United States Patent

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[33] **Great Britain**
[31] **23,277/68**

[54] **WHEELCHAIRS**
3 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** ..... **180/6.5,** 180/65 F, 180/77 H, 180/Dig. 3, 200/6 A, 200/172 A, 280/42
[51] **Int. Cl.** **B62d 11/04,** B60k 7/00
[50] **Field of Search** ..... 180/6.48, 6.5, 65, 65 F, 77 H; 280/242 WC, 42; 200/6 A, 172 A

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ABSTRACT: A motorized wheelchair which has a pair of driving wheels, an electric motor for driving each of the wheels, the wheels being mounted on and supported by output shafts extending from the housings of the associated motors.

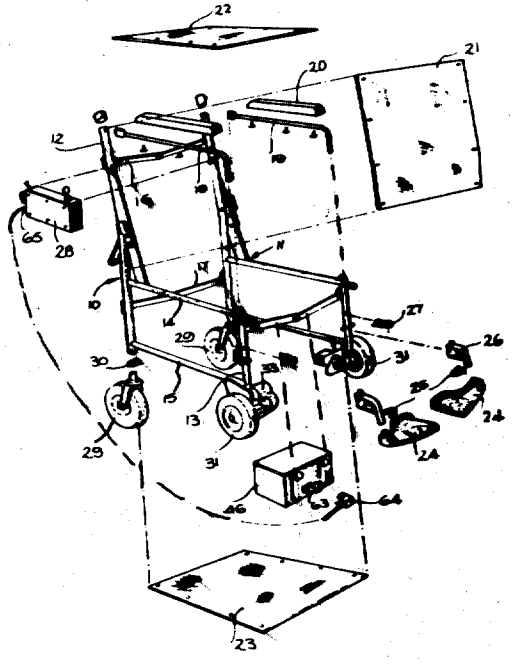
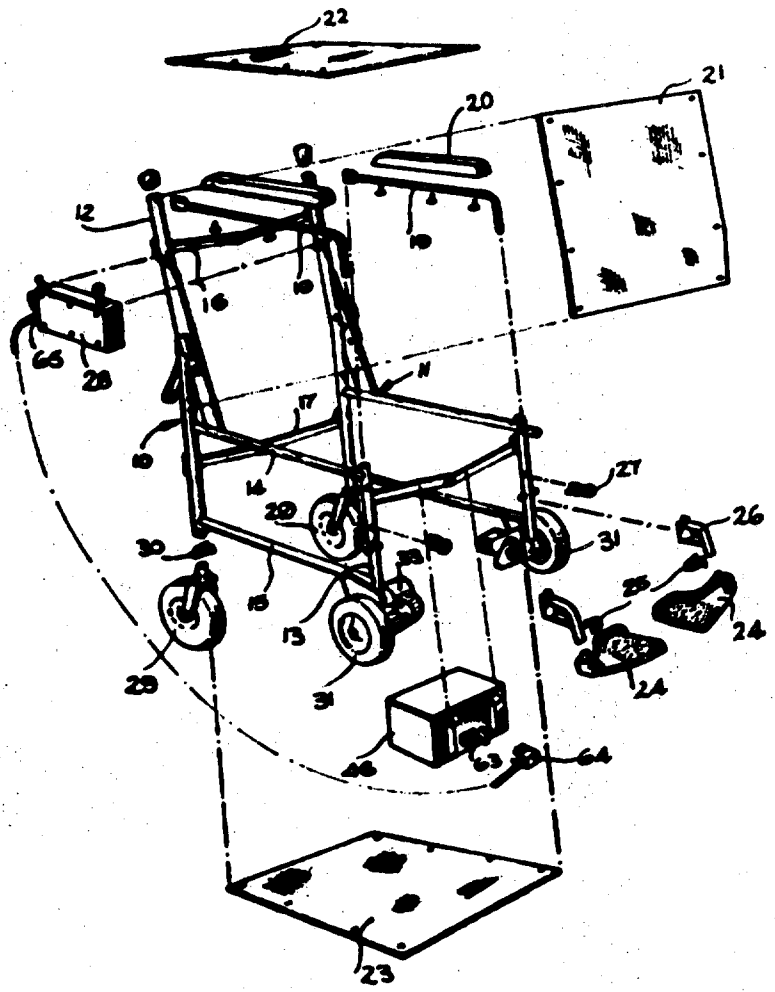


Fig. 1.



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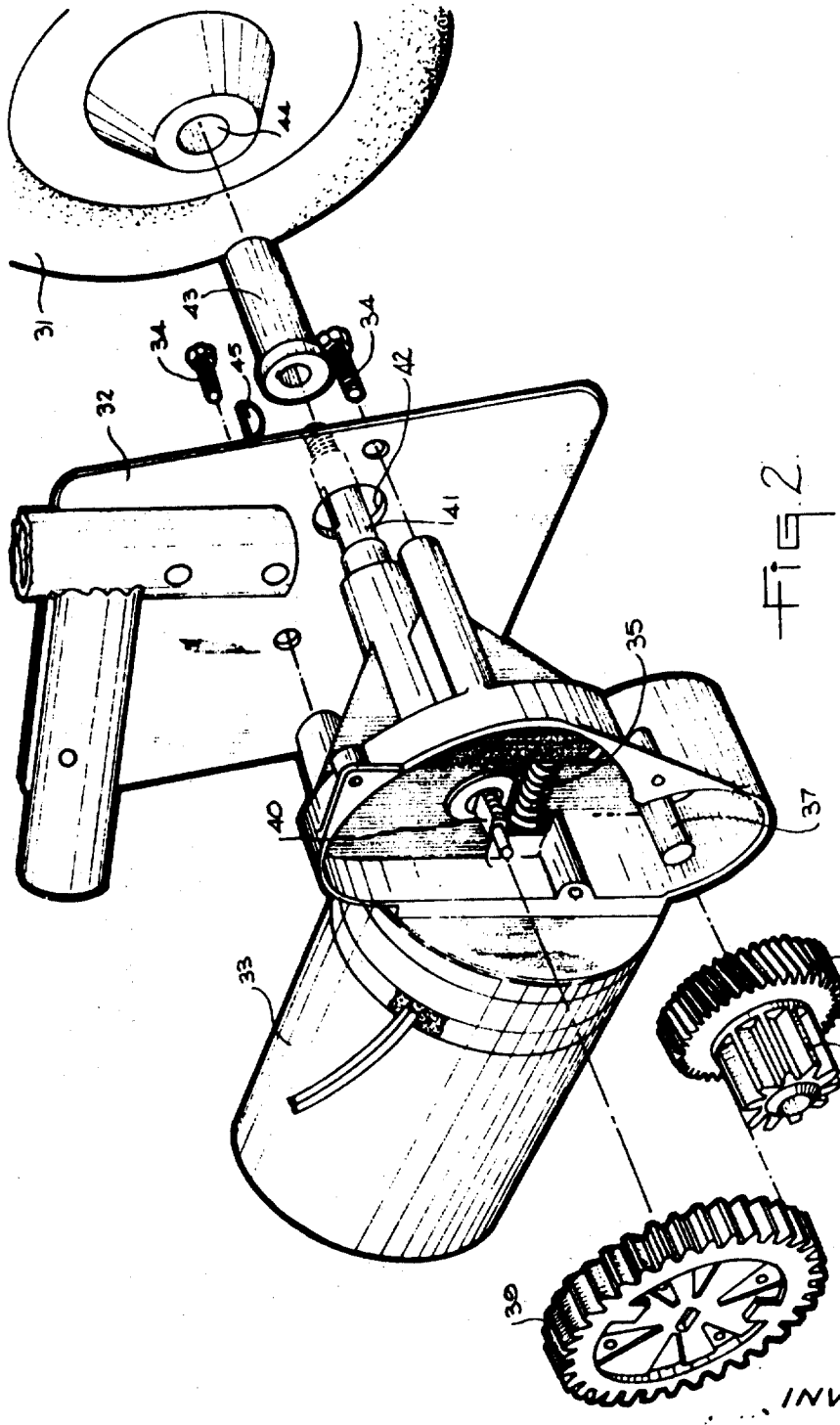


FIG. 2

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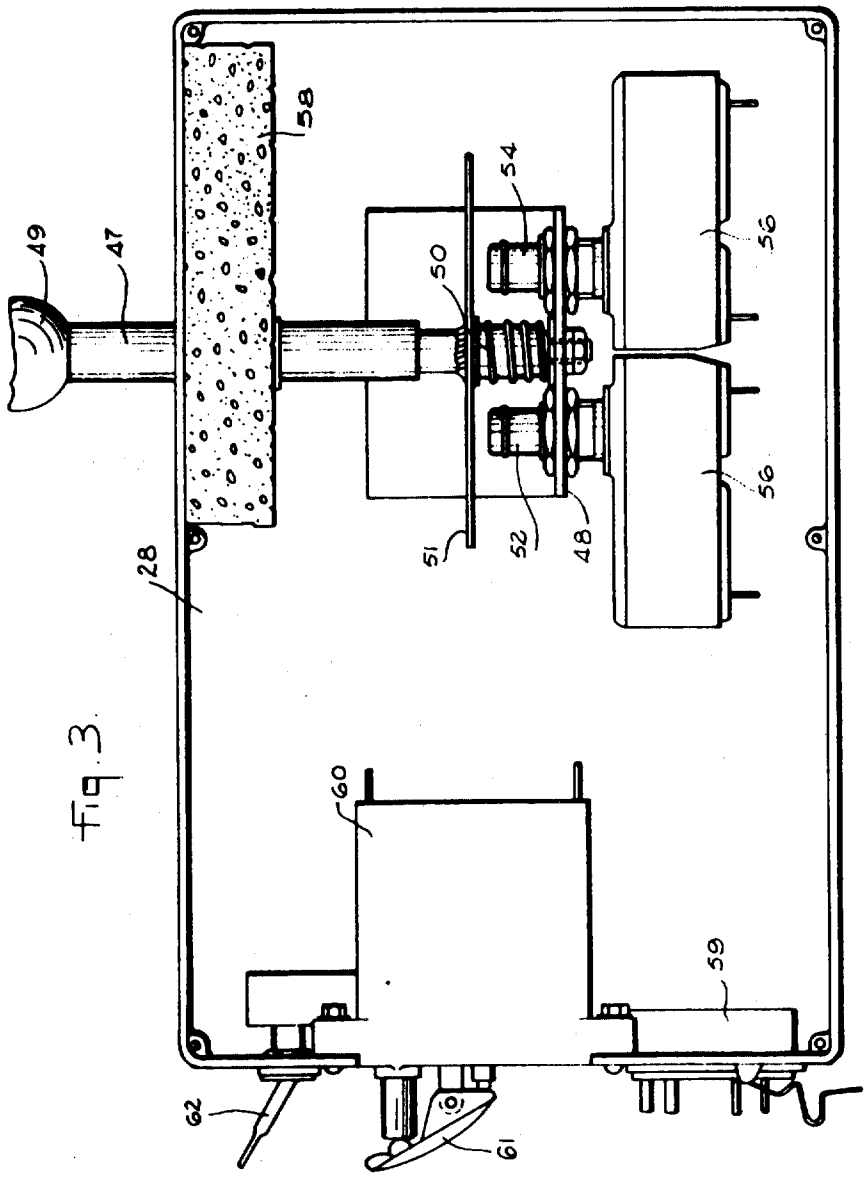


Fig. 3

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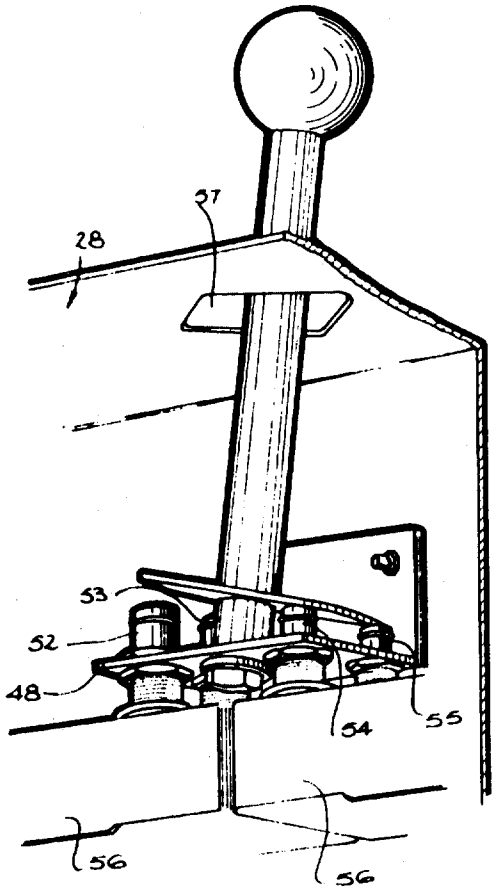


Fig. 4

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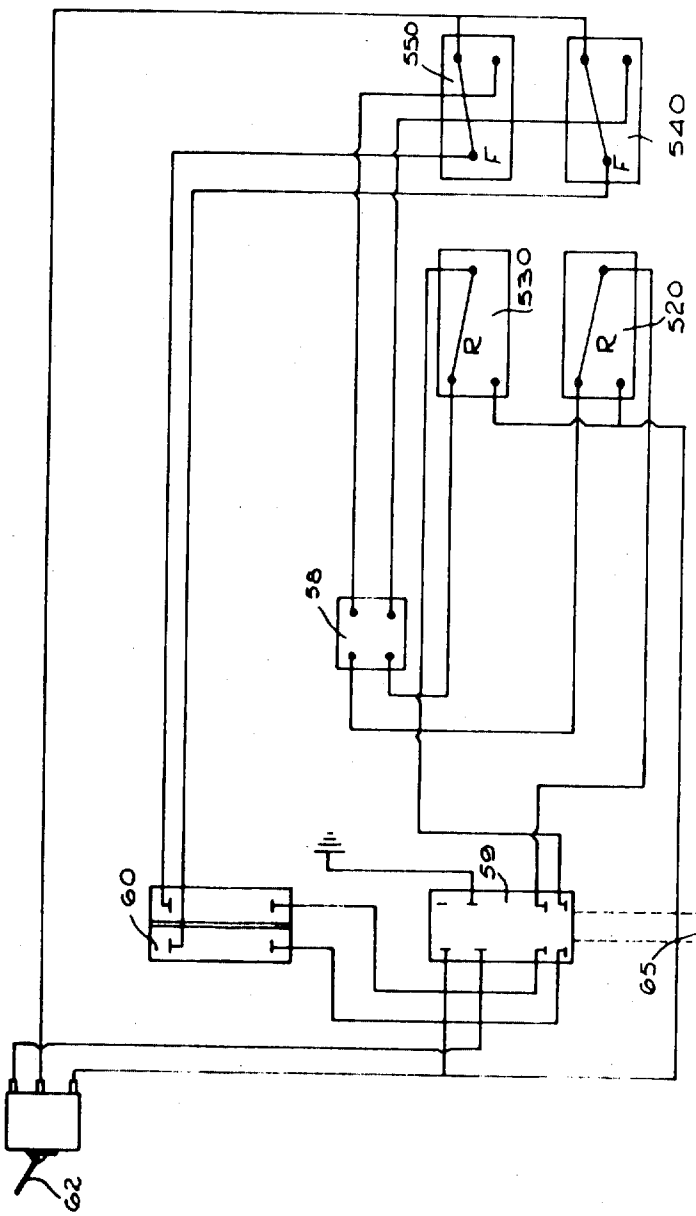


FIG. 5.

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WHEELCHAIRS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to motorized wheelchairs of the kind which include a pair of side members between which the seat portion and the backrest of the chair are disposed.

2. Description of the Prior Art

In previous forms of motorized wheelchair an electric motor has been mounted on the frame of the wheelchair and a gear or pulley system has been provided for transmitting drive to a pair of driving wheels of the chair, the drive system including clutches which can be engaged or disengaged under the control of the occupant of the wheelchair to control steering of the wheelchair.

It is an object of the present invention to provide a form of wheelchair of the above kind in which the drive to the driving wheels of the chair is simplified, in which the construction of the chair is such as to obtain a lightweight construction and in which the construction is such that the chair is collapsible.

SUMMARY OF THE INVENTION

The present invention provides a motorized wheelchair of the kind referred to above having the improvement comprising an electric motor having a housing from which an output shaft projects with each output shaft carrying a driving wheel of the chair and affording the sole support for said wheel.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is an exploded perspective view of the wheelchair,

FIG. 2 is an exploded perspective view showing the drive to one of the driving wheels of the wheelchair,

FIG. 3 is a side elevation of the control for driving and steering the wheelchair, the operating member of the control being shown in a position in which neither of the driving wheels of the chair is driven,

FIG. 4 is a detail view of part of the control shown in FIG. 3 but showing the operating member of the control in a position in which both of the driving wheels of the chair are driven in a forward direction, and

FIG. 5 is a circuit diagram showing the electrical system of the wheelchair.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The wheelchair includes, as shown in FIG. 1, a frame construction which includes a pair of side members 10 and 11, each side member 10, 11 including a back upright member 12 of tubular construction, a front upright member 13 also of tubular construction and a pair of tubular members 14 and 15 interconnecting the front and back members 13 and 12. Three linkages 16, 17 and 18 interconnect the side frame members 10 and 11 and each linkage 16, 17, 18 includes a pair of pivotally connected links which can be moved through positions in which they are aligned to positions as shown in FIG. 1 in which they serve to maintain the side frame members 10 and 11 spaced apart as shown in FIG. 1.

An armrest 19 having a pad 20 is attached to each side of the side frame members 10 and 11, a sheet 21 of flexible material is secured between the back members 12 of the side frame members to form a backrest, a further sheet 22 of flexible material is secured between the upper tubular members 14 to provide the seat portion of the chair and an additional sheet 23 also of flexible material is secured between the lower tubular members 15 to provide a parcel shelf.

Footrests 24 are connected by clips 25 to support members 26 which are connected by clips 27 to the front members 13 of the side frame members 10 and 11 and a box 28 containing a control system hereinafter described in more detail is secured to one of the armrests 19. The wheels of the wheelchair comprise a pair of castor wheels 29 secured in the lower ends of the tubular back members 12 and are held in position by

means of clips 30 and a pair of driving wheels 31 are mounted at the front of the chair. The wheels can either have pneumatic tires or solid rubber tires and conveniently have an external diameter of about 8 inches.

As shown in detail in FIG. 2 a support plate 32 is secured to the lower forward portion of each side member 10, 11 of the chair frame and each support plate 32 carries a motor housing 33 which is secured thereto by threaded fasteners 34. The housing 33 contains an electric motor having a drive shaft 35 in the form of a gear which meshes with a gear wheel 36 mounted on a pin 37. The gear wheel 36 is formed integrally with a further gear wheel 38 which meshes with another gear wheel 39 nonrotatably mounted on a shaft 40, the shaft 40 including an output portion 41 which projects from the motor housing 33 and affords the output shaft of the motor. The gear ratios between the shaft 35 and wheel 36 and between the two gear wheels 38 and 39 are such that, as can be seen from FIG. 2, a stepdown gear drive system is provided.

Each motor housing is disposed inwardly of its associated support plate 32 as can be seen from FIG. 1 and the output shaft 41 projecting from the housing 33 extends through an aperture 42 in the associated support plate 32 and the driving wheel 31 of each motor is disposed outwardly of the associated support plate 32. Each output shaft 41 engages a bushing 43 fitted in a central bore 44 of the associated wheel 31 and a key 45 engages in a slot formed in the bushing and in a slot formed in the output shaft 41 to prevent relative rotation between the shaft 41 and bushing 43 whereby drive is transmitted to the wheel 31, the bushing 43 being a tight fit and welded in its associated bore 44. The output shafts 41 not only provide the drive to the wheels 31 but also afford the sole support therefor thus eliminating the need for any further means for mounting the wheels 31.

The power for driving the motors is obtained from batteries contained within a battery casing 46 which is clipped onto the links of the front linkage 18. The batteries within the casing 46 can be either light duty, nonspillable batteries or heavier duty spillable batteries and are rechargeable and the battery casing 46 is removed from the linkage 18 prior to collapsing of the wheelchair frame which can be effected by moving the pivotal connection of each of the linkages 16, 17 and 18 upwardly and then moving the side frame members 10 and 11 of the chair towards each other. The battery housing will normally contain three batteries.

Operation of the driving motors of the wheelchair is effected by means of a joy stick control which includes a control mechanism mounted within the control box 28 which can be mounted either on the left-hand side or the right-hand side of the wheelchair. The control mechanism includes a lever 47 which is mounted for pivotal movement relative to a plate 48 and has a knob 49 at its upper end to facilitate manual grasping thereof. A helical spring 50 surrounds the lower end portion of the lever 47 between the plate 48 which is fixed within the box 28 and a plate 51 which is fixed to the lever 47 and the spring 50 serves to bias the lever 47 into an upright position. There are four contacts 52, 53, 54 and 55 mounted on the plate 48 and the contacts 52, 53, 54 and 55 control operation of microswitches 520, 530, 540 and 550 (see FIG. 5), the microswitches being contained within switch housings 56. The lever 47 extends through an opening 57 formed in the upper surface of the control box 28 and there is a foam pad 58 (not shown in FIG. 4) which fits round the lever 47 beneath said opening 57 and the pad 58 functions as a sealing member to prevent the entry of dust and dirt into the control box 28.

The arrangement is such that, when the lever 47 is moved in a forwards direction, i.e., into the position shown in FIG. 4, the contacts 54 and 55 are operated to operate the switches of the associated microswitches 540 and 550 the switch members of which are shown in their operated conditions in FIG. 5. The circuit of the control box is such that when the contacts 54 and 55 are operated both electric motors are driven in a forwards direction. The arrangement is also such that, when the lever is moved rearwardly to cause closure of the contacts 52

and 53 both the electric motors are driven in a rearwards direction.

As indicated in FIG. 4 the opening 57 formed in the top plate of the box 28 is of square form with the diagonals of the square extending in a front to back and in a side-to-side direction. When the lever 47 is moved into the right-hand corner of the square contacts 52 and 54 are operated and the left wheel of the chair is driven in a forwards direction and the right wheel is driven in reverse whereby the chair is caused to turn rapidly to the right. When the lever is moved to the left-hand corner of the square to operate contacts 53 and 55 the right-hand wheel of the chair is driven forwards and the left-hand wheel is driven in reverse whereby the chair is turned rapidly to the left.

The arrangement is that when contact 54 is operated (i.e., the right-hand side front contact) the left wheel of the chair is driven forwards, when the contact 55 is operated the right wheel is driven forwards, when the contact 52 is operated the right wheel is driven backwards and when the contact 53 is operated the left wheel is driven backwards.

The switch members of the microswitches are movable between normally open and normally closed positions, the switch members of microswitches 540 and 550 being shown in their operated conditions and the switch members of microswitches 520 and 530 being shown in their nonoperated conditions, a diode assembly 58 being connected between the microswitches to prevent feedback between the microswitches and the leads for the microswitches are connected either directly or indirectly to a plug and socket fitting 59, the indirect connections being effected through a circuit breaker 60 having an operating element 61 which can be moved between an open position as shown in FIG. 3 in which operation of the motors is prevented and a closed position in which operation of the motors is permitted. The circuit breaker 60 includes an overload mechanism which automatically cuts out if the motors are overloaded.

The battery casing 46 contains, as pointed out above, three batteries which are normally 6-volt batteries and the arrangement is that either two or three batteries can be brought into the electrical circuit, this being by means of a switch 62 which, when in the up position, brings two batteries into the circuit and, when in the down position, brings all three batteries into the circuit. The circuitry is such that all three batteries can only be brought into the circuit when the chair is driven in the forwards direction. With an 18-volt supply each electric motor drives its output shaft 41 at a greater speed than with a 12-volt supply. When travelling forwardly therefore, the occupant of the chair can either travel at a first lower speed or at a second somewhat higher speed.

There is a detachable electrical connection between the battery casing 46, the control box 28 and each of the electric motors. The detachable connection includes the socket fitting 59 of the control box, a socket fitting 63 on the battery casing 46, a plug 64 for fitment in the socket fitting 63, a plug 65 for fitment in the socket fitting 59 and leads extending from the plug 64 to the plug 65 and from the plug 65 to each of the electric motors. The plug 65 is indicated in FIG. 5 with the leads 66 and 67 shown extending from the plug 65 to the two electric motors M1 and M2.

It is to be understood that the electrical circuitry shown in FIG. 5 represents only one way in which the various operating components in the control box could be connected together and said electrical circuitry of FIG. 5 has therefore not been described in detail, it being assumed that the detailed operation thereof will be apparent to those skilled in the art.

In the above arrangement a joy stick control is provided for controlling operation of the electric motors but the joy stick control system can be replaced by a pushbutton control system (not shown in the drawings), there being four pushbuttons, depression of one serving to drive both wheels forwards, depression of another serving to drive both wheels in reverse, depression of a further button serving to turn the wheelchair to the right and depression of the fourth pushbutton serving to turn the wheelchair to the left.

In a further pushbutton arrangement there are again four pushbuttons arranged as per the contacts 52, 53, 54 and 55. Depression of the front pair of pushbuttons causes the motors to drive the wheels forwardly; depression of the rear pair of push buttons causes the motor to drive the wheels rearwardly; depression of one diagonal pair of pushbuttons causes the left driving wheel to be driven forwardly and the right driving wheel to be driven rearwardly so that the chair turns to the right and depression of the other diagonal pair of buttons has the opposite effect.

I claim:

1. A motorized wheelchair which includes a pair of said members between which the seat portion and the backrest of the chair are disposed; a pair of electric motors carried one by each side member, each electric motor having a housing from which an output shaft projects, each output shaft being supported at one of its ends within the housing and the other end of the output shaft carrying a driving wheel of the chair, said other end of each output shaft being unsupported and affording the sole support for said driving wheel, said driving wheels being located at the front of the chair; a pair of castor wheels provided at the rear of the chair, the castor wheels being releasably fastened to the respective side members; each side member having a support plate secured thereto, the housing for the associated electric motor being releasably secured to one side of the support plate with the output shaft projecting from said housing and the driving wheel carried by the output shaft being disposed on the other side of the plate, the housing for each electric motor including an elongate bearing sleeve receiving and supporting said one end of the output shaft and a plurality of socket members projecting from the housing, each support plate being formed with a plurality of apertures aligned one with each of said socket members of the associated housing, each aperture receiving a threaded fastener engaging with the socket member aligned with said aperture, the free ends of the socket members lying in a common plane and abutting said one side of the support plate, and each driving wheel including a cylindrical bushing receiving the associated output shaft and having a keyed connection therewith whereby each driving wheel is rotatably fast with its associated output shaft.

2. A wheelchair according to claim 1 wherein a plurality of linkages interconnect the side members, each linkage including a pair of links which are pivotally connected one to each side member and to each other in such a way that the wheelchair can be collapsed by pivoting said links upwardly relative to their respective side members, wherein the electrical power supply for the electric motors comprises a plurality of batteries housed within a casing which is mounted detachably on said wheelchair.

3. A wheelchair according to claim 1 wherein a control unit is mounted on one of the side members, said control unit housing a joystick control for controlling operation of the electric motors, the joystick comprising a lever having a first plate secured thereto, said lever being tiltably connected to a second plate spaced from the first plate with biassing means acting between two plates to bias the first plate into a position in which it lies parallel to the second plate and a plurality of equispaced microswitch contact members surrounding the lever and projecting from the second plate towards the first plate. Each electric motor having one or more of the contact members associated therewith and the arrangement being such that tilting movement of the first plate can be effected to selectively operate the contact members to control operation of the respective electric motors.