

**AUTO-PROVOKING FIRE SUPPRESSION SYSTEM**

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Abstract

The main objective of this paper is to develop an Automatic Fire suppression system application including Car Engine Compartments, Electric Panels, and Electric Vehicles. The risk of fire and the potential for electrocution due to damage to the electric powertrain caused by collisions are the two main worries with regard to electric cars. Yet unlike in regular autos, the latter doesn't develop as rapidly. Even in the case of a battery short-circuit, the fire does not start or spread as rapidly as it would in conventional automobiles, providing the occupants more time to escape. To prevent the loss of Life or Car due to Automotive fires, the system is designed to perform immediately suppresses the fire within a few seconds, this enables detection of fire and dousing it out at the source itself preventing the spread and the scope from reigniting causing harm to the vehicle and more importantly the occupants in Cars.

Keywords: Fires, Fire Extinguishers, Cars, Safety, Automation

1. Introduction

Cases of fires in automobiles can be found anywhere in the world, in every location and in every type of vehicle, apart from vehicles there is always the risk of fires in electrical panels, which include circuits that may heat up and erupt into spontaneous flames. An electric vehicle has many flaws that can be a reason leading to fire accidents. The battery used in electric vehicles is the primary cause of the fires. There have been numerous instances of automobiles catching fire due to these flaws, resulting in the entire vehicle being turned to ashes. Yet, by installing an automated fire suppression system, we can actually minimize the risk of both financial and human loss caused by fire, consequently enhancing safety for the occupants and other commuters.

The primary area of the fire department must overcome a limitation. Sometimes the police and the military arrive at the shooting location to assist them. But this is insufficient. The creation of electric vehicle batteries presents new safety challenges, and in order to make sure that the risk of fire is kept to a minimum, extensive research must be done. According to a source, one of the top 4 reasons for vehicle-related fires is electrical system failure. Many people seem to believe that the only battery packs that are problematic and dangerous are

those in all-electric and hybrid cars. Automobile fires are not a new problem, but the automotive sector faces a big difficulty in addressing it. It is estimated that 1,000 car fires happen on Indian roads for every 100,000 people.

A fire suppression system with automatic triggering will take prompt action if one is currently available. In a region, several number of gas jetting nozzles are positioned where they are required. The gas jetting nozzles are connected through a valve and the pipe is attached to the extinguisher. The thermal sensors are arranged at desired locations within the region. These sensors detect and transmit signals that open the valve and release the fire suppressing gas, followed by the nozzles which allows the agent to penetrate the region achieving automated fire extinguishing.

2. Literature Review

A. J. John, et al. [01] has done research on “Automatic Fire Extinguishing Robotic Vehicle”. Considering that the Fire Fighters face risky situations when extinguishing the fires and rescuing the victims, it is important to acknowledge these risky conditions. The author in concern of Fire fighters have designed a robot which is capable of performing human tasks of extinguishing fires. The automation component is somewhat useful in putting out the fire via human control thanks to the little fire extinguisher that has been mounted on the robot. So, the author comes to the conclusion that this robot can operate on its own or can be commanded from a safe distance, which actually eliminates the risk of fire fighters going in hazardous conditions. Also, the fire fighting and rescue activity can be carried out more efficiently with robot technology providing better functioning at these conditions.

C. K. Das, et al. [02] has studied on Design and Implementation of an “Automatic Fire Extinguishing System Based on Fault Secure Multi-Detectors”. The main objective of this study was to develop an automatic fire-extinguishing system that eliminates the drawbacks of the prior project, to make it simple to install or remove the system from a location where automatic fire- extinguishing should be used, and enables flexible positioning of gas jetting nozzles based on the size and shape of the area. However, due to the complicated network of gas pipes needed to transport gas from a gas bomb to the gas jetting nozzles, classic automatic fire- extinguishing systems come at a high cost and need extensive installation.

A. Lebkowski [03] has done research on “Electric Vehicle Fire Extinguishing System”. Based on information from temperature, flame, and impact sensors, the fire extinguishing system for an electric vehicle that is being proposed can inform the driver of a fire inside the vehicle and take immediate preventive action. As this system may take extra action by actively attempting to put out the current fire, it provides a benefit over solutions that are limited to removing the battery.

3. Problem Statement

Identification of the cause of Fire in Cars and Electric Panels and study to douse these fires automatically before it's out of control and destructive.

The causes of fire, an uncontrolled and spontaneous combustion of matter, can include improvements in material's internal structures, errors in the layout of powertrain (Inadequate safety against cable insulation abrasive wear damage caused due to vibrations occurring during operation, improper cable gauge, lack of insufficient protection against excessive current and short-circuits in the wiring, and other people's acts (arson)for example) (short circuits and physical harm to the cells that ignite them). Regardless of the causes of physical

damage to the battery pack and other electric propulsion system components, efforts must be taken to lessen potential risks to human life and property. Furthermore, any fire inside an electric car usually ends in a total loss and has a very bad financial effect on the owner's economy. It is believed that pure electric vehicles are more secure than conventional or hybrid vehicles (using both traditional and electric mobility) Both propulsion methods have drawbacks, but the latter pose an even bigger threat to people's lives and health because of the chance of passenger's electrocution and the potential for fuel tank fire or explosion.

Electric panels are just as susceptible to short circuits as other electrical equipment when two unprotected wires come in contact or when it is too hot. When too much current passes through a circuit, it is said to be overloaded if the result is heat buildup or damaged wire. Sparks and fire might result from this. An electrical circuit that has a short circuit permits current to flow through an undesired path. Fire is caused by short circuits, especially when the flame and the positive wires comes into contact, causing a spark that ignites fire. A spark that forms when the wires come together could start a fire.

4. Materials Required

1. Modular Valve KEW-10

The valve regulates the extinguishing agent flow. The body of the valve is made by High Tensile Brass Forging. It consists of a Quartzoid Bulb (Día 8 mm). The temp range vary up to 141 C according to your requirement. In this experiment the Red Bulb which Ranges up to 70 C has been used.



Fig 1. Modular Valve KEW-10

2. Mono-ammonium Phosphate (NH₄H₂PO₄)

Monoammonium phosphate is a fire suppressant that resembles yellow talcum powder. Propellers are made of nitrogen gas. Class A, B, and C fires respond well to this extinguisher, but it is also very toxic side by side.

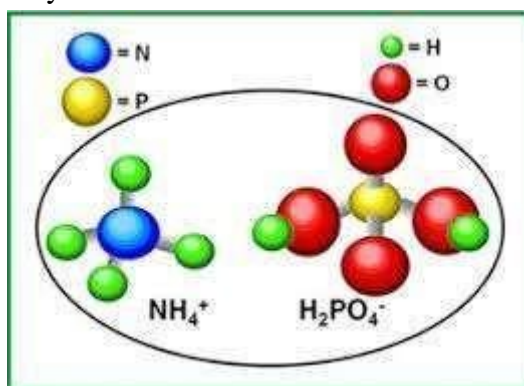


Fig 2. Chemical Reaction of NH₄ H₂ PO₄

5. Methodology

Auto provoking fire suppression systems eliminates human intervention to discover and tackle the fire. The valve immediately detects the radiant heat from the fire, automatically activates the system and delivers the extinguishing chemicals into the heart of the fire within a second after the suppression. This project includes:

A. DESIGN



Fig 3. CAD Image of the cylinder

We have designed a CAD Image which provides the idea about assembly of the system.

B. WORKING

There are 5 stages in which the working can be explained are: -

- 1) **Assembly:** - It is important to study the areas which is most exposed and where there is the highest probability of catching the Fire. As our main is to douse the fire the moment it starts at very initial stage before it is aggravated.
- 2) **Thermal Detection:** - The Quartzoid Bulb having very different temperature ranges are capable to sense the abnormal change in temperature. Once the temperature of the compartment or the area goes beyond the range it acts as a fuse and breaks making path for the material to come out automatically.
- 3) **Thermal Activation:** - The bulb has specific range of temperature where it is operable. A higher range of a few degrees as there is always a possibility of rise in temperature due to long run of the car or the atmosphere contributes in the rise of temperature due little to no space for air to go out. Hence at higher degrees of temperature it is confirmed that abnormal rise in temperature is the reason for activation of the product.
- 4) **Dousing of Fire:** - It simply means taking out one of the components of the Fire triangle. In our case we first take out oxygen available in the compartment with the help of chemical used that is the Mono-Ammonium Phosphate ($\text{NH}_4 \text{H}_2 \text{PO}_4$) after taking out oxygen dousing of fire takes place after the powder gets placed beneath, we remove the contact between the fuel and heat and that's how dousing of Fire takes place.

- 5) **Confirmation:** - After the Automatic Fire extinguisher does its job it is always advised to confirm the dousing of Fire has taken place correctly as Fire needs nothing but oxygen to reignite considering extreme case of leakage in fuel. It is already studied and proven that reignition of Fire is always a possibility.

6. Conclusion

The Current Solution to douse fire in car engine compartment are:

- Manually operated powder type fire extinguishers, Mounted near the driver.
- In the case of fire in the car, occupants get panic and less attention is given to the fire extinguishers, even if available in car.
- In most of the cases, by the time fire is noticed in the engine compartment, it has already aggravated.
- References states that, most of the occupants are not aware of how to use these types of pressurized fire extinguishers.

The Quartzoid bulb instantly detects the radiant heat from the fire, automatically activates the system, and within a second of the suppression, delivers the extinguishing chemicals into the centre of the fire based on the information gathered from the existing study.

Another benefit is that current extinguishing systems may be upgraded without incurring significant costs and so have access to the benefits mentioned in the paper. The installation of the system proposed can minimize potential fire-related financial damage while also improving both the safety of those within the car and other commuters.

Acknowledgment

We are very grateful of the Fire Brigade department of Katraj, Pune who helped us in conduction of the project and guiding through safety while performing. We give a special thanks to **DECCALEAP TECHNOLOGIES** for letting us know the details of Automatic Fire extinguisher product (F-Protekk).

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