April 28, 1925. 1,535,819

W. L. R. EMMET

COOLER AND SEPARATOR

Filed Dec. 26, 1922

Fig. 1.

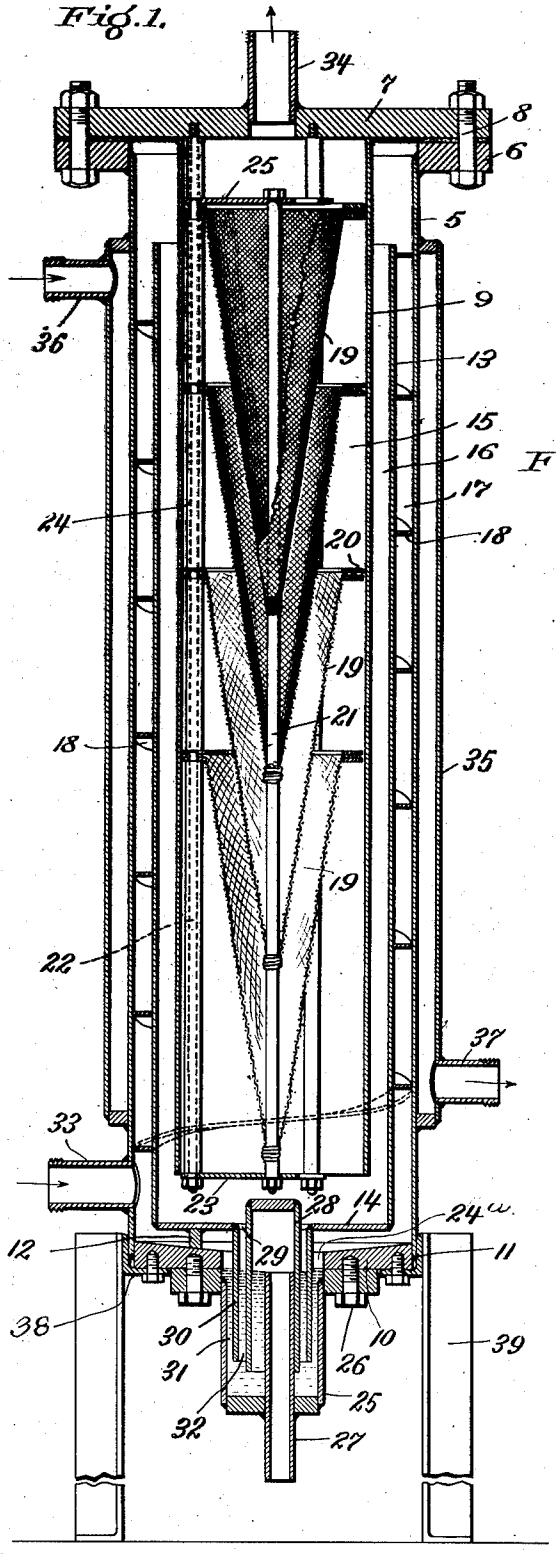
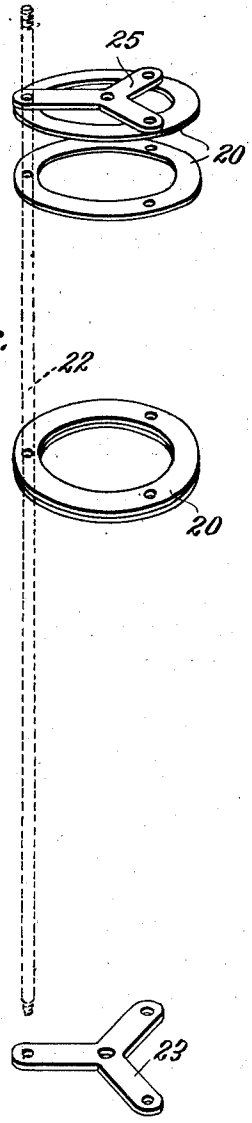


Fig. 2.



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His Attorney.

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UNITED STATES PATENT OFFICE.

WILLIAM L. R. EMMET, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

COOLER AND SEPARATOR.

Application filed December 26, 1922. Serial No. 609,162.

To all whom it may concern:

Be it known that I, WILLIAM L. R. EMMET, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Coolers and Separators, of which the following is a specification.

The present invention relates to an apparatus for cooling a mixture of condensible and non-condensible vapors and separating the condensate formed from the non-condensible vapors.

An application of my invention is in connection with mercury turbine systems wherein in connection with the shaft packings of the turbine there is some leakage of mercury vapor which it is desired to condense and save. This mercury vapor is taken from the packing in the form of a mixture of the vapors with air or other non-condensible gas, there being of course, some liquid particles of mercury, and the object of my invention is to provide a combined cooler and separator which will function to cool the mixture so as to condense the vapors and separate the condensate from the air or other gas.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, Fig. 1 is a longitudinal sectional view of a cooler and separator embodying my invention, and Fig. 2 is a perspective view of certain parts.

Referring to the drawing, 5 indicates a cylindrical casing provided with a flange 6 at its upper end to which is fastened a head 7 by bolts 8. Casing 5 is made of relatively thin material and flange 6 which is much thicker is formed advantageously by welding a collar to the end of the casing. Suitably fastened to head 7 and depending from it is an inner cylinder 9 which terminates short of the bottom of casing 5. The lower end of casing 5 is closed by a head 10 which may be welded to the casing as indicated at 11. Supported on head 10 by suitable spacing blocks 12 is an intermediate cylinder 13 which is closed at its lower end by a head 14. The upper end of cylinder 13 is open and terminates short of the top of casing 5. There is thus formed in casing 5 a central chamber 15 surrounded by two concentric annular chambers 16 and 17. In chamber 17 is a spiral deflecting strip 18 which extends from the lower end of the chamber to the upper end. In central chamber 15 are a number of cone-shaped screens 19 preferably made from cloth. Screens 19 are fastened between pairs of rings 20 at their larger ends and to a central post 21 at their apices. Rings 20 are carried by rods 22 which at their upper ends are fastened to head 7 and at their lower ends to a spider 23. The rings are spaced by sleeves 24 on rods 22 and adjacent to the upper ring is a spider 25 to the center of which the upper end of post 21 is connected, the lower end of such post being fastened to the center of spider 23.

In lower head 10 is a central opening 24^a which connects with a well 25 fastened to the under side of head 10 by bolts 26. Projecting up through the bottom of well 25 is a discharge pipe 27, the upper end of which terminates a suitable distance above such bottom. Over the end of pipe 27 is an inverted cup 28 which is fastened to the side of the pipe and depends to a point well below its top. At the central portion of head 14 is an opening 29 to which is connected a depending sleeve 30 which extends well down into well 25. This arrangement provides an annular passage 31 through which annular chamber 17 is connected to well 25 and an annular passage 32 through which annular chamber 16 and central chamber 15 are connected to well 25. The inner surface of head 10 is beveled to provide a wall which slopes toward central opening 24^a. At the lower end of casing 5 is an admission conduit 33 and at the center of head 7 is a discharge conduit 34.

Surrounding casing 5 is a wall 35 which forms a cooling jacket having a cooling medium inlet conduit 36 and a discharge conduit 37.

The apparatus may be supported in any suitable manner. In the present instance it is shown as being fixed to angle irons 38 carried by posts 39.

In operation, the vapor mixture, for example, air and mercury vapor, enters through conduit 33 and flows upwardly through annular chamber 17 being directed in a spiral course around casing 5 by deflecting strip 18. At the same time cooling medium flows in through conduit 36 through

the cooling jacket and out through conduit 37. Ordinarily, water is used as the cooling medium. The vapor mixture is cooled in passing up through annular chamber 17, the deflecting strip serving to bring it into engagement with the cooled outer wall of the chamber and this effects the condensation of the condensible vapors in the mixture. The major portion of the condensate will fall down on to head 10 and flow through opening 24ª into well 25. Some liquid particles, however, will be carried along with the non-condensible vapors which vapors after reaching the top of chamber 17 are directed down through annular chamber 16 and thence upwardly again through chamber 15 to discharge conduit 34. In flowing from chamber 16 to chamber 15 a considerable portion of any liquid particles will be deposited on head 14 from which they will run down through opening 29 and annular passage 32 to well 25. Any particles carried on into chamber 15 will be caught by screens and find their way down to well 25. Every particle of condensate is thus removed from the vapors and directed to well 25.

Discharge pipe 27 projects above the bottom of well 25 a distance sufficient to maintain a predetermined level of liquid in the well and cup 28 and sleeve 30 dip down into such liquid so as to form a liquid seal at the bottom of casing 5.

My invention has particular utility as a separator for mercury since mercury is relatively expensive and it is important that every particle be saved. By the use of my invention the incoming vapor mixture is thoroughly cooled and the mercury or other condensate efficiently separated out. At the same time the apparatus is simple in structure and easily assembled. In general I prefer to connect the various parts by welding as this makes the joints absolutely tight and does away with packing glands.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In an apparatus of the character described, the combination of an elongated closed casing, walls within the casing forming a series of chambers, said chambers lying one within the other and extending longitudinally of the casing, alternate adjacent ends of said chambers being in communication with each other whereby said chambers are connected in series, means forming a spiral passage through the outermost chamber in a longitudinal direction, a plurality of screens within the innermost chamber, an inlet conduit and an outlet conduit connected with the interior of the casing, and cooling means surrounding the casing.

2. In an apparatus of the character described, the combination of an elongated closed casing, walls within the casing forming a series of chambers, one within the other longitudinally of the casing, alternate adjacent ends of said chambers being in communication with each other whereby said chambers are connected in series, means forming a spiral passage through the outermost chamber in a longitudinal direction, a plurality of screens within the innermost chamber in stacked spaced relation to each other along the length of said chamber, an inlet conduit connected with the outermost chamber at its lower end, an outlet conduit connected with the innermost chamber at its upper end, and cooling means surrounding the casing.

3. In an apparatus of the character described, the combination of an elongated closed casing, walls within the casing forming a series of substantially concentric chambers extending longitudinally of the casing, alternate adjacent ends of said chambers being in communication with each other whereby said chambers are connected in series, means forming a spiral passage through the outermost chamber adjacent and along the wall of the casing, a plurality of screens within the innermost chamber in stacked spaced relation to each other along the length of said chamber, an inlet conduit connected with the outermost chamber at its lower end, an outlet conduit connected with the innermost chamber at its upper end, a well at the lower end of the casing, means within the well forming a liquid seal between the outermost chamber and the remaining chambers and between each chamber and the exterior of the casing, an overflow conduit for the well, and cooling means surrounding the casing.

4. In an apparatus of the character described, the combination of a casing having a head at each end, a wall depending from the upper head in spaced relation to the casing wall, means forming a tortuous path in the space between said walls, a screen located inside said depending wall, an inlet conduit connected to the space between said walls, an outlet conduit connected to the space within the depending wall, a liquid well connected to the lower head, a liquid seal in said well, and cooling means surrounding said casing.

5. In combination, a cylindrical casing, heads at the upper and lower ends thereof, spaced concentric walls in the casing, the inner of which is connected to the upper

head, a spiral deflecting strip between the outer wall and casing, a well connected to the lower head, a liquid seal therein, a plurality of screens inside said inner wall, an inlet conduit connected to the casing, and an outlet connected to the central portion of the upper head.

6. In combination, a cylindrical casing, heads at the upper and lower ends thereof, spaced concentric walls in the casing, the inner of which is connected to the upper head, a spiral deflecting strip between the outer wall and casing, a well connected to the lower head, means within the well forming a liquid seal between the interior of the casing and its exterior, a plurality of screens within the confines of said inner wall, an inlet conduit connected to the casing adjacent its lower end, an outlet conduit connected to the upper head and terminating at its inner end within the confines of the inner wall, and cooling means surrounding said casing.

7. In combination, an elongated casing having upper and lower open ends, heads closing said upper and lower ends, an inner chamber, an intermediate chamber and an outer chamber within the casing extending longitudinally thereof, a plurality of substantially concentric walls separating said chambers, each of said walls being connected with one head and terminating short of the other head, a spiral deflecting member in the outer chamber, a plurality of nested cone-shaped screens arranged in spaced relation to each other within the inner chamber, an inlet conduit opening into the outer chamber adjacent the lower head end of the casing, an outlet conduit leading from the inner chamber at the upper end of the casing, a well at the bottom of the casing, a liquid seal in the well, and cooling means surrounding the casing.

8. In combination, an elongated cylindrical casing having upper and lower open ends, heads forming closures for said ends, an inner chamber, an intermediate chamber and an outer chamber within the casing extending longitudinally thereof, a plurality of substantially concentric walls separating said chambers, each of said walls being connected with one head and terminating short of the other head, a spiral deflecting member in the outer chamber forming a spiral passage along the length of said chamber, a plurality of nested cone-shaped screens arranged in spaced relation to each other within the inner chamber, an inlet conduit connected with the outer chamber at its lower end, an outlet conduit connected with the inner chamber at its upper end, a well at the bottom of the casing, means forming a liquid seal in the well between the outer and inner chambers and between each of said chambers and the exterior of the casing, a conduit for conducting overflow liquid from the well, and cooling means surrounding the casing.

In witness whereof, I have hereunto set my hand this 22nd day of December, 1922.

WILLIAM L. R. EMMET.