M. A. NOBLES.

GAS DETECTOR.

APPLICATION FILED DEC. 27, 1916.

1,313,323. Patented Aug. 19, 1919.

Fig. 1.

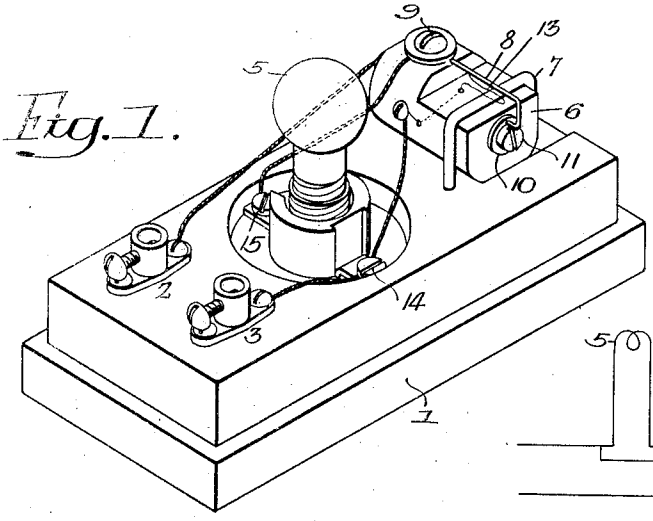


Fig. 6.

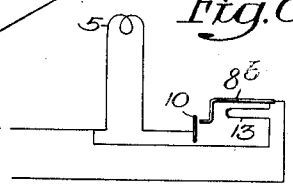


Fig. 2.

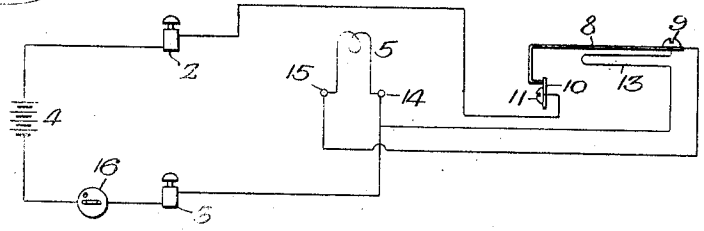


Fig. 3.

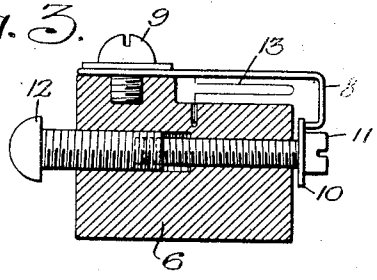


Fig. 4.

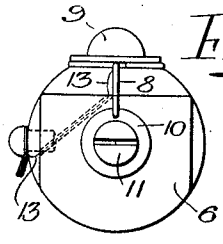
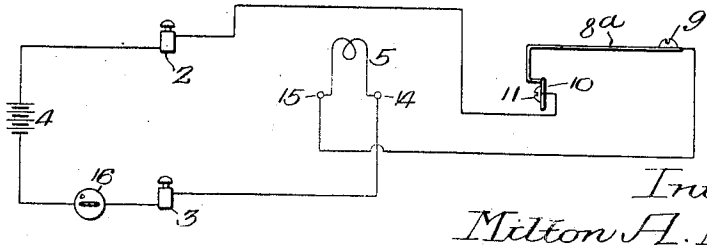


Fig. 5.



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UNITED STATES PATENT OFFICE.

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GAS-DETECTOR.

1,313,323. Specification of Letters Patent. Patented Aug. 19, 1919.

Application filed December 27, 1916. Serial No. 139,228.

To all whom it may concern:

Be it known that I, MILTON A. NOBLES, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented Gas-Detectors, of which the following is a specification.

One object of my invention is to provide a thoroughly practical, substantial and reliable instrument for giving indication of the presence of hydrogen-containing gas, the construction being particularly designed for use to detect the presence of methane or ethane in mines.

It is further desired to provide an instrument of the type above noted which shall act to give an unmistakable alarm whenever certain gases are present in predetermined quantities, the invention contemplating more particularly a combination of parts for alternately extinguishing and lighting a lamp when the above noted conditions exist.

Another object of the invention is to provide a gas detector which shall be absolutely independent of and perform its functions without being practically affected by the temperature of its surrounding atmosphere, the construction being such that the apparatus is not likely to get out of order or require attention under conditions of use.

These objects and other advantageous ends I secure as hereinafter set forth, reference being had to the accompanying drawings, in which,

Figure 1 is a perspective view illustrating the gas detector constructed according to my invention;

Fig. 2 is a diagrammatic view illustrating the electrical connections of the various parts;

Figs. 3 and 4 are respectively a longitudinal vertical section and an end elevation of one of the elements of the instrument forming part of my invention;

Fig. 5 is a modification of my invention in which the thermostatic bar is also the catalytic element; and

Fig. 6 is a diagram, illustrating the open circuit form of my invention.

In the above drawings 1 represents a supporting base upon which are mounted a pair of suitably insulated terminals 2 and 3 connected to a source of current such as a battery 4. In the present instance I have shown an incandescent lamp 5 as mounted upon the base 1 and this lamp would preferably though not necessarily be of the construction and candle power commonly employed in a miner's electric safety lamp. In fact while I have shown the parts in a somewhat diagrammatic form it is to be understood that under conditions of use they would without material change be mounted in and associated with certain well known structures to constitute such a portable safety lamp. Also mounted on the base 1 is a block 6 of insulating material, preferably lava, held in place by any means such as a strap 7 and carrying a temperature responsive element in the form of a thermostatic bar 8. This bar is illustrated as consisting of a wire of silver rigidly clamped at one end to the lava block 6 by means of a screw 9 from which it projects beyond one end of said block.

This projecting end is bent down and then inwardly toward the body of the block so that its extremity under normal temperature conditions rests in electrical engagement with a washer or flange 10 mounted on or held in place by a screw 11 and retained in any adjusted position by a set screw 12 into which it is threaded and which extends adjustably into the block 6 from the end opposite that having the screw 11. The upper face of the block 6 is preferably recessed under the projecting end of the thermostatic bar 8, adjacent which is mounted a catalytic element in the form of a loop or length 13 of thin platinum or other wire, having the property when heated to an elevated temperature by an electric current, of causing chemical reaction without being itself affected other than to have its temperature still further raised. This has one end electrically connected to the thermostatic bar and its opposite end connected to one of the terminals 14 of the lamp 5, the second terminal 15 of said lamp being electrically connected to the clamping screw 9. The adjusting screw 12 and therefore the fixed contact comprised by the screw 11 and flange 10 are electrically connected to the terminal 2, while the lamp terminal 14, in addition to being connected to the catalytic element 13, is likewise connected to the second terminal 3.

Any suitable form of switch 16 is connected at any desired point in the circuit so as to permit the apparatus being put in or taken out of operation at will. Obvi-

ously when said switch is closed, current from the battery 4, after flowing from the terminal 2 to the fixed contact 10 and the movable contact provided by the thermostatic bar 8, divides through the two paths provided by the lamp 5 and the catalytic element 13 respectively, finally flowing back to the current source from the batery terminal 3.

The voltage of the current source is so chosen and the resistances of the lamp 5 and catalytic element 13 are so proportioned, that the normal current flowing from said source causes said lamp to be lighted to full candle power and the catalytic element to be heated to a comparatively high temperature, for example 1200° C. While under these conditions the heat from said catalytic element acts upon the thermostatic element 8 and tends to cause it to so change its dimensions or form as to make its free end disengage the fixed contact 10, the parts are so adjusted that said end none the less remains in engagement with said contact.

When, however the instrument is placed in an atmosphere containing methane, ethane or other gas containing hydrogen, the catalytic action of the element 13, which is usually a body of platinum wire, at once increases its temperature to such an extent—for example 1600° to 1800° C.—that the increased heat transmitted to the thermostatic bar will cause its free ends to disengage the contact 10. As a result, current flow is cut off both from the element 13 as well as from the lamp 5, so that the latter is extinguished and the thermostat as well as the catalytic element is allowed to cool. In a short time however, owing to this reduction of temperature in the thermostatic bar due to the cessation of the catalytic action of the element 13, the free end of said rod or bar 8 again engages the fixed contact 10, closing the lamp circuit and permitting the element 13 to be again heated by the electric current. If the hydrogen-containing gas is still present, the above series of operations is repeated so that there is a continued "winking" caused by the alternate lighting and extinguishing of the lamp 5, which thus gives a most obvious indication of the presence of the gas. Obviously this action ceases and the lamp circuit remains unbroken with the lamp in operation when gas is no longer present.

It is particularly to be noted that since the catalytic element 13 is normally maintained at a high temperature, it is not appreciably affected by such variations in the temperature of the surrounding atmosphere as could possibly occur even in passing from the lowest temperature of the air to the highest temperature of an inhabitable mine. Consequently the device will operate to give an alarm only when, owing to the presence of hydrogen-containing gas, the temperature of the normally heated catalytic element is increased to such a degree that the thermostatic bar 8 is actuated to open the circuit which it controls. Obviously therefore the alternate extinguishing and lighting of the lamp will be continued as long as appreciable quantities of the hydrogen-containing gases are present and that without being appreciably affected by the temperature of the surrounding atmosphere.

It will be noted that a distinguishing characteristic of my device is its extreme simplicity, its inexpensive and substantial construction and its certainty of action due to the further raise in the temperature of the previously heated catalytic element when it is brought into an atmosphere containing a predetermined proportion of gas.

While in Figs. 1 to 4 inclusive I have shown my invention as provided with separate thermostatic and catalytic elements, it is to be noted that I may in some cases employ a single member 8^a as shown in Fig. 5, to perform the functions of both of them. Such an element would be furnished by a body of wire of platinum or other catalytic substance, which in addition to possessing the quality of a thermostatic element in so far that it will elongate or change its form to a predetermined extent when heated to a definite temperature, shall also be capable of acting as a catalytic element as previously explained when sufficiently heated.

Such a double function wire is connected in series with the lamp 5 between the terminals 2 and 3 and its dimensions are such that when current is permitted to flow from the source 4, not only is the lamp 5 lighted but the element itself is raised to a temperature of say 1200° C. The adjustment of the screws 11 and 12 is such that even with this heating, the free end of the element remains in electrical contact with the flange or washer 10, although when the device is brought into an atmosphere containing more than a predetermined amount of hydrogen-containing gas, the temperature of the element is sufficiently raised owing to its catalytic action, to cause its free end to disengage the fixed contact 10 and break the current flowing through it and through the lamp 5. Thereafter when said element cools sufficiently it again engages the contact 10 and lights the lamp.

While the time during which the lamp is lighted varies with the relative proportions of the several parts of the device, in a typical case the thermostatic element was actuated to open the circuit after the lamp had been in operation for about one second, after which said circuit remained open for seven seconds, whereupon the thermostatic element again closed the circuit and repeated the

several operations. This action occurred when 12% of inflammable gas was present in the atmosphere surrounding the instrument and it was found that the periods of light and darkness were dependent upon such percentage of gas, there being a much more rapid alternation of the opening and closing of the circuit when the percentage of inflammable gas was reduced.

As a typical example of the proportions of the controlling elements in that form of my device shown in Fig. 1, I employed .75 of an inch of catalytic platinum wire of a diameter of .0026 of an inch, in combination with a thermostatic silver wire .84 of an inch in operative length and .01 of an inch in diameter. In this case the current source had an electromotive force of two volts while the current flow was at the rate of .45 watts, and I found that an instrument made with its parts arranged and proportioned as specified operated to indicate the presence of hydrogen-containing gas as above set forth.

It is obviously not necessary that the lamp or other alarm device should be operated on closed circuit as shown in Fig. 2, since without departing from my invention, I may arrange the thermostatic element as shown in Fig. 6 so that it is included with the lamp 5 in a branch normally maintained open, while the catalytic element 13 as before is normally in a closed circuit and highly heated to a temperature such as that above indicated. If now, the device be brought into an atmosphere containing more than the predetermined amount of inflammable gas, the latter acts to raise the temperature of the element 13 by reason of its catalytic action, thus so far changing the form or dimensions of the thermostatic element 8^b that its free end comes into engagement with the fixed contact 10 and closes the circuit of the branch including the lamp 5. In this case the latter remains lighted as long as there is more than the predetermined amount of gas present.

In all of the above cases the temperature at which the circuit is opened or closed by the thermostatic bar or element may be adjusted within certain limits by turning the screw 11 into or out of its coöperating screw 12, so as to vary the distance between said element and the contact 10 or to vary the pressure between these structures. Obviously the part of the instrument including the element 13 or 8^a, as the case may be, when used in a safety lamp, is so mounted as to be inclosed by one or more bodies of gauze, which while permitting passage of inflammable gas to said element, will effectually prevent the latter from igniting said gas.

I claim;—

1. The combination in a gas detector of a catalytic element normally maintained at an elevated temperature further increased by inflammable gas; a temperature responsive device mounted adjacent said element and adjusted for operation between the limits of the temperature at which the latter is normally maintained and that to which it is increased by the action of an inflammable gas; and indicating means governed by said temperature responsive device.

2. The combination in a gas detector of alarm-controlled means including a thermostatic switch; with a catalytic element mounted to govern the operation of said switch and adapted to be normally maintained by an electric current at an elevated temperature which will be increased by the action of the element on inflammable gas.

3. A gas detector consisting of an electric circuit including a source of current; a thermostatic switch; with a catalytic element and an electric alarm device in parallel with each other and in series with said switch.

4. A gas detector consisting of an electric circuit including a source of current; a thermostat; a catalytic element mounted to act on the thermostat; with an element in circuit with the thermostat and in parallel to the catalytic element.

5. A gas detector consisting of a normally lighted lamp; a thermostatic switch in circuit with said lamp; and a normally heated catalytic element mounted to act on the thermostatic switch to extinguish the lamp when the temperature of said element is increased by the presence of gas.

6. A gas detector consisting of an electric alarm device; a catalytic element normally maintained by an electric current at an elevated temperature; and a normally closed thermostatic switch adjacent the catalytic element adjusted to open when the temperature of the element is increased by the presence of gas.

7. A gas detector consisting of a source of current; a normally closed thermostatic switch and a normally lighted electric lamp in circuit with said source and switch; with a catalytic element connected in circuit with said current source and mounted to cause opening of the thermostatic switch when its temperature is increased above that due to the flow of electric current.

8. The combination in a gas detector of a catalytic element normally maintained by an electric current at an elevated temperature; with an alarm device associated with said catalytic element and actuated thereby when its temperature is still further raised by the presence of hydrogen-containing gas.

9. A gas detector consisting of a body of insulating material; an elongated bar mounted thereon; a fixed contact normally engaged by said bar; an electric alarm device and a source of current in circuit with said contact and bar; with a catalytic wire

mounted adjacent the bar and normally maintained by the current source at an elevated temperature, said bar and contact being relatively adjusted to disengage each other only when said bar is acted upon by a further elevation of the temperature of the catalytic wire.

10. The combination in a gas detector of a normally closed electric circuit including a lamp, a source of current and a switch; a catalytic element normally maintained at a temperature materially higher than that of the atmosphere; with a thermostat for actuating the switch, adjusted to cause opening of the same only upon a further increase in the temperature of the catalytic element.

11. The combination in a gas detector of a body of insulating material; a fixed contact thereon; a thermostatic bar having a contact portion returned upon itself and placed to coöperate with said fixed contact; a catalytic element in circuit with the thermostatic bar; an electric lamp and a source of current connected both to said lamp and to said catalytic element, the latter being normally maintained by current from said source at an elevated temperature and being adapted to cause an increase in said temperature in the presence of an inflammable gas.

12. The combination in a gas detector of a body of insulating material; a fixed contact thereon; a thermostatic bar having a contact portion returned upon itself and placed to coöperate with said fixed contact; a catalytic element in circuit with the thermostatic bar; a source of current connected both to said lamp and to said catalytic element; and means for adjusting the position of the fixed contact relatively to the thermostatic bar, the latter being normally maintained by current from said source at an elevated temperature and being adapted to cause an increase in said temperature in the presence of an inflammable gas.

In witness whereof I affix my signature.

MILTON A. NOBLES.