July 24, 1928. 1,678,328

R. H. CARR ET AL

TEMPERATURE CONTROLLER FOR OIL SEPARATING TOWERS

Filed April 13, 1926

Fig. 1.

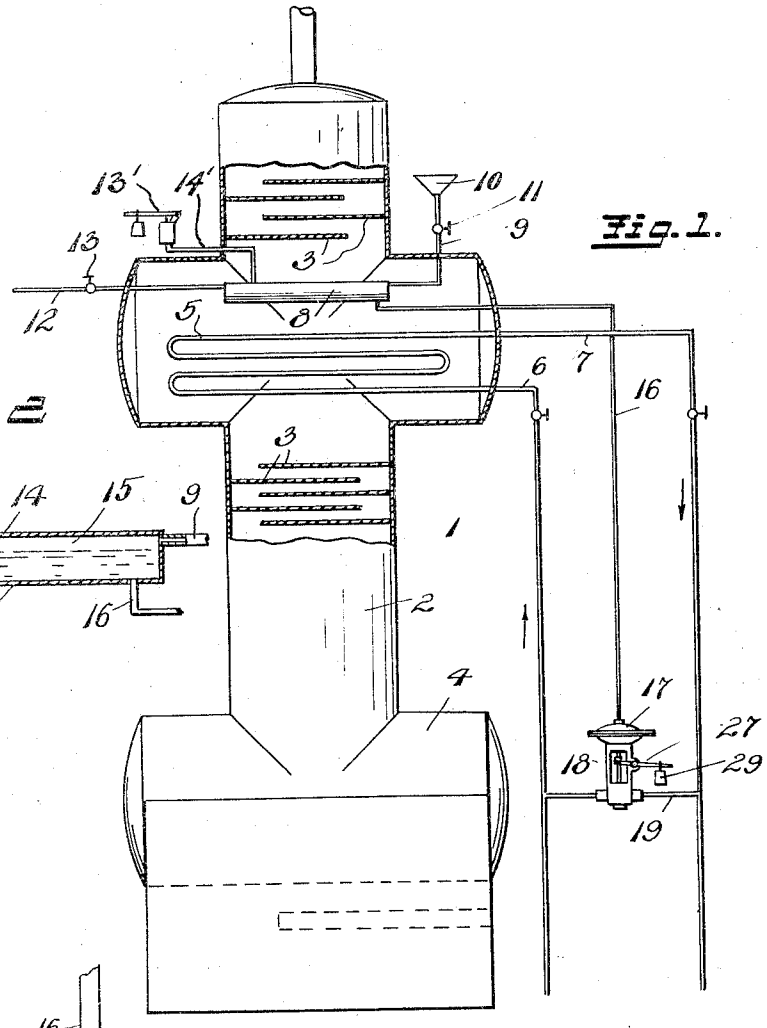


Fig. 2.

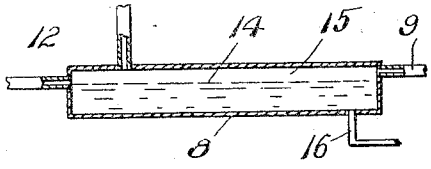
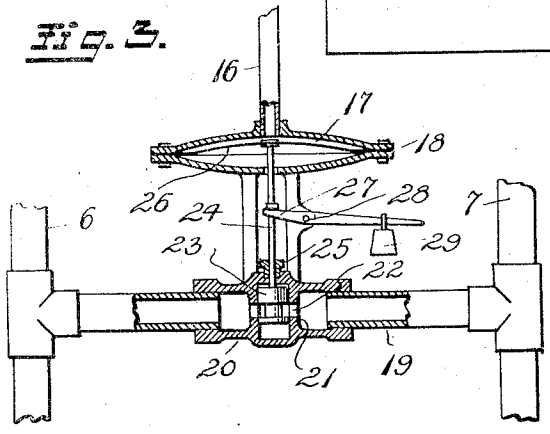


Fig. 3.



Inventor
Richard H. Carr
Cornelius B. Watson

W. D. McDowell.
Attorney

Patented July 24, 1928. 1,678,328

UNITED STATES PATENT OFFICE.

RICHARD H. CARR AND CORNELIUS B. WATSON, OF COLUMBUS, OHIO, ASSIGNORS TO THE PURE OIL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF OHIO.

TEMPERATURE CONTROLLER FOR OIL-SEPARATING TOWERS.

Application filed April 13, 1926. Serial No. 101,790.

This invention relates to improvements in automatic controllers, of the heat regulated type, especially designed in this instance for use in connection with fractionating or separating towers, in cracking or tube stills, or other similar apparatus used in the refining of petroleum and the commercial production and separation of hydro-carbon distillates or fractions.

An object of the invention resides in providing a separating tower, of the type used in gasoline refining apparatus, to separate the various fractions, with a refluxing coil, through which is circulated the original or primary oil stock prior to its introduction into a heating still in order that this original stock, of substantially atmospheric temperature, may be utilized for facilitating condensation in the tower of the heated oil vapors or fluids therein, and wherein a heat exchange is effected allowing the heated fluid to transmit a portion of the released heat thereof to the primary oil stock for preheating the latter before introduction into the still, and to provide in connection with this structure an automatically controlled means, responsive to the internal heat of the tower, to permit of a greater or lesser flow of the primary oil stock to the refluxing coils in accordance with the fluctuating internal temperature of the tower, whereby an automatic control or balance exists for regulating the volume of the oil stock entering the tower with the end in view of maintaining a uniform thermo condition in the tower.

A further object of the invention rests in providing a separating tower with a refluxing coil with which communicates inlet and outlet pipes arranged externally of the tower, the inlet pipe leading from a source of primary oil supply and the outlet pipe to an associated heating still, a shunt pipe being provided to connect the inlet and outlet pipes for the purpose of short circuiting the refluxing coil in the tower, and wherein the tower is provided with an internally situated drum in which, during the operation of the tower, is generated steam or vapor pressure, which, through an associated liquid containing pipe line, exert a variable action on an automatically operating valve arranged in the shunt pipe, in order that when the internal temperature of the tower is raised to approximately a certain desired working limit, the valve is closed to allow for maximum oil stock circulation through the refluxing coil to permit absorption of heat in the tower by the circulating and cooler oil stock passing through the coil, and, conversely, upon the lowering of the internal temperature of the tower the steam or vapor pressure in said drum will be correspondingly lowered to allow the valves to open, thereby shunting the flow of the oil stock either fully or partially from the refluxing oil, thereby allowing the internal heat within the tower to rise.

With these and other objects in view, as will appear as the description proceeds, the invention consists in the novel features of construction, combinations of elements and arrangements of parts hereinafter to be fully described and pointed out in the appended claims.

In the accompanying drawing:

Figure 1 is a view partly in vertical section of a separating tower provided with a refluxing coil and with the automatic temperature controlling mechanism comprising the present invention,

Figure 2 is a vertical sectional view taken through the steam drum or manifold,

Figure 3 is a vertical sectional view through the automatic control valve.

Referring more particularly to the accompanying drawing, the numeral 1 designates a separating tower of the type used in oil refining apparatus for separating the various fractions of oil stock after the latter has been subjected to the action of a heating still. The tower, as presently constructed provides a vertical cylindrical shell 2 in which is provided internally disposed staggered baffle walls 3, and the heated oil vapor from the still is introduced into said tower and allowed to circulate therethrough so that the lighter and more volatile fractions may arise to the top of the tower and be carried off in a separated state, while the heavier or higher boiling point fractions are allowed to condense and collect in the bottom 4, of the tower where they may be either carried off for further heat treatments or to suitable points of deposit and storage. To facilitate condensation within the tower of the oil fractions, and also to provide a means for preheating the primary oil stock, prior to its introduction into the heating or cracking still, the tower is provided at or adjacent the upper part thereof with one

or more refluxing coils 5, with which communicate spaced inlet and outlet pipes 6 and 7 respectively, in this instance arranged externally of the tower. The inlet pipe leads from any suitable source of original or primary oil supply (not shown) and extends to the bottom of coil 5, while the outlet pipe 7, is connected with the top of said coil and is adapted to lead to the oil still or cracking apparatus (not shown).

Arranged within the top of the tower 1, adjacent the refluxing coil 5, is a drum 8, adapted to contain water or other liquid of suitable boiling point. A filling conduit 9 enters the top of the drum and extends to a filling funnel 10 disposed exteriorly of the tower, the said conduit 9 being provided with a control valve 11, also, the drum is provided with an outlet or overflow conduit 12, provided with a regulating valve 13 and leading to a part exterior of the tower. In operation, the valves 11 and 13 are open and water is poured into the funnel 10, so as to fill the drum 8, with liquid up to a predetermined level, indicated at 14 in Figure 2, allowing a stream space 15, to be present between the level 14, and the top wall of the drum. A pressure relief device is shown at 13′ and is connected to the drum 8 by means of the pipe 14′.

Entering and communicating with the bottom of the drum 8 is a pipe line 16, which is also filled with water at the time of filling the drum 8. The lower end of the line 16 enters a diaphram chamber 17, provided in an automatic control valve 18, which is situated in a shunt pipe 19, connecting the inlet and outlet pipes 6 and 7 in a manner to short circuit the refluxing coil or coils 5.

For convenience in illustration the valve 18, has been shown to comprise a body 20, formed with a wall 21, in which is provided an opening 22, the walls of which constitute a seat for the reception of a head 23 provided upon the lower end of a valve stem 24. This stem passes upwardly through a packing gland 25 formed in connection with the body 20 and has its upper end secured to a diaphram 26 mounted in the diaphragm chamber 17. Midway of its length, the stem is provided with a fixed collar with which engages the inner end of a lever 27, pivoted as at 28, upon the valve body and having its outer end provided with an adjustable weight 29, normally serving to retain the valve head in an elevated position and to permit of fluid flow through the shunt pipe.

To illustrate the operation of the apparatus, the drum or cylinder 8, is partly filled with water and likewise the pipe line 16, leading to the regulator valve 18. Assuming, for example, that it is desired to maintain a temperature of approximately 325 degrees Fahrenheit in the tower, the construction of the apparatus is such that when this temperature is reached the steam pressure in the drum 8 will be about 96 pounds absolute, which pressure, plus the hydrostatic head of water in the pipe line 16, will be directed on the diaphragm 26, of the regulator and in opposition to the forces exercised on said diaphragm by the lever 27, and its weight 29. In this instance the arrangement is such that the force of the steam pressure and the head of water at a pressure corresponding to 325 degrees Fahrenheit, will operate to hold the regulating valve in the by-pass or shunt pipe open, allowing the oil to pass through the by-pass before reaching the refluxing coil. When, however, the curvature of the drum or cylinder 8, reaches, for instance, 326.4 degrees Fahrenheit, the steam pressure in the drum will be 98 pounds absolute, and since the hydrostatic head of water in the pipe line 16, will be about the same, there obtains, with the difference in temperature, approximately 2 pounds per square inch available to actuate the diaphragm by overcoming the action of the weight 29, to close the by-pass valve, thereby allowing for the full circulation of the primary oil stock through the valve refluxing coil. It is of course possible for the valve 18, to be actuated by other pressure and temperature conditions, from that given therein, since these figures have been used merely for purposes of illustration and not in any sense as limitations. Also fluids other than water may be used in the drum 8, without departing from the scope of the invention.

What is claimed is:

1. The combination with a separating tower, of a refluxing coil, arranged within said tower, oil inlet and outlet pipes connected with said coil, a by-pass connection for shunting said coil, of a regulating valve in said by-pass, and means responsive to the internal temperature of said tower to admit of the opening and closing of the valve in said by-pass.

2. The combination with a separating tower, of an oil preheater in said tower, inlet and outlet connections admitting of the circulation of oil stock through said preheater, a by-pass for shunting the oil stock circulation from said preheater when said by-pass is open, and means responsive to the internal temperatures of said tower for regulating oil stock flow through said by-pass.

3. The combination with a separating tower, of a preheater in said tower, inlet and outlet connection admitting of the circulation of oil stock through said preheater, a by-pass connection for shunting the oil stock circulation from said preheater, and automatic means responsive to the internal tem-

peratures of said tower for controlling the oil stock flow through said by-pass.

4. The combination with a separating tower, of a refluxing coil arranged within said tower, oil inlet and outlet pipes connected with said coil, a by-pass connection for shunting said coil, a regulating valve in said by-pass connection, a steam generator in said tower, and a pipe connection between said generator and said valve for closing the latter when a predetermined temperature is reached in said tower.

5. The combination with a separating tower, a refluxing coil arranged within said tower, inlet and outlet pipes connected with said coil for circulating oil stock therethrough, a by-pass connection for shunting said coil, of a regulating valve in said by-pass, a liquid containing steam generating drum in said tower, and a pipe connection between said drum and said valve operating to close said valve upon the presence of a predetermined steam pressure in said drum.

6. The combination with a separating tower, of a refluxing coil arranged within said tower, oil inlet and outlet pipes connected with said coil, a by-pass connection for shunting said coil, of a regulating valve in said by-pass comprising a movable valve member, a diaphragm connected with said member, a weight cooperative with said member and operating normally to maintain said member in a position permitting of fluid flow through said by-pass, a steam generator in said tower, and a pipe connection between said steam generator and said valve whereby upon the presence of a predetermined pressure, within said generator said diaphragm will be flexed to cause said valve member to assume fluid flow obstructing position against the resistance offered by said weight.

7. The combination with a separating tower, of a refluxing coil arranged within said tower, oil inlet and outlet pipes connected with said coil, a by-pass connection for shunting said coil, of a regulating valve in said by-pass comprising a movable valve member, a diaphragm connected with said member, a weight cooperative with said member in a position permitting of fluid flow through said by-pass, a steam generator in said tower, a pipe connection between said steam generator and said valve whereby upon the presence of a predetermined pressure within said generator, said diaphragm will be flexed to cause said valve member to assume a fluid flow obstructing position against the resistance offered by said weight, and a pressure relief means carried in connection with said generator.

In testimony whereof we affix our signatures.

RICHARD H. CARR.
CORNELIUS B. WATSON.