

Sonic Fire Extinguisher

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Abstract- *The main idea of this paper is to propose an extinguisher that utilizes sound waves to extinguish fire and also should ensure the environmental sustainability. The conventional fire extinguisher posses various drawbacks. The water fire extinguisher freezes in cold climate and cannot be used in electrical fires. The foam fire extinguisher contains foam concentrate which can cause various respiratory problems during the incident and after the fire. The idea of acoustic fire fighter will be able to reduce all those drawbacks and can evolve as a future of extinguishers. The major raw material is sound which is nothing but a pressure wave. The sound is generated using the amplifier where the input is fed by the function generator. The Output is fed to a sub-woofer which will produce a maximum hertz of about 80Hz to 100Hz. The alternating high- and low-pressure waves created by the sub-woofer is sent into a focused collimator. The focused sound waves from the collimator will tend to extinguish the fire.*

Indexed Terms- *acoustic fire fighter, 80Hz to 100Hz, focused collimator*

I. INTRODUCTION

A fire extinguisher is an active fire protection device used to extinguish or control small fires, often in emergency situations. Instead of using fire extinguisher we would like to precede an alternative method to cut off fire with the help of sound fire extinguisher.

Sound is a vibration that typically propagates as an audible wave of pressure, through a transmission medium such as a gas, liquid or solid. Sound can propagate through a medium such as air, water and solids as longitudinal waves and also as a transverse

wave in solids. The sound waves are generated by a sound source, such as the vibrating diaphragm of a stereo speaker. The sound source creates vibrations in the surrounding medium. As the source continues to vibrate the medium, the vibrations propagate away from the source at the speed of sound, thus forming the sound wave, due to this sound wave the fire can be did*spliced easily.

The idea of extinguishing fire with sound is a novel one, and has many possible applications in today's world. With knowledge of the resonant behavior of a room or enclosure, the present research aids in incorporating a single (or multiple) speaker within it to achieve acoustic velocities in specific areas of interest. One can generate a specific air velocity using various combinations of pressure and frequency. This technique of suppression would require knowledge of the geometry of the acoustic cavity, so that the optimum placement of the speaker(s) can be achieved, as well as excitation with optimal the resonant frequencies for the room.

II. BASIC WORKING

Sound waves have the ability to manipulate both oxygen and burning material. If these two gets separated, the fire dies away. In other words, a sound wave is a type of pressure wave. Pressure wave will remove oxygen from air molecules [5]. Given that oxygen is the main fuel for the fire, this will allow you to eliminate it. Surely the study behind the invention went through a few 'failed frequencies'. By testing out different frequencies, found out that high-pitched tones were ineffective on flames. They came to the realization that it is all about low-frequency bass sounds between 30 and 60 Hz. Therefore, deep bass tunes of hip hop, dub, dub step, d&b, trap or grime would also work on flames. The device is consisted of

an amplifier and a cardboard collimator to focus the sound. Fire cannot exist if deprived of any of these elements, in this sound fire extinguisher both heat and oxygen is removed. Sound is a mechanical wave and it travels in the above pattern. When the sound waves are emitted the bass, the molecules gets vibrated around the surroundings. This in turn removes the oxygen molecule from the fire and creates a space around the fire when the sound waves are directed towards the fire; the area of the flame gets widened. Pressure is inversely proportional to area thus the pressure is reduced. According to ideal gas equation,

$$pV = nRT$$

P=Pressure of the gas

V = volume

n = Number of moles of gas

R = Ideal gas constant

T = Absolute temperature

Pressure decreases the temperature also decreases thus the heat is eliminated. Sound is a pressure wave that oscillates between region of high and low pressure. This oscillation is a capable of creating a vacuum that separates air molecules from the source of the ideal gas low in that the pressure at the principle of the flames source decreases which in turns decreases the temperature at the source of the source of the flame to suppress the fire .In 2015, researchers from George Mason University announced that high volume sound with low bass frequencies in the 30 to 60 hertz range drives oxygen away from the combustion surface, extinguishing the fire, a principle was previously tested by the Defense Advanced Research Projects Agency (DARPA). One proposed application is to extinguish fires in outer space, with none of the clean-up required for mass-based systems. Sound fire extinguisher is a self-approved highly safe fire extinguisher. Sound is created by a pressure wave which vibrates particles as it travels in an accordion-like manner.

A vibrating source pushes particles forwards with a high-pressure wave. The high pressure is immediately followed by a low-pressure which forces the particle

back. The waves then oscillate back and forth, moving through a material until it disperses into nothing. The pressure wave can be created from many different sources, but in the end, they all travel the same way. The intensity of the wave is measured by how big the difference is between the high and low pressure. The greater the difference, the louder the sound. The intensity of the wave is measured by a decibel. For each increase in loudness (for example 1dB to 2dB), there is a 10-times increase in intensity.

III. CHARACTERISTICS OF SONIC FIRE EXTINGUISHER

The sound fire extinguisher is eco-friendly, but normal fire extinguishers most common material used is ammonium phosphate (with some ammonium sulfate). Sound fire extinguisher is chemical free, non-toxic; no liquid substances are used in this extinguisher.

The Instant Fire Suppression device specifically uses new ways of tackling fires in enclosed spaces, such as Aircraft cockpits and ship holds, Kitchen, hospitals and shopping malls, Industry, and railways where fires are obviously devastating and incredibly difficult to control.

IV. THE EFFECT OF FREQUENCY ON PRESSURE AND SOUND

Sound wave significantly effects on the fire extinguishers process. To evaluate the impact of sound waves on the fire, the fire was exposed varied frequency of sound waves from 0 Hz, 10 Hz, 30 Hz, 35 Hz, and 40Hz. Figure 5.1 shows variation of acoustic velocity for varied frequency.

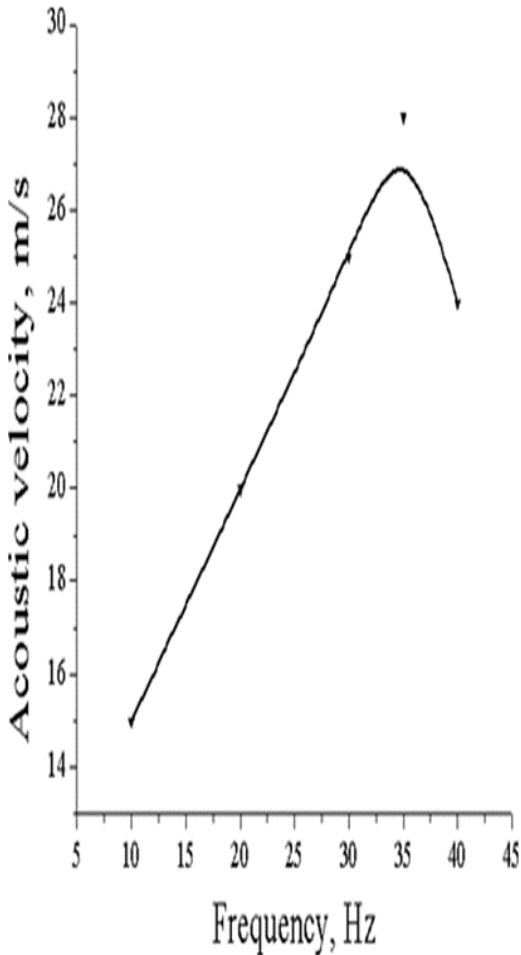


Fig: 4.1

V. APPLICATION

- Space Station

The sound fire extinguisher can be used in space station and satellite fires. Since conventional fire extinguishers are not as much efficient in space, if this technology is utilized efficiently fires in space stations can be controlled appreciably. Oxygen molecule is very less in space compared to earth atmosphere so that the fire in space is very different compared to the earth atmosphere in order to extinguish fire in space, first the desired frequency at which the fire gets extinguished must be first experimented and set. Later, a high efficiency focusing collimator must be implemented when the fire is extinguished in space.

- Electronic Devices

In electronic devices, Because of the heat developed in it due to the over usage of the respective device or due to malfunctioning, fire in those devices is unavoidable.

The use of conventional fire extinguishers during at that time causes severe damage to that devices and therefore if water fire extinguishers are used at that time it will result in electric shock to the person who is encountering the extinguishing process. If sound fire extinguishers are used there will be no such residues compared to normal fire extinguishers so that fire can be also effectively extinguished and causes less damage to that device.

The sound exhibited by the sound fire extinguisher also causes some about of damage to the device due to vibrations, but the damage is less compared to the conventional fire extinguisher.

VI. EVIDENCES

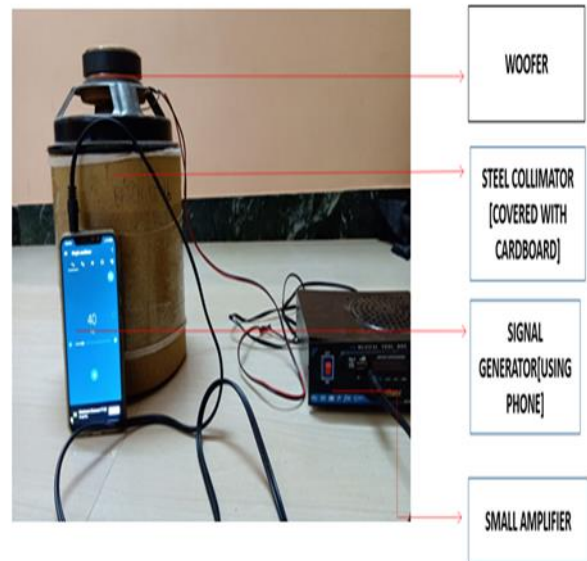


Fig: 6.1



Fig: 6.2

VII. SOUND FLAME INTERACTIONS USING EXTINGUISHER

Sound wave was found to be one of the alternatives in creating new method in flame extinguishing technology. There are some aspects of the combustion that can be affected by sound wave. The flame Air-Fuel Ratio at the boundaries which is at the lowest lean limit of the combustion of fuels can be affected by sound wave by changing the velocity of its medium (air). Furthermore, the changes in air velocity changes will also be able to affect the flow rate of the fuel around the heat source as well as increasing the convective heat transfer of the heat source and reducing the average temperature of the flame.

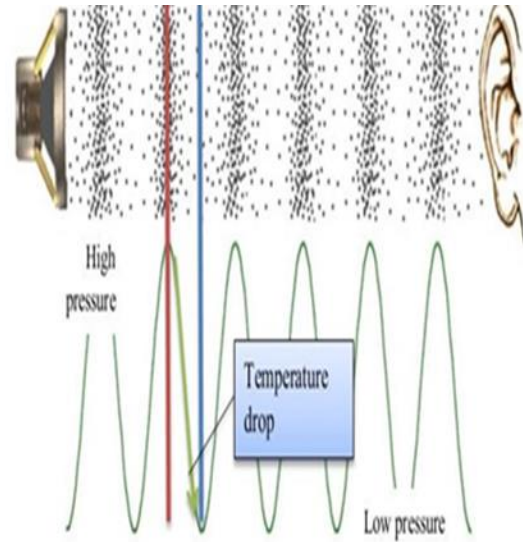


Fig: 7.1

CONCLUSION

The idea of Sonic Fire Extinguisher controlled by speech potentially serves as an alternative to traditional fire extinguishers. It can be programmed to alternate the frequency based on a width of the flame. So, it can be possibly used for a larger area. They can work in environments so hazardous that an unprotected human would quickly die.

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