

[54] **SMOKE DETECTOR IN WHICH AIR ENTRANCE AND EGRESS ARE LOCATED IN OPPOSITELY DISPOSED SURFACES WHICH ARE SHAPED TO CAUSE AN AIR VELOCITY DIFFERENTIAL**

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[52] U.S. Cl.**250/218, 340/237 S, 356/103**

[51] Int. Cl. ...**G01n 21/00, G01n 21/26, G08b 21/00**

[58] Field of Search**356/207, 103; 340/237 S; 250/218**

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[57] **ABSTRACT**

In the smoke detector which comprises a casing having a smoke introducing inlet, and provided with a light source member and a light receiving member wherein the beam of light from the light source member is projected against smoke within the casing and the scattered light generated thereby is caught by the light receiving member, said detector is afforded the improvements (1) that the casing is provided with an inlet and an outlet for smoke flow and two air flow passages so arranged as to cause the air to flow at different velocities, when under the influence of smoke flow, such difference in velocity creating a difference in static pressure that helps introduce smoke into the casing; (2) that a light sheltering plate surrounding the light receiving member is provided within the casing said plate having apertures through which a desired portion of said scattered light is led into the light receiving member; and (3) that a reflector having a desired number of surfaces is provided, on which light beams from the light source member make multiple reflections and pass concentrically through the determined space of the smoke passages.

6 Claims, 17 Drawing Figures

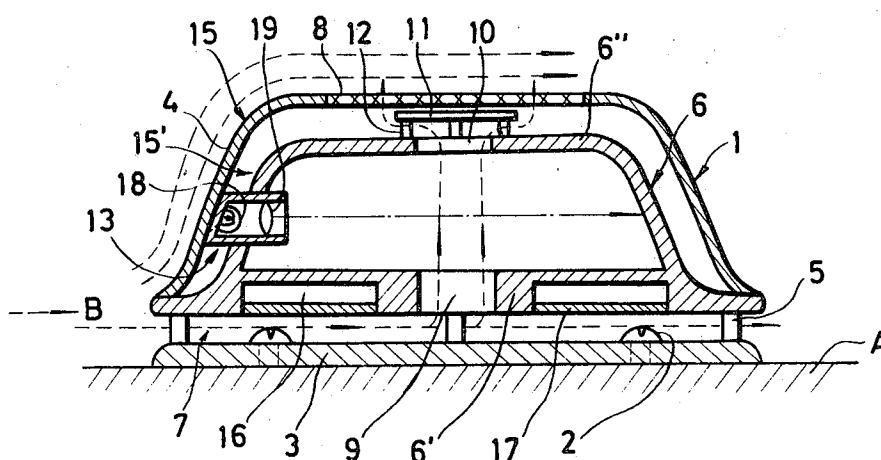


FIG. 1
PRIOR ART

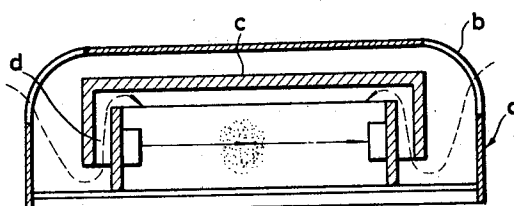


FIG. 2

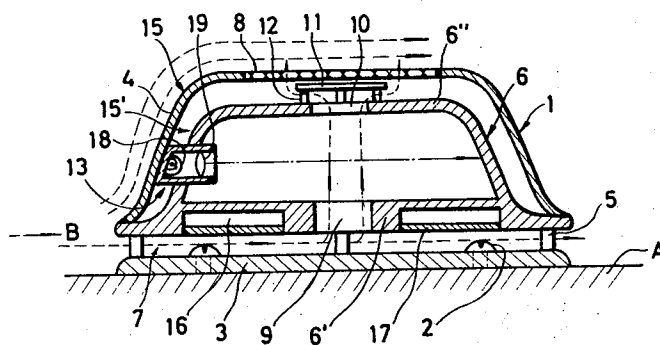
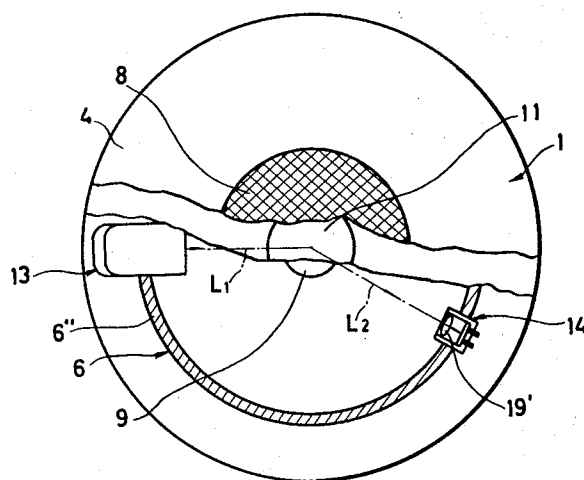


FIG. 3



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FIG. 4

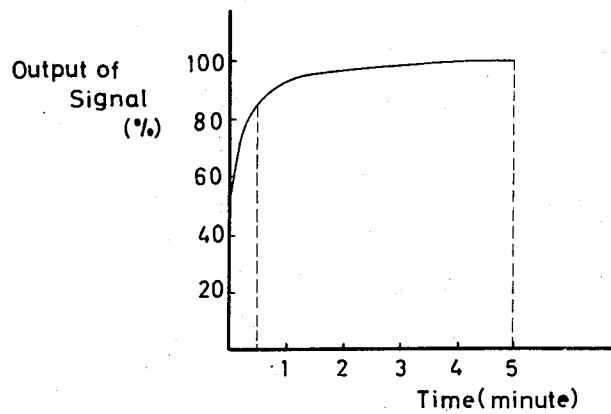
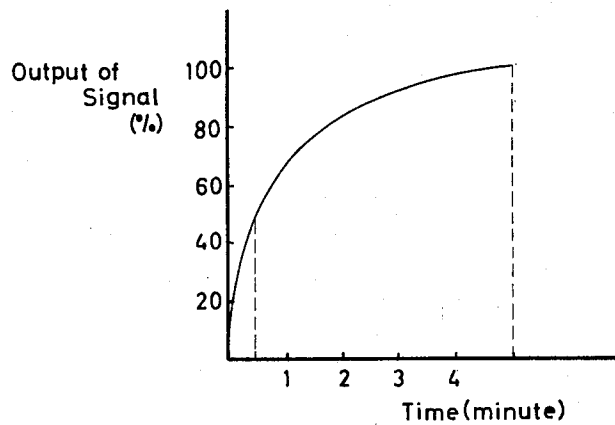


FIG. 5
PRIOR ART



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FIG. 10

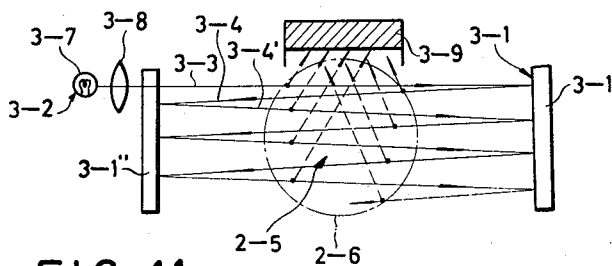


FIG. 11

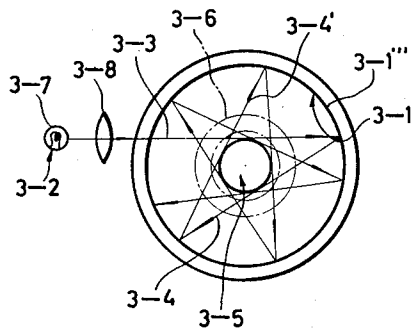


FIG. 13

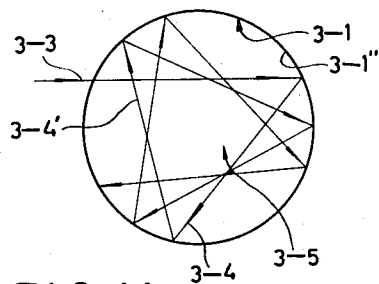


FIG. 14

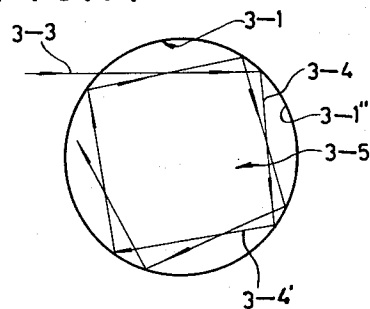
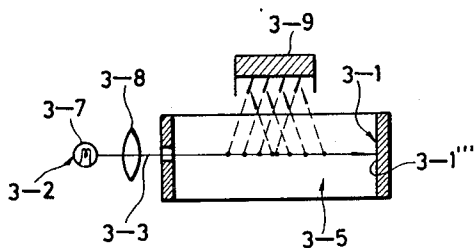


FIG. 12



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FIG. 15

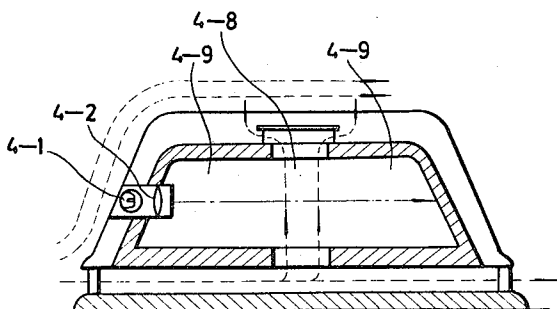


FIG. 16

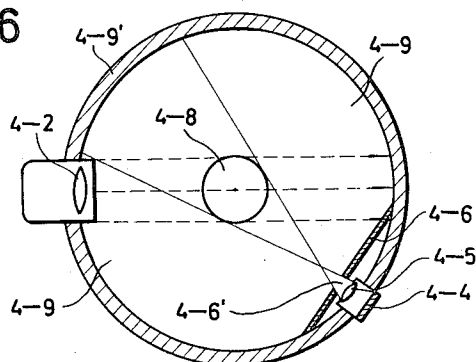
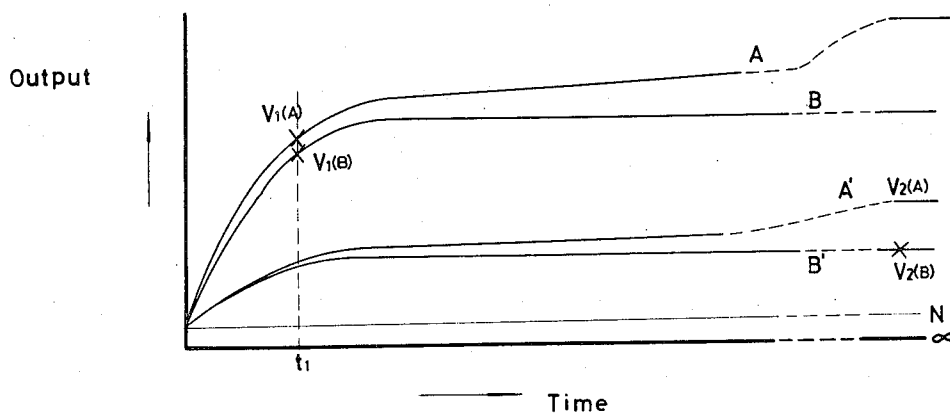


FIG. 17



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SMOKE DETECTOR IN WHICH AIR ENTRANCE AND EGRESS ARE LOCATED IN OPPOSITELY DISPOSED SURFACES WHICH ARE SHAPED TO CAUSE AN AIR VELOCITY DIFFERENTIAL

BACKGROUND OF INVENTION

The present invention relates to the smoke detector to be used for fire alarm, particularly to the smoke detector of scattering light system in which smoke is induced into a casing and is illuminated by light beams whereby said ray of light is scattered to be received by light receiving elements.

Hitherto, as a device for detecting aerosol or smoke, there has been known an ionization apparatus, employing the process of ionization of a radioactive substance, or a smoke detector of extinction, employing attenuation of light by smoke. The present invention relates to a smoke detector of scattered light, in which smoke is guided in a casing and a photosensitive element receives the light, scattered when there is applied to the smoke light beams from a light source.

A conventional light scatter smoke detector is constructed in such a manner that parallel rays are applied to the passage of smoke through a lens, attached to a lamp, and at that time, the scattered light, generated by particles of smoke, is received by a photosensitive part, and the main part is kept in a casing to shield the obstructive ambient light. This structure makes the detector (1) to be constructed more compactly and (2) to get a considerable gain, as compared with a detector of extinction, so that the detector is generally used in practice.

However, it is difficult to get a sufficient ratio of S/N, because of a low level of scattered light in many cases, and an obstructive scattering of light in the inside of the detector and a penetration of ambient light. Besides, in order to keep the influence of the ambient light as little as possible, the smoke inlet of the dark box is constructed in a zigzag form, a so-called labyrinth system. If the entry of ambient light into the interior of the casing is prevented by such a structure, smoke cannot easily enter the casing, because it is guided in only by diffusion. It is difficult to get a sufficient sensitivity of response to smoke.

Hitherto known smoke detector instrument comprises, as shown in FIG. 1, the main body a having an air flowing inlet b opened thereon and the casing c accommodated within said main body a and provided with an air introducing inlet d, so that smoky air flow is introduced into the main body a and only smoke is induced within the casing c by means of its expansion, thereby resulted in such drawback as difficulty to obtain sufficient ratio of sensitivity.

In order to solve the foregoing problem, it is the easiest way to provide bigger air flowing inlet b and air introducing inlet d, but it will cause penetration of scattered light from the environment into the casing to be resulted in unsuccessful solution against the problem in question. Accordingly other schemes are undertaken as a supplementary procedure by creating hot air flow to aid and accelerate the inducement of smoke or inhalation of smoke under compulsion, however, such process as mentioned above is requested for heat source or motive power source to incur too much expense to economical installation of such equipment, moreover, to be unable to endure long durability in ser-

vice as well as has to be taken into consideration for probability of defect being taken place, such foregoing troubles will cause less reliability as to be sensitive instrument to which reliability is an indispensable feature.

Moreover the symbol θ designates the angle formed by the ray (or optical axis A of the light source member c and the ray receiving axis B of the light receiving member d as shown in hitherto known smoke sensitive instrument of FIGS. 6 - 7, light capacity of receiving ray of light at the light receiving will be larger as the angle θ be formed smaller which is understood more favorable for the sensitive instrument when smoke presents in the closed box b as shown by the graphic curve RS in FIG. 9 (in this graph is shown the resistance survey value of light receiving element CdG under the condition of smoke having an extinction rate of 20%/m), accordingly it is desirable to place the light receiving member d closest to the emission point P of ray of light e as shown in FIG. 7, while, on one hand, it is most desirable to place said light receiving member d at the position $\theta = 90^\circ$ where it is hardest to receive ray of light e as is shown by the symbol R'N in case no presence of smoke in the closed box b whereby light capacity to be received at the light receiving member d will be small and R'N designates large resistance value. The angle θ , however, be made smaller, the smaller be the value designated by R'N, because the sensitive instrument will gradually become easier to be influenced by ray of light e and the graphic curve R'N will be formed substantially similar to the extinction curve of RS, so that it can not make larger ratio of RS to R'N after all.

Research has been made for the purpose of obtaining larger ratio of S/N and has resulted in the arrangement of a desired number of stops (shielding plates against ray of light) $h, h' \dots$ providing apertures g on the passage of ray of light e as shown in FIG. 7.

However, even in such case as mentioned above, the light receiving member d is projected by the reflected light i at the stops $h, h' \dots$ and the reflected light j from the flange of said apertures g whereby it will slightly be improved of R'N to R''N as shown in FIG. 9 but it is unable to obtain large ratio of S/N as expected whereat inducement of smoke is resulted to be retarded by a number of stops.

From a point of view of the performance, the above-mentioned prior examples will be examined as follows.

Generally speaking, the performance of a smoke detector depends upon a ratio of working output to non-working output, a kind of S/N ratio, considering the response sensitivity. This fact will be explained, referring to FIG. 16. If the ratio (V_1/V_2) between the output V_1 , which is in a prescribed time t_1 (for example 30 sec.) after the concentration of smoke, corresponding to the time of a fire, grows to c (for example the extinction rate 15%/m), and the output V_2 which is at the fixed time, when the concentration of smoke, corresponding to the amount of smoke, existing in a normal condition, grows c_2 (for example 5%/m), becomes larger, the better it is (if $V_1/V_2 = c_1/c_2$, it is ideal). Namely, it means a large V_1 , i.e., an enough ability for response to smoke, to make V_1/V_2 larger. As the working position V_p is to be set between V_2 and V_1 , the tolerance can be set more than enough, if the space

between V_1 and V_2 is large. Such a high stability can be obtained as to be able to operate with a sufficient allowance for other errors.

On the other hand, in the above-mentioned prior examples, the value of V_1 is low, because of the response sensitivity being low, while V_2 becomes large, because of the S/N ratio being small (owing to noise N being large). Accordingly, V_1/V_2 cannot be made larger.

For attaining the above objects, the present invention is characterized (1) by the provision of a sensitive instrument utilizing the difference of pressure to inducement of smoke by generating the difference of static pressure based upon the difference of flow velocity caused by an appropriate construction of the main body of the sensitive instrument; (2) by the provision of a sensitive instrument having a remarkably elevated S/N ratio without impeding inducement of smoke; (3) by the provision of a sensitive instrument having a multiple reflection structure to increase the scattered light, and (4) by the provision of a sensitive instrument in which, the scattered light only in the smoke introducing inlet is received.

The present invention will now be explained in detail hereinafter with reference to the accompanying drawings:

FIG. 1 is a longitudinal section view of hitherto known smoke sensitive instrument of scattered light type;

FIG. 2 is a longitudinal section view of the sensitive instrument relating to the present invention by way of an example showing the condition in operation thereof;

FIG. 3 is a bottom view broken out one part of said instrument;

FIGS. 4 and 5 are graphs showing by curves respectively designating characteristic of the sensitive instrument relating to the present invention and hitherto known sensitive instrument;

FIG. 6 is a cross sectional plane view of hitherto known smoke sensitive instrument of scattered light type;

FIG. 7 is a plane view of an improved type of said hitherto known instrument;

FIG. 8 is a cross sectional plane view of the sensitive instrument relating to the present invention in the form of an embodiment;

FIG. 9 is a schematic graph showing the relation between the position of the light source and the resistance value of the light receiving member in the smoke sensitive instrument shown in FIGS. 6 to 8;

FIG. 10 is a side view of the smoke sensitive instrument relating to the present invention showing the plane mirrors used as reflector surfaces;

FIG. 11 is a plane view of the above same showing the mirror having cylindrical surface picked up as a reflector surface;

FIG. 12 is a longitudinal section view of the above same showing the side thereof;

FIGS. 13 and 14 are plane views of the foregoing sensitive instrument respectively in the form of the other embodiment;

FIGS. 15 and 16 show respectively a vertically sectioned side view and a cross section view for an embodiment of the present invention; and

FIG. 17 is a graph representing in a series of curves the relationships between time and output.

The present invention is to provide a smoke detector having long durability and high reliability in use and manufacturable at a low cost wherein its main body is constructed in optimum form for creating the difference of air flow velocity and therefore difference of static pressure induces smoke.

The smoke detector relating to the present invention will be explained in detail with reference to the accompanying drawings in FIGS. 2 and 3 wherein said detector is shown in the form of an embodiment.

The main body 1 of said detector comprises the base plate 3 secured to the position A on the ceiling where said main body 1 is mounted by means of threaded bolts 2, bowl-shaped cover 4, supporting legs 5 connecting said base plate 3 and said cover 4, the casing 6 accommodated within said main body 1, the linear passage 7 for air flow formed between the flat bottom plate 6' of said casing 6 and said base plate 3 along the position A and a meshed air flowing outlet 8 provided in the center of said cover 4.

Furthermore in said casing 6 are provided an air introducing inlet 9 in the center of said flat bottom plate 6' and an air flowing outlet 10 opened through in the center of the flat portion 6'' of the casing 6, said air flowing inlet 9 and said air flowing outlet 10 being so arranged that the line between them runs perpendicular to said linear passage 7; the light shielding plates 11 of said air flow outlet 10 securely fixed between said meshed air flowing outlet 8 and said air flowing outlet 10 by means of the upright support 12 of said flat portion 6''; and the light source 13 and the light receiving element 14 disposed along the peripheral wall of said flat portion 6'' for receiving the scattered light L_2 , which is created by projection of light beam L_1 from said light source 13 against smoke particles.

In case of fire, smoke flows along the position A on the ceiling in a smoke current B which is divided into two streams at the main body 1 from which one of said two streams flows straight along said linear passage 7 passing below said air introducing inlet 9, while the other stream flows above said meshed air flowing outlet 8, passing through the loop way 15 formed along the peripheral curvature of said cover 4. In this instance, the static pressure at the meshed air flowing outlet 8 is smaller than the static pressure at the air introducing inlet 9, since the distance of the loop way 15 is, as a matter of course, longer than that of the linear passage 7, so that smoke flowing into the linear passage 7 due to such difference of atmospheric pressure as mentioned above tends to flow towards the air flowing outlet 10 from the air introducing inlet 9, thereby said smoke is positively introduced into the casing 6. It is better to consider preventing the air flow from being reduced when passing through the linear passage 7 and the loop way 15. Accordingly, it is desirable to design for a minimum provision of said supporting legs 5 and formation of such optimum curvature on the cover (4) as to minimize creation of vortexes.

In the drawings, the reference numeral 16 designates space accommodating amplifier for light receiving member provided on said flat bottom plate 6', 17 represents the sealing cover thereof, 18 is the bulb of the light source 13, and 19, 19' are corresponding lens of the light source 13 and the light receiving member 14 respectively.

As we have explained the principle of the present invention by way of the foregoing embodiments for carrying out the same, smoke air flow grown in case of fire is branched into two air streams that run at different velocities for instance, into linear air flow path and loop way. Due to the difference of static pressure caused by the difference of smoke air flow velocity, smoke flows in the direction from the path of lower velocity to the path of higher velocity and is induced into the casing, that is, smoke is positively introduced by making good use of naturally grown air current and the smoke detector of the present invention is confirmed to have efficiency as shown in FIG. 4 resulted through experimentation.

FIG. 5 shows the graph representing the result of experiment by means of the smoke detector illustrated in FIG. 1 under the condition of equal smoke environment.

Experiments on two types of smoke detector, one is a hitherto known smoke detector manufactured in the shape substantially identical to the one shown in FIG. 1 and the other is a smoke detector of the present invention made in the shape substantially identical to the one shown in FIG. 2, to both of which have the same light source and light receiving members, revealed that as shown in FIG. 4, induction of smoke in the invented smoke detector after 30 seconds from its generation was about twice that in the conventional smoke detector in terms of output ratio and that the time required by the invented smoke detector for reaching the output (90%) was about one-sixth the time required by the conventional smoke detector.

In respect of the smoke detector according to the present invention in a form of an embodiment shown in FIGS. 2 and 3, the meshed air flowing outlet 8 is provided only on the cover 4 at the center of the flat portion thereof, however, said meshed air flowing outlet having optimum shape may be provided on the side walls of the cover 4 and, in which case, not only the loop way 15 is provided on the outer wall of the cover 4 but also another loop way 15' is provided along the casing 6, whereby negative pressure is generated at the part adjacent to the air flowing outlet 10. Further, when smoke detector is used in a comparative dark place where the cover 4 is unnecessary, only the loop way 15' is available.

Furthermore, the present invention is intended to carry out the remarkable improvements in S/N ratio without hampering inducement of smoke which is elucidated precisely by way of an embodiment shown in the drawings as follows:

The casing 2-1, as shown in FIG. 8, accommodates the light source member 2-2 and the light receiving member 2-3 arranged at an optimum angle θ less than 90° in the known manner, wherein reference numerals 2-4 and 2-5 designate lens respectively for creating paralleled light beam 2-6 from an electric bulb provided on the light source member 2-2, numerals 2-7 and 2-8 represent the light receiving element such as Cds and lens respectively provided on the light receiving member 2-2, and numeral 2-9 is the smoke introducing duct provided through the center of the closed box 2-1, whereby, in the present invention, the casing 2-1 accommodates the light shielding member 2-10 so arranged as to surround the light receiving

member 2-3, and said light shielding member 2-10 is provided with an aperture 2-12 perforated therethrough for applying the scattered light 11 created by smoke to the light receiving member 2-3, however, in this case, the position of said aperture 2-12 is required to be opened off the main light beams 2-6, and the outer edge 2-12' of said aperture 2-12 is desirable formed parallel to the axis of beams caught by the light receiving member 2-3.

In the drawing is shown the plate-like member serving as a light shielding member 2-10 disposed perpendicularly crossing said axis beams; however, it is not limited to the foregoing shaped member, but it may be substituted for by the member having a hood arranged to cover the light receiving member 2-3. In this case such a hood has to be used after taking the influence of reflection at the inner surface thereof into full consideration.

The aforementioned smoke detector according to the present invention, comprising the casing having the smoke introducing inlet opened thereon, the light source member and the light receiving member for admitting light beams from said light source member to smoke retained within the casing and the scattered light created by projection against smoke for being caught by the light receiving member, is constituted in such a manner that the light shielding members are mounted within the casing to surround the light receiving member, said light shielding members are provided with apertures that lead the scattered light into the light receiving member and said aperture is positioned off the main light beams; consequently such constitution according to the present invention, as mentioned above, is proved to have the features that reflection of light beams from the light source member 2-2 is hard to reach the light receiving member 2-3 which is surrounded by the light shielding members, and the main light beams are not admitted directly through said aperture 2-12, and as a result of actual measurement, it was ascertained that resistance of the light receiving element 2-7 at the light receiving member 2-3 did not show remarkable decrease as shown by the curve RN in FIG. 9 when θ was gradually decreased from the angle 90° to about 30° .

Accordingly it will easily be understood by the graphic curve shown in FIG. 9 that the present invention in a form of an embodiment involves remarkable improvements in efficiency S/N ratio of 200 in case of $\theta = 30^\circ$, approximately 33 times S/N ratio 6 in case of $\theta = 90^\circ$, while hitherto known smoke detector in a form of an embodiment is found to show a very little increase in S/N ratio, 28 in case of $\theta = 30^\circ$, which is no more than 4.7 times of S/N ratio 6 in case of $\theta = 90^\circ$. Thus the present invention is able to obtain the smoke detector having high reliability, maintaining such remarkably high S/N ratio as hereinbefore described without causing any obstacle against inducement of smoke whereby said detector is adapted to receive sufficient scattered light with θ set at a small angle which makes it possible to secure quick response to Cds and others when smoke is induced in it.

Furthermore the present invention is aimed at inspecting smoke of rarefied density which is precisely explained with reference to the accompanying drawings in FIGS. 10 to 14 in a form of embodiments

wherein is provided the reflector 3-1 having a desired number of surfaces to which light beams 3-3 from the light source member 3-2 are made to reflect repeatedly and some of the reflected light beams 3-4, 3-4' . . . are subjected to pass concentrically through the predetermined space 3-6 in the smoke passage 3-5, while the surfaces 3-1 of the reflector is an example for the constitution providing the oppositely disposed flat reflectors 3-1' and 3-1'' arranged to be parallel to each other, and 3-7 and 3-8 show an electric bulb and lens respectively mounted on the light source member 3-2. FIG. 11 and the rest of the drawings show the constitution provided with the reflector 3-1''' having a cylindrical surface thereof substituting for the foregoing flat reflector, and in case of FIG. 11, angle of incidence against the cylindrical surface of the reflector from the light source member 3-2 is small, so that reflected light beams form an asteroidal shape so as to be concentrated within the predetermined annular shape 3-6 shown by the chain dotted line.

Accordingly, as compared with the arrangement of two flat reflectors 3-1' and 3-1'' shown in FIG. 10, two concave mirrors may be disposed oppositely to each other as shown in FIG. 11, so that the bigger is the angle of incidence formed as shown in FIGS. 13 and 14, the nearer the predetermined space approaches to the cylindrical surface 3-1''' of the reflector, in which case the identical object is obtained by using three or four flat reflectors respectively. Moreover according to the present invention, the light receiving member 3-9 is arranged to receive each of the scattered light beams from the predetermined space 3-6, and is desirably mounted right above said space 3-6 as shown in FIGS. 10 and 12 respectively.

The smoke detector according to the present invention has a feature of better stability compared with that of conventional smoke detector wherein light beams from the light source member 3-2 are reflected repeatedly by means of the reflector at the surface thereof, said reflected light beams are made to pass concentrically through the passage 3-5 of the predetermined space, so that the scattered light created by smoke is concentrically led into the light receiving member 3-9 for remarkable increase in the capacity of receiving light at the same density of smoke, as compared with conventional smoke detector and for easy detection of low-density smoke. Furthermore said scattered light has no directional feature since it is created by reflected light beams having various directional features and sensitivity of the detector will be little affected by inclination of the light receiving member.

According to the present invention, ratio of light receiving capacity at the light receiving member in case no smoke in the passage to that in case of smoke present in said passage (said ratio is so-called S/N ratio) can be made higher without causing wrong signal and also highly reliable smoke detector is obtainable, since the scattered light is increased due to the aforementioned manner and influence of light from outside is diluted, thereby resulting in decrease of influence of self-scattering light which is usually called miscellaneous (or sundry) noise.

Furthermore, in the embodiment shown in the drawings, parallel light beams are illuminated from the light source member through lens, while, in the reflector

having a cylindrical surface, the light beams having the predetermined width may be used or light beams spreading forward may be used, and, in this case, it should be taken into consideration that reflected ray light beams which seem to be of no use are shielded or absorbed so as not to be led directly into the light receiving member.

FIGS. 15 and 16 show respectively a vertically sectioned side view and a cross section view for an example of a detector according to the present invention. FIG. 17 shows a comparison of the response sensitivity of a smoke detector, having only the structure according to the first embodiment of the present invention and that of a detector, having the structure according to another embodiment of the present invention.

In the structure of the first embodiment, considered hydrodynamically, smoke is instantly guided into the casing from the smoke flowing inlet by an atmospheric pressure difference, caused by a difference in velocities of air flow between two in passages. Accordingly, the upward line of the response sensitivity, shown in FIG. 17, is mainly controlled by a response of a photo-conductive cell. But, this instantaneous entry of smoke is limited to the flue portion (4-8 in FIGS. 15 and 16. This is a smoke route, generated naturally when the smoke is guided in, but not constructed previously with a partition or the like, as a part of the structure). The entry of smoke proceeds slowly by the mechanism of diffusion in the casing 4-9 outward from there. The curve A, corresponding to the structure only according to the original invention, in FIG. 17, continues to go up sluggishly, after passing the steep upward portion (the instantaneous entry of smoke), because the amount of light received by the photo-conductive cell increases slowly by the amount of light scattered by smoke, which continues to diffuse gradually toward the outside of the above-mentioned flue portion.

It is similar in case of A', a non-working condition. Therefore, it is concluded that the ratio of the working output to the non-working output (V_1/V_2) decreases as V_2 becomes larger. It is not favorable for our object, which is to obtain a high ratio of V_1/V_2 . In view of the above-mentioned, the present invention is to adopt such a structure for receiving light as to receive the scattered light, not in the whole part of the casing, but only in the flue portion. Thus, the scattered light, making the ratio of V_1/V_2 smaller, is shut out from the portion 4-9. Only light, scattered by smoke, which is guided in densely and instantaneously in the flue portion, is received. Therefore, it is possible to realize a quick response. The output of B, corresponding to the working condition, is small, as compared with the output of A. But, the value of the working output V_1 is in the quite short time, for example several tens of seconds, after the beginning of the entrance of smoke. Therefore, the light, scattered by smoke, is almost the only light scattered by smoke in the flue portion. As to the output V_1 at that time, V_1 (B) is lowered only a little below the output V_1 (A) of the first embodiment. On the other hand, concerning the non-working output V_2 , V_2 (B) is considerably small as compared with V_2 (A). So, finally, the difference contributes to the increase in the ratio of V_1/V_2 . Namely, as clearly known from FIG. 16, $V_1(A) > V_1(B)$, $V_2(A) > V_2(B)$. And moreover, because $V_1(A) - V_1(B) < V_2(A) - V_2(B)$,

finally $V_1(A)/V_2(A) < V_1(B)/V_2(B)$. Thus, according to the present embodiment, the ratio of a working output to a non-working output becomes larger than that of the first embodiment.

Such a structure for receiving the scattered light only in the flue portion, as shown in FIG. 15, is easily set on a drawing by a combination of an opening 4-6, of a shade 4-6 and a lens 4-5. In order to decrease the obstructive light scattered from the base body of the casing, it is preferable that the portion of 4-9 is so treated as to absorb the light or so constructed unevenly as to improve light absorption.

What is claimed is:

1. Smoke detector comprising a casing arranged to admit air containing smoke to the interior of said casing, a light source member positioned within said casing, a light receiving member positioned within said casing and arranged to receive light beams from said light source when the light beams are projected against smoke within said casing with the smoke scattering the light beams so that they impinge on said light receiving member, wherein the improvement comprises means within the interior of said casing spaced between said light source member and said light receiving member and forming a predetermined space for admitting scattered light beams to said light receiving member, and a reflector positioned within the interior of said casing between said light source member and said means having a cylindrical mirror surface for affording multiple reflection of the light beams so that the reflected light beams pass through the predetermined space provided by said means when the light beams are scattered by the smoke in the air containing smoke whereby the scattered reflected light is directed onto said light receiving member.

2. Smoke detector comprising a casing arranged to admit air containing smoke to the interior of said casing, a light source member positioned within said casing, a light receiving member positioned within said casing and arranged to receive light beams from said light source member when the light beams are projected against smoke within said casing with the smoke scattering the light beams so that they impinge on said light receiving member, wherein the improvement comprises that said casing has a first surface and an oppositely disposed second surface with the interior of the casing arranged to receive the air containing smoke located between said first and second surfaces, a first opening in said first surface communicating with the interior of said casing, a second opening in said second surface communicating with the interior of said casing, said second surface having a shaped configuration relative to said first surface so that the length of travel of the air containing smoke over the outer surface of said casing from a common point thereon at the junction of

said first and second surfaces is greater from the common point to said second opening than from the common point to said first opening thereby causing a difference in the velocity of the two flows of air containing smoke and affording a difference in the static pressures at said first and second openings so that the air containing smoke flows through the interior of said casing from said first opening to said second opening.

3. Smoke detector, as set forth in claim 2, wherein a light shielding member positioned within the interior of said casing and enclosing said light receiving member so that it blocks said light receiving member from said light source, said light shielding member having an aperture therethrough for admitting the incidence of light being scattered by smoke in the air containing smoke onto said light receiving member, and said aperture in said light shielding member being offset from the normal path of light beams from said light source.

4. Smoke detector, as set forth in claim 2, wherein a reflector is positioned within the interior of said casing between said light source member and said light receiving member and said reflector having a surface for the multiple reflection of the light beam from said light source member, means within the interior of said casing disposed between said deflector and said light receiving member and forming a predetermined space for admitting scattered light beams to said light receiving member so that the multiply reflected light beams scattered by smoke in the air containing smoke are directed onto said light receiving member.

5. Smoke detector, as set forth in claim 2, wherein said light receiving member is offset laterally from the normal path of light beams of said light source and is arranged to receive light beams from said light source when the light beams are projected against smoke within the casing with the smoke scattering the light beams from their normal path so that they impinge upon said light receiving member, the axis of said light receiving source and the normal path of the light beams from said light source are disposed at an angle of less than 90° , a light shielding member positioned within the interior of said casing and enclosing said light receiving member for blocking said light receiving member from said light source, and said light shielding member having an aperture therethrough for admitting the incidence of light scattered by the smoke in the air containing smoke into said light receiving source.

6. Smoke detector, as set forth in claim 2, wherein means for directing onto said light receiving member only the scattered light produced by the smoke in the air containing smoke passing through the casing, said means are disposed within the interior of said casing between said light source member and said light receiving member.

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