

[54] SMOKE DETECTOR

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[51] Int. Cl. **G01n 21/12, G01n 21/26**

[58] Field of Search **356/103, 207; 340/237 S;**
250/239

[56] References Cited

UNITED STATES PATENTS

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[57]

ABSTRACT

A smoke detector assembly in which the components are designed for rapid assembly with a minimum amount of labor, in which a molded mounting plate and a molded retaining plate co-operate with a cylindrical labyrinth wall to form a dark chamber into which smoke can diffuse from either side. The molded components are provided with inter-engaging portions to eliminate any possibility of improper assembly.

In one embodiment of the invention the photo-cell for detecting the presence of smoke is positioned to view the dark chamber through the mounting plate axially of the labyrinth wall, whereby the reflected light received by the photo-cell under conditions of no-smoke is a minimum.

In another embodiment of the invention the rear face of the mounting plate also serves as the support for various electronic components of the detector circuit, and is provided with rearwardly extending connectors for insertion into suitable sockets in a mounting box.

5 Claims, 5 Drawing Figures

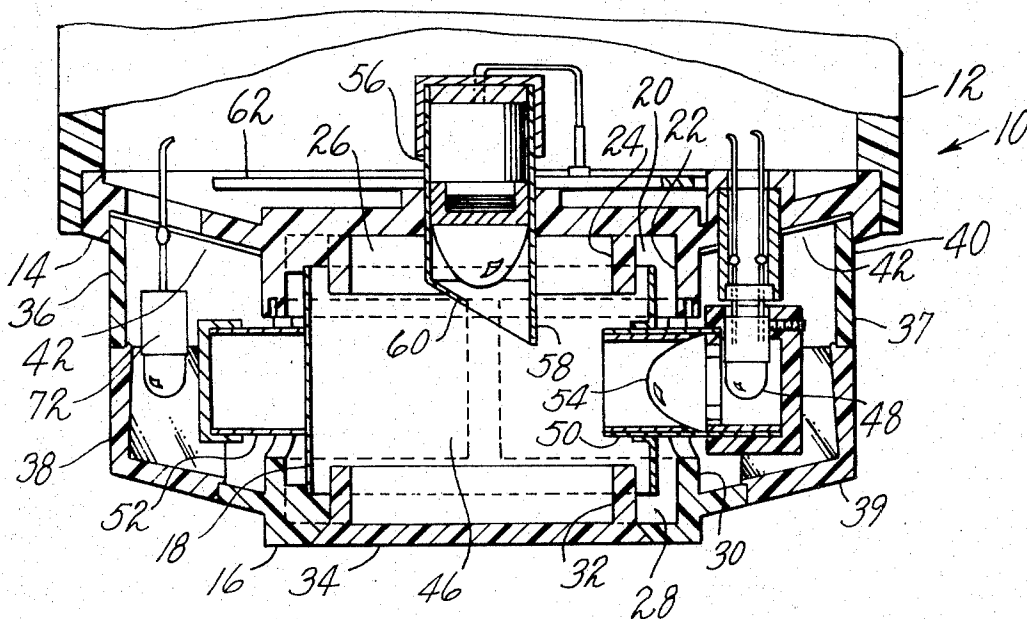


Fig. 1

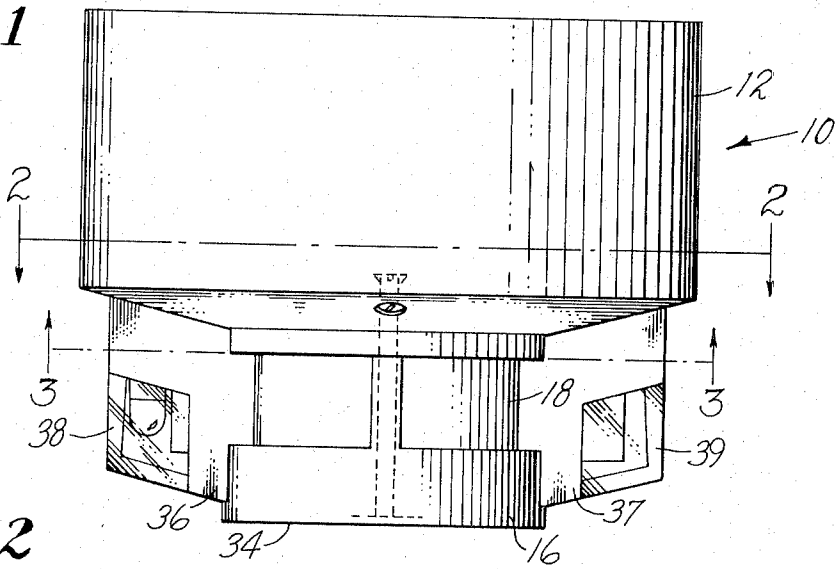


Fig. 2

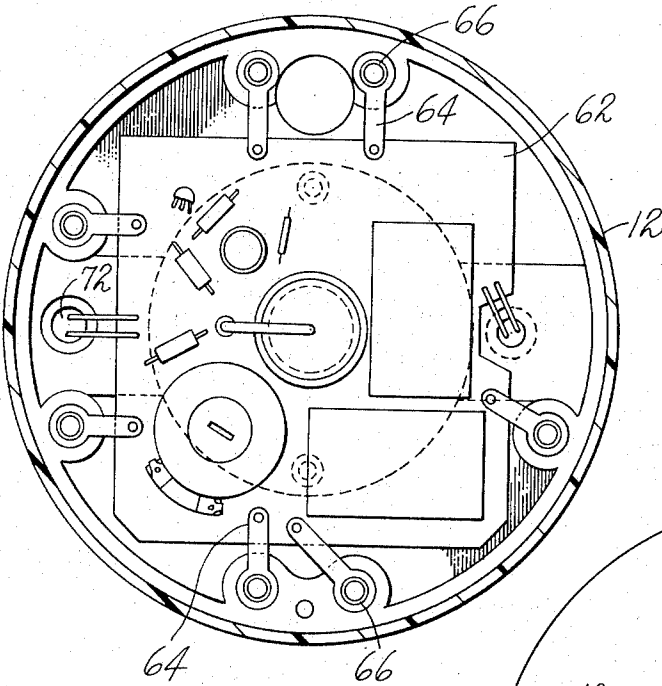


Fig. 3

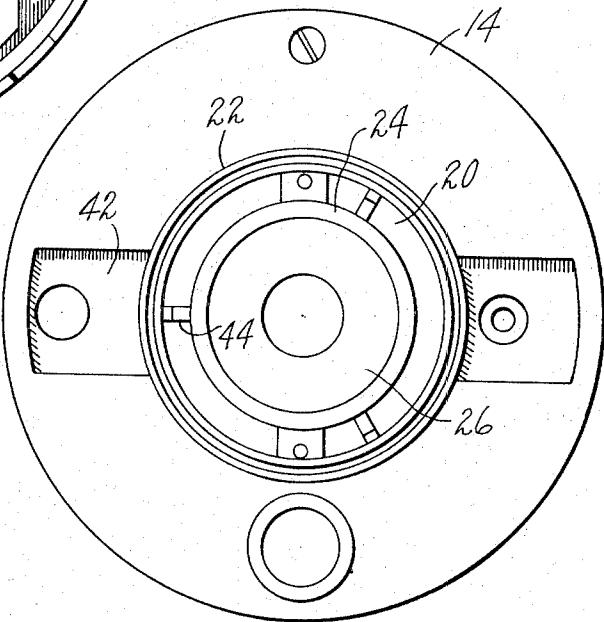
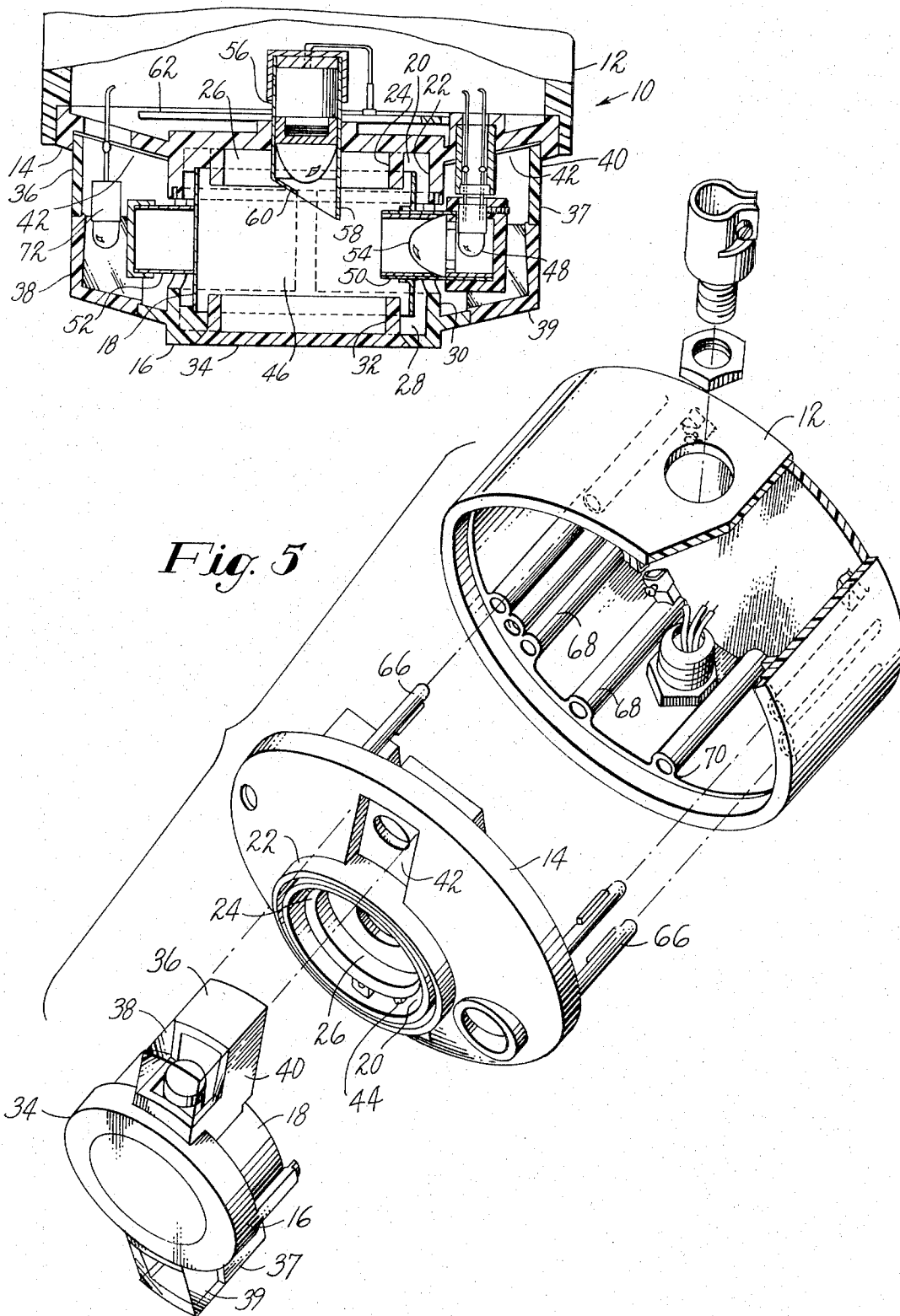


Fig. 4



SMOKE DETECTOR

SUMMARY OF THE INVENTION

In accordance with this invention a smoke detector assembly comprises a mounting plate which, in one embodiment, may carry on its rear surface the necessary electronic components, and a retaining ring assembled on the forward face thereof, with a cylindrical labyrinth wall being retained between the retaining ring and the mounting plate. Both the mounting plate and the retaining ring are formed of molded plastic with interengaging means to insure proper assembly and have recesses receiving the ends of the labyrinth wall. The mounting plate, retaining ring, and labyrinth wall form a dark chamber into which ambient atmosphere can diffuse through appropriate apertures at each end of the labyrinth wall.

In one embodiment of the invention the light beam is projected across the dark chamber through the labyrinth wall in a direction perpendicular to the axis thereof, and the photo-cell views the medial portion of the light beam through an aperture in the mounting plate, in a direction parallel to the axis of the labyrinth wall.

In another embodiment of the invention the rear face of the mounting plate is provided with rearwardly protruding electrical connectors, and a mounting box is provided with suitable receptacles for receiving said connectors, so that the pre-wired smoke detector can be utilized as a plug-in unit.

BACKGROUND OF THE INVENTION

This invention relates generally to smoke detectors operating on the reflected light principle, in which a dark chamber is provided with means allowing ambient atmosphere to diffuse into the chamber, with a light beam projected across the chamber. A photo-cell is positioned to view the center of the light beam transversely, and is shielded from radiation from the light source. When the atmosphere surrounding the chamber contains smoke, it diffuses into the chamber. When a predetermined smoke concentration is reached, the light reflected onto the photo-cell from smoke particles in the light beam causes the resistance of the photo-cell to decrease, which change is utilized to actuate an alarm through suitable circuitry. A smoke detector operating on this principle is disclosed in U.S. Pat. No. 3,382,762 issued Jan. 25, 1966. The detector disclosed and claimed therein has achieved considerable commercial success, however the assembly of the various components is relatively expensive and there is considerable opportunity for errors in assembly.

Also, the positioning of the photo-cell, in the device illustrated in said patent, allows a certain amount of light from the beam to reflect around the circular chamber, since the photo-cell views the dark chamber in the same plane as the light beam. Although this residual light can be compensated for in the alarm actuating circuit, its presence reduces the ratio of smoke to no-smoke resistance of the photo-cell, and hence affects the sensitivity to which the device can be adjusted without encountering false alarm problems due to changing ambient light conditions.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a view in side elevation of a smoke detector assembly embodying the features of the invention;

FIG. 2 is a view in section taken on line 2—2 of FIG. 1;

FIG. 3 is a view in section taken on line 3—3 of FIG. 1;

FIG. 4 is a view in side elevation, partly in section, of the assembly of FIG. 1;

FIG. 5 is an exploded view of the components of the assembly of FIGS. 1 and 4.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Referring to the drawing, there is illustrated a smoke detector 10 which comprises a mounting box 12 for attachment to a ceiling or other support structure, a cover plate 14 assembled onto the base 12, a retaining plate 16 assembled onto the cover plate, and a labyrinth wall 18 retained between the cover plate and the retaining plate.

The cover plate is provided with a circular recess 20 formed by outer and inner forwardly projecting walls 22 and 24, with a central aperture 26. The retaining plate is also provided with a circular recess 28 on the rear face thereof, formed by an outer wall 30 and an inner wall 32. In the illustrated embodiment the inner wall is disposed on a separate removable center cap 34 for a purpose to appear hereinafter.

Disposed on opposite sides of the retaining plate and molded integrally therewith are laterally projecting enclosures 36 and 37, which have outer portions 38 and 39 which may be transparent or translucent for a purpose to appear hereinafter. The enclosures 36 and 37 extend toward the cover plate to seat in suitably shaped recesses 40 and 42 formed in the face thereof, so that when assembled the components are disposed in the proper position in relation to each other and are prevented from relative lateral and rotational movement.

The recesses 20 and 28 are each provided with spacing webs 44 in the bottom thereof, thereby forming a peripheral passageway at each end of the wall for ambient atmosphere to diffuse into the dark chamber.

The wall 18, the cover plate 14, and the retaining plate 16 form a dark chamber 46, across which is projected a light beam from a light source 48 through a tube 50 extending through the labyrinth wall 18. A second tube 52 is disposed on the opposite side of the wall and opens to the interior of the chamber, serving as a light catcher to assist in preventing internal reflection of the light beam. A lens 54 of the converging type is disposed in the light tube 50 so that the light beam is focused into the light catcher.

A detector tube 56 projects into the dark chamber through the central aperture 26 of the cover plate, so positioned that the photo-cell in the tube 56 views generally the medial portion of the light beam. To assist in reducing the amount of stray light reaching the photo-cell under conditions of no-smoke, the end portion 58 of the tube 56 on the side adjacent the light tube extends forwardly to provide a shield against stray light from the inside surface of the light tube. To prevent stray light from the interior of the light trap from reaching the photo-cell, an inclined shield 60 is provided on the end of the light tube.

In the illustrated embodiment the cover plate 14 carries, on its rear face, a printed circuit board 62 retained thereon by strap connectors 64 assembled onto rearwardly projecting prongs 66. The board 62 carries the

electrical components and circuitry necessary for the operation of the detector.

To receive the prongs 66, the mounting box 12 is provided with a plurality of upstanding sockets 68 which are disposed about the peripheral wall of the box, and for rigidity are secured thereto by web attachments 70.

The cover plate also carries suitable mounting means for the light source 48 so that when assembled the light source extends forwardly into one of the enclosures 37 and is positioned behind the lens 54. If the portion 30 38 of the side enclosure translucent the operativeness of the light source may be checked visually.

Another light source 72 for indicating any other condition may be disposed in the other side enclosure. For example, if it is not desired that the light 48 be continuously visible, the light 72 may be used to provide a flashing signal when the light source 48 is inoperative, or may be battery powered to indicate failure of the power to the detector.

The construction of the various components of the device allows rapid and accurate assembly, and the incorporation of the recesses for the labyrinth as an integral part of the molded cover plate and retaining plate reduces the number of pieces of the assembly.

Since certain obvious changes may be made in the device illustrated without departing from the scope of the invention, it is intended that all matter contained herein be interpreted in an illustrative and not a limiting sense.

I claim:

1. A smoke detector assembly, comprising a mounting box having a wall with integrally molded receptacles, a support plate having rearwardly extending plugs to orient said support plate laterally and rotationally in relation to said mounting box, a housing removably mounted on the forward face of said support plate, said housing being shaped and arranged to form, with said plate, a dark chamber with means permitting ambient atmosphere to diffuse into said chamber, said housing and said plate having interengaging means to position said housing laterally and rotationally in relation to said plate.

2. A smoke detector as set out in claim 1 in which said support plate includes a lamp socket so positioned that a lamp bulb mounted therein protrudes forwardly from the support plate, said housing has a laterally extending portion enclosing said bulb and means projecting light from said bulb across said dark chamber in a direction generally parallel to the front surface of the support plate, and a photo-cell mounted on said sup-

port plate and viewing the dark chamber in a direction generally perpendicular to the front surface of the support plate.

3. A smoke detector assembly as set out in claim 1 in which said support plate carries all of the electrical components necessary for the detection of smoke and for actuating an alarm device, including light producing means projecting forwardly from the support plate, said housing having means receiving light from said light producing means and projecting it across the dark chamber in a direction generally perpendicular to the walls of the dark chamber and parallel to the support plate, said support having photo-responsive means viewing said dark chamber in a direction generally perpendicular to the support plate.

4. A smoke detector assembly comprising a support plate carrying on the rear face thereof the components necessary for the detection of smoke and removably carrying on the forward face thereof a housing shaped and arranged to form with said support plate a dark chamber, said support plate carrying lamp bulb receiving means so positioned that a lamp bulb assembled therein projects forwardly from the support plate to project a light beam across said chamber, said support plate carrying photo-responsive means positioned to view said dark chamber forwardly from the plate, said plate and said housing having interengaging means which orient said housing on said plate both transversely and rotationally.

5. A smoke detector assembly of the type in which a photo-cell responds to light reflected from smoke particles in a light beam, comprising a support plate, a retaining plate assembled onto the forward face of the support plate and having a medial portion spaced therefrom and a labyrinth wall retained between the support plate and the medial portion of the retaining plate, said wall and said plates forming a dark chamber with means between the wall and the plates to permit ambient atmosphere to diffuse into the chamber, said retaining plate having enclosures extending laterally from the labyrinth wall, said retaining plate and said support plate having interengaging means positioning said plates laterally and rotationally in relation to each other, and means for mounting a light bulb on the support plate so that it extends into one of said enclosures, lens means in said enclosure for projecting light from said bulb across the labyrinth in a direction perpendicular to the wall thereof, and photo-responsive means on said support plate viewing the interior of the labyrinth in a direction parallel to the labyrinth wall.

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