

Design of Wheelchair Cum Stretcher

Baltha Manoj Kumar ¹, Baltha Sravanthi ²

Department Of Mechanical Engineering , Vidya Jyothi Institute Of Technology, Hyderabad, India¹

Department Of Mechanical Engineering, J B Institute Of Engineering & Technology, India²

Abstract: In India the number of disabled individuals is increasing every year. Mobility aids are useful for patients for transportation and a replacement for walking especially in indoor and outdoor environment. Wheelchairs and stretchers are the most commonly used medical equipment for the transportation of patients. Transferring the patients from wheelchair to stretcher or to the medical bed is always an issue for the attendant or nurse. Understanding the various issues regarding the mobility equipment and introducing a better design will be an asset for the medical field and a helping hand for disabled individual. There is a need for a “WHEELCHAIR CUM STRETCHER” to facilitate the disabled patient’s mobility and to provide a novel medical equipment for use in the Indian hospitals. Adopting various kinds of research methods helped to obtain more information about hospital mobility aids and for data collection.

Keywords: Wheel chair , Stretcher , Wheels gas , Principle of Welding.

1.INTRODUCTION

Chair and wheel were the earliest inventions of man. A wheelchair is a wheeled mobility device designed especially for disabled individuals. The device is propelled either manually (by turning the wheels by the hand) or via various automated systems. Wheelchairs are used by people for whom walking is difficult or impossible due to illness (physiological or physical), injury, or disability. Early wheelchairs were 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. In India the number of disabled population had a tremendous augment in the past few years. Huge amount of people have congenital disabilities, another few percentages are the victim of accidents and various kind of mobility devices are inevitable part of their life. The problem of transfer patients exists from ancient times. People who got seriously injured or ill, were carried by others by means of wooden stretcher with cloth or leather tied to it. Later they were carried on wheels which reduced the effort of the people carrying them. Today the problem still exists. Though we have evolved in the field of healthcare and technology we are not yet able to address the problem efficiently.

1.1 DESIGN EQUIPMENTS

1.1.1 Steel Pipes:

A pipe is a tubular section or hollow cylinder, usually but not necessarily of circular cross-section, used mainly to convey substances which can flow — liquids and gases slurries, powders and masses of small solids. It can also be used for structural applications; hollow pipe is far stiffer per unit weight than solid members



Figure 1.1 - Stainless steel pipes for the construction.

1.1.2 Wheels

A wheel is a circular component that is intended to rotate on an axle bearing. It is one of the main components of the wheel and axle. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel, potter's wheel and flywheel.



Figure 1.1.2- Wheels

1.1.3 HINGES

A Hinge is a mechanical bearing that connects two solid objects, typically allowing only a limited angle of rotation between them. Two objects connected by an ideal hinge rotate relative to each other about a fixed axis of rotation. Hinges may be made of flexible material or of moving components. In biology, many joints function as hinges like the elbow joint.



Figure 1.1.3 -Butt Hinge

1.1.3(a) Why did we use butt hinge ?

A Butt Hinge is usually comprised of two leaves that match. One is usually attached to a fixed component and the other is attached to a moving component. In the closed position, the butt hinge leaves will remain flush with each other where only the curled barrel, often referred to as the knuckle, is exposed.

There are specific applications for a butt hinge in a variety of industries. Many are constructed from stainless steel materials to be able to withstand many types of harsh environmental conditions. Butt hinges can be viewed in many applications including on fire doors, box lids, cabinets, interior & exterior doors, etc.



Figure 1.1.3(a) - Usage of Butt Hinge

1.1.4 BOLTS AND NUTS

A Bolt and Nut in combination is a fastening device used to hold two parts together. The body of the bolt, called shank is cylindrical in form, the head; square or hexagonal in shape, is formed by forging. Screw threads are cut on the other end of the shank. Nuts in general are square or hexagonal in shape. The nuts with internal threads engage with the corresponding size of the external threads of the bolt.



Figure 1.1.4 -Bolts and Nuts

1.1.5 Gas Welding (oxyacetylene welding)

Oxy-fuel welding commonly called oxy-acetylene welding, oxy-welding, or gas welding in the U.S.) and oxy-fuel cutting are processes that use fuel gases and oxygen to weld and cut metals, respectively.

A common propane/air flame burns at about 2,250 K (1,980 °C; 3,590 °F), propane/oxygen flame burns at about 2,526 K (2,253 °C; 4,087 °F), and an acetylene/oxygen flame burns at about 3,773 K (3,500 °C; 6,332 °F).

Oxy-fuel is one of the oldest welding processes, besides forge welding. Still used in industry, in recent decades it has been less widely utilized in industrial applications as other specifically devised technologies have been adopted. It is still widely used for welding pipes and tubes, as well as repair work. It is also frequently well-suited, and favored, for fabricating some types of metal-based artwork. As well, oxy-fuel has an advantage over electric welding and cutting processes in situations where accessing electricity (e.g., via an extension cord or portable generator) would present difficulties; it is more self-contained, and, hence, often more portable. In oxy-fuel welding, a welding torch is used to

weld metals. Welding metal results when two pieces are heated to a temperature that produces a shared pool of molten metal. The molten pool is generally supplied with additional metal called filler. Filler material depends upon the metals to be welded.

In oxy-fuel cutting, a torch is used to heat metal to its kindling temperature. A stream of oxygen is then trained on the metal, burning it into a metal oxide that flows out of the kerf as slag.



Figure 1.1.5 -Gas Welding Equipment

2. MAIN DISCUSSION

2.1 Idea of Introducing Wheel Chair Cum Stretcher:

Now In hospital we see the, for various checkups, patient transfer from one place to another place. As per the demand required for better living quality of immobilized patients, for that should be improved the hospital mattresses for patient handling. Generally immobilized patients transfer by labour or nursing staff. Patients handling in various places are a labour intensive work. It is very dangerous for patient and hospital staff, if all transfer activity not done in exact manner.

Mostly hospitals use fully atomized beds & stretcher for the patient handling. These are costly and cannot be affordable to all the hospital. At the time of patient handling, the stresses generated inpatient & staffs are same for all the hospital. Our aim to provide a better solution for patient handling. According to recent survey in hospital, it found that, 38% of nursing staff and labour suffers work from back injuries, 12% of nursing staff and labour suffer from low back pain at average age 39.

Any other staffs suffer from any other various injuries. The present working proposes designing of a new trolley cum stretcher along with the modified mattresses which will totally eliminate the handling of immobilized patients.

2.2 Objective and Justification of the Design:

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 as handling of old age people is very difficult

The requirements such as adjustable back of the wheel chair, size of wheels, patient safety, braking, auto driving, stretcher chair combination, etc., were considered before designing the new chair.

The designed chair mainly consists of the following features along with all its regular features.

1. Back adjustment mechanism, which rotates the back of the chair to 90°.
2. Leg support mechanism which rotates it through 90°.
3. Lifting mechanism for converting chair in to a stretcher or bed. (Lifts complete chair up to a height of standard table or stretcher)

S.No	Component	Material	Quantity
1.	Hallow Pipes	Stainless steel	21
2.	Wheels	Rubber	8
3.	Hinges	Stainless steel	4
4.	Nuts and Bolts	Stainless steel	16
5	Plates	Wood	3

2.3 Design Parameters :

Table : The above table shows the parameters with suitable materials which is suitable for the design

3. Constructional Setup Procedure of the Design :

The procedure for the construction of design is as follows :



Fig. 3.1

Fig 3.1: shows the raw material i.e,(stainless steel) which is procured from the steel shop which as been cut in to our required size.



Fig 3.2

Fig 3.2 : shows the frame of the base rest which is made by joining the steel pipes by the process of gas welding.



Fig 3.3

Fig 3.3 : shows the frame of the base where the base rest is placed over it.



Fig 3.4

Fig 3.4 : shows the structure of the frame which is manufactured by joining the steel pipes using the welding process by welding equipment.



Fig 3.5

Fig.3.5 : shows the structure of wheelchair when plywood is attached to the frame.



Fig 3.6

Fig.3.6: shows the position of frame when it is in wheel chair position.



Fig.3.7

Fig 3.7 : Shows the position of the wheelchair when it is in stretched

4. PROCEDURE FOLLOWED TO PREPARE THIS DESIGN

- First mark the steel pipes by measuring it with the help of measuring tape.
- Then cut the pipes according to our requirement with the help of electric cutting machine.
- Then drill the holes of dia 4mm with the help of vertical drilling machine on the steel pipes where ever required to insert the bolt in order to join the pipes.
- Then join the steel pipes to make a frame as shown in fig. with the help of gas welding for base rest.
- Again join the steel pipes to make back rest with the help of welding
- As similar to the above process we also made a leg rest frame.
- Insert the bolt into the holes which had been drilled with drilling machine and fix it with the nut.
- Now join the base rest to the leg rest with the help of nut and bolt arrangement .
- Now join the back rest and base frame with the help of butt hinge as show in fig. for 90° rotation of back rest.
- Now insert wheels to the vertical steel pipes at the bottom of the base rest for the movement of chair with the help of nut and bolt arrangement as shown in fig.
- Now attach two steel pipes at the back side of the back rest to give support it when it is in stretched position.

- Attach wheels to the previous steel pipes which are fixed to the back rest
- Take a steel pipe and join diagonally it to the base rest and back rest for various positions of the backrest with the help of bolt and nut arrangement.
- In the same way take another pipe and join it to the base rest and leg rest for various positions of the leg rest.
- Frame of wheel chair cum stretcher is prepared.
- Now take plywood of frame size and attach it to the chair frame with the help of pipe holding clamps.
- Then stick the sponge to the plywood with the help of gum (or) fevicol.
- Then cover the sponge with a cloth for attraction.
- Give finish to the chair by painting, etc.

5. CONCLUSION

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 as handling of old age people is very difficult.

Developed stretcher is very useful and very easy to transfer patient from bed to stretcher and vice versa also stretcher can convert into a wheelchair by attendant or nurse easily. Mobility is possibly in both positions on chairs as well as stretcher.

6. FUTURE SCOPE

A pneumatic or hydraulic system may be arranged instead of mechanical linkages to convert wheel chair cum stretcher and vice versa very easily, conveniently and fast by attendant or nursing staff.

REFERENCES

- [1] S.Shaheen, A.Umamakeswari. "ARM Based 3-in-1 Device People with Disabilities", Journal of Artificial Intelligence, Vol. 6, pp: 82 –88, 2013.
- [2] Peter Axelson., "A guide to wheelchair selection", paralyzed veterans of America, Library of Congress Cataloguing-in-publication data, Washington 1994.
- [3] Olson, David L., ed. ASM handbook: Gas welding, brazing, and soldering. Vol. 6. Asm Intl, 1993.
- [4] Mr. Daniel E. Jolly., "Wheelchair transfer", The Ohio state university college, Columbus, ohio, retrieved on 24th Sept. 2010
- [5] Cooper R, Corfman T, Fitzgerald S, Boninger M, Spaeth D, Ammer W, Arva J., "Performance Assessment of a Pushrim Activated Power Assisted Wheelchair", IEEE Trans Control Sys Tech, Volume 10, ISSN: 1063-6536, Jan 2002.