

SKY SAVER USING CENTRIFUGAL GOVERNOR

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Abstract : Do you live or work in a multi-story building? If the answer is yes, do you have a plan in place to help you evacuate the premises quickly and safely in case of a fire or other emergency? Sky Saver is a life-saving, personal self-rescue device, worn like a backpack. It is lightweight, self-contained and easy to use. Simply strap it on, attach the fire-resistant cable to a secure anchor point, and you can safely lower yourself down the side of the structure. Sky 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. In This project we are substituting traditional sky saver with a device which uses Centrifugal Governor with chain sprocket mechanism and work mechanically, efficiently without the need of any outside power. Sky savers which are in use are very costly and cannot save multiple people at the same time.

IndexTerms - safety, sky saver, governor .rope, centrifugal, sprocket.

I. INTRODUCTION

Fires can cause devastating harm to property and even death to many people. The risk of being injured in a fire or becoming a fire casualty is higher for people with mental, physical and sensory disabilities. The excellent news is that deaths by fires are preventable provided that the person is educated on how to escape from a fire and equipped with devices like a fire alarm and a Sky Saver. Everyone has a diminished capacity to react in a fire emergency so everyone needs to be careful. Some individuals would not want to change their lifestyle and are independent. This mind-set can cause you to overlook fire safety needs that are necessary.

In some circumstances, disabled individuals might require the help of care providers to practice fire safety techniques. It is strongly recommended that you choose a home on the ground floor or first floor of a structure, although you have the right to live where you choose. Additionally, it is advised to have the apartment near a fire exit to make the escape easier. All considerations need to be given when building your plan of escape. To ensure you are able to access all of the exits in your escape plan, you should check in advance, particularly if you're utilizing a wheelchair or a walker.

Your suggestions on needs and fire safety should be hear. It's important that you make certain you're a component of the process and talk. You should talk with your neighbors and building manager regarding escape plans and practice fire drills, especially if you are living alone. Always have a phone close to your bed and save the emergency number for your local fire department. Individuals with disabilities need to be well informed on fire warning apparatuses like fire alarms and smoke detectors. Smoke alarms with the vibrating pad or the flashing light can be obtained for the deaf. You may also request the construction manager to install smoke alarms on every level of your apartment. Make sure that they're tested monthly and functioning correctly. Limitations like diminished mobility, sight, and hearing can prevent an individual from making the quick reaction needed to escape from a fire outbreak.

Compare it to someone who has valuables in their home. The security alarm is their smoke detector, warning them of something bad happening. The safe is their fire extinguisher, a good precaution in case the first line of defence is circumvented. The insurance on the valuables is the Sky Saver, paying you back the value in case they are stolen. In the case of the fire, you are the valuables, and your life is being saved, i.e. the pay-out.

Fires break out in apartments so often that unless you're watching local news, you are unlikely to hear about any of them. Here are just but a few instances (that you probably didn't even hear about) in which people were forced to jump for their lives, some ending in tragedy. Sky Saver is a life-saving, personal self-rescue device, which hangs on wall hook. It is lightweight, reusable and easy to use. Simply hang it on a secure anchor point, and you can safely lower yourself down the side of the structure. When the situation is serious, and there's little time to react, Sky Saver is the ultimate piece of survival gear for multi-story occupants.

II. BACKGROUND

Sky Saver is a device in the form of a backpack which contains an integrated harness and a fire-resistant steel cable. In the event of an emergency, connect the cable to a pre-installed anchor point and the unique braking mechanism will enable a safe descent.

The sky saver which are currently in use are designed in such a way that one person will wear the bag assembly and hang the hook to window. After wearing the bag, person will land from the window to ground. In device a wire of mild steel is bounded on the pulley forcefully which releases the wire slowly according to the weight of the person hanged to wire. Since the wire is bounded so tightly, it cannot release smoothly. When weight of the person acts on the wire, due to the force in form of weight wire get unbound accordingly. The amount of intensity by which wire get unbounded purely depends on the weight of the person.

You might think that Sky Saver's only use is to escape a fire when there is no other way out. Fire safety is the focal point of this device. This is due to fires being a relatively common occurrence. There were nearly 1.3 million fires responded to by US fire departments in 2014. Many people have either experienced a fire breaking out in their home or know someone who has. However, there are other situations in which a Sky Saver can save your life; during an earthquake, during work related violence/active shooter situation, or during a terrorist attack. None of these are as common as fire, but it's essential to know that Sky Saver can be used to save your life during a variety of different emergencies.

This device is not only used as saver in case of fire but also it can be used in case of earthquakes or in any type of work-related violence. The existing device has some advantages & disadvantages of it; which are listed below:

➤ **ADVANTAGES**

- Life of person will be saved
- Can be reused by multiple persons
- Save fire brigade person life too.

➤ **LIMITATIONS**

- One person at a time can go down
- Time will be increased if building is much taller
- If fire takes place at lower floor then it is difficult to go down.

III. IMPORTANCE OF THE PROJECT

Our project deals with the making of a device which can be used to save human lives in case of emergencies like fire, earthquakes, work related violence and also it can be used as life saver at construction sites. Since our project is saving life it ultimately becomes so important because there is nothing more important than the life of an individual. We are making the sky saver using the mechanical components like governor, chain-sprocket, brake liner etc.

The advantage of our project is that multiple people can be rescued by this device one by one. Also, this device is cheap in cost and can be used multiple times without any kind of failure. In the existing device there was a limitation about the weight of the person i.e. the kids weighing 20 kgs or lesser than this and a man weighing 150 kgs or more than this cannot use that device. Because in the first case due to less force the wire will not get unbounded and in the second case due to such a large amount of force the wire will get unbound immediately and the man will fall down on the ground which can cause harm to life. Our project is going to be designed in such a way that any kind of weighted person can use this device and there will be no any kind of weight restrictions. Also, we are using rope instead of MS wire, which will reduce the overall cost of the device and it will also reduce the maintenance of the product.

IV. OBJECTIVE AND SCOPE OF THE PROJECT

Objective:

The objective is to develop a jerk less and descending steady speed reusable device which requires no advance training. The aim is to make a product which works using mechanical components like governor, chain-sprockets and works mechanically without the need for any outside power source. Also, the aim is to develop a low-cost device for multiple people during emergencies.

The sky saver already has been made and also it is being used in many countries. But due to some disadvantages as mentioned above it becomes so costly to use. So, the main aim of our project is to design a substitute device which uses cheaper components like governor, chain-sprockets, rope instead of MS wire and also the objective is to produce the model which can be used widely and efficiently without any kind of difficulties.

Future scope:

This project in the future can be installed in all commercial offices and buildings to save life.

V. SUMMARY

Sky Saver combined top professionals from the military, rescue and emergency readiness fields and cooperated with safety organizations from around the world to create and develop Sky Saver. Sky Saver is the most advanced, simple to use, safe and innovative evacuation device in the world, designed to save lives. By using safe and affordable self-rescue systems one can save their own life and the lives of others. The Sky Saver portable escape system can easily be stored in your home or office. It is lightweight, self-contained, and easy to use. The Sky Saver is not intended for use as a belay device in sports. It is not suitable for and must not be used for rappelling, rock climbing, in a construction environment, or for any purpose other than emergency rescue. The Sky Saver Personal Rescue Device is designed as an emergency escape device for use ONLY when all other options are unavailable.

VI. LITERATURE REVIEW AND PROPOSED WORK

In the current investigation the governor is modified such that it increases the controlling force. In modification the fly-ball is fixed on the lower arm at the small distance below from the point of intersection of arms. The analysis is carried out by mounting the fly ball at the various positions on the lower arm. [1]

The objective of our investigation is to identify stress concentration areas, areas which are most susceptible to failure when the governor is rotating about its axis, also the value of these stresses are measured the displacement of the various elements of the spindle from the base is also calculated and the graphs are plotted. Effect of the "Weight of arms" is the major area of concern for our study & all the calculations are made considering weight of the arm. [2]

The purpose of this report is to present a survey of commercial brake materials and additives, and to indicate their typical properties and functions, especially as regards their use in heavy trucks. Most truck pad and shoe materials described here were designed to wear against cast iron.

Brake material test methods are also briefly described. an attempt has been made to capture the primary constituents and their functions. [3]

The objective of the Research Project is to: Mathematical modelling for geometry of brake lining for band brake arrangement. 3D-Modelling & analysis of plain & composite brake lining ANSYS software. Test & trial on individual brake lining in plain & composite condition to determine absorbed in friction wear rate; Heat dissipation ability & optimal hardening. [4]

This study is concerned with the development of non- destructive testing techniques to investigate the steel wire ropes in suspension bridges. In this research, a radiographic testing is approached to evaluate the steel wire ropes were coated with plastic materials. Through laboratory tests, these methods are proved to effectively increase the accuracy in locating and determining the sizes of defects and components. [5]

VII. ANALYSIS AND PLANNING

Problem Definition:

- No single device, has been introduced yet which will safely land more number of people one by one on ground in case of emergency.
- Challenge is to innovate such a device which has a huge market potential and also to develop a lifesaving kit with less cost.

Methodology:

The methodology for this project can be expressed in the form of given chart:

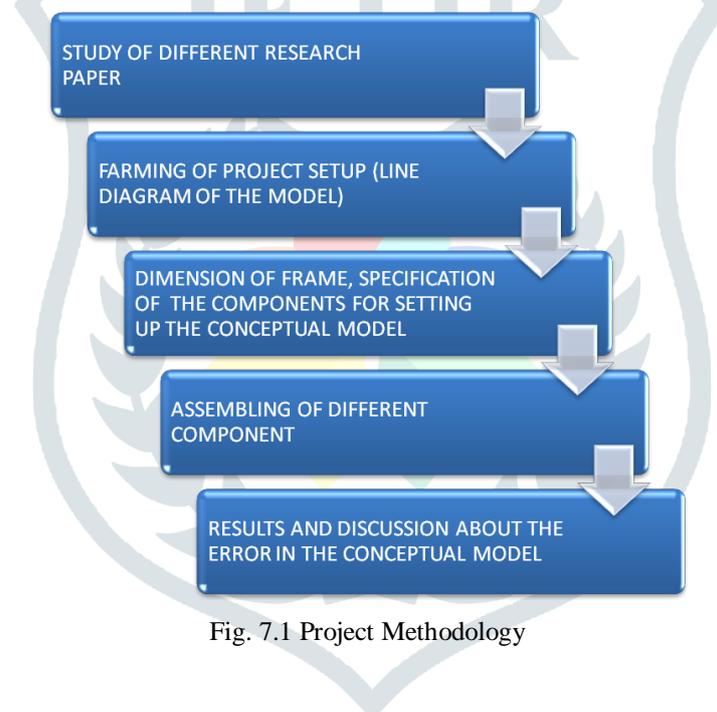


Fig. 7.1 Project Methodology

- 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 porter governor tends to move outwards which applies the frictional brake and reduces the speed
- When the speed reaches reduce the dead weight comes inside and releases the brake.

VIII. ANALYSIS AND PLANNING

MECHANIAL COMPONENTS:

- ❖ Centrifugal Governor
- ❖ Pedestal Bearing
- ❖ Chain & Sprocket
- ❖ Brake Liner
- ❖ Rotating Handle

❖ Hanging Handle

❖ Rope

Governor:

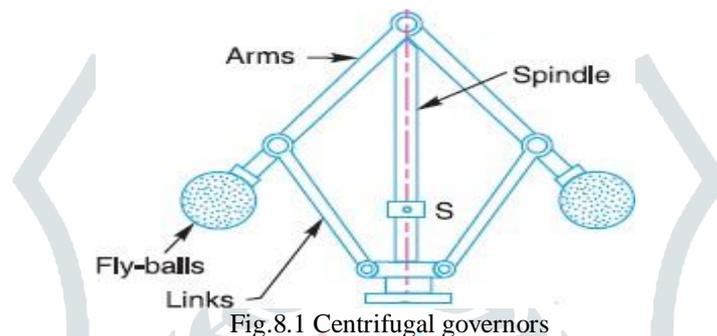
The function of a governor is to regulate the mean speed of a machine, when there are variations in the load *e.g.* when the load on an engine increases, its speed decreases, therefore it becomes necessary to increase the supply of working fluid. On the other hand, when the load on the engine decreases, its speed increases and thus less working fluid is required. The governor automatically controls the supply of working fluid to the engine with the varying load conditions and keeps the mean speed within certain limits.

A little consideration will show, that when the load increases, the configuration of the governor changes and a valve is moved to increase the supply of the working fluid conversely when the load decreases, the engine speed increases and the governor decreases the supply of working fluid.

Types of Governors

The governors may broadly be classified as:

1. Centrifugal governors
2. Inertia governors.



The centrifugal governors are based on the balancing of centrifugal force on the rotating balls by an equal and opposite radial force, known as the controlling force. It consists of two balls of equal mass, which are attached to the arms. These balls are known as governor balls or fly balls. The balls revolve with a spindle, which is driven by the engine through bevel gears. The upper ends of the arms are pivoted to the spindle, so that the balls may rise up or fall down as they revolve about the vertical axis. The arms are connected by the links to a sleeve, which is keyed to the spindle. This sleeve revolves with the spindle; but can slide up and down.

The centrifugal governors may further be classified as follows:

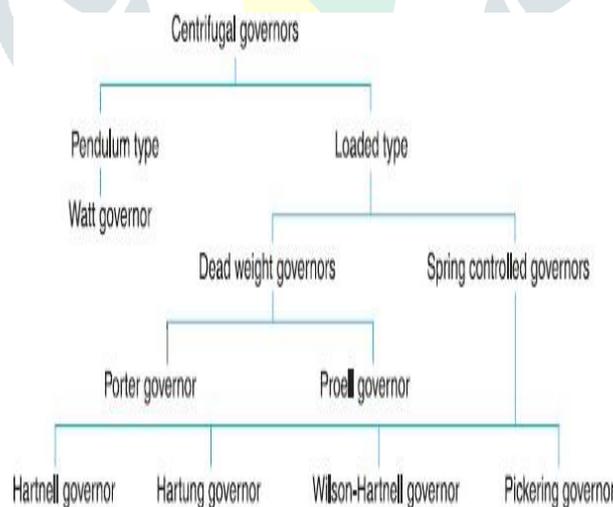


Fig. 8.2 Classification of Governors

The balls and the sleeve rise when the spindle speed increases, and falls when the speed decreases. In order to limit the travel of the sleeve in upward and downward directions, two stops *S, S* are provided on the spindle. The sleeve is connected by a bell crank lever to a throttle valve. The supply of the working fluid decreases. When the sleeve rises and increases when it falls. When the load on the engine increases, the engine and the governor speed decreases. This results in the decrease of centrifugal force on the balls. Hence the balls move inwards and the sleeve moves downwards.

The downward movement of the sleeve operates a throttle valve at the other end of the bell crank lever to increase the supply of working fluid and thus the engine speed is increased. When the load on the engine decreases, the engine and the governor speed increases, which results in the increase of centrifugal force on the balls.

Pedestal Bearing:



Fig.8.3 Pedestal Bearing

This type of bearing consists of:

- i) a cast iron pedestal
- ii) Gun metal, or brass bush split into two halves called "brasses"
- iii) A cast iron cap and two mild steel bolts.

The rotation of the bush inside the bearing housing is arrested by a snug at the bottom of the lower brass. The cap is tightened on the pedestal block by means of bolts and nuts.

Chain & sprocket chain:

A Chain is a serial assembly of connected pieces, called links, typically made of metal, with an overall character similar to that of a rope in that it is flexible and curved in compression but linear, rigid, and load-bearing in tension. A chain may consist of two or more links. Chains can be classified by their design, which is dictated by their use:

- Those designed for lifting, such as when used with a hoist; for pulling; or for securing, such as with a bicycle lock, have links that are torus shaped, which make the chain flexible in two dimensions small chains serving as jewelweed are a mostly decorative analogue of such types.
- Those designed for transferring power in machines have links designed to mesh with the teeth of the sprockets of the machine, and are flexible in only one dimension. They are known as roller chains, though there are also non-roller chains such as block chain.

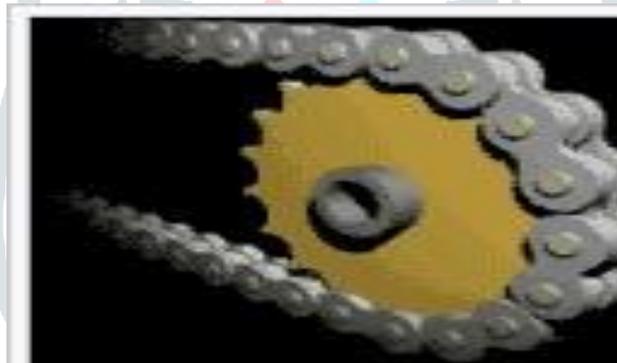


Fig.8.4 Chain Sprocket

A sprocket is a profile wheel with teeth that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery either to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles.

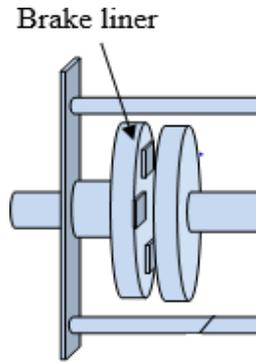
Brake liner:

Fig. 8.5 Brake Liner

Brake liners are composed of a relatively soft but tough and heat-resistant material with a high coefficient of dynamic friction (and ideally an identical coefficient of static friction) typically mounted to a solid metal backing using high-temperature adhesives or rivets. The complete assembly (including lining and backing) is then often called a brake pad or brake shoe. The dynamic friction coefficient " μ " for most standard brake pads is usually in the range of 0.35 to 0.42.

This means that a force of 1000 Newton's on the pad will give a resulting brake force close to 400 Newton's. There are some racing pads that have a very high μ of 0.55 to 0.62 with excellent high-temperature behavior. These pads have high iron content and will usually outperform any other pad used with iron discs. Unfortunately nothing comes for free, and these high μ pads wear fast and also wear down the discs at a rather fast rate. However, they are a very cost-effective alternative to more exotic/expensive materials.

Rotating & Hanging Handle:

Fig. 8.6 Rotating & Hanging Handle

Functions:

- Rotating Handle. It is used for winding of rope, cable, etc.
- Hanging Handle. It is used to hang the entire assembly on the wall.

Rope:

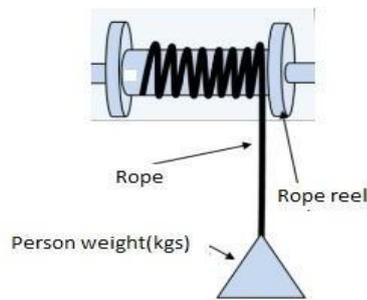


Fig.8.7 Rope

A rope is a group of yarns, plies, fibers or strands that are twisted or braided together into a larger and stronger form. Ropes have tensile strength and so can be used for dragging and lifting, but are too flexible to provide compressive strength. As a result, they can be used for pushing or similar compressive applications. Rope is thicker and stronger than similarly constructed cord, string and twine.

Application of rope in our project:

We are using rope which will hold by the person during landing from building to ground. This rope will be bound on the rope reel which will release the length of rope depend on the application.

IX. RESULT AND DISCUSSION

Over the course of 3 month we have studied the all collected research paper. Also, on the basis of Problem definition and Methodology we have tried to design some components using CAD software. We are trying to finish the design part of each and every component including final product theoretically as well as on CAD software. Currently we have decided the components needed and their material and quantity as shown in Table no.:4.1. Depending on the calculations our project is going to reduce the present cost d then select the correct number of columns from the selection palette.

The existing sky saver is very efficient in working but due to high cost and ONE TIME USE, it became inefficient to use. If we use mechanical components which are cheaper as in compare, we can reduce the cost of the device. Also, the demerits of existing device will get nullified. In case of present sky saver, user has to wear the nag and then he has to land to ground. But making device from our methodology need not to wear on back. It only has to hang on window and just by holding the ropes everyone stuck in the emergency will get rid.

X. CONCLUSION

The weight putted on sky 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. Sky Saver is a hanging machine which contains an integrated harness and a fire-resistant steel cable. In the event of an emergency, connect the whole to a pre-installed anchor point and the unique braking mechanism will enable a safe descent. One single machine can save multiple lives.

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