Jan. 18, 1966 W. M. BOOTH 3,229,788

INVALID ELEVATOR

Filed June 25, 1963 3 Sheets-Sheet 1

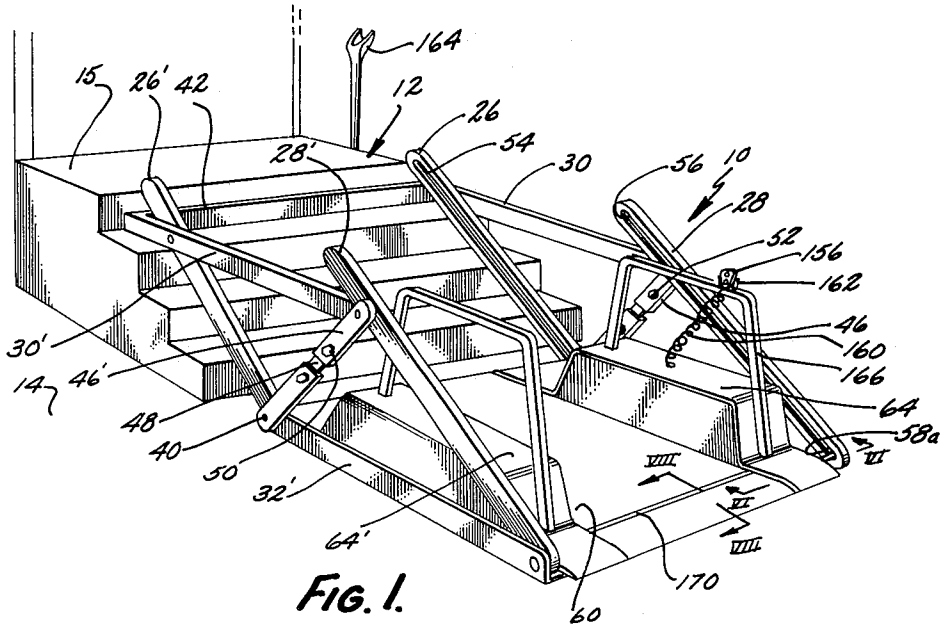

FIG. 1.

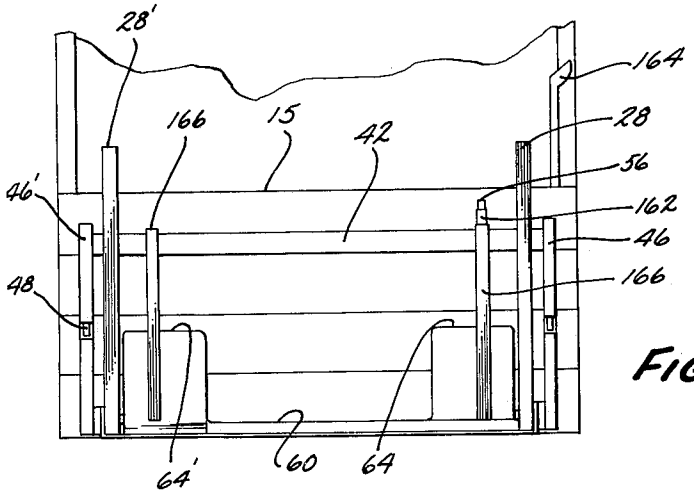

FIG. 2.

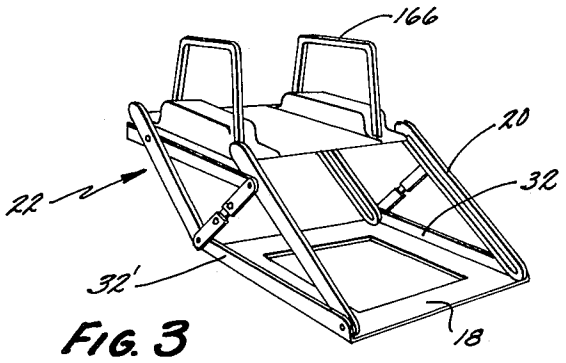

FIG. 3

INVENTOR.
WILLIAM M. BOOTH
BY Cahill & Heneveld
ATTORNEYS

Jan. 18, 1966 W. M. BOOTH 3,229,788

INVALID ELEVATOR

Filed June 25, 1963 3 Sheets-Sheet 2

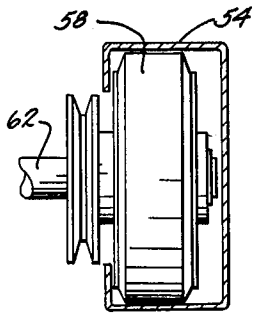

FIG. 6.

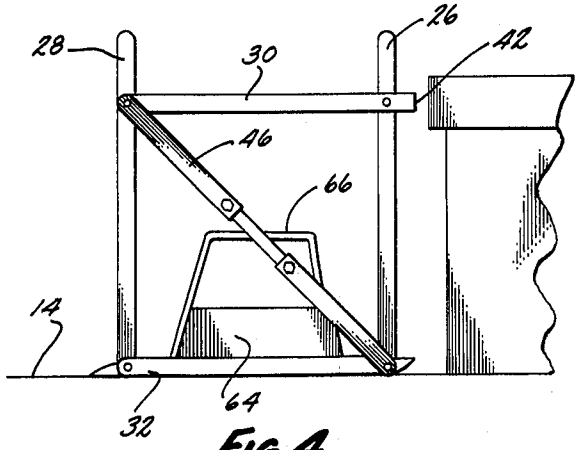

FIG. 4.

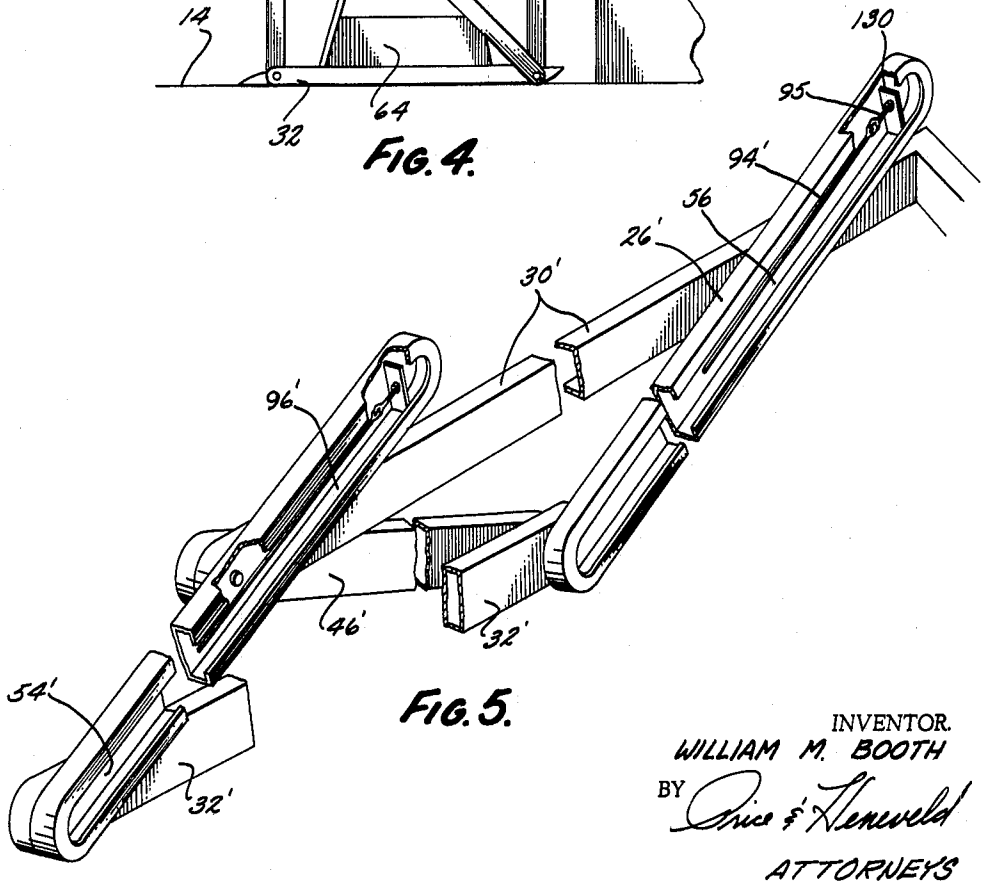

FIG. 5.

INVENTOR.
WILLIAM M. BOOTH
BY Price & Heneveld
ATTORNEYS

Jan. 18, 1966 W. M. BOOTH 3,229,788

INVALID ELEVATOR

Filed June 25, 1963 3 Sheets-Sheet 3

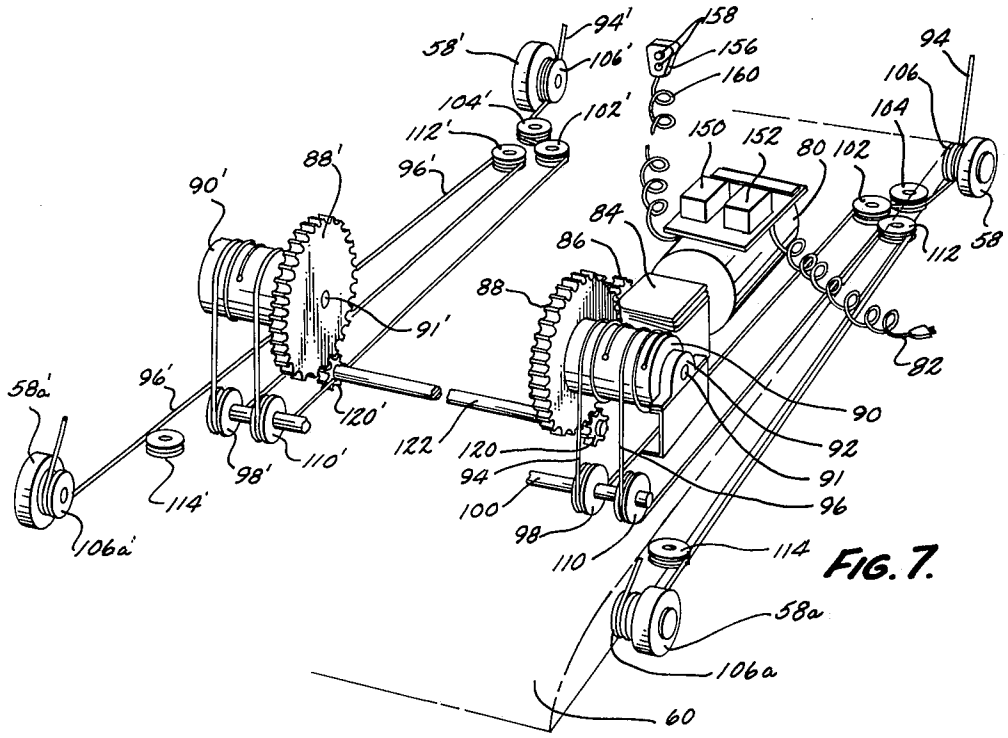

FIG. 7.

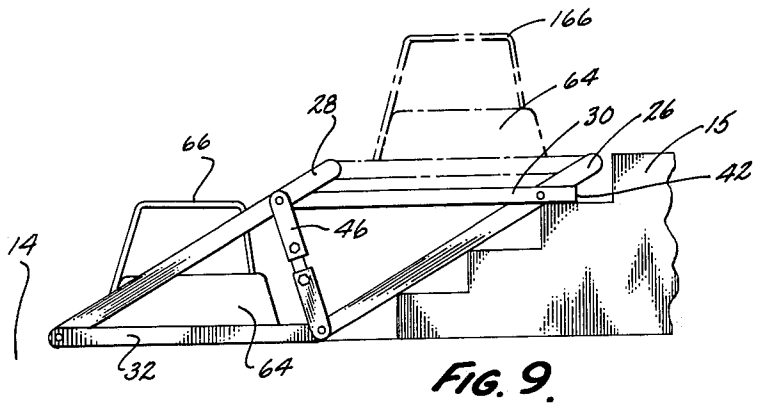

FIG. 9.

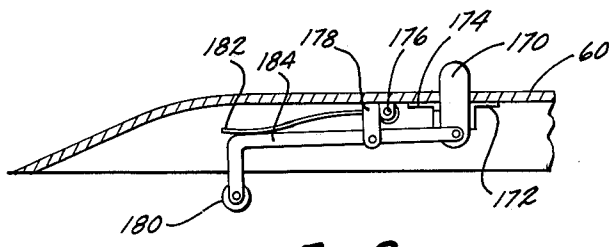

FIG. 8.

INVENTOR.
WILLIAM M. BOOTH
BY Price & Heneveld
ATTORNEYS

United States Patent Office 3,229,788 Patented Jan. 18, 1966

3,229,788

INVALID ELEVATOR

William M. Booth, Grand Haven, Mich., assignor to Welded Products, Inc., Grand Haven, Mich., a corporation of Michigan

Filed June 25, 1963, Ser. No. 290,429
9 Claims. (Cl. 187—10)

This invention relates to an elevator for invalids, and more particularly to a portable self-contained elevator useful to accommodate persons incapable of traversing stairs under their own power, and adaptable to suit almost any stairs encountered. It is especially adapted to wheel chair patients and their chair, being capable of operation by the patient.

Invalids often become very adept at the art of maneuvering, as in wheel chairs, to desired locations in an establishment, whether at home or at a place of business. Stair steps, however, present a constant problem to a wheel chair patient since even one step presents an insurmountable obstacle. Not only wheel chair patients, but also cardiac patients and "walker" patients are often capable of traveling about on a level floor, but incapable of maneuvering up or down stairs by themselves. The patient then requires the help of other persons, or of special ramps or elevating equipment. Usually ramps are impractical, because the stairs are too high or too steep, and/or because a ramp usually covers the steps and renders the stairs useless as stairs.

Elevators devised heretofore for the purpose of hoisting the patient and chair have been elaborate structures built in custom fashion for a particular location and stairs. They are mounted to the stairs with special supports affixed to the stairs, to the ceiling, to the wall or to the floor, to stabilize the equipment. A wheel chair patient must be normally lifted out of his chair, placed on the elevator, removed from the elevator and placed in another wheel chair after traverse of the stairs. These mechanisms are also conventionally expensive and elaborate, thereby discouraging their adoption either in the home, or at a place of business by a businessman who might otherwise be inclined to hire handicapped persons.

It is accordingly an object of this invention to provide a unique, universal, invalid elevator adaptable to any of a variety of stairs, even though the stairs may be of a different height, or a different angle of inclination (including very steep angles), and regardless of whether the stairs possesses one, two, three, four or more steps. The apparatus is highly variable in its angle of inclination, to enable quick, simple and accurate adjustment to suit the steps involved. Moreover, the elevator action is smooth and dependable at any adjusted angle of inclination.

It is another object of this invention to provide a wheel chair elevator capable of uniquely obtaining support and stability from the stairs, without being secured or affixed to the stairs, floor or ceiling, and without additional support braces. The elevator is immediately operable by the wheel chair rider without any help. The novel elevator does not render the stairs useless for its usual purpose for other people, yet is instantly useful for the wheel chair rider without modification.

It is still another object of this invention to provide a safe wheel chair elevator enabling the wheel chair to be directly rolled on the elevator without removal of the patient, yet without danger of the wheel chair rolling off the elevator platform. Moreover, the rider can maneuver the wheel chair onto the elevator platform without help, and can operate the elevator by himself, making assistance from others completely unnecessary. The platform is furthermore normally free of walking obstacles to normal people using the stairs.

These and several other objects of this invention will become apparent upon studying the following specification in conjunction with the drawings in which:

FIG. 1 is a perspective view of the novel elevator shown positioned adjacent a stairs;

FIG. 2 is an end elevational view of the apparatus illustrated in FIG. 1 with the platform lowered;

FIG. 3 is a perspective view of the apparatus adjacent a stairs, showing the platform elevated;

FIG. 4 is a side elevational view of the apparatus at a different and steep angle of inclination;

FIG. 5 is a fragmentary, enlarged, perspective view of one parallelogram side support of the apparatus;

FIG. 6 is an enlarged sectional view of one of the roller wheels on the platform, positioned in a side channel guide of the side support, and taken on plane VI—VI of FIG. 1;

FIG. 7 is a fragmentary perspective view of the hoist mechanism for the platform on the support means;

FIG. 8 is a fragmentary sectional view of the platform taken on plane VIII—VIII of the apparatus illustrated in FIG. 1 to show the safety brake; and

FIG. 9 is a side elevational view of the apparatus showing the platform in its lowered position in solid, and its elevated position in phantom.

Referring now specifically to the drawings, the novel wheel chair elevator **10** is shown positioned adjacent a stairs **12** and generally resting on floor **14**.

The elevator **10** includes a generally rectangular base **18** (FIG. 3) which may comprise a metal plate, and includes a pair of spaced parallelogram side supports **20** and **22** cooperative with the opposite side edges of the base. These parallelogram supports include pairs of generally vertical, parallel legs **26** and **28**, and **26'** and **28'** respectively, and pairs of parallel horizontal legs **30** and **32**, and **30'** and **32'** respectively. The lower legs **32** and **32'** may actually be integral with base **18** by forming upturned flanges along the opposite side edges of the base, or by welding angle elements thereto.

Each of the vertical elements is pivotally connected to the adjacent horizontal elements with which it is associated. This enables the angles between the legs of the parallelograms to be varied, thereby varying the elevator pitch in a manner to be described. The pivotal connections e.g. **40** (FIG. 1) may be formed by suitable pins or bolts.

Upper horizontal elements **30** and **30'** include a connected cross bar **42** extending across the front of the elevator apparatus, between the spaced parallelogram supports, and near the upper ends of the front vertical legs **26** and **26'**. This cross piece **42** protrudes slightly forwardly of the apparatus to form a support surface resting upon one of the steps in stairs **12**. The particular step upon which these elements rest will vary with the height of the steps, the angle of the steps, and the number of steps involved. This apparatus is readily adjustable to suit particular steps involved.

Extending diagonally across each of the parallelogram supports, between two pivotal connections thereof, and normally between the two obtuse angles of the parallelogram, is an adjustable, bracing, locking bar element **46** on one side and **46'** on the other side. Each of these elements basically comprises a telescopically adjustable compression bar. It may have a pair of outer hollow sleeve elements on opposite ends and a central, smaller solid bar **48** fitting telescopically within the sleeve elements for adjustment therewith. Piece **48** may be adjustable with respect to one or both of the sleeve elements, using suitable releasable holding means such as control knobs **50** cooperative with bolts **52**, or any equivalent. Of course, only two telescopically interengaged elements need be employed instead of three. Many variations on this are possible. Loosening of the releasable holding means enables adjust-

ment of the length of bracing leg 46, allowing the parallelograms to be varied with respect to the angle of inclination of the vertical elements. Actually, in practice, it has been found that the bracing bars need not be tightened, or in some instances need not even be employed, since front cross piece 42 provides excellent support for the entire apparatus, and stabilizes it well during use.

Each of the vertical, angularly positioned legs of the parallelogram not only comprises a support element, but also includes an integral guide track for a wheel roller. These include tracks 54 and 56, and 54' and 56' in the four upright legs (FIGS. 1 and 5). These guide tracks are channel shaped in cross-sectional configuration, with open inner-sides (FIG. 6) to enable a guide wheel 58 to ride smoothly up and down the vertical elements with its mounting axle protruding out the side. A plurality of four guide wheels is employed with the apparatus, in the form illustrated, one at each corner of the hoistable platform 60. Axles 62 mounted to the platform (FIG. 6) support the wheel rollers on bearings. The cooperative wheels and tracks cause the platform to follow a selected angle of inclination.

The hoisting platform 60 includes a pair of spaced housings 64 and 64' on opposite lateral sides of the platform for the drive mechanism to hoist the apparatus. Also, a pair of steadying rails 66 and 66', each shaped like an inverted U, are secured to the opposite edges of the platform.

Within the housing 64 is mounted the drive components of the assembly. Referring to FIG. 7, the power drive assembly includes motor means 80, preferably a reversible electrical motor having a plug-in cord 82 of conventional type, and a gear reduction box 84, both mounted to platform 60. The gear box is operably connected to the output shaft of motor 80. Spur gear 86 comprises the output of the gear box 84. It is intermeshed with larger gear 88 keyed to shaft 91, to which a drum type cable winch 90 is also keyed. Gear 88 and drum 90, and more specifically shaft 91, are rotatably mounted on suitable pillow blocks 92 for rotational support. A pair of cables 94 and 96 are affixed on one end to drum 90 and are wound thereupon when the drum is rotated by gear 88. Cable 94 passes around idler pulley 98 mounted on an idler shaft 100 rotatably supported on platform 60 with any suitable means such as pillow blocks. The cable 94, after passing around idler 98, extends lengthwise along the edge of the platform, and around a pair of idler pulleys 102 and 104. The cable then passes around a pulley 106 rotatably mounted to a wheel axle, and then extends upwardly through the vertical support 26. The cable is secured to the upper end of the channel and track with a suitable adjustable eye bolt connection (FIG. 5), explained with respect to the cables on the opposite sides of the platform.

Cable 96, which passes around idler pulley 110 on axle 100, extends forwardly around idler 112 mounted to the platform, back around idler 114, and then around pulley 106A on the axle of roller wheel 58A. This pulley then extends upwardly through the element 28 and is affixed to the upper end of the channel element. Since the cables are fixed on one end to the platform and the other end to the upper end of the vertical elements 26 and 28, winding of the cables on the drum 90 shortens the cables and lifts the one side of the platform to raise it. The wheels follow the guide tracks within which they are placed, no matter what the angle thereof.

The opposite side of the platform is operated by comparable mechanism. Engaged with gear 88 is a spur gear 120, affixed to shaft 122 suspended across the underside of platform 60 on suitable bearing mounts such as pillow blocks (not shown). Gear 120' is affixed on the opposite end of shaft 122. It engages with gear 88' mounted on shaft 91'. A second winding drug 90' is mounted on shaft 91 and is keyed to rotate with gear 88. Cables 94' and 96' are wound around the drum 90'. These cables pass around suitable idler pulleys and from thence around pulleys 106' adjacent wheel 58', and 106A' adjacent wheel 58A'. The upper ends of these cables are likewise affixed to the upper ends of channel guide and support elements 26' and 28'. The securement of these cables is illustrated in FIG. 5. The cable 94' is affixed to an eye bolt 95, which in turn is bolted to a special flange 130 affixed within channel guide element 26'. Slight cable length adjustment is therefore possible. Similarly, cable 96' is affixed to a similar eye bolt and flange connection.

Operation of motor 80 and gear box 84 causes rotation of winding drums 90 and 90' to cause the cables to be shortened, or alternatively lengthened, to thereby elevate, or alternatively lower, platform 60 with respect to the spaced parallelogram supports.

Control of the electric motor 80 is had through a suitable pair of relays 150 and 152 to cause the reversible electrical motor 80 to be actuated in either direction using a movable, hand held control box 156. The box has a pair of actuator buttons 158 for forward and reverse actuation. This control box is electrically connected to the relay mechanism through a suitable extensible cord 160. The control element may be supported in a bracket 162 (FIG. 1) mounted on hand rail 66, or on suitable stands 164 at the top and bottom of the elevator and stairs.

For safety purposes, a depressible rear transverse holding or braking flange 170 is mounted in the rear of platform 60 (FIGS. 1 and 8). This element is elongated and extends transversely across the rear edge of the platform. It is slidably supported between a pair of angle elements 172 and 174 secured to the bottom of the platform. It is pivotally connected to a lever 176, which in turn is pivotally mounted to support 178 depending from platform 60. At the rear end of lever 176 is mounted a roller 180 biased to a downwardly protruding position beneath the lower edge of the platform by a leaf spring 182 mounted to platform 60 at 184.

When the platform is raised, leaf spring 182 biases wheel 180 and lever 176 downwardly to pivot it about support 178 and hoist safety bar 170. This prevents rolling of the wheel chair off the rear of the platform. When platform 60 moves down into contact with floor 14, wheel 180 contacts the floor first, rotates lever 176 about its support 178 against the bias of spring 182, to lower flange 170 into the surface of platform 60, thereby allowing a wheel chair to move onto the platform or off the rear of the platform.

In addition to this rear depressible stop, a second stop similar to this can be mounted at the front of the platform to prevent the wheel chair from rolling off onto the steps during travel of the elevator. Of course, the depressing mechanism would protrude forwardly to be actuated by the top-most step to lower the stop and allow wheel chair exit or entry. It would be spring loaded to a raised position and be depressed against the spring bias as the one shown.

A further safety feature could be incorporated to prevent rapid lowering of the platform in case of drive mechanism failure. This is a fluid cylinder with a dash pot action, connected between the platform and the frame, diagonally of the apparatus and parallel to the stairs. This would not interfere with the normal relatively slow speed movement of the platform, but would decelerate the platform in case of an accident tending to allow rapid descent of the platform.

Operation

When one of the novel elevators is to be employed to enable a wheel chair rider to traverse a set of stairs 12, the elevator assembly 10 is first moved to a position adjacent the stairs, control knobs 50 on the opposite diagonal adjustable bars are loosened, the angle of the supports is adjusted to lower forward transverse support bar 42 onto one of the steps of the stairs. Then, if neces-

sary, control knobs **50** are tightened. The motor is then plugged into an outlet. The apparatus, with no further modifications, is ready for use. No additional supports, braces, suspension elements, or the like are necessary. The wheel chair rider, to use the apparatus for elevating his chair from the floor level **14** to the top stair level **15**, merely rolls his wheel chair up on the support platform **60** between the housings **64** and **64'**. He then takes control box **156**, depresses the appropriate button **158** for driving the reversible electrical motor **80** in the direction to lift the platform. This motor operates the gear box **84**, which drives spur gear **86** and thus gears **88** and **88'**. Drums **90** and **90'** are rotated to wind up the cables **94**, **96**, **94'** and **96'**. These cables pass around their respective idler pulleys and around the pulleys on the respective wheel axles as the cables are shortened. Consequently, the entire platform is raised simultaneously toward the upper ends of the supports **26**, **28**, **26'** and **28'** regardless of the particular angle of the supports. In fact, the supports may be even placed directly vertically as illustrated in FIG. 4, for example. When the platform reaches the level of the stair stop (see the apparatus in phantom in FIG. 9 for example, or in FIG. 3), the operator may control the mechanism to stop it, or suitable limit switches (not shown) are actuated by the platform to shut off motor **80**.

During the time of elevation, the operator and his wheel chair are never in danger of rolling backwardly off the platform **60**, since, as soon as platform **60** raises off the floor, lever **176** lowers under the bias of spring **182** to elevate safety bar **170**, preventing the wheels of the wheel chair from rolling backwardly. Upon reaching the top, the operator merely replaces the control box in bracket **162** or alternatively in bracket **164**, and wheels his chair off. The elevator may then be returned to its initial lowered position for normal usage of the stairs. For the wheel chair rider to use the elevator to lower himself from the top of the stairs to the bottom, the entire process is simply reversed.

It will be obvious to those having knowledge of this field and ordinary skill in it, that the inventive apparatus may be modified in a variety of ways to suit a particular purpose, while still employing the unique concepts set forth herein. Thus, this invention is not to be limited to the specific form illustrated, but only by the scope of the appended claims and the reasonably equivalent structures to those defined therein.

I claim:

1. An invalid elevator, comprising: a frame having a pair of vertically positioned parallelogram supports, and connecting means therebetween; the vertical legs of said parallelogram supports having guide tracks; a platform suspended between said parallelogram supports and including roller elements in operative engagement with said tracks; each of said parallelogram supports being adjustable in its angle of inclination, and including locking means therefor; and power drive means between said platform and said supports to raise and lower said platform on said supports.

2. The elevator in claim **1** wherein a cross tie is affixed between the front of said supports, near the upper ends thereof and protrudes in front of the supports to rest on a step to be traversed by said platform.

3. A wheel chair elevator comprising: a base; a pair of upstanding parallel track elements pivotally mounted on each of two opposite side edges of said base; said elements being interconnected to move as a unit with all elements remaining parallel to each other; locking means to lock said track elements at one particular angle of inclination; a platform between the pairs of elements, including follower means cooperatively engaged with said track elements to guide said platform at the particular angle of inclination of said track elements; and powered hoisting means operably engaged between said platform and said track elements to move said platform up the angle of inclination.

4. The elevator in claim **3** wherein said powered hoisting means includes power winch means on said platform and a plurality of cables extending from said winch means and secured to the upper ends of respective ones of said track elements.

5. A wheel chair elevator, comprising: a frame including a pair of spaced, interconnected parallelogram supports; the elements of each of said parallelograms being pivotally interconnected to enable variation of the angles of the parallelogram; adjustable locking bracing means across at least one of said supports for securing the parallelograms in an angular position to suit the stairs involved; a wheel chair platform suspended between said supports; cooperative guide means between the sides of said platform and said supports to cause said platform to move at the vertical angle of said supports; and hoisting means operably engaged between said platform and said supports to raise and lower said platform along the angle of said supports.

6. The elevator in claim **5** wherein said cooperative guide means comprises a wheel on said platform engaged with tracks in said supports, and said bracing means has telescopically adjustable components.

7. A wheel chair elevator for traversing a stairs comprising: a hoistable wheel chair platform; a pair of spaced supports on opposite sides of said platform; hoisting means between said platform and said supports; cooperative guide means between said platform and said supports; safety stop means movable between a position protruding out of said platform to prevent rolling of the chair off the platform, and a position depressed into said platform to allow rolling of the chair off the platform; and actuating means extending from said platform and engaged with said safety stop means to depress said stop means when said platform reaches the end of its traverse, and to cause said means to protrude when said platform is traversing the stairs.

8. The elevator in claim **7** wherein said actuator engages the floor to depress the stop means, and is biased to a position to cause protrusion of the stop means.

9. A self-contained invalid elevator for traversing a stairs between a lower level and an upper level, while also normally allowing use of the stairs comprising: a frame to rest on the lower level, and having a pair of vertically positioned parallelogram supports laterally spaced to be adjacent opposite sides of a stairs; said supports each having a pair of diagonally oriented vertical track members to be oriented over the angle of the stairs, each pair having one member to be along the stairs and one member to be spaced back from the stairs; a horizontal platform suspended between said supports and having roller elements in operative engagement with said track members to be hoisted in a diagonal path while maintaining its horizontal orientation; said platform having a low profile and having an engagement with said track members allowing it to be at only a slight height above the lower level when not elevated, to form a continuation of the walking surface on the lower level for normal use of the stairs; power drive means between said platform and said supports to diagonally raise and lower said platform over the stairs between the levels; and control means on said platform to said power drive means to allow invalid use thereof for traversing the stairs.

References Cited by the Examiner

UNITED STATES PATENTS

152,013	6/1874	Seeburger	187—10
961,782	6/1910	Liljeros	187—10
1,237,627	8/1917	Forbes	187—12
2,233,009	2/1941	Hinds	187—8.52
2,563,260	8/1951	Miller	187—12

SAMUEL F. COLEMAN, *Primary Examiner.*