This invention relates to improvements in wheel chairs, and more particularly to a wheel chair adapted to move up or down steps or stairs.

A main object of the invention is to provide a novel and improved stair-climbing wheel chair which is relatively simple in construction, which is easy to operate, and which enables the occupant to safely climb or descend stairs with a relatively small amount of effort and without leaving the wheel chair.

A further object of the invention is to provide an improved stair-climbing wheel chair which involves relatively inexpensive components, which is durable in construction, and which includes automatic fluid pressure-operated levelling means which may be employed when the wheel chair is on a level surface as well as during stair-climbing or descending operation of the wheel chair.

A still further object of the invention is to provide an improved stair-climbing wheel chair which is relatively light in weight, which is compact in size, which employs relatively few parts, and which is easy to maintain in operating condition.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

FIGURE 1 is a side elevational view of an improved stair-climbing wheel chair constructed in accordance with the present invention, shown in normal condition.

FIGURE 2 is a fragmentary rear elevational view of the wheel chair of FIGURE 1.

FIGURE 3 is a vertical cross sectional view taken substantially on the line 3--3 of FIGURE 2.

FIGURE 4 is a fragmentary vertical cross sectional view, similar to FIGURE 3, but showing the chair adjusted for climbing stairs.

FIGURE 5 is a vertical cross sectional view, similar to FIGURE 4, but taken on the line 5--5 of FIGURE 2 and showing the position of the elliptoidal chair-elevating members as they are rotated into engagement with a stair step.

FIGURE 6 is a vertical cross sectional view, similar to FIGURE 5, showing the position of the chair as it is elevated on a stair step and maintained levelled by the action of the pneumatic levelling means associated with the wheel chair.

FIGURE 7 is a cross sectional view taken substantially on the line 7--7 of FIGURE 6.

FIGURE 8 is an enlarged cross sectional view taken substantially on the line 8--8 of FIGURE 7.

FIGURE 9 is an enlarged vertical cross sectional view taken substantially on the line 9--9 of FIGURE 2, with the chair adjusted for stair climbing, as in FIGURES 4 and 5.

FIGURE 10 is a vertical cross sectional view taken substantially on the line 10--10 of FIGURE 9.

FIGURE 11 is a horizontal cross sectional view taken substantially on the line 11--11 of FIGURE 9.

FIGURE 12 is an enlarged cross-sectional view taken substantially on line 12--12 of FIGURE 8.

FIGURE 13 is a cross-sectional view taken substantially on line 13--13 of FIGURE 12.

Referring to the drawings, 12 generally designates an improved stair-climbing wheel chair constructed in accordance with the present invention. The wheel chair 12 comprises a chair frame 13 having the seat portion 14, the back rest portion 15, and the foot rest portion 16.
The rollers 54 are so located that when the levers 34 are elevated to cause the pinion gears 40 to meshingly engage with the gear teeth 51, the peripheries of the associated elliptical wheels are moved into engagement with the rollers allowing the elliptical wheels to be rotated responsive to the rotation of the shaft 37, which in turn may be actuated by means of a handle 55. This will be further apparent, when the levers 34 are rotated upwardly, for example, to the upstanding vertical positions illustrated in FIGURE 4, the supporting wheels 38 are elevated sufficiently to allow the bottom loops 25 of the rear post members 23 to come into ground engagement, the supporting wheels 38 being lifted clear of the ground, as shown in FIGURE 4.

As shown in FIGURES 1, 3 and 4, the elliptical wheels 41 are normally arranged with their major axes extending substantially horizontally and rearwardly, the pivot pins 47 being in the forward portions of the guide slots 46. With the levers 34 in their upright positions, as shown in FIGURE 4, rotation of the respective wheels 38 in a clockwise direction, as viewed in FIGURE 4, will cause the associated elliptical wheels 41 to be rotated counterclockwise around their associated pivot pins 47, whereby the elliptical wheels may be employed as elevating means to raise the rear portion of the wheelchair to an stairway step 56. The operation may be repeated for subsequent steps in the manner illustrated in FIGURES 5 and 6.

Telecopically disposed in the respective tubular front leg portions 19, 20 are plunger rod members 59, 59 provided at their lower ends with swiveled caster assemblies 60 having the caster wheels 61. The piston rods 59 have top piston portions 62 which are sealingly and slidably engaged in the tubular leg members 19 and 20 in a chamber defined below a filler plug 63 provided in each leg. Each leg is further provided with an inwardly projecting stop pin 64 slidably engaging in a longitudinal groove 65 formed in the associated piston rod 59 and terminating subjacent the associated piston portion 62, as shown at 66, to limit the downward extension of the associated piston rod.

Each leg member 19 and 20 is provided with an outwardly extending horizontal rotary valve barrel 80 formed with spaced ports 81, 82 in its bottom wall communicating with the subjacent space in the leg member. Each valve barrel is provided with a rotatable core 83 having an outer retaining disc 84 rigidly secured thereto, said disc being formed with a vent aperture 85 communicating with a passage 86 formed in the core and located so as to register with port 82 when the leg member is swung in a clockwise direction from the position shown in FIGURE 13. The inner end of each core 83 is formed with a depending conduit 87 communicating with a passage 88 formed in the core and located so as to register with the port 81 when the associated leg member is swung in a counterclockwise direction from the position of FIGURE 13. A detachably connected to each depending conduit 87 is a compressed air bottle 70 of substantial weight, acting to maintain the associated conduit 87 in a vertical position at all times. As will be apparent when the chair is tilted forwardly through a predetermined angle such as to cause ports 81 to register with the ends of passages 88, compressed air from the bottles 70 is admitted into the leg members 19 and 20, depressing their piston portions 62 and extending the piston rods 59 downwardly. Similarly, when the chair is tilted rearwardly through an angle such as to cause ports 82 to register with the ends of passages 86, ports 88 are sealed and the leg members are returned to their original position by the atmosphere until the leg members descend sufficiently relative to their piston rods 59 to restore the level condition of the chair shown in FIGURE 13.

In the normal condition of the wheelchair, namely, when the wheelchair is on level ground, the bottom rims of the leg members 19 and 20 abut the base flange portions 72 immediately adjacent to the caster assemblies 60.

In operation, when the occupant desires to ascend a series of stair steps 56, he moves the wheelchair into the position shown in FIGURE 4 so that the rearwardly projecting portions of the elliptical wheels 41 extend over the first step 56 on which the chair is to be elevated. The occupant then raises the levers 34 to their upright positions, as shown in FIGURE 4, and rotates the pinion gears 40 into meshing engagement with the internal teeth 51 of the elliptical wheels and simultaneously elevates the normal supporting wheels 38 above ground level, whereby the rear portion of the wheel chair is supported on the bottom loops 25 of the rear leg elements of the chair. The wheels 38 are then rotated upwardly, as shown in FIGURE 4, the driving rings 39 to rotate the elliptical wheels in the manner shown in FIGURES 5 and 6 so as to elevate the rear portion of the wheel chair. This causes the chair to tilt sufficiently to admit compressed air into the working spaces in the leg portions 19 and 20 of the chair so as to maintain the chair level. The elliptical wheels 41 will elevate the chair onto the successive steps and the chair will be supported in level position by the engagement of the caster wheels 61 with the preceding steps. After the series of steps have been climbed and the rear portion of the chair is on the desired upper level, the lever members 34 are returned to their horizontal positions, and the leg members 19 and 20 will be in tilted positions causing the ends of passages 86 to register with ports 82, allowing the working spaces in the leg members 19 and 20 to exhaust, so that the chair will be returned to its normal position, shown in FIGURE 1, for movement on a level surface.

In descending a flight of stairs, the caster assemblies 60 will be lowered, as required, to maintain the wheel chair level as the chair is moved downwardly along said flight of stairs. Upon reaching the bottom level, the caster assemblies 60 will be allowed to retract to their normal positions by the cooperation of the valve barrels 80 with the valve cores 83 in the manner described to exhaust the working spaces above the piston elements 62.

While a specific embodiment of an improved wheelchair has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may be made by those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. A wheelchair comprising a seat frame having depending rear supporting leg means and depending front supporting leg means, supporting wheels connected to the seat frame at its opposite sides, respective elliptical wheels slidably and pivotally connected to the opposite sides of the seat frame at the rear portion thereof and arranged in vertical longitudinal planes, means to rotate said elliptical wheels into engagement with a rearwardly adjacent stair step, whereby to elevate the rear portion of the seat frame, respective caster assemblies slidably connected to the front supporting leg means at the opposite sides of the seat frame, and means to at times extend said caster assemblies downwardly so that the seat frame may be levelled and when the rear portion thereof is raised or lowered.

2. A wheelchair comprising a seat frame having depending rear supporting leg means and depending front supporting leg means, supporting wheels connected to the seat frame at its opposite sides, respective elliptical wheels slidably and pivotally connected to the opposite sides of the seat frame at the rear portion thereof and arranged in vertical longitudinal planes, means to rotate said elliptical wheels into engagement with a rearwardly adjacent stair step so as to elevate
the rear portion of the seat frame, respective caster assemblies slidably connected to the front supporting leg means at the opposite sides of the seat frame, and means to at times extend said caster assemblies downwardly so that the seat frame may be levelled when the rear portion thereof is elevated.

3. A wheel chair comprising a seat frame having depending rear supporting leg means and depending front support legs at the opposite sides of the front portion of the seat frame, supporting wheels connected to the seat frame at its opposite sides, respective elliptical wheels slidably and pivotally connected to the opposite sides of the seat frame at the rear portion thereof and arranged in vertical longitudinal planes, means to at times drivingly connect said supporting wheels to said elliptical wheels, whereby said elliptical wheels may be rotated responsive to rotation of said supporting wheels and whereby said elliptical wheels may be rotated into engagement with a rearwardly adjacent slat step so as to elevate the rear portion of the seat frame, respective caster assemblies telescopically connected to the front supporting legs, and fluid pressure-operated means to at times extend said caster assemblies downwardly so that the seat frame may be levelled when the rear portion thereof is elevated.

4. A wheel chair comprising a seat frame having depending rear supporting leg means and a pair of depending front supporting legs, respective levers pivoted to opposite sides of said frame on aligned transverse axes, respective arms projecting from the pivoted ends of said levers, respective transverse shafts journaled in said arms, a supporting wheel secured on the outer end of each shaft, a pinion gear secured on the inner end of each shaft, respective elliptical wheels located in vertical longitudinal planes at opposite sides of said frame and having rim flanges receiving said gears, means slidably and rotatably connecting said elliptical wheels to said opposite sides of the frame, internal gear teeth on said rim flanges meshingly engageable by said gears when said levers are rotated upwardly, respective idler rollers transversely journaled on the frame forwardly adjacent and engageable by said rim flanges when said gears are moved into meshing engagement with said internal gear teeth, said arms being of sufficient length to elevate the supporting wheels when the levers are rotated upwardly to bring said rear supporting leg means into ground engagement, respective caster assemblies telescopically engaged said front supporting legs, and fluid pressure-operated means to extend said caster assemblies downwardly so that the seat frame may be levelled when its rear portion is elevated on a step by rotating said elliptical wheels thereon.

5. A wheel chair comprising a seat frame having depending rear supporting leg means and a pair of depending front supporting legs, respective levers pivoted to opposite sides of said frame on aligned transverse axes, respective arms projecting from the pivoted ends of said levers, respective transverse shafts journaled in said arms, a supporting wheel secured on the outer end of each shaft, a pinion gear secured on the inner end of each shaft, respective elliptical wheels located in vertical longitudinal planes at opposite sides of said frame, each elliptical wheel comprising an elliptical main body provided with a rim flange, said main body having a longitudinal slot, transverse pivot bolt means on the sides of the seat frame extending through said slots and slidably and rotatably connecting the elliptical wheels to the opposite sides of the seat frame, internal gear teeth on the rim flanges, said rim flanges receiving said gears and the internal gear teeth being meshingly engageable by said gears when said levers are rotated upwardly, respective caster assemblies telescopically engaging said front supporting legs, and fluid pressure-operated means to extend said caster assemblies downwardly so that the seat frame may be levelled when the rear portion thereof is elevated on a step by rotating said elliptical wheels thereon.

6. A wheel chair comprising a seat frame having depending front supporting legs and supporting wheels connected to the seat frame at its opposite sides, ground-engaging means rotatably and slidably mounted on the frame adjacent said wheels to at times elevate the frame, respective caster assemblies associated with said front supporting legs, means telescopically connecting said caster assemblies to the front supporting legs, and means to at times telescopically extend said caster assemblies downwardly so that the seat frame may be levelled when its rear portion is either raised or lowered.
9. A wheel chair comprising a seat frame having depending front supporting legs and supporting wheels connected to the seat frame at its opposite sides, ground-engaging means rotatably and slidably mounted on the frame adjacent said wheels to at times elevate the frame, respective caster assemblies associated with said front supporting legs, means telescopically connecting said caster assemblies to the front supporting legs, and fluid pressure-operated means to at times telescopically extend said caster assemblies downwardly so that the seat frame may be levelled when the wheel chair is ascending or descending a flight of stairs.

10. A wheel chair comprising a seat frame having depending front supporting legs and supporting wheels connected to the seat frame at its opposite sides, ground-engaging means rotatably and slidably mounted on the frame adjacent said wheels to at times elevate the frame respective caster assemblies associated with said front supporting legs, means telescopically connecting said caster assemblies to the front supporting legs, fluid pressure-operated means to at times move said caster assemblies downwardly so that the seat frame may be levelled when the wheel chair is ascending or descending a flight of stairs, a source of fluid pressure on the chair, and pendulum-actuated valve means connected between said source and said fluid pressure-operated means.