"Wheel Chair cum Stretcher", an innovative product for small hospitals and patients

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ABSTRACT

Wheel chairs and stretchers are very commonly used in the hospitals, airports, railway stations, shopping malls, etc. The authors have designed and fabricated a new modified wheelchair cum stretcher. The developed wheel chair can very easily be converted into stretcher as well as operation table depending on the need. Simple parallelogram mechanism has been synthesized for lifting. The mechanism is driven hydraulically. The hydraulic piston can be operated manually as well as automatically. The chair gets converted into stretcher while lifting automatically. Inverted slider crank mechanisms are applied for the purpose. Five-legged support provides required stability to the stretcher. The system can be made manual self driven or motorized. The developed chair is economical as compared to the available modern automatic wheel chairs

Key Words

Wheelchair, stretcher, operation table, hospital, physically handicapped

INTRODUCTION

Wheel chairs, stretchers, adjustable beds, operation tables, etc. are the major furniture items used in the hospitals. Engineers are continuously applying their ideas to make these products more and more sophisticated so as to facilitate the doctors, patients and the assisting staff. The authors developed an innovative wheel chair, which can be easily converted into stretcher or small operation table. The working model has been fabricated and demonstrated before the panel of doctors.

Extensive study of existing wheel chairs and stretchers were made. Discussions were made with doctors, nurses, patients and assisting staff so as to understand their requirements for wheel chairs and stretchers. 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 following features along with all its regular features.

1. Back adjustment mechanism, which rotates the back of the chair up to 90^0.
2. Leg support mechanism which rotates it through 90^0
3. Lifting mechanism for converting chair in to a stretcher or bed. (Lifts complete chair up to the standard table or stretcher height.)
4. Ease in manufacturing.
5. Cost

MECHANISMS

Very basic mechanisms have been selected to perform the desired tasks. The synthesis and design of these mechanisms have been made and the wheelchair was fabricated.

1 Lifting Mechanism

The most important task is to lift a patient without any trouble. Various mechanisms such as power screw, rack and pinion, linkages etc. have been identified. The parallelogram linkage has been selected for the purpose. Two identical mechanisms driven by a slider crank mechanism were selected for stability. Pedal driven hydraulic cylinder has been used to give an input to the mechanism. The following parameters were used for the design

i) Lift: 250mm from the chair height

ii) Angular displacement of a crank of a parallelogram mechanism: 135^0

iii) Angular displacement of a crank of a parallelogram mechanism: 45^0

iv) Displacement of piston: 80mm

Synthesized Dimensions:

- Crank length of a slider crank mechanism: 120mm
- Connecting rod length of a slider crank mechanism: 280mm
- Offset: 100mm
- Link length of a parallelogram mechanism: 295mm
- Crank length of a parallelogram mechanism: 250mm

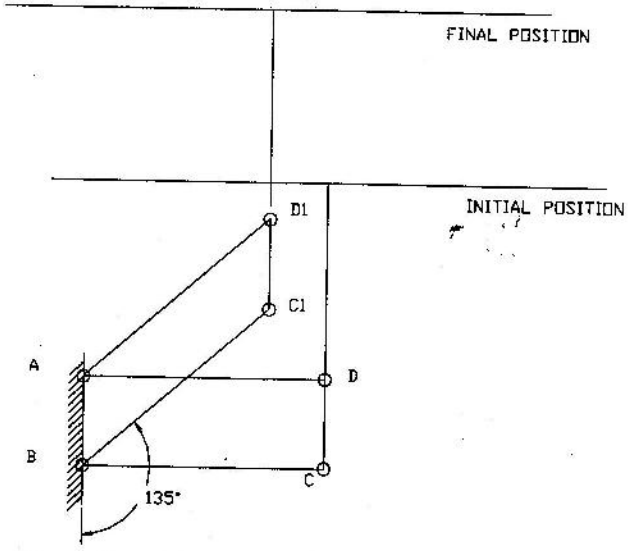


Fig 1 Parallelogram Mechanism

2 Back Reclining and Leg Rest lifting Mechanism

To convert the chair into stretcher the back has to reclined through 90^0. An innovative slider crank mechanism has been designed in which the seat of a chair acts as a slider and back acts as a connecting rod. The crank length has been obtained by inversion technique. Similar mechanism has been designed for the leg rest lifting. The unique feature of these mechanisms is that both the operations are done simultaneously.

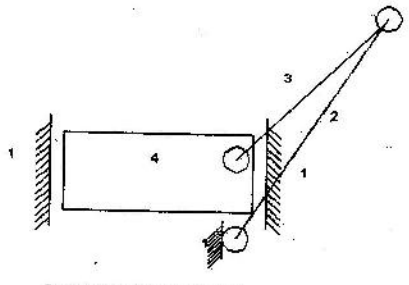


Fig 2 Back Reclining Mechanism

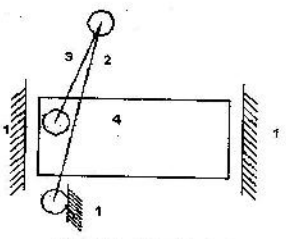


Fig 3 Leg Rest lifting Mechanism

The Design and fabrication of wheelchair cum stretcher

The design includes selection of wheel dimensions, frame design, hydraulic system design, foot pedal mechanism, component design, size determination, and detail drawing of the assembly and subassemblies. The chair has been fabricated and rigorously tested in the presence of doctors and other hospital authorities.

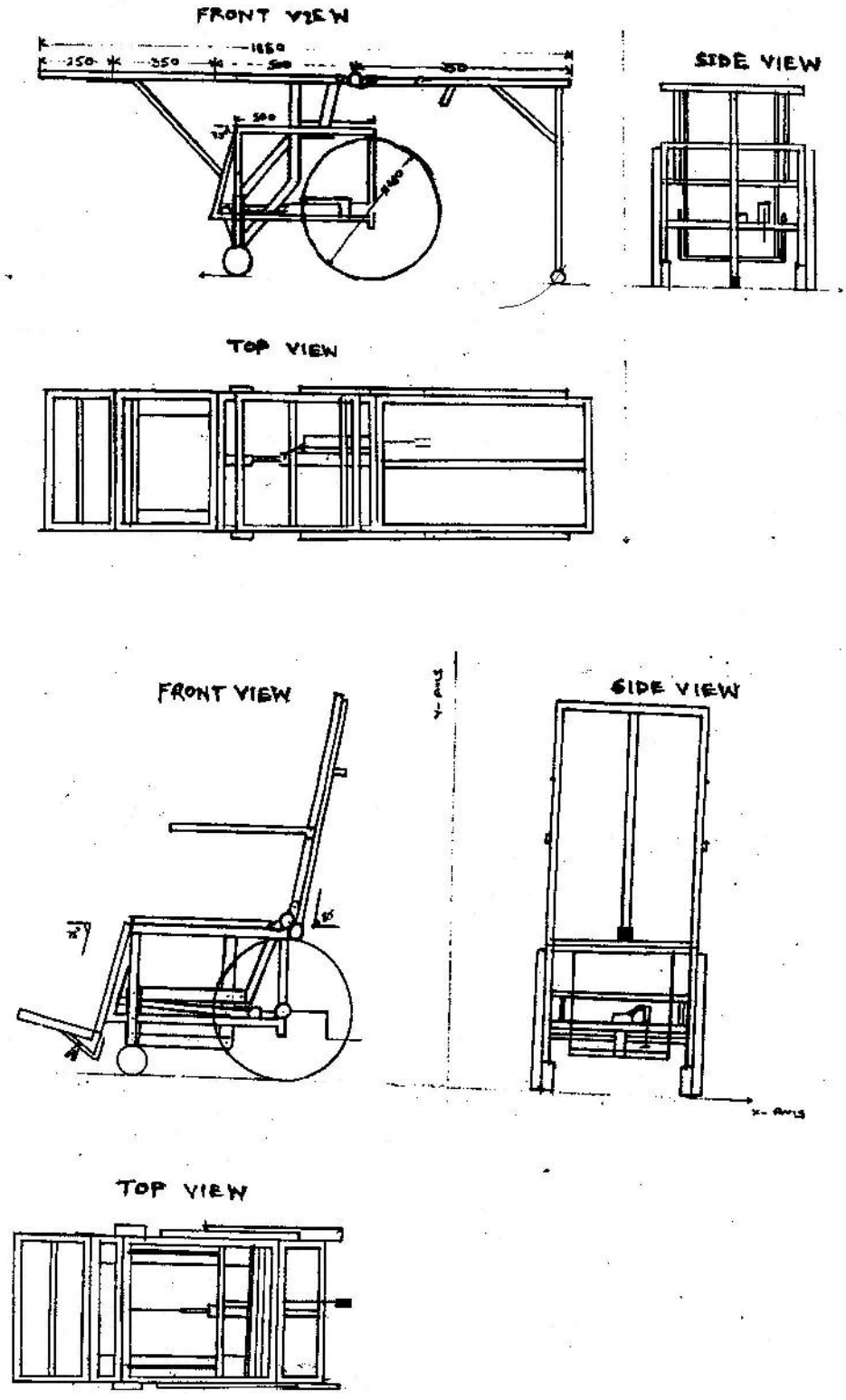


Fig. 4 : Assembly of Wheelchair cum Stretcher

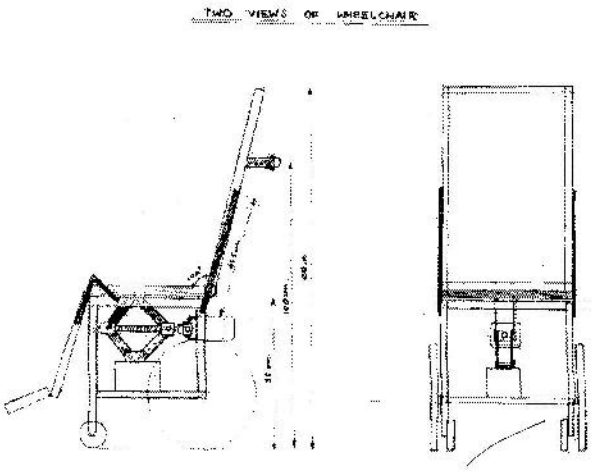
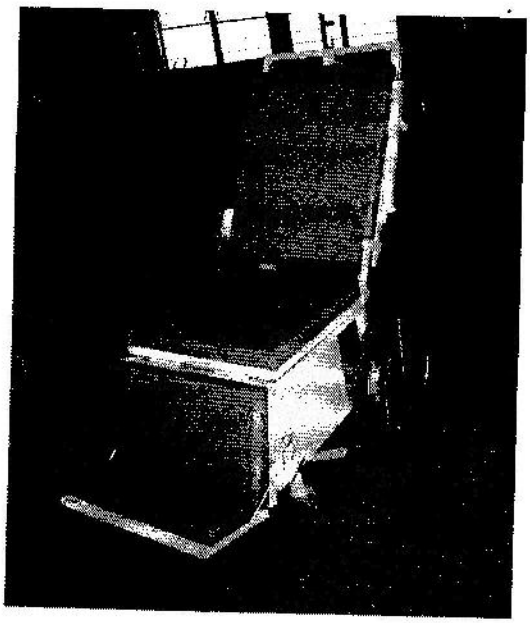
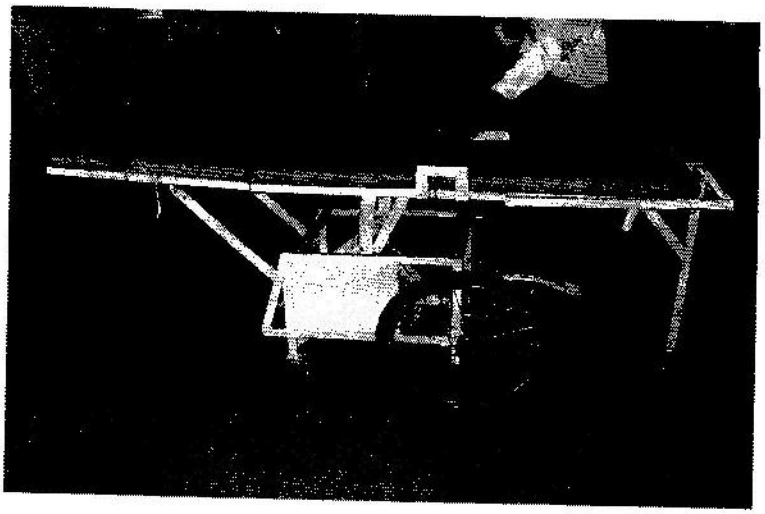


Fig 5: Second version of Wheelchair cum Stretcher

Photographs.:





CONCLUSION

The fabrication of a prototype is done and trials have been carried out in the hospital. An ergonomic analysis has been done and has been accepted for presentation in International Ergonomic Conference HWWE 2005 at IIT,Gohati. The authors are further working to make the wheel chair cum stretcher automatic and remote operated and self driven.

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