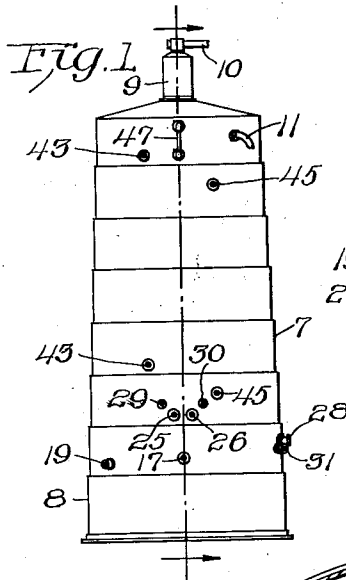
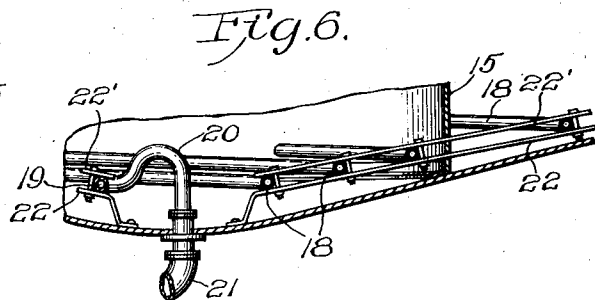
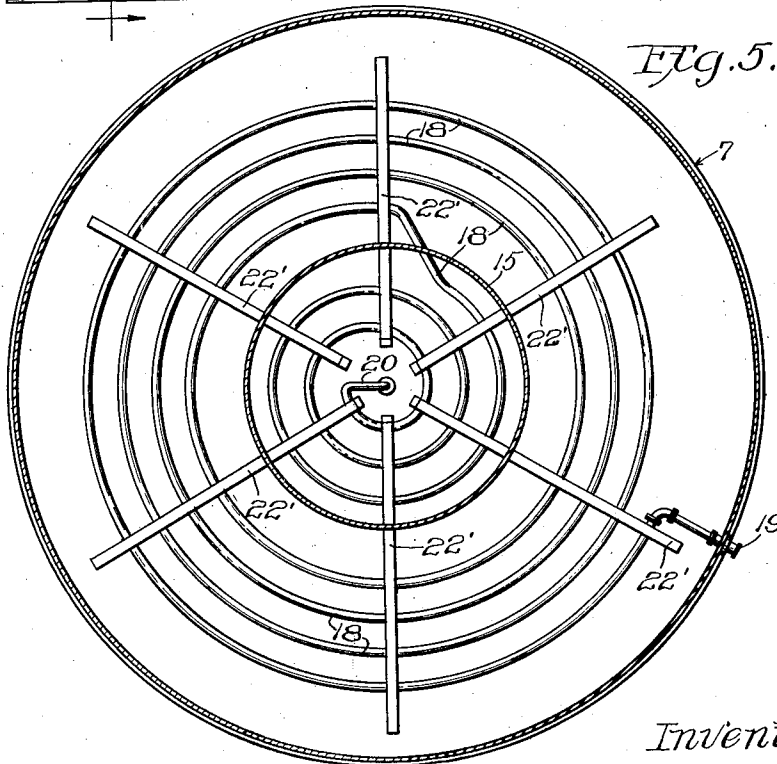


May 22, 1928.

1,670,805

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CRUDE OIL PREHEATER
Filed April 30, 1921

3 Sheets-Sheet 1



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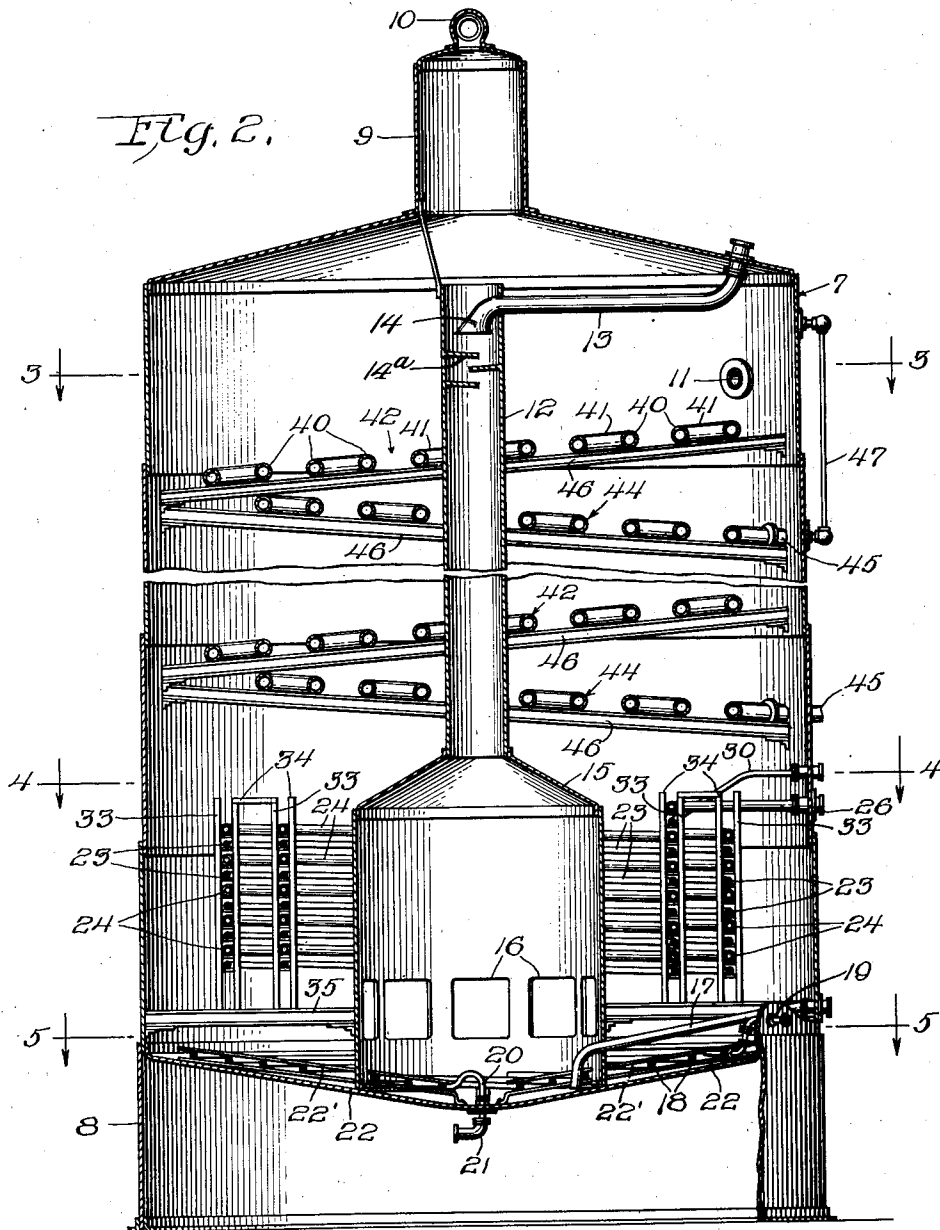
1,670,805

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CRUDE OIL PREHEATER

Filed April 30, 1921

3 Sheets-Sheet 2



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CRUDE OIL PREHEATER

Filed April 30, 1921

3 Sheets-Sheet 3

Fig. 4.

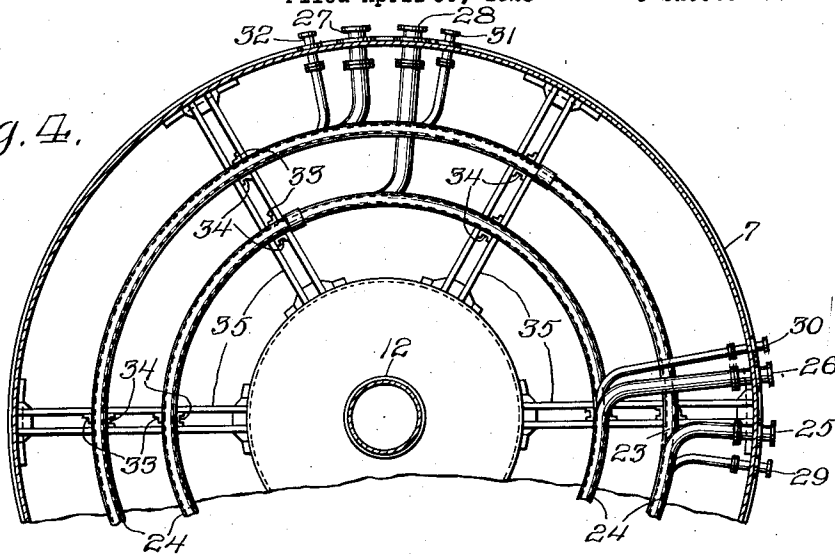
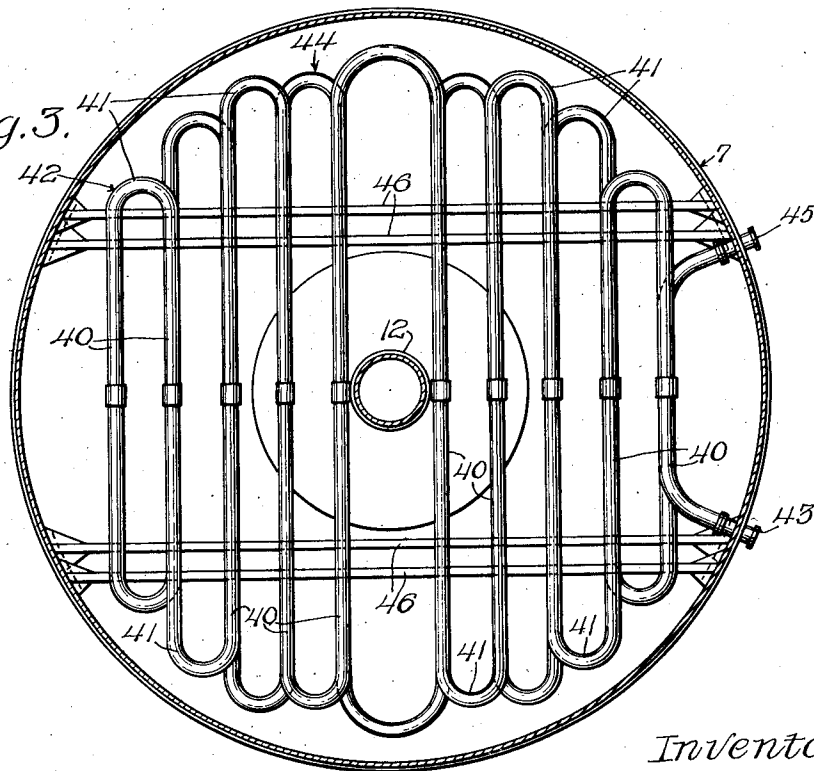


Fig. 3.



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UNITED STATES PATENT OFFICE.

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CRUDE-OIL PREHEATER.

Application filed April 30, 1921. Serial No. 465,689.

Crude petroleum as it comes from the wells contains a varying percentage of water and sand and also of highly volatile hydrocarbons which may be vaporized at relatively low temperature.

Before the oil is submitted to fractional distillation, therefore, in order to save the expense incident to handling these components in the distillation process it is customary to pre-heat the oil to a temperature suitable for the purpose of driving off the highly volatile hydrocarbon and causing the separation of water and impurities, the greater volume of which on the application of the heat separates by gravity at the bottom of the heating container where it may readily be drawn off. My invention relates to a pre-heater for this purpose in which the oil may be economically heated and under such conditions as to separate the largest possible proportion of the water and other impurities and at the same time take care of the volatiles evolved, in the most efficient manner. In the accompanying drawings I have shown, and in the following specification described, a preferred form of my invention; it is to be understood however, that the specific disclosure is for the purpose of exemplification only and that the scope of the invention is defined in the following claims in which I have endeavored to distinguish it from the prior art so far as known to me without, however, relinquishing or abandoning any portion or feature thereof.

Referring now to the drawings, Fig. 1 is an elevation of the preferred form of my invention; Fig. 2 a vertical central section on the plane of the line 2—2 of Fig. 1 on an enlarged scale; Fig. 3 a horizontal section on the line 3—3 of Fig. 2 looking downward, parts being omitted for the sake of clearness; Fig. 4 a similar view on the line 4—4 of Fig. 2; Fig. 5 a similar section on the plane of the line 5—5 of Fig. 2, certain parts being omitted for the sake of clearness, and Fig. 6 a fragmentary vertical section on the same plane as Fig. 2, but on an enlarged scale. Each part is designated by the same reference character wherever it appears in the several views.

The improved pre-heater comprises a closed tank 7, shown as constructed of sheet-steel and circular in cross-section, the capacity of which depends upon the amount of

oil to be treated. As shown it is supported a suitable distance above the ground or foundation, upon a cylindrical skirt 8. The top of the tank or container is provided with a dome 9 for the collection of the separated volatile hydrocarbons and a pipe 10 leading to a condenser not shown, conveys the collected vapors away which are recovered.

An important feature of the invention relates to the introduction of the crude petroleum. To get the maximum separation it is essential that the oil be evenly and uniformly treated and therefore to avoid eddies or currents in the body of the liquid in the tank, and it also facilitates the separation of the water to introduce the crude petroleum to the bottom of the tank with a downward motion which increases the effect of gravity in separating the heavier water from the oil. This effect is enhanced by pre-heating the oil during its downward motion. In my improved apparatus, therefore, the crude petroleum is introduced to the center of the tank from the source of supply, and is there confined in a vertical column which moves slowly downward, absorbing heat from the surrounding body of the oil, and finally is discharged slowly from the bottom of the column and evenly distributed to all parts of the tank near the bottom thereof. It then floats slowly upward as its temperature increases, on the following body of cooler oil which is continuously supplied to the bottom of the tank. The level of the body of oil in the tank is determined by the location of the overflow 11, which in the form of the invention shown is located a short distance below the top of the tank. A hollow column or pipe 12 coaxial with the tank receives the in-coming petroleum near the top thereof, an inlet pipe 13 connected to the source of supply and terminating in a rose or spray nozzle 14 within the column being provided for this purpose. The nozzle or rose is located somewhat above the level of the outlet 11, the height of the column of liquid within the pipe 12 being determined by said outlet, and a series of baffle plates 14^a is mounted just below the nozzle through which the oil is sprayed a short distance, thus breaking it up to a certain extent and contributing to the release of the high volatiles contained in the oil. At its lower end column 12 communicates with a concentric chamber 15 of considerably enlarged

diameter, which chamber is formed at its lower end with a plurality of spaced outlets 16 which communicate with the body of the tank. The relatively cold oil sinks slowly through the column 12, receiving heat continuously from the surrounding body of oil and then enters the chamber 15 where its movement is still further slowed down by the increased cross-sectional area thereof and finally passes slowly out through the openings 16 into the body of the tank. A large proportion of the contained water, however, continues to settle and separates from the oil as the flow of the latter is checked and turns outward through the openings 16 before beginning its upward movement in the tank. By the construction set forth the oil is uniformly and quietly distributed throughout the bottom portion of the tank through which it gradually rises without currents or eddies until it is finally drawn off through the outlet 11. The water and impurities settling out of the incoming petroleum and from the body of the liquid in the tank are drawn off from time to time through the water-draw-off 17, the inner end of which is curved downward to a point closely adjacent the bottom of the tank.

The petroleum is heated in the body of the tank either by closed steam coils or coils containing the hot products of oil distillation, or both. Referring now to Figs. 2 and 5, it will be seen that the tank is provided in its bottom with a spiral steam coil 18, the inlet end 19 of which is connected to the outer convolution of the spiral and the outlet end 20 connects at the center of the tank with a discharge pipe 21. Radial strips 22, 22' maintain the convolutions of the coil in proper position. A short distance above the bottom of the tank and surrounding the chamber 15 are arranged two double helical heating coils, one of which 23, is designed for the use of steam, and the other of which, 24, is designed for the use of heated oil such as is discharged from the distillation apparatus, see Figs. 2 and 4. The inlets to the respective oil coils are indicated at 25 and 26 in Fig. 4, and the outlets thereto at 27, 28, the inlets being at the top and the outlets at the bottom of the respective coils. The inlets to the steam coils are numbered respectively 29, 30 and the outlets thereto, 31, 32, the latter preferably being at the bottom also, for drainage. The coils are supported in position by pairs of uprights 33, 34 arranged at suitable intervals about the coils, and the uprights are in turn supported from horizontal beams 35 attached at their ends to the outer wall of the tank and the wall of the chamber 15, respectively. By the arrangement of coils described the same heating effect may be obtained whether steam or oil or both together are employed.

Where oil is used for the heating coils the arrangement has the advantage not only of heating the oil in the container, but also of cooling the oil in the pipe of the coil. Preferably, and for the sake of economy, as much heat as possible is extracted from the oil and only the excess necessary is taken from the steam.

At suitable intervals along the height or length of the preheater are arranged other steam coils for the purpose of raising the temperature of the oil. The number of these may vary and in the present instance I have shown two such coils. The arrangement of these coils is well shown in Figs. 2 and 3 from which it will be seen that the coils comprise straight top sections 40 parallel to each other and connected by bends 41. The pipes of the coil are arranged in two oppositely inclined planes, the set in the upper plane 42 being connected at its higher end to the inlet 43 and at its lower end to the higher end of the lower set of coils 44, which, at the lower end thereof is connected to an outlet pipe 45. The sets of pipe are supported in any suitable way as by the cross-beams 46. 47 indicates a gauge for observing the height of the liquid in the tank.

The operation of the device has been substantially set forth in connection with the description of the apparatus, but may be summarized as follows: The crude oil to be treated flows into the tank through the inlet pipe 13 and is sprayed at 14 into the column 12 and through the baffle plates. As heretofore stated, in normal operation the tank is filled to the level of the overflow 11 by which the treated crude is carried off to the distillation apparatus or to some receptacle. The oil sprayed into the column 12 is evenly distributed over the upper end of the liquid column therein, avoiding the formation of currents as well as giving opportunity for the release of the volatiles and an initial separation of water. The crude oil slowly and quietly descends the central column, being warmed during its progress by the surrounding body of oil in the tank whereby the very light fractions are volatilized and a further separation of the water due to the heat and the downward motion is accomplished. When the oil reaches the chamber 15 its downward motion is very greatly retarded, due to the larger diameter of the chamber, and it quietly descends to the openings 16 through which it is evenly and quietly distributed to the bottom of the tank. Because of its superior specific gravity the water in the oil tends to continue its downward movement and is thus further separated from the oil when the latter flows laterally through the opening 16 and begins its ascent into the body of the tank. The temperature of

the oil slowly rises as it ascends, and the heating coils being evenly distributed and the liquid rising as it is heated, there is no tendency to the formation of eddy currents which would result in un-uniform treatment and the mixing of oil containing water with oil from which the water had been substantially removed. The water as it accumulates in the bottom of the tank is removed by the draw-off pipe 17, and the level thereof kept well below the openings 16 whereby the water is in contact only with a quiescent body of oil and is not taken up by the moving current through the opening 16.

I claim:

1. In a device of the class described, a tank, a concentric hollow column within the tank, an oil inlet pipe communicating with the column near its top, an enlarged concentric chamber communicating with the column near the bottom thereof, a series of evenly distributed openings in the chamber for discharging the oil uniformly throughout the tank near but above its bottom, and means for heating the contents of the tank, an outlet for the oil near the top of the tank.

2. In a device of the class described, a tank, a hollow column substantially concentric therewith, an oil inlet pipe connected with the upper end of the column, an enlarged chamber with which the lower end of the column communicates, a series of openings in the chamber near but above the bottom thereof, said openings being evenly distributed about the periphery of the chamber to discharge oil evenly to the bottom of the tank, means for heating the oil in the tank and an outlet for the oil near the top of the tank.

3. In a device of the class described, a tank, a hollow stationary column substantially concentric therewith, an oil inlet pipe connected with the upper end of the column, an enlarged chamber with which the lower end of the column communicates, a series of openings in the chamber near but above the bottom thereof, said openings being evenly distributed about the periphery of the chamber to discharge oil evenly to the bottom of

the tank, means for heating the oil in the tank, and a water-draw-off for removing the water and impurities adjacent the bottom of the tank, an outlet for the oil near the top of the tank.

4. In a device of the class described, a tank, a vertical hollow column arranged substantially concentric of the tank and communicating therewith at its top and near the bottom, an outlet opening near the top of the tank, and an oil inlet having a spray nozzle arranged to discharge the oil in a spray at the top of said column.

5. In a device of the class described, a tank, a vertical hollow column therein, an oil inlet communicating with the top of said column, an enlarged chamber communicating with the bottom of the column, there being openings through the walls of said chamber communicating with the lower portion of the tank substantially above the bottom thereof, a pair of similarly arranged coils for different heating media surrounding said chamber near the bottom of the tank, and means for drawing off water and impurities from the bottom of the tank.

6. In a device of the class described, a tank, means for heating oil in the tank, means for introducing oil to the tank comprising an open topped axial column having a peripheral series of openings at its bottom communicating with the body of the tank, a supply pipe having a nozzle located in the column, and baffle plates in said column below the nozzle.

7. In a pre-heater for crude petroleum, a tank adapted to receive and retain a considerable body of liquid and provided with hydrocarbon and water outlets arranged, respectively, near the top and bottom thereof, means for supplying crude petroleum to the tank and causing it to gradually flow upward therein including a stationary column having an enlarged lower end provided with a series of uniformly distributed lateral openings above the bottom of the tank, and means outside of said column for heating the liquid within the tank.

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