Dec. 31, 1929. C. W. STRATFORD ET AL 1,741,887

APPARATUS FOR REFINING OIL

Filed July 8, 1926 2 Sheets-Sheet 1

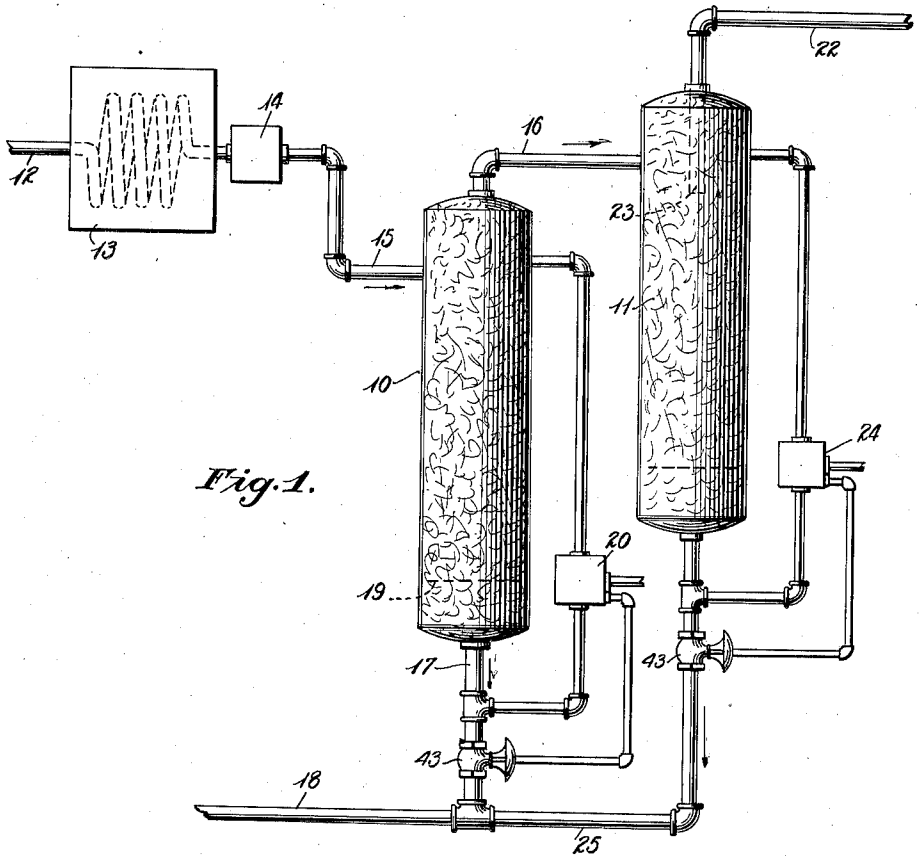


Fig. 1.

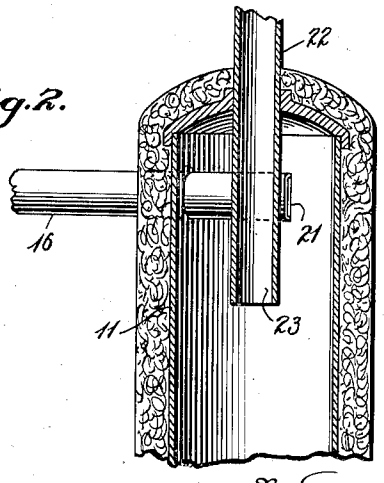


Fig. 2.

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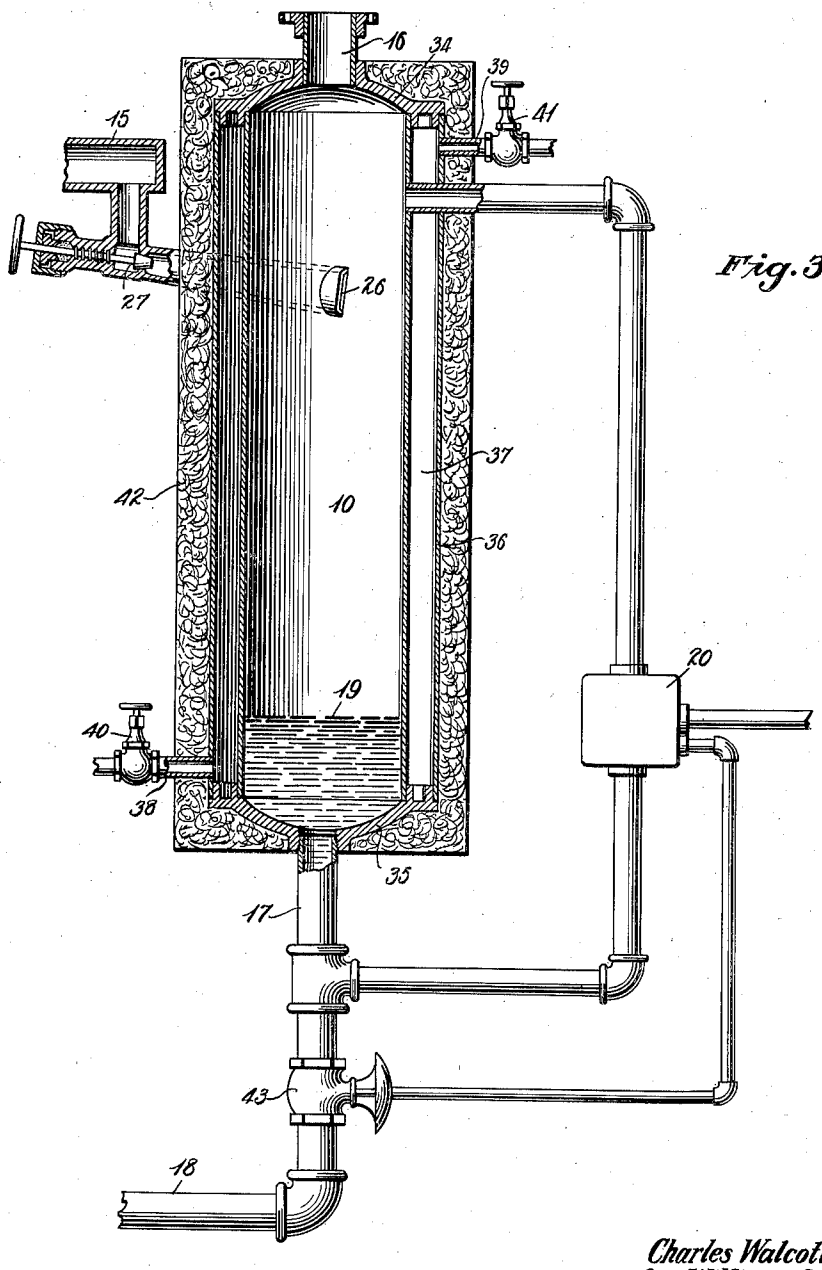


Fig. 3.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR REFINING OIL

Application filed July 8, 1926. Serial No. 121,227.

Our invention relates to the refining of oils and has as an object the provision of a method whereby a large proportion of a desired constituent of crude oil is speedily removed therefrom by very simple apparatus, and whereby further handling of this portion, for instance, the low boiling point gasoline contained in the crude oil, is avoided.

A further object of the invention is the provision of a method and apparatus for removing vapors carrying low boiling point gasoline from a crude oil and for treatment of the vapors to remove entrained liquid bottoms therefrom.

A further object is the provision of the separating means and process above referred to with means for preventing contamination of the bottoms by a portion of the vapors which should be removed.

Illustrative embodiments of the apparatus for carrying out the process are shown in the accompanying drawings wherein:—

Figure 1 is a side elevation;

Figure 2 is a detailed central vertical section of the right hand tube shown in Figure 1 at the upper portion thereof; and

Figure 3 is a central vertical section showing a tube provided with a heating jacket.

As shown in Figure 1, the device comprises two cylinders 10 and 11 which may be of the nature disclosed and claimed in the co-pending application for Patent No. 19,553, filed March 30, 1925, on method of and apparatus for evaporating liquids. Oil to be treated, such as crude oil or the like, may be introduced through a pipe 12 to a heat-exchanger 13 to heat the liquid to the desired temperature. A pump 14 is indicated diagrammatically to inject the liquid tangentially through a pipe 15 into the cylinder 10, as described in the co-pending application above referred to. The liquid by its tangential injection into the cylinder is caused to whirl about and in contact with the inner surface of the cylinder and to travel downwardly in a spiral path therein.

The vapors separated from the liquid by the action of the centrifugal force within the cylinder 10 are withdrawn from the top of the cylinder through a pipe 16 and the liquid separated from its vapors is withdrawn from the cylinder through a pipe 17 and may be led through pipe 18 to any desired point for further treatment. To prevent the escape of vapors with the liquid at the bottom of the cylinder, the present invention contemplates the maintaining of a liquid seal in the bottom of cylinder 10 to a depth, for instance, such as shown by dotted line 19. To preserve this liquid seal, a level control device indicated diagrammatically at 20 is provided. This device may be of any desired character but it is preferred to use the form shown in our co-pending application for patent on level control device filed of even date herewith, Serial Number 121,226.

The vapors escaping or withdrawn through the pipe 16 will inevitably carry therewith in entrainment a certain amount of bottoms in finely divided liquid form, of the character of bottoms withdrawn through pipe 18. To separate the entrained liquid from these vapors there is shown a second cylinder 11 which may be of the form shown more clearly in Figure 2, in which the vapors are discharged through the pipe 16 tangentially into the cylinder through an orifice 21. The operation of separating the vapors from the entrained liquid in tube 11 is exactly the same as the separation of the vapors from the liquid in tube 10 but for its use with vapors it is preferred to provide the arrangement shown in Figure 2 wherein the withdrawal pipe 22 is shown as projecting downwardly within the cylinder 11, as indicated at 23, Figure 2, and by dotted lines in Figure 1. The material escaping or withdrawn through pipe 22 in practice may be made to contain substantially fifty per cent of the gasoline content of the oil under treatment and to carry the low boiling point gasoline.

As in the case of tube 10, a level control device 24 is diagrammatically illustrated to preserve a liquid seal in the bottom of cylinder 11, the bottoms escaping therefrom being discharged through a pipe 25 to the pipe 18.

An enlarged cross-section of tube 10 is shown in Figure 3 to illustrate the interior arrangement thereof. In said figure, the pipe 15 is shown as discharging to the orifice

26, a control valve 27 being supplied to control the rate of discharge. As shown, the tube 10 is shown as closed at the ends by caps 34, 35, which caps extend annularly beyond the tube 10 and are provided with seats for an outer tube or cylinder 36 whereby to provide a jacket surrounding the tube 10. The space in the jacket 37 thus provided is utilized for the application of heat to the outside of the tube 10. For this purpose, pipes 38, 39 are provided having communication with the interior of the jacket and these pipes are equipped with cut-off valves 40, 41. A heat-insulating jacket 42 is shown exterior of the jacket cylinder 36. The level control device shown in Figure 3 is the same as that shown in Figure 1. By the provision of the heat jacket of Figure 3, the crude oil injected into the tube through pipe 15 receives its heat for treatment through the walls of tube 10.

It will be understood that the level control device 20 embodies a mechanism to cause the operation of a valve shown at 43 when the level in the cylinder rises above a fixed point as, for instance, that shown at 19 to allow the accumulating residue to flow away through the pipe 18.

By the provision of the two tubes shown in Figure 1 the vapors carried away through pipe 22 will be effectively cleared from contaminating bottoms and the vapors withdrawn through pipe 22 may be conducted to any desired point for further treatment.

We desire it understood that minor changes in the steps of the process and in the apparatus for carrying out the same may be made within the scope of the following claims without departing from the spirit of the invention.

The location of the level control device outside of the tube, as provided by our invention, has the advantage of placing the working parts thereof for accessibility, an independent replaceable unit in fact.

In carrying out our improved method the vapor is separated from the heated liquid while the liquid is at a pressure above that required to prevent vaporization, the pressure within the tube or cylinder 10 being sufficiently lower than the pressure of the liquid at its inlet into the cylinder to permit vaporization of the desired constituents of the liquid.

We claim:

1. An apparatus for refining oil comprising a substantially vertical cylinder, means to inject oil tangentially into the cylinder, a top vapor outlet extending below the point of injection and a bottom liquid drawoff, means for maintaining a liquid seal over the lower liquid drawoff.

2. A pair of substantially vertical cylinders each having openings in each end, means to inject oil to be treated into one of said cylinders substantially tangentially to its inner surface, means to convey vapors from the upper opening in said last named cylinder with entrained liquids and to deliver the mixture to the interior of the remaining cylinder substantially tangentially to its inner surface whereby to separate vapors from liquids in each of said cylinders to withdraw the vapors from the upper ends of said cylinders and the separated liquids from the lower ends thereof.

3. A pair of substantially vertical cylinders each having openings in each end, means to inject oil to be treated into one of said cylinders substantially tangentially to its inner surface, means to convey vapors from the upper opening in said last named cylinder with entrained liquids and to deliver the mixture to the interior of the remaining cylinder substantially tangentially to its inner surface whereby to separate vapors from liquids in each of said cylinders and the separated liquids from the lower ends thereof and separately acting means to maintain a liquid seal over the lower opening in each of said cylinders.

4. A pair of substantially vertical cylinders each having opening in each end, means to inject oil to be treated into one of said cylinders substantially tangentially to its inner surface, means to convey vapors from the upper opening in said last named cylinder with entrained liquids and to deliver the mixture to the interior of the remaining cylinder substantially tangentially to its inner surface whereby to separate vapors from liquids in each of said cylinders and the separated liquids from the lower ends thereof and separately acting means located exterior of each of said cylinders to maintain a liquid seal over the lower opening in each of said cylinders.

5. An apparatus for refining oil comprising a substantially vertical cylinder, valve-controlled means to inject oil tangentially into the cylinder, a top vapor outlet extending below the point of injection and a bottom liquid drawoff and means for maintaining a liquid seal over the lower liquid drawoff opening.

In testimony whereof they affix their signatures.

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WILLIAM S. JAMES.