United States Patent

Simonelli et al.

[15] **3,651,965**

[45] **Mar. 28, 1972**

[54] WHEEL CHAIR RAMP FOR AUTOMOTIVE VEHICLES

[72] Inventors: **Le Roy S. Simonelli**, East Rochester; **Leonard N. Randolph**, Rushford; **Sam Damico**, Rochester, all of N.Y.

[73] Assignee: **Clover Industries, Inc.**, North Chili, N.Y.

[22] Filed: **May 1, 1970**

[21] Appl. No.: **33,632**

[52] **U.S. Cl.** .....**214/75 R**, 214/75 T, 214/85

[51] **Int. Cl.**.....**B60p 1/46**

[58] **Field of Search**.....214/85, 75 R, 75 T; 14/71; 244/118 P, 129 D

[56] **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
3,516,559	6/1970	Walter	214/75 R
3,371,805	3/1968	Himes	214/75 T
3,204,791	9/1965	Williams	214/85

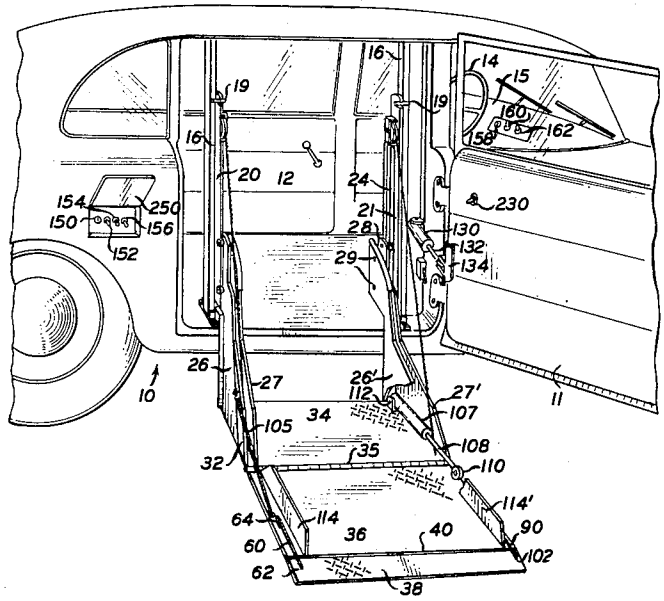
Primary Examiner—Albert J. Makay

Attorney—Shlesinger, Fitzsimmons & Shlesinger

[57] **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 chain 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



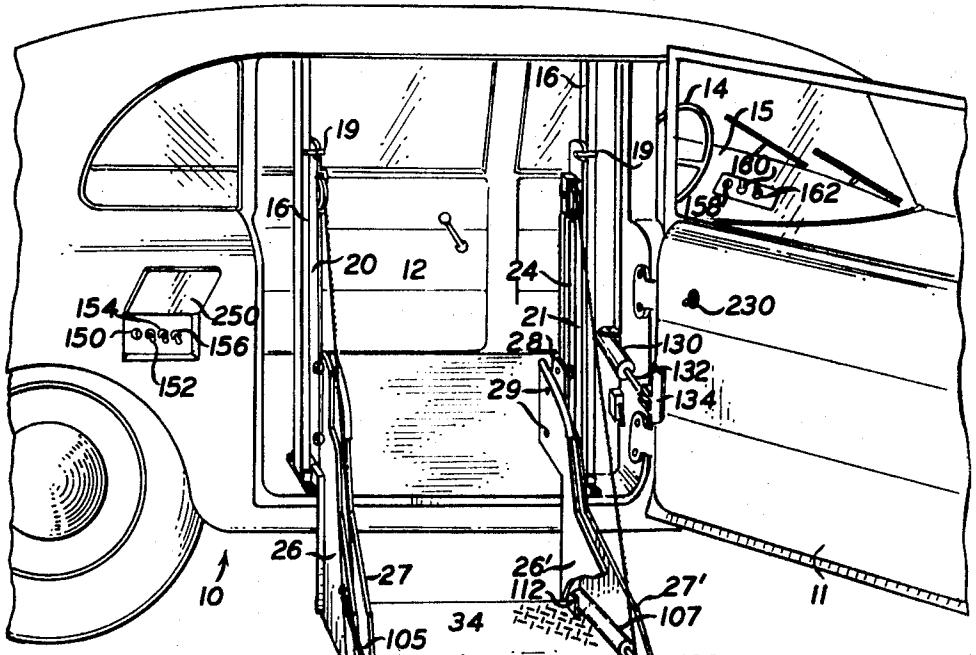


FIG. 1

FIG. 2

INVENTORS
LEROY S. SIMONELLI
LEONARD B. RANDOLPH
SAM DAMICO
BY
Shleinger, Fitzsimmons & Shleinger
Attorneys

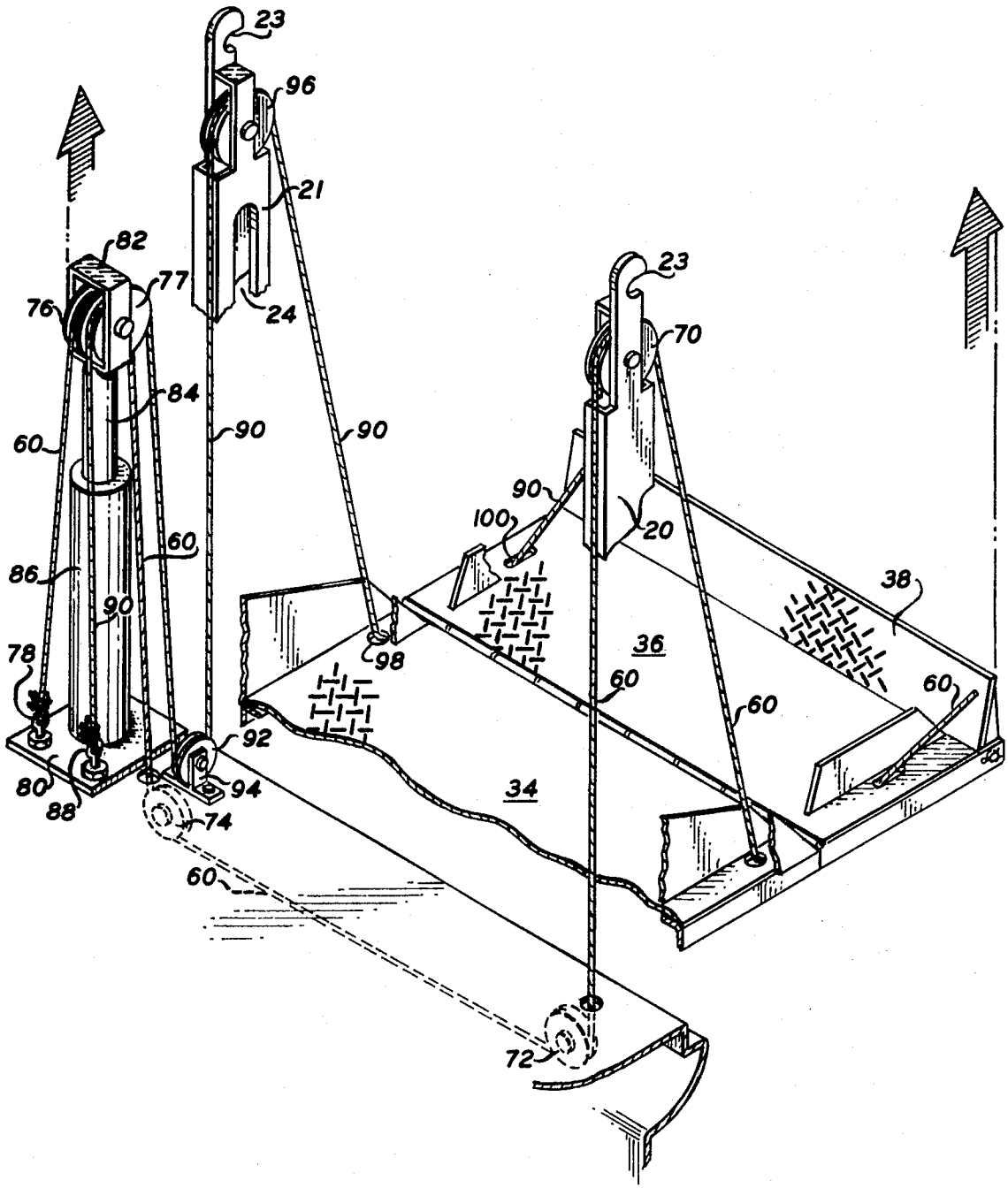


FIG. 3

INVENTORS
LEROY S. SIMONELLI
LEONARD B. RANDOLPH
SAM DAMICO
BY
Shlesinger, Fitzsimmons & Shlesinger
Attorneys

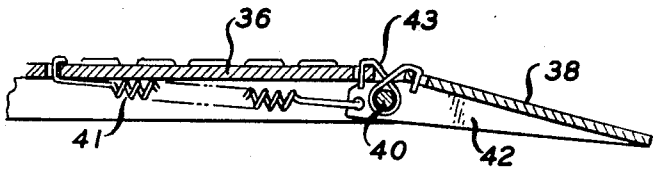


FIG. 6

FIG. 5

FIG. 4

INVENTORS
LEROY S. SIMONELLI
LEONARD B. RANDOLPH
SAM DAMICO
BY Schwinger, Fitzsimmons & Schwinger
Attorneys

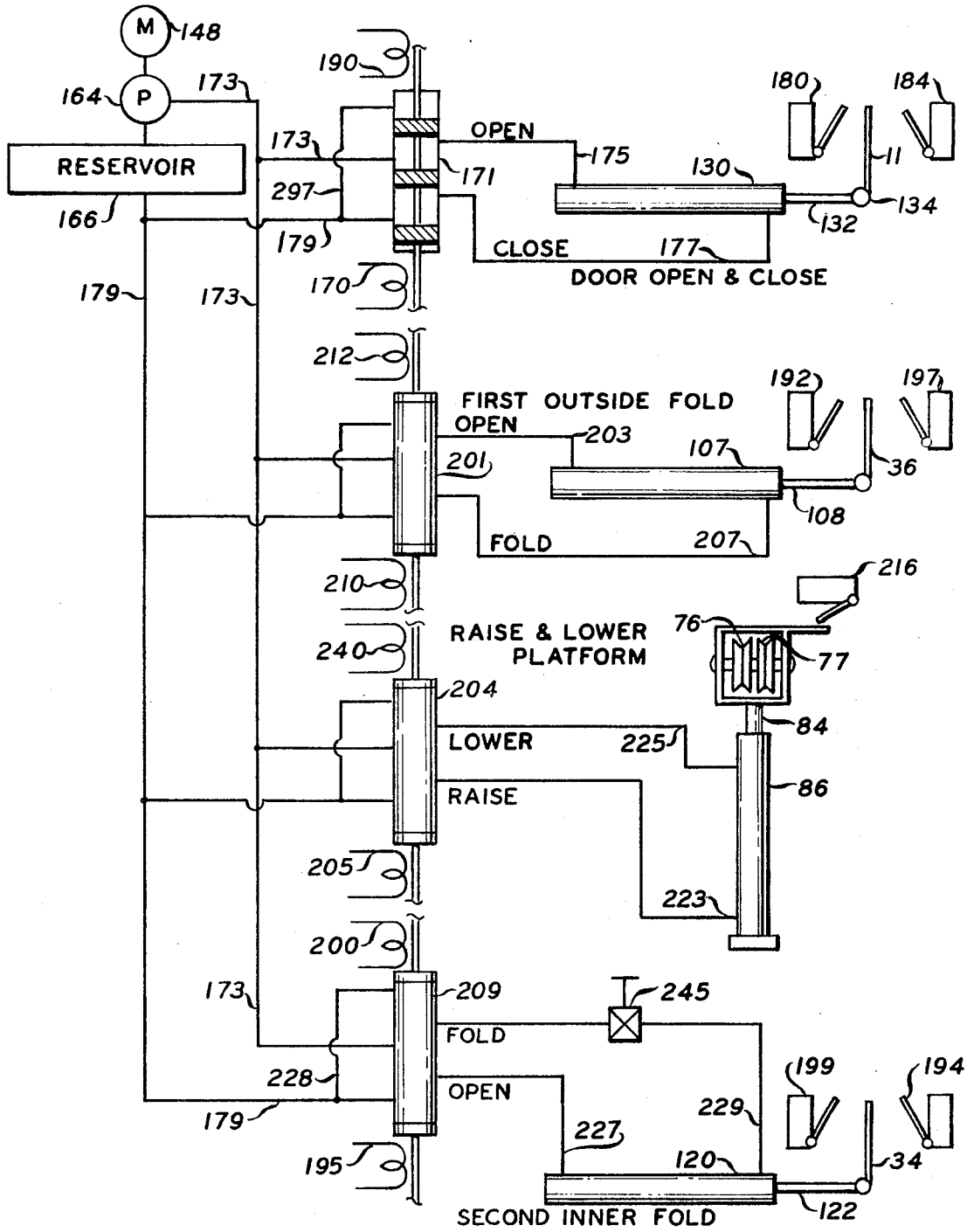


FIG. 7

INVENTORS
LEROY S. SIMONELLI
LEONARD B. RANDOLPH
SAM DAMICO
BY
Schlesinger, Fitzsimmons & Schlesinger
Attorneys

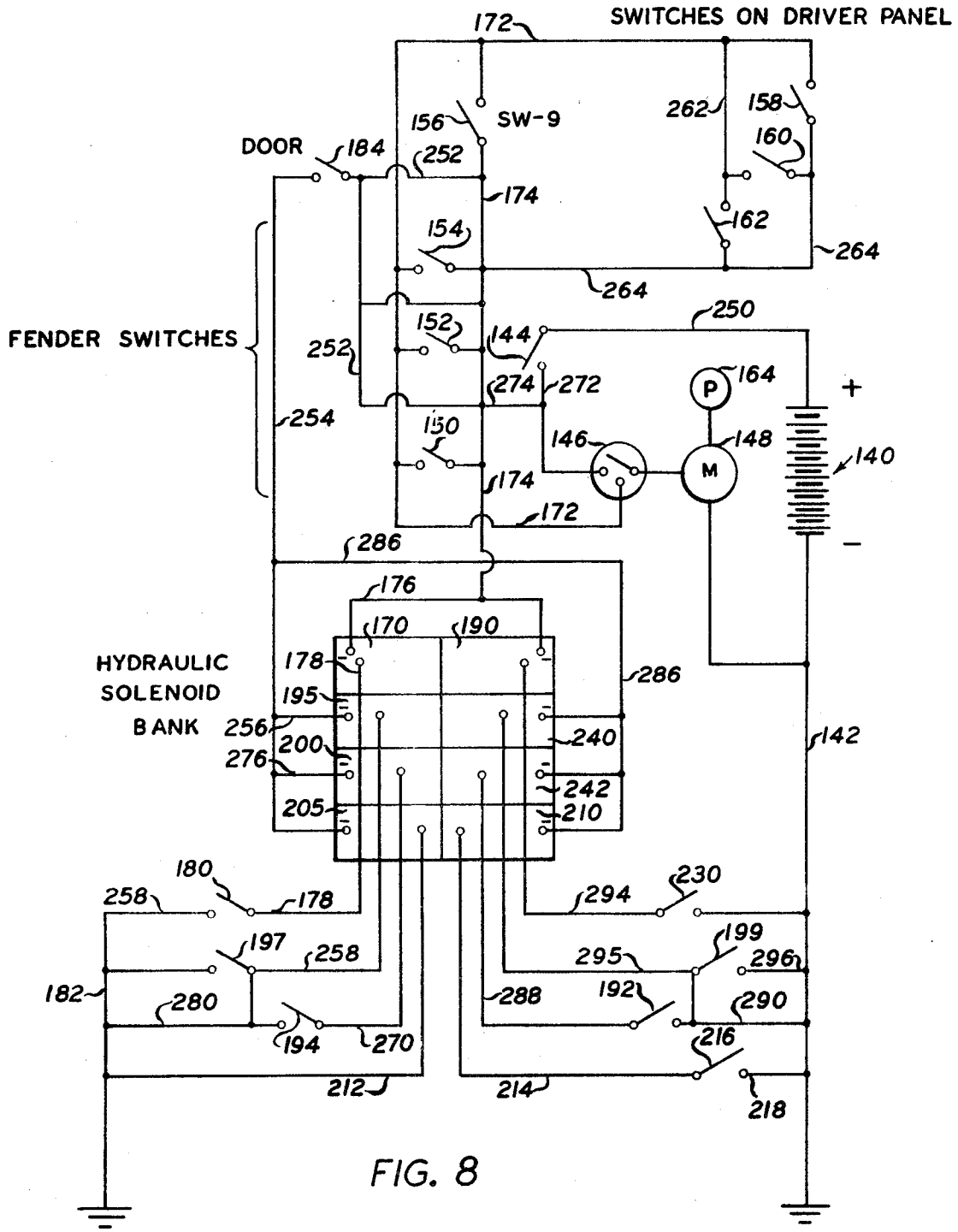


FIG. 8

INVENTORS
LEROY S. SIMONELLI
LEONARD B. RANDOLPH
SAM DAMICO
BY Schlesinger, Fitzsimmons & Schlesinger
Attorneys

WHEEL CHAIR RAMP FOR AUTOMOTIVE VEHICLES

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 means for folding 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).

Pivotally 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 side 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 a coil 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 the panel **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, 107, 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 driver panel not only closes switch 146 to start the motor 148, but also closes the circuit to the solenoid 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 34 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 173, 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 30 (FIG. 2) travel in slots 28 of arms 20 and 21. At this time the motive fluid exhausts from 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 on 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 tread 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 lines 174 and 252, 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 duct 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 148 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 286, 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 173, 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 wheel chair 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.

* * * * *