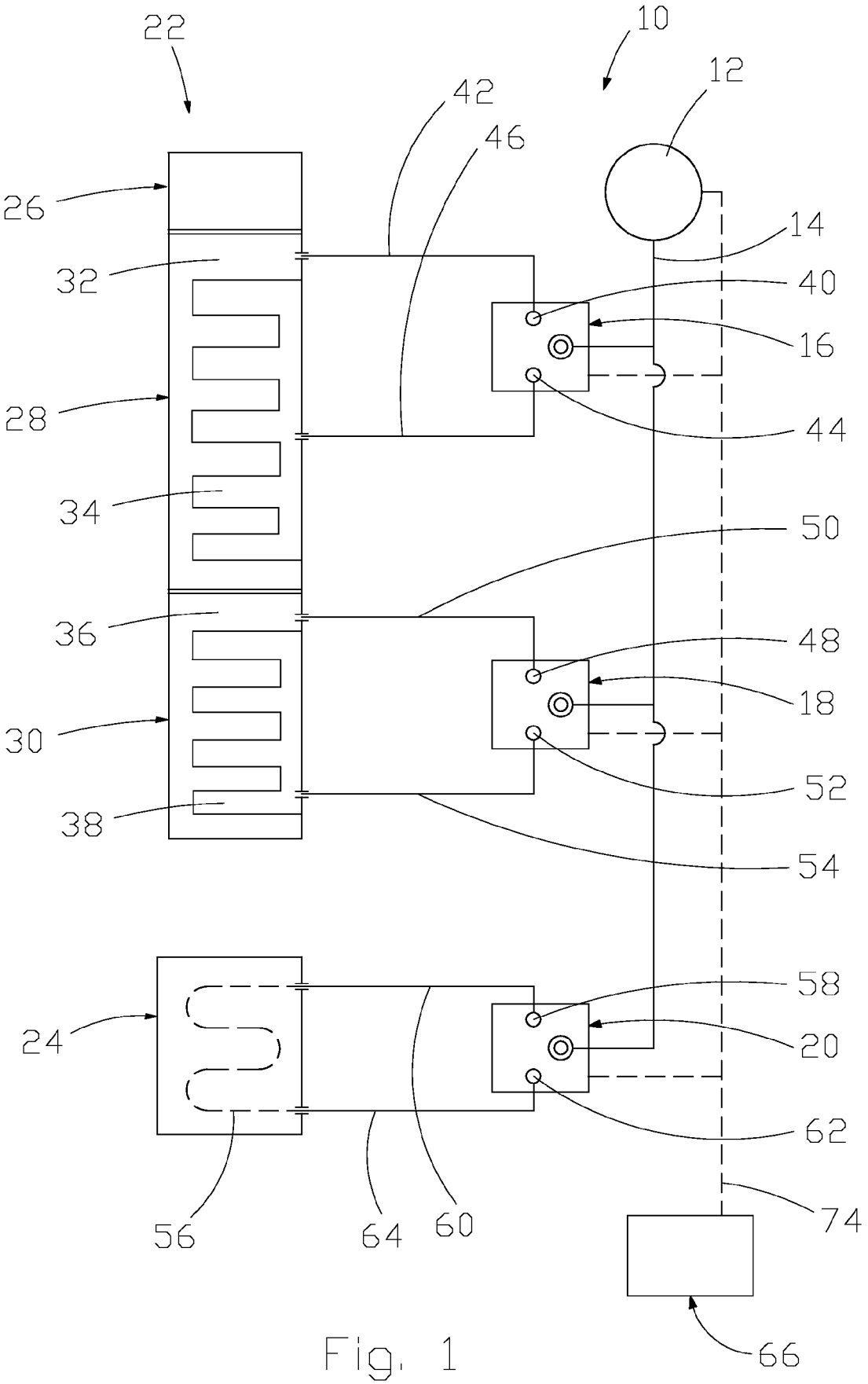
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Fig. 1

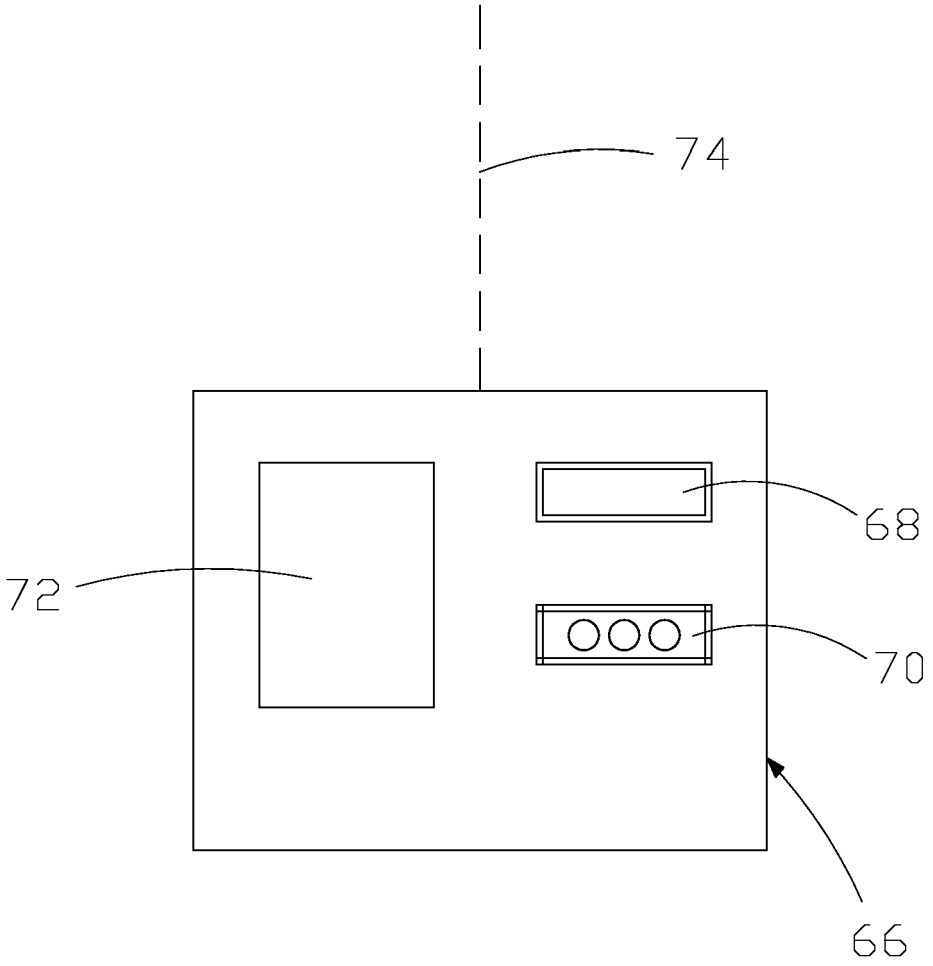

Fig. 2

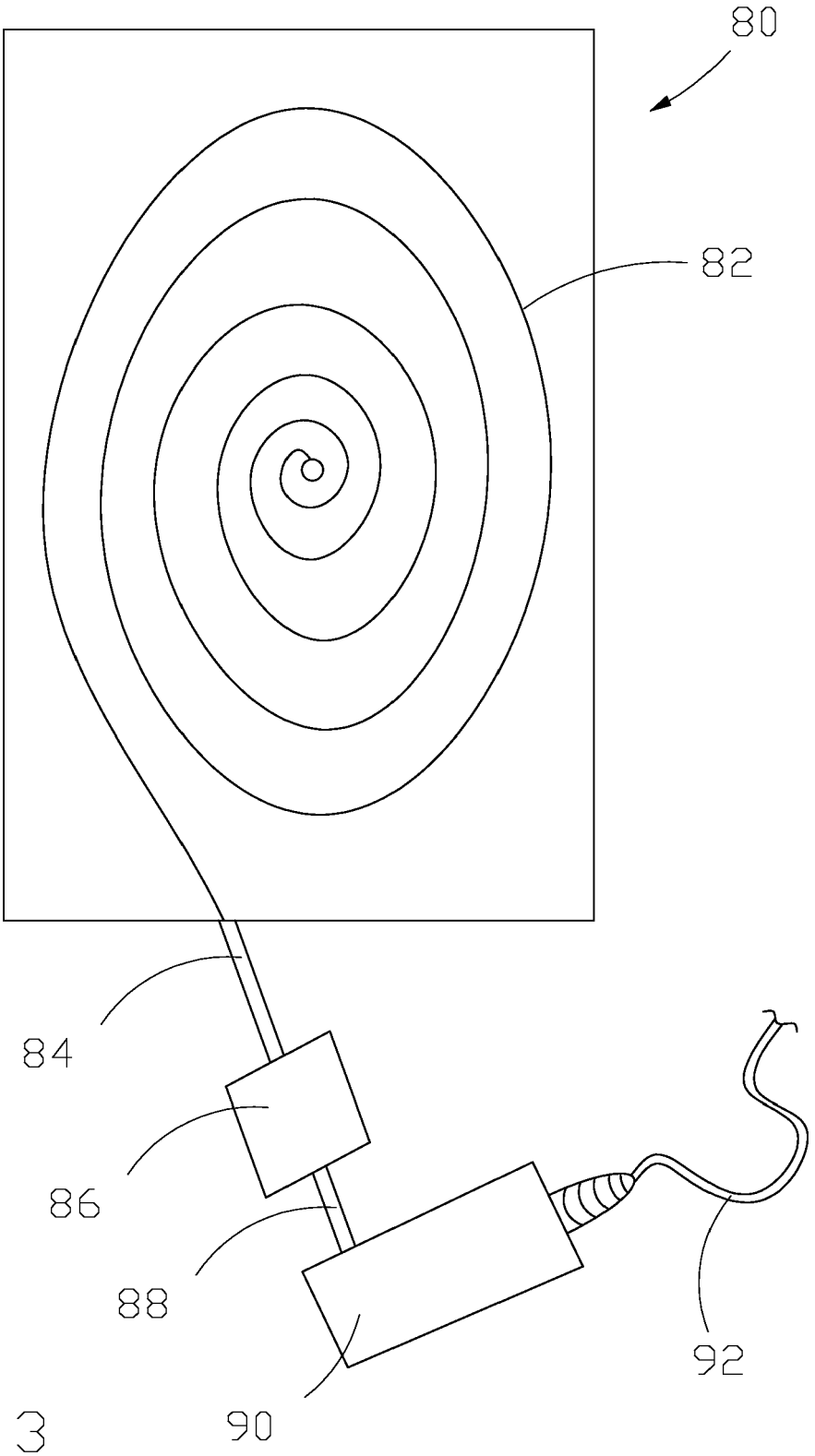

Fig. 3

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 11 19 3503

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 373 189 A (HUNTLEIGH TECHNOLOGY PLC [GB]) 18 September 2002 (2002-09-18) * page 4, line 28 - page 9, line 25; figures 1-4 *	1,4,7	INV. A61G7/057
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X	US 2006/112489 A1 (BOBEY JOHN A [US] ET AL) 1 June 2006 (2006-06-01) * paragraphs [0046] - [0126]; figures 1,3,23 *	1,3,4,7	
X	US 5 634 225 A (MILLER SR CRAIG S [US] ET AL) 3 June 1997 (1997-06-03) * column 4, line 9 - column 7, line 6; figures 1-5A *	1,4,7	
			TECHNICAL FIELDS SEARCHED (IPC) A61G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 May 2012	Petzold, Jan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
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Application Number
EP 11 19 3503

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 373 189 A (HUNTLEIGH TECHNOLOGY PLC [GB]) 18 September 2002 (2002-09-18) * page 4, line 28 - page 9, line 25; figures 1-4 *	1,4,7	INV. A61G7/057
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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	31 May 2012	Petzold, Jan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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1

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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