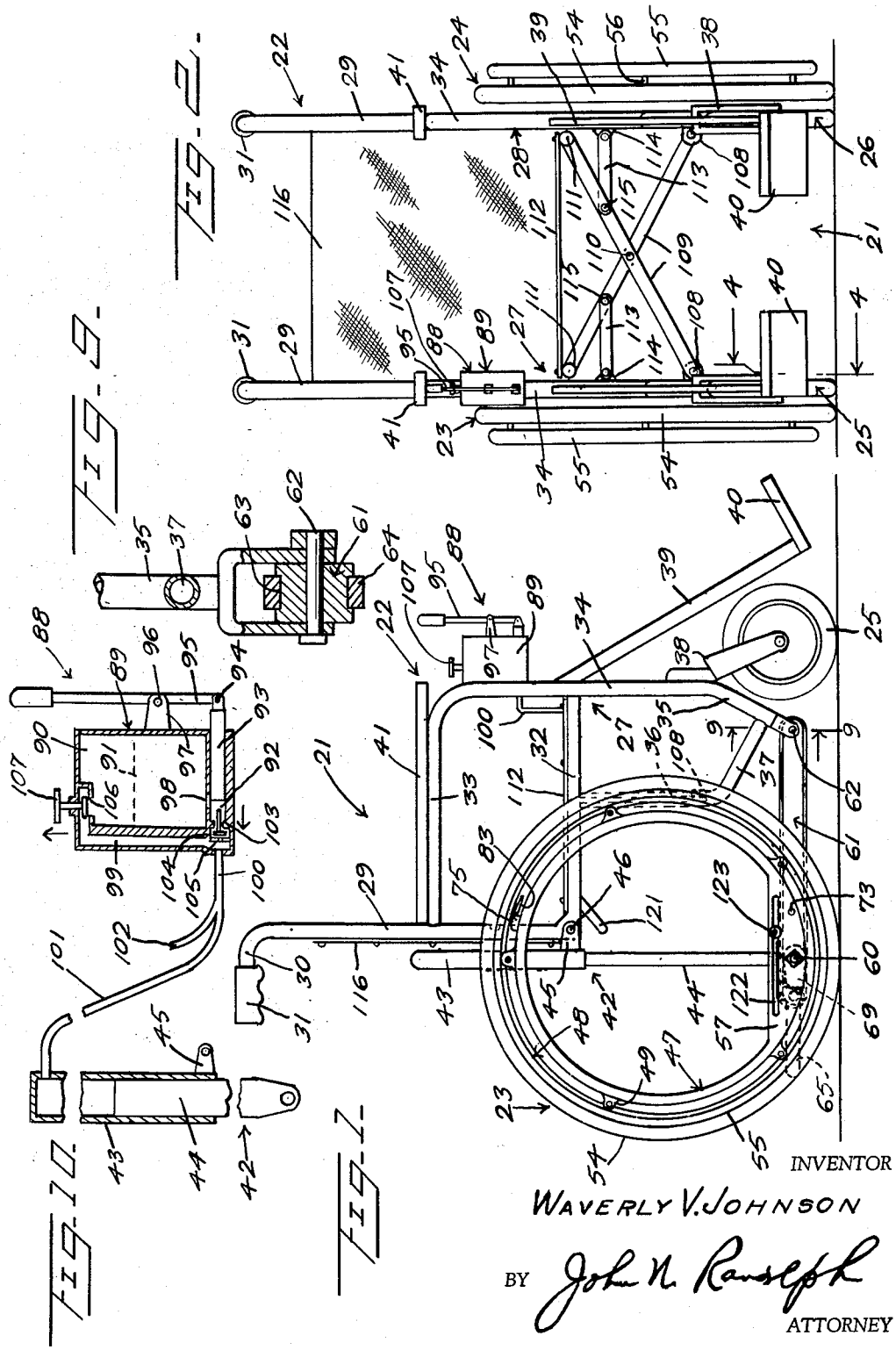
May 31, 1966 W. V. JOHNSON 3,253,837

STAIR CLIMBING WHEEL CHAIR

Filed March 27, 1963 4 Sheets-Sheet 1



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STAIR CLIMBING WHEEL CHAIR

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FIG. 3.

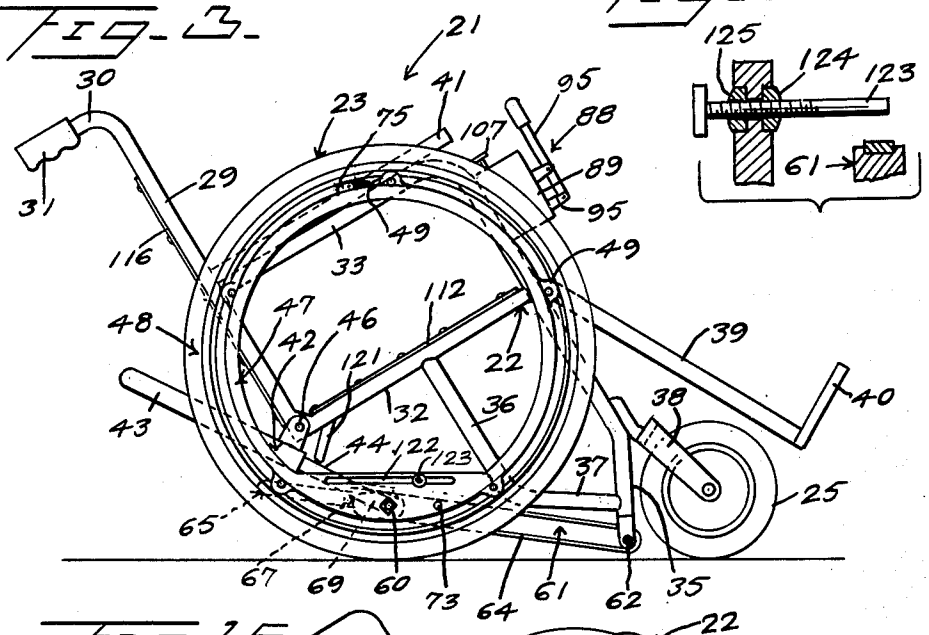


FIG. 15.

FIG. 16.

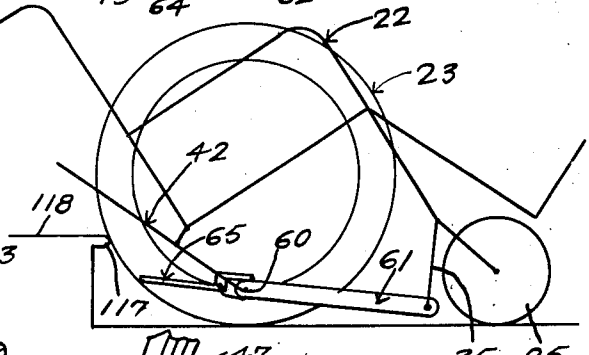


FIG. 11.

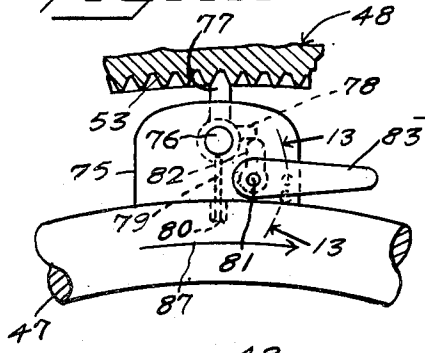
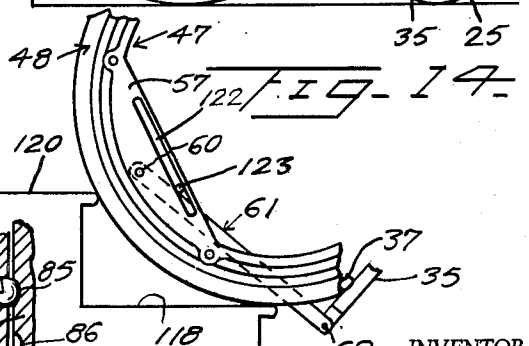


FIG. 14.



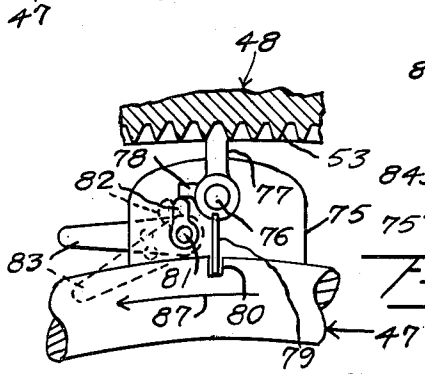


FIG. 12.

FIG. 13.

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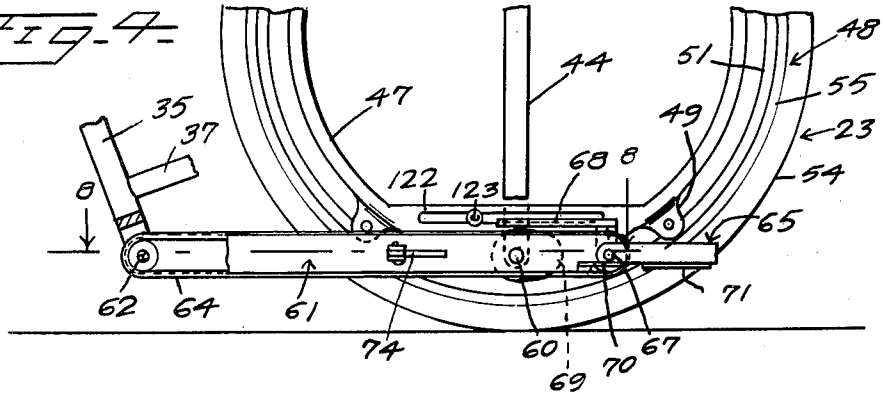
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FIG. 4



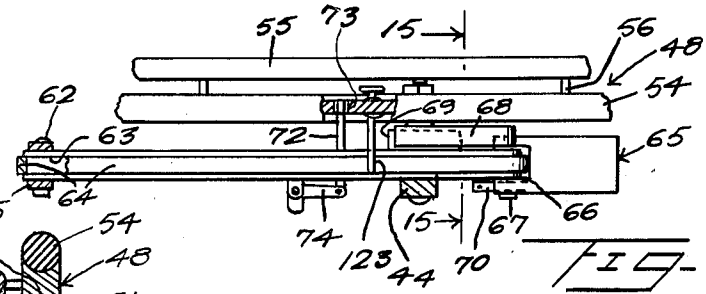


FIG. 5

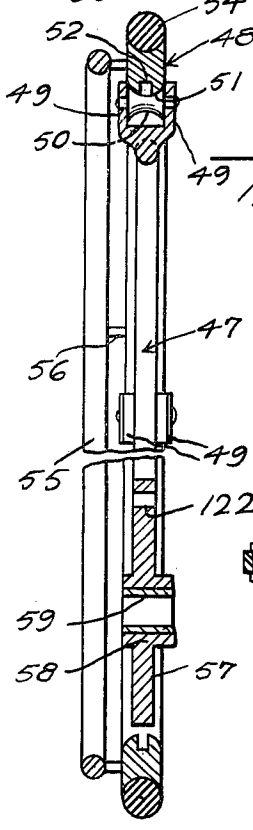


FIG. 7

FIG. 6

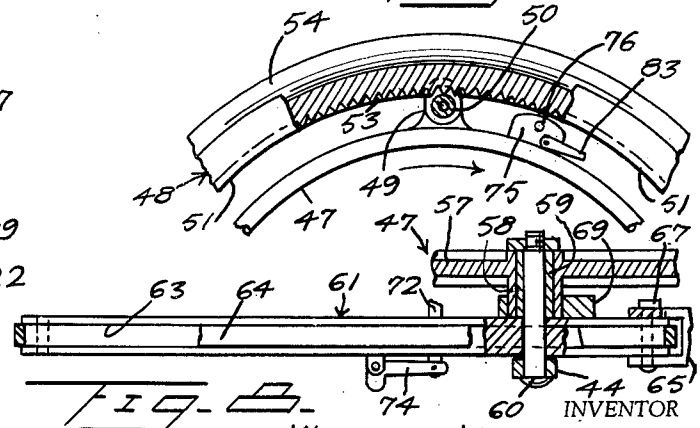


FIG. 8

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Fig. 17.

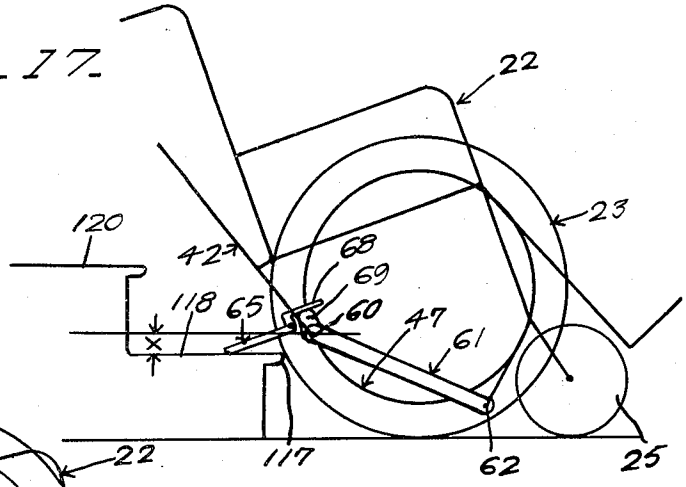


Fig. 18.

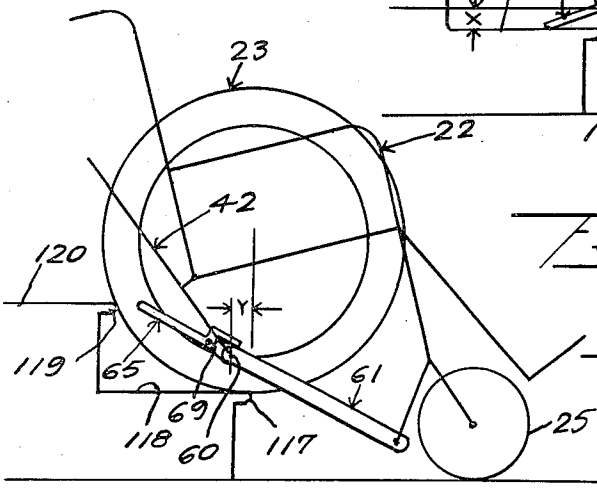


Fig. 19.

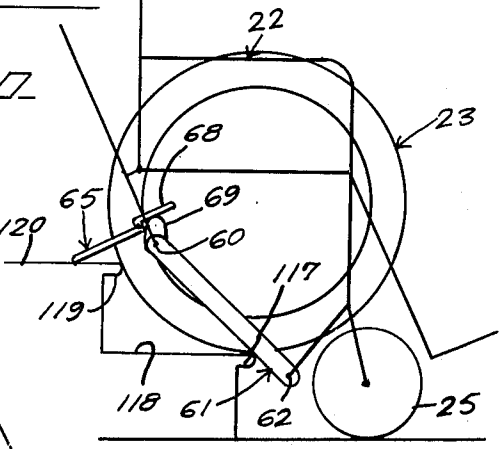
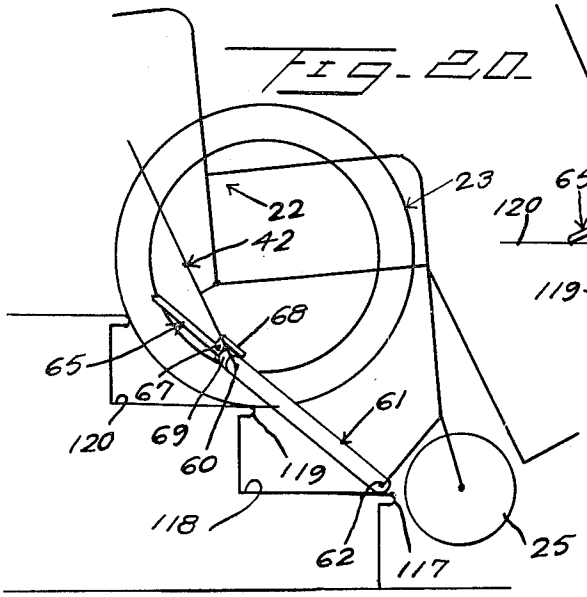


Fig. 20.



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3,253,837

STAIR CLIMBING WHEEL CHAIR

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Filed Mar. 27, 1963, Ser. No. 268,386
11 Claims. (Cl. 280—5.22)

This invention relates to a novel wheel chair intended to be manually operated by its occupant and which is so constructed that the occupant may readily operate the chair for causing it to ascend and descend stairs or curbs safely.

More particularly, it is an aim of the present invention to provide a wheel chair having novel drive wheels which are eccentrically connected to the chair frame in such a manner as to substantially lower the center of gravity of the chair.

Another object of the invention is to provide a wheel chair the frame of which includes extensible and retractable elements by which the frame is connected to the drive wheels to enable the frame to be tilted rearwardly and downwardly for moving the center of gravity of the chair downwardly and rearwardly thereof.

Still a further object of the invention is to provide a wheel chair wherein each drive wheel includes a large diameter hub to which the chair frame is pivotally connected and which can be oscillated within a surrounding rim of the wheel and relative thereto for displacing the frame and the center of gravity of the chair rearwardly relative to the axis of said wheel.

Still another object of the invention is to provide a wheel chair which may be readily collapsed transversely thereof for transportation or storage.

Various other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the drawings, illustrating a presently preferred embodiment thereof, and wherein:

FIGURE 1 is a side elevational view of the wheel chair and shown in its normal position;

FIGURE 2 is a front elevational view thereof;

FIGURE 3 is a side elevational view showing the wheel chair tilted for ascending or descending stairs;

FIGURE 4 is an enlarged fragmentary side elevational view looking toward the inner side of a part of the chair frame and one of the wheels, taken substantially along the line 4—4 of FIGURE 2;

FIGURE 5 is a fragmentary view partly in top plan and partly in horizontal section of the structure as seen in FIGURE 4;

FIGURE 6 is an enlarged fragmentary side elevational view, partly in vertical section, of one of the rear wheels of the wheel chair;

FIGURE 7 is an enlarged diametrical sectional view, partly broken away, of one of the rear wheels;

FIGURE 8 is an enlarged fragmentary horizontal sectional view, taken substantially along a plane as indicated by the line 8—8 of FIGURE 4;

FIGURE 9 is an enlarged fragmentary sectional view taken substantially along the line 9—9 of FIGURE 1;

FIGURE 10 is an enlarged fragmentary sectional view, partly in elevation, illustrating details of a part of the chair operating mechanism;

FIGURE 11 is an enlarged fragmentary side elevational view, partly in section, of a portion of one of the rear chair wheels;

FIGURE 12 is a view similar to FIGURE 11 and looking in the opposite direction;

FIGURE 13 is an enlarged sectional view, taken substantially along the line 13—13 of FIGURE 11;

FIGURE 14 is a fragmentary diagrammatic view of a part of one of the rear chair wheels;

FIGURE 15 is a fragmentary sectional view, on an enlarged scale, taken substantially along the line 15—15 of FIGURE 5; and

FIGURES 16, 17, 18, 19 and 20 are diagrammatic views showing different positions assumed by the wheel chair while ascending or descending stairs.

Referring more specifically to the drawings, the wheel chair in its entirety is designated generally 21 and includes an occupant supporting frame, designated generally 22, two large rear wheels 23 and 24, and two small front wheels 25 and 26, which provide a mobile support for the frame 22. The frame 22 includes two corresponding frame sides 27 and 28, as seen in FIGURE 2.

Each frame side 27 and 28 includes a substantially upright rear member 29 having a rearwardly turned upper end 30 provided with a handgrip 31. A lower frame member 32 extends forwardly from the lower end of the upright member 29 and an upper frame member 33 extends forwardly from the frame member 29, above and spaced from the member 32 but substantially below the rearwardly turned portion 30. The upper member 33 has a downwardly turned extension 34 at its forward end which extends across and is secured to the forward end of the lower frame member 32 and which forms a depending front leg which extends substantially below the member 32 and has a rearwardly inclined lower portion 35. A brace 36 is secured to and depends from the lower frame member 32, approximately midway of the ends thereof, and has a downwardly and forwardly inclined lower end 37 which merges with and is secured to the inclined leg portion 35. The previously described frame parts are preferably formed of lightweight tubular metal.

A fork 38 is secured to the front side of the leg 34, above and adjacent its inclined portion 35, and said fork extends downwardly and forwardly at an incline from the leg 34 to provide a journal for the front wheel 25 or 26 of said frame side. A brace 39 extends downwardly and forwardly from an upper portion of the leg 34 and has a footrest 40 at its lower end which is disposed in front of the front wheel of said frame side. An armrest 41 is mounted on and secured to the upper side of the upper frame member 33.

Each frame side also includes a rear leg, designated generally 42, including an upper section comprising a downwardly opening cylinder 43 and a lower section comprising a rod 44 which telescopes into the cylinder 43 and which extends downwardly therefrom. The cylinder 43 near its open lower end has transversely spaced forwardly projecting apertured ears 45 which straddle the lower end of the upright 29 and which are pivotally connected thereto by a fastening 46 for pivotally connecting the leg 42 to the frame member 29, and so that the upper leg section or cylinder 43 will be disposed directly behind the upright 29 and said leg will be positioned to swing in a plane coinciding with the plane of the frame parts 29, 32, 33 and 34 of its frame side and about the horizontal axis 46.

The rear wheels 23 and 24 straddle the frame 22 and are substantially larger than the front wheels 25 and 26. Each rear wheel 23 and 24 includes a large annular or ring-like hub 47 and an annular rim 48 which is disposed around and journaled on the hub 47. The hub 47 has a plurality of circumferentially spaced outwardly projecting pairs of transversely spaced ears 49, as best seen in FIGURE 7, in each of which is journaled a roller 50. The diameters of the rollers 50 taper from their ends toward their centers to conformably receive the inner edge 51 of the rim 48 which is convexly rounded in cross section and which is provided with a central groove 52 containing teeth forming a rack 53. The periphery of the rim 48 is preferably defined by a tire 54, and a handwheel 55 is sup-

ported by the rim 48 in outwardly spaced relation to the outer side thereof by support elements 56 which extend between said handwheel and rim.

The ring forming the hub 47 is provided with a web portion 57 which is disposed internally of a part thereof and which is provided with an integral boss 58 containing a bushing 59. The boss 58 is disposed perpendicular to the plane of the web 57 and hub 47 and projects from the inner side of said web. The bolt of a nut and bolt fastening 60 extends outwardly through the lower end of the lower rear leg section 44, through a bottom brace 61 and through the boss 58 for pivotally connecting the brace and rear leg to one another and to the wheel hub 47.

The forward end of the bottom brace 61 is pivotally connected by a fastening 62 to the lower end of the rearwardly inclined front leg portion 35. The top and bottom surfaces of the ends of the brace 61 are grooved as seen at 63 to receive an endless belt 64 which slidably engages therein and which protrudes from said groove, as seen in FIGURES 5 and 8. A pedal-like brake member 65 has a bifurcated inner end 66 which straddles the other rear end of the brace 61. A pivot pin 67 extends through the furcations of said bifurcated end 66 and through the brace 61 for pivotally mounting the brake as an extension of the rear end of the brace. An arm 68 constitutes a forward extension of one of said furcations and projects forwardly between the brace 61 and the web 57 and overlies a cam 69 which is fixedly mounted on the boss 58. A spring 70, supported by the brace 61, bears against the underside of the brake member 65 for urging said member to swing upwardly for holding the arm 68 in contact with the cam 69. A traction strip 71 is secured to the underside of the brake element 65.

A locking pin 72 extends slidably through each brace 61 to engage an opening 73 of the web 57, as seen in FIGURE 5. The locking pins 72 function to prevent the rear wheels 23 and 24 from oscillating relative to the frame 22 when said frame is in an upright position as seen in FIGURE 1 and is being propelled forwardly or rearwardly. Since the major portions of the wheels 23 and 24 are disposed above the pivots 60 there would otherwise be a tendency for such oscillation of the wheels. A bellcrank 74 is pivotally mounted on the inner side of each brace 61 and is connected to the inner end of the pin 62 which extends therethrough for moving the pin into and out of engagement with the opening 73 of the adjacent rear wheel.

The hub 47 of each rear wheel has a plate or flange 75 projecting outwardly therefrom and disposed between said hub and the rim 48. A shaft 76 is journaled in the flange 75 and a pawl 77 is fixed to said shaft and disposed on one side of the plate 75. A lug 78 projects from the hub of the pawl 77 and is disposed laterally thereof. A leaf spring 79 is fixed to and projects inwardly from another part of the hub of the pawl 77 and has an inner end which fits loosely in a notch or recess 80 of the wheel hub 47, as seen in FIGURE 12. Another shaft 81 extends through and is journaled in the flange 75 and has a tooth member 82 fixed to one end thereof and disposed in the same plane as the pawl 77. A lever type handle 83 is fixed to the other end of the shaft 81 and is disposed on the other side of the flange 75. The handle 83 carries a spring pressed latch ball 84, as seen in FIGURE 13, for engaging either the recess 85 or the recess 86 of the flange 75 for latching said handle 83 and abutment 82 in either the full line or dotted line positions thereof, as seen in FIGURE 12. When the abutment 82 is in its full line position it engages under the lug 78. FIGURE 11 is a view looking toward the outer side of a portion of the wheel 23. It will be apparent that the pawl 77 by engagement with the rack 53 will prevent the hub 47 from being turned counterclockwise relative to the rim 48 since the abutment 82 by engaging under the lug 78 prevents the pawl 77 from swinging clockwise, as seen in FIGURE 11. However, the pawl 77 is free to swing counterclockwise so that the hub 47 can be turned in the opposite direction or clockwise of FIGURE 11, as indicated by the arrow 87. It will be understood that the spring 79 will tend to hold the pawl 77 in its radial position of FIGURES 11 and 12, so as to always be in engagement with the rack 53. When the handle 83 and abutment 82 are moved to their dotted line positions of FIGURE 12 said abutment is swung from beneath the lug 78 so that the pawl 77 can swing in either direction from its position of FIGURES 11 and 12. It will thus be seen that the abutment 82 is capable of locking the pawl 77 so that the hub 47 of the wheel 23 can only be rotated relative to the rim 48 in a direction for moving the pivot 60 from the position as shown in FIGURES 3 and 16 toward the position as shown in FIGURE 17. The structure as illustrated in FIGURES 11 and 12 is reversed in connection with the wheel 24 so that when the pawl of that wheel, not shown, is held by the abutment 82 the hub thereof cannot be rotated relative to the wheel rim for moving the pivot 60 and the boss 58 rearwardly and upwardly.

A control unit 88 for simultaneously extending or retracting the rear legs 42 includes a casing 89 which is preferably secured to the forward side of the upper portion of the front leg 34 of the frame side 27, as seen in FIGURES 1 and 2. As best illustrated in FIGURE 10, the casing 89 includes a reservoir or tank 90 containing a hydraulic liquid 91. The lower end or bottom portion of the casing 89 is recessed to define a pump barrel or cylinder 92 in which a pump piston 93 is reciprocably mounted. Said piston 93 projects outwardly from a forward part of the casing 89 and has its outer end pivotally connected at 94 to one end of a pump lever 95. The pump lever 95 is pivotally mounted at 96 on a bracket 97 which extends forwardly from the casing 89. The pivot 96 is spaced from the ends of the lever 95 and is preferably disposed nearer the end thereof connected to the piston 93 than to the other lever end, as seen in FIGURE 10. The pump barrel 92 is connected by a port 98 to the bottom of the reservoir 91. A passage 99 is formed in the rear part of a portion of the upper part of the casing 89 and an outlet conduit 100 leads from the lower end of said passage and has branches 101 and 102 connected to the upper ends of the cylinders 43 of the two rear legs 42. A port 103 connects the inner end of the pump cylinder 92 to the lower portion of the passage 99 and is provided with a check valve 104 which opens toward the passage 99 and is confined in its movement by a cage 105. The top portion of the passage 99 has a port 106 opening into the reservoir 90 and which is controlled by a manually operated valve 107, which is preferably threadedly mounted.

The braces 36 have inwardly extending lower ears 108 to which the lower ends of two cross braces 109 are pivotally connected, said cross braces being pivotally connected to one another at 110. Tubular members 111 are fixed to the upper ends of the cross braces 109. The members 111 are connected intermediate of their ends to the braces 109 and are disposed crosswise thereof and are approximately coextensive with the lower frame members 32 along the inner sides of which they are normally disposed. A fabric strip 112 forming the chair seat extends between and is secured to the members 111. Links 113 have outer ends pivotally connected to uppers ears 114 of the frame members 36, and inner ends which are pivotally connected at 115 to the cross braces 109, between the pivot 110 thereof and the members 111. The links 113 prevent the upper ends of the cross braces 109 from swinging downwardly beyond their positions of FIGURE 2. A flexible or fabric back rest 116 extends between and is secured to the frame members 29. It will be readily apparent that the cross braces 109 may pivot so that the upper ends thereof move toward one another and with the links 113 swinging upwardly, to enable the frame sides 27 and 28 to be collapsed toward one another for collapsing the chair 21 for storage or transportation.

The pump lever **95** is manually operated with the valve **107** closed to pressurize the cylinders **43** to extend the rear legs **42** which then maintain the frame **22** in its upright position of FIGURES 1 and 2, in which the wheel chair is normally utilized. With the wheel chair **21** thus positioned the locking pins **72** are maintained engaged in the openings **73** and the levers **83** are disposed in their released positions, as illustrated in dotted lines in FIGURE 12, so that the handwheels **55** of the two wheels **23** and **24** can be manually engaged for propelling the wheel chair either forwardly or rearwardly or so that the wheel chair can be pushed from behind and by someone gripping the handles **31**.

Assuming that it is desired to ascend stairs or a curb, the locking pins **72** are disengaged and after which the valve **107** is opened so that the weight of the frame **22** and of the wheel chair occupant will cause the fluid **91** to be forced from the cylinders **43** back through the conduits **101** and **102**, passage **99** and port **106** into the reservoir **90**. This will enable the rear legs **42** to assume retracted positions and to pivot on the pivot points **46** to move from the position of FIGURE 1 to the position of FIGURE 3. In the position of FIGURE 3, the frame **22** is tilted downwardly and rearwardly and the center of gravity of the wheel chair **21** is lowered and displaced rearwardly relative to the center of gravity of the chair as seen in FIGURE 1. The levers **83** are moved to their operative positions as illustrated in FIGURE 11 so that the wheel hubs **47** can be turned in the rims **48** in directions for moving the pivots **60** upwardly and rearwardly from the position thereof as seen in FIGURES 3 and 16 to the position thereof as seen in FIGURE 17. This is accomplished ordinarily after the wheel chair **21** has been moved rearward until the wheels **23** and **24** are abutting the outer edge **117** of a bottom stair tread **118**. As the hubs **47** are turned from their positions of FIGURE 16 to their positions of FIGURE 17, the cams **69** of the two rear wheels will assume angular positions relative to the bottom braces **61** and in so moving will engage under the arms **68** for swinging the brakes **65** downwardly and into engagement with the stair tread **118**. At any point during this oscillation of the hubs **47** relative to the rims **48**, turning of the hubs **47** can be interrupted and the pawls **77** will prevent the hubs from oscillating in the opposite direction.

After the rear wheels have assumed the positions as seen in FIGURE 17, the occupant manually grasps the two hubs **47** to turn said hubs rearwardly. Since the hubs **47** may not turn rearwardly relative to the rims **48** because of the pawls **77** being held by the abutments **82** to pivot in one direction only, the rims **48** rotate rearwardly in unison with their hubs **47** as the rear wheels ride up onto the tread **118**, as seen in FIGURE 18, and against the forward edge **119** of the next stair tread **120**. During this movement of the wheel chair up onto the step **118**, from the position of the chair in FIGURE 17 to its position of FIGURE 18, the pivot **60** of each wheel **23** and **24** moves downwardly thereby lowering the inclined chair frame **22** which had been previously raised by turning of the hubs **47** within the rims **48** during movement of the chair parts from their positions of FIGURE 16 to their positions of FIGURE 17. The operation previously described is then repeated for moving the chair from the step **118** to the step **120**, this including initially rotating the hubs **47** forwardly within the rims **48** from their positions of FIGURE 18 to their positions of FIGURE 19 and then turning the two rear wheels rearwardly with the hubs and rims thereof turning in unison by grasping the hubs **47**, for moving the chair **21** from its position of FIGURE 19 up and onto the tread of the second stair **120** and with the chair parts assuming the positions as seen in FIGURE 20.

Referring to FIGURE 17, when the hubs **47** are turned to their positions of this view from their positions of FIGURE 16, the fastenings **60** by which the frame **22** is supported on the wheels **23** and **24** are raised above the step **118** a distance as indicated by "X" in FIGURE 17. When the chair is moved up onto the step **118** as seen in FIGURE 18 from its position of FIGURE 17, the fastenings **60** will move from their positions of FIGURE 17 to their positions of FIGURE 18 wherein said fastenings are located above the stair tread **118** and inwardly thereof with respect to its edge **117** a distance as indicated by "Y" in FIGURE 18. Since the point of contact between the rear wheels **23** and **24** and the step is almost directly above the outer edge **117** of said step and because the weight of the chair frame **22** and of its occupant is acting through the attachment points **60** of the chair frame to the rear wheels, a couple is formed which tends to force the rear wheels to rotate counterclockwise against the edge **119** of the next higher step **120**. This force prevents the wheel chair **21** from rolling down the stairs.

When descending stairs, the levers **83** are normally moved to their released positions, as seen in dotted lines in FIGURE 12, so that the latching pawls **77** may oscillate in either direction, to unlatch the hubs **47** from the rims **48**. This is desirable because the hubs **47** cannot turn counterclockwise relative to the rims, as seen in FIGURES 16 to 20, when the pawls **77** are held by the abutment **82** as seen in FIGURE 11. During descent of the stairs, the hubs **47** and rims **48** turn as a unit from one step to the next, as for example, from the position as seen in FIGURE 20 to the position as seen in FIGURE 19. The hubs 47 are then rotated rearwardly or counterclockwise to move the chair parts from their positions of FIGURE 19 to their positions of FIGURE 18, preparatory to moving down off of the lower step **118**. It will be noted that in FIGURES 18, 19 and 20 the points of connection between the rear wheels and chair frame is always rearwardly offset relative to the points where the rear wheels rest upon the stair tread so that the weight of the frame and occupant prevents the chair from descending until the wheels are manually rotated forwardly. It will also be noted that the brakes **65** assume applied positions automatically as the chair **21** descends each step, as seen in FIGURES 19 and 17.

It will also be noted that in ascending or descending stairs the bottom braces **61** will contact the front edge of each stair tread and also a part of the top surface of the stair tread. The endless belts **64** are provided so that these may slide relative to the braces **61** while in contact with the stairs to enable movement of the chair up and down the stairs without damage thereto or injury to the stairs.

As seen in FIGURES 1 and 3, the bottom frame portions **32** are provided with abutments **121** to limit the extent that the rear legs **42** can collapse and pivot about the fastenings **46**, so that the rear legs may not assume a position in alignment with the braces **61**. Each web **57** is provided with a slot **122** to receive an abutment **123**, as seen in FIGURE 15, which is secured in different adjusted positions therein by a clamping nut **124** and a fixed abutment **125**. The abutment or stop **123** is disposed over a part of the brace **61**. The adjustable abutments **123** are provided to take care of steps having different riser heights. When the hubs **47** are rotated forwardly in the rims **48**, as from their positions of FIGURE 16 to their positions of FIGURE 17, the bottom braces **61** will strike the abutments **123**, as seen in FIGURE 14, to signal the occupant that the hubs **47** have been rotated forwardly a proper distance before he turns the hubs and rims as a unit to ascend a stair. In descending stairs, when the bottom braces **61** contact the stair tread, as seen in FIGURE 20, this will indicate to the occupant that the rear wheels can be turned forwardly as units for descending to the next lower stair, as seen in FIGURE 19.

Various modifications and changes are contemplated and may obviously be resorted to, without departing from the function or scope of the invention as hereinafter defined by the appended claims.

I claim as my invention:

1. A stair climbing wheel chair comprising a chair frame, front wheels connected to the chair frame, larger rear wheels straddling the chair frame, each rear wheel including a large annular hub and a rim journaled on said hub, said frame including extensible rear legs pivotally connected to parts of the chair frame, means pivotally connecting lower ends of said legs to the wheel hubs eccentrically of the rear wheels, means for extending said rear legs for positioning the frame in substantially an upright position, means for retracting said rear legs for tilting the frame downwardly and rearwardly, and latch means releasably latching each rim to the hub thereof to prevent rotation of the rim in one direction relative to the hub and to prevent turning of the hub in one direction within the wheel.

2. A stair climbing wheel chair as in claim 1, and bottom braces having forward ends pivotally connected to the chair frame and rear parts pivotally connected to the lower ends of said rear legs.

3. A stair climbing wheel chair as in claim 2, and latch means releasably latching the bottom braces to said hubs to prevent oscillating movement of the hubs relative to the chair frame.

4. A stair climbing wheel chair as in claim 1, a brake member pivotally supported on the frame adjacent each rear wheel, and a brake actuator carried by each hub and engageable with the brake member disposed adjacent thereto for swinging the brake member to a stair tread engaging position when the hub is rotated in one direction within the rim.

5. A stair climbing wheel chair as in claim 1, bottom braces having forward ends pivotally connected to the chair frame and rear parts pivotally connected to the lower ends of said rear legs, an adjustable abutment carried by each hub, said abutments being engageable with said bottom braces for limiting the extent that the hubs can be oscillated in the rims in one direction.

6. A stair climbing wheel chair as in claim 1, said frame including corresponding transversely spaced frame sides, and a collapsible seat including a collapsible frame pivotally connected to said frame sides.

7. A wheel chair including a frame, front wheels and rear wheels, said rear wheels being of large diameter and straddling said frame and each including an annular hub of large diameter and a rim journaled on said hub, said frame having rear legs connected to said hubs eccentrically thereof and substantially below the level of the axis of said rear wheels, said rear legs having upper portions

pivotally connected to the frame, rigid bottom braces having forward ends pivotally connected to the frame, and pivot means pivotally connecting the lower ends of said rear legs and the rear parts of said bottom braces to said hubs, said rear legs being extensible and rectractable between the connection thereof to the frame and hubs for tilting the frame downwardly and rearwardly relative to said rear wheels.

8. A wheel chair as in claim 7, and said hubs being turnable in the rims for moving the chair frame forwardly and rearwardly between said rear wheels.

9. A wheel chair including a frame, front wheels and rear wheels, said rear wheels being of large diameter and straddling said frame and each including an annular hub of large diameter and a rim journaled on said hub, said frame having rear legs connected to said hubs eccentrically thereof and substantially below the level of the axis of said rear wheels, said frame having transversely spaced frame sides, a collapsible seat, and a seat frame formed of pivotally connected parts pivotally connected to said frame sides and foldable for collapsing said frame sides transversely of the frame.

10. A wheel chair including a frame, front wheels and rear wheels, said rear wheels being of large diameter and straddling said frame and each including an annular hub of large diameter and a rim journaled on said hub, said frame having rear legs connected to said hubs eccentrically thereof and substantially below the level of the axis of said rear wheels, and said rear legs being pivotally connected to the frame and to said hubs and being extensible and retractable between the pivots thereof for moving the frame relative to said rear wheels between an upright position and a downwardly and rearwardly tilted position.

11. A wheel chair as in claim 10, and rigid bottom braces having forward ends pivotally connected to forward portions of the frame and rear parts pivotally connected to the pivotal connections of the rear legs to the hubs.

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