

Feb. 26, 1946.

M. E. JOHNSON

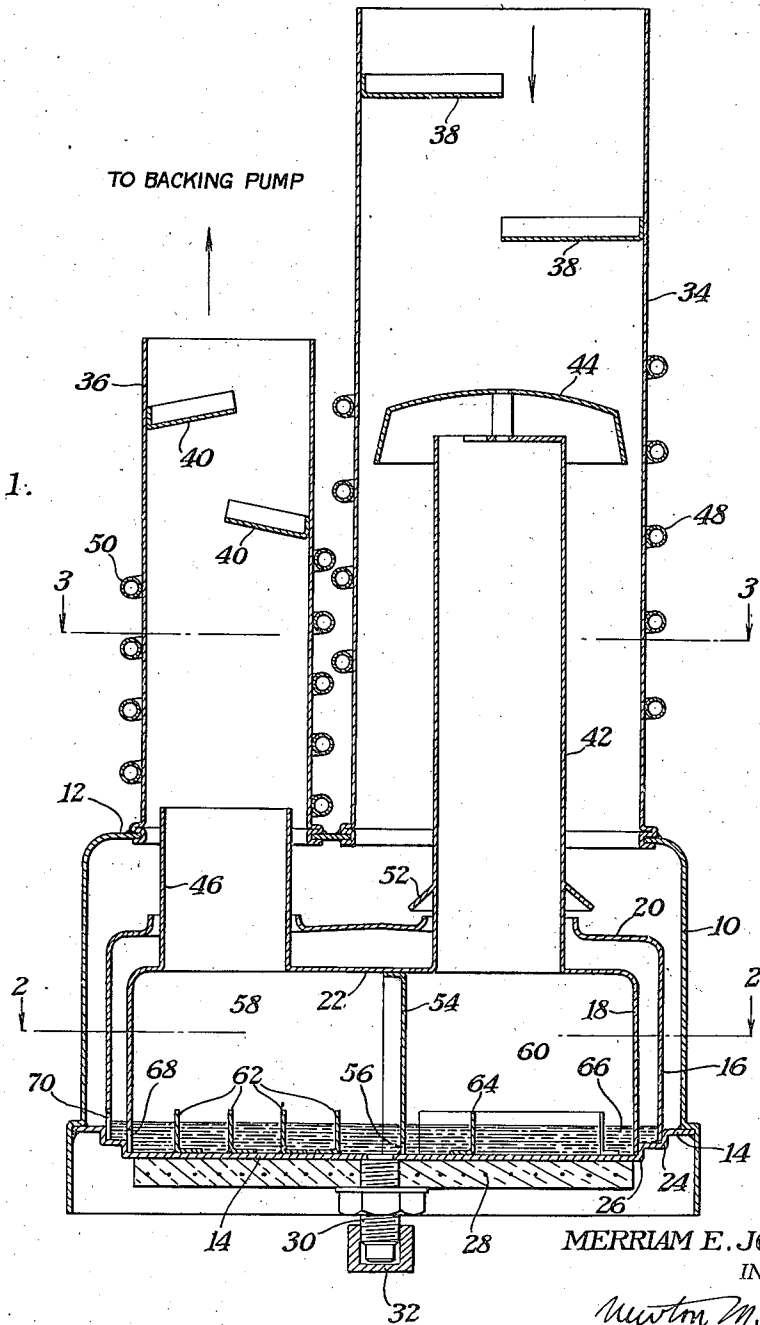
2,395,552

CONDENSATION PUMP

Filed Nov. 4, 1944

2 Sheets-Sheet 1

FIG. 1.



MERRIAM E. JOHNSON
INVENTOR

BY *Newton M. Perkins*
Warren H. Cannon
ATTORNEYS

Feb. 26, 1946.

M. E. JOHNSON

2,395,552

CONDENSATION PUMP

Filed Nov. 4, 1944

2 Sheets-Sheet 2

FIG. 2.

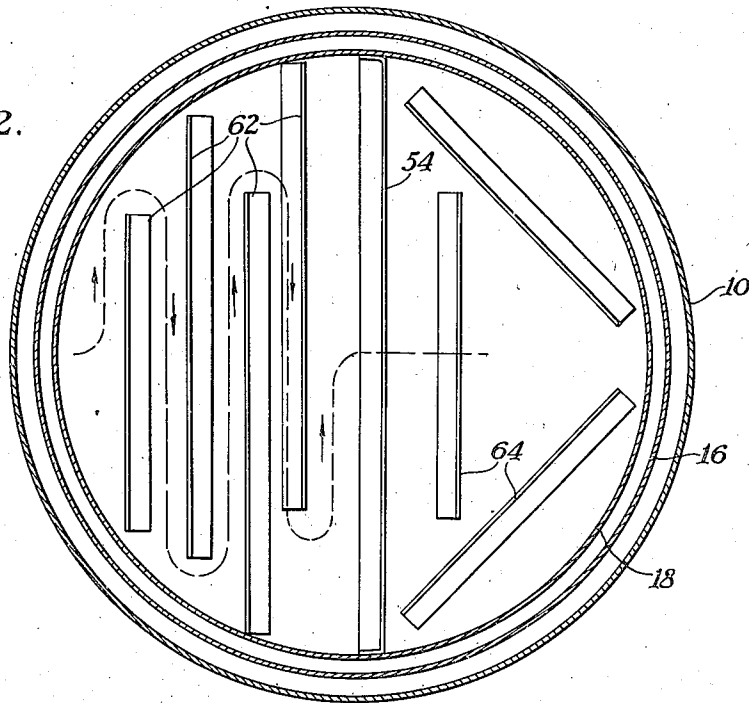
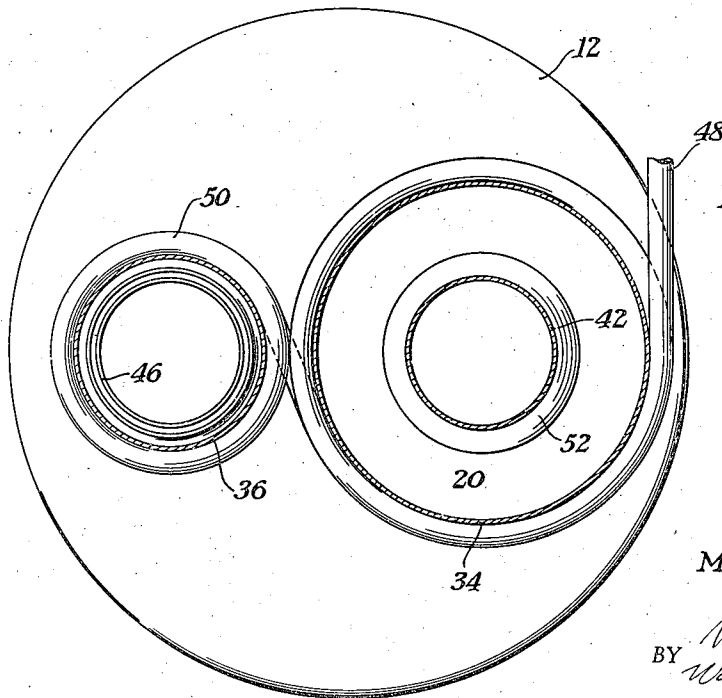


FIG. 3.

MERRIAM E. JOHNSON
INVENTOR

BY *Newton M. Perkins*
Warren H. Cannon
ATTORNEYS

UNITED STATES PATENT OFFICE

2,395,552

CONDENSATION PUMP

Merriam E. Johnson, Rochester, N. Y., assignor to
Distillation Products, Inc., Rochester, N. Y., a
corporation of Delaware

Application November 4, 1944, Serial No. 561,907

5 Claims. (Cl. 230-101)

This invention relates to improved condensation pumps particularly of the fractionating type.

Fractionating pumps are well known; see, for instance, Hickman Patent 2,080,421. Subsequent to the invention of such pumps by Hickman, other investigators described modifications thereof; see, for instance, Malter Patent 2,112,037. Such pumps involve a plurality of jets and a plurality of boilers, and, therefore, have necessitated rather complicated designs which are not readily reproduced on a mass reproduction basis.

This invention has for its object to provide an improved multi-stage condensation pump. Another object is to provide a multi-stage fractionating condensation pump having the advantage of simplicity of construction. A further object is to improve the state of the art. Other advantages will appear hereinafter.

In the following description I have set forth certain preferred embodiments of my invention but it is to be understood that these are given by way of illustration and not in limitation thereof.

In the accompanying drawings wherein I have illustrated a preferred embodiment of my invention: Fig. 1 is a vertical section of an improved pump; Fig. 2 is a horizontal section taken on line 2-2 of Fig. 1, and Fig. 3 is a horizontal section taken on line 3-3 of Fig. 1.

Referring to the drawings, numeral 10 designates a cylindrical pump casing provided with an integral cover 12 and an integral base 14. Numerals 16 and 18 designate similarly shaped cylindrical elements provided with integral covers 20 and 22 respectively. Elements 16 and 18 rest upon the common base 14, preferably in annular grooves 24 and 26 as illustrated. Numeral 28 designates an electrical heating element maintained against the base plate 14 by bolt 30, bolt 30 being hollow and communicating with the inside of the pump casing 10 and being provided with a closure cap 32.

Numerals 34 and 36 indicate conduits mounted upon the cover 12 of the cylindrical casing 10 in a gastight manner. Conduit 34 is provided with a plurality of baffles 38 and conduit 36 is provided with a plurality of baffles 40 which may be mounted at a slight angle in order to form cups in which the pump fluid may be retained and fractionated. Numeral 42 designates a conduit provided at its upper end with an umbrella-type jet 44. The lower end of conduit 42 is integral with cover plate 22 of cylinder 18 and communicates with the inside portion of said cylinder. Numeral 46 designates a conduit which at its lower end similarly communicates with the inside

of cylinder 18 and which is concentrically positioned with respect to conduit 36 so as to cooperate with conduit 36 to form an ejector type nozzle. Numerals 48 and 50 designate cooling coils through which cooling fluid is circulated to cool conduits 34 and 36 respectively. Numeral 52 designates a baffle integral with conduit 42 serving to prevent condensed pump fluid from dropping into the space between cover plate 22 and conduit 42.

Numeral 54 designates a rectangular baffle which divides cuplike member 18 into two approximately semi-cylindrical boiler compartments 58 and 60. Numeral 56 designates an opening in the bottom of baffle 54 whereby liquid pump fluid flows from boiler compartment 58 into boiler compartment 60. Numeral 62 designates a plurality of baffles on the base plate 14 in boiler compartment 58 causing the pump fluid to take a circuitous path in flowing therethrough. Numeral 64 designates a plurality of baffles performing a somewhat similar function and serving to strengthen the base of boiler 60. Numeral 66 designates a body of pump fluid resting in the bottom of the pump casing. Numeral 68 designates a notch or opening in the base of cup 18 to permit the pump fluid to flow into boiler 58. Numeral 70 designates a similar opening in the lower edge of cylinder 16. Cylinders 16 and 18 otherwise make substantially leakproof contact with base plate 14.

In operating the pump illustrated in the drawings, the upper end of conduit 34 is connected to the system to be evacuated. The upper end of conduit 36 is connected to a backing pump (not shown). Cooling fluid is circulated through coils 48 and 50, and heater element 28 is put into operation. Pump fluid 66 is thus vaporized, passes upwardly through chimneys 42 and 46. The vapors in 42 are reversed by umbrella jet 44 and the vapors are thus directed downwardly in the form of a high velocity jet and entrain gases from the upper part of conduit 34. The gases from the system to be evacuated are thus forced down into the upper part of casing 10. The spent pump fluid is condensed on the walls of 34, flows by gravity down the walls to the base plate 14. This condensed pump fluid then flows around the annular space between casing 10 and member 16 and then through openings 70 and 68.

The vapors passing upwardly through conduit 46 entrain the gases in the upper part of casing 10 and force them to the top part of conduit 36 from which point they are removed by the backing pump (not shown). The spent pump fluid

vapors from jet 46 are partially condensed and held by baffles 40. These vapors are thus partially fractionated and the most volatile portions are held in the gutters formed by baffles 40. The remainder of the pump fluid flows down the wall of conduit 36 dropping onto heat shield 20 and flows thence to the bottom of the annular space between casing 10 and cylinder 16. This pump fluid is intermingled with the pump fluid from jet 44 and the mixture flows through openings 70 and 68 and into boiler compartment 58. Here the pump fluid flows in a circuitous path between baffles 62 in boiler 58 and during such passage the more volatile constituents are vaporized and pass upwardly through conduit 46. The lowest vapor pressure constituents remain unvaporized and pass through opening 56 in the bottom of partition 54 and then into boiler compartment 60. Here the lowest vapor pressure constituents are vaporized and pass upwardly through conduit 42 and issue as a high velocity jet from nozzle 44. The pump thus effectively fractionates the pump fluid utilizing the high vapor pressure constituents on the high pressure side and the low vapor pressure constituents on the fine or low pressure side of the pump.

It is apparent that many modifications can be made without departing from the spirit or scope of my invention. Thus, while I have illustrated a pump embodying two jets, it is apparent that the number of jets can be increased by division of the pumping and boiler chambers into compartments corresponding with the number of jets. Also, while I prefer to use baffles 38 and 40, these are not necessary. Baffles 40 may be placed horizontally so that they merely prevent loss of pump fluid rather than serve a double function of fractionation and baffling. The heat shield 20 is a preferred construction but it may be eliminated or alternative constructions such as insulation may be utilized. Baffles 62 and 64 result in improved fractionation and also strengthen the base plate 14. However, their use is not necessary.

The invention has the advantage that the pump can be manufactured readily on a large scale, or mass production basis, and at comparatively low cost. An outstanding advantage of the invention is that metal components which can be readily stamped or turned are used in the construction. The pump can be assembled easily and will retain its good pumping characteristic during use.

What I claim is:

1. A multi-stage fractionating condensation pump comprising in combination a cylindrical pump casing provided with top and base plates integral therewith, a partition approximately parallel with the base plate dividing the pump casing into a lower boiler section and an upper section for pumped gases, means dividing the boiler section into a plurality of boiler compartments, substantially vertical conduits mounted on the top plate of the pump casing so that they are approximately perpendicular to said plate, said conduits communicating with the section for pumped gases inside the cylindrical pump casing, and each being positioned above one of the boiler compartments, a plurality of vapor delivery chimneys positioned so that their upper ends cooperate with said conduits to form a plurality of jet pumps and so that their lower ends terminate in a boiler compartment, means for collecting condensed working fluid from the jet pumps and for returning it to the boiler compartment delivering vapor to the jet pump operating against

the highest pressure, and means for the pump fluid to flow from that boiler compartment to a boiler compartment supplying a jet working against a lower pressure.

2. A multi-stage fractionating condensation pump comprising in combination a cylindrical pump casing provided with top and base plates integral therewith, a partition approximately parallel with the base plate dividing the pump casing into a lower boiler section and an upper passageway for pumped gases, a second partition approximately perpendicular with the base plate dividing the boiler section into two boiler compartments, two conduits mounted on the top plate of the pump casing so that they are approximately perpendicular thereto, said conduits communicating with the passageway for pumped gases inside the cylindrical pump casing, one of said conduits being positioned above one of the boiler compartments and the other conduit being positioned above the other boiler compartment, a chimney positioned inside of and concentric with one of said conduits, which chimney carries an umbrella jet nozzle at its upper end and communicates with one of the boiler compartments at its lower end, a second chimney positioned so that its upper end is in ejector relation with the other conduit and communicating with the other boiler compartment at its lower end, means for collecting condensed working fluid from both jet nozzles and for returning it to the boiler communicating with the ejector jet nozzle and means for delivering fractionated working fluid from the boiler supplying the ejector jet nozzle to the boiler supplying the umbrella jet nozzle.

3. A multi-stage fractionating condensation pump comprising in combination a cylindrical pump casing provided with top and base plates integral therewith, a partition approximately parallel with the base plate dividing the pump casing into a cylindrical-shaped lower boiler section and an upper passageway for pumped gases, a second partition approximately perpendicular with the base plate dividing the boiler section into two semi-cylindrical boiler compartments, two substantially vertical conduits mounted on the top plate of the pump casing so that they are approximately perpendicular thereto, said conduits communicating with the passageway for pumped gases inside the cylindrical pump casing, one of said conduits being positioned above one of the semi-cylindrical boiler compartments and the other conduit being positioned above the other semi-cylindrical boiler compartment, a chimney positioned inside of and concentric with one of said conduits, which chimney carries an umbrella jet nozzle at its upper end and communicates with one of the semi-cylindrical boiler compartments at its lower end, a second chimney positioned concentric with the other conduit and so as to form an ejector jet nozzle at its upper end and communicating with the other semi-cylindrical boiler compartment at its lower end, means for collecting condensed working fluid from both jet nozzles and for returning it to the boiler communicating with the ejector jet nozzle and means for delivering fractionated working fluid from the boiler supplying the ejector jet nozzle to the boiler supplying the umbrella jet nozzle.

4. A multi-stage fractionating condensation pump comprising in combination a plurality of nested concentric inverted cup-shaped elements having a common base, a partition dividing the inside cup-shaped element into two semi-cylindrical

drical boiler compartments, two conduits mounted upon and approximately perpendicular to the top of the outside cup and communicating with the space inside thereof said conduits being positioned so that one conduit is above one of the boiler compartments and the other conduit is above the other boiler compartment, a chimney positioned inside of and concentric with one of said conduits, which chimney carries an umbrella jet nozzle at its upper end and communicates with one of the semi-cylindrical boiler compartments at its lower end, a second chimney positioned concentric with the other conduit so as to form an ejector jet nozzle at its upper end and communicating with the other semi-cylindrical boiler compartment at its lower end, means for collecting condensed working fluid from both jet nozzles and for returning it to the boiler communicating with the ejector jet nozzle and means for delivering fractionated working fluid from the boiler supplying the ejector jet nozzle to the boiler supplying the umbrella jet nozzle.

5. A multi-stage fractionating condensation pump comprising in combination three nested concentric inverted cup-shaped elements having a common base, the outside cup serving as a pump casing, the middle cup as a pump fluid de-

flector, or heat shield and the inside cup as a boiler, a partition dividing the inside cup-shaped boiler element into two semi-cylindrical boiler compartments, two conduits mounted upon the top of the outside cup and communicating with the space inside thereof said conduits being substantially perpendicular to the common base and positioned so that one conduit is above one of the boiler compartments and the other conduit is above the other boiler compartment, a chimney positioned inside of and concentric with one of said conduits, which chimney carries an umbrella jet nozzle at its upper end and communicates with one of the semi-cylindrical boiler compartments at its lower end, a second chimney positioned concentric with the other conduit and cooperating therewith to form an ejector jet nozzle at its upper end and communicating with the other semi-cylindrical boiler compartment at its lower end, means for collecting spent condensed working fluid from both jet nozzles and for returning it to the boiler communicating with the ejector jet nozzle and means for delivering fractionated working fluid from the boiler supplying the ejector jet nozzle to the boiler supplying the umbrella jet nozzle.

MERRIAM E. JOHNSON.