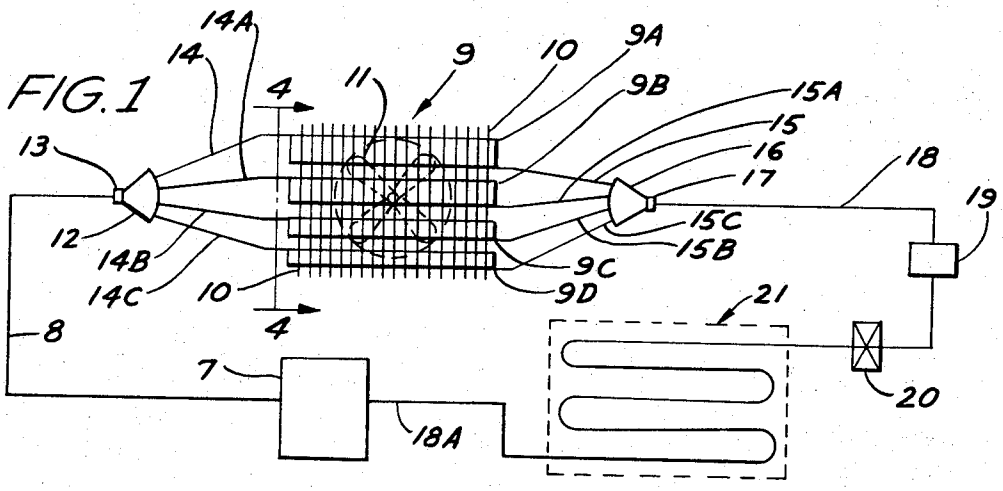
Oct. 10, 1967 H. J. HALL 3,345,829

METHOD AND MEANS FOR CONTROLLING THE CONDENSATION OF VAPORS UNDER A VARYING AMBIENT

Filed April 20, 1966

FIG. 1



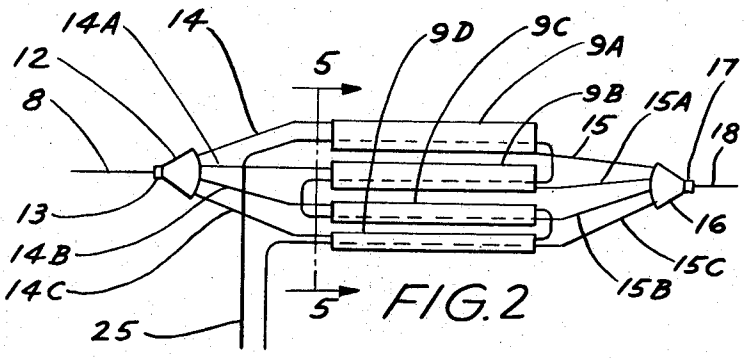


FIG. 2

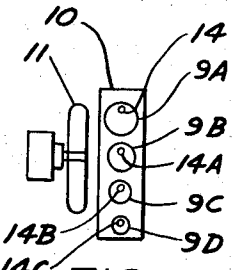


FIG. 4

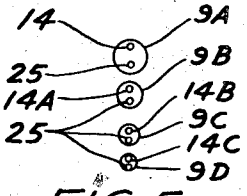


FIG. 5

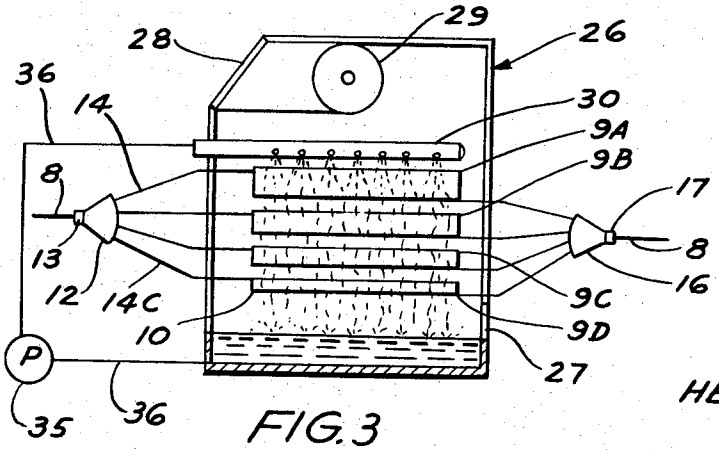


FIG. 3

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United States Patent Office 3,345,829
Patented Oct. 10, 1967

3,345,829

METHOD AND MEANS FOR CONTROLLING THE CONDENSATION OF VAPORS UNDER A VARYING AMBIENT

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Filed Apr. 20, 1966, Ser. No. 545,219
7 Claims. (Cl. 62—93)

ABSTRACT OF THE DISCLOSURE

This disclosure embodies means and method for condensing vapors in the environment of a varying ambient. The invention resides in the provision of a condenser having a multiplicity of condensing circuits, comprising conduits of substantially equal length, but different diameter, which conduits are commonly subjected to an ambient, which because of the different diameters of the conduits effects a different rate of condensation in the circuits. The condensation circuits are provided at either end with conduits of a common, but smaller size diameter, which common and smaller size conduits are connected at the intake end with a distributor head, and at the exhaust end with a collector head, there being a single intake port in the distributor head and a single exhaust port in the collector head.

This invention relates to the condensation of vapors and has particular application to refrigeration circuits, although it may be used in any system, where it is desired to condense a vapor to a liquid, as in the petroleum and chemical industries.

An object of the invention is the provision of a means and method for controlling and balancing the condensation volume in a refrigerator system, or the like, in the presence of a variable ambient.

Another object of the invention is to provide a means and method for controlling and maintaining an even liquid flow from the condenser of a refrigerator system, or the like, under uniform pressure, constant volume, constant temperature, constant density, and constant velocity, where there is a varying ambient supply, either air, or water, or other cooling media, surrounding the condenser.

Another object of the invention is to provide a means and method, which will deliver to the evaporator device of a refrigerator system, a constant volume of liquid refrigerant, whereby to balance the system at its desired capacity and to obviate any tendency of the system to overload, super-cool, or create flash gas.

Another object of the invention is the provision of a means and method, which serves all stages of a refrigerator system with smooth operation and develops in the system an equal displacement of the refrigerant, at all positions in the refrigeration circuit.

Another object of the invention is to provide a condenser, which is constructed and arranged with a plurality of condenser circuits, each having a different size and capacity, but all of said condenser circuits having a common intake and a common outlet, and being subjected to a variable ambient.

Another object of the invention is to provide a condenser for a refrigerating system, or the like, which has a plurality of different size condensing conduits, all having a common inlet and common outlet, both under common pressure, each of which conduits is subjected to a common but variable ambient, whereby the variable ambient, in contact with the surface areas of said conduits, changes the characteristics of the refrigerant in each of said conduits differently, by automatically and simultaneously changing the temperature, in each, which in turn changes the density and controls the velocity and volume of the refrigerant flowing from the condensing conduits, with the result that the refrigerant flowing from the condensing conduits, with the result that the refrigerant will flow from the common outlet of said condenser uniformly and at a constant density and volume and at the same pressure at which it entered the condenser.

Another object of the invention is to provide a condenser with a plurality of condensing circuits therein of different capacities, but all circuits having a common inlet and a common outlet which are under a common pressure, and all circuits being subjected to a common but variable ambient, whereby the refrigerant in the respective circuits will take the paths of least resistance, as determined by the density of the liquid in the respective circuits whereby to balance out the velocity, density and volume of the refrigerant, so that the refrigerant will be discharged from said condenser under a common pressure, and all circuits being subjected to a common but

Another object of the invention is to provide a condenser having a plurality of different size condensing circuits therein, each circuit communicating with a common inlet distributor and each circuit communicating with a common outlet collector.

Another object of the invention is to provide a condenser which is constructed and arranged with a plurality of refrigerant circuits therein, all of which are effected by a common ambient, which may be air, water or any other cooling medium.

The foregoing and other objects and advantages of the invention will become more apparent as the description proceeds, reference being made from time to time to the accompanying drawing, forming part of the within disclosure, in which drawing:

FIG. 1 is a schematic view of a conventional mechanical refrigeration system in which is connected a compressor embodying the invention. In this embodiment the condenser is provided with air as the ambient or cooling medium.

FIG. 2 is a modified form of condenser embodying the invention in which the cooling medium is water.

FIG. 3 is a further modified form of condenser embodying the invention in which the cooling medium is a combination of water and air.

FIG. 4 is a section taken on line 4—4 of FIG. 1 and shows the relation of the gas intake lines with respect to the condensing circuits.

FIG. 5 is a section taken on line 5—5 of FIG. 2 and shows the relation of the gas intake lines with respect to the condensing circuits and the lines carrying the water cooling media.

Referring now more particularly to the drawings it will be understood that in FIG. 1 of the drawings I have illustrated schematically a conventional refrigeration circuit in which the reference character **7** indicates a motor compressor, the reference character **8** indicates the gas discharge line, and the reference character **9** indicates, in general, the condenser, which is provided with cooling fins **10** and a motor driven fan **11**, which provides the ambient or cooling media for the condenser.

The condenser **9**, in this embodiment, consists of a plurality of condensing conduits or circuits **9A**, **9B**, **9G**, and **9D**, each of which has a different capacity, by reason of the different diameters of the conduits.

The condenser **9** is provided with a distributor head **12**, which is in communication, at one side, with the gas line **8**, as at **13**, and is in communication, on the other side, with the respective condensing conduits **9A**, **9B**, **9C**, and **9D**, through the lines **14**, **14A**, **14B**, and **14C**.

It will be noted (FIGS. 1 and 4) that the gas lines **14**–**14C** enter the condenser conduits **9A**–**9D** near the top

of the said condenser conduits. At the opposite ends of the condensing conduits 9A, 9B, 9C, and 9D, are connected the liquid carrying lines 15, 15A, 15B, and 15C, which lines 15–15C leave the condensing conduits 9A–9D, at the bottom of said conduits, and below the liquid levels therein, and communicate respectively with a collector head 16. The head 16 has an outlet 17, which in turn communicates with the liquid carrying line 18, which communicates with a receiver 19 (if one is used) and an evaporator supply metering device 20, and with the evaporator 21. The evaporator 21 communicates through the line 18A with the motor compressor 7, thus completing the refrigeration circuit. The line 8 carries the high pressure gas. The line 18A carries the low pressure gas. The line 18 carries the liquid refrigerant.

With the introduction of my improved condenser 9, and its associated elements, I provide the liquid flow line 18 and the evaporator and the elements communicating therewith, with a flow of liquid refrigerant having a constant pressure, volume, temperature, velocity and density, with the result that the refrigeration system is completely balanced and smooth operating at all times, thereby obviating any tendency to create flash gas, or cause overloading, super-cooling, or the loss of capacity.

In the operation of my improved condenser in the refrigeration system, the gaseous refrigerant, under high pressure, enters the distribution head 12 and is distributed to the various conduits 9A–9D, comprising the different refrigeration circuits inside the condenser 9, through the distribution pipes 14–14C, which are of common diameter, so that the gaseous refrigerant will enter the condenser circuit at the top (FIG. 1), and the condensed liquid will flow from the circuits at the bottom. The velocity of flow of the liquid, refrigerant from the several conduits of the condenser will be governed by the density of the liquid in each conduit. The density of the liquid in the smaller conduit will be less than the density of the liquid in the larger conduits. Therefore, the liquid will flow faster from the smaller conduits. The diameters of the several conduits 9A–9D differing in size will expose different size areas to the cooling medium, or ambient, so that the resulting temperature of the refrigerant, in each of the condensing conduits 9A–9D will accordingly be different. The temperature in the smaller diameter conduits will be higher than the temperature in the larger diameter conduits. Therefore the density will be less in the small diameter conduits and the velocity will be greater. By the same token the different temperatures in the respective conduits will also effect proportional changes in the volume of the refrigerant in each conduit. It will be understood that the lines 15–15C, leading from the bottom of the several condensing circuits 9A–9D, are all of the same size and are the same size as the lines 14–14C which communicate with the common collector head 16. All of the liquid refrigerant flowing from the various refrigerant conduits will be collected and thoroughly mixed together in the head 16, so that it will flow from the collector head 16 into the fluid line 18 at a common temperature, density, and velocity, and at constant volume and pressure, whereby the members 19, 20 and 21, in the refrigeration system, will be supplied with a constant flow of liquid refrigerant at all times while the device is in operation.

The pressure in the high pressure side of the system is the same from the compressor 7, to the metering device 20, and throughout the condenser 9, because of the common size of the gas lines 14–14C and the fluid lines 15–15C, and because the intake to each line 15–15C is always below the level of the fluid in the respective conduits 9A–9D. The temperature of the liquid in each conduit 9A–9D determines the density of the liquid in that conduit, which in turn determines the velocity at which the liquid will flow from each conduit 9A–9D.

In FIG. 2, I show a schematic view of a modified form of the condenser, wherein I provide a water line 25, which extends longitudinally back and forth through the interiors of the various condensing conduits 9A, 9B, 9C and 9D. In this embodiment the water line 25 serves as the cooling media, or ambient, instead of the air cooling elements illustrated in FIG. 1.

In FIG. 3, I show another form of the condenser in which the cooling media, or ambient for the condenser, consists of a combination of water and air. The condenser, which consists of the condensing circuits 9A, 9B, 9C and 9D, and their connecting elements, as previously described, are mounted in a housing 26, which has an air inlet 27 and an air outlet 28. Air is drawn into the housing 26 and over the condensing conduits 9A–9D by a motor-driven blower 29. A waterspray 30 is also provided for additional cooling of the condenser. The water which accumulates in the housing 26 may be recirculated by means of a pump 35 and a water line 36.

The modified forms of condensers as illustrated in FIGS. 2 and 3 function in the same manner as previously described.

In FIG. 4, I illustrate how the gas intake lines 14–14C connect near the top of the condenser conduits 9A–9D.

In FIG. 5, I show the gas intake lines 14–14C as entering the tops of the condenser circuits 9A–9D and illustrate the relation of the gas intake lines to the water cooling lines, which extend through the condensing circuits 9A–9D.

Although I have herein disclosed certain embodiments of my improved means, it will be understood that the condenser also may be constructed in different forms, for instance, the condensing circuits may be arranged in vertical, horizontal, or angular relation to one another, and the distribution and collector elements may be differently formed, without changing the functioning and operation of the system and method as hereinabove described, all of which is within the contemplation of the invention and the scope of the appended claims.

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

1. The method of condensing a gas in the presence of a variable ambient, which consists of passing the gas through a device made up of a plurality of spaced conduits, each having a different diameter and each having a different condensing capacity, and each being directly and commonly exposed to said ambient at any given period of time.

2. The method of handling a gas in the presence of a variable ambient, which consists of moving the gas, at a common pressure, simultaneously into a plurality common size conduits and then into a plurality of different size condensing conduits, each of which is separately effected by the temperature of said ambient, and then withdrawing the products of condensation from said conduits through reduced, individual passageways, all having a common diameter.

3. The method of condensing a gas in the presence of a variable temperature ambient, which consists of moving the gas through an intakeport into a distributor head, from which it is directed into a plurality of common size passageways, which communicate with spaced condensing passageways of different size, all of which are directly effected by said ambient and then withdrawing the products of condensation, from said last named passageways through smaller passageways of common size, which communicate with a collector head, from which the products of condensation are finally withdrawn through a single outlet passageway.

4. The method of condensing a gas in the presence of a variable temperature ambient, which consists of moving the gas through an intakeport into a distributor head, from which it is directed into a plurality of common size passageways, which communicate with spaced condensing passageways of different size, changing the temperature in each condensing passageway by direct expose of its walls to said ambient, whereby to effect condensation,

withdrawing the products of condensation, at a different velocity, from each respective condensing passageway, and then discharging the products of condensation through a common outlet port.

5. A condensing device comprising a plurality of spaced conduits of different size, common means to cool said conduits, a common but smaller diameter size inlet and outlet for each conduit, a common distributor head in communication with said inlets, and a common collector head in communication with said outlets, said distributor head having an inlet port and said collector head having a discharge port.

6. The structure of claim 5, in which the inlets for said conduits are above the center line of said conduits and the outlets for said conduits are below the center line of said conduits.

7. The structure of claim 5, in which said cooling means include a water pipe which extends longitudinally along the interior of said conduits.

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