

[54] SMOKE DETECTOR

[76] Inventor: Joseph Mooibroek, 8673 Hillside Trail, Cottage Grove, Minn. 55016

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[51] Int. Cl.² G08B 17/10

[58] Field of Search 250/573, 574, 576, 564, 250/239; 356/103, 207; 340/237 S

[56] References Cited

UNITED STATES PATENTS

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Primary Examiner—James W. Lawrence
Assistant Examiner—E. R. LaRoche
Attorney, Agent, or Firm—Neil B. Schulte

[57] ABSTRACT

An optical smoke detector having three concentric walls with staggered openings so as to insure an absolutely dark interior chamber wherein light reflected from smoke particles may be detected but still permitting easy entry of smoke into the darkened chamber including also a special housing surrounding the chamber which housing has a large number of narrow slots designed to disrupt the flow of air and encourage the entry of smoke into the chamber.

10 Claims, 4 Drawing Figures

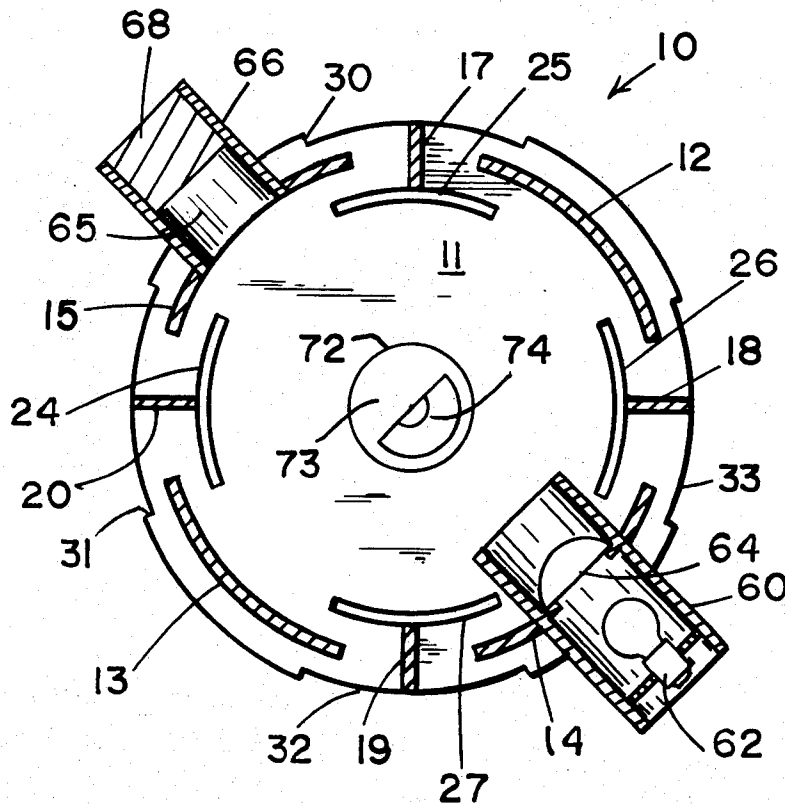


FIG. 1

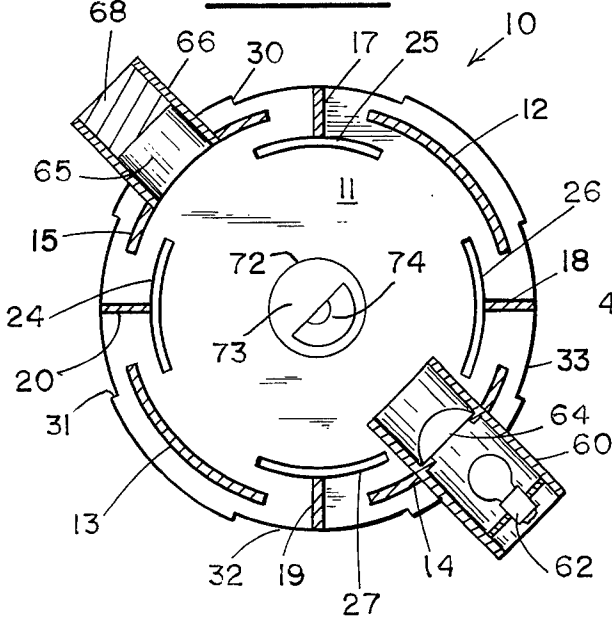


FIG. 2

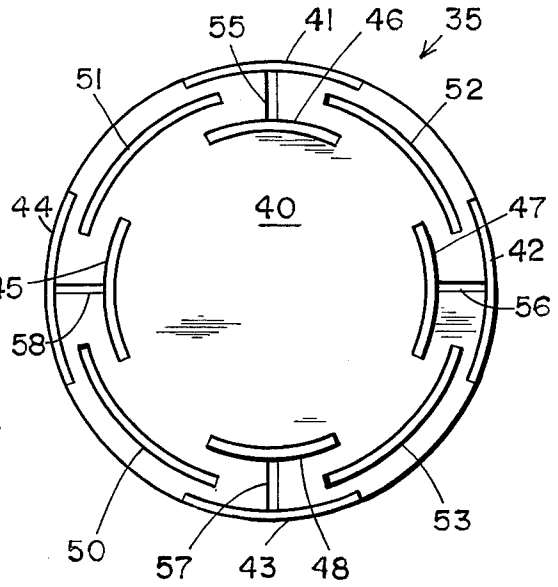


FIG. 4

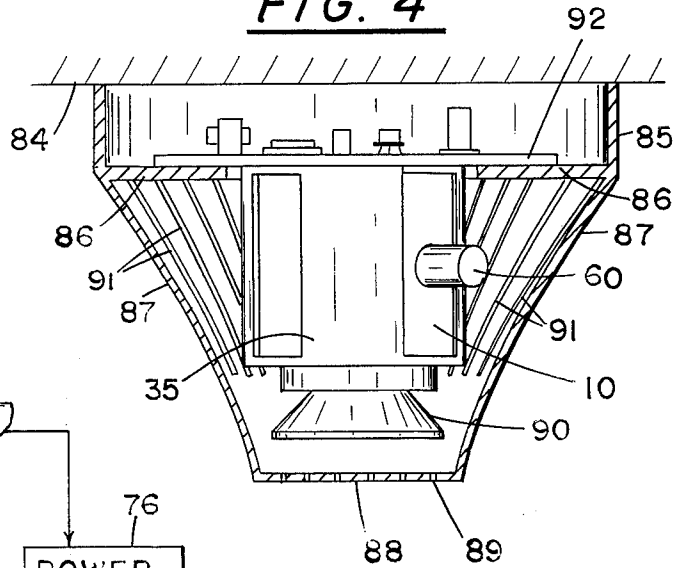
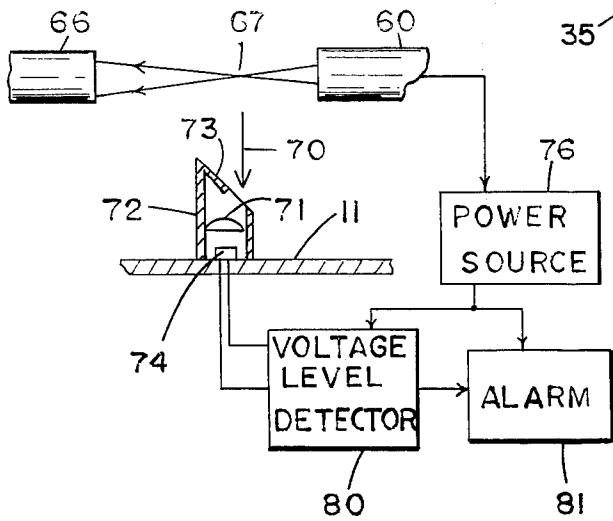


FIG. 3



SMOKE DETECTOR

BACKGROUND OF THE INVENTION

It is known that one can detect smoke particles in the air effectively by providing a totally dark chamber which the smoke may enter and positioning in the dark chamber a light source to project light through the smoke. A light detector is aimed approximately perpendicular to the source light path to sense any optical radiation reflected from smoke particles in the air. These prior art smoke detectors suffer from a basic problem in that it is very difficult to make a chamber which is open enough to easily admit smoke and yet totally dark inside. If stray outside radiation enters the chamber it triggers the detector giving a false alarm. If the openings in the chamber are made very small so as to keep out light, one finds that the chamber is extremely slow to respond to smoke in the air since the smoke takes a long time to find its way into the chamber. Conversely, if relatively large openings are utilized so that the smoke reaches the inside of the chamber promptly, one then finds that it is possible for light to leak into the chamber and the threshold of the detector has to be adjusted upward making the device much too insensitive. If the threshold is not adjusted upward the alarm will be triggered by changes in room light intensity. Thus, extreme care must be taken in the positioning of the detector relative to the room lights. My invention, however, overcomes these difficulties as explained hereinafter.

SUMMARY OF THE INVENTION

Briefly, the present invention overcomes the above difficulties by providing a unique new chamber design using three concentric walls with staggered openings. This arrangement ensures that outside light will have to make several reflections off a non-reflecting surface before it could possibly enter the inside of the chamber. Consequently, the openings can be made quite large allowing easy entry of smoke into the chamber. Accordingly, it is possible to have a device which will respond quickly and still have a high sensitivity. Additionally, the present invention includes a special housing surrounding the detection chamber which includes a large number of narrow flow disrupting slots. This housing not only protects the chamber itself but the slots break up the air flow around the device causing eddy currents which bring in the smoke and encourage its flow into the detection chamber. It may therefore be seen that it is an object of my invention to provide an improved smoke detector which is more sensitive and faster reacting than those of the prior art. Further objects and advantages will become apparent upon consideration of the following detailed description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The smoke detector of the present invention comprises a detection chamber made up of two intermeshing end pieces having the walls molded directly thereto and extending toward each other in an interlocking relationship shown in the drawings as follows:

FIG. 1 shows the first end piece with its arcuate and radial walls sectioned so as to better show the radiation source;

FIG. 2 shows the other end closure with its radial walls extending therefrom but not in section;

FIG. 3 is a schematic diagram showing the optical and electrical circuit paths; and

FIG. 4 is a side view of the assembled smoke detection device inside the housing, which housing is shown in section to provide a better view thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 the first end closure and wall assembly 10 is shown which includes an end closure plate 11 generally in the shape of a disc. Molded integrally with end closure disc 11 are four arcuate walls 12, 13, 14 and 15 which extend up out of the plane of the paper in FIG. 1 and are shown in section. Also extending up from disc shaped end closure 11, and molded integrally therewith, are four radial walls 17, 18, 19 and 20 also shown in section. End closure disc 11 further includes four arcuate shaped slots 24, 25, 26 and 27 which accept the arcuate walls extending from the other end closure piece 35 shown in FIG. 2. It should also be noted in FIG. 1 that the end closure 11 includes four arcuate peripherally positioned slots or indentations 30, 31, 32, and 33. These peripheral indentations accept the outer walls extending up from the other end enclosure shown in FIG. 2.

Turning for a moment to FIG. 2, the other end closure and wall assembly 35 includes disc shaped end closure 40 which is also molded integrally with a number of arcuate walls extending up out of the plane of the paper in FIG. 2. Four outer peripheral arcuate walls 41, 42, 43 and 44 are shown in FIG. 2 along with four inner arcuate walls 45, 46, 47 and 48. When the device is assembled these inner arcuate walls 45 through 48 fit snugly into slots 24 through 27 in end closure 11. Likewise the outer arcuate walls 41 through 44 fit snugly into the peripheral indentations 30 through 33 in end closure 11. Still referring to FIG. 2, end closure disc 40 also has molded integrally therein four arcuate indentations 50, 51, 52 and 53 which do not reach through disc 40 but serve to accept the ends of arcuate walls 12, 13, 14 and 15 on the other end closure 11. End closure 40 in FIG. 2 also has four radial indentations 55, 56, 57, and 58 which accept radial walls 17 through 20 extending from end closure 11. It may therefore be seen that the end assemblies 10 and 35 may be slid together with all of the walls fitting snugly into corresponding slots in the opposite end closure so as to form an entirely closed chamber having three, concentric, cylindrical walls wherein all of the openings therethrough are staggered so as to prevent any direct optical paths from existing from the outside of the chamber to the interior of the chamber. The assembled smoke detector may be seen clearly in FIG. 4 where it is shown mounted inside the outer protective housing 87.

Returning again to FIG. 1 it may be seen that the components for the optical system are mounted on end closure assembly 10. Molded into the intermediate arcuate wall 14 is a tubular housing 60 which includes mounted therein a light source 62 which, for example, may be a light bulb or any other radiation source. A lens 64 is also mounted in housing 60. Lens 64 is designed to focus the radiation approximately at the center of the chamber directly above a detector housing 72. As the light diverges again it is trapped in a receiving chamber 65 in a housing 66 molded into arcuate wall 15. Tubular housing 66 is closed by a suitable plug 68 so as to prevent the entry of any unwanted light.

A radiation detector 74 is mounted inside the housing 72 which housing has a beveled top surface 73 and contains a lens 71. Housing 72 is mounted centrally on the inside surface of end closure disc 11 and may be more clearly seen in FIG. 3. In FIG. 3 it may be seen that the light from source tube 60 is focused at point 67 approximately above the housing 72 containing light detector 74. If any smoke particles are present in the air of the smoke detection chamber, light is scattered therefrom along the path of the arrow 70 in FIG. 3 entering the small semicircular opening in the beveled top 73 and passing through lens 71 to impinge on detector 74. Lens 71 is focused at point 67 so that detector 74 is especially sensitive to light from that location. Beveled top 73 prevents the entry of any radiation which might possibly be reflected from radiation trapping chamber 65 in housing 66. Because of the bevel 73 any radiation coming from that direction can not enter the opening in the top of detector housing 72. When detector 74 is activated a voltage is generated which is detected by voltage level detector 80. Detector 80 is connected to activate a suitable alarm 81 which may comprise, for example, a horn 90 mounted on the bottom of the smoke detection chamber as shown in FIG. 4. Other alarms of course could be utilized depending upon the needs of the user. A power source 76 supplies power to drive voltage detector 80, alarm 81 and radiation source 62. All of the electronic components comprising voltage level detector 80 and the power source 76 may be mounted on a suitable circuit board 92 as shown in FIG. 4.

Normally, it is desirable to mount a smoke detector on the ceiling and thus it is so shown in FIG. 4 mounted to a ceiling surface 84. The entire detector is surrounded by a housing 87 which in the preferred embodiment includes a cylindrical section 85 enclosing the electronic circuit board, a ledge 86 for supporting the circuit board 92, and a tapered cone section having a large number of narrow elongated air flow disrupting slots 91. It has been found that the provision of a large number of narrow slots 91, as shown, prevents the air from simply flowing past the housing by creating turbulence so that the smoke is caused to flow into the slots and into the openings in the smoke detecting chamber. The entire smoke detection chamber can be mounted directly to the bottom of circuit board 92 so as to provide relatively short connections between the radiation source 62, the detector 74, and the electronic circuits. As mentioned before, the alarm can be mounted directly to the bottom of the detection chamber. Holes 89 are provided in the bottom 88 of the housing 87 so as to facilitate the exit of sound therefrom and to also encourage the entry of smoke. In FIG. 4 it will be apparent to one having ordinary skill in the art that the particular shape of the housing could be varied along with the position of the electronic components and the type of alarm. Since a number of variations are possible without departing from the spirit and scope of the invention I intend to be limited only to the following appended claims.

I claim:

1. A smoke detector comprising in combination:
 - a detection chamber comprising a first outer generally cylindrical foraminous wall, a second generally cylindrical foraminous wall inside said first wall, a third inner generally cylindrical foraminous wall inside said second wall, the openings in said walls staggered relative to each other, and radial walls extending between said first and third walls in the openings in said second wall said walls preventing the existence of any straight optical paths from outside the detection chamber to inside the chamber and further including first and second end closures to prevent the entry of spurious radiation;
 - a radiation source operable to direct light into said chamber;
 - a radiation detector positioned out of the path of radiation from said source but in position to receive any radiation from said source which reflects from smoke particles in said chamber; and
 - means connected to said detector to sense the reception of radiation thereby and trigger a suitable alarm.
2. The apparatus of claim 1 including a housing surrounding said chamber, said housing having a large number of flow disrupting slots about its periphery in order to encourage the entry of smoke thereinto.
3. The apparatus of claim 1 in which the first and third walls are formed integrally with the first end closure and said second wall is formed integrally with said second end closure.
4. The apparatus of claim 3 including a housing surrounding said chamber, said housing having a large number of narrow flow disrupting slots about its periphery in order to encourage the entry of smoke thereinto.
5. The apparatus of claim 3 in which said radial walls are formed integrally with and extend up from said second end closure, said radial walls having a width approximately equal to the radial distance from said first wall to said third wall.
6. The apparatus of claim 5 including slots in each of the end closures sized, shaped and positioned to snugly accept the ends of the cylindrical walls and any radial walls extending from the opposite end closure.
7. The apparatus of claim 6 including a housing surrounding said chamber, said housing having a large number of flow disrupting slots about its periphery so as to encourage the entry of smoke thereinto.
8. The apparatus of claim 7 in which said first, second, and third walls are approximately concentric.
9. The apparatus of claim 8 in which said radiation source is mounted in said second wall and generally through openings in said first and third walls so as to direct radiation generally perpendicular to the central axis of said generally cylindrical walls.
10. The apparatus of claim 9 in which said detector is mounted about at the center of said second end closure to detect radiation reflected generally along said axis.

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