

# United States Patent

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[54] **ORTHOPEDIC TRACTION BELT**  
 10 Claims, 11 Drawing Figs.

[52] U.S. Cl. .... 128/75,  
 128/78, 128/87  
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**ABSTRACT:** A traction supporting device is constructed which comprises an upper belt member, a lower belt member, a plurality of linking arms extending between said belt members, peg means fixed to one of said belt members and extending radially therefrom, means defining a rotary orifice on one end of the arm rotatably mounted on said peg means for movement thereof about said peg means while remaining axially captive relative to the peg means, a compression mechanism capable of creating an adjustable traction force tending to urge apart said upper and lower belt means disposed on at least one of said linking arms and means for gauging the traction force within said mechanism.

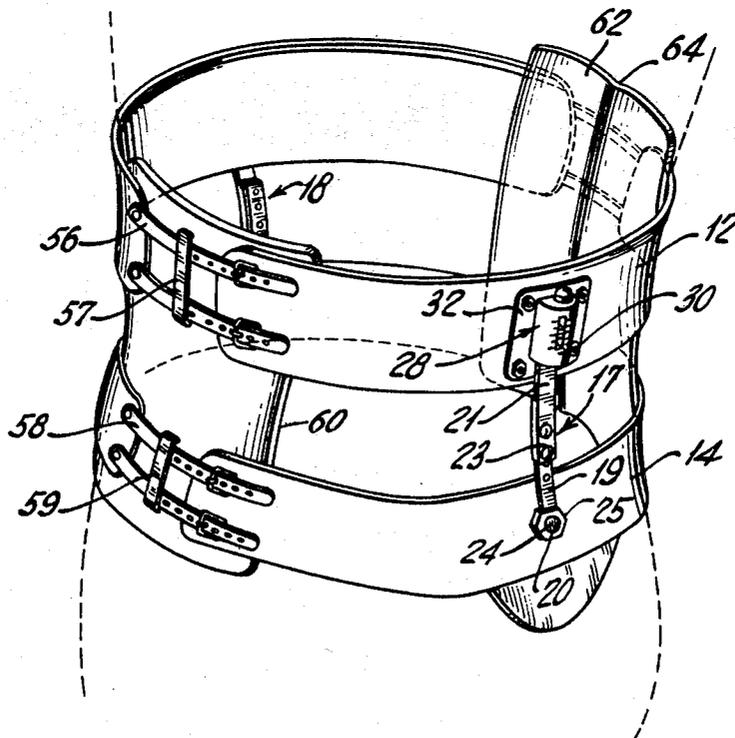


Fig. 1.

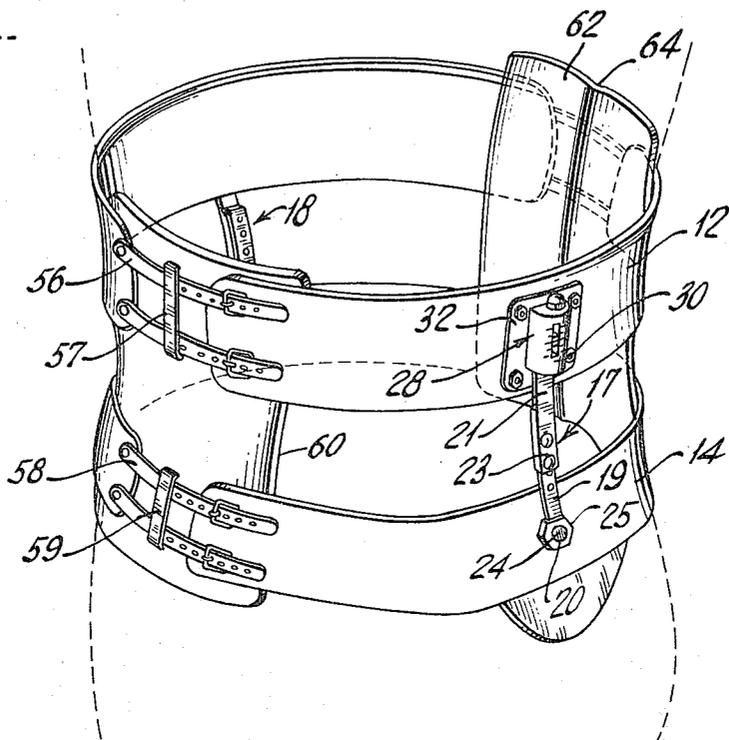
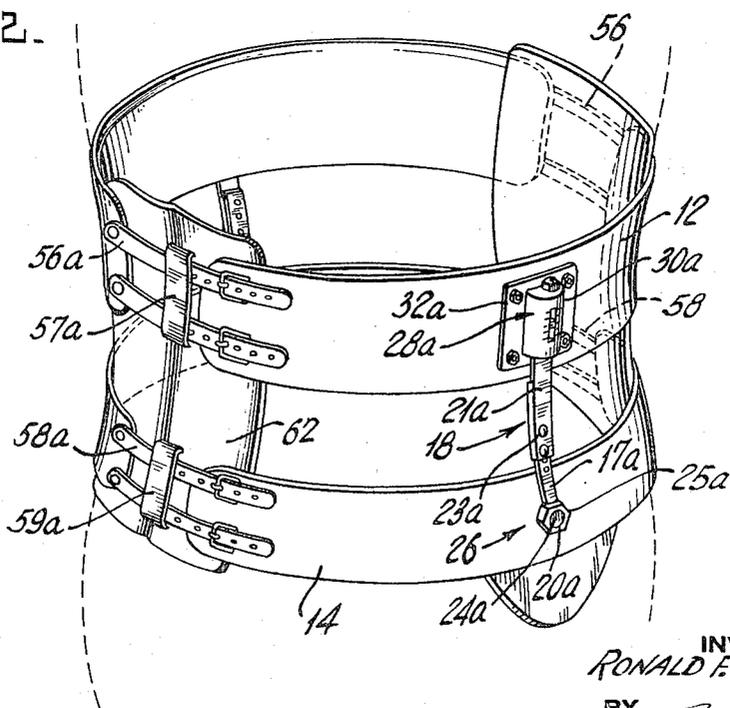


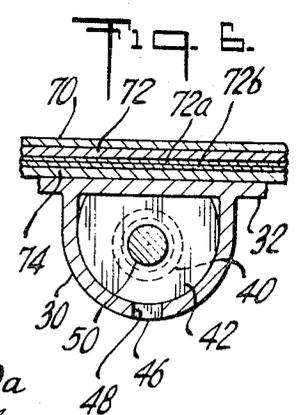
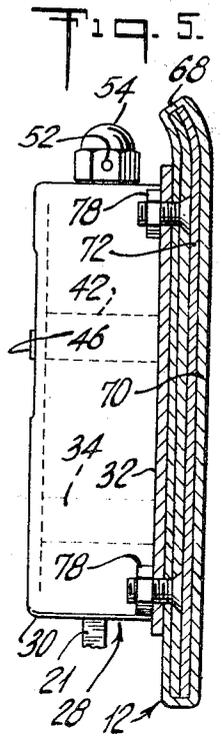
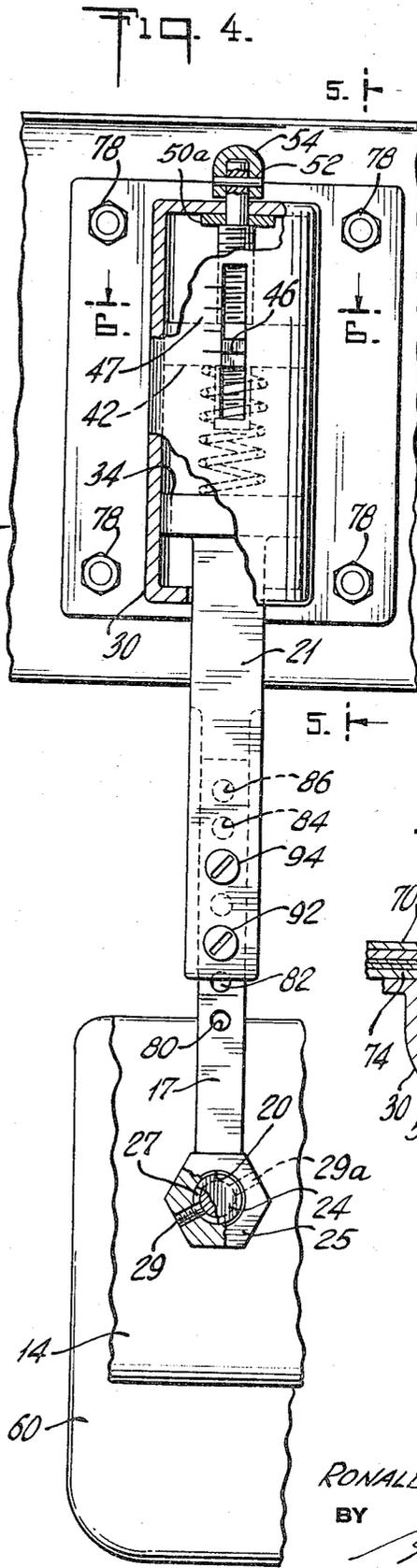
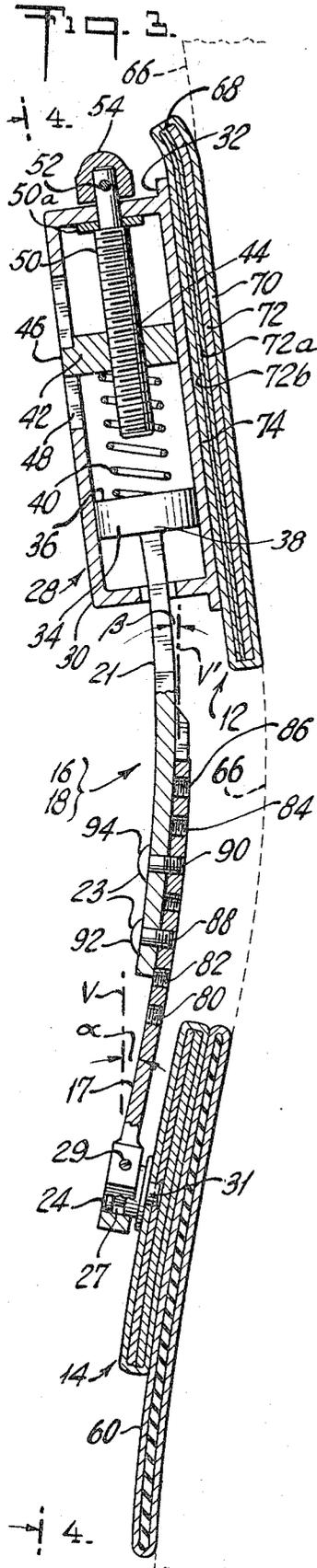
Fig. 2.



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## ORTHOPEDIC TRACTION BELT

## BACKGROUND OF THE INVENTION

This invention relates to body traction support and in particular to a support adapted, in one embodiment thereof, to relieve the lower spine of part of the compressive load endured in supporting the trunk of the body and load handled in working or lifting objects of customary weight.

When the spinal column, in any age category, is unable to properly support loads of common work there is frequently pain occurring in the region of the back, and through the nerves radiating from the spine, pain may be felt in other parts of the body.

Accordingly, it is a principal object of this invention to provide a device which will give supplemental support for the spine and prevent further damage thereto and, in cases of impairment of the spine, to provide helpful relief from pain.

A further object of the invention is to provide a support linked between vertically spaced portions of the body which will permit free but limited movement of the body at all times.

Another important object of the invention is to provide a device which can be worn comfortably even in bed by the patient and which can provide a controlled, adjustable distending force urging upper and lower portions of the body in opposite directions relative to each other.

To these ends, and in accordance with one embodiment of the invention, a supporting structure comprising an upper and a lower belt is worn by the patient to provide support between the rib trunk and the pelvic section of the patient. The supporting structure is completely independent of the spine and, by means of swivel arms curved to fit the contour of the body and located at a vertically inclined angle relative to the axis of pegs located at the hip, the effect of a buttress is obtained which serves to reduce muscular effort necessary to hold the body erect, thereby reducing the compression which would otherwise occur on the discs of the spine. A contoured back cushion is provided to give muscular support to the muscles at each side of the spine, and an abdominal support cushion is provided to help control the abdominal wall and to help control posture of the patient.

According to another important feature of the invention, means are provided for adjusting the degree of force urging apart the upper and lower extremities of the linking arms, so that a physician can adjust the degree of separation pressure or "traction" force exerted by a precision regulating constraint device and acting between the upper and lower portions of the body supported by the respective upper and lower belts. Such adjustment is particularly of benefit when the physician is treating a patient who has an impaired condition in the lower spinal area. With such controlled support, the patient has freedom to move about in a desired and limited manner without danger or worry of increasing pain or of damage to the spinal column. There are many instances, in all age categories, where the spinal column develops inability to support, in addition to the body, normal loads handled in working or lifting objects of limited weight customarily lifted during normal work. When the spinal column becomes unable to properly support such loads of common work, pain frequently occurs in the lower regions of the back, and through the nerves radiating from the spine, pain may be felt in other parts of the body.

Still another object of the invention is therefore to provide supplemental support for the spine which contributes to the ability of the patient to lift and carry normal work loads.

A further object of the invention is to provide an orthopedic support which will permit free movement of the body and which can be comfortably worn by the patient even while sitting or lying in bed. The device is especially helpful to bed patients to make it possible for them to get into and out of bed without assistance and without the need for a cane or crutches.

Prior art methods and devices for supporting the spinal column usually immobilized the patient and provided cumbersome

some overhead traction devices for pulling body portions apart during healing of injuries. Braces and belts of the prior art very often were purchased by the patient, at relatively expensive prices, and then hung up in a closet and not worn again due to the discomfort felt by the patient while wearing it. In contrast thereto, the belt and harness of the present invention can be comfortably worn by the patient, even under normal clothing, and even in bed while sitting or lying down.

The device of the present invention can be sewn or fitted into a space suit to help take the pressure off of the wearer during take off and landing of a space vehicle. The device can be fitted into a suit worn by a deep sea diver to help provide support between portions of the body. The device also can be used by a person carrying a weight, to help relieve the compressive force on the spine or on a selected portion of the body.

According to a further embodiment of the invention, the device can be made of a smaller size and adapted to provide neck traction as a neck brace supported by a harness between the chest strap and a jaw-supporting strap.

Other objects, advantages and features of the invention will appear as it is described in further detail in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view of the appliance according to the invention, as worn on the body of the patient and as viewed from the left front;

FIG. 2 is a perspective view of the appliance as seen from the right rear;

FIG. 3 is a longitudinal cross section taken through a linking member of the device;

FIG. 4 is a fragmentary elevational view of the linking member of FIG. 3, partially cut away, and taken in the direction of arrows 4-4 of FIG. 3;

FIG. 5 is a view taken in the direction of arrows 5-5 of FIG. 4;

FIG. 6 is a transverse cross section taken in the direction of arrows 6-6 of FIG. 4;

FIG. 7 is a front view of the neck brace embodiment according to the invention, shown in position on a patient;

FIG. 8 is a side view of the embodiment of FIG. 7;

FIG. 9 is a rear view of the embodiment of FIG. 7;

FIG. 10 is a vertical cross section showing a detail of the chin rest, taken in the direction of arrows 10-10 of FIG. 7; and FIG. 11 is a vertical cross section of the front connecting link of the embodiment of FIGS. 7-11.

A body support is described which comprises an upper belt 12 and a lower belt 14 joined together by two pivoted linking arms 16 and 18. These two linking arms each have a swivel hole 20,22 which pivots about a pair of swivel pegs 24,24a located on the lower belt 14 at the hip joint 26 when worn on the patient. An adjustable compression spring mechanism 28 is contained in a cylinder 30,30a affixed to a plate 32,32a on each side 32,32a of the upper belt 12. The linking arms 16,18 have a lower portion 17,17a containing the swivel hole 20,20a and an upper portion 21,21a extendable by adjusting means 23,23a relative to the lower portion 17,17a for variable height patients. A lower plunger 34 having a flat top 36 is affixed to the upper end 38 of the upper linking arm 21,21a. A compression spring 40 rests on the lower plunger 34. A top plunger 42 having a threaded through hole 44 rests on top of the compression spring 40 and has a projecting gauge 46 extending laterally through a slot 48 in the side of the cylinder. A threaded vertical bolt 50 fixed by a crosspin 52 to a top nut 54 serves to move the top plunger and its associated gauge up and down when adjusted by a socket wrench to control the compression in the spring. The rotation about the swivel pegs 24 of the lower ends 25 of the links 16,18 permits body movement about the axis of the swivel peg but limits twisting movement of the body, while the upper 12 and lower 14 belts are forced apart a controlled amount.

According to another embodiment of the invention, the device is adapted to act as a chin and neck brace, permitting rotation of the head of the patient. The upper belt 12 and the

lower belt 114 in this embodiment are linked together by pivoted linking arms, a first one 116 linking a chin support and a pivot peg 124 and a rear linking arm 118 connecting a compression spring mechanism 128 supported at the back of the head by a jaw and chin strap 112 and pivoted at the back of the patient on a swivel peg 125 supported on a lower belt 114 forming part of a shoulder harness.

As shown in FIGS. 1-6 of the drawings, the device, generally indicated at 10, comprises an upper belt 12 and a lower belt 14 joined together by two pivoted linking arms or members 16, 18 spaced at diametrically opposite sides of the device 10. The two linking members 16, 18 each have a rotary orifice 20, 20a adapted to pivot about respective pegs 24, 24a located on the lower belt 14 at the hip joint, indicated at 26, when worn on the patient.

As will be more fully explained below in connection with FIG. 3-6, precision regulating constraint mechanism, indicated generally at 28, is provided to make possible an adjustable controlled force tending to push apart the upper and lower belts, 12, 14 generally in the direction of the longitudinal axis of linking members 16, 18.

As shown in FIGS. 1 and 2 of the drawings, in addition to being contoured to fit the shape of the body, the respective upper and lower belts 12, 14 are each made in substantially semicircular segments which are joined by strap members 56, 58 at the front and 56a 58a at the rear for flexibility and for peripheral adjustment. Vertical loop straps 57, 59 at the front and 57a, 59a at the rear provide control of vertical movement of the straps 56, 58 and 56a, 58a respectively. Contoured padding members are provided at 60 at the front over the abdomen and at 62 at the rear across the muscles on each side of the spine. It will be noted that the padded support member 62 is inwardly contoured at 64 to follow the shape of the muscles in proximity to the spine, for added comfort and support.

As shown in FIG. 3, the upper belt 12 rests against the ribcage portion along the body line 66 of the patient and is tilted away from the body at its upper edge 68 for comfort and to avoid pinching of the skin and flesh of the patient when he is bending forward or in seated position, so that folds of the skin do not rub on the upper edge 68 of the belt 12.

The innermost surface of the belt 12 comprises, preferably, a layer of kid leather, a plurality of intermediate felt protective layers of fiber board or felt 72, 72a and 72b followed by a one-quarter inch thick heavy leather layer 74, forming part of the belt 12 proper. A metal plate 32 forming a support for the housing 30 is fastened to the belt portion 74 of upper belt 12 by means of screws or rivets welded to a plate 78. The fiber layer 72 prevents 78 welded to a plate 72b from penetrating and digging too deeply into the kid leather layer 70, and thus protects the skin surface 66 of the patient.

To prevent vertical slippage of the belts 12, 14 relative to the skin layer 66, it has been found preferable that an undergarment be worn between the skin and the leather belts, said undergarment preferably comprising a woven latex type fabric, for example a girdle type garment made of woven fabric known commercially as "Spandex," although other woven girdle type fabrics with similar properties can also be beneficially used to help maintain non-slipping condition of the belts 12, 14 relative to the underlying bone structure.

The linking arms 16, 18 comprise a lower arm portion 17 and an upper arm portion 21. The lower portion terminates in a hexagon-shaped head portion 25, 25a FIGS. 1, 2, 4) adapted to rotate about pegs 24, 24a in the lower belt 14. The pegs 24 each contain a recessed central peripheral groove 27 in which Allen guide screws 29, 29a ride in an axially captive manner, i.e. to prevent lateral movement of the rotary head 25 relative to the axis of peg 24. The peg 24 is fixed into belt 14 by means of a flared rivet 31 fixed and retained between respective layers in a manner somewhat similar to that described above in connection with layers 72, 72a, 72b of upper belt 12.

It is to be noted, as best shown in FIG. 3, that the linking arms 16, 18 are contoured generally to the line 66 of the body of the patient for maximum comfort. Accordingly, the axis of

lower linking arm portion 17 slopes at an angle  $\alpha$  relative to the vertical plane indicated at V in FIG. 3. Similarly, the upper portion 21 defines an angle  $\beta$  relative to the vertical axis V'.

Affixed to the upper end of 38 of the upper linking arm portion 21 is a lower plunger member 34 having a flat top 36. A compression spring 40 rests with its lowest turn on the flat top 36 of the lower plunger 34. A top plunger 42 having a thread throughhole 44 rests on top of the compression spring 40 and has a projecting gauge 46 extending laterally through the slot 48 in the side of the cylinder 30. A threaded vertical bolt 50 fixed by a crosspin 52 to the top nut or gripping member 54 engages the threaded hole 44 and thus serves to move the top plunger 42 and its associated gauge 46 up and down when adjusted by rotating the nut 54 on bolt which rides on washer 50a with a socket wrench to thus control the degree of compression in the spring 40 to any desired value thereby, tending to urge the bottom plunger 42, with the result of controlling "traction" between belts 12 and 14.

In the embodiment of FIGS. 7-11 the numerals designating the various members having functions similar to those of FIGS. 1-6 have been increased by 100 so that they may be more easily recognized as to their function in relation to the overall concept of the invention.

As shown in FIGS. 7, 8 and 9, the lower belt 114 of this embodiment comprises a shoulder harness having a fixed peg 124 fastened to the chest belt 114 of the shoulder harness in a manner similar to that of peg 24 which is fastened to lower belt 14 in the embodiment of FIGS. 1-6. Similarly, a fixed rear peg 124a is fastened to the back belt 114a, located at a fixed point between the shoulder blades about level with the fixed front peg 124. Shoulder straps 156, 158 serve to support the front belt 114 and the rear belt 114a of the shoulder harness. Connecting belts 115 and 115a extending under the armpits give the required stability to the shoulder harness. The upper belt 112 is constructed and positioned in a manner to support the head, and is provided with a chin rest member 134. The chin rest member forms part of belt 112 and is pivotally joined to the upper portion 121 of the front linking member 116 by means of a L-shaped peg 124b provided with a recessed peripheral groove 127a adapted to retain, in an axially captive manner, one or more Allen screws which may be identical to those illustrated at 29, 29a in FIG. 4 for axially retaining the peg 124b in relation to the swivel bore 120. A regulating restraint device 240, located within a front cylinder housing 228 and disposed between the upper flat surface of a lower plunger 234 and a fixed upper surface 242, makes possible limited up and down chin movement of the patient while the chin is upwardly urged by the device 240 to a limited predetermined force and maximum set distance between the horizontal axis of peg 124a at the chest and the axis of peg 124b which support the chin rest 134.

The rear linking member has a hexagon-shaped lower and 134 adapted to rotate about the fixed peg 124a fixed in the rear belt 114a. The curved rear linking arm 118 has extending means 123, analogous to that of extending means 23, with holes 80, 82 etc., and screws 92, 94 similar to the structure 23 of FIGS. 3-4.

The precision regulating constraint mechanism 130 is adapted to be located approximately at the base of the skull, as best shown in FIG. 9, and comprises a precision regulating constraint tension device 130 with adjustable compressive force analogous to the mechanism 28 of the embodiment of FIGS. 1-6. It is linked to the rear portion 127 of upper belt 112.

In operation, the neck supporting device of FIGS. 7-11 is worn by the patient as shown, and permits rotation of the head to the right and left substantially in a horizontal plane, as indicated by arrows A and B in FIG. 7. However, tipping of the head backwards, facing upwards, is prevented by the linking member 118; and tipping of the head face downward is prevented by the linking member 116. Nevertheless, as seen in FIG. 7 swiveling of the front linking member 116 to positions 116' and 116'' does permit limited rotation of the head of the

patient in a horizontal plane in direction of arrows A—B. Eating and chewing of food is made possible by a compression spring 240 located in cylindrical housing 234 beneath the chin rest 134, which permits limited downward movement of the chin rest against the upward urging of the spring 240.

It will be obvious to those skilled in the art, upon studying this disclosure, that certain variations and modifications are possible and hence may be embodied in structures other than those particularly disclosed herein by way of example, within the spirit and scope of the claims annexed hereto.

I claim:

1. A traction supporting structure comprising, in combination:

- a. an upper belt member;
- b. a lower belt member;
- c. a plurality of linking arm means extending between and linking said belt members;
- d. peg means fixed to one of said belt members and extending radially therefrom;
- e. means defining an orifice on one end of the arms rotatably mounted on said peg means for movement thereof about said peg means while remaining axially captive relative to said peg means;
- f. a compression mechanism capable of creating an adjustable traction force tending to urge apart said upper belt and said lower belt disposed on at least one linking arm; and
- g. means for gauging said traction force within said mechanism.

2. A structure according to claim 1, wherein said compression mechanism comprises a housing, a lower plunger in said housing fixed to one end of said linking arms, an upper plunger in said housing, a precision regulating constraint device disposed axially in said housing between said lower plunger and said upper plunger, and means for disposing said plunger within said housing at a selected position therein.

3. A structure according to claim 2, wherein said one linking arm includes extendable means for adjusting the longitudinal distance of said lower plunger from the axis of said peg means.

4. A structure according to claim 1, wherein said upper belt member is contoured to fit and adapted to encircle the upper body trunk area of a patient, said lower belt member is contoured to fit and adapted to encircle the abdominal area of the

patient and said peg means includes a pair of peg members mutually diametrically disposed on said lower belt adjacent the respective hip zones of the patient.

5. A structure according to claim 1, wherein said upper belt member comprises neck and head traction and supporting means having a chin support member, said means defining an orifice including a connection pivotally connecting one of said linking arms to said chin support member, and said lower belt member comprising shoulder harness means having a generally horizontal chest belt and a back belt, said peg means including respective pegs mounted on said chest belt and on said back belt.

6. A structure according to claim 3, wherein said peg means includes a first peg fixed in said chest belt and a second peg fixed in said back belt, and said plurality of linking arm means includes a front linking arm extending between said chin support member and said first peg, and rear linking arm means extending between said rear peg and said traction and supporting means.

7. A structure according to claim 6, wherein said traction and supporting means is disposed at the rear of said upper belt.

8. A structure according to claim 2, wherein said means for moving said upper plunger axially within said housing includes a threaded bolt member axially disposed within said precision regulating constraint tension mechanism within said housing and a gripping member fixed to the upper end of said bolt member for rotating the latter, said upper plunger member being threadedly engaged on said bolt member.

9. A structure according to claim 1, which further comprises a first contoured padded member supported by both of said upper and lower belts and contoured to a predetermined shape for supporting muscles in the abdominal region of the patient, and a second padded member supported by both of said upper and lower belts for supporting muscles in the spinal region of the patient.

10. A structure according to claim 2, which further comprises indicia means on said housing for indicating distance interval positions, means defining a vertical slot through said housing, and wherein said gauge means includes an indicator fixed as part of said upper plunger, said indicator being adapted to extend laterally through said slot and adjacent said indicia means.

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