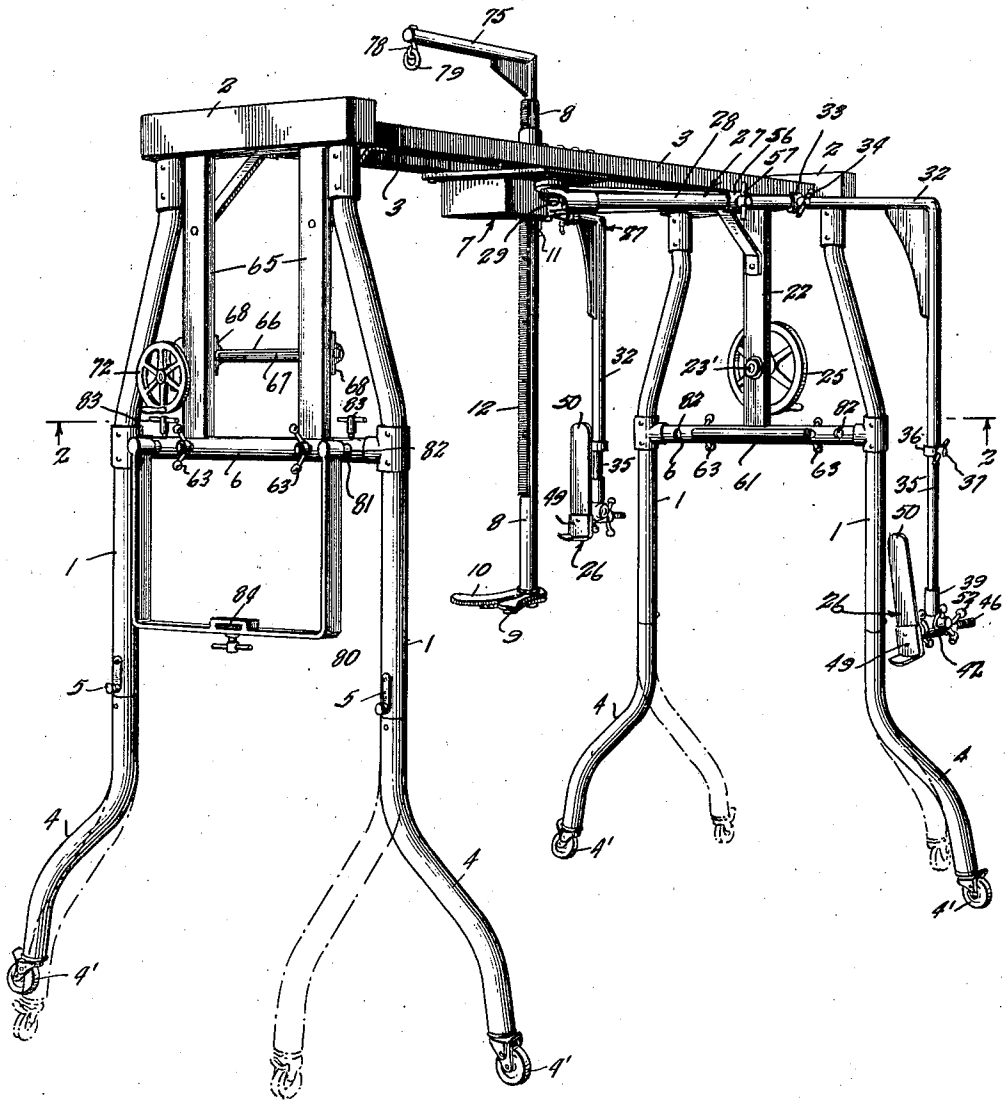
Dec. 29, 1942. H. M. BERGAMINI 2,306,929

FRACTURE FRAME

Filed Aug. 29, 1941 5 Sheets-Sheet 1

FIG. 1.



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FRACTURE FRAME

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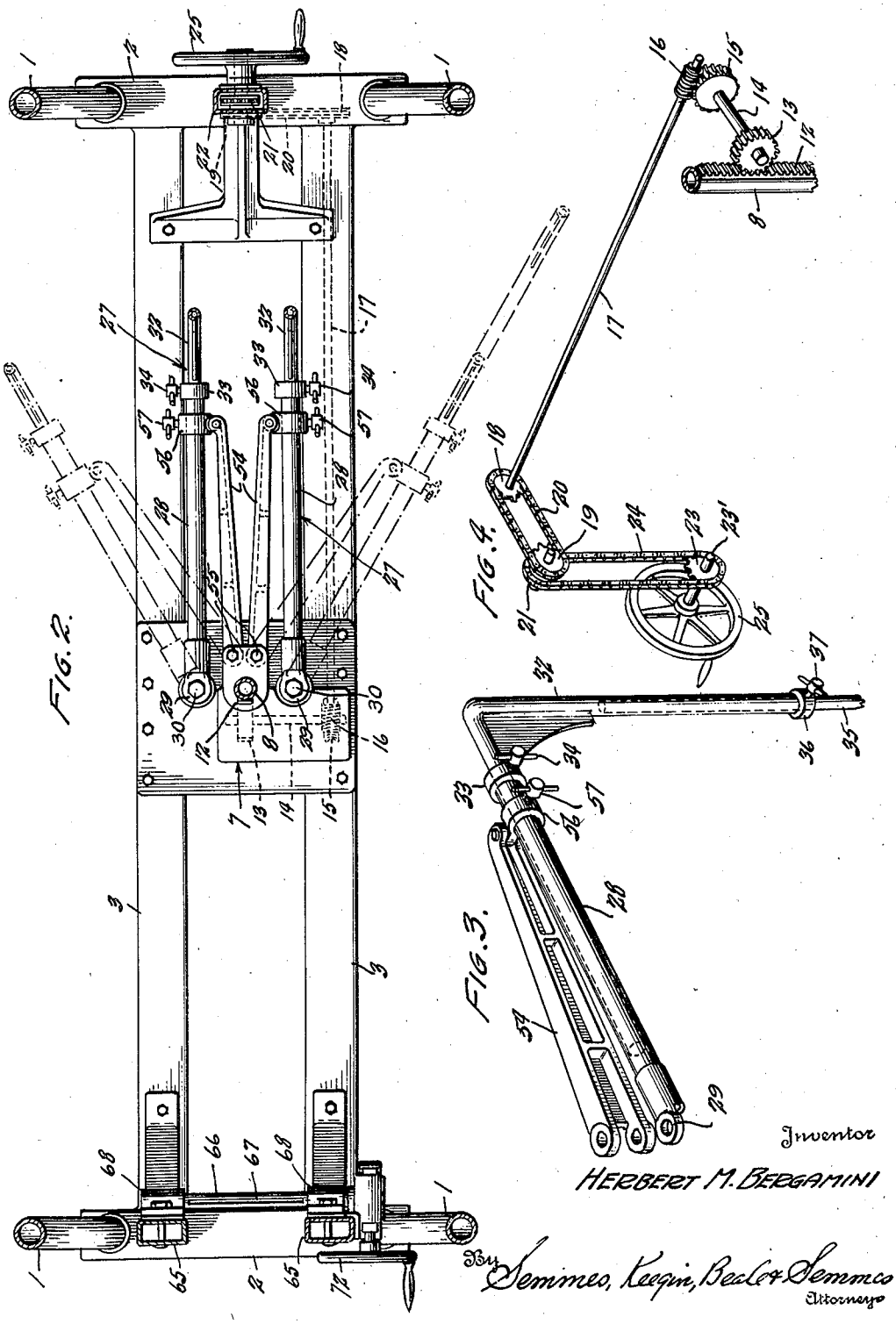

FIG. 2.

FIG. 4.

FIG. 3.

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FRACTURE FRAME

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FIG. 5.

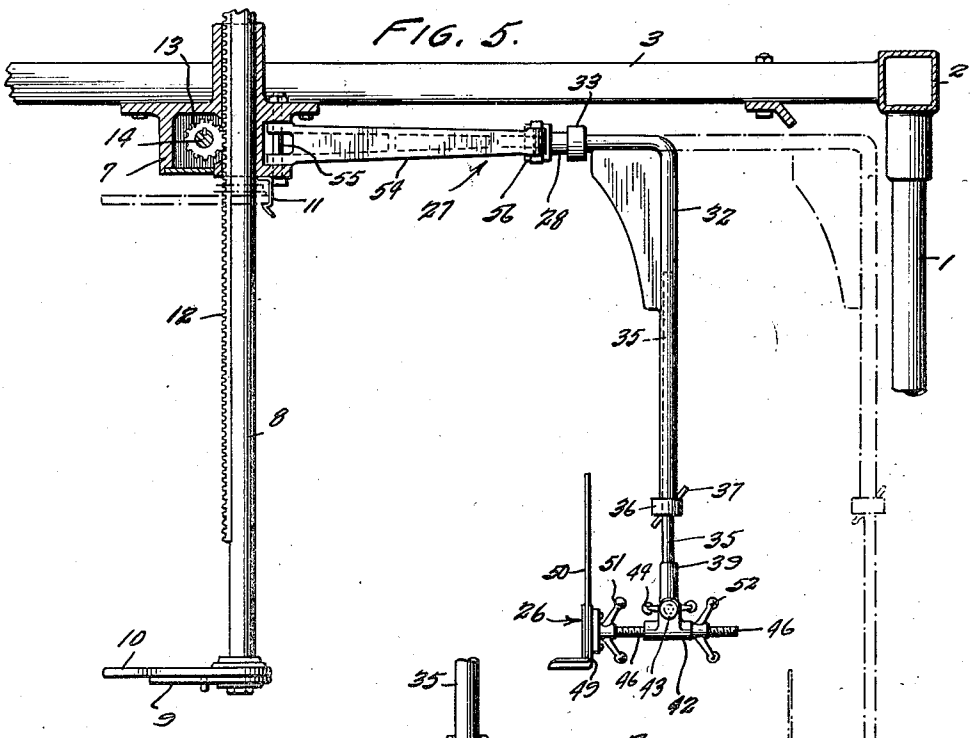


FIG. 7

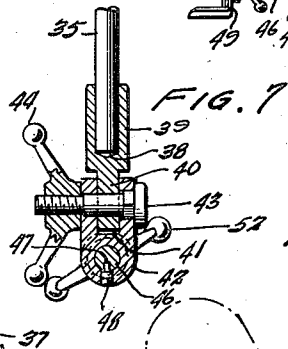


FIG. 6.

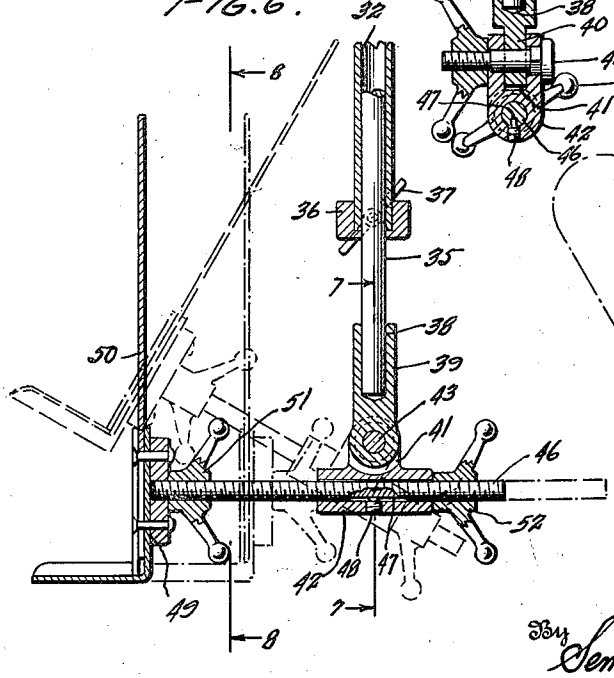
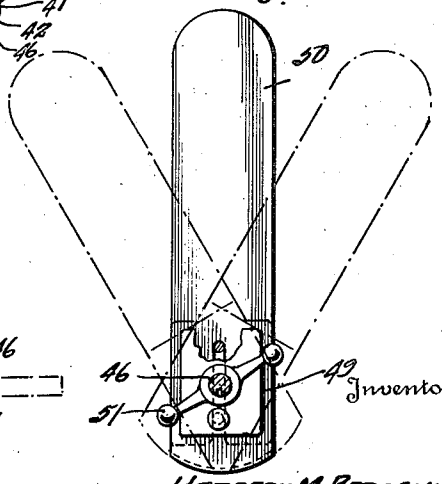


FIG. 8.



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FRACTURE FRAME

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FIG. 9.

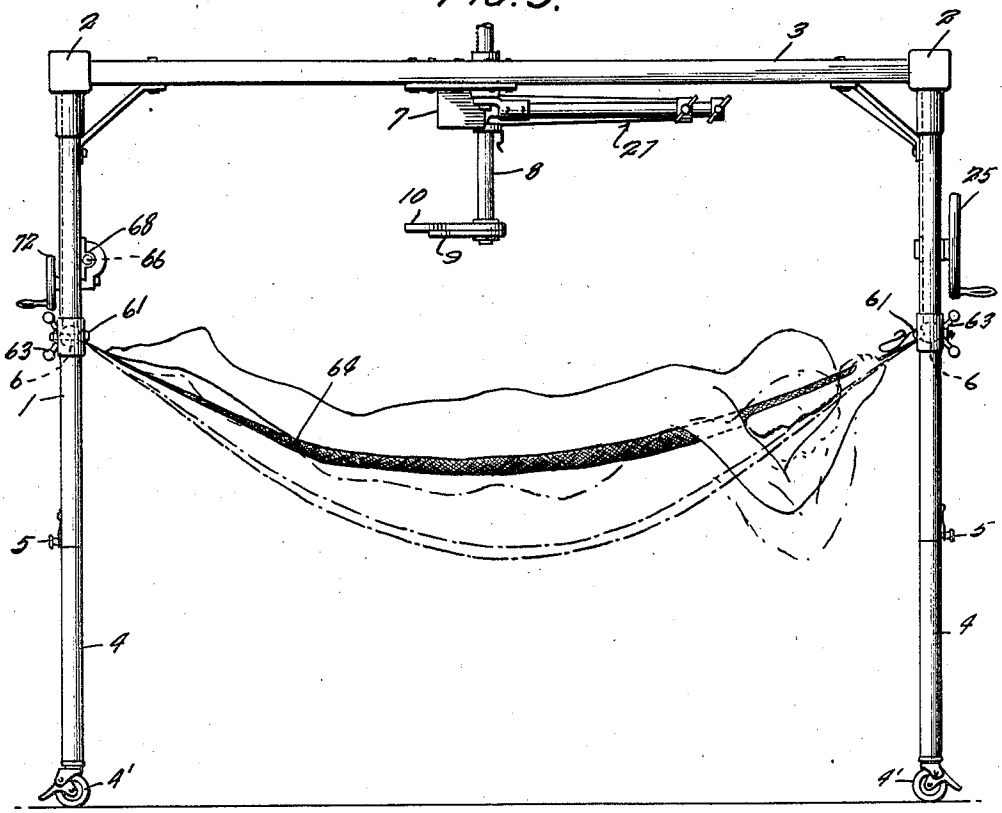
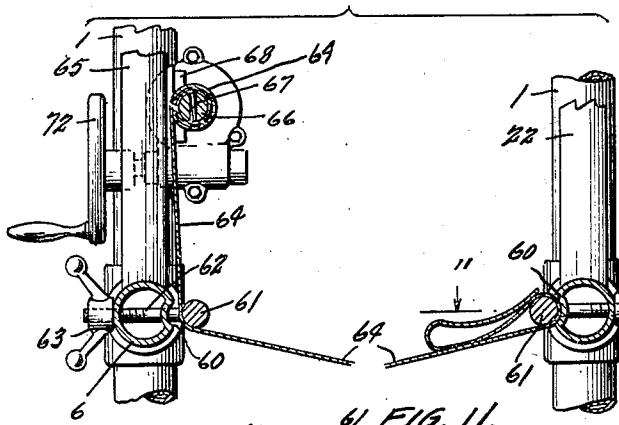


FIG. 10.



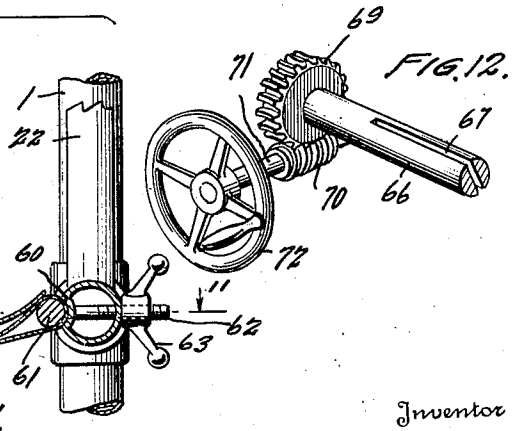
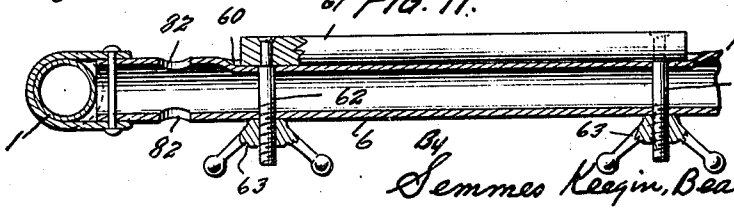


FIG. 12.

FIG. 11.



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FRACTURE FRAME

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FIG. 13.

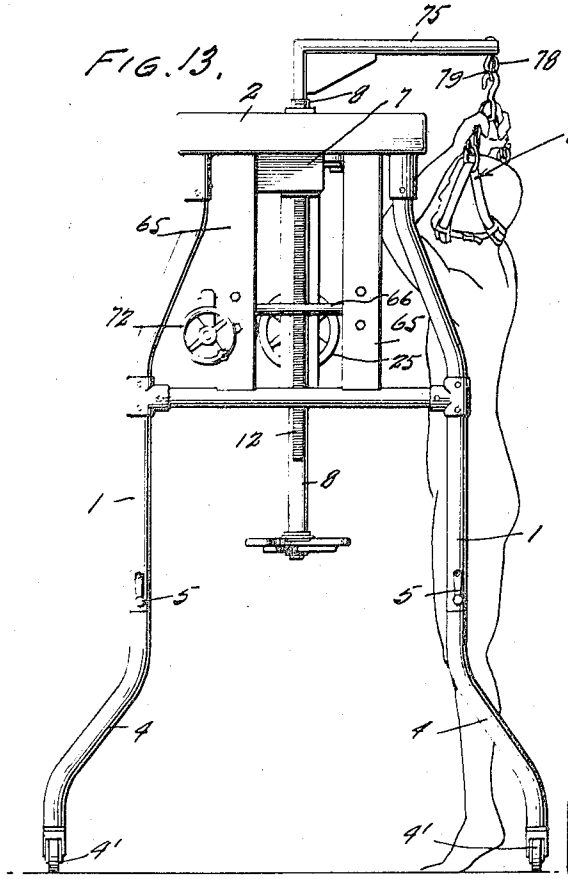
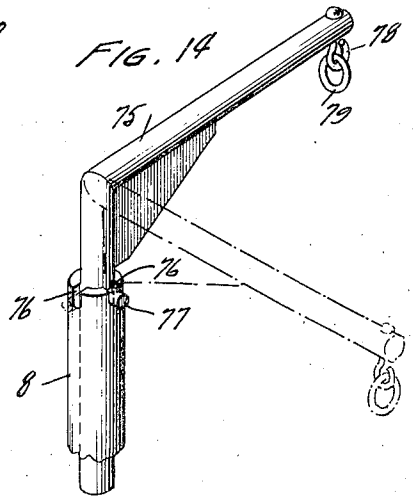


FIG. 14



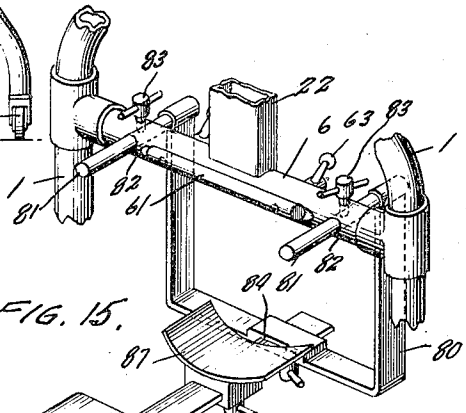


FIG. 16.

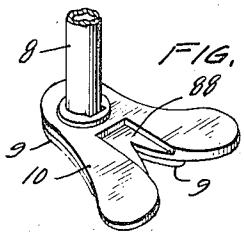
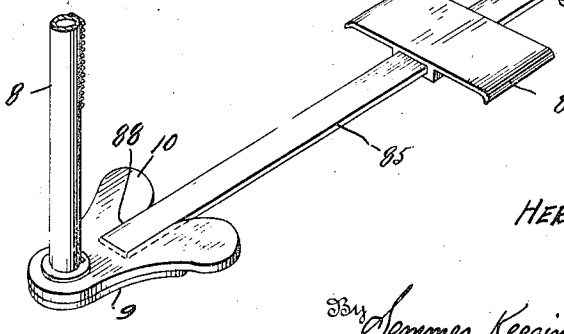


FIG. 15.



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Patented Dec. 29, 1942 2,306,929

UNITED STATES PATENT OFFICE

2,306,929

FRACTURE FRAME

Herbert M. Bergamini, New York, N. Y.

Application August 29, 1941, Serial No. 408,877

10 Claims. (Cl. 128—84)

This invention relates to orthopedic surgery, and more particularly it has reference to a fracture frame or supporting structure wherein the patient is supported from above, thus eliminating the necessity of lifting the patient bodily from a stretcher onto a fracture table and at the same time affording sufficient freedom from obstruction to permit X-ray and fluoroscopic examination of the injured parts from all desired angles.

An object of the invention is to provide a fracture frame that will permit correct manipulation and setting of fractures of either the upper or lower extremities.

Another object is to provide a fracture frame having the patient supporting means and the extremity supporting members suspended from the frame.

A further object is to provide a fracture frame having suspended patient supporting means and extremity supporting members with means whereby the vertical position of the patient supporting means can be varied and the angular, longitudinal and vertical positions of the extremity supporting members with respect to the patient supporting means can be adjusted.

And a further object is to provide a frame of the type herein described with means whereby the extremity supporting members may be suspended from the frame and having the extremity supporting members mounted for universal movement on the suspending means.

An additional object of the present invention is to provide a fracture frame wherein the extremity supporting members are suspended from the frame thereby preventing displacement of the foot piece caused by the weight of the injured part.

Still a further object is to provide a fracture frame with a patient supporting member that is suspended from the frame and vertically adjustable with respect to the frame which carries at its free end a "gallows" for treating patients with broken backs.

Yet another object of the present invention is to provide a fracture frame with means to support a "sling" or "hammock" to enable the treatment of broken backs and provided with further means to adjust the position of the "sling" or "hammock."

Still a further object is to provide a mobile fracture frame that is pleasing in appearance including a few principal working parts and capable of being manufactured cheaply.

To achieve the above and other objects, the invention embraces broadly a mobile frame comprising upright members interconnected by means of longitudinal members. Suspended from the longitudinal members and movable vertically in relation thereto is a patient supporting rest. Likewise suspended from the frame are a plurality of supports each of which may be adjusted with respect to the patient supporting rest. Mounted to each supporting member for universal movement is an extremity supporting member, thereby permitting any type of fracture to be taken care of. The supporting members, in addition to having angular movement have longitudinal and vertical movement whereby the extremity supporting member may be moved closer toward or farther away from the patient supporting rest to accommodate various leg or arm lengths and various methods of treating the injured parts.

A "hammock" for the treatment of patients with broken backs may be associated with the upright members and means are provided whereby the arc of the "hammock" may be varied to compensate for the particular type of injury. In addition, a "gallows" is connected to the upper end of the patient supporting member for the treatment of broken backs.

In the drawings, in which like numerals indicate the same or similar parts:

Figure 1 is a view in perspective of my novel fracture frame;

Figure 2 is a sectional view taken along line 2—2 of Figure 1 looking in the direction of the arrows;

Figure 3 is a view in perspective of one of the members for suspending the extremity supporting member from the frame;

Figure 4 is a diagrammatic representation of the gearing for elevating or lowering the sacral seat;

Figure 5 is a fragmental transverse sectional view of the frame showing perineal bar and sacral seat attached thereto, the extremity supporting member together with its suspension means and showing in broken lines the extremity supporting member in an adjusted position with respect to the sacral seat;

Figure 6 is a detailed transverse sectional view of the extremity supporting member;

Figure 7 is a sectional view taken along the line 7—7 of Figure 6 looking in the direction of the arrows;

Figure 8 is a sectional view taken along the line 8—8 of Figure 6 looking in the direction of the arrows;

Figure 9 is a view in side elevation showing the sacral seat in its elevated position and a

hammock supported by the uprights for the treatment of a patient with a broken back;

Figure 10 is a fragmental view illustrating the mode of attachment of the extremity of the hammock to the uprights and showing the means whereby the arc of the hammock may be adjusted;

Figure 11 is a sectional view taken along the line 11—11 of Figure 10;

Figure 12 is a view in perspective illustrating in detail the means whereby the hammock may be adjusted;

Figure 13 is a view in end elevation illustrating the "gallows" in operative position for the treatment of a patient with a broken back;

Figure 14 is a view in perspective of the "gallows" shown in Figure 13;

Figure 15 is a view in perspective illustrating an attachment to be connected to the uprights and sacral seat for the treatment of fracture of the upper extremities;

Figure 16 is a view in perspective of the sacral seat.

My novel fracture frame comprising uprights 1 interconnected at their upper ends by means of cross beams 2. A pair of longitudinal members 3 are suitably attached to the cross beams 2 as shown in Figure 2. Swivelled to the lower ends of each upright 1 is a bowed leg portion 4 provided with a caster 4'. A suitable locking device 5 is provided whereby the position of the bowed leg portion 4 with respect to the member 1 may be maintained. It will be appreciated, and particular attention is called to Figure 1, that when the leg portion 4 is in the position shown in the full lines a very firm supporting position for the frame is provided, and there can be no danger of the frame tipping over during an operation. By manipulation of the locking device 5, each leg portion 4 may be moved to the position shown in the broken lines thereby enabling the frame to be readily wheeled through doors, etc., thus affording a highly mobile unit.

A transverse tube 6 is attached to each upright 1 as illustrated in Figure 1, and the function of this member will hereinafter be more fully elaborated upon.

Detachably secured to the lower side of the longitudinally extending members 3 and disposed intermediate the cross members 2 is a gear box 7. Extending vertically through the gear box 7 is a perineal bar 8, at the lower end of which is supported a sacral seat 9 to be used for infants or small children and a larger sacral seat 10 for adults. The seat 10 may be moved along the bar 8 and is adapted to be engaged by a spring clip 11 attached to the box 7, for maintaining the seat 10 out of the way when an operation is being performed on an infant. It should be mentioned, however, that under normal conditions the seat 10 rests upon the seat 9 as shown in Figure 5.

As hereinbefore mentioned, an important feature of this invention is that the patient is supported from above and consequently means are provided whereby the height of the sacral seat 10 may be adjusted. To effect such adjustment, it will be noted that the bar 8 has suitably secured thereto a rack 12. A pinion 13 meshes with the rack 12 and is connected to shaft 14 that is also provided with a worm wheel 15. The worm wheel 15 in turn meshes with a worm 16 carried by one end of a shaft 17 that extends through and is suitably journalled in one of the longitudinal members 3, as best shown in Figure 2. The opposite end of the shaft 17 carries a sprocket 18 positioned within the cross beam 2. A second sprocket 19 is laterally spaced from the sprocket 18 and is attached to a short shaft also journalled in the beam 2, and a chain 20 is trained around the sprockets 18 and 19. Carried by the shaft which supports the sprocket 19 and spaced therefrom is another sprocket 21. A hollow vertical support member 22 has its upper end in communication with the beam 2 and its lower end attached to the transverse tube 6. Journalled in the member 22 is a shaft 23' which carries a sprocket 23 within the member 22. A second chain 24 is trained around the sprockets 21 and 23. Fixed to the outer end of the shaft 23' is a hand wheel 25. It is apparent that by rotation of the hand wheel 25, vertical movement of the perineal bar 8 is effected.

From the above, it will be noted that I have provided a very simple structure for adjusting the vertical position of the sacral seat 10 and all working parts are enclosed within the frame or its associated elements.

Another particularly advantageous feature of this frame is that extremity supporting members or stirrups designated generally 26 are suspended from the frame. Attention is now directed to Figure 5, wherein it will be noted that suspension means 27 for the stirrups 26 is likewise supported by the gear box 7. More specifically, each member 27 comprises a hollow tubular member 28 having an eye 29 at its inner end and being mounted for pivotal movement to the gear box by means of a suitable bolt construction 30. Telescoped within the tube 28 is a tubular member 32 which is substantially L-shaped, and a collar 33 having a locking device 34 is utilized to secure the member 32 with respect to the tubular member 28. As perhaps best shown in Figure 5, the longitudinal and vertical positions of the stirrups 26 can be varied with respect to the sacral seat 10 to accommodate various leg or arm lengths as will hereinafter be more fully discussed. When the proper position of the tubular member 32 in relation to the seat is determined, manipulation of the locking device 34 will maintain the member 32 in the correct longitudinal position.

A rod 35 projects within the depending end of the L-shaped tube 32 and a collar 36 is provided on the lower end of the tube 32. A locking member 37 is associated with the collar 36 to lock the rod 35 with the tube 32. By unloosening the member 37 it is thought apparent that the vertical position of the rod 35 with respect to the sacral seat may be changed. The lower end of the rod 35 is securely fitted within a socket 38 formed in a support member 39. The lower end of the support 39 is reduced as shown at 40, and the reduced end 40 fits within a bifurcation 41 formed in a sleeve 42. A bolt 43 extends through aligned apertures in the sleeve 42 and in the reduced portion 40 for mounting the sleeve 42 for pivotal movement about a horizontal axis on the support 39. A wing nut 44 is threaded onto the free end of the bolt 43 to lock the sleeve 42 in the desired angular position.

Slidably mounted in the sleeve 42 is an adjusting screw 46. The screw has a key-way 47 into which fits a key 48 to prevent rotative displacement of the screw. One end of the screw is threaded into a base 49 to which is removably attached a foot receiving portion 50. As best shown in Figure 8, a winged lock nut 51 sur-

rounds the screw 46 adjacent to the base 49 whereby angular adjustment of the foot receiving portion 50 with respect to the screw may be effected. Threaded onto the screw 46 is another wing nut 52, the rotation of which effects linear movement of the stirrup 26 to cause extension of the broken extremity.

It is thought clear that each extremity supporting member, by having universal adjustment, various types of procedure in the treatment of fractured extremities may be easily accomplished.

As mentioned before one of the most important objects of the invention is to provide means whereby the angular position of the extremity supporting means 26 in regard to the sacral seat 10 can be varied. As a consequence, it is necessary to provide a structure whereby the angular adjusted position of the extremity supporting member will be maintained as it is most undesirable to have any shifting, so to speak, of the extremity supporting member during the operation. To accomplish this end, it will be noted that a radius rod 54 is pivoted at one end to the gear box 7 by a bolt 55. The opposite end of the radius rod is attached to a collar 56 which surrounds the tubular member 28 at a point adjacent to the collar 33. A locking screw 57 is threaded into an aperture in the collar 56 as shown in Figure 3. When the desired angular position has been determined, and the tubular member 28 is moved thereto the screw 57 is rotated to lock the collar 56 which, of course, locks the radius rod thus preventing any movement of the tube 28 about its pivot point 30.

While I have described but one of the extremity supporting members 26 and its associated suspending means, it is to be understood that each member is identical in construction and operation.

When it is desired to use my frame for fractures or dislocations of the leg, the patient is rolled under the frame on a stretcher cart. A sacral seat 10 is then lowered by rotating the hand wheel 25 until the seat is in a position to support the patient at his hips. The member 32 is then adjusted to the length of the leg and the foot is taped to the foot receiving portion 50. The entire suspension means for the extremity supporting member 26 may be adjusted to take care of the particular fracture or dislocation encountered. The stretcher cart may then be removed from beneath the patient and rolled back to a position which will enable the patient to rest his head and shoulders on the cart.

The foot receiving portion 50 is then moved away from the perineal bar 8 by rotation of the winged nut 52 to permit replacement of the overlapped fracture. After the fracture has been correctly aligned the cast, etc. is then applied. It can be seen that there is no obstruction between the perineal bar and the foot receiving portion 50 which makes it much easier to perform the operation.

In the event X-ray or fluoroscopic examination is desirable there is sufficient area beneath the patient to enable an examination from all angles.

After the operation is completed the stretcher cart is then wheeled into position to support the full length of the patient and the foot receiving portion 50 is removed from the foot. The sacral seat is then removed by rotation of the hand wheel.

With my novel fracture frame it is obvious that there is no necessity for lifting the patient from the stretcher onto the fracture table to perform the operation or is it necessary when the operation is completed to remove the patient from a table onto the stretcher cart. The advantages of this procedure are thought to be obvious.

The frame is also capable of being converted for operations pertaining to back fractures or injuries and in Figures 9 to 12 inclusive, I have shown the structure for accomplishing this purpose. When the frame is to be used for this type of operation, it is necessary that the sacral seat first be elevated until it is completely out of the way and this is readily done by rotation of the hand wheel 25.

It will be noted that the inner face of each transverse tube 6 is formed with an arcuate surface 60. A bar 61 fits within the arcuate surface and is maintained therein by bolts 62 which extend through apertures provided in the hollow tube 6 and locked by means of wing nuts 63. One end of the hammock 64 is disposed between one tube 6 and its bar 61 as shown in Figure 10, and the wing nut 63 is then rotated to draw the bar 61 tightly against the arcuate surface 60 to secure this end of the hammock to the transverse tube 6.

Attached to the tube 6 on the opposite pair of uprights are a pair of hollow spaced vertical members 65 (see Figure 1). A shaft 66 having a longitudinal slot 67 is rotatably journalled in bearings 68 carried by the vertical members 65. The shaft has keyed to one end thereof, a worm wheel 69 which meshes with a worm 70 formed on a shaft 71. A hand wheel 72 is secured to the shaft 71 so that the worm gearing may be rotated.

The other end of the hammock 64 is guided between the opposite tube 6 and its bar 61 and the free end is inserted through the slot 67 to hold this end of the hammock against slipping. The hand wheel 72 is then rotated and the position of the hammock can be adjusted to take care of the type of back injury in question.

The worm gearing is irreversible and this is particularly efficacious in that it will prevent any slipping of the hammock from its properly adjusted position.

In the use of this particular embodiment, the hammock is preferably placed on the stretcher cart before the patient has been positioned thereon, although this is not absolutely necessary. The cart is then wheeled under the operating frame and the ends of the hammock are secured in the manner previously mentioned. By rotating the hand wheel 72, the hammock may be adjusted to the proper position. The cart is then moved away from beneath the hammock and the patient is ready for the necessary operation.

In Figures 13 and 14, I have shown an attachment, that is incorporated with the perineal bar 8 for the treatment of back injuries. A substantially L-shaped bracket or gallows 75 is fitted within the upper open end of the perineal bar 8. The upper end of the tube is provided with a pair of angularly disposed slots 76. A pin 77 carried by the vertical portion of the bracket is adapted to fit into the slots. By elevating the bracket to withdraw the pin from the slot, it is possible to swing the bracket from its stowed position parallel with the frame to the position shown in Figure 13, wherein it projects a slight distance beyond the top edge of the frame.

The end of the bracket is provided with a hook 78 which carries a ring 80. A harness indicated

79' for fitting around the patient's head is adapted to be attached to the ring 79 as shown in Figure 13. By supporting the patient in the manner shown, it is possible for the attendant to set or otherwise treat the injured back.

By rotating the hand wheel 25, the position of the gallows 75 with respect to the floor may be elevated or lowered.

While the above description with reference to the extremity supporting members 26 is directed to the working on the lower extremities, attention is directed to Figures 15 and 16, wherein I have shown means for employing my inventive concept for operating on the upper extremities. I also provide for use with the frame a back and head supporting structure shown in Figure 15. This comprises a substantially U-shaped bracket 80 which carries at its upper end a pair of tubular extensions 81 which are offset from the bracket. The extensions 81 extend through openings 82 provided in the transverse tube 6, and screws 83 are provided to lock the bracket in the correct position. The horizontal portion of the bracket 80 is formed with a slide 84, and a bar 85 which carries a back support plate 86 and a head supporting member 87 is adapted to have one of its ends extend through the slide. The opposite end of the bar 85 fits into a grooved recess 88 formed in the upper portion of the sacral seat 10. As a consequence, the bar is rigidly supported by the frame.

The plate 86 and the member 87 are movable longitudinally along the bar 85 to accommodate the body proportions of the particular patient, and means are provided to lock the respective parts in their adjusted position.

In operation, the patient lies with his head on the member 87 and his back is supported by the plate 86. The extremity supporting member 26 is then moved to the correct adjusted position to support the fractured member.

It will be appreciated that I have provided a fracture frame wherein the extremity supporting member and the patient support means are suspended from the frame thus obviating the necessity of lifting the patient from the stretcher onto the operating table. Furthermore, by suspending the patient in this manner it affords a large area below the patient to enable much more satisfactory X-ray or fluoroscopic examination of the injured parts and greater facility for affixing casts or other bone retaining appliances. The extremity supporting members are mounted for angular, longitudinal and vertical adjustment, making it possible to use the frame for all types of fractures.

In addition, the upright support members are provided with means whereby a hammock may be suspended therebetween. Further means are provided to change the arc of the hammock to take care of any type of back injury which may have been sustained by the patient.

There is also associated with the perineal bar a gallows likewise for the treatment of patients with broken or injured backs.

The frame is very mobile and can be cheaply and easily manufactured. The operation of the machine is relatively simple and does not necessarily require the services of a skilled surgeon.

While I have shown and described the preferred embodiment of my invention, I wish it to be understood that I do not confine myself to the precise details of constructions herein set forth by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

I claim:

1. A fracture frame comprising upright members, horizontal members connected to the upper end of said upright members, a perineal bar mounted for vertical movement with respect to the horizontal members, a sacral seat attached to the lower end of the perineal bar, means to move the perineal bar vertically to adjust the position of the seat with respect to the horizontal members, and a rigid body support having one end removably attached to the sacral seat and the other end secured to the upright members.

2. A fracture frame comprising upright members, horizontal members connected to the upper ends of the upright members, a perineal bar mounted for vertical movement with respect to the horizontal members, a sacral seat attached to the lower end of the perineal bar, a bracket adapted to be removably affixed to said upright members, and a rigid body support having one end attached to said bracket and the other end secured to the sacral seat.

3. A fracture frame comprising upright members, horizontal members connected to the upper ends of said upright members, a sacral seat suspended from the horizontal members, extremity supporting members, and means to suspend said extremity supporting members from the horizontal members.

4. A fracture frame comprising upright members, horizontal members connected to the upper ends of said upright members, a sacral seat suspended from the horizontal members and movable in relation thereto, extremity supporting members suspended from said horizontal members, and means to adjust the position of said extremity supporting members relative to the sacral seat.

5. A fracture frame comprising upright members, horizontal members connected to the upper ends of said upright members, a sacral seat suspended from the horizontal members, extremity supporting members, supporting means for the extremity supporting members pivotally attached to the horizontal members, said extremity supporting members being mounted for universal movement on said supporting means, and further means to adjust the supporting means longitudinally and vertically.

6. A fracture frame comprising upright members, horizontal members connected to the upper ends of the upright members, a sacral seat suspended from the horizontal members and movable in relation thereto, extremity supporting members, supporting means for said extremity supporting members suspended from said horizontal members, means to adjust the angular position of the supporting means in regard to the sacral seat, and further means to maintain said supporting means in its adjusted position.

7. A fracture frame comprising upright members, horizontal members connected to the upper ends of said upright members, a sacral seat suspended from said horizontal members, extremity supporting members, supporting means for said extremity supporting members suspended from said horizontal members and capable of longitudinal and vertical adjustment, and means to maintain said supporting means in its adjusted position.

8. In a fracture frame of the type having upright members, horizontal members connected

to the upper ends of said upright members, a perineal element mounted for vertical movement with regard to the horizontal members, a sacral seat supported by the lower end of the perineal member, means to move the perineal bar vertically, and a gallows supported by the upper end of the perineal member, the improvement comprising an L-shaped bracket, the vertical portion of which fits into the upper ends of the perineal member, a pair of angularly disposed slots in the upper end of the perineal member and a pin on the vertical portion of the bracket for fitting into either of said slots to maintain the gallows in the proper position.

9. A fracture frame comprising upright members, horizontal members connected to the upper ends of said upright members, a sacral seat supported by said horizontal members, extremity supporting members, supporting means for said extremity members suspended from said horizontal members, means to adjust the angular position of said supporting means, and a radius rod pivoted at one end to said horizontal members and at the opposite end to the supporting means to maintain said supporting means in its adjusted position.

10. A fracture frame comprising upright members, horizontal members connected to the upper ends of said upright members, a sacral seat supported by said horizontal members, extremity supporting members, supporting means for said extremity supporting members suspended from said horizontal members, means to adjust the angular position of said supporting means, further means to adjust said supporting means longitudinally and vertically, and a radius rod pivoted at one end to the horizontal members and at the opposite end to the supporting means to maintain the supporting means in its angularly adjusted position.

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