



GAS AND SMOKE ALARM

BACKGROUND OF THE INVENTION

The invention relates to gas and smoke sensor alarms such as those used in fixed and mobile dwellings and in commercial establishments wherein smoke is an early indication of fire and where poisonous or noxious gases can be encountered. One of the problems with such alarms is cost. Sensitivity can be achieved at a high cost and in a compact package with conventional devices. However, the instant invention provides a gas and smoke sensor alarm of controlled sensitivity and extreme reliability at a cost substantially below that of alarms of comparable quality. Known components are combined in unique fashion to achieve the alarm of the invention.

SUMMARY OF THE INVENTION

The invention contemplates a gas and smoke sensor alarm that comprises a semiconductor sensor sensitive to the presence of gas and smoke, a heater for the sensor and a signal lamp in series with the heater and sensor. An alarm horn deriving power from a source also connecting to the sensor through the lamp is carried by a frame. The frame combines with a U-shaped cover to define a heat flue to which the heater and sensor are proximate. The cover may be translucent. Preferably the circuit includes a reset switch in parallel with a heat responsive switch which is part of a time delay mechanism. The heat responsive switch is associated with the voltage regulating resistor for the sensor such that the reset button cutting off the horn is inoperative after the sensor heater reaches operating temperature.

These and other advantages of the invention are apparent from the following detailed description and drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevation, partly in section, of the alarm of the invention;

FIG. 2 is a front elevation, with the cover removed, of the alarm of FIG. 1;

FIG. 3 is a schematic diagram of the electrical components of the alarm; and

FIG. 4 is a fragmentary elevational detail of the time delay assembly in the reset circuit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As seen in FIGS. 1 and 2, the gas and smoke sensor alarm 10 has a frame 11 suitable for mounting the alarm to a wall or other support surface. The frame has a back panel 12 with two discontinuous segments 12A and 12B. Each segment has an end piece, 14 and 15, respectively. The end pieces are substantially parallel. A pair of spaced central ribs 16, 16A and an integral bridge 17 connect the back panel segments 12A, 12B.

A 12-volt transformer 18 and an alarm horn 19 are fixed respectively to panel segments 12A and 12B. Electrical control components of the alarm are supported from bridge 17. A threaded central post 21 is secured to the bridge by nuts 22, 22A on either side of the bridge. A circuit board 24 is secured to the post and bridge by the nut 22A. A spacer 25 separates the board from the bridge, to adjust sensor position.

Remote from the bridge, central post 21 supports a U-shaped cover 27 secured to the post by a pair of nuts

28. The cover has a front face 31 and parallel spaced sides 32, 33 which extend from the front face to approximately even with back panel 12 of frame 11.

End pieces 14, 15 of the frame extend from the back panel a lesser distance than do the parallel sides 32, 33 of the cover, such that the open ends of the cover are not completely closed. A vertical passageway indicated by the arrows is thus defined between the frame and the front face of the cover.

As can be seen from FIG. 1, a semiconductor sensor 34, a signal lamp 35 and a heating resistor 36, all of which give off heat during operation, are proximate the flue indicated by the vertical arrows. Thus, while the alarm of the invention is in operation, air flow is induced by the alarm component heat rise and air from the room is continuously drawn through the flue past the semiconductor sensor such that the room is sampled continuously during the operation of the alarm.

As inspection of FIGS. 1 and 2 shows, end piece 15 of the frame mounts a reset switch 41 and an A.C. power cord 42, which is the source of supply to the transformer. A grommet 43 secures the cord in the end piece.

Preferably the transformer is similar to one marketed under the name "Calrad" Model 45-729. As can be seen from the schematic diagram of FIG. 3, the secondary coil of the transformer has a lead 44 to one contact of the horn through a diode 58. The other side of the secondary coil connects by a lead 45 is parallel with the sensor, a sensitivity potentiometer 46, a C₂ capacitor 47, a normally closed heat-responsive switch 48 and a reset switch 41, to a silicon controlled rectifier 51 which is in series with the other contact of the horn. The SCR₁ diode 51 is similar to a General Electric Model 106B1, while the simple diode 58 may be an IN4001.

The center tap of the secondary coil connects the R₁ heating resistor 36 and the sensor 34. The sensor is connected to the horn through the CR₂ diode 53, the potentiometer 46 and R₂ resistor 54. The other contact of the heat-responsive switch 48 is to-connected with the silicon controlled rectifier 51 through lead 56 parallel with capacitor 47. Lead 44 from the secondary coil connects through a CR₁ diode 58 to the horn and to a C₁ capacitor 59 in parallel with the horn 19.

A trim potentiometer 46 between the CR₂ and CR₁ diodes may be adjusted to set the sensitivity of the sensor. Normally the sensor is calibrated with reference to a mixture of 0.1% iso-butane in argon, and set to trigger the alarm horn when smoke concentration reaches 2 to 4%, a generally accepted danger level. It has been found that a Taguchi 105 semiconductor sensor that changes conductivity with dioxidation of a sensing surface in response to the presence of gas or smoke operates with great efficiency. A representative parts list is as follows:

Transformer (18) Calrad Model 45-729
 CR₁ and CR₂ Diodes (53, 58) IN4001
 R₁ Resistor (36) 18mu - 2W 10%
 R₂ Resistor (54) 470 mu - ¼W 5%
 R₃ Resistor (46) 2.5K Bourns
 C₁ Capacitor (59) 250 mfd 15V. Mallory Electric
 C₂ Capacitor (47) 50 mfd 15V Mallory Electric
 Horn: Midi Horn 122 6V.D.C. (19)
 Light (35) GE No. 51

The apparatus of the invention has a reset button 41 in the horn circuit. Normally the button, after a service

interruption, must be held depressed for a long interval in order for the heater 63 of the sensor 34 to warm to operating temperature so conductivity is reestablished so that the reset mechanism may work. Conventionally a complicated, expensive time delay mechanism is employed for the warm-up period. The embodiment illustrated employs instead a unique combination of inexpensive parts, including integral parts of the device, to effect a time delay, at a minimum cost.

Adjacent the heating resistor 36 the alarm of the invention mounts a heat sensitive switch 48 of conventional design, normally closed when cold. Intervening between resistor and switch is a disc or wafer 61 of ceramic, with a thickness calibrated in terms of heat transfer commensurate with the warm-up period of the sensor 34 from the heater 36. Thus, the switch opens when resistor heat sufficient to actuate it penetrates the disc, effectuating the reset circuit. A time delay in the reset circuit is thus established conveniently and economically. The disc may comprise an epoxy bonding layer.

It can be observed that the signal lamp 35 is in series with the sensor heater 63. When there is flow through sensor 34 current will flow in the lamp. The signal lamp, therefore, indicates an operating sensor, not just a supply of current available. Also, since the sensor, lamp and heater resistor are adjacent the flue established by the frame and cover, heat generated by their functions induces a draft in the alarm that draws room air past the sensor in an effective room monitoring pattern.

The invention disclosed herein is not restricted to the illustrative embodiments shown and described. Other modifications within the scope of the invention will occur to those skilled in this art. For instance, proper selection of heat sensitive switch components may obviate need of the ceramic disc. It is therefore desired that the invention be measured by the appended claims rather than by the illustrative disclosure herein.

I claim:

1. A gas and smoke alarm comprising a frame, a semiconductor sensor sensitive to the presence of gas and smoke, a heater for the semiconductor sensor, a signal lamp in series with the sensor, a power source electrically connected to the sensor through the lamp, an alarm horn connected to the power source across the sensor, a reset circuit adapted to restore pre-alarm discontinuity to the horn, means for adjusting the sensitivity setting of the semiconductor sensor; said sensor, heater, lamp and horn being secured to said frame; a cover for the frame, and a heat flue defined by the cover and the frame, said heat flue opening upon at least one of said heater, lamp and semiconductor sensor so as to induce convection flow in the flue for sampling ambient atmosphere.

2. Apparatus in accordance with claim 1 further comprising a central post supported on the frame; a circuitry board secured to the post and holding said sensor, lamp and heater; and means on the post securing

the cover at an interval from the frame.

3. Apparatus in accordance with claim 1 wherein said frame comprises parallel end pieces spaced from the cover, spaced central ribs parallel to the end pieces, a back panel connecting the end pieces and the ribs, and a bridge between the ribs intermediate the back panel and the cover adapted to support the central post.

4. Apparatus in accordance with claim 3 wherein the cover comprises a front panel secured to the post, and parallel spaced sides surrounding the frame and extending at least between frame end pieces.

5. Apparatus in accordance with claim 1 wherein said cover is light permeable in the area of the lamp.

6. Apparatus in accordance with claim 1 further comprising time delay means in series with said reset switch in the power circuit for the alarm horn.

7. A gas and smoke sensitive alarm for use with an exterior power source and comprising a frame adapted to mount to a wall, an alarm horn fixed to the frame, a transformer fixed to the frame, a gas and smoke sensor, a signal lamp, a voltage regulating resistor for the sensor, electrical means linking the transformer, lamp and sensor with the horn, said transformer being electrically connected to the sensor through the lamp; means for adjusting the sensitivity setting of the sensor, a reset switch electrically interposed between horn and sensor, time delay means in parallel with the reset switch responsive to the heat condition of the regulating resistor for the sensor, a printed circuit board supporting the lamp, resistor and sensor; a cover for the frame, means supporting both the circuit board and the cover from the frame, and a heat flue defined by the cover and the frame, said heat flue being open to said regulating resistor, lamp and sensor.

8. Apparatus in accordance with claim 7 wherein the time delay means comprises a heat sensitive switch that is normally closed cold, and a heat transfer means in contact with the switch and intervening between the switch and said heat resistor for the sensor.

9. Apparatus in accordance with claim 8 further comprising a central post supported on the frame; a circuitry board secured to the post and holding the sensor, lamp and heater; and means on the post securing the cover at an interval from the frame.

10. Apparatus in accordance with claim 8 wherein said frame comprises parallel end pieces spaced from the cover spaced central ribs parallel to the end pieces, a back panel connecting the end pieces and the ribs, and a bridge between the ribs intermediate the back panel and the cover adapted to support the central post.

11. Apparatus in accordance with claim 8 wherein the cover comprises a front panel secured to the post, and parallel spaced sides surrounding the frame and extending at least between frame end pieces.

12. Apparatus in accordance with claim 8 wherein the cover is light permeable in the area adjacent the lamp.

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