

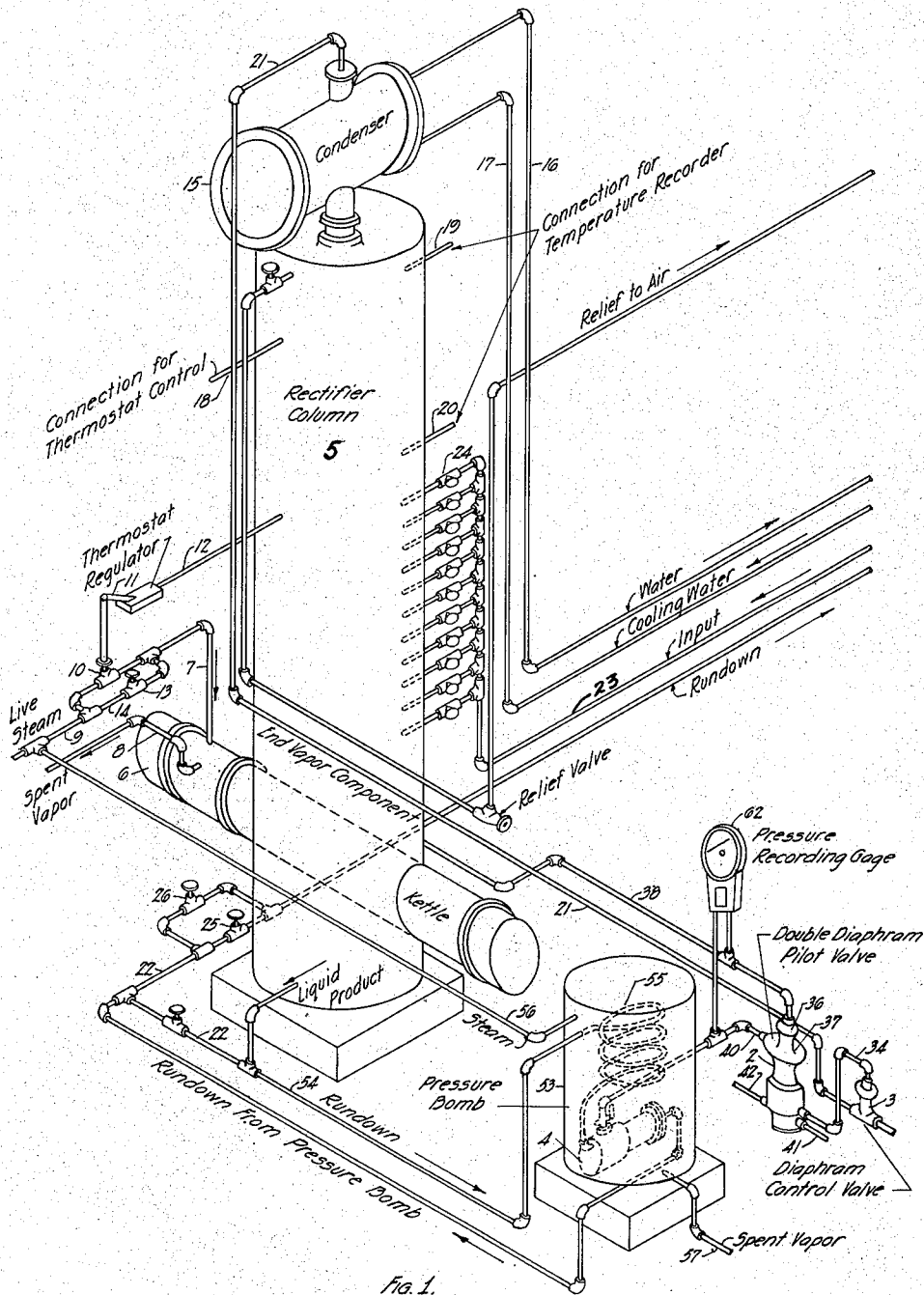
Aug. 9, 1938.

S. S. SMITH

2,126,052

DEVICE FOR RECORDING VAPOR PRESSURE

Original Filed Dec. 29, 1930 2 Sheets-Sheet 1



Inventor: Sydney S. Smith

By his Attorney: H. Birch

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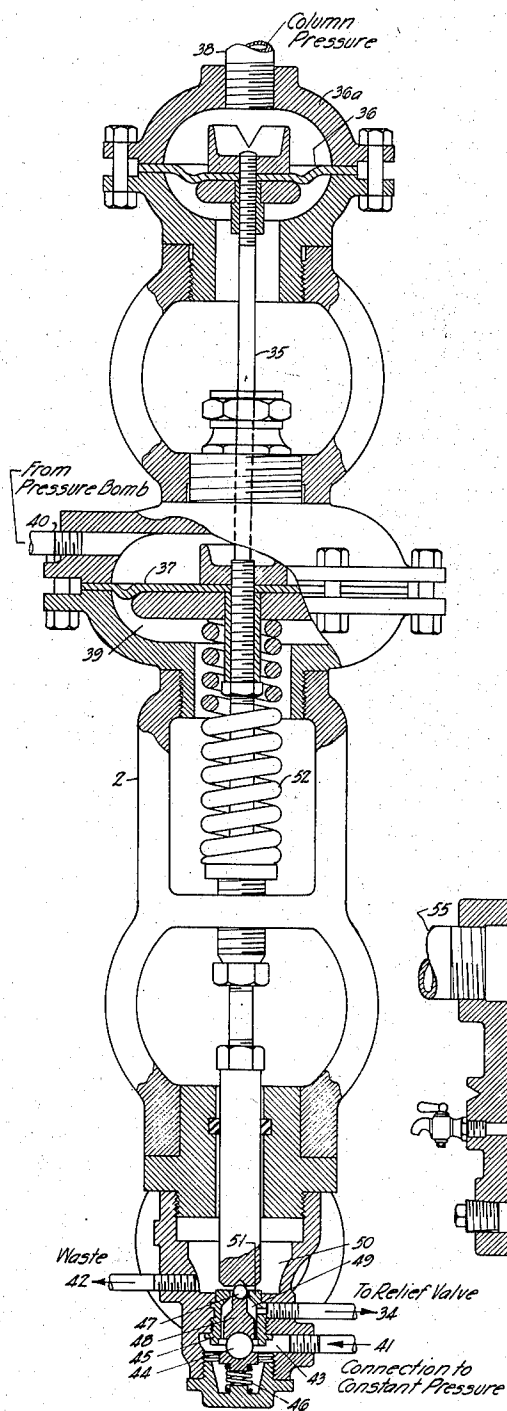


FIG. 2.

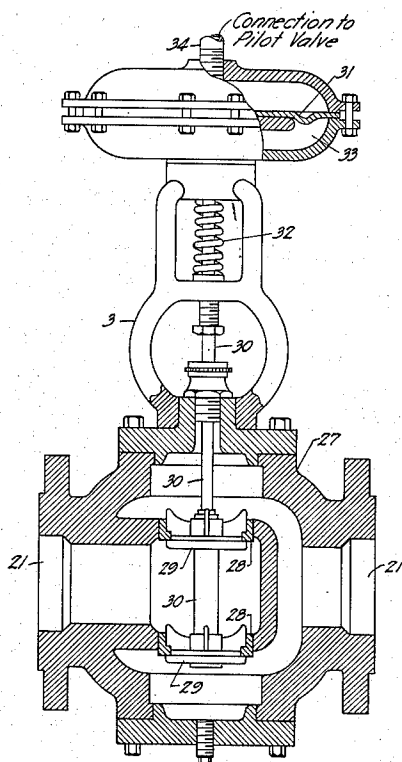


FIG. 3.

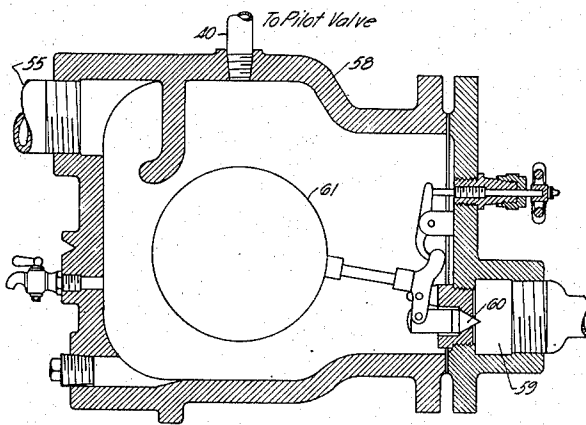


FIG. 4.

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UNITED STATES PATENT OFFICE

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DEVICE FOR RECORDING VAPOR PRESSURE

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Original application December 29, 1930, Serial
No. 505,453. Divided and this application
October 29, 1935, Serial No. 47,338

8 Claims. (Cl. 73—50)

This application is a division of my application Serial No. 505,453 filed December 29, 1930 and subsequently issued into Patent No. 2,073,908 on March 16, 1937.

5 One of the objects of my invention is to provide means for continuously recording the vapor pressure of a liquid product for example, the final end product of a rectifier system.

One of the uses of this invention is in the 10 rectification of gasoline. Probably the most characteristic quality which gasoline has is its vapor pressure and is something which may be mechanically recognized and by which regulating equipment may be actuated.

15 The specific objects of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings, in which—

Fig. 1 is a diagram of a rectifying system including this invention.

Fig. 2 is a side elevation partly in section of a double diaphragm pilot valve 2 shown diagrammatically with its connections in Fig. 1.

Fig. 3 is a side elevation partly in section of a diaphragm relief valve 3 shown diagrammatically with its connections in Fig. 1.

Fig. 4 is a detailed cross section of a trap 4 which constitutes a part of a pressure bomb and which is shown diagrammatically with its connections in Fig. 1.

30 It is to be understood that this invention relates to controlling rectification or the operation of a rectifier column and the particular construction and arrangement of the rectifier itself is of no importance. A typical rectifier system is illustrated and described but it is to be understood that this is merely an exemplification and the apparatus constituting the subject matter of this invention may be used in connection with rectifier 40 columns differing materially in construction from that which is illustrated and described.

A rectifier column 5 has a kettle 6 which is heated by steam introduced through a pipe 7, the spent vapor passing out through a pipe 8. 45 Steam may be introduced into the pipe 7 from a pipe 9 by means of a valve 10, automatically controlled from a thermostat unit 11 having a pipe connection 12 with the interior of the column 5, or it may be controlled manually by a valve 13 in a by-pass 14. A condenser 15 is cooled by water passing into it from a pipe 17 and out through a pipe 16. A connection 18 with the interior of the column near its top provides means whereby 50 cooling water flowing into the condenser may be automatically regulated through a thermostat

valve and unit, not shown but well understood in the art. Connections 19 and 20 with the interior of the rectifier column provide means whereby pressure and temperature recorders may be connected for indicating or recording the pressure and temperatures in the column. The final end vapor product may be withdrawn through a pipe 21, and the final end liquid product may be withdrawn through a pipe 22. The raw product to be rectified, such as raw gasoline, may be introduced 10 on various plates of the rectifier column through a pipe 23, the connections with the various points being regulated by valves 24.

The run down of the final end liquid product may be regulated by valves 25 and 26, one of 15 which is usually regulated automatically by means not shown but which is well understood in the art. The operation of the rectifier is controlled by regulating the discharge of the top product through the pipe 21, for by so regulating this discharge it is obvious that the pressure in the 20 column will be controlled.

A typical rectifier column has been described and now the novel means for controlling the operation of such a rectifier column will be described. 25 It consists, as forecast, of means for automatically regulating the discharge of the final end vapor product in accordance with the column pressure and the vapor pressure of the bottom product. It consists primarily of a valve 3 in the pipe 21. As 30 illustrated this valve is of well known construction and is not of itself novel. It comprises a housing 27 in which are situated valve seats 28 for cooperation with valve discs 29 secured to and operated by the stem 30, which stem is secured to a diaphragm 31. A compressible spring 32 is positioned about 35 the stem 30 in such a manner as to normally close the valve by bringing the discs 29 against their respective seats 28. The diaphragm 31 is situated in a chamber 33 having a connection 34 with a 40 source of liquid pressure which, as will hereafter be described, is regulated in accordance with the column pressure and the vapor pressure of the final end liquid product.

The fluid pressure introduced through the connection or pipe 34 is regulated by the pilot valve 45 2. The valve 2 includes a stem 35 to which is secured diaphragms 36 and 37. The diaphragm 36 is situated in a chamber 36a which has a pipe connection 38 leading to and communicating 50 with the interior of the rectifying column, and, therefore, the diaphragm 36 is responsive to the column pressure. The diaphragm 37 is situated in a chamber 39 having a pipe connection 40 connected with means for securing a constant vapor 55

pressure of the final end liquid product by means which will be disclosed later in detail. A pipe 41 communicates with a source of constant pressure, not shown, and the reciprocation of the valve stem 35 permits a fluid under such constant pressure from the pipe 41 to be impressed through the pipe 34 on the diaphragm 31 of the control relief valve 3. A pipe 42 permits the relief of such pressure from the diaphragm chamber 33 in a manner which will presently be described.

The pipe 41 communicates with a chamber 43 in which is situated the ball 44 having a seat 45 and normally pressed outwardly against its seat by a spring 46. The ball 44 is pressed downwardly by action of the stem 35 against a ball 47 and a floating member 48. The pipe 34 communicates with a chamber 49 which is in communication with the chamber 43 through a passage between the ball 44 and its seat 45. Thus the passage between the pipe 41 communicating with the source of constant pressure and the pipe 34 leading to the diaphragm chamber 33 is controlled by the reciprocation of the ball 44, which reciprocation is caused by operation of the valve stem 35. The pipe 42 communicates with a chamber 50 which has a passage to the chamber 49 controlled by the ball 47 and its seat 51. As the valve stem 35 rises the ball 47 is lifted from its seat at the same time the ball 44 is positioned on its seat, thereby closing the communication between the pipe 41 and the pipe 34, and opening communication between the pipe 34 and the pipe 42. It is to be understood, of course, that the pipe 42 is open to atmosphere.

A compressible spring 52 is positioned to move the stem 35 upwardly in a direction contrary to the movement of the stem when influenced by pressures on the diaphragms 36 and 37.

It is to be understood, therefore, that excessive pressures on the diaphragms 36 and 37 cause the valve stem 35 to be moved downwardly opening communication between the pipe 41 and the pipe 34, thus causing a pressure to be exercised on the diaphragm 31 of the relief valve sufficient to open the valve 3 relieving the pressure on the rectifier column. When the pressure has been sufficiently relieved the spring 52 will cause the stem 35 to move upwardly closing communication between the pipe 41 and the pipe 34 and opening communication between the pipe 34 and the pipe 42, thus venting the chamber 33 to atmosphere and causing the spring 32 to close the valve 3. It will be seen, of course, that so far as principle is concerned the apparatus might work just as well if the valve stems 35 and 30 were integral, thus operating the valve 3 directly by the operation of the diaphragms 36 and 37, but the pilot type of valve is preferred since much finer control may thereby be obtained.

I prefer to make the diaphragm 36, which is responsive to the column pressure, smaller in area than the diaphragm 37, which is responsive to the vapor pressure of the end liquid product. I prefer to make the area of the diaphragm 37 about two and one half times that of the area of the diaphragm 36. In rectifying gasoline typical pressures may be 125 pounds column pressure on the diaphragm 36 and a vapor pressure of 200 to 250 pounds per square inch on the diaphragm 37. The vapor pressure of the final end product is obtained in a pressure bomb 53 including the trap 4 to which is connected the pipe 40. A pipe 54 connects with the pipe 22 containing the run down and with a coil 55 within the bomb 53. The bomb is heated by steam from a pipe 56

and discharged through a pipe 57. The trap 4 is connected to the coil 55 and is of a form which is common as a continuous flow steam trap. It includes a chamber 58 having an outlet 59 controlled by a valve 60 operated by a float 61. The run down product is introduced into the coil 55 from the pipe 54, is heated by steam, and thus caused to impress its vapor pressure through the pipe 40 on the diaphragm 37 and on the pressure recording gauge 62. This gauge 62 is of the well known double pressure recording type, the other pressure being recorded being the pressure in the column transmitted through line 38 as will be seen from the drawings.

From the foregoing description it will be obvious that the objects of the invention have been obtained.

Parts of the invention may be used without the whole and various changes may be made in the details of construction, within the scope of the appended claims, without departing from the spirit of this invention.

I claim as my invention:

1. Apparatus for recording the vapor pressure of a liquid comprising a coil in communication with a source of said liquid, means for keeping said coil under a constant temperature, a trap in communication with said coil, an outlet from said trap, a vapor conduit leading from the trap above the level of liquid therein, and a pressure recorder connected to said conduit.
2. Apparatus for recording the vapor pressure of a liquid comprising a coil in communication with a source of said liquid, means for keeping said coil under constant temperature, a closed vessel in communication with said coil, a liquid outlet from said vessel, liquid level control means in said vessel in communication with said outlet, a vapor conduit leading from said vessel above the liquid level therein and a pressure recorder connected to said conduit.
3. Apparatus for recording the vapor pressure of a liquid comprising a coil in communication with a source of said liquid, a trap in communication with said coil, a constant temperature bath surrounding said coil and said trap, a liquid outlet from said trap, a vapor conduit leading from said trap and above the level of liquid therein and a pressure recorder connected to said conduit.
4. Apparatus for recording the vapor pressure of a liquid comprising a coil in communication with a source of said liquid, a trap in communication with said coil, a pressure vessel surrounding said coil and said trap, means for admitting steam to said pressure vessel, a liquid outlet from said trap, a conduit leading from said trap and above the liquid level therein and a pressure recorder connected to said conduit.
5. Apparatus for recording the vapor pressure of a liquid comprising a conduit in communication with a source of liquid, a trap in communication with said conduit, a constant temperature bath surrounding said trap, an outlet from said trap, a vapor conduit leading from the trap above the level of liquid in said trap, and a pressure recorder connected to said trap through said vapor conduit.
6. Apparatus for recording the vapor pressure of a liquid comprising a coil in communication with a source of liquid, a closed vessel in communication with said coil, means for maintaining said coil and vessel at a constant temperature, a liquid level control device in association with

said vessel, a liquid outlet from said vessel, a pressure recorder and a conduit leading from the vapor space of said vessel to said pressure recorder.

5 7. Apparatus for recording the vapor pressure of a liquid comprising a container having a vapor separating space, in communication with a source of said liquid, means for keeping said vapor separating space under constant temperature, a liquid outlet from said container, a vapor
10 outlet from said vapor separating space of the container above the level of liquid therein, and

a pressure recorder communicating with the vapor space of said container.

8. Apparatus for ascertaining the vapor pressure of a continuous liquid sample, comprising a container in communication with a source of
5 said liquid and having a vapor separating space, means for keeping said vapor separating space under constant temperature, a liquid outlet from said container, a fluid pressure gage, and means
10 connecting said gage with said vapor space of the container.

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