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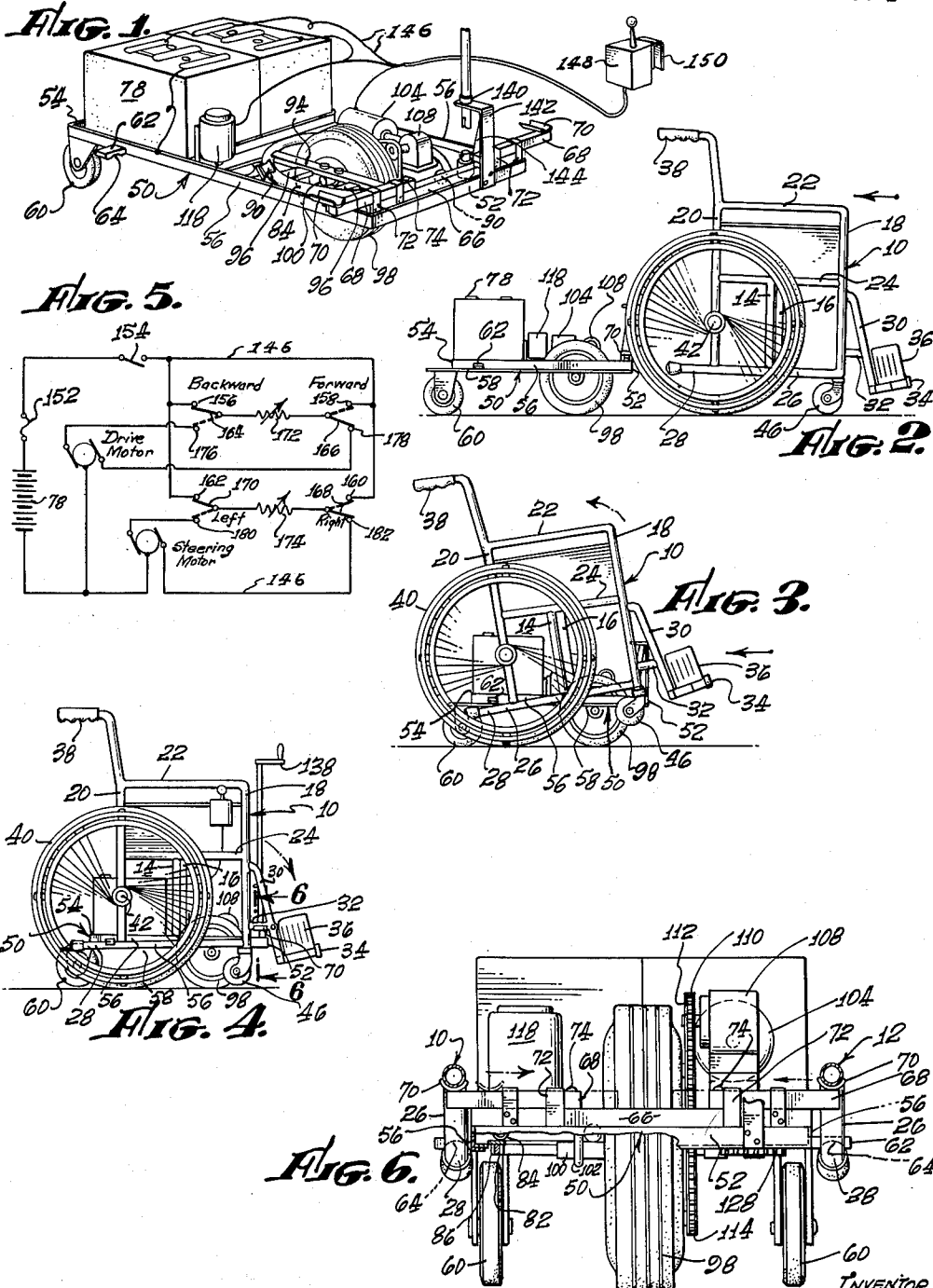
A. O. SCHMIDT

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DRIVING AND STEERING APPARATUS FOR WHEEL CHAIRS

Filed Oct. 21, 1957

2 Sheets-Sheet 1



INVENTOR.  
ARTHUR O. SCHMIDT,

By *Bonard I. Brown*  
ATTORNEY.

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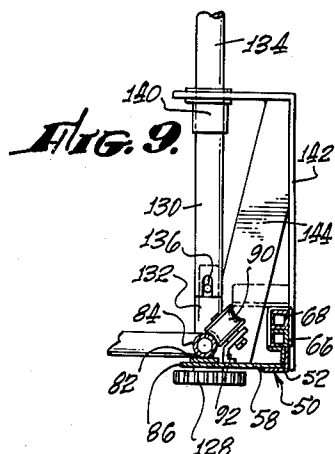
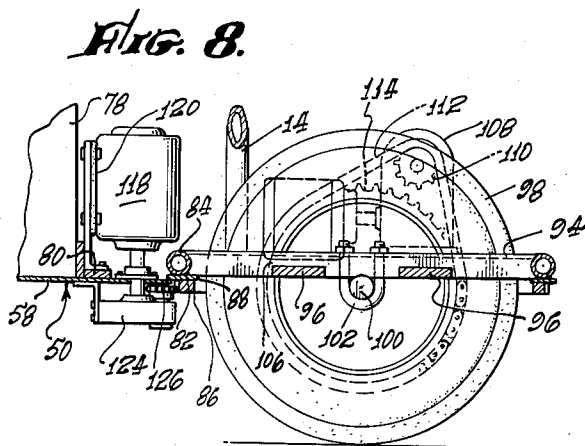
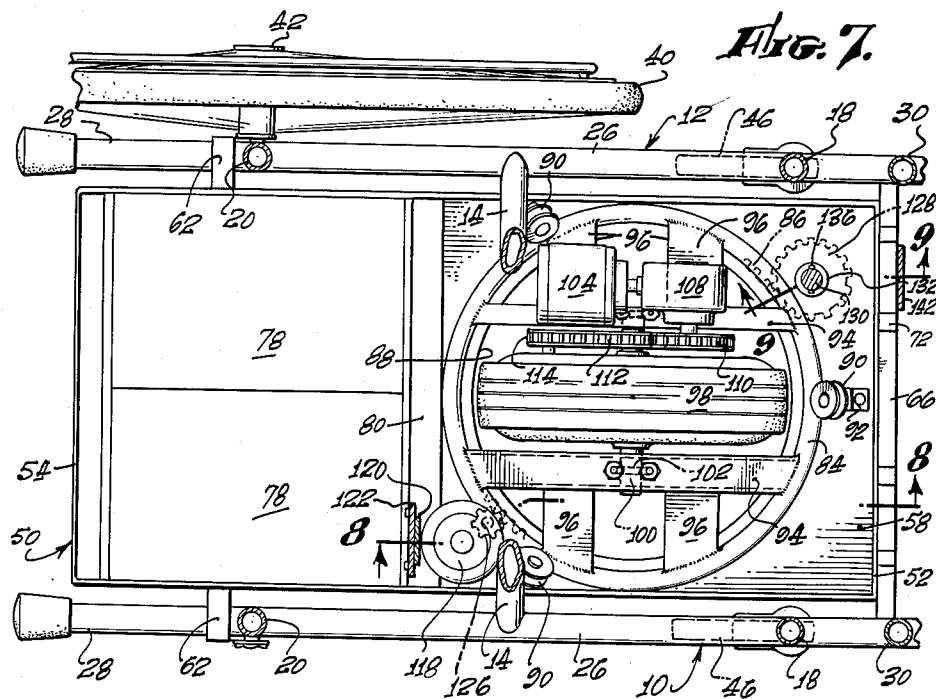
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ARTHUR O. SCHMIDT,  
INVENTOR.

By *Bonard I. Brown*  
ATTORNEY.

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## DRIVING AND STEERING APPARATUS FOR WHEEL CHAIRS

Arthur O. Schmidt, 397 E. Kingsley, Pomona, Calif.

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13 Claims. (Cl. 180—26)

This invention relates generally to motorized wheel chairs; more particularly, it relates to improved propelling and steering apparatus for such chairs.

Powered wheel chairs of the prior art have utilized driving and steering equipment having certain disadvantages and shortcomings which have restricted the utility of the wheel chairs. Such equipment and devices have generally not been adapted for ease of installation or removal. It has generally been required that tools be used in converting a chair from a manually operated chair to a powered one. It has usually been required that portions of the equipment be permanently installed on a wheel chair, or that parts of the chair be modified or removed to accommodate the equipment. Furthermore, there has been a need for improvement in the driving and steering equipment of the prior art to provide improved traction and maneuverability. Previously known equipment has provided relatively limited traction and relatively poor weight distribution, thus limiting wheel chairs with respect to the steepness of the grades which could be climbed and with respect to the surfaces and objects which can be traversed.

It is, therefore, an object of the present invention to provide new and improved driving and steering apparatus for wheel chairs.

An object of this invention is the provision of a powered traction wheel unit which is easily attached to and detached from a wheel chair for ready conversion between a manually operated chair and a powered chair.

It is an object of this invention to provide novel propelling apparatus for wheel chairs in the form of a self-contained unit which is optionally usable for converting a chair for powered operation.

An object of the present invention is the provision of a driving and steering unit which is attachable to conventional wheel chairs without modification of the chairs and without the permanent mounting of special parts on the chairs.

Another object of the present invention is the provision of powered traction wheel apparatus for wheel chairs which provides improved traction and greater climbing ability.

Other objects and features of the present invention, as well as many advantages thereof, will become apparent to those skilled in the art from a consideration of the following description, the appended claims, and the accompanying drawings in which:

Figure 1 is a perspective of a wheel chair propelling and steering unit according to the present invention;

Figures 2, 3 and 4 are side elevational views showing steps in attachment of an apparatus of this invention to a conventional wheel chair;

Figure 5 is a schematic diagram of the electrical circuitry utilized with the unit shown in Figure 1;

Figure 6 is an elevational view showing the apparatus of Figure 1 in assembled relation with parts of a wheel chair taken at line 6—6 of Fig. 5.

Figure 7 is a plan view, partially in section, showing

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the apparatus of Figure 1 in assembled relation with portions of a wheel chair;

Figure 8 is a fragmentary view, partially in section, taken at line 8—8 of Figure 7 and showing certain details of the apparatus of Figure 7; and

Figure 9 is a fragmentary view, taken at line 9—9 of Figure 7 showing certain details of the apparatus of Figure 7.

Briefly described, the preferred embodiment of the present invention, as shown in the drawings, is a self-contained unit mounted on a platform which is readily attachable to a conventional wheel chair by means of supporting lugs provided on the platform. Rotatably mounted on the platform is a traction wheel assembly which includes a pneumatic drive wheel, an electric motor, a gear box and a sprocket-and-chain transmission. Means for steering the wheel are provided by a ring gear on this assembly. A pinion gear engages the ring gear and is rotated for steering either manually by means of a steering column or electrically by a steering motor mounted on the platform. The platform supports batteries for powering the driving and steering motors. An electrical control box is interconnected with the motors by appropriate electrical connections.

Referring to the drawings, there is shown a conventional wheel chair of a well known collapsible type with which the present invention is adapted to be used. It is to be understood that the particular type of chair shown does not constitute a part of the present invention, and that the apparatus of this invention is adapted for use with various types of wheel chairs.

The wheel chair comprises a pair of side frames 10 and 12 which are maintained in laterally spaced relation by bars 14 and 16, which provide means for closing the side frames together to collapse the chair. Each side frame is preferably of unitary tubular welded construction, and includes a vertical front member 18 and a longer vertical rear member 20. The vertical members are connected by an upper or arm bar 22, a central or seat bar 24 and a lower bar 26, to form a rigid unitary structure. Each lower bar 26 has a rearwardly extending portion 28. A bracket section 30 extends angularly from front member 18 and is supported by a horizontal strut 32, as shown. At the lower end of the bracket section and formed integrally therewith is a transverse pivot arm 34 on which is pivotally mounted a foot rest plate 36.

Vertical member 18 extends upward and terminates in a rearwardly extending handle portion 38, on which are mounted grip members for use by an attendant in propelling the chair. The cross bars 14 and 16 are integrally connected to lower bars 26 and pivotally connected with central or seat bars 24, the latter connections not being shown. The cross bars, their pivotal connections and associated means are conventional means for facilitating the collapsing of a wheel chair, and therefore are not set forth in detail herein. A flexible seat member (not shown) is disposed between seat bars 24 and a flexible back member (not shown) is connected with vertical bar members 20, to permit collapsing of the chair. Main wheels 40 are journaled on axle means 42, which extend laterally outward from vertical rear members 20. Secured to each wheel so as to extend laterally outward therefrom is a circular hand grip, by means of which an occupant may manually propel the chair. A caster wheel 46 is pivotally mounted at the end of each vertical front member 18 to implement turning of the chair in response to forces exerted upon main wheels 40.

The power traction wheel unit of this invention comprises a rectangular outer frame 50 which is of unitary welded construction and which is preferably constructed of L-section iron or steel, as shown. The frame has a

front section 52, a rear section 54 and side sections 56, which cooperate to support a floor plate 58. Attached to the rear of the frame by appropriate brackets are small wheels 60. A laterally projecting lug or foot piece 62 is secured as by welding to each side section 56 of frame 50, and has an arcuate seat 64 defined in its lower surface.

Mounted along front section 52 of the frame is a tubular square-section bearing member 66, which is secured as by welding to this section. A pair of support elements 68, each having an arcuate seat 70 mounted thereon, are slidably mounted upon bearing member 66 and are held thereupon by brackets 72. Brackets 72 thus coact with bearing member 66 to support elements 68 and permit their extension outward from the frame. This outward movement is limited by studs 74. A pair of parallel L-section strips are secured as by welding to floor plate 58 and serve to retain a pair of batteries 78 in position. A reinforcement beam 80 is secured transversely between side sections 56 as by welding.

A flat annular plate 82 is positioned between a tubular ring 84 and a ring gear 86, these elements being welded together to form a unitary annular structure for a wheel assembly. The annular plate is somewhat larger in diameter than a circular opening 88 in floor plate 58, and therefore provides means for retaining the annular structure in relation to the frame 50, as shown, while permitting the ring gear to extend below the floor plate. The unitary annular structure which forms a turntable is rotatably mounted upon the frame 50 by means of angularly inclined rotatable bearings 90. The bearings are journaled on axle means secured on appropriate brackets 92 connected with the frame. As shown in Figure 7 a pair of channel bars 94 are welded to tubular ring 84, and flat beams 96 are secured as by welding between each channel bar and the ring, to form a wheel assembly structure. A pneumatic wheel 98 is mounted by bearing means on an axle 100. The axle is seated in arcuate recesses in channel bars 94 and is secured to the bars by a U-bolt assembly 102, as shown.

A reversible electric drive motor 104 is mounted upon one of the flat beams 94 and a resilient member 106 is disposed therebetween. A gear box 108 is similarly mounted upon another of beams 96. The motor is so positioned that its armature shaft extends into the gear box. Extending transversely from gear box 108 is a driven shaft, which engages the armature shaft through worm gearing (not shown). The wheel is driven through power transmission means including a drive sprocket 110 on the driven shaft, a chain 112, and a driven sprocket 114 affixed to the axle 100 of the wheel.

A reversible electric steering motor 118 is mounted to reinforcement beam 80 by means of a resilient mounting member 120 and an appropriate bracket 122. The motor operates through a gear reduction mechanism 124 to drive a pinion gear 126, which is horizontally disposed for engagement with ring gear 86.

Alternative manual steering means are provided and include a second pinion gear 128, and a shaft 130 journaled in a sleeve 132. The shaft engages a steering column 134 through a pin-and-slot arrangement 136, which facilitates engagement and disengagement of the column. The steering column extends upward and terminates in a crank arm, which is positioned to be conveniently accessible to the hand of an operator. The steering column is journaled in a sleeve 140 mounted in a bracket 142 which is supported relative to the frame and sleeve 132 by a rib 144, as shown.

A suitable arrangement of electrical conductors 146 is provided to connect the batteries with the drive motor and the steering motor through a control box 148. The control box is provided with a clip bracket 150 for attachment to a bar of the chair frame. Control box 148 contains certain of the components of the control circuit, which is shown in Figure 5. The batteries 78 are coupled through a fuse 152 and on-off switch 154 to sta-

tionary contacts 156, 158, 160 and 162 which respectively form parts of switches 164, 166, 168 and 170. Switches 164 and 166 are interconnected by a rheostat 172 and switches 168 and 170 are similarly interconnected by a rheostat 174. The reversible drive motor 104 is connected across contacts 176 and 178, and the reversible steering motor 118 is coupled across contacts 180 and 182. It will be understood from examination of Figure 5, that with switches 164 and 166 in the positions indicated by the solid lines, the drive motor is connected to move the wheel chair forward, and that with these switches in the positions indicated by the dotted lines the drive motor is connected for rearward movement. Similarly, the solid lines indicate connection of the steering motor for turning the chair to the right.

In Figures 2, 3 and 4, there is shown the method of engaging the propelling and steering unit of this invention with a wheel chair, to convert the wheel chair for powered operation. The chair and unit are first positioned as shown in Figure 2, with the chair in front of the unit. The chair is next moved backward and is tilted, as shown in Figure 3, so that extensions 28 of lower bars 26 of the frame are positioned under lugs 62 of the unit platform. With the chair still tilted, the extensible support elements or lugs 68 are pulled outward so as to extend laterally from the platform. The front portion of the wheel chair is then lowered so that the struts 32 of the wheel chair are seated in arcuate seats 70 of the support elements 68. With the front portion of the wheel chair thus supported, the rear portion of the chair supports the rear portion of the drive unit by means of extensions 28 of lower bars 26. The rear portion of the unit is supported by means of lugs 62 so that wheels 60 of the unit are off the ground. The front caster wheels 46 of the wheel chair are supported off the ground. Therefore, with the unit in operative relation with the chair, the only wheels contacting the ground are the main wheels 40 of the chair and the pneumatic traction wheel 98 of the drive unit.

The control box is attached to the wheel chair frame by means of the clip 150, which provides a convenient and ready means for attachment or detachment of the box within convenient reach of an operator. If the chair is to be equipped for manual steering, the steering column 134 is passed through the sleeve 140 so as to effect engagement with the pinion gear 128 by means of the pin-and-slot arrangement 136, as shown in Figure 9.

From the foregoing description, it will be understood that the driving and steering unit of this invention is adapted for rapid and convenient attachment to a conventional wheel chair. It will become apparent that the unit is equally adapted for quick and simple disengagement from a wheel chair. It will be observed that no tools are required for either attachment or detachment, and that all parts of the unit are self-contained. No special adaptations of the wheel chair are required and no special parts are required to be attached to the wheel chair.

In operation, a wheel chair powered by the unit of this invention is controlled by means of the control handle on control box 148. The chair may be moved selectively forward or backward and the speed may be selectively controlled. Similarly, where the electric steering motor is utilized, the chair may be turned either right or left, by means of the hand control. From the description hereinbefore of the apparatus of this invention, including the electrical circuit elements, it will be understood that rheostats 172 and 174, together with switches 164 and 166, 180 and 182, provide means for selectively moving the chair forward or backward at varying speeds, and for turning the chair to the left or to the right at a selected speed, by means of the control handle of control box 148. The particular design of the switching arrangement for these purposes is conventional, and is therefore not described in detail.

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Where no electric steering motor is provided, or where manual steering is desired, the steering crank arm 138 on steering column 134 is utilized for turning the pinion gear 128 to effect steering of the chair.

The rotatable wheel assembly of the present invention is adapted to be turned through 360 degrees. It therefore permits the maximum of maneuverability and enables the chair to turn in a minimum turning radius. The provision of these characteristics is an important feature of the present invention.

The weight distribution effected by the apparatus of this invention is such that a considerable portion of the weight of the occupant and of the batteries is supported by the pneumatic traction wheel, in addition to the weight of the components of the circular wheel assembly. Greatly improved traction is thereby provided, and a wheel chair powered by the apparatus of this invention is capable of traversing surfaces which provide relatively poor traction. Wet grass, dirt surfaces and the like may be traversed. The ability of the chair to climb grades is also substantially improved over chairs of the prior art. The provision of improved traction and grade-climbing ability is an important feature of this invention.

The improved ground traction, together with the fact that the front caster wheels of the conventional wheel chair are supported off the ground, enables a wheel chair utilizing the apparatus of this invention to pass over objects on the surface of the ground which would otherwise present relatively impassable obstacles. Such objects as hoses, sticks, heavy rugs, and thresholds can be traversed.

The driving and steering unit of this invention, when disengaged from a wheel chair, may be easily moved under its own power, and by means of the control box 148, to and from a vehicle or a place of storage.

Although a specific embodiment of the present invention has been described and illustrated in detail, it is to be clearly understood that the same is by way of illustration and example only; it is to be understood that the invention is not limited thereto, as many variations will be readily apparent to those versed in the art and the invention is to be given its broadest possible interpretation within the terms of the appended claims.

I claim:

1. A propelling and steering unit for attachment to a wheel chair, said apparatus comprising means for supporting the wheel chair including a wheel assembly having a generally circular periphery, the supporting means including a frame having the wheel assembly positioned at the forward portion thereof and having wheels at the rear portion thereof, bearing means supporting said wheel assembly for rotation relative to said wheel chair, a traction wheel rotatably mounted on said wheel assembly in a position intermediate the front and rear of the wheel chair frame, means at the rear portion of said platform to adapt the rear portion to be supported by the wheel chair, an electric drive motor supported on the wheel assembly, power transmission means interconnecting said motor and said traction wheel, a source of electrical energy connected with the electric motor, a ring gear mounted on said wheel assembly, a pinion gear engaging said ring gear, and manual control means connected for selective rotation of said pinion gear to steer the traction wheel, the propelling and steering apparatus being movable underneath the wheel chair from the rear of the chair.

2. A propelling and steering unit for attachment to a wheel chair, said apparatus comprising means for supporting the wheel chair including a wheel assembly having a generally circular periphery, the supporting means including a platform having the wheel assembly at the forward portion thereof and having wheels at the rear portion thereof, bearing means supporting said wheel assembly for rotation relative to said wheel chair, a traction wheel rotatably mounted on said wheel assembly, means at the rear portion of said platform to adapt the rear

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portion to be supported by the wheel chair, an electric drive motor supported on the wheel assembly in a position intermediate the front and rear of the wheel chair frame, power transmission means interconnecting said motor and said traction wheel, a source of electrical energy connected with the electric motor, a ring gear mounted on said wheel assembly, a pinion gear engaging said ring gear, and an electrical steering motor connected with said pinion gear through gearing means for steering said traction wheel.

3. A propelling unit for attachment to a wheel chair having side frames, said unit comprising platform means adapted to be positioned between said side frames, means for detachably mounting said platform means in operative relation with said chair, a source of electrical energy on said unit, a wheel assembly mounted for rotation on said platform means, a traction wheel rotatably mounted on said wheel assembly in a position intermediate the front and rear of said side frames, an electric motor mounted on the wheel assembly, power transmission means interconnecting said motor and said traction wheel, and means for effecting selective rotational movement of said wheel assembly to steer said traction wheel, said wheel assembly being in the forward portion of the platform means and said platform means being unobstructed over said wheel assembly, whereby the platform means is movable under the wheel chair from the rear thereof.

4. A propelling unit for attachment to a wheel chair having side frames, said unit comprising platform means adapted to be positioned between said side frames, means for detachably mounting said platform means in operative relation with said chair, said means including laterally extending lugs for supporting a rear portion of said platform means on said wheel chair and including laterally extensible lugs for supporting a front portion of the wheel chair on said platform means, a source of electrical energy on said unit, a wheel assembly mounted for rotation on said platform means, a traction wheel rotatably mounted on said wheel assembly, an electric motor mounted on the wheel assembly, power transmission means interconnecting said motor and said traction wheel, and means for effecting selective rotational movement of said wheel assembly to steer said traction wheel.

5. A propelling unit for attachment to a wheel chair having side frames, said unit comprising platform means adapted to be positioned between said side frames, means for detachably mounting said platform means in operative relation with said chair, a source of electrical energy on said unit, a wheel assembly mounted for rotation on said platform means, a traction wheel rotatably mounted on said wheel assembly in a position intermediate the front and rear of said side frames, an electric motor mounted on the wheel assembly, power transmission means interconnecting said motor and said traction wheel, a ring gear mounted on said wheel assembly, a pinion gear engaging said ring gear, and a steering column connected with said pinion gear and manipulatable for steering said traction wheel, said wheel assembly being in the forward portion of the platform means and said platform means being unobstructed over said wheel assembly, whereby the platform means is movable under the wheel chair from the rear thereof.

6. A propelling unit for attachment to a wheel chair having side frames, said unit comprising platform means adapted to be positioned between said side frames, means for detachably mounting said platform means in operative relation with said chair, a source of electrical energy on said unit, a wheel assembly mounted for rotation on said platform means, a traction wheel rotatably mounted on said wheel assembly in a position intermediate the front and rear of said side frames, the platform means including a frame having the wheel assembly at the forward portion thereof for supporting a substantial portion of the wheel chair weight on the traction wheel, means adapting the rear portion of said platform frame to be

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carried by said wheel chair side frame, an electric drive motor mounted on the wheel assembly, power transmission means interconnecting said drive motor and said traction wheel, a ring gear mounted on said wheel assembly, a pinion gear engaging said ring gear, and an electrical steering motor connected with said pinion gear for steering said traction wheel.

7. A propelling unit for use with a wheel chair having a pair of spaced side frames, said propelling unit comprising a platform structure adapted to be positioned between said side frames, means on said structure for detachably mounting the structure in operative relation with the chair, said means including laterally extending lugs for supporting a rear portion of said platform structure on said frames and including laterally extensible lugs for supporting a front portion of the wheel chair on the structure, at least one battery supported on said rear portion of the platform structure, a circular wheel assembly, bearing means rotatably mounting said wheel assembly on the platform structure, a traction wheel rotatably mounted on an axle supported on the wheel assembly, an electric drive motor mounted on the wheel assembly, a sprocket and chain transmission connected with said motor for driving said traction wheel, a ring gear attached to said circular wheel assembly, a pinion gear engaging said ring gear, and a steering column detachably connected with said pinion gear and manipulatable for steering said traction wheel.

8. A propelling unit for use with a wheel chair having a pair of spaced side frames, said propelling unit comprising a platform structure adapted to be positioned between said side frames, means on said structure for detachably mounting the structure in operative relation with the chair, said means including laterally extending lugs for supporting a rear portion of said platform structure on said frames and including laterally extensible lugs for supporting a front portion of the wheel chair on the structure, at least one battery supported on said rear portion of the platform structure, a circular wheel assembly, bearing means rotatably mounting said wheel assembly on the platform structure, a traction wheel rotatably mounted on an axle supported on the wheel assembly, a reversible electric drive motor mounted on the wheel assembly, a sprocket and chain transmission connected with said motor for driving said traction wheel, a ring gear attached to said circular wheel frame, a pinion gear engaging said ring gear, an electrical steering motor connected with said pinion gear through gearing means for steering said traction wheel, and electrical circuit means connecting said battery with the drive motor and said steering motor, said circuit means including switching means for controlling said motors.

9. In a wheel chair having side frames provided with front and rear wheels, an optionally usable power-actuated driving unit comprising a platform structure, lug means for detachably mounting said platform structure in operative assembled relation with the chair, said lug means supporting a rear portion of the platform structure on said side frames and supporting a front portion of said frames on the structure, a source of electrical energy on the unit, a wheel assembly mounted for rotation on the platform structure, a traction wheel rotatably mounted on said wheel assembly, an electric motor supported on the wheel assembly, power transmission means interconnecting said motor and said traction wheel, and means for effecting selective rotational movement of said wheel assembly to steer said traction wheel.

10. In a wheel chair having side frames provided with front and rear wheels, an optionally usable power actuated driving unit comprising a platform structure, lug means for detachably mounting said platform structure in opera-

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tive assembled relation with the chair, said lug means supporting a rear portion of the platform structure on said side frames and supporting a front portion of said frames on the structure, a source of electrical energy on the platform structure, a wheel assembly mounted for rotation on the platform structure, a traction wheel rotatably mounted on said wheel assembly, a reversible electric motor supported on the wheel assembly, electrical circuit means connecting said energy source with said motor, said circuit means including switching means for control of the motor by an operator, power transmission means interconnecting said motor and said traction wheel, a ring gear mounted on said wheel assembly, a pinion gear engaging said ring gear, and manual control means connected for selective rotation of said pinion gear to steer the traction wheel.

11. A propelling and steering apparatus for a wheel chair having said frames, said apparatus comprising platform means adapted to be positioned between the side frames, a circular turntable assembly bearing means rotatably mounting said turntable on said platform means, a traction wheel rotatably mounted on the turntable assembly, means at the rear portion of the platform means to adapt the rear portion to be supported by the wheel chair, an electric motor operatively connected with the traction wheel to propel the wheel chair, and means for partially supporting the wheel chair on an axle supported on said platform means with said traction wheel positioned to support a substantial part of the weight of the wheel chair.

12. A propelling and steering apparatus for a wheel chair having side frames, comprising platform means adapted to be positioned between the side frames, a turntable assembly carried by said platform means, a traction wheel rotatably mounted on the turntable assembly, means for partially supporting the wheel chair on said platform means with said traction wheel positioned to support a substantial part of the weight of the wheel chair, and front wheels on the wheel chair, said supporting means comprising rearwardly positioned members on the platform means to adapt the rear portion of the platform means to be supported by the wheel chair, said front wheels being raised when said wheel chair supports the rear portion of the platform means.

13. A propelling and steering apparatus for a wheel chair having side frames, comprising platform means adapted to be positioned between the side frames, a turntable assembly carried by said platform means, a traction wheel rotatably mounted on the turntable assembly, means for partially supporting the wheel chair on said platform means with said traction wheel positioned to support a substantial part of the weight of the wheel chair, front wheels on the wheel chair and rear wheels on the platform means, said rear wheels being raised when the rear portion of the platform means is supported by said side frames.

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