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DE-A-1 797 079
DE-A-2 624 977
FR-A-2 334 097
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FR-A-2 503 329
US-A-2 812 686

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Description

This invention relates to an optical smoke detector of extremely high sensitivity. A similar detector is disclosed in my European Patent Application EP—A—140 502 with the same priority date as the present application.

The present invention is particularly adapted for use with an axial-light absorber as described in my European Application EP—A—135 361, also having the same priority date, and can utilise a sampling chamber as disclosed in my European Application EP—A—140 502.

An associated smoke detector is disclosed in my European Application EP—A—132 969, published after the priority date of the present application.

With optical smoke detectors it is necessary to provide a light source of low capacity to irradiate any smoke particles that are drawn into the sampling chamber.

Reduction in energy input lengthens the operational life of the light tube and serves to decrease current drain from a standby battery required to maintain operation in the event of mains failure. Reduction in current drain either increases the life of the battery or reduces the capacity requirement and therefore the cost of the standby battery.

The present invention is directed at allowing the use of low energy consumption light sources to provide the aforementioned advantage. However, such light sources, such as Xenon flash tubes, do not produce light from a point source but rather over an elongate length. The instant invention has as an object the provision of a smoke detector which is able to use such elongate light sources, by including suitable reflecting means to usefully focus the light energy produced.

U.S. Patent No. 2,812,686 discloses a pollution detector. It, however, relies on a substantially point-source light source, and uses lenses rather than a specially configured reflector as in the instant invention.

French Patent No. FR—A—2348502 discloses various reflectors for light sources. It does not teach the application of these light sources to pollution detection apparatus. It further does not reach the use in a pollution detector of an elongate light source, nor a reflector having a corresponding configuration to an elongate light source.

The present invention provides smoke detecting apparatus comprising:

- a) means forming a sampling chamber;
- b) inlet and outlet ports spaced from one another for flowing through said sampling chamber a gas to be sampled;
- c) a window in said sampling chamber between said ports;
- d) a light source outside said sampling chamber and adjacent said window for admitting into said sampling chamber a first portion of light emitted from said source; and
- e) reflector means;

characterised in that said light source comprises a U-shaped Xenon flash tube;

said reflector means is supported adjacent said light source for reflecting into said sampling chamber a further portion of light emitted from said source; and

said reflector means includes a U-shaped concave portion arranged to focus light impinging thereon from said flash tube into a central region of said sampling chamber.

Conveniently, the reflector means is supported by means comprising a mounting base and peripheral flanges for mounting said reflector means in sealed relation on said sampling chamber.

The window in the sampling chamber may be an open window to enable circulation of the atmosphere in the sampling chamber within the reflector body when in operation.

The invention will be described in greater detail having reference to the accompanying drawings in which:

Figure 1 is a section view of a sampling chamber showing various components including a light reflector.

Figures 2 and 4 show detailed sectional views of the reflector construction.

Figure 3 is a sectional view on line A—A of Figure 4 and Figure 5 is a sectional view in line C—C of Figure 4.

The reflector body 60 includes a concave U-shaped reflector element 61 designed to focus light impinging thereon from each infinitesimal cross-sectional element of a U-shaped Xenon flash tube into a central region 72 of air sampling chamber 70. The body 60 is attached to a flat surface of the chamber 70 by sealing flanges 60a and 60b. The flat surface 71 of chamber 70 enables simplified sealing and allows the use of an open window 74 for transmission of light into the chamber. The open window allows for circulation of air around the flash tube 62 thereby preventing the build up of potentially damaging ozone in the device.

Alternatively, the light window 74 may be sealed by clear glass or plastic (not shown) to seal the reflector chamber, whereby the reflector chamber 60 can be filled with an inert gas such as nitrogen. Further, alternatively, a flash tube of quartz glass which prevents the formation of potentially corrosive ozone, can be used. However, the use of an inert gas is costly whereas the latter alternative prevents detection of scattered ultra-violet light, thereby altering the calibration of the sampling tube in respect of certain products of combustion.

The reflector 60 is provided with a mounting base 63 which is preferably in the form of a printed circuit board serving as a mounting for the electrode leads of the flash tube 62. Sealing of the circuit board base 63 to the reflector body 60 by sealing flange 60c and sealing of the flanges 60a and 60b to the side of the sampling tube 71 is preferably achieved by a silicone rubber glue. This allows operation of the chamber at other than atmospheric pressure.

The size of the window aperture 74 and the spacing between the light tube 62 and the window together with the focal distance of the concave curved reflector are each optimized to maximize light intensity within the sampling chamber without unduly increasing spurious or stray incident light reflected off the internal walls of the sampling chamber.

The curvature of the reflecting element is developed to follow the "U" shape of the flash tube such that the light output from the whole length of the tube is focused through the flash window into the centre of the sampling chamber.

Accordingly, the use of the present invention directly results in a reduction of energy consumption of the lamp by a factor of 2 and without any loss of sensitivity in the detector.

A commensurate extension in lamp life is achieved.

Claims

1. Smoke detecting apparatus comprising:
 - a) means forming a sampling chamber (70);
 - b) inlet and outlet ports spaced from one another for flowing through said sampling chamber (70) a gas to be sampled;
 - c) a window (74) in said sampling chamber (70) between said ports;
 - d) a light source (62) outside said sampling chamber (70) and adjacent said window (74) for admitting into said sampling chamber (70) a first portion of light emitted from said source (62); and
 - e) reflector means (60);
 characterised in that said light source (62) comprises a U-shaped Xenon flash tube;
 said reflector means (60) is supported adjacent said light source for reflecting into said sampling chamber (70) a further portion of light emitted from said source; and
 said reflector means (60) includes a U-shaped concave portion arranged to focus light impinging thereon from said flash tube (62) into a central region (72) of said sampling chamber (70).
2. Apparatus according to Claim 1 wherein said reflector means (62) is supported by means comprising a mounting base (63) and peripheral flanges (60a, 60b, 60c) for mounting said reflector means (62) in sealed relation on said sampling chamber (70).
3. Apparatus according to Claim 1 or Claim 2 wherein window light (74) is an open window to enable circulation of the atmosphere in the sampling chamber (70) within the reflector means (60) when in operation.

Patentansprüche

1. Rauchdetektorvorrichtung mit:
 - a) Mitteln, die eine Probenkammer (70) bilden;
 - b) Einlaß- und Auslaßöffnungen, die mit Zwischenraum voneinander angeordnet sind, um durch besagte Probenkammer (70) ein Gas strömen zu lassen, von dem eine Probe genommen werden soll;

c) einem Fenster (74) in besagter Probenkammer (70) zwischen besagten Öffnungen;

d) einer Lichtquelle (62) außerhalb besagter Probenkammer (70) und benachbart zu besagtem Fenster (74), um einen ersten Lichtanteil, der von besagter Quelle (62) abgestrahlt wird, in besagte Probenkammer (70) einzulassen; und

e) Reflektormitteln (60);

dadurch gekennzeichnet, daß besagte Lichtquelle (62) einen U-förmigen Xenon-Röhrenblitz umfaßt;

besagtes Reflektormittel (60) benachbart zu besagter Lichtquelle gehalten wird, um einen weiteren Lichtanteil, der von besagter Quelle abgestrahlt wird, in besagte Probenkammer (70) zu reflektieren; und

besagtes Reflektormittel (60) einen U-förmigen konkaven Abschnitt einschließt, der so angeordnet ist, daß er Licht, das von besagtem Röhrenblitz (62) dort auftrifft, in einen zentralen Bereich (72) besagter Probenkammer (70) fokussiert.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß besagtes Reflektormittel (62) von Mitteln gehalten wird, die einen Befestigungssockel (63) und Umfangsflachse (60a, 60b, 60c) zum abgedichteten Befestigen besagten Reflektormittels (62) auf besagter Probenkammer (70) umfassen.

3. Vorrichtung nach Anspruch 1 oder Anspruch 2, dadurch gekennzeichnet, daß die Fensteröffnung (74) ein offenes Fenster ist, um die Zirkulation der Atmosphäre in der Probenkammer (70) bei Betrieb innerhalb des Reflektormittels zu ermöglichen.

Revendications

1. Dispositif de détection de fumée, comprenant:
 - a) des moyens formant une chambre d'échantillonnage (70);
 - b) des orifices d'entrée et de sortie espacés l'un de l'autre pour permettre l'écoulement d'un gaz à échantillonner à travers ladite chambre d'échantillonnage (70);
 - c) une fenêtre (74) ménagée dans ladite chambre d'échantillonnage (70) entre lesdits orifices;
 - d) une source de lumière (62) située à l'extérieur de ladite chambre d'échantillonnage (70) et adjacente à ladite fenêtre (64) de manière à admettre dans ladite chambre d'échantillonnage (70) une première partie de la lumière émise par ladite source (62); et
 - e) des moyens formant réflecteur (60);
 caractérisé en ce que ladite source de lumière (62) comporte un tube éclair à xénon en forme de U;
 lesdits moyens formant réflecteur (60) sont supportés au voisinage de ladite source de lumière de manière à réfléchir en direction de l'intérieur de ladite chambre d'échantillonnage (70) une autre partie de la lumière émise par ladite source; et
 lesdits moyens formant réflecteur (60) incluent

une partie concave en forme de U agencée de manière à focaliser la lumière issue dudit tube éclair (62) tombant sur lesdits moyens, dans une région centrale (72) de ladite chambre d'échantillonnage (70).

2. Dispositif selon la revendication 1, dans lequel lesdits moyens formant réflecteur (62) sont supportés par des moyens comportant une base de montage (63) et des brides périphériques (60a,

60b, 60c) servant à monter d'une manière étanche lesdits moyens formant réflecteur (62) sur ladite chambre d'échantillonnage (70).

3. Dispositif selon la revendication 1 ou 2, dans lequel la fenêtre (74) de passage de la lumière est une fenêtre ouverte permettant à l'atmosphère située dans la chambre d'échantillonnage (70) de circuler à l'intérieur des moyens formant réflecteur (60), lors du fonctionnement.

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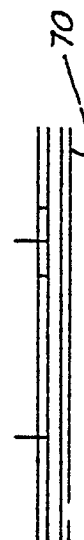
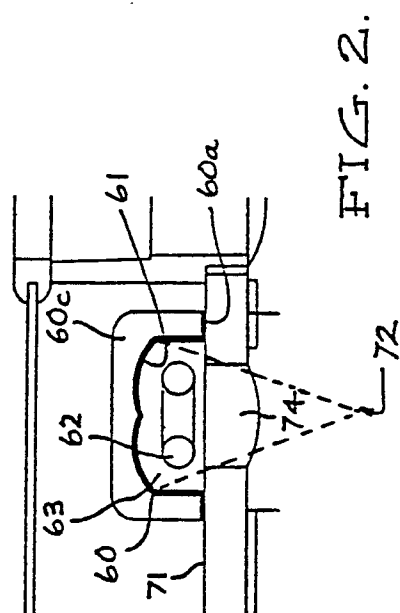
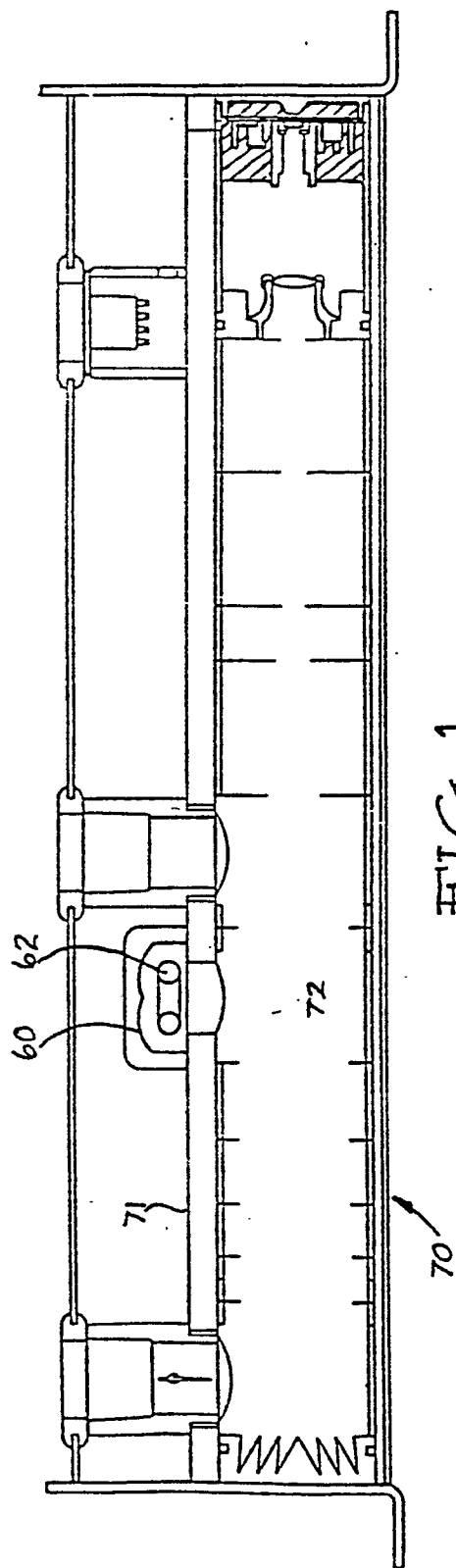
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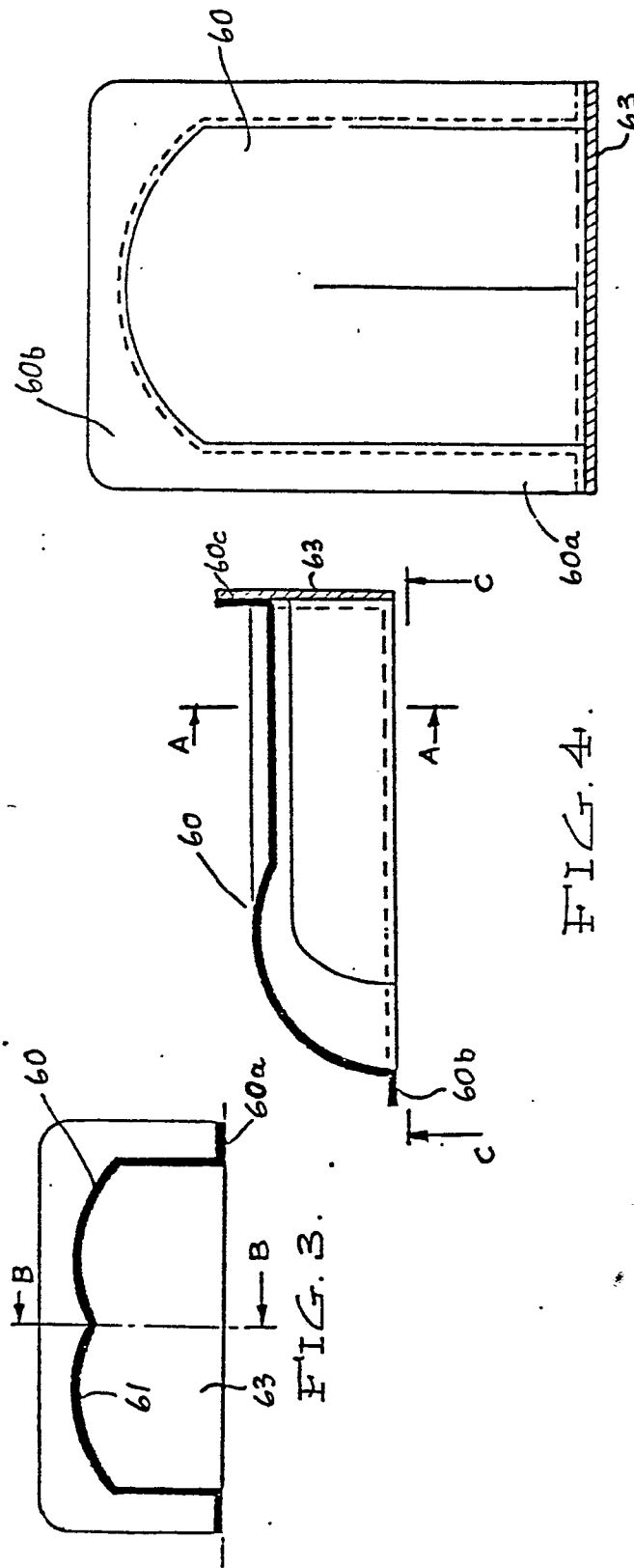


FIG. 5.

FIG. 4.

FIG. 3.