United States Patent

[11] 3,618,968

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[54] **PATIENT-OPERATED WHEELCHAIR**
11 Claims, 24 Drawing Figs.

[52] **U.S. Cl.** ..... **280/47.11,** 280/150 A, 297/DIG. 4
[51] **Int. Cl.** **A61g 5/00**
[50] **Field of Search** ..... 280/36, 47.11, 47.16, 150 A, 239; 297/433, 347, DIG. 4, 345, 377, 69, 416, 417, 224; 5/81, 86

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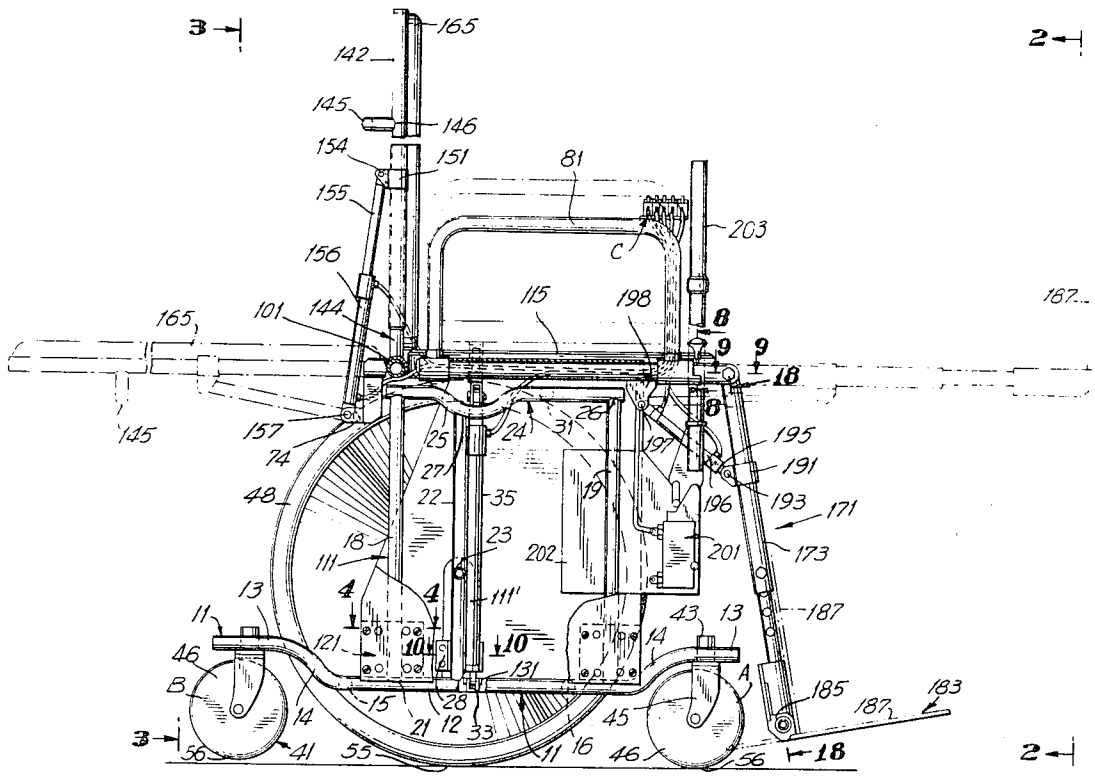
Primary Examiner—Benjamin Hersh
Assistant Examiner—Robert R. Song
Attorney—Arthur B. Colvin

ABSTRACT: A patient-operated wheelchair having improved stability and having a backrest adjustable from the vertical to infinite angles as well as a pair of footrests, each of which is independently infinitely adjustable between a lowermost position to a horizontal position so that when the backrest and both footrests are in the horizontal position, the wheelchair is converted into a stretcher. The wheelchair includes hydraulic or like-powerized controls, permitting the user adjustably to position the various components of the wheelchair for maximum comfort and flexibility. The apparatus, in addition to convertibility from a wheelchair to a stretcher, permits heightwise adjustment of the seat, adjustment of individual leg supports and angular adjustment of the backrest. Arm rests are provided which may be deflected from the normal or vertical position to a horizontal position, facilitating sidewise movement of the patient from the wheelchair to a horizontal surface, such as a bed or massage table.

A powerized mechanism, preferably hydraulic, effects the various adjustments, the hydraulic mechanism being powered either by a hand-operated pump or by an electrically driven pump.

The apparatus is supported on the usual hand driven main wheels and includes front and rear sets of casters disposed at a different level than the main wheels whereby, when the wheelchair is employed in the normal phase, the weight of the device is carried by the front set of casters and the hand-driven wheels. When the apparatus is used as a stretcher, the center of gravity shifts so that the weight is carried by the rear set of casters and the handwheels. In each instance only one set of casters and the handwheels are in contact with the ground to facilitate movement.



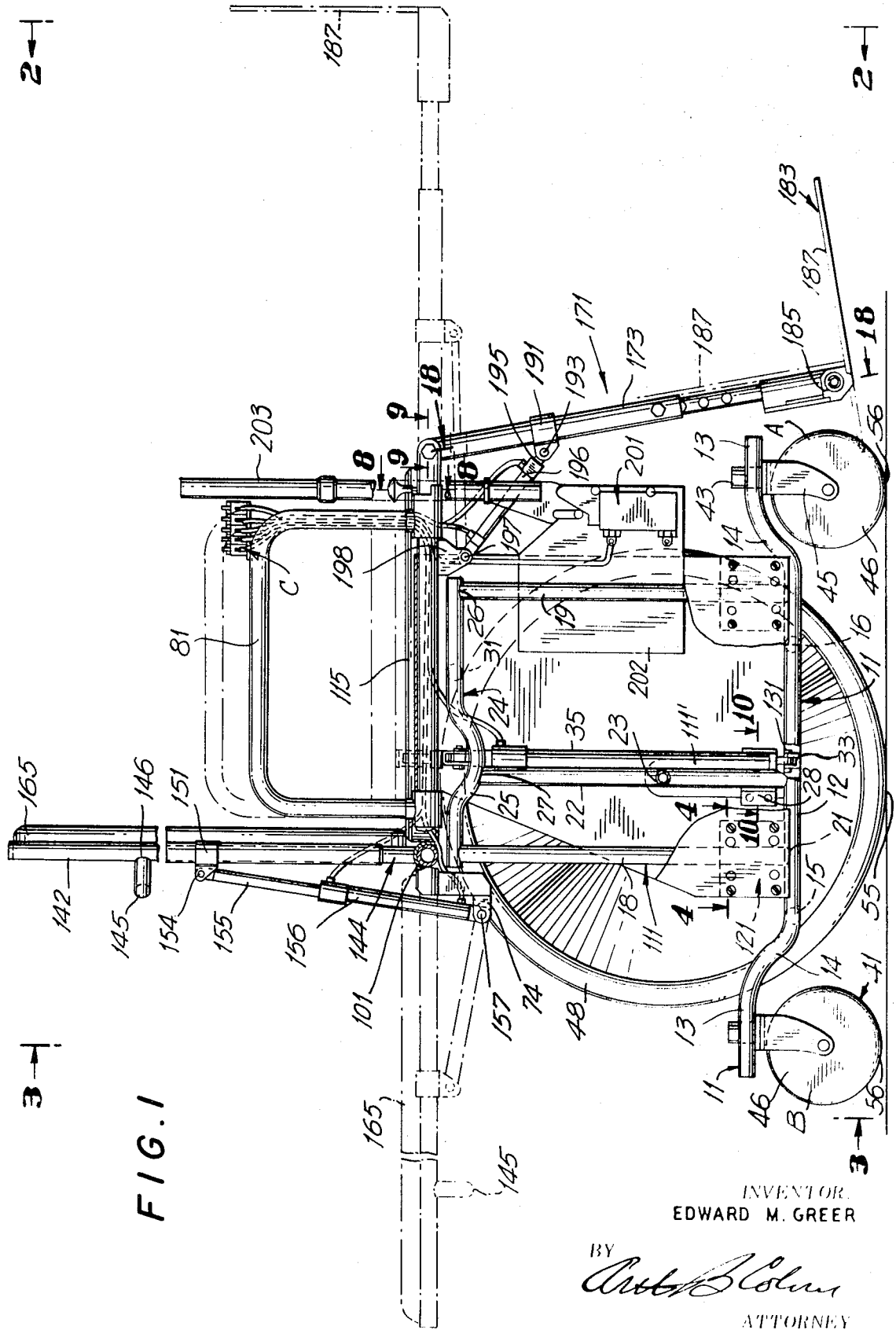


FIG. 1

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FIG. 3

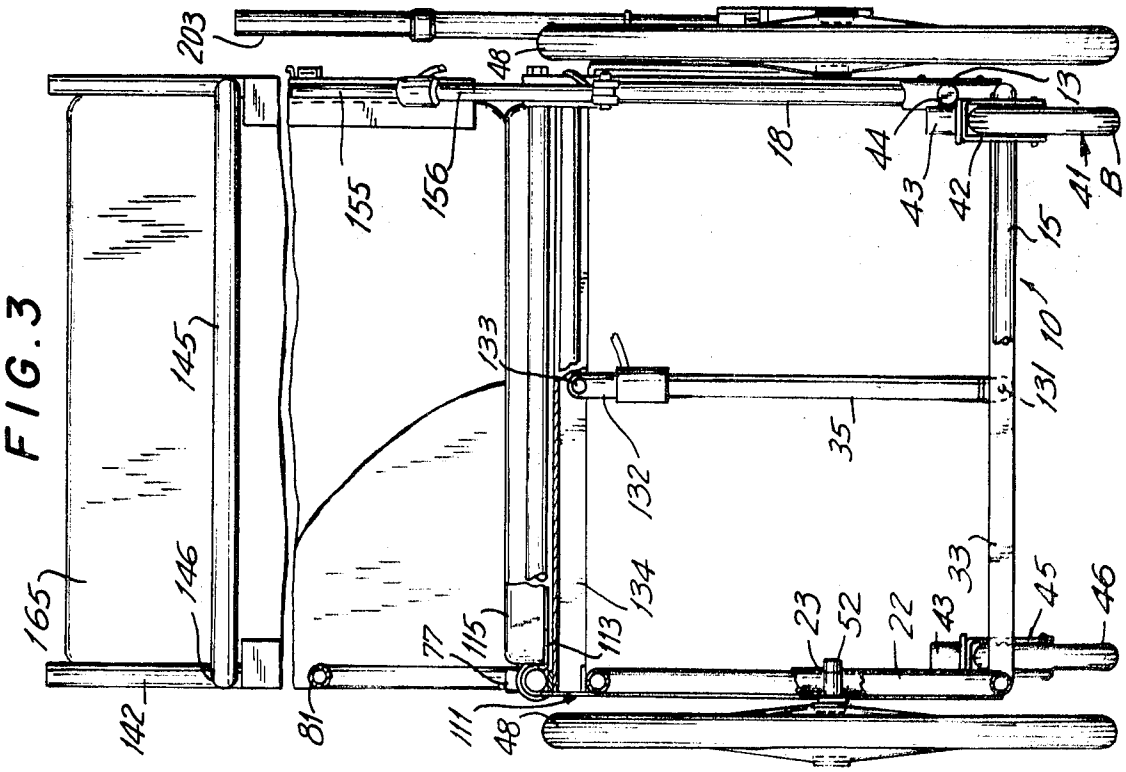

FIG. 2

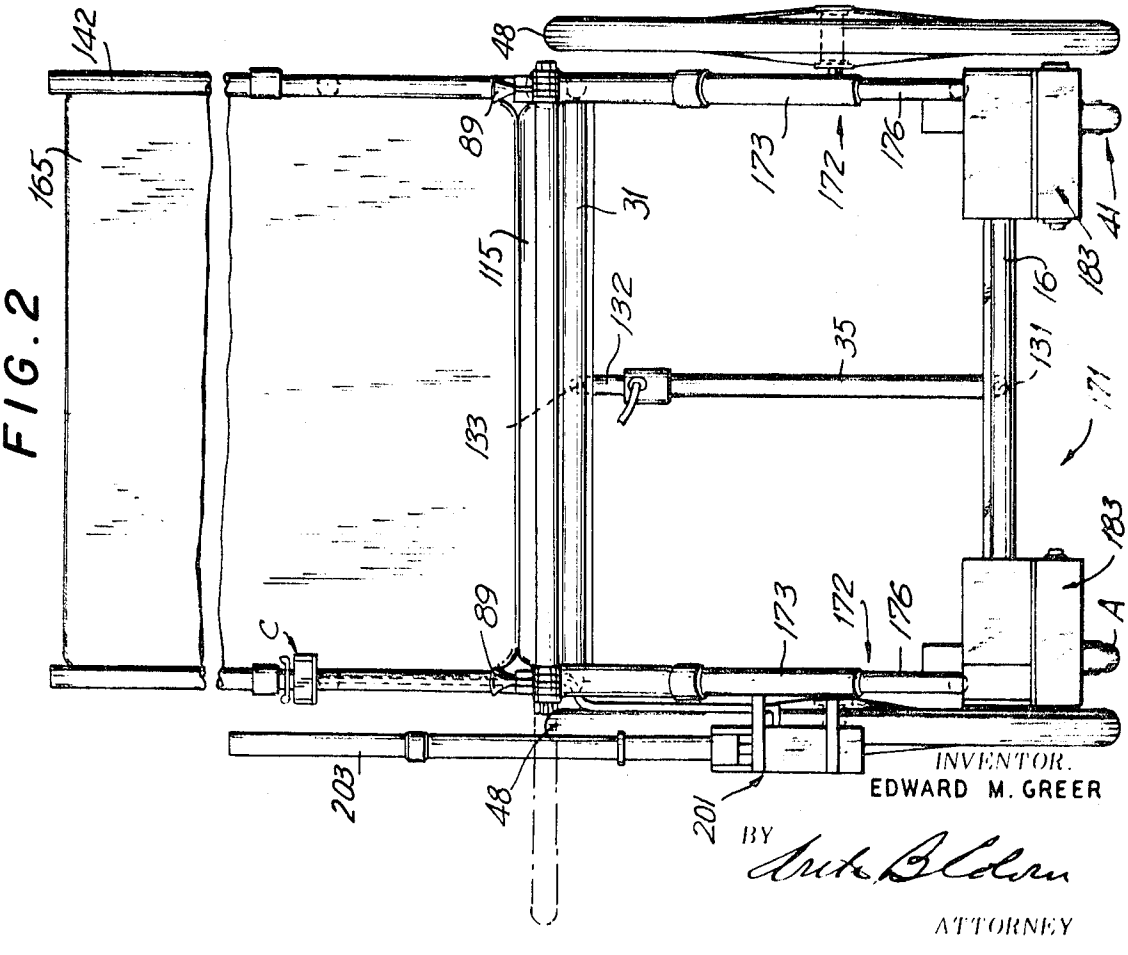

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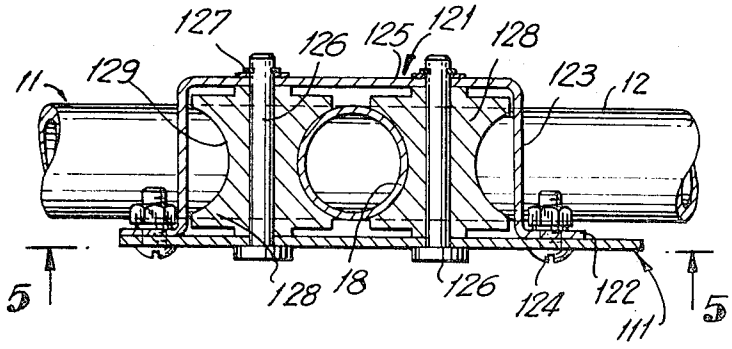
FIG. 4



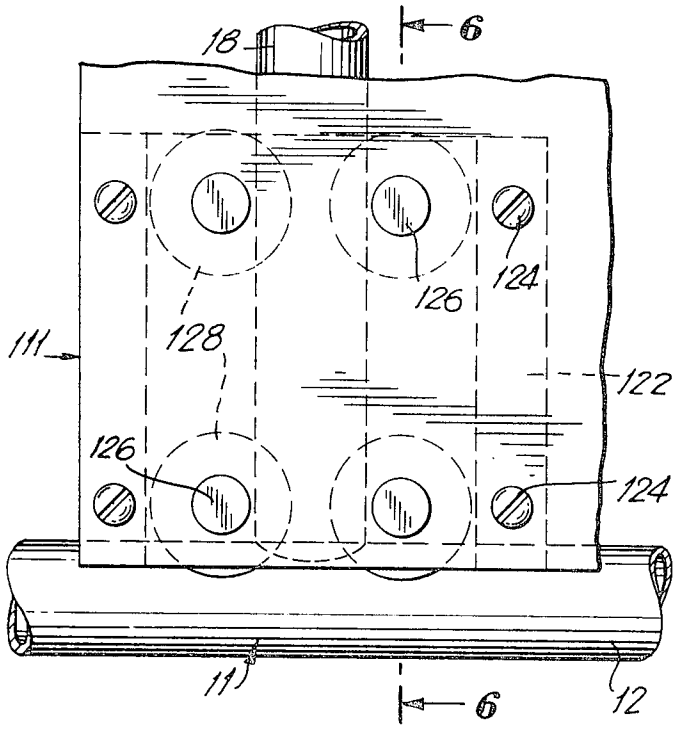


FIG. 5

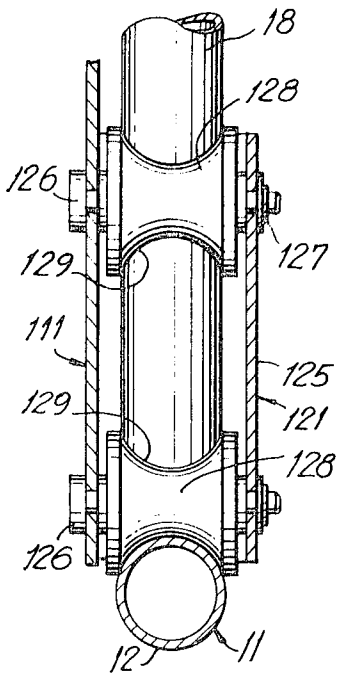


FIG. 6

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FIG. 7

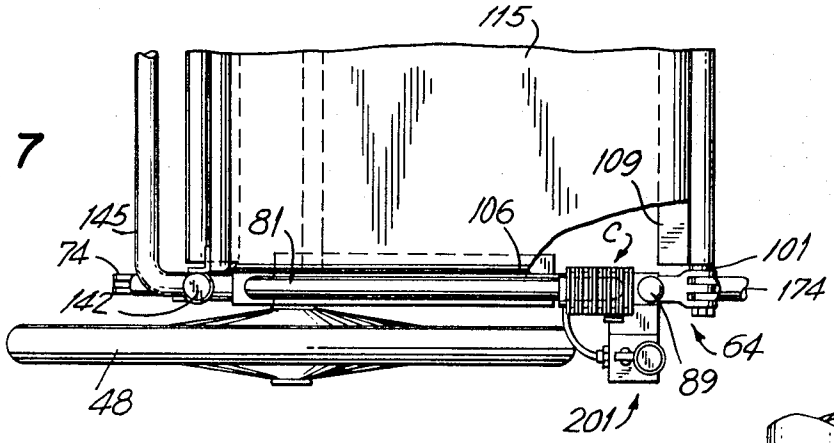


FIG. 8

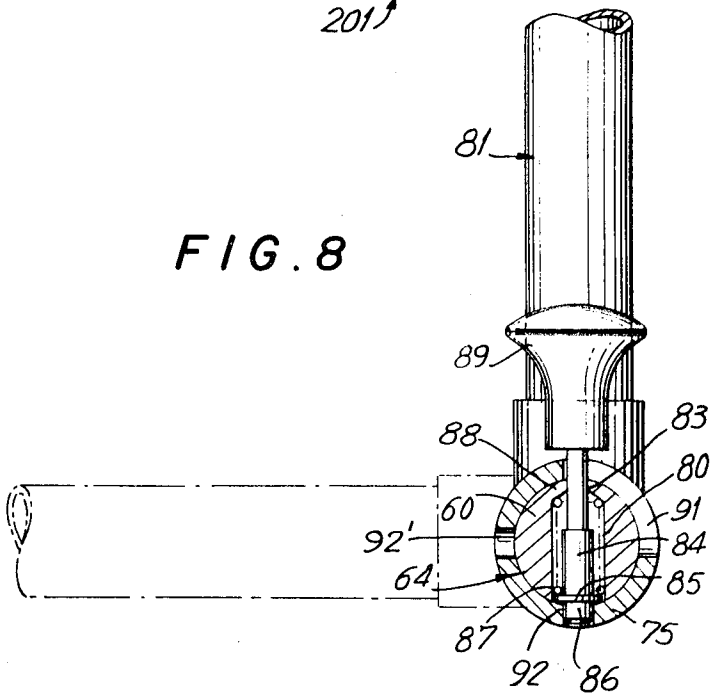
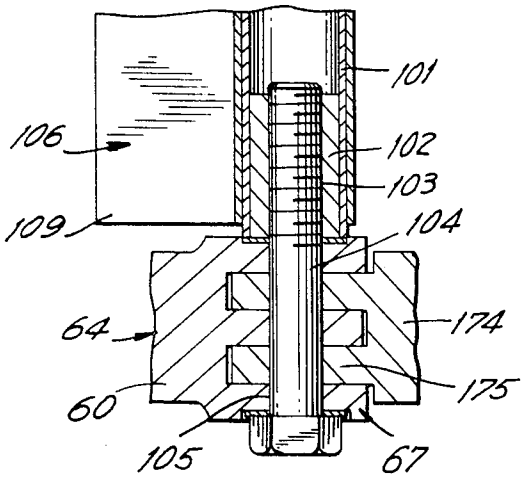


FIG. 9



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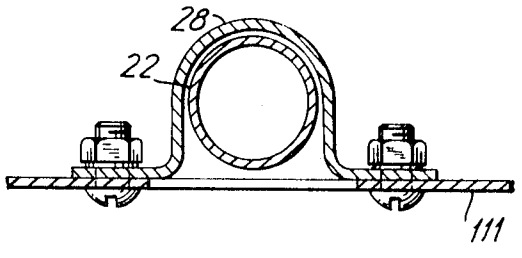

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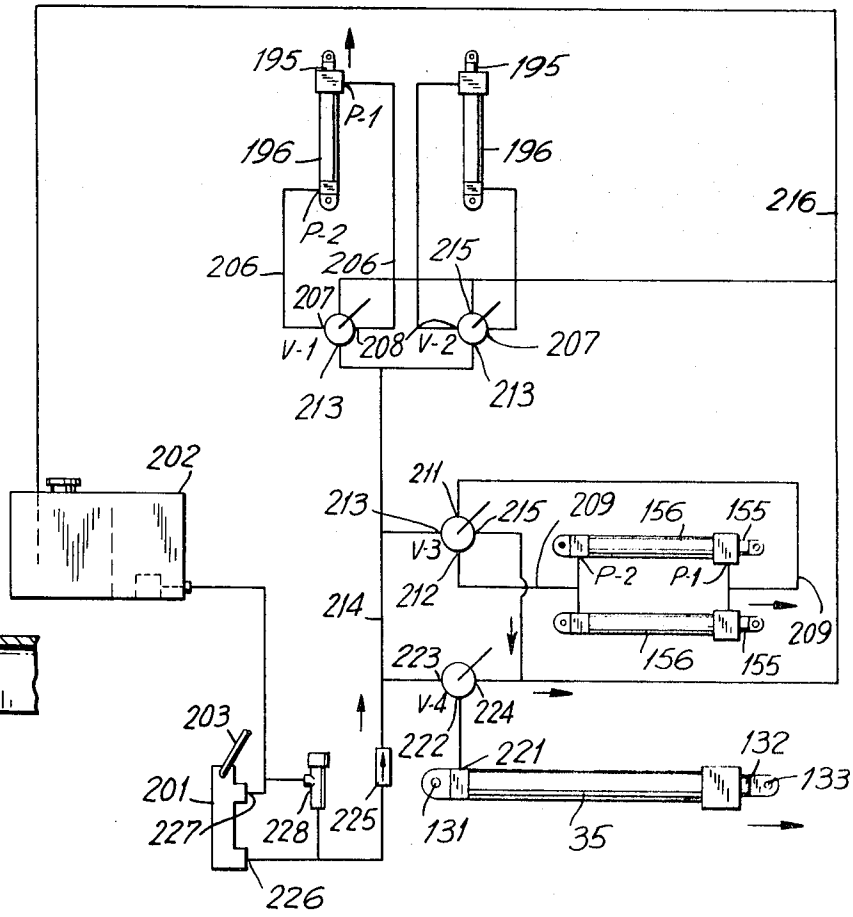
FIG. 11



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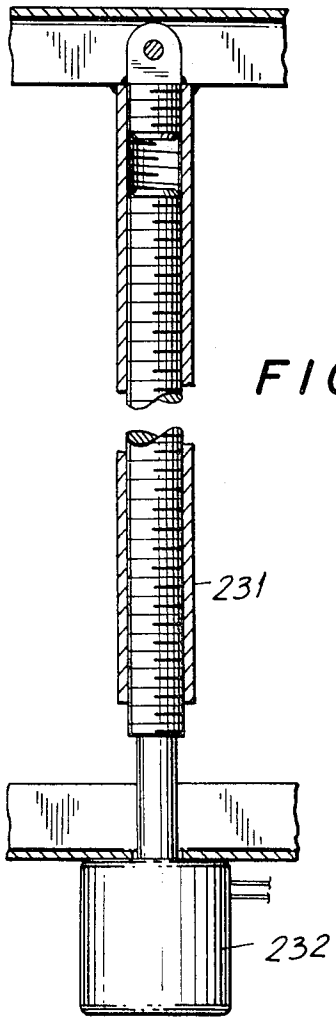

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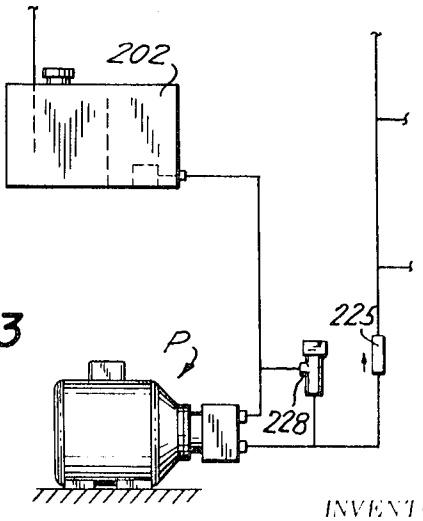

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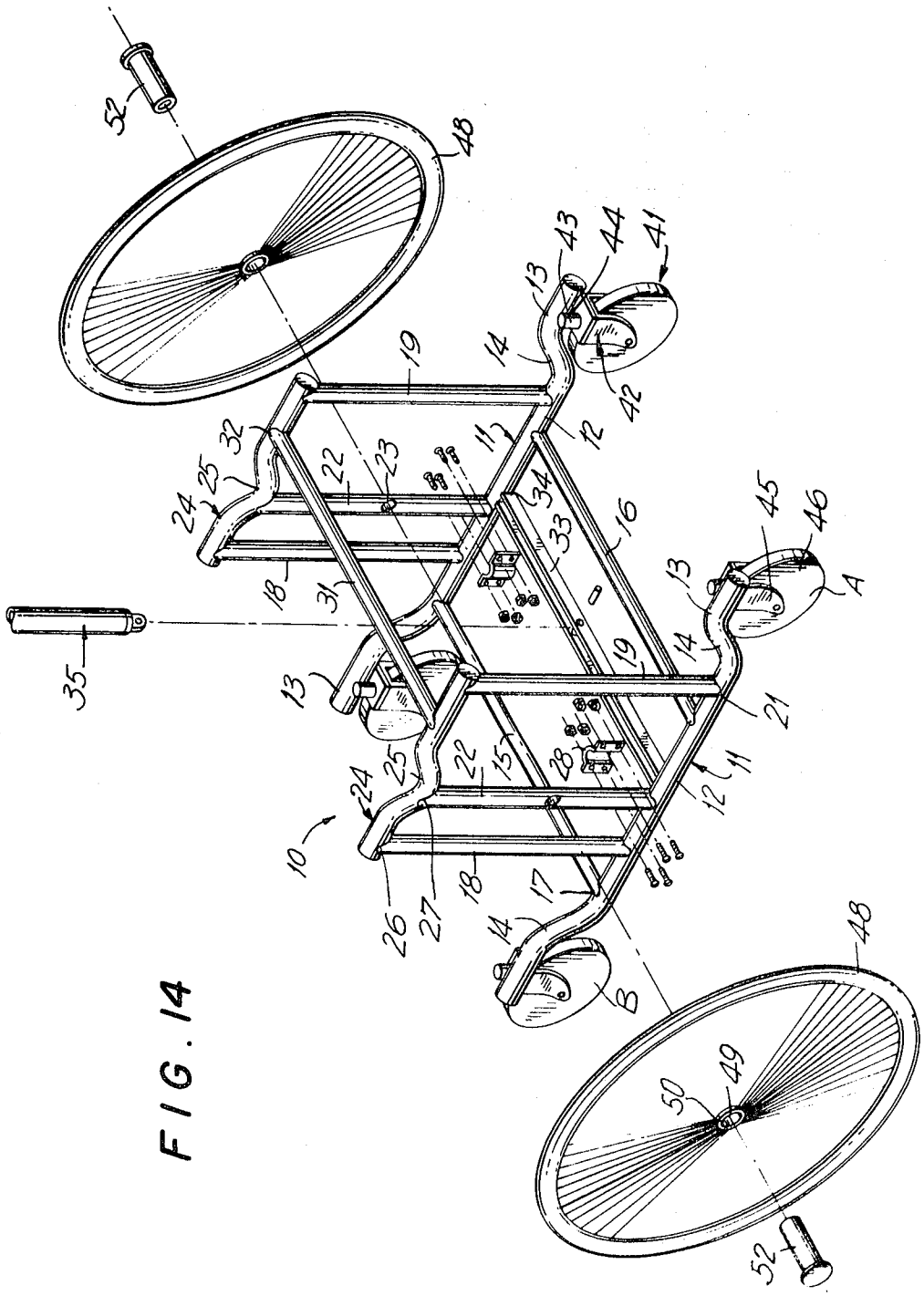

FIG. 14

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FIG. 15

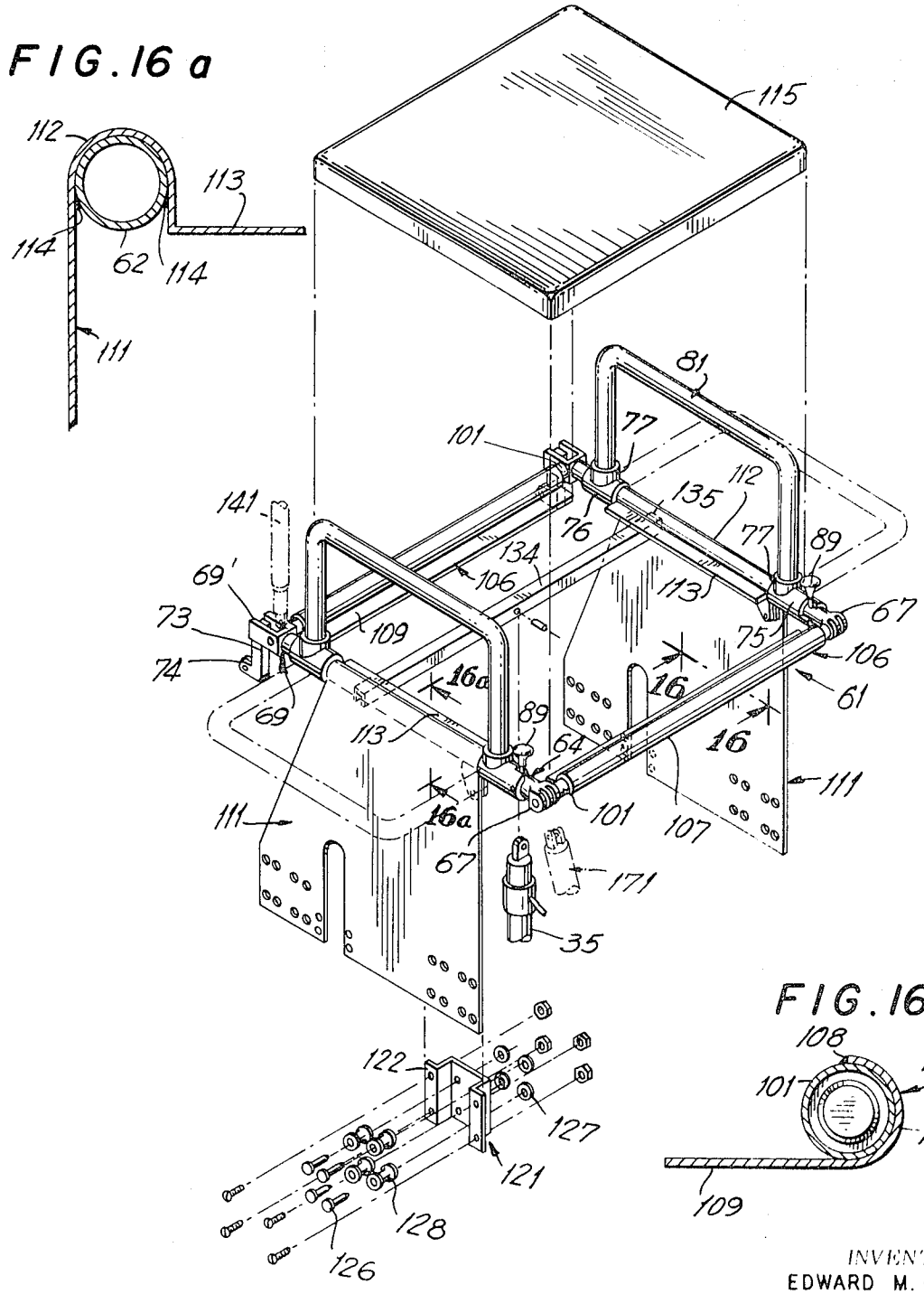

FIG. 16a

FIG. 16

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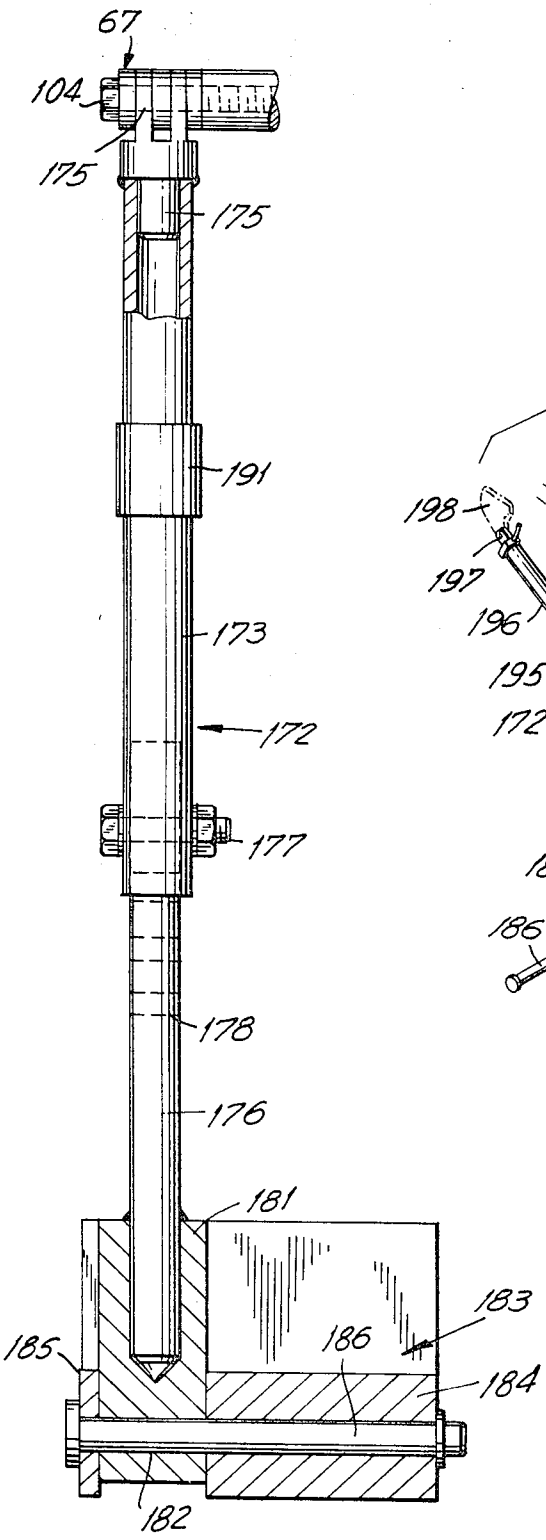
FIG. 18



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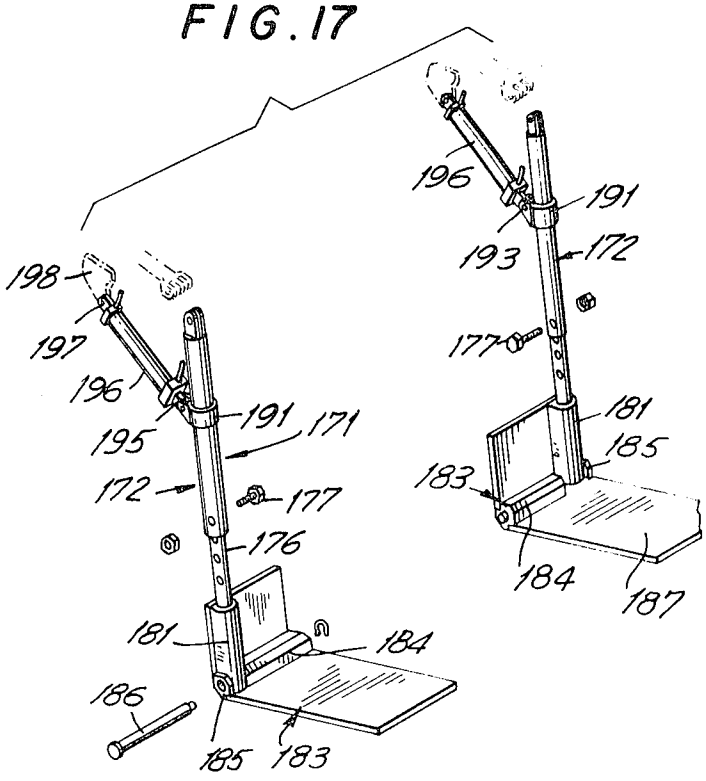

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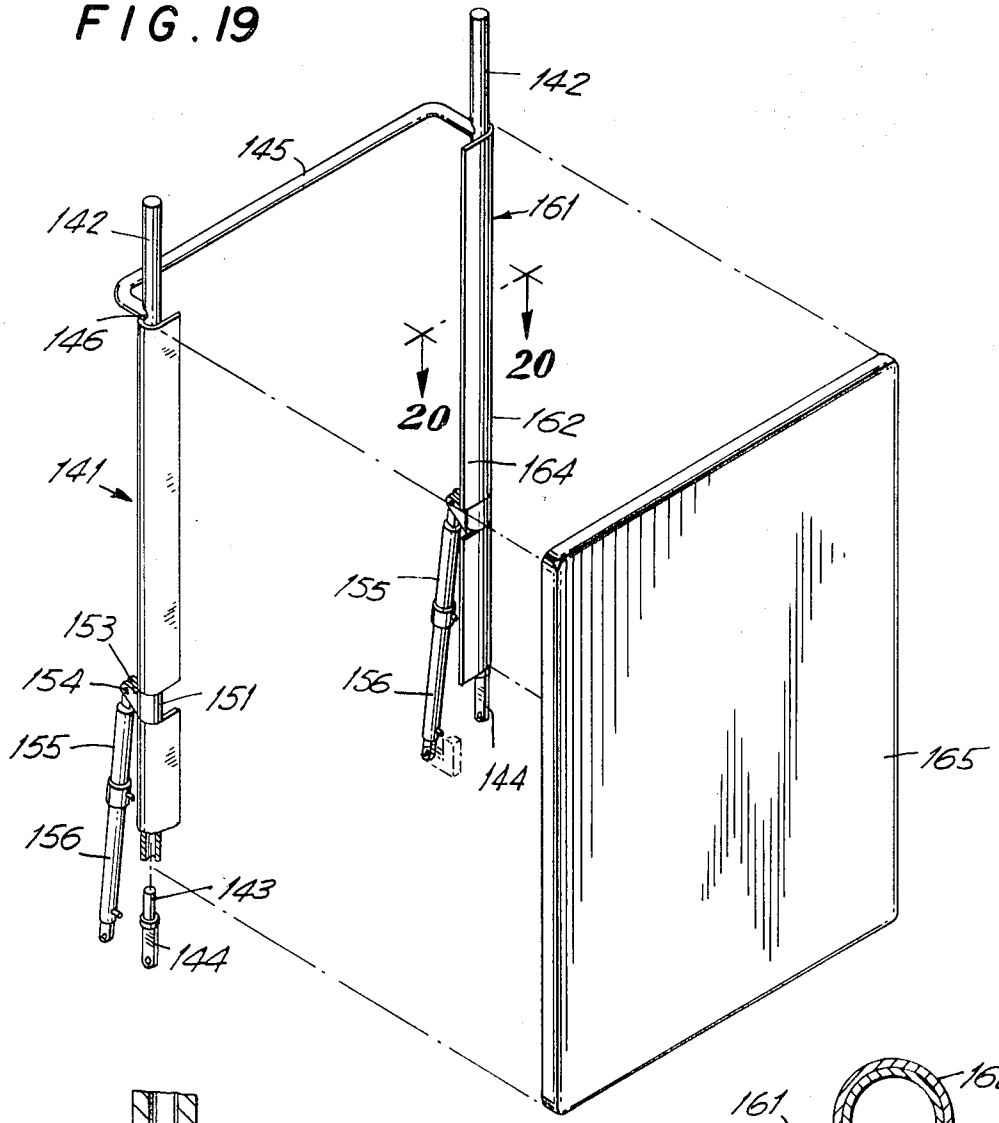
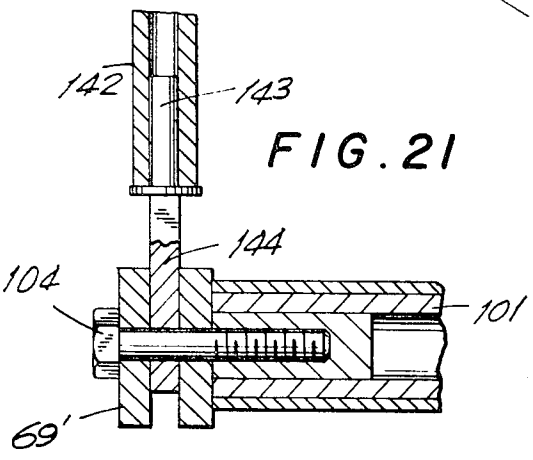
FIG. 19





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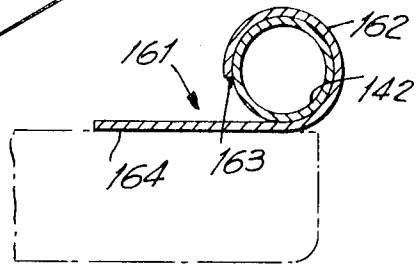

FIG. 20

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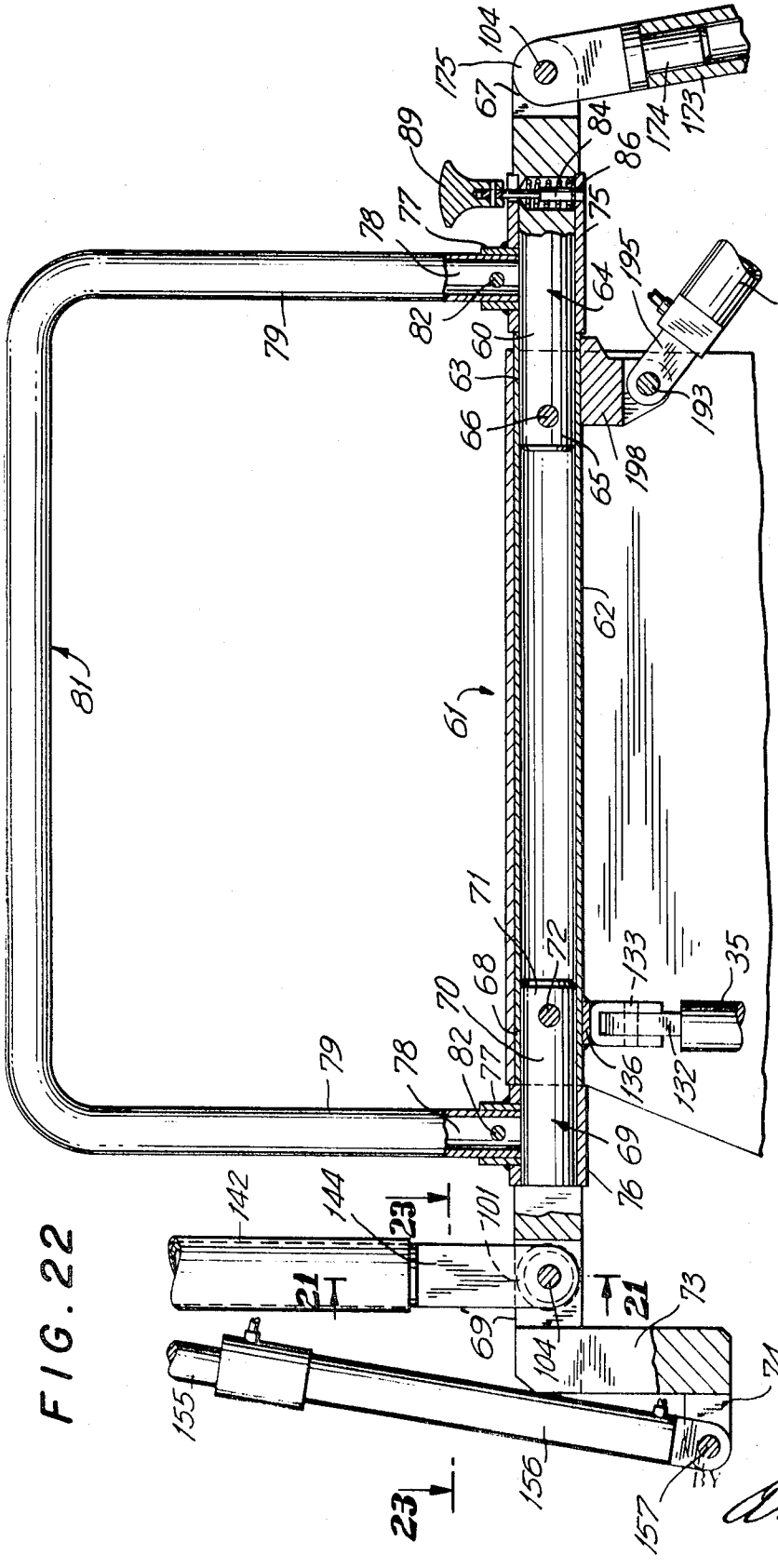

FIG. 22

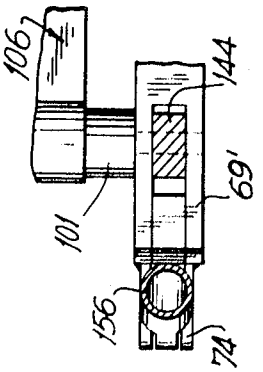

FIG. 23

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PATIENT-OPERATED WHEELCHAIR

BACKGROUND OF THE INVENTION

Field of the Invention

This invention is in the field of wheelchair apparatuses of the type used by temporarily or permanently disabled persons who have normal or partial functioning of their upper extremities but who have lost the use of their lower limbs.

The Prior Art

Wheelchair apparatuses of various sorts have been designed to enable, to the maximum possible degree, paraplegics, polio victims and other persons who have permanently or temporarily lost the use of their lower limbs, to enjoy a normal, useful and productive life. It is the objective of all such devices to enable persons having sufficient strength in their arms and upper torso to compensate for their loss of mobility.

It is accordingly known to provide wheelchairs which may be adjusted to permit the user to assume various comfortable positions. Heretofore, however, such apparatuses have required the assistance, to a greater or lesser degree, of an attendant or aide in initially adjusting the parts to a desired position and locking the parts at such position.

SUMMARY OF THE INVENTION

The present invention relates to an improved wheelchair construction comprising separate modules, namely, a base structure, a seat assembly movably mounted on the base structure, a backrest assembly, a leg support assembly and a control device for actuating the elements of the wheel chair.

The base structure comprises essentially a stabilized platform provided with the usual propulsion wheels, the platform including forward and rearward sets of casters. The vertical disposition of the sets of casters is such that when either set of casters is in engagement with a planar surface, the other set will be slightly removed from such surface. The base structure incorporates vertical struts on which the seat assembly is movably mounted for vertical shifting movement. The seat assembly includes individually articulatable leg supports and a pivotal back assembly.

Powerized means are carried by the seat assembly, the powerized means preferably comprising a series of hydraulic cylinders interposed between the various relatively movable frame components. Thus, for instance, individual cylinders may be interposed between the seat assembly and the leg supports, and one or a pair of such cylinders may be interposed between the back rest and the seat assembly.

Additionally, a vertically directed hydraulic cylinder may be interposed between the seat assembly and base structure to effect vertical shifting movement of the seat assembly.

The hydraulic mechanism may be powerized by a hand pump or by a battery driven pump. A series of hydraulic control valves is provided, preferably on a control block mounted on an arm rest or on a panel mounted vertically below the seat frame, to facilitate operation of the device by the user.

Preferably one or both of the arm rests may be pivoted from the vertical, i.e., the user-constraining position, to a dependent, horizontal position, to enable the user to leave the wheelchair in a sidewise direction.

The backrest of the apparatus may preferably be lowered to a horizontal position in alignment with the padded seat and the leg supports may be pivoted upwardly into alignment with the backrest and seat, in which position the apparatus may be used as a stretcher.

It is therefore an object of the invention to provide a wheelchair apparatus of a high degree of flexibility, powerized to enable the user, without outside assistance, to perform a number of adjustments on the chair, thereby making the user more independent, and which has a high degree of vertical, horizontal and longitudinal stability in all positions of adjustment.

A further object of the invention is to provide a wheelchair of the above type in which vertical adjustment of position is

provided so that the user of the wheelchair in seated position would be able to elevate himself so that his upper torso would be at a height equivalent to a standing position.

A further object of the invention is to provide a device of the type described which may be converted from a wheel chair to a stretcher.

Still a further object of the invention is the provision of a device of the type described having forward and rearward sets of casters, the vertical displacement of which casters is so arranged to assure that only one set of casters at a time will engage a horizontal surface, whereby the chair is supported at all times on the motion propulsion wheels and one set of casters.

Still a further object of the invention is the provision of a wheelchair assembly having powerized means for articulating various parts of the assembly.

Still a further object of the invention is the provision of a device of the class described wherein the powerized means comprises a series of hydraulic cylinders actuated by hydraulic pressure developed through a hand-operated pump or through an electrically driven pump or through a composite of the foregoing pressure developing means.

Still a further object of the invention is the provision of a device of the class described which includes side rails and means for pivoting the side rails to a position at or below the seat so that the user may exit and enter laterally as well as from the front of the wheelchair.

In the accompanying drawings in which is shown one or more of various possible embodiments of the several features of the invention:

FIG. 1 is a side elevational view of the wheel chair in the normal or lowermost position;

FIG. 2 is a front elevational view thereof taken along lines 2—2 of FIG. 1;

FIG. 3 is a rear elevational view thereof taken along line 3—3 of FIG. 1;

FIG. 4 is a transverse sectional view with parts broken away taken along line 4—4 of FIG. 1;

FIG. 5 is a detail side elevational view taken along line 5—5 of FIG. 4;

FIG. 6 is a sectional view taken along line 6—6 of FIG. 5;

FIG. 7 is a fragmentary top plan view with parts broken away of the chair;

FIG. 8 is a detail sectional view taken along line 8—8 of FIG. 1;

FIG. 9 is a detail sectional view taken along line 9—9 of FIG. 1;

FIG. 10 is a sectional view taken along line 10—10 of FIG. 1;

FIG. 11 is a diagrammatic view of the control circuit for the wheelchair;

FIG. 12 is a detail sectional view of another embodiment of the actuator for the seat assembly;

FIG. 13 is a diagrammatic view of another embodiment of the control circuit for the wheelchair;

FIG. 14 is an exploded perspective view of the base structure;

FIG. 15 is an exploded perspective view of the seat assembly;

FIG. 16 is a detail sectional view taken along line 16—16 of FIG. 15;

FIG. 16*a* is a detail sectional view taken along line 16*a*—16*a* of FIG. 15;

FIG. 17 is an exploded perspective view of the leg support assembly;

FIG. 18 is a longitudinal sectional view taken along line 18—18 of FIG. 1 of one of the leg supports of the leg support assembly;

FIG. 19 is an exploded perspective view of the backrest assembly;

FIG. 20 is a detail sectional view taken along line 20—20 of FIG. 19;

FIG. 21 is a detail sectional view taken along line 21—21 of FIG. 22;

FIG. 22 is a side elevational view of the arm rests of the wheelchair, and

FIG. 23 is a detail sectional view taken along line 23—23 of FIG. 22.

Referring now to the drawings, the patient-operated wheelchair shown in FIG. 1, comprises a base structure 10, shown in FIG. 14, which comprises two parallel bottom supports 11 each having a central portion 12 and two end portions 13 in a higher horizontal plane, said two portions being joined by a curved portion 14.

Extending between the bottom supports 11 are transverse supports 15, 16 which are welded at their ends 17 to the bottom supports, adjacent the curved portions 14 thereof. Rising from the central portion 12 of the bottom supports 11 are upright supports 18 and 19, the lower ends of said supports being secured as by welding to the central portion 12 as at 21. As is clearly shown in FIG. 14 the upright support 18 is located inwardly of the transverse support 15 and the upright support 19 is located between the transverse support 16 and the associated curved portion 14.

Also rising from the central portion 12 of each of the bottom supports 11, is an upright wheel support 22, the lower end of which is welded to the associated central portion 12 adjacent the upright support 18. Each of said wheel supports 22 has a tubular bushing 23 mounted therein and extending at right angles thereto. Secured to the upper ends of each of the vertical supports 18, 19 and 22 is an upper support member 24. As shown in FIG. 14 each of the upper support members 24 has a depressed portion 25 and the upper ends of each of the vertical support members 18 and 19 is secured as by welding at 26 to the ends of the upper support members 24 and the upper end of the vertical support member 22 is secured as by welding as at 27 to the depressed portion 25 of each of the support members. To complete the structure of the base member 10, a support member 31 extends transversely between the upper support members 24, being secured at each end thereto as at 32 as by welding.

By reason of the fact that the base structure 10 is preferably made of extruded tubular aluminum stock and the components thereof are welded together and reinforced, the resultant structure is relatively light in weight and is extremely strong and durable as it need be in order to support the remaining components of the wheelchair.

Extending transversely between the central portions 12 of the lower support members 11 is a U-shaped channel member 33 also of extruded aluminum stock, the ends of said channel member 33 being welded as at 34 to the central portions 12 adjacent the lower ends of the upright supports 22. The channel member 33 serves as the bottom support for a hydraulic actuator 35, the purpose of which will be hereinafter described.

The base structure 10 is supported at each of its corners to give it stability. To this end, a caster assembly 41 is provided at each end of each of the bottom supports 12.

As is clearly shown in FIGS. 1 and 14, each caster assembly 41 comprises a yoke member 42 having a crosspiece with a stud 43 rising therefrom that is secured as by welding at 44 to the inner surface of each of the bottom support members 11 adjacent each of the ends thereof so that the spaced parallel legs 45 of each caster assembly will depend in vertically spaced relation. Rotatably mounted between each of the pair of legs 45 is a caster 46, the four casters by reason of their longitudinal and transverse spacing providing great stability to the base structure to prevent tilting thereof when the wheel chair is occupied.

Rotatably mounted on each of the upright wheel supports 22 are the main drive wheels 48. As is clearly shown in FIG. 14, each of the drive wheels 48 has a central hub 49 with an opening 50 in which a bearing is mounted and a stud 52 extends through said bearing 51 and through the bearing sleeve 23 in each of the uprights 22 rotatably to mount the wheel, the stud being secured at both ends in any suitable manner to prevent displacement thereof.

It is to be noted that, as shown in FIG. 1, when the lower support members 11 are in horizontal position, the lower edge 55 of the main drive wheels 48 would be in a plane below the plane of the lower edges 56 of each of the casters 46. As a result, when the chair is in use, it will be supported by either the main drive wheels and the forward pair of casters 46A, as shown in FIG. 1, or by the main drive wheels 48 and the rear set of casters 46B.

Mounted on the base structure 10 so as to be vertically reciprocable, is a seat assembly 61 shown in FIG. 15.

Referring to FIGS. 15, 16 and 22, the seat assembly comprises a pair of spaced parallel tubular side members 62 each illustratively of extruded aluminum stock. Positioned in the front end 63 of each of the tubular members 62 as shown in FIG. 22 is a leg attachment fitting 64 which comprises a relatively heavy stud 60 having its inner end 65 secured in the front end 63 of tube 62 as by a transverse pin 66 and having a clevis configuration 67 (FIGS. 9, 22) at its front end. Positioned in the rear end 68 of each of the tubular members 62, as shown in FIG. 22, is a backrest fitting 69 which comprises a relatively heavy stud 70 having its inner end 71 positioned in the rear end 68 of each of the tubular members 62 and secured as by a transverse pin 72. The outer end of the fitting 69 is bifurcated as shown in FIGS. 22, 23 to define a clevis 69' and a bar 73 is welded to and depends from the outer extremity of said fitting 69, said fitting having a clevis 74 extending outwardly from the lower end thereof.

Encompassing each of the studs 60, 70 forming part of the fittings 64, 69 is a rotatably mounted sleeve 75, 76. Each of the sleeves has a collar 77 welded thereto and extending outwardly therefrom at right angles. Positioned in each of the collars 77 is the free end 78 of the legs 79 of an inverted U-shaped armrest 81, said legs 79 being secured in each collar 77 as by pins 82. By reason of the rotary mount of each of the sleeves 75, 76 on the associated studs 60, 70, it is apparent that the armrests are free to be moved from the vertical position shown in full lines in FIG. 15 to the horizontal position shown in broken lines.

Means are provided releasably to retain said arm rest in either of said two positions.

To this end, as shown in FIGS. 8 and 22, the outer end of each of the studs 60 has a cylindrical bore 80 of reduced diameter at one end as at 83. Positioned in said bore 80 is a locking pin or stud 84 which has a collar 85 of enlarged diameter adjacent its free or locking end 86. A coil spring 87 encompassing the stud 84 and reacting against the collar 85 and the shoulder 88 defined by the reduced diameter portion 83 of bore 80 normally urges said stud 84 outwardly. The end of the stud 84 which protrudes beyond the stud 60 carries an adjustment knob 89. The portion of sleeve 75 transversely aligned with the bore 80 as shown in FIG. 8, has an arcuate slot 91 through which the stud 84 extends. Thus, to adjust the position of the armrest 81, the knob 89 may be moved outwardly to remove the locking end 86 of stud 84 out of locking hole 92 in sleeve 75, permitting the armrest 81 to be pivoted in a counterclockwise direction as shown in FIG. 8, the sleeve 75 being free to rotate in a counterclockwise direction about the stud 64 by reason of the arcuate slot 91.

When the armrest is in the horizontal position, the locking opening 92' will be moved into alignment with the locking end 86 of stud 84 and such locking end will be forced into opening 92' by the coil spring 87.

Means are provided to retain the side members 62 of the seat frame in fixed parallel relation. To this end, as shown in FIGS. 9 and 15, a pair of tubular members 101 are provided, one of which is shown in FIG. 9, which extends respectively transversely between the clevises 67 and 69'. As is clearly shown in FIG. 9, a hub 102 is secured as by force fit in each of the ends of the tubular members 101, said hub having a threaded bore 103 therein. The ends of each of the fittings 64, 69 is secured in rigid position with respect to the ends of each of the tubular members 101 by means of a bolt 104 which extends through a transverse bore 105 in each of the clevises 67

and 69', being threaded into the associated bore 103, said bolts 104 also serving as hinge pins in the manner hereinafter to be described.

Mounted on each of the tubular members 101, as is clearly shown in FIGS. 9, 15 and 16 is a seat support bracket 106, which comprises an elongated strip of rigid material such as aluminum having a curved portion 107 at one end which snugly engages the outer periphery of each of the tubular members 101 and is welded thereto as at 108. The portion 109 of each of the support brackets 106 extends inwardly in a horizontal plane and defines a support flange.

Mounted on each of the tubular members 62 of the seat assembly is a skirt member 111, clearly shown in FIGS. 1 and 15. Referring particularly to FIG. 15, the skirt member comprises a plate of rigid aluminum which has a curved portion 112 at its upper end, referring to FIG. 16*a*, which rests on the associated tubular member 62 with the skirt member 111 depending from the outer side of each of said tubular members 62. Formed integrally with the curved portion 112 of each of the skirt members 111 is an inwardly extending strip or flange 113, said strips or flanges 113 lying in the same horizontal plane as the flanges 109. The skirt member is rigidly secured to the associated tubular member 62 as by being welded thereto as at 114. The inwardly extending flanges 109 and 113 serve as a support for a padded seat or cushion 115 which rests thereon.

Means are provided to mount said seat frame assembly 61 so that it is vertically reciprocable with respect to the base structure 10. To this end, as is clearly shown in FIGS. 1, 4, 5, 6 and 15, a pair of U-shaped brackets 121 are provided associated with each of the side skirts 111, each of said brackets 121 having outwardly extending flanges 122 at the free ends of the legs 123 thereof. A pair of brackets 121 is secured to each of the skirts 111 adjacent its lower portion on the inner surface thereof as by means of bolts 123 extending through aligned openings in the skirts 111 and in the flanges 122 as is clearly shown in FIG. 4, for example. When so mounted, the legs 123 of each of the brackets 121 extend inwardly in parallel relation, from the inner surface of the associated skirt 111.

Extending through transversely aligned openings in each skirt 111 and in the crosspiece 125 of each bracket 121, as is shown in FIG. 4, is a headed stud shaft 126, each stud shaft being secured at its inner end by a split ring 127. As is clearly shown in FIGS. 4 to 6, two pairs of vertically aligned stud shafts 126 are associated with each of said brackets 121 and each of said stud shafts rotatably mounts a roller 128. The rollers 128 each has an annular groove 129 in its periphery which is curved to conform to the curvature of the vertical support members 18 and 19 along which vertically aligned pairs of rollers 128 will ride, said members 18 and 19 defining tracks for said rollers. Due to the relatively close tolerance between the transversely aligned pairs of rollers and the associated vertical supports 18 and 19, it is apparent that the skirts 111 and seat frame carried thereby will move freely up and down with substantially no transverse movement.

As is clearly shown in FIG. 1, each of the skirt members 111 has an elongated slot 111' rising from its lower edge to accommodate the stud 52 on which each of the wheels 48 is mounted so that vertical movement of the skirt members is permitted.

In order to raise and lower the seat assembly 61 shown in FIG. 15, the hydraulic actuator 35 has the lower end of its casing pivotally connected as at 131 to the midpoint of the transverse channel member 33 carried by the base structure and the free end of its piston rod 132 pivotally connected as at 133 to the midpoint of an inverted U-shaped channel member 134 secured at its ends as by welding at 135 to a bar 136 welded to the end 68 of tubular member 62 as shown in FIG. 22.

With the construction above described, it is apparent that by energization of the actuator 35, the seat assembly 61 may be raised or lowered to a desired position while always being retained with the seat 115 thereof in a horizontal position, a pair of U-shaped strips 28 (FIGS. 1 and 10) secured to each skirt member 111 and encompassing the supports 22, enhancing such retention.

In view of the close tolerances between the rollers 128 and the vertical supports 18 and 19, extreme vertical stability of the chair is maintained at all times.

Associated with the seat assembly 61 is the backrest assembly 141 shown in FIGS. 1, 19 and 22, for example.

Referring to FIGS. 19 and 21, the backrest assembly 141 comprises a pair of spaced parallel tubular members 142 each having a stud 143 secured in its lower end as by force fit. Each of the studs has a longitudinally extending tongue 144 at its lower end which fits between the legs of the clevis 69' shown in FIGS. 19, 22 and 23, said tongue being pivoted on the bolt 104 associated with the fitting 69 and which rigidly mounts the tubular members 101 at the rear of the seat.

Secured to the tubular members 142 adjacent their upper ends is a U-shaped crossbar 145, the free ends of the legs of which are secured as by welding at 146 to said tubular members 142, said crossbar 145 serving rigidly to maintain said tubular members 142 in spaced parallel relation and also serving as the means whereby the wheelchair may be moved by an attendant.

Means are provided to effect movement of the backrest 141 from the vertical position shown in full lines in FIG. 1 to the horizontal position shown in broken lines or any intermediate position therebetween.

To this end, a reversely bent clamp member 151 is provided, as shown in FIGS. 1 and 19, which encompasses each of the tubular members 142 with the spaced legs 153 of each of said clamps extending rearwardly as shown. Pivotally mounted as at 154 between the ends of said legs 153 is the free end of the piston rod 155 of a hydraulic actuator 156, the end of the casing of which is pivotally mounted as at 157 between the legs of the clevis 74 (FIG. 22). Thus, when the pistol rod 155 of actuator 156 is in the extended position shown in full lines in FIG. 1, the backrest will be in vertical position shown and when the piston rod 155 is fully retracted, for example, the backrest will be moved to the horizontal position shown.

Mounted on the tubular members 142 are elongated backrest cushion-mounting strips 161, each of which, as shown in FIGS. 19 and 20, has a curved portion 162 encompassing each of said tubular members 142 and welded thereto as at 163 and an inwardly extending flange portion 164 to which a backrest cushion 65 may be secured. The seat cushion 115 and backrest cushion 165 are of thickness such that when the backrest 141 is in horizontal position, the top surfaces of each of said cushions will lie in substantially the same horizontal plane.

Associated with the seat assembly 61 is a leg support assembly 171 which, as shown in FIGS. 1 to 3, 17 and 18, comprises a pair of identical leg support members 172. Each of said members 172 comprises a tubular member 173 in the upper end of which is secured a stud 174, the latter having a pair of parallel legs 175 extending outwardly therefrom which fit between the legs of the clevis 67 at the outer end of stud 60 as is clearly shown in FIG. 9 and FIG. 18, said legs 175 being pivoted by means of bolt 104.

Positioned in the lower end of each of the tubular members 173 is a rod 176 which is maintained in fixed position as by a bolt 177 extending through transversely aligned passageways 178 in the tubular member 173 and the inner end of rod 176. The rod 176 has a plurality of such passageways 178 therethrough so that adjustment may readily be made of the length of rod 176 protruding from the associated end of tubular member 173. Secured to the lower end of rod 176 as by welding is a sleeve 181 which has a transverse bore 182 therethrough. Pivotally mounted to the end of sleeve 181 is a footrest plate 183 which, as clearly shown in FIG. 17 is substantially L-shaped having a hub 184 welded to the junction between the two legs thereof, and also having an outer sideplate 185 welded to the side edge of the plate 183. The sideplate 185 and the hub 184 have transversely aligned passageways which may be aligned with the transverse passageway 182 in the sleeve 181 to receive a pivot pin 186. With the arrangement shown, the footrest 183 may be pivoted between the position shown in full lines in FIG. 1 in which the

front leg 187 thereof extends outwardly at substantially right angles to the tubular member 173 and the position shown in broken lines in which the leg 187 lies against the tubular member 173.

Means are provided to effect independent pivotal movement of each of the leg support members 172 from the lowermost position shown in full lines in FIG. 1 to the horizontal position shown in broken lines in FIG. 1 and to any intermediate position therebetween.

To this end, as is shown in FIGS. 1 and 17, a reversely bent clamp 191 encompasses each of the tubular members 173 and is secured thereto as by welding with the legs of each of the clamps 191 extending rearwardly as shown. Pivotally mounted as at 193 between each of the pair of legs of the clamps 191 is the outer end of the piston rod 195 of an associated hydraulic actuator 196, the end of the casing of which is pivotally mounted as at 197 to a bracket 198 (FIG. 22) depending from the end 63 of each of the tubular members 62. Thus, when the piston rod 195 of each actuator is in the retracted position shown in full lines in FIG. 1, the associated leg support will be in the downward position shown in full lines and when the piston rod 195 is extended, the associated leg support will be moved toward horizontal position shown in broken lines.

Means are provided to energize the various hydraulic actuators to effect vertical movement of the seat assembly which is controlled by actuator 35; to effect pivotal movement of the backrest which is controlled by actuators 156 and to effect pivotal movement of the leg supports which are controlled by actuators 196.

Although the hydraulic actuators can be energized by a motor-driven system such as diagrammatically shown in FIG. 13, which could include a battery mounted on the base structure which actuated a motor driven pump P to force fluid under pressure into the actuators, in the illustrative embodiment shown, a manually actuated system is provided as diagrammatically shown in FIG. 11.

Thus, the system comprises a hand pump 201 which may be secured to a reservoir 202 that in turn is mounted on one of the skirts 111, with the operating handle 203 of the hand pump 201 rising substantially vertically so that it may readily be grasped by the occupant of the wheelchair to be rocked back and forth to actuate the pump.

Mounted on one of the arm rests 81 adjacent the front end thereof so as to be readily available to the occupant of the chair, and positioned adjacent to the handle 203 of the hand pump is a control panel C which comprises three conventional four-way selector valves V-1, V-2 and V-3 and a conventional three-way selector valve V-4.

The hydraulic actuators 196 associated with the leg support assembly, and the hydraulic actuators 156 associated with the backrest assembly each is of the double-acting type having a port P-1, P-2 positioned on each side of the piston of the associated piston rod 195. The ports P-1 and P-2 of each of the actuators 196 are connected respectively by lines 206 to the control ports 207, 208 of the associated valve V-1, V-2. The ports P-1, P-2 of actuators 156 are connected respectively by lines 209 to control ports 211, 212 of valve V-3. The pressure inlet ports 213 of each of the valves V-1, V-2, V-3 are connected to pressure lines 214 and the outlet ports 215 of said valves V-1, V-2, V-3 are connected to return line 216.

The control port 221 of the seat actuator 35 is connected to control port 222 of valve V-4. Pressure port 223 of valve V-4 is connected to pressure line 214 and the outlet port 224 of the valve V-4 is connected to return line 216.

The pressure line is connected through one-way valve 225 to the outlet port 226 of the hand-operated pump 201 and the inlet port 227 of said pump is connected to reservoir 202, the return line 216 also being connected to said reservoir. A pressure regulator 228 of conventional type is connected across the ports 226 and 227 of the hand pump.

In the operation of the wheelchair, above described, it is apparent that with the patient seated in normal position on the seat 115 and with the arm rests 81 in the vertical position shown, the control panel C and hand pump handle 203 will be readily accessible.

With the backrest in the vertical position shown in FIG. 1, and with the leg support assembly 171 in the downward position shown, it is apparent that the center of gravity of the chair with the patient seated thereon will be at a point between the lower edges 55 and 56 of the main wheels 48 and the front caster wheels 46A so that the chair will normally tilt slightly forward. Thus, the front caster wheels 46A will be resting on the floor, as shown in FIG. 1, and the lower edges 56 of the rear caster wheels 46B will be raised from the floor. Since the patient of the chair is able to use his hands, he can propel the chair in the desired direction by merely grasping the adjacent upper portions of the main wheels 48 to move them forwardly or backwardly as desired in conventional manner to cause the wheelchair to move forwardly or backwardly in any desired direction.

If the patient of the wheelchair wishes to adjust the position of the leg support assembly, such adjustment may be accomplished readily by the use of the valves on the control panels which will permit either of the leg support members 172 to be set to any desired position independently of the other.

Thus, referring to FIG. 11, since the control valves V-1, V-2 are of the conventional four-way type, they have a normal neutral position in which all the ports are closed. To raise one of the leg support members, the valve V-1 for example, is moved by the patient to a position to connect the port P-2 of the associated actuator 196 to the pressure 213 and the port P-1 to the return port 215. The hand pump handle 203 is then actuated which will force fluid under pressure to port 226, through the one-way valve 225, pressure line 214, ports 213 and 207 of valve V-1 to port P-2 thereby causing the piston rod 195 of actuator 196 to be moved outwardly so that the leg support will pivot upwardly in a counterclockwise direction from the position shown in FIG. 1. The fluid from port P-1 of actuator 196 will flow through ports 208, 215 of valve V-1 and return line 216 to reservoir 202. As soon as the leg support is in the desired position, the patient need merely move the valve V-1 to neutral position and stop further actuation of the handle 203. As all of the ports of valve V-1 will be closed when the valve is in neutral position, the leg support will remain in its set location.

To lower the leg support it is merely necessary to move the valve V-1 to the position to connect port P-1 to the pressure line and actuate the handle of the pump. The leg support associated with the other actuator 196 may also be raised and lowered in similar manner.

The backrest 141 may be lowered from the position shown in FIG. 1 in which the piston rods 155 of the actuators 156 are extended by a similar operation. As there is no need to have the actuators 156 of the backrest operate independently, they are connected in parallel as shown so that only the valve V-3 need be operated by the patient to effect the desired pivotal movement of the backrest.

The circuits shown, in connection with the actuators for the footrest assembly and the backrest assembly, as well as the actuators associated with such assemblies are of the double-action type, since the weight of the back of the patient and the weight of the legs of the patient may not be sufficient to cause flow of fluid in reverse direction to effect lowering of the backrest or the leg supports. However, due to the circuit and actuator 35 associated with the seat assembly 61, the weight of the patient is sufficient to effect return flow of fluid and hence the actuator 35 for the seat assembly need merely be of the single-action type.

Assuming that the occupant of the chair wishes to raise the seat assembly, he need merely move the valve V-4 to position to connect its pressure ports 223 and control ports 222 to the port 221 of seat assembly actuator 35 and operate the handle 203 of the hand pump. As a result, fluid under pressure will flow into port 221 causing the piston rod 132 thereof to be extended.

As the actuator is mounted between the transverse members 33 and 134, the extension of the piston rod 132 will thereby cause the seat 115 to move upwardly. Since the skirts 111 on which the padded seat 115 is mounted are supported by the four roller assemblies guided by the upright supports 18 and 19 and by the U-shaped strap 28 encompassing the upright support 22, the seat assembly will move vertically with substantially no play.

When the seat 115 has reached the desired position, it is merely necessary for the patient to move the valve V-4 to the closed position to cut off communication from port 221 to actuator 35 and the seat 115 will remain in set position. The unit is designed so that the seat 115 may be raised sufficiently so that the upper torso of the user is at a height equivalent to a normal standing position to enable the user to perform work on apparatus which requires a standing position for operation.

To lower the seat, it is merely necessary for the patient to move the valve V-4 to position to connect control port 221 to return port 224 so that due to the weight of the patient, the fluid in the actuator will be forced from port 221 through return line 216 to the reservoir and the lowered position of the seat 115 may also be set as desired.

With the use of the controls above described, it is apparent that the patient of the chair may readily adjust the backrest and leg supports to the most comfortable position desired.

The construction of the chair and the controls therefor also permits the patient, who may be a paraplegic for example, to readily be moved from the chair to a bed with but a single attendant.

To this end, the chair need merely be positioned so that it extends parallel to the longitudinal edge of the bed. Since the horizontal level or height of the bed is normally higher than the horizontal level of the height of the padded seat 115, the attendant may actuate the valve V-4 so that the seat 115 is made level with the bed surface.

Thereupon, the attendant need merely set the valves V-1, V-2 and V-3 to raising position for the leg support assembly and to lowering position for the backrest assembly and actuate the handle of the hand pump so that the leg support assembly and backrest assembly will be moved to a horizontal position. At this time, the patient will be fully stretched out in substantially the same horizontal plane as the bed. The attendant then need merely lift the knob 89 to move the locking pin 84 out of the associated hole 92 and pivot the arm rest downwardly so that it extends horizontally on the bed. It is then a relatively simple matter for the attendant to move the patient laterally off the chair onto the bed.

By reason of the foregoing, it is apparent that the attendant does not have to exert any great strength to move the patient from the chair onto the bed, which is extremely important, especially where the patient is relatively heavy in weight and no male attendant is available but only a female attendant is present. Furthermore, by reason of the ease of moving the patient, only one attendant need be present.

In cases where it is desired to use the chair as a stretcher with the backrest and leg supports in a horizontal position, it is a simple matter to position a transverse support across the leg assemblies beneath the legs of the patient. If desired, when being used as a stretcher, the footrests 183 may be pivoted so that they extend parallel to the sleeve members 181 to be out of the way.

It is further to be noted that when the backrest is in the horizontal position, the major portion of the weight of the patient will be supported by both the backrest and the seat. In this position the center of gravity will be displaced so that it is now between the lower edges 55, 56 of the main wheels 48 and the rear caster wheels 46B with the result that the chair will tilt backward slightly, raising the front casters 46A off the floor. By reason of such arrangement there will always only be four rotatable supporting points for the chair so as to facilitate its ready movement in any direction.

By reason of the tubular construction above described, and the chair, though relatively light in weight, is extremely sturdy and capable of carrying even extremely heavy patients.

By reason of the close tolerance of the guiding rollers 128 for the seat assembly, the latter will dependably move upwardly and downwardly with substantially no transverse play, thereby insuring free ready vertical movement without likelihood of the center of gravity being moved transversely to an extent that could cause overturning of the chair along its transverse axis. Stability of the chair along its longitudinal axis is provided by reason of the support effected by the main wheel and the associated pair of casters which are engaging the floor.

Although the control circuit for the chair in the preferred embodiment shown utilizes a manually operated pump 201, it is within the scope of the invention to have a motor driven pump P as shown in FIG. 13. The motor driving the pump can readily be energized as desired by means of conventional limit switches (not shown) associated with each of the valves V-1 to V-4, which limit switches would be actuated when the control handle of the valve is moved to each of its operating positions.

Although the actuator for the seat assembly is shown as a conventional hydraulic actuator, it is within the scope of the invention, as shown in FIG. 12, to have a screw-type actuator 231 utilized, driven by a reversible motor 232.

The wheelchair is of course provided with a conventional hand-operated brake to enable the wheelchair to be immobilized when desired by the patient. As the hand brake may be of any conventional type which is well known in the art it has not been shown.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

I claim:

1. A patient-operated wheel chair comprising a base structure including a pair of spaced, parallel, longitudinally extending lower support members, a pair of spaced, parallel upright support members rising from each of said lower support members and rigidly retained in spaced parallel relation, a seat assembly comprising a substantially rectangular frame having spaced, parallel side members and end members, a rigid support structure secured to each said side member of said seat frame and depending therefrom in spaced, parallel relation on the outer side, respectively, of each of said upright supporting members, guiding assemblies secured to each of said rigid support members on the inner sides thereof and coacting with an associated upright support member, the latter serving as tracks for said seat assembly, an actuator interposed between said base structure and said seat frame to effect vertical movement of the latter along said upright supporting members, a backrest assembly pivotally mounted on the rear portion of said seat assembly, a leg support assembly pivotally mounted on the front portion of said seat assembly, a pair of spaced, parallel main wheels rotatably mounted, respectively, on opposite sides of said base structure, and a pair of spaced, parallel caster wheels mounted, respectively, on opposite sides of said base structure and longitudinally spaced from said main wheels.

2. The combination set forth in claim 1 in which an additional upright support member rises from each of said lower support members between the associated pair of upright support members, the additional support members being transversely aligned, each of said additional support members rotatably mounting an associated main wheel.

3. The combination set forth in claim 1 in which an armrest is mounted on each of said side members, independent actuator means associated respectively with said backrest assembly and said leg support assembly to effect movement thereof, a fluid reservoir and a pump carried by said chair, control valve means mounted on one of said armrests, said control valve means, said fluid reservoir and said pump being connected in circuit with said actuators, whereby upon setting of an associated valve and actuation of said pump a desired actuator can be energized.

4. The combination set forth in claim 3 in which each of said rigid support structures comprises a plate depending from the associated side member, said pump is manually operated having a control handle, said fluid reservoir and said pump being mounted on one of said sideplates, said pump handle being positioned outwardly of an associated armrest adjacent the control valve means mounted thereon.

5. The combination set forth in claim 1 in which each of said guiding assemblies comprises two pairs of vertically aligned rollers, each of said pairs of rollers straddling an associated support member.

6. The combination set forth in claim 5 in which each of said upright support members is a length of rigid tubing, each roller having an annular groove in its periphery of configuration conforming to the curvature of the upright support member and positioned closely adjacent thereto whereby said seat frame will move vertically with substantially no longitudinal or transverse play.

7. The combination set forth in claim 5 in which each of said guiding assemblies comprises a substantially U-shaped bracket having a crosspiece and a pair of parallel legs each having an outwardly extending flange at the end thereof, means securing said flanges to said rigid supporting member adjacent the lower end thereof, two pairs of vertically aligned stud shafts extending between said rigid supporting member and the crosspiece of each of said brackets, each of said stud shafts carrying an associated roller.

8. The combination set forth in claim 1 in which a support member extends transversely between said lower support members of said base structure, a support member extends transversely between the side members of said seat frame vertically aligned with said first transverse support member and said actuator extends between said transverse support members and is secured at each end thereto respectively to effect vertical movement of said seat assembly.

9. The combination set forth in claim 8 in which the actuator for said seat assembly comprises a cylinder having a piston rod slidably mounted therein, said cylinder being connected to one of said transverse support members and said piston rod being connected to the other of said transverse support members.

10. The combination set forth in claim 8 in which the actuator for said seat assembly comprises an elongated casing secured at one end to one of said support members and a screw member rotatably mounted in said casing, a motor rigidly secured to the other transverse support member and operatively connected to said screw to rotate the latter.

11. A patient-operated wheelchair comprising a base structure, a seat assembly secured to said base structure, a backrest assembly pivotally mounted on the rear portion of said seat assembly, a leg support assembly pivotally mounted on the front portion of said seat assembly, said back and leg assemblies being shiftable into coplanar alignment with said seat assembly, a pair of spaced, parallel main wheels rotatably mounted, respectively, on opposed sides of said base structure, a first pair of spaced, parallel caster wheels mounted, respectively, on opposite sides of said base structure forwardly spaced from said main wheels, a second pair of spaced, parallel caster wheels mounted, respectively on opposite sides of said base structure and spaced rearwardly of said main wheels, the lowermost peripheries of said second pair of caster wheels being located in a common plane above the plane tangent to the lowermost peripheries of said main wheels and said first pair of caster wheels, whereby said chair will be supported selectively on said main and first pair of caster wheels when the center of gravity is forward of the axes of said main wheels, and on said main wheels and said second pair of caster wheels when the center of gravity is rearward of said axes, said backrest assembly comprises a pair of upstanding support members, trunnion means pivotally mounting each of said support members to the rear end of said seat assembly, means rigidly retaining each of said support members in spaced parallel relation, a pair of pivot mounts rigidly secured to said seat assembly and extending rearwardly of said trunnion means, said mounts being operatively associated respectively with said trunnion means, and a pair of elongated actuating members, each being pivotally secured at one end to an associated pivot mount and at its other end to an associated backrest support member at a point thereon vertically spaced from the pivotal mount whereby upon energization of said actuating members, said backrest may be moved between vertical and horizontal position.

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