May 12, 1959 R. H. MAUDSLEY ET AL 2,886,030

ORTHOPAEDIC APPLIANCES

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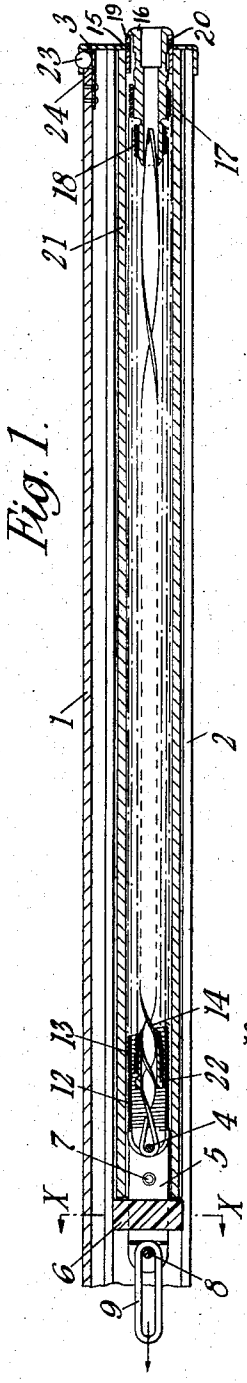


Fig. 1.

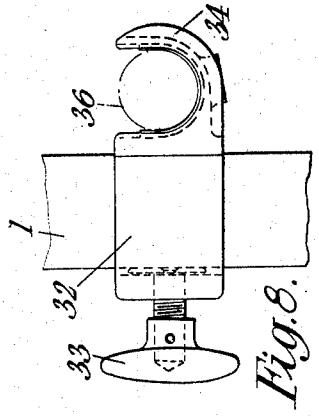


Fig. 8.

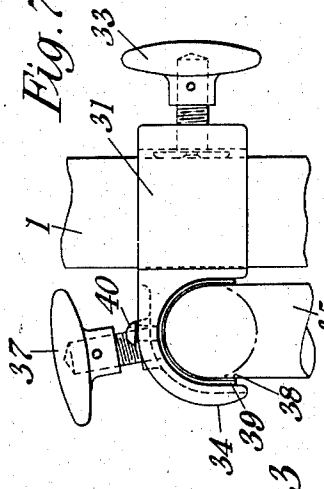


Fig. 7.

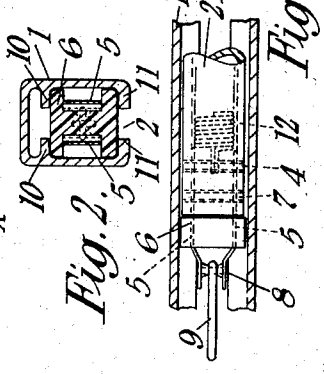


Fig. 3

Fig. 2.

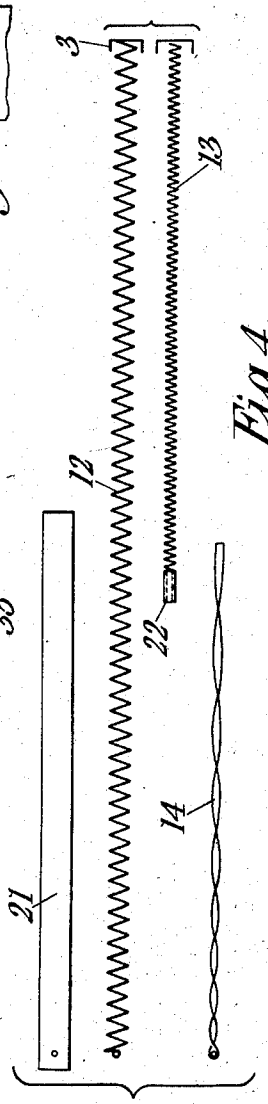


Fig. 4.

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Fig. 6

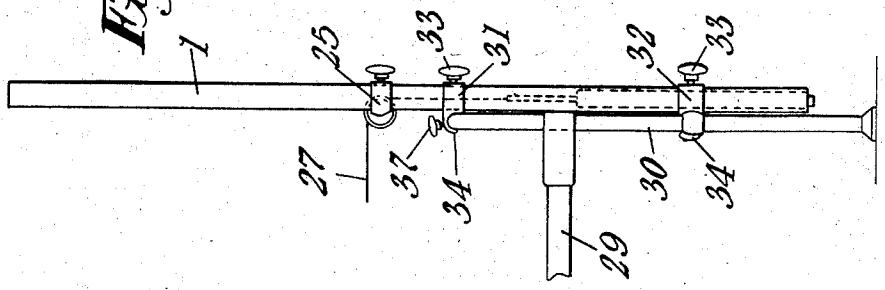
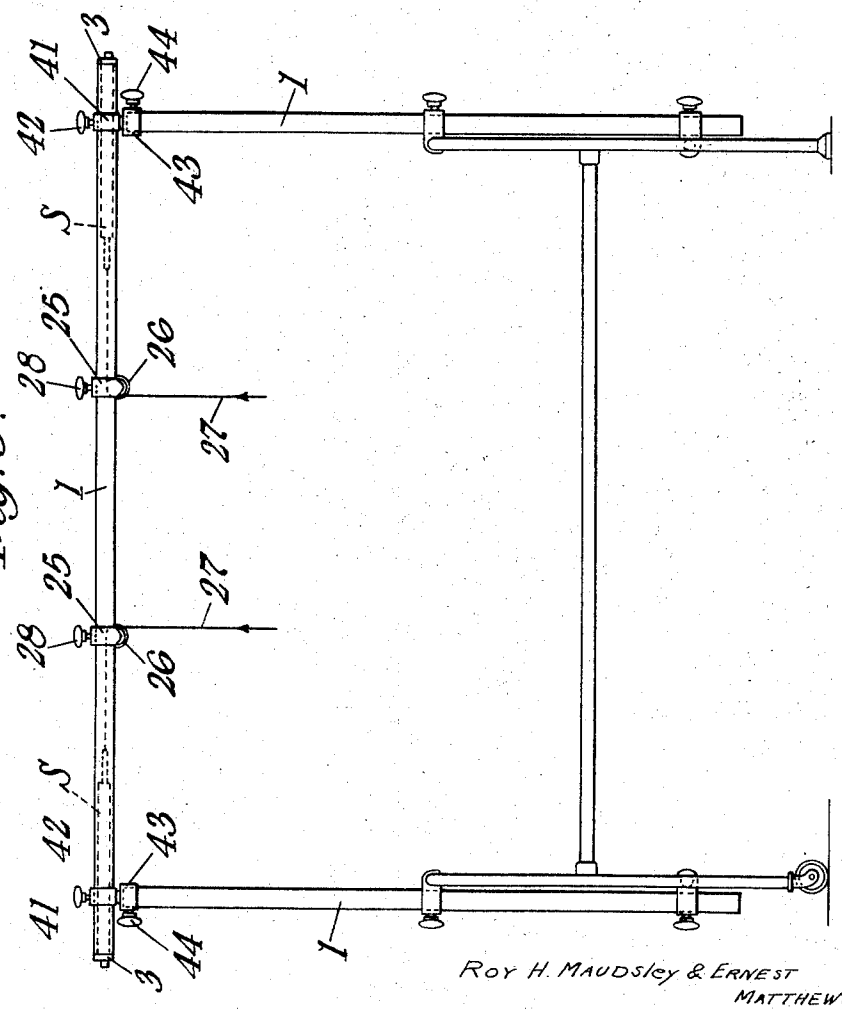


Fig. 5.



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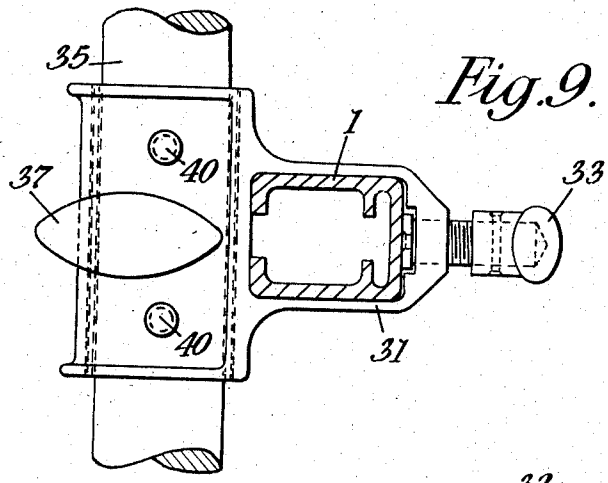


Fig. 9.

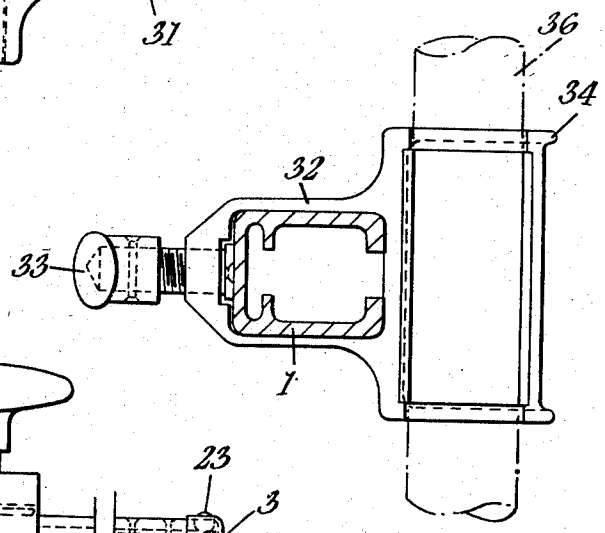


Fig. 10.

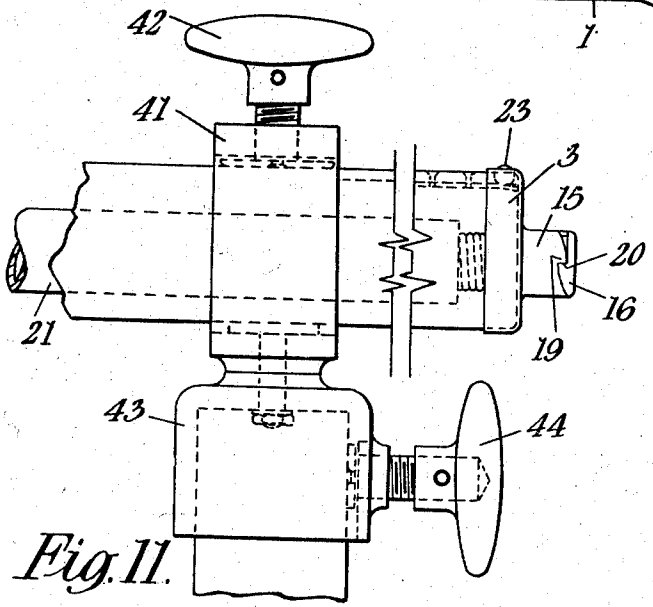


Fig. 11.

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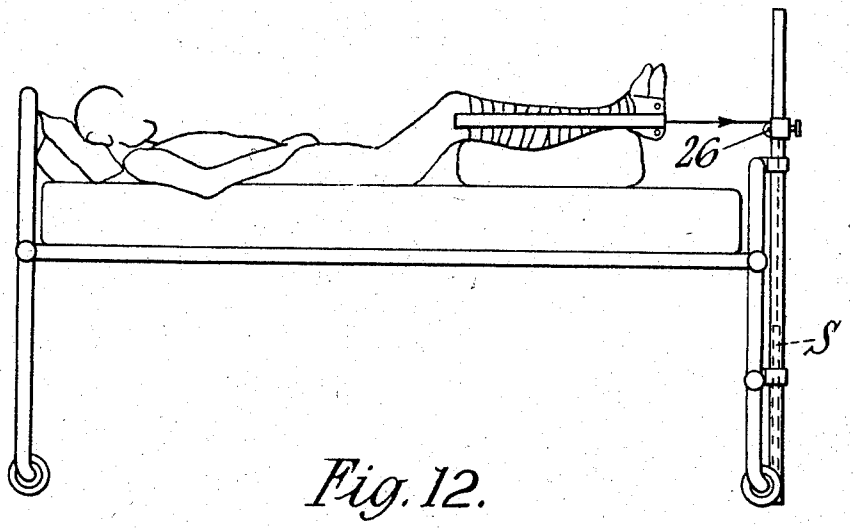


Fig. 12.

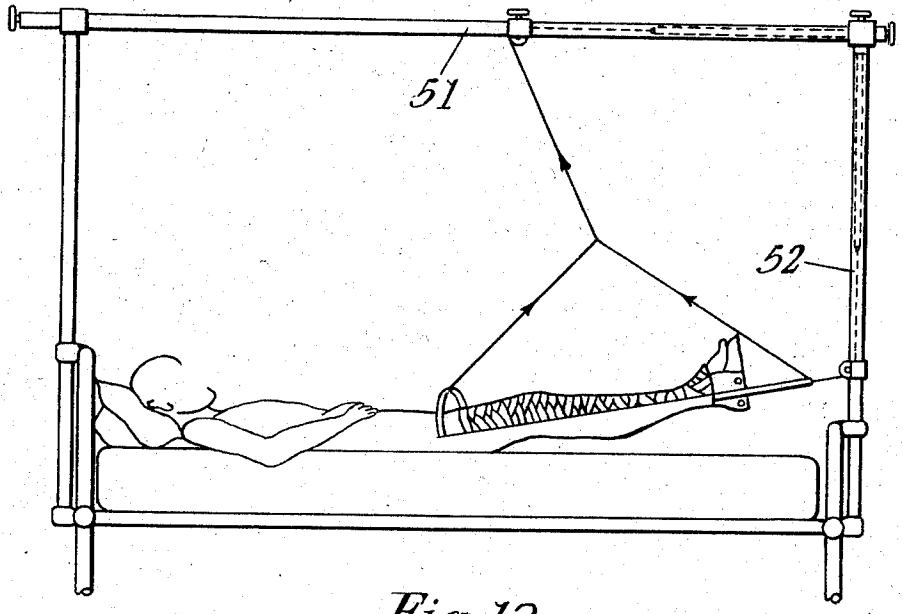


Fig. 13.

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2,886,030

ORTHOPAEDIC APPLIANCES

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Application May 22, 1956, Serial No. 586,600

Claims priority, application Great Britain May 26, 1955

15 Claims. (Cl. 128—75)

This invention relates to orthopaedic appliances as employed in hospitals and elsewhere for applying traction or suspension to a patient or to any part of the body in the practice of orthopaedic treatment or surgery. Appliances hitherto employed for this purpose have involved the use of cords, pulleys and weights in conjunction with a beam or beams attached to the bed and connected in the required manner to the limbs or body of the patient. Difficulties are frequently encountered in the use of such appliances since some knowledge of mechanics is required for satisfactory results and the bed structure frequently interferes with the action of the weights. Also trouble is often caused by twisting of the cords and by weights becoming detached. It is one of the objects of the present invention to provide improved appliances for the purposes in question which are not subject to the above mentioned disadvantages and which are simpler to use and neater in appearance. A further object is to provide an improved appliance for this purpose which is less bulky and has fewer separate parts, thereby affording greater convenience and expedition in use.

According to the invention an orthopaedic appliance for applying traction or suspension comprises a supporting element or beam adapted to be secured to or mounted upon a bed or like structure, and a spring balance of the spiral rod type anchored at one end to the element or beam and having at its extensible end means for the attachment of a flexible means or cable for connection to the body of a patient or a part thereof.

The invention also comprises an appliance according to the preceding paragraph having pulley means adjustably mounted on the supporting element or beam over which the cable or the like can be trained.

In a preferred arrangement according to the invention a beam element of hollow or tubular form is provided within which the spring balance is enclosed and having a longitudinal slot in conjunction with an adjustably mounted pulley for the cable or the like attached to the extensible end of the spring balance.

According to a further feature of the invention the extensible end of the spring balance is provided with guide means coacting with the beam or support to prevent twisting of the attachment at such extensible end under the torsion of the balance.

The supporting or beam element is preferably provided with one or more clamps or other attachments whereby it can be secured on a hospital bed or like structure in horizontal, vertical or inclined position as may be required. Such beam or like elements may be provided in various sizes for different purposes and two or more elements may be employed in conjunction.

In one particular arrangement according to the invention, a pair of spring balances are anchored at opposite ends of a single beam element and provided with pulley means whereby two pulling forces may be applied simultaneously from the same element.

The spiral spring balances employed may be of the

kind described in any of the British patent specifications Nos. 384,534; 465,925; 648,989; and 648,990. A preferred form of spring balance comprises a tension spring and a torsion spring both of helical form arranged one within the other and attached at one end to a common anchorage. The opposite end of the tension spring is attached to a carrier or guide structure which constitutes the extensible end of the balance and to which is also attached one end of a spirally formed rod which extends inside the tension spring. The other end of the torsion spring is attached to a nut or slotted member slidable on the spiral rod but not rotatable relative to the latter. The pitch of the spiral rod increases progressively from its point of attachment to the carrier. The arrangement is such that when the balance is first extended its pull is provided both by extension of the tension spring and by torsion of the torsion spring acting through the nut on the spiral rod. As the extension continues the load afforded by the torsion spring alone diminishes due to the increased pitch of the spiral rod and hence the total pull afforded by the balance remains approximately constant. It will be understood that this result may be achieved in other ways as indicated by the patent specifications referred to above.

The clamping devices for securing the beams conveniently comprise open ended box structures slidable upon the hollow beams and having clamping screws for securing them in desired position thereon. For securing horizontal and vertical beams together a double box clamp structure is provided, and the box structures may be arranged so that the beams are secured in one plane or in staggered planes. For securing the beams to bed or cot rails, similar box form clamps may be provided with hook shaped extensions for engaging over the rails.

In the accompanying drawings,

Figure 1 is a sectional elevation of part of a beam unit including a spring balance arranged and constructed in accordance with the invention;

Figure 2 is a cross section on the line X—X of Figure 1;

Figure 3 is a sectional plan view of the left hand end of Figure 1;

Figure 4 is a diagram illustrating the operation of the spring balance;

Figure 5 is an elevation of a horizontal beam arrangement mounted on a bed;

Figure 6 is an elevation of a vertical beam arrangement mounted on a bed;

Figure 7 is an elevation of an upper rail clamping bracket;

Figure 8 is an elevation of a lower rail clamping bracket;

Figure 9 is a plan view, partly in section, of Figure 7;

Figure 10 is a plan view, partly in section, of Figure 8;

Figure 11 is an elevation of a clamp for connecting two beams;

Figure 12 shows the invention applied to provide skin traction of a limb without overhead support;

Figure 13 shows the invention applied to provide skin traction with a balanced Thomas splint.

In carrying the invention into effect according to one convenient mode as applied to a traction or suspension unit which can be attached to or mounted upon a bed or cot, reference being had to Figures 1, 2 and 3, there is provided a rectilinear hollow beam 1 of metal having a rectangular or square section and formed with a slot 2 extending longitudinally along one side thereof. A spring balance of the spiral rod type has one end thereof connected to a cap 3. The extensible end of the spring balance is attached by a cross pin 4 to a pair of side plates 5 which are also attached to a guide block 6 of channel section as seen in Figure 2, the

plates lying in the lateral recesses constituted by the opposed channels. A second cross pin 7 assists in securing the plates 5 and the further ends of these latter are joined by a pin 8 over which is engaged a link 9 to which a cable or cord can be attached. The guide block 6 can travel along the beam interior and is prevented from twisting or rotating therein by its engagement with interior shoulders 10 and the lower edges 11 of the beam. The spring balance comprises an outer tension spring 12, a torsion spring 13, and a spiral rod 14. The outer ends of the tension spring and spiral rod are attached to the guide block 6 by means of the pin 4 as seen in Figure 1. Provision is preferably made for enabling the amount of torsion of the spring 13 to be adjusted without dismantling the balance. This is effected by providing the cap 3 with a sleeve 15 secured therein which receives a head cylindrical member formed with cylindrical surfaces 17, 18 of different diameters to which the ends of the springs 12 and 13 are attached. The outer end of the sleeve 15 has one or more ratchet tooth formations 19 therein which can be engaged by complementary tooth formations 20 formed inwardly of the head 16 which lies outside the outer end of the sleeve. Thus by rotating the head 16, e.g. by a suitable key, the spring torsion can be adjusted. The torsion spring 13 lies within the tension spring 12. The spring assembly is enclosed in a cylindrical casing 21 which is secured to the guide structure 5, 6 by the pins or rivets 4 and 7. The spiral rod 14 extends freely within the torsion spring 13, and the extensible end of the latter carries a nut or slotted member 22 engaging the rod. The pitch of the rod 14 is small at the carrier end and increases towards the free end of the rod. When the balance is extended the cylindrical casing 21 is drawn away from the anchored ends of the springs and the nut 22 slides up the spiral rod 14. This relation of the various parts of the balance is illustrated diagrammatically in Figure 4. The end cap 3 may be conveniently secured to the beam 1 by a ball catch 23 loaded by a spring 24.

Referring to Figure 5, a bracket 25 is slidably mounted on the outside of the hollow beam 1 and carries a flanged pulley 26 which extends partly into the beam slot 2 to receive a cable 27 attached to the link 9 of the guide structure of the spring balance. The bracket 25 is of open ended box construction and carries a screw having a handle 28 for clamping the pulley bracket at any desired position along the beam. In the arrangement shown in Figure 5, a spring balance S (shown in broken lines) is anchored at each end of a single beam and two pulley brackets 25 are provided for the two cables.

The beams are adapted to be mounted by means of suitable clamps or brackets on a hospital bed or like structure in any desired position, e.g. either vertical, horizontal, or inclined.

One convenient mode of mounting a vertical beam 1 on two horizontal end rails of a bed is shown in Figure 6. The horizontal bed frame 29 is connected to the usual vertical frames 30. A pair of box brackets 31 and 32 are adjustably clamped upon the beam by headed screws 33. Each bracket has a hook shaped extending portion 34, see Figures 7, 8, 9 and 10, one of which is arranged to engage over the top bed rail 35 and the other is arranged to engage over the lower rail 36. The brackets are adjusted together to engage the rails, and final tightening is effected by a clamping screw 37 extending through one of the hook shaped portions. Such an arrangement may be employed for example where it is desired to apply traction to a single limb. Each hook shaped portion 34 is provided with a resilient liner comprising a sheet 38 of rubber or the like secured to a U-shaped metal liner 39 mounted for radial sliding movement upon a pair of pins 40 located in holes in the bracket.

Where a single horizontal beam above the bed is required, as shown in Figure 5, the beam is supported by a pair of vertical beams attached as described with reference to Figure 6. The connections between the vertical and horizontal beams is effected by double box clamps. As shown in Figure 11, each clamp comprises an open ended box portion 41 slidable along the beam and clamped by a screw 42. Attached to the box portion 41 in any convenient manner is a rectangular socket or box portion 43 which fits over the end of the vertical beam and is secured by a clamping screw 44.

It will be seen that beams as described above can be arranged in various ways and in various combinations, several beams being used together when it is required to apply several forces acting in different directions. It will be understood that the required traction or suspension force is to be applied through spring balance means in various ways. Thus two beams each having a spring balance at each end as shown in Figure 5 can be arranged side by side in a horizontal plane over the bed to enable a patient in a plaster bed or cradle to be completely suspended and balanced by applying the balancing forces at each of four points, and in such a way that the patient can be moved to a variety of positions and angles. In another arrangement a single balance horizontal beam above the bed may be employed to suspend a fractured pelvis. In another arrangement a double balance horizontal beam above the bed may be employed to apply Bryant's traction to infants. As shown in Figure 12, a single vertically arranged balance beam is employed at apply skin traction to a limb by means of a pulley 26. As shown in Figure 13, a balance in a horizontal beam 51 affords suspension for a limb in a Thomas splint, and a vertical balance beam 52 is employed to apply skin traction to the limb.

We claim:

1. An orthopaedic appliance for applying traction or suspension comprising a supporting element, means for mounting said element upon a bed, a spring balance of the spiral rod type comprising a coiled tension spring and a coiled torsion spring each anchored at one end, a spirally formed rod coacting with the torsion spring and arranged to wind and unwind said spring and to extend and contract the tension spring when one end of the balance is displaced relatively to the other end thereof together with means on said rod to vary the action of the torsion spring as the tension spring is extended and thereby to afford thereby substantially constant traction, means for anchoring one end of said spring balance to the supporting element, and flexible means attached to the extensible end of the spring balance and adapted for connection to a part of the body of a patient on the bed.

2. An appliance according to claim 1 comprising pulley means adjustably mounted on the supporting element and arranged so that the flexible means can be trained over said pulley element.

3. An appliance according to claim 1, in which the supporting element is of tubular form and the spring balance is enclosed therein.

4. An appliance according to claim 1, in which the supporting element is of tubular form having a longitudinal slot therein, and pulley means adjustably mounted on the said element, the flexible means being trained over the pulley means and extending through said slot.

5. An appliance according to claim 1, comprising guide means on the extensible end of the spring balance coating with the supporting element to prevent twisting of said extensible balance end under torsion.

6. An appliance according to claim 1, in which the supporting element is of tubular form and the spring balance is enclosed therein, and comprising a guide block on the extensible end of the spring balance, said guide block being slidable in the tubular element and coating therewith to prevent twisting of said extensible balance end under torsion.

7. An appliance according to claim 1, in which the

means for mounting the supporting element on the bed comprise adjustable clamps.

8. An appliance according to claim 1, in which two spring balances are anchored at opposite ends of a single supporting element and pulley means for each balance mounted on the said element to receive the two flexible means for the balances.

9. An appliance according to claim 1, in which the tension spring and the torsion spring are arranged one within the other and attached at one end to a common anchorage, and further comprising a guide structure constituting an extensible end of the balance to which the other end of the tension spring and also an end of the spirally formed rod are attached, and a nut member slidable on the spirally formed rod and attached to the other end of the torsion spring.

10. An appliance according to claim 1, in which the means for mounting the supporting element on the bed comprises a clamp including an open ended box structure slidable upon said element and a clamping screw threaded in said box structure.

11. An appliance according to claim 1, in which the means for mounting the supporting element on the bed comprises a clamp including a pair of open ended box structures arranged at right angles and each adapted to receive a supporting element, and a clamping screw threaded into each of said box structures.

12. An appliance according to claim 1, in which the

means for mounting the supporting element on the bed comprises a clamp including a pair of box structures arranged at right angles and each adapted to receive a supporting element, one of said box structures being open at both ends and the other being closed at one end only to fit over the end of a supporting element, and a clamping screw threaded into each of said box structures.

13. An appliance according to claim 1, in which the means for mounting the supporting element comprises a clamp having a box structure slidable upon the supporting element, and having a hook shaped extension for engaging over a bed rail.

14. An appliance according to claim 1, in which the means for anchoring the spring balance comprises a cap adapted to engage over an end of the supporting element and catch means for holding said cap in position.

15. An appliance according to claim 1, in which the means for anchoring the spring balance comprises a cap adapted to engage over an end of the supporting element, catch means for holding said cap in position, and means on the cap for adjustably varying the torsion of the balance.

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