

LIFE SAVER – FIRE SAFETY AND EVACUATION DEVICE

Prasad Lawand¹, Sachin Gore², Nayan Suryawanshi³, Prof. Pramod Suryavanshi⁴

^{1,2,3}Student, Dept. of Mechanical Engineering, Bharati Vidyapeeth College of Engineering, Navi Mumbai

⁴Professor, Dept. of Mechanical Engineering, Bharati Vidyapeeth College of Engineering, Navi Mumbai

Abstract:- This paper is about a personal rescue device named as Life Saver. It is lightweight and easy to use Fire safety device. Life saver operates using mechanical systems such as Governors and Frictional braking assuring its complete working capability. It provides safe and affordable self-rescue systems that anyone can operate in order to save their own life and the lives of others. Life saver is effective for use in residential multi-floor buildings, Corporate buildings etc. When the situation is serious, and there's little time to react, Life saver is the ultimate piece of survival gear for multi-story occupants. Life saver is a unique personal rescue device which uses an individual harness to help a user safely escape from an emergency situation in a multi-story building.

device can be hanged on the preinstalled hook at the safety points of buildings. A harness will be provided with device for better load distribution. The evacuation speed of device will be predetermined. [2]

Key words: Life Saver, Governor, Frictional Braking System, Survival Gear, Emergency. etc.



Figure 2 Life Saver 3D model

1. INTRODUCTION

During the last one decade there was a vibrant growth in the construction activities in India, especially in High Rise buildings. Thousands of High-rise buildings have already constructed in metros and major cities in India, and thousands are under construction. [1] But in case of any life-threatening situation occurs it will be disastrous and sometimes even resulting in many deaths and huge property losses. There are conventional solutions available but they will not assure safety of your life. So, there is a need of self-rescue fire safety device. [3]

Life saver is based on Mechanical Systems such as Governors, Frictional braking, Pulley transmission etc. but Governor is heart of Life saver it controls the evacuation speed. [4]

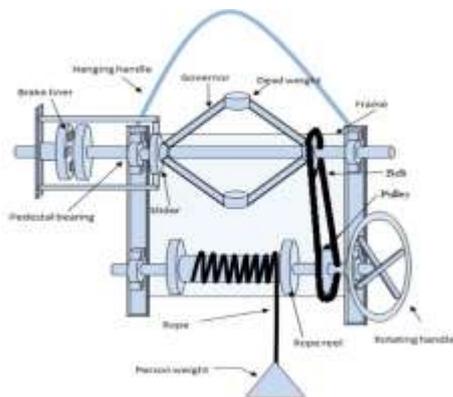


Figure 1 Life Saver concept diagram

2. OPERATING MECHANISMS:

This Device consists of following parts:

2.1. Governor

Governor is a device used to regulate speed of machine. There are two types of governors:

- Inertia Governor
- Centrifugal Governor

In our project we've used Centrifugal Governor. This type of governor is used from 17th century in windmills to regulate speed. Centrifugal governors are first invented by Christiaan Huygens. Governors are used to limit the maximum speed of vehicles. They use the Principle of Proportional control.

Life saver is a simple personal rescue device. The working principle of this device is purely based on governor which will maintain the speed irrespective of weight by increasing or decreasing speed with the help of braking system. The

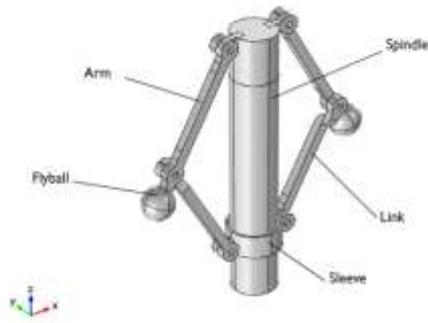


Figure 3 Governor

The governor balances centrifugal force on rotating balls by equal and opposite radial force. It consists of free balls of equal mass which are attached to the arms as shown in figure also known as Fly balls. The fly balls revolve with spindle, which is driven through mechanism. The upper ends of arms are attached to spindle so that fly balls may rise or fall down as they rotate around the spindle. The arms are attached through links to sleeve which is keyed to spindle. The sleeve rotates with spindle but can slide up and down on the spindle. [5]

When load increases the governor speed decreases which results by decreasing centrifugal force on the balls hence the balls move inwards and sleeve moves downwards similarly when load decreases governor speed increases which results by increasing centrifugal force on balls and balls move outwards which moves sleeve upwards.

2.2. Frictional Braking system

A Brake is a device used for applying artificial frictional resistance to a moving object in order to stop the motion of object. In the process of applying brake it absorbs the kinetic energy of the moving object which is further stored in brake and gets converted and dissipated in form of heat. The capacity of brake depends on following things:

- Pressure between the braking surfaces,
- Coefficient of friction between friction material,
- The peripheral velocity of moving disc,
- The projected area of friction surface,
- Ability of brake to dissipate heat.

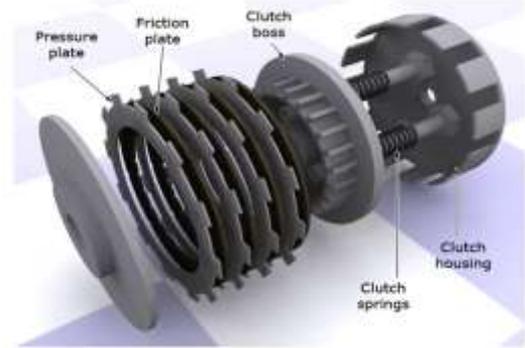


Figure 4 Braking System

The major difference between a clutch and brake is that clutch is used to keep driving and driven members moving together while brakes are used to retard motion of vehicle. [5]

Types of brakes:

- Hydraulic Brakes
- Electric Brakes
- Mechanical Brakes

The hydraulic brakes and Electric brakes are unable to bring the member to the rest they are used where large amounts of energy is to be transferred, the mechanical brakes are used to retard and stop the motion of the moving member.

2.3. Belt and Pulley Mechanism:

The belt or ropes are used to transmit power from one shaft to another shaft with same or different speeds by means of pulley mechanism. The amount of power transmitted depends on following factors:

- Velocity of belt,
- Tension on the belt attached between pulleys,
- The arc of contact between the belt and pulley,

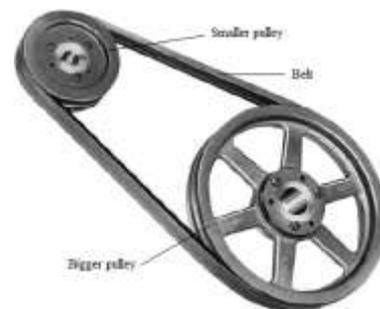


Figure 5 Belt and Pulley system

The following conditions should be satisfied for optimum working of belt and pulley mechanism:

- The shafts should be properly in line to insure uniform tension along belt cross section,
- There should be minimum distance between two pulleys in order that the arc of contact on the smaller pulley may be as large as possible,
- There should be limit on the maximum distance between two pulleys to cause the belt weigh heavily on the shaft thus increasing the friction on the bearings.

Factors affecting the selections of belt drive:

- Speed of operating shafts,
- Speed reduction ratio required,
- Power transmission required,
- Layout of shaft,
- Available space,
- Operating conditions.

2.4. Bearing:

Whenever we observe a very smooth surface under microscope it is found to have a lot of irregularities and roughness, which cannot be felt by normal touch. The opposing force acting against the direction of motion is called as Force of friction.



Figure 6 Bearing

Bearing is a mechanical device that constrains the relative motion to desired motion and also reduces the friction between rotating parts. The rotary bearings hold rotating components such as shafts with in the mechanical systems and transfer the axial loads from the source of load to the structure supporting it.

3. WORKING:

- When weight is pull down, the rope tends to move the reel.
- Reel is connected to governor shaft by chain sprocket.
- As the speed increases the dead weight on governor tends to move outwards which applies the frictional brake and reduces the speed.
- When the specified speed is reached, the dead weight comes inside and releases the brake.
- So, it will always maintain its specified speed.



Figure 7 Life Saver

4. ADVANTAGES:

- Life of person will be saved,
- It can be reused by Multiple people,
- It can save fire brigade person life too.
- Purely mechanical system so most reliable,
- Light weight and easy to use.

5. Conclusion

The weight attached to life saver machine goes at a moderate speed of 1 m/s, which will not harm the person hanging on it and also take him down quickly. One single machine can save multiple lives in case of emergency. This device is purely mechanical system which works on various parts.

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BIOGRAPIES:

Nayan V. Suryawanshi currently studying as a student in Bharati Vidyapeeth college of engineering, kharghar. His field of interest are Production Planning and Control, Material Technology, Metrology and Quality Control.



Sachin P. Gore currently studying as a student in Bharati Vidyapeeth college of engineering, kharghar. His field of interest are Production Planning and Control, Applied Mathematics and Quality Control.



Prasad S. Lawand currently studying as a student in Bharati Vidyapeeth college of engineering, kharghar. His field of interest are Production Planning and Control, Thermal Engineering, Finite Element Analysis and Production Process.



Prof. Pramod R. Suryavanshi currently working as Assistant Professor in Bharati Vidyapeeth college of engineering, kharghar. He has 5 years of teaching experience. He has specialization in Finite Element Analysis & Operational Research subject and guide for this research paper.