Types and history of heat detectors engineering essay

Fire is one of the biggest threats people are facing in our society these days. Many methods are being used to prevent such danger on the citizens, such as making sure that every house has a fire extinguisher incase of fire starting in a person’s house. These methods are improving by time and are getting more advanced and safer for the protection of people. Many changes were made to a fire alarm, yet the most recent and favorite ones are the fire detectors with all its types. However, to avoid danger most latest buildings provide each flat with a fire detector that can detect any hazard that will be caused by fire caused unintentionally.

Fire alarms consist of many different types mainly smoke alarm detectors and heat detectors. We chose to build our own heat detector that detects any change in the temperature of the room. This experiment will include mainly a heat sensor and a temperature detector, and a buzzer that turns on when the temperature changes. The report includes a search on different types of fire alarms and their use.

Types of fire alarms …

It is definitely hard to get robbed and lose your belongings, yet a thief will leave your home where you live with your family and are considered your shelter. Fire will leave nothing except ashes of what was before a house. However, fire can be a very destructive force. Acting too late in the instance of a fire can not only entail the loss of your property, but of your life as well. This is the reason is why having a fire alarm in your home is necessary.

Brief history…

The first automatic electric fire alarm was invented n 1890 by Francis Robbins Upton. In late 1930s the Swiss physicist Walter Jaeger tried to invent a sensor for poison gas. He expected that gas entering the sensor would bind to ionize air molecules and thereby alter an electric current in a circuit in the instrument. Francis Upton

His device failed (small concentration of gas had no effect on the senor's conductivity). When Jaeger lit a cigarette he was surprised to notice that a meter on eh instrument had registered a drop on current. Therefore, he discovered that smoke particles had done what poison gas could not do. Jaeger's experiment was one of advances that paved the way for the modern day smoke detector. Smoke detectors started off with a generally high price that people couldn't afford, except for major businesses and theaters. The first affordable smoke detectors were invented by Duane D. Pearsall and Stanley Peterson in 1965, featuring individual battery powered units that could be easily installed and replaced. The first units for mass production came from the manufacturing mind of Stanley B. Peterson in 1975 at Duane Pearsall's company in Lakewood. These first units were made from strong fire resistant steel and shaped much like a bee's hive. The battery was a rechargeable specialize unit created by gates energy.

We all know that fire alarms are designed to alert people to the possibility of a fire in their homes. Although any smoke alarm can be useful, it is often recommended that you choose a specific type of fire alarm for your home. This is because certain types of fire alarms can be more suited for certain places and for certain people.

There are different types of fire alarms that people usually choose from to use in their houses for protection.

Smoke detector

1) Smoke alarm detectors – These are the most common types of fire alarms. Often, the term “ smoke alarm” is used interchangeably with “ fire alarm”. Smoke alarms actually detect smoke, not the actual fire. There are generally two types of smoke alarms:

A) Photoelectric – This type of fire alarm “ sees” the smoke. This fire alarm is particularly responsive to smoldering fires or the type of fires that give out a lot of smoke. These are ideal for places where there are things like PVC (Polyvinyl chloride) or foam. This fire alarm, though, is slightly more expensive than ionization alarms. This fire alarm must also be kept clean since it can give off false alerts due to dust and insects. In one type of photoelectric device, smoke can block a light beam. In this case, the reduction in light reaching a photocell sets off the alarm.

In the most common type of photoelectric unit, however, light is scattered by smoke particles onto a photocell, initiating an alarm. In this type of detector there is a T-shaped chamber with a light-emitting diode (LED) that shoots a beam of light across the horizontal bar of the T.

A photocell, positioned at the bottom of the vertical base of the T, generates a current when it is exposed to light. Under smoke-free conditions, the light beam crosses the top of the T in an uninterrupted straight line, not striking the photocell positioned at a right angle below the beam. When smoke is present, the light is scattered by smoke particles, and some of the light is

directed down the vertical part of the T to strike the photocell. When sufficient light hits the cell, the current triggers the alarm.

Figure 1 -In this type of detector there is a figure 2- When sufficient light hits the cell,

T-shaped chamber with a light-emitting the current triggers the alarm.

Diode (LED) that shoots a beam of light

across the horizontal bar of the T.

B) Ionization – This type of fire alarm detects the invisible particles caused by combustion. As opposed to the photoelectric fire alarm " seeing" the smoke, this type " feels" the smoke. This can best detect flaming fires with no visible smoke. However, you should not place this type of fire alarm in the kitchen as it is susceptible to false alarms. It is also cheaper than other types of fire alarms. Ionization detectors have an ionization chamber and a source of ionizing radiation.

The ionization chamber consists of two plates separated by about a centimeter. The battery applies a voltage to the plates, charging one plate positive and the other plate negative. Alpha particles constantly released by the americium knock electrons off of the atoms in the air, ionizing the oxygen and nitrogen atoms in the chamber. The positively-charged oxygen and nitrogen atoms are attracted to the negative plate and the electrons are attracted to the positive plate, generating a small, continuous electric current. When smoke enters the ionization chamber, the smoke particles

attach to the ions and neutralize them, so they do not reach the plate. The drop in current between the plates triggers the alarm.

Which Method is better?

Both ionization and photoelectric detectors are effective smoke sensors. Both types of smoke detectors must pass the same test to be certified as UL smoke detectors. Ionization detectors respond more quickly to flaming fires with smaller combustion particles; photoelectric detectors respond more quickly to flaming fires. In either type of detector, steam or high humidity can lead to condensation on the circuit board and sensor, causing the alarm to sound. Ionization detectors are less expensive than photoelectric detectors, but some users purposely disable them because they are more likely to sound an alarm from normal cooking due to their sensitivity to minute smoke particles. However, ionization detectors have a degree of built-in security not inherent to photoelectric detectors. When the battery starts to fail in an ionization detector, the ion current falls and the alarm sounds, warning that it is time to change the battery before the detector becomes ineffective. Back-up batteries may be used for photoelectric detectors.

Ionization chamber

Heat detector

Smoke alarms in homes can go off whenever there’s smoke present. If a person smokes cigarettes, burns food or lights incense, a smoke alarm might go off. A heat detector, on the other hand, is indifferent to how much or what

type of smoke is in the air. It will only react when it detects a change in heat, associating that heat change with the possibility of a fire in the area.

2) Heat alarm detectors- are devices that respond to changes in temperature of the surrounding area. If the ambient temperature rises above a predetermined threshold an alarm signal is triggered. In the case of sprinkle systems, water will be released to extinguish the fire.

Heat detectors can also be further broken into two main classifications:

Rate-of-rise heat detectors- ROR heat detectors react to the sudden change or rise in ambient temperature from a normal baseline condition. Any sudden temperature increase that matches the predetermined alarm criteria will cause an alarm. This type of heat detector can react to a lower threshold condition than would be possible if the threshold were fixed. A typical alarm may sound when the rate of the temperature rise exceeds the rate that was chosen as the normal safe rate of the temperature per minute. However, it detects fires that rapidly grow in intensity. This method responds to abnormally fast temperature increases.

Fixed temperature heat detectors- this type of detector reacts when the ambient temperature reaches a fixed point. The most common fixed temperature point is 136. 4 F (58C). Recent technological developments have enabled the perfection of detector that activate at a temperature of 117 F (47 C), providing increased time to escape. This method detects fires that build temperatures to a high level at a slow rate. This method responds to a specific temperature setting. A fixed head detector must be completely

heated to alarm temperature and therefore a disastrous interval in time may occur with a fast rate fire.

Which method is better?

Heat detectors commonly have a label on them that says “ not a life safety device”. That is because heat detectors are not meant to replace smoke detectors in the bedrooms or in the hallway outside of the bedrooms. A heat detector will nonetheless notify of a fire in a kitchen, where smoke detectors should not be installed. This will allow more time to evacuate the building or put out the fire if possible. Each type of heat detector has its advantages, and it cannot be said that one type is better than the other. If we placed a rate-of-rise heat detector above a large, closed oven, then every time the door is opened an alarm could be generated due to the sudden heat transient. In this situation the fixed threshold detector would probably be best. If a room filled with highly combustible materials is protected with a fixed heat detector then a fast-flaming fire could exceed the alarm threshold due to thermal interval. In that case the rate-of-rise heat detector may be preferred.

The secret of the heat detection unit’s sensitivity is in the design. The outer shell is made of a rapidly expanding alloy which closely follows changes in surrounding air temperature. The inner struts are made of a lower expanding alloy. Designed to resist thermal energy absorption and sealed inside the shell, the struts follow temperature changes more slowly.

A slow rate fire will heat the shell and struts together. At the “ set point”, the unit will trigger, actuating the alarm or releasing the extinguishment. A

transient rush of warm air up to 40°F /min. may expand the shell, but not enough to trigger the unit. By ignoring transient warm air excursions, the DETECT-A-FIRE unit virtually eliminates false alarms prevalent with rate-of-rise devices. If a fast rate fire starts, the shell will expand rapidly. The struts will close, actuating the alarm or releasing the agent. The faster the fire rate of growth, the sooner the DETECT-A-FIRE unit will react.

Why Heat Detectors?

No annoying beep when the battery is low

Best loop capability

Affordable compared to other detectors

Immunity towards electromagnetic interference

Resistive against contagion like UV and IR rays

No necessity to change batteries

Inherently secure and reliable