

1

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DETECTION OF GAS LEAKS

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5 Claims. (Cl. 48—193)

ABSTRACT OF THE DISCLOSURE

The process of identifying or detecting gas leaks from a closed receptacle or conduit containing a normally colorless gas by adding a distinctive coloring agent to gases which are substantially colorless to the eye but which will be made visible by the presence of the added coloring agent. The colored gases can be also identified before use or while passing through conduits so that the flow of the gas can be observed through transparent windows provided in the conduits.

This application is a continuation of application Ser. No. 251,035, filed Jan. 14, 1963, now abandoned.

This invention relates to the process of identifying or detecting gas leaks from a closed receptacle or conduit containing a normally colorless gas. More specifically, the invention relates to adding a coloring agent to gases which are substantially colorless to the eye but which will be made visible by the presence of the added coloring agent.

An object of the invention is to impart a visible coloration to elemental gases, such as oxygen, hydrogen and nitrogen; gaseous compounds, such as carbon dioxide, carbon monoxide and acetylene; mixtures of gases; synthetic gases, such as fuel gases; and natural gases, such as natural fuel gases.

Another object of the invention is to color gases for the purpose of visually detecting their escape from conduits, tanks, and the like, and to serve as visible warning means when leakage occurs.

A further object of the invention is to color normally colorless gases so that they may be readily identified before use or while passing through conduits so that the flow of the gas can be observed through transparent windows provided in the conduits.

My invention has wide application to all types of natural and synthetic gases which may be used for domestic and industrial purposes. For example, a coloring agent may be added to fuel gases, such as natural gas, coal gas, water gas, producer gas, acetylene, butane, and propane, so that leakage of such gases may be readily detected in pipe lines or storage receptacles. The leakage of such colored fuel gases can thus be readily observed at any point in the pipe lines without use of expensive equipment. Such colored fuel gases can also serve as a safety warning to the lay person or consumer upon escape. The addition of a coloring agent to any gas or gas mixture can also serve as visual identification means when passing through a transparent pipe. For example, specific colors can be used to code and identify specific gases so that no errors will be made in using the proper gas.

My invention also contemplates the addition of fluorescent agents to gases so that the gases will emit a distinctive color under ultra-violet light when passing through a transparent conduit. Also phosphorescent agents may be added to gases so that they may be visible to the eye in the dark. Also pyrophoric or inflammable agents may be added to gases so that upon escape into the atmosphere a flame will be visible. Various other agents may be added to gases so as to produce a visible colored smoke when such gases escape into the air.

2

The coloration of gases has many uses, as previously indicated, for easy and quick identification, as well as for warning purposes. Oxygen and hydrogen which are at present widely used can be colored with distinctive coloring agents so that they can be readily identified before or during use, thus eliminating the danger of explosions and accidents. In the field of medicine and dentistry the identification of colored oxygen, nitrous oxide and other gases which are used would result in greater safety and elimination of mistakes in administering the proper gases to patients.

The article "Detection, Repair, and Prevention of Gas Leaks" published in American Gas Journal, August 1959, pages 16-28, points out that fuel gas lost through leakage represents a great economic loss today besides potential hazard to public safety. This article contains a survey of ten company practices and refers to 100 literature references. The article refers to the various methods used to detect gas leaks. It is significant that prior to this invention no one has suggested the use of a colored gas in gas systems to detect leaks.

In addition, leakage of fuel gas reduces the effective capacity of a distributing system. The detection and location of fuel gas leakage have been previously based on a variety of physical and chemical principles which are costly, require elaborate and expensive equipment and trained technical personnel. The most widely used means is the combustible gas indicator which is based on the controlled aspiration of a sample of the atmosphere to be tested over a hot-wire, catalytic combustion element. The heat of combustion increases the electrical resistance of the wire which is used as a basis for determining the amount of combustible gas present in the sample atmosphere. Infrared gas detectors have also been used which have to be mounted on trucks or automobiles since considerable equipment is involved. Stethoscopes, sonic leak detectors, mass spectrometers and even trained dogs have been used to detect leaks in fuel gas mains. The addition of strong odoriferous compounds to gas mains has also been utilized so that leaks might be detected by smell. Radioactive gases have also been added to gases to serve as leak detectors requiring special detection instruments and trained personnel.

My invention provides a simple means for detecting gas leaks by the addition of a coloring agent to the gas. When such colored gas is stored in tanks or is supplied through gas mains or pipes any leaks which may develop are readily and immediately detected visually by the escaping colored gas without requiring any special equipment of the kind previously in use. In order to color any given gas or mixture of gases, I add a selected coloring agent which may be an inorganic or organic agent and which is stable and non-reactive with the gas. A sufficient amount of the coloring agent is added so that the gas will be visible to the eye upon escape into the atmosphere or when viewed through a transparent window or conduit. I may add to natural gas, for example, diazomethane which is a yellow gas under normal conditions in amounts from about 10 to 20% by volume to give a distinctive color. Other colored gases which may be used in suitable amounts are chlorine monoxide, a yellow-red gas; chlorine dioxide, a reddish-yellow gas; dinitrogen trioxide, a reddish-brown gas; nitrogen trioxide, a bluish gas; nitrosyl bromide, a brownish gas; nitrosyl chloride, a yellow gas; nitryl chloride, a pale yellow-brown gas; nitrogen dioxide or tetroxide, a reddish-brown gas. I may also add to a gas elemental chlorine which is a greenish gas, or elemental bromine, which is a brownish-red gas, in order to impart color to the gas. These agents must of course be used in compatible environmental conditions which one skilled in the art can readily determine so that the added colored

gases will not react with any moisture, or corrode or react with the receptacle or conduit in which the gas is present. The gas should of course also be non-reactive with the added chlorine or bromine. I may also add a suitable reactive agent to a selected gas which is to be colored, so that the added agent will react with all or a portion of the gas, so as to color the gas.

I may also add a suitable opacifying agent to the colored gas so that the color will be accentuated or deepened by reflected light to make it more visible either while passing through a transparent pipe or upon escaping into the air. For example, very fine dispersed opaque white solids, such as titanium dioxide, may be added to a gas along with the coloring agent in suitable amounts. I also may add other colored finely divided solids of various shades or finely divided carbon black so as to produce various blends of color or shades of color that may be desired. I may also add an agent, such as titanium tetrachloride or stannic chloride, which will produce upon escape into the atmosphere an opacifying background or smoke so as to reflect impinging light and thus accentuate or deepen the color agent in the gas.

I may also add to gases pyrophoric gases which will spontaneously ignite in air and produce a visible flame when they escape into the atmosphere, such as, for example, dimethyl arsine, boron hydride, and phosphine. I may also add to gases extremely finely divided suspended pyrophoric solids, such as finely powdered pyrophoric iron particles, finely divided lead, iron oxalate, nickel oxide, and the like, which will spontaneously ignite when gas leakage should occur into the atmosphere. Vapors of phosphorus may also be admixed with gases which upon escape into the atmosphere may phosphoresce in the dark or if present in sufficient concentration may ignite to produce a visible flame. I may add naphthalene or metallic mercury vapors to various gases so that they will fluoresce under ultra-violet light and produce visible color.

As previously stated, my invention is particularly useful for detecting leaks in natural fuel gas pipe line systems at various points in route to the final consumer. My invention also serves as a consumer safety warning agent since the lay person can easily identify any leaks visible by the color of the escaping gas. A further use of the coloration of gases is to identify specific gases supplied through specific pipes made of transparent material so that the color of the gas being fed is visible. Odorants, which are presently in use, may be used if desired in conjunction with coloring agents. Suitable agents may be used which will leave a colored residue in the soil or

color vegetation adjacent the points where leaks may occur in fuel gas mains buried in the soil.

I claim:

1. The process of detecting gas leaks from a conduit through which fuel gas is flowing which comprises the steps of admixing a coloring agent with a fuel gas and transmitting said admixed gas through a conduit, said coloring agent being present in said fuel gas in amount to be visible when said admixed gas escapes or leaks into the atmosphere.

2. The process of claim 1, characterized in that the coloring agent is a fluorescent agent.

3. The process of claim 1, wherein the fuel gas is selected from the group consisting of natural gas, coal gas, water gas, producer gas, acetylene, propane and butane, and the coloring agent is selected from the group consisting of diazomethane, chlorine monoxide, chlorine dioxide, dinitrogen trioxide, nitrogen trioxide, nitrosyl bromide, nitrosyl chloride, nitryl chloride, nitrogen dioxide, nitrogen tetroxide, bromine and chlorine.

4. The process of detecting fuel gas leaks from a container which comprises the step of admixing a coloring agent with a fuel gas, and storing said admixed gas in a container, said coloring agent being present in said fuel gas in amount to be visible when said admixed gas escapes or leaks into the air.

5. The process of coding a fuel gas by visible color identification which comprises the steps of admixing a selected coloring agent with a selected fuel gas, and transmitting said admixed gas through a conduit having a transparent portion whereby the coded color of said gas is visible through said transparent portion.

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