

[54] THERAPEUTIC APPARATUS AND METHOD

1,371,332 7/1964 France..... 128/75

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[52] U.S. Cl..... **128/75, 128/71**

[57] **ABSTRACT**

[51] Int. Cl..... **A61h 1/02**

[58] Field of Search 128/75, 71, 70, 299, 300,
128/84

[56] **References Cited**
UNITED STATES PATENTS

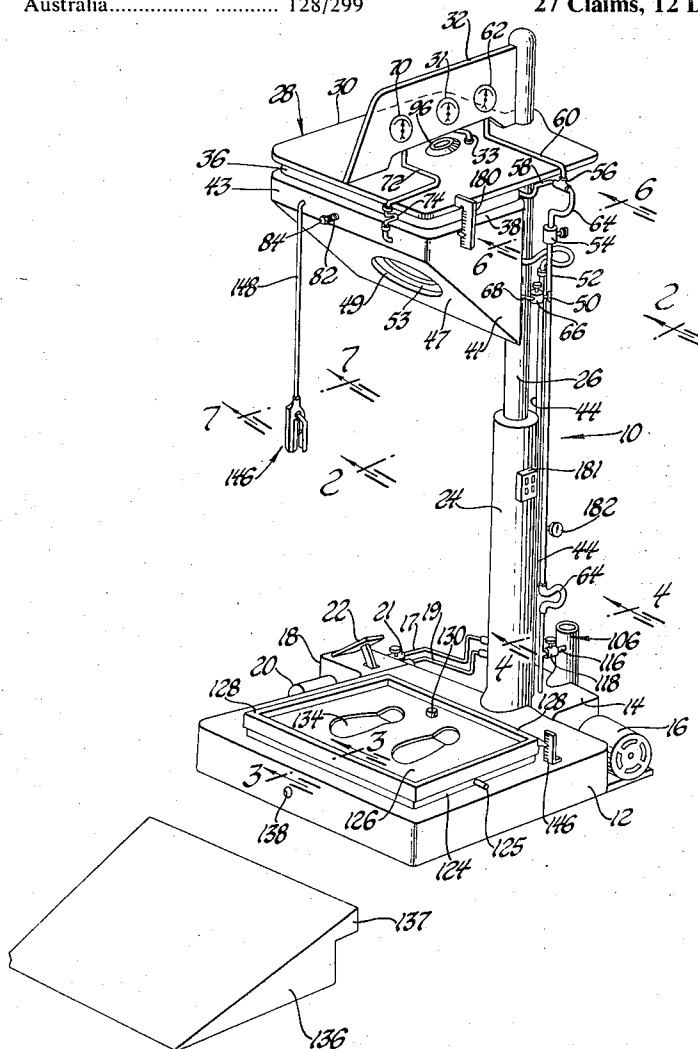
861,349	7/1907	Beaubien	128/299 X
2,227,673	1/1941	Price	128/352
2,655,145	10/1953	Heger	128/300 X
2,949,152	8/1960	Hipps et al.	128/75 X
3,202,152	8/1965	Wood et al.	128/300 X
3,207,160	9/1965	Heyns	128/299 X
3,236,231	2/1966	Schneider et al.	128/299 X
3,403,675	10/1968	Carr	128/75
3,413,971	12/1968	Evans	128/75
3,516,411	6/1970	Adler	128/300 X
3,570,479	3/1971	Horn	128/71

FOREIGN PATENTS OR APPLICATIONS

101,841	8/1937	Australia.....	128/299
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A therapeutic apparatus and method for stretching the neck muscles, spinal column, etc., as in the case of treatment of arthritis, pinched nerves and other similar human ailments, the method being controlled use of vacuum to lift the patient upwardly by the head, and one embodiment of the apparatus comprising generally a platform on which the subject stands, a vacuum chamber above the platform having an opening into which the subject's head is sealably inserted, a hydraulic piston-cylinder extending between the platform and the vacuum chamber by which the chamber can be adjusted to the patient, a vacuum-pressure pump for supplying the lifting vacuum and the pressure for sealing and other control purposes, the platform and the chamber having safety features for breaking the lifting vacuum under certain conditions.

27 Claims, 12 Drawing Figures



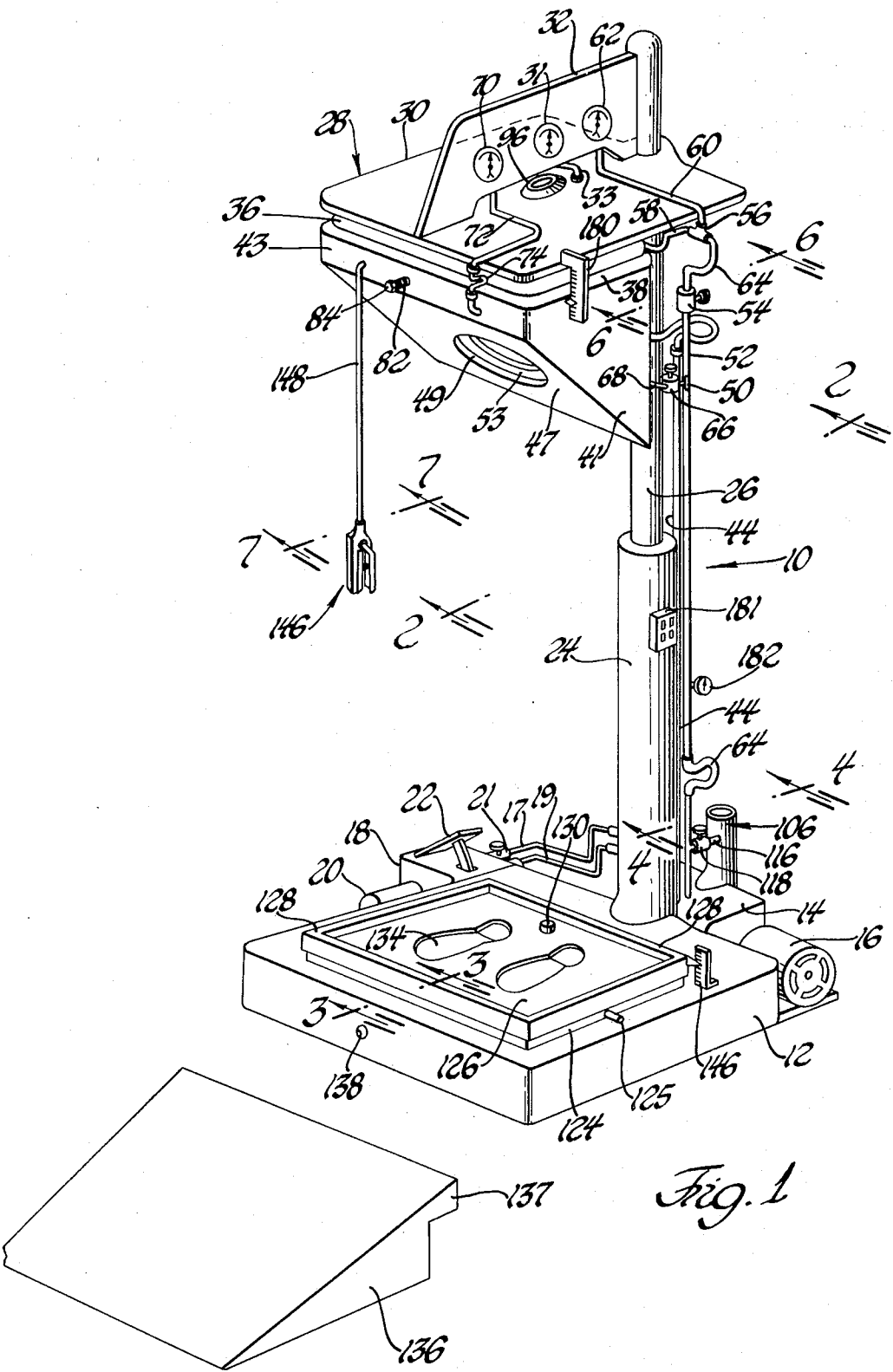
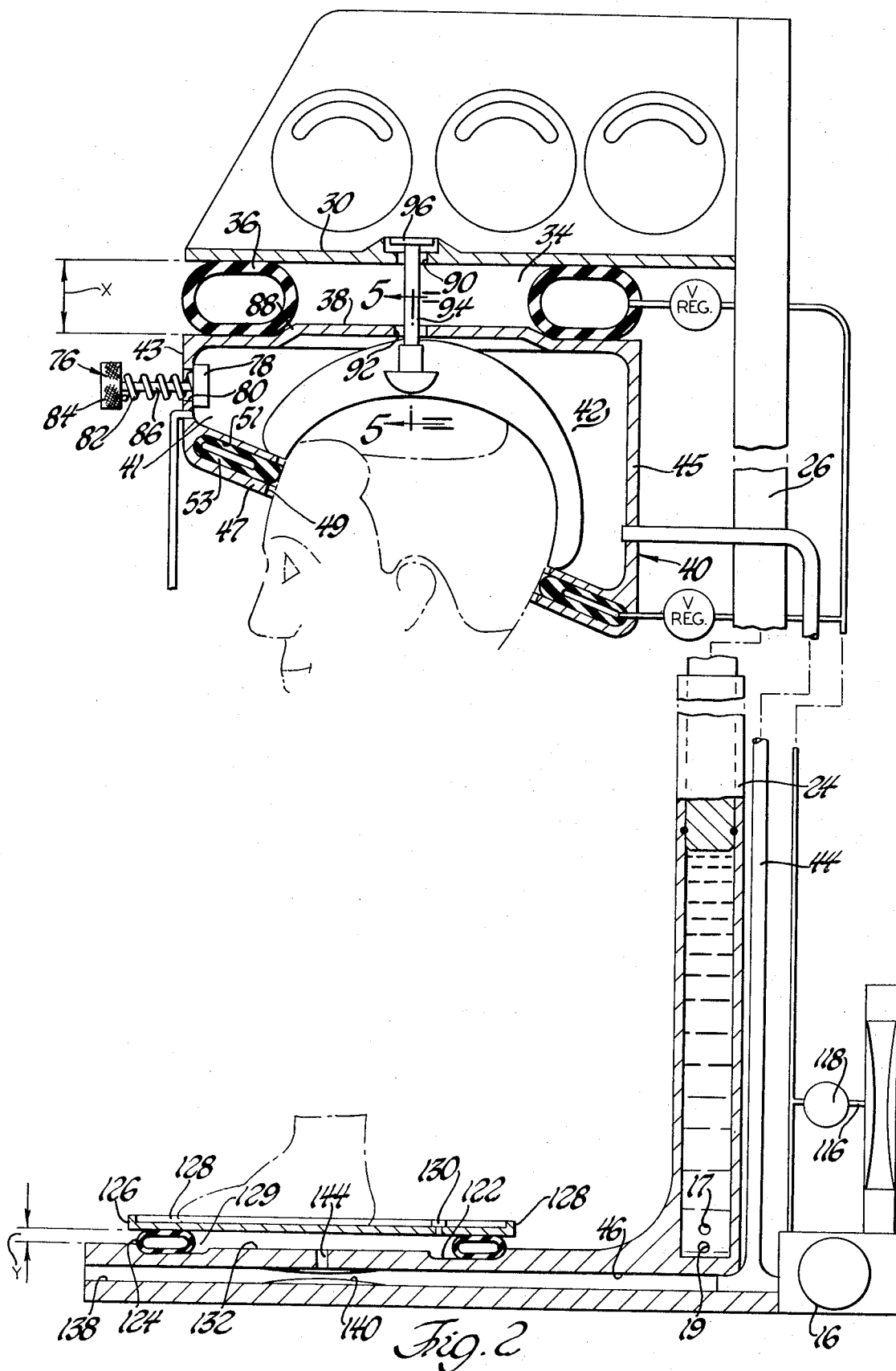


Fig. 1



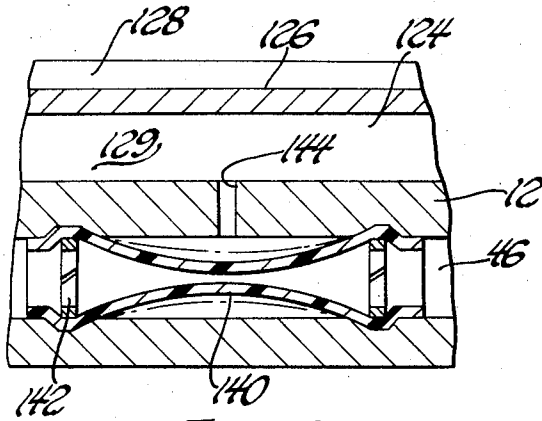


Fig. 3

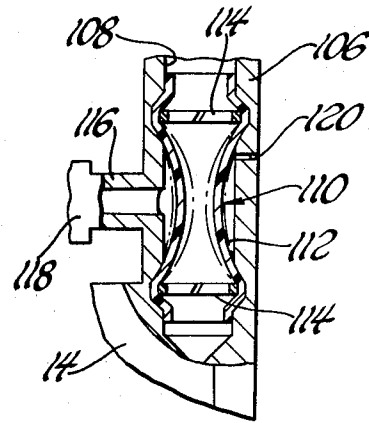


Fig. 4

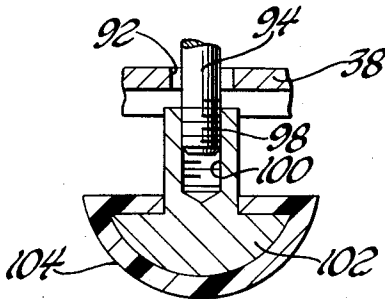


Fig. 5

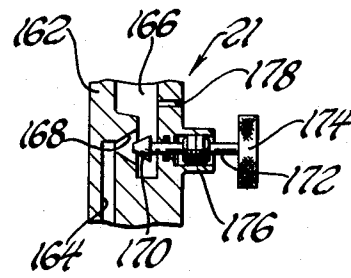


Fig. 6

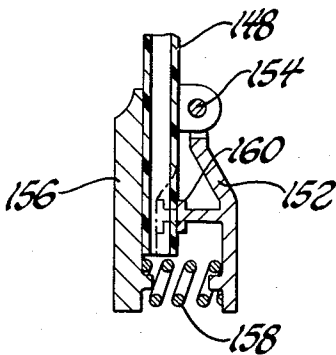


Fig. 7

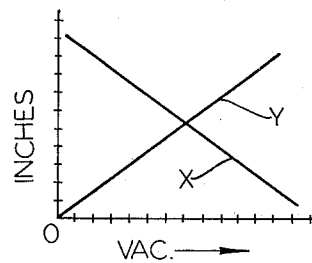


Fig. 8

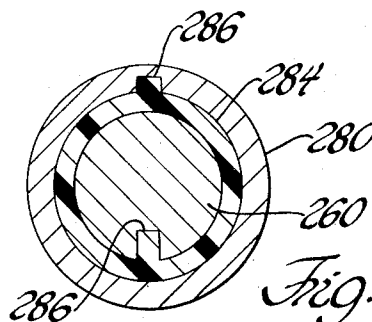


Fig. 10

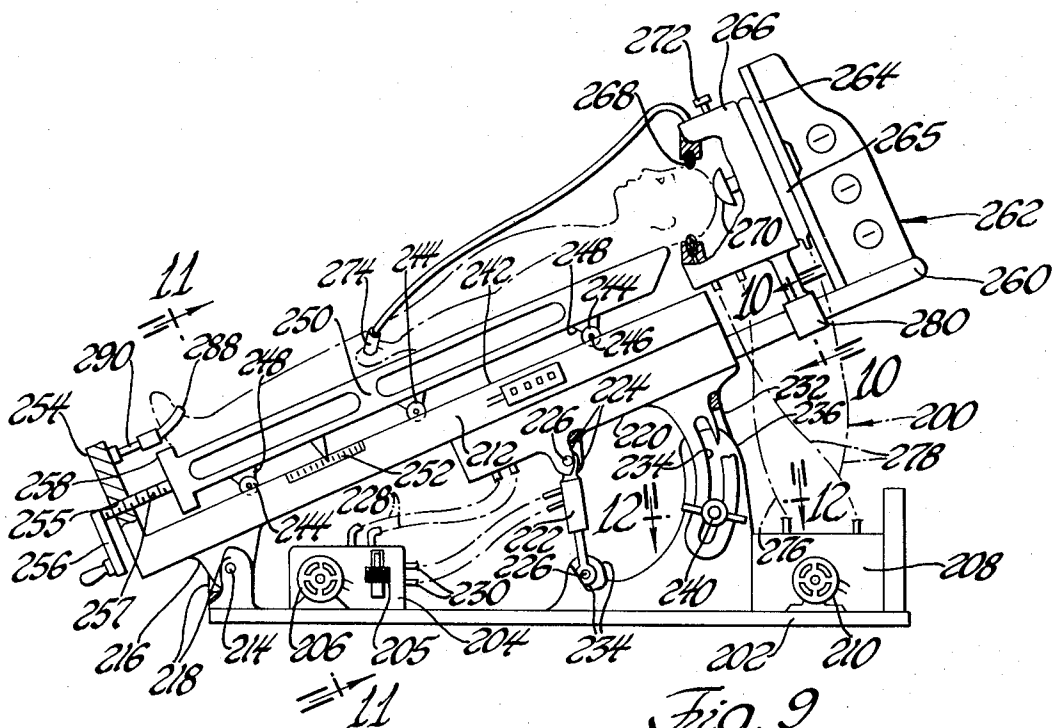


Fig. 9

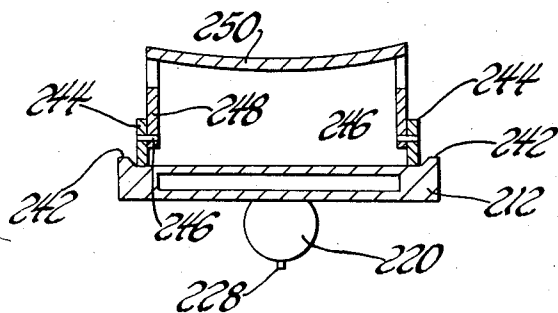


Fig. 11

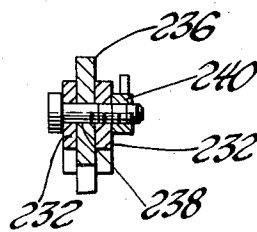


Fig. 12

THERAPEUTIC APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

Certain types of human ailments, particularly those manifesting pain caused by pinching of nerve tissue due to muscle spasms and/or compression fracture or deterioration of vertebrae, or herniation of intravertebral discs in the cervical, thoracic or lumbar regions, are sometimes alleviated, at least temporarily, by traction therapy. The theory of this treatment is that the pinching of the nerve, and thus the pain, is relieved by the stretching of the spinal column or the muscles.

Such traction may be accomplished by anchoring one end of the body, such as the feet, legs or hips, and pulling on the other end of the body, as by an attachment fitting on the head or under the chin, with a force prescribed by the doctor. In another method used for "neck-stretching" treatments for arthritis, the patient is lifted slightly, by any suitable means including a chin attachment, while seated on weighing scales so that the upward force can be determined.

Such treatments can themselves become quite uncomfortable, and often actually painful, depending upon their frequency and duration and the force applied.

It has been found that the discomfort or pain resulting from such neck treatment for arthritis is not in the neck, but in the patient's jaw, from the lifting on the chin straps or other attachments for periods of five minutes or longer, even where the force employed is fifteen small, 15 pounds for example.

It has been found, further, that it is possible to lift the patient's full weight, without any jaw pain, by apparatus that eliminates the need of a chin strap attachment.

This invention contemplates a method and apparatus wherein the patient is lifted from a standing or other position by atmospheric pressure using only the projected surface area of his head, chin straps and the like being completely eliminated and the stretching force being the gravitational force of the patient's own body weight.

SUMMARY OF THE INVENTION

Accordingly, a main object of the invention is to provide a method and apparatus for performing traction treatment of human ailments requiring such therapy.

Another object of the invention is to provide such a method and apparatus wherein the traction force is the gravitational force resulting from lifting the patient by the head.

Another object of the invention is to provide such a method and apparatus wherein the traction force is directly proportional to the extent to which the patient is lifted, from substantially zero to a maximum of the patient's weight when he is completely suspended.

Another object of the invention is to provide such a method and apparatus wherein the body is suspended vertically so that the spinal and/or muscular traction is in a direction wherein the spine is erect and freely suspended.

Another object of the invention is to provide such a method and apparatus wherein the patient is lifted by atmospheric pressure by the application of vacuum to an area of the patient's head.

A further object of the invention is to provide such apparatus wherein a primary vacuum chamber adjust-

ably suspended above the patient is adapted to be brought into sealing engagement with the top of the patient's head, the primary vacuum chamber communicating with an upper secondary vacuum chamber in a manner so as to allow limited controlled relative movement of the primary chamber toward the secondary chamber, whereby, upon the application of vacuum to the chambers, the patient will be lifted by the head.

Still another more specific object of the invention is to provide such apparatus comprising a base, a platform upon which the patient stands, an upper vacuum chamber, means extending between the base and the upper vacuum chamber for positioning the chamber with respect to the base, a lower vacuum chamber attached to the upper chamber in a manner to provide for movement of the lower chamber toward the upper chamber, the lower chamber having means for sealably receiving the top portion of the patient's head and vacuum and pneumatic means for controlling the application of vacuum to the vacuum chambers.

These and other more specific objects and advantages of the invention will become more apparent to those skilled in the art upon reference to the accompanying specification and claims, and to the drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of one form of therapeutic apparatus embodying the invention for practicing the method.

FIG. 2 is an enlarged side elevational view, with portions thereof cut away and in cross-section, taken in the plane of line 2—2 of FIG. 1, looking in the direction of the arrows.

FIGS. 3 and 4 are enlarged fragmentary cross-sectional views taken in the planes of lines 3—3 and 4—4, respectively, of FIG. 1, looking in the direction of the arrows.

FIG. 5 is a fragmentary, enlarged cross-sectional view taken in the plane of line 5—5 of FIG. 2, looking in the direction of the arrows.

FIG. 6 is a fragmentary, enlarged cross-sectional view taken on the plane of line 6—6 of FIG. 1, looking in the direction of the arrows.

FIG. 7 is a fragmentary, enlarged cross-sectional view taken on the plane of line 7—7 of FIG. 1, looking in the direction of the arrows.

FIG. 8 is a graph illustrating qualitatively some of the functional characteristics of the invention.

FIG. 9 is a side elevational view illustrating a modification of the apparatus shown in FIGS. 1—8.

FIGS. 10, 11 and 12 are enlarged, cross-sectional views taken on the planes of lines 10—10, 11—11 and 12—12 of FIG. 9, looking in the direction of the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With the above introduction, reference is now made to the drawings, and particularly to FIGS. 1—8, showing, for purposes of illustration only, one embodiment of a therapeutic apparatus embodying the invention.

The apparatus 10 comprises a stable base 12 of any suitable configuration, the base having associated therewith a combination vacuum-pressure pump 14 driven by a motor 16 and a hydraulic pump 18 driven by a motor 20 and having a manual activator or foot

pedal 22. Hydraulic lines 17 and 19 extend between the pump 18 and the cylinder 24, pressure line 17 having a manual control valve 21. The structural details of such pumps are well known in the art and are not shown. However, the functions thereof in apparatus 10 will be explained as the description proceeds.

Extending upwardly from the base is a hydraulic cylinder 24 receiving a piston 26 having fixedly secured at the upper end thereof a support bracket 28 comprising a horizontal plate 30 and a vertical member 32.

In addition to mounting various gauges, indicators, fluid lines and the like, which will be described, bracket 28, specifically the plate 30 thereof, forms the upper wall of an upper or secondary vacuum chamber 34, the side walls of chamber 34 being formed by the inflated hollow elastomeric torus 36 which is cemented or otherwise sealably attached to the bottom surface of plate 30. In effect, the torus 36 comprises a continuous, resilient compressible wall such that the chamber 34 is of variable volume.

The bottom side of the torus 36 is likewise cemented or otherwise attached and sealed to the upper wall 38 of a hollow housing 40 of any suitable configuration and forming a primary vacuum chamber 42. The remainder of the housing 40 is formed by identical side walls 41, a front wall 43, a rear wall 45 and a resulting sloped bottom wall 47, the latter having an annular opening 49 formed with an annular recess 51 containing an inflatable hollow elastomeric seal torus 53, the purpose of which will be described.

Referring again now to the pump 14, it will be noted that a vacuum conduit 44 extends from the vacuum side of the pump to the chamber 42 while a branch vacuum conduit 46 extends into the base, for a purpose to be described. A vacuum gauge 31 connects by a conduit 33 to the chamber 34.

Similarly, a pneumatic pressure conduit 48 extends upwardly from the pressure side of the pump 14 to a T fitting 50. From the T fitting 50, a branch conduit 52 extends upwardly to a manual pressure regulating valve 54, and then to another T fitting 56, from which one branch conduit 58 communicates with the torus 36 and another branch conduit 60 connects with any suitable pressure gauge 62. Note that conduit 52 includes flexible portions 64, for a purpose that will become evident. Another pressure regulating valve 66, which may be identical to valve 54, may be connected to T fitting 50 and to a flexible branch conduit 68 communicating with the seal torus 53. A pressure gauge 70 connects by a conduit 72 having a flexible portion 74 to the torus 53.

Excessive vacuum in primary chamber 42 is prevented by the valve assembly 76 in wall 43, the assembly comprising a springbiased valve member 78 for closing the bleed opening 80 at all vacuum values less than a predetermined value set by preloading the spring 82 by means of the nut 84 on the threaded stem 86.

Plate 30 and wall 38, which is shown beveled at 88 to locate and support torus 36, have aligned openings 90 and 92, respectively, receiving loosely therein a valve stem 94 having a valve body 96 sealing opening 90 by gravity and the action of vacuum therein, the clearance of the stem 94 in the opening 92 at all times communicating vacuum in chamber 42 to chamber 34.

As more clearly seen in FIG. 5, the free end of stem 94 is threaded at 98 and received in a member 102 in-

ternally threaded at 100 and having a protective sponge or other soft cover 104. Whatever the vacuum in chambers 34 and 42, any upward or lateral movement of stem 94 due to contact with the patient's head will unseat valve 96 and bleed the vacuum to atmosphere as an additional safety feature to prevent pulling the patient's head into chamber 42 too far.

Referring again to the vacuum-pressure pump 14, it will be noted that the vacuum pump exhaust outlet 106 comprises a passage 108 having an adjustable flow valve 110 to limit, as another safety feature, the maximum vacuum produced by the pump, and thus in the conduits 44 and 46 and the chambers 34 and 42.

The valve 110 comprises an elastomeric sleeve or tube 112 sealably retained at its ends against the wall of the passage 108, so as to prevent leakage, by any suitable means, such as split, spring expanding rings 114. In its free position, the sleeve 112, intermediate the rings 114, would be expanded by its own dimensions and resiliency, to engage the inner wall of the passage 108.

A conduit 116 connects between passage 108 and pressure conduit 48, through a manual pressure control valve 118. Limitation of pump vacuum is accomplished by restricting, and thereby increasing the back pressure in, the vacuum pump exhaust passage 108.

The adjustable restriction of the passage 108 is accomplished by applying sufficient pressure from conduit 48, as controlled by valve 118, around the outer surface of tube 112 to constrict the same, as shown in solid and broken lines in FIG. 4, the degree of constriction varying with the pressure applied. A small bleed passage 120 to atmosphere may be provided to bleed the constricting pressure to atmosphere when the valve 118 is closed.

A feature of the apparatus yet to be described is shown in FIGS. 1, 2 and 3. The base 12 is formed with an annular or other ring depression 122 locating an inflated hollow elastomeric torus 124 having a valve 125 for inflation thereof. A platform 126 having a peripheral flange 128 is supported by the inflated torus 124, and the torus is preferably cemented or otherwise sealably attached to base 12 and platform 126 so as to provide a sealed, pneumatic, compressible control chamber 129, which may have means 130, such as a valve, enabling the chamber to be pressurized if so desired. The inner raised portion 132 defining the depression 122 may be provided to decrease the volume of the chamber, if so desired.

Footprints 134 may be provided on the platform 126, which forms the upper wall of chamber 129, to locate the position at which the patient is to stand. Also, a portable ramp 136 having a portion 137 for abutting the platform 126 may be provided, in the event the patient is confined to a wheel chair, which may be located and retained by the peripheral flange 128.

Reference was previously made to the branch vacuum passage 46, which extends through the base 12 and below the chamber 129, the passage opening to atmosphere, as at 138. The passage 46 is provided with an elastomeric sleeve 140 retained at its ends by split, spring retaining rings 142, and a passage 144 communicates chamber 129 with the clearance between the wall of passage 46 and the outer surface of sleeve 140.

The sleeve 140 thus comprises a valve that is substantially open when there is no weight on platform 126 and closed when a patient is standing with his full weight

bearing on the platform, the operation of sleeve 140 being similar to that of sleeve 112 of FIG. 4.

The torus 124, which may be inflated to any desired pressure, retains the unloaded platform 126 at some known elevation, as indicated by the pointer gauge 146, which may be calibrated in terms of pounds of patient weight. At such time, the pressure in chamber 129, which is transmitted through the passage, is not sufficient to constrict the sleeve 140 to close passage 46. However, when the patient is positioned on platform 126, the platform is urged downwardly against the predetermined resistance of the inflated torus 124, decreasing the volume of and increasing the pressure in chamber 129, the increased pressure being transmitted through passage 144 to constrict sleeve 140 sufficiently to close the passage 46.

When the weight on platform 126 is decreased, the reverse operation takes place, providing an automatic means for bleeding off, at predetermined conditions to be explained, the vacuum in the primary and secondary vacuum chambers 42 and 34, respectively.

Another safety feature controlled by the patient that may be provided is the manual vacuum bleed device 146 shown in detail in FIG. 7. A flexible conduit 148 capable of recovery from compression communicates with chamber 42 and opens to atmosphere at its free end 150; which may be closed by a hand grip comprising a movable element 152 pivoted at 154 and urged away from fixed member 156, to which the conduit 148 may be cemented, by the spring 158.

When the element 152 is depressed by the patient against spring 158, the foot 160 extending therefrom closes the conduit 148, allowing chamber 42 to be evacuated. If, for any reason the patient releases the device 146, the action of spring 158 will allow the conduit 148 to open, by its own resiliency and recovery to original shape, and bleed the vacuum to atmosphere.

FIG. 6 illustrates the typical structure of manual control valves 21, 54, 66 and 118, any one of which, if preferred for a more sophisticated apparatus 10, could be replaced by automatic control means. Basically, the valve, such as valve 21, comprises a body 162 having an inlet 164, an outlet 166, a valve seat 168 and a valve 170 positioned by a stem 172 adjusted with the knob 174 by threaded means 176. A calibrated bleed passage 178 may be provided to bleed the pressure to atmosphere when the valve is closed.

OPERATION

To explain the operation of the apparatus 10, it will be assumed that there is a patient that requires traction therapy and that the apparatus is shut down, with the control valves 21, 54, 66 and 118 closed.

The patient, if ambulatory, is directed to stand erect on the footprints 134 of platform 126. If the patient is in a wheel chair, the wheel chair is rolled backwards up the ramp 136 and onto the platform, and the patient is made to sit erect. Depending upon the weight on platform 126, it may be necessary or desirable to adjust the pressure in chamber 129 and/or in the torus 124.

Next, the operator turns on the hydraulic pump 18, as by a switch on the control panel 180, and carefully lowers the piston 24 until the primary chamber 42 partially encloses the patient's head, with the deflated torus 53 being positioned substantially as shown in FIG. 2. The foot pedal 22 may, of course, be used to effect minute adjustments of the piston.

Having approximately located the primary vacuum chamber, the operator, who, it is assumed, has been thoroughly trained in the operation of the apparatus, activates the pressure-vacuum pump 14 and, by opening the valve 66, pressurizes torus seal 53, causing it to contract inwardly to provide a pneumatic seal about the circumference of the patient's head. Ideally, the torus pressure required is that just sufficient to maintain a suitable pressure differential, taking into account head movement and a certain amount of leakage through the patient's hair, etc., across the pressure-responsive area, which is defined by the circumference of the patient's head at the torus seal, projected on a horizontal plane.

That is, the patient is to be lifted from his head by the action of atmospheric pressure upon the effective area, as defined above, of that portion of his body below the seal and the lesser pressure over the effective area above the seal. The initial pressure in torus 53 may be reduced, at a later stage after the remainder of the system has been balanced, to the minimum pressure necessary to perform the function required, in order to not restrict blood circulation past the seal.

The next step is to activate (evacuate) the primary chamber 42, and thus the secondary chamber 34, to a pre-approximated vacuum value based upon a prior physical measurement of the patient's head circumference. It should be understood that this head measurement is only for approximation of vacuum value; it will not be relied upon for the final degree of accuracy required.

It will be appreciated that as the vacuum is very slowly increased in chambers 42 and 34, certain resulting movements will occur in the apparatus which must be carefully observed by the operator.

First, due to the face that torus 36 is a flexible, inflated elastomeric, and thus compressible, the dimension X (see FIG. 2) will decrease with increasing vacuum, as can be observed on the pointer gauge 180. Secondly, due to the seal of torus 53, the patient's head will tend to be drawn into chamber 42 with increasing vacuum. Thirdly, as soon as any lifting of the patient occurs, inflated torus 124 will correspondingly raise (dimension Y in FIG. 2 increases) the platform 126 toward its original unloaded position, due to the decreased weight on the platform, as can be observed on gauge 146.

The ideal or desired operation is for the dimension X to decrease at the same rate as the dimension Y (patient's weight on platform 126) increases, without any significant change in the original position of torus seal 53 on the patient's head. This is shown qualitatively in FIG. 8.

Accordingly, as the operator slowly increases the vacuum, he simultaneously observes the position of the torus head seal and gauges 146 and 180. If X is decreasing, but the torus seal 53 is shifting upwardly on the patient's head, then the vacuum in chambers 34 and 42 is too low (pressure too high), and the pressure in torus 36 must be increased slightly, by opening valve 54 and observing gauge 62, to increase the resistance (opposing pressure) of torus 36 to upward movement of chamber 42. This is so that the vacuum applied to the patient's head can be increased without pulling chamber 42 away from his head.

If, on the other hand, the reverse result is observed, i.e., dimension X does not decrease with increasing

vacuum, as shown on gauge 70, but dimension Y is increasing (weight on platform 126 is decreasing), then the patient's head is being drawn into the primary vacuum chamber 42 because the vacuum therein is too high or the pressure in torus 36 is too high.

It is for such reasons that the technician or operator must be thoroughly trained so as to be familiar with the operation and prepared to take corrective action.

During the initial adjustment, it is desirable for the technician to make frequent lifting adjustments of the hydraulic piston 26, as by the foot pedal 22, so that when the torus seal 36 is being inflated, and before any vacuum is applied, the patient is already standing on his toes, whereby the initial vacuum physically lifts the patient rather than merely moving him from a flat-footed to a tip-toed position.

Operation of the apparatus is clarified by noting that during training, the technician should be made to frequently "drop" the patient by releasing the sealing pressure in torus 53. This enables the technician to develop a technique for limiting the lift vacuum to a value just sufficient to lift the patient, and at which any minute increase in leakage at torus 53 will result in a drop or inability to maintain the patient suspended. Likewise, the operator will develop a feel for the minimum effective head seal.

In order to prevent any possibility of injury to the patient due to his own action or due to excessive vacuum in the system or in the chambers 42 and 34 for any reason, certain automatic safety features are provided.

First, the maximum vacuum that the pump 14 can generate, as read on gauge 182, is controlled by setting the valve 118 so that sleeve 112 restricts the vacuum pump exhaust outlet 106. Once set, the pump cannot exceed the selected maximum vacuum.

Secondly, and independently of the control of the vacuum pump, the spring-biased valve 78 will automatically bleed chamber 42, the vacuum in which is read on gauge 31, to atmosphere when a predetermined vacuum, as determined by the force of spring 82, is exceeded.

Additionally, prior to application of vacuum, the member 104 (FIG. 5) is adjusted so that any lateral or upward movement of the patient's head will automatically open valve 96 to bleed chambers 34 and 42 to atmosphere.

Finally, if the patient should for any reason release the optional device 146, which he is instructed to squeeze during the treatment so as to close bleed conduit 148, the open conduit will bleed the vacuum to atmosphere. Also, reduction of weight on the platform below some predetermined setting will open valve 140 to the atmosphere to reduce or nullify the lifting force.

MODIFICATION

FIG. 9 illustrates a modification of the invention adapted for use in the case of bed patients.

It will be understood that many of the details employed in the embodiment illustrated in FIGS. 1-7 can or must also be employed in the modification illustrated in FIGS. 9-12, except as to be indicated. Accordingly, to simplify the description, many common and/or necessary elements, such as hydraulic, pneumatic and vacuum conduits, control valves, and the like, are not shown.

In the modified apparatus 200, the base 202 is mounted with a hydraulic pump 204, driven by motor 206 and having a manual pump 205, and a combination vacuum-pressure pump 208 driven by motor 210, similar to, and for the same purpose as, those employed in apparatus 10.

A main difference between the first-described embodiment and the modification is that it is adapted for traction therapy for a patient that is confined to bed. Accordingly, a tiltable support or platform 212 of any desired configuration is pivoted at one end thereof to one end of the base by any suitable means, such as a pin 214 extending through the lug 216 positioned between spaced supports 218 extending from the base.

A hydraulic cylinder 220, similar to cylinder 24 of FIG. 1, is secured in any suitable manner to the underside of platform 212, and a hydraulic activator 222 is pivotally connected at its ends between pairs of spaced lugs 224 formed on cylinder 220 and base 202 by pins 226. Pairs of hydraulic lines 228 and 230 connect pump 204 with cylinder 220 and activator 222, respectively.

Spaced arms 232 each having an arcuate slot 234 extend from cylinder 220, and they receive between them a member 236. As seen in FIG. 12, a bolt 238 extends through the slots 234 and a passage in member 236, one end being threaded to receive a clamping nut 240, by which the platform 212 can be retained at any desired incline to which it is positioned by pump 204 and activator 222.

The platform 212 is formed with side flanges 242 to guide the rollers 244 supporting, on pins 246 extending through brackets 248, a patient-supporting cot or frame 250 of any desired configuration. It will be apparent that the frame 250 is free to move lengthwise on the platform 212 on rollers 244, the extent of movement being observed on pointer gauge 252.

It will be noted that the upstanding wall 254 at the end of platform 212 is formed with a threaded hole 255 receiving a threaded hand crank 256, the free end 257 of which engages the end wall 258 of frame 250 and determines its initial position on the platform.

As in apparatus 10, a hydraulic piston 260, received in cylinder 220 and movable by operation of pump 204, extends outwardly and has fixedly secured thereto the bracket 262, including the plate 264. A torus 265, similar in structure and function to torus 36 in apparatus 10, is sealably fixed to plate 264 and to the primary vacuum chamber 266, which is provided with the same inflatable seal torus 268 and safety valves 270 and 272 and the patient controlled safety device 274. Vacuum and pressure conduits 276 and 278, respectively, connect between the pump 208 and the chamber 266 and inflated torus 265 and inflatable torus 268.

Since the apparatus 200 is tilted, vacuum chamber 266 is slidably secured to piston 260 by an arm 280 having a support sleeve 282 slidable on the piston, with a self-lubricated or other suitable bushing 284. Groove and rib means 286 may be provided to prevent rotational displacement of the sleeve on the piston.

The operation of apparatus 200 is essentially the same as that of apparatus 10, except that apparatus 200, as shown, does not include the platform 126, torus 124 and weight-responsive vacuum bleed valve 140 structure of apparatus 10. Apparatus 200 could, of course, include such structure.

In operation of apparatus 200, the patient is placed on the frame 250, which was previously lowered to a horizontal position, with his head extending beyond the frame, substantially as shown. The crank 256 is then adjusted so as to position frame 256, and thus the patient, as desired. The vacuum chamber 266 is then positioned by piston 260, by operation of pump 204 and foot activator 205, over the patient's head, as shown. The frame is then tilted to the desired position by pump 204 and activator 222.

When all adjustments have been made, the torus seal 268 is inflated and vacuum is applied by operation of the pump 208, in the manner explained with reference to apparatus 10.

It will be apparent that with the apparatus 100, the traction force is the resultant force of the frame and patient's weight, which is dependent upon the inclination of frame 220, or the patient's feet or other portion of the lower extremities can be anchored, as by a strap 288 which may include a spring weight scale 290, similar to a simple fisherman's scale calibrated to measure the traction force.

With the preceding description, it will be readily apparent that the invention provides a method and apparatus for the practice of traction therapy by application of vacuum at the top portion of the patient's head, about which a seal has been established, without the use of chin strap apparatus, the traction force preferably being the patient's weight, depending upon the extent to which the patient is suspended by the action of atmospheric pressure. However, in either embodiment, the patient's lower extremities may be anchored, in which case the patient is not suspended, the traction force being essentially the pressure differential acting on the projected area at the torus head seal.

Under certain conditions, it is possible that the secondary vacuum chamber 34 might not be required, as where patient physical configurations (head size, etc.) were constant.

It will be apparent that the embodiments of the invention shown and described for purpose of illustration accomplish the initially stated objects. It will also be apparent to those skilled in the art that certain other modifications can be made, within the scope of the appended claims.

I claim:

1. A method of traction therapy for a human patient, comprising the steps of establishing a seal about the upper portion of the patient's head, creating a pressure differential across said seal, with the lower pressure above said seal and the higher pressure below said seal, increasing said pressure differential to a value sufficient to cause the higher pressure acting upon the patient's body below said seal to move the patient by his head toward the lower pressure side of said seal thereby causing a traction force to be applied along the spinal column of said patient, and anchoring the patient's lower extremities while applying the pressure differential at the patient's head.

2. A therapeutic apparatus for traction therapy of a human patient, comprising a housing forming a first chamber having an opening to receive the upper portion of the patient's head within said first chamber, sealing means for providing a seal between the patient's head and said housing, said sealing means being effective to sealingly engage the patient's head in a manner defining a band-like path passing about the forehead of

the patient's head and extending therefrom and about the sides and rear of the patient's head, means for variably providing a pressure differential across said sealing means when said patient's head is in sealing engagement with said sealing means, and additional means sensitive to travel of the patient's head in a direction more inwardly of said first chamber, said additional means being effective when said patient's head has moved inwardly past a preselected relative position to increase the magnitude of the pressure within said first chamber and thereby limit the magnitude of said pressure differential across said sealing means.

3. Apparatus according to claim 2, and further comprising a base, means for supporting the patient, and means operatively connected to said housing for adjusting the position of said housing relative to said patient support means, and thus to the patient's head.

4. Apparatus such as that recited in claim 3, wherein said patient supporting means comprises a platform connected to said base so as to be tiltable from a more nearly horizontal position to an inclined position.

5. Apparatus according to claim 2, and further comprising additionally means forming a second variable-volume vacuum chamber communicating with said housing.

6. Apparatus such as that recited in claim 2, wherein means is provided for controlling the pressure in said first chamber.

7. Apparatus such as that recited in claim 6, wherein said pressure control means includes means for at times bleeding said pressure.

8. Apparatus such as that recited in claim 6, wherein said pressure control means is constructed to control said pressure automatically under certain conditions of operation of said apparatus.

9. Apparatus such as that recited in claim 8, wherein said automatic control is constructed so as to be operative when said pressure reaches a predetermined value.

10. Apparatus such as that recited in claim 8, wherein said automatic control is constructed so as to be operative in response to a physical act of the patient.

11. Apparatus according to claim 2, wherein said sealing means comprises a hollow, inflatable, elastomeric torus, said apparatus including means for controllably inflating said torus.

12. A therapeutic apparatus for tractor therapy of a human patient, comprising a housing forming a first chamber having an opening to receive the upper portion of the patient's head, means for providing a seal between the patient's head and said housing, means for variably providing a pressure differential across said seal, a base, means for supporting the patient, adjusting means operatively connected to said housing for adjusting the position of said housing relative to said patient support means and thus to the patient's head, said adjusting means comprising a fluid piston having a member fixed thereto and extending laterally therefrom, continuous resilient compressible wall means sealably secured to said member and to the side of said housing opposite said opening thereby providing a variable volume second sealed chamber, and means for communicating said second chamber with said first chamber.

13. Apparatus such as that recited in claim 12, wherein said means for providing said pressure differ-

ential comprises a vacuum pump, and conduit means connecting said pump to one of said chambers.

14. Apparatus according to claim 13, and further comprising means for controlling the pressure in said first chamber, said means for controlling the pressure in said first chamber comprises means for controlling the maximum vacuum produced by said pump.

15. Apparatus according to claim 11, wherein said pump comprises a pump exhaust passage, and wherein said means for controlling maximum pump vacuum comprises means for varying the back pressure in said pump exhaust passage.

16. Apparatus according to claim 15, wherein said means for varying said back pressure comprises a constrictable elastomeric sleeve disposed in said exhaust passage, and variable fluid pressure supply means for applying external pressure on said sleeve to constrict said sleeve to a degree determined by the magnitude of said fluid pressure.

17. A therapeutic apparatus for traction therapy of a human patient, comprising a housing forming a first chamber having an opening to receive the upper portion of the patient's head, means for providing a seal between the patient's head and said housing, means for variably providing a pressure differential across said seal, a base, means for supporting the patient, and adjusting means operatively connected to said housing for adjusting the position of said housing relative to said patient support means and thus to the patient's head, said patient support means comprising a platform supported on said base by means providing a sealed compressible control chamber of which said platform forms the upper wall, whereby the volume of said control chamber varies inversely with the patient's weight on said platform and the pressure in said control chamber varies directly with the patient's weight on said platform.

18. Apparatus according to claim 17, wherein said means for providing said pressure differential comprises a vacuum system including a vacuum pump connected by a first main conduit so as to evacuate said first chamber, a second branch conduit connected between said vacuum system and atmosphere, said branch conduit including a valve controlled in response to the weight on said platform, said valve being closed when the patient's full weight is on said platform and open to bleed said vacuum when the patient is suspended by his head off the platform to a predetermined degree.

19. Apparatus according to claim 18, wherein said branch conduit communicates by a restricted passage with said control chamber and said vacuum bleed valve comprises an elastomeric sleeve sealably secured at its ends in said branch conduit with said restricted passage positioned intermediate said sealed ends of said sleeve, whereby increased pressure due to a decreased volume of said control chamber by the patient's weight is trans-

mitted through said restricted passage to constrict said sleeve and close said branch conduit.

20. A therapeutic apparatus for traction therapy of a human patient, comprising a housing forming a first chamber having an opening to receive the upper portion of the patient's head, means for providing a seal between the patient's head and said housing, means for variably providing a pressure differential across said seal, a base, means for supporting the patient, adjusting means operatively connected to said housing for adjusting the position of said housing relative to said patient support means, and thus to the patient's head, said patient supporting means comprising a platform connected to said base so as to be tiltable from a more nearly horizontal position to an inclined position, and said platform comprising a frame on which the patient can lie, said frame being freely slidable on said platform toward said first chamber.

21. Therapeutic apparatus for traction therapy of a human patient, said apparatus comprising a base, a platform tiltable on said base, means for tilting said platform, a patient support frame freely moveable lengthwise on said platform, means for adjusting the free position of said frame on said platform, housing means tiltable with said platform formed to provide a vacuum chamber, said housing having an opening for receiving therein a portion of the patient's head when the patient is reclined on said frame, means for providing a pneumatic seal between said housing and the patient's head, means for adjusting said housing with respect to said platform and means for evacuating said chamber.

22. Apparatus according to claim 21, and further comprising means for anchoring the lower extremities of a patient reclining upon said frame to said platform.

23. Apparatus according to claim 21, wherein said housing is mounted so as to be movable in directions toward and away from said platform on and separately from said housing adjusting means.

24. Apparatus according to claim 23, and further comprising means for varying the rate of decrease of volume of said second vacuum chamber.

25. Apparatus according to claim 23, and further comprising means forming a second variable volume vacuum chamber having a movable common wall with said housing whereby evacuation of said second vacuum chamber causes said common wall and thus said housing to move away from said platform thereby applying a traction force to the patient.

26. Apparatus according to claim 25, wherein said last named means is a variable inflatable wall of said second chamber.

27. Apparatus according to claim 21, and further comprising means provided for at times automatically bleeding said vacuum in said housing.

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