

[54] APPARATUS FOR HIP DISLOCATION TREATMENT

[76] Inventor: Seymour S. Berman, 2001 Fallen Leaf Ln., Los Altos, Calif. 94022

[22] Filed: Oct. 10, 1972

[21] Appl. No.: 296,332

[52] U.S. Cl. 128/70, 128/80 A, 269/328

[51] Int. Cl. A61f 5/00

[58] Field of Search 128/70, 68, 71, 72, 128/73, 74, 80, 83; 5/68; 269/328

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Primary Examiner—Richard A. Gaudet

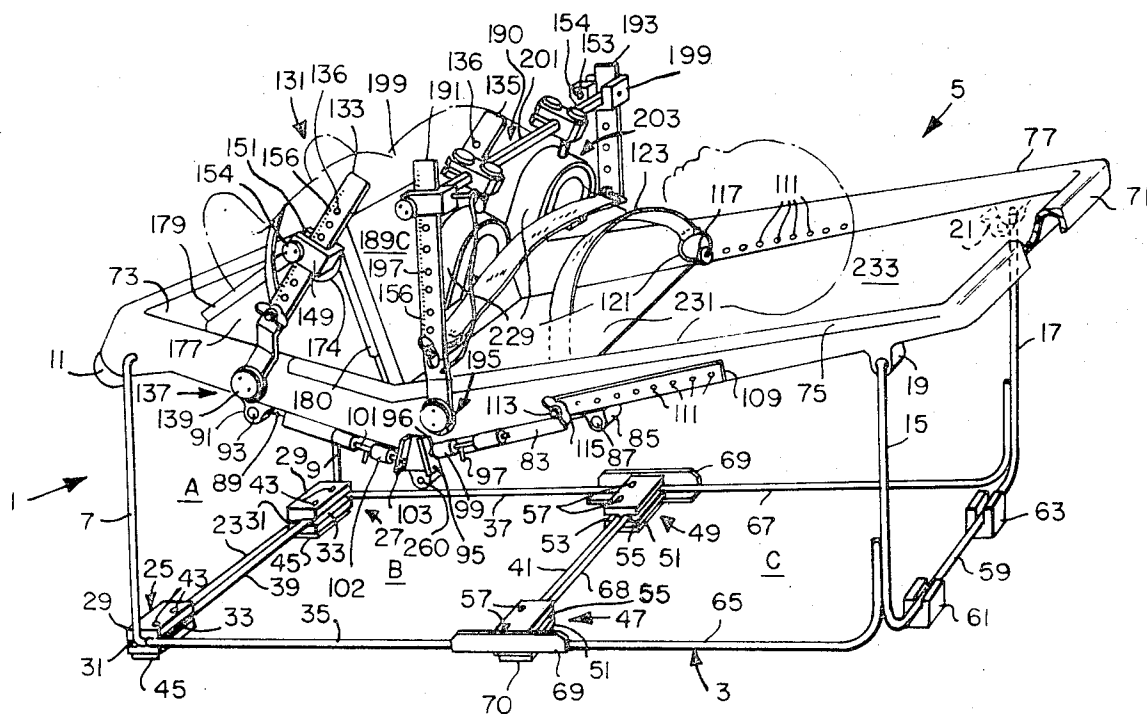
Assistant Examiner—J. Yasko

Attorney—Thomas E. Schatzel et al.

[57] ABSTRACT

Apparatus for hip dislocation treatment adapted for positioning and securing the bones of the leg and hip of an individual patient in a selected relative position for immobilizing said bones during a healing period. The apparatus comprises a cradle shell for cradling the patient's body; a first support bar for engaging the individual about the underneath side of the individual's knees so as to support the patient's legs at a fixed elevation, said first support bar being positionally adjustable to select the degree of flexion of the individual's legs relative to his trunk; and an adjustable support yoke assembly for engaging about the top side of the patient's leg to anchor the leg in a fixed degree of abduction and to anchor the leg in said degree of flexion and abduction.

26 Claims, 11 Drawing Figures



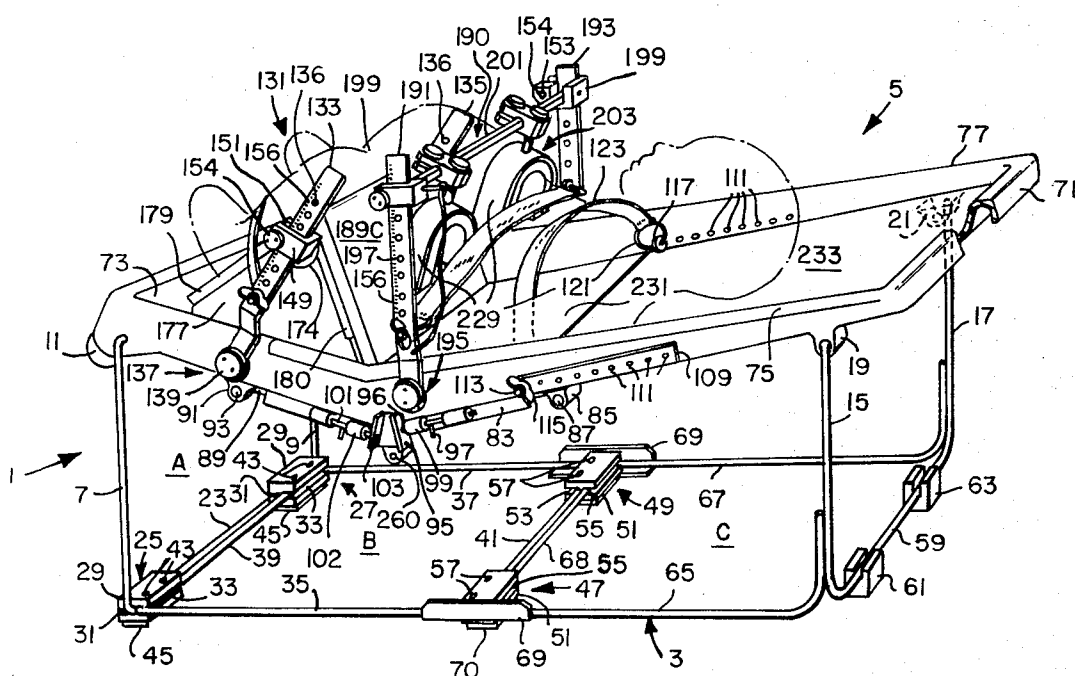


FIG. 1

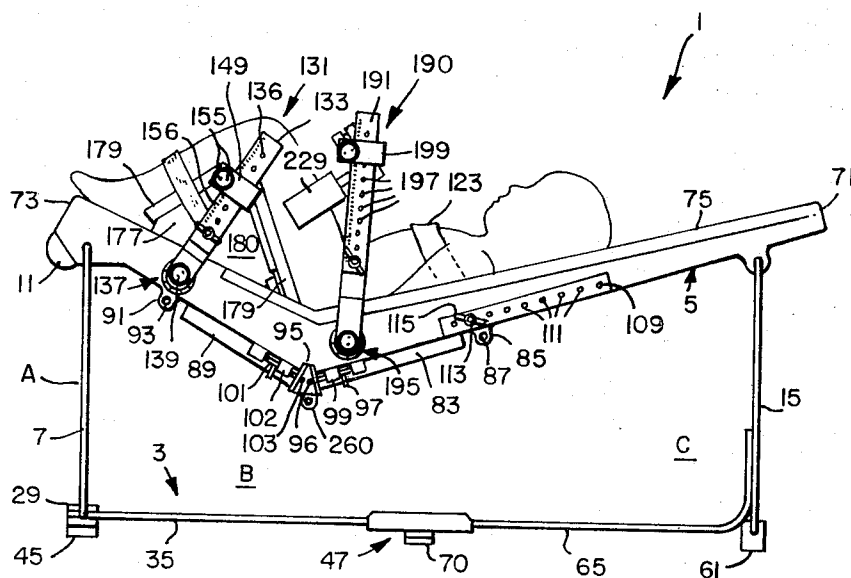


FIG. 2

FIG. 5

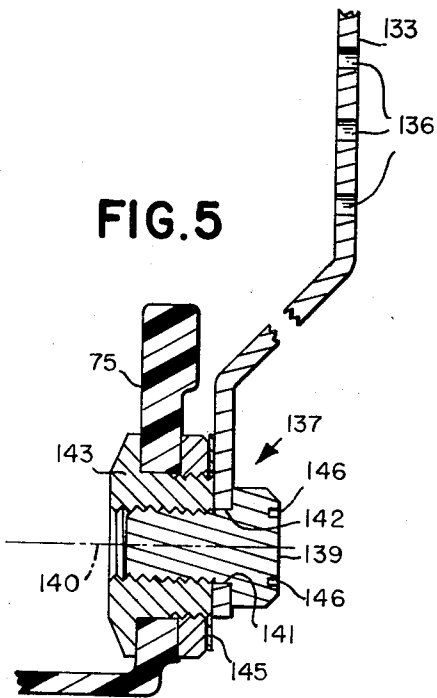


FIG. 6

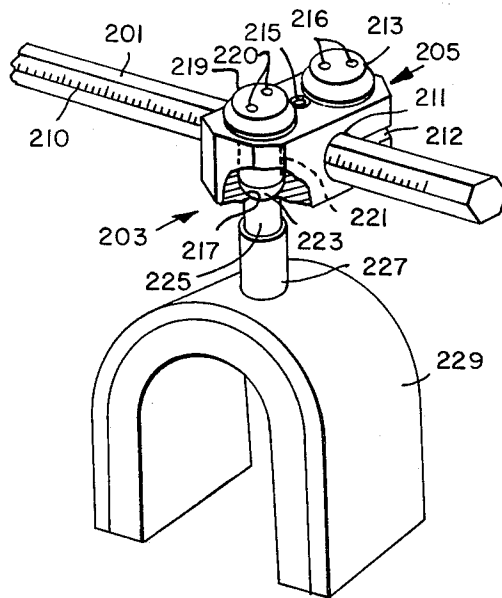
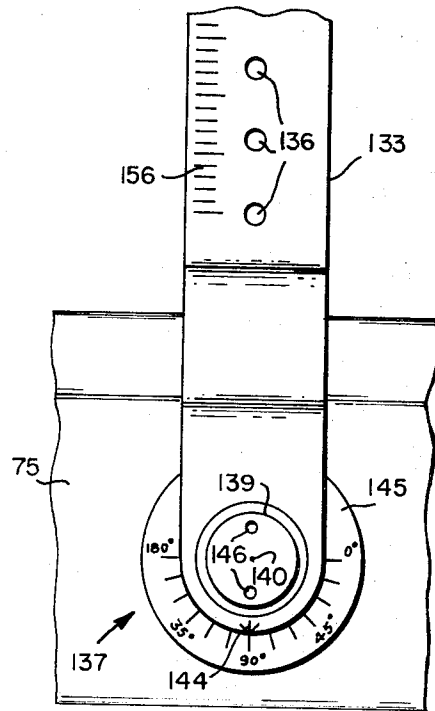


FIG. 8

APPARATUS FOR HIP DISLOCATION TREATMENT

BACKGROUND OF THE INVENTION

The present invention relates to an orthopedic device and more specifically to an apparatus for aiding in the treatment and healing of hip dislocations of an individual.

Dislocation of the hip is a common ailment suffered by infant individuals. In some instances hip dislocation is accompanied by hip dysplasia. Frequently an infant suffers from hip dislocation occurring before, during or shortly following birth. With newborn and young children, non-surgical treatment is conducted by manipulation of the bones, under anesthesia, to place the head of the femur in the acetabulum and then anchoring the bones in said set position by the use of plaster casts. The set position is maintained during a healing period of approximately four to 6 months.

The hip is a "ball and socket" joint, such that the applied cast generally encompasses a very large portion of the patient's body so as to limit leg motion in flexion and extension, and sometimes in rotation. The cast frequently extends from the patient's rib cage to the proximity of the knees. The cast is set by the attending physician or nurse so as to establish the patient's hip in a fixed flexion position, in a fixed abduction-adduction position and to restrict flexion and abduction-adduction movement during the healing period. In some instances it is necessary to affix a rigid bar between the patient's ankles so as to restrict rotation of the femur during the healing period.

The use of casts to aid in treatment of hip dislocation and dysplasia poses various shortcomings and inconveniences to patients and the patient's attendants. The use of the casting process dictates that the initially selected position of the bone be done with a high degree of care and that the cast be carefully applied so as not to disturb the selected position. Once the cast is applied it assumes a permanent position, and once applied it does not allow for adjustments of the relative bone position. Accordingly, initial application of the cast requires that the bones be retained in a precise desired set position. This requires considerable skill. Not only must the persons applying the cast possess and exercise a great deal of skill in selecting the bone position, but they must possess and exercise a great deal of skill in supporting the bones in the selected position during application of the cast. Misalignment of the relative position of the bones during the difficult casting process requires tedious removal and replacement of the cast to support the bones in the adjusted reset position. Due to the long period of time involved in the casting process, and due to the need to maintain cooperative patient immobility, anesthesia must be employed in babies and children thereby adding an element of risk to the patient care process. Since setting the hip joint is must faster with the present invention, the need for anesthesia is minimized, if not completely eliminated.

Immediately following the casting, the physician frequently desires to obtain a confirming x-ray of the hip region. Also, the attending physician frequently needs to take x-ray pictures of the hip during the healing period in order to monitor its healing progress and to determine the desirability of resetting the relative position of the femur and the acetabulum. The cast offers inconvenience in taking such x-rays, increases the x-ray dos-

age that must be imposed upon the patient and degrades the quality of the resulting x-ray picture.

Discharge of body waste is of key concern during the period the patient wears the cast. The cast must be designed to include openings about the patient's perineal region to permit the release of urine and feces. Even with said openings in the cast, cleanliness of the patient's body and the cast about the perineal region is difficult to maintain. This cleanliness problem together with the need to cleanse and aerate the patient's skin beneath the cast requires cast removal and recasting, sometimes as often as every thirty days. Further, as the infant patient increases in size during the healing period it may become necessary to periodically remove the cast and replace it.

Further, the cast adds considerable weight and makes the patient's body difficult to lift, carry and transport by the attendant caring for the patient.

The present invention provides an appliance adapted to overcome, at least in part, all of the above mentioned shortcomings of casts.

SUMMARY OF THE INVENTION

The present invention provides an improved apparatus for aiding in the treatment of hip dislocation and its possible accompanying hip dysplasia. The apparatus is adapted to provide a portable orthopedic appliance for supporting a patient and the patient's hip and leg bones in any of numerous selected positions over an extended period of time. The apparatus is adapted to avoid the need for casts and to provide readily adjustable means for adjusting the relative support position within broad dimensional ranges at any time during the healing period. Continuous visual monitoring of the patient's body and skin surface during the healing period is readily facilitated. Further, the patient may be easily removed from and replaced in the apparatus. The apparatus is adapted to provide assurance that the same relative position of the patient's leg bones are retained after the patient is replaced in the apparatus. The patient may be transported while positioned in the apparatus. The apparatus is further adapted to permit change of the patient's diapers without disturbance of the set bones.

The apparatus includes a support cradle adapted to support the body of the individual in a relatively supine position and to secure the hip and thigh bones in a set fixed position. The fixed positioning of the femur relative to the hip joint's acetabulum is provided from outside the body by means of polar positioning to obtain hip and knee flexion combined with linear transverse positioning for hip and knee abduction. The apparatus includes an adjustable elevated horizontal support means engaged to the cradle and adapted to provide support beneath the patient's knees to maintain the thighs in elevation at a predetermined relative fixed flexion position. It also includes an adjustable angled support means engaged to the cradle and adapted to provide support beneath the patient's thighs. The apparatus also includes a first adjustable elevated projecting arm means positioned above the patient's body for engagement with the patient's thighs to adjustably support the relative abduction-adduction position of the patient's legs. It may include a second adjustable elevated projecting arm means positioned above the patient's lower legs for positional engagement with the tibia to adjustably restrict the relative rotational posi-

tion of the hip joint. The cradle further includes opening means about the patient's perineal region to readily permit changing of clothing and cleansing of the patient's body due to discharge of urine and feces. Said changing and cleansing may be conducted without disturbance of settings of the patient's hip, thigh and leg bones, and to permit unobstructed x-ray photographing of the hip region.

The apparatus is adapted to permit the attending physician to continuously monitor the healing process, to take x-ray pictures when desired without removing the patient from the fixed position and to alter and adjust the position settings as desired during the healing process. The apparatus is further adapted to permit the patient to be removed from and replaced in the apparatus as desired by the attendant. The patient may be removed and replaced without disturbance of the predetermined position setting or adjustment of the setting. The apparatus may further be of a compact design to permit the attendant to readily transport the patient as desired while the patient is positioned in the apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a hip treatment apparatus of the present invention illustrating an infant patient in place;

FIG. 2 is a side view of the apparatus of FIG. 1;

FIG. 3 is a top view of the apparatus of FIG. 1;

FIG. 4 is a side view of the cradle shell of the apparatus of FIG. 1 with access doors released;

FIG. 5 is a sectional end view of a lock assembly of the projecting arms of the apparatus;

FIG. 6 is a side view of the lock assembly of FIG. 5;

FIG. 7 is a plan view of a traveler assembly of the apparatus of FIG. 1;

FIG. 8 is a perspective view of a yoke hold-down assembly of the apparatus;

FIGS. 9 and 10 illustrate the cradle shell of the appliance of FIG. 1 in various relative elevated positions; and

FIG. 11 illustrates a perspective view of the adjustable seat platform of the apparatus of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, FIGS. 1-3 depict a hip dislocation and treatment apparatus referred to by the general reference character 1, adapted for use by a small child suffering from hip dislocation. The apparatus is adapted for positioning and anchoring a patient's femur relative to the hip joint's acetabulum and to provide a padded couch-like structure for long-term and round-the-clock use. The apparatus is portable and may be carried by the patient's attendant while the patient is supported in position. The apparatus thus simultaneously functions as an orthopedic appliance, cradle and chair during the healing period.

The apparatus 1 comprises a pivotable removable support frame 3 for supporting a body-support platform 5 in an elevated position relative to a reference plane, e.g., floor or table. The frame 3 is combined of three rigid subframes A, B, and C capable of pivoting relative to one another while subject to limiting angular and lateral movement constraints. The frame 3 carries a pair of front vertical support columns 7 and 9 respectively, engaged to a pair of corner bosses 11 and 13; and a pair of rear vertical support columns 15 and 17

respectively engaged to a pair of corner bosses 19 and 21 adjacent the back end of the platform 5. The front columns 7 and 9 and rear columns 15 and 17 are pivotable about their respective bosses. The subframe A includes the front vertical support columns 7 and 9. The columns 7 and 9 are each fixed at opposite ends and at right angles to a lateral base member 23. A pair of pivot assemblies 25 and 27 are engaged adjacent the corners of the columns 7 and 9 to permit the subframe A to be pivoted about the axis of the lateral base member 23. The pivot assemblies 25 and 27 each include a rectangular-shaped anchor member 29. The member 29 carries a pair of longitudinally extending apertures 31 and 33. The brace 23 is engaged within the apertures 31 to permit the columns 7 and 9, and brace 23 to be pivoted about the axis of the brace 23.

The subframe B is a stationary subframe comprising a pair of parallel longitudinal members 35 and 37 interconnected at opposite ends by a pair of lateral parallel base members 39 and 41. The lateral member 39 is engaged within the apertures 33 of the pivot assemblies 25 and 27. The pivot assemblies 25 and 27 each carry a pair of set screws for impinging on the lateral brace 39 and locking it in place. The pivot assemblies 25 and 27 each further carry a skid-resistance foot 45 to permit the framing to be placed on a smooth surface. The subframe B is further engaged to a pair of stabilizer-pivot assemblies 47 and 49. Each assembly 47 and 49 includes a rectangular-shaped anchor member 51 possessing two laterally-extending parallel slots 53 and 55 and a pair of set screws 57 in vertical alignment with the slots 53. The brace 41 of the subframe B is positioned in the slots 53 and the set screws 57 are adapted to lock the brace 41 in place.

The subframe C is pivotable about the bosses 19 and 21 of the platform 5 and the stabilizer-pivot assemblies 47 and 49. The subframe C includes the rear vertical columns 15 and 17. The columns 15 and 17 are integral with a lateral support member 59 engaged to a pair of support feet 61 and 63 which clamp on the member 59. A pair of longitudinal braces 65 and 67 are integral with the columns 15 and 17 and extend at right angles relative to said columns. The braces 65 and 67 are interconnected by a lateral brace 68. Opposite ends of the brace 68 are engaged about the aperture 55 of the pivot assemblies 47 and 49. The brace 68 may be pivoted about its axis and the axis of the apertures 55. The pivot assemblies 47 and 49 each further include a stabilizer member 69 so as to provide further lateral stabilization to the braces 35 and 37 of subframe B and braces 65 and 67 of subframe C. Said stabilizer members 69 further provide restriction of pivot of braces 65 and 67 in a vertical plane by permitting only elevation above the horizontal. Accordingly, as hereinafter discussed in further detail and as illustrated in FIGS. 9 and 10, the frame 3 may be pivoted in various elevational positions with the subframes A and C pivoting about the subframe B. The stabilizer-pivot assemblies 47 and 49 each further carry a foot pad 70.

The platform 5 is illustrated as comprised of a cradle shell having a back-support segment 71 for supporting the trunk and back of the patient in a supine position and a leg-support segment 73 adapted to support the legs of the patient. The apparatus 1 may be readily transported by an attendant by grasping the segments 71 and 73 at their respective ends, suitably recessed for finger gripping. Transport of the platform may be made

with the frame 3 attached or removed and while the patient is supported by the cradle shell 5. The back-support segment 71 is integrally engaged to the leg-support segment 73 at a fixed permanent angle so as to cradle the patient's body with the buttocks and hip region of the body positioned to approximately coincide with the apex of the angle. The cradle shell 5 carries a pair of curved side rails 75 and 77 extending longitudinally along the sides of the back-support section 71 and portions of the leg-support section 73.

Within the cradle shell 5 is a rectangular opening 79 (see FIG. 3) extending partially through both the back-support segment 71 and the leg-support segment 73 of the shell. This opening 79 is established to coincide with the perineal region of the patient's body when the patient is supported within the shell cradle 5. A pivotable access door 83 (see FIG. 4) is engaged to the underside of the shell 5 for partially closing and opening passage through a portion of the opening 79 in the segment 71. The door 83 is hinged to a pivot boss 85 and a hinge-pin 87 extending laterally across the underside of the back-support segment 71. A pivotable access door 89 is engaged about the underside of the leg-support segment 73 for opening and closing the passage through the corresponding portion of the opening 79. The door 89 is hinged by means of a pivot support boss 91 and a hinge-pin 93 extending the lateral width of the shell 5 about the leg-support segment 73. Accordingly, passage through both portions of the opening 79 may be opened or closed by controlling the opening and closing of the doors 83 and 89, respectively.

To secure the door 83 in place, a boss 95 is engaged to each of the side rails 75 and 77 about the apex of the angle formed by the back-support segment 71 and leg-support segment 73. Each of the bosses 95 carries an aperture 96. The door 83 further carries a bolt 97 about each lateral side and which bolt is slideable within a longitudinal guide 99. Accordingly, when the door 83 is positioned to close the back portion of the opening 79, the bolts 97 are slid within the guides 99 such that the bolts 97 project within the apertures 96 to lock the door in place. When the door 83 is to be released, the bolts 97 are slid back along the guides 99 such that the end of the bolts are out of engagement with the bosses 95, thereby releasing the door.

The front door 89 carries a bolt 101 within a guide 102 along each lateral side. Each of the bolts 101 is adapted for engagement within an aperture 103 of each of the boss members 95. When the door 89 is positioned to close the front portion of the opening 89, it is pivoted such that the bolts 101 may be inserted within the apertures 103. To release the door 89, the bolts 101 are slid back along the guides 102 such that the bolts are out of engagement with the bosses 95.

The cradle shell 5 further carries a pair of anchor bosses 109 for anchoring a chest strap for securing the patient when the doors 83 and 89 are opened (FIGS. 1, 2 and 3). The anchor bosses 109 extend longitudinally along the exterior of the side rails 75 and 77 of the back support segment 71. Each anchor bar 109 carries a plurality of spaced apertures 111. A threaded bolt 113 projects through an aperture 111 and is engaged to a wing-nut 115. The threaded bolt 113 carries an eye 117 in turn engaged to an O-ring 121 positioned within the interior of the shell 5 (see FIG. 1). Each of the O-rings 121 is engaged to a pliable chest strap segment 123 adapted to be secured about the chest of the pa-

tient. The apertures 111 for engaging the bolts 113 are selected depending upon the physical size of the patient. Preferably, the bolts 113 are positioned such that the strap 123 will extend beneath the arm-pits of the patient to support the patient's body from sliding through the opening 79 when the doors 83 and 89 are released. Depending on the size of the patient, an auxiliary support plate 125 (see FIG. 3) may be positioned within the back-support region 71 to cover a portion of the opening 79. The plate 125 may be used when a very small infant patient must be supported when the door 83 is open.

The leg-support segment 73 of the cradle shell 5 includes a knee support structure referred to by the general reference character 131 for engaging the patient about the underneath side of the patient's knees so as to support the patient's legs at a fixed elevation and set degree of flexion. The knee support structure 131 is adapted to be readily positioned to a desired elevation and angular relationship. Once positioned, it is adapted to retain said position and restrict motion in flexion of the individual's thigh in a counter-clockwise direction as viewed in FIG. 2. The knee support structure 131 includes a pair of pivotable column support arms 133 and 135 respectively engaged to the side rails 75 and 77 and projecting vertically therefrom. Each of the column support arms 133 and 135 carries a number of vertically spaced apertures 136 as illustrated in FIG. 1 and 2.

The arms 133 and 135 are each engaged about one terminal end to a pivot-lock assembly 137. FIG. 5 illustrates a pivot-lock assembly 137 in an enlarged section view and FIG. 6 illustrates an enlarged side view. The pivot-lock assemblies 137 permit the column arms to be pivoted within a plane normal to both planes of the platform 5. For engagement to the side rails 75 and 77 each of the pivot-lock assemblies 137 include a threaded lock-bolt 139 coaxial with an axis 140 of an aperture 141 of the arm 133. The lock-bolt 139 carries a smooth-surfaced shoulder 142 about which the arm 133 may be rotated. A female bushing 143, for receiving and interconnecting with the bolt 139, is embedded within the side rail of the cradle shell 5. The bushing 143 carries internal threads for receiving the lock-bolt 139. The inter-engagement between the head of the lock-bolt 139, the column-arm 133 and bushing 143 provides for the locking of the column arm in a select angular position relative to the plane of the leg-support segment of the cradle shell 5. When the bolt 139 is loosened within the bushing 143, the column arm 133 is free to pivot about the axis 140 in a plane perpendicular to the planes of the cradle shell 5. As the bolt 139 is tightened within the bushing 143, it provides a pressure lock of the arm 133 intermediate the bushing 143 and interior wall of the head of the bolt 139. With the bolt 139 locked in place the degree of hip flexion is established.

An angular reference marker 144 is inscribed on the column support arm 133 adjacent to the terminal end to facilitate in establishing and recording the angular setting. A circular scale 145 coaxial with the axis 140 and inscribed with angular markings is carried adjacent to the bolt 139 and the reference marker 144 to permit precise relative positioning and selection of the relative angular position of the column arm along a vertical plane relative to the plane of the knee support segment 73.

The head of the bolts 139 is smooth and carries a pair of diametrically-opposed indents 146. The indents 146 are adapted to receive a wrench to permit control of the adjustments of the bolt 139. Accordingly, once the angular position of the arms 133 is selected, the bolt 139 is locked in place with a tool designed to inter-engage with the indents 146. Adjustments of the angular position may only then be made through use of the tool. Preferably, the attending physician will retain control of the tool such that alterations of the positions may only be made under the physician's control.

A traveler 149 is engaged to each of the column support arms 133 and 135 and is adapted to be positioned at a desired elevation. Viewing the enlarged view of FIG. 7, the traveler 149 carries a rectangular shaped slot 151 to permit the traveler to travel along the associated rectangular-shaped column support arm. The traveler 149 carries an internally threaded aperture 153 extending laterally through the slot 151. A threaded, removable lock fastener in the form of a lock bolt 154 is positioned within the aperture 153 such that when the bolt is tightened, it provides a friction lock about the column. The lock bolt 154 is adapted such that when loosened, the traveler 149 may be slid and vertically positioned along the associated column support arm 133 and 135 to a desired elevation. The head of the bolt 154 carries a pair of indents 155 similar to the indents of the head of the bolt 137 such that the bolt 154 may only be adjusted through use of the special tool. The column support arms 133 and 135 carry an inscribed millimeter scale 156 to provide a reference for positioning the elevation of the traveler 149 (see FIG. 6). When the desired elevation is attained, the bolt 154 may be tightened within the threaded aperture 153 to lock the traveler 149 in place to the associated column arm.

The traveler 149 further carries a laterally projecting channel 157. An aperture 158 extends transversely through the channel 157 to receive a lock pin 159. The lock pin 159 is adapted to extend through the aperture 158 and the channel 157. The lock pin 159 carries a pair of spring loaded bosses 161 which extend outwardly to lock the pin 159 in place. The pin 159 further carries a head 163. To remove the pin, an individual exerts end pull on the head 163 thereby causing the bosses 161 to retract and permit the pin to be released through the aperture 158.

The knee support structure 131 further includes a circular horizontal knee support bar 171 projecting laterally across the cradle shell 5. Opposite ends of the bar 171 are engaged to the travelers 149 on the column support arms 133 and 135 (see FIGS. 3 and 7). The bar 171 carries an aperture 173 adjacent each terminal end. The apertures 173 are adapted for alignment with the apertures 157 of the travelers 149 to receive the pins 159. When the bar 171 is positioned within the channel 157 and the apertures 158 and 173 are in alignment, the pin 159 may be inserted to lock the bar in place to the traveler. Accordingly, as provided, the horizontal bar 171 may be positioned at a desired elevation along the column support arms 133 and 135 by selecting the elevational position of the travelers 149 and at a desired angular position by pivoting the column arms about the lock-bolts 139 to a select angular position.

A hollow cylinder of fabric-covered-foam 174 surrounds and provides a cushion on the bar 171. With the

patient resting on the cradle shell 5, the bar 171 engages the patient about the underside of the patient's knees (see FIGS. 1 and 2). To further support the patient's legs, a triangular shaped support platform 177 is placed in position on the leg-support segment 73. The platform 177 is positioned to support the below-knee region of the patient's leg. Platform 177 may be comprised of disposable lightweight material, e.g., foam rubber, styrene, etc., and may be cut to shape by the attending physician. An additional removably affixed pad 179 is positioned over the bar 171 and the support platform 177 to provide further comfort to the patient. Accordingly, the knee support structure 131 establishes the degree of flexion and restricts movement of the patient's thighs counter-clockwise as viewed in FIG. 2.

Fixed to the door 89 and pivotable with it, is an adjustable seat platform 180. The platform 180 is illustrated in detail in FIG. 11. The platform 180 is adapted to provide an inclinable surface to support the patient within the region extending from the patient's buttocks to his knees. At the same time the platform 180 may be removed from engagement with the patient by opening the door 89. The platform is further adapted such that the angle of inclination may be readily supported to correspond with the angle of flexion selected by the positioning of the crossbar 171.

Viewing FIGS. 1 and 11, the platform 180 includes a support plate 181 engaged to the door 89 by means of a hinge 182 to permit the plate to be rotated relative to the plane of the door 89 and the plane of the leg support segment 73 of the cradle shell 5. An extension plate 182A is guided by a pair of u-shaped guides 182B bearing upon the two lateral edges of the plate 181. The extended position of the plate 182A relative to plate 181 is locked in place by means of pressure sensitive tape 182C. The plate 182A may be extended to provide complete thigh-length support of the patient. The plate 181 is engaged about the back side to a support brace 183 engaged about one terminal end to an anchor 184 by means of a pivot pin 185. The anchor 184 is in turn secured in place to the rear surface of the plate 181. The other terminal end of the brace 183 is secured to a slide anchor 186 by means of a pivot pin 187. The slide anchor 186 is supported within a guide track 188 integral with the door 89. The track 188 extends longitudinally of the door 89 such that the angle of incline of the plate 181 relative to the plane of the door 89 may be adjusted to a select angle. The slide anchor 186 is retained within the guide track 188 by means of a clamp 189 positioned about the underside of the door 89 and secured to the slide anchor 186 by means of a threaded fastener 189A. The fastener pin 189A carries a pair of indents 189B such that the special tool is required to adjust the tension between the slide anchor 186 and the clamp 189. Accordingly, to adjust the angle of inclination of the plate 181, the pin 189A is loosened such that the guide 186 may be slid along the track 188. Once the desired angle is realized, the pin 189A is tightened. The platform 181 may be removed from contact with the patient and pivoted out of the way simply by releasing the door 89. In position, the fixed platform 177 and adjustable platform 180 establish a pyramid type support with the apex of the pyramid positioned adjacent the cross-bar 171. Said pyramid type support may be viewed as a flexion support platform for supporting the patient in the selected

degree of hip flexion. A pad 189C may be secured over the top surface of the plates 181 and 182A to provide a cushion for the patient.

An adjustable support yoke assembly referred to by the general reference character 190 is positioned about the shell cradle 5 for engaging the thighs of the patient in order to anchor the thighs in a fixed degree of hip flexion and abduction (see FIGS. 1 and 3). The support yoke assembly 190 includes a second pair of vertical support columns 191 and 193 anchored to the sidewalls 75 and 77, respectively, of the cradle shell 5 about the back support region 71. The columns 191 and 193 are structurally similar to the columns 133 and 135. Each of the support columns 191 and 193 is engaged to a pivot-lock assembly 195 of similar structure to the pivot-lock assembly 137 as illustrated in FIGS. 5 and 6. Each column 191 and 193 carries a number of spaced apertures 197 for belt attachment similar to those at columns 133 and 135. Each of the columns 191 and 193 is engaged to a traveler 199 of similar structure to the travelers 149 illustrated in FIG. 7.

Protruding laterally from each of the travelers 199 of the support yoke assembly 190 is a hexagonal shaped arm 201 (see FIGS. 1, 3 and 8). The arm 201 supports a pair of hold-down yoke assemblies 203. FIG. 8 illustrates an enlarged view of one of the hold-down yoke assemblies 203. Each hold-down yoke assembly 203 comprises a traveler 205 adapted to travel over the arm 201. The traveler 205 is adapted to permit the associated yoke assembly to be positioned laterally and angularly relative to the arm 201. The arm 201 carries an inscribed millimeter scale 210 to provide a reference to aid in placing the lateral location of the yoke assemblies 203. The traveler 205 carries an aperture 211 for receiving the cross-bar 201. A slot 212 extends from the aperture 211 to the edge of the traveler. A fastener in the form of a lock-bolt 213 extends through the traveler 205 in alignment with the slot 212. The lateral position of the traveler 205 relative to the arm 201 is controlled by means of the lock-bolt 213 and a set screw 215. The lock screw 213 carries a pair of indents 216 similar to the indents of the bolt 139 and 195 such that the special tool is required to make adjustments of the lateral position of the traveler 205. The traveler 205 may be rotationally adjusted on the cross-bar 201 and keyed into rotational position to the cross-bar 201 with a set screw 215. When the desired lateral position of the traveler 205 is attained, the lock bolt 213 will lock the traveler 205 in place by pressure engagement with a surface of the cross-bar.

The traveler 205 further carries an internal conically shaped socket 217. A threaded pin 219, having a pair of indents 220 at the head end and a conical concavity at the other end, projects through a threaded aperture 221 such that the concave tip of the bolt 219 projects to within the socket 217. Within the circular socket 217 is a ball end 223 which in turn is engaged to an arm 225. The arm 225 in turn is engaged to a shoulder 227 integral with a yoke 229. The yoke 229, illustrated in the form of a u-shaped yoke, carries a cushion lining about the interior and is adapted to cup the patient's thigh. Accordingly, the yoke 229 may be swiveled and adjusted to polar position by turning the yoke 229 with the pin 219 slightly retracted and ball end 223 free to pivot within the socket 221. When the yoke 229 is in the desired polar position, the pin 219 is tightened to lock the ball end 223 in place in the socket 217. The

yokes 229 may then be engaged to the patient's thighs, as illustrated in FIGS. 1 and 2. When so engaged, the yokes 229 secure the patient's legs in place at the desired degree of abduction as set by the positioning of the yoke assemblies 203 and at the desired degree of flexion as established by the knee support structure 131.

Accordingly, the apparatus 1 provides for three dimensional fixed positioning of the femur relative to the hip joint's acetabulum from outside the patient's body. The fixed position is adjustable and lockable in the adjusted position. The apparatus provides polar positioning for hip and knee flexion combined with linear transverse positioning for hip and knee abduction. As illustrated by FIG. 3, the yoke assembly 190 may be moved in its entirety in and out of engagement with the patient by removing the pin 159 from one traveler 149 to free one end of the cross-bar 201. The cross-bar 201 may then be pivoted about the pin 159 of the other engaged traveler 149. When so pivoted, the patient may be removed from the apparatus 1. It may be noted that when the yoke assembly 190 is moved, the positions of the columns 191 and 193 and the position of the yokes 203 are not disturbed. Thus the preselected positions may be retained even though the yoke assembly 190 is removed from engagement with the patient and then placed back in engagement. When placed back in position, the yoke assembly 190 assumes its preset position. Thus, the patient may be removed, reinserted, and/or repositioned without loss of the preset positions.

For the comfort of the patient, a pair of pad segments 231 and 233 are placed over the interior surface of the back support segment 71 (see FIG. 1). The pad 231 is positioned to pivot with the door 83 when it opened (see FIG. 4).

FIGS. 1, 9-10 illustrate various elevational positions which the apparatus 1 may assume by adjusting the relative positions of the subframes A, B and C. For illustrative purposes, only the framing 3 and cradle shell 5 are illustrated in the embodiments of FIGS. 9-10. As previously discussed in FIG. 1 the cradle shell 5 is supported such that the patient may rest in substantially a prone position. FIG. 9 illustrates the cradle shell 5 in a mid-upright position from the lying position illustrated in FIGS. 1 and 2. The cradle shell 5 is urged forward such that subframe A rotates 90° relative to subframe B, and the corner braces 29 and 39 to a horizontal position. At the same time the subframe C rotates about the common pivot assemblies 47 and 49.

FIG. 10 illustrates the cradle shell 5 in a near direct upright position. To assume the position of FIG. 10, the rear vertical columns 15 and 17 of the subframe C are removed from the rear boss members 19 and 21 and inserted in a pair of bosses 260 located to the side rails 75 and 77 of the cradle shell 5 and adjacent to the braces 95.

As illustrated by FIGS. 1, 2 and 3, the apparatus provides for unobstructed visual and manipulative access to the patient's upper thighs, buttocks, excretory, lower abdominal and lower back areas for diapering, hygienic, examination and radiographic purposes. It permits continuous air circulation about much of the patient's body and the patient has unrestricted freedom of movement above the waist and below the knees. The apparatus 1 further provides for adjustment of the angular and linear positions of the legs during the healing period. The selected set positions may be readily calibrated, lock-in

place and recorded to aid the attending physician. The selected positions are relatively tamper-proof since a special tool is necessary in order to make adjustments. At the same time, the attending physician may make positional adjustments if at any time during the healing period such adjustments are deemed advisable.

I claim:

1. An apparatus for hip dislocation treatment, said apparatus comprising, in combination:

a body-support platform for supporting an individual patient in a supine position, the body-support platform forming a leg-support region and a back support region;

a knee support structure projecting at an elevated position over the platform and laterally across the platform above said leg-support region for supporting the knees of said patient at a desired elevation and angle relative to the individual's hip joint and for restricting hip motion in flexion and leg motion in one rotational direction, said knee support structure means including a first column support means having at least one support column engaged about one end to the platform and about the other end to a knee support bar projecting laterally over the leg-support region of the platform; and

an adjustable yoke assembly supported over the platform at an elevated position, the yoke assembly including a second support column means having at least one support column projecting vertically from the platform and engaged to a lateral member projecting laterally over the platform, a yoke engagement means coupled to said lateral member and projecting from said lateral member for engagement about the top side of the leg to restrict hip motion in flexion and leg motion in the other rotational direction.

2. The apparatus of claim 1 in which the first column support means includes a support column engaged about one lateral side of said leg-support region of the platform, said support column being engaged about one terminal end to a first pivot-lock assembly means to interconnect said support column and the platform, said support column being pivotable about the engaged pivot-lock assembly in a plane normal to the plane of the platform, said pivot-lock assembly including lock means to lock said support column in a selected angular position.

3. The apparatus of claim 2 in which the pivot-lock assembly of the knee support structure includes a female bushing integral with the platform, a fastening bolt coaxial with and lockable to said bushing, said bolt carrying a shoulder adjacent the head of the bolt for receiving the column, said column being pivotable about said shoulder.

4. The apparatus of claim 2 in which the knee support structure includes a traveler engaged to said support column of the first column support means, said traveler interconnecting the associated column and said knee support bar, the position of said traveler along said column being adjustable.

5. The apparatus of claim 4 in which the knee support structure includes a lock fastener means for locking said travelers in position of engagement to the associated column.

6. The apparatus of claim 1 in which the second column support means of the yoke assembly includes a support column engaged about one lateral side of the

platform with said support column engaged about one terminal end to a second pivot-lock assembly means to interconnect said support column of the second column support means and platform, said column of the second column support means being pivotable about the second pivot-lock assembly means in a plane normal to the plane of the platform, said second pivot-lock assembly means including lock means to lock said support column in a selected angular position.

7. The apparatus of claim 6 in which the second pivot-lock assembly of the yoke assembly includes a female bushing integral with the platform, a fastening bolt coaxial with and lockable to said bushing, said bolt carrying a shoulder adjacent the head of the bolt for receiving the engaged column, said engaged column being pivotable about said shoulder.

8. The apparatus of claim 6 in which the yoke assembly includes a traveler engaged to said support column of the second column support means, said travelers interconnecting the associated column and said lateral projecting member, the longitudinal position of said traveler along said column being adjustable.

9. The apparatus of claim 8 in which the yoke assembly includes a lock fastener means for locking said traveler in position of engagement to the associated column of the second column support means.

10. The apparatus of claim 9 in which the yoke assembly further includes at least one yoke projecting from the lateral member, said yoke being interconnected to said lateral member by means of a ball-and-socket coupling to permit said yoke to be polar positioned and rotated about its own axis.

11. The apparatus of claim 10 in which the yoke assembly includes a traveler coupled to said lateral member and to said yoke, the traveler being slideable along said lateral member, and lock means for locking said traveler in place to said lateral member at a select position.

12. The apparatus of claim 11 in which said traveler is rotatable about the axis of the lateral member, and keying means for keying said yoke assembly traveler to said lateral bar in a desired relative angular position.

13. The apparatus of claim 1 in which the body-support platform carries an opening about the bottom side to permit access to the perineal region of the individual supported on said body-support platform, and door means for opening and closing said opening.

14. The apparatus of claim 5 further including an inclined platform means positioned in the leg support region of the body-support platform for establishing a seat support for the buttocks and thighs of the individual while maintaining a selected degree of hip flexion.

15. The apparatus of claim 14 in which the inclined platform means includes means for adjusting the angle of incline and means for adjusting the length of the platform.

16. The apparatus of claim 14 in which the body-support platform carries an opening about the bottom side to permit access to the perineal region of the individual supported on said body-support platform; door means for opening and closing said opening, said inclined platform means being engaged to said

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door means to facilitate removal of said inclined platform from engagement with the patient.

17. The apparatus of claim 1 further including a support frame means for supporting the body-support platform in an elevated position, the support frame means including a first subframe engaged about said leg-support region of the body-support platform and a second subframe engaged about said back-support region of the body-support platform, the elevation of said first and second subframes being adjustable to vary the elevation of said leg-support region relative to said back-support region.
18. The apparatus of claim 17 further including a third subframe engaged intermediate said first and second subframes, said first subframe being pivotable relative to said third subframe and said second subframe being pivotable relative to said third subframe.
19. The apparatus of claim 18 in which said first subframe includes a pair of frontal column means engaged to said leg-support region of the body-support platform and interconnected with said third subframe, said frontal column means being pivotable relative to the body-support platform.
20. The apparatus of claim 19 in which said second subframe includes a pair of back support column means engaged to said back support region of the body-support platform and interconnected with said third subframe, said back support column means being pivotable relative to the body-support platform.
21. The apparatus of claim 14 in which said first column support means of the knee support structure includes a support column engaged about each lateral side of said leg-support region of the body-support platform, each of said support columns being engaged about one terminal end to a first pivot-lock assembly means to interconnect said engaged support column and the platform, each of said columns being pivotable about the engaged pivot-lock assembly in a plane normal to the plane of the platform, each of said pivot-lock assemblies including lock means to lock said support column in a selected angular position; and the second column support means of the adjustable yoke assembly includes a support column engaged about each lateral side of the platform with each of said support columns engaged about one terminal end to a second pivot-lock assembly means to interconnect said support columns of the second column support means and platform, each of said columns of the second column support means being pivotable about the second pivot-lock assembly means in a plane normal to the plane of the platform, each of said second pivot-lock assembly

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means including lock means to lock said support columns in a selected angular position.

22. The apparatus of claim 21 in which the first pivot-lock assemblies of the knee support structure and the second pivot-lock assemblies of the yoke assembly each include a female bushing integral with the platform, a fastening bolt coaxial with and lockable to said bushing, said bolt carrying a shoulder adjacent the head of the bolt for receiving the engaged column, said engaged column being pivotable about said shoulder.
23. The apparatus of claim 21 in which the knee support structure includes a traveler engaged to each of said support columns of the first column support means, said traveler interconnecting the associated column and said knee support bar, the position of each of said travelers along each of said columns being adjustable; and the yoke assembly includes a traveler engaged to each of said support columns of the second column support means, said travelers interconnecting the associated column and said lateral projecting member, the position of each of said travelers along each of said columns being adjustable.
24. The apparatus of claim 22 in which the knee support structure includes a first lock fastener means for locking said travelers of each of said support columns of the first column support means in position of engagement to the associated column; the yoke assembly includes a second lock fastener means for locking said travelers of each of said support columns of the second column support means in position of engagement to the associated column of the second column support means.
25. The apparatus of claim 24 in which the yoke assembly further includes a yoke means for engagement about the top and sides of each of the patient's legs, said yoke means projecting from a traveler coupled to the lateral member and slideable along said lateral member, said yoke means being interconnected to said traveler by means of a ball-and-socket coupling to permit said yoke to be polar positioned relative to said body-support platform and rotated about its own axis, and lock means for locking said traveler in place to said lateral member at a selected position.
26. The apparatus of claim 25 in which the body-support platform carries an opening about the bottom side to permit access to the perineal region of the individual supported on said platform; door means for opening and closing said opening, said inclined platform means being engaged to said door means to facilitate removal of said inclined platform from engagement with the patient.

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