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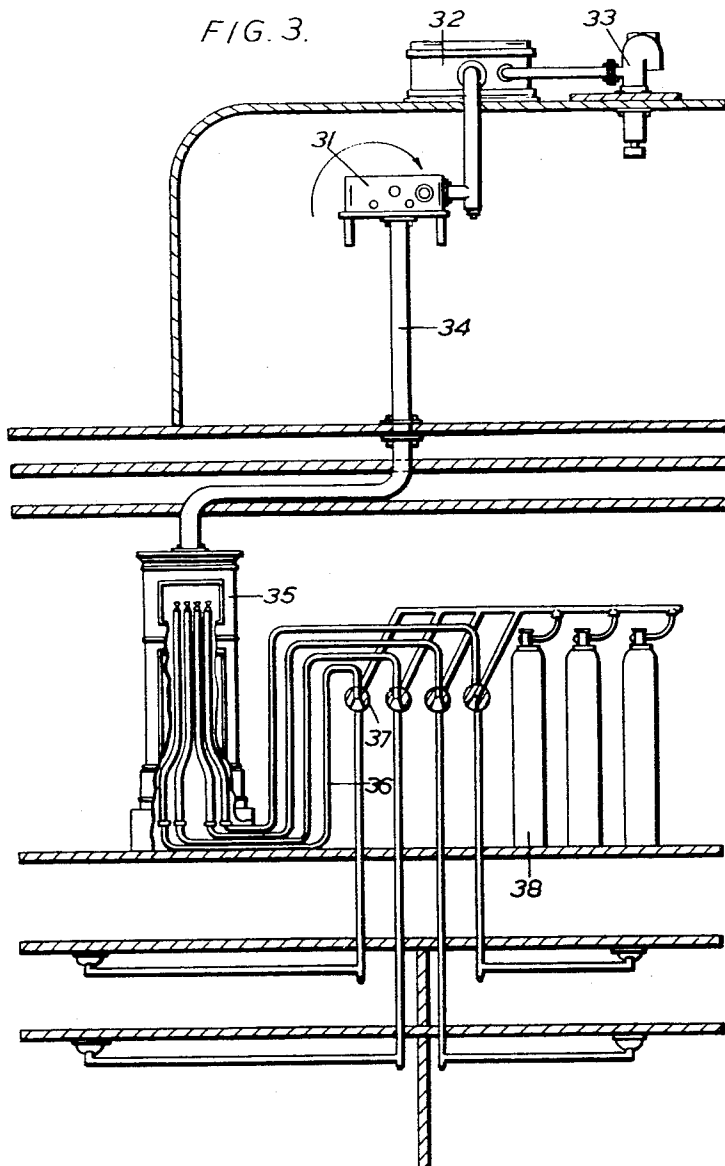
C. C. HALL

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SMOKE DETECTING AND SIMILAR SYSTEMS

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3 Sheets-Sheet 2



Inventor

Cyril Clifford Hall

By

J. William Carson

Attorney

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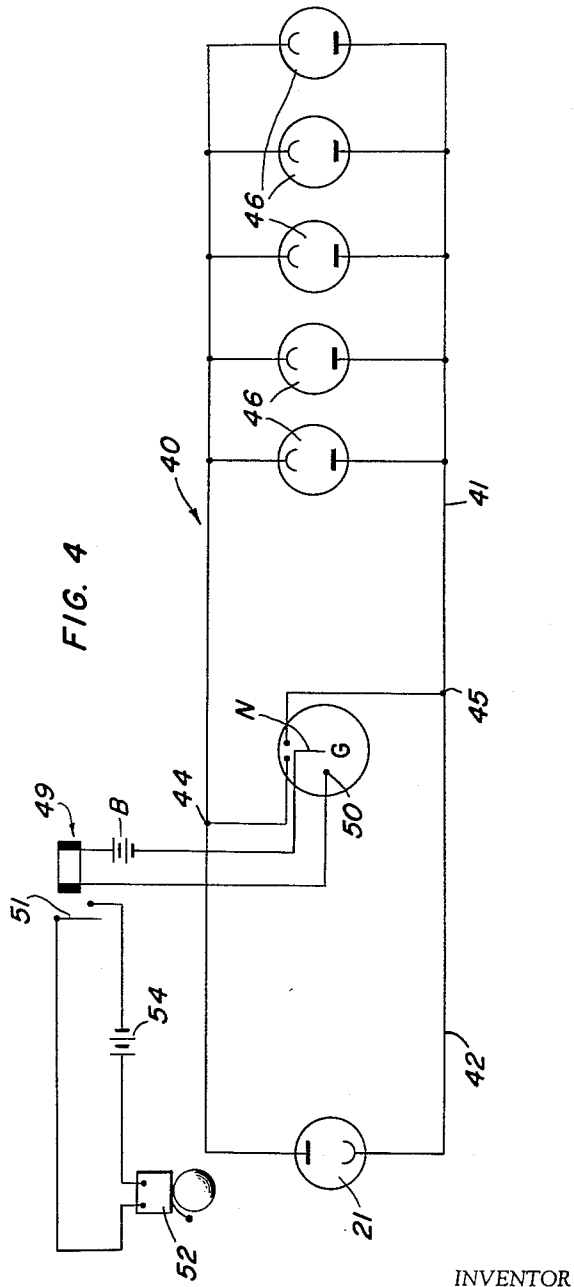
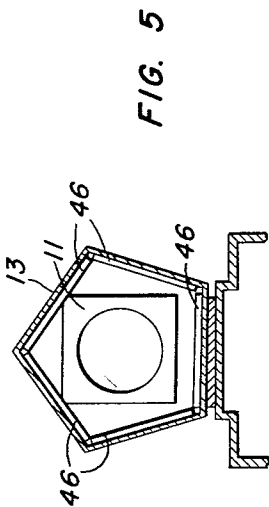
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INVENTOR
CYRIL CLIFFORD HALL

BY *J. William Carson*
ATTORNEY

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SMOKE DETECTING AND SIMILAR SYSTEMS

Cyril Clifford Hall, Ealing, London, England, assignor to Specialties Development Corporation, Belleville, N. J., a corporation of New Jersey

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5 Claims. (Cl. 340—237)

This invention relates to smoke detecting systems and similar systems such as are employed for keeping a check on air conditions where subject to contamination by dust particles. Smoke detecting systems are commonly employed for checking the conditions in the various compartments and holds of a ship and also in the workshops and storerooms of a factory.

The present invention is intended primarily, but not exclusively, for use in systems and apparatus of the kind in which a stream of air under test serves, when contaminated by smoke or like particles, to activate light-sensitive instruments, which when activated by light dispersed from the particles, serve to actuate an electric alarm instrument or indicator. Thus, it is known to employ a smoke detecting system in which light-sensitive elements are normally unilluminated and are included in a balanced electrical network, such as a Wheatstone bridge, the arrangement being such that the balance of the network is adapted to be disturbed by the activation of one or more of the light-sensitive instruments by light dispersed from a beam, from which it or they are normally shrouded, by the presence of smoke particles in an air sample drawn past the light-sensitive instrument or instruments. The unbalance current in the network is then employed to energize the alarm instrument or indicator.

One of the objects of the present invention is to improve smoke detecting systems of the general class above referred to by providing means for the direct optical observation of the presence of smoke in the air under test in addition to the normal automatic alarm means.

A further object is to provide direct optical means for observing air samples and detecting smoke therein, which is of simple but effective and reliable construction capable of being readily embodied in the cabinet of a normal automatic audible alarm apparatus of the type above referred to.

A still further object of the invention is to reduce the amount of air sample piping required in the construction of a satisfactory and reliable system for detecting the presence of smoke in air samples drawn from the holds of a ship.

According to the present invention, means for direct optical detection of smoke or like particles in an air sample comprises a dark chamber such as a tube, into which sample air passes, which is set transversely of the beam from a light source, said chamber having a narrow slit in the side wall nearer the light source and a relatively broad slit in the opposite side wall, so that light entering the narrow slit passes out through the broad slit to maintain a beam of light extending transversely across the chamber and invisible to the eye of the observer except when dispersed by the presence of smoke or like particles in the air sample present in the chamber.

It will be understood that because the second slit is relatively wide there will ordinarily be no internal reflection of light within the chamber and the light beam will only, in effect, become visible from the observer's

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eyepiece in the end of the chamber when the air inside the chamber becomes charged with suspended particles, such as smoke or dust particles. It will also be understood that no lenses will be required in the beam slits to condense the beam, so that there will be no loss of light from such use and the price of the instrument may be kept low also. The construction of the device may be quite simple; it may, for example, consist of a plain tube with slits formed therein diametrically opposite to one another; it may be formed from flat plates, preferably inclined towards the light source to provide a sharp-edged slit.

The direct observation, optical smoke detector provided by the present invention lends itself to incorporation in the cabinet of an audible alarm of the type controlled by a light-sensitive, instrument, previously referred to.

In order that the invention may be more fully understood, reference is made to the accompanying drawings wherein:

Figure 1 is a section of one form of smoke detector made in accordance with the invention.

Figure 2 is a section of a combined visual and audible smoke detector.

Figure 3 is a diagram of a layout of a ship's smoke detecting system including a combined visual and audible smoke detector.

Figure 4 is a schematic wiring diagram showing suitable electrical apparatus and connections for carrying out the invention.

Figure 5 is a sectional view taken along the line 5—5 of Figure 2, illustrating details of the apparatus.

The visual smoke detector shown in Figure 1 is intended for location inside an outer casing anywhere in the stream of one or more air samples. It comprises a tube 1 having a narrow slit 2 cut in it and a wider slit 3 cut diametrically to the slit 2. It has an eyepiece 4 in one end and an air sample entry 5 in the other end. The detector is intended to be mounted so that a light falls on the side of the tube and a beam enters the slit 2 normally and passes out through the wider slit 3. In this manner the inside of the tube 1 cannot be illuminated by the light beam, unless there is smoke or dust present, so that the inside of the tube will appear dark when observed through the eyepiece 4. On the other hand, when the tube 1 is filled with smoke, the beam of light will appear as a light band stretching transversely across the tube.

In Figure 2 there is shown a combined visual and audible smoke indicator (with the front of the cabinet removed), which employs a visual indicator of the present type.

This combined visual and audible indicator is mounted in a light-proof cabinet and comprises a lamp 10, with a condensing lens system 11 mounted in a screen 12 and adapted to concentrate the light from the lamp to a substantially parallel beam.

The parallel beam of light passes through a hollow pentagonal framework 13, which acts as a mounting for five inwardly facing photo-electric cells which control an audible alarm system. After passing through the pentagonal framework, the light beam falls on the visual indicator 15. The visual indicator has a front formed of a pair of inclined plates 16 sloping away from the direction of the light beam, with their edges slightly spaced apart to provide a sharp edged slot 17. The top and bottom and the rear of the visual indicator are formed from a pair of suitably bent plates 18, which are spaced apart to leave a wider gap 19 to let the beam of light pass out of the visual indicator without impinging on any interior surface of the indicator. The visual indicator is provided with an eyepiece 20, mounted in the front of the cabinet,

the position of which is indicated in dotted lines. A screened photo-electric cell 21 is provided, which is included for balancing purposes in the network of the audible alarm control circuit. Sample air, which is a mixture of all the air samples drawn from the various holds of a ship, is drawn in through an aperture in the base of the cabinet of the combined visual and audible indicator and out through an outlet 22 in the end of the cabinet. The drawing of the sample air through the cabinet is sufficient to ensure that if smoke is present in the air sample it will be detectable both by the operation of the audible and visual detector units.

A typical lay-out of a combined visual and audible smoke detecting system in a ship is shown in Figure 3.

The combined visual and audible smoke detecting unit 31 is located in the wheel house of the ship and sample air is drawn through it by a suction motor unit 32 and discharged through a two-way valve 33, which normally allows the sample air to be discharged into the wheel house so that the presence of smoke may also be detected nasally. The discharge of the sample air into the wheel house when the cargo is of an odorous nature is obviously impracticable and in that event the sample air is discharged to atmosphere by operation of the switch valve 33.

The sample air is led up to the detector unit 31 through a pipe 34 of large diameter from a visual detector and line identification unit 35 of known construction located several decks below, into which the sample air is drawn from the different holds by means of small diameter pipes 36, which may be up to fifty in number. This arrangement permits of a considerable economy by having one large pipe 34 in place of a large number of small pipes leading up to the wheel house.

A two-way valve 37 is located in each of the pipes 36 to enable it to be used for the delivery of carbon dioxide for fire extinguishing purposes from cylinders 38 to the hold with which the particular pipe 36 is associated.

The use of the combined visual and audible indicator unit 31 allows the line identification unit 35 to be placed below decks, instead of in the wheel house and thus permits the substitution of the single large diameter pipe 34 in place of leading all the small diameter pipes 36 up into the wheel house, as was formerly necessary.

As shown in Figure 4, the electrical circuit 40 is of the balanced bridge type and may consist of a pair of branches 41 and 42 and a conventional galvanometer G connected across the branches at their juncture 44 and 45. A plurality of photoelectric cells 46 are connected identically in parallel in the branch 41 and the balancing cell 21 is connected in the branch 42 in opposed relation to the cells 46.

A normally open relay 49 has one end of its coil connected through a battery B to the galvanometer G indicator needle N and has the other end of its coil connected to a contact 50 in the path of the needle so that the relay is energized when the galvanometer needle is deflected and engages the contact 50 whereupon the relay switch 51 closes an alarm circuit which includes alarm means such as a bell 52 and a source of electrical energy 54.

The photoelectric cells 46 are mounted in the framework 13 (Figures 2 and 5) facing inwardly so as to surround the light beam from lamp 10, and the cell 21 is mounted at the other side of the visual indicator structure 15 adjacent the end of the cabinet, as shown.

In operation, air from the spaces to be protected is drawn into the cabinet through an aperture (not shown) in the base thereof, through a zone surrounded by the cells 46, through the structure 15 and out through the outlet 22. When a fire occurs in any of the protected

spaces, smoke particles drawn into the cabinet thereby pass through the light beam and reflect light on the cells 46 causing the bridge circuit to become unbalanced whereupon the indicator needle of galvanometer G engages the contact 50 to effect actuation of the alarm means 52. At the same time smoke particles passing through the structure 15 will be illuminated and can be visually observed through the eyepiece 20.

From the foregoing description, it will be seen that the present invention provides an improved smoke detecting system for detecting smoke therein, which is simple, effective and reliable in construction.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

I claim:

1. Apparatus for direct visual detection of particles suspended in an air sample comprising a source of light, a dark chamber into which sample air passes and which is set transversely of a beam from said light source, said chamber having a narrow slit in its side wall nearer to said light source and a relatively broad slit in its opposite side wall so that the light entering the narrow slit passes out through the broad slit without illuminating the interior of said chamber, and an eyepiece in said dark chamber for viewing the interior thereof.

2. Apparatus according to claim 1 wherein said chamber is in the form of a tube having said narrow slit and said broad slit diametrically opposite thereto, said tube having an eyepiece in one end and having an air sample admission inlet in the other end.

3. Apparatus according to claim 1 comprising an outer cabinet having said light source therein and means for passing sample air therethrough.

4. A smoke detecting system for a ship having a plurality of individual holds, said system comprising detection apparatus according to claim 3 located in the wheel house of the ship, line identification apparatus located below decks, small pipes leading to said line identification apparatus from the individual holds for drawing sample air therefrom, and a large diameter pipe for the sample air leading up to said detection apparatus from said line identification apparatus.

5. In apparatus for detecting matter suspended in air, the combination of a cabinet through which a single sample of air is drawn, a light source for directing a beam of light axially through said cabinet, a series of light sensitive elements circumferentially arranged in an annular zone surrounding said light beam and being adjacent thereto but out of the path thereof and each radially facing the axis of the light beam whereby any of said elements are adapted to be rendered responsive to suspended matter in the sample, and alarm means under the control of said light sensitive elements.

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