

Jan. 8, 1963

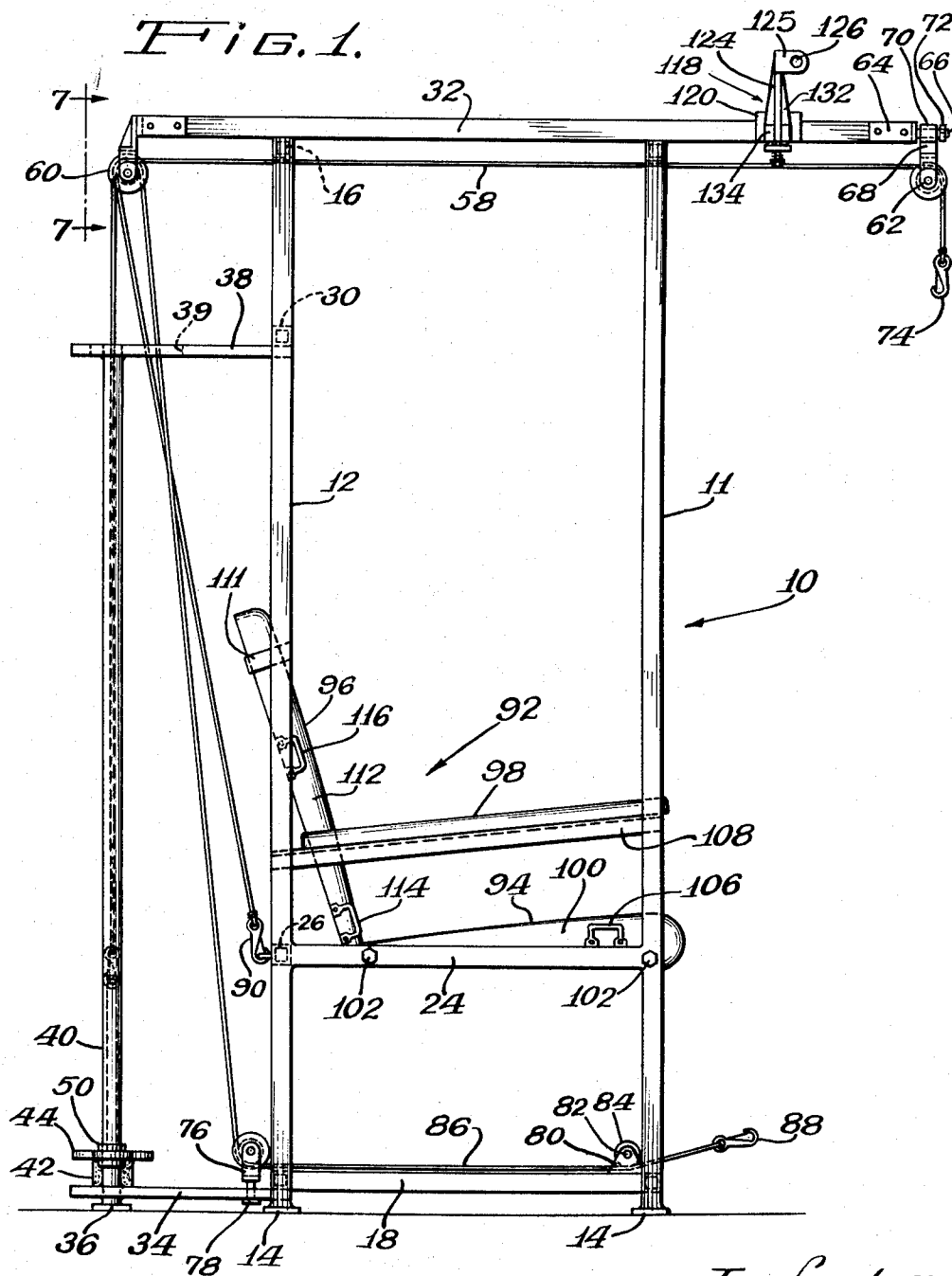
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3,072,400

THERAPEUTIC EXERCISE CHAIR

Filed Nov. 16, 1959

3 Sheets-Sheet 1



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FIG. 2.

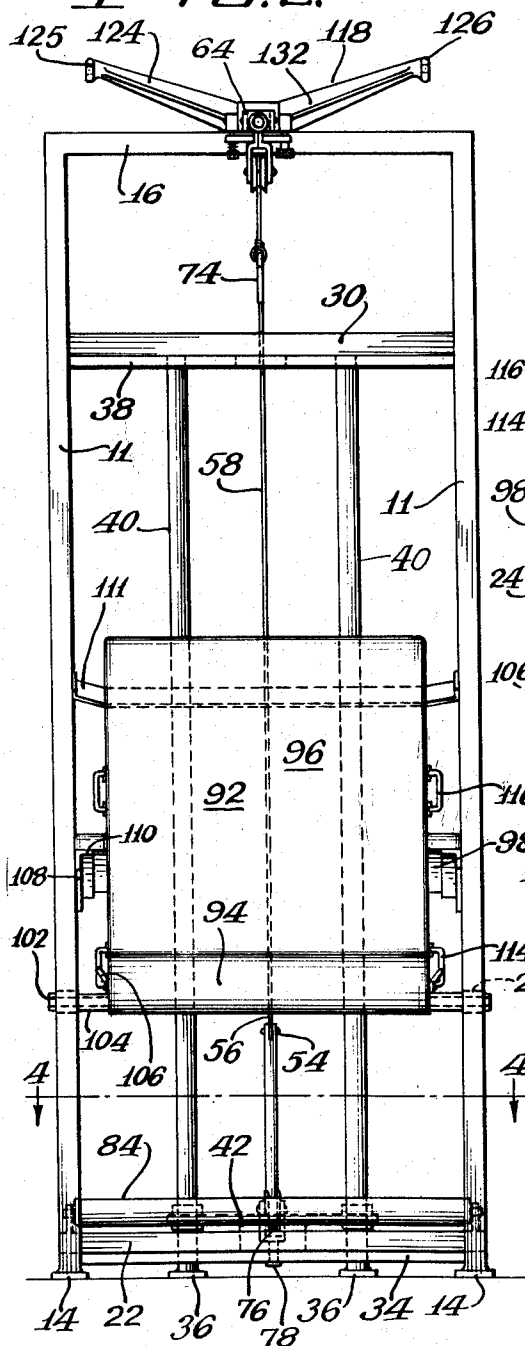
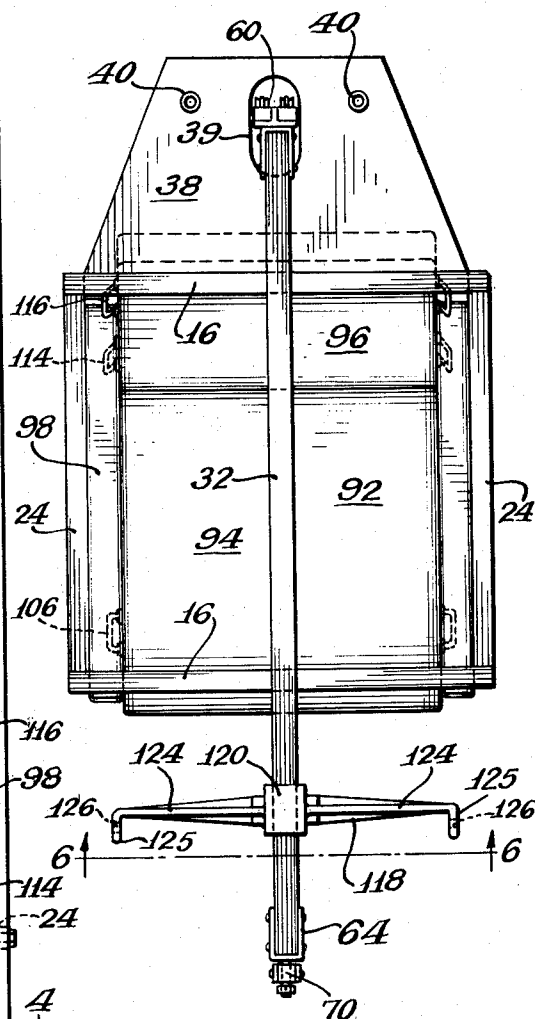


FIG. 3.



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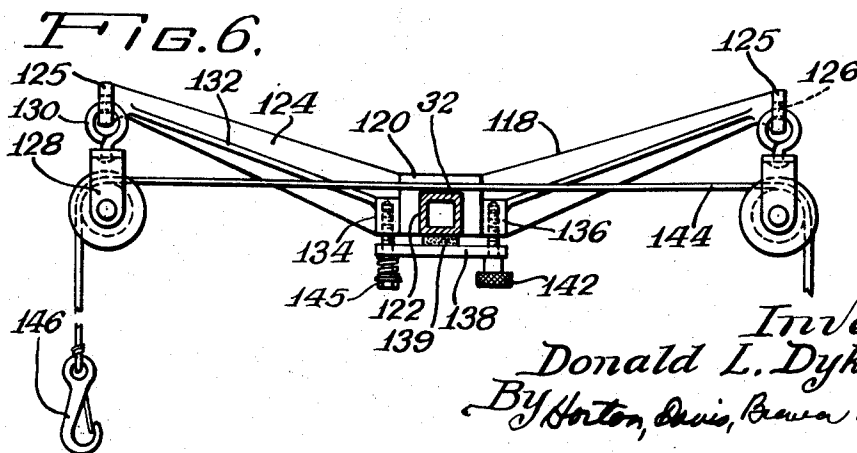
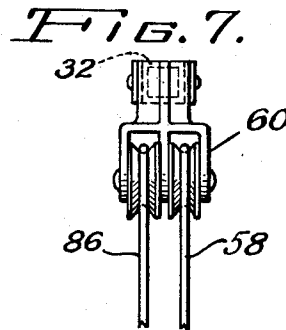
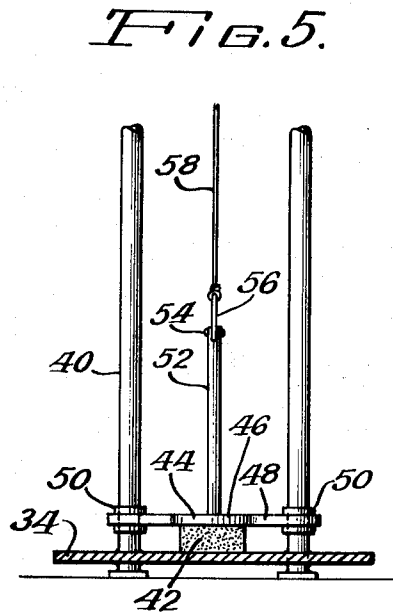
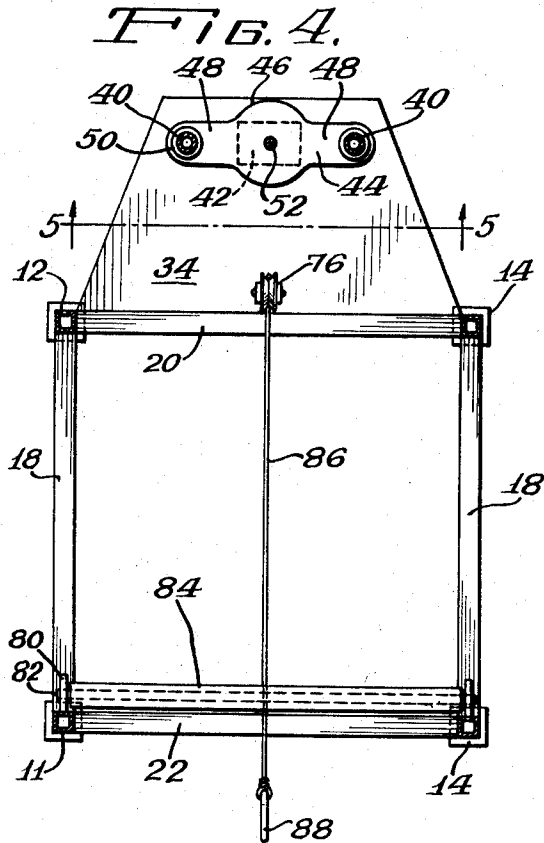
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THERAPEUTIC EXERCISE CHAIR

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3 Sheets-Sheet 3



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3,072,400

## THERAPEUTIC EXERCISE CHAIR

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Filed Nov. 16, 1959, Ser. No. 853,089

6 Claims. (Cl. 272—58)

My invention relates to a therapeutic exercise chair.

In the case of many patients afflicted with muscular weakness or paralysis, remedial exercise has proved to be of enormous value, both in muscular regeneration and in flexing, stretching and loosening tendons, muscles and joints. To deliver such exercise the patients have been placed either in a lying position on a bed or table or in a sitting position on a table or chair. The difficulty with apparatus heretofore known in which the sitting position is employed is that the patient, due to his muscular weakness or failure, feels insecure and uncomfortable and often develops backaches and other distress occasioned both by the discomfort inherent in the apparatus and also by an employment of muscles other than those which it is intended shall be exercised. The insecurity mentioned is not purely psychological; because of the muscular weakness and the effort involved in the exercise, it is very real.

The difficulty with the lying position is that, while the patient feels a sense of stability and security, the position is not suited to the most efficacious therapy of the muscles or muscle groups generally needing such treatment.

My invention has as a first objective the provision of apparatus wherein a person needing therapeutic exercise of the limbs may be seated in comfort and in absolute stability and in a position where the body is best oriented to receive the benefits from such exercise.

Another object of my invention is the provision of a chair of this character wherein a patient may be confined so as to insure body portions needing exercise will receive the benefit of that exercise and that muscle substitution on the part of the patient will be avoided.

Still another object of my invention is the provision of such a chair wherein either assistive or resistive force may be applied to facilitate movement of the exercised body portions for loosening or stretching or to resist them for muscular development and regeneration.

A still further object of my invention is the provision of apparatus of this character which permits the reciprocal exercise of, for instance, both arms or both legs.

Yet another object of my invention is the provision of apparatus of this character wherein the exercise given may be delivered from a wide range of angles to work the limb muscles, joints or tendons from any of a variety of positions with the assistance of or against the force of a wide variety of loads.

Another object of my invention is the provision of a therapeutic exercising apparatus wherein the patients, when properly placed in and connected to the apparatus can exercise themselves and thereby speed recovery and at the same time relieve the therapist from active manipulation and permit him to supervise the therapy of several patients simultaneously.

Other objects and advantages of my invention will be apparent from the following description and drawings of which:

FIG. 1 is a side elevation of a therapeutic exercise chair embodying my invention;

FIG. 2 is a front elevation thereof;

FIG. 3 is a top plan view thereof;

FIG. 4 is a section taken along the line 4—4 of FIG. 2 looking in the direction of the arrows showing the base structure of the apparatus in plan;

FIG. 5 is a section taken along line 5—5 of FIG. 4 looking in the direction of the arrows illustrating the weight pan assembly in elevation;

FIG. 6 is a section taken along the line 6—6 of FIG. 3

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looking in the direction of the arrows showing the reciprocal motion wing supports in elevation; and

FIG. 7 is an elevation of the top portion of the rear of the apparatus taken substantially from the line 7—7 of FIG. 1 looking in the direction of the arrows showing particularly the rear pulley.

The embodiment of the apparatus of my invention illustrated in the drawings consists of a rectilinear frame 10 formed of square tubing and including four corner uprights, the front uprights 11 and the rear uprights 12, terminating at their lower end in feet 14. In this embodiment, I contemplate that the uprights be about seven feet high. The uprights are transversely connected at their upper ends by cross beams 16. Adjacent the feet 14, similar tubing is welded to the four uprights to interconnect them and constitute lower side braces 18, a lower rear brace 20 and a lower front brace 22.

Upwardly of the braces similar tubing is welded at its ends longitudinally of the frame to constitute chair seat supports 24. A third tube extends between the rear uprights 12 at the level of the chair seat supports as a central back brace 26. Another tube extends between the rear uprights spaced downwardly from the upper ends thereof to constitute a shelf support 30.

A beam 32, again of square tubing, is mounted centrally on the cross beams 16 to extend substantially beyond the front and rear of the frame.

A trapezoidal sheet metal lower shelf 34 is mounted on its long edge against the underside of the rear lower base 20 to extend rearwardly therefrom. A pair of feet 36 are secured to the underside of the shelf adjacent its outer end to provide floor support for that end of the shelf.

A trapezoidal sheet metal upper shelf 38 is secured along its broad base to the underside of the shelf support 30 again extending rearwardly therefrom. A large elliptical hole 39 is formed in the center of the upper shelf.

A pair of parallel guide posts 40 extend from the lower shelf 34 to the upper shelf 38. The posts are secured to the lower shelf directly over the feet 36. Indeed, the feet may be simply lower extensions of the guide rods 40. The rods may be secured to the upper and lower shelves by welding as illustrated or by threaded engagement of any sort. A sponge rubber pad 42 is cemented to the bottom shelf directly between the guide rods.

The guide rods mount a weight pan 44 which consists of a circular central body 46 with ears 48 extending out to either side thereof. The ears 48 have apertures therein mounting bearing sleeves 50 which encircle the guide rods 40. A post 52 extends upwardly from the center of the weight pan. The top end of the post is bifurcated, and a pin 54 extends across the arms of the bifurcation to which a hook 56 in the end of a cable 58 may be secured.

The beam 32 terminates at its rear end over the sponge rubber pad 42 and the hole 39 and has secured in alignment therewith a double pulley 60. The forward end of the beam 32 extends well to the front of the frame 10 and has a single pulley 62 mounted thereon to swivel about a horizontal axis. To obtain the swiveling action the forward end of the beam 32 has a cap 64 mounted thereto and a stud 66, threaded at its outer end, extending forwardly from the cap. The shank of the sheave support 68 of the pulley terminates in a sleeve 70 mounted on stud 66 and secured to the stud by a nut 72. The cable 58 extends up over one of the sheaves of the double pulley 60, is entrained over the pulley 62 and terminates, for example, in a snap hook 74.

A second single pulley 76 is mounted to the lower shelf closely adjacent the rear lower brace 20 in the transverse center of the shelf. This pulley is mounted to the shelf by a headed pin 78 extending through an appro-

priate bore in the shelf to permit swiveling action of the pulley about a vertical axis.

A pair of ears 80 are welded to the side lower braces immediately adjacent the front uprights which support inwardly directed pins 82. A round tube 84 is mounted at its ends on pins 82 to be rotatable thereon, the tube spanning the width of the frame. A second cable 86 has a snap hook 88 at one end thereof and is entrained, from that end, under roller 84, under pulley 76, over the other sheave of double pulley 60, and terminates at its other end in a hook 90. The hook 90 is shown secured to the back of the frame 12 in a stored, inactive position, but is attachable, alternatively to hook 56 of cable 58.

The chair portion 92 of my apparatus consists of a seat 94, a back 96 and arms 98. The seat portion is an upholstered member somewhat narrower than the spacing between the uprights of the frame and having an horizontal underside and a comfortably upholstered top side sloping downward toward the rear of the apparatus. The sides 100 of the seat are formed of metal. The chair seat is secured to the frame by elongated bolts 102 extending through the chair seat supports 24 and into the chair sides 100. Spacers 104 encircle the shanks of the bolts between the chair seat supports and the seat sides to position the chair seat centrally within the frame. A pair of strap loops 106 are secured to the chair seat sides 100 adjacent the forward end thereof.

The chair arms 98 are upholstered wood or steel members. They are supported by angle irons 108 secured at their ends against the inside surfaces at the front and rear uprights 12 to incline upwardly toward the front of the apparatus. The angle irons are oriented with their upper flange 110 extending inwardly, and the arm members are secured in any appropriate fashion against the upper flange 110.

The chair back 96 is likewise an upholstered member equal in width to the chair seat. The chair back is mounted in the frame to incline rearwardly at about a 30° angle from the vertical. The chair back is secured against the rear edge of the seat as by screwing, bolting, etc. The upper end of the chair seat is supported by a light strap 111 welded at its ends to the inside surfaces of the rear uprights 12, extending convergently backward a distance to the desired line of the upper end of the chair back and thence across the rear side of the chair back 96.

The sides 112 of the chair back have two pair of strap loops 114, 116, secured thereto. The lowermost pair 114 is secured at the lowest point on the side of the chair back to hold straps for confining a patient's hips and the upper loops 116 situated at about chest level to hold a patient's shoulders against the movement.

For reciprocal arm or leg exercise I provide a pair of pulley wing supports 118, one of which is particularly illustrated in FIG. 6. This member in the illustrated embodiment is an aluminum casting having a central rectilinear portion 120 with a rectilinear channel 122 in the bottom edge thereof, formed to embrace closely the top and sides of the beam 32, and wings 124 extending outwardly and upwardly from the central portion 120. As illustrated, the wings incline upwardly at about 15° to the horizontal. The outer ends of the wings are turned through right angles as at 125 and have holes 126 formed therein to which pulleys 128 may be attached as by hooks 130 on the shanks thereof. The arms 124 taper toward their outer ends and have longitudinal ribs 132 thereon for additional strength. Bosses 134 and 136 are provided on the lower surfaces of the arms adjacent their juncture with the central portion 120 which are tapped for the reception of screws. My support likewise includes a plate 138 proportioned to span the bosses 134, 136 and the central portion 120. The plate has a strip of hard rubber 139 secured centrally thereto and adapted to bear forcibly against beam 32. The plate is attached

against the underside of the wing support by a spring loaded tension bolt 140 threaded into boss 134 and a clamping bolt 142 threaded into boss 36.

In use, the wing supports will each support a pair of the pulleys 128 spaced to each side of beam 32 with the uppermost portion of sheaves thereof above the level of beam 32. A cable 144 having a snap 146 at each end thereof will be entrained through the two pulleys and over the top of beam 32. The upper inclination of the wings and the displacement of the holes 126 from the longitudinal axis of the support ensure freedom of the cable 144 between the pulleys and no interference therewith from the beam 32 or the pulley wing support 118.

It is believed that the operation of my device will be evident from the drawings and the above description. The patient will be seated in the chair seat 92. Assuming it is desired to provide assistance to leg movement, snap 74 of cable 53 will be secured in any well known fashion to the ankle or foot of the patient and the other end of that cable connected to the weight pan 44. In the case of such assistive exercise the weight pan should be elevated a distance about equal to the desired leg movement above the rubber pad 42 by a relatively close coupling of the hook 74 to the ankle of the patient. Thereafter, the weight pan will be loaded with weights about equal to the weight of the leg. In this fashion the patient may move his leg up and down and from side to side as recommended by his therapist in a condition of near weightlessness. The pulley 62 will swivel freely so as to accommodate cable movements therein from a wide variety of angles.

The same connections may be used to exercise arms and shoulders in a similar fashion.

Should resistive force be desired to the exercise of the flexors of the leg, the weight pan may be overloaded with reference to the weight of the leg and the length of connection between the hook 74 and ankle be adjusted to drop the weight pan on the rubber pad 42 at the desired upper end of leg movement. When it is desired that the patient exercise the extensors of the leg against some force less than the weight of his own leg, the weight pan may be proportionately lightened so as to give the leg the appropriate effective weight.

Should resistive force to the leg flexors be desired, cable 53 will be uncoupled both from the patient and the weight pan and cable 86 connected by hook 88 to the ankle of the patient and by hook 90 to the weight pan. The weight pan may then be loaded to any desired degree to cause the patient to straighten his leg against any force deemed proper by the therapist. Again, since the cable is positionally fixed only toward the rear of the seat by pulley 76 and is free to travel across the width of roller guide 84, a wide angle and range of movement is possible to the patient. Again hook 88 may be attached to the wrist or arm to provide resistive force to the movement of the arms or shoulders.

It frequently occurs in apparatus hitherto known that a patient will, by body twisting, etc., avoid the use of those muscles which he should be exercising and substitute other muscles to obtain the mechanical movement. By virtue of the sitting posture which I employ together with the strap loops 106, 114, 116 a patient may be strapped tightly to the chair 92 at the hips, over the thighs and about the chest to confine his body effectively, avoid such muscle substitution and compel the use of the proper muscles. The patient, of course, need not be strapped for any particular exercise at all of these points. Usually a single strap will suffice to obtain the desired immobility.

The wing support 118 with its associated pulleys and cable makes possible reciprocal motion and exercise of legs and arms and shoulders. In such case the cable hooks 146 of cable 144 may be attached to each ankle of the patient, for instance. The patient may then obtain exceedingly beneficial loosening and freeing exercise by

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movement of the legs alternately up and down with each leg being counterbalanced by the other. Likewise in the case of a hemiplegic a muscled and controlled leg can be employed to exercise the other injured leg. The situation is similar, of course, with regard to the arms and shoulders. The wing support may be moved along beam 32 by first removing the clamping nut 142 and then the spring loaded nut 140 to remove plate 138. The wing support may then be lifted off beam 132 and replaced thereon at any desired overhead location. To lock the plate again to beam 32 the plate is secured to the wing support first by spring loaded nut 140 and then by clamping nut 142 to bring the rubber pad 139 firmly into contact with the under side of beam 32. Appropriate connection can then be made by hooks 146 to the wrists or arms of the patient for reciprocal movement exercises of the arms and shoulders.

The exercises and stretches that can be obtained from my apparatus are reciprocal motion exercises for the knees and hips and for the elbows and shoulders, resistive or assistive knee extension or flexion exercises, resistive or assistive hip flexion or extension exercises, external and internal rotation of the hip exercises, resistive or assistive elbow extension or flexion, resistive downward rotation and depression of the shoulders or assistive upward rotation and elevation thereof, and hamstring and quadriceps stretching.

I have employed experimentally a chair incorporating my invention as described and have found the patients able to lift substantially more weight in quadriceps and hamstring exercises than in any other apparatus directed to this purpose. In stretching the quadriceps and hamstrings, the patients' ranges of movement increased substantially more rapidly when doing the stretching themselves as my apparatus provides than where stretching was done by others. None of the patients treated in my apparatus have complained of fear of falling or of back-aches.

Finally since my apparatus contemplates that the patients, in effect, exercise themselves it makes possible a single attendant serving several patients at the same time and exercising more a supervisory function than an arduous and time consuming manipulation.

Although I have described but a single embodiment of my invention and certain applications thereof, it will be understood that the apparatus may be extensively modified without departing from the spirit of my invention and that many other applications may be made in the way of different cable and pulley hook-ups etc., and that I therefore desire that my invention be regarded as being limited only as set forth in the following claims.

I claim:

1. A therapeutic exercise chair comprising

(a) a frame,

(b) a seat supported by said frame,

(c) a horizontal beam mounted on said frame and extending forwardly beyond the front edge of said seat to the front whereby the forward extent of said beam provides convenient access to each of the limbs of a patient seated in the chair for assistive therapy, said horizontal beam also extending beyond said seat to the rear thereof,

(d) pulleys secured to the front and rear ends of said beam,

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(e) a vertical guide spaced from the rear of said seat and positioned immediately below the rearmost periphery of the rear pulley on said beam,

(f) a cable entrained over said pulleys,

(g) a weight pan mounted to slide vertically in said guide and connected to the rear extremity of said cable,

(h) and means on the forward extremity of said cable for engaging the limb of a patient, whereby placing various amounts of weight on said weight pan provides varying degrees of assistive force to aid in the exercise of a handicapped limb.

2. The combination as set forth in claim 1 wherein said pulley at said forward end of said beam is mounted to said beam to swivel about an axis parallel with said beam.

3. A therapeutic exercise chair comprising a frame, a seat supported by said frame, a horizontal beam supported by said frame above said seat and extending forwardly of said seat, a weight pan under the other end of said beam, pulley means at said other end of said beam, a pair of cables alternately attachable at one end to said weight pan and extending over said pulley means, a pulley adjacent the forward end of said beam having one of said cables entrained thereover, a pulley below said seat having the other of said cables entrained thereunder and extending to the front of said seat and means at the other ends of said cables for attachment to the limbs of a patient.

4. A combination as set forth in claim 3 including additionally means guiding said weight pan for vertical movement.

5. The combination as set forth in claim 3 including additionally a resilient pad under said weight pan.

6. A therapeutic exercise chair comprising a frame, a seat supported by said frame, a beam supported by said frame over said seat and extending beyond the front and rear thereof, a weight pan under the rear end of said beam, pulley means on the rear end of said beam over said weight pan, a first and a second cable entrained over said pulley means and alternately attachable at their rear ends to said weight pan, a first pulley at the forward end of said beam, said first cable being entrained over said first pulley and having means at the forward end thereof for attachment to a limb of a patient, a second pulley below said seat, said second cable being entrained under said second pulley and having means at the forward end thereof for attachment to the limb of a patient, a member attachable to said beam along the length thereof having wings extending angularly away therefrom to either side of said beam, pulleys secured to the ends of said wings and a cable entrained over said pulleys and means at each end of said cable for attachment to a limb of a patient.

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