

[54] AUTOMATIC LIFT APPARATUS

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Related U.S. Application Data

[63] Continuation of Ser. No. 260,906, June 8, 1972, abandoned.

[52] U.S. Cl. 214/75 G, 292/201

[51] Int. Cl. B60p 1/44

[58] Field of Search 214/75 R, 75 G, 75 T; 70/279, 280, 281, 277; 292/144, 201; 49/326, 357, 360; 296/146, 155

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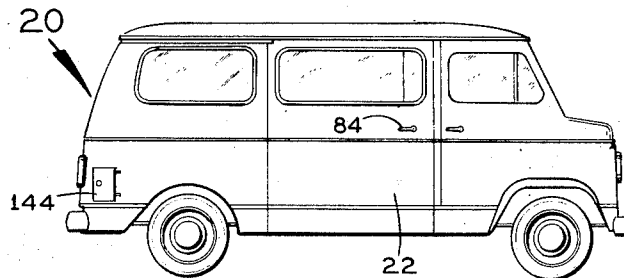
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[57] ABSTRACT

Automatic lift apparatus for an automotive vehicle such as a van to be used by a disabled person in a wheel chair. The apparatus includes separate drive systems for operating a lift platform, a door latch and a door of the vehicle. The drive systems include electric motors which are powered by the battery of the vehicle and controls which are actuated by the disabled person from his wheel chair. In a particular embodiment, one set of controls is provided outside the vehicle, and another set is provided with the lift platform so that the occupant of a wheel chair can unlatch and open the door of the vehicle and be lifted into the vehicle without leaving his wheel chair. Likewise, he can unlatch and open the door from inside the vehicle and be lowered to the ground without leaving his wheel chair.

1 Claim, 10 Drawing Figures



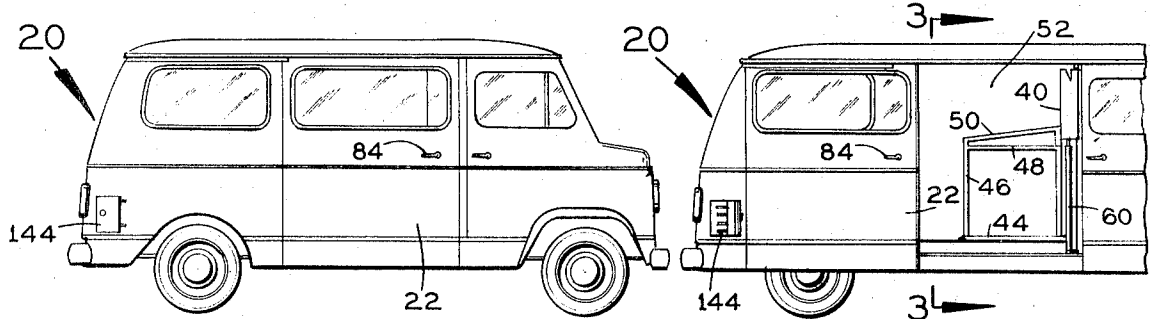


FIG. 1

FIG. 2

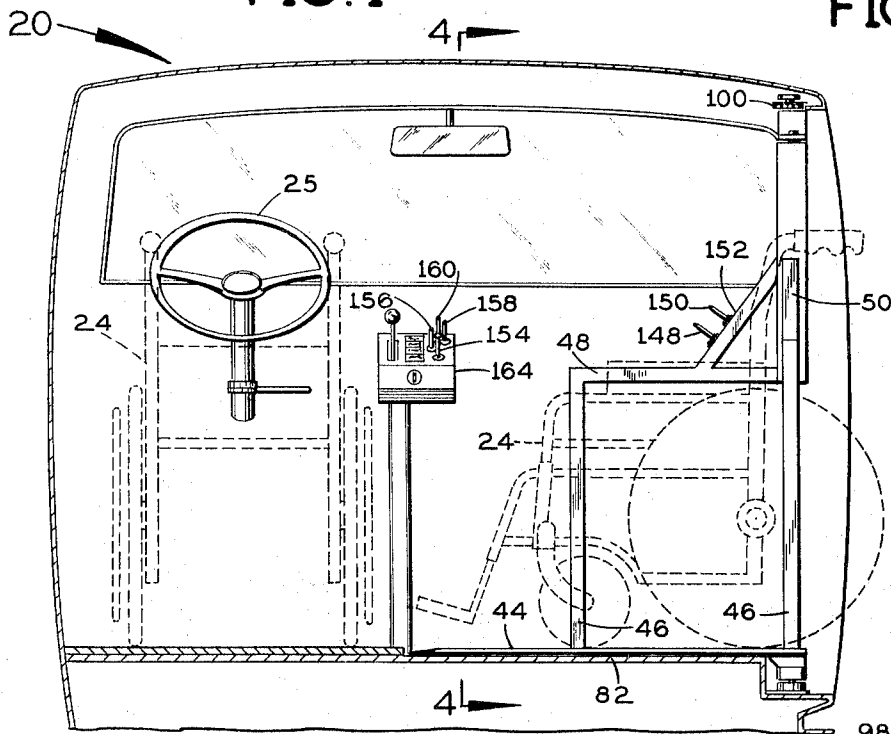


FIG. 3

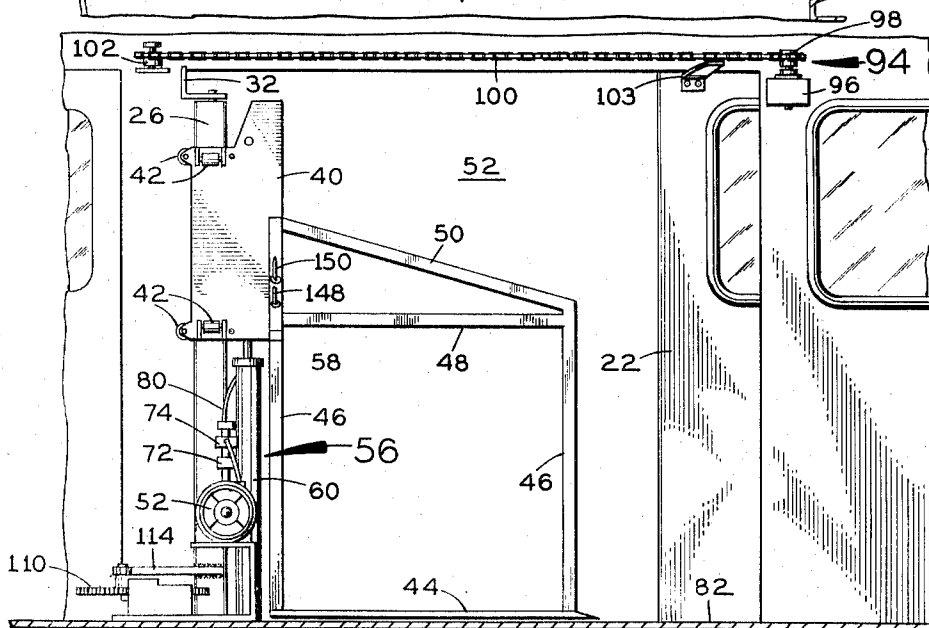


FIG. 4

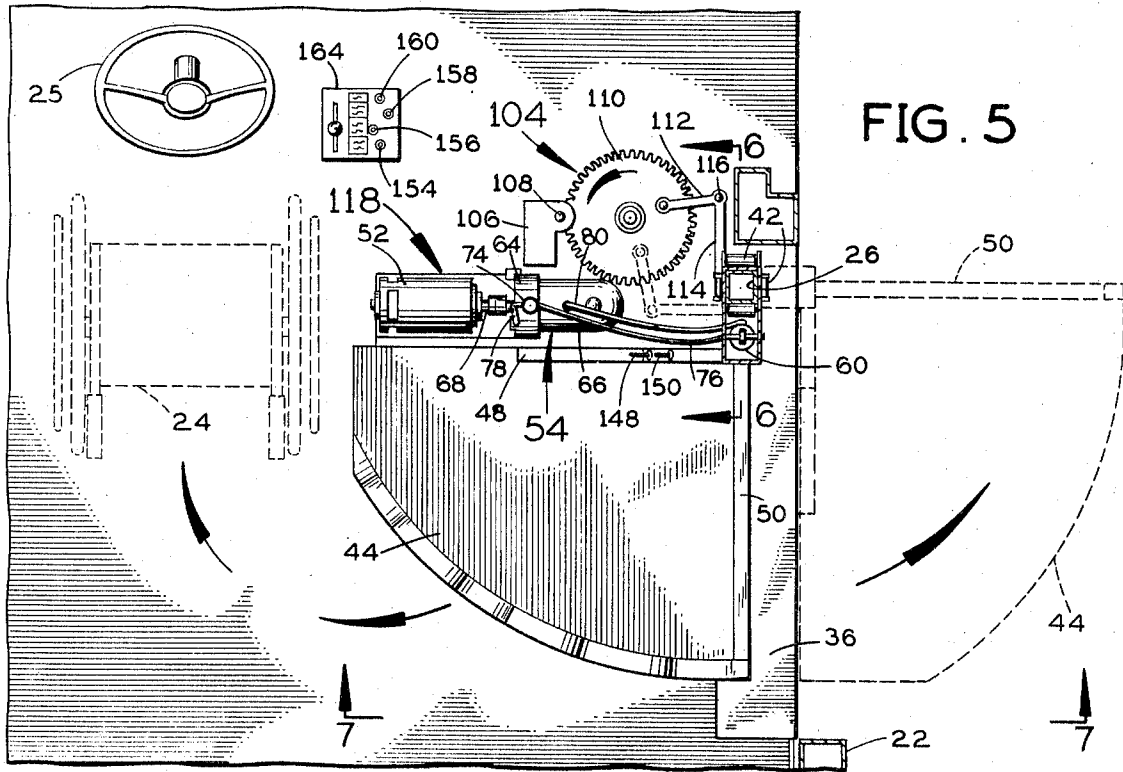


FIG. 5

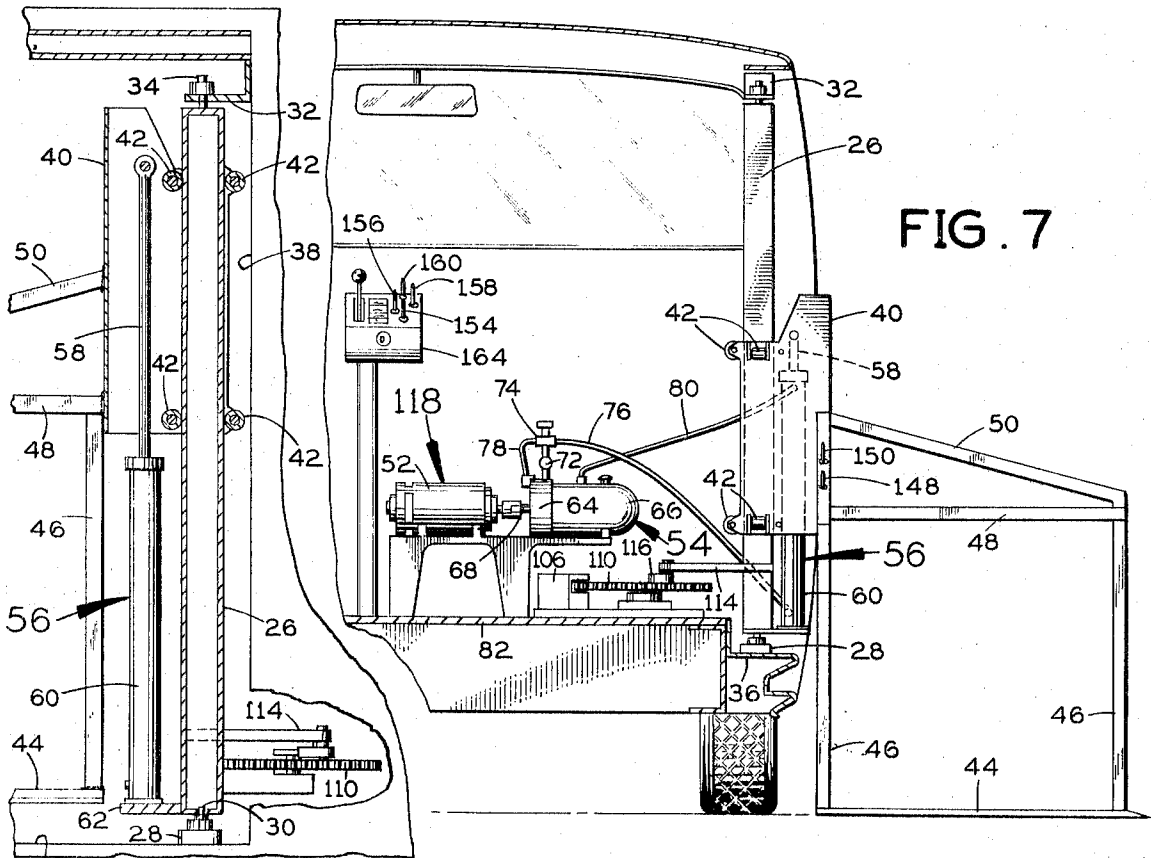


FIG. 7

FIG. 6

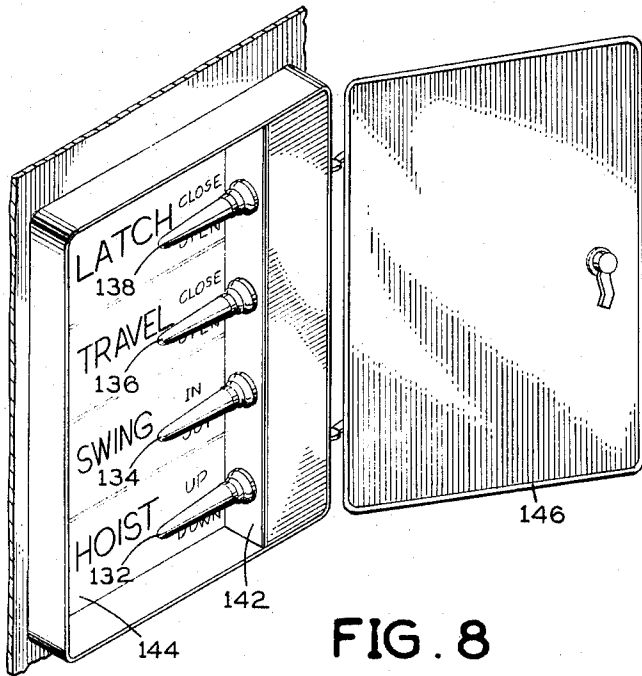


FIG. 8

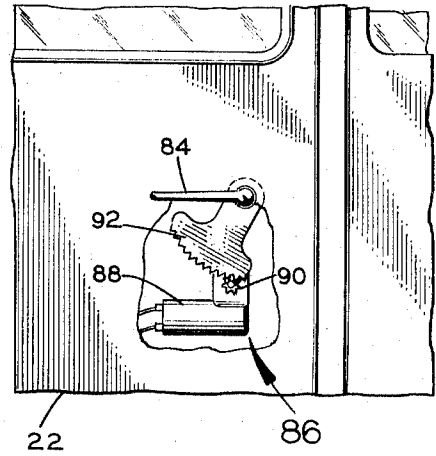


FIG. 9

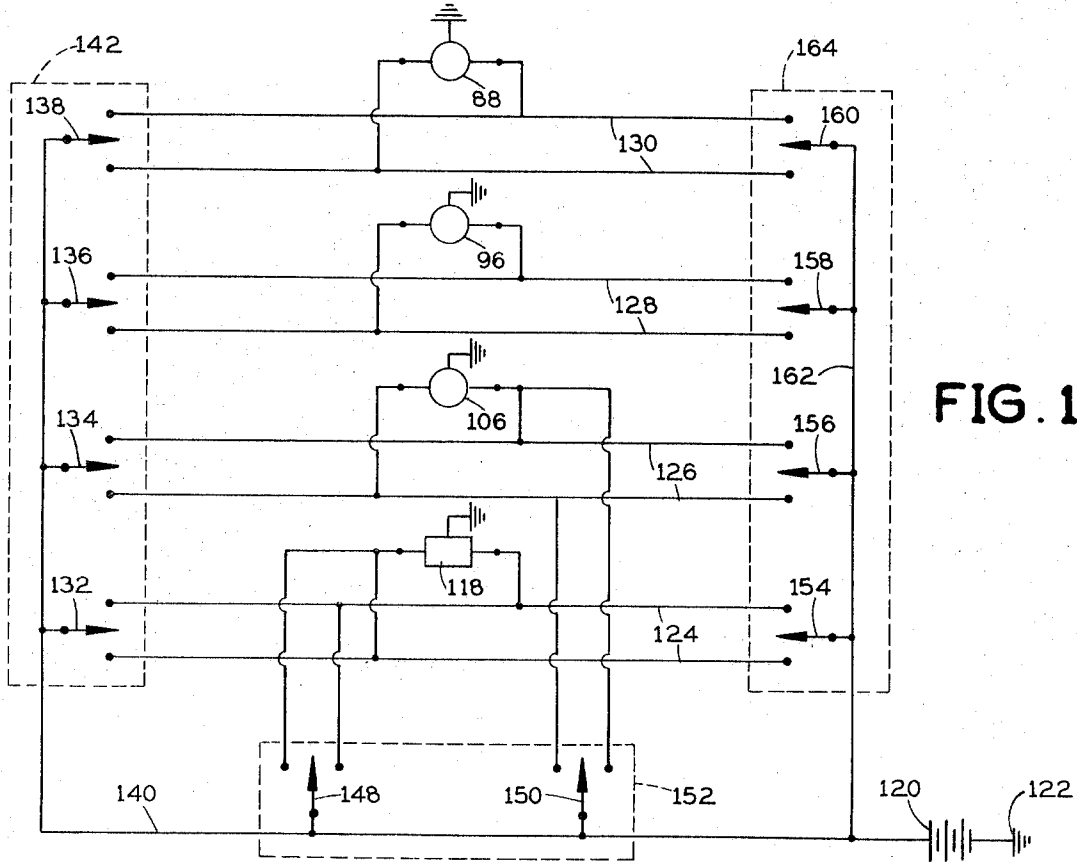


FIG. 10

AUTOMATIC LIFT APPARATUS

RELATED PATENT

This application is a continuation of our earlier-filed, 5
 copending U.S. Pat. application, Ser. No. 260,906,
 filed June 8, 1972, now abandoned.

This invention is an improvement over the invention
 described and claimed in U.S. Pat. No. 3,204,791 issued
 on Sept. 7, 1965 to C. E. Williams, one of the 10
 present inventors.

BACKGROUND OF THE INVENTION

Disabled persons such as paraplegics and quadraplegics
 who depend on a wheel chair usually have difficulty 15
 in entering and leaving an automotive vehicle. Some
 paraplegics can transfer themselves from a wheel
 chair into the driver's seat of a vehicle, collapse their
 chair and put it in the vehicle. It is usually not possible
 for quadraplegics to perform these acts since use of 20
 both the hands and legs is severely limited. Neverthe-
 less, it would be advantageous to both paraplegics and
 quadraplegics to be able to drive themselves without
 the help of an attendant and to enter and leave the ve-
 hicle without the help of an attendant. Thus, there has
 been a need for apparatus with which the occupant of
 a wheel chair could enter, operate and leave an auto-
 motive vehicle while staying in his wheel chair.

SUMMARY OF THE INVENTION

The present invention provides automatic lift apparatus
 for an automotive vehicle with which a disabled
 person in a wheel chair can automatically unlatch and
 open the door of a vehicle, be raised into the vehicle on
 a lift, and after driving the vehicle, unlatch and open 35
 the door of the vehicle and be lowered to the ground,
 all without leaving his wheel chair. A lift platform is
 movable vertically and horizontally relative to a support
 inside the vehicle, and the lift platform is normally
 located in the vehicle. Separate drive systems are pro-
 vided for moving the lift platform vertically and hori-
 zontally. A drive system is provided for latching and
 unlatching a door of the vehicle, and another drive sys-
 tem can be operated to open and close the door. The
 drive systems preferably include electric motors which
 can be operated by means of controls such as switches.
 In a preferred embodiment, one set of switches is
 mounted outside the vehicle, and another set of
 switches is mounted on or adjacent the lift platform.
 When the disabled person wishes to enter the vehicle,
 he wheels his chair up to the exterior switches and op-
 erates them successively to unlatch the door, open the
 door, swing out the platform, and lower the platform.
 He then wheels his chair onto the platform, and oper-
 ates the switches associated with the platform to raise
 himself up to the floor of the vehicle and swing himself
 into the vehicle without leaving his chair. The vehicle
 has no driver's seat, so he wheels himself to a position
 under the steering wheel where he can drive the vehicle
 while sitting in his wheel chair. When he wishes to leave
 the vehicle, he operates another set of switches inside
 the vehicle, preferably located either with the lift plat-
 form or on a panel beside the steering wheel. With
 these switches he unlatches the door of the vehicle,
 opens the door, swings himself outside the vehicle, and
 lowers himself to the ground. By again operating the
 exterior switches, he returns the lift platform to the ve-

hicle and closes the door. Thus, the automatic apparatus
 of the invention enables a disabled person who has
 only very limited use of his hands and legs to operate
 an automotive vehicle including entering and leaving
 the vehicle without the help of an attendant, all without
 leaving his wheel chair.

Accordingly, it is an object of the present invention
 to provide apparatus for assisting a disabled person in
 a wheel chair to enter and leave a vehicle while staying
 in the wheel chair.

Another object of the invention is to enable a person
 in a wheel chair to enter and leave a vehicle while stay-
 ing in his wheel chair and without the assistance of an
 attendant.

A further object of the invention is to equip a vehicle
 with apparatus which can be operated automatically by
 a person in a wheel chair to operate a door and lift plat-
 form so that the person can be raised into and lowered
 out of the vehicle in his wheel chair.

Another object of the invention is to provide a lift for
 a vehicle which can be automatically raised and lower-
 ed and also moved horizontally in and out of a door
 of the vehicle.

Another object of the invention is to provide apparatus
 which includes a drive system for latching and unlatch-
 ing a door of the vehicle and another drive system for
 opening and closing the door of the vehicle.

A further object of the invention is to enable a person
 in a wheel chair to be lifted into a vehicle and lowered
 out of a vehicle merely by operating switches or equivalent
 controls located at convenient positions on the ve-
 hicle.

Other objects of this invention will appear from the
 following description and appended claims, reference
 being had to the accompanying drawings forming a part
 of this specification wherein like reference characters
 designate corresponding parts in the several views.

FIG. 1 is an elevational view of an automotive van
 provided with automatic lift apparatus in accordance
 with one embodiment of the invention;

FIG. 2 is a fragmentary elevational view of the van of
 FIG. 1 showing a sliding door of the van in an open po-
 sition;

FIG. 3 is a cross sectional view through the van taken
 along line 3—3 of FIG. 2 and looking in the direction
 of the arrows;

FIG. 4 is a fragmentary sectional view of the van
 taken along the line 4—4 of FIG. 3 and looking in the
 direction of the arrows;

FIG. 5 is a fragmentary plan view looking down on
 the inside of the van;

FIG. 6 is a fragmentary vertical sectional view taken
 along line 6—6 of FIG. 5 and looking in the direction
 of the arrows;

FIG. 7 is a fragmentary vertical sectional view taken
 along line 7—7 of FIG. 5 and looking in the direction
 of the arrows;

FIG. 8 is a perspective view of a control panel
 mounted on the outside of the vehicle including a set
 of switches for automatically operating the lift apparatus;

FIG. 9 is a fragmentary view of a door latch for a
 door of the vehicle showing part of the door broken
 away; and

FIG. 10 is a schematic diagram of a control circuit for
 the automatic lift apparatus.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

The invention is illustrated herein as applied to an automotive van 20 having a sliding door 22. A particular embodiment of the invention has been installed on a Chevrolet sliding door van, 10 Series. However, it will be understood that the invention may be applied to other vehicles.

In the van 20, the driver's seat is removed so that a wheel chair 24 (shown in dashed lines) can be positioned under the steering wheel. The van is especially equipped to enable the occupant of the wheel chair to drive the vehicle while seated in the wheel chair 24 even though the driver may be partially disabled. Preferably, the van 20 has power brakes, power steering, and automatic transmission, and suitable controls are provided in known manner (not shown) to enable the occupant of the wheel chair to drive the van. The invention is not specifically directed to these driving controls, so they are not illustrated herein.

A support 26 in the form of a squared tubular post is mounted inside the vehicle. The support post 26 is best seen in FIG. 6. Support post 26 is rotatably mounted on a base 28 having a pivot pin 30 receiving the lower end of the post, and an upper bracket 32 receiving a pivot pin 34 extending from the upper end of the post. The base 28 is mounted on the door step 36 of the van, and the bracket 32 is attached to a door post 38 so that the post 26 is located inside the vehicle.

A carriage 40 is movable vertically up and down the support post 26, and has wheels 42 which ride on the support post 26. A lift platform 44 is mounted on the carriage 40 by means of bracing members such as 46, 48 and 50 which are welded to the carriage 40. The bracing members form a frame suspending the lift platform 44 from the carriage 40 such that the carriage, frame and platform can move together up and down the support post 26. The carriage, frame and platform are also movable horizontally in and out of the doorway 52 when the door 22 is open since the support post 26 is rotatable relative to the base 28 and the bracket 32.

A first drive means is provided for raising and lowering the lift platform 44. This first drive means includes an electric motor 51, a hydraulic pump and reservoir unit 54, and a hydraulic lifter 56. The hydraulic lifter 56 may be a hydraulic piston and cylinder device wherein the piston rod 58 (FIG. 6) is attached to the carriage 40, and the cylinder 60 is mounted on a shelf 62 which is welded to and extends out from the lower end of the support post 26. The unit 54 includes a pump section 64 and a reservoir section 66. The pump 64 has a shaft 68 which is coupled to and driven by the electric motor 51.

The pump section 64 of the unit 54 has an output line 70 leading through a check valve 72 to a solenoid valve 74. From solenoid valve 74, a line 76 leads to the lower end of the cylinder 60, and another line 78 leads back to the pump section 64. From the top of the cylinder 60, a return line 80 leads back to the reservoir 66.

In order to raise the lift platform 44, the motor 52 is started. The solenoid valve 74 initially directs hydraulic fluid from pump 64 through lines 70 and 76 to the bottom of the cylinder 60. The fluid is prevented from returning by check valve 72. The pressure of this fluid causes the piston rod 58 to rise, and this in turn pushes the carriage 40 and platform 44 upward. When the piston rod is fully extended, an overload switch in the motor 52 causes the motor to stop. If any hydraulic fluid leaks past the piston inside the cylinder 60, excess hydraulic fluid returns through line 80 to the reservoir 66.

In order to lower the platform 44, the solenoid valve 74 is actuated so as to direct fluid through line 78 back to the pump 64. Hydraulic fluid then returns from the bottom of the cylinder 60 back through lines 76 and 78 to the pump section 64 of unit 54. The platform 44 can then gradually settle either to the floor 82 of the van, or to ground level where it is shown in FIG. 7.

Referring to FIG. 9, it may be seen that the latch 84 of the door 22 is provided with a drive means 86 which will be referred to as the second drive means of the apparatus. The drive means 86 includes a reversible electric motor 88 operatively coupled by a gear 90 to a gear segment 92 which is connected to the latch handle 84. The motor 88 is operated in one direction to turn gears 90 and 92 so as to unlock the latch 84. The motor 88 is operated in the reverse direction to reversely rotate the gears 90 and 92 and lock the latch 84. Suitable controls for the motor 88 will be described later.

Referring to FIG. 4, it may be seen that a third drive means 94 is provided for opening and closing the door 22. This drive means includes another reversible electric motor 96 which rotates a sprocket 98 which in turn rotates a chain 100 looped around another sprocket 102 mounted at the other side of the doorway 52. The door is connected to chain 100 by arm 103. The motor 96 is operated in one direction to open the door and in the reverse direction to close the door. A suitable control for the motor 96 will be described later.

A fourth drive means for moving the platform 44 in and out of the doorway 52 is shown particularly in FIG. 5. The fourth drive means 104 includes a reversible electric motor 106 that is operatively coupled by a gear 108 to another gear 110. A crank consisting of arms 112 and 114, which are pivotally connected together at 116, connects the gear 110 to the support post 26. Arm 112 is connected to the gear 110, and arm 114 is attached to the support post 26. The motor 106 is driven in one direction to turn gears 108 and 110 counterclockwise as viewed in FIG. 5 in order to rotate support post 26 and swing the lift platform 44 out through the doorway 52. Conversely, the motor 106 is operated in the reverse direction to swing the platform 44 back inside the van.

FIG. 10 shows the controls and control circuit for operating the various drive means respectively. The motor 52 and solenoid valve 74 are represented by a box 118, and the motors 88, 96 and 106 are shown schematically. The battery 120 of the vehicle is shown in FIG. 10, and it has one side grounded at 122. Each of the motors of the system also has one side grounded.

There are four pairs of operating circuits designated 124, 126, 128 and 130. Four switches 132, 134, 136 and 138 are provided respectively for the four circuit pairs 124, 126, 128 and 130. The four switches just re-

ferred to are connected by a line 140 to the positive side of the battery 120. These four switches may be mounted together on a panel such as panel 142 shown in FIG. 8, and the panel is enclosed in a box 144 having a door 146. The box 144 may be mounted on the outside of the vehicle 20, for example, at the right rear side of the vehicle as shown in FIGS. 1 and 2.

Referring to FIG. 3, it may be seen that two additional switches 148 and 150 are mounted on or adjacent to the frame of the lift platform 44. Referring to FIG. 10, the switches 148 and 150 are provided on a lift panel 152, and they are connected by line 140 to the positive side of the battery 120. Switch 148 is operated to select between the two circuits of circuit pair 124, and switch 150 is used to select between the two circuits of circuit pair 126.

Optionally, the switches 132, 134, 136 and 138 may be duplicated by another set of switches 154, 156, 158 and 160. These latter switches are connected by a line 162 to the positive side of the battery 120. The switches may be mounted on a panel 164 which is installed next to the steering wheel 25 of the vehicle. The switches are used to select between the two circuits of circuit pairs 124, 126, 128 and 130 respectively.

In describing the operation of the lift apparatus of the invention, it will be assumed that the platform 44 is initially inside the van 20, and the door 22 is initially closed. It will also be assumed that the person who is to drive the van is in his wheel chair outside the vehicle.

The person wheels his chair up to the box 144 at the right rear side of the van 20, and opens the door 146. He first pushes switch 138 down to operate the motor 88 in a direction so as to open or unlock the latch 84 of the door 22. After the door is unlatched, the operator pushes switch 136 down to operate motor 96 in a direction so as to open the door 22. With the door open, he pushes the switch 132 up momentarily to raise the platform 44 slightly. The operator can then push switch 134 down to operate motor 106 in a direction so as to swing the platform 44 out of the vehicle. Next, the operator pushes switch 132 down, and this operates solenoid valve 74 in drive means 118 in a sense so as to allow hydraulic fluid to flow from the bottom end of cylinder 60 back through lines 76 and 78 to the pump 64. This in turn allows the platform 44 to settle to the ground to the position shown in FIG. 7.

The person can then wheel his chair onto the platform 44. Once on the platform, he pushes switch 148 up (to the right as shown in FIG. 10), and this starts motor 52 in drive means 118 so as to pump hydraulic fluid back into the cylinder 60 and raise the platform 44. Once the platform reaches its maximum height, the motor 52 stops. The person then pushes switch 150 up (to the right as shown in FIG. 10) to drive motor 106 in a direction so as to swing the platform 44 inside the van. He then pushes switch 148 down (to the left as viewed in FIG. 10) to lower the platform 44 onto the floor 82 of the vehicle.

The operator then wheels his chair from the platform 44 to the steering wheel 25 as shown in FIG. 3. The wheel chair 24 can be locked in position under the steering wheel by providing a suitable clamping arrangement (not shown) adjacent to the steering wheel for holding the chair in place.

In order to lower the platform 44 to the ground, either for the purpose of lowering his wheel chair to the

ground, or moving the platform down so as to bring another wheel chair occupant into the van, the operator utilizes the switches on the panel 164 next to the steering wheel 25. He pushes switch 160 down to unlatch the door, and pushes switch 158 down to open the door. If he is going to lower the platform so as to accept another wheel chair occupant, he pushes switch 154 to raise platform 44 slightly, then he operates switch 156 down to swing the platform out of the vehicle, and he pushes switch 154 down to lower the platform. On the other hand, if he is going to lower himself out of the vehicle, he pushes switch 148 up to raise the platform, then pushes switch 150 down (to the left as viewed in FIG. 10) to swing the platform out of the vehicle, and pushes switch 148 down (to the left as viewed in FIG. 10) to lower the platform.

Thus, the apparatus of the invention is particularly helpful to a disabled person in a wheel chair, and enables to enter and leave a vehicle while staying in his wheel chair and without the help of an attendant. The apparatus is rugged and reliable, and it can be installed in commercially available vehicles such as vans. The door of the van is latched and unlatched and also opened and closed automatically when the person operates suitable control switches. Similarly, the lift platform of the apparatus is raised and lowered and also moved in and out of the vehicle when the person operates suitable control switches in the manner described above. Even though the disabled person may not have full control over his grip, he often has sufficient use of his hands to operate the various control switches. The invention makes the disabled person more mobile and self-sufficient.

We claim:

1. In combination, an automotive vehicle; sliding door means for providing a closure for one side of said vehicle and slidable between an open and closed position; a door latch; power-operated means for latching said door closed and unlatching said door, a first switch on the outside of the vehicle for selectively actuating said last-mentioned power operated means to latch the door, a second switch on the inside of the vehicle for selectively actuating said last-mentioned power operated means to latch or unlatch the door, said switches being independently operable; said power operated means comprising a first reversible electric motor, a driving gear connected to said first electric motor, and a gear segment coupled to and driven by said driving gear, said gear segment operatively connected to said door latch whereby operation of the said first electric motor latches and unlatches said door; motor operated means for sliding the unlatched door between closed and open positions, a third switch on the outside of the vehicle for selectively actuating said motor-operated means to slide the door between its closed and open positions, a fourth switch on the inside of the vehicle for selectively actuating said motor-operated means to slide the door between its closed and open positions, said switches being independently operable; a support post having a rectangular cross-section mounted in a substantially vertical position on said vehicle adjacent said slidable door means;

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a carriage slidably mounted for vertical movement on said support post, said support post providing a surface upon which said carriage rides; said carriage having four rollers which contact said surface;

a hydraulic drive means including an electric motor connected between said post and said carriage for raising and lowering said carriage;

said support post being rotatably supported with respect to said vehicle about a vertical axis;

a horizontal platform supported by said carriage;

a horizontal beam extending from said carriage;

a vertical beam connecting the outermost end of said horizontal beam to the outermost end of said platform;

a second reversible electric motor;

a first gear driven by said second electric motor;

a second gear in engagement with said first gear;

a pivoted crank connected at one end thereof to said second gear;

the other end of said pivoted crank being connected to said post for turning said post and said carriage

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through an angle sufficient to move said carriage into and out of said vehicle;

a fifth switch on the outside of said vehicle for selectively actuating said second reversible motor to turn said post and carriage, a sixth switch on the inside of said vehicle for selectively actuating said second reversible motor to turn said post and carriage, said switches being independently operable;

a seventh switch on the outside of the vehicle for selectively actuating said hydraulic drive means, an eighth switch on the inside of said vehicle for selectively actuating said hydraulic means, said switches being independently operable;

a ninth switch on said platform for selectively actuating said hydraulic drive means independently of said other switches; and

a tenth switch on said platform for selectively actuating said reversible motor independently of said other switches.

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