WHEEL CHAIR RAMP FOR AUTOMOTIVE VEHICLES

Inventors: Le Roy S. Simonelli, East Rochester; Leonard N. Randolph, Rushford; Sam Danico, Rochester, all of N.Y.

Assignee: Clover Industries, Inc., North Chili, N.Y.

Filed: May 1, 1970

Appl. No.: 33,632

U.S. Cl. .................214/75 R, 214/75 T, 214/85
Int. Cl. ..................B60p 1/46
Field of Search .......214/85, 75 R, 75 T, 14/71; 244/118 P, 129 D

References Cited

UNITED STATES PATENTS

3,176,334 4/1965 Lovdahl .................14/71
2,531,263 11/1950 Fink et al ............214/85 X
2,541,288 2/1951 Rice .................214/85
2,530,341 11/1950 Satsky ...............214/75 T

3,371,805 3/1968 Himes ..................214/75 T
3,204,791 9/1965 Williams ...............214/85

Primary Examiner—Albert J. Makay
Attorney—Shlesinger, Fitzsimmons & Shlesinger

ABSTRACT

This ramp is adapted to be permanently secured to a vehicle. Two stanchions are fixed at the two sides of a door of the vehicle. Two levers, which are pivoted at their lower ends to the stanchions carry a floor section of the ramp. To this section is hinged a second floor section; and to this second floor section is hinged the step plate or lip of the ramp. Fluid-pressure-operated pistons and cables through manually operated switches open the ramp to swing it down out of the door of the vehicle to a position where a wheel chair patient can roll his or her chair with himself or herself in it onto the ramp and into or out of the vehicle. When the patient is safely inside or outside the vehicle he can operate the switches to fold the ramp into the vehicle, and close the door.

6 Claims, 8 Drawing Figures
The present invention relates to apparatus for aiding wheel chair patients to get into and out of automobiles. It is extremely difficult with present day automobiles for a wheel chair patient to get into and out of an automobile. Usually the patient has to be lifted bodily into or out of the car by some other person. This is a burden on a friend or relative, and because of it, a wheel chair patient, particularly one who is confined to a wheel chair, gets an auto ride only in case of dire necessity.

A primary object of this invention is to provide an automotive vehicle designed to enable a wheel chair patient to get into or out of the vehicle by himself or herself without outside aid.

Another object of the invention is to provide an automotive vehicle equipped with a foldable ramp which can be unfolded to enable a wheel chair patient to roll himself or herself into or out of the vehicle unaided, and which can be folded up into the vehicle itself after use.

Another object of the invention is to provide a vehicle equipped with a foldable ramp of the character described so located that it can be operated from either inside or outside a vehicle.

A still further object of the invention is to provide a wheel chair ramp for the purpose described which in operation will move a wheel chair and a patient therein from ground level into a vehicle, or vice versa.

A further object of the invention is to provide a vehicle equipped as described in which the ramp can be folded into compact position in the vehicle, and can be quickly and smoothly moved either to open or to folded position.

Still another object of the invention is to provide a ramp attached to a vehicle for the purpose described and so constructed that it can be raised or lowered at will to bring the wheel chair to the level of the floor of the vehicle or lower it to the level of the sidewalk, for instance.

Other objects of the invention will appear hereinafter from the specification and from the recital of the appended claims, particularly when read in conjunction with the accompanying drawings.

In the drawings:

FIG. 1 is a fragmentary side elevation of an automotive vehicle built according to one embodiment of this invention, showing one of the side doors of the vehicle open and the elevating ramp in lowered position ready to receive a wheel chair;

FIG. 2 is a fragmentary side elevation of the ramp showing the wheel chair rolled thereon;

FIG. 3 is a fragmentary perspective view, illustrating part of the machine and unfolding of the ramp;

FIG. 4 is a fragmentary side elevation further illustrating the means for effecting folding and unfolding of the ramp, and showing the ramp in completely folded condition in the vehicle;

FIG. 5 is a fragmentary side elevation showing the apparatus in the first step of being unfolded;

FIG. 6 is a fragmentary sectional view on an enlarged scale illustrating a detail of the ramp;

FIG. 7 is a diagram of the hydraulic mechanism used for effecting folding and unfolding of the ramp; and

FIG. 8 is a diagram illustrating schematically the electrical wiring of the apparatus.

Referring now to the drawings by numerals of reference, 10 denotes an automotive vehicle built to practice this invention. 11 denotes one of the doors of the vehicle, and 12 another door. 14 is the steering wheel, and 15 designates the dashboard of the vehicle. These may be conventional.

Secured in the doorway of the door 11 are two parallel, spaced vertical posts or stanchions 16. Each stanchion is welded at its top to the frame 17 (FIG. 4) of the automobile, and at its bottom to the floor 18 of the vehicle. Each stanchion has a pin 19 welded to one side near its top (FIG. 1).

Pivoted mounted on the stanchions by means of pins 22 (FIG. 2) adjacent the bottoms thereof are two tubular straps 20 and 21 (FIG. 3), which are generally rectangular in cross-section.

Each of the hollow straps 20, 21 has a slot 24 (FIG. 3) in one side of it. Brackets 26, 26' are mounted to slide on the straps 20, 21. Each bracket has a plate 28 (FIG. 1) secured thereto by means of rivets 29, for instance; and each bracket carries two vertically spaced rollers 30 (FIG. 2) which engage and ride in the slot 28 of the associated strap. The bracket 26 comprises two parallel, spaced, plates, the inside plate being denoted at 27. The bracket 26' also comprises two parallel, spaced plates of which the outside one is designated 27'. Each bracket 26, 26' has a plate 32 welded to its front edge; and the two plates 32 are welded to a tread-plate 34, which extends transversely between the two brackets 26, 26' and the two side plates 32. Hinged to the front edge of the plate 34 by a hinge 35 (FIG. 5) is another tread-plate 36; and hinged to the plate 36 by means of a hinge pin 40 is a step plate 38.

FIG. 1 shows the apparatus extended to receive a conventional wheel chair 45 (FIG. 2), having the usual wheels 46 and 47, handles 48, side arms 49, seat 50, and back 52.

An elongate coiled tension spring 41 (FIG. 6) connected at one end to the plate 36 and at its opposite end to a rib 42 which is integral with ledge 38, and spring 43, which is wrapped around hinge-pin 40 and which has its opposite end engaged in holes in plates 36 and 38, respectively, tend to keep ledge 38 in extended position as shown in FIG. 6. The ledge 38, when extended is inclined as shown in FIG. 6; but the plates 34 and 36 are then preferably horizontal as shown in FIG. 2.

When a person in a wheel chair wants to get into or out of the vehicle 10, he extends the ramp or lift to the position shown in FIG. 1, and rolls, or has rolled, his wheel chair over the ramp. If he is getting into the vehicle, the ledge 38 is folded to the position shown in FIGS. 2 and 3, after the wheels 47 have rolled over ledge 38, to prevent the wheel chair from rolling back off of the carrier until the chair has been rolled into the vehicle.

The ledge 38 is moved to folded position by cables 60 and 90 (FIGS. 2 and 3). One end of cable 60 is secured underneath the tread 38. It extends through a hole 62 therein, through a hole 64 (FIG. 1) in tread 36, under rollers 66 and 68 carried by the side flanges of the treads 36 and 34, respectively, over a pulley 70, housed in the upper end of the brace 20, down under a pulley 72, whose axis extends at right angles to the axis of pulley 70, and which is journaled in the floor of the vehicle at one side of the door opening. The cable 60 extends under the floor of the vehicle to a pulley 74 (FIG. 3) journaled at the opposite side of the door opening, to rotate about an axis parallel to the axis of pulley 72, and over a first groove in a pulley 76, down to an anchor bolt 78 which is secured in a plate 80 that is fastened to the floor of the vehicle.

The pulley 76 is journaled in a yoke 82 (FIG. 3), which is carried by the upper end of a piston 84 that reciprocates in a cylinder 86 which is secured at its bottom to the plate 80 and extends upwardly therefrom.

Fastened to an anchor bolt 88, that is also secured in the plate 80, is the other cable 90. This cable extends over a second groove in the pulley 76, down under a pulley 92, which is journaled in a strap 94 that is secured to the floor of the automobile, up over a pulley 96 that is journaled in the upper end of the strap 24 down through a hole 98 in the panel 34, under this panel, and up through a hole 100 in the panel 36, and through a hole 102 (FIG. 1) in the ledge 38. Cable 90 is fastened at its outer end to the back of the ledge 38 in the same manner as the cable 60 is fastened to this ledge.

The plate 36 is folded and unfolded by operation of a piston which reciprocates in a cylinder 107 (FIGS. 1 and 5). The rod 108, which is secured to this piston, is pivotally connected at its outer end to an ear 110 (FIG. 1) attached to plate 36. Cylinder 107 is housed between plates 26' and 27' (FIG. 1) and is pivotally connected at its inner end to a yoke 112 that is fastened to the plate 34. It is mounted in the space between plates 26' and 27'. This space, and the corresponding space
between the plates 26, 27 are also adapted to receive the side flanges 114, 114", respectively, of the panel or plate 36. A cable 105 (FIGS. 1, 2 and 4), which is fastened at one end to one of the plates 32 and at its opposite end to a side flange of the plate 36, after passing through a hole in that plate, serves to limit the unfolding movement of the plate 36.

For raising the side straps 20, 21 (FIG. 1) and the parts attached thereto, that is, for folding them from the position shown in FIG. 4 to that of FIG. 5, and unfolding or lowering them again, a piston (not shown) is provided, which reciprocates in the cylinder 120 (FIG. 4). A piston rod 122 is secured to this piston at one end, and at its opposite end is pivotally connected to the strap 21. The cylinder 120 itself is pivotally mounted by means of pin 126 in the yoke 128 that is fastened to the floor of the vehicle.

For opening and closing the door 11 of the vehicle, a piston (not shown) is reciprocated in a cylinder 130 (FIG. 1). The rod 132, which is secured to this piston, is pivotally connected at its outer end to a bracket 134 that is fastened to the door 11.

The directions of movement of the pistons in the several cylinders 86, 120, 162, 130 (FIGS. 7, 1, 4, and 5), and thereby the directions of movement of the parts connected to the pistons are controlled by valves 204, 209, 201, 171, respectively, (FIG. 7) which are operated in proper sequence by solenoids 205, 240, 170, 190, 195, 200, 210, and 212 (FIG. 8). The whole mechanism is operated by a battery 140 (FIG. 8), which may be the battery supplying electrical energy for operating the lights and supplying the power for the spark of the automotive vehicle, or may be a separate battery. This battery is connected to ground by line 142.

Mounted in the inside of the vehicle on the dashboard or at any convenient location is a plurality of manually operable switches 150, 152, 154, 156, 158, 160 and 162; and mounted on one fender of the vehicle at the outside of the car is a duplicate set of these switches wired in parallel to switches 150, 152, 154, 156, 158, 160 and 162. The fender switches are indicated by the legend "Fender Switches" in FIG. 8. The purpose of these two sets of switches is to enable the folding ramp to be operated either from inside or from outside the vehicle.

To render the apparatus operative, the main line switch 144 is closed. Upon closing of any of the switches 150, 152, 154, 156, 158, 160, or 162, the magnetic solenoid switch 146 is closed, thereby starting motor 148. This drives the hydraulic pump 164 (FIGS. 7 and 8) which pumps the motive fluid from the reservoir 166 (FIG. 7) to the various hydraulically operated parts of the apparatus.

Closing of the switch 150 on the fender or of switch 158 on the dashboard or the panel near the door closes switch 146 to start the motor 148, but also closes the circuit to be supplied to the "on" position from 170 from battery 140 through line 250, now closed main line switch 144, switch 146, line 172, switch 150, lines 174, 176, solenoid 170, line 178, normally open switch 180, which is held closed, when the door of the vehicle is closed, and line 182 to ground. This shifts the valve 171 (FIG. 7) to cause the motive fluid to be supplied from pump 164 through line 173, valve 171 and line 175 to one end of cylinder 130, and to be exhausted from the opposite end of the cylinder through line 177, valve 171 and line 179. This applies the pressure fluid to the piston in cylinder 130 in the direction to cause the door to be opened.

Valve 171 is shown as a reciprocable valve, shiftable in opposite directions by solenoids 170 and 190, respectively. The pressure fluid is supplied to valve 171 by duct 173. Ducts 175 and 177 connect the valve with opposite ends, respectively, of the cylinder 130; and the duct 179 connects opposite ends of the chamber, in which the valve reciprocates, with the reservoir or sump 166. The valves 209, 204, and 201, to which reference will be made hereinafter, are of the same construction as valve 171, but have not been illustrated in detail.

When the door is fully open, the normally open limit switch 184 (FIG. 8) closes. This switch is mounted on the door frame of the vehicle.

The switch 152 may then be closed manually, so that a circuit is made from battery 140 through line 250, main line switch 144, magnetic solenoid switch 146, line 172, the closed switch 152, line 174, line 252, now closed switch 184, line 254, line 256, solenoid 195, line 258, switch 197, and line 182 to ground. Limit switch 197 is a normally open switch but is held closed, by the ramp when the ramp is folded.

Thus solenoid 195 is energized to shift valve 209 (FIG. 7) to cause the piston in cylinder 120 to pivot arms 20, 21 (FIGS. 4 and 5) upwardly and plate 36 downwardly.

When the panel-board switch 160 or the fender switch 154 is closed manually, the circuit is from battery 140 through mainline switch 144, magnetic solenoid switch 146, lines 172 and 262, switch 160, lines 264, 174 and 252, now-closed switch 184, lines 254 and 256, solenoid 195, line 258, now-closed switch 197, and line 182 to ground.

Whether fender switch 154 or dashboard switch 160 is closed, then, the solenoid 200 is energized, shifting the valve 209 (FIG. 7), which causes the motive fluid to flow from pump 164 through line 273, valve 209 and line 227 to cause the piston in cylinder 120 to move outwardly, pushing arms 20 and 21 upwardly from the position of FIG. 4 to that of FIG. 5.

In this movement rollers 230 (FIG. 2) travel in slots 28 of arms 20 and 21. At this time the motive fluid exerts on the outer end of cylinder 120 through line 229, metering valve 245, valve 209, line 228, and line 179 to the sump or reservoir 166.

When the lift or ramp is tilted out, limit switch 199 (FIG. 8) is released and opens, but limit switch 194 is closed. With switch 194 closed, a circuit is made to the solenoid 200 from battery 140 through line 250, mainline switch 144, lines 272, 274, 174, 252, now-closed switch 184, lines 254 and 276, solenoid 200, line 270, now-closed switch 194, and lines 280 and 182 to ground. Energization of solenoid 212 causes valve 201 (FIG. 7) to be shifted. This causes the motive fluid to flow from pump 164 through line 173, valve 201 and line 203, to one end of cylinder 107. The other end of this cylinder is an exhaust through line 207, valve 201 and line 179 to the sump or reservoir 166. The piston in cylinder 107 is, therefore, moved outwardly. This unfolds treadmill plate 36 (FIG. 5). Normally open limit switch 192 (FIG. 5), which has been held closed by folded plate 36, then opens.

Switch 154, 156, or 162 may now be closed. This again starts the motor 148 and also closes the circuit to the solenoid 205, the circuit being made from battery 140, through line 250, switch 144, line 272, and switch 146 to motor 148, and from switch 146 through line 172, switch 154, if the latter is closed, or through switch 156 if the latter is closed, or through line 262, switch 162 and line 264 if the last-named switch is closed, through line 264, now closed switch 184, line 254, solenoid 205, and lines 212 and 182 to ground. Energization of solenoid 205 causes valve 204 (FIG. 7), which is associated with cylinder 86 to be shifted to lower piston 84 in cylinder 86, causing lowering of plate 38 through operation of sheaves 77, 92, 96, 74, 72, 70 and cables 90 and 60 (FIG. 3). The motive fluid flows to the lower end of cylinder 86 from pump 164 through ducts 173, valve 204, and duct 223. It exhausts from this cylinder through ducts 225 and 179 to reservoir 166.

The lip 38 is raised to the correct height, by closing switch 154, 156 or 162 (FIG. 8), thereby closing a circuit to motor 173, from battery 140 through line 250, switch 144, line 272, and switch 146, and from switch 146 through line 172, switch 154, 156 or 162 as the case may be, as described above, lines 174 and 252, now-closed switch 184, lines 254 and 266, solenoid 210, line 214, now-closed, normally open switch 216 and lines 218 and 142 to ground. This shifts valve 204 (FIG. 7), causing the motive fluid to flow from the pump through line 252, and valve 204 to raise piston 84 in cylinder 86 until the lip 38 reaches the proper height. Then limit switch 216 is released and opens, breaking the circuit.

The ramp is now unfolded at the desired height. If the patient is inside the vehicle, he can operate his wheelchair to roll
it down the ramp so he can leave the vehicle. If the patient is outside the vehicle and wants to enter it, he can roll his wheel chair up the ramp into the vehicle.

When the patient has left the vehicle, or when he is inside, if he is entering the vehicle, he can fold the ramp inside the vehicle, and then close the vehicle door.

When it is desired to fold the ramp, the switch 154, 156 or 162 is closed, thereby energizing the solenoid 212 (FIG. 7), normally open limit switch 192 (FIG. 8) being at this time held closed by the ramp in its tilt-out position, the circuit being from line 172 through whichever switch 154, 156 or 162 is closed, through lines 174, 252, switch 184, lines 254 and 286, solenoid 240, line 295, now-closed switch 199 and lines 296 and 142 to ground. This shifts valve 204, causing the pressure fluid to be supplied to the cylinder 86 to fold the lift section 38.

Limit switch 192 is held closed by the lift in its tilt-out position. When the fold action of the lift is completed, the limit switch 192 is released and opens, and the limit switch 194 is closed causing the oil to flow to the outer end of the cylinder 107 to tilt the lift from the position shown in FIG. 5 to that in FIG. 4.

When the tilt-in action of the lift is completed, the limit switch 180 opens and the switch 230 is closed, making a circuit which will permit closing the door when switch 150 is closed. Closing the switch 150 starts the motor and also closes the solenoid 190 causing oil to flow to the door cylinder 130, closing the door. Closing switch 150 (FIG. 8) closes a circuit from battery 140 through switch 144, and switch 146 to motor 148 to drive pump 164, and also closes a circuit from switch 146 through line 172, switch 150, and lines 174 and 176, solenoid 190, line 294, now-closed switch 230, and line 142 to ground. The pressure oil flows from the pump through line 173, valve 171 and line 177 to the door cylinder 130; and the other end of this cylinder is on exhaust through duct 175, valve 171 and lines 297 and 179. When the door closes, the limit switch 184 is released and opens, opening all circuits but the door circuit.

The switches 150, 152, 154, and 156 may be mounted on the fender of the vehicle in a recess, as shown in FIG. 1. The switches 158, 160 and 162 may be mounted on the dashboard of the vehicle.

In use, if the patient is outside the vehicle, he can press the switches 150, 152, 154 and 156 to cause the door to be opened, and the lift to be unfolded and extended out of the door opening. Then he can roll his wheel chair over the incline 38 onto the plates 36 and 34 as shown in FIG. 2 and into the vehicle. He or she can then push the buttons 158, 160 and 162 to cause the lift to be folded into the vehicle, and then push the button 150 to close the door of the vehicle. The wheel chair patient can then drive the vehicle off. When he wants to leave the vehicle he can push the buttons 158, 160, 162 on the dashboard to open the door, and unfold the ramp. He can then manipulate the wheels of his chair to roll the chair down the ramp out of the vehicle. With a vehicle equipped with the ramp and control apparatus of the present invention, then, the wheel chair patient is self-sufficient so far as getting into or out of a vehicle is concerned; he does not have to depend on someone else to help him get into or out of a vehicle. Moreover, when he is in the vehicle he can drive the vehicle himself. Thus a wheel chair patient has a great deal more freedom in travel than has heretofore been possible. He can go and come in an automobile at his own pleasure, and in his own good time.

Having thus described our invention, what we claim is:

1. The combination with an automotive vehicle having a door opening therein, of a foldable and extensible ramp comprising a plurality of floor sections hingedly connected together, means in said door opening for supporting said ramp, and means operable selectively to fold said ramp into said vehicle through said opening and extend said ramp out of said opening, said supporting means comprising a pair of vertically extending posts disposed, respectively, at opposite sides of said door opening, and two lever arms, each pivotally connected at one end to one of said posts, respectively, and swingable in parallel paths from a lower position adjacent and approximately parallel to the floor of the vehicle to an erected position approximately parallel to said posts, and said ramp comprising a first floor section slidably mounted on said lever arms, a second floor section hingedly connected to said first floor section, and a lip hingedly connected to said second floor section, and means for pivoting said arms on said posts, means for selectively raising and lowering said first floor section, means for hinging said second floor section on said first floor section, and means for hinging said lip on said second floor section.

2. The combination claimed in claim 1, wherein said means for pivoting said arms on said posts, said means for raising and lowering said first floor section, said means for hinging said second floor section on said first floor section, and said means for hinging said lip on said second floor section are operable separately and independently of one another.

3. The combination claimed in claim 2, wherein said several means are all operated by electrically controlled means, including separate manually operable electric switches.

4. The combination claimed in claim 3, wherein said electrically operated means includes, in the case of said means for pivoting said arms, a cylinder pivotally connected to the floor of the vehicle, a piston reciprocable in said cylinder and pivotally connected at its outer end to one of said arms, and a solenoid-operated valve for controlling the direction of flow of motive fluid to said cylinder to control the direction of movement of said piston in said cylinder, and thereby the direction of swing of said arms.

5. The combination claimed in claim 3, wherein said electrically operated means includes, in the case of said means for hinging said second floor section on said first floor section, a cylinder pivotally connected to said first floor section, a piston reciprocable in said cylinder and pivotally mounted at its outer end to said second floor section, and a solenoid-operated valve for controlling the direction of flow of motive fluid to said cylinder to control the direction of movement of said piston in said cylinder, and thereby the direction of hinging movement of said second floor section on said first floor section.

6. The combination claimed in claim 3, wherein said electrically controlled means includes, in the case of said means for hinging said lip on said second floor section, a vertically disposed cylinder, a piston reciprocable in said cylinder, a sheave carried by said piston on the upper end thereof, a cable secured at one end to the floor of the vehicle and secured at its opposite end to said lip, and a solenoid-operated valve for controlling the direction of flow of motive fluid to said cylinder to control the direction of movement of said piston in said cylinder, and thereby the direction of hinging movement of said lip on said second floor section.