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An Innovative Fireball Fire Extinguishing System to Enhance Industrial Safety

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ABSTRACT: Many fire-based accidents are occurring in Industries now. Consequently, massive losses of lives, as well as money, are suffered by the owners. The conventional fire extinguishing systems are found to be not enough to reduce losses, including eliminating them. Most are conversant in the fact that the large fires originate from very small sparks or pretty little fires which are very easy to manage. So, in this research, the main objective was to easily control these small fires at the initial phase. By using the traditional fire extinguisher, it's not always possible to extinguish a small fire. One of the main reasons for this inability is that the manual handling nature. So, the authors worked with the automated extinguishing equipment and tried to enhance them to extinguish the small fire at a very initial stage and prevent huge fire which will cause massive losses. In this research, a sustainable fireball was designed and manufactured using locally available raw materials. In the ball, dry powder is used as an extinguisher referred to as ABC dry chemical powder. A stands for ash, B stands for barrel while C stands for current. The powder is typically a mixture of mono ammonium phosphate and ammonium sulfate, the previous being the active one. The combination between the two agents is typically 40–60%, 60-40%, or 90-10% counting on local standards worldwide. An innovative fireball extinguisher system has been developed using this powder to extinguish the fire quickly and conveniently. In this paper, the design and fabrication procedures of an innovative fireball extinguisher system are described along with the test result

KEYWORDS: Fire extinguishers, Dry powder, Mono ammonium phosphate, Sodium bicarbonate, ABC dry chemical powder, Fire extinguishing ball, Fire safety

I. INTRODUCTION

Fire is a common hazard for all industries. There are different methods and equipments have been developed to deal with fire hazard [1]. This research study aims to develop an innovative method to enhance industrial safety. Therefore an elaborate exploratory literature review has been done. After that it becomes evident that for small and medium type of industries or in general industries would benefit from a fire extinguishing systems like fire ball. So in this paper, fire extinguishing methods and different fire extinguishing equipments are described first. Afterwards, research gap, objectives of this study, design and fabrication of the fireball with actual experimental result of its effectiveness are briefly described.

II. OBJECTIVES

We have five main objectives which are stated below-

- To prevent big fires by putting out small fires at the very initial stage
- To reduce damage originated from fire accidents
- To extinguish fire efficiently from a safe distance
- To extinguish fire without causing any harm to the environment
- To make the fire extinguishing device more user friendly

III. WORKING PRINCIPLE

Fire Extinguisher Ball could be termed as a fully automatic type of extinguisher. When thrown or rolled into fire, it will burst and extinguish the fire instantly. It may be positioned where the hotspots are such as flammable objects, circuit breaker box, gas tank etc.

An activation or trigger strip is implanted into the ball's outer casing. It firmly holds the dry fire extinguishing agent inside. When the activator or trigger is exposed to flames for more than a few seconds, the casing will burst open and disperse a cloud of chemical powder in the surroundings.



Fire extinguishing device

IV. MATERIALS USED

Five raw materials were used to produce the fire extinguishing device. They were:

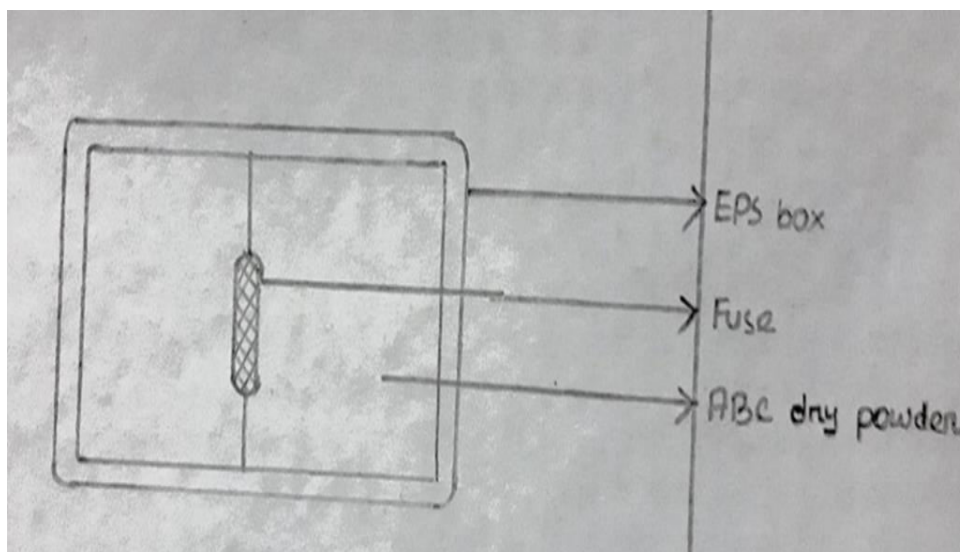
1. EPS Box: Expanded Polystyrene (EPS) is a lightweight cellular plastic material consisting of small hollow spherical balls. This closed cellular construction that provides EPS its remarkable characteristics. EPS is produced during a wide selection of densities providing a varying range of physical properties. These are matched to the varied applications where the material is employed to optimize its performance and strength.
2. ABC dry powder: ABC Dry Chemical, ABE Powder, tri-class, or multi-purpose dry chemical is a dry chemical extinguishing agent used on class A, class B, and class C fires. It uses a specially fluidized and siliconized mono ammonium phosphate powder. ABC dry chemical is typically a mixture of mono ammonium phosphate and ammonium sulfate, the previous being the active one. The combination between the two agents is typically 40–60%, 60-40%, or 90-10% counting on local standards worldwide. The USGS uses an identical mixture, called PhosChek G75F.
3. Ammo: Ammunition (informally ammo) is the material fired, scattered, dropped, or detonated from any weapon. Ammunition is both expendable weapons (e.g., bombs, missiles, grenades, land mines) and therefore the component parts of other weapons that make the effect on a target (e.g., bullets and warheads). Nearly all mechanical weapons require some sort of ammunition to work.
4. Fuse: In an explosive, pyrotechnic device, or military munitions, a fuse (or fuse) is the part of the device that initiates function. In common usage, the word fuse is employed indiscriminately. However, when being specific (and

especially during a military context), the term fuse describes an easy pyrotechnic initiating device, just like the cord on a firecracker whereas the term fuse is occasionally used when pertaining to a more sophisticated ignition device incorporating mechanical and/or electronic components.

5. Adhesive: Adhesive, also called glue, cement, mucilage, or paste, is any non-metallic substance applied to at least one or both surfaces of two separate items that binds them together and resists their separation. The utilization of adhesives offers many advantages over binding techniques like sewing, mechanical fastening, thermal bonding, etc. These include the power to bind different materials together, to distribute stress more efficiently across the joint, the value effectiveness of an easily mechanized process, an improvement in aesthetic design, and increased design flexibility. Disadvantages of adhesive use include decreased stability at high temperatures, relative weakness in bonding large objects with a little bonding area, and greater difficulty in separating objects during testing. Adhesives are typically organized by the method of adhesion. These are then organized into reactive and non-reactive adhesives, which ask whether the adhesive chemically reacts so as to harden. Alternatively, they will be organized by whether the raw stock is of natural or synthetic origin, or by their starting physical phase.

V. PROTOTYPE DESIGN

The prototype was designed in order to develop the prevalent design. The shape was changed from circle to rectangular in order to increase efficiency of the device. The change in design also made this device user friendly



Final Design

The fuse was placed in the middle of the device. So when the explosion happens, the powder can cover the maximum amount of area. Surely it makes the device a more effective one.

VI. ADVANTAGES

- It needs to throw into the flames or mounted on the place where the chances of fire has occur.
- It is easy to use, just thrown to the fire from a safe distance.
- It will automatically activate if contact with the flame. That means it will protect the area from fire when you are not present.
- Fire Extinguisher ball is non-toxic and harmless to humans and animals.
- Multiple fire extinguishing balls help control the spread of fire and it can extinguish the large fire.
- This fireball not only fight with the internal fire but also it can fight with the outside fire



VII. APPLICATIONS

- Warehouse
- Office Buildings
- Transportation
- Residential Buildings
- Nursing Homes
- Storage Rooms
- Commercial Buildings

VIII. CONCLUSION

In this research, we tried to develop the existing fire extinguishing ball and ended up making a device with more efficiency and more potential. The device certainly covers more area than the existing ball because of its shape. We also fabricated it with a very low cost. So it is affordable for the factories in the developing countries to meet their own demand themselves. Therefore it is expected to play a role in the industrial development of these countries. Besides, researchers may continue to work on these fireballs specifically how the large fire could be addressed

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