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SMOKE AND HEAT DETECTORS

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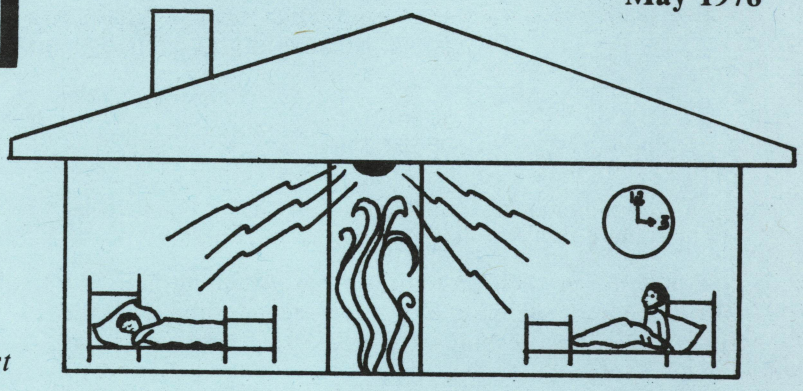

Nearly 7,000 people are killed by fires each year in the United States. Less than one-fourth of these deaths are the result of burns. Almost 75% are caused by smoke and toxic gas inhalation. Most home fire deaths occur between midnight and 6 a.m. when people are asleep and unaware of what is going on around them.

Providing a fire detector in your home can greatly reduce your odds of a death by fire. In Idaho, fire detectors are required for all new dwellings, homes, mobile homes and apartment houses.

You can buy detectors for as little as $25.00 However, with so many brands and types on the market, selection of the proper unit for your situation can be confusing. There are two basic types of detectors — heat detectors and smoke detectors. An understanding of home fires will help you understand the specific use of these detectors.

Fires have three stages of development:

1. In the initial stage, invisible particles of combustion are produced without significant amounts of smoke, flame or heat.
2. In the second stage, smoke can be seen but little heat or flame is present.
3. In the third stage, a flame is visible and high temperatures are generated.

An overloaded electrical circuit may take days to complete the initial stage. Grease spilled on a hot stove goes through all three stages in seconds.

Most fire casualties result from inhaling smoke and toxic gases produced by slowly developing fires in the first two stages. The National Fire Protection Association (NFPA) has observed that in nearly all fires detectable quantities of smoke precede detectable heat. Fires that develop slowly and smolder seldom increase room temperature, but they nearly always release toxic gases such as carbon monoxide. Since many new synthetic materials (rugs, furniture, etc.) found in homes produce deadly gases as they burn, the NFPA recommends that each home should include at least one smoke detector in any fire protection system.

Though smoke detectors offer better early warning protection, heat detectors offer additional protection if located in areas such as a kitchen, attic, basement or an attached garage where smoke from cooking or dust would cause a smoke detector to signal a false alarm.

Smoke Detectors

Photo-electric and ionization are two of the most common types of smoke detectors.

Photo-Electric Smoke Detectors normally contain a light beam which shines across the sensing chamber and is caught in the light trap on the far side. When smoke enters the chamber, light reflected by the smoke particles is received by a photo-cell on the side of the chamber. When the photo-cell receives a certain amount of light, the alarm circuit is activated (Fig. 1).

Ionization Type Smoke Detectors use a harmless source of alpha particles to ionize the air within the sensing chamber. This ionized air conducts electricity across a gap between two electrodes. When combustion particles enter the chamber the ions attach themselves to these particles and the current flow is reduced (Fig. 2). The alarm circuit is activated when the current reduction reaches a set amount.

Photo-electric or ionization detectors offer about equal protection in early warning of fires. The photo-electric detector will respond more quickly to a slow, smoldering

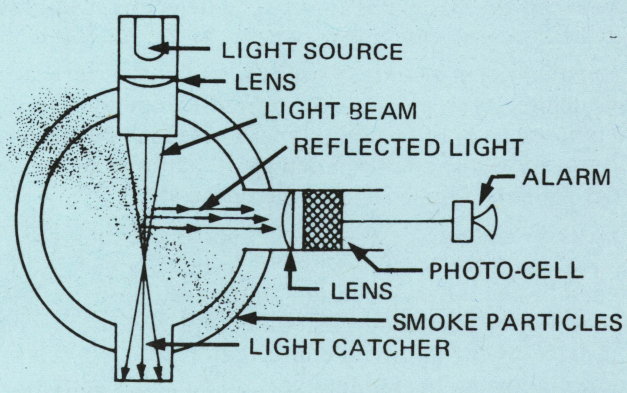

Fig. 1. Sensing chamber in a photo-electric smoke detector. Smoke particles deflect the light beam and trigger the alarm.

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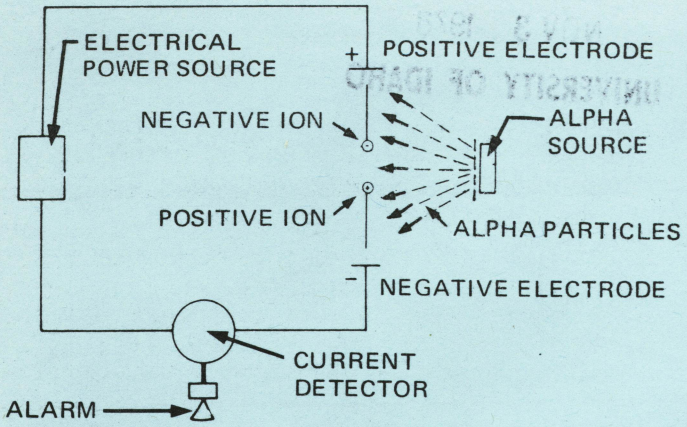

Fig. 2. Circuit of an ion chamber detector. Combustion particles reduce electrical flow and trigger the alarm.

fire, but slower than an ionization in a flaming fire. The difference in detection is only a few seconds, and since the type of fire which develops is unpredictable, neither type has the advantage.

Another type of detector is the semi-conductor gas detector. This detector uses a semi-conductor crystal with a metallic-oxide coating. Combustible gases near the device cause a flow of current and triggers the alarm. Any flammable gas in the home (ammonia, alcohol, perfume or cooking smoke) can set off the alarm. Tests have shown that they do not respond to fast-burning fires with little smoke. Because of this characteristic, semi-conductor gas detectors are not as desirable for home use as photo-electric and ionization detectors.

Current

Smoke detectors operate either on house current or batteries. House current detectors operate only as long as the current is on. Only 10% of home fires involves power failure, and in most cases the alarm will go off before the power fails. Some 120-volt fire detectors use batteries as stand-by power. These units use either rechargable batteries and have a charging unit built in or they use non-rechargable batteries. These dual power units are more expensive than the conventional single power source 120-volt or battery-operated units.

Ionization units require little electrical current and can be operated on batteries alone. NFPA requires that battery-operated units be operable for at least 1 year and that they produce an audible trouble signal at least once a minute for 7 days when the battery is low. Some detectors also have a signal flag to indicate a low battery.

Before buying battery-operated smoke detectors, consider the type of battery required to operate the unit. Batteries may be of a special type. These may be expensive and not locally available. Keep spare batteries on hand in order to make replacements when necessary.

Battery-operated units generally cost more than 120-volt models, but they may cost less to install if a new outlet is needed. The battery-operated units may have a slightly higher yearly operating cost due to battery replacement compared to the electrical consumption of a 120-volt unit. Some authorities believe that battery-operated units are not sufficiently reliable. They are not approved for installation in federally insured housing. On the other hand, battery units do have the advantage of continuing protection during power outages.

Maintenance

Most smoke detector units require little maintenance. The batteries must be faithfully changed once a year in the battery operated units. With the photo-electric type, the bulb will normally need replacing every 3 to 5 years. These bulbs are usually inexpensive. Some new models use light emitting diodes that will last 15 to 20 years.

Heat Detectors

Heat detectors respond to unusually high temperatures near them. Types of heat detectors available include thermostats, spring-wound alarms, gas-operated alarms and rate-of-heat-rise detectors.

Thermostate Detectors are normally wired to supply power to an alarm when the heat exceeds a pre-set temperature limit. For most home locations, these heat detectors are pre-set for about 135°F. In a furnace room or other areas where temperatures may exceed 100°F, the heat detector may be pre-set at 200°F.

Spring-Wound Alarms react when a fusible element melts in abnormal heat conditions, releasing a spring-driven alarm gong. When you replace the element and rewind the spring, the unit can be reused.

Gas-Operated Alarms use a pressurized container of liquified gas (Freon). A metal strip is placed in the pipe which connects the Freon to the alarm horn. Normally this strip blocks the flow of gas, but the strip will melt at high temperatures, allowing gas to flow into the horn to sound the alarm (Fig. 3). Periodically check the sight glass on the cylinder to be sure the container is filled with gas.

Rate-of-Temperature-Rise Detectors use a bellows with a permeable membrane at one end. During normal air pressure changes, air passes through the permeable membrane. In a fire, however, the air pressure rises faster,

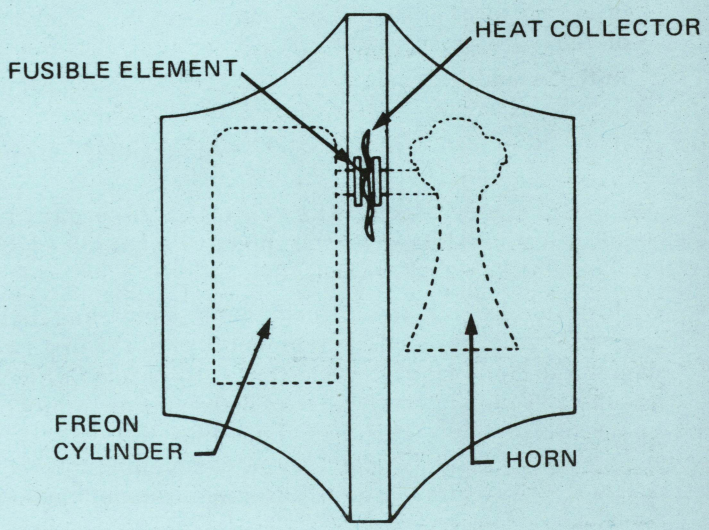

Fig. 3. Gas-operated heat sensing fire alarm. Fusible element normally melts at 135°F. to release the Freon that sounds the horn.

causing the air in the bellows to expand faster than it can escape through the membrane. The expansion of the bellows will activate the alarm.

Heat detectors must be near the fire to be able to detect the heat. This would require several units to adequately protect a household if they were used alone. Furthermore, because of their design, they cannot react to the early stages of a fire, but are effective in areas where large amounts of dust or cooking smoke are present. Heat detectors can be used in high investment buildings such as barns, shops and machine sheds.

Requirements

The uniform building code requires that every new dwelling be equipped with detectors. The detectors shall be mounted on the ceiling or wall at a point centrally located in the corridor or area giving access to rooms used for sleeping purposes. If sleeping rooms are on the upper level, the detector shall be placed at the center of the ceiling directly above the stairway. All detectors shall be located within 12 inches of the ceiling.

Installation

The location and number of detectors depend on the type of protection the homeowner decides is best for his situation.

Generally, in a single story house with the bedrooms opening into a common area, one smoke detector is adequate (Fig. 4). The detector should be mounted near the living area. If bedrooms are located in opposite ends or on other levels, detectors should be placed outside these areas (Fig. 5). Since studies show that over 10% of fires start in the basement, a smoke detector should be placed near the top of the basement stairway.

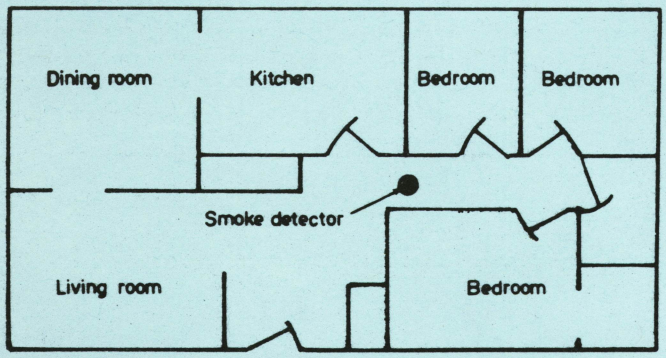

Fig. 4. The floor plan of a 6 room, single level house. Only one smoke detector in the hallway, connecting the bedrooms is adequate. If the house has a basement, placing one detector at the top of the stairway is recommended.

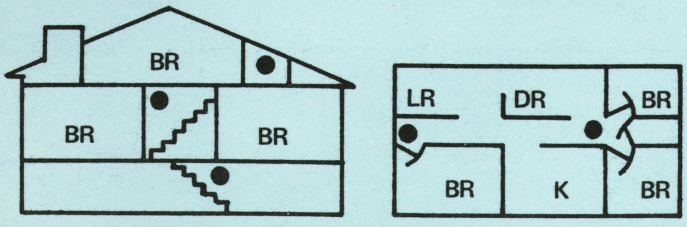

Fig. 5. In homes with more than one sleeping area on the same level or on different levels, a smoke detector should be installed to protect each separate sleeping area. A smoke detector at the top of the basement stairway is also recommended.

Because "dead air spaces" exist in most corners of a room, ceiling-mounted smoke detectors should be placed at least 6 inches from the wall. Wall-mounted smoke detectors should be placed from 6 to 12 inches from the ceiling. Never mount smoke detectors near ventilation systems since they may cause smoke to be drawn away from the detectors (Fig. 6). Tests reveal that smoke enters ceiling-mounted detectors more readily than wall-mounted detectors.

Connect detectors requiring house current to a 120-volt outlet. Be careful to avoid using an outlet that is controlled by a wall switch since you may inadvertently turn off the smoke detector when you turn off the switch. Switch-controlled outlets are often found in living rooms and family rooms. Extend an existing circuit or, if necessary, install a new curcuit for ceiling and upper wall mounting. Do not use extension cords. If you are building or remodeling, consider providing outlets for smoke detectors.

After the detector has been installed, test and clean it regularly. To test a smoke detector, simply blow smoke into the unit. To stop the alarm, blow the smoke out. Some detectors have a test button. Consult your owner's manual when testing. Tests should be made on a regular basis.

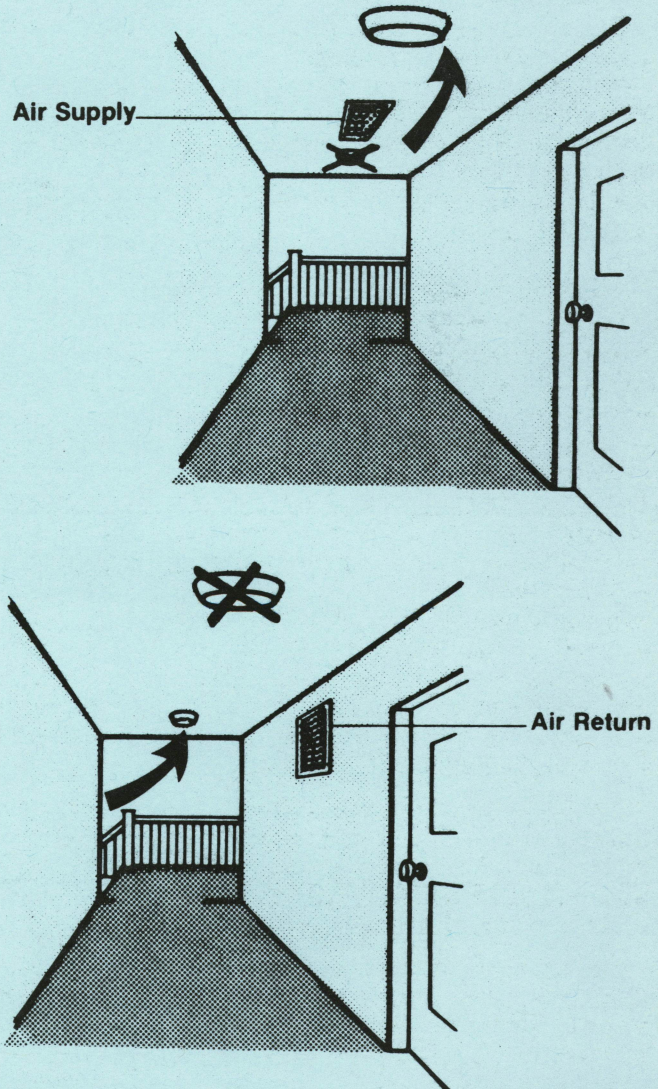

Fig. 6. Mount smoke detectors away from ventilation systems. Detectors improperly located in relation to air supply and air return registers may not detect a fire when one occurs.

Clean detectors at least once a year. Vacuuming the chamber or dusting with a cloth may be all that is needed. Check the manual for proper cleaning procedures.

Additional Precautions

If you have a centrally located smoke alarm, sleep with the bedroom door open. Tests have indicated that with the bedroom door closed, a fire starting inside the bedroom could cause lethal conditions before smoke could get to the detector. An alternative is to install separate detectors in each bedroom.

When purchasing a detector look for the label from Factory Mutual (FM) or Underwriters Laboratory (UL). These labels can insure that the units have been tested and meet fire standards. You should also compare the manufacturers guarantee of the units you are considering.

Fire detectors alone won't provide complete home fire protection. In addition to a fire warning system, the NFPA suggests you should try to minimize hazards. Do not allow trash to accumulate. Keep stoves and furnace rooms clean. Use proper size wiring and fuses. Avoid smoking in bed. Never leave children at home alone. Never store or use gasoline inside the house.

The NFPA also recommends that you have and practice an escape plan. You should have two routes — a primary route and an alternate escape route in the event your main escape route becomes blocked. Hold fire drills, instruct family members not to open a hot door, and establish a meeting place outside and away from the house.

Some concern has been expressed about the possible radiation hazard from the ionization smoke detectors. These detectors do not give off harmful amounts of radiation while in use in the home. The problem lies in disposal. These units should be sent back to the manufacturer for disposal.

10 cents per copy

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