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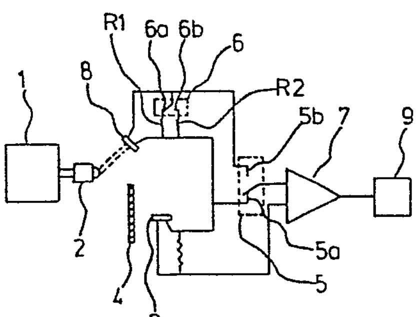
(54) **Functional test means of light scattering type smoke detector.**

(57) The test means is equipped with an optical arrangement for smoke detection comprising a light emitting element for smoke detection and a photoelectric element for smoke detection located at such a position that it does not receive the light directly from the light emitting element. The opitcal arrangement for testing comprises a light emitting element for testing and a photoelectric element for testing which directly receives the light from the light emitting element for testing.

FIG 1



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Functional Test Means of Light Scattering Type Smoke Detector

This invention relates to a functional test means of the light scattering type smoke detector.

The light scattering type smoke detector fails to initiate an alarm when the light emitting surface of its light emitting element or the light receiving surface of its photoelectric element is soiled, or produces a false alarm when the inner wall surfaces of its labyrinth for detecting smoke is soiled.

Therefore, it is prescribed by law that function of the light scattering type smoke detectors shall be periodically checked. Up to now, the check has been performed in the following manner.

In one method, the smoke detector which is installed on the ceiling is exposed to smoke from a smoke generating tester to see if the smoke detector operates within a predetermined time. In another method, a smoke detector is removed from the ceiling and is set in a sensitivity tester for smoke detector. Whether the sensitivity to smoke is within the normal level range or not is checked by this tester.

In the former method, at least two persons are required, one for operating the smoke generating tester at the position of smoke detector and the other for checking by receiver whether the smoke detector has operated or not. Additionally, there still remain the problems of liaison between the attendants at the smoke detector and receiver, and of the smoke detector being soiled by smoke generated by tester. The latter method requires much time to remove smoke detectors from the ceiling, one by one for checking. Further, failure to properly reinstall the detector after test causes insufficient contact, or even there may be a failure to reinstall the detector.

In consideration of these drawbacks in the prior art, one object of this invention is to offer a means which enables one person to carry out the functional test of the smoke detector from the receiver or repeater by remote operation without going to the site of smoke detector.

Another object of this invention is to provide a method by which precise check of function of the smoke detector can be performed, and which causes no trouble in smoke detector after functional test.

This invention relates to a functional test means of the light of scattering type smoke detector which comprises an optical system for detecting smoke consisting of a light emitting element for detecting smoke and a photoelectric element for detecting smoke which is disposed at a position where the light from said light emitting element does not directly reach; an optical system for test consisting of a light emitting element for test and a photoelectric element for test which receives directly radiation from said light emitting element for test; and a circuit for measuring a total output by received light of an output by received light from said optical system for detecting smoke added to that from said optical system for test.

Now, the first embodiment of this invention will be explained in the following with referring to accompanying drawings. In fig. 1, reference numerals 1 and 2 indicate a light emitting circuit and a light emitting element for detecting smoke respectively. The light emitted from said light emitting element 2 for detecting smoke strikes with smoke particles and scattered. A part of the reflected light is received by a photoelectric element 3 for detecting smoke. The photoelectric element 3 for detecting smoke is connected to an amplifier circuit 7 via a change-over switch 5. Moreover, the amplifier circuit 7 is connected to a switching circuit 9. A shield plate 4 is disposed between the light emitting element 2 for detecting smoke and the photoelectric element 3 for detecting smoke in order to prevent direct incidence of the light from the light emitting element 2 for detecting smoke upon the photoelectric element 3 for detecting smoke. A photoelectric element 8 for test is arranged at a position where the radiant energy from the light emitting element 2 for detecting smoke can be directly received and no influence of the external light is given. The photoelectric element 8 for test is connected to the amplifier circuit 7 of the above-mentioned optical system for detecting smoke via change-over switches 6 and 5.

Operation of this embodiment will be described in the following. During supervisory condition the change-over switch 5 comprising a relay and other parts is connected to a contact 5a. Every time when the light emitting element 2 for detecting smoke emits light (in the case of pulse light emitting system), a random reflected light (internal noise light) is generated at an inner wall surface of the labyrinth which is not shown in the drawing and the photoelectric element 3 for detecting smoke receives this internal noise light to produce a noise light output. Only this output is sent to an amplifier circuit 7. In the case of continuous light emitting system, these processes are continuously performed.

When smoke enters the labyrinth not shown in the drawing, a scattered light is generated by smoke and the photoelectric element 3 for detecting smoke produces an output by received light which is the sum of an output by internal noise light and an output by received said scattered light due to smoke. When this total output reaches a fire level, the switching circuit 9 is actuated to send a fire signal. This is a normal operating condition of the smoke detector. Assuming that this detector sends out a fire signal with a smoke density of 10% and that the intensity of internal noise light corresponds to a smoke density of 5%, the switching circuit 9 should be actuated to send out a fire signal in normal condtion whenever the sum of the internal noise light N and the smoke density S amounts to the fire level of 15% as shown in Fig. 2 (A), the former being of 5% and the latter being of 10%. However, when the internal noise light N has been lowered to 2.5% as shown in Fig. 2 (B), for example, due to soil of the light receiving face of the of photo-electric element 3 for detecting smoke, smoke density S of 12.5% (actually more than 12.5% in consideration of attenuation by soil) is necessary for the output to reach the fire level. In contrast, when the internal noise light N has increased to 7.5% as shown in Fig. 2 (C), for example, due to soil of the inner wall of the labyrinth, the output reaches the fire level with a smoke density S of as low as 7.5%. Accordingly the internal noise light is expressed in terms of smoke density, and the following converted values are used to indicate the various conditions. As basic level of normal condition a smoke density of 5% is taken, plus or minus 2.5% of which i.e. 5 ± 2.5% is the normal level range. The condition wherein the internal noise light reduced to smoke density is 2.5% (lower limit of normal level range) or less is the condition under which the detector fails to alarm. Additionally, the condition wherein the internal noise light reduced to smoke desnity is 7.5% (upper limit of normal level range) or more is the false alarm condition. Further, the conditon wherein

/the internal noise light remains between the lower limit and the upper limit of normal level range is a normal condition. To discriminate these conditions, the non-operation test and the operation test are performed. To this end, the change-over switch 5 is connected to contact 5b by control signal from a receiver or a repeater not shown. Into the amplifier circuit 7 is fed a total output by received light of an output from the photoelectric element 3 for detecting smoke added with an output from the photoelectric element 8 for test, and the total output after being amplified is sent to the switching circuit 9. If, for example, a solar battery is used as photoelectric element, resistors R_1 and R_2 having different resistances are connected to contacts 6a and 6b in the change-over switch 6 composed of a relay etc. in Fig. 1. The output of photoelectric element 8 for test can be regulated by changing over the switch 6. For non-operation test, the resistance of resistor R_1 is adjusted to achieve a smoke density of 7.5 % so that the total of the output by the received internal noise light added with the output by received light from photoelectric element 8 for test may not reach the fire level even if the output by the received internal noise light is near the upper limit of normal level range. For operation test, the resistance of resistor R_2 is adjusted to a smoke density of 12.5 % so that, when the output by received internal noise light is somewhat lower than the lower limit of normal level range, the total of said output added with the output by received light of photoelectric element 8 for test may not reach the fire level.

Thus, in the non-operation test, a signal "normal" is sent to a receiver not shown and the like when the total output by received light is at non-operation level. A signal "abnormal" is sent to a receiver when the total output by received light is at operation level. In the operation test, a signal "abnormal" is sent to the receiver and the like when the total output by received light is at non-operation level, and a signal "normal" is sent when the total output is at operation level. As mentioned above, the operation and non-operation tests of the smoke detector can be simply conducted by switching the change-over switches 6 and 5 with the control signal from the receiver, in order to check whether the detecting function of the detector is normal or not. Even if a photoelectric element other than solar cell is employed, it is possible to chekc the detecting function in the similar manner as described above by altering the way of changing over the output from the above-mentioned photoelectric element 8 for test. It is also possible that the photoelectric element 8 for test is disposed at any desired position by connecting the light emitting element 2 for detecting smoke to the photoelectric element 8 for test with an optical path, such as optical fiber, as shown with dotted lines in the drawing. By providing an address circuit comprising, for example, an oscillator having a specific frequency for each smoke detector to modulate the signal from the detector, it is possible to identify from which detector the signal has been initiated. In the following, a second embodiment of the present invention will be described with reference to Fig. 3.

This embodiment differs from the first embodiment in that a comparator circuit 10 is connected to an amplifier circuit 7 and, moreover, a memory circuit 11 is connected to said comparator circuit 10. Usually, both fire supervision and function test are performed and the result of the function test is stored. The mechanism of this embodiment is so constituted that a signal "normal" or "abnormal" is sent out on the basis of the stored result of function test when a test signal is received from a receiver not shown or the like. For the purpose, a relay 12 usually repeats "on" and "off" to open and to close a switch 13. As the switch 13 remain closed while relay 12 is "off", the amplifier circuit 7 is fed only with an output from photoelectric element 3 for detecting smoke and fire supervision is performed. As the switch 13 opens when relay 12 is "on", the amplifier circuit is fed with a total output (by received light) from photoelectric element 3 for detecting smoke and from photoelectric element 8 for test and a function test is performed. The result of function test is stored in the memory circuit 11.

The discrimination of functional conditions is made by the comparator circuit 10, which determines whether or not the output from amplifier circuit 7 has reached the lower limit of normal level range, i.e. the critical level at which the detector fails to alarm. And, a distinction is also made as to whether or not the above-mentioned output has reached the upper limit of normal level range, i.e. false alarm level.

With a test signal from a control panel (or a repeater), which is not shown in the drawing, the relay 12 is actuated, the switch 13 is closed, and the amplifier circuit 7 is fed with a sum of the outputs (by received light) of photoelectric element 3 for detecting smoke and of photoelectric element 8 for test. In this case, a normal signal is sent to the receiver if the output (by received light) just before has been in the normal level range and the all circuits are normal. If said output by received light just before is in false alarm condition, an abnormal signal such as repeated frequency different from normal signal, is sent to the receiver.

An abnormal signal is also sent to the receiver and the like when the output (by received light) just before is at such a level that the detector fails to alarm. Further, if the light emitting element 2 stops emitting the light, for example, owing to breaking of wire and both the photoelectric element 3 for detecting smoke and the photoelectric element 8 for test do not produce the output by received light, or if the switching circuit 15 has a fault, such faults of the detector can be easily found because no signal is sent to the receiver or the like (no signal) even if the test signal is sent from the receiver and the like.

Therefore, it is possible to make an overall test of functions of the smoke detector by checking whether the signal returned from the detector after the test signal is sent from a receiver or repeater is a normal signal (normal condition), an abnormal signal (alarm failure condition or false alarm condition) or no signal (fault) is returned.

In Fig. 3, reference numeral 15 indicate the switching circuit which is actuated to send out a fire signal when the output has reached the fire level. The same reference numerals in Figs. 1 and 3 indicate the same parts having the same function. In the following third embodiment of this invention will be described with reference to Fig. 4.

In Fig. 4, reference numerals 21 and 22 indicate a light emitting circuit and a light emitting element for detecting smoke, respectively. The light emitting element 24 equipped with the seitch 23 is connected in series with the light emitting element 22.

A change-over switch 25 for changing a light emission current is provided between the light emitting element 22 for detecting smoke and the light emission circuit 21. Light from the light emitting element 22 for detecting smoke and from the light emitting element 24 for test is received by a photoelectric element 26 which is connected to an amplifier circuit 27 connected to a switching circuit 28. A shield plate 29 is disposed between the light emitting element 22 for detecting smoke and the photoelectric element 26 so that the photoelectric element may not directly receive the light from light emitting element 22 for detecting smoke. In additon, an optical path 30, such as optical fiber, is provided so as to pass directly the light from light emitting element 24 for test to photoelectric element 26.

Now, operation of this embodiment will be described. During the supervisory condition the switch 23 comprising a relay is closed, and the changeover switch 25 comprising a relay is connected to the contact 25a.

Every time the light emitting element 22 for detecting smoke emits light (in the case of pulse light emitting system), a random reflected light (internal noise light) develops at the internal wall surface of the labyrinth not shown and the photoelectric element 26 for detecting smoke receives this internal noise light to produce an noise light output. Only this output is sent to the amplifier circuit 27. In the case of continuously light emitting system, these processes are continuously performed. As the resistor Ra connected to the contact 25a of the change-over switch 25 serves as a limiting resistor or for the light emission current of light emitting element 22 for detecting smoke during the supervisory condition, the light emitting element 24 for test does not emit light owing to closure of switch 23 and only the light emitting element 22 for detecting smoke emits light during the supervisory condition.

When smoke enters the labyrinth not shown, the light emitted from the light emitting element 22 is scattered by smoke. The output by received internal noise light from photoelectric element 26 for detecting smoke is added to the output by received smoke-scattered light to produce a total output. When the output from the amplifier circuit 27 which has amplified said total output rises to fire level, the switching circuit 28 is actuated to produce a fire signal.

This is normal condition of the detector. The light emitting element 22 for detecting smoke is emitting a radiant energy as shown by (A) of (1) in Fig. 5 by a light emission current fed through resistor Ra. Meanwhile, the photoelectric element 26 for detecting smoke produces an output as shown by (A) of (3) and (4) in Fig. 5, provided that the function is normal and so the intensity of internal noise light is in the normal level range. When the internal noise light increases by dust deposit on inner wall surface of the labyrinth or the like, the output from photoelectric element 26 for detecting smoke becomes high as shown by (A) of (5) in Fig. 5. On the other hand, when the light receiving surface of photoelectric element 26 for detecting smoke is soiled, the output from the photoelectric element becomes low as shown by (A) of (5) in Fig. 5.

When the switch 23 is opened with control signal from a receiver not shown or the like, the light emitting element 24 for test as well as the light emitting element 22 for detecting smoke emit light. The light emitted by light emitting element 24 for test is received by photoelectric element 26 for detecting smoke through the optical path 30, and the total output is fed to the amplifier circuit 27 and, after amplified, is sent to the switching circuit 28.

For testing the function of this detector, resistors Rb and Rc having different resistances are connected to contacts 25b and 25c of the change-over switch 25 comprising a relay etc., respectively. To test, the light emission current is controlled by switching the change-over switch 25 to a proper contact. For non-operation test, the resistor Rb is set so that the output during testing may not reach fire level even if the output from the photoelectric element 26 for detecting smoke during the supervisory condition is near the upper limit of normal level range, as shown by (A) of (3) in Fig. 5, and that the output by received light during testing can reach fire level when the output during the supervisory condition somewhat surpasses the upper limit of normal level range, as shown by (A) of (5) in Fig. 5. For operation test, the resistor Rc is set so that the output during testing may reach fire level even if the output from the photoelectric element 26 for detecting smoke during the supervisory condition is near the lower limit of normal level range, as shown by (A) of (4) in Fig. 5, and that the output during testing cannot reach fire level when the output during the supervisory condition is somewhat lower than the lower limit of normal level range as shown by (A) of (6) in Fig. 5.

In non-operation test, the change-over switch 25 is connected to the contact 25b and a light emission current is fed to the light emitting element 22 for detecting smoke and the light emitting element 24 for test through the resistor Rb. As a result, the light emitting element 22 for detecting smoke emits light in radiation as shown by (B) of (1) in Fig. 5 and the light emitting element 24 for test emits light in radiation as shown by (B) of (2) in Fig. 5.

The photoelectric element 26 for detecting smoke receives a direct light from the light emitting element 24 for test and a scattered light from wall surface which arise from light emitted by the light emitting element 22 for detecting smoke. When the function is normal, the photoelectric element 26 for detecting smoke produces an outputs as shown by (B) of (3) or (4) in Fig. 5. The element 26 produces an output by received light as shown by (B) of (5) in Fig. 5, if the internal noise light is too intense. The element 26 produces an output as shown by (B) of (6) in Fig. 5, if the light-receiving surface of photoelectric element 26 for detecting smoke is soiled.

In operation test, the change-over switch 25 is connected to contact 25b and contact 25c, and a light emission current is fed to the light emitting element 22 for detecting smoke and the light emitting element 24 for test through resistor Rb and resistor Rc. As a result, the light emitting element 22 for detecting smoke emits light in radiation as shown by (C) of (1) in Fig. 5 and the light emitting element 24 for test emits light in a radiation as shown by (C) of (2) in Fig. 5.

The photoelectric element 26 for detecting smoke receives the light from both light emitting elements 22 and 24 and produces an output as shown by (C) of (3) or (4) in Fig. 5, when the function is normal. The element 26 produces an output as shown by (C) of (5) in Fig. 5, if the internal noise light is too intense. The element 26 produces an output by received light as shown by (C) of (6) in Fig. 5, if its light-receiving suface is soiled.
Further, in non-operation test, a signal "normal" is sent to a receiver not shown or the like when the total output is at non-operation level, and a signal "abnormal" is sent when the total output is at operation level. In operation test, a signal "abnormal" is sent to a receiver when the total output is at non-operation level, and a signal "normal" is sent when the total output is at operation level.

As stated above, the operation and non-operation tests of the smoke detector are simply conducted by switching the switch 23 and the change-over switch 25 with a control signal from the receiver, in order to check whether the detecting function of the detector is normal or not. As for alarm failure condition and false alarm condition, they are the same as described in the first embodiment.

Now, a fourth embodiment of the present invention will be described with reference to Fig. 6.

This embodiment differs from the third embodiment in that a comparator circuit 31 is connected to an amplifier circuit 27 and, in addition, a memory circuit 32 is connected to said comparator circuit 31. Usually, both fire supervision and function test are performed and the result of function test is stored. The mechanism of this embodiment is so constituted that a signal "normal" or "abnormal" is sent out on the basis of the stored result of function test when a test signal is received from a receiver not shown or the like.

As this embodiment is essentially identical with the second embodiment (Fig. 3) except the constitution of the light emitting part and the light receiving part, the detailed description will be omitted. Usually, a relay not shown repeats "on" and "off" to open and close a switch 23. While the relay is "off" the change-over switch 25 is connected to contact 25a and a large current I_1 as light emission current flows through the resistor Ra. As the switch 23 is closed at this time, the light emitting element 24 for test is short-circuited and the light emission current I_1 flows only through the light emitting element 22 for detecting smoke to emit light in a large radiant energy. The noise light arising from this light is received by the photoelectric element 26 for detecting smoke and the output by received light therefrom is fed to the amplifier circuit 27.

When the relay becomes "on", the switch 23 is opened to release the sort-circuit of the light emitting element 24 for test, and simultaneously the change-over switch 25 is connected to contact 25b.

A small current I_2 as light emission current is fed to the light emitting element 22 for detecting smoke and the light emitting element 24 for test through the resistor Rb. Due to this light emission current I_2, the light emitting element 22 for detecting smoke and the light emitting element 24 for test emits light in a small radiation. The photoelectric element 26 for detecting smoke receives the noise light arising from light emitted by light emitting element 22 for detecting smoke and a direct light from light emitting element 24 for test, and feeds the total outputs to the amplifier 27.

In Fig. 6, reference numerals 21, 28, 29 and 30 indicate a light emission circuit, a switching circuit, a shield plate and an optical path such as optical fiber, respectively.

Further, regarding the third and fourth embodiments, it is described that the light from light emitting element 24 for test is led to the photoelectric element 26 through the optical path 29.

Nevertheless, the light emitting element 24 and photoelectric element 26 may be arranged in such a way that they face each other so that the light is directly led to the photoelectric element 26 without passing through optical path 29.

As the means according to this invention comprises an optical system for detecting smoke, an optical system for test, and a circuit for measuring a total output of an output by received light from said optical system for detecting smoke added with an output from said optical system for test, it is not necessary to remove the smoke detector from the ceiling or to apply smoke to the detector for testing. Thus, one person can test the functions of the smoke detector from the receiver etc. Moreover, the light-receiving surface of the photoelectric element is not soiled because no smoke is used.

Additionally, due to the above-mentioned constitution of this invention, it is possible not only to check whether the smoke detector is in normal condition or not, but also to properly determine whether the abnormal condition is alarm failure condition, or a false alarm condition, or trouble in the detector itself (e.g. breaking of wire in light emitting element).

Brief Explanation of the Accompanying Drawings

Figs. 1, 3, 4, and 6 represent block diagrams of various embodiments according to this invention. Fig. 2 shows the relation between the smoke density and fire level etc. in the embodiment of Fig. 1. Fig. 5 illustrates the relation among the radiant energy of light emitting element, the output by received light from photoelectric element, and fire level in the embodiment of Fig. 4.

2, 22 . . . light emitting element for detecting smoke

24 . . . . light emitting element for test

3, 26 . . . photoelectric element for detecting smoke

8 . . . . . photoelectric element for test

Claims

(1) A functional test means of a light scattering type smoke detector which is equipped with an optical arrangement for smoke detection comprising a light emitting element for smoke detection and a photoelectric element for smoke detection located at such a position that it does not receive the light directly from the light emitting element; an optical arrangement for testing comprising a light emitting element for testing and a photoelectric element for testing which directly receives the light from the light emitting element for testing; and a circuit which measures a combined output obtained by adding the output of the optical arrangement for smoke detection and that of the optical arrangement for testing.

(2) A functional test means of a smoke detector as set forth in Claim (1) wherein one light emitting element is commonly used as said light emitting element for detecting smoke and said light emitting element for test.

(3) A functional test means of a smoke detector as set forth in Claim (2) wherein said circuit for measuring a combined output by received light is characterized by monitoring fire by discriminating between presence and absence of fire on the basis of the

output by received light from said photoelectric element for detecting smoke, sending out a signal "normal" or "abnormal" to a receiver when said combined output by received light is respectively non-operation or operation level provided that a non-operation test signal is issued, and sending out a signal "abnormal" or "normal" to the receiver when said combined output by received light is respectively non-operation level or operation level provided that an operation test signal is issued.

(4) A functional test means of a smoke detector as set forth in Claim (2) wherein said circuit for measuring a combined output by received light is characterized by monitoring fire by discriminating between presence and absence of fire on the basis of the output by received light from said photoelectric element for detecting smoke, monitoring the function by discriminating between normal and abnormal functions on the basis of the combined output by received light, said fire monitoring step and said function monitoring step being alternately performed, and sending out a signal "normal" or "abnormal" to a receiver when the result of function test immediately before receiving test signal is respectively normal or abnormal, owing to test signal.

(5) A functional test means of a smoke detector as set forth in Claim (1) wherein one photoelectric element is commonly used as said photoelectric element for detecting smoke and said photoelectric element for test.

(6) A functional test means of a smoke detector as set forth in Claim (5) comprising a light emission circuit in which said light emitting element for detecting smoke is connected in series

with said light emitting element for test.

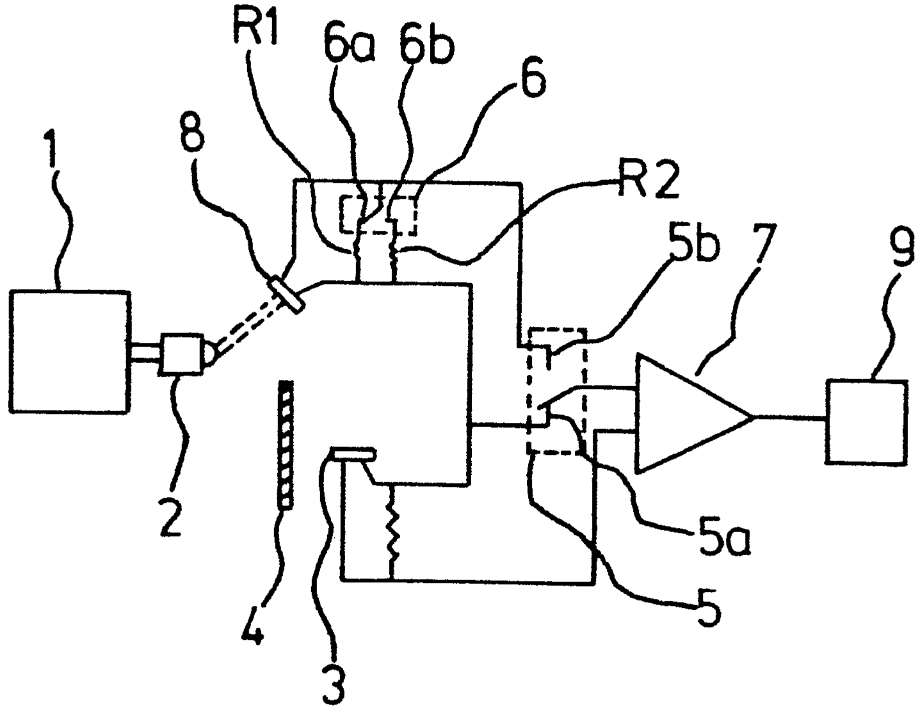
(7) A functional test means of a smoke detector as set forth in Claim (6) wherein, only when the test is conducted, said light emission circuit feed a light emission current to said light emitting element for test throught said light emitting element for detecting smoke to generate a light emission from said light emitting element for test, said light emission current being made different from that during fire monitoring.

(8) A functional test means of a smoke detector as set forth in Claim (6) wherein said light emission circuit comprises a short-circuiting circuit connected in parallel with said light emitting element for test.

(9) A functional test means of a smoke detector as set forth in Claim (8) wherein said circuit for measuring a combined output by received light is characterized by monitoring fire by light emitted solely from said light emitting element for detecting smoke with closed short-circuit, sending out a signal "normal" or "abnormal" to a receiver when the combined output by received light resulting from light emission from said light emitting element for test is respectively non-operation or operation level during no-operation test with the short-circuit disclosed due to a test signal, and sending out a signal "abnormal" or "normal" to the receiver when the combined output by received light which has a radiation larger than that during non-operation test is respectively non-operation or operation level during operation test with short-circuit disclosed due to a test signal.

(10) A functional test means of a smoke detector as set forth in Claim (8) wherein said circuit for measuring a combined output by received light is characterized by monitoring fire by discriminating between presence and absence of fire owing to a light emission current being fed only to said light emitting element for detecting smoke, monitoring function by discriminating between the combined output by received light from the photoelectric element being within and out of the normal level range when a light emission current which is lower than that during fire monitoring is fed to the light emitting element for test through the light emitting element for detecting smoke, said monitoring fire step and said monitoring function step being alternately performed, and sending out a signal "normal" or "abnormal" to receiver when the result of function test immediately before receiving test signal is respectively normal or abnormal, owing to test signal.

FIG 1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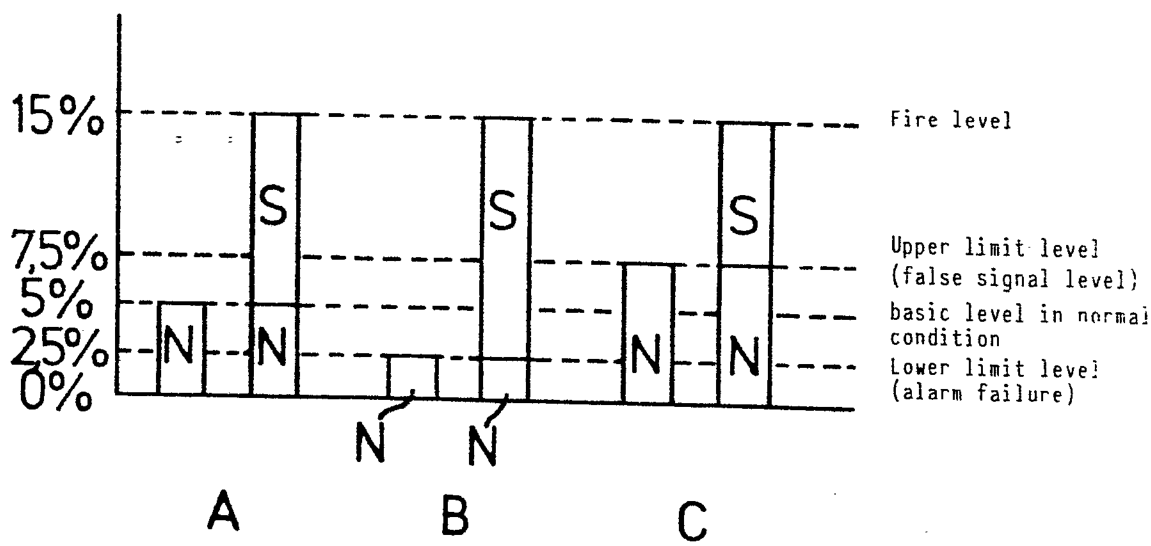
6b
6
1
8
R2
5b
7
9
2
5a
4
5
3

FIG 2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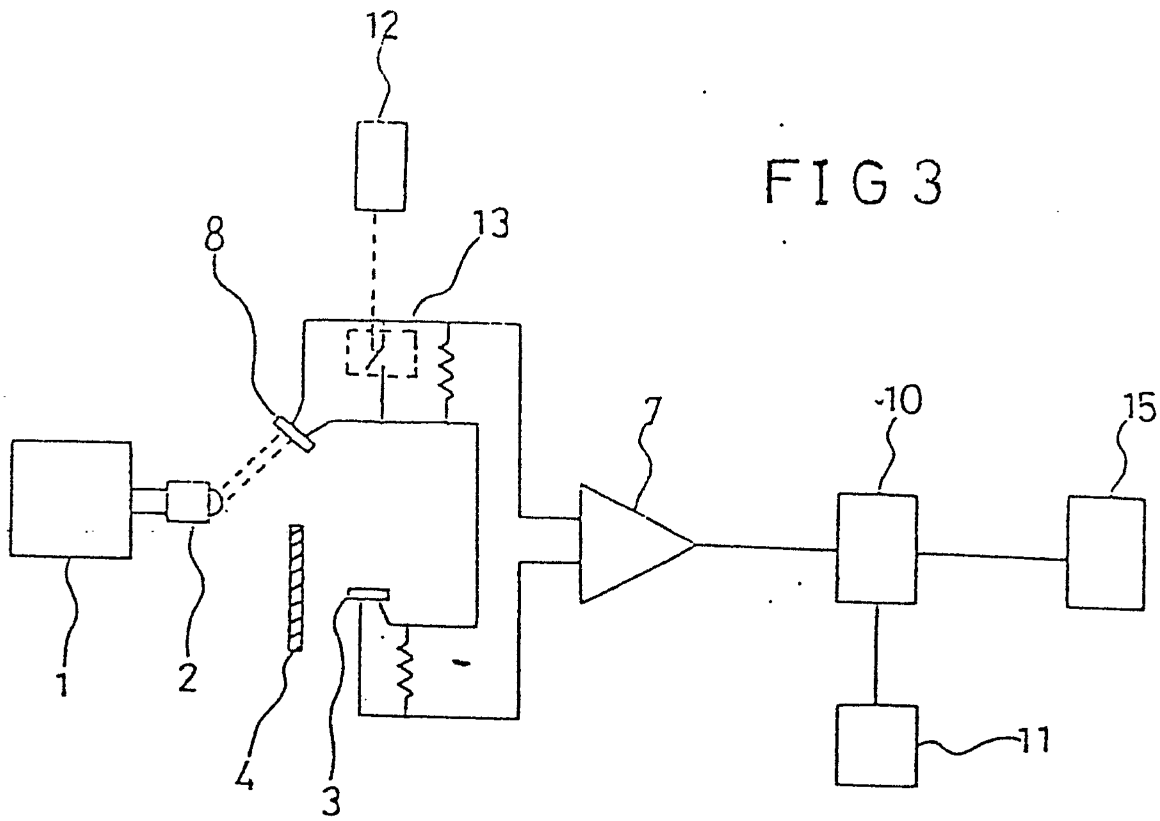
7,5%
5%
2,5%
0%
S
S
S
N
N
N
N
N
N
Fire level
Upper limit level
(false signal level)
basic level in normal
condition
Lower limit level
(alarm failure)
A
B
C

FIG 3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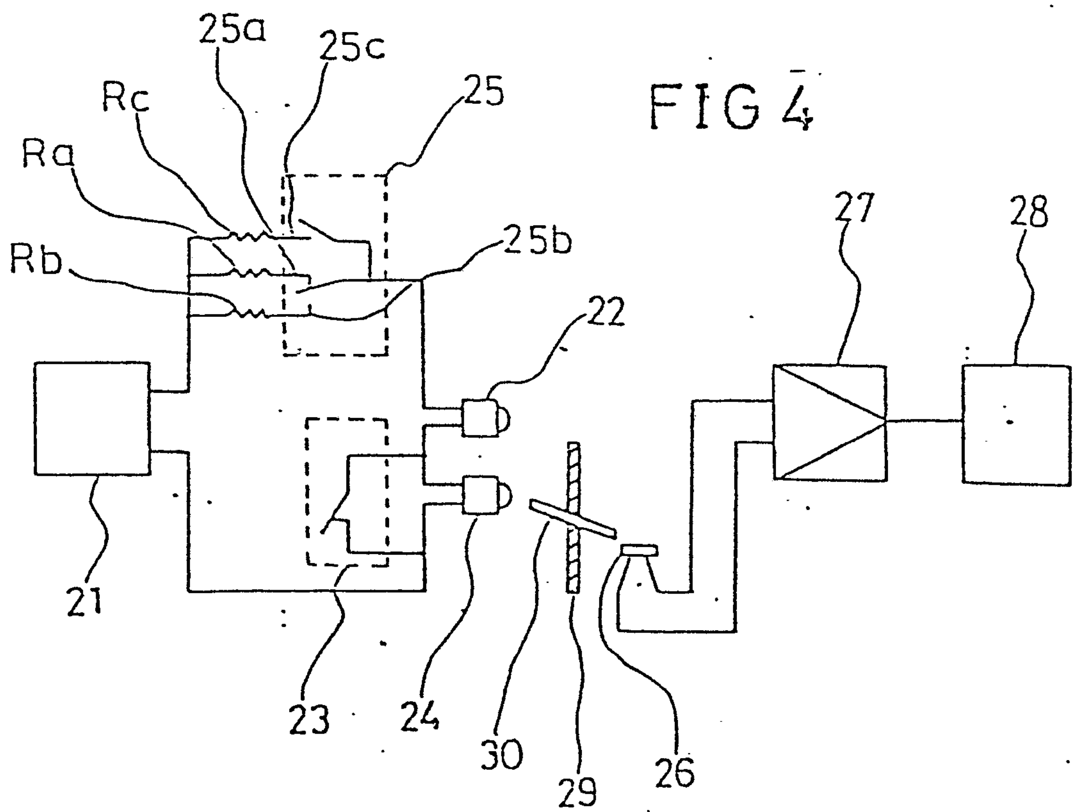
11

FIG 4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25c
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Rc
Ra
Rb
25b
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27
28
21
23
24
30
29
26

FIG 5

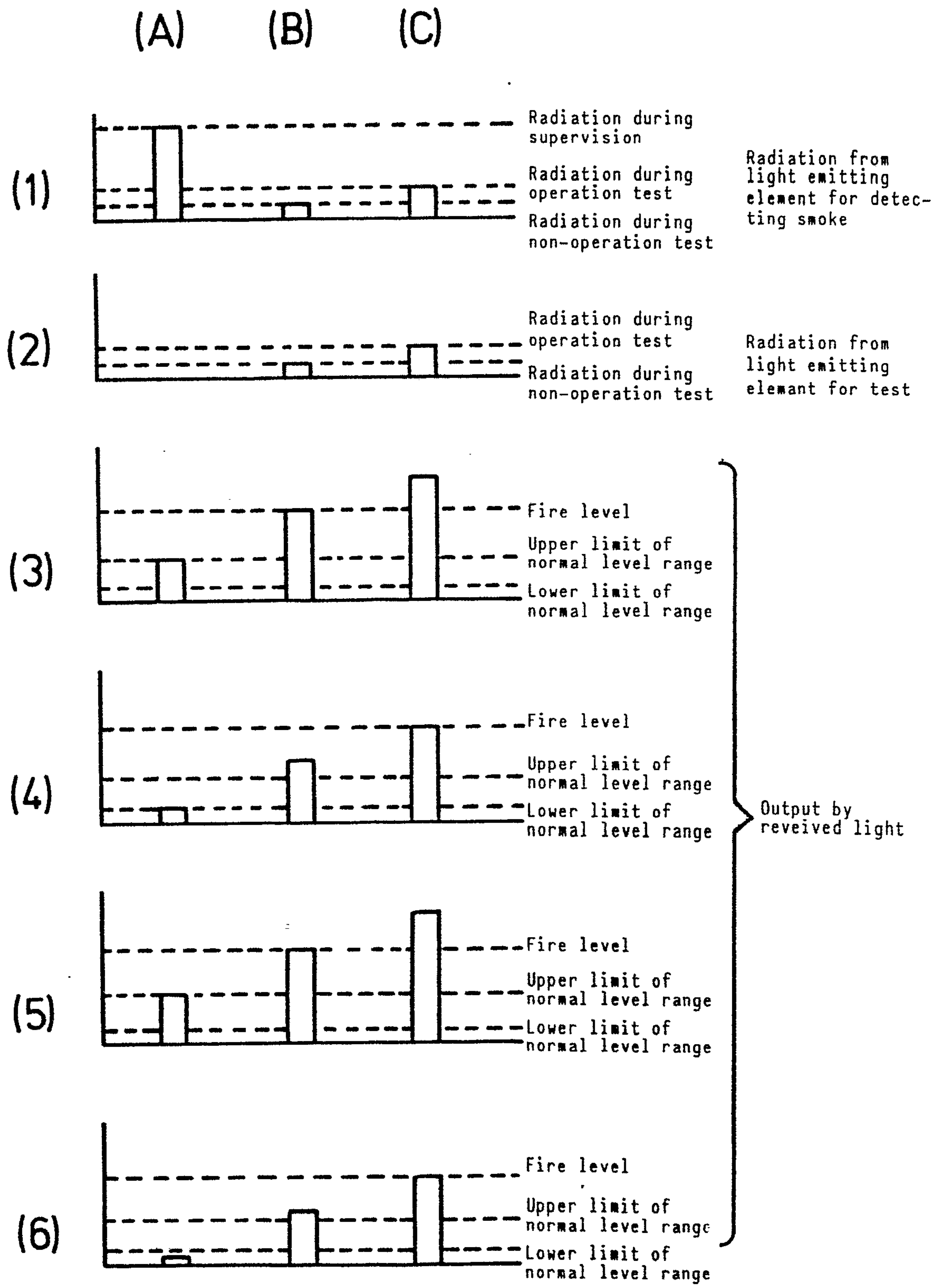
(A)
(B)
(C)
(1)
Radiation during supervision
Radiation during operation test
Radiation during non-operation test
Radiation from light emitting element for detecting smoke
(2)
Radiation during operation test
Radiation during non-operation test
Radiation from light emitting elemant for test
(3)
Fire level
Upper limit of normal level range
Lower limit of normal level range
(4)
Fire level
Upper limit of normal level range
Lower limit of normal level range
Output by reveived light
(5)
Fire level
Upper limit of normal level range
Lower limit of normal level range
(6)
Fire level
Upper limit of normal level range
Lower limit of normal level range

FIG 6