

Design and Modification of Stair-climbing Wheelchair

Mr. Diptesh Pipaliya

Student,

Department of Mechanical Engineering

IITE, Indus University

Ahmedabad, India

Mr. Avani Jagani

Student,

Department of Mechanical Engineering

IITE, Indus University

Ahmedabad, India

Mr. Smit Patel

Student,

Department of Mechanical Engineering

IITE, Indus University

Ahmedabad, India

Prof. Piyush S. Surani

Assistant Professor,

Department of Mechanical Engineering

IITE, Indus University

Ahmedabad, India

Abstract— the only option for the disabled to ascend stairs is to purchase a high-tech battery operated wheelchair with elaborate sensors and gyroscopes, which can cost around \$25,000. As a result, there is a high demand for a cheap and efficient way to climb stairs with a practical wheelchair. With the safety of the user as a main concern, it is the goal of this report to provide a lightweight, inexpensive stair climbing wheelchair. In order to significantly reduce cost of production, the wheelchair will not have any outside power source. The user's strength is the only means of energy for climbing. Our specific design relies on three critical modules: wheels with retractable spokes, a lock in ratchet on the axel, and a tilted seat. By focusing on integrating lightweight materials into the design, the force required to operate the wheelchair should be very manageable. The final product should provide the disabled with a safe, reliable, and inexpensive wheelchair capable of ascending nearly any staircase.

Keywords— *Stair climbing, Wheelchair, Y-shape Wheel, Lever Mechanism for climbing, Design, Ergonomics.*

I. OBJECTIVES OF DESIGN

- A) To provide a stair climbing wheelchair that can accommodate user while requiring minimal drive skill and strength.
- B) To provide a Stair-climbing Wheelchair that also functions as a normal wheelchair that also functions as a normal wheelchair without compromise to that function.
- C) To provide the driver with a smooth comfortable ride on stair with a feeling of confidence and without fear of unsafe condition.
- D) It is a further object of the invention to provide a wheelchair which is relatively inexpensive, being entirely self-contained and operable independently of external aids.
- E) It is still another object of this invention to provide a Stair climbing wheelchair with a little modification of normal wheelchair.

II. BACKGROUND OF THE INVENTION

Wheelchairs are used by people with various infirmities. Those Wheelchair occupants that have limited upper body muscle control or suffer from some type of paralysis, for example, are unable to easily balance themselves or compensate for an uneven ground surface over which the wheel chair passes. Because of this impaired balance, wheelchair users are extremely cautious and have a reoccurring fear of losing their balance or control over uneven or sloping terrain. Even when an attendant is available to assist the wheelchair occupant, the inability to control one's balance can be an imposing fear. This fear is heightened when a power wheelchair user, more accustomed to his or her freedom associated with individual control, is then placed in a situation where the ground surface causes momentary instability or loss of balance. Moreover, many surfaces over which the Wheelchair traverse are not, in fact, level. Therefore it is a frequent or common disturbance and concern for the wheelchair occupant.

These same wheelchair users are confined to their chair for substantially all of their waking hours. Commercially available products provide limited pressure relief for the occupant, for example, by changing the orientation of the user or providing specially designed seat cushions to alleviate pressure points. Reclining and tilt-in-space features for wheelchair seats are particular examples of products where the orientation of the wheelchair occupant is altered or modified to provide pressure relief. Thus, a need exists for a wheelchair, and particularly a wheelchair seat and rear wheel that can able to climb the stair with less effort by the person. A major challenge for wheelchair designers has been to design a wheelchair which can ascend and descend stairs, and yet not be unduly large, cumbersome or expensive. One problem with movement down a stairway is that as a wheelchair edges over the stairway, it will suddenly tilt downward and slam onto the stairway, jolting the user or potentially injuring the user. In order to provide maximum comfort for a user during the ascending or descending of stairs, the seat is tilted so that the user is held horizontal while the body of the wheelchair is inclined.

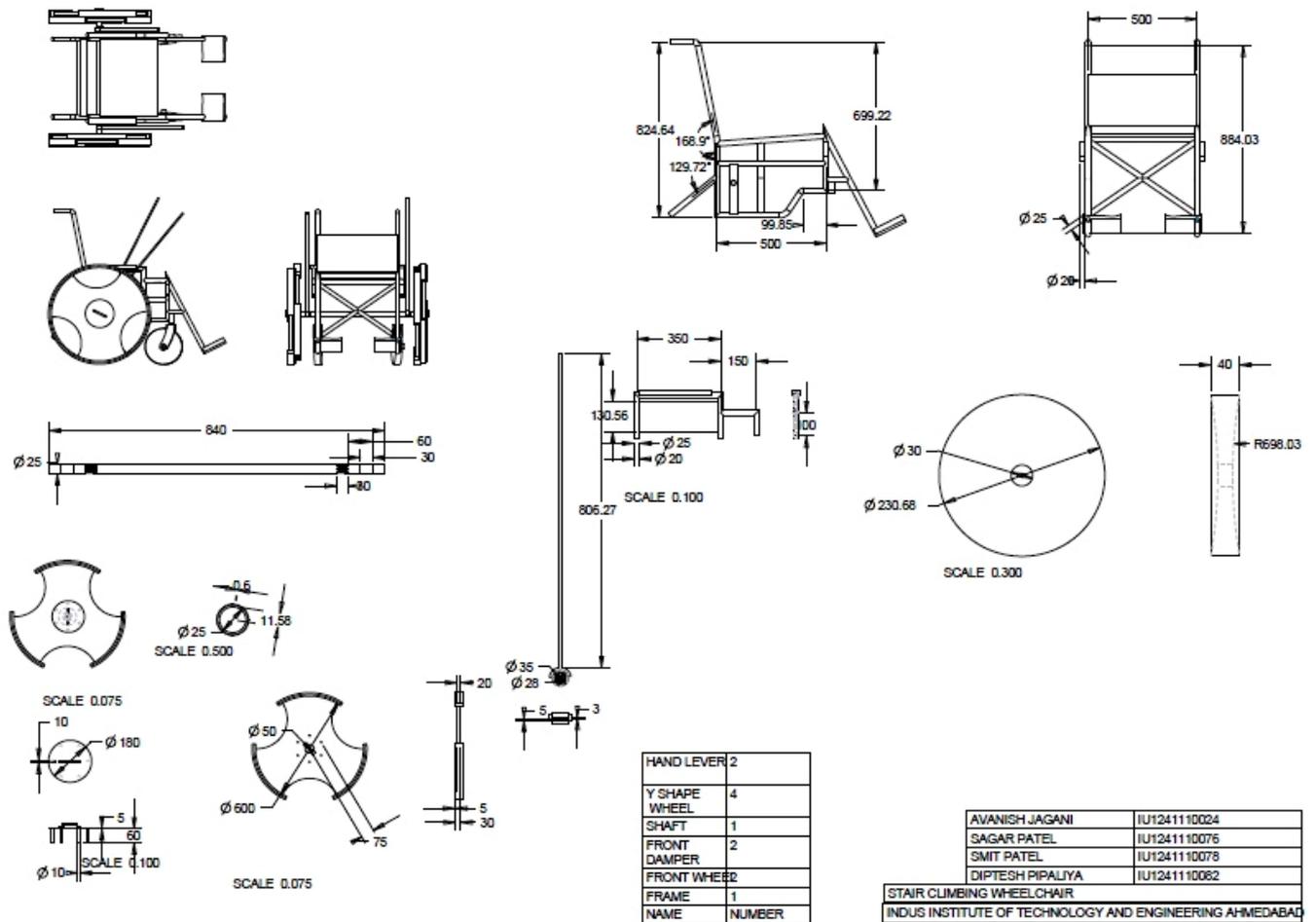


Fig. 1. Detail Drawing of Invention

III. DISCLOSURE OF THE INVENTION

It is an object of the invention to provide a wheel chair that enables an occupant-operator to climb curbs and stairways easily. The stair climbing wheel chair comprises three major assemblies, wheelchair frame and Y-shape wheel, ratchet mechanism. Referring now to the drawings wherein the showings are for the purposes of illustrating the preferred embodiment of the invention only and not for purposes of limiting same, the Fig.1 shows a wheelchair drawing which consist of frame of normal wheelchair with little modification and other innovative parts like Y-shape Wheel and Ratchet mechanism.

To satisfy objective of the project modification in the normal wheelchair is

1. Modification in the Rear wheel
2. Tilted seat to completely eliminate tilting mechanism during climbing operation
3. Shaft to connect both Rear wheel

Having thus described the invention, it is now claimed:

A. Specification of the frame consist:

Frame consists of hollow pipe which gives the strength to the structure and reduce the weight of wheelchair. Seat is fixed to the frame which is tilted up to 10-20 degree to the horizontal because when wheelchair is in climbing or disclaiming position person in the wheelchair doesn't fall from the wheelchair and it increase the ergonomically stability.

B. Y-shape Wheel consists:

1) Normal Wheel: Normal wheel of wheelchair is in circular shape so it does not able to climb the stair and if so it is not beneficiary to the life of the chair as well as the person seated in the wheelchair, so we came up with new idea of the Y-shape wheel as shown in figure ,Y-shape wheel is made up of circular shape with semicircle is cut inside the circumference of the wheel. Outer boundary is coated with rubber material so life of wheel is increase and grip of wheel is sufficient to not fall during operation. In the Center of the

Y-shape wheel hole is provided to fit in the shaft which is at the lower side of the frame. Two Y-shape wheel is connected such that it provide circular boundary in the normal condition and during climbing operation the two wheel disengage and rotate one wheel And make the arrangement such that both wheel occupy the same Y-shape circumference, so which is very easy to climb the stair.

2) *Rotate Y-shape Wheel:* To set the position of wheel during change in operation of normal to climbing or vice versa, the shaft is designed such as one Y-shape wheel is fixed in the shaft and other Y-shape wheel is connected to the bearing which is fixed in the shaft so because of the bearing that wheel is easy to rotate. If wheel is connected to the bearing the problem is how it is rotated during operation so we have solution for that problem is connect both wheel by using pin so it restrict the relative motion of both wheel, if so again there is a problem of failure of a pin because during climbing motion it require high strength during this operation so solution for that is we connected six pin in the circular pattern and that six pin is connected to the flat disc and one handle is connected to that as shown in drawing so easy to remove pin assembly during position change of Y-shape wheel.

C. Ratchet Mechanism consists:

In our design ratchet mechanism is the optional part which helps to perform operation with use of hand and because of lever mechanism force required is very less so by use of minimum force person can climb stair safely. As shown in design drawing ratchet is connected to the groove in the shaft. Groove is designed such that teeth of the ratchet is fixed as well as easily removed during operation. During movement of the wheelchair it can perform with help of the ratchet mechanism by just engaging teeth in the groove in the shaft but when ratchet is in position where person doesn't able to rotate it further then just disengage and rotate in opposite direction up to safe position and then engage to rotate again and process continues.

D. Assembly of components:

Frame is fixed on the coordinate. Front wheel damper is connected with pin joint at given slot in the frame. Because of the pin joint front wheel can able to turn in any direction. Front wheel is connected by the pin joint with the axis of wheel and axis of hole in damper is coincident. Hand rest is fixed and coincident at the slot given in the frame. Shaft is connected at the shaft hole provided in the frame by the pin joint. Hand lever is connected on the groove of gear provided on the shaft. Shaft is pinned and hand lever is fixed. One Y-shape wheel is fixed on the shaft. Sub assembly of another Y-shape wheel. External teeth gear is fixed on the coordinate. Internal teeth gear is fixed with the both axis coincident. Y-shape wheel is fixed on the internal teeth gear. Connecting pin is inserted in the hole provided in the Y shape wheel Headings, or heads, are organizational devices that guide the reader through your paper.

REFERENCES

- [1] G. S. Modak, Dr. Manmohan Bhoomkar, "Innovative Design of Staircase Climbing Wheelchair", International Journal of Engineering Research & Technology (IJERT), 2 (2), 2013.
- [2] "Stair-climbing wheelchair comes to a halt. How much will society agree to pay for high-tech help for the disabled?", Article published online by MSNBC, on 25.5.2009J.
- [3] T. Jozaki, M. Tanaka, M. J. Lawn, T. Ishimatsu, "Motored wheelchair applicable to a variety of disabled," Proc. Int'l Conf. on Control, Automation and Systems, Jeonbuk, Korea, pp. , Oct. 2002
- [4] McKee C , "A Market-Based Approach to Inclusive Mobility", TRANSED 2010, 12th International Conference on Mobility and Transport for Elderly and Disabled Persons, Hong Kong, China, 2010
- [5] Yokota S, "An Assistive Plate Wheelchair Caster Unit for Step Climbing", Setsunan University, Osaka, Japan Takanori Ito Graduate School of Engineering Kagawa University, Kagawa, Japan, 2002
- [6] Siegwart, R., Lauria, M., Mäusli, P., Winnendael, M., "Design and Implementation of an Innovative Micro-Rover," Proceedings of Robotics 98, the 3rd Conference and Exposition on Robotics in Challenging Environments, April 26-30 1998, Albuquerque, New Mexico
- [7] F. W. Crimson, "U.S. Military Wheeled Vehicles", Crestline Publishing Co. Inc., 1983.

IJERT

ISSN : 2278 - 0181

**Call for
Papers
2018**

OPEN  ACCESS


Click Here
for more
details

International Journal of Engineering Research & Technology

- ✓ **Fast, Easy, Transparent Publication**
- ✓ **More than 50000 Satisfied Authors**
- ✓ **Free Hard Copies of Certificates & Paper**

**Publication of Paper : Immediately after
Online Peer Review**

Why publish in IJERT ?

- ✓ **Broad Scope : high standards**
- ✓ **Fully Open Access: high visibility, high impact**
- ✓ **High quality: rigorous online peer review**
- ✓ **International readership**
- ✓ **Retain copyright of your article**
- ✓ **No Space constraints (any no. of pages)**

**Submit
your
Article**

www.ijert.org