

July 26, 1960

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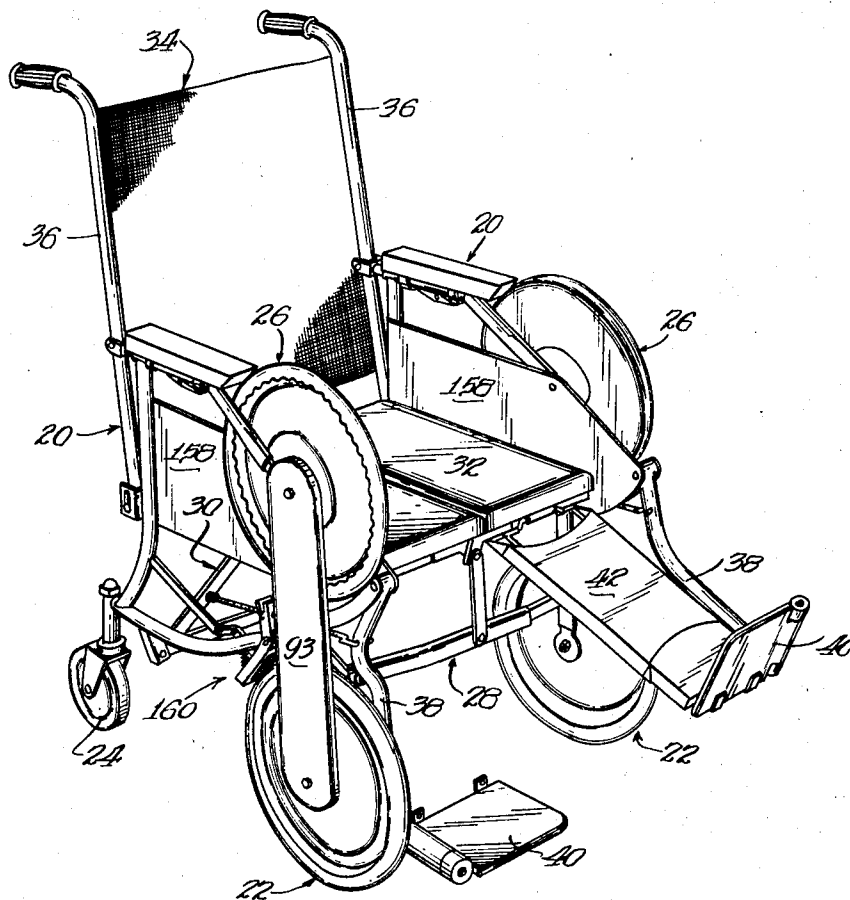
2,946,602

WHEEL CHAIRS WITH HAND PROPULSION MEANS

Original Filed Sept. 10, 1953

5 Sheets-Sheet 1

Fig. 1.



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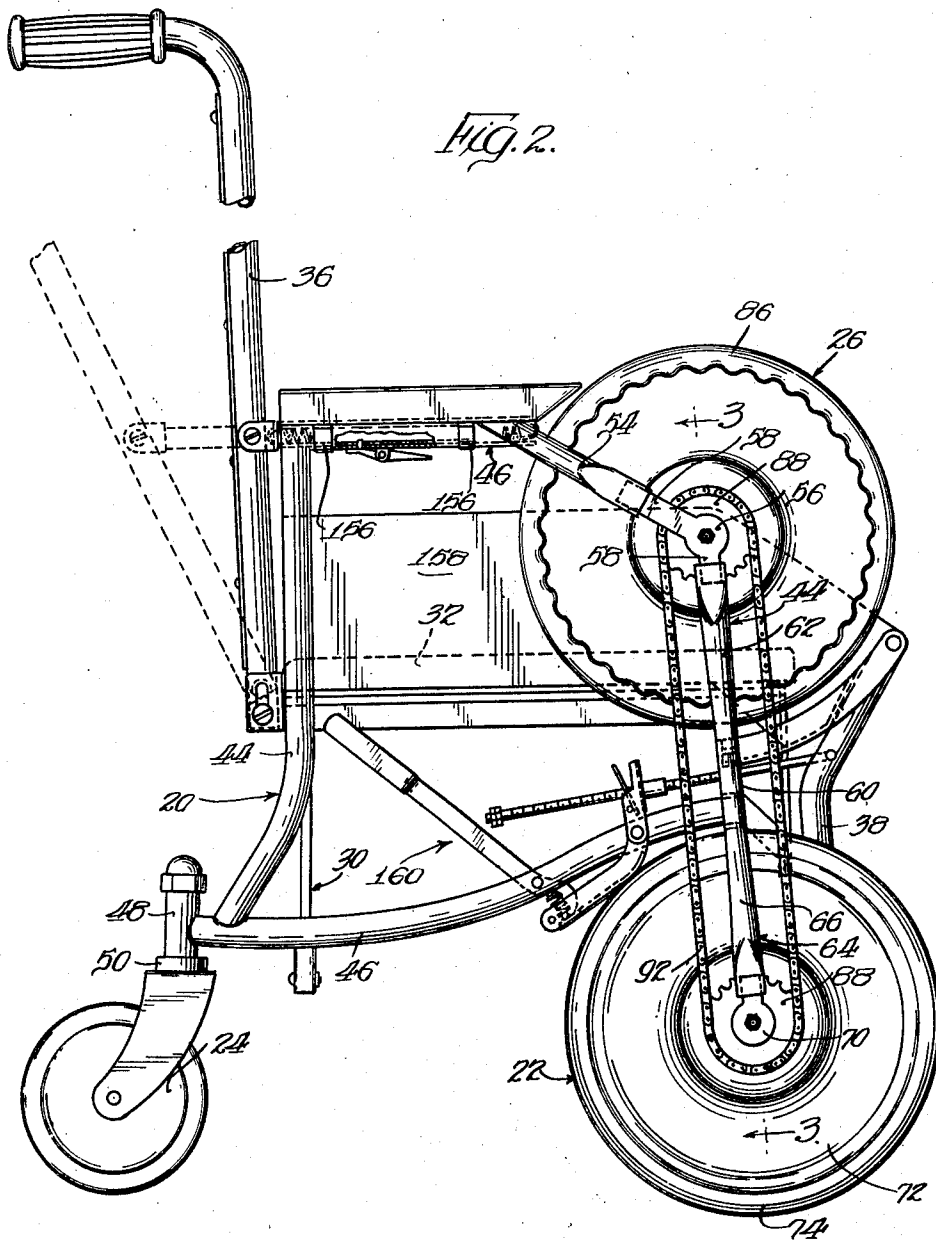
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2,946,602

WHEEL CHAIRS WITH HAND PROPULSION MEANS

Original Filed Sept. 10, 1953

5 Sheets-Sheet 2



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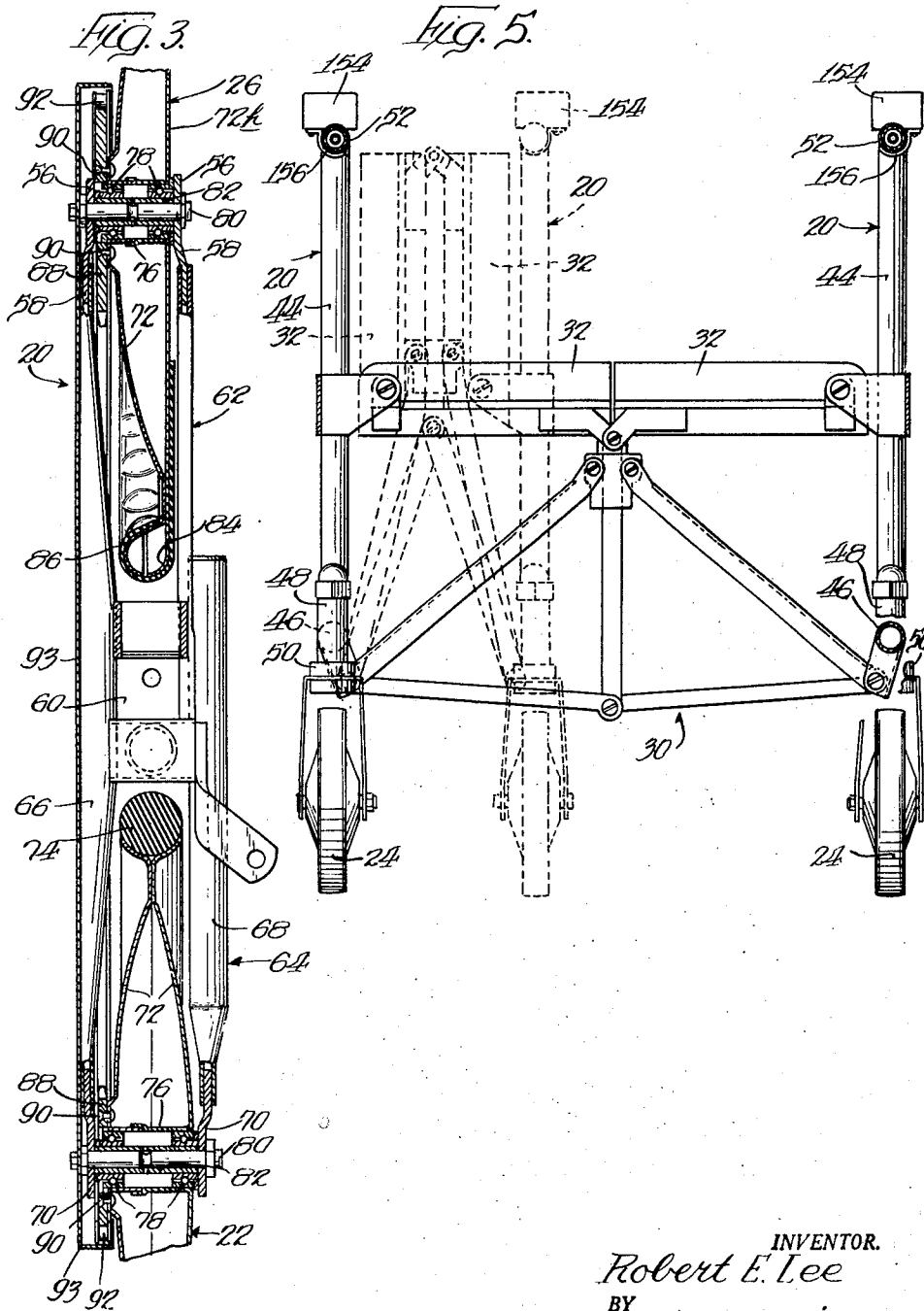
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2,946,602

WHEEL CHAIRS WITH HAND PROPULSION MEANS

Original Filed Sept. 10, 1953

5 Sheets-Sheet 3



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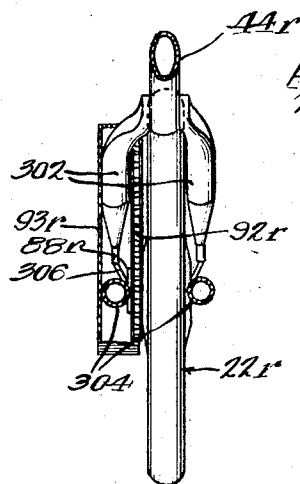
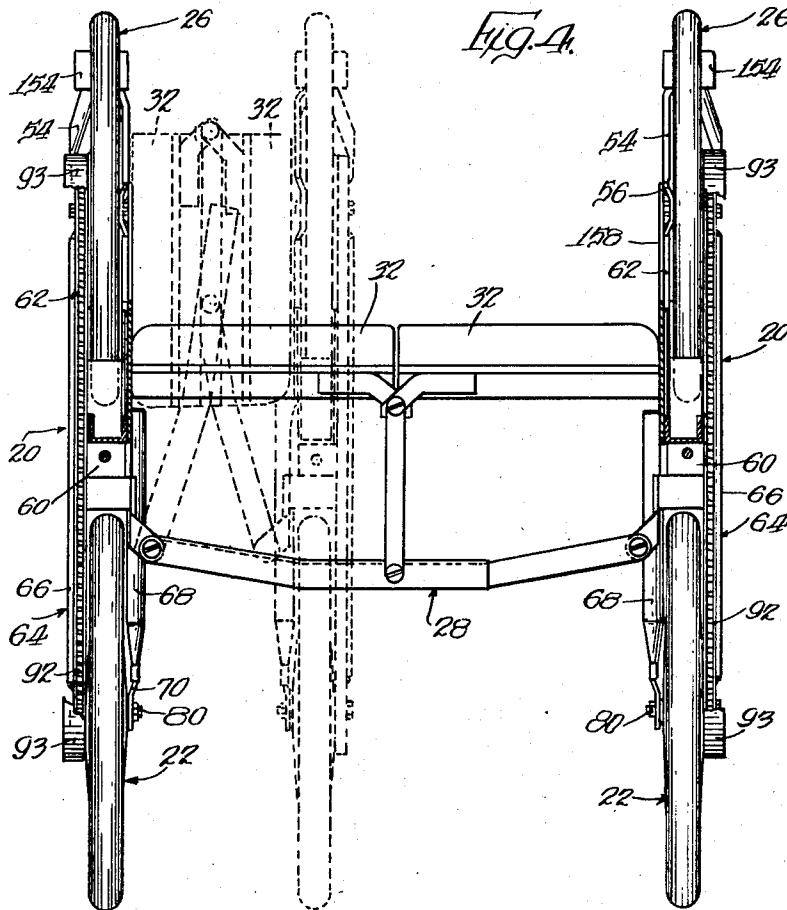
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2,946,602

WHEEL CHAIRS WITH HAND PROPULSION MEANS

Original Filed Sept. 10, 1953

5 Sheets-Sheet 4



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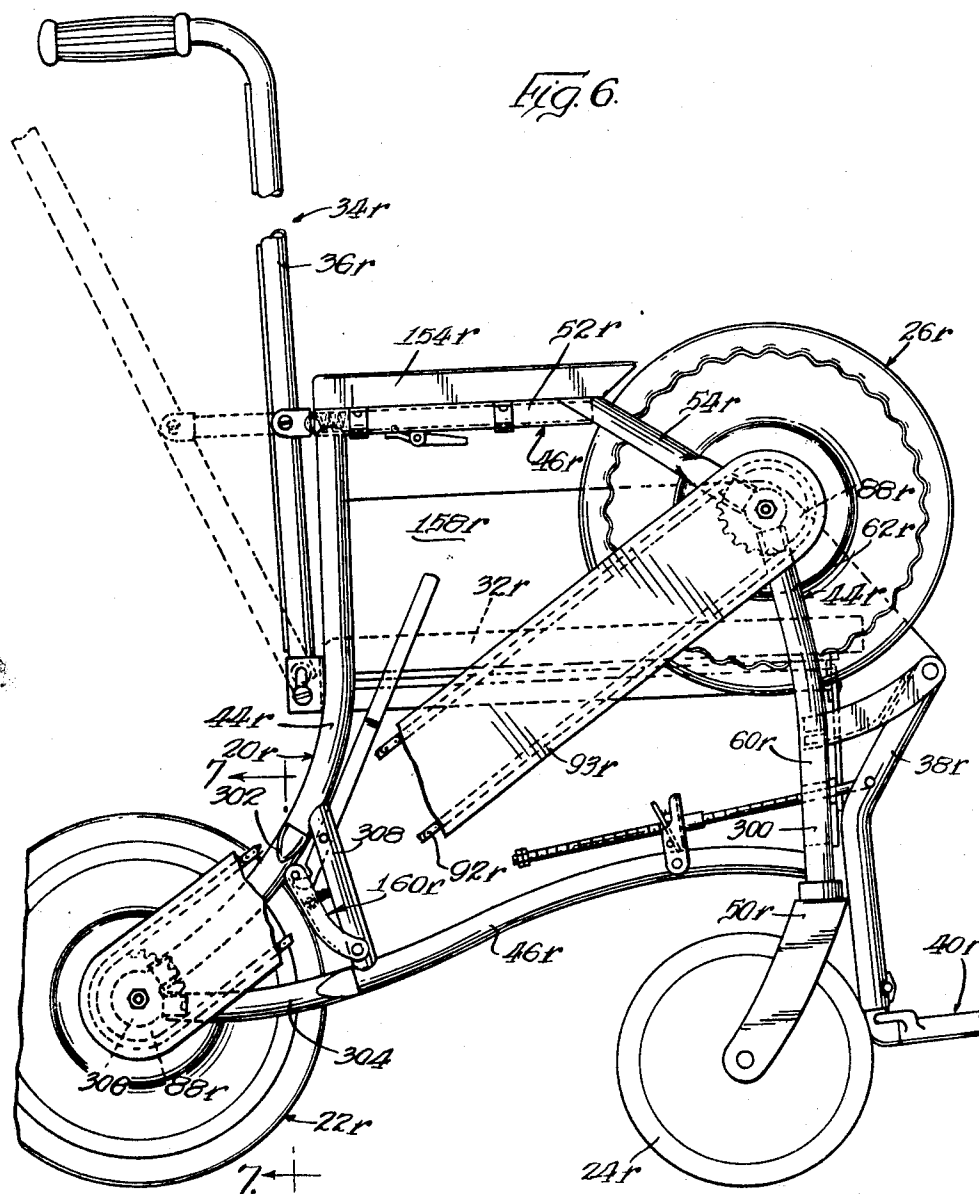
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2,946,602

WHEEL CHAIRS WITH HAND PROPULSION MEANS

Original Filed Sept. 10, 1953

5 Sheets-Sheet 5



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2,946,602

WHEEL CHAIRS WITH HAND PROPULSION MEANS

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Original application Sept. 10, 1953, Ser. No. 379,361, now Patent No. 2,847,058, dated Aug. 12, 1958. Divided and this application Apr. 28, 1958, Ser. No. 736,430

6 Claims. (Cl. 280—250)

The present invention relates to wheel chairs and, particularly, to improvements in the propulsion and frame means thereof.

This application is a division of co-pending application Serial No. 379,361, filed September 10, 1953 (now Patent No. 2,847,058).

Various devices have been proposed for centuries past to provide a conveyance for the physically disabled, which devices have evolved into the relatively modern wheel chair. Wheel chairs may be classified into two broad categories, namely, rigid and folding. Generally, however, both types comprise a chair including a pair of side frames, a seat and a back rest extending between the side frames, and a plurality of ground engaging wheels movably supporting the chair, at least some of the wheels being adapted to be motivated by the chair occupant to effect propulsion of the chair.

Despite the long history and high degree of activity in the wheel chair art, conventional wheel chairs, both of the rigid and folding types, suffer a great many disadvantages. Perhaps foremost among these is the extreme overall width of the chair whereby the chair cannot successfully negotiate narrow doorways, aisles and the like. This disadvantage stems principally from the fact that the occupant motivated wheels of the chair are disposed exteriorly of the side frames and include a hand rail or the like, extending still further outwardly of the side frames, to accommodate actuation of the wheels. Due to the exterior disposition of the wheels, the side frames themselves must be formed of heavy stock and of relatively great width.

A first object of the present invention is to overcome the above noted disadvantage and, in particular, to provide an improved wheel chair having the same seat width or seating capacity as a conventional wheel chair, but having an overall width substantially less than that of conventional wheel chairs, whereby the improved chair is adapted readily to negotiate narrow doorways and aisles, such, for example, as the aisles of railroad coaches and pullmans.

In accordance with the above object, another object of the invention is the provision of improved side frame means for wheel chairs including a fork or a yoke within which an occupant motivated wheel may be mounted. Such structure substantially reduces the overall width of the chair since the ground engaging wheel is not disposed exteriorly of the side frame. Secondly, the fork or yoke accommodates support of the wheel axle to both sides of the wheel, whereby the frame need not be of the substantial bulk and width customarily required for the cantilever support of an axle.

A further object of the invention, also in accordance with the first object, is the provision of improved actuating or motivating means for the occupant motivated ground engaging wheels of the chair, comprising suitable means disposed in the same vertical plane as the ground engaging wheel and operatively associated therewith, said means preferably being mounted in a second yoke or

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fork portion of the side frame. By the provision of actuating means located as defined, laterally extending hand rails are omitted, whereby a further element contributing to the disadvantageous width of conventional wheel chairs is eliminated. Preferably, the actuating means for each ground engaging traction wheel comprises a separate hand wheel disposed in vertically spaced relation to, but in the same vertical plane as the ground engaging wheel, chain and sprocket means being provided operatively to associate the wheels.

In addition to the above, wheel chairs conventionally include an arm rest on each side frame for the comfort of the vehicle occupant. With reference to the foregoing objects, it is a more specific object of the invention to provide a side frame assembly including a side frame, a ground engaging wheel and an actuating hand wheel having an overall width approximately equal to or less than that of a conventional arm rest.

A still further object of the invention is the provision of improved drive means of the character referred to for wheel chairs including a ground engaging traction wheel, a hand wheel, and sprocket and chain means operatively connecting the two wheels, wherein the hand wheel is disposed immediately forward of the arm rest on the side frame for convenient manipulation by the chair occupant and wherein power transmission to the traction wheel is highly efficient to accommodate ready propulsion of the chair.

It is also an object of the invention to provide two general types of embodiments of the wheel chair formed in accordance with the above objects, namely, a first embodiment having the traction wheels disposed adjacent the front of the chair, and a second embodiment having the traction wheels disposed adjacent the rear of the chair.

Yet another object of the invention is the provision of an improved wheel chair of economical manufacture and assembly, that is highly efficient and practical in use, comfortable, easily operated, light in weight, readily transported from place to place, and that affords the physically disabled user the opportunity of escaping the confining orbit of activity customarily associated with physical disability.

Other objects and advantages of the present invention will become apparent in the following detailed description of preferred embodiments of the invention.

Now, in order to acquaint those skilled in the art with the manner of making and using the wheel chair of my invention, I shall describe, in connection with the accompanying drawings, preferred embodiments of my invention, and preferred manners of making the same.

In the drawings:

Figure 1 is a perspective view of an embodiment of the folding wheel chair of my invention including forwardly disposed traction wheels, the view showing the chair in its extended position and showing one leg rest of the chair in its in-use position;

Figure 2 is a side elevation of the embodiment of the wheel chair shown in Figure 1;

Figure 3 is an enlarged vertical sectional view, taken substantially on line 3—3 of Figure 2, of one side frame of the chair showing the forking of the side frame and the mounting of the traction and hand wheels;

Figure 4 is a generally frontal view of the wheel chair, with the leg rests, foot rests and foot rest supports removed, disclosing the collapsible linkage at the front of the chair only, the view showing the extended position of the chair in solid lines, and the folded position thereof in dotted lines;

Figure 5 is a view somewhat similar to Figure 4 taken from the rear of the wheel chair, with the back rest removed, showing the collapsible linkage at the rear of the chair only, the view showing the extended position of the

chair in solid lines and the folded position thereof in dotted lines;

Figure 6 is a side elevation, similar to Figure 2, of a second embodiment of the wheel chair of the invention wherein the traction wheels are disposed at the rear of the chair; and

Figure 7 is a fragmentary cross-sectional view, taken substantially on line 7—7 of Figure 6, showing in detail one traction wheel fork of said second embodiment of the wheel chair.

Referring now to the drawings, and particularly to Figure 1, I have shown a preferred embodiment of the wheel chair of my invention as comprising a pair of side frames 20, each providing a mounting for a ground engaging traction wheel 22, a ground engaging caster wheel 24 and a hand wheel 26. The two side frames 20 are disposed in spaced parallel relation in all positions thereof and are connected together by collapsible linkage means, namely, a front linkage 28 and a rear linkage 30, whereby the side frames are movable from the extended position shown in Figure 1, wherein the same are disposed in substantially spaced relation, to a collapsed position wherein the same are disposed adjacent one another, as is shown in dotted lines in Figures 4 and 5. A two part seat 32 is disposed between the side frames, as is a back rest 34, the back rest 34 extending between a pair of supports 36, each of which is mounted on one of the side frames 20. At the front of the chair, a foot rest support 38 is pivoted to each of the side frames and each support 38 carries a foot rest 40, which in turn is adapted to provide support for a leg rest 42.

The side frames 20 are the same as one another, with the exception that the same are of opposite hands, and each comprise, as is best shown in Figures 2 and 3, a pair of generally vertical beams 44 and a pair of generally horizontal beams 46. In the embodiment shown in Figures 2 and 3, the rear vertical beam 44 and the lower horizontal beam 46 are preferably formed of tubular stock, with the beams being curved at the lower and forward ends thereof, respectively, to provide a stable support and to accommodate the traction wheel 22, respectively. At the rearward end thereof, the lower horizontal beam 46 extends beyond the rear vertical beam 44 to provide a mounting for a tubular bearing portion 48 within which the mounting means 50 of the caster wheel 24 is journaled. The upper generally horizontal beam 46 includes a horizontal arm rest portion 52 formed of tubular stock that is secured to the top of the rear vertical beam 44 and extends forwardly therefrom to terminate short of the front vertical beam 44. Forwardly of the arm rest portion 52 thereof, the upper generally horizontal beam 46 includes a fork portion 54 extending forwardly and downwardly of the arm rest portion 52. The fork portion 54 may suitably comprise a tube flattened at its ends and welded or otherwise secured to the outer side of the arm rest 52 at one end thereof, and a bar of generally channel form disposed to the inner side of the frame in the same manner as the tube of the fork is secured to the outer side of the frame. Preferably, as is best shown in Figure 3, the channel-shaped inner bar of the fork is preferably a planar member and extends forwardly from the arm rest portion 52 in parallel relation thereto, while the outer tubular member of the fork first extends outwardly of the arm rest tube 52 and then forwardly therefrom in slightly spaced relation to the vertical plane of the tube 52 to provide the said fork portion 54. At the outer or forward end thereof, the bar and tube of the fork portion 54 each carry a wheel mount 56 for the hand wheel 24, each wheel mount comprising a member formed of sheet stock and including a circular central portion and a pair of radially extending legs 58. As will be appreciated from Figure 2, one leg 58 of each mount 56 enters into and is secured within the flattened end portion of the outside tube of the fork and the channel of the inside bar of

the work, respectively. The other leg 58 of each mount 56 extends in the direction of the front generally vertical beam 44.

The front vertical beam of each side frame, as is shown in Figure 3, includes a relatively short central section 60 of tubular form to which the forward end of the lower horizontal beam 46 is secured, as by welding. To the upper side of the section 60 thereof, the front vertical beam 44 includes a fork portion 62 of the same general character as the fork portion 54, the members of which are secured at the upper end thereof to the said other leg 58 of the respective wheel mounts 56 and at the lower end thereof to opposite sides of the central section 60. Below the central section 60, the front vertical beam includes a second fork portion 64 comprising a first tubular member 66 disposed to the outside of the frame and a second tubular member 68 secured to the inside of the frame. Preferably, the tubular member 66 comprises an integral continuation of the outer member of the fork portion 62, and the second tubular member 68 is preferably a separate member fixedly secured to the inside of the central section 60 on top of the inside channel bar of the fork portion 62, the member 68 at its upper end defining an abutment adjacent the level of the lower surface of the seat 32 for a purpose to be described. At the lower end thereof, each of the tubular members 66 and 68 is flattened for the conformable reception and securement therein of the single leg of a mounting member 70 for the traction wheel 22.

In construction, all of the members of each side frame 20 are preferably formed of light weight yet sturdy stock, such as aluminum, and are rigidly secured together to provide a frame affording a first fork 64, comprising the members 66, 68 and 70, opening to the bottom of the frame for the reception of the traction wheel 22, a second fork, comprising the fork portions 54 and 62 and the wheel mounts 56, opening to the top and front of the frame for the reception of the hand wheel 26, and a bearing portion 48 for the reception of the caster wheel 24. In such construction, as will be apparent, the three wheels 22, 24 and 26 are disposed in alignment with the frame, particularly the rear vertical beam 44, the lower horizontal beam 46 and the arm rest portion 52 thereof, whereby the complete assembly of wheels and frame is not of substantially greater width than the frame alone of a conventional wheel chair. In such assembly, the three wheels are disposed in spaced relation in a common vertical plane.

As shown in Figure 3, the traction wheel 22 preferably comprises a pair of spun metal discs 72 which are dished oppositely of each other adjacent the center of the wheel and are brought and secured together along a circular line spaced inwardly of the periphery of the wheel, the portions of the disc outwardly of the circular line of securement thereof being oppositely curved to define a substantially semi-cylindrical recess for the reception of a conventional rubber tire 74. Adjacent the center thereof, the discs 72 are each turned inwardly to define a cylindrical hub 76 within which a pair of ball bearings 78 are disposed. The bearings 78 rotatably support the wheel 22 on an axle 80 comprising a bolt extending through the two wheel mounting members 70 and the bearings 78, the assembly being secured together by a nut threaded to one end of the bolt. Preferably, an axle sleeve 82 is disposed about the bolt 80 between the mounting members 70 properly to space the members 70 and to mount the bearings 78. To accommodate lubrication of the bearings 78 and the sleeve 82, the bolt 80 is preferably provided with an axial bore communicating with a radial bore, which in turn communicates with a circumferential depression in the bolt, the sleeve 82 being provided with one or more holes in the region of the said depression, whereby lubricant introduced into the axial bore in the bolt 80 may flow to the bearings 78 and the bearing surfaces of the sleeve 82.

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The hand wheel 26 is preferably formed and mounted in much the same manner as the traction wheel 22. However, to provide a wheel optimally gripped and manipulated by the chair occupant, the inner disc of the wheel, as indicated at 72h, preferably is a planar member, only the outer disc being dished, and the two discs themselves provide a generally cylindrical rim portion 84 for engagement by the chair occupant. Preferably, the radially inward surface of the said rim portion 84 to the outside of the wheel is provided with finger indentations, and a rubber sheath 86 is provided on the said rim portion 84 to afford an optimum hand gripping surface.

As will be appreciated, the hand wheel 26 is disposed immediately forward of the arm rest portion 52 of the side frame whereby the same is adapted readily to be manipulated by the chair occupant for the purpose of motivating the ground engaging traction wheel 22 to propel the chair. To establish driving connection between the wheels 22 and 26, a toothed sprocket 88 is secured to the exterior surface of each wheel, as by screws 90 or the like, and a drive chain 92 is trained over the two sprockets. The chain drive is positive and thus preferred. However, other conventional drives may be employed. If desired, the sprockets 88 may be of different sizes, as may the wheels 22 and 26, to provide various speed ratios. However, I have found it preferable to provide sprockets 88 of the same size and wheels 22 and 26 of the same size. A suitable wheel size is 10 inches in diameter, while a suitable sprocket is 3 3/4 inches in diameter and provided with 22 teeth. With wheels of the size stated, a suitable caster wheel size is 6 inches in diameter, the assembly thus formed providing a stable support for the chair occupant. As will be appreciated, the sprockets 88 are disposed inwardly of the adjacent fork member whereby the sprockets, the chain and the two wheels of the drive mechanism are disposed entirely within the lateral limits of the side frame. Preferably, the sprockets 88 and chain 92 are shielded, for esthetic purposes as well as to prevent injury as a result of entanglement in the chain, by a guard 93 which may suitably be secured to the frame by screws passed through the guard and threaded into a tapped portion of the axial bore in each of the axle bolts of the two wheels.

The upholstery of the chair includes a cushioned arm rest 154 disposed on the upper surface of the arm rest portion 52 of each side frame, the same being suitably secured to the tubular portion 52 by brackets 156. As shown in Figure 2, each arm rest 154 extends forwardly of the arm rest portion 52 to overlie a portion of the hand wheel fork 54. Preferably, each arm rest 154 is provided with an inclined front edge to accommodate disposition of the arm rest immediately adjacent the rim 84 of the hand wheel, whereby the chair occupant may rest his arms on the arm rests even when effecting propulsion of the chair. In addition, it is to be observed from Figures 4 and 5 that the total width of each side frame, including the traction means, is not significantly greater than the width of a conventional padded arm rest. Each side frame preferably is also provided with an ornamental metallic shield 158 extending along the inside of each side frame from a level below the upper surface of the seat 32 and extending upwardly therefrom and forwardly of the hand wheel 26 to provide an enclosed seat portion and to protect the chair occupant from any possible entanglement in the hand wheel or associated apparatus.

To insure perfect safety of operation of the chair, and thus to induce a sense of complete self-reliance on the part of the chair occupant, a brake mechanism 160 is preferably provided on each side frame for the respective traction wheel whereby the chair may be parked by its occupant without concern.

The collapsible linkage means 28 and 30 interconnecting the two side frames of the chair at the front and rear, respectively, are described and claimed in said par-

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ent application Serial No. 379,361, to which reference is made for a detailed description. The adjustable foot-rests 40 and the adjustable and retractable leg rests 42 are also described and claimed therein. The back rest 34, which is likewise described in detail in my said parent application is automatically adjustable by manipulation of latches provided on the under surface of the hand grip portions 52 of the side frames 20, thereby to permit the user to attend to his own comfort.

From the foregoing, it will be appreciated that the frame and traction means of the wheel chair of my invention are formed in a highly efficient, practical and economical manner. Also, the assembly of the frames and traction means in the completed wheel chair, as shown in Figure 1, is readily effected to provide an improved wheel chair that has a very pleasing appearance, and that is sturdy and reliable in use. Included among the advantages of the wheel chair are the fact that for a given seat size, the wheel chair of the present invention is of substantially less width than conventional wheel chairs, which decrease in width leads to the ability, heretofore unaccomplished, of negotiating narrow passages and the like, such as the aisles of pullman and coach cars in railroad trains, whereby a greater freedom of movement is afforded the chair occupant than previously thought obtainable. Such decrease in width is accomplished according to the present invention by the provision of the forks or yokes for mounting the hand and traction wheels of the chair, whereby the wheels are disposed in a common vertical plane in alignment with the side frames of the chair, and further by the particular improved drive means provided according to the present invention. Also, the drive means provided by the present invention is positive and efficient in action and the hand wheel motivating means is disposed for ready and convenient actuation by the chair occupant.

In view of the above, it will be appreciated that the present invention provides an improved wheel chair that not only exhibits advantageous structural qualities over prior developments in the art, but that also provides the further advantage that the same is readily operated and used by the chair occupant himself, whereby his feeling of self-reliance and independence is appreciably enhanced, thus rendering his life and the lives of those about him more enjoyable. Also, the wheel chair of the present invention accommodates convenient travel in a substantially non-restricted orbit, whereby the mental anguish heretofore caused by the confining restrictions of invalidity is at least substantially reduced if not entirely eliminated.

A second embodiment of my invention accomplishing the same objects and advantageous as above noted, and providing a modified drive, is shown in Figure 6. The principal difference between the two embodiments of the invention as shown in Figures 2 and 6 resides in the disposition of the traction wheels at the front and rear, respectively, of the chair. Due to the similarity between the two embodiments, parts similar or identical to parts of the previously described embodiment of the invention are indicated in Figure 6 by the same reference numerals with the suffix "r." As will be appreciated from the foregoing, and a comparison of Figures 2 and 6, the only differences in structure reside in the formation of the lower portions of the side frames, and the disposition and mounting of the traction and caster wheels, and the disposition of the brake.

As to the formation of each side frame 20r, the front vertical beam 44r thereof is, as to the upper portion thereof, the same as previously described, but the tubular central section 60r thereof in the present embodiment of the invention extends somewhat lower and provides a bearing 300 for the mounting portions 50r of the caster wheel 24r. The rear vertical beam 44r at its lower end is curved sharply rearwardly and adjacent the middle of the curve is formed, in the same manner as described

hereinbefore with respect to the fork portions 54, 62 and 64, to define a traction wheel fork portion 302. The lower horizontal beam 46r is generally similar to the form thereof described hereinbefore with the exception that the same is formed at the rear portion thereof, as described with respect to the fork portions 54, 62 and 64, also to define a traction wheel fork portion 304. The two fork portions 302 and 304 afford a downwardly and rearwardly open fork and provide support for a pair of suitable wheel mounts 306, upon which the traction wheel 22r is mounted for rotation.

To rigidify the two fork portions 302 and 304, a brace 308 preferably is provided between the base portions of the two forks. The brace 308 also provides a member upon which the brake shoe and lever, 62r and 66r, may be pivotally mounted, substantially in the manner described hereinbefore, for actuation and use in the manner described.

As will be appreciated, the drive means employed is the same as that previously described, except, of course, that the chain 92r and the guard 93r are longer.

In wheel chairs employing rear traction wheel drive, it is desirable to provide larger casters than would be provided if the traction wheels were at the front of the chair. For example, with the wheel sizes given hereinbefore of 10 inch traction and hand wheels, it is desirable to employ 8 inch caster wheels rather than the 6 inch caster wheels used at the rear of the chair in the embodiment previously described.

From the foregoing, it will be appreciated that the present invention provides two embodiments of an improved wheel chair which affords substantial structural advantages over prior developments in the art and also, and even more importantly from the invalid's aspect, substantially reduces and/or eliminates the mental anguish accompanying physical disablement by affording the ability, on the part of the physically disabled, to be self-reliant and substantially independent.

While I have described what I regard to be preferred embodiments of my invention, it will be appreciated that various changes, rearrangements and modifications may be made therein without departing from the spirit and scope of the invention, as defined in the appended claims.

I claim:

1. A wheel chair comprising a pair of spaced parallel side frames, a seat disposed between said side frames, each of said side frames including a pair of fork portions, one opening to the front and top thereof and the other opening to the bottom thereof, a ground engaging traction wheel rotatably mounted on each of said side frames in said other of said fork portions, a hand wheel rotatably mounted on each of said side frames in said one of said fork portions, the wheels on each of said side frames lying in a substantially vertical plane common to the wheels and the respective side frame, and operating means extending between and operatively associated with each of the wheels on each of said side frames within the confines of the respective fork portions.

2. A wheel chair comprising a pair of spaced parallel side frames, a seat disposed between said side frames, each of said side frames including a pair of fork portions, one opening to the front and top thereof and the other opening to the bottom thereof, a ground engaging traction wheel rotatably mounted on each of said side frames in said other of said fork portions, a hand wheel rotatably mounted on each of said side frames in said one of said fork portions, the wheels on each of said side frames lying in a substantially vertical plane common to the wheels and the respective side frame, a sprocket mounted on each of said wheels, and chain means extending between and operatively associated with the sprockets on each of the wheels on each of said side frames.

3. A wheel chair comprising a pair of spaced parallel side frames, a seat disposed between said side frames, each of said side frames including a pair of fork portions, one opening to the front and top thereof and the other opening to the bottom and front thereof, a ground engaging traction wheel rotatably mounted on each of said side frames in said other of said fork portions, a hand wheel rotatably mounted on each of said side frames in said one of said fork portions, the wheels on each of said side frames lying in a substantially vertical plane common to the wheels and the respective side frame, operating means extending between and operatively associated with each of the wheels on each of said side frames within the confines of the respective fork portions, and at least one caster supporting said frames at the rear.

4. A wheel chair comprising a pair of spaced parallel side frames, a seat disposed between said side frames, each of said side frames including a pair of fork portions, one opening to the front and top thereof and the other opening to the bottom and rear thereof, a ground engaging traction wheel rotatably mounted on each of said side frames in said other of said fork portions, a hand wheel rotatably mounted on each of said side frames in said one of said fork portions, the wheels on each of said side frames lying in a substantially vertical plane common to the wheels and the respective side frame, operating means extending between and operatively associated with each of the wheels on each of said side frames within the confines of the respective fork portions, and at least one caster supporting said frames at the front.

5. A side frame for wheel chairs comprising a substantially planar frame structure including a pair of vertically spaced generally horizontal beams, and a pair of generally vertical beam means connected to said horizontal beams at the opposite ends thereof, said beams and beam means lying substantially in a common vertical plane, said vertical beam means defining a pair of forks, one opening to the front and top of the frame for receiving a hand wheel within the plane of the frame, and the other opening to the bottom of the frame for receiving a ground engaging wheel within the plane of the frame in coplanar relation to the hand wheel.

6. A side frame for wheel chairs comprising a pair of vertically spaced generally horizontal beams, and a pair of generally vertical beam means connecting said horizontal beams at the opposite ends thereof, said vertical beam means defining a pair of forks, one opening to the front and top of the frame and the other opening to the bottom of the frame, a hand wheel rotatably mounted on the frame in said one fork, a ground engaging wheel mounted on the frame in said other fork, said wheels being disposed in spaced relation in a substantially vertical plane common to the wheels and said beams and beam means, a sprocket secured to each of said wheels coaxially thereof, said sprockets each being disposed between the associated wheel and one of the fork members of the respective fork, and an endless chain trained over said sprockets, said chain being disposed inwardly of the lateral limits of the frame.

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