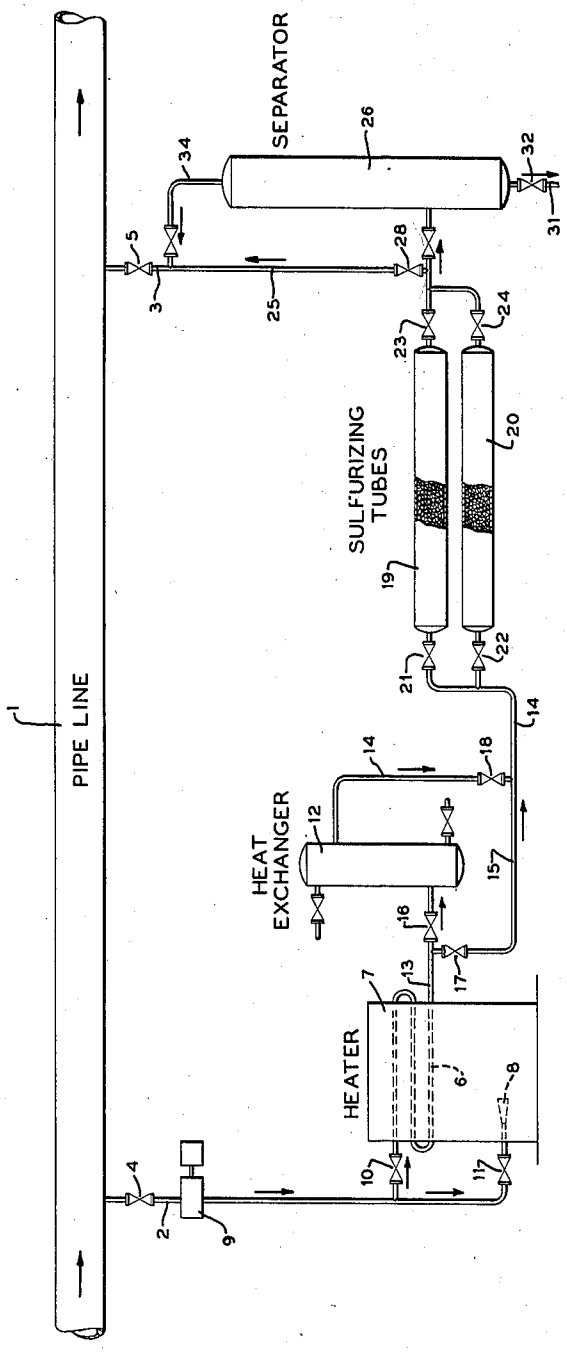
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TREATMENT OF GASEOUS FUELS

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TREATMENT OF GASEOUS FUELS

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This invention relates to the treatment of gaseous fuels and has to do particularly with the production of a gaseous hydrocarbon fuel containing an odorizing material adapted to serve as a warning agent by means of which leaks or open gas cocks are brought to the immediate attention of the consumer in order that they may be properly corrected.

Ordinarily natural gas and other fuel gases do not, of themselves, possess sufficient odor to warn of their presence when they escape from the containers, piping, or fixtures wherein they are used, and a danger results in such instances due to the explosive or toxic hazards created.

Various odorants have been used heretofore to give the gas a characteristic odor which will give proper warning of danger. Added reagents, such as mercaptans, have been used for this purpose, but odorants of this type are somewhat expensive. It is an object of this invention to produce a novel gaseous fuel, containing an odorant which is effective and inexpensive, and improved methods of making same.

My invention comprises a process in which a main body of the gas to be odorized is moved through a pipe, a relatively small part of said gas is continuously withdrawn from said pipe, as hereinafter described, and thereafter returned to said main body of gas. The invention relates more particularly to a process in which an odorant is produced by passing the gas through a treating zone in which it is contacted with sulfur at an elevated temperature. Atmospheric pressure may be employed, but it is often advantageous to conduct the reaction under pressures of from 50 to 400 pounds, for example. The gas to be treated should contain a small proportion of sulfur reactive compounds, such as hydrocarbons of higher molecular weight than methane. In the case of natural gas, for example, it is desirable that the gas contain a small amount, say 2–10% of ethane, propane and butanes; for example a natural gas containing about 95% methane and 5% of hydrocarbons of higher molecular weight than methane is satisfactory. In my process, it is intended that these heavier constituents be converted into odorants, such as butyl mercaptan.

The invention will be better understood by referring to the accompanying drawing, the single figure of which illustrates a preferred form of apparatus suitable for carrying out the process of my invention.

Referring to the drawing, the numeral 1 represents a pipe line forming a part of a gas distribution system through which a main body of the gas to be odorized is moved. A portion, usually a relatively small part of said gas, is withdrawn from the pipe 1 through a branch pipe 2 and treated to produce an odorant therein and thereafter returned to the main pipe 1 through a branch pipe 3 in sufficient amount to odorize said main body of gas. Valves 4 and 5 are provided in the pipes 2 and 3, respectively, for regulating the flow of gas to and from the treating system.

A heating coil 6, which is situated in a furnace 7, is used to heat a portion of the gas which is withdrawn from the pipe 1 through the pipe 2. Another portion of said gas may be delivered to a burner 8 for supplying heat to the coil. A compressor 9 is used to move the gas through the pipe 2 under a pressure which is greater than the pressure which is maintained in the pipe 1. Valves 10 and 11 are used to regulate the amount of gas which is delivered to the heating coil 6 and to the burner 8, respectively, from the pipe 2.

The gas may be heated in the heating coil 6 to a temperature of from about 750° F. to about 1500° F., for example. It is desirable to regulate the time during which the gas is maintained at high temperatures whereby at least a portion of the gases, for example, the heavier constituents thereof may be converted into olefins. For purpose of limiting the time of reaction a cooling device, such as a heat exchanger 12 is provided. Any desired amount of the heated gas may be withdrawn from the heating coil 6 and delivered to the heat exchanger 12 in which the heated gas is contacted indirectly with a cooling fluid, or the heat exchanger 12 may be by-passed entirely if desired. A pipe 13 is provided for delivering the heated gas from the heating coil 6 to the heat exchanger 12 and a pipe 14 is provided for withdrawing gas from said heat exchanger. A by-pass line 12 connects the outlet of the heating coil 6 directly to the line 14. Valves 16, 17 and 18 are provided to regulate the flow of heated gas through the heat exchanger 12 and the by-pass line 15.

Two cylindrical vessels 19 and 20 are provided, each of which contains sulfur. The heated gas which is withdrawn from the heating coil 6, with or without intermediate cooling, is delivered by the pipe 14 into either or both of the vessels 19 and 20, in which said gas is reacted with the sulfur to produce sulfur compounds having the desired odorizing properties. The temperature which is maintained in the vessels 19 and 20 may vary within wide limits. Temperatures of from about 750° F. to about 1500° F., for example, may

be used. Valves 21 and 22 are provided in the pipe 14 so that the gas may be delivered into either or both of the vessels 19 and 20. Valves 23 and 24 are provided at the outlets of the vessels 19 and 20, respectively. The outlets of the vessels 19 and 20 are connected by a pipe 25 to the pipe 3, controlled by valve 5, so that the treated gas withdrawn from the vessels 19 and 20 may be returned to the pipe 1.

An appreciable amount of polymerization may occur during the conversion and subsequent treating of the gas as above described, whereby higher boiling materials, which are liquid at ordinary temperatures, such as tars, may be formed. For the purpose of removing constituents of this type the treated gas which is withdrawn from the vessels 19 and 20 may be delivered into a separator or fractionating tower 26. In the separator 26 the liquids or tars are separated and withdrawn from the bottom of the tower 26 through a pipe 31 which is controlled by a valve 32. The separated gas may be withdrawn from the tower 26 through a pipe 34 and returned to the pipe 25.

The gas which is withdrawn from the top of separator 26 may contain a small amount of hydrogen sulfide and other acidic compounds. If desired such compounds may be removed from the gas by subjecting said gas to the action of aqueous sodium carbonate or other alkaline material in a scrubbing tower (not shown) or other suitable means.

In practicing the invention, about 1–5% of sulfur compounds is formed in the gas treated. These compounds have a vile odor and when added to a fuel gas in the proportion of about 0.005 to 0.5% impart to the gas a characteristic odor which can easily be detected even in small quantities in the air.

The following example will illustrate the invention:

Natural gas, comprising about 95% methane and remainder heavier hydrocarbons, is heated to a temperature of about 800° F. and contacted with sulfur, under pressures of 200 lbs. About 3% of sulfur compounds was formed. The sulfurized product after removing hydrogen sulfide is mixed with a main body of gas in such proportion as to give about 0.01% of the sulfur compounds in the final product.

Obviously many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. A method of odorizing a gaseous hydrocarbon fuel containing appreciable quantities of heavy gaseous hydrocarbons which comprises contacting the hydrocarbons with sulfur at temperatures of 750° to 1500° F., whereby a sulfurized hydrocarbon odorant is formed in the fuel.

2. A method of odorizing a gaseous hydrocarbon fuel containing appreciable quantities of heavy gaseous hydrocarbons, which comprises continuously treating a portion of said fuel by passing it through a treating zone in which it is contacted with sulfur at an elevated temperature to produce a sulfurized hydrocarbon odorant therein, and then combining said odorant with the main body of gas.

3. A method of odorizing a gaseous hydrocarbon fuel containing appreciable quantities of heavy gaseous hydrocarbons, which comprises moving the main body of said fuel through a conduit, continuously withdrawing a small portion of said fuel from the conduit, heating the withdrawn fuel to a temperature at which it will react with sulfur to form odorous sulfurized hydrocarbon bodies, passing the heated product through a treating zone in which it is contracted with sulfur at an elevated temperature to produce said odorant bodies therein and then returning the treated fuel to said conduit to odorize the main body of the fuel.

4. The method of odorizing a gaseous hydrocarbon fuel comprising mainly methane and small amounts of heavier volatile hydrocarbons, which comprises reacting said heavier hydrocarbons with sulfur to produce sulfurized compounds having substantially the odorous properties of mercaptans, in sufficient amount to odorize the entire volume of the fuel.

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