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Performance and Analysis of Wheelchair cum Stretcher

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ABSTRACT: The problem of Transferring the patients from prehistoric times. An adaptive technology know as wheelchair is used to deal with loss of mobility for the patients who are not able to walk normally due some injury or some other agerelated walking disabilities permanent or under treatment. mobility aids are used for carrying the patients. wheelchairs, stretchers and walkers are the most generally used mobility aids for the movement of patients. when it comes to caretakers. so there is a need for a wheelchair cum stretcher to facilitate the disabled patient's .Mobility and to provide novel medical equipment for use in the Indian hospitals.

KEY WORDS: wheelchair, stretcher, mobility aids, walkers.

I. INTRODUCTION

wheelchairs are used by the people for whom walking is impossible due to some problems physiological or physical. with the help of this wheelchair cum stretcher a patient can be seated on wheelchair on which he can be also operated by converting it to stretcher also it will be convenient for hospital staff to move a patient.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 a multipurpose wheelchair that can work as wheelchair as well as a stretcher. The project which we have selected is to reduce the human needs for the physical disabled person. For the person sitting on the chair should have to move the bed in the constant speed. Early wheelchairs are intended only to help a disabled individual to move from one place to another but today the wheelchairs are considered as not only for the transportation purpose but also a way to express users individuality. today there exits a huge variety of wheelchairs -manually, electric,or self-propelled, foldable or rigid. Apart from these there are classified based on their usage, standing wheelchair,sports wheelchair, mobility scooters, bathroom wheelchair, steps climbing wheelchair etc.

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II. OBJECTIVES

In easy words a wheelchair is a structure having a set of wheels attached to a chair. Wheelchair is an equipment which can empower and enable a person with a disability to live a normal and independent life. For the past years wheelchairs have evolved rapidly from the manual wheelchairs to the powered wheelchairs. To decrease the cost by selecting the type of mechanism. To work reliably under different operating conditions.

III. WORKING PRINCIPLE

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. 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. 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.

3D diagrams :



FIGURE 3.1 WHEELCHAIR MODE

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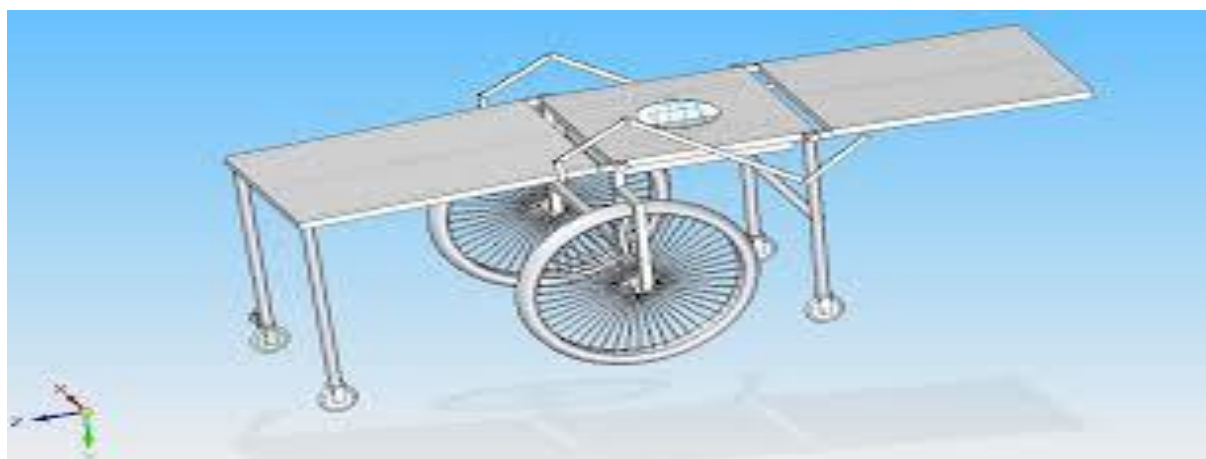


FIGURE 3.2 STRETCHER MODE

IV. DESIGN SPECIFICATION AND CALCULATION

TABLE 4.1: DESIGN SPECIFICATION.

COMPONENTS	MATERIALS	DIMENSIONS
Ratchet	Stainless steel	Diameter- 16 cm Width- 4 cm Teeth- 40 no's
Seating Portion	Mild steel Square pipe (3/4")	Width-48 cm Length-58 cm
Wheels (big)	Aluminum alloy	Diameter- 64 cm
Wheels (small)	Plastic	Diameter- 10 cm
Backrest	Mild steel Square pipe (3/4")	Width-44cm Length- 92 cm

TABLE 4.2: CALCULATION FOR HUMAN WEIGHT CONSIDERATION.

Different Part of Human Body	Weight In (%)	Weight of Human Body Parts (Kg) (If we suppose weight is 80 KG)
Trunk (Chest, Back and Abdomen)	51.8	41.64
Lower leg	5.65	4.72
Forearm	1.62	1.27
Upper arm	2.8	2.18
Head	7.32	5.86
Thigh	9.87	7.907
Foot	1.46	1.18
Hand	0.67	0.522

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❖ **Load on front casters**

Weight of body: $W = 24.26 \text{ Kg}$
 $= 230.07 \text{ N}$

Weight of frame: $W_f = 12.3746$

Inclination angle: $\Theta = 10^\circ$

Force front (vertical): $F_{fv} = \text{Weight of body} + \text{Weight of frame}$
 $= 242.4446 \text{ N}$

Force front (incline): $F_{fi} = F_{fv} \times \cos\Theta$ (1)
 $= 238.7613 \text{ N}$

❖ **Force on each caster**

Force: $F = F \text{ vertical} / 2$ (2) $= 121.2223 \text{ N}$

❖ **Load on rear wheels Weight of body:**

$W = 24.26 \text{ Kg}$
 $= 230.07 \text{ N}$

❖ **Weight of human body:**

$W_1 = 80 \text{ Kg}$
 $= 784.8 \text{ N}$

Inclination angle: $\Theta = 20^\circ$

Force rear (vertical): $F_{rv} = \text{Weight of body} + \text{Weight of human body}$
 $= 1014.87 \text{ N}$

Force rear (incline): $F_{ri} = F_{rv} \times \cos\Theta$ (3)
 $= 953.665 \text{ N}$

Force on each wheel Force: $F = F \text{ vertical} / 2$ (4)
 $= 475.89 \text{ N}$

❖ **Load on backrest portion**

Link inclination: $\alpha = 30$

❖ **Weight of human body (back):** $W_b = 50 \text{ Kg}$

Weight of frame: $W_f = 20 \text{ Kg}$

Force $F = (50+20) \times 9.81$
 $= 686.7 \text{ N}$

Force actual: $F_a = F \times \sin\alpha$ (5)

❖ **Load on leg support portion**

Link inclination: $\beta = 55^\circ$

❖ **Weight of human body (leg) = 12 kg**

Weight of frame = 10 Kg

Force: $F = (12+10) \times 9.81$
 $= 215.82 \text{ N}$

❖ **Force actual:** $F_a = F \times \sin\beta$ (6)
 $= 176.78 \text{ N}$

V. APPLICATIONS

- All physically challenged people.
- Highly useful for senior citizens.
- Most useful in hospitals.
- Most useful in old age homes.

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VI. ADVANTAGES

- Prevent damages to patient while transferring from wheelchair to stretcher.
- Shifting of patient is reduced i.e. stretcher is not needed anymore.
- Increase in comfort level of the patient.
- Is more efficient than other chairs.
- Patients with serious injuries need not be moved to aggravate their injuries even more.

VII. RESULT AND DISCUSSIONS

- Construction of this design is simple.
- It would also help to reduce to some extent the precluding exertion by the patient.
- This model is cheaper than the model in the market.
- In this model ratchet mechanism is used for lifting and reclining of backrest.
- This model consume less space as well as less maintenance.
- Even after detaching, the base can be used as a chair.

VIII. CONCLUSIONS

The mechanism is designed and developed in order to reduce the human fatigue. It also allow the help of nurse to ease in handling the patient in severe cases. 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. This paper 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 cost of this design may be little higher than the common wheelchair. Cost of such type of wheelchair cum stretcher will be affordable for all type of hospitals and it will be beneficial for patient handling. Also we have understood that there are many scope for future improvements.

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