United States Patent [19]

Weant et al.

[11] **3,907,051**

[45] **Sept. 23, 1975**

[54] **STAND-UP WHEELCHAIR**

[75] Inventors: **Charles M. Weant,** Annapolis; **Arthur Schwartz,** Edgewater, both of Md.

[73] Assignee: **Arthur Schwartz,** Edgewater, Md.

[22] Filed: **Apr. 19, 1973**

[21] Appl. No.: **352,495**

Related U.S. Application Data

[62] Division of Ser. No. 236,268, March 20, 1972, Pat. No. 3,807,795.

[52] **U.S. Cl.** **180/6.2;** 180/74; 180/DIG. 3

[51] **Int. Cl.²** **B62D 11/00**

[58] **Field of Search** ..... 180/74, 6.2, 9.24, DIG. 3, 180/65 R; 297/DIG. 6, DIG. 10, 71, 330, 42; 280/36 B

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Primary Examiner—Kenneth H. Betts

Attorney, Agent, or Firm—Arthur Schwartz

[57] **ABSTRACT**

A wheelchair including motor-operated means for raising and lowering a partially paralyzed person from a seated to a substantially standing position. The same motor also provides propelling means for the wheelchair while in both its lower and raised position. The seat, arms, back and front braces form a parallelogram which is pivotable about its axes to form a back support when raised to the standing position. Suitable means are provided for restraining the patient in the chair when in the standing position to provide support, both while standing and moving around in the upright position.

22 Claims, 10 Drawing Figures

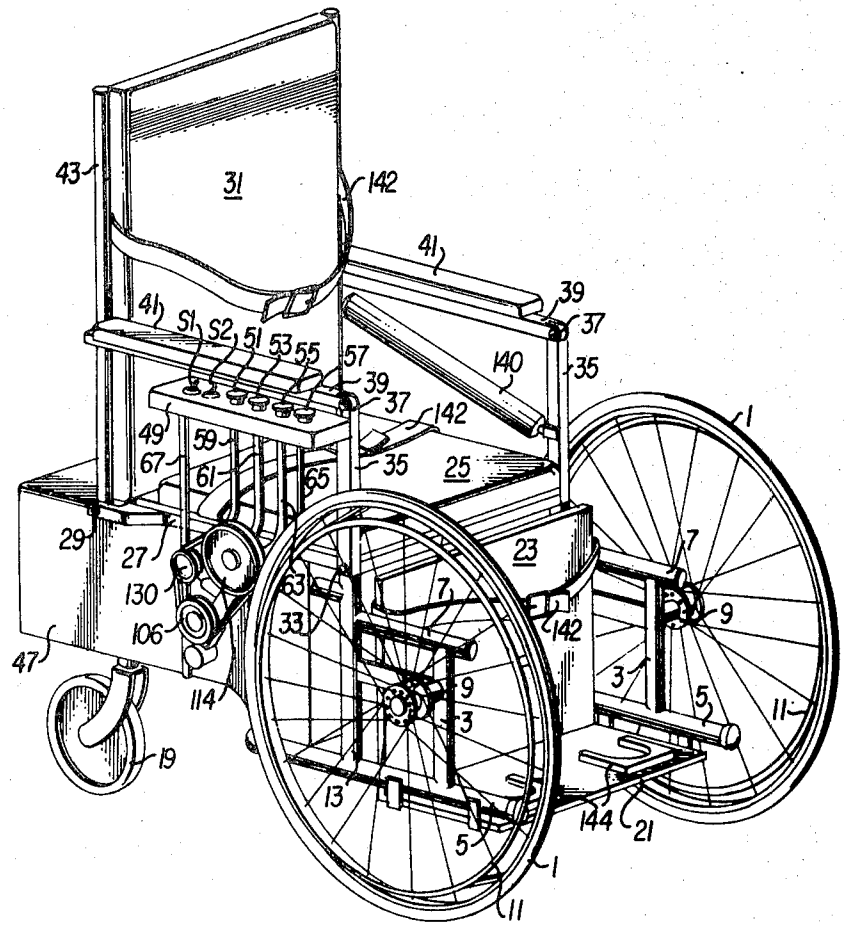


FIG. 1

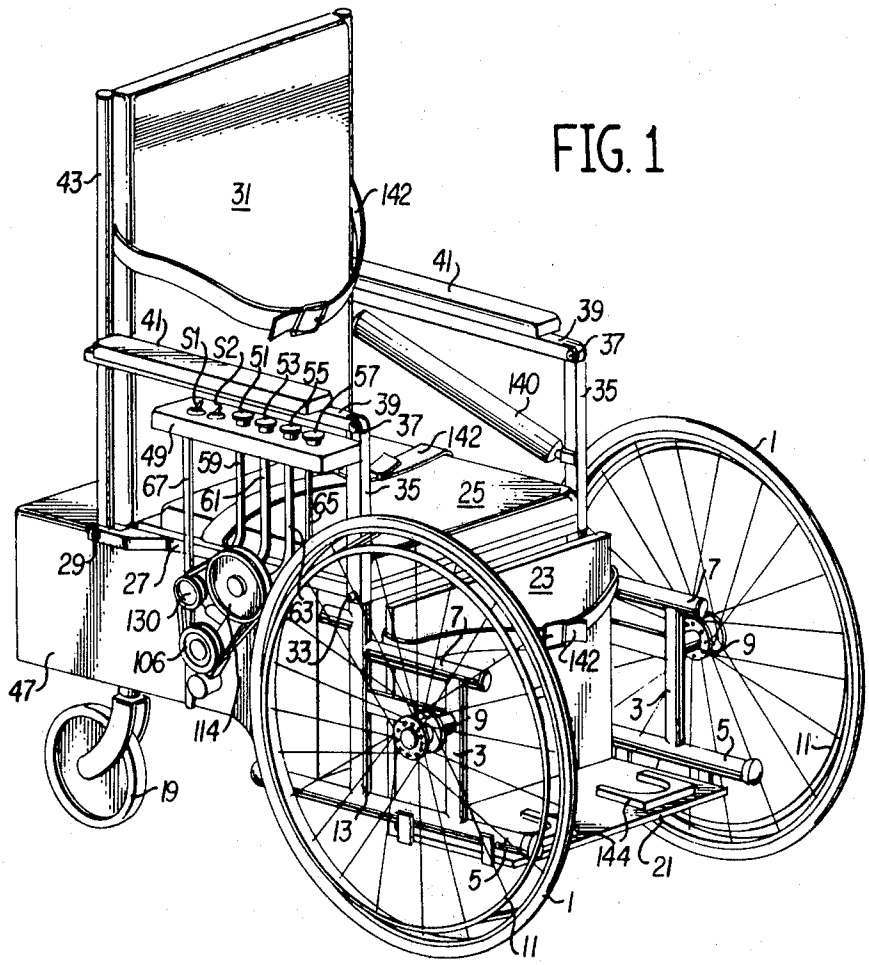


FIG. 8

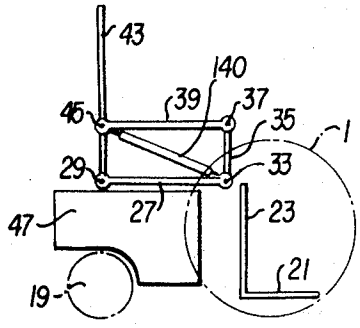
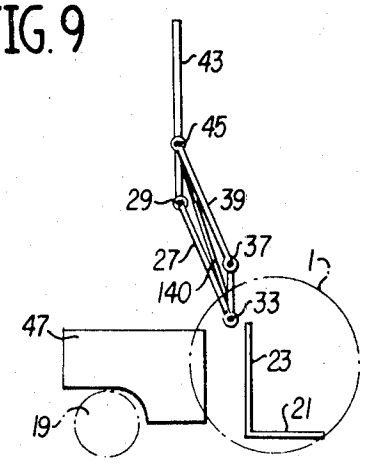
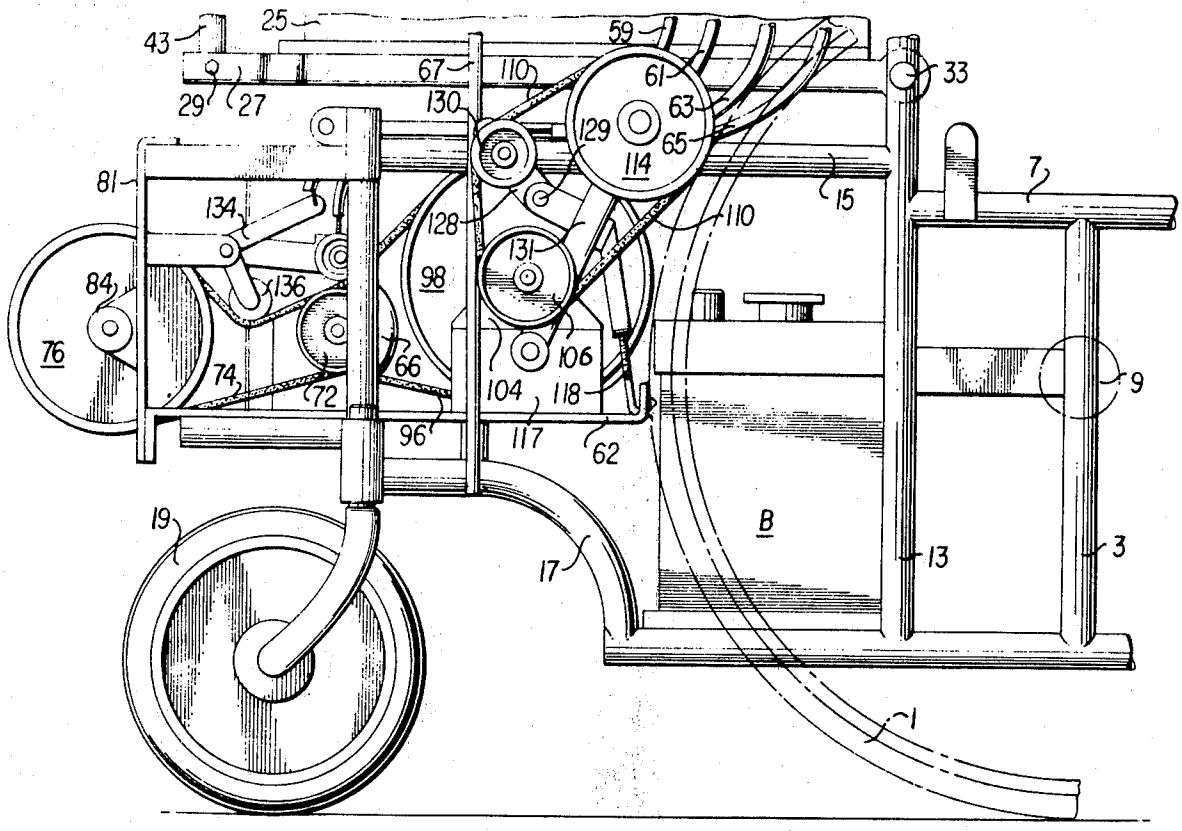


FIG. 9

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129
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114
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15
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128
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131
84
136
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106
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74
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118
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B
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1

FIG. 2

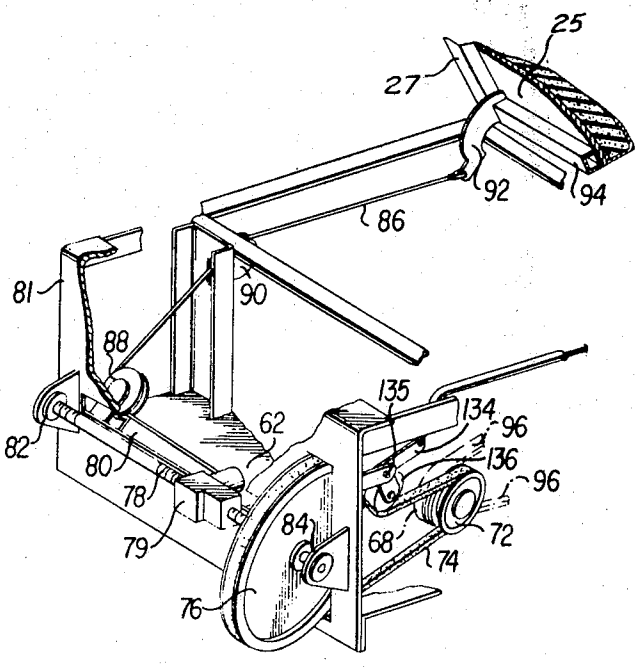
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FIG. 4

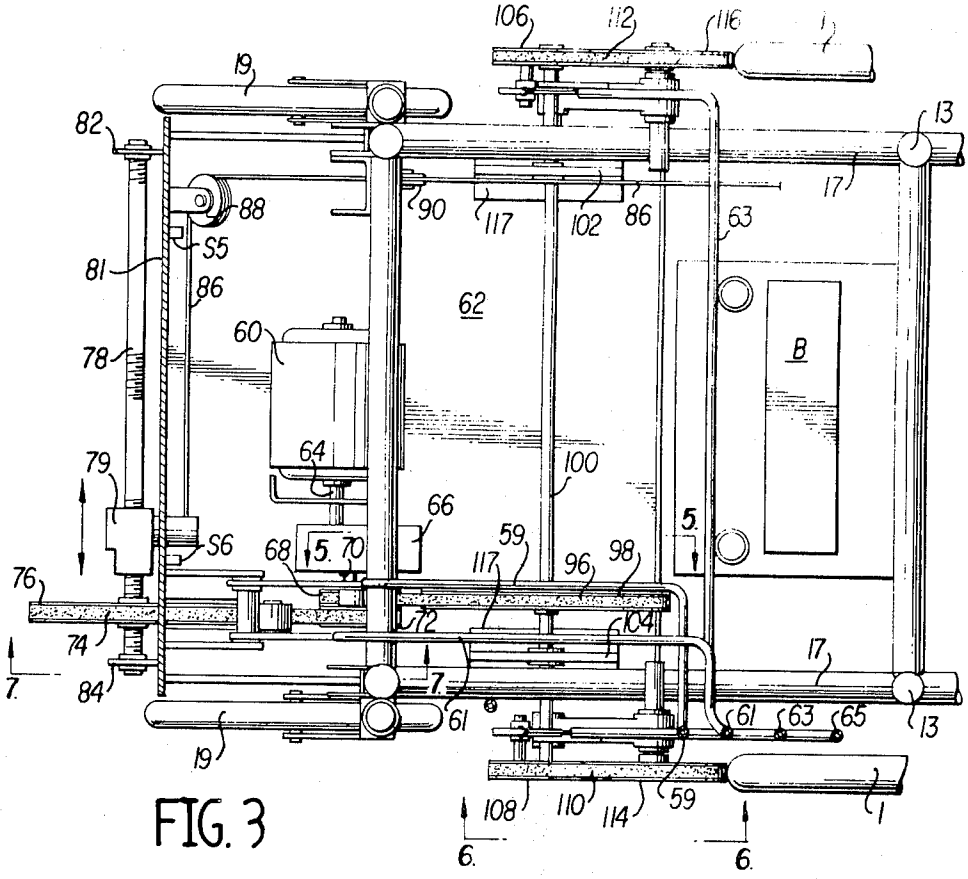

FIG. 3

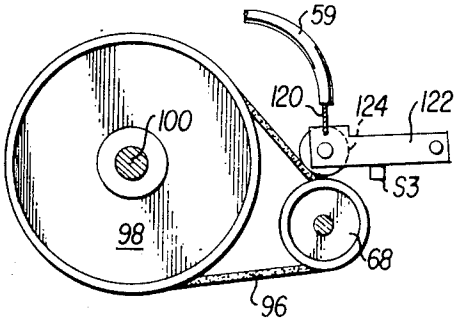

FIG. 5

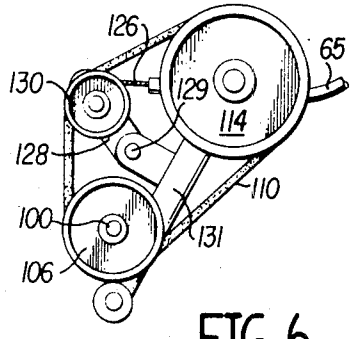

FIG. 6

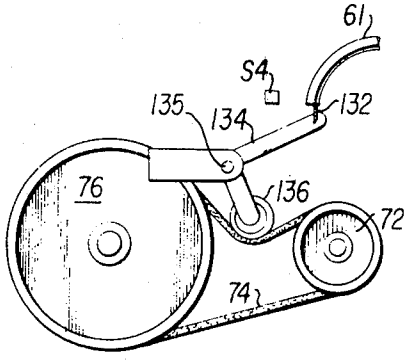

FIG. 7

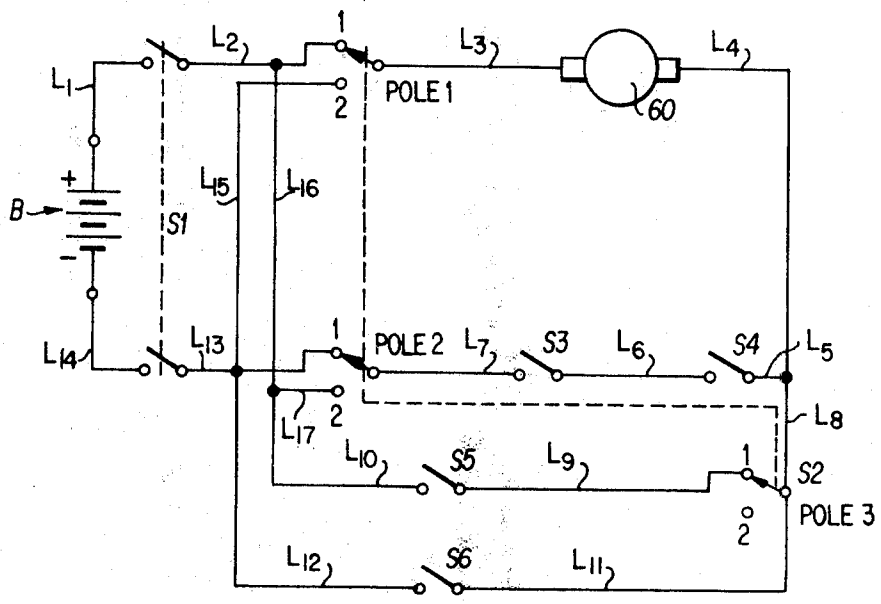
L1
L2
1
2
POLE 1
L3
60
L4
+
B
-
S1
L15
L16
L14
L13
1
POLE 2
L7
S3
L6
S4
L5
L8
L17
2
L10
S5
L9
1
S2
2
POLE 3
L12
S6
L11

FIG. 10

STAND-UP WHEELCHAIR

This is a division of application Ser. No. 236,268, filed Mar. 20, 1972, now U.S. Pat. No. 3,807,795.

BACKGROUND AND OBJECTS OF THE INVENTION

Reference is first made to U.S. Pat. No. 3,463,146, issued Aug. 26, 1969, to Arthur Schwartz and Frederick L. Day wherein an invalid mobility device was provided for not only raising and lowering a patient, but also propelling him in the standing position. The instant invention is designed to achieve substantially the same goals as the Schwartz et al. Patent; however, it will also provide a device which may be used as a wheelchair both for a feeling of security in the patient, and the advantages of having the availability of a wheelchair.

Reference is made to the introductory portion of the above-mentioned patent wherein the background as well as the therapeutic advantages of positioning partially paralyzed persons in a substantially standing position was discussed. Also referred to in that patent was some of the prior art known at the time.

Reference should also be made to U.S. Pat. Nos. 3,261,031, 3,379,450 and 3,406,772 which all provide wheelchairs which can be pivoted to a variety of positions including a standing position. These are all motor-operated; however, they have the common disadvantage of being extremely complex, and all require a plurality of motive means for doing the raising and lowering. Whereas, the instant invention utilizes only one motor for raising and lowering, as well as propelling the device if desired.

Another patent in the general field known to applicants is U.S. Pat. No. 3,589,769 which also discloses a wheelchair for lifting a person to a substantially standing position. In that device a spring motor is used to straighten the seat and seatback to a substantially upright position. However, among other things, a spring motor does not provide the adjustability and versatility which an electric motor can provide.

It will be appreciated that the device of the instant invention has numerous advantages, along with the beneficial aspects to the bones, muscles, and internal organs of the body. The patient will be able to perform such functions as reaching things in kitchen cabinets, working at a bench or the sink, as well as moving from place to place in a standing position. Further, for the non-paralyzed, yet infirm, the device can provide not only the basic wheelchair, but also means for assisting him to the standing position from which he can then walk.

Another distinct advantage of the invention is the ability to either use or not use the motor means for propelling the wheelchair. It is well known that for those individuals who are physically capable, it is best for them to use their hands and arms to propel the wheels. Most people should not be encouraged to use the power means for propelling them if at all possible. However, when the individual is in the standing position and wants to move a few feet, for example from one cabinet to another cabinet, with the instant invention he may do so without returning to the seated position.

SUMMARY OF THE INVENTION

One form of the invention includes a conventional wheelchair with a seat, back and arms included in a parallelogram arrangement movable from the seat-forming position to a vertical back-bracing position. A single motor drives a screw element which is connected to a means for raising the back and seat. The same motor means is connected to a pair of drive belts which frictionally engage the wheels of the chair for driving. Control means are provided for actuating and deactuating the raising and lowering mechanism, connecting the motor to the means for driving the wheels, and means for selectively driving either or both wheels. The motor is reversible so that the device can be lowered as well as raised and whereby the wheelchair can be propelled in the reverse direction as well as the forward direction.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will become more apparent from the following detailed description and accompanying drawings wherein:

FIG. **1** is a perspective view of a wheelchair according to the instant invention;

FIG. **2** is a side elevation view of a portion of the drive mechanism;

FIG. **3** is a top plan view of the drive mechanism;

FIG. **4** is a fragmentary perspective view of the raising and lowering mechanism;

FIGS. **5, 6** and **7** are details of the operating mechanisms for the power-driven belts taken along lines **5—5, 6—6** and **7—7** in FIG. **3**;

FIG. **8** is a schematic view of the wheelchair in its seat-forming position;

FIG. **9** is a schematic view of the wheelchair pivoted to its vertical, back-bracing position; and

FIG. **10** is a schematic diagram of the electrical circuitry.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, particularly to FIG. **1**, a wheelchair is seen having a pair of conventional large wheels **1** connected to a pair of uprights **3** on a frame which includes a pair of lower portions **5** and upper portions **7**. The wheels are conventionally rotated on a pair of axles **9**. The wheels also include a usual hand-propelling rim **11**.

The frame includes another upright member **13** and rearwardly extending upper and lower braces **15** and **17** respectively (FIG. **2**). Conventionally pivoted to the lower brace **17** are a pair of roller wheels **19** which provide the ability for the wheelchair to turn on a very small radius about the larger wheels. The framing and wheels are conventional, and in the instant disclosure are merely adapted from an existing wheelchair currently available on the market.

Connected to each of the frame portions **5** is a foot support **21** to which is connected a lower vertical member **23**. A seat **25** is connected to a lower seat frame **27**, which in turn is pivotally connected at **29** to a back **31** and at pivot **33** to a pair of vertical front arm supports **35**. The front arm supports **35** are pivoted at **37** to a pair of horizontal arm supports **39**, each having an arm cushion **41** thereon. The back **31** is supported on back frame elements **43**, which are pivotally connected to the arm supports **39** at a point **45** (FIG. **9**).

In FIG. **1** a skirt or cover **47** is seen covering an operating mechanism contained therein.

Mounted on an arm support **35** is a support **49** having a plurality of push-pull knobs **51, 53, 55** and **57** connected to Bowden wires passing through cable covers **59, 61, 63** and **65** respectively for a purpose which will be discussed below. A support means **67** connects the rear of the support **49** to the lower rearward support brace **17.**

The drive mechanism includes a motor **60** mounted in the usual manner on a drive housing floor **62.** An output shaft **64** is connected to a gear box assembly **66** to reduce the rpm of the output motor. The output from the gear box **66** is connected to a pulley **68** via an output shaft **70.** A second pulley **72** is also connected to the shaft **70.** A belt **74** connects pulley **72** to a third pulley **76** (see FIG. 7) which rotates a screw **78.** As the screw **78** rotates a carriage block **79** moves there along, a portion of which extends through a slot **80** in the back plate **81.** Appropriate bearing means are positioned at **82** and **84.**

As best seen in FIG. **4,** a cable **86** is connected to the screw nut of carriage block **79** and passes around a first cable pulley **88** and then over a second cable pulley **90.** The cable is then connected to a C-shaped crank arm **92.** Arm **92** is rigidly connected to a cross-brace piece **94** on the seat **25.** The cross-brace **94** is also connected to the seat frames **27.**

Surrounding pulley **68** is a belt **96** connecting it to a larger pulley **98** mounted on a shaft **100** which will rotate therewith (see FIG. **5**). The shaft **100** passes through a pair of bearings **102** and **104** and is connected to another pair of pulleys **106** and **108.** Surrounding pulleys **108** and **106** are a pair of belts **110** and **112** respectively. These in turn surround larger pulleys **114** and **116** respectively (see FIG. **6**).

In FIGS. **2** and **3,** a pair of blocks **117** are mounted on floor **62,** the bearings **102** and **104** being mounted thereon. Hook means **118** is used to adjustable support pulley **114.**

As seen in detail in FIGS. **5–7,** idler arms are used to tension the various pulleys as follows:

Push-pull knob **51** is connected to a Bowden wire **120** in cable cover **59,** the Bowden wire being connected to a lever arm **122** having an idler roller **124** engagable with belt **96.** When the knob **51** is pulled outwardly, the wire **120** pulls the idler wheel **124** out of engagement with the belt. Upon pushing the knob in, the idler wheel **124** engages the belt, thus causing tension thereon. This in turn will drive pulley **98,** rotating shaft **100.**

As seen in FIGS. **1, 2** and **3,** the right wheel is engaged by the operation of knob **57** which in turn pulls on a wire **126** within the cable cover **65.** Wire **126** is in turn connected to a lever arm **128** pivoted at **129** and having an idler wheel **130** thereon. Pulley **114** and arm **128** are suitably connected to a support **131** attached to the frame. By pulling on the knob **57** the wire **126** will be pulled up so that the idler wheel **130** will tension the belt **110,** thus causing pulley **114** to rotate. Since belt **110** is in contact with wheel **1,** the movement of the pulley will cause the wheel to rotate also. The same operation will effect the engagement of belt **112** by operation of lever **55** through cable cover **63,** etc.

The raising and lowering mechanism is operated by push-pull knob **53.** A cable **132** is within cable cover **61** and is connected to a bell crank **134** pivoted to the frame at **135** and having an idler wheel **136,** thereon. By pulling knob **53,** the cable **132** is pulled up, thus pivoting bell crank **134** and disengaging idler **136.** By depressing knob **53,** the idler **136** will engage belt **74,** thus tensioning same and causing the pulley **76** to rotate, thereby raising or lowering the device, depending upon which way the motor is turning.

A braking means in the form of a spring return cylinder **140** is seen connected between one front arm support **35** and a back frame element **43** as a safety mechanism in the event cable **86** should break.

A line switch and breaker S1 and a three pole, polarity and motor reversing switch S2 are mounted on support **49.** A limit switch S3 is mounted on the frame in contact with lever arm **122** when in the position seen in FIG. **5.** A limit switch S4 is seen in FIG. **7** mounted on the frame wherein it will be contacted by bell crank **134** when idler **136** is in the non-tensioned position. A pair of limit switches S5 and S6 are mounted on the back plate **81** at opposite ends of screw **78** to de-energize the motor **60** when the seat has reached its respective extreme positions.

A plurality of seat belts **142** are added where needed; e.g., across the chest, across the waist and adjacent the knees. Also a pair of foot blocks **144** position the feet on the foot support **21.**

The electrical circuitry is seen in FIG. **10.** A battery B has a positive terminal connected via a line L1 through line switch S1 and a line L2 to Position **1,** Pole **1** of the polarity and motor reversing switch S2, and a line L3 to the motor **60.** Switch S2 has three poles (Pole **1,** Pole **2,** and Pole **3**), each having Positions **1** and **2.** The other side of motor **60** is connected via lines L4 and L5, a limit switches S4, a line L6, another limit switch S3, a line L7, Position **1,** Pole **2** of switch S2, a line L13, switch S1 and a line L14 to the negative terminal of battery B. In parallel with lines L5–L7 is a line L8, Position **1,** Pole **3** of switch S2, a line L11, a limit switch S6, and a line L12. Line L12 can also be connected, via a line L15 to Position **2,** Pole **1** and line L13 to motor **60.** Line L8 is connectable through Position **1,** Pole **3** of S2, a line L9, a limit switch S5, a line L10, and a line L16 to line L2—or via a line L17, Position **2,** Pole **2** of S2 to line L7. A variable resistance speed control can be added to the circuit if desired.

Briefly, the operation is as follows:

Assuming the wheelchair is in the position seen in FIG. **1,** the operator can energize the device by actuating line switch S1. If he desires to go forward, he actuates the motor reversing switch S2 to Position **1** to place the unit in the forward mode. Since the idlers are engaged when their respective knobs are down, knob **53** should be raised so that the raising mechanism is not actuated. Switch S1 is closed, switch S2 in Position **1,** knobs **51, 55** and **57** down, limit switch S4 closed, and limit switch S3 closed by the engagement of idler **124** (depression of knob **51**). Current from the positive terminal of battery B flows through L1, S1, L2, Pole **1** of S2, L3, Motor **60,** L4, L5, S4, L6, S3, L7, Pole **2** of S2, L13, S1, L14 to the negative terminal. If the elevating drive screw nut **79** happens to be in a position between S5 and S6, S6 will be closed, thus permitting the motor to run irrespective of the position of the propelling drive. To turn to the right, knob **57** is pulled up, thus disengaging idler **130** from belt **110.** Knob **55** likewise controls the left wheel in the same manner.

When the operator desires to stop the forward motion, he can either turn switch S1 to the "off" position, or preferably simply lift knob **51.**

To propel the wheelchair in the reverse direction, S1 is closed, S2 is placed in Position 2. Current will flow from the positive terminal of battery B through L1, S1, L2, L16, L17, Pole 2 of S2, L7, S3, L6, S4, L5, L4, motor 60 (which now reverses since the current through it has reversed direction), L3, Pole 1 of S2, L15, L13, S1, L14 to the negative terminal of battery B. Again, if the screw nut 79 is not at either end, S5 will be closed, thus permitting the motor to run irrespective of the position of the propelling lever.

Assuming now the operator wishes to raise the seat to the upright position, he pushes knob 53 down and actuates switch S1. Motor reversing switch S2 is set in Position 1. Limit switch S4 is open since the elevating drive is engaged (see diagram in FIG. 7). Therefore, current flows from the positive terminal of battery B through L1, S1, L2, Pole 1 of S2, L3, Motor 60, L4, L8, Pole 3 of S2, L11, S6, L12, L13, S1, L14 to the negative terminal. Idler 136 is engaged with belt 74, thus rotating pulley 76 and screw 78. By rotating the screw 78, the screw nut or block 79 will be driven toward the end as seen in FIG. 3. This will in turn pull cable 86, rotating arm 92, thereby raising the seat. When the block 79 reaches the position wherein the seat is raised, limit switch S6 will be struck, opening the circuit, and the raising mechanism will stop. Knob 53 may now be pulled out.

If the operator wishes to engage the propelling drive to move about in the upright position, the elevating drive must be disengaged by pulling out knob 53. This will energize S4 (FIG. 7). Propelling knob 51 must also be pushed down closing S3.

To return to the seated position, S1 is closed and S2 is placed in Position 2. Switch S4 is open since knob 53 is depressed (FIG. 7). Current will flow from the positive terminal, through L1, S1, L2, Pole 1 of S2, L16, L10, S5, L9, Pole 3 of S2, L8, L4, Motor 60 which now will run in the reverse direction, L3, Pole 1 of S2, L15, L13, S1, L14 to the negative terminal. When screw nut 79 reaches the end of its travel, S5 will be opened when struck by the nut, and the motor will stop. If the operator wishes to engage the propelling drive to move about, the elevating drive must be disengaged by raising knob 53, closing S4. The propelling drive must be engaged by depressing knob 51, closing switch S3, permitting the motor to again run.

Of course the location of knobs 51–57 is a matter of choice, as is their in-out positions. Further, electrical means can be substituted for the Bowden wire arrangements. The locations and manner of operation shown are merely one embodiment.

While one embodiment of the invention has been described, it will be understood that it is capable of many further modifications and this application is intended to cover any variations, uses, or adaptions of the invention following in general, the principles of the invention and including such departures from the present disclosure as come within knowledge or customary practice in the art to which the invention pertains, and as may be applied to the essential features hereinbefore set forth and fall within the scope of the invention or the limits of the appended claims.

What is claimed is:

1. An invalid mobility device comprising:
   a. a frame,
   b. an invalid supporting means including a seat pivoted to said frame and a back pivotally supported to said seat,
   c. means for raising and lowering a person from a substantially seated position to a substantially standing position by pivoting said seat from a horizontal position to a generally vertical position and wherein said back remains generally vertical and moves upwardly with said seat, whereby the person's buttox and back are supported in both the seated and standing position,
   d. a motor on said frame for operating said raising and lowering means,
   e. a plurality of wheels on said frame for permitting movement of the device over a surface, and wherein
   f. said motor is connected to means for propelling at least one of said wheels, whereby the person may move about in either the seated or standing position.

2. An invalid mobility device as defined in claim 1 wherein said propelling means includes a pair of pulleys, a belt surrounding said pulleys, said belt frictionally engaging one of said wheels whereby rotation of said belt will cause said wheel to rotate.

3. An invalid mobility device as defined in claim 1 and wherein said raising and lowering means includes a screw rotated by said motor, screw engaging means cooperating with said screw, and means connecting said screw engaging means to said invalid support means, whereby rotation of said screw in one direction will cause said invalid support means to pivot from a seat-forming position to a substantially upright position, and rotation of said screw in the other direction will cause said invalid support means to return to its seat-forming position.

4. An invalid mobility device as defined in claim 3 including a pulley connected to said motor, a pulley connected to said screw, a belt surrounding said pulleys, and means for selectively tensioning said belt.

5. An invalid mobility device as defined in claim 1 wherein said motor is an electric motor.

6. An invalid mobility device as defined in claim 5 including means to de-energize said motor when said raising and lowering means reaches their extreme substantially seated and standing positions.

7. An invalid mobility device as defined in claim 1 including invalid support means connected to said raising and lowering means and braking means for slowly lowering said invalid support means in the event of a breakage of a supportive portion of the device.

8. An invalid mobility device as defined in claim 1 including means for selecting which of two of said wheels will rotate.

9. An invalid mobility device as defined in claim 1 including means for selecting the direction in which at least one of said wheels will rotate.

10. A wheelchair as defined in claim 9 wherein said braking means includes a spring return cylinder having one end connected to said supporting means and another end connected to non-raising and lowering means on the frame.

11. An invalid mobility device having means for raising and lowering a person from a substantially seated position to a substantially standing position, and vice versa, comprising:
   a. a frame,

b. a supporting means including:
1. a seat pivotally supported to said frame, and
2. a back pivotally supported to said seat,
c. a single electric motor on said frame,
d. a rotatable member on said frame
e. means for connecting said motor to said rotatable member, said connecting means including means for controlling the rotation of said rotatable member having an engaged position and a disengaged position wherein said motor rotates said rotatable member when said controlling means is in the engaged position and said motor is rotating.
f. a movable member movable by said rotatable member,
g. means connecting said movable member to said supporting means whereby rotation of said rotatable member in one direction will cause said supporting means to pivot from a seat-forming position to a substantially upright position, and rotation of said rotatable member in the other direction will permit said supporting means to return to its seat-forming position, and
h. means for permitting movement of the device over a surface, and means for propelling said movement permitting means.

12. An invalid mobility device as defined in claim **11** wherein said rotatable member is a screw and said connecting means includes a pulley connected to said motor, a pulley connected to said screw, a belt-like means surrounding said pulleys, and said controlling means includes means for selectively tensioning said belt-like means.

13. An invalid mobility device as defined in claim **11** including automatically responsive means for deenergizing said motor when said raising and lowering means reaches its extreme substantially seated and standing positions.

14. A wheelchair as defined in claim **13** wherein said rotatable member is a screw and further including a block on said screw, said deenergizing means including a pair of limit switch means spaced from each other along said screw and adapted to be actuated by movement of said block.

15. A wheelchair as defined in claim **11** including means for operating said controlling means and means for operating said motor means, said operating means including a plurality of actuating means mounted adjacent an arm of the wheelchair.

16. A wheelchair as defined in claim **11** wherein said rotatable member is a screw and said movable member is a block transversely movable on said screw, and said connecting means includes:
a. a cable connected to said block,
b. said cable being connected to a crank arm, and
c. said crank arm being connected to said supporting means.

17. A wheelchair as defined in claim **11** including arm rests pivotally supported to said frame and back; said frame, seat, back and arm rests forming a parallelogram.

18. A wheelchair as defined in claim **11** including means for restraining a person to the seat and back.

19. A wheelchair having means for raising and lowering a person from a substantially seated position to a substantially standing position, and vice-versa, comprising:
a. a frame
b. an invalid supporting means including:
1. a seat pivotally supported on said frame, and
2. a back pivotally supported to said seat,
3. arms pivotally supported to said frame and back, whereby said frame, seat, back and arm rests form a pair of parallelograms in all positions of the elements,
c. a single electric motor on said frame,
d. rotatable means,
e. means for connecting said motor to said rotatable means,
f. means cooperating with said rotating means including a crank arm,
g. said crank arm being connected to said seat at a point, whereby rotation of said rotatable means by said motor in one direction causes the suppporting means to pivot from a seat-forming position to a substantially upright position, and rotation of said rotatable means in the other direction will permit said supporting means to return to its seat-forming position, and
h. means for permitting movement of the device over a surface and means for propelling said movement permitting means.

20. A wheelchair as defined in claim **19** wherein said connecting means includes means for controlling the rotation of said rotatable member, said controlling means having an engaged position and a disengaged position wherein said motor rotates said rotatable member when said controlling means is in the engaged position.

21. A wheelchair as defined in claim **19** wherein said rotatable member is a screw, said cooperating means further including a transversely movable block on said screw.

22. A wheelchair as defined in claim **19** including a foot rest connected to said frame and immovable with said supporting means.

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