# Multi-Function Wheelchair

## Description

This Multi-Functions wheelchair is designed to enable handicapped person to live more independently, reduce or do without the helps from others by enabling the user to perform basic daily activities by him/herself, and hence, reduces the helps needed to frequently transferring the user from one activity to another. In order to achieve these objectives, the Multi-Function wheelchair, on top of the usual mobility function for the user to move around, it also has "Stand-Up Assist" function, which help the user to get up from sitting position, "Self-Help Toiletry Activity" function, which allows the user to use toilet with total privacy, "Bed Transformation" function, which transform the wheelchair into a bed. Therefore, when the user feels strain in the neck or simply need to lie down, he/she does not need to be transferred from wheelchair to bed whereby at least one helper is required. The most important function of this Multi-Function wheelchair is that it helps a handicapped person to "Stand Up" again, with its "Standing" mode. This "Standing" mode utilises Parachute Straps, as shown in Fig. 5, so that the user can perform more daily activities, such as boiling water and making a cup of coffee for himself.

**Basic Structure and Mechanism**

The basic structure is as shown in Fig. 1. Compared to a normal wheelchair, it has additional devices/components, such as Centre Pad, Linear Actuator, and some mechanical links. The joints between the front and back legs to the centre piece is by Bush Bearing or Sleeve Bearing, hence, when the Linear Actuator is Retracting or Extending, it will result in movement of front and rear legs. Retraction of the Linear Actuator will bring the front and back legs closer; this brings it to Stand-Up Assist mode or Standing mode. This is achieved by making the rear legs longer than the fronts. Vice versa, extension of Linear Actuator will bring down the seat and backrest.

**Mobile Mode**

This is the usual function similar to those electrical wheelchairs that are available in the market. It consists of two electric wheels, two universal free wheels, a Joystick, and of course, a battery pack. The movement of the wheelchair is controlled by the joystick.

**Toilet Assist Mode**

Please refer to Fig. 2. The wheelchair is designed to be structureless under the seat, but before the wheelchair is reversed onto the top of toilet bowl, the centre pad must be lowered first, either manually or electrically. The height of the seat can also be further adjusted by some fine adjustments of linear actuator, as described above. The Linear Actuator is not shown in the above diagram, as the main purpose of Fig. 2 is to illustrates this function.

It is worth mentioning that this can be a "Hands-Free" experience if a water spray toilet seat, and air blower is installed. This option will be of great help to handicapped person. In addition, the user can also take shower on it, if water resistant parts and proper covers are used to build this Multi-Function wheelchair.

**Stand-Up Assist Mode**

Please refer to Fig. 3. This Stand Assist function would reduce the efforts and helps needed in the case of using a normal wheelchair, especially if the user is heavy. By pressing a button, the seat will slowly push up, walking aid, such as walking stick, can be readily take over as the user stands up. To achieve that, the rear legs are made longer than the front. As Linear Actuator retracts, the seat is being pushed up by the rear legs, as shown in the diagram.

The mechanical links on the front legs to the backrest and legrest will take some effects while the Linear Actuator retracts. The mechanical link will pull the Lever extended from the backrest, and hence, keeps the backrest in the upright position. At the same time, it will slightly push up the legrest. Therefore, the angle, length and position of these links and pivot points need to be optimised when it comes to actual equipment design.

**Bed Mode**

Handicapped person usually feels strain in the neck after some time in sitting position, or simply feels the need to lie down to rest or sleep. The frequent switch of these two activities would cause some efforts and attentions from the helper, but with the Multi-Function wheelchair, the user does not have to bother others. When the user feels like sleeping, he can convert the wheelchair into a bed anytime he likes by a press a button. This can be achieved by extending the Linear Actuator.

As shown in Fig. 4, extension of Linear Actuator will push the front and rear legs apart, as a result, the seat is being lowered, and at the same time, the mechanical link will pull down the backrest by pulling the backrest lever and pushes up the legrest. The mechanical links, position and length needs to be optimised to achieve the Stand-Up and Bedding objectives.

The longer rear legs help to widen the base, and therefore, improve the stability by shifting the C.G. (Centre of Gravity) further out. This is especially crucial when the backrest is being lowered, as the risk of overturning is high if the C.G. is not shifted out.

**Standing Mode**

The Standing Mode is somehow similar to Stand-Up Assist mode, except that the user, instead of getting off the wheelchair, is secured on his seat with the provision of parachute straps, as shown in Fig. 5. By secured strapping around the chest and inner thigh, the user can move around by controlling the joystick, and also able to perform some basic daily activities, such as boiling water and make himself a cup of coffee. Again, the user is one step closer to being a normal person.

**Optional add-on**

The actual Multi-Function Wheelchair should have the option to attach other equipment, such as pull-up dining table, exercise equipment for physiotherapy, adjustable headrest/leg rest, back massager, water circulating backrest, air jet backrest, etc.., to minimise uncomfortable feelings after long hours on the wheelchair.

**Brief description of the drawings:**

| FIGURE | DESCRIPTION |
|---|---|
| **Fig. 1** | **Basic Structure and Mechanism of Multi-Function Wheelchair** |
| **Fig. 2** | **Toilet Assist Mode** |
| **Fig. 3** | **Stand-Up Assist Mode** |
| **Fig. 4** | **Transform into a Bed** |
| **Fig. 5** | **“Standing” Mode** |

CLAIMS

1. A Wheelchair with Multi-Functions, for use by a handicapped person, comprising :-

a chair with a backrest, seat with a hole in a centre of the seat, said hole fitted with a

centre pad and a leg rest;

a pair of front legs, connected to the seat, each leg being mounted with an universal wheel;

a pair of rear legs, each leg with an electric wheel;

a pair of arm rests with a joy stick on an arm rest to manoeuvre the wheelchair;

a linear actuator with a mechanical link connected to each front leg; and

the linear actuator connected to a mechanical link to each rear leg

a set of chest safety straps installed on back rest

a pair of safety straps for inner thigh installed on seat

wherein the handicapped person seated in the wheelchair may switch from one function, Mobile Mode to another function, namely Wheelchair Assist Mode or Bed Mode or Stand Up Assist Mode or Standing Mode, by adjusting the wheelchair and the handicapped person could switch back to Mobile Mode by further adjusting the Wheelchair.

2. A Wheelchair with Multi-Functions as claimed in Claim 1, when said wheelchair is to be changed from Mobile Mode to Toilet Assist Mode, to allow the handicapped person to use a toilet, by adjusting the Wheelchair as follows:-

using the joystick to reverse the wheelchair towards a toilet bowl so that the seat is over a top of the toilet bowl;

lowering the centre pad of the seat so that the hole in the seat is over the toilet bowl; and

further adjusting the height of the seat using the linear actuator so that the height of the seat of the wheelchair is slightly above the top of the toilet bowl.

3. A Wheelchair with Multi-Functions as claimed in Claim 1, when said wheelchair is to be changed from Mobile Mode to Toilet Assist Mode, to allow the handicapped person to use a toilet, by adjusting the Wheelchair as follows:-

lowering the centre pad of the seat to be slightly above the level of a toilet bowl,

using the joystick to reverse the wheelchair towards the toilet bowl so that the seat

is over a top of the toilet bowl; the hole in the seat is over the toilet bowl; and

further adjusting the height of the seat using the linear actuator so that the height of the seat of the wheelchair is slightly above the top of the toilet bowl.

4. A Wheelchair with Multi-Functions as claimed in Claim 1, when said wheelchair is to be changed from Mobile Mode to Stand Up Assist Mode, to assist the handicapped person to stand up with assistance of the wheelchair, by :-

retracting the linear actuator;

causing the rear legs and mechanical link connected to the backrest and rear legs to move towards the front wheels, resulting in the rear legs being longer than the front legs, thereby pushing the seat and backrest up;

until the handicapped person is being pushed from a sitting position to a standing position, causing the handicapped person to stand up with the assistance of the Wheelchair in this Stand Up Assist Mode.

5. A Wheelchair with Multi-Functions as claimed in Claim 1, when said wheelchair is changed from Mobile Mode to Bed Mode, by :-

extending the linear actuator to push the front and rear legs apart, so that the mechanical link causes the back rest to be pulled down;

extending the mechanical link to linear actuator causing the front leg rest to be pushed up;

until the back rest and front leg rest are in a horizontal plane with the seat; and

turning the arm rests to be aligned to the horizontal position of the back rest;

thereby creating a leg rest and back rest which is in a horizontal position, and with the seat already in a horizontal position, forming a horizontal bed made up of a leg rest, back rest and seat, all in a horizontal plane.

6. A Wheelchair with Multi-Functions as claimed in Claim 1, when said wheelchair is changed from Mobile Mode to a Standing Mode, by :-

retracting the linear actuator,

causing the rear legs to move towards the front wheels, thereby pushing the seat and backrest up; and

causing the handicapped person is be pushed by the seat and back rest into a standing position.

7. A Wheelchair as claimed in Claim 6, when said wheelchair has changed from Mobile Mode to a Standing Mode, the handicapped person in the said Standing Mode is further secured by being fastening with one or more chest straps and one or more inner thigh straps to prevent the handicapped person from falling.