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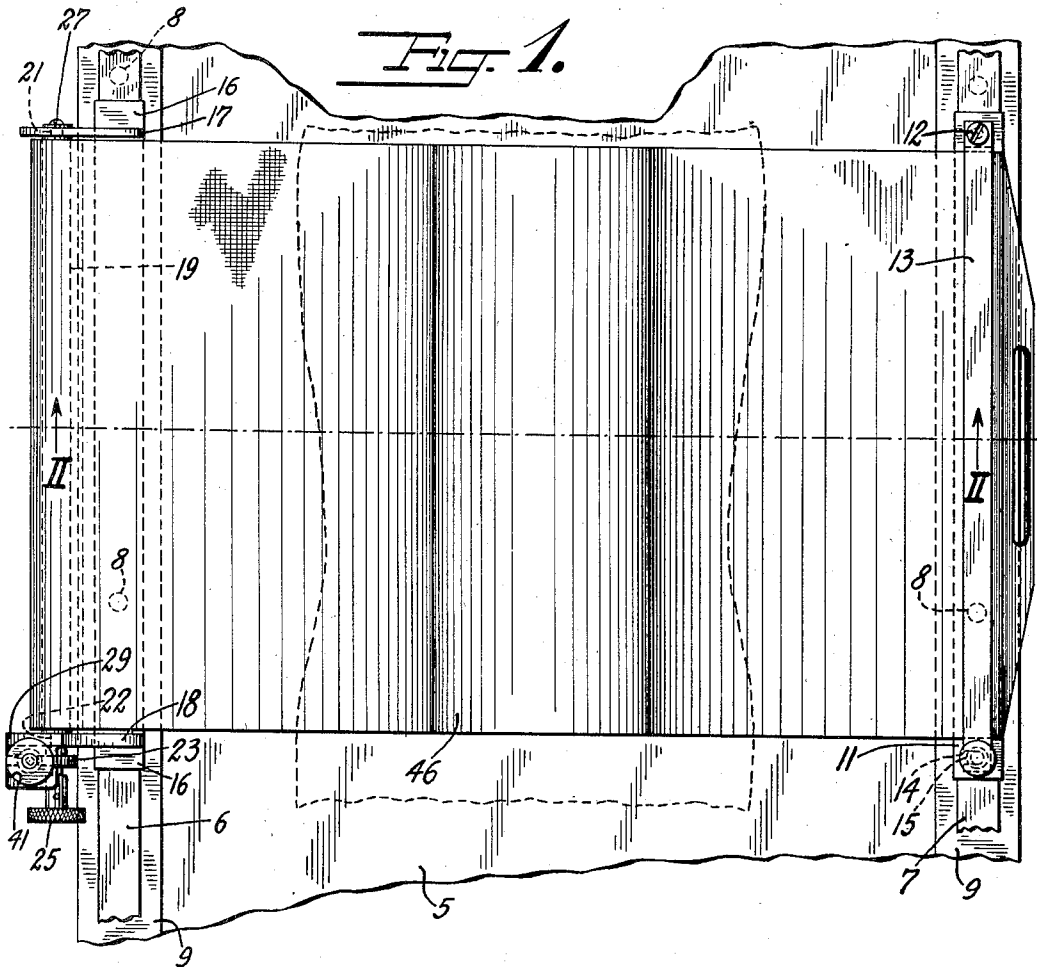
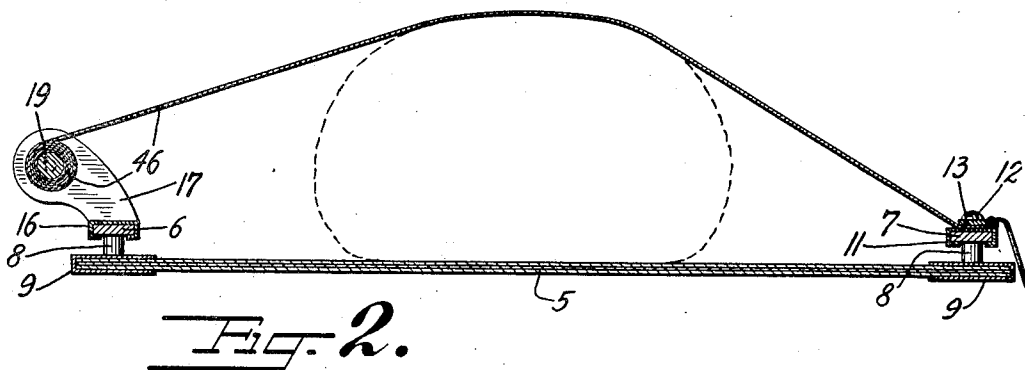
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2,027,318

IMMOBILIZATION BELT FOR X-RAY APPARATUS

Filed Sept. 2, 1932

3 Sheets-Sheet 1



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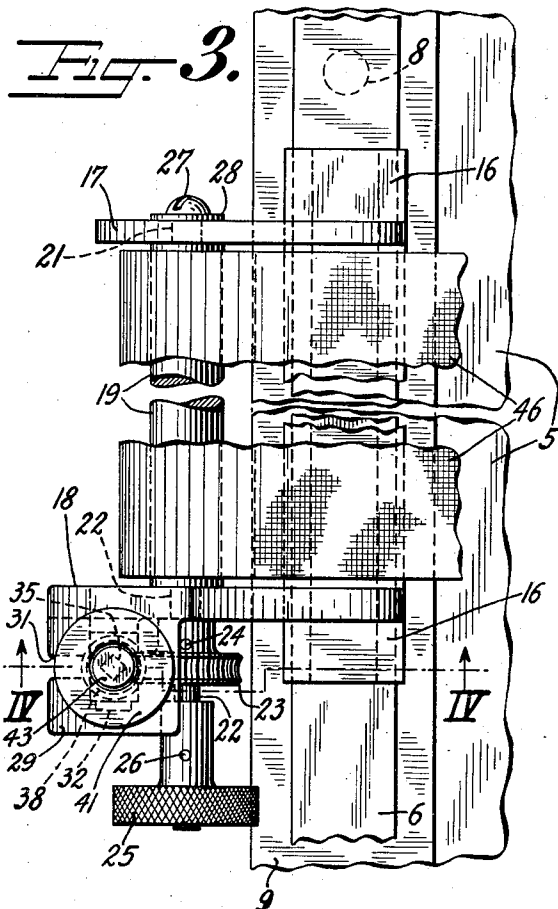
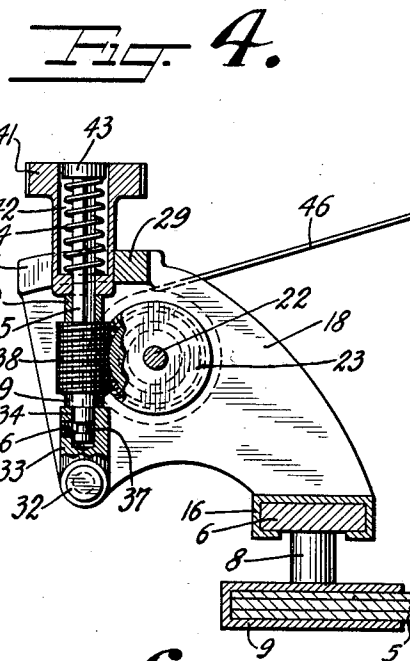
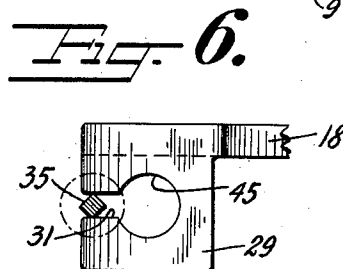
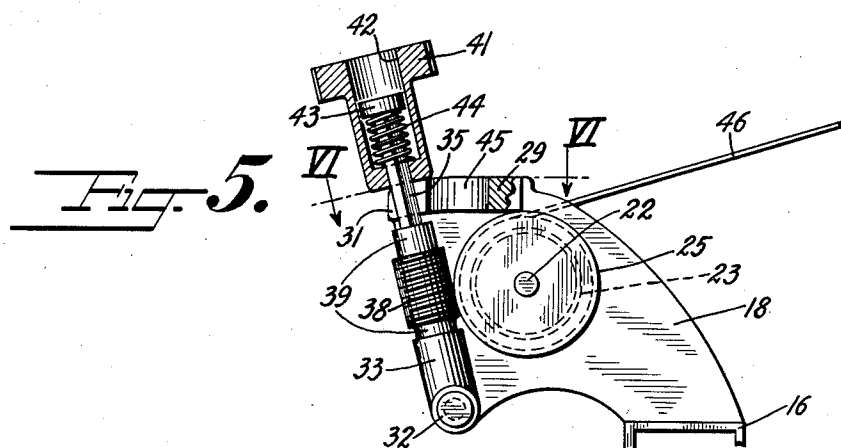
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IMMOBILIZATION BELT FOR X-RAY APPARATUS

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3 Sheets-Sheet 2



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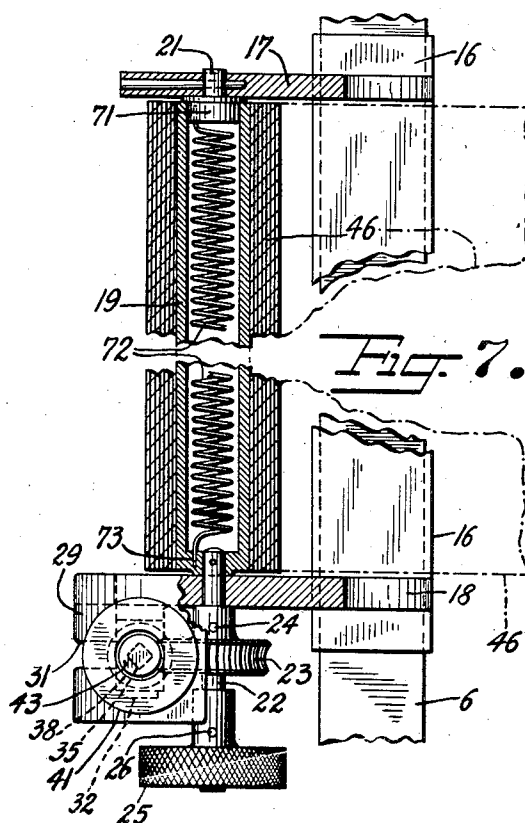
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IMMOBILIZATION BELT FOR X-RAY APPARATUS

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,027,318

IMMOBILIZATION BELT FOR X-RAY
APPARATUS

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Application September 2, 1932, Serial No. 631,487

6 Claims. (Cl. 250—34)

My invention relates to X-ray apparatus and has particular relation to what is termed in the art an immobilization belt for such apparatus.

In the taking of radiographs of various parts of the human body or a fluoroscopic diagnosis thereof it is of primary importance that the patient remain, as far as practical, in a state of immobility. Any movement therefor which is disclosed by the screen or film will be readily recognizable as only the movements of the various organs in their natural function.

In the taking of either of these types of diagnostic examinations the patient is usually placed in an erect or prone position, against a supporting panel which is permeable to X-rays, such as is usually employed upon X-ray tables. In securing the patient to the supporting member it has been heretofore the practice to employ a belt of woven or strong fabric material which is naturally transparent to X-rays. These belts have been wound upon a roller and after the patient is placed upon the table in the desired position one end of the belt is passed over the body of the patient and secured to the opposite side of the table top or supporting panel. The roller is then rotated by means of a hand knob until the belt is drawn as tight as possible without discomfort to the patient.

In these former devices, however, the leverage applicable to the belt for tightening the same has been considerably limited due to the necessity for the conservation of space, smallness of the control knob, and other difficulties. Moreover, after the diagnostic examination is completed the belt, after being unfastened from one side of the table, must be again wound by hand upon the roller which requires an appreciable period of time and effort on the part of the operator.

It is accordingly an object of my invention to provide a mechanism in which the immobilization belt can be readily tightened with very little effort on the part of the operator.

Another object of my invention is the provision of mechanism for making the immobilization belt as taut as desired wherein the leverage required is increased to such an extent that a finer degree of tautness can be obtained than has been possible heretofore.

A further object of my invention is the provision of an immobilization belt for X-ray apparatus wherein the tautness of the belt can be readily regulated to substantially any desired degree and in which the belt is automatically retracted to its normal position upon the roller upon release of the fastened end.

Still further objects of my invention will become readily apparent to those skilled in the art by reference to the accompanying drawings showing several forms which my invention may take and wherein

Figure 1 is a plan view of an X-ray apparatus wherein my novel mechanism is shown with the immobilization belt in the diagnostic position over the body of a patient,

Figure 2 is a sectional view taken on the line II—II of Figure 1,

Figure 3 is a plan view on an enlarged scale of the mechanism shown in Figure 1 with portions of the apparatus broken away to better illustrate the several parts,

Figure 4 is a sectional view in elevation taken on the line IV—IV of Figure 3,

Figure 5 is similar to Figure 4 showing disengagement of some of the elements shown in detail in the latter figure,

Figure 6 is a plan view of a portion of the mechanism taken on the line VI—VI of Figure 5, and

Figure 7 is a sectional plan view of still another modification which my invention may take.

Referring now to the drawings in detail I have shown in Figure 1 a patient supporting member 5 which may be the usual panel employed in X-ray tables or vertical fluoroscopes. A pair of rails or tracks 6 and 7 are supported by suitable means, such for example as lugs 8, slightly above the panel or member 5 and extend longitudinally thereof adjacent the sides of the supporting member which is suitably reinforced by plates or a metallic channel iron 9. A channel bar 11 is loosely secured to the track or rail 7 for movement along this rail and secured to one extremity of this channel bar, by means of a suitable pivot 12, is a flat bar 13. This flat bar 13, at its other extremity, is provided with a slot 14 which is adapted to engage an upstanding pin or bolt 15 to secure this bar in position upon the channel bar 11.

A channel bar 16 is likewise loosely secured to the track 6 for movement longitudinally thereof and a pair of arcuate brackets 17 and 18 extend slightly upwardly and outwardly therefrom. A roller 19 is disposed between these brackets and at one end is provided with a portion of reduced diameter 21 which is journaled in the bracket 17. A similar reduced diameter portion 22 forming a shaft is journaled in the bracket 18 and extends a substantial distance beyond this bracket. A worm gear 23 is rigidly secured to this shaft portion 22 by a key or set screw 24 and a control knob 25 is similarly secured to the end of this shaft by a set screw 26. The roller 19, worm gear 23 and

control knob 25 thus form an integral unit which is rotatable by means of the control knob in the bearings formed by the brackets 17 and 18. A fastener, such for example as a screw 27 and washer 28, is provided in the end portion or shaft 21 to prevent end play and render the roller and cooperating parts detachable.

The bracket 18 is provided with a laterally extending portion 29 which is provided with a slot 31 and also with a laterally extending pin 32. A collar 33 is rotatably secured to the pin 32, and is provided with an upwardly extending hole 34. A square shaft 35 is provided with a rounded end which fits into the hole 34 and is held in place by means of a set screw 36 which engages a peripheral groove 37 provided in the shaft to allow rotation thereof and to prevent the shaft from becoming disengaged from the collar 33. A worm 38 is rigidly carried by the square shaft 35 and movement of this worm longitudinally of this shaft is prevented by means of suitable spacers or collars 39.

A control knob 41 is secured to one end of the square shaft 35 for the purpose of rotating the shaft and worm 38. This control knob, however, is arranged to move a short distance longitudinally of the shaft 35 for a purpose hereinafter more fully described. A slot 42 is accordingly provided in the control knob 41 and the extremity of the square shaft 35 is provided with a collar or shoulder 43 having a diameter slightly less than that of the slot 42. A coil spring 44 is positioned between the collar or shoulder 43 and the control knob 41 which tends to force the control knob 41 downwardly into contact with the upper collar 39 and the shoulder 43 flush with the control knob 41 as can be appreciated by reference to Figure 4.

The slot 31, provided in the laterally extending portion 29, is rounded out at the inner extremity thereof, such as is shown more clearly at 45 in Figures 5 and 6, to a diameter slightly larger than that of the lower portion of the control knob 41 to form a suitable seat for the latter. The control knob 41, square shaft 35, and worm 38 thus form an integral unit similar to that previously described relative to the control knob 25, worm gear 23, and roller 19.

This embodiment of my invention may be best understood by a description of the operation thereof. Assuming, therefore, that the immobilization belt 46, which may be of woven material, such as canvas or the like, is completely wound upon the roller 19 and it is desired to secure a patient to the table top or supporting member 5 the operator first pulls on the control knob 41 which raises it from the seat 45 or from the position shown in Figure 4. The control knob upon being removed from its seat enables it together with the square shaft 35 and worm 38 to be moved outwardly about the pivot 32 to disengage the worm 38 from the worm gear 23.

The control knob will thus remain in this position, as shown in Figure 5, due to the pressure exerted by the spring 44 upon the control knob 41 maintaining it in frictional engagement with the laterally extending portion 29 of bracket 18. The operator then grasps one end of the belt 46 and pulls it toward the other side of the table or supporting member 5 across the body of a patient, as shown in dotted lines in Figures 1 and 2, which will now unwind quite freely. He then swings the flat bar 13 in a counter-clockwise direction as viewed from Figure 1, causing the slotted end 14 to become disengaged from the pin 15. The end of the belt, which is provided

with a small rod running therethrough or a flap of increased thickness, is placed over the channel bar 11 and the flat bar 13 again swung back into its usual position thus forming a clamp for the belt.

The control knob 25 is then rotated in a counter-clockwise direction, as viewed from Figures 1 and 2, until the belt is as taut as possible. The maximum tautness thus attainable is entirely inadequate to maintain the patient in the state of immobility, however, because of the fact that the control knob 25 has an insufficient leverage which is limited by its size and direct connection to the roller 19. The operator accordingly pushes inwardly on the control knob 41 before removing his hand from the control knob 25. This causes a clockwise rotation of the control knob 41, worm 38, and square shaft 35 about the pivot 32 until the control knob snaps into its seat 45.

The worm 38 will accordingly engage the worm gear 23 which will prevent the roller 19 from unrolling upon removal of the operator's hand from the control knob 25. The control knob 41 is now rotated (its direction depending upon the pitch of the thread of the worm 38) which continues to rotate the roller 19, worm gear 23, and control knob 25 in a counter-clockwise direction thus increasing the tautness of the belt 46 with very slight effort on the part of the operator due to the increase in leverage now obtained. Moreover, upon release of the control knob 41 there is absolutely no slippage or slackening of the belt because the engagement of the worm 38 and worm gear 23 forms a lock which prevents this occurrence.

When the examination is completed the operator merely slackens off the belt by first rotating the control knob 41, in a direction opposite to that required to tighten the belt, disengages the worm and worm gear as previously described, unfastens the free end of the belt from the clamp formed by the bars 11 and 13, and rewinds the belt by rotating the control knob 25.

It thus becomes quite obvious that I have provided a simple mechanism for enabling an operator to increase the tautness of an immobilization belt to substantially any desired degree with a minimum of effort. However, with the structure of my invention thus far described considerable time and effort is required to rewind the belt upon the roller after the consummation of an examination. Accordingly I have shown in the remaining figures of the accompanying drawings mechanism which cooperates with that previously described to automatically return the belt to its normal or completely wound position.

Referring now more particularly to Figure 7 I have shown a modification of my invention which causes automatic retraction of the belt upon the unfastening of the free end thereof. In this particular modification the roller 19 is hollowed and the bracket 17 is provided with a cylindrical collar 71 rigidly secured thereto which forms a bearing for one end of the roller 19. The remaining end of the roller 19 is provided with a short shaft 22 which carries the various parts and is journaled in the bracket 18, this entire construction being identical to that described relative to the embodiment of my invention shown in Figures 1 to 6.

A coil spring 72 is disposed interiorly of the roller 19 within the hollow portion thereof with one end of this spring being secured to the stationary collar 71 which forms a bearing for the roller 19 and the remaining end of the spring is

secured to the roller in any suitable manner, such as shown at 73. In the operation of this modification the spring 72 is tensioned by rotation of the roller 19 in a clockwise direction as the belt 46 is unwound therefrom by the operator and secured by the clamp to the opposite side of the panel or supporting member 5 opposite the roller. After securing the free end of the belt the operator in rotating either or both of the control knobs 25 and 41 to make the belt 46 taut in the identical manner as previously described relative to Figures 1 to 6 releases some of the tension of the spring 72. This is because rotation of the roller is in a direction opposite to that required to tension the spring, but this release of tension is very slight and sufficient tension remains in the spring 72 to automatically retract the belt to its normal or completely wound position on the roller 19 immediately upon disengagement of the control knob 41 from the control knob 25 and the unfastening of the free end of the belt from the clamp comprising the bars 11 and 13.

The roller 19 and mechanism associated therewith, as well as the clamp or fastening device, is mounted upon the rails or tracks 6 and 7 as before stated to permit movement thereof longitudinally of the panel or supporting member. This enables the belt to extend transversely of the supporting member across any desired portion of the body of a patient to retain the body itself or any extremity, such as the arms or legs, in a state of immobility during a diagnostic examination.

It thus becomes obvious to those skilled in the art that I have provided a simple mechanism for X-ray apparatus in which the immobilization belt can be readily made taut to any desired degree with the expenditure of little or no effort on the part of an operator. Moreover, the belt is automatically retracted to its normal position upon the roller after the completion of the examination.

Although I have shown and described several embodiments of my invention I do not desire to be specifically limited thereto as various other modifications of the same may be made without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In an X-ray apparatus, the combination with a patient supporting member, of means for rigidly securing the body of a patient to said member comprising a roller secured to one side of said patient supporting member and movable longitudinally thereof, a belt normally wound upon said roller adapted to be unwound therefrom and to extend transversely of said patient supporting member across the body of a patient with its free end secured to said patient supporting member opposite said roller, a shaft extending from said roller provided with a worm gear and a control knob, said control knob being operable to make said belt taut across said patient supporting member and the body of a patient, and a pivoted shaft adjacent the worm gear carried by said first mentioned shaft and provided with a control knob and a worm, said pivoted shaft being rotatable to cause said worm to engage said worm gear for rendering said last mentioned control knob operable to increase the tautness of said belt across the body of a patient, and for locking said roller in a desired position.

2. In an X-ray apparatus, the combination with a patient supporting member, of means for rigidly securing the body of a patient to said member comprising a roller carried by said patient sup-

porting member, a belt normally wound upon said roller adapted to be unwound therefrom and to extend transversely of said patient supporting member across the body of a patient with its free end secured to said patient supporting member opposite to said roller, and means connected to said roller and operable upon the unfastening of the free end of said belt to automatically retract said belt to its normal position upon said roller.

3. In an X-ray apparatus, the combination with a patient supporting member, of means for rigidly securing the body of a patient to said member comprising a roller carried by said patient supporting member, a belt normally wound upon said roller adapted to be unwound therefrom and to extend transversely of said patient supporting member across the body of a patient with its free end secured to said patient supporting member opposite to said roller, means connected to said roller and operable to make said belt taut, and means connected to said roller and operable upon the unfastening of the free end of said belt to automatically retract said belt to its normal position upon said roller.

4. In an X-ray apparatus, the combination with a patient supporting member, of means for rigidly securing the body of a patient to said member comprising a roller carried by said patient supporting member, a belt normally wound upon said roller adapted to be unwound therefrom and to extend transversely of said patient supporting member across the body of a patient with its free end secured to said patient supporting member opposite to said roller, means connected to said roller and operable to make said belt taut, means connected to said roller and rotatable therewith, means movable into engagement with said last mentioned means and operable to increase the tautness of said belt and lock said roller in the desired position, and means connected to said roller and operable, upon the disengagement of said last mentioned means and the unfastening of the free end of said belt, to automatically retract said belt to its normal position upon said roller.

5. In an X-ray apparatus, the combination with a patient supporting member, of means for rigidly securing the body of a patient to said member comprising a roller carried by said patient supporting member, a belt normally wound upon said roller adapted to be unwound therefrom and to extend transversely of said patient supporting member across the body of a patient with its free end secured to said patient supporting member opposite to said roller, means connected to said roller and operable to make said belt taut, means associated with said roller and said first mentioned means and rotatable with said roller, means adapted to be operably connected to said last mentioned means for causing said roller to increase the tautness of said belt and lock said roller in the desired position, and means carried by said roller and operable, upon the disengagement of said last mentioned means and the unfastening of the free end of said belt to retract said belt to its normal position.

6. In an X-ray apparatus, the combination with a patient supporting member, of means for rigidly securing the body of a patient to said member comprising a roller carried by said patient supporting member, a belt normally wound upon said roller adapted to be unwound therefrom and to extend transversely of said patient

supporting member across the body of a patient
with its free end secured to said patient support-
ing member opposite to said roller, a control knob
connected to said roller and operable to make said
5 belt taut across said patient supporting member
and the body of a patient, a gear connected to
said roller and operable to cause rotation thereof,
a pivoted shaft provided with a wear gear mov-
able into engagement with said last mentioned
10 gear, a control knob secured to said shaft and

operable to cause rotation of said roller when said
gear and worm gear are in engagement to in-
crease the tautness of said belt and lock said
roller in a desired position, and a spring affixed
to said roller for storing potential energy therein 5
as said belt is unwound from said roller and oper-
able to retract said belt to its normal position
upon disengagement of said gear and worm gear
and the unfastening of the free end of said belt.

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