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Effective Staircase Sliding Lift for Existing Building

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Abstract - The design and fabrication of a staircase slider lift, which converts electric energy into mechanical energy for lifting people upstairs and downstairs, in existing where there is no lift or elevator this staircase slider lift is effective and economical. A staircase lift can also be used for material handling in industries. For suitably wide stairs, a rail is mounted on the wall which is located beside the stairs. At which is used for elevation is attached to the rail. A person standing on the platform is elevated as the platform moves along the rail. A Staircase slider lift is a device that can be set up on the stair case without modifying the present structure of existing building. This slider runs on electric power and consists of an electric motor, wire rope, two rails and a sliding platform, guide rollers. Advantages of staircase slider lift are no civil structure modification is required for installing staircase slider lift, less power consumption comparatively, low maintenance cost, considering some drawbacks of the staircase slider due to weight carrying capacity is completely depends upon the capacity of the electric motor.

Key Words: **Staircase sliding lift**, **Electric Motor**, **Slider Mechanism**.

1. INTRODUCTION

A staircase slider lift is a safe and secure method for human transportation which converts electric energy into mechanical energy for lifting people upstairs and downstairs. As we all know the lifts had been made a lot of development till now lifts that we see now a days in markets. A lift is a vertical transport equipment that efficiently moves people between different phases (floors) of a building. Lifts are in general powered by electric motors. Because of wheelchair access laws, lifts are often a valid requirement in new multi-story buildings, especially where wheelchair ramps would be impractical. Sometimes the lifts need extra depth underground to be set up and mainly in multi storied buildings. If the lifts are to be fixed in a stalk kind of structure, then the modification cost will be high.

Since the urbanization has started 20 to 30 years ago due to which the city limits have been compressed. Most of the residential buildings were given permission to build 2 or more floors were the elevators / lift not present and during at that period the people preferred stairs instead of elevator / lift. As the time changed and life style changed the resident buildings which have 4 or more floor they now have started to feel the need of having an elevator / lift. But there are factors which prevent them from having an elevator / lift. The factors are as follows:

1) Constructional requirement
2) Governing rules for town planning
3) Cost of installation of elevator / lift

To avoid or overcome all this factors the concept of the staircase slider lift is introduced. With this concept the extra cost of lift mechanism is reduced. This concept of staircase slider has wide stairs and also a rail that is mounted at the side of walls of stairs. In the staircase slider a person standing on platform will be lifted as platform is pushed up by a mechanical means. Basically in staircase slider for sufficiently wide stairs, a rail is mounted to side wall of stairs, a lifting platform will be attached to the rail, a person standing on the platform is lifted as platform is moved along the rail. Staircase slider is also known as stair lifts or stair gliders this slider runs on electric power and two rails and sliding platform. This staircase slider can be used also to carry handicapped or old age or other people with incapability to walk upstairs by themselves. In old building that do not have elevator / lift or consist of two or more floors should have a device for transportation. So we have made a research to overcome this problem which is becoming need of the time, as this staircase slider is easy to install, economic and it even does not requires high maintenance.

2. SYSTEM CONFIGURATION

- **COMPONENTS**

1) MS Steel Frame
2) Caster Wheel
3) Limit Switch
4) Toggle Switch
5) Electric Motor

1. **MS Steel Frame**=

1)300*900mm

2)300*300mm

2. **Caster Wheel**= "A caster is an assembly that includes a wheel and a mount. Casters support and make it easy to manoeuvre carts, racks, dollies and other equipment".

3. **Limit Switch**= "A limit switch is an device operated by a physical force applied to it by an object".

4. **Toggle Switch**= "A toggle switch is used to open or close an electrical circuit by sliding a lever back and forth.".

5. **Electric Motor**= "An electric motor is an electrical machine that converts electric energy into mechanical energy".

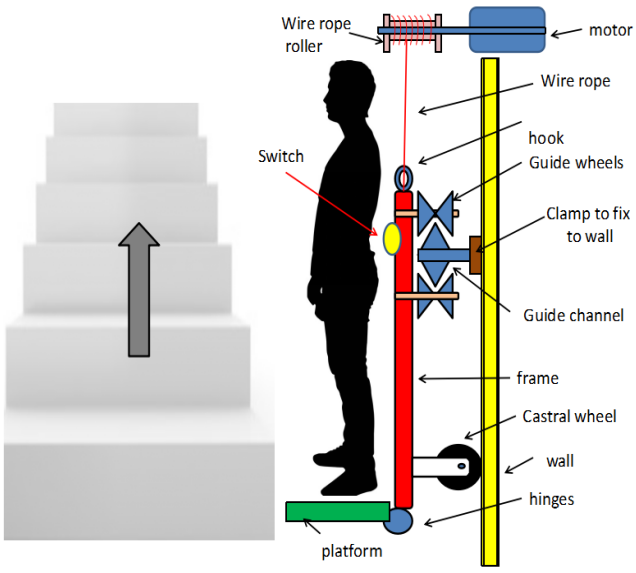
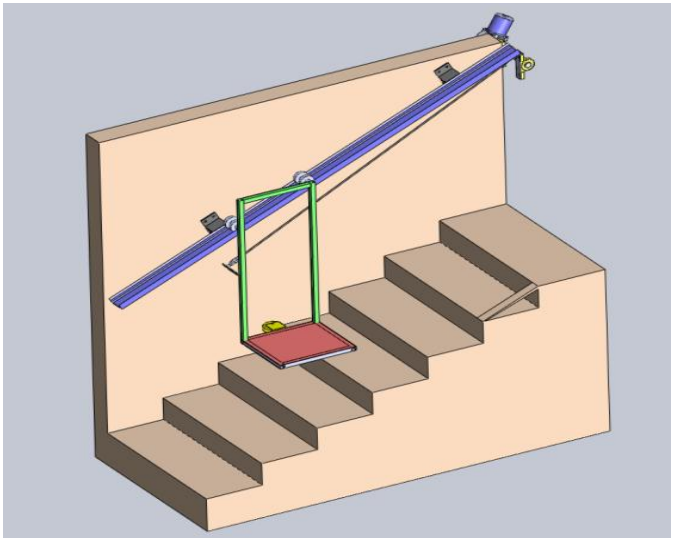


Fig -1: Line diagram

3. WORKING

When switch provided at lower level of wall is turned On, the motor runs. Here driving shaft is the motor shaft and driven shaft is the roller or working shaft, when working shaft

rotates, it lifts the platform with the help of rope drive and pulley. In order to reduce friction between platform and rail, rollers are used. Alone the guide channel the platform moves upwards. At topmost and down most step a limit switch is provided. The toggle switch is provided at platform by which we can stop and start the movement. The downward motion can be obtained by changing the polarity of motor i.e. by turning on the switch provided at upper level. The platform can be folded when it is not in use.



4. CALCULATION

Selection of motor

Assuming :

- Efficiency of motor = 80%.
- Time taken to lift from ground floor to a height of 2m = 25.5 sec
  From work energy principle
- Work Done = Final potential energy - Initial potential energy
  = (m×g×h) - (0)
  = 100×9.81×1.79
  = 1756 J
- Power = Work Done/Time
  =1756/25.5
  =68.87W.
- Considering efficiency of motor
  Input power= Power/ Efficiency
  = 68.87/0.8
  = 86.09 W.
- Considering Service Factor
  Actual input power = input power × service factor
  = 86.09 × 4
  =345 W.

(For 1HP = 0.735kW)

= 735 W

N1 = 1480 rpm

Power transmission by means of V-belt

Smaller pulley = 60mm

Larger pulley = 180mm

N2/N1=D2/D1

Ratio = 1: 3

N2 = 60/180*1480

N2 = 497rpm

Center distance between the pulleys = 140mm

$Lp = 2c + 1.57(D + d) + \frac{(D-d)^2}{4c}$

= 682.51mm

- Torque

$Power_{th} = \frac{T \times N}{955 \times 10^4}$

$0.735 = \frac{T \times 1490}{955 \times 10^4}$

0.735=T*1490/955*10^4

Tth= 4710.9 N-mm

- $Power_{act} = \frac{2\pi \times NT}{60 \times 1000}$

$345 = \frac{2\pi \times 497 \times T}{60 \times 1000}$

Tact= 6628.79 N-mm

3. CONCLUSIONS

The design of the staircase sliding lift is compact and hence it is able to lift the platform along the straight stairs that we find in old buildings. The design is made very safe and there is no change of failure of the frame under normal conditions.

It is cost effective and platform is capable to hold a human up to 100kgs.It can be used in transportation of luggage from stairs. It can also be used for material handling. Future work is required for lifting on cross stairs.

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