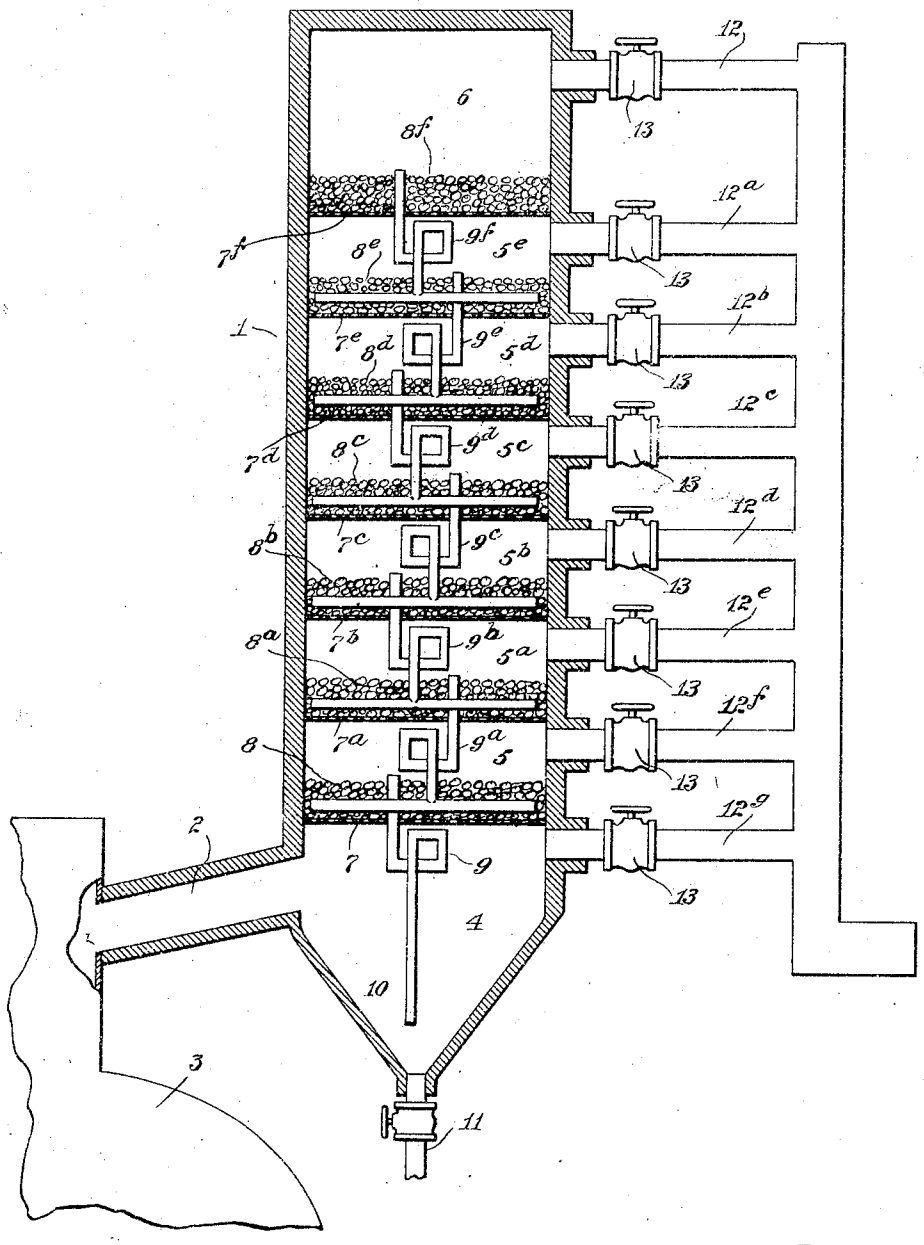
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H. P. STRAUS

APPARATUS FOR THE FRACTIONATION OF PETROLEUM

Filed June 19, 1920



Inventor:
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by

Atty

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HENRY P. STRAUS, OF NEW YORK, N. Y.

APPARATUS FOR THE FRACTIONATION OF PETROLEUM.

Application filed June 19, 1920. Serial No. 390,053.

To all whom it may concern:

Be it known that I, HENRY P. STRAUS, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Apparatus for the Fractionation of Petroleum, of which the following is a specification.

Crude petroleum is a mixture of a large number of compounds whose boiling points cover a wide range of temperature. The refiners of petroleum for gasolene, naptha, and burning oils, endeavor to make cuts or fractions of the distillates from the still which will give products within special ranges of boiling points in order to obtain the largest yields of these light oils.

By the process of redistillation and by the use of dephlegmators and fractionating columns, refiners are able to obtain larger yields of light oils than could be obtained by a straight distillation from the crude petroleum itself.

The object of my invention is to subject the vapors from the distillation of crude petroleum or crude petroleum distillates to a series of continuous condensations and redistillations without increasing the costs above the costs of a straight distillation of the crude petroleum or crude petroleum distillate itself. This object I attain by the conservation of heat energy within an insulated multiple chamber redistillation and reflux column, whereby I increase the yield of light oils and improve the quality of these products.

In the accompanying drawing I have shown, in vertical section, a suitable form of apparatus for the practice of my invention:

(1) is the multiple chambered column well insulated from the surrounding air. (2) is the vapor line from the still (3) of which a fragment only is shown. The vapor line (2) is connected with the column (1) and the still (3) at an angle sufficient to allow the return of liquid from the column (1) to the still (3). The vapor line (2) is well insulated to prevent loss of heat to the atmosphere. (4) is the lower chamber of the column (1) and the vapor line (2) enters the side of (4) about half way the height of the chamber (4). (5) (5^a) (5^b, etc.) are intermediate chambers. (6) is the top or highest chamber of the column (1). (7, 7^a, 7^b, etc.) are perforated metal plates and act as partitions between adjacent chambers. (8, 8^a, 8^b, etc.) are condensing masses of stone or metal balls or coarse material, which rest upon the perforated plates to a depth of about one-third the height of the chambers.

(9, 9^a, 9^b, etc.) are reflux tubes designed to carry excess liquid from any chamber to the adjacent chamber immediately below. The reflux tubes have bends or traps which allow the flow of liquid through them only from an upper to a lower adjacent chamber and prevent the passage of vapor through them from a lower to an upper chamber. With the exception of the reflux tube (9), the reflux tubes have perforated branched lower ends or spiders, which terminate in the masses (8, 8^a, 8^b, etc.) just above the plates (7, 7^a, 7^b, etc.). The reflux tube (9) passes from the chamber (5) to the chamber (4) and has no branched lower end, but the end extends below the level of the entrance point of the vapor line (2) in the side of chamber (4). The part of the reflux tube (9) below the plate (7) is insulated from the heat of the vapors from the vapor line (2) from the still (3). The reflux tubes (9, 9^a, 9^b, etc.) start from a point about an inch above the masses (8, 8^a, 8^b, etc.) on the plates (7, 7^a, 7^b, etc.). The lower branched ends of the reflux tubes rest about an inch above the plates.

It is optional for these reflux tubes to pass either internally or externally from one chamber to another adjacent lower chamber.

In the side of the chamber (4) a pocket 10 is formed below the entrance of the vapor line (2). At the bottom of the pocket (10) is a draw off (11). From chamber (6) a line (12) leads to the condenser (not shown). Similarly from each of the other chambers a vapor line (12^a—12^g) to the condenser can be operated or cut out by means of suitably placed valves 13 and the distillate from any chamber taken off at will.

In the operation of the apparatus above described, the vapors from the oil charged in the still (3) pass through the vapor line (2) from the still (3) into the chamber (4) of the column (1) and thence through the perforations of the plate (7) into the mass (8) in chamber (5) where the vapor is condensed into liquid by the mass (8) and will continue to condense until the mass (8) and the liquid in the interstices of the mass become sufficiently heated to allow the low-

est boiling constituent compounds of the condensed liquid to redistill and the vapors of redistillation will pass through the perforations of the plate (7^a) into the mass (8^a) in the chamber (5^a). The vapor pressure of distillation and redistillation is sufficient to prevent the condensed liquid field in the masses above the plates from returning through the perforations in the plates to a lower chamber. The condensed liquids will therefore accumulate in the chambers above the plates until the level of the upper ends of the reflux tubes is reached when the excess of further accumulation of condensation will flow through the reflux tubes and pass into the lower chambers. The vapor pressures of distillation are nearly equal in any two adjacent chambers and the height of the column of liquid in the reflux tubes is sufficient to prevent any accumulation of condensation above the level of the upper ends of the reflux tubes in sufficient quantity to flood the upper chambers from the lower chambers.

The process of condensation and redistillation of the vapors in chamber (5) is repeated in chambers (5^a, 5^b, etc.) and finally in chamber (6) or top chamber of the column (1) whence the vapors pass into the line (12) leading to a condenser.

The liquid returned from an upper chamber to a lower chamber always contains some light ends, and these light ends are evenly distributed in the masses on the plates by the perforated branches at the lower end of the reflux tubes, and revaporize and pass again into the upper chambers.

The redistillations which take place in the chambers are the result of the exchange of heat from the condensation of the higher boiling constituent compounds of the vapors and the subsequent redistillation of the lower boiling constituent compounds of the liquid in the masses on the plates of the chambers. The masses on the plates have a high specific heat and accumulate a large amount of heat energy which acts as a balance for each chamber and keeps distillation conditions uniform.

The liquid returning from chamber (5) to chamber (4) is trapped in the pocket (10) until the level of the point where the vapor line (2) into the side of chamber (4) is reached when further flow of liquid from the upper chambers causes a return flow through the vapor line (2) into the still (3).

Any water which may be condensed in the column in the beginning of the distillation is caught in the pocket (10) and drawn off at the drip (11).

After the lighter fractions of the oil have distilled off and the column as a whole is hot enough, steam may be used to bring off the higher boiling compounds from the still.

The height of the chambers may be about two feet each and the width will vary with the size of the still. For a still of 1000 bbls. capacity, a column from sixteen to twenty feet in height and five feet in diameter is sufficient.

I claim:—

1. In a fractionating apparatus, a closed chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and means for maintaining condensate at a substantial, predetermined height above said plates.

2. In a fractionating apparatus, a closed chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and an eduction pipe terminating at approximately the height of said material and arranged to conduct liquid to a lower compartment.

3. In a fractionating apparatus, a closed heat insulated chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and means for maintaining condensate at a substantial, predetermined height above said plates.

4. In a fractionating apparatus, a closed heat insulated chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and an eduction pipe terminating at approximately the height of said material and arranged to conduct liquid to a lower compartment.

5. In a fractionating apparatus, a closed chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and means for maintaining condensate at a substantial, predetermined height above said plates, and vapor offtakes in each of said compartments and means for conducting from said apparatus.

6. In a fractionating apparatus, a closed chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and means for maintaining condensate at a substantial, predetermined height above said plates, including means for conducting the excess therefrom to the adjacent lower compartment.

7. In a fractionating apparatus, a closed chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and means for maintaining condensate at a sub-

stantial, predetermined height above said plates, including means for conducting the excess therefrom to the adjacent lower compartment and to distribute it uniformly throughout the contact material therein.

8. In a fractionating apparatus, a closed chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and an eduction pipe terminating at approximately the height of said material and arranged to conduct liquid to a lower compartment and said pipe having a vapor seal therein.

9. In a fractionating apparatus, a closed chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and means for maintaining condensate at a substantial, predetermined height above said plates, including means for conducting the excess therefrom to the adjacent lower compartment, and a liquid draw off from the compartment defined by the lowermost plate and the bottom of the chamber.

10. In a fractionating apparatus, a closed chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and means for maintaining condensate at a substantial, predetermined height above said plates, including means for conducting the excess therefrom to the adjacent lower compartment, said apparatus having the vapor intake in the compartment defined by the lowermost plate and the bottom of the chamber, said intake being above the end of said means conducting the excess condensate from the compartment immediately above it.

11. In a fractionating apparatus, a closed heat insulated chamber, a plurality of spaced, perforated plates therein dividing said chamber into a plurality of compartments, a layer of contact material on each of said plates and means for maintaining condensate at a substantial, predetermined height above said plates, including means for conducting the excess therefrom to the adjacent lower compartment and to distribute it uniformly throughout the contact material therein.

In testimony whereof I have affixed my signature.

HENRY P. STRAUS.