M. J. TRUMBLE.

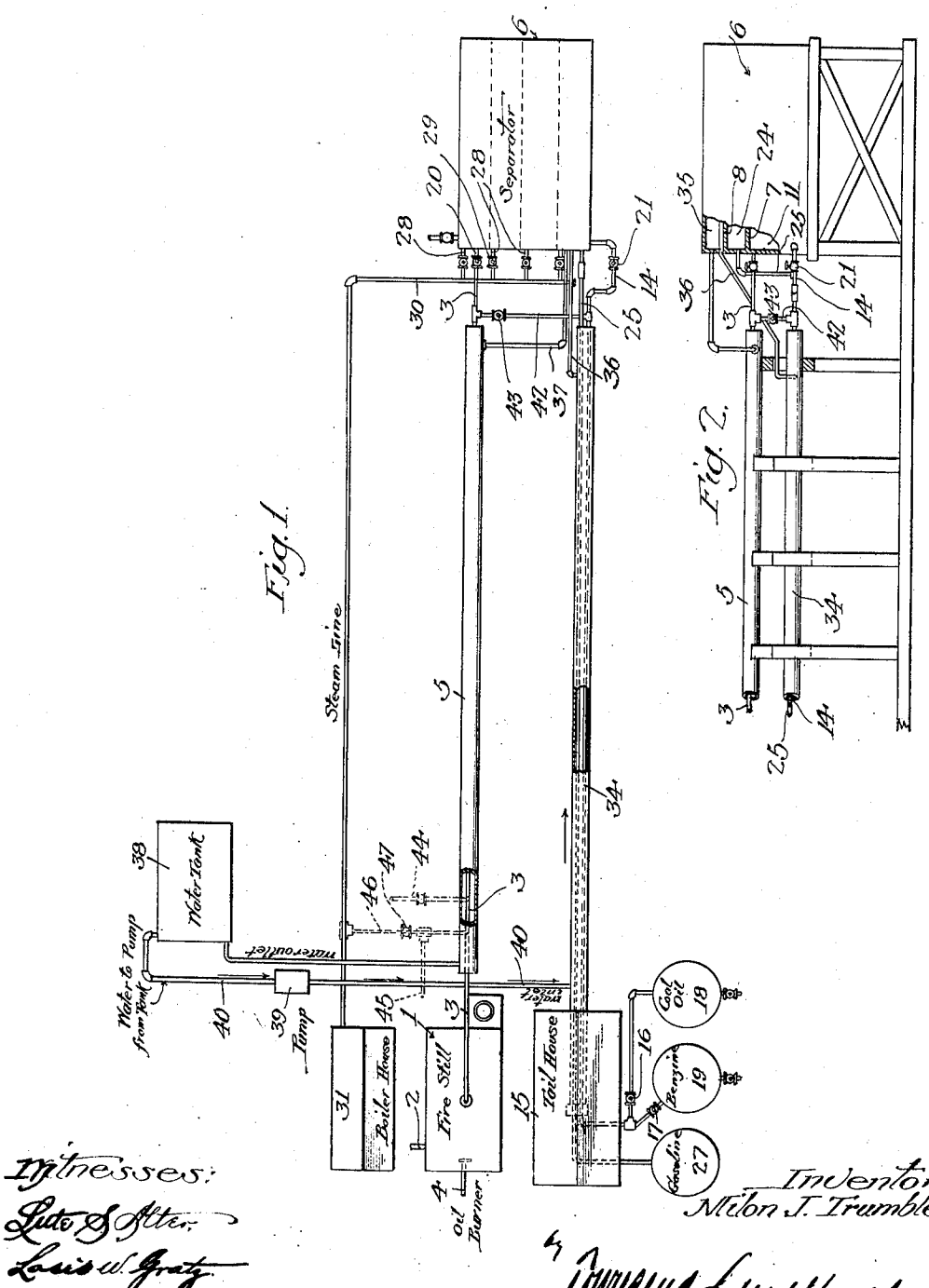
APPARATUS FOR REFINING PETROLEUMS.

APPLICATION FILED SEPT. 27, 1909.

1,002,474.

Patented Sept. 5, 1911.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 3.

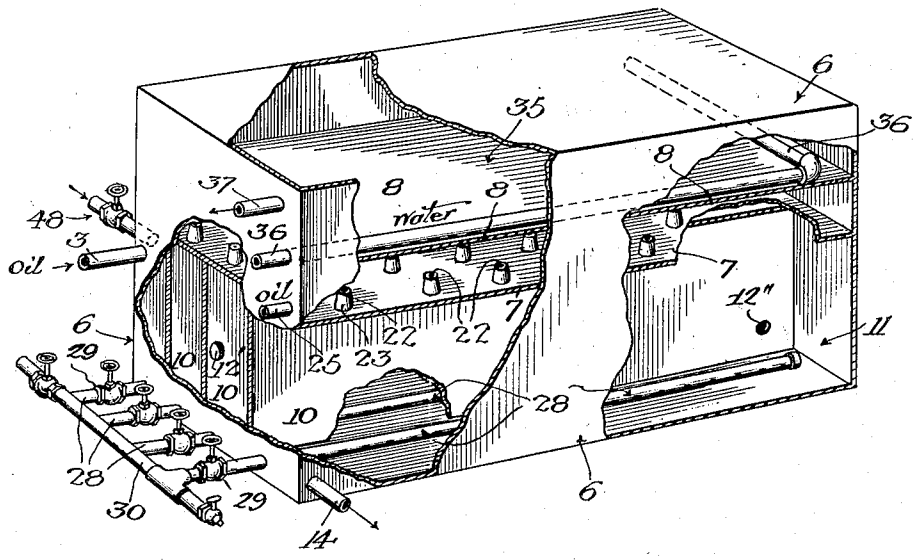


Fig. 4.

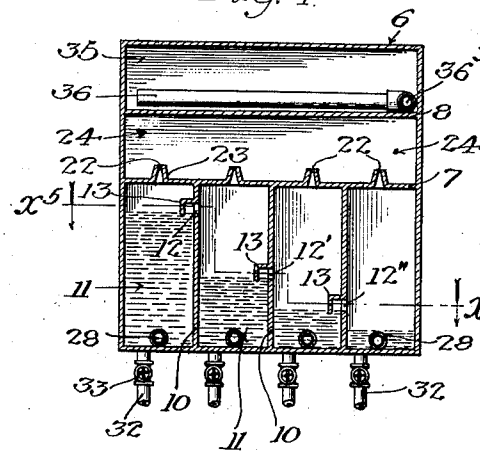
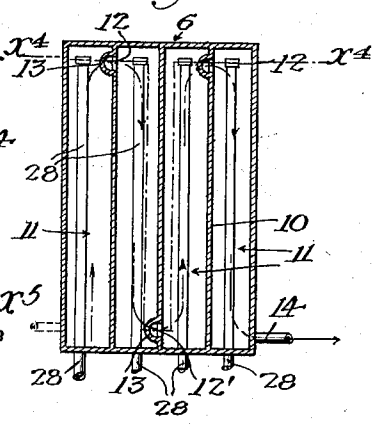


Fig. 5.



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UNITED STATES PATENT OFFICE.

MILON J. TRUMBLE, OF LOS ANGELES, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO TRUMBLE REFINING COMPANY, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA.

APPARATUS FOR REFINING PETROLEUMS.

1,002,474. Specification of Letters Patent. Patented Sept. 5, 1911.

Application filed September 27, 1909. Serial No. 519,884.

To all whom it may concern:

Be it known that I, MILON J. TRUMBLE, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Apparatus for Refining Petroleums, of which the following is a specification.

This invention relates to an improved apparatus for refining and separating hydrocarbon oils and the main object of the invention is to provide an apparatus for separating or fractionating oils, at the same time refining the oils so that they are deodorized and in a marketable condition, without necessitating the use of chemicals, such as sulfuric acid or caustic soda.

A further object of the invention is to provide for the recovery of the lightest and most volatile hydrocarbons which pass over in the beginning of distillation.

Another object of the invention is to provide for production of commercial oils from natural gases which are evolved from oil wells and which are ordinarily wasted.

The apparatus has been particularly applied in connection with oils having an asphaltum base, such as California petroleum, and especially in connection with the final refining and separation of the final products from the oils which are known as distillates, being the lighter products of the first distillation of crude oil.

The apparatus hereinafter described may be used to execute the process forming the subject matter of my application of even date herewith, Serial No. 519,883.

The accompanying drawings illustrate an apparatus embodying the invention.

Figure 1 is a plan of the apparatus. Fig. 2 is a side elevation, partly in section, of that portion of the apparatus in which the oil and oil vapor are subjected to the action of steam and hot water for fractional separation and refinement thereof. Fig. 3 is a perspective of said separating apparatus with parts broken away. Fig. 4 is a transverse section thereof on line x^4—x^4 in Fig. 5. Fig. 5 is a horizontal section on the line x^5—x^5 in Fig. 4.

1 designates a fire-still which may be of any usual or suitable construction and is provided with a vapor outlet pipe 3.

4 designates the burner or heating means for the still which may be an oil burner.

The outlet pipe 3 from the still is inclosed in a jacket 5 for receiving cooling medium, as hereinafter set forth, for condensing the vapor.

The separating apparatus proper consists of a casing 6 with two horizontal partitions or plates 7, 8, dividing the interior of the casing into three superposed chambers. Vertical partitions 10 extend from the bottom of the casing 6 to the lowermost horizontal plate 7, dividing the space therebetween into a plurality of compartments 11 extending side by side. The oil vapor pipe 3 opens into the first compartment 11 near the top thereof and an opening 12 is provided in the wall 10 between said chamber and the next compartment 11 near the top thereof for the overflow of liquid from the first compartment 11 to the next chamber. A similar opening 12′ is provided in the next vertical wall 10 for the passage of liquid from the second to the third compartment and a similar opening 12″ in the next wall 10 for the passage of liquid from the third to the last compartment, it being understood that any desired number of chambers may be used, each compartment communicating with the preceding and the succeeding compartment. A hood 13, acting as a trap, is provided for each opening 12, etc., to prevent passage of steam from one compartment to the next. The openings 12, 12′, etc., are provided alternately near opposite ends of the walls 10, so that the liquid in passing through the compartments is caused to traverse substantially the entire length of each compartment and the said openings in successive walls 10 are at successively lower levels, so that the liquid is maintained at the highest level in the first compartment, at a lower level in the next compartment and so on. The final compartment 11 is connected near its bottom with the oil outlet pipe 14 leading to the tail house 15 where it may be connected, through valve 16, 17 with the tanks 18, 19 for the heavier qualities of oil, such as benzene and kerosene. Valves 20, 21 are provided in the respective pipes 3 and 14 adjacent to the separating apparatus.

The plate 7 which forms the top of the

compartments 11 is provided with a plurality of perforations or openings 22, the plate being formed with lips or raised walls 23 around said openings. The chamber 24 between this plate 7 and the upper division plate 8 forms a condensing chamber for the lighter products of the oil, an outlet pipe 25 being connected with this chamber and leading to the tail house 15 where it is connected to the gasolene or light gravity oil tank 27. A steam supply pipe 28 extends into each of the chambers 11 near the bottom thereof and is provided with a series of perforations preferably in the bottom of the pipe; said pipe extending substantially the entire length of the chamber, so as to distribute steam throughout the body of oil in the chamber. Each pipe 28 is provided with a valve 29 and said pipes are connected to a common supply pipe 30 leading to a suitable source of steam, for example, boiler house 31. A drain pipe 32 may also be provided in the bottom of each chamber 11, said drain pipe being normally closed by a valve 33.

The oil delivery pipes 14 and 25 may extend parallel to one another and are inclosed by a water jacket 34. The upper chamber 35 of the casing 6, above the division plate 8, is provided with a connection for the supply of cooling water thereto, a perforated pipe 36 extending in said chamber for admission of water and a delivery pipe 37 leading from said chamber for the discharge of the water. Means are provided for circulating a current of water through the water jacket 34, said water being supplied from a tank 38 by a pump 39 through a pipe 40 to the water jacket 34 near the tail end thereof. The farther or head end of the water jacket 34 is connected to the water supply pipe 36 for the water chamber 35 and the outlet pipe 37 from said chamber is connected with the adjacent end of the water jacket 5, the farther end of said water jacket being connected to the water tank 38 into which it discharges.

A by-pass pipe 42 connects the two pipes 3 and 14 and is provided with a valve 43, by opening of which the vapor from the still is allowed to pass through the pipe 14 to the tail house without passing through the separator. 44 designates an independent supply connection to the pipe 3 for the admission or supply of natural gas or other gas for use in the apparatus and 45 designates a supply pipe for distillate or other hydrocarbon which is injected into the pipe 5 by steam supplied by pipe 46 provided with a valve 47. An independent oil supply connection 48, for example, from a pump line, leads into the first compartment 11, to supply oil thereto from an independent source, if desired.

The operation is as follows: Steam is generated in the boiler house 31 and water is circulated through the system of water jackets 34, 5 and the water chamber 35 of the separator with the result that the compartments 11 of the separator become filled with water up to the level of the respective outlets 12 thereof. Assuming that the apparatus is being used for the refining and separation of distillates, the stock or base distillates or hydrocarbons are pumped through the pipe 2 to the fire-still and said still is operated with fire heat along, and without steam, so as to maintain a steady heat on the oil or distillate therein causing the distillates to vaporize, the vapor passing off through the vapor line 3. The hydrocarbon is supplied to the still in separate charges, each charge being run through before the next charge is admitted. The circulation of water through the jacket around said vapor line causes condensation of the vapor, so that the product enters the first compartment 11 of the separator wholly or partly in a liquid condition. In said compartment the action of the steam supplied by the pipe 28 and the hot water contained in said compartment, on the oil entering the body of water, causes emulsification of the oil and imparts sufficient heat to the oil to cause part of the lighter constituents, for example, gasolene, to pass upwardly as vapor through the openings 23 in the top of the compartment. Such portion of the condensed distillate as is not vaporized in this manner in the first compartment overflows into the next compartment, where on account of the greater amount of steam space in the upper portion of the compartment a higher temperature is imparted to the liquid and an additional quantity of vapor is driven off, the liquid being in this manner subjected to a series of heating operations at progressively higher temperatures and in contact with a body of water. The primary effect of this is as stated to drive off from the condensed distillate the lighter vapors therein contained. Another important effect is to change the constitution of the lighter portions of the product, so that they become more condensable, as hereinafter set forth. The oil vapors which are expelled from the compartments 11 and pass upwardly into the chamber 24 are subjected therein to the cooling influence of the body of water in the water chamber 35 and are thereby condensed, passing out through the gasolene line 25 to the gasolene tank.

I have found that the above described operation and the action of the hot water and steam on the condensed oil vapor suspended and intermixed with the water and steam in the form of an emulsion, causes such an alteration in the constitution of the product that the lightest and most volatile vapors which are not generally subjected to

condensation, are by this operation rendered condensable, so that in passing off through the gasolene line 25 they become condensed along with the gasolene by the cooling effect of the water flowing in the water jacket 34. In fact, I have found that it is possible to condense and liquefy natural gas such as escapes from the oil as it is pumped from oil wells by admitting it to the vapor inlet pipe 5 along with the condensed vapor from the still or along with distillate admitted through the pipe 45 without operation of the still. In either case there is produced from the gas a condensable product which liquefies in the gasolene line 34 and can be drawn off into the gasolene tank. That portion of the condensed vapor product from the inlet pipe 5 which is not subject to vaporization by the successive action in the compartments 11, passes from the final compartment 11 through the pipe 14 to the benzene or kerosene tanks in the tail house, along with any excess water of condensation, said water settling out from the oil and being drawn off as required by connections 50. The apparatus is also applicable for the separation and refining of oil without preliminary distillation, such oil being led directly from the pump line through the pipe 48 into the first compartment 11 and being subjected in its passage through the successive compartments to the action of hot water and steam at successively higher temperatures to cause the lighter products to pass upwardly into the condensing chamber 24, the lighter and heavier products passing from the separator by the pipe lines 25 and 5, as before described. The apparatus is generally applicable to hydrocarbon oils of any kind, for example, distillates, and if applied to such oils without previous treatment, it will in general produce oils of sufficiently definite composition and purity for commercial use. I have, for example, treated by this apparatus dark stock distillate having a gravity of about thirty eight producing kerosene with a gravity of about forty five and gasolene of a gravity of about sixty five, the kerosene and gasolene being water white and free from objectionable odor. The odorous and cooling matter is absorbed by the water of condensation in the compartments 11 and passes off with said water. In this connection it is important that the water should be absolutely pure and this is insured by the use of water of condensation only.

While my apparatus enables chemicals to be dispensed with, such chemicals may be used if desired, and in some cases, for example, in treating crude oil directly in one distillation, the usual chemical treatment with sulfuric acid followed by washing with caustic soda solution may be employed, the first distillate, in that case, being run through the separator to produce the final product. I prefer, however, to use the first distillate as stock for the distillation in the apparatus as above stated.

What I claim is:

1. An apparatus for refining and separating petroleum comprising a series of separate compartments, each provided with an overflow through the succeeding compartment, an oil inlet at the upper part of the first compartment of the series, an oil and water outlet for the last compartment of the series, a condensing chamber extending over all of the compartments and communicating with the upper portion of each of the compartments, means for cooling said condensing chamber, and means for supplying steam to each of said compartments at the lower portion thereof.

2. An apparatus for refining and separating petroleum comprising a series of separate compartments, each provided with an overflow through the succeeding compartment, an oil inlet at the upper part of the first compartment of the series, an oil and water outlet for the last compartment of the series, a condensing chamber extending over all of the compartments and communicating with the upper portion of each of the compartments, means for cooling said condensing chamber, means for supplying steam to each of said compartments at the lower portion thereof, the overflow means being at successively lower heights for successive compartments of the series.

3. In an oil refining apparatus, the combination with a fire-still, a vapor outlet pipe therefrom, water jacket means for said vapor outlet pipe and means for circulating the water through said water jacket means, of a separating apparatus having a series of separate compartments, the first of said compartments being connected to said outlet pipe, an overflow connection being provided between each compartment and the succeeding compartment, an oil outlet from the last compartment, a condensing chamber extending over all of said compartments and communicating with the compartments at the upper portions thereof, means for cooling said condensing chamber, and means for supplying steam to the respective compartments at the lower portions thereof.

4. In an oil refining apparatus, the combination with a fire-still, a vapor outlet pipe therefrom, water jacket means for said vapor outlet pipe and means for circulating the water through said water jacket means, of a separating apparatus having a series of separate compartments, the first of said compartments being connected to said outlet pipe, an overflow connection being provided between each compartment and the succeeding compartment, an oil outlet from the last

compartment, a condensing chamber extending over all of said compartments and communicating with the compartments at the upper portions thereof, means for cooling said condensing chamber, and means for supplying steam to the respective compartments at the lower portions thereof, and a valved by-pass connection from the inlet to the outlet of the separating apparatus.

5. An apparatus for refining and separating petroleum comprising a series of separate compartments, each provided with an overflow through the succeeding compartment, an oil inlet at the upper part of the first compartment of the series, an oil and water outlet for the last compartment of the series, a condensing chamber extending over all of said compartments and communicating with the upper portion of each of the compartments, means for cooling said condensing chamber, means for supplying steam to each of said compartments at the lower portion thereof, a jacketed pipe connected to said oil inlet, means for supplying distillate together with hydrocarbon gas to said pipe, and means for circulating cooling medium through the jacket of said pipe.

6. An apparatus for refining and separating petroleum comprising a series of separate compartments, each provided with an overflow through the succeeding compartment, an oil inlet at the upper part of the first compartment of the series, an oil and water outlet for the last compartment of the series, a condensing chamber extending over all of the compartments and communicating with the upper portion of each of the compartments, means for cooling said condensing chamber consisting of a chamber extending over said condensing chamber, means for supplying cooling medium therein, and means for supplying steam to each of said compartments at the lower portion thereof.

In testimony whereof I have hereunto set my hand at Los Angeles, California, this 20th day of September, 1909.

MILON J. TRUMBLE.

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