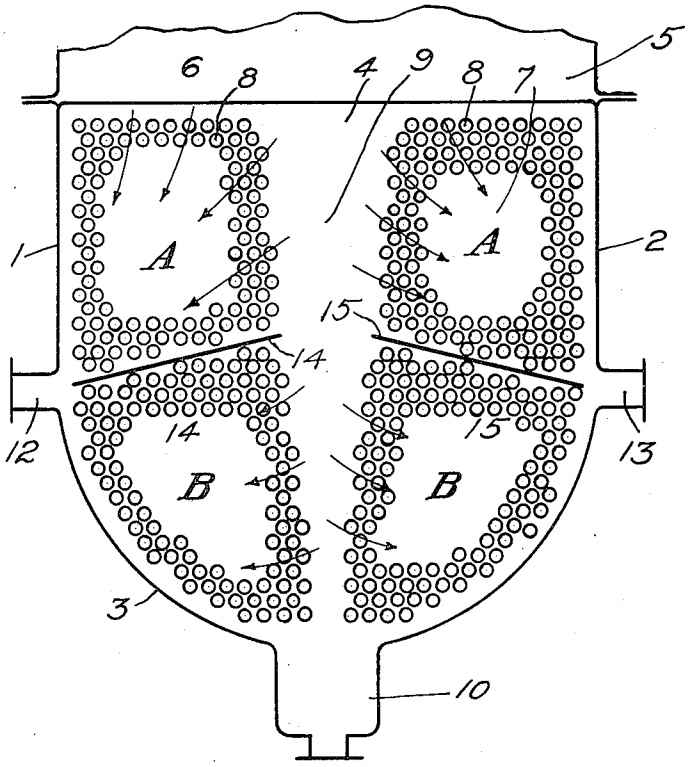
R. N. EHRHART.

CONDENSER.

APPLICATION FILED NOV. 8, 1918.

1,407,137. Patented Feb. 21, 1922.



WITNESSES:

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UNITED STATES PATENT OFFICE.

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CONDENSER.

1,407,137. Specification of Letters Patent. Patented Feb. 21, 1922.

Application filed November 8, 1918. Serial No. 261,711.

To all whom it may concern:

Be it known that I, RAYMOND N. EHRHART, a citizen of the United States, and a resident of Edgewood, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Condensers, of which the following is a specification.

This invention relates to surface condensers. The efficiency of a condenser of a given size depends upon the distribution of the cooling surface or tubes. Exterior conditions frequently determine the exterior shape of the condenser shell, and the purpose of this invention is to arrange a system of cooling tubes so as to obtain maximum efficiency from a substantially rectangular condenser, since condensers of this shape are usually more suited to exterior conditions.

There are certain principles of condenser construction that have been found to produce the best obtainable results, that is, condensers having a short flow through the nests offer least resistance to the passage of the fluid to be condensed and therefore the difference in pressure between the point of complete condensation and the fluid inlet to the condenser is held to a minimum, and the best distribution of cooling surface is obtained in condensers having a diminishing or converging condensing area from the inlet toward the point of complete condensation within the condenser.

The principal objects of this invention are to produce an arrangement of condenser elements that will offer a short path for the fluid to be condensed passing across the elements; to produce an arrangement of tubes in a shell of the above described shape that will present diminishing or converging condensing areas as the fluid to be condensed progresses through the system; to produce arrangement or disposition of the condensing units whereby hot condensable fluid may be supplied directly to the condensate outlet and increase the temperature of the condensate; to produce a system of condensing units that obtains full advantage of the available space within a condenser shell without occasioning a drop in pressure between the inlet and the point of complete condensation within the shell. These and other objects are attained by means of a condenser embodying the features herein described and illustrated.

In the drawing the figure is a diagrammatic transverse section through a condenser shell, illustrating the principle involved in the invention, no attention being directed to details as it is thought that the drawing and description will be clear to those skilled in the art.

Referring to the drawing; the condenser illustrated includes a shell made up of parallel side walls 1 and 2, a substantially semi-circular bottom 3 and the usual water box construction at the ends, one tube plate 4 being shown. As illustrated the condenser is provided with an inlet port 5 through which fluid to be condensed enters the condenser.

The condenser is provided with two nests 6 and 7 of tubes 8, each located adjacent to one of the side walls 1 and 2 of the shell in such a manner as to provide a wedge shaped entrance passage 9 extending from the inlet port to the bottom of the condenser and communicating with a condensate outlet 10 located at the bottom of the shell. It will be seen from the foregoing that condensable fluids entering the port 5 of the condenser will pass through the exposed portions of the tube nest and also the entrance faces at the side of the nest exposed to the passage 9.

About midway between the top of the condenser and the bottom thereof a pair of outlets 12 and 13 for noncondensable fluids are provided and the tube nests are each divided into separate sections by means of diaphragms 14 and 15 extending from the inner side of the tube nest downward and terminating adjacent the said outlets. It will be seen that this arrangement of diaphragms divides the nests into upper sections A—A and lower sections B—B. The upper sections A receive condensable fluid through both the upper and side faces and it will be seen that the fluid will encounter a diminishing number of tubes as it progresses in its passage toward the outlets for the noncondensable fluid. The condenser sections B will receive condensable fluid through inner side entrance faces from the entrance passage 9 and this fluid will be directed outwardly and upwardly toward the outlets for the noncondensable fluid. This arrangement also provides a series of tubes diminishing in number from the entrance face toward the outlets 12 and 13,

thereby providing a diminishing or converging condensation area for the condensable fluid.

The entrance passage 9 extends downwardly between the nest supplying condensable fluid thereto, and the passage terminates adjacent the condensate outlet 10, so as to supply heated condensable fluid to this outlet so that the temperature of the condensate flowing to the outlet 10 will come in direct contact with fluids of higher temperature, thereby resulting in a condensate having a temperature just below the joint of evaporation. It will be seen from the above that the cooling tubes have been arranged so as to produce a minimum of resistance to the passage of the condensable fluid and that ample provision has been made for securing condensation with a minimum of tubes.

While I have described and illustrated but one embodiment of my invention, it will be apparent to those skilled in the art that various changes, modifications, additions and omissions may be made in the apparatus described and illustrated without departing from the spirit and scope of the invention, as set forth by the appended claims.

What I claim is:

1. In a condenser, a shell having a port adjacent to its top, a condensate outlet adjacent to the bottom of the shell, nests of cooling tubes having upper faces disposed transversely of the shell and to the direction of flow through the port and other faces defining therebetween a passageway from the port to the condensate outlet, and a single non-condensable fluid outlet located in each side of the shell and arranged to extract non-condensable fluids at points intermediate the nests.

2. In a condenser, a shell comprising upper parallel sides and a lower convex portion and having an inlet port, a condensate outlet adjacent the bottom, an upper pair of nests of cooling tubes having upper faces disposed transversely of the flow of fluid through the port and opposed faces defining an intermediate passageway in communication with the port, a lower pair of nests of cooling tubes in the convex portion and having a passageway therebetween in continuation of the upper passageway and in communication with the condensate outlet, diaphragms separating the upper and lower nests of tubes, and a non-condensable fluid outlet adjacent each diaphragm and adapted to receive non-condensable fluid from the adjacent upper and lower nests of tubes, the shell and diaphragms defining groups having surfaces converging toward the non-condensable fluid outlets and the nest between each pair of surfaces having a less number of tubes as the surfaces converge.

3. In a condenser, the combination with a shell having a fluid inlet port formed in the top thereof and a condensate port formed in the bottom thereof, of two nests of tubes so located within the shell as to form therein a substantially central fluid passage extending from the inlet port to the condensate port, an air off-take port at an intermediate portion and at the side of each tube nest, and a baffle extending through each tube nest from a point adjacent the air off-take and dividing each tube nest into two substantially triangular portions, whereby the fluid to be condensed is caused to traverse the tubes of each tube nest in paths of decreasing flow area downwardly through the portion of the nest above the baffle and upwardly through the portion of the nest below the baffle toward the air off-take.

4. In a condenser, the combination with a shell having a fluid inlet port formed in the top thereof and a condensate outlet port formed in the bottom thereof, of two nests of cooling tubes arranged within the shell so as to provide a substantially central fluid passage between the nests, an air off-take port in each side of the condenser shell at a point intermediate the top and bottom of the adjacent tube nest, and an upwardly inclined baffle extending through each tube nest from a point adjacent the air off-take and dividing each nest into two substantially triangular portions whereby the fluid to be condensed is caused to traverse the tubes of each tube nest in paths of decreasing flow area downwardly through the portion of the tube nest above the baffle and upwardly through the portion of the nest below the baffle toward the air off-take, and the condensate from the tubes above the baffles to be directed toward the sides of the condensers.

In testimony whereof, I have hereunto subscribed my name this 5th day of November, 1918.

RAYMOND N. EHRHART.