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 APPARATUS FOR THE DETECTION OF DANGEROUS GASES.
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1,016,305.

Patented Feb. 6, 1912.

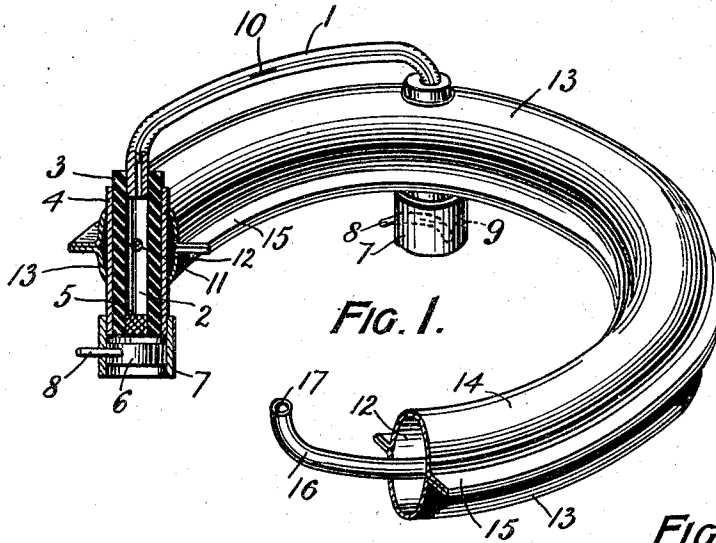


FIG. 2.

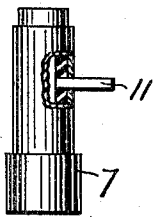


FIG. 3.

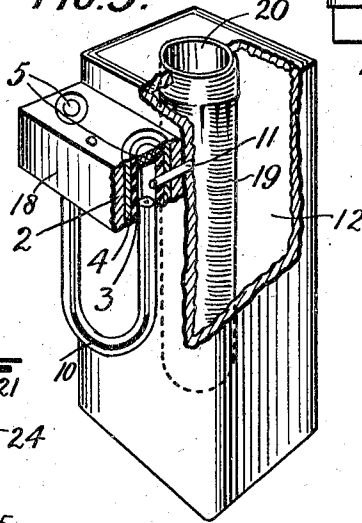


FIG. 6.

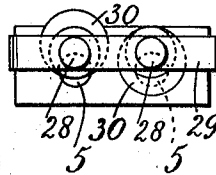


FIG. 4.

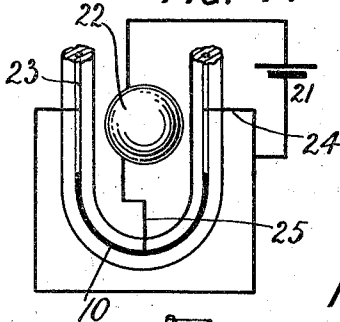
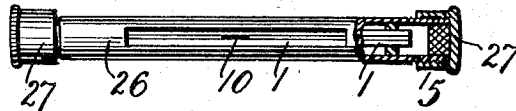


FIG. 5.



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UNITED STATES PATENT OFFICE.

FREDERICK JAMES TURQUAND AND WILLIAM EDWIN GRAY, OF LONDON, ENGLAND.

APPARATUS FOR THE DETECTION OF DANGEROUS GASES.

1,016,305.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, FREDERICK JAMES TURQUAND and WILLIAM EDWIN GRAY, subjects of the King of Great Britain, and residents of London, England, (whose post-office addresses are 4 and 5 Albany Court Yard, Piccadilly, in the county of London, England, and 53 Bayham Place, Camden Town, in the county of London aforesaid, respectively,) have invented certain new and useful Improvements in Apparatus for the Detection of Dangerous Gases, of which the following is a specification.

This invention relates to that class of apparatus known as diffusimeters, that are adapted to utilize the law of gaseous diffusion according to which, for example, a light gas or gas of low density or specific gravity is found to be capable of diffusing through a porous medium at a greater velocity than is the case with a gas of higher specific gravity. By retaining one of the gases in a chamber, whose only communication with the exterior where the other gas may be presumed to be, is by way of a porous medium, an increase or decrease of pressure results in the chamber, which may be shown by a suitable indicator in communication therewith.

The present invention, broadly speaking, consists of a diffusimeter having two diffusing chambers, with an indicator between them, the whole forming what might be termed a differential diffusimeter. It is particularly adapted to detect the presence of deleterious or explosive gases in coal mines and other places.

In addition to the main porous septa of the diffusion chambers, we may provide auxiliary porous septa each communicating between one of the chambers and a fresh gas reservoir for communicating with each other and so adjusted or constructed that diffusion only takes place slowly therethrough; this fresh gas reservoir being of necessity a closed chamber, any change of temperature would give rise to pressure variations therein which might have a disturbing effect on the indicator; to avoid this, some device may be introduced into the reservoir which being easily expanded or contracted will serve to keep the pressure constant. Obviously, other means may be employed to produce the same result.

The fresh air reservoir should be appended to those forms of the apparatus particularly applicable for use in coal mines or other places wherein various gases are to be tested and in which ready access to fresh air is not obtainable.

The apparatus may conveniently be fitted at the top of a safety or other lamp, and in order to facilitate observation of the indicator a lens may be mounted and suitably arranged above the same.

The accompanying drawings illustrate suitable forms of the present invention, Figure 1 being a perspective view (part broken away) of a form particularly adapted for use with certain kinds of miners' lamps, and Fig. 2 is a view of a detail; Fig. 3 is also a perspective view (part broken away) of another form. Fig. 4 is a view, on an enlarged scale, of a detail; Fig. 5 is a plan (with part broken away) of a straight form, and Fig. 6 is a view of a detail.

As shown in Fig. 1, a transparent tube 1, thermometrically bored, opens at each end into a diffusion chamber 2 composed of a heat resisting liner 3 and a surrounding metal or other tube 4. The liner may be made of wood, rubber, or any other suitable material. At the other end of the diffusion chamber is secured a plug or septum 5 of porous material through which the gases diffuse. The porous material may be composed of carbon, unglazed earthenware, paper dipped into collodion, rubber, or so forth. Caps or plugs 6, of non-porous material, are retained in tubes 7, by pins 8, which passing through curved slots 9 in the tubes 7, serve to bring the plugs 6 close up against their respective septa 5, so as to prevent diffusion, or allow of their withdrawal to a distance sufficient to admit of the passage of the surrounding gas through the slot 9, or other orifice, into the space opened below the septum and thence through the latter.

For clearness, one of the slots 9 has been shown as facing toward the center of the device, with its pin 8 pointing inward. In most cases, however, the slot and pin should really be on the outside, the pin pointing outward.

For convenience, the slots 9 curve rapidly downward toward their lower ends, while they are horizontal at their upper ends.

A fluid or other index 10 is provided in

the tube, said index being displaced along the tube when the pressure differs on either side of it. The tube and index will be referred to as an indicator.

5 The normal position of the index 10 is at the center of the tube 1. The penetration of a foreign gas into the diffusion chamber 2 will cause it to move in one direction or another according to whichever septum 5 is opened to take the reading, and as to whether the result of the diffusion is to increase or decrease the pressure in the exposed chamber.

15 The tube 1 may be calibrated, with its central point as zero. To facilitate the setting of the index 10 at zero, before or after a reading, the bore of the tube may be slightly increased or diminished at the center, so as to attract the index back to zero by capillary action; the increase is necessary for such indices as mercury; the decrease for alcohol and certain other indices.

20 Instead of accurate calibration, it would do equally well for some purposes, to hide or cover the index when in the neighborhood of zero, and only to allow it to be seen, on emerging from the cover, when it has moved considerably. Thus, if used in coal mines, no needless alarm would be caused by its slight movements about zero, but it would become visible as soon as a real danger threatened.

25 There are one or more subsidiary septa 11 fitted to and communicating with each chamber and with a fresh gas reservoir 12 formed in this case by two channeled rings 13, 14, hermetically joined to one another at their outturned rims 15, 15. This arrangement has for its purpose to purge or free, either automatically or otherwise as deemed desirable or necessary, the chambers 2 from the admixed gases which accumulate therein, by way of the main permeable media 5. A lead or other tube 16 contained within the fresh gas reservoir 12, and opening into it at one end, passes at the other end 17, through a hole in one of the rings 14. All communication with the reservoir, however, is prevented by a short column of liquid; the function of the tube 16 is to keep the gas in the reservoir 12 at a constant pressure despite changes of level and temperature. This it does, for the oil column is forced one way or another along the tube 16 as the volume of gas increases or decreases. The dimensions of the tube 16 and position of the column are obviously such that the latter is always contained within the boundaries of the tube. The column is introduced into the tube 16 when the latter is heated beyond the maximum temperature it is likely to attain. Its subsequent cooling withdraws the column securely into the tube.

65 The annular form of the apparatus above described, particularly adapts it for use in

combination with certain kinds of miners' lamps, upon the cylindrical body of which it can be securely fixed. For most purposes to which this and the following forms of the invention are to be applied, air is used as the standard comparative gas, and is the one originally inclosed within the diffusion chamber. An additional supply of it is then, of course, inclosed in the fresh gas reservoir. These two steps occur during the manufacture of the device.

70 When not in use, the porous septa are closed by their respective blocks 6; to take a reading, one of them should be uncovered; another reading could then be obtained by closing this last one and opening the other.

Fig. 3 shows an upright form of the apparatus, in which the diffusion chambers 2 are both situated in an ebonite or similar block 18. Similar reference numerals refer to like parts, a pocket 19 serving the purpose of the tube 16 with its movable column in the just described form; said pocket 19 is constructed of material having sufficient give and resiliency to allow of the air in the reservoir 12 remaining at constant pressure under a varying temperature. It is secured to a band 20, hermetically sealed in the cover of the reservoir 12, and its interior is open to the atmosphere or other surrounding gas.

Fig. 4 shows how a mercury or similar index 10 can be used, to make or break an electric circuit which in this case is composed of a battery 21, a lamp 22, and contacts 23, 24, 25, passing through the glass tube 1, 25 being in constant contact with the mercury, while one of the others 23 or 24 is in contact when the index has risen high enough on one side or another, and the circuit is then completed. Obviously such a circuit could, by means of a relay, or so forth, be made to control the whole of the mine's or other electrically driven machinery.

Fig. 5 shows a straight form of the device, 26 being a metal frame and 27 caps screwing on to its ends and serving when removed to expose their respective porous septa 5.

Fig. 6 shows another device for covering or uncovering the porous septa 5, two pins 28 pass through the yoke 29 and carry eccentric pads 30, which in their normal positions cover the septa 5, but can be caused to uncover them in part.

120 In operation, both chambers and the vessel are exposed to fresh air or neutral gas; the whole of the inlets are then closed with the reception of the permeable connection between the chambers and those between the latter and the reservoir. The apparatus is now ready for carrying out a test which is effected by exposing one of the chambers at the place where it is desired to make the test. The maximum reading of the indi- 130

cator is then noted, after which the exposed chamber is closed until the indicator assumes its original position. A second reading is obtainable by closing the first chamber and exposing the second one in a manner similar to that above described.

We claim:

1. A device for indicating the diffusive action of gases, comprising a closed chamber, a porous septum or diaphragm arranged in the walls of said chamber, the interior of the latter having communication with the exterior atmosphere only through said porous septum, a device having communication with said chamber for indicating the pressure of gas within the latter, a cover for said porous septum consisting of material impervious to gases, a sleeve or socket in which said cover is adapted to move, said sleeve or socket being provided with a slotted opening in its wall, and a pin attached to said cover and projecting through said slotted opening to allow of said cover being moved toward and from said porous septum, said slotted opening further serving for the admission of gas so that it may pass through said porous septum.

2. A device for indicating the diffusive action of gases, comprising a closed chamber, a porous septum or diaphragm arranged in the walls of said chamber, the interior of the latter having communication with the exterior atmosphere only through said porous septum, a transparent tube communicating with said chamber said tube having a movable body of liquid therein for indicating the pressure of gas within said chamber, a cover for said porous septum consisting of material impervious to gases, a sleeve or socket in which said cover is adapted to move, said sleeve or socket being provided with a slotted opening in its wall, and a pin attached to said cover and projecting through said slotted opening to allow of said cover being movable toward and from said porous septum, said slotted opening further serving for the admission of gas so that it may pass through said porous septum.

3. A device for indicating the diffusive action of gases, comprising a closed chamber, a porous septum or diaphragm arranged in the walls of said chamber, the interior of the latter having communication with the exterior atmosphere only through said porous septum, a device having communication with said chamber for indicating the pressure of gas within the latter, means for covering or uncovering said porous septum to prevent or allow the passage of gas therethrough, a second closed chamber adapted to contain fresh air or other gas arranged adjacent said first named closed chamber, and a second porous septum or diaphragm arranged in

the walls of said first named closed chamber affording communication between said two closed chambers.

4. A device for indicating the diffusive action of gases, comprising a closed chamber, a porous septum or diaphragm arranged in the walls of said chamber, the interior of the latter having communication with the exterior atmosphere only through said porous septum, a device having communication with said chamber for indicating the pressure of gas within the latter, means for covering or uncovering said porous septum to prevent or allow the passage of gas therethrough, a second closed chamber adapted to contain fresh air or other gas arranged adjacent said first named closed chamber, a second porous septum or diaphragm arranged in the walls of said first named closed chamber affording communication between said two closed chambers, and means for regulating the pressure of the gas within said second named closed chamber.

5. A device for indicating the diffusive action of gases, comprising a closed chamber, a porous septum or diaphragm arranged in the walls of said chamber, the interior of the latter having communication with the exterior atmosphere only through said porous septum, a transparent tube communicating with said chamber having a movable body of liquid therein for indicating the pressure of gas within said chamber, a cover for said porous septum consisting of material impervious to gases said cover serving, when in operative position, to prevent the passage of gas through said porous septum, a second closed chamber adapted to contain fresh air or other gas arranged adjacent said first named closed chamber, and a second porous septum or diaphragm arranged in the walls of said first named closed chamber affording communication between said two closed chambers.

6. A device for indicating the diffusive action of gases, comprising a closed chamber, a porous septum or diaphragm arranged in the walls of said chamber, the interior of the latter having communication with the exterior atmosphere only through said porous septum, a transparent tube communicating with said chamber having a movable body of liquid therein for indicating the pressure of gas within said chamber, a cover for said porous septum consisting of material impervious to gases said cover serving, when in operative position, to prevent the passage of gas through said porous septum, means for moving said cover toward and away from said porous septum, a second closed chamber adapted to contain fresh air or other gas arranged adjacent said first named

closed chamber, a second porous septum or diaphragm arranged in the walls of said first named closed chamber affording communication between said two closed chambers, and a tube communicating with the interior of said second closed chamber and also communicating with the exterior atmosphere adapted to contain liquid so as to maintain the pressure within said chamber at the desired standard.

7. A device for indicating the diffusive action of gases, comprising a closed chamber, a porous septum or diaphragm arranged in the walls of said chamber, the interior of the latter having communication with the exterior atmosphere only through said porous septum, a device having communication with said chamber for indicating the pressure of gas within the latter, means for covering or uncovering said porous septum to prevent or allow the passage of gas therethrough, a second closed chamber adapted to contain fresh air or other gas partially surrounding said first named closed chamber and through which the latter passes, and a second porous septum arranged in the walls of said first named closed chamber affording communication between said two closed chambers.

8. A device for indicating the diffusive action of gases, comprising a closed chamber, a porous septum or diaphragm arranged in the walls of said chamber, the interior of the latter having communication with the exterior atmosphere only through said porous septum, a transparent tube communicating with said chamber said tube having a movable body of liquid therein for indicating the pressure of gas within said chamber, a cover for said porous septum consisting of material impervious to gases, means for moving said cover toward and away from said porous septum, a second closed chamber partially surrounding said first named closed chamber and through which the latter passes, a second porous septum arranged in the walls of said first named closed chamber affording communication between said two closed chambers, and means for regulating the pressure within said second named closed chamber.

9. A device for indicating the diffusive action of gases, comprising a pair of closed chambers, each chamber being provided with a porous septum or diaphragm arranged in the walls thereof, the interior of each chamber having communication with the exterior atmosphere only through said porous septa, a device connecting said pair of closed chambers and having communication with the interior of each for indicating the pressure of gas within said chambers, and means for covering or uncovering said porous septa to prevent or allow the passage of gas therethrough.

10. A device for indicating the diffusive action of gases, comprising a pair of closed chambers, each chamber being provided with a porous septum or diaphragm arranged in the walls thereof, the interior of each chamber having communication with the exterior atmosphere only through said porous septa, a device connecting said pair of closed chambers and having communication with the interior of each for indicating the pressure of gas within the chambers, and a cover for the porous septum of each chamber consisting of material impervious to gases, said cover serving when in operative position to prevent the passage of gas through the porous septa.

11. A device for indicating the diffusive action of gases, comprising a pair of closed chambers, each chamber being provided with a porous septum or diaphragm arranged in the walls thereof, the interior of each chamber having communication with the exterior atmosphere only through said porous septa, a transparent tube connecting said pair of closed chambers and having communication with the interior of each, said tube having a movable body of liquid contained therein for indicating the pressure of gas within the closed chambers, and means for covering or uncovering said porous septa to prevent or allow the passage of gas therethrough.

12. A device for indicating the diffusive action of gases, comprising a pair of closed chambers, each chamber being provided with a porous septum or diaphragm arranged in the walls thereof, the interior of each chamber having communication with the exterior atmosphere only through said porous septa, a transparent tube connecting said pair of closed chambers and having communication with the interior of each, said tube having a movable body of liquid contained therein for indicating the pressure of gas within the closed chambers, a cover for the porous septum of each closed chamber, a sleeve or socket associated with each of said closed chambers in which said cover is movable, each of said sleeves or sockets being provided with a slotted opening affording passage of gas to pass through said porous septum, and a pin connected with said cover and passing through said slotted opening for moving said cover toward and away from said porous septum.

13. A device for indicating the diffusive action of gases, comprising a pair of closed chambers, each chamber being provided with a porous septum or diaphragm arranged in the walls thereof, the interior of each chamber having communication with the exterior atmosphere only through said porous septa, a device connecting said pair of closed chambers and having communication with the interior of each for indicating

the pressure of gas within said chambers, means for covering or uncovering said porous septa to prevent or allow passage of gas therethrough, a chamber adapted to contain
 5 fresh air or other gas arranged adjacent said pair of closed chambers, and a porous septum arranged in the walls of each of said pair of closed chambers for affording communication between each of said pair of
 10 closed chambers and said last named chamber.

14. A device for indicating the diffusive action of gases, comprising a pair of closed chambers, each chamber being provided
 15 with a porous septum or diaphragm arranged in the walls thereof, the interior of each chamber having communication with the exterior atmosphere only through said porous septa, a device connecting said pair
 20 of closed chambers and having communication with the interior of each for indicating the pressure of gas within said chambers, a chamber adapted to contain fresh air or other gas arranged adjacent said pair of
 25 closed chambers and a porous septum arranged in the walls of each of said pair of closed chambers for affording communication between each of said pair of closed chambers and said last named chamber.

15. A device for indicating the diffusive action of gases, comprising a pair of closed chambers, each chamber being provided
 30 with a porous septum or diaphragm arranged in the walls thereof, the interior of each chamber having communication with the exterior atmosphere only through said porous septa, a device connecting said pair
 35 of closed chambers and having communication with the exterior of each for indicating the pressure of gas within the chambers, a closed chamber adapted to contain fresh air or other gas partially surrounding said first
 40 named chambers and through which the latter pass, and porous septa arranged in the walls of said pair of closed chambers for affording communication between the latter
 45 and said last named closed chamber.

16. A device for indicating the diffusive action of gases, comprising a pair of closed
 50 chambers, each chamber being provided with a porous septum or diaphragm arranged in the walls thereof, the interior of each chamber having communication with the exterior atmosphere only through said
 55 porous septa, a device connecting said pair of closed chambers and having communication with the interior of each for indicating the pressure of gas within the chambers, means for covering or uncovering said
 60 porous septa to prevent or allow the passage of gas therethrough, a closed chamber adapted to contain fresh air or other gas partially surrounding said first named chambers and through which the latter pass,
 65 porous septa arranged in the walls of said

pair of closed chambers for affording communication between the latter and said last named closed chamber, and means for regulating the pressure of the gas within said
 last named closed chamber.

17. A device for indicating the diffusive action of gases, comprising a pair of closed chambers, each chamber being provided
 with a porous septum or diaphragm arranged in the walls thereof, the interior of
 75 each chamber having communication with the exterior atmosphere only through said porous septa, a transparent tube connecting said pair of closed chambers and having communication with the interior of each,
 80 said tube having a movable body of liquid contained therein for indicating the pressure of gas within the closed chambers, a cover for the porous septum of each of said
 85 chambers, means for moving said covers toward and away from said porous septa so as to prevent or allow the passage of gas through the latter, a closed chamber
 adapted to contain fresh air or other gas partially surrounding said first named
 90 chambers and through which the latter pass, porous septa arranged in the walls of said pair of closed chambers for affording communication between the latter and said
 last named closed chamber, and means for
 95 regulating the pressure of the gas within said last named closed chamber.

18. A device for indicating the diffusive action of gases, comprising a pair of closed
 100 chambers, each chamber being provided with a porous septum or diaphragm arranged in the walls thereof, the interior of each chamber having communication with the exterior atmosphere only through said
 105 porous septa, a transparent tube connecting said pair of closed chambers and having communication with the interior of each, said tube having a movable body of liquid contained therein for indicating the pressure
 110 of gas within the closed chambers, a cover for the porous septum of each of said chambers, means for moving said covers toward and away from said porous septa
 115 so as to prevent or allow the passage of gas through the latter, a closed chamber adapted to contain fresh air or other gas arranged adjacent said pair of closed chambers, means of communication between each
 of said pair of closed chambers and said last named chamber, and means for regulating
 120 the pressure of gas within said last named chamber.

19. A device for indicating the diffusive action of gases, comprising a pair of closed
 125 chambers, each chamber being provided with a porous septum or diaphragm arranged in the walls thereof, the interior of each chamber having communication with the exterior atmosphere only through said
 130 porous septa, a transparent tube connecting

said pair of closed chambers and having communication with the interior of each, said tube having a movable body of liquid contained therein for indicating the pressure of gas within said chambers, covers for said porous septa for preventing or allowing the passage of gas through the latter, a closed tubular chamber partially inclosing said pair of closed chambers and through which the latter pass, said tubular chamber being of ring shape so as to be adapted to surround a lantern or the like, porous septa arranged in the walls of said pair of closed chambers for affording com-

munication between the latter and said last named chamber, and a tube communicating with the interior of said last named closed chamber and having communication with the exterior atmosphere for maintaining the pressure within said last named chamber at the desired standard.

In testimony whereof we affix our signatures in presence of two witnesses.

FREDERICK JAMES TURQUAND.

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Witnesses:

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