Oct. 27, 1964 E. MEILI ETAL 3,154,773

FIRE ALARM WITH AN AEROSOL INDICATOR FOR DETECTING COMBUSTION PRODUCTS SUSPENDED IN THE AIR

Filed Feb. 23, 1961

Fig.1

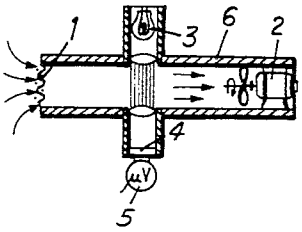


Fig.2

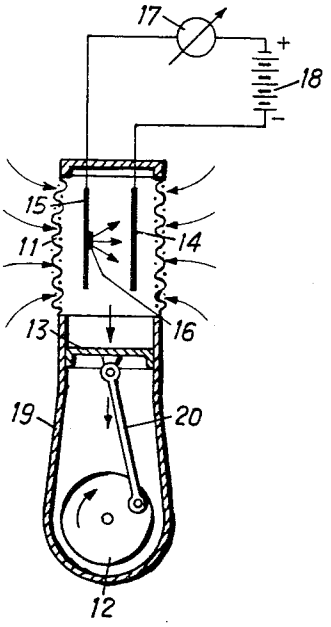


Fig.3

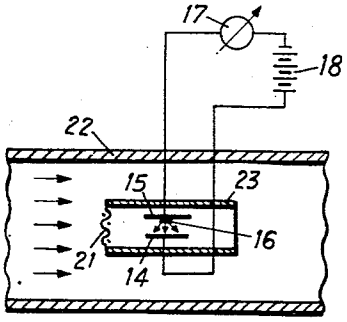
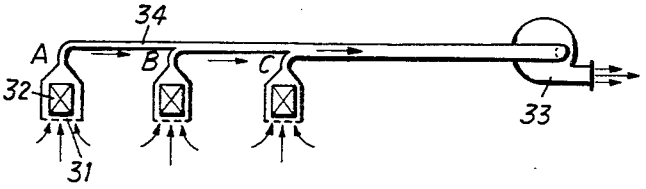


Fig.4



INVENTORS
Ernst Meili & Thomas Lampart
BY Werner W Kleeman
ATTORNEY

United States Patent Office 3,154,773 Patented Oct. 27, 1964

3,154,773

FIRE ALARM WITH AN AEROSOL INDICATOR FOR DETECTING COMBUSTION PRODUCTS SUSPENDED IN THE AIR

Ernst Meili, Kusnacht, and Thomas Lampart, Mannedorf, Switzerland, assignors to Cerberus AG., Mannedorf, Switzerland, a corporation of Switzerland

Filed Feb. 23, 1961, Ser. No. 90,989
Claims priority, application Switzerland, Feb. 25, 1960, 2,208/60
5 Claims. (Cl. 340—237)

The present invention relates to a novel fire alarm system of the type provided with an aerosol indicator for detecting combustion products suspended in the air. For the purposes of the present disclosure, the term "combustion products" relates to particles of microscopic and submicroscopic sizes which are produced by combustion and which float or are suspended in the air.

A number of fire alarm systems are known which respond to these particles and, more specifically, aerosols in order to actuate, for example, a fire alarm. By way of example, mention is made of ionization fire alarms which respond to visible and invisible combustion products. Also, alarms which operate with a light source and a photosensitive cell which respond either to a decrease in the intensity of the light received by the photosentive cell from the light source in the event that aerosols are present between them, or to the reflection of light by the aerosols.

The heretofore mentioned indicators of aerosols provided in fire alarm systems operate prefectly if the air does not contain substantial portions of other suspended contaminants, such as dust, soot, vapors and the like. If such contaminants are present, the operation of the fire alarm systems is adversely affected, or rendered impossible, since the contaminants cause the same effect as the combustion products which are to be detected. The contaminants may have the same effect on the transparency or reflective power of a gas at the aerosols, and they may alter the current flowing through an ionization chamber in the same manner as the aerosols stemming from combustion. In rooms and surroundings in which dust or other impurities are present, the sensitivity of the indicators must be considerably reduced if continual false alarms are to be avoided. Obviously, such an alteration in the system always involves a loss of sensitivity in detection of actual fires.

A further detrimental effect experienced with the operation of fire alarm systems provided with aerosol indicators is due to the soiling of these indicators by dust. If a breakdown after a short period of operation is to be prevented, costly cleaning processes are required.

Accordingly, the present invention has for one of its primary objects to provide a fire alarm system of the type mentioned which obviates the disadvantages mentioned hereinabove, which operates reliably even in rooms containing heavily contaminated air, and which responds most sensitively to the aerosols formed by combustion, even if such aerosols are present in very low concentrations.

Another important object of the present invention is to provide means preventing contaminants, other than those generally resulting from a combustion process, for actuating a fire alarm system.

Still a further object of the present invention is to provide means for filtering out foreign particles within a predetermined size range prior to entry into a fire alarm system in order to preserve the integrity of said system.

Yet another object of the present invention is to provide means for improving the sensitivity of a fire alarm system in detecting the presence of combustion products, such as aerosols.

Extensive tests have revealed the surprising result that the particles to which the aerosol indicators of the aforementioned type respond are commonly smaller than one μ, while the particles usually contained in air, by way of example, soot or dust particles, are considerably larger. The symbol "μ" as employed herein is to be understood as designating microns.

According to the teachings of this invention the disadvantageous influence of the foreign particles frequently present in air is overcome by causing the air to first pass through a filter before it reaches the indicators. The fire alarm according to the present invention is characterized by the fact that a filter is provided through which the gas to be tested reaches the aerosol indicator under the influence of a pressure difference created across said filter. The filter is preferably designed in such a manner that it will allow at least the majority of the aerosol particles having a diameter smaller than one μ to pass, while it retains the majority of particles having a diameter of more than five μ. It has been found that a fire may be reliably indicated by means of aerosol indicators even in very dusty or contaminated premises if these preconditions are met.

Still further objects of the present invention and the entire scope of applicability thereof will become apparent from the detailed desciption given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

In the drawing:

FIGURE 1 illustrates a fire alarm system provided with a light source and a photoelectric cell between which the air to be tested is passed;

FIGURE 2 shows an ionization fire alarm in which the air to be tested consecutively passes through a filter in both directions;

FIGURE 3 shows an ionization fire alarm arranged, by way of example, in a conduit or line; and

FIGURE 4 shows several fire alarms connected to a common fan which produces the pressure difference at the filters.

Referring now to FIGURE 1, the fire alarm system of the present invention is provided with an indicator comprising a light source 3 and a photoelectric cell 4 to which a microvoltmeter 5 may be connected. The light source 3 and the photoelectric cell 4 are located at diametrically opposite locations of a tube or housing 6 in which a fan 2 is located. One end of the housing defining an inlet is covered by a filter 1. In operation, the fan 2 draws the air to be tested through the filter 1 and into the housing 6 in the direction of the arrows shown.

The normal dust particles are retained by the filter 1 so that they cannot impede the light passing from the light source 3 to the photoelectric cell 4. However, if combustion products occur, aerosol particles of which the diameter is less than about one μ will be present in the indicating area of the housing 6. These particles will pass through the filter 1 and cause the light energy passing to the photoelectric cell 4 to be reduced. This results in a reduction of the voltage which will be indicated by the microvoltmeter 5. Such reduction of voltage is an indication of the presence of a combustion process. The microvoltmeter 5 may also be replaced by relay members

or the like, which are suitable to trigger the alarm if the voltage supplied by the photoelectric cell 4 drops below a predetermined value.

The filter 1 may be formed of a nylon or cotton fabric, much in the same manner as presently employed as a filtering material in commercial vacuum cleaners. For the present application, filters formed of non-swelling fibers may be advantageous, since the filtering properties will then be independent of humidity. In particular, filters formed of spun-glass fabrics may be found to be suitable. As hereinbefore stated, the filters are designed so that, for example, particles having a diameter or greatest dimension preferably less than one μ are passed, while particles of a dimension exceeding five μ are retained. The fiber grade employed in each particular case will also depend on the degree of contamination of the air.

It may here be pointed out that the filter 1 will also retain part of the particles produced in combustion. However, experience has shown that the smaller particles having a diameter less than about one μ will easily suffice to ensure reliability of indication of a combustion process.

In FIGURE 2 there is shown an ionization fire alarm system in which the gas to be tested is capable of passing through the filter 11 in both directions. The indicator of the fire alarm, according to FIGURE 2, contains two electrodes 14 and 15 connected to an indicating or measuring instrument 17 provided with a direct voltage source 18. Provided for one electrode, such as electrode 15, is a radioactive material 16, which at least partly ionizes the space between the two electrodes 14 and 15. If aerosols reach the space between the electrodes, the ions, as is generally known, will adhere to the aerosols, thus reducing the effective mobility of the oins. This will result in a certain decrease in the ionization current. The current decrease may be detected by the sensitive current indicator 17 or be employed to initiate an alarm by means of a relay member. Further details of the ionization fire alarm system can best be ascertained by referring to the copending U.S. application of Heinrich Derfler, Serial No. 710,732, filed Jan. 23, 1958, now United States Patent 2,994,768, issued August 1, 1961, and commonly assigned.

The two electrodes 14 and 15 are enclosed by a filter 11 which is designed and formed in the same manner as disclosed in conjunction with FIGURE 1. Enclosed in the space encompassed by the filter 11 is a housing or cylinder 19 within which a piston 13 reciprocates. The piston 13 may be connected, by way of example, with a connecting rod 20 eccentrically attached to a crank or wheel 12 which may be driven by a synchronous motor. In operation, the piston 13 reciprocates in the cylinder 19 and, thus, causes air to be consecutively drawn in and forced out of the housing 19. In the suction stroke, as indicated by the arrows in FIGURE 2, air from the outside is drawn through the filter 11 into the space between the two electrodes 14 and 15, whereas at least portions of the air located in this space are subsequently passed to the outside of the housing through the filter 11 during the pressure stroke.

In the embodiment according to FIGURE 2, which may naturally be combined with an optical aerosol indicator, the filter 11 cannot become soiled since the dirt particles which are deposited on the outside surface of the filter during the suction stroke are blown away during the pressure stroke. The filter will, therefore, remain operative for considerable periods without necessitating servicing.

FIGURE 3 shows a further embodiment of an ionization fire alarm. The electrical members are arranged in a manner similar to FIGURE 2, so that for clarity in comprehension the same reference numerals have been employed. The two electrodes of the indicator are arranged within a tubular housing 23 which may be arranged, for example, in a duct or conduit. The gas to be tested for combustion products flows through the duct in the direction indicated by the arrows. Provided at the side of the housing 25 which faces the incoming air stream is a filter 21 which retains the aerosol particles having a diameter of, for example, over five μ while the particles having a smaller diameter are allowed to pass. In the embodiment according to FIG. 3, the filter 21, furthermore, performs the function of reducing the flow within the tube 23. This is desirable because excessive flow may change the relationship between the electrodes 14 and 15 so as to reduce indicator sensitivity.

It may be appreciated from the examples disclosed that, either an existing flow or, a pressure difference is employed to pass the air to be tested through the filter, or means may be provided to produce such a pressure difference (FIGURES 1 and 2).

If means for artificially producing a pressure difference on the two sides of a filter must be provided, it will be possible to connect several individual alarms to a common negative-pressure source, as for example to a fan. Such an arrangement is shown in FIGURE 4. Three fire alarms A, B and C, each comprising an aerosol indicator 32 and a filter 31, are connected, via lines 34, with a fan 33 which maintains constant negative pressure in the line 34. This negative pressure will regularly cause air to be drawn through the filters 31 and tested in the indicator 32. Soiling of the filters 31 may be avoided by forcing air through the lines 34 in the opposite direction at regular intervals for the purpose of cleaning the filters 31. As generally known in the art, the indicators 34 are connected with a central station which may actuate an alarm if the content of floating particles or aerosols having a diameter of, for example, one μ exceeds a predetermined critical value.

It is readily to be appreciated that the pressure difference in the embodiments shown may influence the response threshold of the alarm. By way of example, if the pressure difference in the alarm is relatively great, a larger number of floating particles will pass through the filter than if the pressure difference is smaller. Reliable monitoring and communication, respectively, may therefore require control of the pressure difference at the filters for the reason just mentioned.

Having thus described the present invention, what is desired to be secured by United States Letters Patent is:

1. The combination with a fire alarm, for detecting the presence of products of combustion contained in a fluid medium, of the type comprising circuit means for operating said fire alarm, housing means having an inlet opening and internally provided with an ionization chamber communicating with said inlet opening and including spaced electrode means and radioactive material provided in said ionization chamber for at least partially ionizing the space therebetween, filter means operatively associated with said inlet opening of said housing for preventing particles entering said ionization chamber which substantially result from other than a combustion process, said filter means being constructed to pass particles having a diameter smaller than 1 micron while retaining the majority of particles having a diameter greater than 5 microns.

2. The combination of claim 1, including a plurality of fire alarms, each provided with at least one separate ionization chamber, and individual filter means operatively associated with said ionization chamber of each fire alarm for preventing said particles from entering each ionization chamber which result from other than a combination process.

3. The combination of claim 1, including means cooperating with said filter means for creating a pressure difference across said filter means.

4. The combination of claim 3, said pressure difference creating means being a pump, said pump drawing, via said filter means, fluid medium into said housing during its suction stroke and forcing at least a portion of said fluid medium, via said filter means, from said housing during

its exhaust stroke, to carry out a cleaning action on said filter means.

5. The combination of claim 1, wherein said housing means is an elongated member provided with openings at opposite ends, said filter means being arranged in one of said ends to contact fluid medium flowing in the direction of said one end, with said housing means adapted to be arranged within a duct member, said housing means possessing a cross-sectional area with respect to that of said duct member such that a pressure difference is created across said filter means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,079,474	Walsh	May 4, 1937
2,228,216	Morgan	Jan. 7, 1941
2,572,008	Cahusac et al.	Oct. 23, 1951