The vehicle further includes a plurality of ground engaging wheels wherein each wheel of the plurality of wheels is rotatably mounted at an edge of each radial arm of said at least four radial arms, a motor, and a differential or epicyclic gearing mechanism having an input pinion shaft being powered by the motor.

**Abstract:** A vehicle for ascending and descending stairs includes a frame assembly having a pair of lower elongate side members, and a lower elongate cross member interconnecting each lower elongate side member of the pair of lower elongate side members. The vehicle further includes at least one power driven axle rotatably mounted on opposite sides of the lower elongate cross member of the frame assembly, at least one non-power driven axle rotatably mounted on one end of the pair of lower elongate side members of the frame assembly, at least one spider having an inner plate and a parallel outer plate. The at least one spider is rotatably mounted on the at least one power driven axle and on the at least one non-power driven axle. The spider is further disposed of to form at least four radial arms. The vehicle further includes a plurality of ground engaging wheels wherein each wheel of the plurality of wheels is rotatably mounted at an edge of each radial arm of said at least four radial arms, a motor, and a differential or epicyclic gearing mechanism having an input pinion shaft being powered by the motor.
METHODS AND SYSTEMS FOR ASCENDING AND DESCENDING STAIRS

BACKGROUND OF THE INVENTION

Field of invention

Embodiments of the present invention generally relate to vehicles adapted to surmount impediments such as stairs, and other surfaces above the ground level, and, more particularly, to methods and systems for ascending and descending stairs, surfaces with modest slopes, surfaces with steep slopes and the like.

Description of the Related Art

Stair-climbing apparatuses mounted on wheelchairs or load carrier vehicles are well known in the art. Generally, these apparatuses are battery powered or motor driven with a chair or platform permanently connected to the apparatuses. Most of these vehicles and particularly wheelchairs are heavy, bulky and equipped with complicated shock absorber systems.

US Pat. No. 6,619,414 discloses a personal mobility vehicle including a frame with a pair of parallel tracks for moving the vehicle, a lifter arm to assist the vehicle in traversing the upper end of a flight of stairs in either the ascending or descending directions and a retractable rod with freewheeling roller to prevent the vehicle from tipping rearward as the vehicle ascends a slope.

US Pat. No. 4,564,080 and US Pat. No. 4,671,369 describe wheelchairs including a pair of cushioning arms, a fluid piston and cylinder assemblies
operate to avoid rapid downward movements of the front and the rear of the wheelchair as the wheelchair moves from a horizontal surface to an inclined surface or from an inclined surface to a horizontal surface. The system performs latching and unlatching of the cushioning arms respectively when the wheelchair moves over a horizontal surface or senses proximity to an inclined surface.

The system described in US Pat. No. 4,564,080 and US Pat. No. 4,671,369 discloses ground-engaging wheels and a pair of endless flexible tracks. However, each wheel and track is driven by four individual motors and a control is provided to allow for forward, reverse and turning movements of the wheelchair. Consequently, the system is only power-driven and is not suitable to be operated manually as a conventional wheelchair.

In the above mentioned prior art, the user's chair is configured to be switched between two fixed positions. A first position employed is horizontal when the wheelchair moves on its wheels on a horizontal surface or a second position employed is tilted backward at a fixed angle related to the frame when the wheelchair moves on the tracks up or down an inclined surface. However, in the latter position, the orientation of the chair relative to the horizontal surface depends upon the slope of the inclined surface. Subsequently, at a certain slope the wheelchair user may experience discomfort.

US Pat. No. 4,898,256 describes a crawler unit for coupling to a wheelchair. The unit is designed to climb stairs and travel up access ramps. The crawler unit includes power-driven tracks, an adapter for securing the wheelchair in a rearward tilted traveling position in which the wheels of the wheelchair are
lifted off the ground. However, in this structure supporting rails are curved upwards like the blade tip of a cross-country or running ski are employed instead of cushioning arms with a roller. Subsequently, this construction increases the danger of an accident if the supporting rail suddenly meets with an obstacle while landing on a horizontal surface.

In US Pat. No. 4,564,080, the wheelchair is tilted backward at a fixed angle relative to the frame of the crawler unit and consequently can cause discomfort to a wheelchair user at a certain rate of inclined slope as described above.

US Pat. No. 5,158,309 describes an apparatus attached to a conventional, collapsible wheelchair so as to enable a wheelchair user to independently ascend and descend stairs and other obstacles without assistance from another individual. The stair-climbing apparatus includes a pair of laterally spaced and aligned tread units. The tread units are split into two sections: forward and rear. Treads when lifted allow the wheelchair to be propelled on its wheels. Treads in position to engage the surface are manually driven by main wheels, which are disengaged from the ground and stairs. However, this structure of the apparatus does not prevent the rapid downward movement of the front and the rear of the wheelchair as the wheelchair moves from a horizontal surface to an inclined surface or from an inclined surface to a horizontal surface that can cause discomfort to a wheelchair user.

In summary, it should be emphasized that the above-mentioned power driven, stair-climbing vehicles disclose complicated mechanical and kinematic
structures and also incorporate a suitable servo control system that influence a system cost, reliability, and safety.

Generally, most machines/wheelchairs known in the prior art are unable to handle flight of stairs. Subsequently these types of wheelchairs may lead to accidents on stairs in which the steps are not of even tread depth and/or riser height. However, such devices are using a number of wheels and motors and are hence misusing a lot of resources. Moreover, being fully automatic for its intended purpose of ascending and descending the flight of stairs, these machines are very typical in nature, complicated and costly. Furthermore, these machines need expert assistance of operator while ascending and descending the stairs, and consequently a thorough care is required by the user for operating the machine.

Therefore, the prior art devices generally require an accompanying person to assist the user for ascending and descending the stairs. So these are not safe as well as they are not user friendly. Furthermore, while ascending and descending stairs, less volume of load is carried with respect to the total size of the stair climbing device.

Accordingly, there exists a need in the art for a simple, easy to use and a user friendly stair climbing device for ascending and descending stairs, one or more surfaces with modest slopes, one or more surfaces with steep slopes and the like.
OBJECTS OF THE INVENTION

Where a Stair climbing device is employed to transport very heavy loads up and down a stairway, it is important that the operator has the device under his complete control at every moment during the time of ascent or descent. If the operator loses control at any time, the device may get away from him and cause great damage to the load being carried or to the stairway. Many of the proposed stair-climbing devices do not afford the means for such control. For example, where such devices are employed to transport a load down a flight of steps, they must be correctly positioned manually at the forward edge of each step before their traction mechanism can be used to lower them to the next step. The operator of any of the devices which stands behind it can usually not see precisely the position of the device on the step since his vision is impaired by the load. If the operator pushes the device too far forward, it will topple over the step which will eventually result in damage to the load and to the next lower step.

The operator of any of the stair-climbing devices described above in the prior art may also lose control of it when it is employed to transport the load up the flight of stairs. After the device has been deposited on each higher step by the traction mechanism the device is free to roll on the step. Unless the operator has a firm hold on the device, it may roll forward and fall off the step. Since the operator's attention during this time is directed to operating the traction mechanism it may be difficult for him at the same time to prevent the device from rolling on the steps. The present invention seeks to provide a stair-climbing device including means for preventing the device from accidentally falling over
the free edge of a step. It is the object of this invention to provide a stair climbing mechanism which may be employed for material handling, as a wheelchair for ascending and descending stairs. It is yet another object of the present invention to provide safe, smooth, convenient, light design and user friendly stair climbing device.

It is yet another object of the present invention to provide a stair climbing mechanism, which can handle flight of stairs in which the steps are not of even tread depth and/or riser height and the like.

A further object of the present invention is to provide a stair climbing mechanism as described which is automatically adaptable to the negotiation of stairs and slopes of varying dimensions.

The invention itself, along with its construction and method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments, when read in connection with the accompanying drawings.

SUMMARY OF THE INVENTION

Embodiments of the present invention generally disclose a vehicle for ascending and descending stairs includes a frame assembly having a pair of lower elongate side members, and a lower elongate cross member interconnecting each lower elongate side member of the pair of lower elongate side members. The vehicle further includes at least one power driven axle rotatably mounted on opposite sides of the lower elongate cross member of the
frame assembly, at least one non-power driven axle rotatably mounted on one end of the pair of lower elongate side members of the frame assembly, at least one spider having an inner plate and a parallel outer plate. The at least one spider is rotatably mounted on the at least one power driven axle and on the at least one non-power driven axle. The spider is further disposed of to form at least four radial arms. The vehicle further includes a plurality of ground engaging wheels wherein each wheel of the plurality of wheels is rotatably mounted at an edge of each radial arm of said at least four radial arms, a motor, and a differential gearing mechanism having an input pinion shaft being powered by the motor.

The present invention aims at overcoming these drawbacks of the prior art and provides a moving device which greatly facilitates the autonomous stair climbing, with or without heavy loads.

Another object of the present invention is to provide a moving device whose safety is substantially increase and which in the case of a wheelchair for handicapped people may be used without an accompanying person.

There is disclosed a stair climbing and descending vehicle, including: a frame and an assembly including a power driven axle rotatively mounted on the frame, a spider freely rotatable on the axle, and forming at least four radial arms, evenly spaced, ground engaging wheels each rotatably mounted at one extremity of a radial arm, a differential gearing including an input pinion shaft powered by the motor, the input pinion shaft drives the crown gears which rotates freely on the left axle. To the crown gear is attached a cage which carries a cross pin. Two
sun gears mesh with one or more planet pinions, a left half shaft and a right half shaft are splined to each of the two sun gears.

The crown gear is free to rotate on the right half axle shaft. The left half axle shaft torque is used to turn a central gear, which intern turns one or more wheels (each rotatably mounted at one extremists of a radial arm), where by the driving force of the axle is distributed proportionally to the one or more wheels (powered by the left half axle shaft) and to the spider wheel radial arm's inner, internal and outer plate (powered by the right half axle shaft) to rotate spider radial arm's inner and outer plates, when any of the wheels is prevented from rolling and wherein the wheels rotate in the same direction as the spider radial arm.

In case of wheelchair, a chair is attached to the frame above the latter. Preferably, a power source such as a battery is secured to the chair or on the frame. The chair is pivotally mounted on the frame and a first actuation means pivot the chair so as to shift the centre of gravity of the vehicle towards the rear, as will be explained. The two front corners of the frame have depending wheels adapted for use on level ground or floors.

In order to help in the ascent or descent of stairs, the vehicle is further provided with a stabilizing means including a pair of laterally spaced identical free spiders. The free spiders may have four rotatably mounted wheels at the ends of their respective arms.

The free spiders are also each rotatable attached to a lengthwise extending carrying member.
The forward ends of the latter are each operatively joined to a second actuation means. Such actuation means is adapted to tilt the frame forwardly, downwardly for a purpose explained below. The free spiders of the stabilizing means are retractable when the vehicle is on level surfaces.

These and other aspects of the embodiments herein will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood that the following descriptions, while indicating preferred embodiments and numerous specific details thereof, are given by way of illustration and not of limitation.

Many changes and modifications may be made within the scope of the embodiments herein without departing from the spirit thereof, and the embodiments herein include all such modifications.

BRIEF DESCRIPTION OF DRAWINGS

So that the manner in which the above recited features of the present invention can be understood in detail, a more particular description of the invention, briefly summarized above, may be had by reference to embodiments, some of which are illustrated in the appended drawings. It is to be noted, however, that the appended drawings illustrate only typical embodiments of this invention and are therefore not to be considered limiting of its scope, for the invention may admit to other equally effective embodiments.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter that is regarded as the present invention, it
is believed that the invention will be more fully understood from the following
description taken in conjunction with the accompanying drawings. None of the
drawings are necessarily to scale.

These and other features, benefits and advantages of the present
invention will become apparent by reference to the following text figures, with like
reference numbers referring to like structures across the views, wherein:

FIG. 1 is a schematic general perspective view of a stair climbing
mechanism, which can be fitted on a wheelchair, hand truck, vehicles, robots and
the like, according to various embodiments of the present invention.

FIG. 2 is a side view of the mechanism shown in FIG. 1, according to
various embodiments of the present invention.

FIG. 3 is a top view of the mechanism shown in FIG. 1, according to
various embodiments of the present invention.

FIG. 4 is a bottom view of the mechanism shown in FIG. 1, according to
various embodiments of the present invention.

FIG. 4a is the part of the mechanism shown in a rectangle (shown in FIG.
4.), according to various embodiments of the present invention.

FIG. 5 is a modification of the part of the mechanism shown in FIG. 4 and
FIG. 4a, according to various embodiments of the present invention.

FIG. 6 is a part of the mechanism shown in FIG. 5 shown without plates,
gears, wheels and disc, according to various embodiments of the present
invention.
FIG. 7(a) to 7(d), illustrate very schematically successive steps to develop omni-wheels, which can be used as wheels 181 or 189 or both (as rear wheels or front wheels or both), according to various embodiments of the present invention.

FIG. 8 is another arrangement of FIG. 6, which will give the same function which can be achieved by the arrangement mentioned in FIG. 6. In FIG. 8, right half shaft of the differential is powered by motor and the power from crown gear is used to drive the central gear, through solid shaft and the power from left half shaft with the help of an idle gear, is used to rotate the cross plates, through hollowed shaft, according to various embodiments of the present invention.

FIG. 9 is another arrangement of FIG. 6 which will give the same function that can be achieved by the arrangement mentioned in FIG. 6. In FIG 9, left half shaft of the differential is powered by motor, and the right half shaft is used to power the central gear through solid shaft with the help of an idle gear, and the power from crown gear is used to rotate the cross plates through hollowed shaft, according to various embodiments of the present invention.

FIG. 10 is another attachment which can give the same function that can be achieved by the arrangement mentioned in FIG.6. In FIG. 10, epicyclic gear train is used in which, planet carrier is powered by the motor and the power from the crown gear is used to power the central gear through solid shaft, and the power from sun gear is used to rotate the cross plate through hollowed shaft, according to various embodiments of the present invention.

FIG. 11 illustrates a planet carrier powered by the motor, and a sun gear is used to power the central gear through solid shaft and a crown gear is used to
rotate the cross plate through hollowed shaft, according to various embodiments of the present invention.

FIG 12 illustrates a sun gear powered by the motor, and a planet carrier is used to power the central gear through solid shaft, and a crown gear with the help of an idle gear is used to rotate the cross plate through hollowed shaft, according to various embodiments of the present invention.

FIG. 13 illustrates a sun gear is powered by the motor, and a crown gear is used to power the central gear through solid shaft, and planet carrier with the help of an idle gear is used to rotate the cross plate through hollowed shaft, according to various embodiments of the present invention.

FIG. 14 illustrates a crown gear powered by the motor, and a planet carrier is used to power the central gear through solid shaft and a sun gear with the help of an idle gear is used to rotate the cross plate through hollowed shaft, according to various embodiments of the present invention.

FIG. 15 illustrates a crown gear is powered by the motor, and a sun gear is used to power the central gear through solid shaft and a planet carrier with the help of an idle gear is used to rotate the cross plate through hollowed shaft, according to various embodiments of the present invention.

FIG. 16 illustrates a crown gear powered by the motor, and a planet carrier with the help of an idle gear is used to power the central gear through solid shaft and a sun gear is used to rotate the cross plate through hollowed shaft, according to various embodiments of the present invention.
FIG. 17 illustrates a planet carrier powered by the motor, and a crown gear is used to power the central gear through solid shaft and a sun gear is used to rotate the cross plate, through hollowed shaft, according to various embodiments of the present invention.

FIG. 18 illustrates another attachment which can give the same function that can be achieved by the arrangement mentioned in FIG. 6, but it helps in better space management, in this differential gear is fitted in between the inner and outer plates, according to various embodiments of the present invention.

FIG. 19 is showing another attachment mentioned in FIG. 18, in this epicyclic gear train is fitted with the help of crown gear and inner plate itself, according to various embodiments of the present invention.

FIG. 20 illustrates another attachment as shown in FIG. 6, for same function, but it uses the combined help of differential and epicyclic gear train, according to various embodiments of the present invention.

FIG. 21 illustrates the part of the mechanisms shown in FIG. 5 and FIG. 6, showing mechanism for pulling and releasing the spring loaded body from the disc, which are attached with the wheels, according to various embodiments of the present invention.

FIG. 22 is a modification of FIG. 4, which shows a third differential, and this third differential is powered by the third motor, whose left half shaft is used to power the left spider wheel assembly and right half shaft is used to power the right spider wheel assembly, according to various embodiments of the present invention.
FIG. 23 illustrates the same function as mentioned in FIG. 22 wherein additional epicyclic gear train is used for the same, according to various embodiments of the present invention.

FIG. 24 illustrates an arrangement of the mechanism, powered by single motor, to both the left and right spider wheel assembly, using two differentials, according to various embodiments of the present invention.

FIG. 25 illustrates an arrangement of the mechanism, powered by single motor, to both the left and right spider wheel assembly, using one differential, according to various embodiments of the present invention.

FIG. 26 is a top view of the disc which is fitted with the wheels, showing spring loaded bodies, bound with string to a common bush or bearing, according to various embodiments of the present invention.

FIG. 27(a) is another schematic view of component shown in FIG. 26, showing either two discs, with many spring loaded bodies protruding outside both discs. FIG. 27(b) to 27(e) illustrates the construction of this disc shown in FIG. 27 (a), according to various embodiments of the present invention.

FIG. 28 is a schematic view of the gears mounted over the axles with the help of inner plate, according to various embodiments of the present invention.

FIG. 29 A to 29 D, show very schematically successive steps of the mechanism of the invention negotiating stairs, with powered and non powered spider wheel assembly, according to various embodiments of the present invention.
FIG. 30 A to 30 D, show very schematically successive steps of the mechanism of the invention negotiating stairs, with only powered spider wheel assembly, according to various embodiments of the present invention.

FIG. 31 is a schematic general perspective view of a stair climbing mechanism, in accordance with one embodiment of the invention fitted on a wheelchair, while ascending stairs, according to various embodiments of the present invention.

FIG. 32 shows a wheelchair while ascending a flight of stairs, with castors at front and stair climbing mechanism at rear, according to various embodiments of the present invention.

FIG. 33 shows a hand truck, with both powered as well as non powered spider wheel assembly, according to various embodiments of the present invention.

FIG. 34 shows a hand truck while ascending flight of stairs, fitted with stair climbing mechanism (with only powered spider wheel assembly), according to various embodiments of the present invention.

FIG. 35 illustrates another method of power transmission (from central gear 276 to wheel 282) using belts and pulleys or same can be replaced by chain and sprocket using spider wheel assembly with four wheels, according to various embodiments of the present invention.

FIG. 36 illustrates another method of power transmission (from central gear 276 to wheel 282) using belts and pulleys or chain and sprockets using
spider wheel assembly with three wheels, according to various embodiments of the present invention.

FIG. 37(a) and Fig. 37(b) illustrate a side view of a mechanism using gears for power transmission (from central gear 276 to wheel 282), according to various embodiments of the present invention.

FIG. 38 is another perspective view of the vehicle (without disc 201) while ascending a flight of stairs, according to various embodiments of the present invention.

FIG. 39 shows a wheelchair (without disc 201) while ascending a flight of stairs, with castors at front and stair climbing mechanism at rear, according to various embodiments of the present invention.

FIG. 40 shows a hand truck (without disc 201) while ascending a flight of stairs, fitted with stair climbing mechanism, according to various embodiments of the present invention.

DETAILED DESCRIPTION OF INVENTION

In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent, however, that the present invention may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

FIG. 1 illustrates a vehicle 100, fitted with a stair climbing mechanism 104, in accordance with the embodiment of the invention. As will be appreciated from
the description below, a wheelchair (shown in FIG. 31 and FIG. 32) is for exemplar purposes only, and the vehicle may be fashioned with various transfer mechanisms such as a car, trunk, wheelchair, motor cycle, lift or hand trucks, snow vehicles and the like.

The stair climbing device shown in FIG 2 includes below the frame 157 and respectively in the two side regions thereof, two powered spider wheel assembly 150, 151 (one on each side — left and right) and two without powered spider wheel assembly 187, 188 (one on each side — left and right ) including four wheels, generally shown at 100.

In FIGS. 1 to 4(a), a pair of identical spider wheel assemblies designated as 150, 151 are shown. Each spider is formed of an inner plate 152 and a parallel outer plate 153, both being of a generally square shape, having concavely curved sides and convexly curved corners.

A perimetrical cover (not shown) throughout inner plate 152 is provided to house the transmission means.

Referring FIG. 4 and FIG.4(a), each motorized spider wheel assembly is rotatably centrally mounted on a transverse axle shaft 271. The frame 185 is used to maintain the support and alignments of the axle half shafts 168,155, hollowed shaft 197, shaft 171, and further used to hold bearing 158 and also used to couple the motor 173 (see FIG.3 although one side of the frame is described, it does the same of the other side). The inner ends of the axle half shaft 155 extend through frame 185 (shown in FIG.4 and FIG. 4 (a)) , one axe half shaft 155 on each side being mounted in the frame by bearing 158, and carrying gear
Planet pinions 163, 164 are mounted on cross pin 165. Cross pin 165 is carried by a cage 166, which is attached to the crown gear 167 mounted freely over the axle half shaft 168, which carries gear 169. Gear 169 is meshed with the gear 170, which is mounted over the one end of shaft 171. Shaft 171 carries two gears at its both ends gear 170 and gear 162, which are keyed over the shaft 171. Gear 159 is free to rotate over shaft 155. Gear 159 is coupled with the one end of hollowed shaft 197. And, to the other end of hollowed shaft 197 inner plate 152 is welded (or coupled) (as shown in FIG.4 and FIG. 4 (a)). Hollowed shaft 197 is coaxial with the axle half shaft 155 and 168.

Input pinion 172, coupled to the shaft of motor 173, drives the crown gear 167. Two sun gears 160 and 174 mesh with the two planet pinions 163, 164. (even though here cross pin with two planet pinions are mentioned but, a spider with four planet pinions can also be used here). Axle half shafts 168, 155 are coupled to each of these sun gears 174 and 160 respectively.

Crown wheel 167 is free to rotate on the half shaft 168. Planet pinions 164, 163 are free to rotate on the cross pin 165. Sun gears 160, 174 preferably have equal diameters. But, the diameter of sun gears 160, 174 may have a diameter equal to the double or any other ratio (as per the requirement of the speeds) as compared to the diameter of planet pinions 163, 164.

The transmission means for each radial arm 175 (shown in FIG. 28 by removing the wheels 181, disc 201, and other attachments for clarity) consists of a gear train consisting of central gear 176, idle gear 177, and a wheel gear 178,
through which wheel 181 and disc 201 are coupled. The vehicle having wheels with high grip may or may not use disc 201 and its attachments, depends on the production cost and choice of expert developing the vehicle.

Each gear 177 is secured to short shaft 179, being journalled between inner plate 152 and outer plate 153, as clearly shown in FIG. 4, FIG. 4(a) and FIG. 5. Each of the four wheel gears 178 are secured to a transverse axle 180, on which is solidly mounted a wheel 181 (having a rubber tire 182) and disc 201 with spring loaded body 670 to increase the grip and eliminate any skidding action, while wheels are encountered by any impediment or riser of the stair. Wheels 181 are each secured to their respective axles by a key (not shown) and, moreover, the gears 178 are themselves fixedly secured to their respective wheels 181 or are keyed or coupled.

Referring now to FIG. 1, FIG. 2, FIG. 3, FIG. 4 and FIG. 4(a), two free spiders 187, 188 are rotatably mounted on front stub axle at the front end of each carrying member 157, 657 respectively. Spiders 187, 188 have four radial arms, each having wheels 189, respectively mounted between pairs of plates 187' and 188' on stub shafts 190, 191 respectively. (Wheels 189 can be of small size or of same size as compared to wheels 181).

Omni wheels shown in FIG. 7(d) can be used in place of wheels 181 or 189 or both. The vehicle unit is completed by a pair of swivel wheels 192 (as shown in FIG. 32 not shown in FIG. 3 1), 193 (not shown) pivotally secured to the two front corners of the frame 157 between two front free spider wheel assembly 187 and 188. Swivel wheels 192 is so placed that it makes ground contact and
two front free spider wheel assembly 187 and 188 is free in air with little ground clearance. Swivel wheels 192 may or may not be used. Even though sometimes one of the frames at a time is shown for the sake of simplicity and clarity, it is to be understood Frame 157 is joined by the frame 185.

FIG. 31 and FIG. 32 illustrate the wheelchair vehicle, in accordance with one embodiment of the invention, while negotiating stairs. The stabilizing means (not shown) can be retracted upwardly so that a short wheelbase between the swivel wheels 192, 193 and the wheels 181 is defined to maximize the handling and turning capability of the vehicle. The vehicle can travel forward or rearward and can be steered by selectively controlling the polarity and speed of motors 173, 194 by control panel also having joystick 195 (shown in FIG. 31 and 32). As seen in FIG. 4 and FIG. 4(a), the spider wheel assembly 150 has torque delivered to the differential means 161, through shaft of motor 173.

As long as wheels 181 are free to rotate and to travel over unobstructed ground, the spider wheel assembly does not rotate, and input sun gear 160 rotates output gear 176 through planet pinions 163, 164, which in turn power wheels 181 through the transmission means. So, in the situation mentioned above when wheels 181 rotate freely on the ground, sun gears 174 does not rotate, so gears 169, 170, 162 and 159 does not rotate.

As seen in FIG. 29B and FIG. 30B, when wheel tire 182 of the vehicle shown in FIG. 1 and FIG. 2, strikes an impediment, such as a stair riser 196, the wheel and disc 201, which is attached with the wheel is locked against riser 196.
and ceases to turn. Consequently, the entire transmission means ceases to turn, including sun gear 160, and hence central gear 176.

As seen in FIG. 4 and FIG. 4(a), since the torque supplied by the motor remains constant, such locking of gear 160 will cause the sun gear 174, to rotate, since the planet pinions 163,164 continue to rotate about their individual axes. Since , the gear 169 is mounted (keyed or splined) on the same shaft 168, on which sun gear 174 is mounted, when sun gear 174 rotates gear 169, gear 159 gets torque from gear 162, to rotate the inner plate 152, and outer plate 153.

It is to be understood, in some specific situations both gears 160 and 174 will rotate together, when torque is applied to the crown gear 167. Thus, inner plate 152 and outer plate 153 begins to turn in the same direction as that of wheels 181 when they are rotating.

The spider wheel assembly 150 is thereby rotated about its axle half shaft 155. The other spider, of course, is actuated in the same way.

With particular reference to FIG. 2 and others in which only a single travelling assembly has been shown for the sake simplicity, the other traveling assembly being, of course, symmetrical to the first one which is shown.

FIG. 29A to 29D, in this order are for illustrating successive steps in operation of the device when climbing up stairs in relation with the continuous line arrows illustrating rotational directions.

For climbing up, a first step is illustrated in FIG. 29A. The device rests by its two motorized spider wheel assembly 150 and 151, and free spider assemblies 187 and 188. Free spiders just follow the motorized spider wheel
assembly (see FIG. 31). Here only motorized spider wheel assembly 150 is shown (and the symmetrical motorized spider wheel assembly 151 is not shown).

Two wheels 181 shown in FIG. 29A of the motorized wheel assembly rests on the level surface 198. The wheels rotate in the clockwise direction until the "front" wheel tire 182 A, and body 670, of the disc 201 which is attached with the wheels abuts against the riser 196, (see FIG. 29B) and then the wheels are blocked, their drive motor continuing to apply a drive torque. At this moment, the wheel input sun gear 160 is blocked, and sun gear 174 receives the torque from motor which, in turn begins to rotate the spider wheel assembly 150.

It is to be understood here, the behavior of this specific drive system (see FIG.4 and FIG. 4(a)) is that it senses the torque requirement, in both axle half shafts 155,168 and it supplies the torque to the shaft which requires less torque as compared to other. Since, in this situation when the wheel tire 182A and body 670 of disc 201, which is attached with the wheel 181, is blocked by stair riser 196, the torque requirement is higher at axle half shaft 155 to rotate the wheel, so the drive system supplies the torque to axle half shaft 168, which in turn begins to rotate the spider wheel assembly 150. The spider wheel assembly then passes from the position shown in FIG. 29B to that of FIG. 29C in which the wheel 182B comes to rest on the tread 197 of the following step. FIG. 29C shows a subsequent step during which the device rises up on to the tread 197 while bearing on wheel 182B, the motors being driven.

The device reaches from the position shown in FIG. 29C to 29D, by the continuous torque supply to sun gear 174, to rotate the spider wheel assembly
150. Thus, a single step is climbed automatically, by just keeping the power supply of motors 173 and 194 ON”. In the same way, it can climb over flight of stairs.

In the same manner, the device is much capable to climb flight of stairs, even with the different tread depth, riser height or both.

To balance the wheelchair (shown in FIG. 31 and FIG. 32) mercury switch, tilt sensor or accelerometer (not shown) is used both while ascending and descending the stairs and at any such situations.

In its preferred embodiment even though in order to descend a stair case the reverse procedure is followed with the free spiders first, but even motorized spiders can also be first (depends on the requirement and balancing of the wheelchair).

However, for spiral stairs, during rolling over the tread the wheels of the outer travelling assembly (the farthest from the ramp), can be rotated at a speed greater than that of the wheels of the inner traveling assembly. In an extreme case, it is even possible for the speed of the inner wheels to be zero.

It is also to be noted that the differential assemblies rotate the spider wheel mechanism at no more than one-half (or even less) than the speed of wheels 181, thereby ensuring that the motors 173, 194 will not be overloaded and that stair climbing is effected at a safe speed.

One or two of the motorized spider wheel assemblies of the invention can replace the wheels of one wheel hand barrow or of a two-wheel hand truck (with or without free spiders) for transporting loads up and down stairways.
For certain applications, the two separate axles 155,156 can be replaced by a single driving axle powered by a single motor. Mechanical or electrical braking method or combination of both can be used. The vehicle mentioned here can have motorized spider wheel assembly to the front and free spider wheel assembly to the rear and also vice versa.

The free spider wheel assembly can be of smaller size as compared to the motorized spider wheel assembly and also vice versa. The free wheel assembly can have three radial arms and motorized wheel assembly can have four radial arm or vice versa or both can have either same or varying (and also many) number of radial arms.

It is to be understood, any one of the axle half shafts can be used to drive the wheels and other can be used to rotate the spider wheel assembly. Using the torque of sun gear 167, Axle half shaft 168 can be extended to drive the gear 176, through the hollowed shaft 155, and then in that case hollowed shaft 155 will use the torque from the sun gear 155, to rotate the spider wheel assembly. Thus, many such attachments can be done, but all are in accordance with the invention.

There can be many more attachments which can give the same function as described above for ascending and descending stairs. It is now clearly understood that mechanism shown in FIG. 4 and FIG. 4(a) are responsible for automatically ascending and descending the stairs. So, different possible mechanisms are described below as shown in FIG. 4 and FIG. 4(a), which can give the same function of automatically ascending and descending the stairs.
Referring to FIG. 5, alternate construction of FIG. 4(a), is shown (for the sake of clarity of transmission means, with only two wheels are shown). For achieving more stiffness and strength in design, shaft 271, which is mounted over the bearings 301 and 302, is further extended to power the central gear 176. Gear 270 is keyed over the shaft 271. Gear 270 is meshed with the gear 269, which is keyed over the right half axle shaft 268, which is splined by the sun gear 274 and mounted with the help of bearings 303 and 304. The other half axle shaft 255 is splined with the sun gear 260 and to the other end shaft 255 is keyed with the gear 262, which powers the gear 259, which is coupled to the hollowed shaft 297, and this hollowed shaft at other end is coupled with the inner plate 152. Crown gear 267, is free to rotate on the half shaft 268. The crown gear 267 is powered by the gear 272, which is coupled with the shaft of the motor 173. Planet pinions 263, 264 are mounted freely over the cross pin 265, which is attached with the cage 266, which is mounted or say attached with the crown gear 267. The transmission means after central gear 176 as already explained above.

FIG. 6 is similar to FIG. 5, by removing the wheels 181, disc 201, inner plate 152 and outer plate 153, gears 176, 177, 178 and their axles 179, and 180. It is shown that shaft 271, is keyed or splined with central gear 176, and hollowed shaft 297 is coupled with the inner plate 152. Shaft 271 and hollowed shaft 297 are coaxial. All the other possible mechanisms of FIG. 8 and FIG. 9 will be described taking reference to FIG. 6.
In FIG. 8, right half axle shaft 268, is powered by motor 173, with half axle shaft 268 is keyed or splined a gear 320 which is powered by the gear 272, which is keyed by the shaft of the motor 173. Half axle shaft 268 is mounted with the help of bearing 303, 304 and frame 185.

Half shaft 255 is keyed or splined with sun gear 260. Planet pinion 263, 264 are free to rotate on their axes.

Crown gear 267, is free to rotate on the half shaft 268, and is meshed with the gear 321, which is keyed with the shaft 271, mounted over the bearing 301, 302 with the help of frame 185.

Planet pinion are mounted over the cross pin 165, which is attached over the cage 166, which is attached to the crown gear 267.

Gear 262, is keyed with the half shaft 255. Torque of gear 262 is used to power the gear 259 with the help of idle gear 327 (which is free to rotate over the shaft 330, mounted with the help of bearings 328 and 329).

Hollowed shaft 297 is coupled with the one of its end with the gear 259.

The shaft 271, protruding outside hollowed shaft 297 is used to power the central gear 176 of transmission means and hollowed shaft 297, is coupled with the internal plate 152 of the spider wheel assembly.

In FIG. 9, another possible attachment of FIG. 8 is shown. Keeping all the construction of differential as conventional mentioned above for FIG. 9, in this left half axle shaft 255 is powered with the help of gear 272 coupled with the shaft of motor 173. And the right half shaft 268 is used to power the shaft 271, with the help of idle gear 327. And, the gear 259, coupled with the hollowed shaft 297, is
powered by the Crown gear 267. The shaft 271, protruding outside hollowed shaft 297 is used to power the central gear 176 of transmission means and hollowed shaft 297, is coupled with the internal plate I52. Hollowed shaft 297 and gear 259 is freely rotated over the shaft 271. Some other possible mechanisms are mentioned below from FIG 10 to FIG 16, using epicyclic gear train.

Common constructions from FIG. 10 to FIG. 17 are mentioned here.

Sun gear 342 and gear 250 is keyed over the shaft 346. Planet carrier 341 and crown gear 345 are free to rotate over the shaft 346. Shaft 346 is mounted with the help of bearings 347 and 348. Hollowed shaft 297 is coupled with the gear 259 which is free to rotate over the shaft 271. Shaft 271 is mounted with the help of bearings 351 and 352. All the bearings and motors are mounted with the help of frame 185. Gear 321 is keyed over the shaft 271. Planet gears 343 are freely mounted over the shaft 344, which is attached with the planet carrier 341.

The shaft 271, protruding outside hollowed shaft 297 is used to power the central gear 176 of transmission means and the other end of the hollowed shaft 297, is coupled with the internal plate 152 of the spider wheel assembly.

If any idle gear used, it will be noted as gear 370, mounted freely over the shaft 373, which is mounted with the help of bearings 371 and 372. Idle gear is shown in the FIG. 12, FIG. 13, FIG. 14 FIG. 15 and FIG. 16.

In FIG. 10, gear 272, coupled with the shaft of the motor 173 is used to power the Planet carrier 341 (here constructed in the form of gear which is meshed with the gear 272). Planet carrier 341 and crown gear 345, is mounted
freely over the shaft 346, which is mounted over the bearings 347, 348 and frame 185. Crown gear is in the form of gear meshed with the gear 321, which is keyed with the shaft 271 mounted with the help of bearings 351, 352 and frame 185. Hollowed shaft 297 is coupled with the gear 259 is free to rotate over the shaft 271.

Planet gear 343 is mounted freely over the shaft 344. Shaft 344 is mounted over the planet carrier 341. Gear 259 is meshed with the gear 250, which is keyed over the shaft 346, and this shaft 346 is splined or keyed with the sun gear 342. Main thing is that here Planet carrier 341 is powered and Crown gear is used to power the shaft 271, and sun gear is used to power the hollowed shaft 297 and gear 259.

In FIG. 11, almost everything is same as mentioned in FIG 10, except that sun gear 342 is used to power the gear 321, keyed over the shaft 271. And crown gear 345 is used to power the Hollowed shaft 297, leaving the construction of epicyclic gear train same. In FIG. 12, Sun gear 342, is powered with the gear 250, which is meshed with the gear 272, which is coupled with the shaft of motor 173. Planet carrier 341 is used to power the gear 321, keyed over the shaft 271. And, crown gear 345 with the help of an idle gear 370 is used to power the gear 259 and hollowed shaft 297.

In FIG. 13, Sun gear 342, is powered with the gear 250, which is meshed with the gear 272, which is coupled with the shaft of motor 173. Planet carrier 341 is used to power the gear 259 and hollowed shaft 297, with the help of idle
gear 370. And, crown gear 345 is used to power the gear 321, which is keyed over the shaft 271.

In FIG. 14, Crown gear 345, is powered with the gear 272, which is coupled with the shaft of motor 173. Planet carrier 341 is used to power the gear 321, which is keyed over the shaft 271. And, sun gear 342, is used to power the gear 259 and hollowed shaft 297, with the help of idle gear 370. Gear 370 and gear 250 are meshed together. In FIG. 15, Crown gear 345, is powered with the gear 272, which is coupled with the shaft of motor 173. Sun gear 342, is used to power the gear 321, which is keyed over the shaft 271. Gear 250 and gear 321 are meshed together. And, Planet carrier 341 is used to power the gear 259 and hollowed shaft 297, with the help of idle gear 370. Gear 370 is meshed with gear 259 with one side and planet carrier 341 at the other side.

In FIG. 16, Crown gear 345, is powered with the gear 272, which is coupled with the shaft of the motor 173. Planet carrier 341 is used to power the gear 321, which is keyed over the shaft 271. Idle gear 370 is meshed with the gear 321 with one side and planet carrier 341 at the other side. Sun gear 342, is used to power the gear 259 and hollowed shaft 297. Gear 250 is meshed with the gear 259.

In FIG. 17, Planet carrier 341 is powered, with the gear 272, which is coupled with the shaft of the motor 173. Crown gear 345, is used to power the gear 321, and keyed over the shaft 271. Sun gear 342, is used to power the gear 259 and hollowed shaft 297. Gear 250 is meshed with the gear 259. In all the
figures from FIG. 5 to FIG. 17 (excluding FIG. 7), gear 259 and hollowed shaft 297 is freely rotated over the shaft 271.

In FIG. 18 and FIG. 19 the possible mechanisms are fitted either in between the inner plate 152 and outer plate 153, or are fitted with the help of inner plate 152. This is done to save the manufacturing costs and for more space management.

Referring to FIG. 18, Gear 404 is powered with the gear 272, which is coupled with the shaft of motor 173. Gear 404, is keyed over the shaft 401, which is mounted with the help of bearings 402 and 403. Bearings 402, 403 and motor 173 is clamped with the help of frame 185. Shaft 401 is further extended to the center of the outer plate 153. Hollowed shaft 405 and hollowed shaft 406 are mounted freely over the shaft 401. Hollowed shaft 405 and hollowed shaft 406 is keyed or splined with the sun gears 407 and 408, respectively. Hollowed shaft 405, at one end is splined with the sun gear 407, and with the other end is coupled with the inner most plate 420. Hollowed shaft 406 at one end is splined with the sun gear 408, and with the other end is coupled with the central gear 176. Planet pinions 409 and 410 are mounted freely over the cross pin 411. Cross pin 411 is perpendicular to the shaft 401 and is welded or keyed with it. Two sun gears 407 and 408 mesh with the two planet pinions 409 and 410.

Shaft 401 is coaxial with Sun gear 407, 408 and center of plates 420, 152 and 153 and, the power flow from central gear 176 to the wheel gear 178, with the help of idle gear 177, is already discussed. Hence the other transmission means will be same. A shaft 179 is used to join the plates 420, 152 and 153.
Referring FIG. 19, Gear 404, is powered with the gear 272, which is coupled with the shaft of motor 173. Gear 404, is keyed over the shaft 401, which is mounted with the help of bearings 402 and 403. Bearings 402, 403 and motor 173 is clamped with the help of frame 185. Shaft 401 is further extended to the center of the outer plate 153. Hollowed shaft 430 and sun gear 342 are mounted freely over the shaft 401. Hollowed shaft 430 at one end is coupled with the central gear 176 and at the other end is coupled with the sun gear 342. Hollowed shaft 430 is freely rotated over the center of inner plate 152. Shaft 401 is coaxial with sun gear 342, hollowed shaft 430, and central gear 176, center of outer plate 153 and center of inner plate 152. Shaft 401 is keyed or splined with the center of planet carrier. Planet gear 343 is freely mounted over the shaft 344. Shaft 344 is mounted over the Planet carrier 341. Crown gear 345 is coupled with the inner plate 152.

And, the power flow from central gear 176 to the wheel gear 178, with the help of idle gear 177, is already discussed. Hence the other transmission means will be same. Referring FIG. 22, a third differential 661 is used to power the other two differentials 161 and 561, with the help of a third motor 573. The left differential 161 is powered by the motor 173 as already mentioned, and the right differential 561 is powered by the motor 194, as already mentioned. This third differential is powered only while ascending or descending stairs or any specific situation, as this third differential will help to eliminate any problem such as — While climbing stairs even though the right spider wheel assembly have not contacted the riser of the stair but the left spider wheel assembly is starting to
climb as it have reached to the riser of the stair and it's further movement is ceased due to the riser or any impediments. So, in this situation, powering third differential 661, with the third motor 573, will help to climb over any impediments only when the both spider wheel assembly are ceased to turn due to the impediments or riser of the stair. Thus, this helps for further balancing of the vehicle. It is to be noted, this third differential will give smoother ascending or descending movement. Moreover, it may be possible that this third differential will help to climb over the spiral stairs automatically, without using to steer the vehicle.

A different attachment for achieving the above mentioned function which is achieved by the attachment of FIG. 22 is mentioned in FIG. 23.

Referring FIG. 23, an epicyclic gear train 575, is powered by the motor 574, as mentioned in FIG. 10, here the power from the sun gear is used to power the left differential 161 and power from crown gear is used to power the right differential 561. The same thing can be achieved by a mixture of differentials and epicyclic gear train. In FIG. 22, differentials 161 and 561 is used which are further powered by the third epicyclic gear train 575. The same can be done when at the place of differentials 161 and 561, epicyclic gear train as mentioned in the FIG. 10 to FIG. 17 and they are further powered by the third differential as shown in FIG. 22. (Or they can also be powered by the third epicyclic gear train itself as shown in FIG. 23).

Referring FIG. 24, here only one motor 173 is used to power the both left and right differential. Left differential 161 and right differential 561, is powered by
the gears 572 and 573 respectively. These gears 572, 570, 573 are keyed over the shaft 571, which is powered by the gear 272, which is coupled by the shaft of the motor 173. Gear 272 is meshed with the gear 570. And, the movement after gear 572 and 573 are same as mentioned in FIG. 5 and FIG. 6. So, the further transmission means are already understood.

The shaft 271, protruding outside hollowed shaft 297 is used to power the central gear 176 of transmission means and the other end of the hollowed shaft 297, is coupled with the inner plate 152 of the spider wheel assembly.

Referring FIG. 25, here only one motor 173 and one differential 161 is used to power the both sides of spider wheel assembly. One half axle shafts 268 are used to power the hollowed shaft 259 to both sides. Gear 269, is keyed over the shaft 268, and is meshed with gear 259' of the hollowed shaft 297'. Gear 259' is further meshed with the gear 591 which is keyed over the shaft 590, which is mounted over the bearings 593, 594. Gears 592 is keyed over the same shaft 590 to the other left end which is further meshed with the gear 259, and this gear is coupled with the hollowed shaft 297. Shaft 297 is powered by the gear 262. Gear 262 is meshed with the gear 595, which is keyed over the shaft 297.

The shaft 271, protruding outside hollowed shaft 297 is used to power the central gear 176 of transmission means and the other end of the hollowed shaft 297, is coupled with the internal plate 152.

Referring FIG. 20, shown gear 404, which is keyed over the shaft 401, which is mounted over the bearings 402 and 403, with the help of frame 185 and Gear 404, is powered by the gear 272, which is coupled to the shaft of the motor
Shaft 401 is passed through the hollowed shaft 606, over which gear 610 is keyed or splined. Shaft 401 is further moved and is finally splined or keyed with the sun gear 601. Gears 611 are mounted freely over the shaft 179. Planet pinion 603, 604 are mounted freely over the cross pin 604", which is attached to the cage 605, which is clamped or coupled with the inner plate 152. Hollowed shaft 607 is mounted freely over the shaft 401, and at the one end it is splined or keyed with the sun gear 602, and at the other end it is coupled with the central gear 176. The power from central gear 176 is transmitted to the wheel gear 178 through the idle gear 177. So, when ever shaft 401 is powered to clockwise, sun gear 601 rotates in clockwise but the sun gear 602, rotates in anticlockwise, when plate 152 does not rotates (i.e. cage does not rotates), so gear 176 rotates in anticlockwise, so finally the wheel gear 178 moves in the anticlockwise. This anticlockwise movement is converted to the clockwise with the help of epicyclic gear train, which are placed at the wheel gears. The planet carrier is fixed with the help of gear 612, using shaft 180. Actually, gear 612 is keyed or splined over the shaft 180 to the right end and at the other end planet carrier 341 is keyed or splined. Since, gear 610 is keyed over the hollowed shaft 606, which is fixed with the help of frame 185. So, gear 610, 611 and 612 acts as the four bar mechanism (assuming the size of gear 610 and 612 same.). Wheel gear 178 is coupled with the hollowed shaft 650 to the one end and sun gear 342 is splined to the other end. So, when wheel gear 178 rotates in anticlockwise since wheel gear 178 is keyed or splined over the hollowed shaft 650, it rotates the sun gear 342 in the anticlockwise. But since, the planet carrier 341 is fixed by
the gear 612, the planet gear 343, rotates in anticlockwise, hence finally crown
gear 345, rotates in clockwise, with the crown gear is coupled disc 201, (having
spring loaded body) and wheel 181. Gears 610, 611, 612 are guided by the
plates 651 and 652. Shaft 401 is moved freely over the center of plate 651 and
153. Hollowed shaft 606, gear 610, sun gear 601 sun gear 602. hollowed shaft
607 centre of plates 152, 153, 651 and 652 are coaxial with the shaft 401.
Referring FIG. 26, here the internal construction of disc 201 is described. Disc
201 with Spring loaded bodies are used to increase the surface grip, while
vehicle or device is encountering any impediments or stairs, so to eliminate any
skidding action, this special disc 201 is also attached with the wheels or wheel is
such constructed with the disc 201. Disc 201 constitutes of compression spring
673, body 670 in the form of cuboids stopper 671 coupled with the body 670, and
stopper 672 coupled with the disc 201. And, one end of the compression spring
673 should be coupled with the stopper 671 and other end with the stopper 672.
The outer end of body 670 should be curved for aesthetic consideration, so that
when many discs are used (as shown in FIG. 2 7(a) it should look perfect circular
(in the view which is shown in FIG. 26). So, whenever the disc 201 is rotated with
the wheel 181, body 670 is compressed and released continuously as it is
mounted over the compression spring 673. Since, spring 673 fitted in between
the body 670; body 670 compresses only when the force is applied towards the
center as shown by the arrows 677 and 678. This spring loaded body, is so
placed that after it's fitting it comes slightly outside the circumference of disc 201.
Spring 673, can also be tension spring, but when it is tension spring, stopper 671
should be coupled with the disc 201, and stopper 672 should be coupled with the body 670. And one end of the tension spring should be fixed with stopper 671 and the other end with the stopper 672.

All the spring loaded body 670, are tied with string 674, and then they are tied to the hollowed shaft 675, which rotates freely over the shaft 676. Shaft 676 and disc 201 is coaxial. And, this hollowed shaft 675 is mounted over the shaft 676, such that it does not slip out over it. So, when ever shaft 676, is pulled up or down (see FIG. 26), the hollowed shaft 675 moves up or down, and since spring loaded bodies 670 is tied with this hollowed shaft 675, with the help of thread or string 674, the body 670, comes inside the circumference of disc 201 or comes outside, depends on the pulling or releasing action of shaft 676.

Referring FIG. 21, here the construction is almost everything similar to FIG. 5, but some necessary attachments are provided to pull or push the spring loaded body, as per requirement.

The construction of disc 201 with the spring loaded bodies is well understood with the FIG. 26. So, in the FIG. 21, the shaft 676, is pulled with the help of string or thread 704, using the guide of pulleys 705, 706 which are mounted over the outer plate 153; Thread 704, is further tied to the hollowed shaft 675, which can rotate freely over the shaft 676 (another hollowed shaft 675 and shaft 676 is also placed in center of the plate 801). The shaft 676 is tied by another string or thread 703, which is wrapped over the pulley 702, which is coupled over the shaft of motor 701. Thus when, motor 701 rotates clockwise thread 703, is wrapped over the pulley, pulling the thread 703, which pulls the
shaft 676, then hollowed shaft 675, then thread 704, then hollowed shaft 675, then shaft 676, then thread 674, then body 670 compresses the spring 673 (when spring 673 is compression spring.). Thus by just rotating in specific direction the shaft of motor 701, we can control the spring loaded body to go outside the circumference of the disc 201, or come inside the circumference of the disc 201.

Referring FIG. 27 (a), shows the spring loaded disc 201-, using two discs 201 and coupling by slightly rotating, so that the angle made by the body 670 and just next body 670, becomes less The other, requirement was also to bring these bodies 670 nearer and more nearer, so that it would look as complete circle while looking from side. In FIG. 27 (a), only two disc 201 (as shown and mentioned in FIG 26) are coupled by slightly rotating to decrease the distances in between the respective bodies 670.

In FIG. 27 (b), shaft 676 is shown, which is guided by the bush 680, which is coupled over the surface of the disc 201. The only plate of the disc 201 is shown in FIG 27(c), with the shaft 676 and its guide 680.

Many things in sectional and hidden of the construction of disc 201 are shown in FIG 27 (d) and 27 (e).

Finally, any one of the axle half shafts can be used to drive the wheels and other can be used to rotate the spider wheel assembly, all the attachments are in accordance with the invention. The gears shown in all of the figures are shown in circular, just to show the exact meshing of the gears (even though tooth are not shown); So, nothing should be misinterpreted by the circular or
cone discs (cylinder), which are just to show the gears either spur, helical or bevel gears.

Any transmission attachment can be used to transmit central gear torque to the wheels, also any mechanism used to rotate the spider wheel assembly when the wheels are blocked by the stairs or impediments, is said to be in the claim of the present invention. It will be understood that, each of the elements as described above or two or more together, may also find a useful applications, in other types of constructions different from the types described above.

While the presently preferred embodiment of the invention have been shown and described above, it is to be understood that these disclosures are for the purpose of the illustrations, and that the various changes, and modifications may be made without departing from the scope of the invention.

In the Figures showing the possible mechanism for stair climbing, the gear ratios are not considered. It is to be noted that the differential assembly or epicyclic gear train rotate the spider wheel assembly at more than one half (or even less) than the speed of wheels 181. So, all the possible reduction of gear ratios are to be done here, even if in any shown mechanism it is not shown, it should be understood well, as reduction of gear ratios are known technology. So, whatever gear ratios are shown here, to opt for which gear ratios depends on the expert of the concerned field, which is designing or developing this.

Referring to FIG. 35, the motorized spider wheel assembly includes four minor wheels 282, rotatably mounted to the spider wheel inner frame 252. Nothing is shown hidden here after frame 252, for the sake of simplicity.
A small diameter chain sprocket 200 is torsionally connected to each minor wheel 282, by a minor wheel axle 280. The four sprockets 200 are mechanically coupled to each other by an endless link chain 201. The four sprocket idlers 202 are rotatably mounted to the spider wheel frame 252 to provide suitable routing for the endless link chain 201.

A central sprocket 276A is in the same way mechanically coupled to sprocket 278A by an endless link chain 203. Two idlers 204 are provided to tighten the chain, to have sufficient contact with the both sprockets. The centre sprocket 276A is coaxially and rotatably mounted to the spider wheel assembly.

Referring to FIG. 36, in the same way as mentioned in FIG. 35, power transmission from central sprocket 276A or gear 276, the torque to the wheels are transmitted, with the three radial arms.

In the foregoing specification, specific embodiments of the present invention have been described. However, one of ordinary skill in the art will appreciate that various modifications and changes can be made without departing from the spirit and scope of the present invention as set forth in the various embodiments discussed above. Accordingly, the specification and figures are to be regarded in an illustrative rather than a restrictive sense, and all such modifications are intended to be included within the scope of present invention.

The benefits, advantages, solutions to problems, and any element(s) that may cause any benefit, advantage, or solution to occur or become more pronounced are not to be construed as a critical, required, or essential features or elements as described herein.
CLAIMS

1. A vehicle for ascending and descending stairs, said vehicle comprising:
   a frame assembly comprising a pair of lower elongate side members, and
   a lower elongate cross member interconnecting each lower elongate side
   member of said pair of lower elongate side members;
   at least one power driven axle rotatably mounted on opposite sides of said
   lower elongate cross member of said frame assembly; and
   at least one non-power driven axle rotatably mounted on one end of said
   pair of lower elongate side members of said frame assembly; at least one spider
   having an inner plate and a parallel outer plate, said at least one spider rotatably
   mounted on said at least one power driven axle and on said at least one non-
   power driven axle, said spider being further disposed of to form at least three
   radial arms;
   a plurality of ground engaging wheels wherein each wheel of said plurality
   of wheels is rotatably mounted at an edge of each radial arm of said at least
   three radial arms;
   a motor; and
   a differential gearing mechanism having an input pinion shaft being
   powered by said motor.

2. The vehicle of claim 1, wherein said at least one power driven axle is
   rotatably mounted on opposite sides of said lower elongate cross member of said
   frame assembly.
3. The vehicle of claim 1, wherein said vehicle further comprises a plurality of crown gears rotatably mounted on said axle.

4. The vehicle of claim 3, wherein said vehicle further comprises a cage operably coupled to each crown gear of said plurality of crown gears, said cage comprising a cross pin.

5. The vehicle of claim 1, wherein said vehicle further comprises a seat member operably coupled to said frame, said chair comprising:
   a generally planar upper surface which is oriented generally horizontally;
   a backrest mounted to said frame;
   a footrest assembly removably attached to said frame;
   an armrest assembly removably mounted on said frame; and
   a lift assembly mounted on said frame and on said seat member, said lift assembly being extendable and retractable to raise and lower said seat member and said armrest assembly with respect to said frame and said backrest, wherein said lift assembly is configured for raising and lowering said seat member with said upper surface maintained in a generally horizontal orientation.

6. The vehicle of claim 5, wherein said seat member is pivotally mounted on said frame.
7. The vehicle of claim 1, wherein said vehicle further comprises a stabilizing mechanism for helping said vehicle in ascending and/or descending said stairs, said stabilizing mechanism having a pair of laterally spaced identical free spiders.

8. The vehicle of claim 1, wherein said vehicle further comprises a power source for driving said motor.

9. The vehicle of claim 8, wherein said power source is a battery.

10. A vehicle for ascending and descending stairs, said vehicle comprising:
    a frame assembly comprising a pair of lower elongate side members, and
    a lower elongate cross member interconnecting each lower elongate side member of said pair of lower elongate side members;
    at least one power driven axle rotatably mounted on opposite sides of said lower elongate cross member of said frame assembly;
    at least one non-power driven axle rotatably mounted on one end of said pair of lower elongate side members of said frame assembly; at least one spider having an inner plate and a parallel outer plate, said at least one spider rotatably mounted on said at least one power driven axle and on said at least one non-power driven axle, said spider being further disposed of to form at least three radial arms;
    a plurality of ground engaging wheels wherein each wheel of said plurality of wheels is rotatably mounted at an edge of each radial arm of said at least three radial arms;
a motor; and
an epicyclic gearing mechanism having an input pinion shaft being powered by said motor.

11. The vehicle of claim 10, wherein said at least one power driven axle is rotatably mounted on opposite sides of said lower elongate cross member of said frame assembly.

12. The vehicle of claim 10, wherein said vehicle further comprises a plurality of crown gears rotatably mounted on said axle.

13. The vehicle of claim 12, wherein said vehicle further comprises at least a planet gear attached to each crown gear of said plurality of crown gears, said planet gear comprising a shaft.

14. The vehicle of claim 10, wherein said vehicle further comprises a seat member operably coupled to said frame, said chair comprising:
   a generally planar upper surface which is oriented generally horizontally;
   a backrest mounted to said frame;
   a footrest assembly removably attached to said frame;
   an armrest assembly removably mounted on said frame; and
   a lift assembly mounted on said frame and on said seat member, said lift assembly being extendable and retractable to raise and lower said seat member and said armrest assembly with respect to said frame and said backrest,
wherein said lift assembly is configured for raising and lowering said seat member with said upper surface maintained in a generally horizontal orientation.

15. The vehicle of claim 14, wherein said seat member is pivotally mounted on said frame.

16. The vehicle of claim 10, wherein said vehicle further comprises a stabilizing mechanism for helping said vehicle in ascending and/or descending said stairs, said stabilizing mechanism having a pair of laterally spaced identical free spiders.

17. The vehicle of claim 10, wherein said vehicle further comprises a power source for driving said motor.

18. The vehicle of claim 17, wherein said power source is a battery.

19. The vehicle of claim 1, wherein said vehicle further comprises a differential gearing being located between inner plate and internal plate, and transmission means being located between said internal plate and outer plate.

20. The vehicle of claim 10, wherein said vehicle further comprises an epicyclic gearing being located with inner plate, and transmission means being located between said internal plate and outer plate.
21. The vehicle of claim 1, wherein said vehicle further comprises a disc having spring loaded bodies and another motor, which controls the spring loaded body to go outside and inside the circumference of the disc.

22. The vehicle of claim 10, wherein said vehicle further comprises a disc having spring loaded bodies and another motor, which controls the spring loaded body to go outside and inside the circumference of the disc.

23. The vehicle of claim 1, wherein said vehicle further comprises epicyclic gearing with the wheels as direction reversing transmission means.