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APPARATUS FOR VISUAL DETECTION OF SUSPENDED MATTER IN FLUIDS

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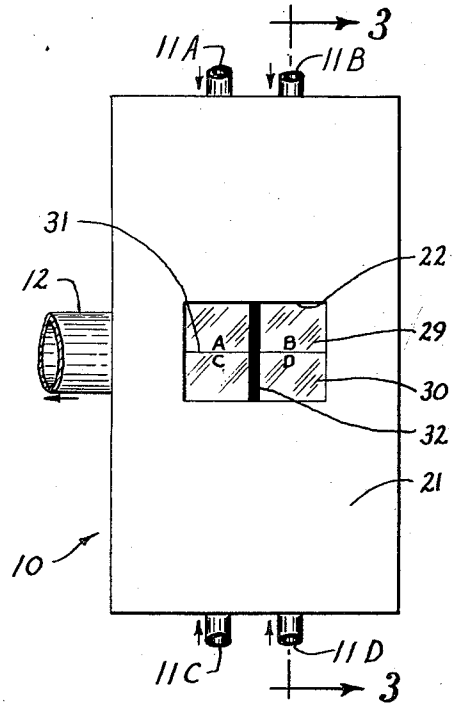


FIG. 1

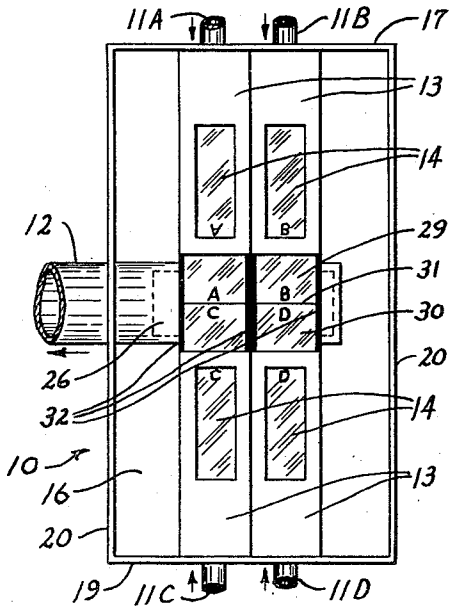


FIG. 2

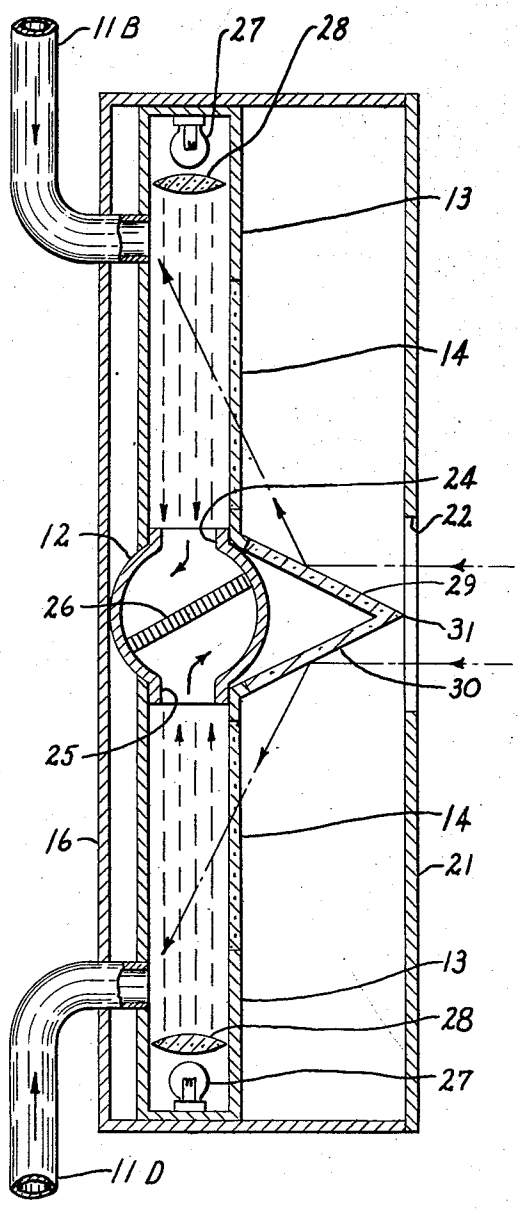


FIG. 3

INVENTOR
Arthur W. Uhl
BY
Ernest A. Jorgensen
ATTORNEY

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APPARATUS FOR VISUAL DETECTION OF SUSPENDED MATTER IN FLUIDS

Arthur W. Uhl, Inwood, N. Y., assignor to Specialties Development Corporation, Belleville, N. J., a corporation of New Jersey

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8 Claims. (Cl. 88—14)

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The present invention relates to improvements in apparatus for visually detecting suspended matter in fluids, and, more particularly, relates to apparatus for detecting or observing smoke particles or the like suspended in air.

The present invention is primarily concerned with such apparatus adapted to be utilized to supervise a plurality of compartments, zones or spaces, for example on ships or in warehouses and the like, by continuously withdrawing samples of air from such compartments or zones and conducting the same to a central observation station where a beam of light is passed through the samples to illuminate smoke particles suspended therein and suitable means are provided for visually observing the illuminated particles to detect the commencement of a fire or other abnormal condition.

In connection with such apparatus, it has been found that the illuminated particles can be seen more readily when looking obliquely in the direction toward the origin of the beam of light.

Accordingly, an object of the present invention is to utilize the foregoing principle in connection with apparatus wherein a plurality of observation windows are provided which correspond in number to the number of compartments or zones to be supervised.

Another object is to provide such apparatus which is extremely simple and economical in construction, and comprises a minimum number of parts which are readily assembled in compact arrangement.

Another object is to provide such apparatus wherein means are provided for indirectly observing the air stream.

Another object is to minimize the reflection of light or images on the observation means from external sources to thereby provide a clear and distinguishable smoke picture.

A further object is to provide such apparatus wherein the observation means are readily identified for association with the compartment or zone supervised thereby.

A still further object consists in the construction and arrangement of the parts and elements of the apparatus whereby the foregoing objects are accomplished.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

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A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawing, forming a part of the specification, wherein:

Figure 1 is a schematic front elevational view of apparatus in accordance with the invention shown with the cover at the front thereof in place.

Figure 2 is a front elevational view of the apparatus shown in Figure 1, the cover being removed to illustrate the interior thereof.

Figure 3 is an enlarged sectional view taken along the line 3—3 on Figure 1, illustrating details of the apparatus.

Referring to the drawing in detail, there is shown by way of example a smoke detector in accordance with the present invention generally comprising a cabinet 10, air sample inlet conduits 11A, 11B, 11C and 11D connected with the compartments, zones or spaces to be supervised, a common outlet conduit 12, a tube 13 connected between each inlet conduit and the outlet conduit having a window 14, means for directing a beam of light through each tube to illuminate suspended matter in the air passing therethrough, and means for facilitating observation of the air stream through the windows. While four inlet conduits and four tubes 13 have been shown herein by way of example, it will be understood that any desired number of these elements may be utilized, depending on the number of spaces to be supervised.

The cabinet 10 is generally rectangular as shown and comprises a rear wall 16, a top wall 17, a bottom wall 19, side walls 20, and a front wall 21 in the form of a hinged or otherwise removable cover or door having a rectangular opening 22 therein (Figure 1).

The outlet conduit 12 extends through one of the side walls 20 into the cabinet and is provided with a plurality of aligned openings 24 at the upper side thereof and a plurality of aligned openings 25 at the lower side thereof with each opening 24 being substantially opposite an opening 25. A partition 26 is arranged in the conduit 12 to divide the same into two zones adjacent the upper and lower openings 24 and 25 whereby direct fluid flow communication between opposite openings is prevented. As shown, the conduit 12 may be cylindrical and the partition may extend diametrically across the interior of the conduit and diagonally with respect to the longitudinal axes of the opposite openings 24 and 25 (Figure 3).

The tubes 13 are generally elongate and may

have any desired cross-sectional shape. For example, these tubes may be rectangular in cross-section to facilitate arranging them in side by side relation to provide compact upper and lower rows of tubes having a generally flat surface facing the front wall 22 of the cabinet but set inwardly therefrom. The windows 14 are provided in this surface and are generally flat and elongate.

The upper tubes each have their lower end in fluid flow communication with an opening 24 of the outlet conduit, and have an inlet conduit connected in fluid flow communication therewith adjacent the upper ends thereof. Similarly, the lower tubes each have their upper end in fluid flow communication with an opening 25 of the outlet conduit, and have an inlet conduit connected in fluid flow connection therewith adjacent the lower ends thereof. In this manner, the sample air is introduced into the tubes, conducted therethrough and withdrawn to provide an air stream adapted to be observed through the windows to detect suspended matter therein. As shown in Figure 3, the inlet conduits extend through the rear wall 16 of the cabinet and into the tubes.

The means for illuminating the air stream in the tubes, as shown herein, comprise a lamp 27 and a lens 28 for directing a beam of light longitudinally through the tubes in a direction substantially parallel to the windows. In the illustrative embodiment, the lamp is at the end of the tube opposite the end in communication with the outlet conduit, the upper tubes having the lamps at the upper ends thereof and the lower tubes having the lamps at the lower ends thereof.

The partition 26 in the outlet conduit 12 is constructed of light impervious material and prevents the beams in the tubes from entering an opposite tube whereby all of the illumination in each tube is provided from one point. Also, by arranging the partition diagonally with respect to the longitudinal axes of the tubes and the light beam axes, reflection of light back into the tubes is minimized.

The means for facilitating indirect observation of the air stream through the windows and obliquely into the light beam comprise a pair of rectangular mirrors 29 and 30 each positioned at an obtuse angle with respect to the upper and lower tubes 13, respectively, and positioned at an acute angle with respect to each other. One end of each mirror is adjacent one end of the windows of a row of tubes, and the other ends of the mirrors meet acutely at 31 to provide a sharp line of demarcation between the upper and lower mirrors. Each mirror is coextensive widthwise with its row of windows, whereby a single mirror element can be utilized for a plurality of windows in a row.

As will be seen more particularly in Figure 3, the mirrors are exteriorly mounted of the tubes 13 and extend towards the front wall or cover of the cabinet but are fully within the cabinet whereby the cabinet minimizes the reflection of external images thereon. Also, the cabinet cover conceals the windows to prevent external interference by light or the reflection of images thereon.

The opening 22 in the cover is in horizontal alignment with the mirrors to enable the mirrors to be visually observed from the exterior of the cabinet. The mirrors are so positioned that upon looking through the opening 22 in a generally horizontal direction, the reflection of the air stream as viewed obliquely through the windows 14 along the entire length thereof will be seen on the mirrors. This arrangement provides for readily observing a relatively large area in which a smoke picture may appear.

In order to identify the zone, space or compartment wherein a smoke condition occurs when smoke laden air thereof is conducted through the tube associated therewith, each window has indicia thereon which distinguishes it from the other. For example, the windows may be marked A, B, C and D, respectively, placed upside down near the ends of the windows adjacent the respective mirrors, whereupon, when smoke is illuminated in a particular tube, the shadow of its marking will be reflected on the mirror and will be clearly seen in right side up position (Figure 2). If desired, the mirrors may be similarly marked at points in alignment with the respective windows, to readily identify the tube and its associated space in which smoke is detected.

As previously indicated, the edge 31 at which the mirrors 29 and 30 meet provides a line of demarcation for the reflections of opposite tubes. In order to more clearly distinguish the reflections of adjacent tubes, stripes or bands 32 may be provided on the mirrors to sectionalize the same. Thusly, the edge 31 and stripes 32 may be utilized to divide the mirror elements into a number of rectangular areas corresponding in number to the number of tubes 13, so that a tube in which a smoke signal occurs is readily spotted and identified.

From the foregoing description, it will be seen that the present invention provides improved apparatus for supervising a plurality of compartments, zones or spaces in which suspended matter in a fluid is to be detected, although it will be recognized that certain features of the invention may be embodied in apparatus for supervising a single space or the like. The apparatus is extremely simple and compact, and is readily assembled and installed. The improved arrangement of the light beam, the window and mirror provides a clearly recognizable smoke picture. By reason of the concealment of the window and shielding of the mirrors, stray images are reduced to a minimum thereby eliminating interference with the observer's vision in being able to definitely distinguish a smoke signal from a mirage.

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. In apparatus for detecting the presence of suspended matter in a fluid, the combination of a conduit having opposite openings, a partition in said conduit arranged to prevent direct fluid flow communication between said openings, an elongate tube for each opening having one end in fluid flow communication with said conduit and having an inlet opening adjacent the opposite end for introducing into the tube a stream of fluid in which suspended matter is to be detected, an elongate window in said tubes, means for each tube adjacent the inlet opening end thereof and one end of said window for directing a beam of light towards the other end of said tube, and a mirror for each tube adjacent the other end of its said

window at the exterior thereof and positioned at an obtuse angle with respect to its said window.

2. In apparatus for detecting the presence of suspended matter in a fluid, the combination of a conduit having opposite openings, a partition in said conduit arranged to prevent direct fluid flow communication between said openings, an elongate tube for each opening having one end in fluid flow communication with said conduit and having an inlet opening adjacent the opposite end for introducing into the tube a stream of fluid in which suspended matter is to be detected, an elongate window in said tubes, means for each tube adjacent the inlet opening end thereof and one end of said window for directing a beam of light towards the other end of said tube, a mirror for each tube adjacent the other end of its said window at the exterior thereof and positioned at an obtuse angle with respect to its said window, and a cover for concealing said windows, said cover being spaced from said windows and having an opening in alignment with said mirrors.

3. In apparatus for detecting the presence of suspended matter in a fluid, the combination of a conduit having opposite openings, a partition in said conduit arranged to prevent direct fluid flow communication between said openings, an elongate tube for each opening having one end in fluid flow communication with said conduit and having an inlet opening adjacent the opposite end for introducing into the tube a stream of fluid in which suspended matter is to be detected, an elongate window in said tubes, means for each tube adjacent the inlet opening end thereof and one end of said window for directing a beam of light towards the other end of said tube, and a generally rectangular mirror for each tube having one end adjacent the other end of its said window at the exterior thereof and positioned at an obtuse angle with respect to its said window, said mirrors having the other ends thereof adjacent each other and being positioned at an acute angle with respect to each other.

4. In apparatus for detecting the presence of suspended matter in a fluid, the combination of a conduit having opposite openings, a partition in said conduit arranged to prevent direct fluid flow communication between said openings, an elongate tube for each opening having one end in fluid flow communication with said conduit and having an inlet opening adjacent the opposite end for introducing into the tube a stream of fluid in which suspended matter is to be detected, an elongate window in said tubes, means for each tube adjacent the inlet opening end thereof and one end of said window for directing a beam of light towards the other end of said tube, a generally rectangular mirror for each tube having one end adjacent the other end of its said window at the exterior thereof and positioned at an obtuse angle with respect to its said window, said mirrors having the other ends thereof adjacent each other and being positioned at an acute angle with respect to each other, and a cabinet for enclosing said tubes having an opening in alignment with said mirrors for visual observation thereof.

5. In apparatus for detecting the presence of suspended matter in a fluid, the combination of a conduit having opposite openings, a diagonally extending partition in said conduit between said openings to prevent direct fluid flow communication therebetween, an elongate tube for each opening having one end in fluid flow communication with said conduit and having an inlet opening adjacent the opposite end for introducing into the tube a stream of fluid in which suspended matter is to be detected, an elongate window in said tubes, means for each tube adjacent the inlet opening end thereof and one end of said window for directing a beam of light towards the other end of said tube, a mirror for each tube adjacent the other end of its said window at the exterior thereof positioned at an obtuse angle with respect to its said window.

6. In apparatus for detecting the presence of suspended matter in a fluid, the combination of a conduit having a plurality of aligned openings at one side and a plurality of aligned openings at the opposite side, a partition in said conduit arranged to prevent direct fluid flow communication between opposite openings, an elongate tube for each opening having one end in fluid flow communication with said conduit and having an inlet opening adjacent the opposite end for introducing into the tube a stream of fluid in which suspended matter is to be detected, an elongate window in said tubes, means for each tube adjacent the inlet opening end thereof and one end of said window for directing a beam of light towards the other end of said tube, and a pair of generally rectangular mirrors coextensive widthwise with said windows and positioned at the exterior thereof, each mirror having one end adjacent the other ends of said windows of the tubes of the openings at one side of said conduit and being positioned at an obtuse angle with respect to its said windows and having the other ends thereof adjacent each other and being positioned at an acute angle with respect to each other.

7. In apparatus for detecting the presence of suspended matter in a fluid, the combination of a conduit having a plurality of aligned openings at one side and a plurality of aligned openings at the opposite side, a partition in said conduit arranged to prevent direct fluid flow communication between opposite openings, an elongate tube for each opening having one end in fluid flow communication with said conduit and having an inlet opening adjacent the opposite end for introducing into the tube a stream of fluid in which the suspended matter is to be detected, an elongate window in said tubes, means for each tube adjacent the inlet opening end thereof and one end of said window for directing a beam of light towards the other end of said tube, a pair of generally rectangular mirrors coextensive widthwise with said windows and positioned at the exterior thereof, each mirror having one end adjacent the other ends of said windows of the tubes of the openings at one side of said conduit and being positioned at an obtuse angle with respect to its said windows and having the other ends thereof adjacent each other and being positioned at an acute angle with respect to each other, and a cabinet for enclosing said tubes having an opening in alignment with said mirrors for visual observation thereof.

8. In apparatus for detecting the presence of suspended matter in a fluid, the combination of a conduit having a plurality of aligned openings at one side and a plurality of aligned openings at the opposite side, a partition in said conduit arranged to prevent direct fluid flow communication between opposite openings, an elongate tube for each opening having one end in fluid flow communication with said conduit and having an inlet opening adjacent the opposite end for introducing into the tube a stream of fluid in which suspended matter is to be

detected, an elongate window in said tubes, means for each tube adjacent the inlet opening end thereof and one end of said window for directing a beam of light towards the other end of said tube, a pair of generally rectangular mirrors coextensive widthwise with said windows and positioned at the exterior thereof, each mirror having one end adjacent the other ends of said windows of the tubes of the openings at one side of said conduit and being positioned at an obtuse angle with respect to its said windows and having the other ends thereof adjacent each other and being positioned at an acute angle with respect to each other, and a cabinet for enclosing said tubes having an opening in alignment with said mirrors for visual observation thereof, said windows having indicia thereon

positioned to be viewed in said mirrors for distinguishing said tubes from each other.

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