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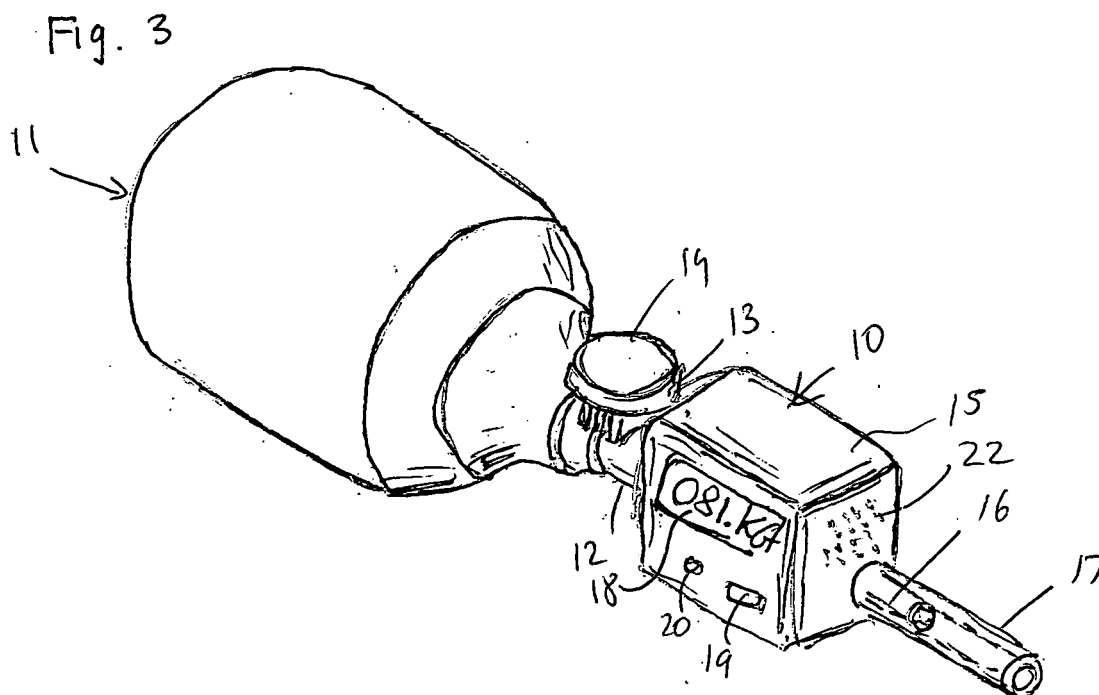
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(54) **Inflation control**

(57) A device 10 for controlling the inflation pressure of an inflatable pad or cushion includes a control unit 15 connected to an outlet tube 12 of a pump 11, and an inlet tube 17 of a cushion etc to be inflated. The control unit includes means for converting the pressure of air from

the pump sensed by a pressure sensor in the unit 15 to an equivalent body weight deemed to be the optimum to be supported at that pressure. There are means 18 for displaying the equivalent body weight, and for inputting a target weight, and alerting the user when the target weight is matched or exceeded.



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Description

[0001] This invention relates to a device and method for controlling the inflation pressure of inflatable pads used in support cushions and the like.

[0002] It is known to provide support cushions for bed ridden or chair bound patients, and others, which include inflatable pads on their own or in combination with pads of e.g. formed polyurethane.

[0003] Such pads are used to prevent or minimise pressure ulcers and other sores, as lumbar supports, and to aid in the healing of injuries and surgical scars through prevention of chaffing.

[0004] It has been found that the most efficacious support is provided by establishing a relationship between the inflation pressure of the pad and the body weight of the patient.

[0005] In general, the air pressure in the pad requires to be increased as body weight increases.

[0006] An object of the invention is to provide an inflation control device which will enable an air cushion or inflatable pad to be filled with air at the optimum pressure for a given body weight.

[0007] According to the invention there is provided a device for controlling the inflation pressure of an inflatable pad or cushion comprising, means for sensing the back-pressure from an inlet to an inflatable pad or cushion, means for converting the back pressure sensed into an equivalent body weight which would be supported by the sensed pressure, and means for displaying the equivalent body weight.

[0008] The device is preferably provided connected into the outlet conduit of an inflation device, and the latter may be for example a foot pump, hand pump or electrically driven pump. The pump may be a plunger operated pump, a diaphragm pump or fan operated pump, or a deformable hand bulb, or hand or foot operated bellows pump.

[0009] The device may be associated with a pressure relief valve, and may operate the same, to ensure that the back pressure and thus the air pressure within the pad or cushion does not exceed the pressure corresponding to a given body weight.

[0010] The device may include means whereby the target body weight, for example the known weight of a patient, for whom a particular pad or cushion is intended, may be input to the device, so that when the corresponding pressure within the cushion is reached, the relief valve is activated if the pressure substantially exceeds the target pressure, and an audible aid or visual signal is given, such as a continuous or intermittent tone with or without a flashing lamp, when the target pressure is achieved.

[0011] The user can then disconnect the inflation device from the pad and seal the inlet, so that the pad or cushion is then ready for use by the intended patient, inflated to the pressure which is optimum for supporting the body weight of the intended user.

[0012] An embodiment of the invention will now be described by way of example with reference to the accompanying drawings, wherein:-

Figure 1 is a perspective view of the device of the invention, as applied to a hand operated deformable bulb pump from one side;

Fig 2 is a side elevation thereof;

Fig 3 is a perspective view similar to fig 1 from the opposite side, and

Fig 4 is a side elevation similar to fig 2 from the opposite side of fig 2.

[0013] The drawings show an embodiment of inflation control device 10 according to the invention, in conjunction with a manually operated inflation pump 11, in the form of a hand bulb device.

[0014] The pump device 11 is connected to an outlet tube 12 which includes a pressure relief valve 13 having a finger turnable actuator 14, which leads to a control unit 15. The control unit 15 has an outlet spigot 16 which is inserted as shown in broken lines as fig 1 and 3 into an inlet tube 17 of a cushion, mattress or pad to be inflated.

[0015] The control unit 15 comprises a generally box like housing containing a microprocessor, power unit such as a battery, and input and display drivers to enable data to be supplied to the microprocessor, and a result displayed at the window 18 provided in the housing.

[0016] The input driver may be operated by a multi-function switch 19 which is adapted to operate as an on/off switch, and to select between kilograms or pounds for the display window 18, which is operated by the microprocessor to convert currently sensed pressure, occurring for example as a back pressure in the tube 17 between actuations ("puffs") of the bulb 11, into a corresponding body weight which will be optimally supported by the pad inflated to the currently sensed pressure. This is calculated by means of an empirically derived relationship obtained by practical test rather than on the basis of any theory.

[0017] The housing of unit 15 also carries a warning lamp 20, in the form of an LED, a closure 21 for a battery compartment, in which a compact battery, such as a mercury cell of the type used in hearing aids for example, is placed, and also a sound emitter may be mounted within a grille or perforated area 22, to give an audible warning for example concurrently with the visual signal of the LED lamp 20.

[0018] The warning signals lamp 20 and the sound emitter may be activated by occurrence of excessive sensed pressure, which may then be relieved using the pressure relief valve 14.

[0019] The audible sound emitter may be a piezo-electric device adapted to emit a continuous or intermittent tone, or other appropriate speaker device which can be activated by the control unit 15 at the voltages and current levels in use.

[0020] In practice, the user of the cushion or pad or their carer for example a chair cushion, or a bed or recliner mattress, would input the user's known body weight, and then the back pressure between puffs of the bulb 11 would be sensed and the correspondingly displayed weight monitored until the desired pressure is reached.

[0021] Going beyond the pre-input weight would activate the warning light 20, and the audible device if the pressure was further exceeded. The pressure would then be reduced using the pressure relief valve 14.

[0022] In a trial the following results were obtained, the optimum pressures being obtained by pressure mapping.

Subject	Height (m)	Weight (kg)	Average pressure mm hg
ID 01	1.55	40.0	26.91
ID 02	1.58	96.0	26.88
ID 03	1.60	57.0	27.34
ID 04	1.66	49.0	30.43
ID 05	1.62	101.0	30.73
ID 06	1.75	55.0	31.06
ID 07	1.67	63.0	25.12
ID 08	1.64	45.0	28.84
ID 09	1.75	75.0	31.45
ID 10	1.82	79.0	34.46

[0023] The following relationship for optimum inflation pressure has been derived from these trials:-

$$P = 0.41W$$

Wherein:-

P is the optimum inflation pressure in mmhg, and W is the body weight in kilograms.

[0024] This may not be valid for all pad structures, and may require to be established empirically for each pad model.

[0025] The inflation control device of the apparatus makes possible inflation of inflatable pads for use in chairs, beds, or the like to the optimum pressure for the body weight of the individual patient or user, enabling prevention of pressure sores and reducing discomfort. The device may be of use in care homes, hospitals, and on an individual basis by people in their own homes.

[0026] The inflation device is shown as being a hand operated bulb, but may be of any other convenient kind, such as a hand or foot operated bellows pump, a piston or plunger pump or a fan pump which may be powered by an electric motor.

Claims

1. A device for controlling the inflation pressure of an inflatable pad or cushion comprising means for sensing the back-pressure from an inlet to an inflatable pad or cushion, means for converting the back pressure sensed into an equivalent body weight to be supported by the pad, and means for displaying the equivalent body weight.

2. A device according to Claim 1, which is adapted to be connected into an outlet conduit of an inflation device.

3. A device according to Claim 1 or 2, which is associated with, and adapted to operate a pressure relief valve to

ensure that the back-pressure, and thus the air pressure within the pad or cushion does not exceed the pressure corresponding to a target body weight.

- 5 **4.** A device according to Claim 3, wherein the device includes input means to input a target body weight, and comparison means for comparing the target body weight with the equivalent body weight derived by the converting means from moment to moment, and means for operating the pressure relief valve if the pressure exceeds the pressure equivalent to the target body weight.
- 10 **5.** A device according to Claim 4, wherein further means, for operating a visual and/or audible signal are provide to be activated if the pressure exceeds the pressure equivalent to the target body weight.
- 6.** A device according to Claim 2, or any claim appendant thereto wherein the inflation device comprises a hand operated deformable bulb pump.
- 15 **7.** A device according to any of Claims 2 to 5 wherein the inflation device comprises anyone of a foot pump, a plunger operated pump, a diaphragm pump, a fan operated pump, or a hand or foot operated bellows pump.
- 8.** A device according to any preceding claim which has a display window which is adapted and controlled to display the value of the body weight equivalent to the sensed pressure from moment to moment.
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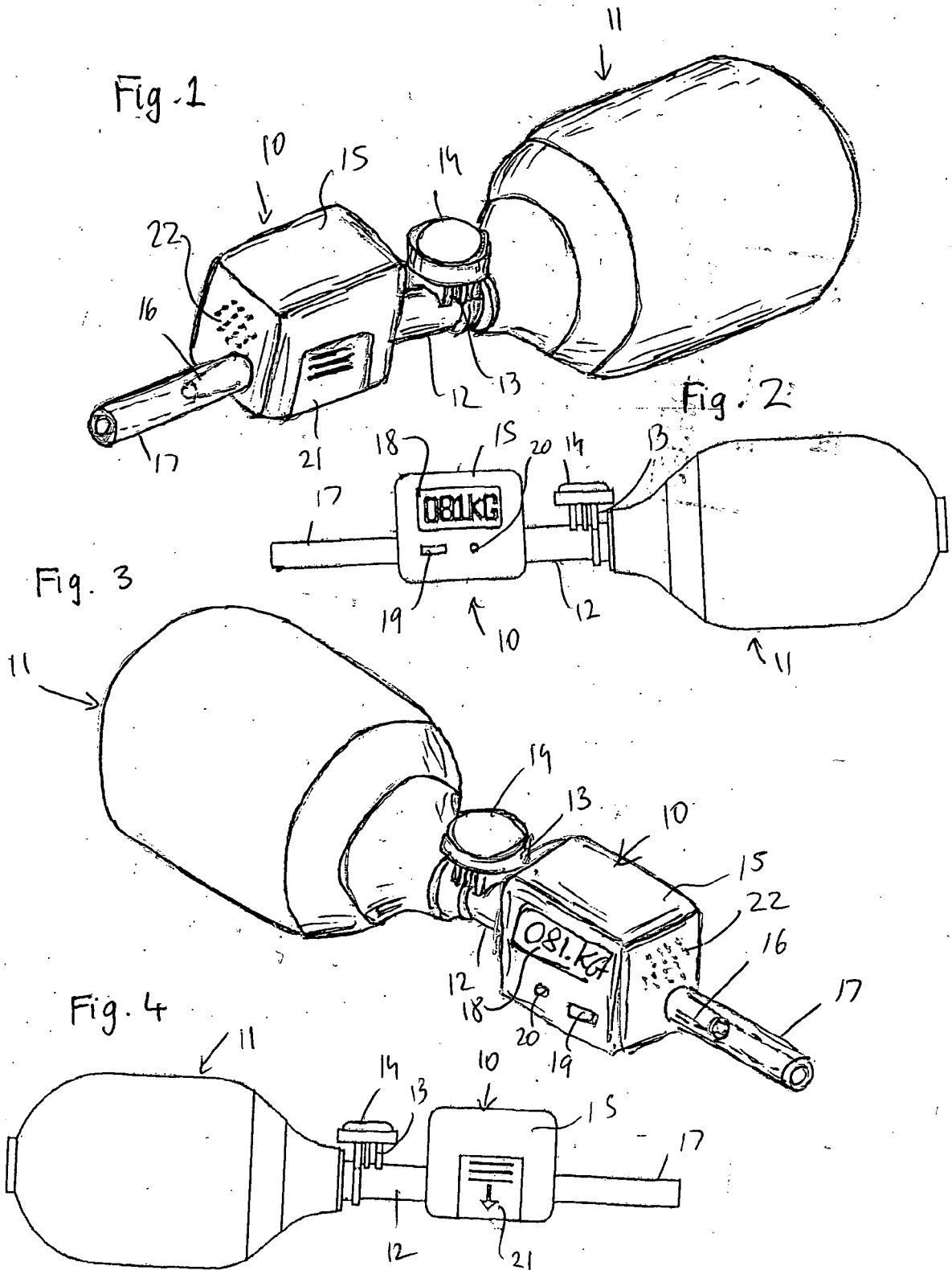
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EUROPEAN SEARCH REPORT

Application Number
EP 05 25 7479

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	US 6 483 264 B1 (SHAFER) 19 November 2002 (2002-11-19) * column 4, line 56 - column 6, line 59; claims; figures 1-4 *	1-5,7,8	A47C27/08
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			TECHNICAL FIELDS SEARCHED (IPC)
			A47C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		15 February 2006	VandeVondele, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 25 7479

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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