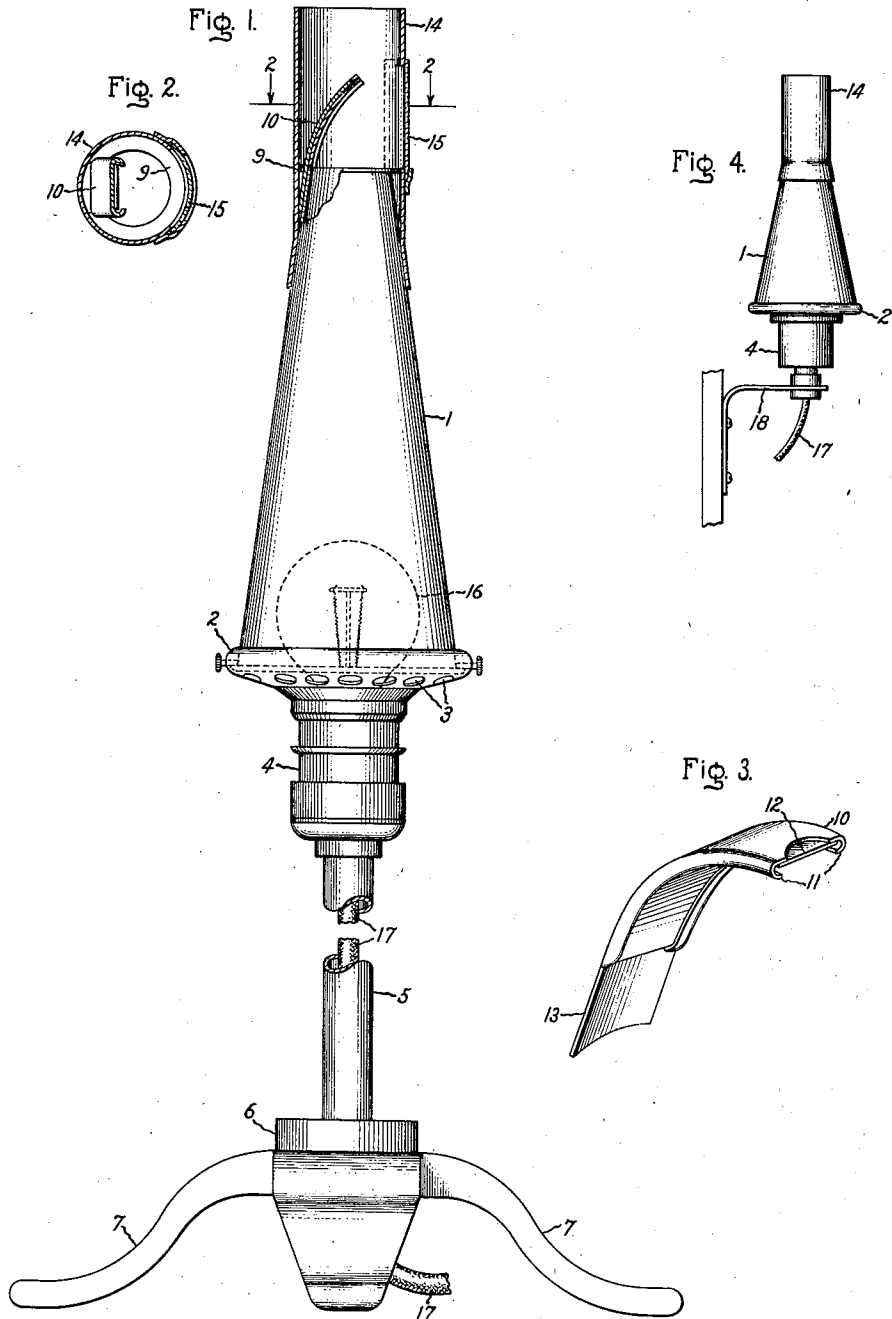


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MERCURY VAPOR DETECTOR

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## MERCURY VAPOR DETECTOR

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My invention comprises improved apparatus for detecting mercury vapor or similar harmful impurities in the atmosphere.

The increasing industrial use of mercury, particularly in power generation applications, makes it extremely desirable from the point of view of health security to have means available for detecting mercury leakage immediately upon its occurrence. While apparatus has been previously developed which satisfactorily performs this function, the amount of equipment involved is so great as to make both its cost and its operation burdensome.

It is an object of the present invention to provide a portable mercury vapor detector in which the number of essential parts is greatly reduced without impairing the maximum sensitivity. To this end, my invention utilizes a sensitized film of a known type in combination with a single operative element which serves to illuminate the film, to maintain it at a temperature of optimum sensitivity, and to circulate the contaminated air into contact therewith.

The novel features which I consider to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and the method of operation will best be understood by reference to the following specification taken in connection with the accompanying drawing, in which Fig. 1 represents an assembly view partly in section of an apparatus embodying the principles of my invention; Fig. 2 is a section taken on line 2—2 of Fig. 1; Fig. 3 is a perspective view showing the details of a film holder suitable for use with my invention, while Fig. 4 illustrates in elevation an alternative form of apparatus mounting.

Referring to Fig. 1, I have shown a chimney shaft 1, which comprises a hollow element suitably dimensioned to induce and direct continuous circulation of an upwardly directed air stream. In particular, the wall of the chimney, which is preferably of metal, takes the form of a truncated cone increasing in diameter from top to bottom. The chimney shaft 1 is open at the bottom and is removably supported in a base or closure 2 which is provided with a series of circular apertures 3 whose total area is as great or greater than the area of the top of the chimney shaft. The assembly so far described is supported by means of a coupling member 4 on an elongated vertical shaft 5. This in turn is mounted at its lower end in a heavy tripod 6

comprising a number of symmetrically spaced legs 7.

At its upper and smaller end, the upwardly tapered chimney shaft 1 is provided with an outwardly extending flange 9, which is slotted at one side thereof to receive and retain a holder for a sensitized film. The nature of the film holder will be most readily apparent from an inspection of Fig. 3. As there illustrated, a curved metallic retainer 10 is provided with suitable intumed flanges 11 for receiving a flexible strip of film 12. The lower end of the retainer is provided with an extension 13 adapted to pass through a corresponding slot in the chimney flange 9.

The strip 12 preferably embodies a film of selenium sulphide or other compound of selenium and sulphur, such as is described and claimed in Patent No. 1,711,742 to B. W. Nordlander, assigned to the same assignee as the present invention. As described therein, selenium sulphide is characterized by being extremely sensitive to the presence of mercury vapor in minute quantities. It is known, for example, that a concentration of mercury vapor of one part in 5,000,000 parts of air by volume will produce marked blackening of the sulphide layer in about four minutes, assuming the air current to be heated to about 70° C. and the velocity of the current to be kept at one meter per second. Since the blackening of the film in a given time interval is proportional to the concentration of the mercury vapor, it is possible by comparison of the indicator strip with a calibrated color chart to determine very readily the presence of physiologically dangerous quantities of mercury.

The curvature of the holder 10 is such that the sensitized strip 12 is curved into increasing angular divergence with the axis of the chimney shaft at the upper end of the strip. It has been found that with such a relation of the strip to the air stream a much more uniform discoloration of the sulphide film will be obtained than is the case if a straight strip is used.

In order to protect the film 12 from cross-drafts of air other than those circulated through the chimney 1, I provide a hood or shield 14 which may be slipped down over the tapered surface of the chimney itself. So that the use of the shield shall not interfere with convenient observation of the film surface, I may provide in connection with the same a suitably positioned window 15 of glass or other transparent material. It will be apparent that the whole body of the shield may alternatively be made of glass for the same purpose.

In accordance with my invention, I provide within the chimney 1 and at the lower portion thereof a luminous heat source, most conveniently exemplified as an incandescent light bulb 16. This is mounted in a suitable socket (not illustrated) provided in the coupling member 4 and is supplied with current through a conductor 17 which passes upwardly through the shaft 5. It is a primary function of the lamp 16 to act as a means for drawing air through the apertures 3 and circulating the same through the chimney and into proximity with the film 12 in accordance with the well-known principles of convection ventilation.

Combined with this function, however, a lamp utilized in the manner shown serves the equally useful purpose of maintaining the film 12 at a temperature of optimum sensitivity. It is known, for example, that the sensitivity of a selenium sulphide film of the type above described is much greater at a temperature of from about 20 to 30° C. above room temperature than it is at a lower temperature. For this reason, by associating the air-circulating heat source with the film retainer in the manner specified, my invention makes it possible to detect a much smaller concentration of mercury and to greatly decrease the required reaction time. It is true, however, that when films of the type under consideration are exposed for prolonged periods at too high a temperature, they turn pink, due to a "softening" action. Accordingly, I select a lamp or corresponding electrical resistance heater of the maximum wattage which will not cause the sensitized material to turn pink during the desired time of exposure. For example, with an 8½ inch chimney shaft, tapering from a diameter of 4 inches at its bottom to about 1½ inches at the top I have found an incandescent lamp of 25 watts rating to be most satisfactory. It will, of course, be understood that with different chimney dimensions correspondingly different lamp sizes will prove suitable.

With an embodiment such as that illustrated, in which the heat source employed takes the form of an incandescent lamp, I obtain the additional advantage of causing the film surface to be continuously illuminated for convenient observation without requiring a separate element for this purpose. Tests have shown that a red light, because of its slighter actinic radiation with respect to selenium sulphide, causes less discoloration of the film than a white light, with no change whatever in reaction sensitivity. For this reason, I prefer to avoid the possibility of misleading results by using a screened light source such as an incandescent lamp having a reddened bulb.

The operation of my apparatus may be briefly described as follows: Contaminated air from the ambient atmosphere is drawn into the chimney through the apertures 3 by convection action caused by the lamp 16. This air, heated to a temperature calculated to cause the maximum possible chemical activity without softening the sensitized material, is circulated upwardly through the chimney into contact with the film 12. The nature of the contact is continuously modified along the length of the strip by the changing curvature of the same with respect to the axis of the chimney, thus assuring a uniform change of color of the sensitized film. An observer looking in through the window opening 15 is able, by means of light reflected from the

lamp 16, to tell at a glance the degree of discoloration of the film. Then by comparing the same with a standard color chart, he is able to determine the amount of mercury present in the air being tested.

It will be understood that the particular mounting above described is not essential to the utilization of my invention. An alternative arrangement is shown, for example, in Fig. 4, which illustrates a simple wall bracket 18 which may be mounted to support the chimney 1 at any desired height from the floor. The other numbered elements correspond to the same elements described in connection with Fig. 1.

It will also be apparent that apparatus constructed in accordance with the principles of my invention will prove equally useful in the detection of chemical impurities, other than mercury, which may be caused to react with a sensitized indicating film. Furthermore, while I have described a particular embodiment of my invention, it will of course be understood that I do not wish to be limited thereto since many modifications in the structure may be made, and I contemplate by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Apparatus for indicating the presence of physiologically harmful quantities of mercury vapor in an atmosphere, comprising a chimney shaft having an opening adjacent the bottom thereof, a selenium sulphide film sensitive to mercury mounted at the top of said shaft, and a luminous heat source of slight actinic radiation mounted adjacent the bottom of said shaft.

2. Apparatus for indicating the presence of a chemical impurity in air comprising a chimney shaft of relatively great length with respect to its cross section, an air circulating heating means mounted in said shaft adjacent the bottom thereof, and a strip of indicating film mounted vertically adjacent the top of said shaft, said strip being highly sensitive to said impurity at the temperature maintained by said heating means and curved at its upper end into increasing angular divergence with the axis of said shaft.

3. Apparatus for indicating the presence of physiologically harmful quantities of mercury in an atmosphere, comprising a truncated conical chimney shaft open at the top and bottom thereof, a selenium sulphide film sensitive to mercury mounted at the top of said shaft, a luminous heat source at the bottom of said shaft for circulating said atmosphere therethrough into contact with said film, and a closure for the bottom of said shaft, said closure having apertures therein whose area is at least as great as that of the top of said shaft.

4. Apparatus for indicating the presence of physiological harmful quantities of mercury in an atmosphere, comprising a truncated conical chimney shaft open at the top and bottom thereof, a selenium sulphide film sensitive to mercury mounted at the top of said shaft, a luminous heat source at the bottom of said shaft for circulating said atmosphere therethrough into contact with said film and a shield positioned at the top of said shaft and surrounding said film, said shield being provided with a window adapted to permit observation of said film.

5. Apparatus for indicating the presence of a chemical impurity in air comprising an upwardly tapered chimney shaft of relatively great

length with respect to its cross-section, said chimney shaft being open at the top and bottom thereof, an indicating film sensitive to said impurity mounted at the top of said shaft, the sensitivity of said film being a function of temperature and velocity of air circulation, and an air circulating means consisting of an electrical resistance heater mounted adjacent the bottom of said shaft, said heater being adapted to maintain said film at a predetermined temperature effective to produce optimum film sensitivity.

6. Apparatus for indicating the presence of

mercury in air comprising an upwardly tapered chimney shaft of relatively great length with respect to its cross-section, said chimney shaft being open at the top and bottom thereof, an indicating film of selenium sulphide sensitive to mercury mounted at the top of said shaft, and air circulating means consisting of a heat source mounted adjacent the bottom of the shaft, said heat source being adapted to maintain said film at a predetermined temperature effective to produce optimum sensitivity.

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