

Multipurpose Medical Bed

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Abstract—: Our country, India is seeing a tremendous rise in the number of disabled personalities. Mobility aids are useful for patients for transportation and it's a substitute for patients for walking in environments both indoor and outdoor. Wheelchairs and stretchers or medical beds are usually employed medical equipment for the transportation of patients. Transferring the patients from medical bed to stretcher or to wheel chair or vice versa is always an issue for the attendant or nurse. Understanding the various issues regarding the current mobility medical equipment and introducing a better design will be an asset for the medical field and a better, reliable solution for disabled individuals. Thus a need arises for a wheelchair cum stretcher cum medical bed to facilitate the disabled patient's mobility and to provide a simple cheaper and an efficient medical equipment for use in the Indian hospitals. Hence our project "MULTIPURPOSE MEDICAL BED" is introduced to solve problems related to the conventional medical care equipment and would be cheap and affordable and could be efficiently used in hospitals to save space, time and to provide better care to the required.

Keywords:-- Mobility Aid, Wheelchair cum Stretcher, Multipurpose Bed

I. INTRODUCTION

A wheelchair is a wheeled mobility device designed especially for disabled individuals. Generally, a person who is suffering from some kinds of medical problem and requires continuous attention and care by doctor and may require external equipment's like oxygen, blood transformation, saline etc. is known as a patient. The patients are taken to hospitals for better care and cure. The patient is confined to bed in hospital and is required to be moved to different places for taking X-ray or undergoing other observational procedures like CT scan and sonography.

The handling of the patient is rather difficult and is required to be planned meticulously. In 'patient handling', a lot of problems are being faced by nursing staff, the people who handle the patient at home, and the patient himself. The patients are subjected to various pain such as shoulder pain, back pain, leg ache and other body aches while moving him from one place to another. In the hospitals, the nursing attendants and staffs are also suffering from the same health problems like pain in their shoulders and backbone, as they have to continuously work of patient handling repeatedly throughout a day. The "MULTIPURPOSE MEDICAL BED" which is a wheelchair cum stretcher cum medical bed can be an asset for Indian hospitals and can resolve the problems faced by conventional equipment's.



Fig.1 Multipurpose Bed

II. OBJECTIVES

The major struggle associated with latest and hospital beds for the bed ridden patients is that, the patient has to be moved frequently to avoid further complications in their present medical conditions. At present, it is very difficult even with the help of a bystander. So multipurpose medical bed is a solution for this problem. Multipurpose medical bed is the bed, which enables the movements of a bed to either side, to lift the head of the patient, to help movement of the leg side of the bed, it also helps in patient transfer from bed to wheel chair and much more. In our concept a mechanism was employed so as to lift the patient and transfer it to any other bed automatically. A mechanism to lower the leg rest and to raise the head rest is essential to bring the patient to a seating posture. A simple mechanism which helps in the entry and exit of the bedridden patients to bed was also

required. In spite of all these equipment's and mechanism the product should be cheap and must be viable and affordable to a common man. The provision of control switches must be apt enough to handle the bed. As a whole our multipurpose medical bed need to reduce the physical and medical discomfort of a bed ridden patient to a great extent at a minimal cost and can be a helping hand to all the bedridden sufferers in the world. Also it helps in easy and comfortable patients handling by the staff and nurses.

III. LITERATURE REVIEW

The journal referred are related directly or indirectly to the proposed area of work that is design and development of a multipurpose medical bed. These papers are to support and enlighten the whole process of design in the specific area. A wheelchair is chair with wheels, designed to help the disabled individuals. Stretchers are mobility devices which have the function of transferring patients from one place to another. Medical bed are permanent facilities in which the patient is laid for their treatment. These three medical mobility and care aids are used in hospitals and clinics for helping the patients.

According to Mr. Peter Axelson, Mr. Jean Minkel, and Mr. Denise Chesney [1] selection of an appropriate wheelchair is necessary for better comfort of patients. Performance, safety and dimensions are the three key factors to be considered when selecting a manual or powered wheelchair. An excellent approach to the wheelchair selection is prioritise the needs of patients based on user's mobility and seating. Self-propelled wheels invention was created enormous demand in the market and it was a better aid for patients[2].

Mr. Richard Simpson, [3] says almost 10% of all individual who lack the ability of sight also have a mobility impairment and majority of these individuals are dependent on external aid for their mobility. A SMART POWER ASSISTED MODULE for manual wheelchair is being developed to provide independent mobility for these individuals. This wheelchair that provides for obstacle detection and avoidance for those with lack of vision. Wheel chair control will be carried out by the microprocessor and also allow the SPAM to provide a smoother and nuanced control.

According to Mr. Rory A. Cooper, [4] rehabilitation is a humanistic profession. user and wheelchair measurements are critical to achieving maximum functional mobility. Ergonomics and biomechanics provides resourceful information to gain knowledge of many aspects of wheelchair use. These factors affect seating comfort, efficiency, pain and

propulsion, and posture. Proper seating is an important aspect of wheelchair selection, and pressure relief and some postural support are provided by wheelchair cushions.

IV. PRESENT METHOD OF PATIENT HANDLING

Various stages of patient handling to transfer patient from hospital bed to MR machine / Sonography / X-ray centre / CT scan, are shown in Fig.2

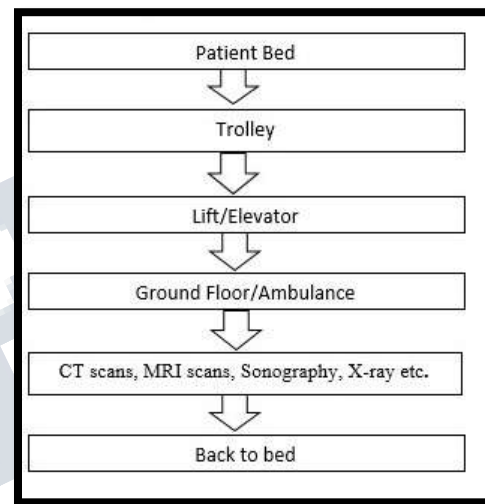


Fig. 2 Flow chart for Present method of patient

V. THE PROBLEMS ASSOCIATED WITH HANDLING OF THE PATIENT

The various problems associated with patient handling are

- 1). The stresses are produced in the body both for the patient and nursing staff while moving the patient on same floor by wrapping the patient in a bed sheet. This may cause injuries and cramps in backbone and other parts of the body.
- 2). During the manual handling of the patient various accessories like oxygen supply, blood transmission facility, saline facility, are not available and this may create serious problem if the patient is serious.
- 3). There is a chance for slip/slide down of patient on the inclined surface while taking to the scanning centres or to ambulance etc.

VI. DESIGN AND CONSTRUCTION

In Our multipurpose bed hydraulic jack mechanism is used to adjust height of stretcher base as per

required height, mechanism able to adjust height parallel to bed. Back rest can be turn from vertical position to horizontal position and vice versa. The attendant or nursing staff can be easily operated. Leg rest can be turn from vertical to horizontal position and vice versa and it can be also operated by the nursing staff or attendant. Instead of a mechanical linkage Hydraulic or Pneumatic system can be employed to convert wheel chair to bed or to stretcher and vice versa. Therefore it can be use very easily, conveniently and quickly by the nursing staff or attendant. Designing is done by using solid works 2015



Fig.3 Wheel Chair Position

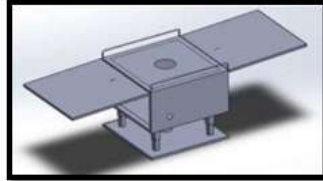


Fig.4 Stretcher Position

VI.1 MECHANISMS

VI. 1.1 HYDRAULIC JACKS- Hydraulic jacks are jacks that are placed in a horizontal position. These jacks push against a lever, which functions to lift the main arm. Bottle jacks have a longer handle than most hydraulic jacks, however, and it is possible with the increased leverage to get more lift per stroke they provide when compared to regular models of jacks.

VI. 1.2 LEAD SCREW- A lead screw or power screw is used for the linkage in machine to translate rotary motion to linear motion. Lead screw threads have larger frictional energy losses compared to another linkage due to the large area of sliding contact between male and female members. It can carry high power, but it is used more for intermittent use in positioner mechanisms and power actuators. In our project power screw mechanism is employed for the shifting of transferring the patients from stretcher to the bed and vice versa.

VI.1.3 CASTER WHEEL MECHANISM- The displacement from the vertical axis of suspension of steered wheel measured longitudinally is known as the Caster angle. It is the angle between pivot line and vertical. Adjusting the caster angle will help to optimize the handling characteristics in particular driving situations. By means of a special arrangement the stability of direction is ensured. To bring left a positive caster angle is shown with the front of the vehicle.

VI.1.4 BRAKING MECHANISMS- Toggle clamp mechanism is fixed on rear wheel for braking in manual wheelchairs. Lever type mechanism is used in hand brake system. Hand braking system is used in most of the manual wheelchair and will be helpful for the user's convenience.

VI.1.5 DRIVING MECHANISM- A porta wheel mechanism is used to convert a manual wheelchair into a mobility vehicle which can be driven by the patient itself. This involves an independent handle which can be easily removed or attached to the manual wheelchair using a mechanical coupling. On engaging the handle with the wheel chair it turns to mobility vehicle. The components of a porta wheel mechanism are lithium ion batteries used to power the sole wheel which is driven by a high power dc motor. It also employs independent brakes for wheel to stop and control the speed of the wheelchair once in motion.

VII. CONCLUSION

The present study was intended to develop a concept for a multipurpose medical bed. Considering various methods of researches helps to identify the various issues of the topic, importance of safety and significance of materials and different manufacturing processes involved in the Multipurpose bed. The patient transfer mechanism was of immense help to the nursing staff as it reduced the human effort of lifting and shifting the patients. The porta wheel mechanism helped the patients to use the transformed wheelchair as a mobility vehicle and can be driven by themselves. Our Project helps to save 50% space by the medical purpose medical bed as it integration of multiple functions of wheelchair, stretcher, medical bed with automatic patient transfer and a mobility aid for patients. The product will thus likely be an efficient mobility aid in hospitals. It has been concluded that the multipurpose medical bed fulfills the requirement of the stakeholders associated with the product.

REFERENCE

- [1] Peter Axelson., "A guide to wheelchair selection", paralyzed veterans of America, Library of Congress Cataloguing-in-publication data, Washington 1994.
- [2] Anonymous, "History of the wheelchair", www.inventors.about.com, retrieved on 27th Sept.2010.
- [3] 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.

[4] Dr. Rory A. Cooper., “Wheelchair selection and configuration”, ISBN 1-888799 18 – 8, March 1998.

