Title: MOTOR POWERED ALL TERRAIN WHEELCHAIR

Abstract: An all terrain wheelchair for outdoor recreational use includes opposite frame members each having a forward wheel and a rear wheel rotatably mounted thereto. A collapsible hinged brace assembly fitted between the frame members locks in an expanded box configuration to hold the opposite frame members apart, defining an operable position for use of the wheelchair. The front and rear wheels include wide rims and tires to provide increased traction and surface contact area when traversing soft terrain. Batteries placed in the box-shaped brace assembly, below the seat, supply power to electric motors of a belt drive system which drives the rear wheels in the forward and reverse direction. A joystick controller on the armrest allows the user to control the speed and direction of movement of the wheelchair.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
MOTOR POWERED ALL TERRAIN WHEELCHAIR

BACKGROUND OF THE INVENTION

5 Field of the Invention

The present invention relates to a wheelchair and, more particularly, to a collapsible power wheelchair constructed for outdoor recreational use and including wide rim wheels and an electric motor powered belt drive system operated by a joystick controller.

10 Discussion of the Related Art

Historically, wheelchairs were designed for use indoors, and particularly in medical institutions and homes having hard floor surfaces such as tile, pavement, concrete and the like. Through evolution of the development of the modern day wheelchair little attention was given to aesthetics and multi-terrain features. Consequently, most wheelchairs have institutional, unattractive design which is limited to use on flat, hard surfaces. Moreover, the conventional wheelchair evokes a negative stigma, especially in the perception of children and those people new to the use of a wheelchair. Additionally, the wheels on conventional wheelchairs are narrow and perform poorly on soft surfaces, such as grass, sand, mud, and the like,
resulting in much inconvenience for wheelchair users when they wish to participate in outdoor activities.

There has been some development in the field of specialty wheelchairs that are designed for particular sporting activities. For instance, there are various wheelchairs particularly designed for sports such as wheelchair basketball and road racing. Others in the art have proposed oversized wheels for use on sand, grass, mud, and like terrain. While some of these all terrain wheelchairs have been found to be generally effective in traversing softer ground surfaces, they are usually large and bulky and not cosmetically pleasing. They often do not conform to internationally recognized wheelchair dimensions which are usually applied to the construction of wheelchair facilities such as ramps, access ways, lifts, and the like. For this reason, most "all terrain" wheelchairs in the art are not able to use public wheelchair facilities due to their enlarged size.

Summary of the Invention

The present invention is directed to an electric motor powered all terrain wheelchair for outdoor recreational use which is capable of traveling over surfaces such as grass, sand, mud and the like, regardless of weather conditions, and yet its dimensions conform to modern building codes regulating door clearances and the like. The
rugged and cosmetically pleasing design of the power all terrain wheelchair reduces the stigma that is sometimes associated with wheelchairs for the physically challenged.

In addition to its ruggedness, the power all terrain wheelchair of the present invention is designed for extended exposure to the elements, including fresh and salt water, without damage. All of the components used in the construction of the all-terrain wheelchair are non-corrosive and include such materials as molded polyethylene plastic, stainless steel and aluminum. The rims of the wheels are constructed to be extra wide to provide increased surface contact area in softer terrain. Traction means are provided as transverse ribs extending outwardly and inwardly from the base of the tire to the edges of the rim. Upper and lower hinged horizontal support members provide means for locking the wheelchair into an expanded operable position or collapsed storage position. A collapsible box structure below the seat with hinged rear doors provides an area between the horizontal support members for storage of two 12-volt batteries. The batteries supply power to electric motors of a drive belt system for drivingly rotating the rear wheels in both a forward direction and reverse direction. A joystick controller on the armrest allows the user to control the speed and direction of movement of the wheelchair.
Objects and Advantages of the Invention

It is a primary object of the present invention to provide an all terrain wheelchair powered by electric motors.

It is a further object of the present invention to provide a powered all terrain wheelchair for outdoor recreational use.

It is still a further object of the present invention to provide a powered all terrain wheelchair which has a cosmetically pleasing design.

It is yet a further object of the present invention to provide a powered all terrain wheelchair which is collapsible for ease of transport and storage.

It is still a further object of the present invention to provide a powered all terrain wheelchair which is designed to conform to modern building codes regulating door clearances and other size restrictions.

It is yet a further object of the present invention to provide a powered all terrain wheelchair which is constructed of corrosion resistant materials.

It is yet a further object of the present invention to provide a powered all terrain wheelchair which is powered by electric motors and which is capable of traveling over a variety of outdoor terrains.

These and other objects and advantages of the present invention are more readily apparent with reference to the following detailed description and the accompanying drawings.
Brief Description of the Drawings

For a fuller understanding of the nature of the present invention, reference should be made to the following detailed description taken in conjunction with the accompanying drawings in which:

Figure 1 is a perspective view of the power all terrain wheelchair in an expanded, operable position;

Figure 2 is a right side view of the power all terrain wheelchair in an expanded, operable position;

Figure 3 is a rear view of the power all terrain wheelchair in an expanded, operable position;

Figure 4 is a top view of the power all terrain wheelchair in an expanded, operable position;

Figure 5 is a rear view of the all terrain wheelchair in a folded, storage position;

Figure 6 is an isolated top perspective view showing the electric motor and drive belt system associated with the left rear wheel of the wheelchair;

Figure 7 is a perspective view of the inside of one of the rear wheels of the wheelchair, showing a belt drive pulley mounted to the rear wheel to surround the rear axle; and

Figure 8 is an isolated perspective view showing the battery power system comprising a pair of 12-volt batteries connected in series.
Like reference numerals refer to like parts throughout the several views of the drawings.

**Detailed Description of the Preferred Embodiment**

Referring to the several drawing figures, the power all terrain wheelchair is shown and is generally indicated as 1. The power all terrain wheelchair 1 includes two side frame members 10, 11 which are connected together by expanding and collapsing means for locking the frame members in an operable position and further for collapsing the frame members towards one another for transporting or storing the all terrain wheelchair when not in use. The expanding and collapsing means is defined by a brace assembly 8, having a generally box-like structure which includes a lower horizontal support member 12 and an upper horizontal support member 13 which, together, provide the primary support structure for maintaining the wheelchair 1 in an expanded, operable position. Embodied in the side frame members 10, 11 is a square section 26 from which the nose sections 28, 29 protrude forward, the handles 30, 31, 32, 33 extend rearwardly and upwardly, and the armrests 34, 35 and rear wheels 36, 37 attach.

The upper and lower support members 12, 13 are hingedly moveable between a collapsible position and an expanded, locked position. Each support member includes two rigid rectangular panels 16. Outboard edges 17 of each of the panels 16 are movably attached to
the respective side frame members 10, 11 by hinges 18, creating a collapsible box structure which folds along a central hinge line 20, using hinges 22 which attach to inboard edges 19 of the panels 16. The hinges 22 are structured to allow the inboard edges 19 of the panels 16 to fold upward along the hinge line 20, so that the two side frame members move together, in stacked relation, as shown in Figures 8 and 9, thereby facilitating storage and/or transport of the wheelchair. A rigid locking clip 24 having a U-shaped channel is removably fitted across the front peripheral edges of the panels 16 of the upper horizontal support to prevent hinge movement along the hinge line when the frame members are in the expanded (fully separated), operable position. The panels 16 are available in a variety of widths to allow for various wheelchair sizes.

Two rear doors 17, 18 are provided, vertically extending from the lower horizontal support member to the upper support member, including a left door and a right door. Hinges 86 are provided to permit the doors to swing outwardly from a closed position to an open position. Upper and lower lock elements having a U-shaped channel are molded into the doors 17, 18. When the doors are in the closed position, the U-shaped channels of the lock element fit over the rear peripheral edges of the upper and lower horizontal support members, preventing movement of the hinges along the hinge line when the supports are in the expanded, operable position, thereby maintaining the frame members
10, 11 in the fully separated, operable position. The doors 17, 18 can be made in a variety of widths to allow for various wheelchair sizes.

A locking hinged clasp 82 is provided to lock the doors together into the closed position. Facing the rear of the wheelchair, the hinge clasp is mounted on the left door. Two plastic blocks are aligned vertically and mounted along the inner edge of the right door for the hinge clasp to lock around prior to being snapped closed. The blocks are separated by approximately 1/8 of an inch. The inner side of the clasp has a horizontal ridge that fits into a slot, thereby maintaining proper alignment of the doors when the clasp is locked. The area between the upper and lower support members, the side supports and the rear doors, serves as a storage area for a pair of 12-volt batteries 40 connected in series. A removable torsion bar fits to the back of the frame, above the doors 17, 18 to provide rigidity and resist squatting and stress on the rear wheels.

Dual grip handles are provided at the upper rear zone of each side frame member as shown in several of the drawing figures. The upper grip handles 31, 33 on each structure is used for pushing the wheelchair in a normal fashion. The lower grip handles 30, 32 are angled at approximately 65° counterclockwise from horizontal, when viewing the right side of the wheelchair. The positioning of the lower grip handle provides greater leverage for pulling the wheelchair through rugged terrain, such as sand, tall grass, or snow.
The footrest is embodied as an adjustable plate 44 located at the lower forward portion of the wheelchair. The plate is attached to the lower portion of an adjustable U-shaped aluminum tubular structure 45 that protrudes downward at an angle approximately 45° from the horizontal, when viewing the right side of the wheelchair. The plate is affixed into place using metal clamps 46 secured around the tube and to the underside of the plate. In order to prevent undesirable movement of the plate, relative to the tube, the underside of the plate is contoured for congruent, fitted receipt of the tube.

The front wheels 52, 53 and rear wheels 36, 37 are constructed to be extra wide for an increased surface contact area in softer terrain. On each rear wheel, the rim surface 60, 61 extends axially away from the outer and inner edges of the tire, creating an enlarged ground engaging area in softer terrain. From the outer edge of the tire, an outboard extension forms an integrated handrail for manual propulsion. The width of the rim allows the user to grab the rim with the entire hand area, thereby providing better control and enabling one to apply sufficient force for propulsion of the wheel when the wheel is disengaged from the gear drive of the power train. The wheels also include an inboard rim extension adjacent the inner edge of the tire.

The increased surface area provided by the rim 60, 61 limits sinking of the wheels into soft soils and sand. Traction means are provided as transverse ribs extending outwardly and inwardly from the
base of the tire to the edges of the rim. The transverse ribs serve as a grip means when turning the wheels manually and improve traction while traversing across soft surfaces. The tires 64, 65 are all terrain style, having larger tread than conventional tires, to additionally aid in traction and add to the rugged appeal of the wheelchair.

The rear wheel further includes struts 68 which extend from the hubs 70, 71 to the rims 60, 61.

The front wheels 52, 53 are pivotally mounted to the side frame members. On each front wheel, the rim surface 62, 63 extends axially outwardly from both sides of the tire. As with the rear wheels, the rim increases the ground-engaging surface area in soft soil and sand.

A seat 76 manufactured from nylon or canvas weave material is suspended above the storage compartment of the wheelchair. On each side, the seat material is riveted or grommeted to square aluminum tubes, one attached horizontally to the inside of each side frame member. Plastic end caps are provide to protect the wheelchair occupant from potentially sharp corners at the ends of the tubes.

A panel of nylon or canvas weave material 77 is also fitted between two vertical cylindrical aluminum supports 78, 79, one attached to each side frame member to provide a backrest. At the base, each support is hinged so that the backrest may be reclined. Plastic clamps mount around the supports and attach with bolts to two square runners mounted in C-channels 80. The C-channels 80 are embedded
in the side frame members and secured with bolts. The upper end of each C-channel is located approximately 1 inch behind the upper rear joint of the armrest and side frame member. The C-channels 80 are approximately 6 inches long and extend at an angle approximately 25° counter-clockwise from horizontal. The bolts attaching the clamps have plastic grips so that they may be easily loosened and the inclination angle of the backrest may be adjusted. Approximately 3 inches of adjustment travel is available, following an adjustment from approximately 15° to 40° vertical.

The wheelchair is powered by an electric motor and drive belt system. Specifically, each rear wheel is operatively driven by an independent drive belt system 100. Each drive belt system associated with each of the rear wheels includes a 24-volt dynamic electric motor 104. In a preferred embodiment, the electric motors run at 120 rpm and provide 50 lbs. of torque. Each motor 104 is mounted to a reduction gear box 106. Each reduction gear box 106 is mounted to the frame assembly on the back of the wheelchair. A gear lever 108 on each gear box 106 is operable to engage and disengage the gear assembly. This allows the user to disengage the drive system for manual propulsion of the wheelchair by grasping the rear wheel rims.

The motor and gear box assembly drives a belt 110 fitted about a first pulley 112 attached to the output shaft of the gear box and a second pulley 114 mounted on the inside of the rear wheel, about the
rear axle. Tensioners 116 maintain the belts 110 of the drive belt systems taut to prevent slippage of the belt on the pulleys 112, 114.

The motors 104 are powered by a battery power source consisting of a pair of 12-volt batteries 130 connected in series. The battery power pack is placed within the storage compartment below the seat of the wheelchair. A quick disconnect fitting connects the batteries 130 to a joystick controller 140 on the armrest of the wheelchair. The joystick controller 140 directs power to each of the belt drive systems and allows the user to control the speed and direction of movement of the wheelchair by controlling the power output and direction of each motor. The joystick controller may further be provided with an electric-powered horn and battery charge indicator lights.

For storage and transportation purposes, the wheelchair may be collapsed by opening the rear doors and removing the front rigid locking clip 24 from the upper horizontal support 13. The batteries 130 are then removed after unplugging the power cable from the quick disconnect. A strap 83 on the rear of the wheelchair is used to keep the wheelchair in its folded position. The strap is located midway up the rear surface of the right side support structure as shown in Figure 9. One end of the strap is permanently attached to the right side frame member with a screw 84. The opposite end of the strap has a hole approximately 1/2 inch in diameter that mounts over a screw 85 permanently attached to the left side frame member.
While the instant invention has been shown and described in accordance with a preferred and practical embodiment thereof, it is recognized that departures from the instant disclosure are contemplated within the spirit and scope of the present invention.
Claims

1. A wheelchair comprising:

   a left frame member and a right frame member, said left and right frame members each including an inboard side, an outboard side, a forward nose portion, an armrest portion and a handle portion;

   left and right front wheels each rotatably and pivotally mounted to said forward nose portion of a respective one of said left and right frame members;

   left and right rear wheels each rotatably mounted to the wheelchair on said outboard side of a respective one of said left and right frame members;

   a brace structure connecting between said left and right frame members for supporting and maintaining said left and right frame members in spaced, parallel relation to one another, said brace structure being operable between a folded, collapsed position to move said left and right frame members towards one another and an expanded, locked position to maintain said left and right frame members spaced apart in an operable position;

   a collapsible seat and a collapsible back rest attached between said left and right frame members;

   at least one motor supported on said wheelchair;

   a drive assembly operatively linked between said at least one motor and at least one of said left and right rear wheels for drivingly
rotating said at least one rear wheel upon operative engagement of said at least one motor; and

control means operable from said seat for selectively operating said at least one motor between a stop mode, a forward driving engagement mode to drivingly rotate said at least one rear wheel in a forward rotation and a rear driving engagement mode for drivingly rotating said at least one rear wheel in a rear rotation.

2. The wheelchair as recited in Claim 1 further comprising:

two of said motors, including a first motor and a second motor;

and

two of said drive assemblies including a first drive assembly operatively linked between said first motor and said left rear wheel, and a second drive assembly operatively linked between said second motor and said right rear wheel.

3. The wheelchair as recited in Claim 2 wherein said controller is structured and disposed to selectively operate both of said first and second motors independently and in unison in both said forward driving engagement mode and said rear driving engagement mode.

4. The wheelchair as recited in Claim 3 wherein said first and second motors are each structured and disposed to be selectively disengaged from said respective first and second drive assemblies to permit manual rotation of the respective left and right rear wheels.
5. The wheelchair as recited in Claim 4 further comprising a battery power source carried on said wheelchair for energizing said first and second motors.

6. The wheelchair as recited in Claim 5 wherein said brace structure forms a compartment below said seat for holding said battery power source.

7. The wheelchair as recited in Claim 6 wherein said first and second drive assemblies each comprise:

   a reduction gear assembly operatively connected to an output of a respective one of said first and second motors, and said reduction gear assembly including an output shaft;

   a main drive pulley attached to said output shaft of said reduction gear assembly and rotatable with said output shaft upon operation of said respective one of said first and second motors;

   a second drive pulley coaxially attached to said respective left and right rear wheels and rotatable therewith;

   a drive belt fitted to said main drive pulley and said second drive pulley for drivingly rotating said second drive pulley upon driven rotation of said main drive pulley; and

   tensioning means for maintaining said drive belt in driven engagement with said main drive pulley and said second drive pulley.

8. The wheelchair as recited in Claim 6 wherein said left and right rear wheels further comprise:
an annular rim;

tire fitted about said annular rim; and

an outer facing rim surface extending radially outboard of said tire and defining a ground engaging surface; and said ground engaging surface of said annular rim being structured and disposed to provide traction when said tire sinks into an underlying ground surface.

9. The wheelchair as recited in Claim 8 wherein said left and right front wheels further comprise:

an annular rim;

tire fitted about said annular rim; and

an outer facing rim surface extending radially outboard of said tire and defining a ground engaging surface; and said ground engaging surface of said annular rim being structured and disposed to provide traction when said tire sinks into an underlying ground surface.

10. A wheelchair comprising:

a left frame member and a right frame member, said left and right frame members each including an inboard side, an outboard side, a forward nose portion, an armrest portion and a handle portion;

left and right front wheels each rotatably and pivotally mounted to said forward nose portion of a respective one of said left and right frame members;
left and right rear wheels each rotatably mounted to the wheelchair on said outboard side of a respective one of said left and right frame members;

a brace structure connecting between said left and right frame members for supporting and maintaining said left and right frame members in spaced, parallel relation to one another, said brace structure being operable between a folded, collapsed position to move said left and right frame members towards one another and an expanded, locked position to maintain said left and right frame members spaced apart in an operable position;

da collapsible seat and a collapsible back rest attached between said left and right frame members;

a pair of motors supported on said wheelchair;

a first drive assembly operatively linked between said first motor and said left rear wheel for drivingly rotating said left rear wheel upon operative engagement of said first motor;

a second drive assembly operatively linked between said second motor and said right rear wheel for drivingly rotating said right rear wheel upon operative engagement of said second motor; and

control means operable from said seat for selectively operating said first and second motors, independently and in unison, between a stop mode, a forward driving engagement mode to drivingly rotate said
rear wheels in a forward rotation and a rear driving engagement mode for drivingly rotating said rear wheels in a rear rotation.

11. The wheelchair as recited in Claim 10 wherein said first and second motors are each structured and disposed to be selectively disengaged from said respective first and second drive assemblies to permit manual rotation of the respective left and right rear wheels.

12. The wheelchair as recited in Claim 10 further comprising a battery power source carried on said wheelchair for energizing said first and second motors.

13. The wheelchair as recited in Claim 12 wherein said brace structure forms a compartment below said seat for holding said battery power source.

14. The wheelchair as recited in Claim 13 wherein said left and right rear wheels further comprise:

   an annular rim;

   a tire fitted about said annular rim; and

   an outer facing rim surface extending radially outboard of said tire and defining a ground engaging surface; and said ground engaging surface of said annular rim being structured and disposed to provide traction when said tire sinks into an underlying ground surface.

15. The wheelchair as recited in Claim 14 wherein said left and right front wheels further comprise:

   an annular rim;
a tire fitted about said annular rim; and

an outer facing rim surface extending radially outboard of said tire and defining a ground engaging surface; and said ground engaging surface of said annular rim being structured and disposed to provide traction when said tire sinks into an underlying ground surface.
FIG. 6