April 20, 1926.

1,581,098

H. E. BYER

CONDENSER

Filed July 28, 1924

Fig. 1.

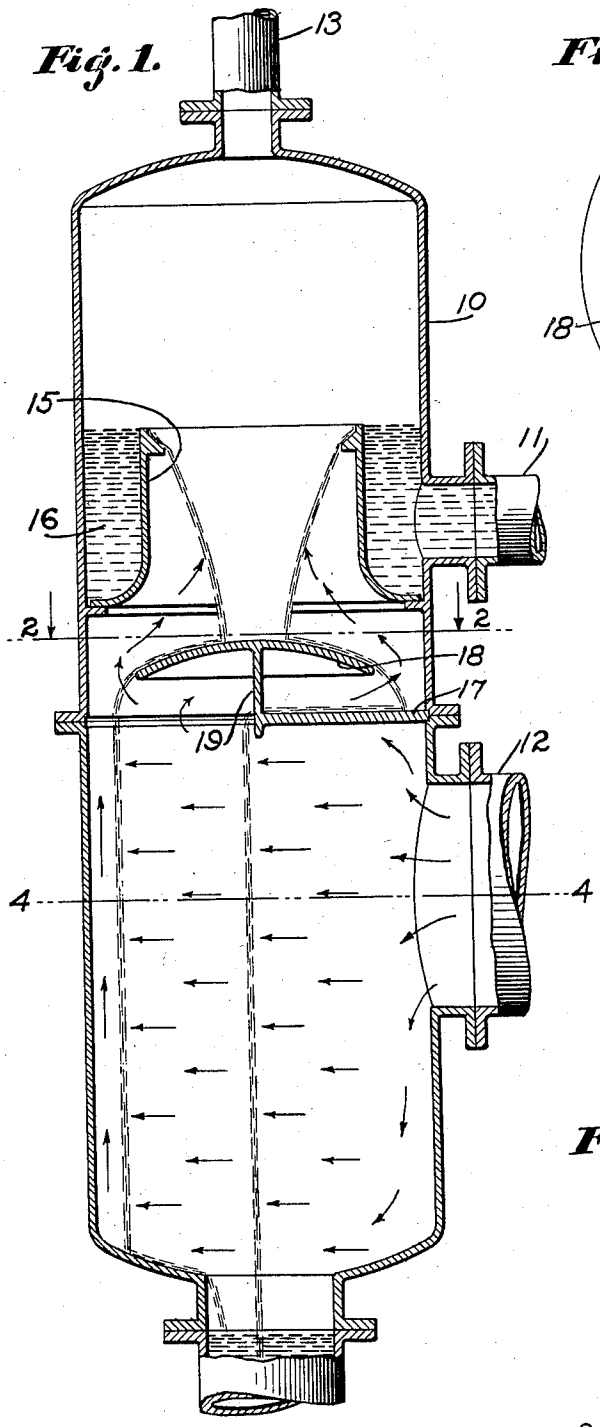


Fig. 2.

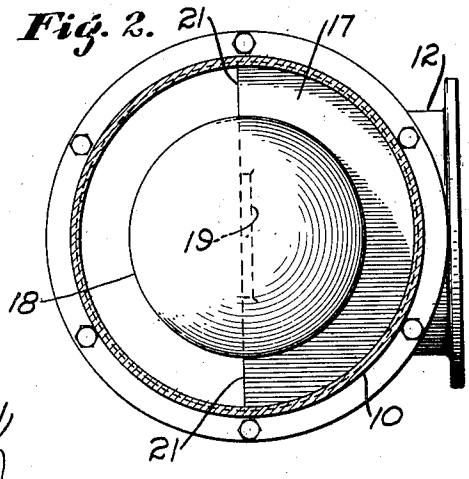


Fig. 3

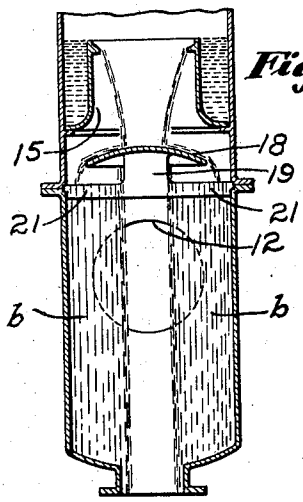
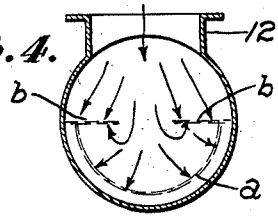


Fig. 4.



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UNITED STATES PATENT OFFICE.

HENRY E. BYER, OF SAUSALITO, CALIFORNIA, ASSIGNOR TO CHICAGO PNEUMATIC TOOL COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

CONDENSER.

Application filed July 28, 1924. Serial No. 728,617.

To all whom it may concern:

Be it known that I, HENRY E. BYER, citizen of the United States, residing at Sausalito, county of Marin, and State of California, have invented new and useful Improvements in Condensers, of which the following is a specification.

This invention relates to condensers of the counter-current type for steam and other vapor-laden gases.

It is well known in the art that counter-current condensers are subject to a condition known as "getting hot" or "boiling over", under which large quantities of hot water and steam pass over into the air suction pipe at the top of the condenser, as described in Weiss Patent No. 496,761. Due to this defect it is common practice to employ a water separator provided with a barometric leg to prevent flooding of the air pump.

This defect is due to the fact that in condensers as heretofore constructed the means provided for bringing the condensing water in contact with the steam or vapor, and cooling the air and gases passing upwardly to the air suction pipe, result in too short a vertical water fall. Therefore, there is not sufficient weight of cooling water in immediate contact with steam in the steam space to resist the sudden upward rush of the steam and expanded air developed under such boiling conditions. I have found that by presenting a vertical film or sheet of water to the entering steam or vapor with sufficient unbroken fall, this defect of "boiling over" is effectually overcome, due to the increased weight of water meeting the steam or vapor. The problem, however, is to provide such a sheet of water in an unbroken wall without unduly increasing the thickness of the sheet or exceeding commercial limitations as to the size of the condenser.

It is the object of the present invention to provide a condenser of the counter-current type which will remedy this defect by affording a maximum of surface area for contact with the steam, and so contain sufficient weight to resist the pressure of the steam under all conditions, and at the same time keep the diameter and length of the condenser within the limits of the commercial requirements.

This object I accomplish by so constructing the condenser that two sheets or curtains of water of approximately equal weight and area will fall vertically through the steam space for a considerable length. One of these sheets, which may be termed the "front curtain", preferably extends diametrically of the steam chamber and at right angles to the steam inlet. This front curtain is divided so as to leave an opening at its middle portion to permit part of the steam to pass directly through. The second sheet which may be termed the "back curtain", preferably is in the form of a semi-circle at the back of the front sheet, and extends from one leg to the other of the front sheet, so as to form a pocket enveloping the opening in said front sheet. Thereby the steam passes through said opening and comes in contact with the back curtain of the water, where it is acted upon. The air and other gases of a non-condensible nature will rise through the sheets of water and be taken off in the usual manner at the top of the condenser.

The solid "spill" or cascade placed above the steam space, and over which the entering cooling water must flow, has a definite relationship to the thickness of the vertical sheet or film of water meeting the steam below. The latter must never exceed in thickness that of the water flowing over the cascade above, and preferably should be much thinner. By employing two sheets or films of water, in accordance with the present invention, I am enabled to obtain the desired thinness of the sheets, without unduly increasing the size of the condenser.

One form which my invention may assume is exemplified in the following description and illustrated in the accompanying drawings, in which—

Fig. 1 shows a vertical central sectional view of my improved condenser;

Fig. 2 shows a plan view in section, taken on the line 2—2 of Fig. 1;

Fig. 3 shows a vertical central sectional view taken at right angles to the section of Fig. 1;

Fig. 4 shows a sectional view, taken on the line 4—4 of Fig. 1.

Referring in detail to the accompanying drawing, the condenser comprises a casing or shell 10, preferably cylindrical, and having a water inlet 11 at one side, near the top thereof, and a steam inlet 12 at one side, and below the water inlet. An air suction outlet

13 is arranged in the top of the casing or shell, and a hot water discharge opening is arranged at the bottom thereof.

Within the casing, and adjacent the water inlet, is a weir 15, forming a reservoir 16 for the incoming water. Beneath the weir and above the steam inlet is a diaphragm 17, which is preferably semicircular, and closes one-half of the area of the casing or shell, and serves to divide the latter into a steam space or chamber below and an air-cooling space above. In the space above the diaphragm is a baffle 18, preferably dome-shaped, and having one-half its area overlying the diaphragm and the other half projecting beyond the straight side of said diaphragm. Preferably this baffle is supported upon the diaphragm by means of a centrally disposed web 19, extending parallel to and along the straight edge of the diaphragm. The web thus supports the baffle on the edge of the diaphragm on the straight side and at the middle thereof, and divides the sheet of water falling from the diaphragm into two portions separated by a central open space substantially the width of the web.

In the operation of this condenser the cold water overflows the rim of the weir, falling upon the baffle as indicated by the lines and arrows in Figs. 1 and 3. Here it spreads evenly over the baffle, one-half falling onto the diaphragm and the other half falling directly down through the steam space in the form of a semicircular curtain, which may be termed the "back curtain," as indicated at *a* in Fig. 4. The portion of the water falling on the diaphragm overflows the straight side thereof in two parts, one at either side of the web 19, as indicated at *b* in Figs. 3 and 4, and may be termed the "front curtain." Steam enters the casing below the diaphragm, and a portion of such steam will come in contact with the two sheets or curtains *b*, and the remaining portion of the steam will pass through the opening in the front curtain and into the pocket at the back thereof, formed by the curtain *a*. The opening between the two parts of the curtain *b* should of course be of less width than the diameter of the baffle, so that the back curtain of water will overlap each part of the front curtain, affording an increased surface area of water to be met by the steam, after it passes through said opening.

Due to the increased area of the condensing sheets, and their length of fall, it becomes possible to provide an extremely small and compact condenser having the maximum of condensing capacity. It will be seen that the full quantity of steam entering the condenser meets a vertical sheet of water of considerable length, whose cross-sectional form is that of a straight line having a central gap and a semicircular sheet back of the gap and spanning the latter.

While I have shown and described a preferred embodiment of my invention, it will be understood that various changes in the form and arrangement of the several parts may be employed without departing from the spirit of my invention as disclosed in the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a condenser of the counter-current type, means for forming a divided sheet of water across the casing of the condenser, in front of the steam or vapor inlet, and means for forming a second sheet of water back of the first sheet and spanning the space between said divided sheets.

2. In a condenser of the counter-current type, means to form an interrupted sheet of water across the condenser casing in front of the steam or vapor inlet, and means to form a second sheet of water back of the first sheet and spanning the interruptions in the first sheet.

3. In a condenser of the counter-current type, means to form a straight sheet of water extending centrally across the condenser casing in front of the steam or vapor inlet, and open near its middle portion, and means to form a concave sheet of water back of the first sheet and spanning the opening in said first sheet.

4. In a condenser of the counter-current type, a casing having an opening for steam or vapor, an opening near its top for the escape of air, and an opening between for admission of water, means for directing water through the casing to form a vertical sheet across the casing adjacent the steam inlet, and having an opening therein near its middle portion, and means to form a second sheet back of the first sheet, spanning said opening, said sheets completely segregating the portion of the casing adjacent the air outlet from that adjacent the steam inlet, whereby the steam will be brought into contact with said sheets of water, and air and other incondensible gases will be compelled to pass through the sheets of water and be cooled on their way to the air inlet.

5. In a condenser of the counter-current type, a casing having an opening for steam or vapor, preferably at the side, an opening near its top for the escape of air, and an opening between for admission of water, a diaphragm extending horizontally across a portion of the casing, a baffle spaced above the diaphragm and projecting partially over the diaphragm and partially overhanging it, said baffle and diaphragm acting to form a vertical sheet of water extending across the casing adjacent the steam inlet, and having an opening near its middle portion, and a

second sheet of water back of the first sheet and spanning the opening in said first sheet.

6. In a condenser of the counter-current type, a casing having an opening for steam or vapor, an opening near its top for the escape of air, and an opening between for admission of water, a diaphragm extending horizontally across a portion of the casing, a baffle spaced above the diaphragm and projecting partially over the diaphragm and partially beyond, a weir above the baffle for directing water thereon, whereby the baffle acts to discharge a portion of the water onto the diaphragm and the remainder of the water directly downward through the casing, means on the diaphragm to direct water thereon downwardly through the casing in the form of a straight sheet having an opening near its middle portion, which opening is spanned by the sheet of water falling from the overhanging portion of the baffle, whereby the incoming steam is brought partially in contact with the sheets formed by the diaphragm and partially in contact with the sheet formed by the overhanging portion of the baffle, the air and other incondensible gases passing through the said sheets of water before reaching the air outlet.

7. A condenser of the counter-current type having an annular weir adjacent its top, a baffle positioned substantially centrally of the condenser casing to form a sheet or curtain of water in front of the steam inlet, and a diaphragm extending partly across said condenser casing beneath said baffle and above said steam inlet to intercept a portion of the water falling from said baffle and to form a second sheet or curtain of water before said steam inlet.

8. A condenser of the counter-current type having an annular weir adjacent its top, means dividing the water falling from said weir to form two sheets or curtains in front of the steam inlet, said means including a diaphragm extending partly across said condenser casing above said steam inlet, and a projection adjacent the edge of said diaphragm for producing a gap in one of said sheets.

9. A condenser of the counter-current type having an annular weir adjacent its top, a baffle positioned substantially centrally of the condenser casing to form a sheet or curtain of water in front of the steam inlet, a diaphragm extending partly across said condenser casing beneath said baffle and above said steam inlet to intercept a portion of the water falling from said baffle and to form a second sheet or curtain of water before said steam inlet, and means on said diaphragm forming a substantially centrally disposed gap in said second sheet or curtain.

10. A condenser of the counter-current type having an annular weir adjacent its top, a baffle positioned substantially centrally of the condenser casing to form a sheet or curtain of water in front of the steam inlet, a diaphragm extending partly across said condenser casing beneath said baffle and above said steam inlet to intercept a portion of the water falling from said baffle and to form a second sheet or curtain of water before said steam inlet, and means interconnecting said diaphragm and said baffle and forming a gap in said second sheet or curtain.

11. A condenser of the counter-current type having an annular weir adjacent its top, a baffle positioned substantially centrally of the condenser casing beneath said weir, a diaphragm extending partly across said condenser casing beneath said baffle and above the steam inlet, said baffle and said diaphragm together forming two curtains of water before said steam inlet, and a projection in the form of a web rising from the edge of said diaphragm to serve as a support for said baffle and to provide a centrally disposed gap in the curtain falling from said diaphragm.

HENRY E. BYER.