

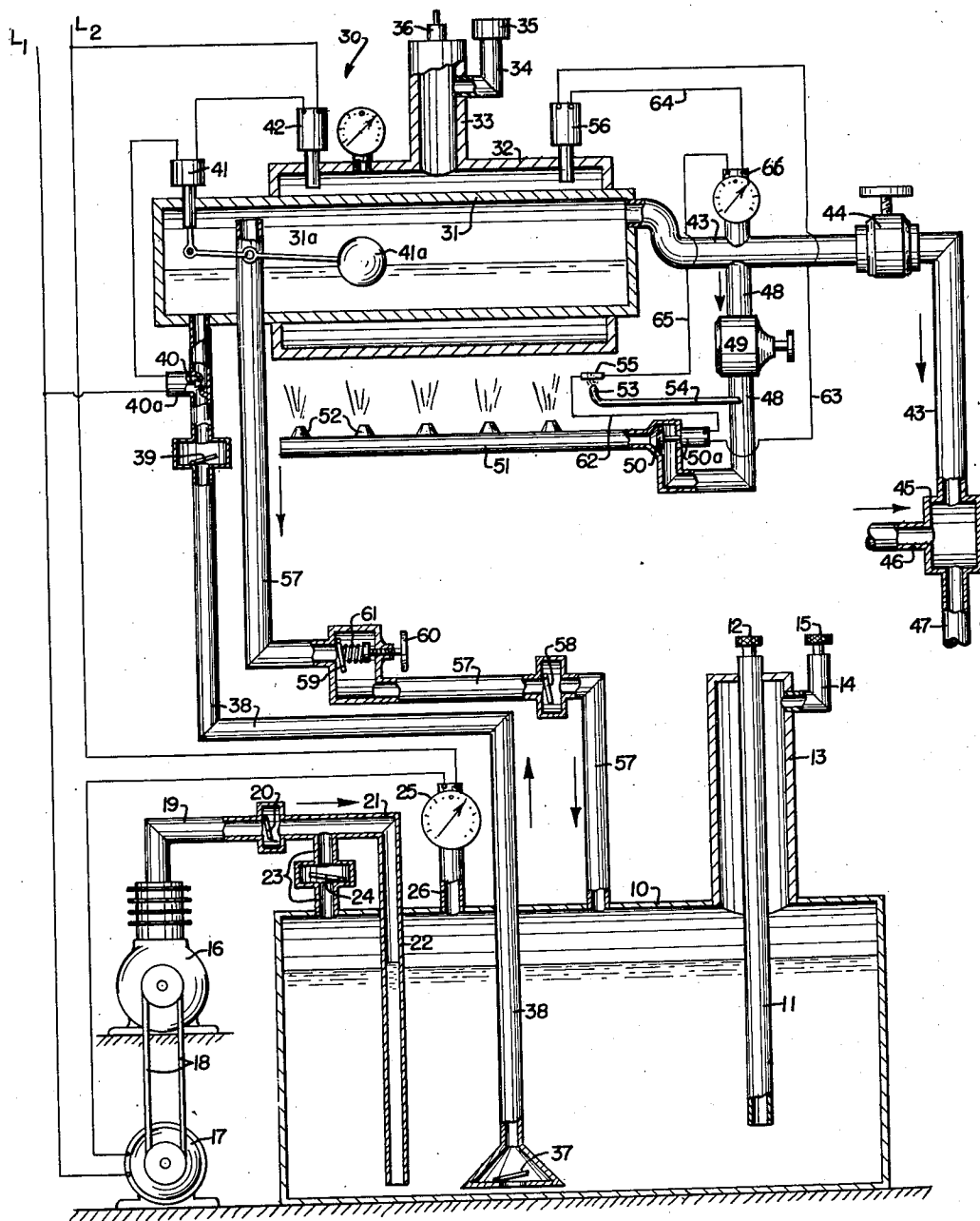
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APPARATUS FOR VAPORIZING HYDROCARBONS

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APPARATUS FOR VAPORIZING
HYDROCARBONS

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4 Claims. (Cl. 62-1)

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This invention relates to improvements in methods and apparatus for vaporizing hydrocarbons.

Among the objects of the invention are the provision of improved methods and apparatus for automatically vaporizing hydrocarbons.

Another object is to provide apparatus of the foregoing type which embodies certain safety devices.

Another object is to vaporize hydrocarbons with novel heat exchanger apparatus which is supplied with heat by burning a portion of the vaporized hydrocarbon.

Still further objects, advantages, and salient features will become apparent from the description to follow, the appended claims, and the accompanying drawing in which:

The single figure diagrammatically illustrates apparatus and a system, portions being shown in section and other portions being broken away, with which the method of vaporizing hydrocarbons may be practised.

Referring in detail to the drawing, a hydrocarbon tank 10, which may be any shape, is provided with a filler pipe 11, having a conventional filler valve 12 at the exposed end thereof, and vapor return pipes 13, 14, the latter being provided with a similar valve 15. The tank contains butane, pentane, propane, or any mixture of the foregoing or similar hydrocarbons. When it is desired to fill the tank, a hose is connected between the supply of liquid hydrocarbon and valve 12, and a similar hose is connected between the space above the supply and valve 15 to permit the vapor above the liquid in tank 10 to return to the supply, as well understood in the art.

To maintain the hydrocarbon in the tank under pressure an air compressor 16 is provided, this being driven by a suitable electric motor 17 by means of belt 18 or other power transmission means. The compressor, when in operation, delivers air through pipe 19, check valve 20, pipe 21 and pipe 22. A branch pipe 23 having a check valve 24 therein connects pipe 21 and the space above the liquid in tank 10.

A pressure responsive gauge and electric switch device 25 is connected to the tank by a pipe 26, the switch being adapted to close when the pressure in the tank falls below a predetermined value and to open when the pressure rises to another predetermined value. Details of this device have been omitted since there are various commercially available types, well known in the art, and no novelty is predicated on this device per se. The switch and motor are electrically

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connected in series to electric lines L1, L2, and it will be apparent that the compressor automatically maintains the pressure in tank 10 between the predetermined values previously referred to.

The heat exchanger apparatus 30 comprises a tube 31, closed at its ends, providing a vaporizing chamber 31a, and a surrounding spaced tube 32, also similarly closed, to provide a jacket for receiving a suitable heat exchange liquid, such as water. Upstanding pipe 33 contains air and forms an expansion chamber for the liquid in the jacket. A pipe 34 is connected to the expansion chamber and is provided with a closure member 35 which may be removed to fill the jacket. A safety blow-off valve 36 is connected to the expansion chamber and is adapted to release excess pressure in the jacket in event certain of the controls should fail to function properly. Safety valves of this type are well known and hence details thereof are omitted to simplify the disclosure.

Liquid hydrocarbon from tank 10 passes through foot check valve 37, pipe 38, check valve 39, valve 40 operated by solenoid 40a, and into chamber 31a. Solenoid operated valve 40 is controlled by a liquid level responsive switch device 41 operated by a float device 41a, the switch device closing when the liquid level in chamber 31a falls below a predetermined level and opening when it rises to the predetermined level, thus maintaining a substantially predetermined liquid level in chamber 31a. A jacket temperature responsive switch device 42 is wired in series with the level responsive switch, this switch opening upon a jacket temperature drop and closing upon a jacket temperature rise. It is apparent, therefore, that if the jacket temperature falls below a predetermined value valve 40 will not open, but when the jacket temperature rises to a predetermined value valve 40 may open if the liquid level responsive means calls for addition of liquid to chamber 31a.

A discharge vapor pipe 43 is connected to the other end of chamber 31a and is provided with a shut-off valve 44. This pipe connects with a mixing or carbureting chamber 45 having an air supply pipe 46 and a discharge pipe 47. The carbureting portion of the system may be of different forms, one of which is disclosed in detail in my copending application, Serial No. 210,011, filed on February 8, 1951, concurrently with this application. A branch pipe 48 connects with pipe 43 and is provided with a conventional pressure

reducing device 49, which will maintain the pres-

sure downstream thereof at a constant value. A valve 50, operated by a solenoid 50a, is provided between the delivery end of pipe 43 and a burner 51 having a plurality of burner jets 52. The latter may be provided with any suitable and well known air mixers for adding air to the hydrocarbon vapor to render it combustible as it issues from the burner jets. A pilot burner 53, having a similar air mixer, is connected by a pipe 54 to pipe 48 downstream from pressure regulator 49. Thermocouple means 55 is disposed in the flame of the pilot light and provides a source of electric current for operating solenoid 50a. A pressure responsive switch device 66 is connected to pipe 43, the switch being normally closed but adapted to open if the pressure in pipe 43 exceeds a predetermined value. A temperature responsive switch device 56, similar to 42, is connected to the jacket.

A conduit 57 communicates with chamber 31a and tank 10, this conduit being provided with a check valve 58 and a valve 59 adapted to open when the pressure in chamber 31a exceeds the pressure in tank 10 by a desired differential, the latter being adjustable by a movable actuator 60 adapted to vary the pressure of spring 61 engaging valve 59.

Assuming that the jacket temperature of the heat exchanger has fallen to a certain predetermined value, the switch in temperature responsive device 56 closes and a circuit is established from one terminal of thermocouple device 55, through wire 62, solenoid 50a, wire 63, temperature responsive switch device 56, wire 64, pressure responsive switch device 66, and to the other terminal of the thermocouple device through wire 65. When this circuit is established, valve 50 is open and liquid hydrocarbon is delivered to jets 52 which are lighted by pilot light 53. When the temperature rises to a higher predetermined value, the switch in temperature responsive device 56 opens the circuit and permits valve 50 to close, thus discontinuing the addition of heat to the heat exchanger. In the operation just described, the switch of pressure responsive device 66 normally remains closed. If, however, temperature responsive device 56 should fail to open the circuit when the heat exchanger reached the higher predetermined temperature, it is apparent that the temperature would continue to rise. This, however, would increase the pressure in chamber 43 and after it has increased to a certain value, the switch of pressure responsive device 66 will open, thus opening the circuit and permitting valve 50 to close, discontinuing the addition of heat to the heat exchanger. It will be apparent that under normal conditions there will be a closed circuit through pressure responsive switch device 66 but if the pressure in the heat exchanger should exceed a predetermined value, switch 66 serves as a safety device to ensure that the burner will be shut off. During normal operation, valve 59 will be closed. If for any reason, however, pressure in chamber 31a exceeds a certain predetermined value above tank pressure, this valve will open and permit hydrocarbon to return to tank 10, thus relieving the pressure in chamber 31a.

Valve 24, previously referred to, serves as a safety means for preventing liquid hydrocarbon from flowing from the tank to the compressor in event valve 20 should leak. When the compressor ceases operation (valve 24 being closed), the pressure in conduit 21 will balance the pressure of the liquid in conduit 22. If valve 20

should now leak, the pressure of liquid in conduit 22 will exceed the air pressure and the liquid will rise in conduit 22; after it rises to some extent, the pressure in the space above the tank will exceed the pressure in conduit 21 and open valve 24. Any leakage thereafter, past valve 20 will be vapor leakage rather than liquid leakage.

Having described the invention, what is claimed as new is:

1. Apparatus for vaporizing liquid hydrocarbons, comprising a tank for containing the hydrocarbon, means for intermittently delivering air to the tank and for automatically maintaining a hydrocarbon therein between predetermined limits of pressure, a heat exchanger having a closed vaporizing chamber, a conduit for delivering liquid hydrocarbon from the tank to the chamber, a valve in the conduit adapted to open or close to permit or prevent flow of liquid therethrough, first electric means for operating the valve, chamber temperature and liquid level responsive switches and an electric circuit including same and said first electric means adapted to open the valve when the temperature in the chamber rises to a predetermined limit and the liquid level falls below a predetermined level and to close the valve when the liquid level rises to said predetermined level, means for heating the chamber comprising a main burner adapted to burn a portion of the vaporized hydrocarbon, a valve adapted to open or close to permit or prevent supply of vapor to the main burner, second electric means for operating the last named valve, a pilot burner, a thermocouple heated by the pilot burner, a temperature responsive switch and an electric circuit including the thermocouple and second electric means adapted to open the second named valve when the temperature in the chamber falls to a predetermined limit and to close the second named valve when the temperature in the chamber rises to another predetermined limit.

2. Apparatus in accordance with claim 1 including a normally closed pressure responsive switch in the last named circuit adapted to open when the pressure in the chamber rises to a predetermined limit.

3. Apparatus in accordance with claim 1 including a conduit communicating the tank with said chamber, and valve means in the last named conduit adapted to open when the pressure in said chamber exceeds, by a predetermined amount, the pressure in the tank.

4. Apparatus in accordance with claim 1 including a normally closed pressure responsive switch in the last named circuit adapted to open when the pressure in the chamber rises to a predetermined limit, a conduit communicating the tank with said chamber, and valve means in the last named conduit adapted to open when the pressure in said chamber exceeds, by a predetermined amount, the pressure in the tank.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,046,539	Bates	Dec. 10, 1912
1,337,108	Weithaus	Apr. 13, 1920
1,960,108	Hernsdorf	May 22, 1934
2,329,750	Faucher	Sept. 21, 1943
2,493,369	Smith et al.	Jan. 3, 1950