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PROCESS OF REFINING OIL.

APPLICATION FILED JULY 24, 1909.

998,837.

Patented July 25, 1911.

2 SHEETS—SHEET 1.

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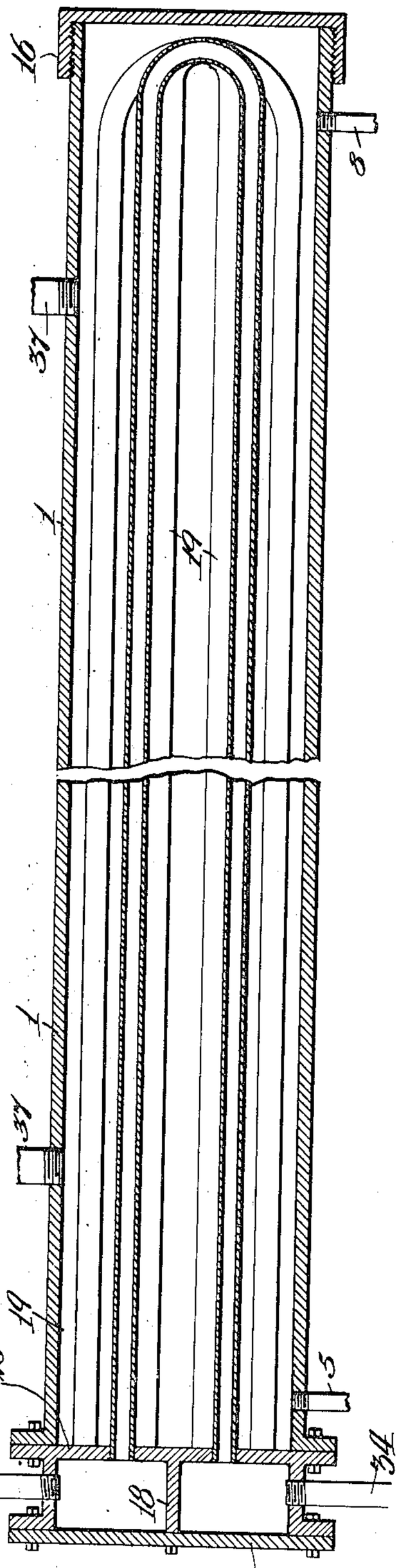

Witnesses:-

Louis W. Gratz.

Laura L. Abraham

Inventor

Hubert G. Burrows

by Townsend Lyon & Hackley,

his attys.

UNITED STATES PATENT OFFICE.

HUBERT G. BURROWS, OF ORCUTT, CALIFORNIA.

PROCESS OF REFINING OIL.

998,837. Specification of Letters Patent. Patented July 25, 1911.

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To all whom it may concern:

Be it known that I, HUBERT G. BURROWS, a citizen of the United States, residing at Orcutt, in the county of Santa Barbara and State of California, have invented a new and useful Process of Refining Oil, of which the following is a specification.

This invention relates particularly to the treatment of crude oil containing a considerable amount of mineral matter in suspension, for example, crude oil which is obtained in Santa Barbara county, California, and which is found to contain mineral matter in the form of infusorial earth, in a state of such fine division that it remains permanently suspended in the oil and cannot be separated therefrom by the usual settling process on account of the viscosity of the oil.

The main object of the invention is to provide for the effective separation of such mineral matter from the oil. I have discovered that by distillation of such oil under the proper conditions, this finely divided mineral matter will be carried over with the distillate, and owing to the relatively small viscosity of the distillate the mineral matter can be separated therefrom by the usual settling operation.

Another object of the invention is to provide for most efficient use of the heat employed in distillation.

A further object of the invention is to provide for production of different grades of oil.

The accompanying drawings illustrate an apparatus suitable for carrying out the invention, and referring thereto: Figure 1 is a perspective of the apparatus. Fig. 2 is a transverse section through one of the heads of the tubular stills. Fig. 3 is a longitudinal section of one of the stills.

The apparatus comprises a series or plurality of stills 1, 2, 3 arranged preferably one above the other, each still being formed as an elongated horizontal tubular member, and connections being provided for passing the oil successively through the several stills.

4 designates an oil supply tank from which a pipe 5 having a valve 6 leads to the upper still 1 near one end thereof, this end being termed the front end. From the rear end of the still a pipe 8 leads forwardly to the front end portion of the second still 2, the oil connections being preferably in each case made at the bottom of the still as indicated. From the rear end portion of the second still a pipe 9 leads to the front end portion of the third still 3, and from the rear end portion of said third still, or from the last still in the series, a pipe 10 leads to a sump or residue tank 11. Valves 12 and 14 are provided in the respective pipes 8, 9.

Stills 1, 2, 3 are closed at their rear ends by caps 16, and at their front ends by hollow heads 17, 17′ and 17″ respectively, each of said heads having a horizontal partition 18 dividing it into upper and lower chambers and tubes or pipes 19, bent in U-form, are connected at their respective ends to the inner wall 20 of the head so as to communicate with these upper and lower chambers, these bent tubes extending longitudinally within the still the entire length thereof. A heating medium, such as steam, is supplied to the heads of stills 2 and 3, the heating medium being preferably superheated steam generated by a boiler 23 superheated in a superheater 24 of any suitable construction. A valve pipe 25 leads from the boiler to the superheater and a pipe 26 having a valve 27 leads from the superheater and is provided with branches 28, 29 extending to, say, the upper chambers of the heads 17′ and 17″ of the two lower stills, the lower chambers of said heads being connected by pipes 30, 31 through a valve 32 and pipe 35 with the upper chambers of the head for the upper or first still 1, the lower chamber of the last named head being connected by grip or joist pipe 34 with a steam trap or waste means 33.

The stills 1, 2, 3 are provided with means for taking off or collecting the distilled gas or vapor therefrom together with finely divided mineral matter such as infusorial earth, said means consisting of pipes 37, 38, 39 communicating with said stills at distributive points along the length thereof and leading to condensing chambers 40, 41, 42, and provided with or contained in a suitable cooling means, such as a casing 43 having inlet and outlet means 44, 45 for cooling medium, said condensers being provided with outlet pipes 46, 47, 48 for the condensed products. The outlet pipe 46 is shown leading to a settling tank 49.

The process is carried out as follows: The crude oil or the oil to be refined is supplied from tank 4 through the pipe 5 to the uppermost still 1 and passes the entire length of said still thence through pipe 8 through still

2, etc., through the series of stills in succession. This oil is preferably subjected to a preliminary heating by means of a pipe 50 having a valve 51 communicating with the boiler 23 for delivering a supply of steam to the tank 4, said steam being delivered directly to the tank or to the heating coil therein, so that the oil reaches the first retort or still 1 at the right temperature for distillation. The superheated steam from the superheater 24 passes through the pipes 28, 29 to the two lower stills and passing through the tubes 19 in said stills it causes the oil therein to be heated to a relatively high temperature, at the same time cooling the steam. The steam at a reduced temperature passes from the outlet end of said heating pipes and the lower chambers of the heads 17′ and 17″ through pipes 30, 31, 35 to the head 17 and the heating tubes 19 of the first still wherein the steam gives up a portion of its heat to the oil therein contained, the condensed steam or drip running off at 34. The oil is progressively heated by the above described operation to successively higher temperatures and by means of the pipes 37, 38, 39 successive portions of the vapors arising from the oil are taken off, the vapor being removed as fast as it is formed. The successive portions of vapor taken off from one still being nearly of one gravity are combined together in a single condenser to form a product of one gravity, but the portions taken off in different stills are delivered to different condensers. When oils containing finely divided mineral matter, such as infusorial earth, are distilled in this manner the rapid evolution of vapor and light oil carrying entangled mineral matter from the oil in the stills causes such mineral matter to be carried over with the distillate, this mineral matter being in fact carried over with the lighter portion of the distilled product, namely, the gasolene, or with the second product or kerosene, according to the rapidity of distillation. In either case the resulting fluid or oil containing the mineral matter is of such low viscosity that the mineral matter readily separates therefrom by settling.

It is essential to the successful carrying out of the process that the oil should be boiled or vaporized with sufficient rapidity to cause the mineral matter to be carried off with the vapor and it is also essential to the process that a plurality of outlets should be provided, located at separated points along each retort or still, so that the vapor taken off is removed from the still immediately after being vaporized, and at frequent intervals during the progressive heating thereof, thereby preventing the settling of the mineral matter back into the oil.

By means of the pipes 28 and 29 leading from the superheater to the stills 2 and 3 and the valves therein, I am enabled to regulate the temperature of these two stills to obtain different temperatures therein. By allowing a larger amount of superheated steam to enter still 3 the temperature thereof may be raised to approximately 800 degrees F. While by allowing a smaller amount to enter still 2 a temperature of not to exceed 500 degrees F. may be maintained. By taking the combined exhaust from stills 2 and 3 to still 1 the oil therein is maintained at a temperature of above 350 degrees F. By this arrangement I am enabled to drive off the different vapor products in successive stages without allowing them to combine with vapors of other qualities.

Oil is fed to the still 1 in proportion to the heating capacity of the steam supply so that the oil will be heated to the proper temperature for the formation of the products desired to be produced from the oil.

In actual practice I have treated oils produced in the Santa Maria oil fields of California which when taken from the well had a gravity of 23 Baumé at 60° F. and contained 80% of water and mineral matter. Two hundred barrels of such oil was treated in an apparatus substantially the same as illustrated in the drawings, with the exception that only two stills were employed, each still being 12½ inches in diameter and 40 feet long, and each having four outlets, as shown. The temperature obtained in the top still was 200° F., while the temperature of the lower or second still did not exceed 325° F., and the two hundred barrels of oil, of 42 gallons to the barrel, were run through the two stills in eight hours' time. The oil delivered from the lower still, after having been treated to free the same from the water and foreign matter, had a gravity of 16 Baumé at 60° F. and contained only 3% of water and foreign matter. The oil thus produced was marketable, while the oil before treatment was absolutely worthless and unmarketable.

What I claim is:

1. The process of refining oil containing finely divided mineral matter in suspension, which consists in distilling the oil with sufficient rapidity to cause the finely divided mineral matter to pass into the distilled product and condensing the distilled product into liquid form, and allowing the mineral matter to settle out from the oil.

2. The process of separating finely divided mineral matter from an oil of sufficient viscosity to hold said mineral matter permanently in suspension, which consists in distilling the oil with sufficient rapidity to cause the mineral matter to pass into the distilled portion of lower viscosity, conveying the vapor away from the liquid before

the mineral matter settles back into the liquid, condensing the distilled product and allowing the mineral matter to settle out.

3. The process of separating finely divided mineral matter from an oil of sufficient viscosity to hold said mineral matter permanently in suspension which consists in passing the oil continuously through an elongated conduit, supplying sufficient heat to the conduit along the length thereof to progressively increase the temperature of the oil, and to cause the oil to vaporize with sufficient rapidity to cause the mineral matter in the oil to pass into the distilled portion of lower viscosity, conveying the vapor away from the body of the oil at repeated intervals during the progressive heating thereof, condensing such vapor, and allowing the mineral matter to settle out from the condensed product.

In testimony whereof, I have hereunto set my hand at Los Angeles California, this 19th day of July 1909.

HUBERT G. BURROWS.

In presence of—
ARTHUR P. KNIGHT,
FRANK L. A. GRAHAM.