

March 14, 1939.

W. L. BELL

2,150,314

ORTHOPEDIC APPARATUS

Filed Oct. 28, 1935

3 Sheets-Sheet 1

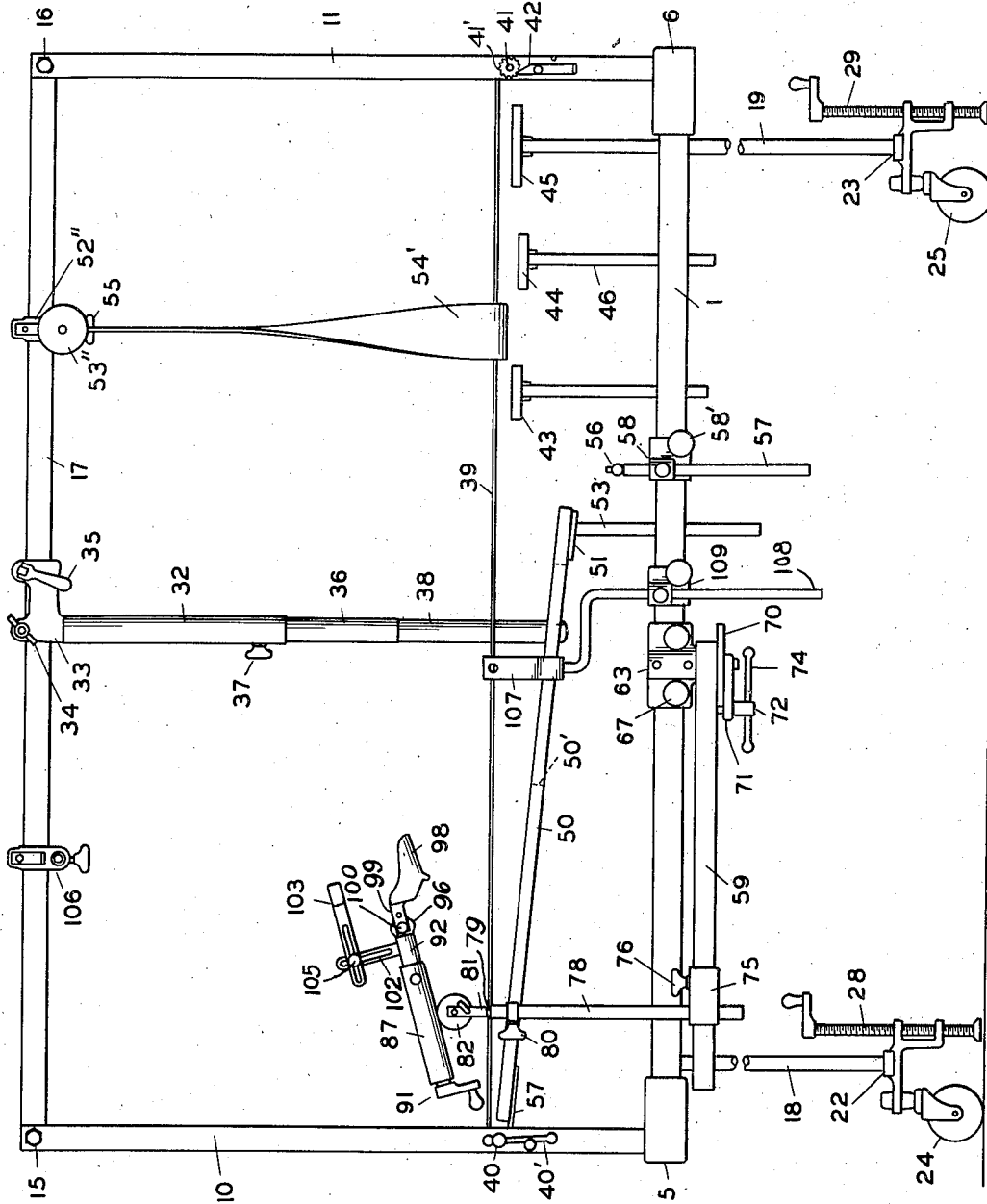


FIG. 1.

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FIG. 2.

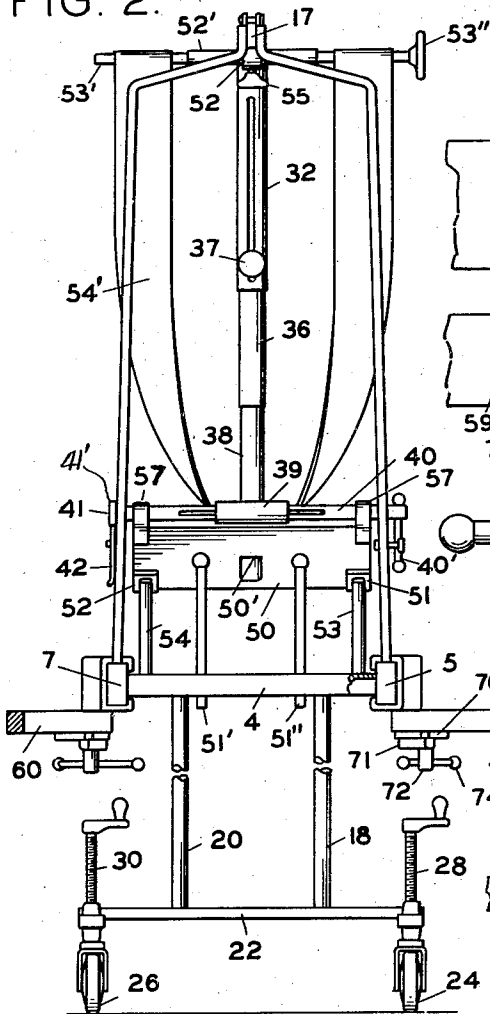


FIG. 4.

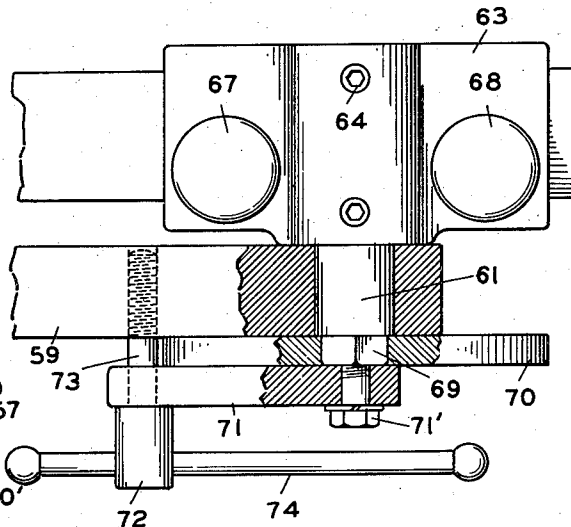


FIG. 5.

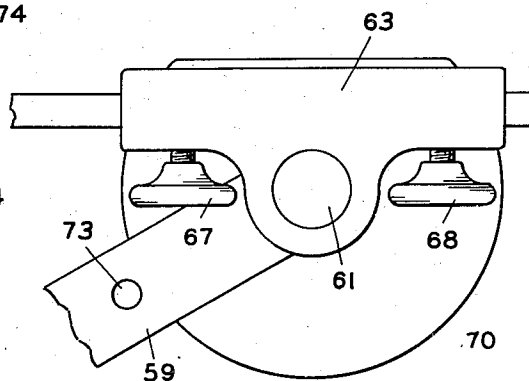
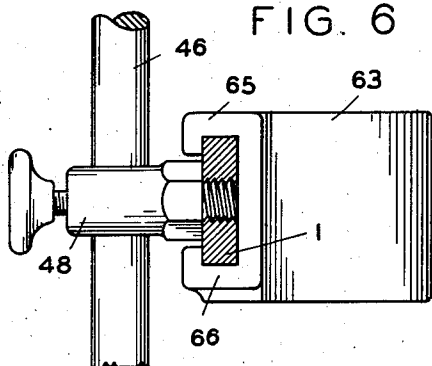


FIG. 6



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FIG. 3.

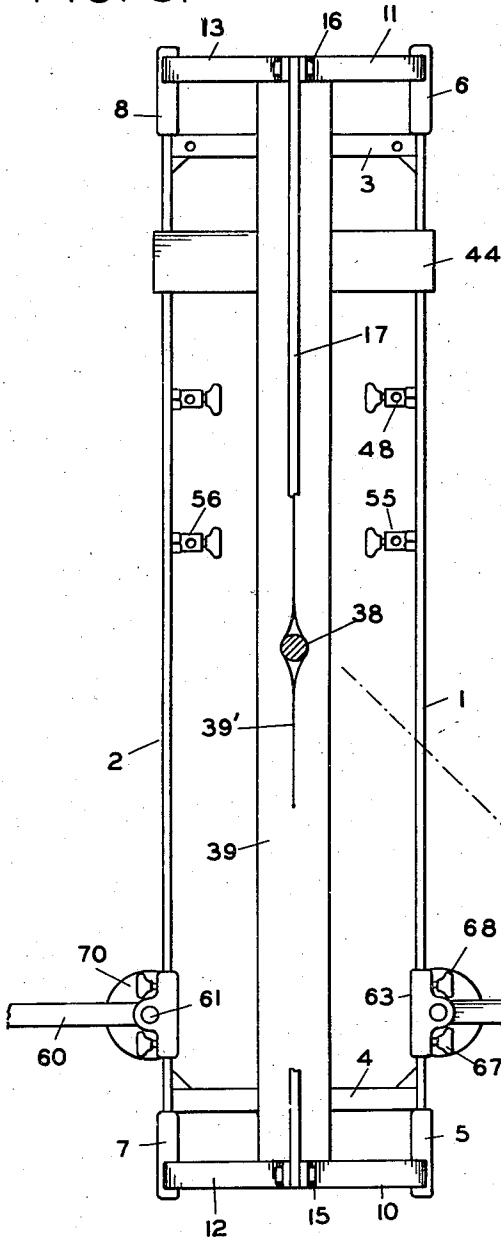


FIG. 7

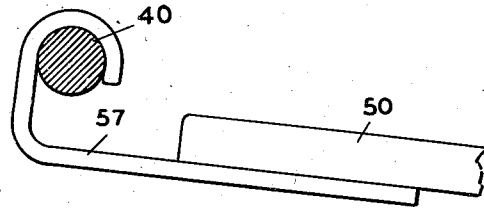
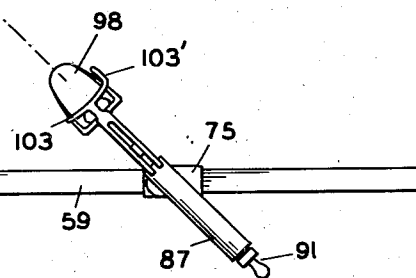
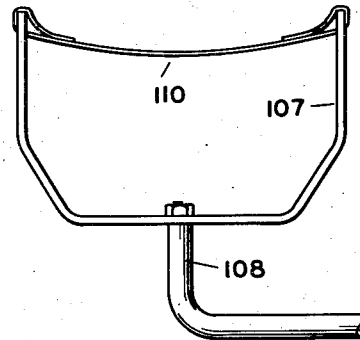


FIG. 8



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2,150,314

ORTHOPEDIC APPARATUS

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Application October 28, 1935, Serial No. 47,066

1 Claim. (Cl. 128—84)

This invention relates to improvements in orthopedic apparatus and more particularly to the general construction and arrangement of the frame and the accessories combined therewith.

An object of the invention is to support a human body in such a manner that it may be subjected to X-ray photography at any angle without interposed supporting means impenetrable to the photographic rays.

Another object is to subject the human body to orthopedic stresses for the restoration or correction of fractures or maladjustments, while suspending the body in a manner to permit free access thereto for the purposes of fluoroscopic examination photography and/or the application of plaster casts or other corrective means.

Another object is to provide means for subjecting the human anatomy to all the tractive, rotative and compressive stresses that the articulated members of the body will permit and maintain said stresses as long as required.

Another object is to support the human body as long as necessary to perform operations or orthopedic manipulations without undue injurious trauma or pressure.

Another object is to provide an apparatus easily knocked down or assembled for emergencies such as war conditions.

Other objects and advantages will appear as the description progresses.

The X-ray is a very important adjunct in modern orthopedic, surgical and therapeutic practice. Heretofore surgical tables have not given the necessary freedom of access to the body of the patient, with a sufficient range of angularity to meet all requirements. In orthopedic practice, especially in reducing skeletal fractures, it is essential that the operator know at all times, by fluoroscope or photography, the exact condition of the bone structure buried within the intervening tissue free from extraneous shadows cast by contiguous apparatus. It is equally important that tractive and other accessories be attached to the table frame in such a manner that corrective stresses can be applied to the limbs of the patient at a full range of angles not limited by any inadequacy of the apparatus.

For further particulars regarding the tractive accessory particularly adapted for use in this connection, reference is made to my co-pending application, Serial Number 47,065, filed Oct. 28, 1935, entitled Orthopedic appliances.

In the present invention any articulated member of the human skeletal structure can be subjected to traction or compression by placing the

patient or the accessories in appropriate relative positions in the apparatus.

In this specification and the accompanying drawings the invention is disclosed in its preferred form. It is to be understood, however, that it is not limited thereto because it may be embodied in modifications within the purview of the claim following the description.

In the three sheets of drawings:

Fig. 1 is a side elevation of an orthopedic apparatus constructed in accordance with this invention.

Fig. 2 is an end view of the same.

Fig. 3 is a plan view from above of the same.

Fig. 4 is an enlarged detail in side elevation of the pivotal spar mounting.

Fig. 5 is a plan view from above of the same.

Fig. 6 is a fragmentary detail in elevation showing the adjustable supports for the transverse boards.

Fig. 7 is a side elevation partly in vertical section of the mounting of the supplementary supporting table.

Fig. 8 is an elevation of the knee rest.

In detail the construction illustrated in the drawings, referring first to Fig. 3, comprises a rectangular main frame comprising the side bars 1 and 2 joined by the cross struts 3 and 4 spaced inward from the ends of the side bars. The opposite ends of these struts are welded or bolted to the side bars 1 and 2 and suitably reinforced to strengthen the structure. These side bars 1 and 2 are preferably formed of steel flats either solid or tubular stock about $\frac{1}{2}$ " x $1\frac{3}{4}$ " and 7 feet long. Where saving of weight is desirable suitable aluminum alloys may be substituted.

The several sleeves 5 to 8 have vertical sockets to receive the uprights 10, 11, 12 and 13 fixed therein. These uprights are bent inward and have their upper ends joined by the bolts 15 and 16 respectively. The longitudinal beam 17 has its ends fixed between the uprights by the bolts 15 and 16 to form a rigid superstructure above the main frame.

The main frame is supported by the standards 18, 19, 20 and 21, fixed to the end struts 3 and 4 at the top and to the transverse trucks 22 and 23 supported upon the suitable caster rollers 24, 25, 26 and 27. These trucks also have the screw spindles 28, 29, 30 and 31 at the several corners of the apparatus, so that they may be lowered to the floor to support the apparatus for greater rigidity when portability is undesirable. The standard 21, the roller 27 and the spindle 31 are obscured by their companion parts in Fig. 1. Ele-

vating the frame to accommodate various heights of operators may also be effected by these screw spindles.

The vertical tube 32 is fixed to the bracket 33 adjustably clamped on the beam 17 by the thumb bolts 34 and 35. The tube 36 is slidable in the tube 32 and may be fixed by the set screw 37. The perineal post 38 is preferably of wood or any material that will cast the least shadow when penetrated by X-ray is fixed in the end of the tube 36 and is adapted to fit into the crotch of the patient.

The relatively narrow strip 39 of fabric such as canvas extends between the uprights 10—11 and encircles the windlasses 40 and 41 at its respective ends. Relatively narrow, defines a strip narrower than the human torso. These windlasses have transverse slots therein to receive the ends of the strip 39 to facilitate engagement of these respective ends to draw the strip tight. The opposite ends of these windlasses extend through bearings in their respective uprights 10—12 and 11—13. One end of each windlass has a cross pin therethrough such as 40' to turn the windlass. And the opposite ends have a ratchet such as 41' fixed thereon to engage a ratchet pawl 42 pivoted on the upright to hold the tension applied to the strip by one or both of the windlasses. This strip is elevated above the main frame and is adapted to support the whole weight of the patient reclining thereon. The strip may be slit at 39' to pass the end of the post 38 to hold it in engagement with the rod should the patient tend to roll off the strip.

It is often desirable to vary the hammock like suspension of the patient on the strip 39. To this end the transverse supports 43, 44 and 45 cooperate with the strip 39 to vary its horizontal plane at the cranial, cervical and dorsal portions of the patient, to change the posture to meet the operative requirements. These supports are alike in structure and the description of one will apply to all. The transverse boards such as 44 have the legs 46 fixed thereto and extending downward and adjustably through sockets in studs such as 48 which are screwed into the side bars 1 and 2 from the inside at the desired positions, see Fig. 3. One or all of these supplementary supports 43—45 may be removed or omitted when they would interfere with photographic or operative access to the respective portions of the patient. The several boards 43—45 can be of glass or other photo-penetrable material and may remain in position if necessary.

The fluoroscope may then be employed at any time during the progress of the operation without disturbing the position of the patient and apparatus.

The table 50 is of material similar to that of the supports 43—45 and is adapted to support the buttocks and lower limbs of the patient not shown as in Fig. 1. Its inner end extends to approximately the center of the length of the main frame. This end has the socket plates 51 and 52 engaging the upper ends of the legs 53 and 54 which adjustably engage sockets in the studs 55 and 56, alike in structure and effect with the studs 48 and 49. The outer end of the table has hooks such as 57 fixed thereto and adapted to hook over the adjacent windlass 40. Where such procedure is indicated the torso of the patient may rest upon this table 50, or the table may be omitted or removed when not required. The guide posts 51' and 51'' support the table 50 to facilitate its removal after its having been unhooked from the

windlass 40. The table 50 has the longitudinal slot 50' therein to receive the lower end of the perineal post 38. This serves to brace the post 38 to increase its transverse stability.

The bracket 52'' is adjustably fixed on the beam 17 and has the transverse sleeve 52' therein. The windlass 53' is rotatable in the sleeve 52' and has the opposite ends of the canvas sling 54' wound thereon. The sling 54' may extend below or above the strip 39 as indicated in the technique of the operation to be performed. The hand wheel 53'' is provided for turning the windlass to raise the sling 54'. The hand screw 55 in the bracket 52 locks the windlass 53' after the sling has been raised to the desired position.

The transverse bar 56'' has the legs 57'' at each end which are vertically adjustable in the brackets 58'. The brackets are slidable on the side bars 1 and 2 and are held in adjusted position thereon by the hand screws 58'', see Fig. 1. This transverse bar 56'' may be raised to support the lumbar region of a patient resting upon the strip 39.

Thus far the combination and arrangement of parts of the apparatus lends itself to the comfortable support of the patient in a manner best adapted to photography and fluoroscopic examination by X-ray, with minimal interposition of the various parts of the apparatus.

It is of prime importance that the patient be as comfortable as his condition will permit if conscious, so that he may physically and mentally relax. If unconscious he must be protected against falling from the strip 39, and against any contact or pressure that will irritate his organism, since he may be confined to the apparatus over a period of hours in extreme instances. It is equally important that the above conditions be maintained during the period of orthopedic or surgical operations.

The lateral spars 59 and 60 are preferably square in cross section for strength and rigidity. They are alike in assembly and the description of one will serve for both. A gudgeon pin 61 is fixed in a socket in the block 63 by the set screws 64, see Fig. 4. The block 63 has the hook flanges 65 and 66 overhanging the side bar 1 and clearing the studs 48, see Fig. 6, to permit the block to slide freely on the side bar from end to end of the main frame. The block is fixed in the desired position by the hand screws 67 and 68.

The lower protrusion 69 of the gudgeon pin 61 has the quadrant plate 70 forced thereonto to form a practically integral structure therewith.

The spar 59 or 60 has its end mounted on the gudgeon pin 61 between the quadrant plate 70 and the block 63 and is freely pivotal thereon supported by the quadrant 70. The bolt 71' screwed into the gudgeon pin 61 pivots the end of the clamp bar 71. The spindle 73 passes through the clamp bar 71 and is threaded into the spar 59. It has the head 72 bearing beneath the clamp bar. The handle 74 passes through the head 72 and provides means for turning the spindle to clamp the spar and the clamp bar 71 against the immovable quadrant plate 70, to fix the spar at any desired angle to the side bar of the main frame.

The spars are each provided with encircling sleeves such as 75, see Fig. 1, freely slidable thereon and held in any desired position by the set screw 76. Each sleeve is provided with a lateral vertical socket 77 and a set screw 78', to receive and adjustably hold the tubular standard 78. The rod 79 telescopes within the standard and is held at any adjusted radial angle by the set screw 80, see Fig. 1.

This rod has the yoke 81 fixed on its upper end, see Fig. 8. The disk 82 is pivoted in this yoke on the cross pin 83. The set screw 84 is threaded through one leg of the yoke and bears against the side of the disk 82 to hold it in adjusted position.

The barrel 87 is slidably connected to the disk 82 by means shown and described in Patent No. 2,124,102 issued to me July 19, 1938. The crank 91 is adapted to advance or retract the barrel 87 with respect to the disk 82.

The heel rest 98 has the split stem 99 pivoted on the flat portion 96 by transverse bolt 100. When the heel of the patient is placed in the heel rest 98, the foot can be tipped at any desired angle, and the axis of the patient's leg can be arranged in alinement or at an angle to the axis of the shank 92 and held in position by means of a suitable hand screw.

The toe stirrup 103 has a slotted shank, adjustably fixed to the standard 102 by the thumb screw 105, for holding the patient's foot in adjusted relation to the heel rest 98. The toe stirrup has the lateral extension 103' which engages the side of the patient's foot against its natural tendency to turn outward. The patient's limb may be supported intermediate its length by the knee rest consisting of the yoke 107, see Figs. 1 and 8, mounted on the offset standard 108 vertically adjustable in the bracket 109 on the side bar 1 or 2. The fabric strip 110 traverses the yoke 107 and receives the patient's knee.

With the patient's foot secured to the heel rest, traction can be applied to the patient's leg by turning the hand crank 91 to advance or retract the supporting barrel 87.

The perineal post 38 set in the crotch of the patient takes the stress of the traction applied to the leg of the patient. This post is padded with cotton to relieve the pressure against the patient. If a similar spar and assembly is set upon the opposite side of the table, the patient can thus absorb most of the stress of the traction on the opposite leg and relieve the pressure against the post 38. It is obvious that through the various adjustments of the spar assembly with respect to the main frame, the various adjustments in the support of the tractive elements thereon and the motions possible with the foot support, all the motions provided by the articulations of the human leg can be accomplished and held indefinitely by this apparatus in setting a fracture or applying corrective measures. In

the case of displaced knee bones, while the leg is under traction the set screw 95 can be released and the patient's foot rapidly oscillated with the result that the displaced bones of the knee will return to proper inter-relation without palpation of injured tissue. Traction can then be reduced, the screw 95 reset and the knee bandaged or set in plaster for proper healing.

If it is desired to elevate the traction assembly for oblique action from above, the standard 78 can be transferred to the clamp 106 adjustably fixed to the upper beam 17 of the table. If traction is not required from above a rod through this clamp in place of the standard 78 provides means for suspending the patient's flexed legs by bandages passed under his knees and over this rod.

In applying traction to the patient's limb obliquely to the long axis of the strip, the intermediate weight of the limb is supported by the yoke 107 having the stem 108, vertically adjustable in the clamp 109 fixed to the side bar of the main frame. The yoke 107 has the canvas strip 110 fixed therein and adapted to comfortably support the limb.

By swinging the spars at the proper angles to the sides of the main frame similar rotative and tractive stresses may be applied to the arms and shoulders of the patient by setting his elbows in the heel rest 98 and his forearm in the toe stirrup 103 and taping them thereto. Or full length arm stresses may be applied by taping the hands to the heel or toe members mentioned.

The uses and possible combinative modes of operation are so extensive that in actual practice over a period of many months this invention has never failed to meet every condition required of it, with mechanical and merciful advantages too numerous to be set forth herein.

Having thus described this invention what is claimed and desired to secure by Letters Patent is:

An orthopedic apparatus including a main frame; a superstructure supported by said frame; a taut relatively narrow flexible strip supported intermediate said frame and superstructure, an X-ray penetrable perineal post mounted on said superstructure and extending downwardly through said strip; and traction means on said frame in operative relation to said strip and post.

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