

UNITED STATES PATENT OFFICE

1,935,925

PROCESS OF GENERATING COMBUSTIBLE GAS

Carl Otto Wannack, Chicago, Ill., assignor, by
mesne assignments, to S. H. G. Incorporated,
Chicago, Ill., a corporation of Delaware

Application November 16, 1929
Serial No. 407,608

6 Claims. (Cl. 48—219)

This invention relates to a process of generating combustible gas by intimately associating air under pressure with combustible fluid.

One of the features of my invention comprises separating the main bulk supply of combustible fluid from the zone in which the generated combustible gas is confined or stored, pending withdrawal for use.

In a preferred embodiment, generation of the gas may take place in the gas storage zone, but it is to be understood that the invention in its broadest aspect contemplates the generation of combustible gas either in the gas storage zone or in the combustible liquid storage zone.

Other and further important objects of the present invention will be apparent from the accompanying drawing and following detail description.

In the drawing, Fig. 1 is a diagrammatic elevational view of an arrangement suitable for carrying out my invention.

Fig. 2 is a schematic diagram of the electric current circuit and connections.

Referring in detail to the drawing, 1 indicates an air intake pipe connected to a blower or air compressor 2. The pipe 1 may preferably open to a point exterior of a building 3. The blower 2 may be operated by a motor or the like 4, which may drive the blower through the agency of a belt or sprocket chain 5. The blower 2 may draw air through the intake pipe 1 and discharge said air through a pipe 6.

A tank 7 may be buried in the ground exterior of the building 3, and is preferably divided into two separate compartments 8 and 9 by means of a vertical partition 10. The compartment 9 may be utilized to confine a quantity of combustible fluid 11 which may be charged through a filler pipe 12 which extends downwardly a relatively short distance into the compartment 9. A screen 13 may be associated with the pipe 12 serving as a fire preventing means. The downwardly extending filler pipe 12 serves to prevent the compartment 9 from being completely filled with fluid. In other words, an air space is always provided above the surface of the fluid 11.

A housing 14 may be connected to the compartment 9, adapted to receive a liquid level gauge (not shown) of any accepted design.

The compressed air passing through the pipe 6 is diverted at the T 15 through two lines 16 and 17 respectively. Interposed in the line 16 is a check valve 18 which opens away from the compressor. The other end of the line 16 may be connected into the compartment 9. When

the blower is operating, air under pressure is delivered through the pipe 6, check valve 18, and line 16 to the air space above the fluid 11 in the compartment 9.

The pipe 17 may be connected to, and extend downwardly into compartment 8. Interposed in the line 17 is a check valve 19 which opens away from the blower 2, and prevents the back flow of gas from the compartment 8 to the blower when the motor 4 is not in operation. The end of the pipe 17 within the compartment 8 may be provided with a removable nozzle 17', which will be hereinafter more fully described.

A pipe 22 may extend downwardly into the compartment 9, the end of which may be open and disposed within, say 2 to 6 inches, (more or less) from the bottom of said compartment so as to be submerged in the liquid. The pipe 22 virtually forms a U, the other end of which terminates within the compartment 8, adjacent the end of the compressed air pipe 17. The end of pipe 22 in compartment 8 may be bent, as shown at 23 in Fig. 1 so as to discharge fluid at an angle to the air issuing from nozzle 17'. In order to control the quantity and velocity of the fluid issuing from the pipe 22 the latter may be provided with a removable nozzle 22'. The arrangement is such that the point of intersection of the fluid and air streams is spaced from the air discharge a sufficient distance so that the cooling effect produced by the rapid evaporation of the fluid will not freeze the moisture entrained in the compressed air and foul the air discharge.

An automatic solenoidally actuated valve, designated as a whole 24, may be interposed in the pipe 22 exterior of both compartments, the arrangement being such that, when motor 4 is functioned, the valve 24 will be simultaneously energized through the electrical connection 25. In this manner, while motor 4 is operating air under pressure will be introduced into chamber 9 through pipe 16, and a pressure will be established in said chamber above the surface of the fluid 11 contained therein, forcing a portion of said fluid through pipe 22 and valve 24 and discharging the fluid from orifice or nozzle 22' in chamber 8. At the same time air under pressure is also issuing from line 17 through the air nozzle 17', and is directed into contact with the stream of fluid issuing from nozzle 22', thereby breaking up the fluid into a finely divided vapor or fog and producing a combustible gas.

A gas outlet pipe 26 is connected into the chamber 8 and preferably extends downwardly therein to within a few inches of the bottom. A T

coupling 27 may be connected to the upper end of pipe 26 into which a gas discharge line 28 may be connected. The third end of the T 27 may be closed by means of a removable plug or the like 29'. By this arrangement, if unvaporized fluid, such as water, accumulates at the bottom of the compartment 8, it may be withdrawn without disconnecting the line 28, merely by removing plug 29', inserting a pipe or the like (not shown) through pipe 26 and withdrawing the water or unvaporized fluid through the auxiliary pipe.

The line 28 may lead to the building 3 or to any point of gas consumption; a conventional pressure reducing valve 29 may be interposed in line 28 to reduce the pressure of the gas from chamber 8 to a pressure at which gas may be conveniently and efficiently consumed. A vent pipe 30 may communicate with valve 29 and may open at a point exterior of the building 3. A flash-back arrester 31 may be interposed in line 28 preferably on the low pressure side of the valve 29.

Interposed in gas discharge line 28, preferably between the pressure reducing valve 29 and the T 27, is a pressure-actuated switch 20. The arrangement is such that, when the pressure within the pipe 28, and hence the pressure in compartment 8, reaches a predetermined minimum, say for instance, one-half to one and one-half pounds per square inch, more or less, the pressure-operated switch 20 will be actuated to simultaneously energize the motor 4 and valve 24, thereby generating gas in the compartment 8. When the generation of gas has proceeded to the point where a predetermined maximum pressure is reached in compartment 8, say for instance, four to five pounds per square inch, more or less, the switch 20 functions to disconnect the motor 4 and deenergize valve 24, thereby cutting off the generation of gas, and completely separating the two compartments, 8 and 9. In this manner gas generated and confined in compartment 8 is unaffected by evaporation from the main bulk supply of fluid 11.

Referring particularly to Fig. 2, a schematic diagram of the electrical circuit and connections is shown; 32 indicates a source of electrical current across which motor 4 is connected while 20 indicates an automatic pressure-operated switch connected in series with the motor. A solenoid 24' may also be connected across the motor 4 being operated when the switch 20 is closed. A plunger or core 24'' is adapted to be raised when solenoid 24' is energized, thereby opening the valve 24'''. When the switch 20 is opened, the motor stops and solenoid 24' is simultaneously deenergized, permitting the core 24'' to fall by gravity, thereby closing the valve 24'''. It is to be understood of course, that elements 24', 24'' and 24''' correspond to valve 24.

In one mode of carrying out my invention, a quantity of combustible fluid may be introduced into the compartment 9 of tank 7 through filler pipe 12. The compartment 9 may be initially filled to approximately the lower end of pipe 12, which pipe is then closed by means of a conventional cap 33. The motor 4 may then be started functioning the blower 2 and opening the valve 24. Compressed air will pass through line 16 and establish a pressure upon the fluid 11, thereby forcing a desired quantity of fluid through pipe 22, nozzle 22' and into chamber 8. Simultaneously compressed air will be passed through pipe 17 and will discharge from nozzle 17' in chamber 8. The stream of fluid issuing from nozzle 22'

is directed into contact with and at an angle to the stream of air issuing from the nozzle 17' thereby intimately associating the air and combustible fluid and forming a combustible gas.

The calorific value of the combustible gas generated can be accurately regulated by controlling the ratio of the quantity of air and fluid brought into contact in the chamber 8. These factors may be varied at will by changing the relative sizes of the nozzles 17' and 22' of the air and fluid streams respectively. In this manner, for the production of a combustible gas of a desired calorific value, a suitable arrangement of nozzle sizes may be utilized which will insure the vaporization of all of the fluid introduced into the compartment 8. The rate of gas generation can be readily controlled by the capacity of the blower 2.

With the generation of combustible gas in the chamber 8, the pressure in said chamber will increase, until a predetermined maximum pressure is reached, say for example, four to five pounds per square inch, more or less. Upon reaching this critical pressure, the pressure-actuated switch 20 will function to stop the motor 4 and simultaneously deenergize the solenoid 24', permitting the plunger 24'' to fall by gravity, closing the valve 24'''. Hence, the generation of combustible gas is stopped and all means of communication between the compartments 8 and 9 is cut off.

The withdrawal of combustible gas for consumption reduces the pressure in gas compartment 8. When this pressure is reduced below a predetermined minimum, say 1 to 1½ pounds per square inch, more or less, the pressure-actuated switch 20 is automatically functioned to again start the motor 4 and simultaneously open valve 24. The motor 4 being directly connected to the compressor 2 will operate the compressor to charge air under pressure through lines 16 and 17 until the pressure again reaches the predetermined maximum. By this arrangement the entire operation is automatically controlled and is functioned solely by the pressure within the two compartments. The check valves 18 and 19 prevent liquid and gas, respectively, from flowing back to the air compressor in case of unforeseen accident.

I have found it desirable to dispose the mouth of the gas withdrawal pipe 26 in the chamber 8 remotely with respect to the point of gas generation inasmuch as the freshly generated gas is thus permitted to travel through the entire compartment 8 before it is withdrawn. In this manner a homogeneous gas will always be withdrawn.

While I have illustrated the switch 20 as taking the form of a mercoide switch, it is to be understood that any equivalent element which is automatically functioned by the pressure within the gas compartment to start or stop the motor may be utilized. Also, I do not wish to be limited to a solenoid valve 24, since any type of valve which will be automatically functioned can be used. I illustrate the valve as being of the solenoid or magnetic type, since solenoid valves have been approved by the Board of Underwriters.

It may be found desirable under certain conditions to introduce a heating element (not shown) such as a closed coil or the like, into the chamber 8 to assist vaporization of the combustible fluid. A heating medium, such as hot water, steam, hot oil or the like may be passed through the coil. One condition which may warrant

the use of the heating element in the gas chamber, may exist when a combustible fluid of comparatively high boiling point is used.

It is apparent that I have provided a method of producing a combustible gas of substantially any desired calorific value and producing throughout the continuance of the process a combustible gas of constant heat content; a method in which the heat content of the combustible gas may be changed at will and maintained constant regardless of atmospheric temperature changes and humidity conditions met in practice.

By the expression "combustible fluid" as used in the specification and claims is meant a fluid other than a true gas which when suitably mixed with air will produce a combustible gas. Such fluids as gasoline, pentane, hexane, benzol, alcohols and the like may be used, but it is to be understood that I do not wish to be limited thereto except as specified in the appended claims.

I have found it to be advantageous to so proportion the quantity of combustible liquid and air brought into intimate association in the compartment 8, that the air admitted is not saturated, for instance, the resultant gas when formed may be of a calorific value corresponding to approximately 25% (more or less) saturation of the air. In this manner atmospheric temperature changes and moisture conditions of the air will have little or no effect upon the heat value of the gas.

I claim as my invention:

1. A process which comprises maintaining a bulk supply of low boiling liquid fuel not substantially heavier than gasoline in a closed zone, removing fuel from said zone, mixing the withdrawn fuel outside said zone with air substantially free of combustibles to form a combustible gas, said air being drawn from an air supply outside the closed zone and mixed directly with the fuel without prior passage through the closed zone, storing the combustible gas in a second closed zone maintained substantially free of uncarbureted combustible liquid, preventing vapor communication between the first and second mentioned zones during storage therein of the liquid fuel and the combustible gas respectively, and passing combustible gas from said second zone to a point of consumption without appreciable dilution.

2. A process which comprises maintaining a bulk supply of low boiling fuel not substantially heavier than gasoline in a closed zone, removing fuel from said zone and introducing the same to a second closed zone maintained substantially free of uncarbureted combustible liquid, passing air substantially free of combustibles directly from an air supply outside said zones and without prior passage through the first-mentioned zone into said second zone and intimately mixing the

same therein with the fuel withdrawn from the first-mentioned zone to form a combustible gas, storing the combustible gas in said second zone and preventing vapor communication between said zones during the storage of the combustible gas and liquid fuel therein, and passing combustible gas from said second zone to a point of consumption without appreciable dilution.

3. A process which comprises maintaining a body of low boiling combustible liquid not substantially heavier than gasoline in a closed zone, introducing a stream of air under pressure into said zone and forcing liquid out of the zone by the pressure of the air into a second closed zone maintained substantially free of uncarbureted combustible liquid, introducing directly to said second zone a second stream of air, substantially free of combustibles, from a source outside the first-mentioned zone and without prior passage through the first-mentioned zone, intimately mixing the second stream of air with the liquid in said second zone to form a combustible gas, storing the combustible gas in said second zone and preventing vapor communication between said zones during the storage of the combustible gas and liquid fuel therein, and passing combustible gas from said second zone to a point of consumption without appreciable dilution.

4. A process which comprises maintaining a body of low boiling combustible liquid not substantially heavier than gasoline in a closed zone, compressing air in a zone of compression, removing a first stream of compressed air from the compression zone and introducing the same to said closed zone, forcing liquid out of said closed zone by the pressure of said air stream into a second closed zone maintained substantially free of uncarbureted combustible liquid, removing a second stream of compressed air from the compression zone and introducing the same directly into said second closed zone without prior passage through the first-mentioned closed zone, intimately mixing the second stream of air with the liquid in said second zone to form a combustible gas, storing the combustible gas in said second zone and preventing vapor communication between said zones during the storage of the combustible gas and liquid fuel therein, and passing combustible gas from said second zone to a point of consumption without appreciable dilution.

5. The process as defined in claim 3 further characterized in that the introduction of said second stream of air to said second zone is controlled in response to pressure variations in said second zone.

6. The process as defined in claim 2 further characterized in that the combustible gas is withdrawn from said second zone at a point remote from the point of mixing the combustible fluid and air.

CARL OTTO WANNACK.