

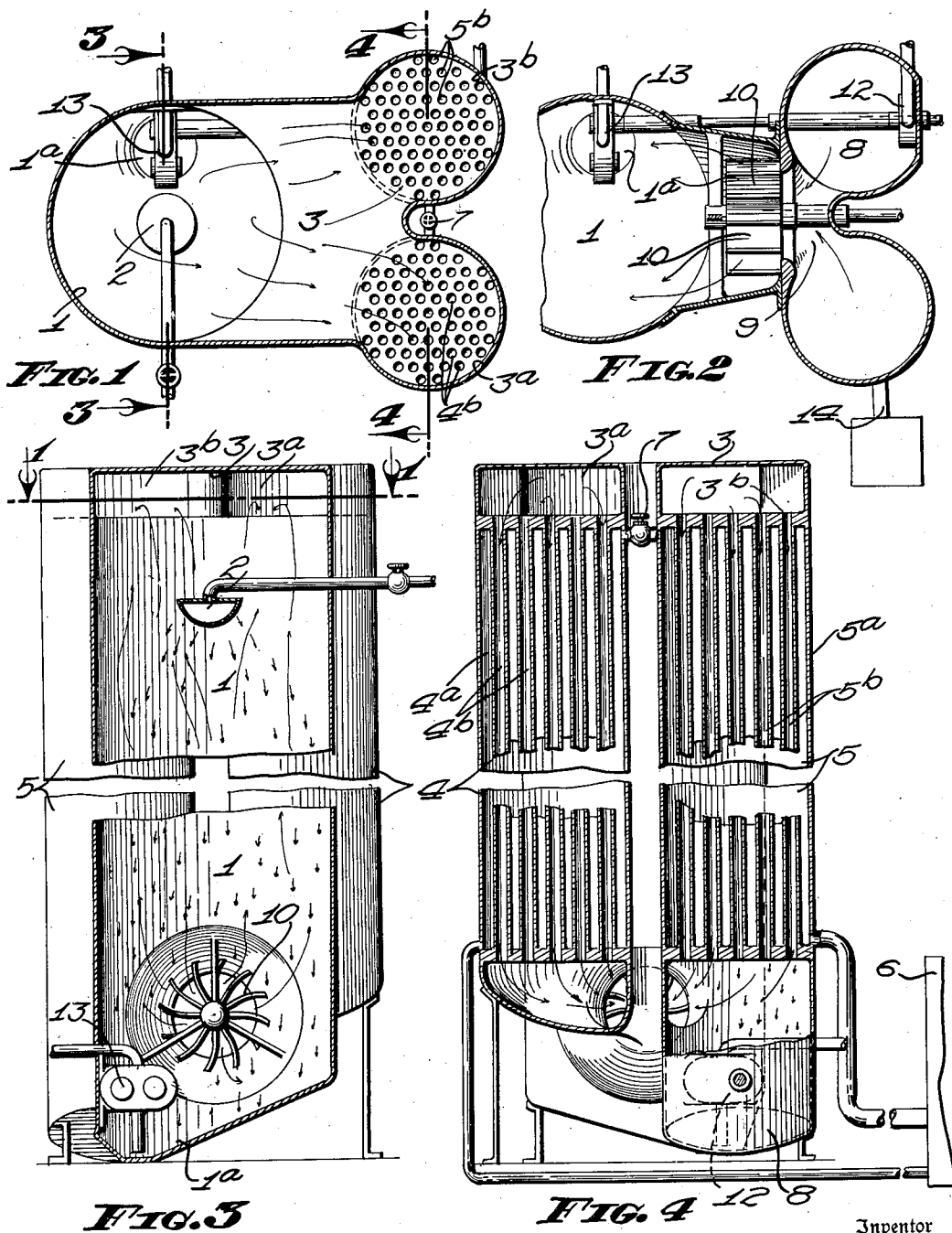
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DISTILLING AND CONDENSING APPARATUS

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DISTILLING AND CONDENSING APPARATUS

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12 Claims. (Cl. 202—236)

My invention relates to distilling and condensing apparatus, and the objects of my invention are:

First, to provide an apparatus of this class which may be used to extract water from liquids, such as milk, fruit juices, vegetable juices, beef juices, etc., and to distil liquors, oils and other liquids;

Second, to provide an apparatus of this class in which the entire process takes place in a closed system free from air or other contamination and is continuous of operation;

Third, to provide an apparatus of this class which will distil liquids and condense parts of the same and which is operative over a wide range of temperature and capable of accurate control so as to prevent undesirable physical and chemical changes;

Fourth, to provide an apparatus of this class which is continuous in its operation and which incorporates a condensing chamber and a heating chamber arranged in parallel in the same circulatory system so that the vapor from the substance undergoing treatment is divided to pass through these means and reunited until the condensed or distilled products have been withdrawn, and

Fifth, to provide an apparatus of this class which is particularly efficient and economical of operation and which offers only a minimum cause of contamination and physical abuse of the product by foreign contact.

With these and other objects in view as will appear hereinafter, my invention consists of certain novel features of construction, combination and arrangement of parts and portions as will be hereinafter described in detail and particularly set forth in the appended claims, reference being had to the accompanying drawing and to the characters of reference thereon which form a part of this application, in which:

Figure 1 is a transverse sectional view of the apparatus taken through 1—1 of Fig. 3; Fig. 2 is another transverse sectional view thereof taken through 2—2 of Fig. 3; Fig. 3 is a longitudinal sectional view thereof through 3—3 of Fig. 1 with parts and portions in elevation, and Fig. 4 is a longitudinal sectional view through 4—4 of Fig. 1 with parts and portions shown in elevation.

Similar characters of reference refer to similar parts and portions throughout the several views of the drawing.

Chamber 1, spray means 2, head 3, heater 4, cooler 5, refrigerating unit 6, expansion valve 7,

collection sump 8, conduit 9, blower 10, pumps 12 and 13, and pipe 14, constitute the principal parts and portions of my novel distilling and condensing apparatus.

A mixing chamber 1 is provided which is in the form of an elongated upright cylinder of any desired length. At any suitable point the mixing chamber is intersected by a spray means 2 which extends therein to the central portion of the chamber and is directed downward. The spray means is provided with a plurality of small orifices from which the substance to undergo treatment is discharged at a mere nominal pressure. A head 3 is provided at the upper end of the mixing chamber which extends laterally therefrom forming two partially circular lobes 3a and 3b. The lobe 3a forms the head of a heater 4, while the lobe 3b forms the head of a cooler 5. The heater 4 comprises a cylindrical shell 4a extending downwardly from the lobe 3a in which are mounted a plurality of tubes 4b. The tubes are supported in an end plate 4c forming the bottom wall of the lobe 3a. The lower ends of the tubes pierce a bottom plate 4d so that the interior of the several tubes communicate with the head 3 but do not communicate with the remaining space formed within the shell 4a. The cooler 5 is constructed identically. That is, said cooler comprises an outer shell 5a, a series of tubes 5b, a head plate 5c, and a bottom plate 5d. The heater 4 is provided with an intake 4e leading from a compressor of a conventional refrigerating unit 6. Said intake communicates with the portion of the heater surrounding the tubes 4b. Near its upper end the heater is provided with an outlet which communicates with an expansion valve 7 which in turn communicates with the shell 5a of the cooler 5. Said cooler is provided with an outlet 5e which leads to the above-mentioned compressor. The heater and cooler form respectively the condenser and expansion chambers of a refrigerating system incorporating the refrigerating unit. That is, the heater functions to cool the compressed refrigerant transferring the heat to the vapor of the substance undergoing treatment and passing through the tubes 4b, while the cooled refrigerant absorbs heat from that portion of the vapor passing through the tubes 5b of the cooler 5.

The tubes 5b discharge into a collection sump 8. Said sump is intersected at a point well above its lower end by a conduit 9 which also connects with the lower end of the heater 4. The conduit leads therefrom to an intake of a blower 10 mounted below the mixing chamber 1, as shown 55

in Fig. 3. The blower 10 discharges into the mixing chamber thereby causing the vapor of the substance undergoing treatment to circulate and re-circulate upwardly through the mixing chamber and downwardly simultaneously through the heater and cooler.

The blower is driven by any suitable conventional means. In addition to the blower there is provided a pump 12 in the sump 8. Also, the bottom of the mixing chamber 1 forms a sump portion 1a in which is mounted a pump 13. These pumps may be in the form of gear pumps and are arranged to withdraw distilled vapors from the sump 8 and the condensed substance from the sump portion 1a.

If it is desired to operate the apparatus in such a manner that the substance undergoing treatment is subjected to a partial vacuum, at some point in the system a pipe 14 is provided which leads to a suitable vacuum pump designed to maintain the desired sub-normal pressure, or one or both of the pumps 12 or 13 may be utilized for this purpose.

Operation of my apparatus is essentially as follows: To begin operation the blower 10, pumps 12 and 13 and refrigerating unit 6 are started. The substance to be treated in a liquid form is brought to the desired temperature then introduced through the spray means 2 so as to fall gently in the mixing chamber 1. The rate at which the product is admitted is the controlling factor of the extent of distillation or condensation since the capacity of the heat transit or circulation will be constant for a given machine. That is, when the liquid is admitted relatively slowly the condensed product will be made more concentrated, and when the liquid is admitted relatively fast only the more highly volatile portions of the liquid will be distilled.

Whatever substance constitutes the gaseous content of the system flows upward through the chamber 1 by the action of the blower then divides and flows downward through the heater and the cooler and returns to the blower to again flow upward in the chamber 1. As the apparatus operates vapors from the liquid undergoing treatment are carried to the head 3 and divide as they flow down through the heater and cooler. The portion flowing through the cooler distills out in part and collects in the sump 8. The portion of vapor flowing down through the heater is raised in temperature. The remaining vapor from the cooler and the heated vapor from the heater mix in the conduit 9 and blower 10 so that the resulting vapor is capable of absorbing more moisture as it flows up through the chamber 1 and consequently draws off additional moisture from the liquid undergoing treatment. The condensed concentrated portion of the liquid is collected in the sump portion 1a and is withdrawn by the pump 13, while the more volatile distilled liquid collected in the sump 8 is withdrawn by the pump 12.

If it is desired to operate the apparatus with a partial vacuum within the same, the vacuum pump associated with the pipe 14 is set into operation along with the blower and pumps. The purpose of creating a partial vacuum is to permit ready vaporization or boiling of the substance undergoing treatment at the most suitable temperature, the greater the vacuum, the lower the temperature at which the substance may be introduced.

If desired the mixing chamber, heater and cooler, etc., may be encased in a suitable insulat-

ing cover, which has been omitted to simplify the illustration.

Though I have shown and described a particular construction, combination and arrangement of parts and portions, I do not wish to be limited to this particular construction, combination and arrangement, but desire to include in the scope of my invention the construction, combination and arrangement substantially as set forth in the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said mixing chamber at their upper and lower ends.

2. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said mixing chamber at their upper and lower ends, means for introducing substances in spray form for treatment into said mixing chamber, a first collection means associated with said mixing chamber at its lower end, and a second collection means associated with said cooling chamber.

3. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said mixing chamber at their upper and lower ends, and means for heating said heating chamber and cooling said cooling chamber.

4. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said mixing chamber at their upper and lower ends, a jacket for the heating chamber and cooling chamber, a conduit and expansion valve therein communicating between said jackets, and a refrigerant circulating means associated with said jackets whereby said jackets form condensing and expansion elements of a refrigeration system.

5. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said mixing chamber at their upper and lower ends, means for heating said heating chamber and cooling said cooling chamber, means for introducing substances for treatment into said mixing chamber, a first collection sump means in said mixing chamber at its lower end, and a second collection sump means in said cooling chamber.

6. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said mixing chamber at their upper and lower ends, a jacket for the heating chamber and cooling chamber, a conduit and expansion valve therein communicating between said jackets, and a refrigerant circulating means associated with said jackets whereby said jackets form condensing and expansion elements of a refrigeration system, means for introducing substances spray

form for treatment into said mixing chamber, a first collection sump means in said mixing chamber at its lower end, and a second collection sump means in said cooling chamber at its lower end.

5 7. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said
10 mixing chamber, a blower interposed between the receiving end of said mixing chamber and the outlet ends of the other chambers, whereby vapors of a substance undergoing treatment is divided to flow simultaneously through the heating and cooling chambers and re-mix upon entering
15 the mixing chamber.

8. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said
20 mixing chamber, a blower interposed between the receiving end of said mixing chamber and the outlet ends of the other chambers, whereby vapors of a substance undergoing treatment is divided to flow simultaneously through the heating and cooling chambers and re-mix upon entering the mixing chamber, and means for heating the heating chamber and cooling the cooling member.
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30 9. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said
35 mixing chamber, means for introducing substances spray form for treatment into said mixing chamber, a blower interposed between the receiving end of said mixing chamber and the outlet ends of the other chambers, whereby vapors of a substance undergoing treatment is divided to flow
40 simultaneously through the heating and cooling chambers and re-mix upon entering the mixing chamber, a first collection sump means in said mixing chamber at its lower end, and a second collection sump means in said cooling chamber
45 at its lower end.

10. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said
50 mixing chamber, means for introducing substances in spray form for treatment into said mixing chamber, a blower interposed between the

receiving end of said mixing chamber and the outlet ends of the other chambers, whereby vapors from a substance undergoing treatment is divided to flow simultaneously through the heating and cooling chambers and re-mix upon entering the
5 mixing chamber, a jacket for the heating chamber and for the cooling chamber, a conduit and expansion valve therein communicating between said jackets, and a refrigerant circulating means associated with said jacket whereby said jackets
10 form condenser and expansion elements of a refrigeration system, a first collection sump means in said mixing chamber at its lower end, and a second collection sump means in said cooling chamber at its lower end.
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11. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said mixing
20 chamber, means for introducing substances for treatment into said mixing chamber, a first collection sump means in said mixing chamber at its lower end, and a second collection sump means in said cooling chamber at its lower end, and vacuum means for maintaining a predetermined sub-atmospheric pressure within said chambers.
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12. In a distilling and condensing apparatus, a mixing chamber, a heating chamber, and a cooling chamber all in adjacent vertical alinement, the heating and cooling chambers connected together side by side and communicating with said
30 mixing chamber, means for introducing substances for treatment into said mixing chamber, a blower interposed between the receiving end of said mixing chamber and the outlet ends of the other chambers, whereby vapors from a substance undergoing treatment is divided to flow simultaneously through the heating and cooling chambers and re-mix upon entering the mixing chamber, a jacket for the heating chamber and for the cooling chamber, a conduit and expansion valve therein communicating between said jackets, and a refrigerant circulating means associated with said jacket whereby said jackets form condenser
45 and expansion elements of a refrigeration system, a first collection sump means in said mixing chamber at its lower end, and a second collection sump means in said cooling chamber at its lower end, and vacuum means for maintaining a predetermined sub-atmospheric pressure within said chambers.
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