

# “Fabrication of Pneumatic Operated Stair Climbing and Load lifting Mechanism”

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**ABSTRACT:** This project deals with the design and manufacture of mechanism for stairclimbing to lift load over staircase flight. Our project consists of the construction of a base and pistons to move load using compressed air as a medium. It is easy with the help of wheels on straightlevel paths carrying heavy load but it is a challenge especially in indian rural areas in the case of stairs. This project offers an alternative to carrying load in buildings that do not have elevators. It is a mechanical system in which the load can be carried by an individual through a flight of stairs. The project may also be used with wheel chair to move the handicapped staff over a flight of stairs. This is a pure mechanical-based system there for potential usage areas also include areas where electricity is not available. The project focused on both an average family's economic needs and the efficiency requirements of any industry

## I. INTRODUCTION:

**BACKGROUND** Lifting heavy parts and moving them to different locations takes a lot of effort and time. This kind of problem is very common in industries, factories, production, and manufacturing departments, which transport heavy equipment parts from one place to another and from one floor to another. The proposed stair climbing trolley is the vehicle to use with less human effort to operate the cart and move through the stairs. It is one of the wheel mechanisms adapts to stairs and climbs various floors with the vehicle and on uneven ground. It is very troublesome to manually carry various things (especially heavy objects) to the upper floors through the stairs many times. Hence the buildings do not have elevators, remains with only one solution to i.e. carrying the equipment with human effort. This issue can be resolved if the trolley can lift the cargo while traveling down or up

the stairs. This project will introduce a new way to carry your luggage to the stairs. The vehicle is designed to have single wheel on each side instead of three wheels as the existing design. The main focus of this project is to develop a trolley which is ergonomically and economically useful. The need of carry heavy loads through the stairs in a more time-saving, energy-saving and in less cost, increase the need of this project and its usefulness. This paper analyses the entire cart structure, including the wheels. In everyday life, especially in offices, schools, colleges, hotels, industries, homes, etc., have not elevators **HAND TROLLEY:** A hand trolley is a small transport device used to move heavy loads from one place to another. It is a very common tool used by a large number of industries that transport physical products. Also called a hand truck or a dolly, the hand trolley is often used by stock persons who arrange and restock merchandise in retail stores. When used properly, trolleys can protect people from back injuries and other health problems that can result from lifting heavy loads.

**Description:** A typical hand trolley consists of two small wheels located beneath a load-bearing platform, the hand trolley usually has two handles on its support frame. These handles are used to push, pull and maneuver the device. The handles may extend from the top rear of the frame, or one handle may curve from the back. An empty hand trolley usually stands upright in an L-shape, and products are usually stacked on top of the platform. When the goods are in place, it is tilted backward so that the load is balanced between the platform and the support frame. Especially if heavy or fragile materials are moved, the person operating the trolley should return it to an upright position carefully, to insure nothing falls off the platform.

The front of the frame may be squared off for boxes or curved for drums and barrels. Sometimes, a hand truck also has straps for securing loose freight during transport. Professional material handlers prefer to use a hand truck when moving stackable items such as boxes, crates or packages. Heavier items are usually stacked on the bottom of the hand truck, with lighter objects saved for the top. Hand truck users must be careful not to stack it so high that their vision is blocked or the load becomes unstable. Generally, it is safe to load a hand truck to the level of its handles or the top of the frame. The load is then shifted onto the wheels with a backwards lifting motion. The user can maneuver the cargo by steering it left, right or forward.

**TYPES OF TROLLEY:** Different types of these trolleys exist, and the type used is often chosen based on what type of material it will move. Hand trolleys are made of various types of hard materials, including steel, aluminium and high-impact plastic. Most hand trolleys come in standard sizes and are used for general loads, but there are some that are specifically designed for very small or large products.

**Wheeled trolley:** Wheeled trolleys made from stainless steel are the most common type of hand trucks used. These are used in places with heavy loads to move, like retail stores and factories, and typically have wheels made out of stainless steel as well. Welded steel and metal wheel trolleys are typically much more lightweight and are often used to carry lighter materials. Those with a frame and wheels made of a metal alloy are heavier and sturdily made. Trolleys of this type usually have a wider platform for oversized loads. Metal alloy hand trucks are typically used to transport heavy products, such as items made of steel.

**Folding Trolley:** A folding trolley is another type of hand tool, and is often made of rustproof aluminium. It is also lightweight but is usually able to carry heavy loads, and can fold to take up less space when not in use. This feature also allows it to be easily transported to places where it is needed.

**Garden Trolley:** The garden trolley is a maneuverer with the use of a pull handle. Garden trolleys tend to have narrow profiles so that they will fit easily on paths and walks without damaging plants. These are designed so that they are capable of lifting both dry and marshy loads which are most commonly found in gardens.

**Kitchen Trolley:** A kitchen trolley is a serving cart that can also be used for storage. It is designed that it has more than one section in it which enables

people to carry various utensils and for various purposes.

**Sack Trolley Sack trolley:** or Sack barrow is a fairly generic term describing a range of light, single operator hand trucks or trolleys used to move cartons, feed and grain sacks, and other light, stackable goods. Lots of different materials are used to make sack trucks. This includes high impact plastics, tube steel, aluminium steel, and aluminium excursion.

## PROBLEM IDENTIFICATION

### NEED FOR STAIR CLIMBER TROLLEY

Lifting heavy objects to upper stories or lifting patients to upper levels from the ground are not painless jobs, especially where there are no lifting facilities (elevator, conveyer, etc.). Moreover, most of the buildings are structurally congested and do not have elevators or escalators. This project can introduce a new option for the transportation of loads over the stairs. The stair climbing hand trolley can play an important role in those areas to lift loads over a short height. **AIM AND OBJECTIVES Aim:** To design and fabricate “Pneumatic Operated Stair Climbing and Load Lifting Mechanism”

### Objectives:

1. To reduce the human effort
2. To replace human's effort by mechanism (for farmer's economical and effort point of view).
3. To make it usable for several purposes
4. To reduce the time

## II. LITERATURE REVIEW

**2.1] Mr.Rohit B. Yadav et.al (2020) design a Stair Climbing Trolley & give idea.** Trolleys are one of the important and supporting machines in transportation of the material for one place to other within the organization. Almost all manufacturing industries and workshops are using the trolleys for moving the material. The main issues associated are the design for proper application with better capacity to handle the load.

**2.2] Mr.MuhammadMeesum Ali et.al (Sep 2020) Design Stair Climbing Mechanism to Lift Load Over Stair** This project deals with the design and manufacture of mechanism for stairclimbing to lift load over staircase flight. Our project consists of the construction of a base and pistons to move load using compressed air as a medium. It is easy with the help of wheels on straight-level paths carrying heavy load but it is a challenge especially in Pakistan in the case of stairs. This project offers an alternative to carrying load in buildings that do not have elevators. It is a mechanical system in which

the load can be carried by an individual through a flight of stairs.

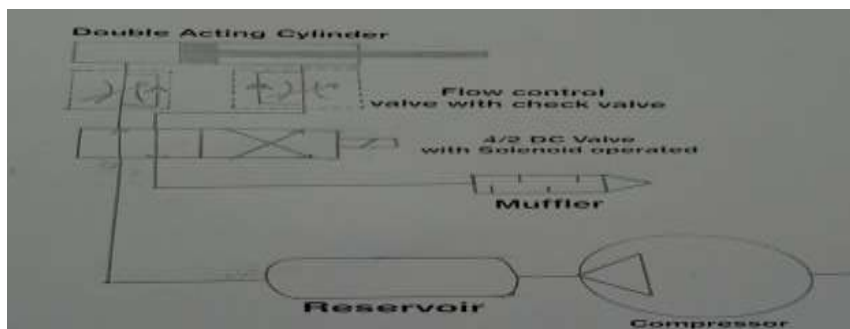
**2.3] Mr. MallikarjunaMaKana et.al (May 2019) Design & Fabrication of Stair Climbing Trolley**  
**Local Goods Transportation Local Goods Transportation Generally depends on manual Trolleys** which are used in warehouses, construction sites, malls, residential relocations etc., These Trolleys when they are used on staircases have some severe limitations. So here we propose a smartly designed staircase climbing trolley. This staircase climbing trolley which is to be used to carry goods up and down on staircases easily generally depends on manual Trolleys which are used in warehouses, construction sites, malls, residential relocations etc., These Trolleys when they are used on staircases have some severe limitations. So here we propose a smartly designed staircase climbing trolley. This staircase climbing trolley which is to be used to carry goods up and down on staircases easily.

**2.4] Mr. Basil Hamed Design and implementation of Stair Climbing Robot for Rescue Applications (June 2011)** For disaster mitigation as well as for urban search and rescue missions, it is often necessary to place sensors or cameras into dangerous or inaccessible areas to get better situation awareness for the rescue personnel, before they enter a possibly dangerous area. Robots are predestined to this task, but the requirements for such mobile systems are demanding.

### III. METHODOLOGY:

To start of this project, a meeting with guide in the first week is done to manage the schedule of weekly meetings. The purpose is to inform the guide on the progress of the project and guided by the guide to solve difficulty. Briefing based on the introduction and next task of the project is given by guide. Make research of literature review with the means of the internet, books, available published articles and materials that is related to the title. Designing phase start of by sketching few model

### WORKING:



models using manual sketch on A4 papers The preparation of mid-presentation of the project is next. Before presenting, the guide will see through the slide presentations and comment on corrections to be made. Then, presentation on the knowledge attained and instilled in the design phase is presented to a panel. Following up, is the fabrication of make some method for this project. Choose the material, make some list for the material and dimension. Doing it planning of fabrication process for this project. After that, start the fabrication process. It would take seven weeks to get this design and fabrication process alteration done. Make some analysis and testing for the project. Do it correction for error this project. Finish the fabrication process with painting process. After that, the final report writing and final presentation will be the last task to be accomplished. The guide will review the final presentation and revise mistakes to be amended. The final presentation then again will be presented to three panels. A draft report would then be submitted to the guide to be point out the flaws. Corrections are done and the real final report is handed over as a completion of the final year project.

### CONSTRUCTION

1. Fabrication of the frame structure,
2. Fabrication of the pillow block bearings to the frame,
3. mounting the wheels on the axle by interference fit,
4. Mounting and aligning the crown wheel to the rear axle centre,
5. Inserting the axle through the pillow block bearing hubs,
6. Aligning and positioning of pneumatic cylinder
7. Mounting the guide rods 8. Placing and aligning the air reservoir tank
9. Fabricating the handle to the frame

### CIRCUIT DIAGRAM

- 1] A compressor is used to fill the tank situated in frame
- 2] The compressor is supplied to the double acting actuator using 4/2 D.C.V
- 3] This 4/2 D.C.V operated by push button
- 4] During intake at port a the air is supplied at section
- 5] The exhaust of air from cylinder is return to the atm through DCV via muffler
- 6] In next case, by pushing push button the direction control valve changes the port & piston moves backward & this process goes on

### FABRICATION PROCESS

- 1] After selection of components like cast iron for frame, air receiver, hoses, 4/2 Direction control

valve solenoid operated, Double Acting Cylinder , etc. Assemble them

- 2] First we made frame by proper dimensions, which can able to carry load, the frame is properly made using Arc welding, the length, width & height is taken as 400mm, 520mm & 930mm.
- 3] An air receiver is fitted on one side & 4/2 direction control valve on other side. An Actuator is placed properly to lift load.
- 4] Connecting using hosing is done by using circuit diagram.
- 5] Whells are properly arranged on the bottom of machine.
- 6] The machine is tested first using solenoid valve.
- 7] All the necessary corrections are made & then tested again.
- 8] Finishing and Painting is done.

### SPECIFICATION

S.r No.	Components	Specification
1	Compressor	Reciprocating compressor 100-300 watts, pressure 500 psi
2	Reservoir	5 kg storage capacity
3	Battery	12 volts, 7.5 Ah
4	Flow control valve	Needle valve
5	Actuator	Double Acting Actuator
6	Pipes or housing	3 mm dia.
7	Direction control valve	4/2 direction control valve with solenoid operated
8	Wheels	60mm, 100mm, 20mm dia.
9	Bearings	Rolling type ball bearing

10	Frame 1	400mm,520mm,930mm
11	Frame 2	30mm,300mm

#### ADVANTAGE

- Stair climbing can be easily operated on stairs, slopes and uneven surfaces.
- This staircase climbing trolley is more economical the other means e.g.
- hiring labour for this.
- It is time saving.
- One can carry heavy load for long distance with comparatively less effort.
- This new design of stair climbing trolley is reasonable to nearly all stairs
- . Compact in size
- .Less chance of slip compared to Tri-Star wheel model.
- Eco friendly
- Light weight

#### APPLICATION

- Can also be used as normal trolley on even surfaces.
- It can be used for carrying load from one floor to another by stairs in houses, shopping centres and hospitals
- It can be utilized in construction works.

#### IV. RESULT

- As per calculations this machine design to lift a load of abow 50 kg easily on stairs. A simple pneumatic system is used to lift a load easily. This can easily replace TRI-WHEEL STAIR MECHANISM, an economical design is made to lift to load.Because there is no complex structure hence dimension of the trolley can be changed easily according to different requirement based on load capacity and stair dimension such as step-rise and tread.

#### V. CONCLUSION

- In this stair climbing cart design cost, material availability, production process availability, human factors, customer requirements, etc. all factors have been equally considered. The newly added features in this design will eliminate stress on fingers, hands, backbone & corresponding body parts. There is a direct relationship between the pulling angle and pulling force. The pulling angle varies according to user height. This design can carry a satisfactory range of load that is determined from the structural analysis. This design

is unique than others in the pause- rest feature which provided the function to keep the cart standing between two stairs by keeping two backward wheels on a stair and other forward wheels on the next stair. In this design, all constraints have been satisfied & also the strength, durability & longevity of the structure have been increased which has been tested in the structural simulation. Carrying heavy loads over stairs may cause injuries to a human being such as back pain. This stair climbing cart eliminates human effort to carry goods. This research will help interested manufacturers who want to commercially produce it for mass customers. The manufacturing process and bill of material will help the manufacturers to determine the required machines, the number of operators, required space and finally the cost of the product.

#### VI. FUTURE SCOPE

- If used in any industry where emphasizing factor is time not cost, then using hydraulic jacks in place of pneumatic jacks are better option because they use costly oil but are better in performance.
- With slight modification in mechanism, this device is also used to shift handicapped persons.
- If used in a condition where availability of electricity is not an issue than with the help of solenoid valve and rotors, and compressor, we can achieve better efficiency.

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