Oct. 10, 1933. H. E. BYER 1,929,403

CONDENSER

Filed July 31, 1931

Fig. 1.

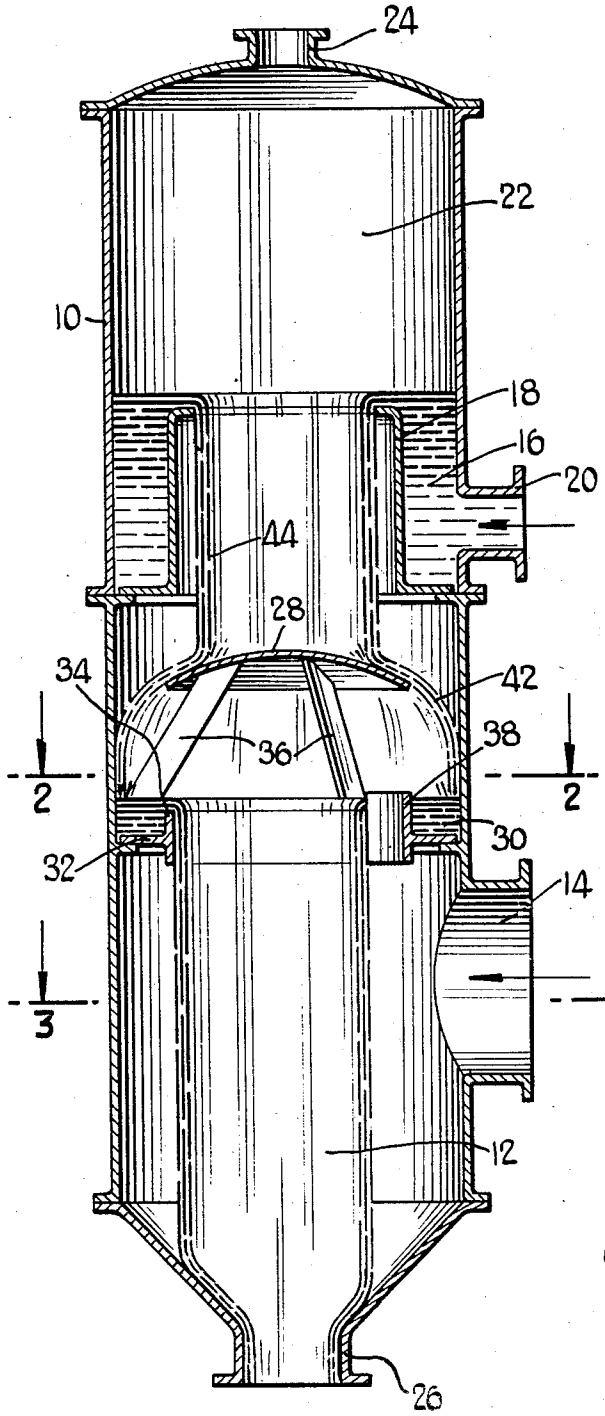


Fig. 2.

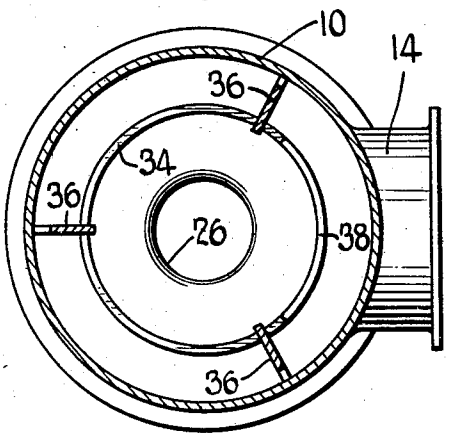
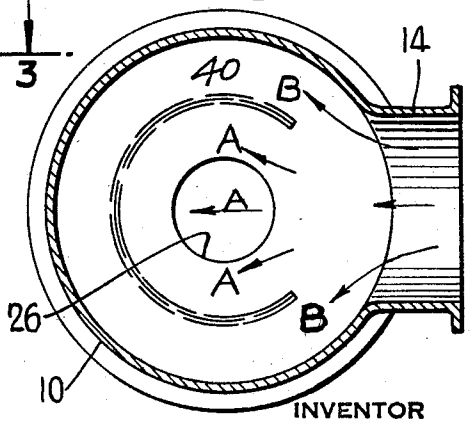


Fig. 3.



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CONDENSER

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8 Claims. (Cl. 261—108)

This invention relates to improvements in counter-current condensers for steam and other vapor laden gases, and more particularly relates to improvements in the water shed for more effectively distributing the water.

Prior counter-current condensers have had a common difficulty, namely, that the incoming steam which contacted with the water stream so distorted the surface of water that the effective cooling surface was considerably lower than desired with a resulting reduction in condensing efficiency. Prior constructions have also been defective in requiring an elaborate complicated series of chambers and have thereby reduced the effective condensing chamber and required very large devices for satisfactory results.

It is the principal object of this invention to provide a condenser in which the steam pressure will be balanced on opposite sides of the water screen whereby the incoming steam will not blow the water screen aside, and greater condensing efficiency will be secured for the size of condenser or water screen used.

Another object of this invention is to provide a condenser having a substantially C shaped water screen with the opening adjacent the inlet for the steam, which water screen will maintain its shape and condition during the inflow of steam.

Another object of the invention is to provide a counter-current condenser having a minimum number of internal compartments and a minimum number of parts thereby increasing the effective size of the condensing chamber and reducing the cost of construction of the condenser.

Further objects and advantages of this invention will appear from the following description thereof taken in connection with the attached drawing which shows one form of embodiment to which my invention is susceptible and in which:

Figure 1 is a central vertical section through a form of condenser, diagrammatically showing the course of the water and gases.

Figure 2 is a horizontal section substantially on the line 2—2 of Figure 1.

Figure 3 is a diagrammatic cross section taken substantially on the line 3—3 of Figure 1 and showing the C shaped water screen and the path of the incoming steam.

Prior forms of counter-current condensers have been designed to pass a sheet of water in the form of a plane, cylinder, or the like, past the steam inlet so that the incoming steam would immediately impinge upon the sheet of water and be cooled and partially condensed thereby. The incoming steam, however, usually blows aside the sheets of water immediately in front of the steam inlet so that the desired cooling and condensing action does not take place until after the steam has penetrated for some distance into the condenser and the cooling and condensing effect of the water sheet immediately in front of the steam inlet is substantially wasted. I have found that by providing a condenser in which the water stream or sheet is not substantially blown aside or disturbed by the incoming steam more efficient utilization of the water is attained and greater condensing effect secured.

One form of construction of my balanced water column condenser is shown in Figure 1 in which the condenser 10 is provided with a condensing chamber 12 into which the steam enters through the conduit 14. A water chamber 16 is formed above the condensing chamber 12 by the weir 18 into which the water flows from the conduit 20. A collection chamber 22 for uncondensible gas is also provided at the top of the condenser 10 from which the gases are removed by a suitable vacuum pump or other means (not shown) through the conduit 24. The hot water is discharged from the bottom of the condenser 10 through the conduit 26.

The weir 18 is adapted to retain a substantial quantity of water which when it overflows will pass downward in a substantially cylindrical sheet through the mixing chamber 27 onto an umbrella shaped deflector 28, and thence into a second water receiving chamber 30 which is formed by a central ring 32 having an upstanding rim 34 which also acts as a weir. The umbrella shaped deflector 28 is suitably mounted on supports 36 rising from the ring 32 or any other suitable place in the condenser.

For a distance approximately equal to the diameter of the opening of the steam inlet 14, the ring 32 is provided with a secondary baffle or raised lip 38 which extends above the rim 34. This baffle prevents water from flowing into the condensing chamber 12 adjacent the steam opening 14 while the rim 34 permits the water to flow in an otherwise unbroken sheet into the condensing chamber. The resulting water flow is in the shape of a circle with a segment broken away or substantially C shaped as shown at 40 in Figure 3, with the open side of the C facing the steam inlet 14.

As the steam enters through the inlet 14, particularly shown in Figure 3, a portion of the steam enters directly into the center of the C shaped water sheet 40 following the arrows A and an-

other portion passes between the sides of the condenser 10 and the water screen 40 following the path B. This divided path of the steam brings about an equalization of pressure on opposite sides of the water column 40, and permits the water to fall substantially plumb or straight through the condensing chamber with the result that there is little agitation or crossing about of the water column by the incoming steam and the steam contacting with both sides of the C shaped column is more quickly condensed than with the prior condensers where the incoming steam impinges directly on the water column. This enables me to reduce the size of my condensing chamber and still get the same condensing results as are allowed with the larger size condensers previously used.

The steam which is not entirely condensed within the condensing chamber 12, together with such air as may be entrapped within the steam and other uncondensible gases will pass upward to the water shed 42 formed by the umbrella shaped deflector 28 which will effectively condense all the remaining steam and the uncondensible gases will then pass through the water stream 44 from the top of the weir 18. The steam will therefore be condensed by either of the two lower courses of water which are continuous and will be entirely condensed before it reaches the air chamber 22 as before mentioned. The air and any other uncondensible gases collect in the chamber 22 and are removed by a suitable vacuum pump through the outlet 24.

It is preferable that the area of the C shaped water sheet 40 be as large as possible and this is governed to some extent by the velocity of the incoming steam. It is essential that a sufficiently large space be provided for the steam to pass between the condenser housing and the water sheet. It is not necessary that the C shaped column 40 be exactly located so as to bring about this result, as variations are possible due to the rate of flow of water and the conditions, and the construction shown gives a substantial balance on each side of the water column and permits the column 40 to fall substantially plumb through the chamber 12 thus condensing steam on both sides simultaneously.

As substantially all of the condensing action takes place in the chamber 12 there is little tendency to blow aside the water column of the shed 42 or stream 44 and little tendency for water to be blown or sucked through the outlet 24 so that the air chamber 22 may be made shorter than in previous condensers without detrimental results.

It will thus be seen that the steam will be condensed by the C shaped water shed in the condensing chamber and by the umbrella shaped water shed between the weirs thus affording a large surface for exposure to the steam. The C shaped water shed in the condensing chamber will remain constant in position and due to the balance in pressure it will not be deflected by the incoming steam so that it will continually operate for condensing purposes. It is thus possible to use a smaller and more compact condenser to bring about satisfactory condensing of the steam.

While I have shown a preferred form of embodiment of my condenser it will be understood that modifications may be made therein and I therefore desire a broad interpretation of my invention within the scope and spirit of the description thereof and of the claims appended hereinafter.

I claim:

1. In a steam condenser of the type described a vertical condensing chamber, means to pass a sheet of water through said chamber, means to maintain an opening in said sheet of water adjacent the steam inlet and means to maintain an opening for steam on opposite sides of said water sheet whereby the water will not be substantially blown aside by the incoming steam.

2. In a countercurrent condenser a condensing chamber and a water distributor mounted above the condensing chamber and comprising means to discharge the condensing water into the condensing chamber in the form of a cylindrical sheet, said sheet having an open side adjacent the steam inlet, said sheet of water being spaced from the sides of said chamber whereby steam may pass between the sheet of water and the casing.

3. In a countercurrent condenser a casing having in its lower portion a steam inlet, a water outlet, a weir arranged at an intermediate point in the casing above the steam inlet, a water supply pipe for the weir, a water distributor directly above the steam inlet, forming a substantially completely cylindrical sheet of water, said water sheet being spaced from the casing to form a steam path between the water sheet and the casing, said water distributor forming an opening in the water sheet for a second steam path into said water sheet and an air suction pipe leading from the casing above the water supply pipe.

4. In a countercurrent condenser a casing having a deflector therein to divide off the water mixing chamber from a condensing chamber, means to support said deflector, said supporting means having a large central opening surrounded by a raised edge projecting into the mixing chamber, said deflector having a cupped portion disposed above said supporting means and spaced from said supporting means, said deflector being spaced from the side walls of the mixing chamber to form an easy passage for the air through said mixing chamber, and an air suction pipe leading from above the deflector substantially as described.

5. A condenser of the counter-current type having an annular weir adjacent the top, a baffle positioned substantially centrally of the condenser casing to form a circular sheet of water in front of the steam inlet, a water distributor mounted above the steam inlet to intercept all of the water falling from said baffle, and means on said water distributor forming a substantially centrally disposed gap in said circular sheet of water.

6. In a condenser of the counter-current type having an opening for the introduction of steam or vapor, means to introduce water for condensing purposes into said condenser, a baffle means for forming a C shaped sheet of water in front of the steam or vapor inlet with the opening directly in front of the steam or vapor inlet and free from the walls of said condenser, the incoming steam or vapor surrounding said sheet of water forming a pressure balance on both sides of said C shaped sheet of water, said water sheet being spaced from said casing whereby the steam or vapor may pass between said sheet and said casing.

7. In a condenser of the counter-current type having a steam inlet, a water inlet, a weir forming a water reservoir, and a cylindrical sheet of water and a baffle forming a C shaped sheet of water in front of the steam inlet, said water sheets

being so arranged that a portion of the entering steam will fully surround the C shape of the sheet of water.

8. A steam condenser having a condensing chamber into which steam is admitted, a plurality of weirs, and an umbrella shaped deflector between said weirs, one of said weirs forming a cylindrical sheet of water onto said umbrella deflector, said umbrella deflector forming an umbrella sheet of water, the second of said weirs having a baffle to form a C shaped sheet of water, the opening of said C sheet being directly in front of the steam inlet, said C shaped sheet forming a plurality of paths of inflowing steam maintaining a uniform pressure balance to prevent distortion of the C shaped sheet.

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