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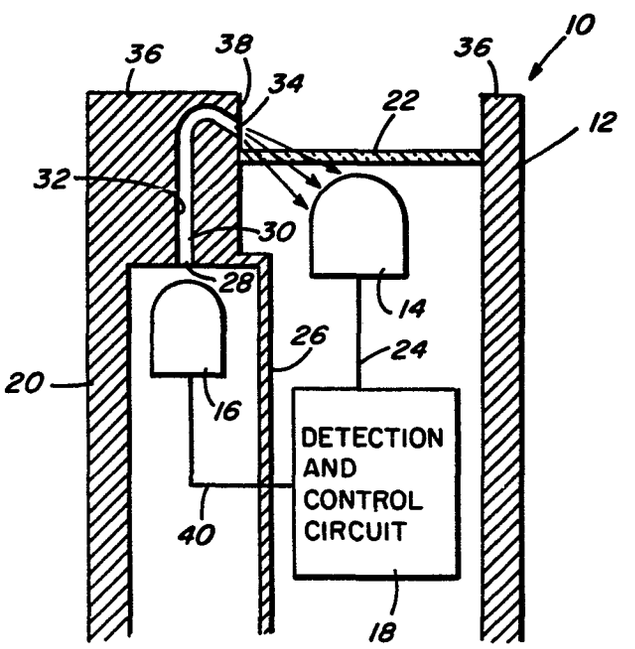
(54) Fire detection system.

(57) An optical fire detector has a radiant energy detector mounted within a housing including a window through which radiant energy is received by the detector. An optical fiber bundle arranged in the wall of the housing has an end emitting light to the detector through the window, and another end receiving light from a test lamp also within the housing but shielded from the detector by an optical shield.



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FIRE DETECTION SYSTEM

This invention relates generally to fire detection systems and particularly to testing fire detection systems that detect fire by detecting the presence of ultraviolet radiation and/or infrared radiation.

Background

A common means for detecting fires is an optical fire detector system that detects ultraviolet light or infrared radiation caused by a fire. Ordinarily the system incorporates a detector that transforms ultraviolet or infrared light falling on it into an appropriate electrical signal. The detector is usually housed in a protective container having a lens or window whereby radiation from the exterior (i.e., a fire) can fall upon the detector. A typical problem of such detection systems is that the lens or window through which the light must be transmitted (so that it can be detected) may accumulate dirt or grime. The accumulation of this or any other foreign material on the light transmitting window reduces, of course, the amount of light transmitted and could prevent the detection of a fire by the system.

It is an object of this invention to provide an optical fire detection system that includes a reliable and efficient assembly for testing the light transmitting capacity of the system's window. If the window is too dirty for proper detection, appropriate steps can be taken to clean it.

The problem of testing the transmitting capacity of a window in a detection system has been addressed. In U.S. Patent

3,952,196, for example, a radiation detection system includes a test lamp mounted within the assembly. Ultraviolet radiation from the test lamp is shielded from directly affecting the detector, but the radiation from the test lamp does leave through the window, strike a reflective surface and return to the detector through the window, thereby testing the cleanliness of the window.

The object of the invention is to provide a surer and more reliable testing system for optical fire detectors than currently exists. This invention does not rely on the cleanliness of a reflective surface and the radiation from the source covers a large area of the window or lens. It is another object to provide such a system that is durable, inexpensive and easy to manufacture. It has high reliability in corrosive atmospheres which normally would dull reflective surfaces.

Summary of the Invention

The optical fire detection system of the invention includes a housing, a portion of the housing including means allowing passage of radiant energy from the exterior to the interior of the housing, a radiant energy detector located in the housing and adapted to detect radiant energy through the passage means and to energize an alarm when the radiant energy exceeds a pre-determined level, wherein the improvement includes a radiant energy emitting test means located in the housing, an optical light transmission means for transmitting radiant energy from the test means to the exterior of the passage means, the transmission means having a light receiving end facing said test means and a light emitting end located outside the passage means for emitting light to the detector through the passage means.

In a preferred embodiment, the light transmission means is an optical fiber bundle, an optical shield is arranged in the housing to shield the detector from radiant energy being transmitted directly within the housing from the test means to the detector, and the housing includes a wall extending past the passage means, that contains the optical fiber light transmission means.

Brief Description of the Drawing

Other objects, features and advantages of the invention will be described in, or will be inherent in, the following description of a preferred embodiment of the invention, including the drawing thereof, in which:

Fig. 1 is a view of the interior of an optical fire detection system embodying the invention, in somewhat diagrammatic form.

Description of a Preferred Embodiment

As shown in Fig. 1, an optical fire detection system 10 includes a housing 12 that is generally explosion proof and/or weather/waterproof a radiation energy detector 14 (usually the energy detected is in the form of ultraviolet or infrared light), a test lamp 16, and a detection and control electronic circuit 18 (shown diagrammatically).

The housing 12 shown in the drawing is actually only a part of the full housing of a fire detection system 10. The remainder of the housing, not shown, is conventional, and its

components and assembly are well known to those skilled in the art. The housing 12 includes an opaque wall 20 and a window 22 set in the housing 12. The window 22 passes light radiation from outside the housing 12 to the detector 14 located inside the housing 12 in the conventional way. That is, when the light radiation reaches a certain predetermined level, indicating the presence of flame, the detector 14 responds by sending a signal via a connecting wire 24 to the detection and control circuit 18, and an alarm of the conventional kind, such as a light or sound alarm and/or a message to a central monitoring station, is generated.

The test lamp 16 is also located in the housing 12, but an optical shield, such as an opaque wall 26, is arranged within the housing 12 so that any light given off by the test lamp 16 does not pass through the interior of the housing and fall directly on the detector 14. The test lamp 16 is located so that light from the lamp can fall on the receiving end 28 of an optical light transmission element, which in the case of the preferred embodiment, is a fiber bundle 30. The light transmission element could be a light pipe or light conduit of a type different from an optical fiber bundle. The optical fiber bundle 30 is arranged in a channel 32 in the housing wall 20 to extend from the receiving end 28 facing the test lamp 16 to a transmitting end 34. The transmitting end 34 is located outside the window 22, that is, on the side of the window 22 opposite the detector 14. In the embodiment illustrated, the optical fiber bundle 30 is arranged in a channel 32 in a wall 20 that extends beyond the window 22. That is, the window 22 is recessed from the outer edge 36 of the housing wall 20. The transmitting end 34 of the

optical fiber bundle 30 is located in an interior side surface 38 of the wall 20 so that when the test lamp 16 is on, light transmitted from the test lamp 16 through the bundle 30 will impinge on the detector 14 through the window 22 (see the arrows in Fig. 1). The fiber optic bundle 30 is sealed within the channel 32 with a potting material, such as epoxy to retain explosion proof and/or waterproof integrity of the housing.

In the preferred embodiment, the test lamp 16 is energized intermittently, either automatically or by a human operator. The detector 14 is calibrated, and the detection and control circuit 18 is so arranged in ways well known to those skilled in the art, that when the test lamp 16 is energized the detector 14 requires a minimum quantity of light to be passed through the window 22 from the fiber bundle end 28 and detected by the detector 14, or else the detector 14 will signal a "dimmed window" signal. The detection and control circuit 18 is preferably arranged so that the presence-of-fire signal will be suppressed, or inhibited, during the test period. Power for the test lamp 16 may be provided by a cable or wire 40 from the detector and control circuit 18. In short, the detection and control circuit 18, using electronic components well known to those skilled in the art and therefore not described in detail here, energizes the test lamp 16 and detector 14 intermittently, surpresses the presence-of-fire alarm at the same time, and causes a dimmed-window signal if the light on the detector (from the optical bundle end 30) fails to rise above a predetermined level. When the dimmed-window signal, or alarm, is made, the window 22 should be cleaned.

Alternatively, rather than intermittent operation of the test lamp 16 being automatic and initiated by the detection and control circuit 18, operation of the test lamp 16, and detection, can be initiated by a human operator whenever a test of the detector window 22 is desired.

Advantages and Non-Obviousness over the Prior Art

The fire detection system of the invention will be stable for operations of the housing system of long duration because of the reliability and sturdiness afforded by the arrangement of components of the system. Light for testing the system is presented through the fiber optic bundle from outside the window as effectively as if the light source for testing were located there, but the actual light source, the test lamp, is located securely in the housing.

Variations of the specific embodiment shown above are possible. The test lamp, for example, may be used continuously to test the system instead of intermittently. Other variations may be devised by those skilled in the art, but are intended to be within the scope of the invention as set forth in the following claims.

1. An optical fire detection system comprising

a housing,

a portion of said housing including means allowing passage of radiant energy from the exterior to the interior of said housing,

a radiant energy detector located within said housing and adapted to detect radiant energy through said passage means and to energize an alarm when said radiant energy exceeds a predetermined level,

wherein the improvement comprises

a radiant energy emitting test means located in said housing,

an optical light transmission means for transmitting radiant energy from said test means to the exterior of said passage means,

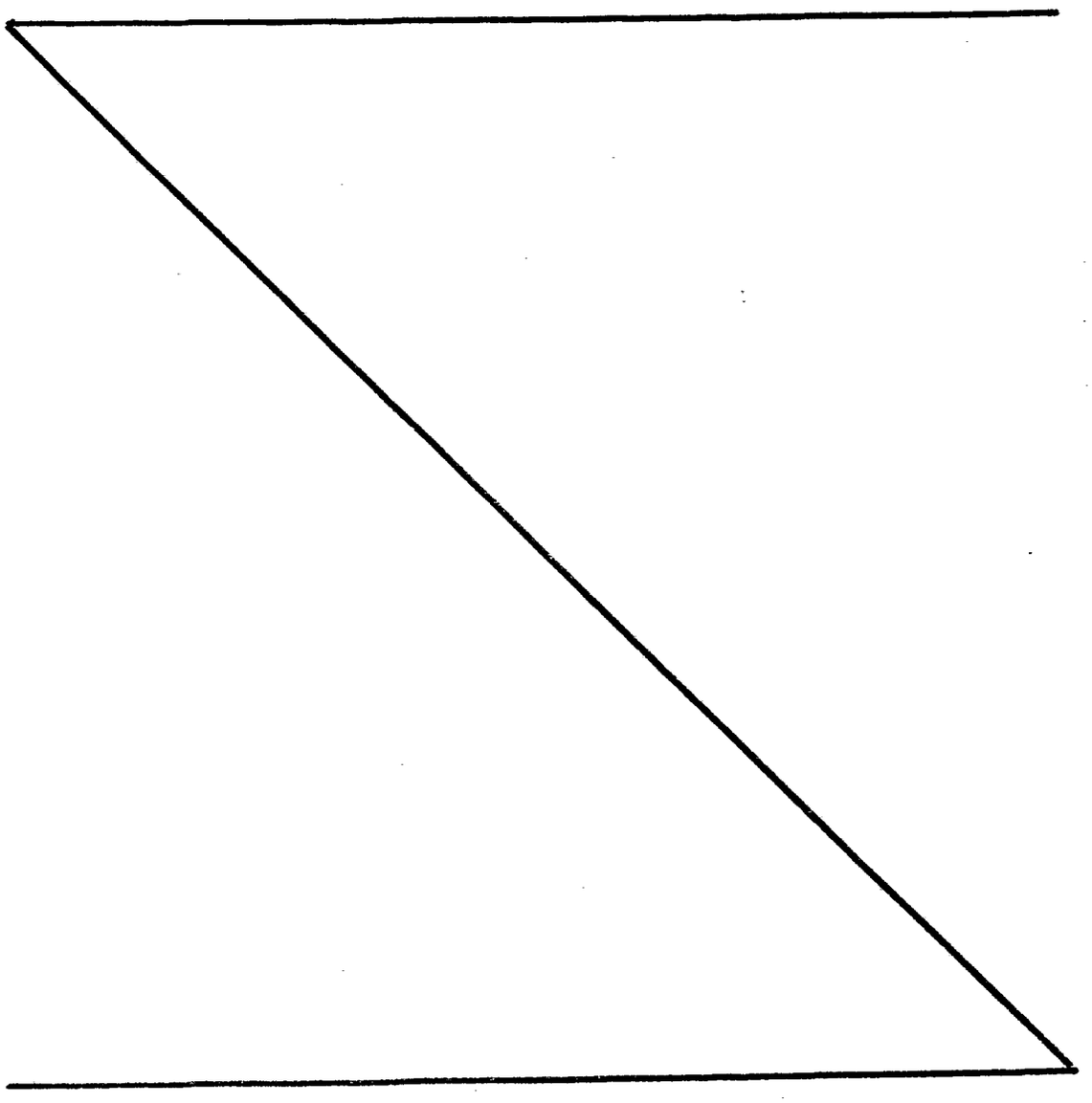
said transmission means having a light receiving end facing said test means and a light emitting end located outside said passage means for emitting light to said radiant energy detector through said passage means.

2. The optical fire detector system of claim 1 in which said optical light transmission means comprises an optical fiber bundle.

3. The optical fire detector system of claim 1 further including an optical shield means arranged to shield said radiant energy detector from radiant energy being transmitted directly within said housing from said test means to said radiant energy detector.

4. The optical fire detection system of claim 1, 2, or 3 wherein said housing includes a wall extending past said passage means,

said wall containing said optical light transmission means.



5. An optical fire detection system comprising

a housing,

a first portion of said housing including means for allowing passage of radiant energy from the exterior to the interior of said housing, and

a second portion of said housing extending exteriorly of said passage means,

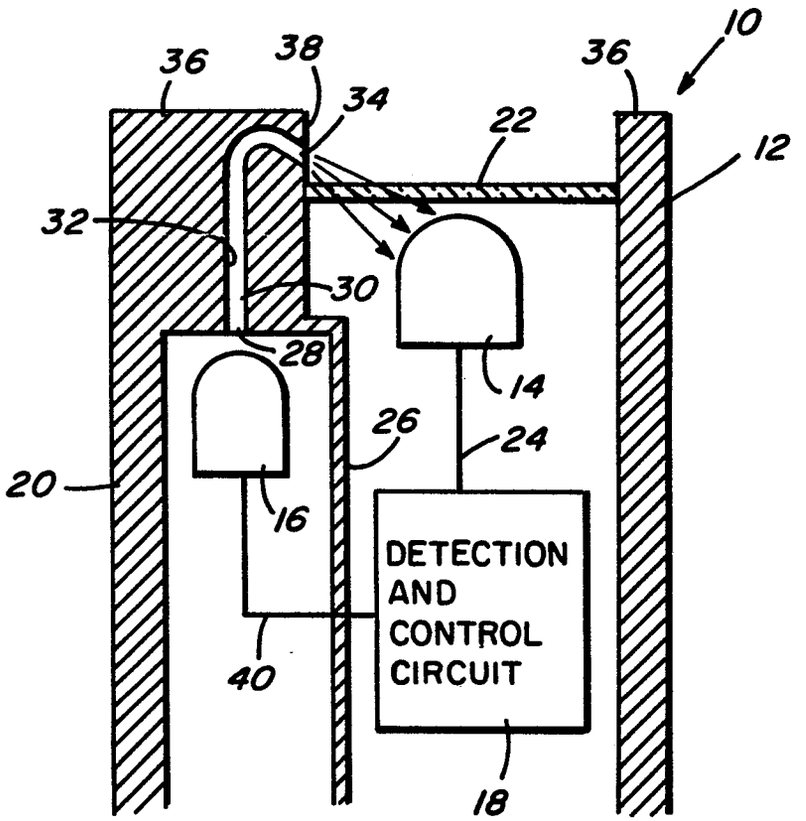
a radiant energy detector located with said housing and adapted to detect radiant energy through said passage means and to energize a first alarm when said radiant energy exceeds a predetermined level,

a radiant energy emitting test means located in said housing,

an optical fiber light transmission means for transmitting radiant energy from said test means, from the interior of said housing to the exterior of said passage means,

said transmission means having a light receiving end facing said test means and a light emitting end located in said second housing portion for emitting light to said radiant energy detector through said passage means, and

an optical shield means arranged to shield said radiant energy detector from radiant energy transmitted directly within said housing from said test means to said detector.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DETECTION
AND
CONTROL
CIRCUIT
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FIG. 1