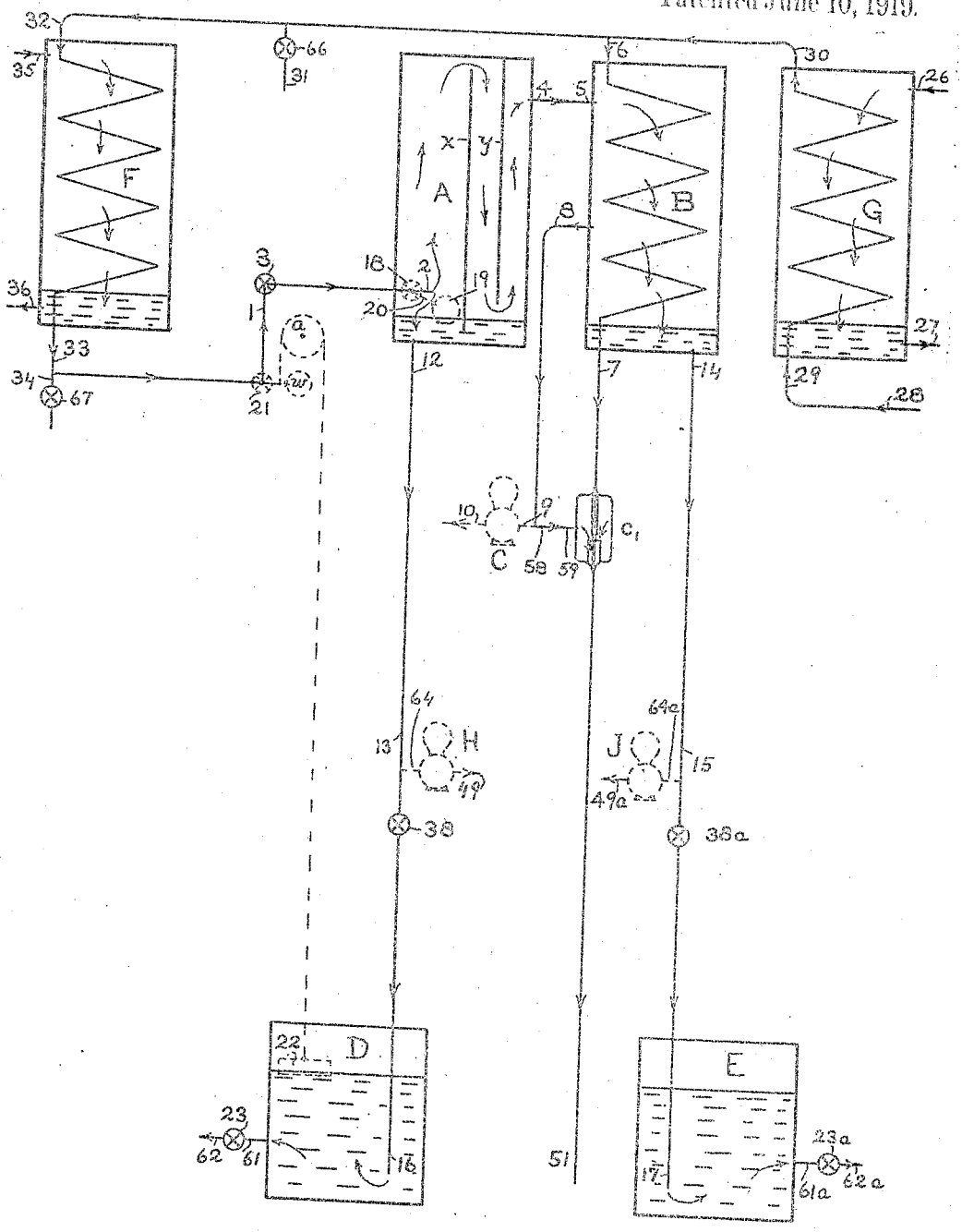
W. FOURNESS.

DISTILLING APPARATUS.

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1,306,056.

Patented June 10, 1919.



WITNESSES:

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DISTILLING APPARATUS.

1,306,056. Specification of Letters Patent. Patented June 10, 1919.

Application filed October 28, 1914. Serial No. 869,102.

To all whom it may concern:

Be it known that I, WILFRED FOURNESS, a citizen of the United States, residing at Pasadena, in the county of Los Angeles and State of California, have invented a certain new and useful Distilling Apparatus, of which the following is a specification.

My invention relates to improvements in distilling apparatus in which part of the heat in waste hot water is made available through a reduction in its pressure as a step in distilling a part of said water. My invention relates particularly for the use of such distilled water for being frozen into ice in an ice making plant. I attain these objects by the apparatus illustrated in the accompanying drawing which is a diagrammatic part sectional elevation of the apparatus. A is a separator having baffles x, y; B is a low pressure steam condenser having cooling coils, 6, 7; G is a refrigerant condenser having cooling coil 29, 30; F is a higher pressure steam condenser having cooling coil 32, 33; C is an air pump; c, is a jet apparatus; D and E are water tanks preferably open to the air; H is a water pump as is also J; 18, 21, are valves adapted to be automatically governed by variations of liquid levels.

A simple form of operation of my apparatus is as follows: Cooling water flows through pipe 28, 29, and cooling coil 29, 30, of refrigerant condenser G thereby condensing a refrigerant vapor flowing into it through pipe 26, pipe 27 conducting the condensate therefrom.

The warmed cooling water flows from condenser G by pipe 30, 6 and pipe 30, 32, to the cooling coils of condensers B and F. Part of this water may be wasted through valve 66 and pipe 31. Steam enters condenser F through pipe 35 and is condensed therein and the condensate flows therefrom through pipe 36. The cooling water flowing through coil 32, 33 is heated by the condensing steam and flows through pipe 33, 1, 2, past regulating valve 3 to separator A. Part of this water may be wasted through pipe 34 and valve 67. Separator A has a low pressure maintained therein so that hot water passing the regulating valve 3 will have its pressure reduced below that of its boiling point at its temperature before valve 3. I usually maintain a partial vacuum in separator A and therefore in condenser B. The hot water passing regulating valve 3 thus splits up into some steam and some water and this mixture issues from pipe 2 into separator A. The unevaporated water being drawn off in any desired manner, through pipe 12, 13 and the low pressure steam passing baffles x, y and flowing through pipe 4, 5 into low pressure steam condenser B, wherein it is condensed by the cooling action of coil 6, 7. The distilled water from condenser B being taken therefrom through pipe 14, 15 in any desired manner and air or non-condensable gases being taken from condenser B by pipe 8, 9 in any desired manner.

It is evident that condenser B and separator A could be combined in one piece of apparatus if desired. Regulating valve 3 may be replaced by automatic regulating valve 18 or automatic regulating valve 21. Automatic regulating valve 18 has lever arm 20 and float 19 so that a fluctuation of the water level in the lower part of separator A will regulate valve 18. Automatic regulating valve 21 has a lever arm with weight w and a cord attached to the lever arm running over pulley a to float 22 so that a fluctuation of the water level in tank D will regulate valve 21. The unevaporated water from separator A or the distilled water from condenser B may be taken therefrom by barometric columns 12, 13, 16 and 14, 15, 17 with valves 38, 38^a open or by pumps H and J with valves 38, 38^a shut, in which case pump H takes water through pipe 64 and discharges it through pipe 49 and pump G takes in water through pipe 64^a and discharges it through pipe 49^a. The water from tanks D and E may be drawn off through pipes 61, 62 and 61^a, 62^a past valves 23, 23^a. Air or non-condensable gases are taken from condenser B through pipe 8, 9, 58, 59 into jet apparatus c, which is actuated by the force of the water from cooling coil 6, 7 flowing out through pipe 51 so as to entrain this air or these gases. Jet apparatus c, may be assisted by or replaced by air pump C so that all or part of the air and gases will go to the pump through pipe 9 and be discharged from it through pipe 10.

I also produce distilled water without the conjunction of a refrigerating system by my apparatus, in which case, refrigerant condenser G may be considered as out of operation, in which case the cooling water will flow directly to condensers B and F through

pipe 28, 29, 30, 6 and 32, in which case the former preliminary heating effect of refrigerant condenser G will not be available.

An example of the approximate thermal operation of my apparatus is as follows: Suppose we have an ice making system and that it is operated by an engine, exhausting through pipe 35 into condenser F at atmospheric pressure and that this engine actuates an ammonia compressor that discharges its compressed ammonia through pipe 26 into condenser G and that we are desirous of obtaining 1 ton of distilled water ice per 24 hours, requiring approximately 1½ pounds of distilled water per minute. Assume that the engine driving the compressor produces 1 pound per minute of distilled water by exhausting its steam into condenser F, which distilled water is withdrawn through pipe 36. Now assume that the cooling coil 29, 30 of ammonia condenser G is supplied with 20 pounds per minute of 70° cooling water, which heats up to 88° in passing therethrough and that 12 pounds of this 88° water passes through coil 6, 7 of condenser B and is thereby heated to 93° and that 8 pounds of this 88° water passes through condenser F's cooling coil 32, 33 and comes out therefrom at 208° and that this 208° water, after passing regulating valve 3, flows into separator A at 24 inches of vacuum and 141° so that $6\frac{4}{10}\%$ of it turns into steam and $93\frac{7}{10}\%$ of it remains as water, thereby giving ½ pound per minute of low pressure steam to condenser B which is condensed therein and drawn off into tank E from which it is used to augment the one pound per minute of distilled water from pipe 36 thereby adding 50% to the distilled water available from condenser F.

It is evident that I can distil other liquids than water with this apparatus, by waste heat in such liquids under this invention and I desire that my claims shall be so interpreted.

What I claim is:

1. The combination of a high pressure steam condenser, a low pressure steam condenser, a separator, a conduit to conduct hot condensing water from the high pressure steam condenser to the separator, means in said conduit to regulate the quantity of hot condensing water passing therethrough, a conduit to conduct steam from the separator to the low pressure steam condenser, means to remove unevaporated water from the separator and means to remove condensed steam from the low pressure steam condenser.

2. The combination of a high pressure steam condenser, a low pressure steam condenser, a separator, a conduit to conduct hot condensing water from the high pressure steam condenser to the separator, automatic means in said conduit to regulate the quantity of hot condensing water passing therethrough, a conduit to conduct steam from the separator to the low pressure steam condenser, means to remove unevaporated water from the separator and means to remove condensed steam from the low pressure steam condenser.

3. The combination of a high pressure steam condenser, a low pressure steam condenser, a separator, a conduit to conduct hot condensing water from the high pressure steam condenser to the separator, means in said conduit to regulate the quantity of hot condensing water passing therethrough, a conduit to conduct steam from the separator to the low pressure steam condenser, means to remove unevaporated water from the separator, means to remove condensed steam from the low pressure steam condenser and means to remove non-condensable gases from the low pressure steam condenser.

4. The combination of a high pressure steam condenser, a low pressure steam condenser, a refrigerant condenser, a separator, a conduit to conduct condensing water from the refrigerant condenser to the steam condensers, a conduit to conduct hot condensing water from the high pressure steam condenser to the separator, means in said conduit to regulate the quantity of hot condensing water passing therethrough, a conduit to conduct steam from the separator to the low pressure steam condenser, means to remove unevaporated water from the separator and means to remove condensed steam from the low pressure steam condenser.

5. The combination of a high pressure steam condenser, a low pressure steam condenser, a refrigerant condenser, a separator, a conduit to conduct condensing water from the refrigerant condenser to the steam condensers, a conduit to conduct hot condensing water from the high pressure steam condenser to the separator, automatic means in said conduit to regulate the quantity of hot condensing water passing therethrough, a conduit to conduct steam from the separator to the low pressure steam condenser, means to remove unevaporated water from the separator and means to remove condensed steam from the low pressure steam condenser.

6. The combination of a high pressure steam condenser, a low pressure steam condenser, a refrigerant condenser, a separator, a conduit to conduct condensing water from the refrigerant condenser to the steam condensers, a conduit to conduct hot condensing water from the high pressure steam condenser to the separator, means in said conduit to regulate the quantity of hot condensing water passing therethrough, a conduit to conduct steam from the separator to the low pressure steam condenser, means to remove unevaporated water from the separator, means to remove condensed steam from the

low pressure steam condenser and means to remove non-condensable gases from the low pressure steam condenser.

7. The combination of a high pressure steam condenser, a low pressure steam condenser, a refrigerant condenser, a separator, a conduit to conduct condensing water from the refrigerant condenser to the high pressure steam condenser, a conduit to conduct hot condensing water from the high pressure steam condenser to the separator, means in said conduit to regulate the quantity of hot condensing water passing therethrough, a conduit to conduct steam from the separator to the low pressure steam condenser, means to remove unevaporated water from the separator, means to remove condensed steam from the low pressure steam condenser and means to remove non-condensable gases from the low pressure steam condenser.

8. The combination of a high pressure steam condenser, a low pressure steam condenser, a separator, a conduit to conduct hot condensing water from the high pressure steam condenser to the separator, automatic means in said conduit to regulate the quantity of hot condensing water passing therethrough, a conduit to conduct steam from the separator to the low pressure steam condenser, means to remove unevaporated water from the separator, automatic means to remove condensed steam from the low pressure steam condenser and means of the ejector type to remove non-condensable gases from the low pressure steam condenser.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILFRED FOURNESS.

Witnesses:
L. R. Clark,
W. D. Lacey.