

June 2, 1964

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3,135,950

FIRE DETECTING UNIT

Filed Aug. 14, 1961

2 Sheets-Sheet 1

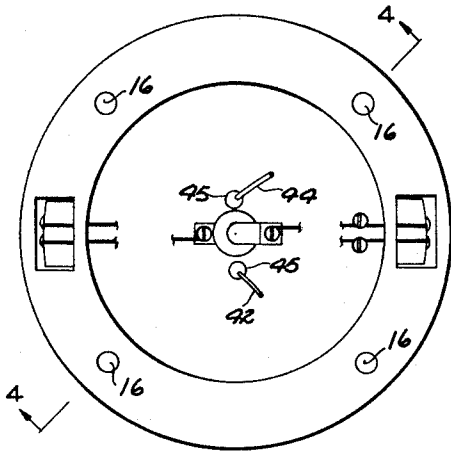


FIG. 1

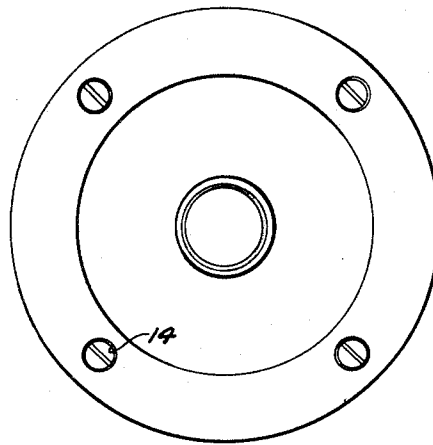


FIG. 3

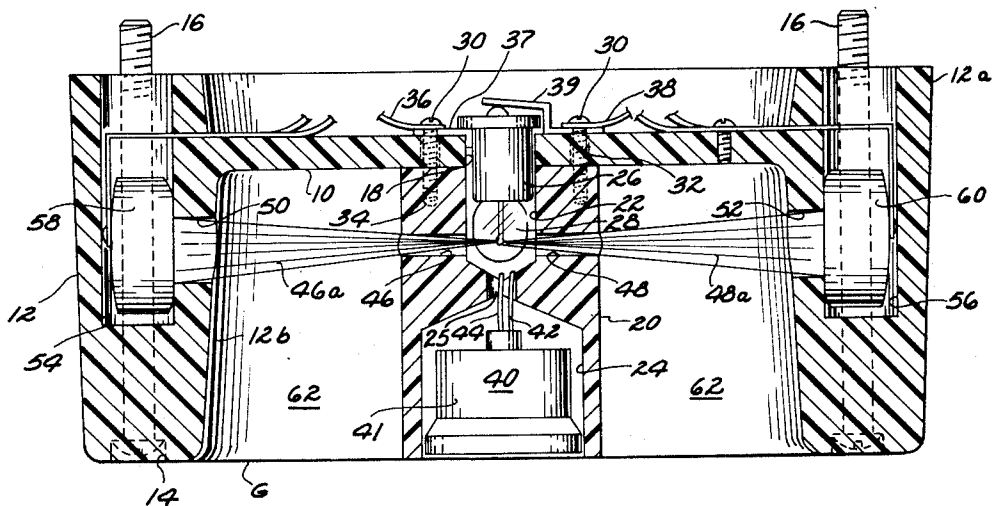


FIG. 2

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FIG. 4

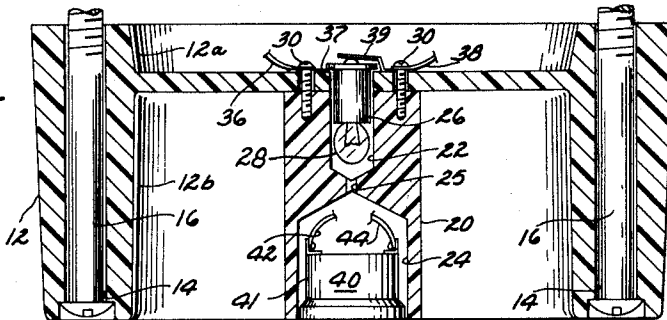


FIG. 5

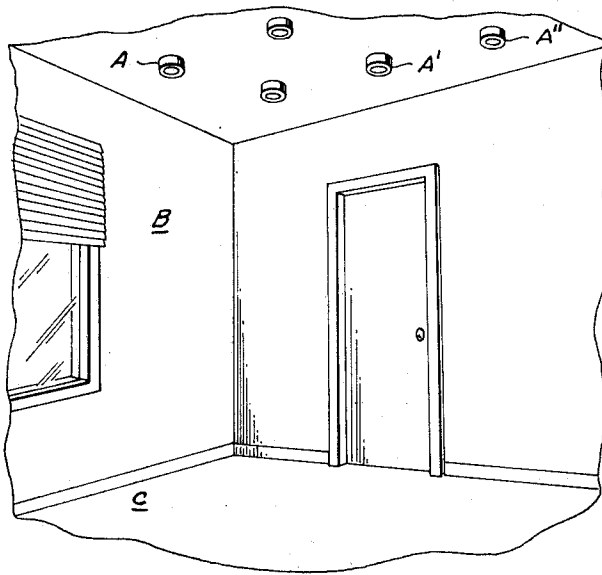
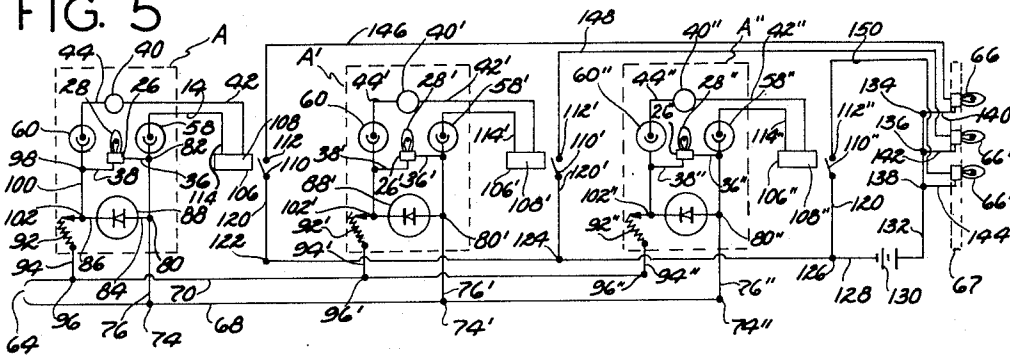


FIG. 6

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FIRE DETECTING UNIT

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Filed Aug. 14, 1961, Ser. No. 131,180
6 Claims. (Cl. 340—237)

The present invention relates generally to the field of fire detecting devices, and more particularly to a device that causes an alarm to be given either by the presence of smoke in a particular location or when the temperature of the ambient atmosphere at that location rises above a predetermined level.

The initiation of a fire in a residence or commercial building may be signaled by the presence of smoke if combustible items such as upholstered furniture, a mattress or the like, which burn with difficulty, are first ignited. However, a fire may also start with little or no smoke being initially present yet with an abnormally high temperature, as in the case of such highly combustible materials as cleaning solvent, gasoline, dry wood or draperies are first ignited.

It is well known that irrespective of the type of fire initially started, tremendous damage can be done by this fire unless it is brought under early control. Accordingly, it is of equal importance that the earliest possible warning be given of the presence of a fire, irrespective of whether it is of the type that initially smolders or one characterized by a high initial temperature and a minimum of smoke. In the past, various types of fire detecting devices have been devised and used to a limited extent, but the majority thereof have been actuated either by a rise in the temperature to an abnormal level or the presence of smoke in a building. Such prior devices have not been entirely satisfactory, for in many instances serious damage has been done to buildings by fire due to the fact that the fire did not immediately manifest the particular characteristics that would actuate the fire detecting device. It will be evident that in order for a fire alarm system to be of maximum value, it must be actuated either by the presence of smoke in one or more predetermined locations in a building or the temperature in one of these locations rises above a normal level.

A major object of the present invention is to provide a fire detecting unit that can be incorporated in existing fire alarm systems or can be installed with suitable electrical circuits as a completely new alarm system in either homes or commercial buildings.

Another object of the invention is to provide a fire detecting unit that is of extremely simple mechanical structure, is attractive in appearance when installed, can be manufactured from standard commercially available materials, and can be energized by a low voltage electrical supply.

These and other objects of the present invention will become apparent from the following description of a preferred and certain alternate forms thereof and from the drawings illustrating the same in which:

FIGURE 1 is a top plan view of the preferred form of the fire detecting unit;

FIGURE 2 is a vertical cross-sectional view of the unit shown in FIGURE 1 taken on line 2—2 thereof;

FIGURE 3 is a bottom plan view of the unit;

FIGURE 4 is a vertical cross-sectional view of the unit taken on line 4—4 of FIGURE 1;

FIGURE 5 is a diagram of an electrical circuit that may be used with the unit; and

FIGURE 6 is a perspective view of an area in which a number of the detectors are installed in the ceiling.

Referring now to FIGURES 1 and 2 of the drawings for the general arrangement of the preferred form of fire detecting unit, it will be seen to include a circular plate 10 having a cylindrical side wall 12 of substantial thick-

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ness supported from the outer extremity of the plate. A portion 12a of the side wall extends upwardly above the plate, and a portion 12b downwardly therefrom. A number of circumferentially spaced bores 14 extending upwardly through the side wall 12 are adapted to have screws 16 disposed therein. Screws 16 engage tapped openings, or the like, formed in the ceiling, wall or floor in which a fire detecting unit A is to be installed, to support the unit thereon, as may best be seen in FIGURE 6.

A centrally located bore 18 is formed in plate 10. A housing 20 of generally cylindrical shape is provided in which a cavity 22 is formed that extends downwardly from the upper surface thereof, and a second cavity 24 extends upwardly from the lower end of the housing (FIGURE 2). Cavities 22 and 24 are preferably connected by a passage 25 formed in housing 20. A socket 26 removably supports a small electric incandescent bulb 28 which is disposed within the confines of cavity 22.

Housing 20 is removably supported from plate 10 by a number of screws 30 that project downwardly through openings 32 formed in the plate to engage tapped bores 34 extending downwardly in the housing from the upper surface thereof. One of the screws 30 removably engages an electrical conductor 36 which is rigidly connected to the socket 26, as well as a spring clip 37, that is in electrical communication with one terminal of bulb 28. A second electrical conductor 38 is rigidly held in a fixed position on the upper surface of plate 10 by another of the screws 30. This second conductor 38 is held in electrical communication with a second terminal of bulb 28 by means of a second spring clip 39. Plate 10, as well as the housing 20 are preferably formed from a polymerized resin, which is an electrical non-conductor, and accordingly the screws 30 and the first and second electrical conductors 36 and 38 are insulated from one another.

A thermostat 40 is provided which includes a bimetallic disc (not shown) that is housed in a cylindrical container 41. This disc, by means not shown, is in electrical communication with two contacts (not shown) that are connected to two electrical conductors 42 and 44 respectively, as shown in FIGURE 1. When the temperature of the ambient atmosphere about the thermostat 40 rises above 135° F., or other selected temperature, the disc deforms out of contact with the terminals connected to conductors 42 and 44, and the electrical circuit between these two conductors is broken. Thermostat 40 fits snugly within cavity 24, as shown in FIGURE 2. The material from which housing 20 is fabricated is preferably opaque. The two conductors 42 and 44 are extended upwardly through passage 25 and cavity 22 to emerge through openings 45 formed in plate 10 (FIGURE 1).

Two oppositely disposed light tunnels 46 and 48 are formed in the upper portion of housing 20 which permit beams of light 46a and 48a to be directed into two openings 50 and 52 formed in the lower side wall portions 12b. Openings 50 and 52 communicate with two cavities 54 and 56 that extend downwardly through the side wall portion 12a into the lower portion 12b. Each of the cavities 54 and 56 have identical photo-electric cells 58 and 60 respectively disposed therein, and the electrical resistance of these cells is decreased when the beams of light 46a and 48a fall thereon. It will be apparent from an examination of the preferred form of the invention that any smoke arising from a fire, if it is lighter than air, will rise toward the detector to accumulate in the annulus-shaped space 62 defined between housing 20 and the interior surface of the lower wall portion 12b. Accumulation of smoke within space 62 decreases the intensity of the light beams 46a and 48a emitted from tunnels 46 and 48, and as less light falls on the photo-electric cells 58 and 60,

the electrical resistance thereof is increased. A number of the preferred forms of the invention may be spaced about a room or area as shown in FIGURE 7.

If the fire detectors are to be installed in an area wherein smoke caused by fire would be heavier than air, the detectors, referred to generally in the drawings by the letter A, would be installed in the lower portions of the walls B or in the floor C. The smoke, being heavier than air, would tend to accumulate in the spaces 62 of the detectors as it passed along or towards the floor C.

The manner in which each fire detector A is electrically connected to a source of electrical energy 64 to energize a particular incandescent bulb 66 on a switchboard 67 to not only signal the presence of a fire but the location thereof in a plant or building, is shown in FIGURE 5. The components included in each of the fire detecting units A is enclosed within a dotted rectangle 65 in FIGURE 5. The component parts of each fire detecting unit A are the same, and accordingly only one unit will be described. The like components in the fire detecting units A' and A'' are identified by the same identifying numerals of unit A, but to which a prime and double prime have been added.

Two electrical conductors 68 and 70 are provided for supplying electrical energy to the units A, A' and A''. Conductors 68 and 70 are connected to the source 64 of electrical energy which is preferably low voltage direct current. The direct current at source 64 may be obtained by rectification of a domestic alternating supply. Also, in order that operation of the alarm system may continue in the event of failure of the domestic source of power, an auxiliary power source (not shown) such as batteries or the like, may be provided that is cut in automatically upon failure of the domestic source.

For the purposes of illustration herein, the invention is shown in FIGURE 5 as including three fire detecting units A, but it will be apparent that as many units as desired may be included in the system. Each unit A, A' and A'' has a corresponding incandescent bulb 66, 66' and 66'' on switchboard 67 that is illuminated when a unit is energized upon an outbreak of a fire.

Electrical conductor 68 has three junction points 74, 74' and 74'' therein from which electrical conductors 76, 76' and 76'' extend to one terminal of photo-electric cells 58, 58' and 58''. Conductor 76 includes two junction points 80 and 82 from which conductors 84 and 36 extend. Conductor 84 is connected to one terminal of a Zener diode glow tube 88, or a General Electric 18-29 tube. The opposite terminal of tube 88 is connected by a conductor 86 to a variable resistance 92. A conductor 94 extends from resistance 92 to a junction point 96 on conductor 70. Conductor 38 extends from socket 26 to a junction point 98 in a conductor 100. Conductor 100 extends from a junction point 102 in conductor 86 to one terminal of photo-electric cell 60.

Unit A has a relay 106 that includes a solenoid 108, armature 110, and contact 112. When solenoid 108 is electrically energized above a predetermined voltage, armature 110 is held out of engagement with contact 112. Armature 110 is in engagement with contact 112 when solenoid 108 is not energized or when the current flowing to solenoid 108 falls below this predetermined voltage. One terminal of solenoid 108 is connected to a second terminal of photoelectric cell 58 by conductor 114. The other solenoid 108 is connected by conductor 42 to one terminal of thermostat 40, with the second terminal of the thermostat being connected by conductor 44 to a second terminal of photoelectric cell 60.

Relay armatures 110, 110' and 110'' are connected by conductors 120, 120' and 120'' respectively to contact points 122, 124 and 126 in a conductor 128. Conductor 128 extends to one terminal of a second source of electric power 130. The other terminal of the source of power 130 is connected to a conductor 132 which includes junction points 134, 136 and 138. Conductors 140, 142 and 144 extend from junction points 134, 136 and 138 respec-

tively to terminals of incandescent bulbs 66, 66' and 66'' (FIGURE 5). The other terminals of incandescent bulbs 66, 66' and 66'' are connected by conductors 146, 148 and 150 to contacts 112, 112' and 112'' respectively. The resistances 92' and 92'' are connected by conductors 94' and 94'' respectively to junction points 96' and 96'' in conductor 70.

The use of the fire detecting units A when electrically connected as shown in FIGURE 5 and installed as illustrated in FIGURE 6 is quite simple. Line voltage fluctuations at source 64, line loss, and small differences in the same type of bulb 28 are compensated for by utilizing the Zener diode tube 88 and the variable resistance 92. The electrical energy supplied at the junction points 82 and 98 is accordingly constant. By means of the variable resistance 92, the voltage supplied at junction points 82 and 98 is just sufficient to energize solenoid 108 to the extent that armature 110 is maintained in the open position.

In the event of a fire and when smoke enters the space 62, the intensity of the beams of light 46a and 48a falling on cells 58 and 60 is diminished, causing a corresponding increase in the electrical resistance of these cells. This increased resistance of the cells results in a drop in the voltage supplied to relay solenoid 108 whereby the solenoid permits armature 110 to move to a closed position to engage contact 112. When armature 110 moves to the closed position, bulb 66 is lighted, for the circuit from the electrical source 130 is completed thereto. Lighting of bulb 66 not only signals the presence of a fire, but due to the fact that the location of the unit A associated with bulb 66 is known, the particular area in which the fire has started is also known. If unit A' or A'' (FIGURES 5 and 6) is actuated by the presence of a fire, the operation thereof would be the same as above described, but with illumination of the bulb 66' or 66'', as the case may be.

Should a fire which gives off little smoke break out in an area protected by the invention, the presence of the fire will still be signalled by illumination of one of the bulbs 66, 66' or 66''. A fire of this type will heat the area around one of the thermostats 40, 40' or 40'' to the extent that the thermostat will assume an open position, and the circuit to relay solenoids 108, 108' or 108'' will be broken. The circuit from electrical source 130 to one of the bulbs 66, 66' or 66'' is then completed in the same manner previously described.

It will be obvious that if a large fire gets under way, more than one of the bulbs 66, 66' or 66'' will be illuminated, due to actuation of more than one of the units A, A' and A''. Thus, the invention not only signals the presence of a fire, the location of the fire, but the magnitude of the fire and the extent of the area over which it has spread.

The source 64 of electrical energy is preferably derived from the line side of the master switch (not shown) that controls the supply of electrical energy to that area protected by the invention. In this manner any fault existing in the electrical circuit past the main switch before the main fuses (not shown) will not interrupt the function of the invention.

The lower open end of the invention, as may best be seen in FIGURE 2, is preferably covered with a porous sheet material G, that may be of the same color as the ceiling or wall in which the invention is installed. Material G must be sufficiently porous as to permit smoke to pass readily therethrough into space 62, and in addition to improving the appearance of the installation, material G also serves to prevent insects and bugs from entering space 62 to perhaps actuate the system by obstructing all or a portion of one of the light beams 46a and 48a relative to one of the cells 58 or 60.

It will be apparent that the polymerized resin used in forming the inventions must be heat resistant, and urea base plastics have been found from experience to be quite

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satisfactory for this purpose. Although the source of electrical power 130 is shown separate from source 64, the two sources may be one and the same if desired.

Although the present invention is fully capable of achieving the objects and providing the advantages hereinbefore mentioned it is to be understood that it is merely illustrative of the presently preferred embodiment thereof and I do not mean to be limited to the details of construction herein shown and described, other than as defined in the appended claims.

I claim:

1. A fire detecting unit for energizing an electrically operated alarm when either the ambient atmosphere in a building in which said unit is situated rises above a predetermined temperature or smoke is present in said atmosphere, including:

- (a) a plate;
- (b) a continuous wall projecting from a first side of said plate;
- (c) an opaque housing projecting from said first side and disposed inside said wall, said wall, plate and housing cooperating to define an annulus-shaped smoke receiving space, said housing having longitudinally spaced first and second cavities therein, and a transverse light tunnel that is in communication with said first cavity and said annulus-shaped space;
- (d) first means for supporting said plate at a position in said structure towards which smoke will tend to move in case of a fire;
- (e) a solenoid operated relay that remains open only so long as an electric current is supplied to said solenoid above a predetermined minimum voltage;
- (f) a first electric circuit capable of supplying electrical energy to said solenoid of said relay at above said minimum voltage;
- (g) electrically operated light generating means in said first cavity that form a part of said first circuit, with light from said generating means passing as a beam from said tunnel into said space;
- (h) photo-electric means that form a part of said first circuit supported from said wall and in radial alignment with said tunnel to have said beam of light fall thereon, said photo-electric means increasing in resistance as the intensity of said beam diminishes due to presence of smoke in said annulus-shaped space;
- (i) a normally closed thermostat that forms a part of said first circuit and disposed in said second cavity, said thermostat opening to break said first circuit when said ambient atmosphere rises above said predetermined temperature;

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(j) first means forming a part of said first circuit for holding the voltage supplied to said light generating means constant and at a magnitude greater than said predetermined minimum voltage; and

(k) a second normally open electric circuit of which said solenoid operated relay and alarm form a part, said second circuit being closed to energize said alarm by either said thermostat opening to break said first circuit to said solenoid operated relay due to said ambient atmosphere rising above said predetermined temperature, or the magnitude of the current in said first circuit dropping below said predetermined voltage due to increase in resistance of said photo-electric means by smoke accumulating in said annulus-shaped space to lessen the intensity of said beam of light falling on said photo-electric means.

2. A fire detection unit as defined in claim 1 wherein said first means is a diode tube and a variable resistance.

3. A fire detection unit as defined in claim 1 wherein said plate and wall are integral and formed from a heat resistant polymerized resin.

4. A fire detection unit as defined in claim 1 wherein said means for mounting said plate are a plurality of elongate rigid members that extend upwardly through a plurality of bores formed in said wall, said bores being substantially normal relative to said plate.

5. A fire detection unit as defined in claim 1 which further includes a plurality of screws that extend through a plurality of bores in said plate to engage a plurality of tapped recesses formed in said housing to removably support said housing from said plate.

6. A fire detecting unit as defined in claim 1 in which said wall has a third cavity therein and an opening extending from said cavity to communicate with said annulus-shaped space, said third cavity and opening being in radial alignment with said light tunnel, and said photo-electric means disposed in said third cavity and supported by said wall.

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