

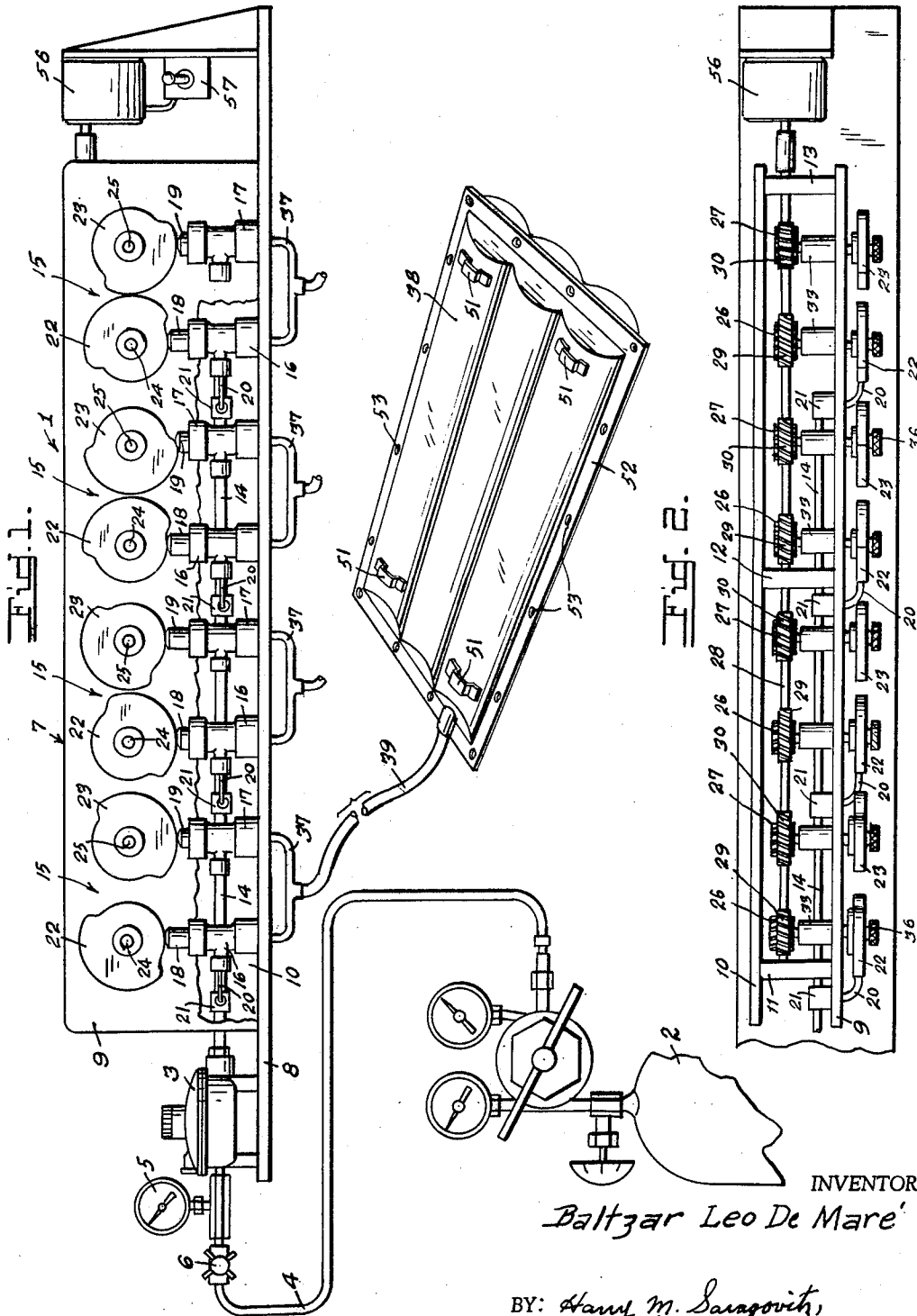
Feb. 3, 1970

B. L. DE MARÉ
PNEUMATIC POSITIONER

3,492,988

Filed Sept. 1, 1967

3 Sheets-Sheet 1



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Fig. 3.

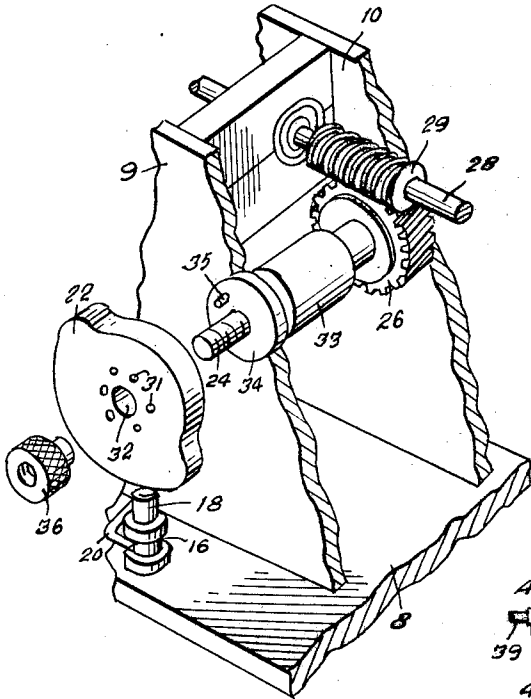


Fig. 4.

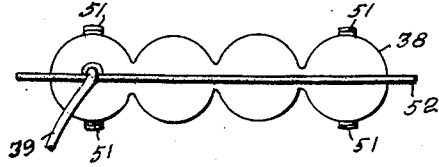


Fig. 5.

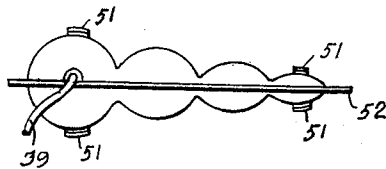


Fig. 6.

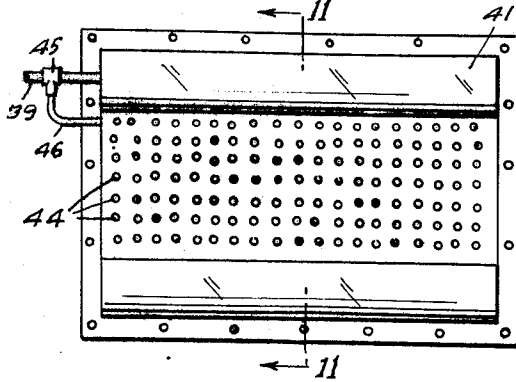
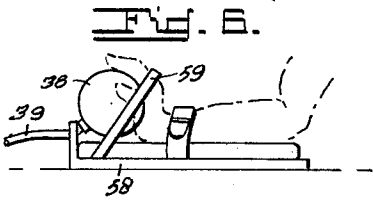


Fig. 7.

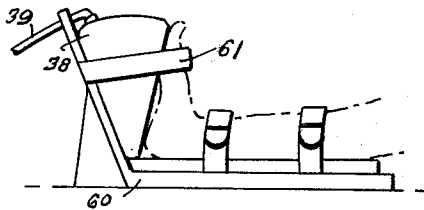


Fig. 8.

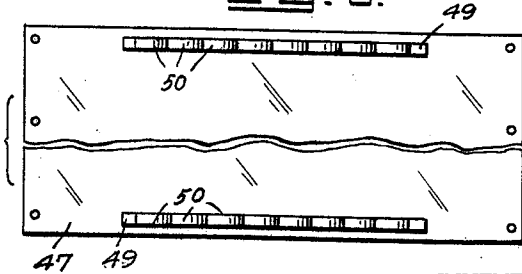
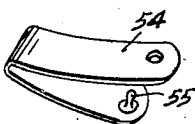


Fig. 10.



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Fig. 11.

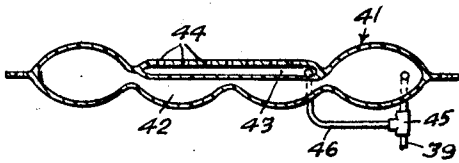


Fig. 12.

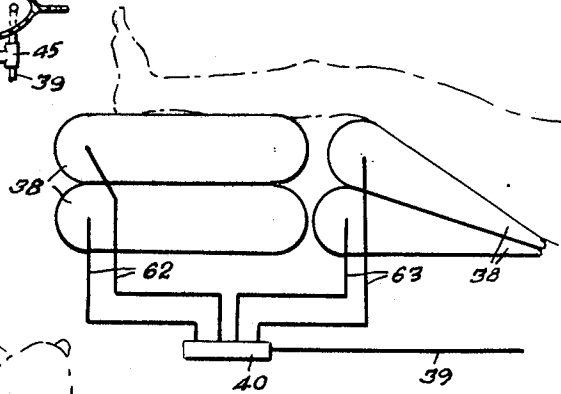


Fig. 13.

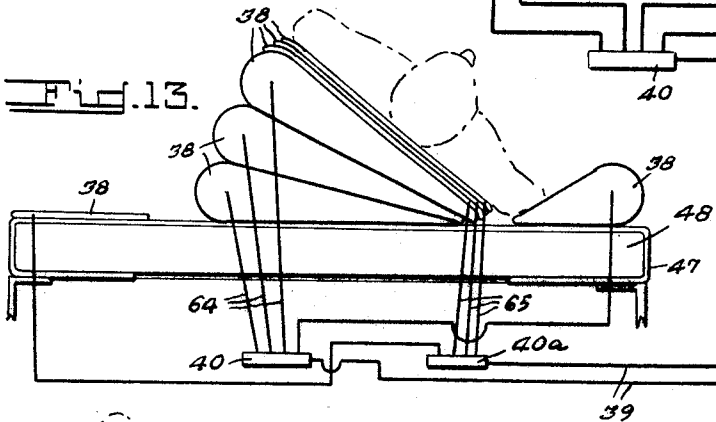


Fig. 14.

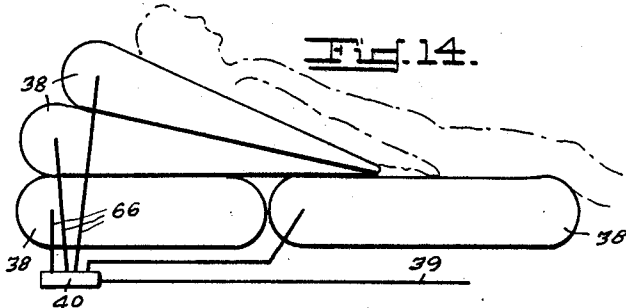
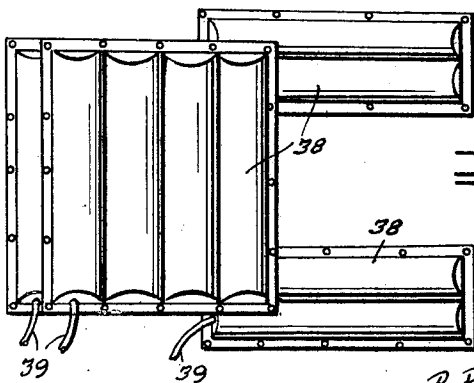


Fig. 15.



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5 Claims

ABSTRACT OF THE DISCLOSURE

A pneumatic positioner in which a series of inflatable cushions placed at selected positions relative to the body and/or limbs of a bed-ridden patient are alternately inflated and deflated by pressurized air from a source, and controlled by a valve mechanism, for alleviating the discomforts of lying in bed for a prolonged period of time.

The invention described herein may be manufactured, used, and licensed by or for the Government for governmental purposes without the payment to me of any royalty thereon.

Bed patients require frequent shifting of their positions to prevent formation of bed sores. Also limbs must be exercised to prevent stiffness and to aid blood circulation, and strenuous labor on the part of the attendant is required.

The crowded conditions and shortage of personnel as well as rising labor costs are becoming acute.

The present invention is designed to relieve the aforesaid conditions by providing a device that will replace personnel and perform shifting, lifting and limb flexing by using inflatable cushions which are placed at advantageous points under a patient. The cushions are adapted to be inflated and deflated by a valve mechanism to which pressurized air is supplied from a source.

The valve mechanism is driven by a small electric motor and may be operated by the patient. The valve mechanism is designed to service one or more bed patients as is desired.

In case of power failure, the valve mechanism may be operated by a hand pump, etc.

It is therefor a prime object of this invention to provide an automatically operated pneumatic means for the manipulation of a bed patient's body and/or limbs.

Another object is to provide a valve mechanism designed to permit automatic inflation and deflation of a cushion, or cushions, which are placed at advantageous positions under the body or limbs of a bed patient.

A further object of the invention is to provide inflatable cushions of varied construction and sizes for the performance of pneumatic therapy.

A still further object is to provide means for the performance of pneumatic therapy automatically to reduce manual labor and personnel required therefor.

A final object is to provide a series of cams driven by a motor for cycling the valve mechanism to effect alternate inflation and deflation of the cushions.

These and other objects and advantages of the present invention will be fully apparent from the following description when taken in connection with the annexed drawings in which:

FIG. 1 is a side elevation, partly broken away to expose mechanism of the pneumatic positioner of the present invention and showing, in perspective, one of the inflatable cushions;

FIG. 2 is a top plan view of the valve and cam mechanism;

FIG. 3 is a fragmentary perspective view of a portion of the valve mechanism and showing the gearing arrangement which drives the cams that alternately depress the valve plungers;

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FIG. 4 is an end view of the cushion shown in FIG. 1; FIG. 5 is a similar view of a wedge shaped cushion; FIG. 6 illustrates a ball shaped cushion as applied for flexing a patient's wrist;

FIG. 7 is a similar view showing a wedge cushion as applied for flexing a patient's angle;

FIG. 8 is a top plan view of a modified cushion for supplying ventilation;

FIG. 9 is a top plan view of a sheet having strips of loops to used in preventing displacement of the cushion, or cushions when in their positions on the bed;

FIG. 10 is a perspective view of a fastener for securing a cushion to the loops on the sheet of FIG. 9;

FIG. 11 is a cross sectional view taken along the line 11—11 of FIG. 8;

FIG. 12 is a schematic view in which an arrangement of positioners are shown to flex the leg of a patient and showing a manifold for the air line connection;

FIG. 13 is another arrangement for rocking a patient's body from side to side to an angle of 45°;

FIG. 14 shows the arrangement for raising a patient to a semi-reclining position;

FIG. 15 is a schematic view showing an arrangement of cushions for lifting a patient into a position for placement of a bed pan thereunder.

With reference to the drawings in which like reference numerals designate like parts throughout, reference numeral 1 indicates generally the pneumatic positioner of this invention generally and is shown assembled in FIG. 1.

A portion of a tank containing pressurized air or nitrogen is indicated by 2 which is connected to a standard pressure regulator 3 by an air supply line 4.

A pressure gage 5 in line 4 provides means for the reading of pressure which may be regulated as desired by a valve 6 in line 4 between tank 2 and pressure regulator 3 for hand operating by a patient or an attendant.

A cycling and control mechanism is indicated generally by 7 and consists of a base 8 on which is mounted a pair of spaced, vertical plates 9 and 10 and which are reinforced by spacers 11, 12 and 13, see FIG. 2.

An air line 14 is connected at one end to pressure regulator 3 and extends longitudinally between plates 9 and 10 and is supported in spacers 11, 12 and 13.

As seen in FIG. 1, there are four cam and valve units and are indicated generally by 15, however this number may vary as to the requirements therefor.

Each unit consists of a pair of plunger type valves 16 and 17, valve 16 being the inlet valve and 17 the exhaust valve, the valve plungers being indicated by 18 and 19.

Valves 16 and 17 are mounted on base 8 and the inlet valve 16 is connected to air line 14 by a branch line 20 and a connection 21. Valves 16 and 17 are mounted outside plate as shown.

Valves 16 and 17 are of the standard plunger type in which a spring biased plunger slides in a housing, therefore no detailed description will be necessary thereof.

A pair of cams 22 and 23 are mounted one each on idler shafts 24 and 25 which are journaled in plate 9. The cams 22 and 23 are mounted on the end of shafts 24 and 25 outside the plate 9 and cam 22 is in contact with plunger 18 while cam 23 contacts plunger 19, as seen in FIG. 1.

The inner ends of shafts 24 and 25 are provided worm gears 26 and 27 which rotate therewith, see FIG. 2.

A drive shaft 28 is longitudinally mounted in the mechanism 15 and is journaled in spacers 11, 12 and 13, see FIG. 2, and a pair of worms 29 and 30 are carried thereon. Worm 29 meshes with gear 26 on shaft 24 while worm 30 meshes with gear 27 on shaft 25.

Cams 22 and 23 are of a contour that will operate to slide plungers 18 and 19 to open and close valves 16 and 17.

17. The cycle may be varied by the design of the cam as desired so that the inlet valve 16 will be open, while exhaust valve 17 will be closed or vice versa.

Another method of varying the cycle of valve operation by which valves 16 and 17 may be timed is shown in FIG. 3 wherein the cams 16 and 17 may be removed.

Only an inlet valve of the unit is shown in this figure, since all valves are similar, both in construction as well as their mounting.

Cam 22 (also cam 23) is shown as provided with a series of holes 31 arranged in a circle around its axial mounting bore 32.

Journal bearing 33 on shaft 24 has an annular flange 34 extending outside plate 9, and this flange carries a pin 35 near its periphery as shown.

In assembly, the cam 22 is positioned as desired whereby pin 35 will enter one of the holes 31 and the cam 22 is then secured on shaft 24 by a nut 36.

In each valve unit, valve 16 and 17 are connected by a Y-shaped conduit 37.

In FIG. 1, there is illustrated one of the inflatable cushions 38 that will be placed on a patient's bed and positioned at a point under the body or limbs to be manipulated.

Cushion 38 is connected to the Y-shaped connection 37 by a flexible hose 39 as shown.

Each unit 15 is capable of servicing more than one cushion and when this is necessary, a manifold will be used, as seen in schematic FIGS. 12 and 13 wherein the manifold is designated by 40.

While four units 15 are shown in the cycling and control mechanism 7, more may be added to service a greater number of bed patients.

Cushions 38 are constructed of a heavy fabric such as used for high quality air mattresses and it may be a full size one as seen in FIG. 1, or a half size as seen in FIG. 15. The shapes may vary according to the use intended. Some examples are shown in FIG. 5 wherein the cushion is wedge shaped and in FIG. 6 wherein the cushion is a ball.

A ventilating cushion, indicated generally by 41 is shown in FIGS. 8 and 11 for relieving perspiration of the patient.

Cushion 41 is divided into upper and lower compartments 42 and 43, compartment 42 being the main cushioning area while compartment 43 being the ventilating compartment.

Compartment 43 is provided with ventilating holes 44 in its upper wall as shown.

Hose 39 is connected to a T-connector 45 and a branch line 46 connects T-connector 45 with compartment 43 so that, in operation, air will be directed into compartments 42 and 43. Since by-pass 46 is smaller in diameter than hose 39, a smaller amount of air will be directed into compartment 43 and cause a gentle flow of air through holes 44.

Cushions 38, when placed in various positions under the patient are apt to become displaced, and means are provided to secure them to one another or on the bed and consists of a sheet 47 as seen in FIG. 9 and will be of suitable material and a size applicable for use on the size bed it covers and will be applied in the usual manner as seen in FIG. 13 with the ends tucked under the mattress 48.

Strips of material 49 will be sewed on sheet 47 as expedient, and strips 49 will be formed to provide loops 50.

Cushions 38 are provided with loops 51 placed also at expedient points thereon, and cushions 38 are provided with a flange 52 (see FIG. 1). Flange 52 is provided with grommets 53 at point there as shown. (The flange 51 will extend on all sides of the cushion.)

A fastener 54 is shown in FIG. 10 and is provided with a snap fastener at its ends as at 55.

Fastener 54 will snap through grommets 53 on cushions

38 or loops 50 on sheet 47 to secure two or more cushions together or to secure cushions 38 on sheet 47.

The operation of the device is simple and is easily set up for use.

The cushions 38 are placed at the selected positions and secured to the sheet 47, then connected to a hose 39.

After all hose connections are completed, valve 6 is opened and regulated to the desired pressure shown on gage 5.

Air is then admitted to valves 16 and 17 of the units 15 and the cams 22 and 23 are driven by a small electric motor 56 which may be operated by the patient by a switch 57.

Once the motor 56 is energized, air will be alternately admitted and exhausted in cushions 38 by cams 22 and 23 opening and closing valves 16 and 17.

The cycling and control mechanism 7 may be placed on a table near the patient for convenience of operation at will of the the switch 57.

In FIGS. 6, 7, 12, 13, 14 and 15 there are shown several arrangements of cushions 38 to perform pneumatic therapy for patients.

FIG. 6 shows the manner in which the wrist of a patient is flexed.

In this figure, cushion 38 is in the shape of a ball. The arm of the patient may be secured on L-shaped bracket 58 and secured by an elastic strap 59. Cushion 38 is placed in the palm of the patient's hand and when it is inflated, the hand is raised to flex the wrist.

For flexing the ankle of a patient, as seen in FIG. 7, a different shaped bracket 60 is used and a cushion of wedge shape is placed between a leg of the bracket and foot. The foot is held by an elastic strap 61. The manner of operation is the same as shown in FIG. 6.

An arrangement for flexing the leg of a patient is shown in FIG. 12 wherein two half size cushions 38 of the type shown in FIG. 1 and two wedge shaped cushions 38 are used. The two full sized cushions are placed under the leg of the patient and are supplied with air from hose 62 leading from manifold 40, while the two wedge shaped cushions are placed under the thigh, as shown, the wedge shaped cushions being supplied with air from hose 63 leading to manifold 40 which is connected to valves 16 and 17 by hose 39.

In operation, the two full size cushions and the two wedge shaped cushions will be alternately inflated and deflated simultaneously, thus alternately raising and lowering the leg.

Another arrangement of cushions 38 is seen in FIG. 13 for rocking the body of a patient from side to side. In this arrangement six full sized wedge cushions 38 and two half size cushions 38 are used.

The six full size wedge cushions are placed under the patient's body, as shown, and a smaller wedge cushion placed on each of his sides to prevent the patient from rolling off the bed.

As shown, three full sized lower cushions are inflated through hose 64 from manifold 40 and also the wedge cushion at the right from the same manifold. In this position, the patient's body assumes approximately a 45° angle to the right.

When the aforesaid cushions are deflated, the three cushions on top of the lower cushions are inflated as well as the wedge cushion on the left from a second manifold 40a through hose 65, the patient's position is reversed. Thus the body can be rocked from side to side.

Since two manifolds 40 and 40a are used, it is necessary to also use two valve and cam units 15 to perform the aforesaid operation, two lines 39 are shown.

The body of a patient may be raised into a semi-reclining position as shown in FIG. 14 wherein two cushions of the type shown in FIG. 1 and two wedge cushions are employed. The cushions 38 are all in connection with manifold 40 by hose 66.

The aforesaid arrangement can also be used if it is desired to elevate the patient for placement of a bed pan.

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The arrangement of the cushions is the same as in FIG. 14 except that two of the cushions on which the patient sits will be cushions of half size as seen in FIG. 15.

Other arrangements are possible by varying the size and shape of cushions 38 and cycle of operation.

While only preferred forms of the invention are shown and described, other forms of the invention are contemplated and numerous changes and modifications may be made therein without departing from the spirit of the invention as set forth in the appended claims.

What is claimed is:

1. A pneumatic positioner for the automatic manipulation of the body and limbs of a bed patient and comprising, at least one inflatable cushion for placement on a bed and adjacent the body and limbs of said patient, said cushion being divided along a substantial portion of its medial length to form an upper and lower compartment, there being vent holes in the upper wall of said upper compartment, an air supply hose connected to said lower compartment, and a branch air hose of smaller diameter than said air supply hose in connection between said air supply hose and said upper compartment whereby said upper compartment will be supplied with air of lower pressure than said lower compartment, means for preventing displacement of said cushion on said bed, means for supplying pressurized air to said cushion, and a mechanism for cycling and controlling said air and being in fluid connection between said air supplying means and said cushion, said mechanism being adapted to alternately inflate and deflate said cushion.

2. A device as set forth in claim 1 wherein said cushion comprises an inflatable envelope of flexible material, a flat, non-inflatable flange surrounding its perimeter and being disposed medially therewith, and a series of grommets arranged in spaced relation therein whereby two or more cushions may be secured together.

3. A device as set forth in claim 1 wherein said means for supplying pressurized air to said cushions comprises a tank of pressurized air, an air line in fluid communication between said tank and said cushions, an air flow regulator in said air line, a shut off valve in said line and a pressure gage in said air line between said shut off valve and said regulator.

4. A pneumatic positioner for the automatic manipulation of the body and limbs of a bed patient as set forth in claim 3 in which the means for preventing displacement

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of said cushion on said bed comprises a sheet for placement over said bed, at least one elongated strip of material fastened on said sheet, said strip being formed to provide a series of loops, there being a series of loops on each side of said cushion and a fastening member adapted to be passed through said loops on said sheet and said cushion whereby said cushion will be secured against displacement while in use on said bed.

5. A pneumatic positioner for the automatic manipulation of the body and limbs of a bed patient and comprising, at least one inflatable cushion adapted for placement in selected positions on a bed and adjacent the body and limbs of said patient, means for supplying pressurized air to said cushion, a base, a pair of parallel plates rising from said base, a plurality of spacers between said plates, a driven shaft journaled in said spacers and disposed parallel with said plates, at least two worms carried by said driven shaft, at least two idler shafts journaled in a said plate and disposed normal to said driven shaft, a worm gear carried by the inner end of each said idler shaft and in mesh with a said worm, a cam carried by the outer end of each said idler shaft, an inlet and an exhaust valve housing on said base and disposed in longitudinal alignment, each said housing having a valve plunger therein and contacting the periphery of one of said cams, an air supply line supported by said spacers and connected to said means for supplying pressurized air, a branch air line connecting said air supply line with said inlet valve housing, a Y-conduit connected to said inlet and exhaust valve housings, and a flexible hose connected to said Y-conduit and said cushion whereby when said cam is rotated by said driven shaft, said inlet and exhaust valves will be operated by said plungers to alternately inflate and deflate said cushion.

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