

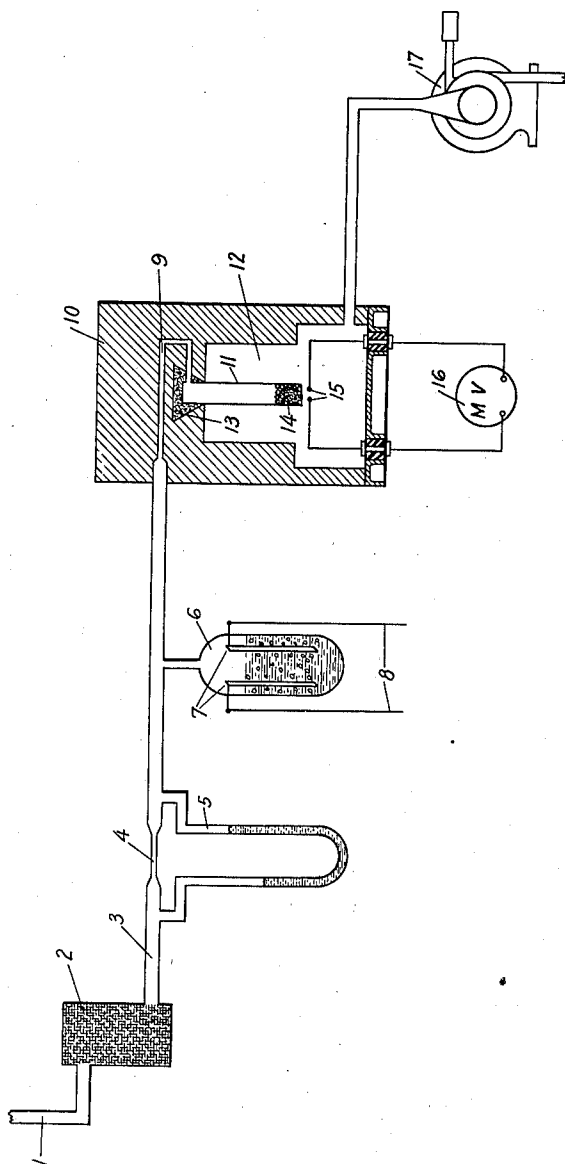
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R. H. CANFIELD

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DETECTOR FOR COMBUSTIBLE GAS

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INVENTOR

R. H. CANFIELD

BY

Harold Dodd

ATTORNEY

UNITED STATES PATENT OFFICE

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DETECTOR FOR COMBUSTIBLE GAS

Robert H. Canfield, Washington, D. C.

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8 Claims. (Cl. 23-255)

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This invention relates to a device for detecting the presence of combustible gases in air and indicating the percentage thereof.

Among the objects of this invention are:

To provide a simple, reliable apparatus for detecting the presence, and measuring the percentage of, combustible gas in air;

To provide in such a device means for calibrating and checking the accuracy of the measuring elements thereof;

To provide a device of the type mentioned having means for removing from the air passing therethrough any droplets of acid that may be entrained by the air when this invention is used in connection with storage batteries or the like.

The drawing shows schematically an apparatus adapted to the practice of my invention.

It is frequently desirable to detect the presence of combustible gases in air and to measure the percentage of such gases in order that steps may be taken to prevent the accumulation of the gases to an extent that the mixture thereof with air would be explosive. This is particularly true in rooms where storage batteries of large capacity are being charged and considerable quantities of evolved hydrogen are freed.

A stream of the air to be tested is taken in through a pipe 1 to a porous element 2 that is constituted of such material that it will react chemically with any droplets of acid entrained by the air and so effect the removal of such acid from the air stream. It has been found that a roll of iron wire gauze serves very satisfactorily for this purpose. After passing through the element 2, the air is carried in a pipe or conduit 3 having a constricted portion 4 of known cross-sectional area with the legs of a U-tube manometer 5 connected to the conduit 3 adjacent the opposite ends of constriction 4. Connected to conduit 3 is an electrolytic cell having electrodes 7 connected by wires 8 to a source of direct current whereby known quantities of electric current may be passed through the cell 6 and thus a known volume of hydrogen be supplied to conduit 3. However, it is to be understood that other means of supplying a known quantity of gas having a known heat of combustion per unit volume may be substituted for the electrolytic cell 6 which is shown for purpose of illustration only.

The gas passes from conduit 3 into a tortuous passage 9 in a massive body 10 of heat conducting material, such as iron, which body is adapted to be heated and thereby transfer heat to the gas in the passage 9. A satisfactory temperature for the body 10 is about 212° F. A thin hollow cyl-

inder 11 of brightly polished metal is suspended in cavity 12 in the body 10 by having the upper end of the cylinder embedded in a mass 13 of heat insulating, non-combustible material which prevents transfer of appreciable quantities of heat to or from the cylinder 11 by conduction, and since the cylinder is brightly polished there will be practically no loss of heat through radiation. In the lower end of cylinder 11 is disposed a body 14 of catalyst having a large surface area which may be formed by coating a porous refractory material such as pumice with palladium black, the said material being supported on a piece of wire gauze secured against the end of the cylinder 11. The combustible constituent in the stream of gases, having been heated while traversing the passage 9, is immediately ignited upon contacting the catalyst and as the stream of gases, heated by the burning of the combustible constituents thereof, emerges from the cylinder 11, it passes over a thermopile 15 and the effect thereof is indicated by an electrical measuring instrument 16 which may be a millivolt meter or an ammeter. The term "electrical quantities" as hereinafter used refers to both millivolts and milliamperes. A pump 17 withdraws the gases from the cavity 12 but it may equally well be connected to the pipe 1 and force the gases through under pressure instead of withdrawing them by suction.

It is to be understood that the electrolytic cell 6 is not operated when air containing an unknown percentage of combustible gas is being tested, the purpose of the cell being merely to supply a known quantity of combustible gas whereby the meter 16 is to be calibrated, or to be checked for accuracy after having been in use. It is evident that, the cross-sectional area of portion 4 and the pressure under which the air is flowing therethrough being known, the quantity of air taken into the apparatus in a given time is known and hence the percentage of combustible gas therein can be determined by measuring the heat developed when such gas is burned. If desired, the meter 16 can be calibrated to read percentage of hydrogen or any other gas of known heat of combustion instead of millivolts or milliamperes. It is to be understood that other means for measuring the temperature of the gases emitted from cylinder 11 may be substituted for the thermopile and electric meter.

If the cylinder 11 is made very thin so it will have negligible capacity for heat conduction longitudinally thereof and the thermopile elements are made thin and the weight of the catalyst is

small, the readings of the instrument are, within permissible limits of error, independent of the rate of flow of the gases. The uniform high temperature of the body 10 insures the activity of the catalyst by preventing condensation of water or other vapor and also raises the enclosing air to the same temperature as the thermopile elements which prevents the meter from giving an indication in case no combustible gas is present in the air stream. The cylinder 11 is readily removable and may therefore be replaced with a minimum of trouble and delay.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes, without the payment of any royalties thereon.

I claim:

1. In combination, a reticulated body of material that will unite chemically with acid entrained by a stream of gas, means to pass a stream of gas into said body, a conduit through which gases are carried away from said body, means connected to said conduit to measure the pressure of the gases flowing therein, means for introducing a known quantity of combustible gas of known thermal characteristics into said conduit, a member of heat conducting material having in it a tortuous passage in communication with said conduit, said member being heated when in use, a hollow element having surfaces that reflect radiant energy, said element being disposed within said member in communication with said passage, said element being insulated against conduction of heat from said member, a foraminous body coated with a combustion-initiating catalyst in said element, electro-thermal means disposed to be contacted solely by gases that have passed over said catalyst, and means to measure the electric quantities developed in said electro-thermal means.

2. In combination, a reticulated body of material that will unite chemically with acid entrained by a stream of gas, means to pass a stream of gas into said body, a conduit through which gases are carried away from said body, means connected to said conduit to measure the pressure of the gases flowing therein, a member of heat conducting material having in it a tortuous passage in communication with said conduit, said member being heated when in use, a hollow element having surfaces that reflect radiant energy, said element being disposed within said member in communication with said passage, said element being insulated against conduction of heat from said member, a foraminous body coated with a combustion-initiating catalyst in said element, electro-thermal means disposed to be contacted solely by gases that have passed over said catalyst, and means to measure the electric quantities developed in said electro-thermal means.

3. In combination, a conduit through which gases are carried, means connected thereto to measure the pressure of gases flowing therein, means for introducing known quantities of combustible gas of known thermal characteristics into said conduit, a member of heat conducting material having in it a tortuous passage in communication with said conduit, said member being heated when in use, a hollow element having surfaces that reflect radiant energy, said element being disposed within said member in communi-

cation with said passage, said element being insulated against conduction of heat from said member, a foraminous body coated with a combustion-initiating catalyst in said element, electro-thermal means disposed to be contacted solely by gases that have passed over said catalyst, and means to measure the electric quantities developed in said electro-thermal means.

4. In combination, a conduit through which gases are carried, means connected thereto to measure the pressure of gases flowing therein, a member of heat conducting material having in it a tortuous passage in communication with said conduit, said member being heated when in use, a hollow element having surfaces that reflect radiant energy, said element being disposed within said member in communication with said passage, said element being insulated against conduction of heat from said member, a foraminous body coated with a combustion-initiating catalyst in said element, electro-thermal means disposed to be contacted solely by gases that have passed over said catalyst, and means to measure the electric quantities developed in said electro-thermal means.

5. In combination, means to remove entrained acid from a stream of gases, means to determine the volume of gas passed in such stream, means to raise the temperature of the gas in said stream, a catalyst inclosed in the last mentioned means and disposed in the path of the said gas, a thermopile disposed in said temperature raising means to the adjacent boundry of said catalyst at which the gases leave the catalyst, but exteriorly thereof and in the path of gas that has traversed the catalyst, and means to measure the electric quantities developed by said thermopile.

6. In combination, means to remove entrained acid from a stream of gases, means to determine the volume of gas passed in such stream, means to raise the temperature of the gas in said stream, a catalyst inclosed in the last mentioned means and disposed in the path of the said gas, a thermopile disposed in said temperature raising means adjacent to the boundary of said catalyst at which the gases leave the catalyst but exteriorly thereof and in the path of gas that has traversed the catalyst, and means to measure the temperature of gases that have passed over said catalyst.

7. In combination, means to measure a volume of gas having a combustible constituent, catalytic means to ignite the said combustible constituent, thermo-electric means to determine the temperature of the gases after the burning of said combustible constituent, and means to calibrate and to check the accuracy of the temperature determining means including an electrolytic cell connected to pass into the foregoing means a known quantity of combustible gas having a known heat of combustion per unit volume.

8. In combination, means to measure a volume of gas having a combustible constituent, catalytic means to ignite the said combustible constituent, thermo-electric means to determine the temperature of the gases after the burning of said combustible constituent, and means to pass into the foregoing means a known quantity of combustible gas having a known heat of combustion per unit volume.

ROBERT H. CANFIELD.