

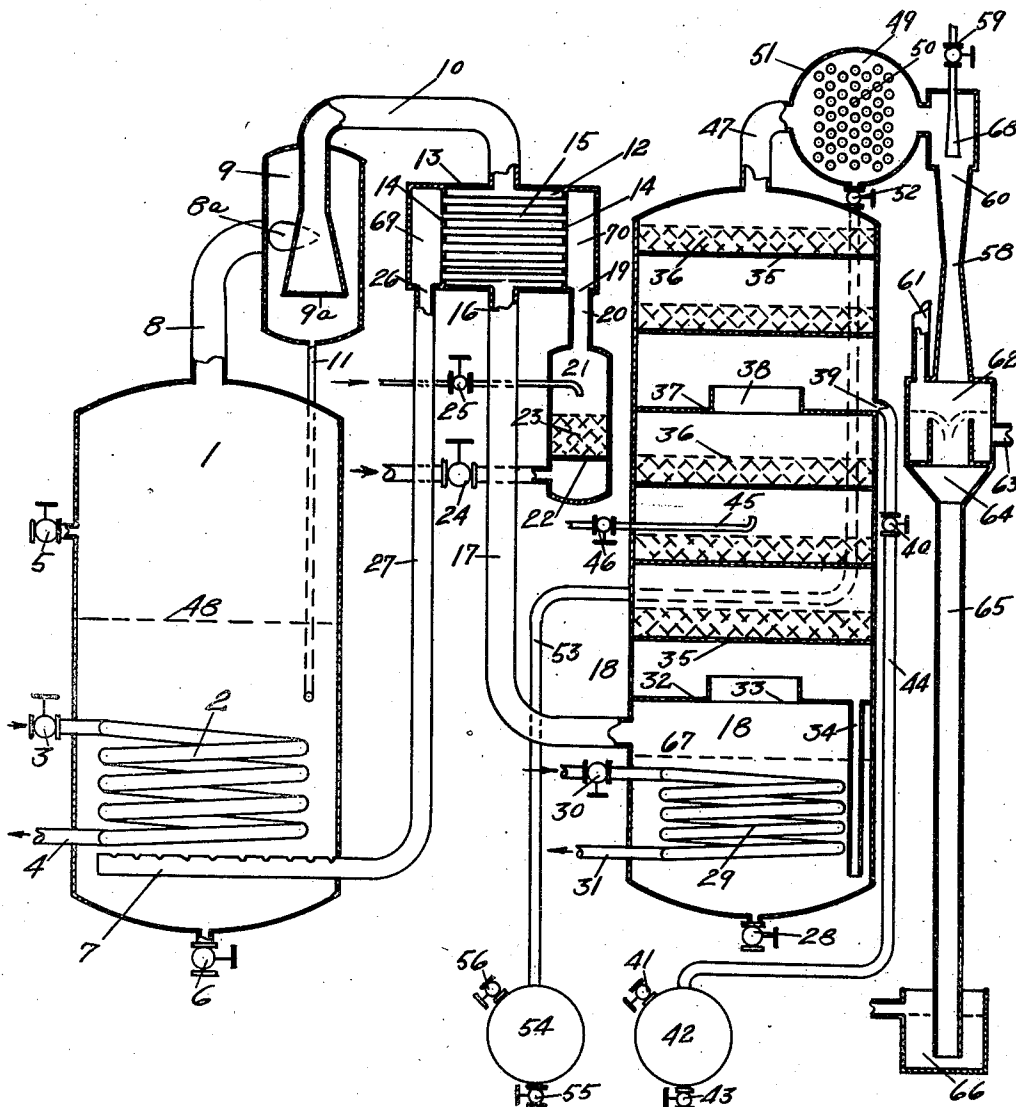
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DISTILLATION APPARATUS

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DISTILLATION APPARATUS

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4 Claims. (Cl. 202—153)

This invention relates to improvements in distillation apparatus particularly adapted, though not necessarily limited in its use, for the distillation of glycerine, fatty acids, and the like, and one of the objects of the same is to provide an improved apparatus of this character in which there is provided a heat interchanger for causing partial condensation of the vapors leaving the still, the latent heat of such condensation being transferred into steam or fluid injected into the still to assist the vaporization of the liquid being distilled.

A further object is to provide in an apparatus of this character a reflux column for the separation of the vapors, and which column is provided with means for regulating the temperature of the column, a condenser with which the column is connected to effect complete or partial condensation of the vapors leaving the column, and a steam ejector for maintaining a high vacuum in the entire system.

To the attainment of these ends and the accomplishment of other new and useful objects as will appear, the invention consists in the features of novelty in substantially the construction, combination and arrangement of the several parts hereinafter more fully described and claimed and shown in the accompanying drawing illustrating this invention, and in which

The figure is a diagrammatic cross-sectional view of an apparatus of this character constructed in accordance with the principles of this invention.

Referring more particularly to the drawing, the numeral 1 designates generally a still of any suitable material, fitted with a heating coil 2 into which latter steam, or a heating fluid, may be admitted through a valve 3 and discharged through an outlet 4.

The still is provided with a filling valve 5 and a discharge valve 6 for removing the residue of the distillation, and is also provided with a perforated pipe 7 or a number of perforated pipes therein and near the bottom thereof, for the purpose of admitting steam directly into the material to be distilled.

The top of the still is fitted with a vapor outlet 8 which has communication with and extends to a separator 9. The separator preferably consists of a shell with a tangential inlet opening 8^a through which the vapors from the still 1 are admitted.

Extending into the separator is an outlet pipe 10 which is preferably flared out at the lower end, and is covered at the lower end with a fine mesh screen or perforated metal disc 9^a.

A drain pipe 11 leads from the bottom of the separator 9 to the still 1 and enters the still, terminating at a point below the normal liquid level 48 in the still.

The outlet pipe 10 which leads from the top of the separator communicates with a heat interchanger 12, preferably of a tubular type, consisting of a casing 13 provided with tube sheets 14, into which latter are extended the ends of the tubes 15. The ends of these tubes open into two end compartments 69—70 arranged in the heat interchanger so that steam admitted through the opening 19 into the compartment 70 will flow through the tubes 14 into the other compartment 69 and will pass out through an opening 26.

The bottom of the casing 13 is provided with a vapor outlet 16 which is connected to a reflux column 18 by means of a pipe 17. The outlet 19 is connected to a desuperheater 21 by means of a pipe 20. The opening 26 of the heat interchanger 12 is provided with a pipe 27 leading therefrom and communicating with the perforated pipe 7 in the still.

The desuperheater 21 preferably consists of a closed tank with a perforated metal plate 22, upon which latter is preferably placed suitable packing material 23, to constitute extended surfaces for the deposit of condensation and between which material the vapors and gases pass without excessive resistance. Steam enters the desuperheater through an inlet valve 24 and water enters through a valve 25.

The column 18 is provided with a discharge valve 28 to remove the finished product, and a heating coil 29 to which steam, or a heating fluid, may be admitted through a valve 30 and discharged through an outlet 31.

The lower column tray 32 has in its center a vapor opening 33 provided with an encompassing vertical rim or flange, and with a drain pipe 34, which latter extends toward and terminates adjacent the bottom of the column. Perforated plates 35 are provided and thereupon is placed suitable packing material 36, between which the vapors may pass. A column tray 37 is provided with a vapor opening 38 encompassed by a vertical rim, and the column itself has adjacent the tray an opening 39 to which is connected a pipe 44 which has communication with a closed tank 42. The pipe 44 is preferably provided with a valve 40, the opening of which valve allows the liquid in the tray to drain into the tank 42. The liquid is removed from the tank 42 by means of a drain valve 43, and

a vacuum breaking valve 41. The numeral 45 represents a pipe for supplying water or any other liquid to the column, the supply of which is controlled by means of a valve 46.

5 In order to obtain a good distribution of this water over the entire cross section of the column, the end of the pipe 45 is preferably fitted with a spray nozzle of any suitable construction.

Leading from the column 18 is a vapor outlet 10 which has communication with a condenser 49, by means of a pipe 47. The condenser 49 is preferably of a tubular type consisting of a casing 51 provided with tube sheets through which are extended the ends of the tube 50, and through 15 which latter the cooling medium flows, the vapors to be condensed passing around the outside thereof. The condenser is provided with a discharge valve 52 connected to a pipe 53, which latter communicates with and extends to a closed tank 54. The opening of the valve 52 allows condensates from the condenser 49 to flow into the tank 54 and are removed from the latter by means of a valve 55, and a vacuum breaker valve 56 may be provided.

25 The condenser 49 is connected to an ejector 60, preferably of the jet type, consisting of a throat member 58 and a steam nozzle 68, the flow of steam to the latter being controlled by a valve 59.

30 The discharge end of the ejector is connected to a condenser 64 preferably of the barometric type, consisting of a condensing chamber 62 and a barometric leg 65, terminating in a hot well 66. The condenser 64 is provided with a water supply pipe 63, and an outlet 61 leading from the condensing chamber and through which outlet pipe air or other non-condensable gases may be removed by means of a vacuum pump (not shown) or any other suitable means.

40 A description of the operation of the apparatus will be given in the distillation of glycerine, but it is to be understood that it is not desired to be limited to this particular product, as other products may be distilled in the apparatus with equal efficiency.

45 The still 1 is filled to a level approximately indicated at 48, with crude glycerine, and steam is admitted to the coil 2. The steam ejector 60 is then set into operation, and the whole system is exhausted thereby to a vacuum of at least twenty-nine inches of mercury.

50 The steam valve 24 is gradually opened to admit steam into the desuperheater 21. Water is then admitted through the spray pipe by means of the valve 25, until the temperature of the steam leaving the desuperheater is that corresponding to a vacuum of about twenty to twenty-five inches of mercury. Water will be evaporated or flashed into steam and this will withdraw enough heat from the live steam to reduce its temperature. The desuperheated steam flows through the tubes of the heat interchanger 12 and finally through the glycerine in the still by means of the pipes 27—7. The mixture of hot glycerine vapor and steam will pass up through the outlet pipe 8 and into the separator 9. Any entrained liquids in the separator will be thrown or forced into the bottom of the separator and will drain or flow back into the still 1 through 65 the pipe 11, and the vapors will proceed through the pipe 10 to the heat interchanger 12.

70 Due to the large difference in the boiling points of water and glycerine, some of the glycerine vapors will be condensed in the heat interchanger 12, and will flow in the form of a liquid,

to the bottom of the column through the pipe 17, together with the remaining vapors now containing a higher percentage of steam. By maintaining the proper temperature in the steam flowing through the tubes of the heat interchanger, the glycerine condensed at this point will be of high gravity and high purity.

At the same time the latent heat of condensation of the glycerine condensed in the heat interchanger 12 will be transferred to the desuperheated steam flowing through the tubes 15, resulting in the superheating of the steam leaving the heat interchanger and entering the glycerine in the still 1 through the pipes 27 and perforated pipe 7.

15 The uncondensed glycerine vapors and steam pass up through the reflux column 18 through the perforated plates 37—35 and pervious packing material thereupon. Due to the reflux action of the plates and the pervious packing material each plate will accumulate a mixture of glycerine and water, and the concentration of the glycerine in this mixture will vary on the different plates, being high on the lower plates and low on the upper plates, in fact if temperature and vacuum conditions are properly controlled the upper plates will contain practically pure water.

20 Due to condensation of glycerine on the plates 35—37, and on the pervious material, heat will be liberated, and unless this liberated heat is controlled, the temperature of the vapors and liquid in the column will rise, allowing glycerine vapors to reach the top of the column. To prevent this, water is injected into the column by means of the spray pipe 45, and which injected water, upon flashing into steam, will absorb heat and tend to cool the vapors passing to the upper plates.

25 Vapor composition curves of glycerine and water mixtures boiling under a high vacuum show the glycerine content of these vapors to be practically zero at a temperature of about 30° C. The introduction of water from the spray and its evaporation will tend to establish this condition on the upper plates and prevent loss of glycerine from the top of the column.

30 The water vapors and non-condensable gases leaving the column 18 pass through the tubular condenser 49 where some of the water may be condensed, depending on the temperature of the cooling medium.

35 The remaining water vapor and non-condensable gases will be removed by the ejector 60 to the condenser 62 in which latter the water vapors and the steam admitted to the ejector will be condensed, and from which, the non-condensable gases are removed through the pipe 61 by means of ejectors or vacuum pumps (not shown).

40 The liquid dripping from the bottom plate 35 on to the tray 32 will be rich in glycerine and will flow to the bottom section of the column through the pipe 34. Steam is admitted to the coil 29, and the concentrated glycerine from the column and the interchanger is heated to boil off the remaining water until proper concentration is reached. Any low boiling fractions will gradually collect on the tray 37, and will, from time to time, be drained to the tank 42 by means of the pipe 44.

45 While the preferred method and apparatus for carrying this invention into operation have been herein described, it is to be understood that various changes may be made in the apparatus and in the steps of the method of process, within the

scope of the claims, without departing from the spirit of this invention.

What is claimed as new is:—

1. A distilling apparatus embodying a still, 5
a separator for receiving and separating from the vapors from the still foreign particles and entrained liquid in the vapors, a heat inter-
changer with which the separator is connected, means for circulating a cooling fluid through
10 the heat interchanger out of commingling relation with the vapors therein, the temperature of the cooling fluid being raised thereby, means for discharging the heated cooling fluid into the still, a reflux column, means for discharging the condensed and uncondensed vapors from the heat
15 interchanger into the said reflux column, and means for discharging a cooling liquid into the said reflux column in commingling relation with the fluid therein to extract the remaining degree
20 of heat by reducing the temperature caused by the condensation of the vapors.

2. A distilling apparatus embodying a still, a separator for receiving and separating from the vapors from the still foreign particles and entrained liquids in the vapors, a heat inter-
25 changer with which the separator is connected, means for circulating a cooling fluid through the heat interchanger out of commingling relation with the vapors therein, the temperature of the cooling fluid being raised thereby, means for dis-
30 charging the heated cooling fluid into the still, a reflux column, means for discharging the condensed and uncondensed vapors from the heat interchanger into the said reflux column, means
35 for discharging a cooling liquid into the said reflux column in commingling relation with the fluid therein to extract remaining degree of heat by reducing the temperature caused by the con-
40 densation of the vapors, a condenser, means for passing vapors from the top of the reflux column into the condenser, and means for drawing any remaining vapors from said condenser.

3. A distilling apparatus embodying a still, a separator for receiving vapors from the still and for separating foreign particles and entrained liquid therefrom, a heat interchanger for receiv-
5 ing vapors from the separator, a reflux column for receiving condensed and uncondensed vapors from the heat interchanger, said heat inter-
changer embodying spaced chambers, passages forming communication between said chambers and constituting condensation surfaces, means
10 forming communication between one of said chambers and said still, an additional chamber communicating with the other chamber in the heat interchanger, means for admitting liquid into the said additional chamber, and means for
15 admitting a heating medium into the said additional chamber to flash the last said liquid into steam to be circulated through said heat inter-
changer and into the still.

4. A distilling apparatus embodying a still, a 20
separator for receiving vapors from the still and for separating foreign particles and entrained liquid therefrom, a heat interchanger for receiv-
ing vapors from the separator, a reflux column for receiving condensed and uncondensed vapors
25 from the heat interchanger, said heat interchanger embodying spaced chambers, passages forming communication between said chambers and constituting condensation surfaces, means
30 forming communication between one of said chambers and said still, an additional chamber communicating with the other chamber in the heat interchanger, means for admitting liquid into the said additional chamber, means for ad-
35 mitting a heating medium into the said additional chamber to flash the last said liquid into steam to be circulated through said heat inter-
changer and into the still, and means individual to the last said liquid supplying means and the
40 said heating medium for controlling them.

WILLIAM SIECK, JR.

CERTIFICATE OF CORRECTION.

Patent No. 1,986,165.

January 1, 1935.

WILLIAM SIECK, JR.

It is hereby certified that the name of the assignee in the above numbered patent was erroneously written and printed as "William Garrique & Company, Inc." whereas said name should have been written and printed as William Garrigue & Company, Inc. as shown by the records of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of February, A. D. 1935.

(Seal)

Leslie Frazer
Acting Commissioner of Patents.