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DISTILLATION APPARATUS

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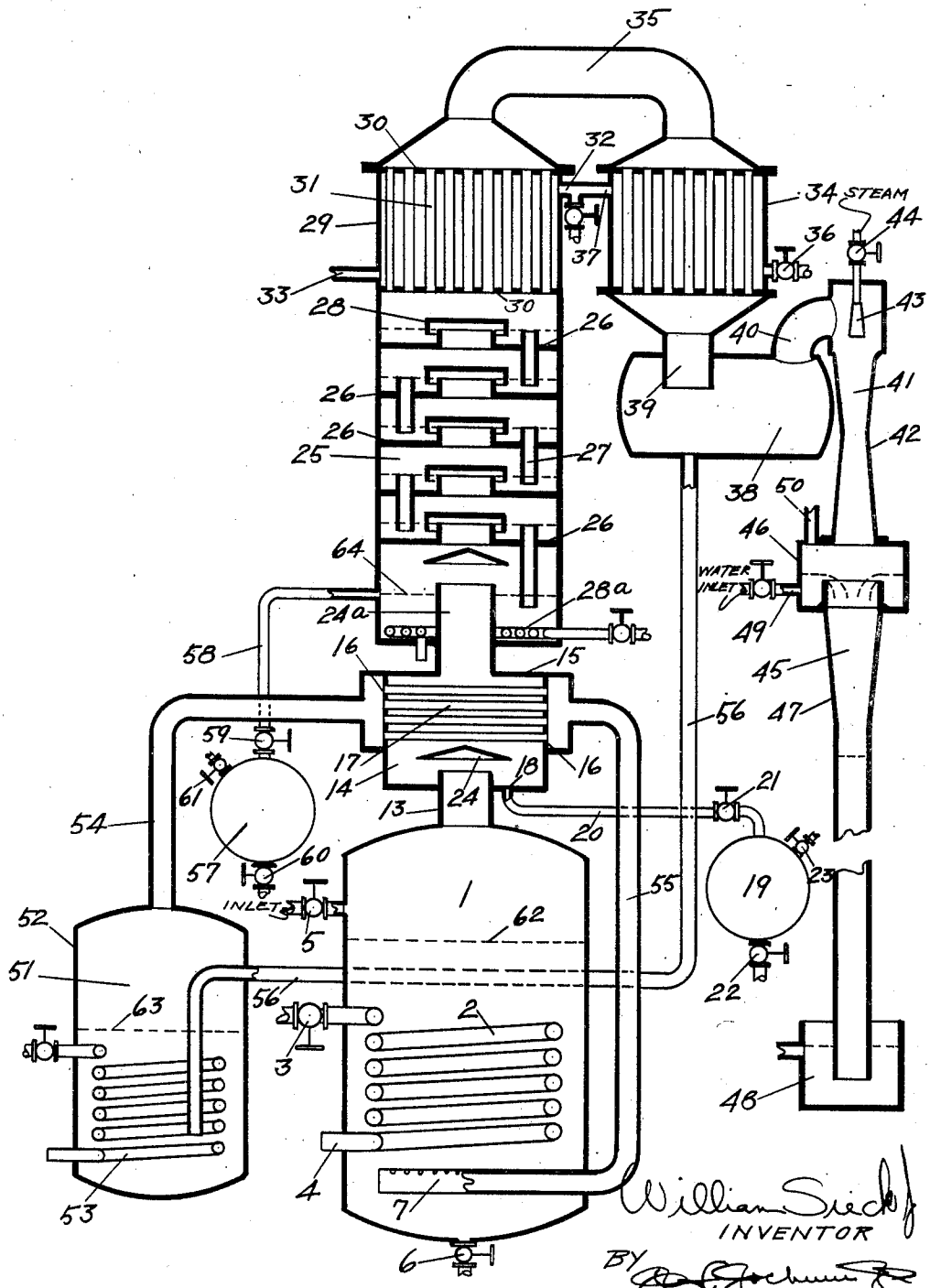

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UNITED STATES PATENT OFFICE

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DISTILLATION APPARATUS

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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 a partial condensation of the vapors leaving the still, the latent heat of such condensation being transferred into the steam or fluid injected into the still to effect such condensation.

A further object is to provide in an apparatus of this character a reflux column for the vapors, provided with a heating coil for effecting a partial condensation of the vapors leaving the column and condensers with which the column is connected to effect a complete condensation of the vapors, a steam ejector being provided for maintaining a high vacuum in the 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 section 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 to which latter steam or other 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 perforate pipe 7 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 provided with a vapor outlet 13 which has communication with and extends into a heat interchanger 14 preferably of a tubular type, consisting of a casing 15 provided with tube sheets 16, into which latter are extended the ends of tubes 17.

The bottom of the casing 15 is provided with an outlet 18 which is connected to a tank 19 by means of a pipe 20 provided with a valve 21. The tank 19 is provided with a drain valve 22 and a vacuum breaker valve 23.

To prevent condensates from falling back into the still 1, a deflector plate 24 is provided which extends over and is spaced from the vapor pipe 13. The top of the heat interchanger 14 is provided with a vapor pipe 24^a which communicates with and extends into a reflux column 25, the latter being provided with plates or partitions 26, overflow pipes 27 and bubbler caps 28, and the reflux column 25 is provided with a heating coil 28^a.

The top of the reflux column is provided with a tubular condenser 29 preferably of the type embodying tube sheets 30 into which are extended tubes 31. A pipe 32 is provided for supplying a cooling medium to the condenser, and an outlet 33 leads from the condenser for removing the cooling medium. The condenser 29 is connected to a second tubular condenser 34, preferably of a construction similar to the condenser 29, by means of a pipe 35. The condenser 34 is provided with an inlet 36 for the cooling medium and an outlet 37 is provided in the condenser 29 for the cooling medium, and to which outlet the pipe 32 is connected. The bottom of the condenser 34 is connected to a receiver tank 38 by means of a pipe 39. The top of the receiver tank 38 is connected by means of a pipe 40 to an ejector 41 preferably of the jet type, consisting of a throat member 42 and a steam nozzle 43, the flow of steam to the latter being controlled by a valve 44.

The discharge end of the ejector 41 is connected to a condenser 45, preferably of the barometric type, consisting of a condensing chamber 46, and a barometric leg 47 terminating in a hot well 48. The condenser 45 is provided with a water supply pipe 49, and an outlet 50 in the condensing chamber, through which latter air or other non-con-

densable gases may be removed by means of a vacuum pump or other suitable means.

A suitable evaporator 51 is provided preferably of the type embodying a shell 52 of any suitable material and arranged therein is a heating coil 53. The evaporator 51 is connected with the interior of the tubes 17 of the heat interchanger 14 by means of a pipe 54. The other end of the tubes of the heat interchanger are connected to the perforated pipe 7 by means of a pipe 55.

The evaporator 51 is connected to the bottom of the receiver tank 38 by means of a pipe 56. The reflux column 25 is connected to a receiver tank 57 by means of a pipe 58 provided with a valve 59, and the receiver tank 57 is provided with a draw off valve 60, and a vacuum breaker valve 61.

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.

For the distillation of glycerine, the still 1 is filled to a level approximately indicated at 62, with crude glycerine, and steam is admitted into the coil 2. The steam ejector 41 is then set into operation and the whole system is exhausted thereby to a vacuum of at least twenty-nine inches of mercury. The evaporator 51 is filled with water to a level as indicated at 63, and steam is turned into the coil 53 causing the water in the evaporator 51 to boil. Steam from the boiling water will flow through the pipe 54, heat interchanger tubes 17, pipe 55, and finally through the crude glycerine in the still 1, by means of the pipe 7. The mixture of glycerine vapor, and steam will pass up through the outlet pipe 13 into the heat interchanger 14. Due to the difference in boiling points of the water and glycerine, a large portion of the glycerine vapor will be condensed in the heat interchanger and will flow into the receiver 19 by means of the pipe 20. At the same time the latent heat of condensation of the glycerine condensed in the heat interchanger 14 will be transferred to the steam flowing through the tubes 17, resulting in the superheating of the steam that is leaving the heater interchanger through the pipe 55. The mixture of glycerine vapor and steam, now containing a considerably lowered percentage of glycerine content will pass from the heat interchanger 14 into the reflux column 25 through the pipe 24a. At the same time cooling water will be admitted at 36 to the container 34 and the flow so regulated that the water flowing into the condenser 29 is of such a temperature that any glycerine vapors which may reach the top of the reflux column 25 will be condensed, and at the same time is of a high enough temperature to allow steam to flow through the condenser 24 without condensing. The action of the reflux column 25 together with the heating coil 28, is to produce different concentrations of glycerine varying from low concentration at the top plate or partition 26 to practically 100% concentration in the bottom of the column. When the concentrated glycerine in the bottom of the reflux column 25 reaches a level as indicated at 64, it will flow into the receiver tank 57, through the pipe 58. The water vapor passing through the condenser 29 will be entirely condensed in the condenser 34. The condensates collect in the receiver 38 and will flow back into the evaporator 51 through the pipe 56. Non-condensable gases collecting in the receiver 38 will be removed by the ejector 41 to the condenser 45, in which latter the steam admitted to the ejector will be condensed and from which the non-condensable gases are removed through the pipe 50.

While the preferred form of the invention has been herein shown and described, it is to be understood that various changes may be made in the details of construction and in the combination and arrangement of the several parts, 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, an evaporator for heating fluid, means for vaporizing and heating fluid from the evaporator and ejecting said heating fluid into the lower part of the still, means connected with the still for receiving and partially condensing the vapors leaving the still, the said means operating to transfer latent heat of such condensation to the said heating fluid which is injected into the still, a reflux column connected with the first said means, a condenser connected with the reflux column, and means for returning the condensates from the last said condenser to said evaporator.

2. A distilling apparatus embodying a still, an evaporator for heating fluid, means for vaporizing and heating fluid from the evaporator and ejecting said heating fluid into the lower part of the still, means connected with the still for receiving and partially condensing the vapors leaving the still, the said means operating to transfer latent heat of such condensation to the said heating fluid which is injected into the still, a reflux column connected with the first said means, a condenser connected with the reflux column, means for returning the condensates from the last said condenser to said evaporator, and means for maintaining a high vacuum within the system.

3. A distilling apparatus embodying a still, an evaporator for heating fluid, means for vaporizing and heating fluid from the evaporator and ejecting said heating fluid, into

the lower part of the still, a heat interchanger connected to the still to cause partial condensation of the vapors leaving the still and to transfer the latent heat of such condensation to the steam or fluid injected into the still, a reflux column connected with said heat interchanger, a condenser connected with the reflux column to cause a partial condensation of the vapors leaving the reflux column, a second condenser to cause a complete condensation of the vapors from the last said condenser, and means for returning the final condensates to the evaporator.

4. A distilling apparatus embodying a still, an evaporator for heating fluid, means for vaporizing and heating fluid from the evaporator and ejecting said heating fluid into the lower part of the still, a heat interchanger connected to the still to cause partial condensation of the vapors leaving the still and to transfer the latent heat of such condensation to the steam or fluid injected into the still, a reflux column connected with said heat interchanger, a condenser connected with the reflux column to cause a partial condensation of the vapors leaving the reflux column, a second condenser to cause a complete condensation of the vapors from the last said condenser, means for returning the final condensates to the evaporator, and means for maintaining a high vacuum in the system.

In testimony whereof I have signed my name to this specification, on this 27th day of December, A. D. 1929.

WILLIAM SIECK, JR.