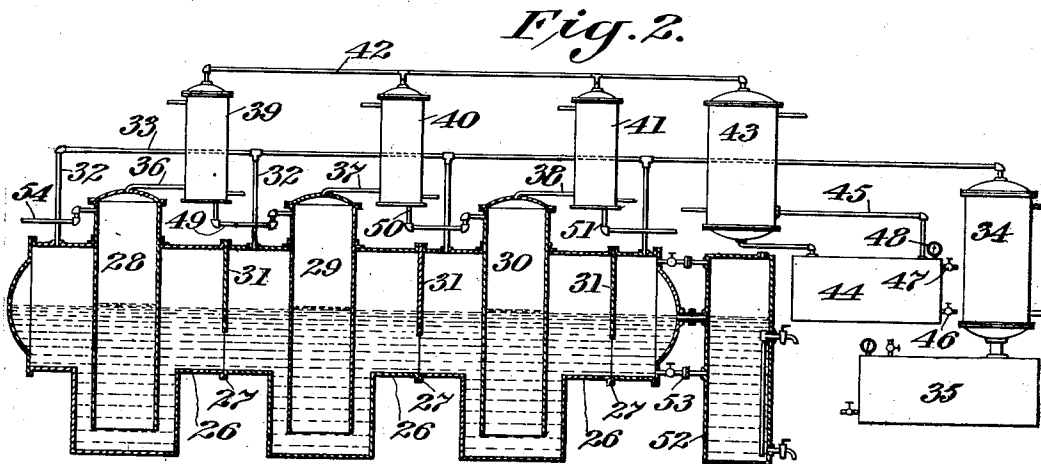
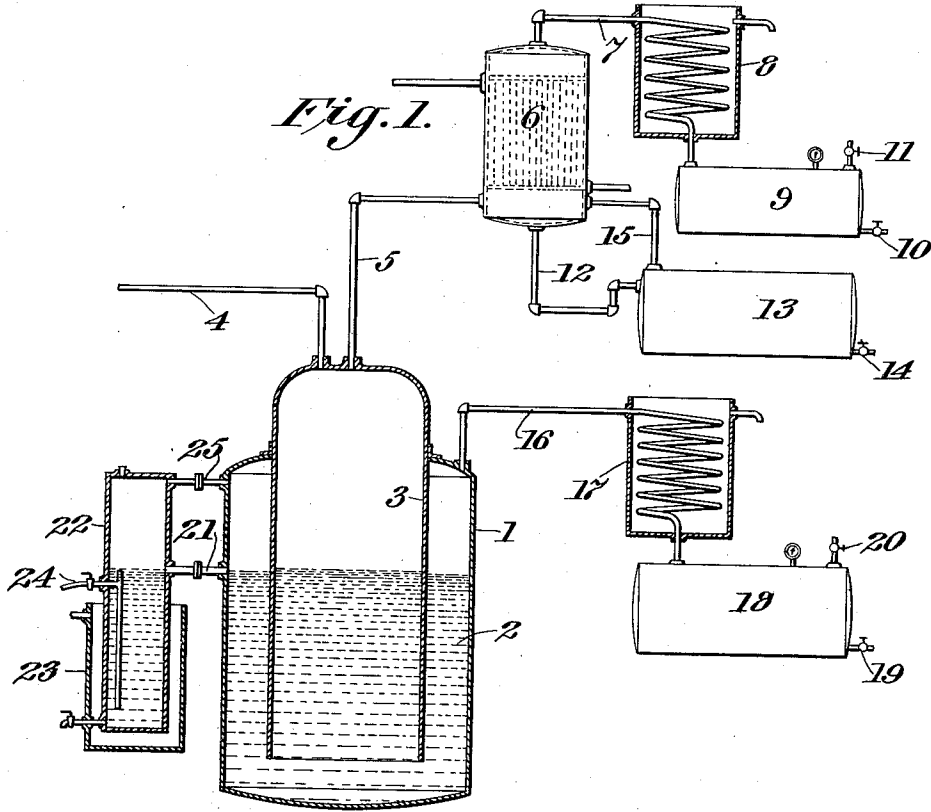


H. A. FRASCH.
METHOD OF AND APPARATUS FOR DISTILLATION.
APPLICATION FILED JAN. 12, 1917.

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Inventor
Hans A. Frasch
by
M. M. Finner
Attorney

UNITED STATES PATENT OFFICE.

HANS A. FRASCH, OF NEW YORK, N. Y.

METHOD OF AND APPARATUS FOR DISTILLATION.

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To all whom it may concern:

Be it known that I, HANS A. FRASCH, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Methods of and Apparatus for Distillation, of which the following is a full, clear, and exact description.

10 The object of this invention is to provide for the separation and recovery of volatile matters or fluids of fixed specific gravity and boiling point from substances composed of or containing a mixture of several volatile ingredients differing in and having various specific gravities and boiling points, and more particularly to the separation and recovery of petroleum products of various specific gravities by fractional distillation.

20 It is well known that distillates from petroleum and coal tar and the like, of different boiling points, may be separated from each other by means of differential condensers by the proper adjustment of the temperatures of the condensers; and as distinguished from this prior art, my present invention provides for obtaining separately from one another and rectifying the vapors of volatile substances independently of the condensers, or in combination with the same, in such manner as to permit the recovery of a number of fractional distillates of various fixed and desired boiling points in one and the same operation; and the invention also consists in an apparatus for carrying out the process, composed of one or more units and operating periodically or continuously as may be desired, all as I will proceed now to explain and finally claim.

40 In the accompanying drawings illustrating the invention, in the several figures of which like parts are similarly designated, Figure 1 is a diagrammatic view of a single unit embodying the principle of the invention, and Fig. 2 is a similar view of a series of connected units under a somewhat different arrangement.

Referring now more particularly to the apparatus shown in Fig. 1, 1 is the still body suitably supported to receive externally applied heat, and adapted to contain a heating agent 2, which may be of any suitable material, and 3 is a retort arranged in the still body, with its open inner end immersed in the heating agent 2, and supplied

with the fluid to be distilled through the feed pipe 4, and having a vapor outlet pipe 5 which opens into a condenser 6 heated to the desired degree and discharging its vapor through the pipe 7 into an unheated condenser 8 which in turn opens into a receiver 9 from which the oil may be drawn through any suitable outlet as valve 10. This receiver may be provided with a vent 11. The condensation products collecting in the condenser are discharged through pipe 12 into a receiver 13 and such products may be removed from that receiver through the discharge valve 14 for such use or such further treatment as may be desired. The condenser and its receiver 13 may be connected by an equalizer pipe 15. The condenser 6 may be any of the common and well known condensers in which the condensate moves in a direction opposite to the vapor and may be returned to the still or conveyed to another vaporizer or to another vessel for further treatment.

Such portions of the heavier fluid under treatment as escape through the open end of the retort 3 into the heating agent 2, are vaporized, and this vapor escapes from the still body 1 through pipe 16 into a condenser 17 which also may be unheated, and this heavier condensation product is then discharged into the receiver 18 from which it may be withdrawn for use or further treatment through valve 19. This receiver likewise may have a vent 20. The still body preferably is provided with an overflow pipe 21 opening into a vessel 22 preferably surrounded by a water-cooler 23 and having an automatic or other discharge 24. The upper end of the overflow vessel 22 is connected with the vapor chamber of the still body by means of an equalizer pipe 25.

While the invention is not limited to the treatment of any particular substance, still for a concrete example, the operation of the apparatus will be described in connection with the distillation of petroleum. In that case the heating agent 2 may be the tarry residue of distillation, kept at a relatively high heat, as already suggested, and the petroleum to be distilled is fed into the retort 3 through the feed pipe 4, and as it is exposed to the heat in the still body, the vapor of light oils escapes through the pipe 5 into the condenser 6, which may be kept at any desired temperature, where the vapor

of the heavier oil condenses while the vapor of the lighter oils passes into a condenser 8 of lower temperature and thence is discharged into the receiver 9. The heavier products of condensation pass from the condenser 6 through pipe 12 into the receiver 13. The vapor of the heaviest products which collects in the vapor chamber in the still body itself above the heating agent 2, escapes through pipe 16 into the condenser 17 and thence is collected in the receiver 18. The condensers 6 and 17 and receivers 13 and 18 may be located sufficiently high to permit the products of condensation to be returned by gravity to the retort; or the heavier condensates may be forced by pump or other suitable means back into the retort of this same unit or to another unit to be further treated.

Units in any number, depending upon the desired fractionation of the article under treatment, may be assembled in a variety of ways, and capable of differential control to meet the requirements of the operator, and as one such illustration, reference is made to the assembly shown in Fig. 2, wherein there are three retorts shown as connected for continuous operation and for the separation of at least three bodies of different specific gravities. In this case the still body may be made up of a series of connected vessels 26 of suitable shape and material, jointed together at 27. That is to say, the still body in this instance may be composed of a series of sections suitably connected and of suitable shape and adapted to receive the several retorts 28, 29 and 30 of like construction essentially and similar in construction to the retort 3 previously described. If it be desired to segregate the several retorts, bridge plates 31 may be interposed in the joints of the sections with their lower ends sealed in the heating agent, and in this case each section will be provided with a vapor outlet 32 and these several vapor outlets may open into a common pipe 33 leading to a condenser 34 which in turn opens into a receiver 35. Each retort has its own vapor outlet 36, 37 and 38, which respectively open into condensers 39, 40 and 41 of similar type to the condenser 6, Fig. 1, and these condensers may be maintained at different temperatures. These several condensers may discharge their vapor into a common pipe 42 which in turn discharges into a condenser 43, and the products of condensation from this condenser may be discharged into a receiver 44 which is connected with the condenser 43 by an equalizer pipe 45 and has a valvular discharge outlet 46 and a vent 47 and a pressure gage 48. In this arrangement the products of condensation of the condenser 39 escape through pipe 49 into retort 29 in which they are volatilized, and the products of condensa-

tion from condenser 40 escape through pipe 50 into retort 30, and the products of condensation from condenser 41 are conducted through pipe 51 to any suitable receiver for further treatment. In this case the overflow vessel 52, corresponding to the overflow vessel 22 of Fig. 1, is arranged at the end section containing the retort 30 and similarly connected therewith. A valvular connection 53 between the still body and the overflow tank may be provided for use in removing the heating agent from the still body.

As will be understood, the fluid to be treated is introduced through pipe 54 into the retort 28 and the lighter vapor escapes into the condenser 39 and is condensed therein at a given or desired temperature, while the products of condensation pass thence into the retort 29 from which the lighter vapors escape into the condenser 40, and the products of condensation are discharged thence through pipe 50 into retort 30 from which again the vapors are discharged into the condenser 41. If the several condensers 39, 40 and 41 are maintained at different temperatures, then each will have its own separate receiver and condenser, or if these several condensers are connected in series, as shown in Fig. 2, then they will discharge their vapor into a common condenser 43.

During the operation of the apparatus, the residual tar or residue as it accumulates in the retorts passes thence by gravity into the body of the heating agent, and any unvolatilized remainder passes thence to the overflow tank 52, and is removed therefrom as may be desired.

The operation may be conducted under atmospheric or higher or lower pressure as may be required.

While I have described here the use of my invention in connection with the treatment of petroleum, I wish it to be understood that the invention is not to be limited to this particular substance, but can be applied in every instance where volatile substances are to be separated and recovered, and more particularly it is applicable to the distillation of coal tar products, turpentine, glycerin and the like.

The heating agent or medium also is not limited to the residual product of the substance subjected to distillation, but may be any other organic or inorganic substance which will not volatilize at the temperature required to carry out the process, and it may be of a nature to react, if desired, with the matter under treatment, so as to bring about chemical alteration of the volatile substances while at the same time serving as a heating medium.

As already sufficiently indicated, the invention is not limited to the details of con-

struction of the apparatus, since these may be varied so long as they embody the principle of the invention as herein claimed.

What I claim is:—

5 1. In distilling volatile substances by means of a retort contained within a distilling vessel, the method of separating lighter from heavier constituents of volatile substances by exposing the substance to be distilled in the retort to an extraneous heating agent of higher boiling point to effect therein volatilization, and conducting the vapor from the retort to a suitable condenser, allowing the residue to accumulate in and
10 pass through the bottom of the retort into the body of the still, thence conducting the vapors of higher boiling point generated therein to another condenser, and utilizing the residue as a heating medium for the
15 retort.

2. The method of obtaining and separating lighter from heavier constituents of volatile substances, consisting in charging the substance into a retort which is immersed in
20 a heating medium contained in a still body and of higher boiling point, exposing the retort and its contents to the temperature necessary to effect volatilization, conducting the vapors from the retort to a suitable condenser, and allowing the residue of higher
25 boiling point in the retort to pass into the still body, and using such residue for the heating medium of the retort while conducting the vapor generated within the still body
30 to another condenser.

3. The method of separating lighter from heavier constituents of volatile substances, consisting in exposing the substance to the temperature necessary to effect volatilization
35 of the desired products in a retort arranged within a distilling vessel and having an outlet submerged in a heating agent contained in the body of the distilling vessel, said heating agent having a higher boiling point than
40 the desired products and being maintained at the proper temperature to effect their volatilization, and by the addition of fresh volatile substance into the retort displacing the non-volatilized residue from the retort into
45 the heating agent, conducting the vapor escaping from the retort to one condenser and the vapor generated in the body of the distilling vessel to another condenser, and finally collecting the different products of
50 condensation.

4. In distilling hydrocarbons by means of a retort exposed to a volatilizing heat within the body of a still and having one end opening into said body and immersed in a
55 fluid heating agent of higher boiling point contained therein, the method of separating the lighter from the heavier constituents, which consists in charging the retort with the hydrocarbon, conducting the resulting
60 vapor from the retort to a condenser, allow-

ing the residue to pass from the retort into the heating agent and therein exposing it to volatilization, and conducting the vapor thus last generated to another condenser.

5. The method of separating lighter from
65 heavier constituents of a volatile substance by exposing the substance in a retort to the temperature necessary to effect therein volatilization, said retort having an open end submerged in a heating agent contained in
70 the body of a still and having a higher boiling point than the desired products, conducting the resulting vapor from the retort to a condenser kept at a desired temperature, conveying the condensate to another
75 similar retort and repeating this operation until the desired fractionation is obtained, and at the same time conveying away and condensing the vapors escaping from the condensers and the vapor generated in the
80 body of the still from the residue of the several retorts.

6. The method of distilling hydrocarbons, consisting in exposing the substance to the required temperature in a retort arranged in the body of a still and having an open end submerged in a heating agent composed of a heavy hydrocarbon contained in the still, maintaining such heating agent at a temperature sufficient to volatilize the
85 desired constituents of the hydrocarbons, conducting the resulting vapor from the retort to a condenser at a desired temperature, and conducting the condensate to another similar retort, the residue from the retort passing into the heating agent, and any vapors there generated being conducted from the still body to a condenser, and repeating the operation until the desired fractionation is
90 effected.

7. The method of distilling petroleum by exposing the petroleum in a retort to a temperature necessary to effect therein volatilization, said retort having an open end submerged in a heating agent contained in the
95 body of a still and having a higher boiling point than the desired products, conducting the resulting vapor to a condenser, and subjecting the condensate to further distillation.

8. The method of distilling petroleum by exposing the petroleum in a retort to a temperature necessary to effect therein volatilization, said retort having an open end submerged in a heating agent contained in the
100 body of a still and having a higher boiling point than the desired products, conducting the resulting vapor to a condenser, subjecting the condensate to further distillation, and discharging the residue from the retort into the heating agent and recovering therefrom the vapors generated in the still body by suitable condensation.

9. The method of distilling petroleum, consisting in exposing the petroleum in a
105 110 115 120 125 130

series of retorts which are mounted to extend within the body of a distilling vessel, to the action of a fluid heating agent in said distilling vessel, and discharging the vapor into condensers and the residue into the body of the distilling vessel wherein it becomes the heating agent of all the retorts when heat is applied to the distilling vessel.

10. The method of distilling petroleum, which consists in exposing the petroleum contained in a series of retorts successively to the action of a fluid heating agent in the body of a still, said retorts having open ends submerged in such heating agent which latter has a higher boiling point than the desired products, said retorts discharging their vapor into condensers successively, and maintaining the temperature of the several condensers at the requisite degree to obtain distillates of desired gravity and boiling point.

11. Distilling apparatus of the character described, comprising essentially a still body containing a fluid heating agent, a retort within the still body and dipping into the heating agent, a condenser connected with the retort, means to recover the condensate and means for returning the condensate to the heating agent.

12. Distilling apparatus of the character

described, comprising a retort, a still body containing a fluid heating agent in which the retort is exposed, means to charge the retort independently of the still body, a vapor outlet for the retort, a residue outlet for the retort opening into the heating agent and immersed therein, means to conduct away any vapor from the still body, and separate condensers connected respectively with the vapor outlet of the retort and vapor outlet of the still body.

13. Distilling apparatus of the character described, comprising a still body containing a fluid heating agent, retorts arranged in the still body and adapted to receive the substance to be distilled, each retort having a vapor outlet and an outlet opening into and immersed in the heating agent and adapted to discharge the residue into the still body, and a condenser for each of the retorts adapted to convey its condensate to one or another of the retorts for further distillation.

In testimony whereof I have hereunto set my hand this 12th day of January A. D. 1917.

HANS A. FRASCH.

Witnesses:

WM. H. FINCKEL,
W. H. FINCKEL, JR.