

# Mechanically Operated-Wheelchair convertible stretcher and walker

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## ABSTRACT

The problem of transferring the patients exists from prehistoric times. An adaptive technology known as wheelchair is used to deal with loss of mobility for the patients who are not able to walk normally due to some injury or some other age related walking disabilities permanent or under treatment, Later they were carried on wheels which reduced the effort of the person carrying the patients. Though we have evolved in the field of health care and technology we are not yet able to address this problem efficiently.

Mobility aids are used for carrying the patients. Wheelchairs, stretchers and walker are the most generally used mobility aids for the movement of patients. Transferring the patients from wheelchair to stretcher or else when they want to walk with the help of walker or to the medical bed or to stretcher is always an issue for the attendant or nurse. There is a wide range of wheelchairs available today driven by needs and desire of man.

Hence we suggest a design of wheelchair convertible stretcher and then to a walker which is a boon to the medical field. It would be maintained and operated easily either by the patient as per his wish of walking through walker or sitting on wheelchair or by sleeping on stretcher, by the attendant according to the comfort of the patient.

**Key Words:-** Wheelchair, Stretcher, Walker, Review, Wheelchair convertible stretcher and walker, Mobility aids, Health care.

## 1. INTRODUCTION

A wheelchair is a wheeled by mobility device designed especially for disabled individuals. Wheelchair is a device which can empower and enable a person with a disability to live a normal and independent life. Over the years this device has evolved rapidly from manually to the powered automated wheelchairs. Wheelchairs are used by that people for whom walking is impossible due to various problems physiological or physical. Huge amount of people have congenital disabilities, so the percentage of the victim of accidents and that is the inevitable part of their life. Mobility scooters for more severe disability or longer journeys are used. Mobilizing or shifting of patient from wheelchair to stretcher or vice-versa causes discomfort. But still these wheelchairs have not been able to satisfy the needs of the disabled people. With the help of this wheelchair convertible to stretcher and Walker, a patient can be seated on wheelchair on which he can also be operated by converting it to stretcher also it will be convenient for hospital staff to move a patient, also it will be easy if we provide a electrical system to control the overall movement and functioning of stretcher convertible wheelchair and apart from this there are many patients who can also walk but frequently required wheel chair for rest purpose and hence a compact device which can fulfil the nee of all type of patients. Understanding various issues regarding mobility equipment, the better design will be an asset for medical field and helping hand for disabled individual. The present project proposes a development of wheelchair convertible stretcher as well as walker with ability to transform according to the need of patients movement and functioning like walking sitting or sleeping. So we have designed multipurpose wheelchair that can work as

wheelchair as well as a Stretcher. Its construction is so easy and can be operated and maintained easily. We have used simple mechanical linkages along with certain mechanism to achieve the required motion. This paper is the result of a design and development of a multi functional Wheelchair that would perform all the required functions which could be required by patients and attendant needs.

### 1.2 Problem Identification

But still these wheelchairs have not been able to satisfy the needs of the disabled people. It is therefore critical that the problems of disabled be understood and accordingly wheelchairs are developed fulfilling their needs

We have thought of designed a multipurpose wheelchair that can work as wheelchair as well as a Stretcher.

Its construction is so easy and can be operated and maintained easily.

We will used simple mechanical linkages along with seat back recliner mechanism to achieve the required motion.

This project is the result of a design and development of a Multi-functional Wheelchair that would perform all the required functions.

### 1.3 Objective of Study

- ◆ Satisfying the needs of the needy people.
- ◆ Decrease the cost by using new mechanism.
- ◆ Works reliably under different operating conditions.
- ◆ To save space and precluding exertion of the patient.

## 2. LITERATURE REVIEW

A wheelchair is chair with wheels, designed to help the disabled individuals whereas walker is the stable device which is used by the patient to stand and give support to the patient to walk and stretchers are mobility devices used to transport the patients from one place to other. These medical mobility aids are used in hospitals and clinics for helping the patients. Stretchers are simple in construction and the patient needs the support of an assistant to transport from one place to other. Whereas walker is used by patient to walk without any help of any assistance and wheelchair is designed in such a way that either patient can control the device manually or with the help of someone's assistance.

According to Peter Axelson[1], selection of an appropriate wheelchair will lead a comfortable living to the user. Performance, safety and dimensions are the three categories which have to be considered while selecting a manual or powered wheelchair. An excellent approach to the wheelchair selection is to set priorities based on user's mobility and seating needs. It is highly recommended that a novice can consult with there habilitation specialists in order to select the appropriate wheelchair.

James Kauzlarich [2], says self excited vibrations one of the most interesting topics in the field of vibrations and is the science prevailing caster wheel shimmy. Self excited vibration is characterized by vibration that is produced by the motion of the system like wheelchair speed. It can be observed that in most of the cheapest wheelchairs, the design of the casters makes use of a sliding frictional damper in the spindle support to improve the shimmy characteristics. Understanding the theory of damping for the casters show how shimmy prevention works in ultra-light and powered wheelchairs.

Richard Simpson [3], studied almost 10% of all individual who are legally blind also have a mobility impairment and majority of these individuals are dependent on others mobility. A smart power assistance module (SPAM) for manual wheelchair is being developed to provide independent mobility for this population. The power assist wheelchair that provides for obstacle detection and avoidance for those with visual impairments. The control of the wheelchair will be carried out by the microprocessor and also allow the SPAM to provide a smoother and advanced control.

According to Rory Cooper [4], rehabilitation is a humanistic profession. Measurement of the user and wheelchair are critical to achieving maximum functional mobility. He says Biomechanics and ergonomics provide the information necessary to understand many aspects of wheelchair use. These factors affect seating comfort and posture, propulsion, efficiency and pain. Proper seating is an important aspect of wheelchair selection, and wheelchair cushions provide pressure relief and some postural support.

Daniel Jolly [5], proved proper preparation should be taken before transferring the patient from wheelchair to bed or vice versa. Use of sliding boards will be helpful for paraplegic patients. The best sliding board is made of hard wood, smooth, tapered on ends. Support of two assistance, support straps, belts etc will facilitate easy transfer. The patient should not be slide into chair, lift from the wheelchair and transfer is the optional and safety method for patient transfer.

Amos Winter, [6], discussed following the mechanical principles will be helpful for a better design. Understanding the centre of gravity location is important in wheelchair design. Weight should be the other important factor for wheelchair design. Reducing weight will results the comfortable use for the user and also lowers material cost. The best strategy is to maximize the strength and minimize the weight of the frame tubing. Calculating the moment of inertia and weight results the best strength and can be used to make the strongest frame at the least weight.

Debkumar Chakrabarti [7], says primary consideration should be given for comfort, so that people can sit for long time without feeling any physical discomfort. Considering the suitable materials for seat surface, frame and can make a comfortable seating for the design. Without considering the ergonomics and application can make a diverse effect to the user. Seat cushions are so important in the design of wheelchair.

Arunkumar S M [8], says about Design and Fabrication of Stretcher cum Wheelchair which gives the idea of force required to for sustenance of the wheelchair the dimensions used by them was as per standards and calculation done by considering Human weight but the material used can be optimized as can reduce the weight to more extent.

### 3. Design and Working principle

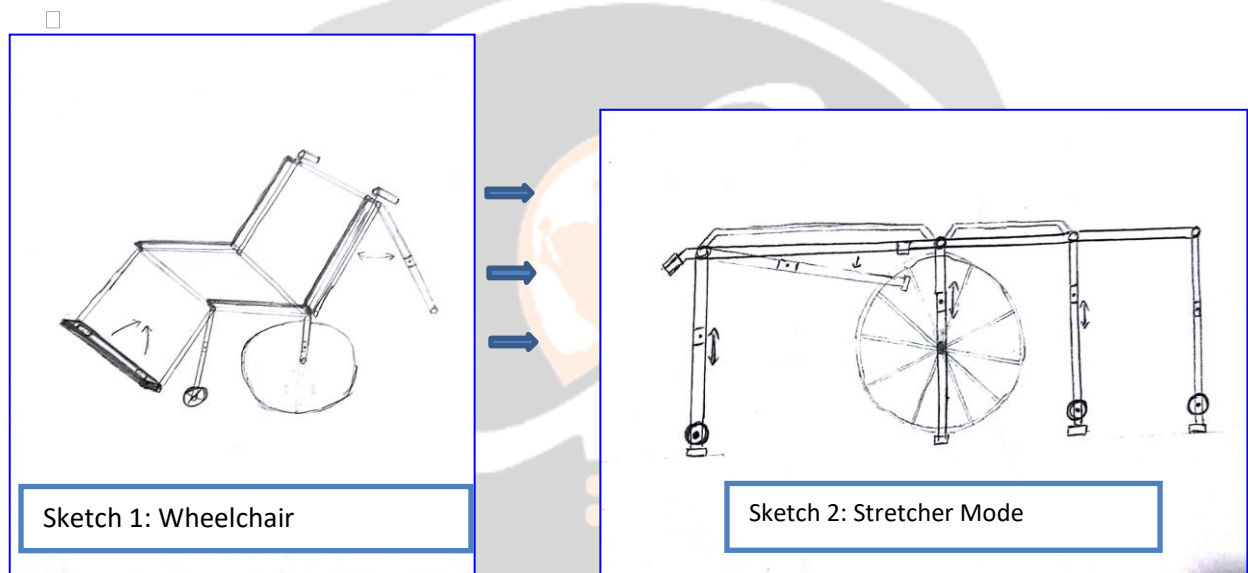
Uniqueness of this design is when the product is in stretcher or bed mode height will match the conventional stretcher or bed. Height is adjustable to bed or stretcher or wheelchair or to any height desired. Conversion from wheelchair to bed or stretcher or vice versa can be done by both the patient and handler. Below are the three different platforms of product

- ◇ Ratchet mechanism
- ◇ Armrest
- ◇ Backrest
- ◇ Leg support
- ◇ Seat cushions
- ◇ Tires
- ◇ Caster tire

Ratchets are provided at the joint where these meet so that it will lock at each step of conversion assuring the safety while converting. Ratchets are also provided to the Upper legs so that those will be in locked position when the product is in wheelchair mode. Detailed images are as below The working of wheelchair convertible stretcher is so simple that the patient feels comfortable during the transformation from wheelchair into stretcher and vice versa. In operation when the wheelchair is to be converted into stretcher the operation starts with rotating the ratchet lever. The lever is connected to the backrest with radial spring.

After rotating the lever, the gear in the seat back recliner mechanism un-meshes and due to the weight on the backrest it will gradually lower down. This will convert the wheelchair into the stretcher and same mechanism for interlocking the walker will form a stable stand to come into working position .

Now if we have to convert the stretcher into wheelchair, again rotating the lever of the seat back recliner mechanism. By applying light load on the back rest, the backrest will also rise up till its original position.



The main components used to fabricate the model are

### 3.1 Ratchet Mechanism

A ratchet is a mechanical device that allows continuous linear or rotary motion in only one direction while preventing motion in the opposite direction. Ratchets are widely used in machinery and tools. Though something of misnomer, “ratchet” is also often used to refer to ratcheting socket wrenches.

### 3.2 Armrest

Armrest is places to rest your arms when you are not moving. They can be wraparound, full-length or desk-length, fixed or height-adjustable, removable or flip-back. Fit is important because armrest position can alter the way you propel your wheelchair. Many individuals choose not to have armrests because they don't like the way they look or they get in the way of propulsion.

### 3.3 Backrest

Sling backrests are the most common, but provide little postural support. Adjustable tension backrests can provide more support and can be adjusted over time. Rigid backrests provide the best support, but may make it more difficult to collapse the chair. The weight and height of the backrest are important. In general, the lighter the better, with carbon fibre backrests being a nice option. If support is not needed, a lower backrest is better as it does not get in the way of pushing.

### 3.4 Leg Support

Leg support is the place where it support your legs in wheelchair. They can be fixed, and folded.

### 3.5 Seat Cushions

Cushions come in a huge and ever-changing array of different types and materials and comprise a major topic unto itself. While pressure relief is an important consideration when selecting a cushion, you should also keep in mind that you want a firm base and a light-weight cushion. A firm base refers to feeling stable, not sliding on the cushion when reaching for an object or propelling your chair.

### 3.6 Tiers

Tires are most commonly air-filled (pneumatic) and therefore lightweight. They also require maintenance and can puncture. If you maintain them, this is usually the best choice. Pneumatic tires may instead be filled with solid foam inserts; these won't puncture but are slightly heavier and don't perform as well. Solid tires are low-cost and no-maintenance, but make for an uncomfortable ride and are not usually recommended.

### 3.7 Caster Tier

The caster tier provides the contact between the caster and the ground. Tire materials vary from solid plastic to Pneumatic. The firmer the material the greater the maneuverability, the softer the material the more cushioned the ride.

## 4. Design specification and calculation

The design specification is given in the below TABLE1.

Table1. Design specification

Components	Material	Dimension
Backrest	Mild steel Circular pipe (3/4")	Width-45 cm Length- 91 cm
Seating Portion	Mild steel Circular pipe (3/4")	Width-45 cm Length-56
Leg support	Mild steel Circular pipe (3/4")	Width-45 cm Length- 46cm
Wheels (big)	Aluminum alloy	Diameter- 66 cm
Wheels (small)	Plastic	Diameter- 12 cm
Ratchet	Stainless steel	Diameter- 15 cm Width- 5 cm Teeth- 40 nos.

## 5. ADVANTAGE OVER OTHER PRODUCTS

Our study was intended to develop a concept of wheelchair convertible stretcher with the motivation of saving space and prevent exertion of patient as well as by making sure that the patient does not get hurt.

The mechanism and safety of patient were our main priorities while designing the conceptual model of wheelchair convertible stretcher. Our study shows that it is possible to save 80% space by using wheelchair

Convertible stretcher rather than using wheelchair walker and stretcher separately. This design eliminates the steps of shifting patients from wheelchair to stretcher and vice versa as nurturing of disabled people becomes difficult. Our design will thus be an efficient mobility aid for the medical field

Adding the features of Walker would make the product more reliable be much more innovative and can satisfy the needs of the patients to much higher extent.

## 6. CONCLUSIONS

The main objective of this product is to make the helper life easy and to make sure the patient is not hurt during the process of treatment. This product eliminates the step of shifting patient from bed or stretcher to wheelchair and vice versa we could make the life of disable person more Nurturing and independent. Through this we are achieving goals- "To make our Society more independent and could fulfil there own need through the branch of Mechanical. "


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