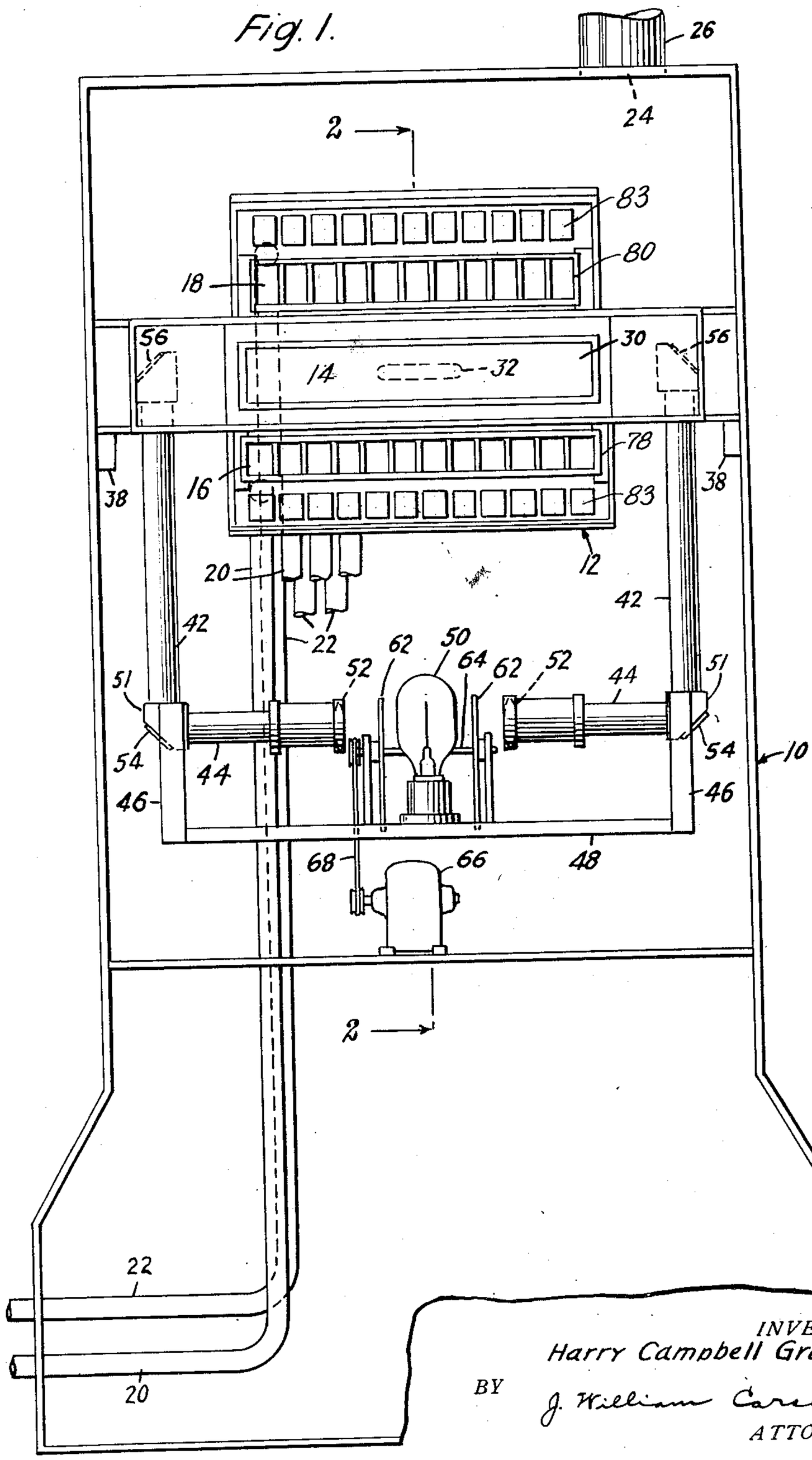
Oct. 25, 1949. H. C. GRANT, JR 2,485,588

APPARATUS FOR VISUAL DETECTION OF ILLUMINATED SUSPENDED MATTER IN FLUIDS

Filed Dec. 23, 1944

2 Sheets-Sheet 1

Fig. 1.



INVENTOR
Harry Campbell Grant, Jr.

BY J. William Carew

ATTORNEY

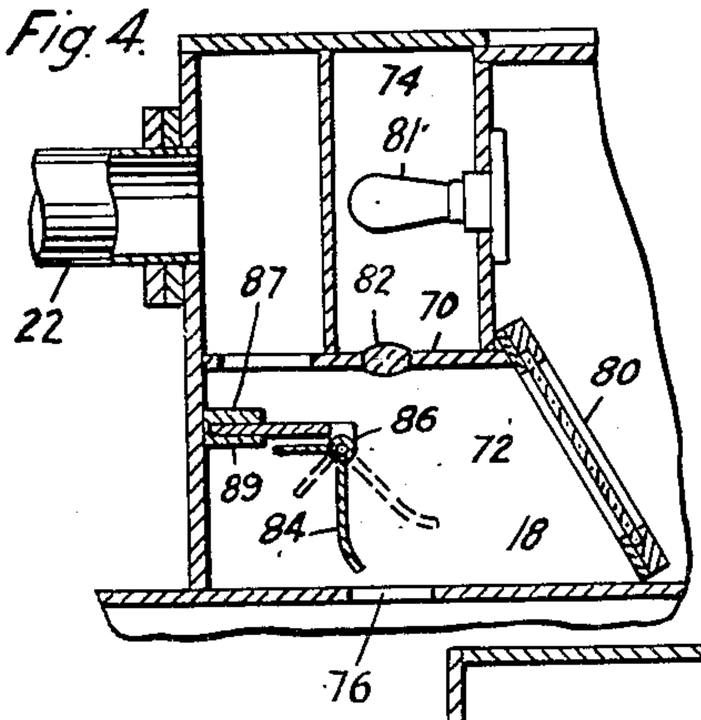
Oct. 25, 1949. H. C. GRANT, JR 2,485,588

APPARATUS FOR VISUAL DETECTION OF ILLUMINATED SUSPENDED MATTER IN FLUIDS

Filed Dec. 23, 1944

2 Sheets-Sheet 2

Fig. 4.



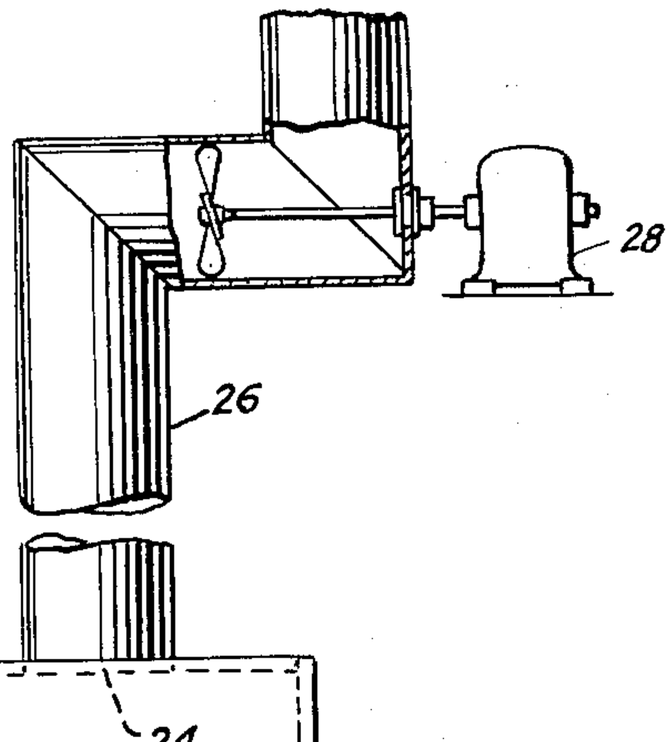


Fig. 2.

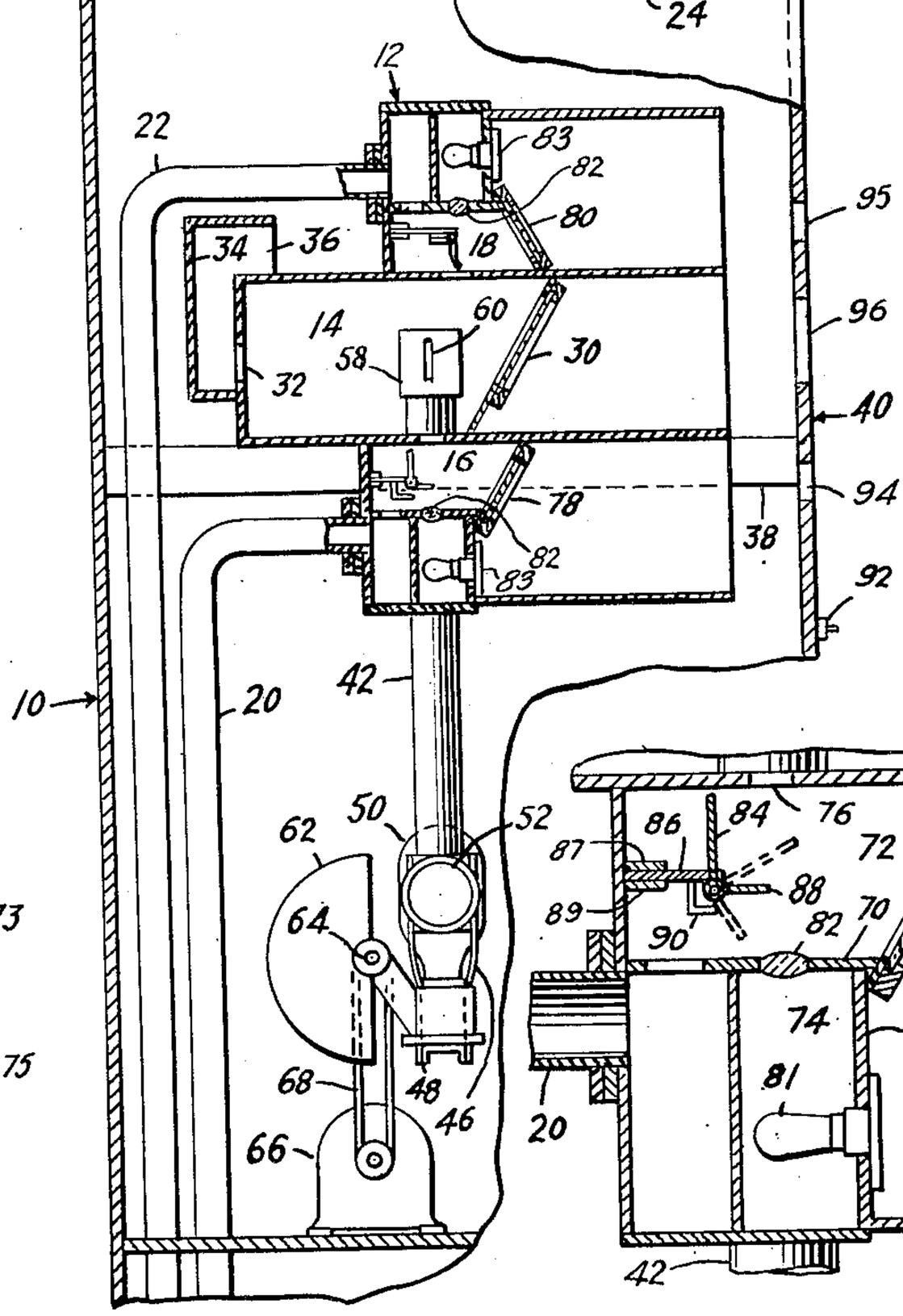


Fig. 5.

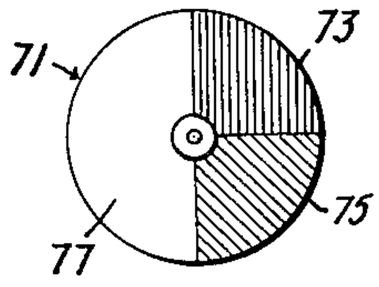


Fig. 3.

INVENTOR
Harry Campbell Grant, Jr.

BY
J. William Carson
ATTORNEY

Patented Oct. 25, 1949 2,485,588

UNITED STATES PATENT OFFICE

2,485,588

APPARATUS FOR VISUAL DETECTION OF ILLUMINATED SUSPENDED MATTER IN FLUIDS

Harry C. Grant, Jr., New York, N. Y., assignor to Specialties Development Corporation, Bloomfield, N. J., a corporation of New Jersey

Application December 23, 1944, Serial No. 569,534

3 Claims. (Cl. 88—14)

1

This invention relates to improvements in apparatus for detecting suspended matter in fluids.

More specifically, the invention is directed to the detection or visual observation of smoke particles or other suspended matter in air or other fluids.

The present invention is particularly well adapted for the visual detection or observation of smoke in air by means of smoke detecting apparatus wherein air is continuously drawn to a central observation station from a plurality of compartments or supervised areas whereby, when fire occurs in any of the compartments or areas, the air drawn from the compartments will have smoke commingled therewith, which, when illuminated by passing through a beam of light at the observation station, is readily observed. The apparatus of the present invention has many advantages over smoke detectors heretofore known, as will be apparent from the description to follow.

One of the objects of the present invention resides in the provision of an apparatus of the character indicated wherein the visibility of the suspended matter is greatly increased over that provided by apparatus of this character heretofore known.

Another object of the present invention resides in the provision of means for attracting attention to the presence of suspended matter in fluids.

Another object of the present invention resides in the provision of means whereby, upon the observation of suspended matter, the source of such matter can accurately and quickly be determined.

Another object of the invention resides in the provision of novel means for indicating a cessation of flow of fluid.

A further object of the present invention resides in the provision of an apparatus of the character indicated wherein reflection on the windows of the apparatus from outside objects is entirely eliminated.

A still further object of the present invention resides in the provision of an apparatus of the character indicated wherein light is absorbed and rendered invisible, except when suspended matter is present in the fluid.

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.

2

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

Figure 1 is an elevational view of a cabinet, with the front cover removed, showing various parts of the detecting apparatus of the present invention.

Figure 2 is a sectional view substantially on line 2—2 of Figure 1.

Figure 3 is an enlarged sectional view of one of the lower spotter compartments.

Figure 4 is a similar view of one of the upper spotter compartments, and Figure 5 is a plan view of modified form of light chopper employed in the device of the present invention.

The invention has manifold applications and may be employed for the detection of any suspended matter in fluids. However, for convenience of description, the application of the invention to smoke detection will be described, from which other applications of the invention will readily be appreciated.

Smoke detectors are employed where it is desired to detect smoke resulting from fire at some point or points remote from the detector. For example, on board ship the detector is generally located in the wheelhouse and tubes or conduits are provided leading from the various supervised areas such as compartments, state rooms, holds, etc., to the detector. Air is continuously drawn through these tubes or conduits, and through a visual or observation chamber in the detector cabinet, where a beam of light is directed through the air. When the air is free from smoke, the light is invisible. However when smoke is commingled with the air, the light is reflected by the smoke particles and rendered clearly visible to the observer, so that, should a fire occur in any of the supervised areas, the smoke is immediately detected upon reaching the detector, and the observer then takes the necessary action to extinguish the fire. The individual tubes also are generally provided with windows or peep holes, or the open ends of these tubes are in view of the observer, so that the observer can determine from which supervised area the smoke is being withdrawn. Such detectors are also generally provided with means for giving an audible alarm when smoke is present. However, the present invention is directed to improvements in the visual detection only, but it will be understood that any conventional audible mechanism may be associated therewith.

The apparatus of the present invention comprises a cabinet 10 for housing the various parts of the apparatus. A visual detection or observation section or unit 12 is suitably mounted within the cabinet 10 and includes a main visual chamber 14 and lower and upper series of individual chambers 16 and 18, respectively, which for convenience of description will be referred to as spotter chambers.

The walls of all the chambers are opaque and are rendered light absorbent by painting the same black or by any other suitable means.

A plurality of tubes or conduits 20 and 22, respectively, lead to the spotter chambers 16 and 18 from individual supervised areas (not shown). The number of tubes or conduits and spotter chambers is determined by the number of areas to be supervised.

The purpose of arranging the spotter chambers in two tiers or series, one above and the other below the main visual chamber is to provide a more compact apparatus.

The cabinet is provided with an aperture 24 in its top wall which is adapted to receive a conduit 26 leading to a suction device such as a blower 28. The cabinet is air tight so that, when the blower is in operation, the cabinet is under vacuum and air is drawn through the tubes 20 and 22 from the supervised areas first through the individual spotter chambers, then through the main visual chamber and thence out of the cabinet to atmosphere.

The main visual chamber 14 has a glass observation window 30, which extends across the front of the chamber and which, as will be seen from Figure 2, is positioned at an angle to the vertical axis of the cabinet and is set back from the front of the cabinet a predetermined distance whereby to prevent reflection on the window of objects outside of the cabinet. The prevention of reflection on the window from outside sources is of utmost importance, especially on board ship where the wheelhouse necessarily must be kept in complete darkness at night.

The rear wall of the main visual chamber has an elongated opening 32 as shown in broken lines in Figure 1, through which the air is continuously drawn in the manner heretofore described. A light baffle 34 in the form of a housing is secured to the rear of the main visual compartment about the opening 32 for the purpose of preventing any stray light entering the visual chamber through the opening. This baffle has an open end 36 through which air is drawn from the chamber.

The visual unit 12 is supported on bars or rails 38 secured to the inside of the side walls of the cabinet, whereby the entire unit may be removed, if desired, by merely sliding the unit outwardly of the cabinet on the bars or rails after removal of a front cover section 40 of the cabinet. This unit 12 includes, in addition to the main visual and spotter chambers, vertical light tubes 42 at either side of the unit, horizontal light tubes 44, brackets 46 and a supporting bar 48 for lamp means 50. Elbows 51 are formed at the joints between the horizontal light tubes 44 and the vertical light tubes 42, and the tubes 44 are provided with lenses 52 which are manually adjustable whereby properly to focus the light rays from lamp 50 on the mirrors 54. Light is reflected from the mirrors 54 through the tubes 42 onto mirrors 56 and then in opposed directions through the main visual chamber 14. The ends of the vertical light tubes 42 projecting into the visual chamber are each provided with a shield 58 having a narrow vertically extending slot 60 for confining the light rays within a predetermined path in the visual chamber.

The use of opposed light beams as just described does not constitute part of the present invention, but is the subject matter of co-pending application, Serial No. 569,535.

A light chopper 62 is provided on either side of the lamp 50 when two tubes 42 are employed. When one light tube is employed a single light chopper intermediate the light and the chamber 14 will suffice as is obvious. The chopper is in the form of a semi-circular disc mounted on a shaft 64 driven by a motor 66 through a belt 68 and when driven, the light beams from the lamp 50 are intermittently interrupted whereby to cause a flashing of light on the smoke particles to attract the attention of the attendant.

Instead of the disc 62 the light chopper may be in the form shown in Figure 5. In this form a disc 71 is provided with colored sectors 73 and 75, of contrasting colors, preferably red and green with a clear sector 77, or a blank section associated therewith. The rotation of this disc in the path of light will cause the light directed on the suspended matter to intermittently change color whereby to direct attention to smoke in the visual chamber.

The individual spotter chambers 16 of the lower tier or series are identical in structure. Each of these chambers is divided into two compartments by a partition 70, one of which compartments may be designated a smoke compartment 72 and the other a light compartment 74. Smoke laden air enters the smoke compartment from the tube 20 and passes out of the compartment through an orifice 76 into the main visual chamber 14 from which it is drawn out of the cabinet by means of the blower 28.

The forward ends of the spotter chambers are provided with a glass window 78 common to all of the lower spotter chambers, which window extends the length of the chambers in the lower tier. This window as will be seen from Figure 2 is positioned at an angle to the vertical axis of the cabinet and is set back a predetermined distance from the front of the cabinet as is also a window 80 of the upper tier of spotter chambers 18. The purpose of positioning and setting these windows in the manner described is to avoid reflection as described in connection with the window 30 of the main visual chamber.

A lamp 81, having a base portion 83, is mounted in the light compartment 74 and is adapted to project light into the smoke compartment through a lens 82 mounted in the partition 70. As will be appreciated, the smoke particles in the smoke laden air passing through the light chamber 72 will be illuminated by the light from the lamp 81 and will be clearly visible through the window 78.

An air flow indicator is mounted in the smoke compartment 72 whereby the attendant can readily determine whether or not air is flowing through the compartment. This indicator comprises a flap 84 of any suitable light weight sheet material pivotally mounted on a supporting bracket 86 removably mounted in slots formed by plates or strips 87 and 89 secured to the side walls of the compartment or otherwise suitably mounted. A counterweight 88 of substantially the same width as the flap is carried on the side of the pivotal mounting opposite the flap whereby when no air is flowing through the smoke compartment the flap will fall by gravity, to the

broken line position shown in Figure 3, into the path of light from the lamp 81 so that the light will fall on this flap rendering the flap visible through the window, and thereby indicating to the attendant that there is a failure of the air flow. On the other hand, when air is flowing through the compartment, the current of air engaging the flap 84 and the counterweight 88 will cause the flap to move out of the path of light and be retained in that position to assure the same being invisible through the window 78. A stop or projection 90 is provided for the flap when in the broken line position as shown in Figure 3, whereby to prevent the flap falling to a position out of the path of light.

The construction of the spotter chambers 18 of the upper tier is somewhat similar to that of the chambers of the lower tier 16 in that they each have a partition 70, smoke compartment 72, light compartment 74, orifice 76, lamp 81, lens 82 in the partition 70, an air flow indicating flap 84 and a supporting bracket 86 on which the flap is pivotally mounted.

Each of the spotter chambers 18 of the upper tier is in inverted position as compared with the chambers 16 in that the air enters the upper end of the smoke compartment from the tube 22 and passes downwardly into the main visual chamber.

The air flow indicating flap 84 of the chamber 18 operates in the same manner as the flap in the chamber 16 in that it is held out of the light path by means of the current of air flowing through the smoke compartment and when there is no air flowing the counterweight will fall by gravity moving the flap into the path of light. The flap in chamber 18, however, does not require a stop, such as the stop 90 provided for the flap of chamber 16 and therefore, none is provided.

The lamps 81 in the spotter chambers are all in the circuit of a switch and by pressing a switch button 92 on the front panel 40 the switch is closed, thereby closing the circuit to all the lamps whereby all lamps are illuminated simultaneously at the will of the attendant.

As will be seen from Figure 2 the front panel 40 is provided with horizontally extending openings or slots 94 and 95 in line with the windows 78 and 80, respectively. A similar slot 96, but slightly wider, is provided in line with the window 30 of the main visual chamber 14. Each of the slots 94, 95 and 96 extends the full length of its window, whereby suspended matter in the chambers may be observed from outside of the cabinet.

The front panel 40 is removably secured to the cabinet in any suitable manner, as for example by screws (not shown).

The removal of this panel permits access to the lamps 81 whereby the same can be readily removed for replacement when burned out; and also permits access to the windows 78 and 80 of the spotter chambers and the window 30 of the main visual chamber 14, whereby these windows, which are removably secured in place can be readily removed for cleaning. When the panel 40 is removed the entire unit 12 may be removed from the cabinet, after detaching the belt 68 from the motor pulley, by sliding the same along the rails 38 as hereinbefore mentioned.

Removal of the windows 78 and 80 permits access to the air flow indicators in the spotter chambers 16 and 18. As previously mentioned these indicators are each pivotally mounted on a bracket 86 which in turn is removably mounted in slots in the side walls of the compartment. In

Figures 3 and 4 the brackets 86 are each shown mounted between a pair of plates 87 and 89 secured to the rear wall of the compartment. These plates may be employed instead of the slots in the side walls or both means of support may be employed as desired, the desideratum being to removably mount the indicator flaps in the compartments.

During operation, the blower 28 is continuously operating to draw air out of the cabinet, the main visual lamp 50 is always illuminated and the motor 66 energized to drive the light choppers 62.

With the blower and motor operating and the main lamp 50 illuminated, air is drawn through the several tubes or conduits 20 and 22 to their respective spotter chambers and thence into the main visual chamber 14 from which the air passes by way of conduit 26 out of the cabinet.

When fire occurs in one of the supervised areas, the air drawn from that particular area through the tube leading therefrom will be commingled or laden with smoke. When this smoke laden air reaches the main visual chamber the beams of light from lamp 50 will illuminate the smoke particles, thereby rendering the same clearly visible, and the intermittent interruption of the light beams produced by the light chopper will cause a flashing of the light thereby attracting the attention of the attendant. The attendant observing smoke in the main visual chamber immediately is warned that fire has broken out in one or more of the supervised areas at the remote end of one or more of the tubes.

It will be understood from the foregoing that air drawn from any or all of the supervised areas enters the common or main visual chamber for the purpose of calling attention of the attendant to the presence of smoke; the attendant, of course, cannot thereby determine the source of the smoke laden air. However, by pressing the switch button 92 all of the spotter chambers are illuminated and the chamber through which the smoke laden air is passing is readily observed by reason of the light from the lamp of that chamber illuminating the smoke particles passing therethrough, while the light in the other spotter chambers is not visible because of the absence of smoke.

The individual spotter chambers may be numbered to correspond with the number of the corresponding supervised areas, or may bear the names of the corresponding rooms or compartments, so that the attendant can notify the proper authority of the location of the fire or take whatever action is necessary with respect to extinguishing the fire.

While the present invention has been described in connection with smoke detection, it is to be understood that the apparatus may be employed for the detection of any suspended matter in any fluid, by merely connecting the tubes 20 and 22 to the source of the fluid containing suspended matter to be detected or observed.

It will be seen from the foregoing description and the accompanying drawings that the present invention provides novel apparatus for detecting suspended matter in fluids wherein the visibility of suspended matter is greatly increased; the attention to the presence of suspended matter immediately attracted; the source of the suspended matter immediately and accurately determined; glare from outside source entirely eliminated, and wherein the cessation of flow of fluid is immediately indicated.

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 suspended matter in fluids, the combination of a cabinet having a plurality of elongated transverse apertures in one wall thereof; an observation unit including a main observation chamber within and extending transversely of the cabinet; an elongated window for said chamber secured in said unit in alignment with, but remote from, one of said apertures; said observation unit also including a plurality of spotter chambers in transverse alignment in said unit; an elongated window for said spotter chambers secured in said unit in alignment with, but remote from, another of said apertures; means for drawing fluid from separate sources through each of said spotter chambers into said main observation chamber; a source of light for said main chamber; means for directing a beam of light from said light source longitudinally through said main chamber; means for intermittently interrupting said light beam, whereby intermittently to illuminate suspended matter in the fluid in said main chamber to render the same visible through said first-mentioned aperture and window and to attract attention thereto; and means for illuminating said spotter chambers, whereby to render suspended matter therein visible through said second-mentioned window and aperture to determine the source of the suspended matter in the main chamber.

2. In apparatus for detecting suspended matter in fluids, the combination of a cabinet having a plurality of elongated transverse apertures in one wall thereof; an observation unit including a main observation chamber within and extending transversely of the cabinet; an elongated window for said chamber removably secured in said unit in alignment with, but remote from, one of said apertures, and at an angle to the vertical axis of the cabinet; said observation unit also including a plurality of spotter chambers in transverse alignment in said unit; an elongated window for said spotter chambers removably secured in said unit in alignment with, but remote from, another of said apertures, and set at an angle to the vertical axis of the cabinet; means for drawing fluid from separate sources through each of said spotter chambers into said main observation chamber; a source of light for said main chamber; means for directing a beam of light from said light source longitudinally through said main chamber; means for intermittently interrupting said light beam, whereby

intermittently to illuminate suspended matter in the fluid in said main chamber to render the same visible through said first-mentioned window and aperture to attract attention thereto; and means for illuminating said spotter chambers, whereby to render suspended matter therein visible through said second-mentioned window and aperture to determine the source of the suspended matter in the main chamber.

3. In apparatus for detecting suspended matter in a fluid, the combination of a cabinet, a main visual chamber in said cabinet, means for drawing fluid into said chamber from a plurality of sources outside said cabinet, said cabinet having an aperture in one wall thereof, a removable window for said chamber in alignment with said aperture and set at an angle to the vertical axis of said cabinet, a source of light illuminating suspended matter in the fluid in said chamber, rotating means in the path of light from the said source for intermittently interrupting said light, a plurality of individual chambers in said cabinet each communicating with one of said sources through which the fluid is first drawn by said fluid drawing means from the source for the respective individual chamber, said last mentioned chambers each communicating with said first mentioned chamber, means in said individual chambers illuminating suspended matter in the fluid passing therethrough, a removable window for said individual chambers aligned with an aperture in the wall of the cabinet through which said illuminated matter passing through the individual chambers is visible, and pivoted means removably mounted in each of said individual chambers held by the flow of fluid out of the path of light from said illuminating means and adapted to fall by gravity when no fluid is flowing into the said path of light, whereby the same is rendered visible through said last mentioned window.

HARRY C. GRANT, JR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,648,369	Svedberg et al.	Nov. 8,1927
1,967,018	Bohner	July 17, 1934
2,012,230	Grant	Aug. 20, 1935
2,285,658	Hitchock	June 9, 1942
2,306,589	Cahusac et al.	Dec. 29, 1942

FOREIGN PATENTS

Number	Country	Date
333,732	Great Britain	Aug. 21, 1930
728,032	France	Apr. 5, 1932
579,790	Germany	June 30, 1933