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Fire Safety System For Train

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Abstract—The Trains are moderate vehicles used for transporting people and goods. Mostly, the people prefer the train journey for longer distance as it is cheaper. Since induction of train for public transportation, the fire accidents are not catered seriously by the Indian Railways. The notices showing "Do not smoke", "Do not carry inflammable material" are the only precautionary warnings about the fire in each compartment. However, because of failure in routine maintenance system or by the activities of illegal social elements, the fire accidents in train occur frequently. These fire accidents are among the most serious disasters to human lives and the property of government. In recent days, the train fire accident occurred and made several life loss. The prevention of train fire has become a serious concern in our country. Currently, Our Indian Railways doesn't use any sophisticated fire prevention methods. But it is realized to have an automatic system to monitor the fire in the coach giving alarm to the people, the fire is extinguished with the help of automatic sprinkler system. This system is used for monitoring, automatic fire sprinkling, cautioning and preventing of fire in running trains in economic cost.

Keywords—Fire, Sprinkler system.

I. INTRODUCTION (*HEADING 1*)

Fire accidents are occurring very frequently in public transport system which causes the loss of most valuable human lives and the government property. There are a number of methods to avoid fire accidents and to reduce the severity of loss in case of fire accidents in public transport system. But the damage is catastrophic as a rescue service could not reach at right time due to improper communication. So we can further reduce the loss caused by fire accidents in trains with the use of sprinkler system.

Fig. 1.1 Sprinkler

II. TYPES OF SPRINKLER

Pre-action
Pre-action fire sprinkler systems are filled with air and water is allowed to pass through when the smoke alarm or detector goes off. This type of system requires two triggers to start water flow. It helps greatly that the pre-action fire sprinkler can be set to prevent water from spouting in case of a false alarm or a mechanical failure. The pre-action system is good for use in places where the sprinklers are only necessary when there is an actual fire so other items in the building do not get water damage from an accidental sprinkling. Such buildings include libraries and data centre. These places contain items of high value like electronics and goods damageable by water such as books.

Dry Pipe
Dry pipe sprinklers are similar to pre-action systems as they use pressurized air in the pipe which exits before water escapes. This causes a minute delay in water discharge but is ideal for buildings with low temperatures so the pipes do not freeze. These fire sprinkler systems have a fast opening tool to get rid of the air and speed up the flow of water. Warehouses located in the north are a good example of what buildings should use dry pipe sprinklers.

Wet Pipe
Wet pipe fire sprinklers constantly have water in them. This allows for a quick reaction to a fire and is the most common type of sprinkler installed in buildings. A type of building that uses the wet pipe system is a high-rise or office building with a few floors. This fire sprinkler system is cost efficient and low maintenance.

Deluge
These types of fire sprinkler systems also need a smoke or heat detector like the pre-action system. A deluge system has open nozzles that can be used when a hazard is present. When flammable liquids are spread across a floor, deluge fire sprinklers are good to have. In that case, buildings such as industrial parks and buildings with many tanks have deluge fire sprinkler systems installed. Sprinkles are specially developed spray nozzles: they are sealed by a glass bulb, and they react automatically to the heat of a fire.

Mechanism of Sprinkler

Sprinklers go into action when the glass bulb bursts and the nozzle closure is released. Water immediately emerges from the nozzle, and a spray plate effectively distributes it over the entire seat of the fire in the form of a fine shower of water droplets. Depending on the particular risk, the area protected by each sprinkler varies between 9, 12 and 21 m2. The choice of spray plate depends on the type and position of the sprinkler installation.

When the actuation temperature of the sprinkler is reached, the bulb bursts, the sealing element is pushed out by the water pressure, and the water flows onto the deflector and is distributed over the seat of the fire.

Fig. 1.2

Sprinkler Head Types

There are a number of different types of sprinkler heads that meet different needs which covers the operation types (fusible link vs. bulb), the distribution types (pendant, upright, sidewall), and response temperatures.

Fusible Link Sprinklers and Glass Bulb Sprinklers

All wet-pipe sprinklers are held closed by either a fusible link or a glass bulb that contains a heat-sensitive liquid.

A **fusible link** sprinkler head has a two-part metal element that is fused by a heat-sensitive alloy. The link holds the pip cap, or plug, in place. Once the ambient temperature around the sprinkler head reaches a specified temperature, the alloy releases and the metal elements separate, which causes the pip cap to fall away. Water is then released. Note that water is only released by sprinkler heads where the ambient temperature reaches a specified level - therefore, water is only released in the area of a fire, which helps limit water damage.

Glass bulb sprinkler heads have a small glass reservoir that holds a heat-sensitive liquid. This glass bulb holds the pip cap in place. When the ambient temperature of the liquid reaches a certain level, the liquid expands causing the glass bulb to break, which allows the pip cap to fall away releasing water. As with the fusible link heads, water is only released where the ambient temperature reaches a certain level, which helps limit water damage.

Pendant Sprinkler Head

Pendant sprinkler heads hang down from the ceiling and spray water in a circle pattern.

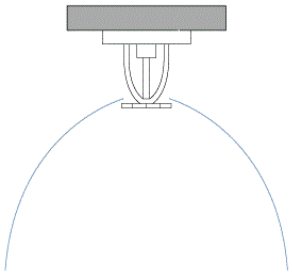


Fig. 1.3

*1) **Concealed Pendant Sprinkler Head***

Concealed pendant sprinkler heads are recessed in a ceiling and are covered with a decorative cap. The cap will fall away about 20°F prior to activation of the sprinkler. Once the sprinkler reaches its rated activation temperature, the head will drop below the ceiling. The water pattern of concealed sprinkler heads is a circle.

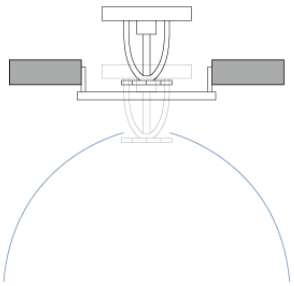


Fig. 1.4

*1) **Upright Sprinkler Head***

Upright sprinkler heads project up into a space and have deflectors that spray the water downward. They are generally used in mechanical rooms or other inaccessible areas to provide better coverage between obstructions like beams or ducts. They also provide a circle spray pattern

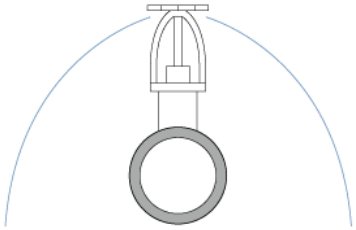


Fig. 1.5

1) ***Side Wall Sprinkler Head***

Side wall sprinkler heads stand out from a wall and have a deflector that sprays water away from the wall in a half-circle spray pattern. A second deflector also sprays water back toward the wall so that the wall is protected. These are used when sprinklers cannot be located in the ceiling.

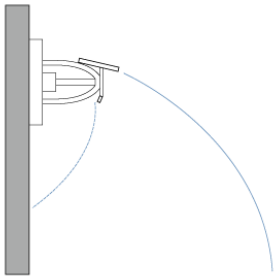


Fig. 1.6

B. ***Sprinkler Response Temperatures***

Since ambient air temperatures can vary widely depending on the use of a space or surrounding environment, sprinklers come rated for different activation temperatures.

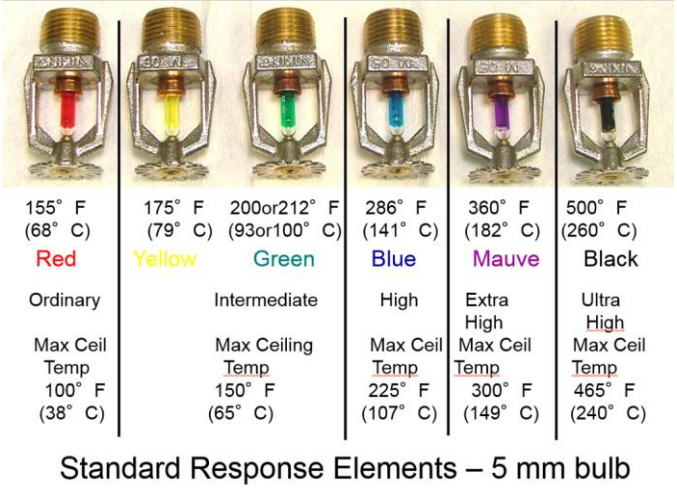


Fig. 1.7

(B)Methods of fire protection:-

(I)Passive fire protection:-

Passive fire protection is applied at the time of design and before the construction of the building. Passive fire protection is an integral component of the three components of structural fire protection and fire safety in a building. Passive Fire Protection attempts to contain fires or slow the spread, through use of fire-resistant walls, floors, and doors.

Passive Fire Protection in a building can be described as a group of systems within systems. An installed fire stop, for instance, is a system that is based upon a product certification listing. It forms part of a fire-resistance rated wall or floor, and this wall or floor forms part of a fire compartment which forms an integral part of the overall fire safety plan of the building. The building itself, as a whole, can also be seen as a system.

(II)Active fire protection:-

Active Fire Protection is a group of systems that require some amount of action or motion in order to work efficiently in the event of a fire. Actions may be manually operated, like a fire extinguisher or automatic, like a sprinkler. Active Fire Protection includes fire/smoke alarm systems, sprinkler systems, and fire extinguishers. Fire/smoke alarm systems are used to detect whether there is fire and/or smoke in a building. Sprinkler systems are used to help slow the growth of the fire. Fire extinguishers are used to extinguish the fire at incipient stage. Some system which are included in the Active Fire Protection they are:-

I. Fire Sprinkler system
II. Fire Hydrant system
III. Fire Extinguisher

(I)Fire sprinkler system:-A fire sprinkler system is an active fire protection method, consisting of a water supply system, providing adequate pressure and flow rate to a water distribution piping system, onto which fire sprinklers are connected.Over 96% of fires were controlled by fire sprinklers alone.Each closed-head sprinkler is held closed by either a heat-sensitive glass bulb or a two-part metal link held together with fusible alloy. The glass bulb or link applies pressure to a pipe cap which acts as a plug which prevents water from flowing until the ambient temperature around the sprinkler reaches the design activation temperature of the individual sprinkler head. A sprinkler activation will do less water damage than a fire department hose stream, which provide approximately 900 liters/min (250 US gallons/min).types of sprinkler system are:-

(a)Dry pipe system(b)Wet pipe system (c)Deluge system
(d)Pre-action system (e)Foam water sprinkler(f)Water spray.

Fig 1.8 sprinkler

(II)Fire Hydrant:-A fire hydrant is an active fire protection measure, which provides a source of water from the municipal water system or other source. Building located near fire hydrant may qualify for special insurance rate reduction on the basis of the proximity of the hydrant. Fire hydrant are color coded to indicate their specific water flow rate.

Fig 1.9 Hydrant

(III)Fire Extinguisher:-A fire extinguisher is an active fire protection device to extinguish or control the small fire in emergency situation. It is not intended for use on an out-of-control fire, such as one which has reached the ceiling, endangers the user (i.e., no escape route, smoke, explosion hazard, etc.), or otherwise requires the expertise of a fire department. Fire extinguisher is a portable device that discharges a foam, gas, jet of water, and other material to extinguish the fire. A fire extinguisher is an active fire protection device used to extinguish or control small fires, often emergency situations. A fire extinguisher consists of a hand held cylindrical pressure vessel containing an agent which can be discharged to extinguish fire. There are two main types of fire extinguishers: stored-pressure and cartridge-operated. In which they are classified in to different types they are:-
(a)water type (b)co2 type extinguisher (c)foam type (d)dry chemical powder type

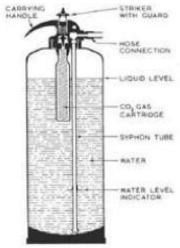


Fig 1.10 Fire extinguisher
Parts of a fire extinguisher:(1)Handle and operating lever (2)Locking pin Pressure gauge (3)Discharge nozzle(4)Siphon tube(5)Safety pin(6)Discharging tube(7)Co_2 cartridge.

2.METHODLOGY

Fig 2.1 Fabrication Model

Fig 2.2 DC Motor

Fig 2.3 6mm tube

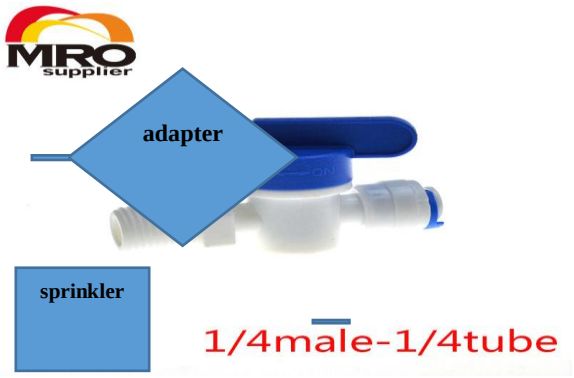
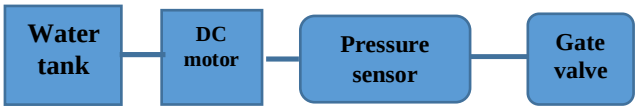


Fig 2.4 Gate Valve

Fig 2.4 Pressure Valve

Fig 2.5 T- Joint

Fig2.6 Buzzer



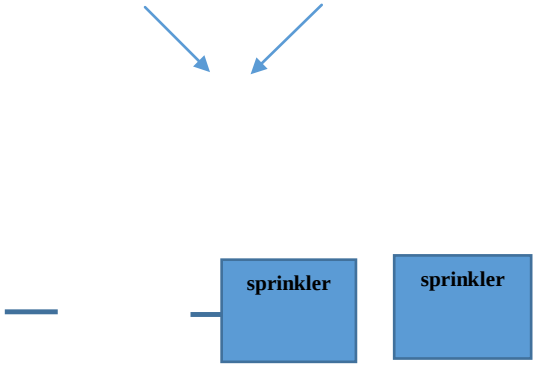


Fig2.7 Design layout

In my project the main objective is to put off the fire with the use of automatic fire sprinkler and to alert the people with the use of fire alarm. Here the DC motor is used to pump the water from the tank and send the water to the gate valve. The pressure sensor which is in off position when the water pressure is high and gets on when the pressure of the water is low. The water is fully pressurised in the gate valve when the gate valve gets opened the water passes through the sprinkler and puts off the fire then the pressure sensor gets activated after the pressure gets reduced and gives supply to the alarm and the alarm gets activated.

3.Conclusion

The progress in science & technology is a non-stop process. New things and new technology are being invented. As the technology grows day by day, we can imagine about the future in which thing we may occupy every place.

The proposed system is based on the mechanism of the wet pipe sprinkler system is found to be more compact, user friendly and less complex, which can readily be used in order to perform. Several tedious and repetitive tasks. Though this system is very useful to put off the fire and it is a cost effective and easily maintainable.

The principle of the development of science is that “nothing is impossible”. So we shall look forward to a bright & sophisticated world

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