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DEVICE FOR ABSORPTION OF MERCURY VAPOR

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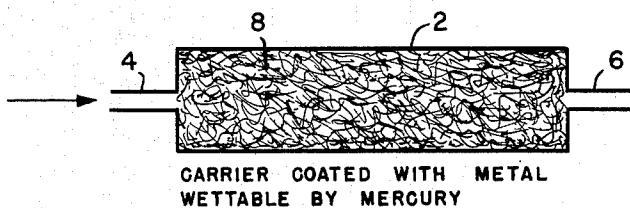


FIG. 1.

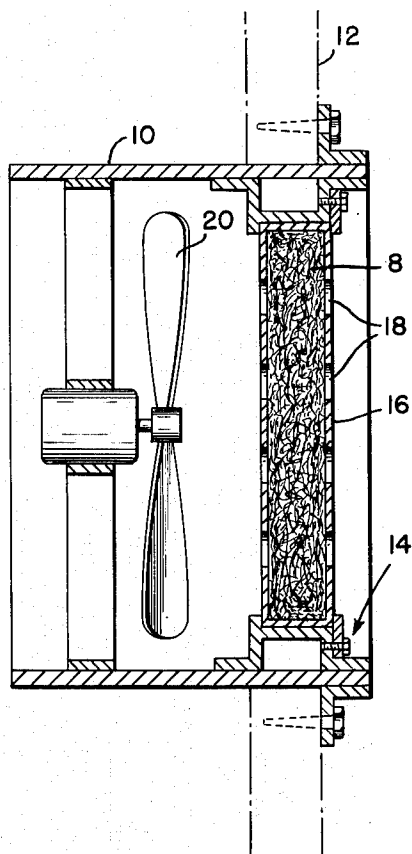


FIG. 2.

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DEVICE FOR ABSORPTION OF MERCURY VAPOR

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1 Claim. (Cl. 55—387)

This invention relates to devices for absorption of mercury vapor in air or other gases.

This application is in part a continuation of our application Serial No. 177,951, filed March 5, 1962, now Patent No. 3,173,016 issued March 9, 1965.

The removal of mercury vapor from air or other gases is desirable for various reasons. It is considered that health hazards exist if the concentration of mercury vapor in air rises above about 3×10^{-4} grams per cubic meter and such hazards may exist in chemical laboratories where mercury is used or in plants, such as those utilizing mercury boilers, where leakage of mercury vapor may possibly occur accidentally. It may be readily appreciated that the dangerous concentration may readily exist in enclosed places when there is considered the fact that air saturated with mercury vapor at ordinary temperatures may contain around 1.5×10^{-2} grams of mercury per cubic meter. Exposed or spilled liquid mercury may thus raise the concentration of mercury vapor substantially above the danger point. The removal of mercury vapor from air or other gases may also be desirable for technological reasons as well as for health reasons. For example in our prior application referred to above there is disclosed a method and apparatus for detection and measurement of mercury vapor which is extremely sensitive and involves in its operation steps of procedure for the almost complete elimination of mercury vapor from flowing gas. For example, when it is desired to detect mercury vapor in an ambient atmosphere of deposits containing mercury it is desirable that in sampling from holes provided in the earth's surface that inflowing air which is to pick up mercury should initially be free of mercury so as to avoid fluctuations in measurements due to such disturbing factors as wind. Further, the most sensitive detection system involves the comparison of samples of gas derived from a common source from one of which mercury is substantially completely removed.

As a part of the apparatus disclosed in said prior application there is provided a device for absorption of mercury vapor which is extremely effective for that purpose, and it is the object hereof to claim such device per se which may be used generally for the removal of mercury vapor for any such purposes as have been indicated.

Specifically, in accordance with the invention, the device comprises a chamber containing a porous absorbent which presents an extended surface of a mercury-wettable metal. The metals desirably used are silver, gold, or combinations of these metals, preferably carried in the form of very thin films on an extended support which may take the form of glass or other wool, granular material, or the like.

The invention will become more apparent from consideration of the following description, read in conjunction with the accompanying drawing, in which:

FIGURE 1 is a diagram showing a form of device in its general form; and

FIGURE 2 is a section illustrating the device particularly in a form adapted for elimination of health hazards.

FIGURE 1 shows in diagrammatic form the general aspects of the absorbing device. A chamber 2 is provided with inlet and outlet openings 4 and 6 which may respectively communicate with the source of gas containing mercury vapor, for example, air, and with the device

or space within which mercury-free gas is desired. A chamber having this construction, for example, is used in the apparatus described in said prior application.

The chamber 8 contains the absorbent material and, as a specific example, this absorbent material may be glass wool (providing high porosity for the flow of the gas) the fibers of which are coated with pure gold. The gold may be deposited in the form of a quite thin film on the glass wool by any of numerous processes which are known for the deposition of gold, an ordinary and convenient method merely involving the wetting of the glass wool with a gold salt such as the chloride which is then decomposed for deposition of the gold by heat. For use in a measuring apparatus the cost of using gold is immaterial since only small quantities of gold are involved. In place of glass wool as a carrier nickel wool may be used on which the gold may be deposited in the same fashion as described or by precipitation by the nickel from a solution of the gold salt. The carrier may be of many types so long as it is of a physical form to present a maximum absorbing surface, reasonably low resistance to flow, and adhesion to its absorbent coating. Granular alumina may be used, for example, completely coated to prevent absorption of water. Porous ceramic pellets may also be used. If it is desired to regenerate the absorbent after it absorbs sufficient mercury to lower its effectiveness, and since regeneration is most readily effected merely by heating the absorbent material to drive off the mercury, the carrier should be resistant to heat, a property shared by the materials referred to such as glass wool, nickel wool, alumina or ceramic material.

In larger installations, for example for the removal of mercury vapor from rooms or other enclosures, the deposited absorbent metal may well be silver which has the advantages of lower cost and very simple deposition procedure, carriers being used such as those indicated for gold. Silver has a slight disadvantage in that it may be rendered ineffective by hydrogen sulphide or chlorine in the atmosphere; but it is found that its life even under the adverse conditions of such atmosphere is so long that it is actually preferred for the provision of absorbent cartridges which may be disposable without attempts at regeneration. The silver may be deposited in numerous fashions utilizing baths such as are commonly known for the deposition of silver for mirrors, or silver salts may be precipitated or used to wet the carriers which are readily decomposable by heat. Among such salts are the nitrate and a large group of silver salts of organic acids as well as silver oxide. The length of active life of a silver coating in atmospheres of hydrogen sulphide or chlorine may be lengthened by coating a deposit of silver with an extremely thin film of gold which, in itself, might not have a sufficiently long life for practical use, the mercury being then, in effect, absorbed by the gold and passing into the silver so that the life is essentially that of the silver from the standpoint of absorbability. The same end may be achieved by precipitating mixtures of gold and silver which at elevated temperatures will form alloys resistant to corrosion, such alloys being as effective as the separate metals. Alloys of gold and silver with other metals which are high in gold or silver content may also be used.

The general property of the absorbent metal coating which may be said to measure its effectiveness is its wettability by mercury. In a sense this property may be said not to be directly pertinent since the mercury vapor reaches the absorbent in a non-liquid state; but a mercury-wettable metal does inherently possess the property of absorbing mercury vapor so that mercury-wettable metals in general may be used. Gold and silver are, of course, outstanding among the common metals

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having this property. While various other metals may be used, in general they suffer the disadvantage that they are corrodible by various gases or vapors which may be in the atmosphere. Preferably, therefore, the class of mercury-wettable metals which are practically usable are the noble metals of this class, including substantially non-corrodible alloys. The noble metals are also usually more readily deposited, simplifying the production of the absorbent material.

FIGURE 2 illustrates a typical installation which may be used for removing mercury vapor from relatively large flows of air as, for example, for reducing the concentration of mercury vapor in an enclosed atmosphere. A housing 10, open at both ends, may be mounted in a wall or partition 12 and is provided with a flanged structure 14 of any suitable type for holding a large cartridge 16 containing the absorbent material 8 such as already described. The chamber provided at 16 has inlet and outlet passages in the form of holes 18 through which the air may enter and leave. Flow may be provided by a motor driven fan indicated at 20.

The cartridge 16 in its simplest form may be merely a cardboard box provided with openings and containing the absorbent material. When the effectiveness of its absorption is reduced to a degree making replacement desirable, the entire cartridge may be thrown away and replaced by a new one. It is in such a case that the relatively inexpensive absorbent material using silver as the coating for the carrier may be used. Even a very

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thin coating of silver will ordinarily take care of thoroughly effective removal of mercury from a very large volume of air or other gas.

It will be obvious that the invention may be embodied in numerous forms of devices and is not to be regarded as limited except as required by the following claim.

What is claimed is:

An absorption device for extraction of mercury vapor from a gas comprising a chamber having inlet and outlet passages and containing, between said passages a porous absorbent comprising a glass wool carrier having an extended surface coated with metallic gold.

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