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

(11) **EP 1 408 906 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
24.10.2012 Bulletin 2012/43

(21) Application number: **01953596.2**

(22) Date of filing: **24.07.2001**

(51) Int Cl.:
A61G 7/05 *(2006.01)* ***A61G 7/057*** *(2006.01)*

(86) International application number:
PCT/US2001/023234

(87) International publication number:
WO 2003/009796 (06.02.2003 Gazette 2003/06)

(54) **A therapeutic patient support system**

Therapeutisches Patientenliegesystem

Système thérapeutique de support de patient

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR

(43) Date of publication of application:
21.04.2004 Bulletin 2004/17

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WO-A-90/05471 **US-A- 5 267 364**
US-A- 5 594 963 **US-A- 5 630 238**

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Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a therapeutic patient support system.

[0002] The field of therapeutic patient supports has been well developed since at least the 1960s and 70s. While various kinds of therapeutic patient supports exist, inflatable therapeutic patient supports have, over time, become increasingly popular. These supports are more complex than a conventional medical therapeutic mattress as they require additional control systems to regulate the inflation of all or part of the mattress. Such early therapeutic beds were very expensive, requiring complicated control systems to be integrated within the dedicated bed frame supporting the inflatable surface. These systems, which still exist today, still require dedicated bed frames, and, to the extent practical, are restricted to patients requiring a high level of patient care, beyond that provided by a static, pressure relieving mattress.

[0003] Through the years, therapeutic patient support system purchasers, mostly health care providers, began demanding static pressure relieving mattress systems that were adapted for use with conventional bed frames, which did not require the uses of a dedicated frame, as do more complex systems referred to above. These conventional bed frames, as is well known in the art, generally have front or rear portions, and usually both, that may be raised, or lowered, as desired, commonly by means of patient remote controllable electric motors. As a consequence, the baseboards of such beds are articulable, and are divided into a plurality of independently moveable planar sections, most usually a head section, a body section, and a foot section. This allowed, and allows, a health care provider, such as a hospital, to use different therapeutic mattress system with the same bed frame. This also allowed bed frames to be moved among various services as patient census may dictate.

[0004] A typical example is the First Step Select® mattress system available from Applicant. This system provides an inflatable, low-air-loss patient support with multiple zones of pressure control, together with heater control and other features. A compact control unit that was adapted to be hung on the footboard of a standard hospital bed frame regulates all of these features. Such a system enables a conventional hospital bed to be equipped with a standard medical mattress for most patients, but when required a low air loss mattress could be installed instead, with the mattress control system mounted (or hung) upon the footboard of the bed. Other such mattress systems were also offered under the "MRS" (mattress replacement system) designation to replace the entire mattress.

[0005] Significant problems arise from placing controls on the bed footboard. This footboard is valuable space and typically is the preferred location for putting patient clipboards, and other frequently used devices. This allows them to be placed both close to the patient, and to be readily accessible to medical caregivers. Also, a patient care room is often cluttered. Having a protrusion beyond the preexisting footprint of the bed could lead to the controls, and the bed attached thereto being inadvertently jostled. This could lead to patient discomfort, or worse.

[0006] As is well known in the art, conventional medical bed frames, generally have front or rear portions that may be raised, or lowered, as desired, commonly by means of patient controllable electric motors. As a consequence, the baseboards, which support the mattress of such beds are articulable, and are divided into a plurality of independently moveable planar sections, including at least a head section, a body section, and a foot section. Further, the space beneath the baseboards is not empty.

[0007] Conventional medical bed frames typically use electrically driven mechanisms, such as jackscrews or worm gears for adjusting the elevation and inclination of the various portions of the bed. Most commonly this mechanism is centrally disposed on the underneath of the baseboards, and occupies some portion of the centreline portion of the space there defined, much like the well known transmission hump long found in rear wheel drive automobiles equipped with automatic transmissions. Fortunately, likely for mechanical reasons, this configuration is reasonably standard.

[0008] More recently, various other bed frames have been commercialised with a modularised approach, wherein the bed frame is adapted for a variety of mattress systems. The Total Care system, commercialised by Hill-Rom, Inc, of Batesville, Indiana, is a typical example. That system is commercialised with a bed frame that is customised during manufacture to receive a variety of different surfaces. Particulars of this system may be better understood from US patent 5630238 issued May 20, 1997, Weismiller et al.

[0009] A bedframe where a control unit for an inflatable mattress is suspended from the bed-frame is known from WO 90/05471.

[0010] To date, however there has been no patient support system which provides an inflatable pressure relieving patient support system which coacts with a conventional medical bed frame to provide a lower air loss inflatable mattress which is contained within such a bedframe, which also has its control and power modules also located within the footprint of such a bed. It is towards meeting this need that the present invention is directed.

[0011] According to one aspect of this invention there is provided an assembly for supporting a patient having the features of claim 1, the assembly comprising an inflatable pressure reducing mattress, a bed-frame with a footboard, and a therapeutic patient support system, characterised in that the therapeutic patient support system comprises a power/control module, a baseboard and a blower assembly attached to the underside of the baseboard in a cavity proximal to the footboard, wherein the baseboard is adapted to replace the foot end baseboard of the bed-frame.

[0012] Further features of the present invention are set

forth in claims 2 to 7 appended hereto.

[0013] The invention also provides method of modifying a conventional baseboard containing bed-frame so as to enable receipt of a modular control system for speciality patient support systems therein, comprising equipping said baseboard with release enabling mechanisms; removing components that re beneath said baseboard from the underside of said bed-frame; creating a cavity within said frame within which a blower and control assembly may be positioned; further adapting said baseboard to provide a sufficient number of air hose outlets for controlling a therapeutic air mattress mountable on top of said baseboard; and mounting said air hose containing mattress having a plurality of air hoses, said air hoses being connected to said outlets, upon said frame.

[0014] The preferred embodiment of the present invention embodies an inflatable patient support, and a control and power system required for its operation, which fit within, beneath, and upon a conventional hospital bed frame, after the bed frame has been internally modified. The system operatively interacts with a bed frame, and comprises a modular control assembly, an inflatable mattress and various operative connections there between. In the preferred embodiment this is a conventional bed frame that, although modified to receive the modular control assembly may also support a wide variety of other mattresses as are typically employed within the medical environment.

[0015] Then, when a pressure-relieving surface is required, the foot end baseboard of the frame can be removed and replaced with the modular control assembly. A low air loss mattress can be utilized with the system without the necessity of utilizing a blower control assembly that hangs on the footboard or is placed on the floor in the patient room.

[0016] A preferred embodiment of the present invention provides a means whereby a low air loss inflatable pressure-relieving mattress, and the power / control module thereof, may be installed upon and within the footprint of a conventional hospital bed.

[0017] Also a preferred embodiment of the present invention provides a means whereby a low air loss inflatable pressure-relieving mattress, and the power / control module thereof, may be installed upon and within the footprint of a conventional hospital bed, wherein the controls are accessible to a caregiver of the user of the mattress.

[0018] Additionally a preferred embodiment of the present invention provides a means whereby a low air loss inflatable pressure-relieving mattress, and the power / control module thereof, may be installed upon and within the footprint of a conventional hospital bed, by locating this module within space otherwise wasted in the cavity beneath the foot end baseboard of a conventional hospital bed.

[0019] These and still further objects and advantages of the invention will be readily apparent to those skilled in the art from the following description taken in conjunction with the accompanying drawings. The drawings constitute part of this specification and include exemplary embodiments of the present invention and illustrate various objects and features thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG 1 is a partial isometric perspective view of a therapeutic patient support system embodying the various aspects of the present invention.

FIG 2 is a top perspective view of the modular control assembly.

FIG 3 is a partial exploded view of the modular control assembly of FIG 2.

FIG 4 is a front view of the control panel of the modular control assembly

FIG 5 shows the control panel of an alternative embodiment of the present invention.

Fig. 6 shows schematically components inside a blower control assembly.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] The present invention may be embodied in a wide variety of therapeutic patient support systems. Fig's 1-4 depict a first preferred embodiment of the present invention represented within therapeutic patient support system 10. As most clearly illustrated in FIG 1, the system 10 operatively interacts with a bed frame 20, and comprises a modular control assembly 30, a mattress 40, and various operative connections there between.

[0022] In the preferred embodiment, frame 20 is a conventional bed frame that, although modified to receive modular control assembly 30, may also support a wide variety of other mattresses as are typically employed within the medical environment. Then, when a pressure-relieving surface is required, the foot end baseboard of frame 20 can be removed and replaced with the modular control assembly 30, and mattress 40 can be utilized with the system without the necessity of utilizing a blower control assembly that hangs on the footboard or is placed on the floor in the room.

[0023] More particularly, frame 20 of the presently most preferred embodiment is a Hill-Rom Model 834A or 835 frame that has been adapted to allow space for receiving the modular control assembly 30. Such conventional bed frames are available with baseboards including a foot section baseboard of the same shape as baseboard 31. In contrast to a spring surface, such baseboards are suited for use in the medical industry when therapeutic mattresses, are installed upon bed frame 20.

[0024] With reference to Figures 2 and 3, modular control assembly 30 comprises baseboard 31, blower control assembly 32 attached thereto, and air hose outlets 33-35, which are provided within recess 36 defined within base-

board 31. In the usual operating configuration, hose 41 is operatively connected to outlet 33, hose 42 is operatively connected to outlet 34, and hose 43 is operatively connected to outlet 35. The precise function and uses of hoses 41, 42, 42, when connected to outlets 33, 34, 35, is described more fully below.

[0025] Figure 2 shows the molded, plastic shroud that covers the individual components of blower control assembly 32. Shroud is described in greater detail, below.

[0026] Figure 3 depicts in exploded view the devices and components of an exemplary embodiment of blower control assembly 32. Power switch assembly 151 is mounted to bracket 150 and is equipped to receive a conventional power cord. Assembly 151 has a rocker style toggle switch to interrupt or allow flow of electrical power to the electronic control board 152, that in turn processes signals and directs electrical power to blower motor 153 and to pinch valves 162, 163, and 164, which are mounted on hose valve mounting bracket 165.

[0027] Foam block 154 fits snugly over blower motor 153 to reduce noise and vibration from blower motor 153. Blower motor 153 is seated in a Styrofoam nest, which sets snugly into a shallow, rectangular metal frame 176. Metal frame 176 is affixed to baseboard 31 by machine screws No bolts, or strap holds the blower motor to baseboard 31. This is so to prevent and/or reduce transmitting mechanically induced vibration from blower motor 153 to bed frame 20. Blower motor 153 is held in place by virtue of mechanical pressure exerted by the shroud 200 pressing upon foam block 154.

[0028] Electric wires and spaghetti air tubes are "dressed" around various components by means of commercially available management appliances, such as open spiral cable wrap tubing and cable tie down clamps, as are well known to those skilled in the art.

[0029] The air output chamber of blower motor 153 is mechanically linked to air/heater manifold 155. Temperature sensor 156 is affixed to and imbedded into manifold 155. Temperature sensor 156 is also electrically linked to control board 152, and provides blower air temperature signals to control board 152 for processing along with other signals.

[0030] Further referring to Figure 3, three air hoses 158, 159, and 160 proceed from air/heater manifold 155 and continue through, in substantially parallel configuration, valve assembly 161. Three pinch valves 162, 163, and 164 are mounted onto valve assembly 161, directly above each air hose 158, 159, and 160, respectively.

[0031] As shown in Figure 4, the preferred embodiment of the present invention is adapted to provide customers with one of the popular First Step Select mattress systems available from Applicant. Figure 4 depicts a control panel 60 for such a system. Control panel 60 includes a power button 61 and a First Step Select membrane panel 62 as is presently commercialized with the First Step Select blower unit. The functions of the First Step Select membrane panel and its related components are virtually identical to the function of like components and controls in the First Step Select mattress systems presently on the market. Hence, once modular control assembly 30 has been installed within therapeutic patient support system 10, and once mattress 40 and its related air hoses 41-43 have been connected to outlets 33-35, respectively, system 10 is ready to provide patient pressure relief and other therapeutic features for patients.

[0032] In an alternative embodiment, TheraPulse Light control panel 60' may replace the deformed elongated oval FirsStep Select control panel 60. The TheraPulse-Light control panel and basic air handling components used therewith, are the same as are used in the commercialized TheraPulseLight unit sold by assignee. The face of this control panel 60' is an elongated irregular hexagon. Either of such shapes, or any other desirable shaped control panel 60 could be used.

[0033] Figure 5 provides frontal view of the TheraPulse Light control panel 60'. This control interface has the power switch integral with the control panel membrane.

[0034] Referring to Figure 6, baseboard 31 is a rigid, phenolic, flat, rectangular board measuring approximately 92,7 cm (36.5 inches) wide, 66 cm (26 inches) front to back, and 0,64 cm (0.25 inches) thick; two of its adjacent corners are rounded to a radius of approximately 5 inches. Baseboard 31 is of such material so as to be machine bolt thread tapable to accept machine bolts without need for nuts. Holes for handholds are cut into baseboard 31 at opposite sides; the presently preferred dimensions for such handholds are approximately 4.44 cm (1.75 inches) wide by 12.7 cm (5 inches) long. Further reference to Figure 6 shows schematically the components inside first preferred embodiment of blower control assembly 32. Components that constitute blower control assembly 32 are affixed to baseboard 31.

[0035] Control panel 60 protrudes from the foot end of the bed frame 20 as depicted in Figure 1, but does not extend beyond the footprint established by frame 20. Alternate embodiments for equipping conventional bed frames can be achieved with baseboard options when manufacture supplied baseboards of the same shape, or substantially the same shape as baseboard 31, shown in Figure 2, are provided by the bed frame manufacturer.

[0036] Such electronic, electro-mechanical, and mechanical devices schematically depicted in Figure 6 are substantially similar to those found in the First Step Select mattress system available from assignee. The individual devices and components are well known to those skilled in the art and therefore do not require detailed description herein. Electronic, electro-mechanical, and mechanical devices herein are operatively connected to baseboard 31, either directly, or to a bracket such as bracket 176 that is preferrably fabricated from a corosion resistant easily machineable metal such as aluminum. Bracket 176 is in turn fastened to baseboard 31 presenting a somewhat "flat" configuration upon baseboard 31. Mounting of individual components to baseboard 31 may be accomplished by use of standard machine bolt screws into holes threaded into baseboard 31, as are well known

in the art, or in any other conventional manner known to the art that does not have an adverse impact on the operation of the present invention.

[0037] No bolts or other fastening devices should extend out the opposite side of baseboard 31 more than 0·4 to 0·8 mm (1/64 to 1/32 of an inch) that being the side of baseboard 31 upon which mattress 40 rests. Although there is nothing unique about the method of mounting the individual components to baseboard 31, any alternative mounting method is contemplated by the teachings of this invention. For example, all of the components could be mounted to a chassis, which could in turn be mounted to baseboard 31.

[0038] A molded, high impact plastic, contoured shroud shown partially in Figure 2, preferably covers all of the devices and components of blower control assembly 32 when affixed to baseboard 31, and is held in place to it by machine screws. The shroud has openings for access to power switch assembly 151, features a filtered air inlet for blower motor 153, and a cut-away area to receive and accommodate a control panel 60. Of particular importance to the shape of the shroud is a 12·7 cm (5 inch) wide by 10·1 cm inch) deep channel that runs the length of shroud. The Channel is of sufficient depth, width, and length to accommodate mechanical features of bed frame 20, especially the centrally disposed jackscrews, also known as worm gears, of bed 20 that articulate the foot baseboard portion of bed 20.

[0039] Air/heater manifold 155 and valve assembly 161 are mounted to metal bracket 176, which is in turn, mounted to baseboard 31. Metal bracket 176 is longer than it is wide, is bent at several substantially right angles to provide plateaus of various heights from baseboard 31 to accommodate mounting of valve assembly 161 and allow hoses 158, 159, and 160 to pass from air/heater manifold 155 beneath pinch valves 162, 163, and 164, and continue on to hose port block 166.

[0040] Pinch valve controllers 162, 163, and 164 regulate the volume of air that flows through air hoses 158, 159, and 160. Pinch valve assemblies 162, 163, and 164 respond to electrical signals produced by electronic control board 152.

[0041] Air hoses 158, 159, and 160 proceed on from through valve assembly 161 to three ports, respectively, on one face of hose port block 166. On the obverse side of hose port block 166 are three air hose outlets 33, 34, and 35, depicted in Figure 2 and Figure 3. From these outlets 33, 34, and 35, air hoses proceed to mattress 40.

[0042] On an adjacent face of hose port block 166 are three, air pressure sensing ports 171, 172, and 173. Proceeding from the pressure sensing ports 171, 172, and 173 are three air pressure sensor, spaghetti hoses 168, 169, and 170, that connect to three pressure transducers on and integral to electronic control board 152. This air pressure sensing configuration provides feedback signals to electronic control board 152. A fourth pressure transducer integral to electronic control board 152 is linked by yet another air spaghetti hose to air/heater manifold 155 to provide air temperature feedback to electronic control board 152.

[0043] These three pressure sensing ports 171, 172, and 173 provide pneumatic feedback to electronic control board 152 for the feet, body and head aspects of air being delivered to those respective zones of air mattress 40. The proximate end of a flat ribbon electric cable attaches to electronic control board 152 and the distal end thereof attaches to a First Step Select membrane panel 60 of the preferred embodiment as shown in Figures 1-3. An alternative control panel is the TheraPulse Light depicted in Figure 5.

[0044] In sum, Figures 1 - 6 show a basic bend frame 20 adapted to accommodate modular control assembly 30, and figure by figure zoom in to reveal greater detail of blower control assembly 32 and alternate control panels 60, 60'.

[0045] Many references have been made in this detailed description to particular commercial embodiments, such as the First Step Select, the TheraPulse Light and others. It should be recognized by those of ordinary skill in the art, however, that such reference is made because that is Applicant's present perspective - to utilize the present invention together with such products. It is readily contemplated, however, that the present invention will be utilized with many other mattress systems as are available from Applicant's current and future competitors.

Claims

1. An assembly for supporting a patient, the assembly comprising an inflatable pressure reducing mattress (40), a bed-frame (20) with a footboard, and a therapeutic patient support system (10), **characterised in that** the therapeutic patient support system (10) comprises a power/control module (30), a baseboard (31) and a blower assembly (32) attached to the underside of the baseboard (31) in a cavity proximal to the footboard, wherein the baseboard (31) is adapted to replace the foot end baseboard of the bed-frame (20).

2. An assembly according to claim 1, wherein the power/control module (30) is a modular assembly comprising said baseboard (31).

3. An assembly according to claim 1 or claim 2 wherein the power control module (30) has a control panel portion (60) positioned so as to be viewable by a caregiver of a user of said system when the power/control module (30) is supported on the bed-frame (20).

4. An assembly according to claim 3 wherein the system is installable within a bed-frame (20) having a footboard, such that said control panel (60) protrudes beyond the footboard of said bed-frame (20).

5. An assembly according to claim 3 or claim 4 wherein the control panel (60) is connected to the-blower assembly (32).

6. An assembly according to any one of the preceding claims comprising a support assembly on said baseboard (31) wherein said support assembly defines a blower-receiving cavity beneath said baseboard (31).

7. An assembly according to claim 6 wherein the baseboard (31) defines the top of the blower-receiving cavity.

Patentansprüche

1. Anordnung zum Stützen eines Patienten, wobei die Anordnung eine aufblasbare druckreduzierende Matratze (40), einen Bettrahmen (20) mit einem Fußteil und ein therapeutisches Patientenstützsystem (10) umfasst, **dadurch gekennzeichnet, dass** das therapeutische Patientenstützsystem (10) ein Antriebs-/Steuermodul (30), eine Grundplatte (31) und eine Aufblasanordnung (32) umfasst, die in einem Hohlraum nahe dem Fußteil an der Unterseite der Grundplatte (31) angebracht ist, wobei die Grundplatte (31) dafür eingerichtet ist, die Grundplatte am Fußende des Bettrahmens (20) zu ersetzen.

2. Anordnung nach Anspruch 1, wobei das Antriebs-/Steuermodul (30) eine Modulanordnung ist, welche die Grundplatte (31) umfasst.

3. Anordnung nach Anspruch 1 oder 2, wobei das Antriebs-/Steuermodul (30) einen Steuertafelabschnitt (60) aufweist, der derart angeordnet ist, dass er für den Pfleger eines Benutzers des Systems einsehbar ist, wenn das Antriebs-/Steuermodul (30) am Bettrahmen (20) gehalten wird.

4. Anordnung nach Anspruch 3, wobei das System derart in einem Bettrahmen (20) mit einem Fußteil installiert werden kann, dass die Steuertafel (60) über den Fußteil des Bettrahmens (20) hinaus hervorsteht.

5. Anordnung nach Anspruch 3 oder 4, wobei die Steuertafel (60) an die Aufblasanordnung (32) angeschlossen ist.

6. Anordnung nach einem der vorhergehenden Ansprüche, an der Grundplatte (31) eine Stützanordnung umfassend, wobei die Stützanordnung unter der Grundplatte (31) einen Hohlraum definiert, der das Aufblasgerät aufnimmt.

7. Anordnung nach Anspruch 6, wobei die Grundplatte (31) die Oberseite des Hohlraumes definiert, der das Aufblasgerät aufnimmt.

Revendications

1. Un ensemble pour soutenir un malade, l'ensemble se composant d'un matelas gonflable à réduction de pression (40), d'un cadre de lit (20) avec un panneau de pied et d'un système thérapeutique de soutien de malade (10), **se caractérisant par le fait que** le système thérapeutique de soutien de malade (10) comprend un module d'alimentation/commande (30), une plaque de base (31) et un ensemble de soufflerie (32) fixé sur le côté inférieur de la plaque de base (31) dans une cavité proche du panneau de pied, dans lequel la plaque de base (31) est adaptée pour remplacer la plaque de base d'extrémité de pied du cadre de lit (20).

2. Un ensemble selon la revendication 1, dans lequel le module d'alimentation/commande (30) est un ensemble modulaire comprenant la plaque de base (31).

3. Un ensemble selon les revendications 1 ou 2, dans lequel le module d'alimentation/commande (30) possède une partie panneau de commande (60) positionnée de façon à pouvoir être vue par un soignant d'un utilisateur du système lorsque le module d'alimentation/commande (30) est supporté sur le cadre de lit (20).

4. Un ensemble selon la revendication 3, dans lequel le système peut être installé dans un cadre de lit (20) ayant un panneau de pied, de telle sorte que le panneau de commande (60) dépasse du panneau de pied du cadre de lit (20).

5. Un ensemble selon les revendications 3 ou 4, dans lequel le panneau de commande (60) est connecté à l'ensemble de soufflerie (32).

6. Un ensemble selon n'importe laquelle des revendications précédentes, comprenant un ensemble de support sur la plaque de base (31), dans lequel l'ensemble de support définit une cavité recevant la soufflerie au-dessous de la plaque de base (31).

7. Un ensemble selon la revendication 6, dans lequel la plaque de base (31) définit le haut de la cavité recevant la soufflerie.

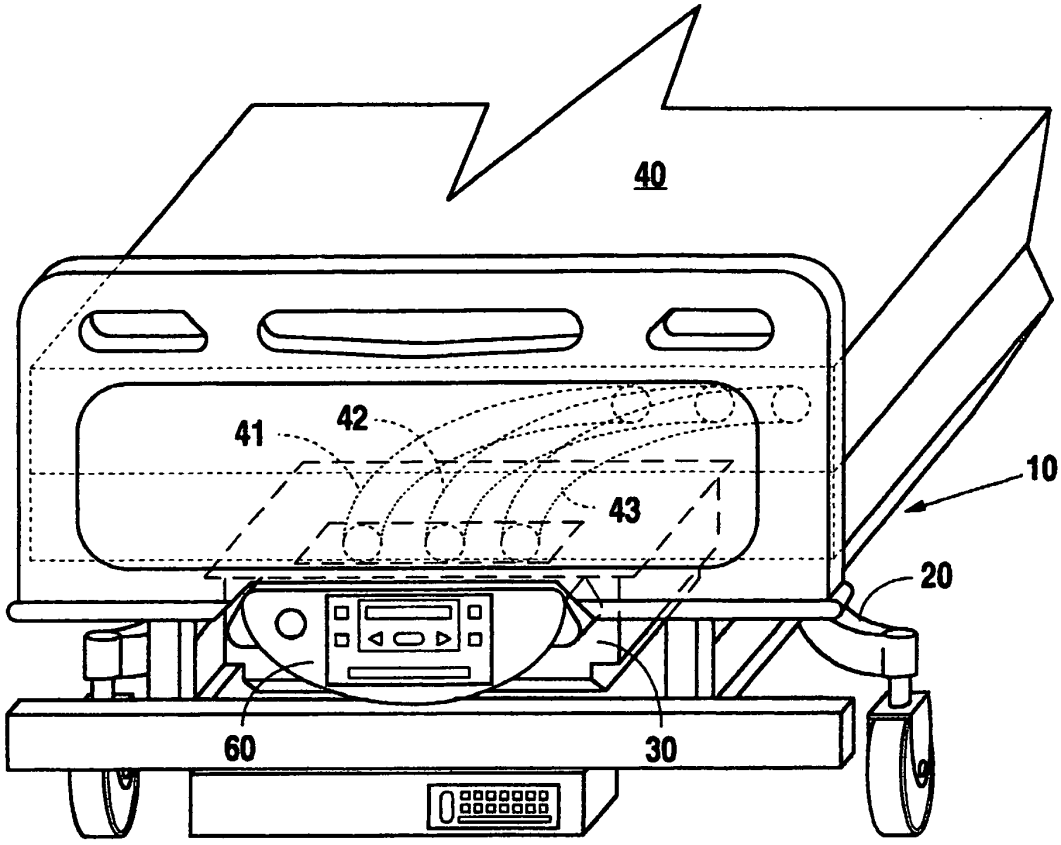


Fig. 1

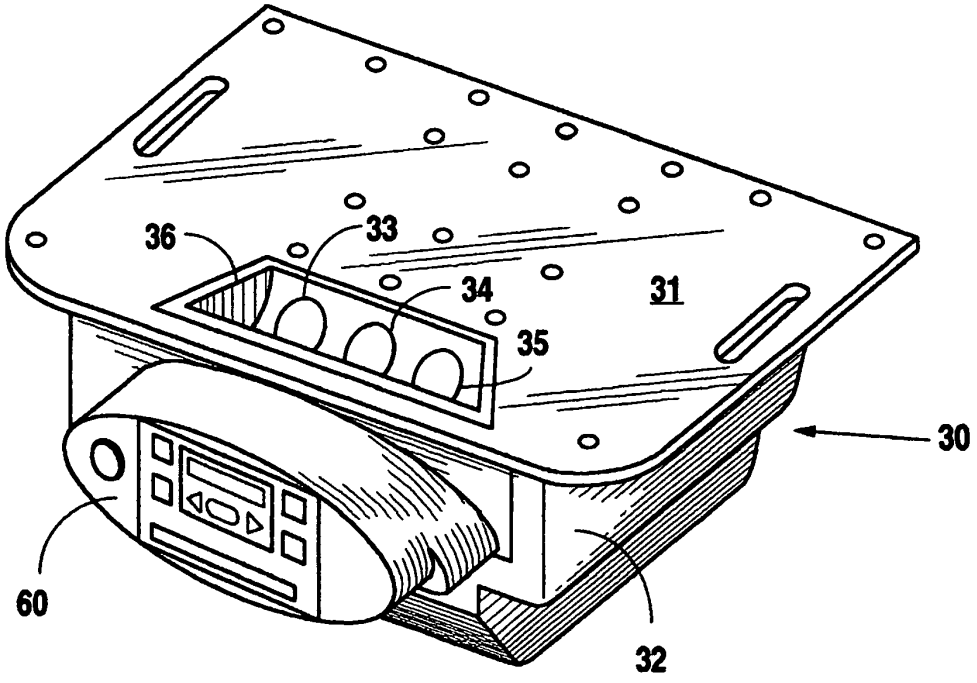


Fig. 2

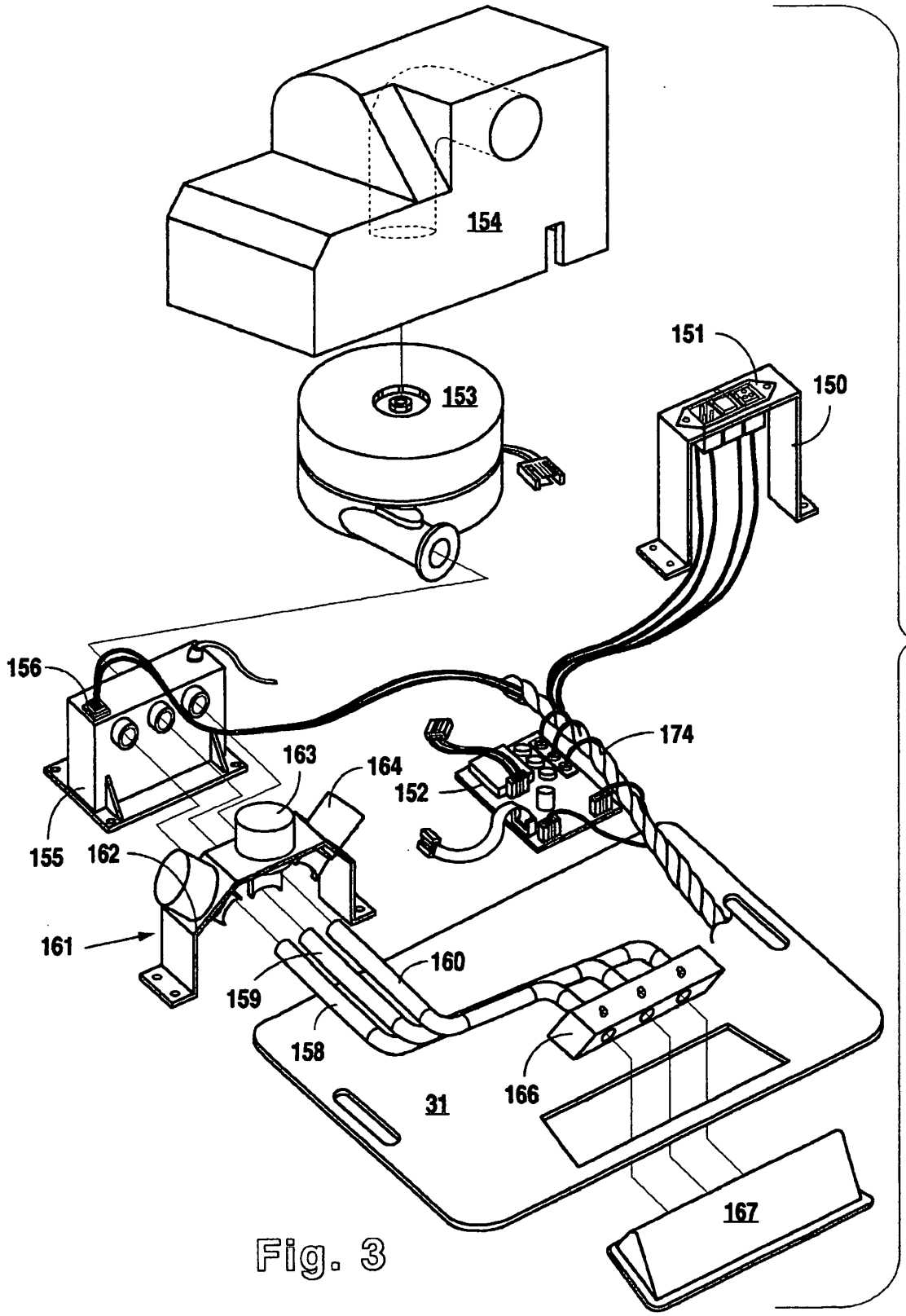

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Fig. 3

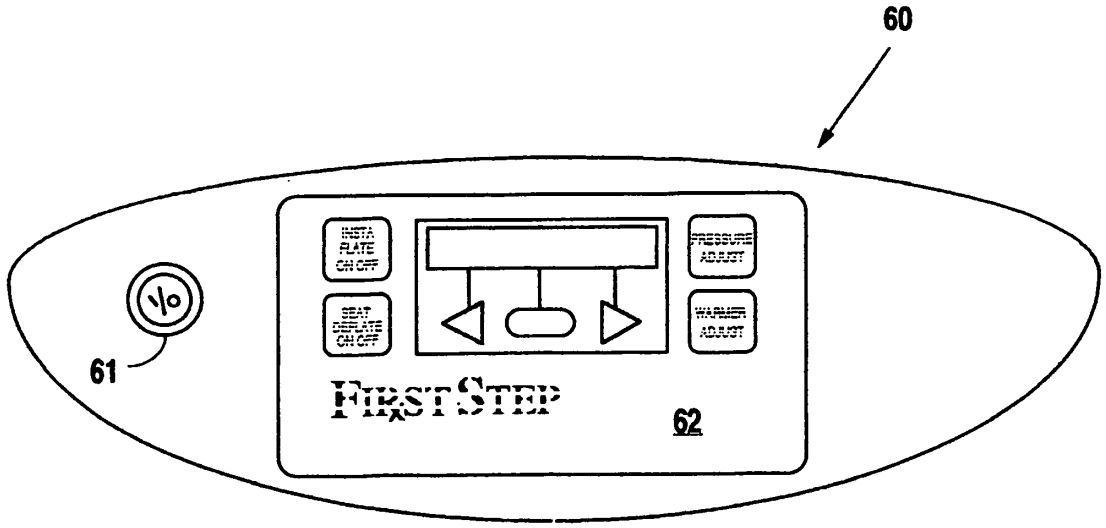


Fig. 4

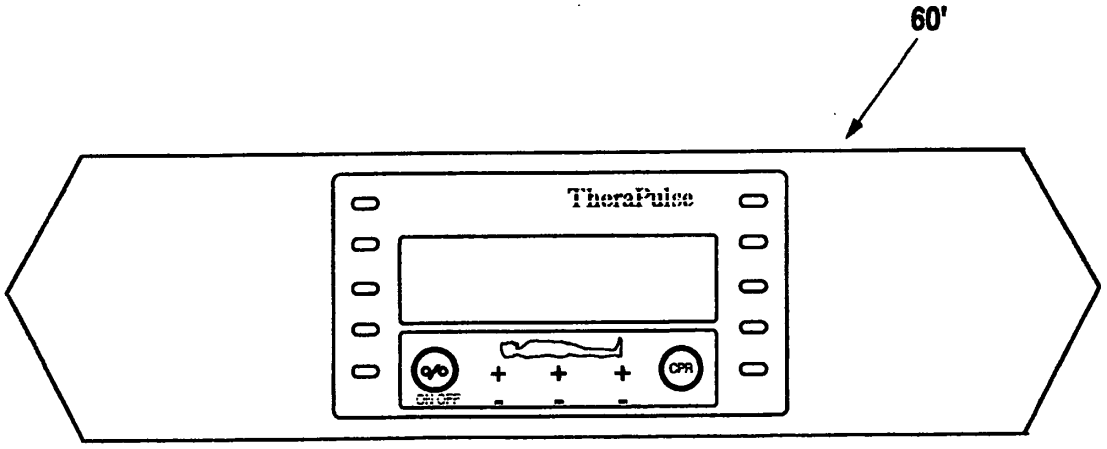


Fig. 5

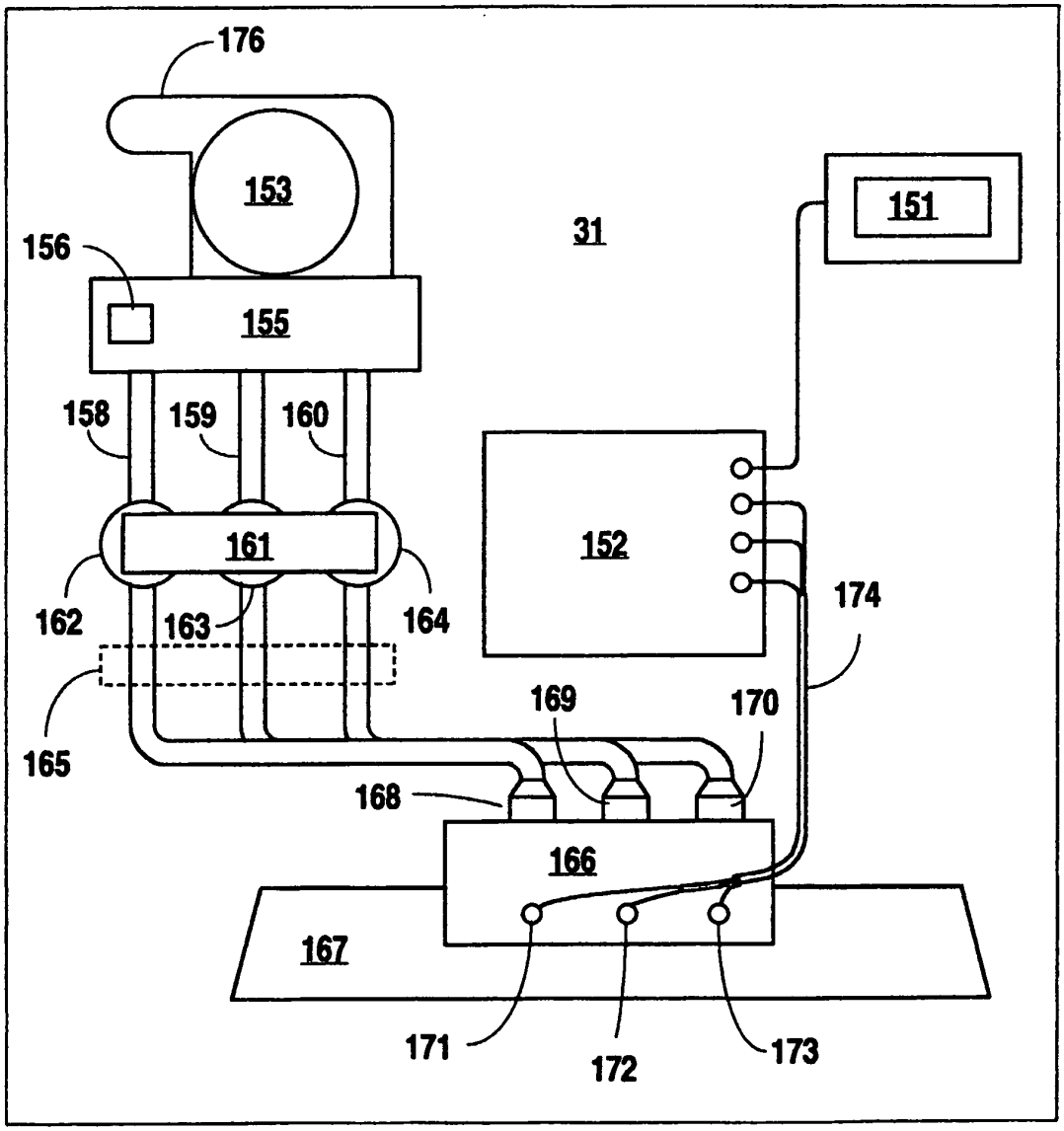

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Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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