

Nov. 13, 1934.

R. KAY ET AL

1,980,623

CALANDRIA

Filed May 15, 1934

2 Sheets-Sheet 1

Fig. 1.

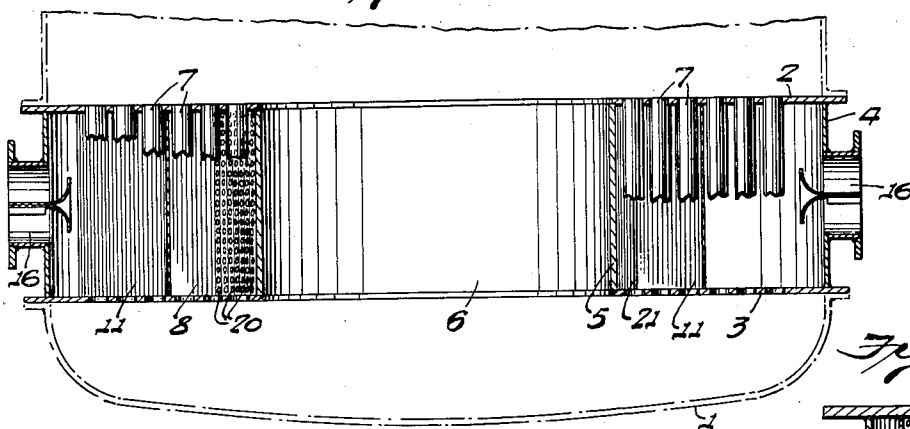


Fig. 5.

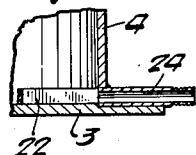


Fig. 2.

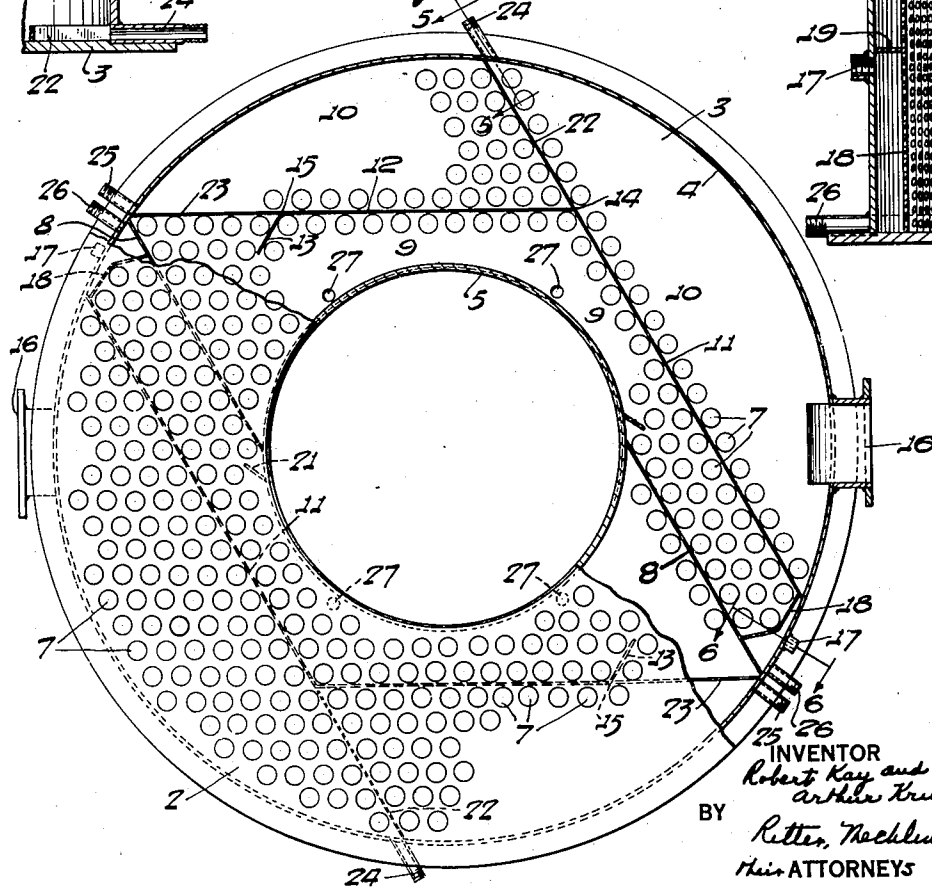
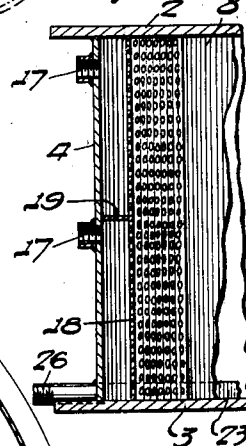


Fig. 6.



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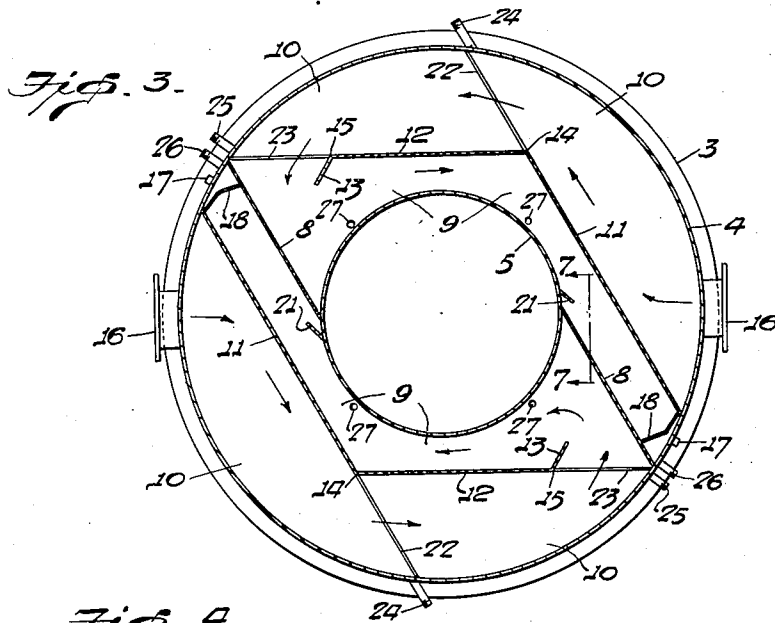
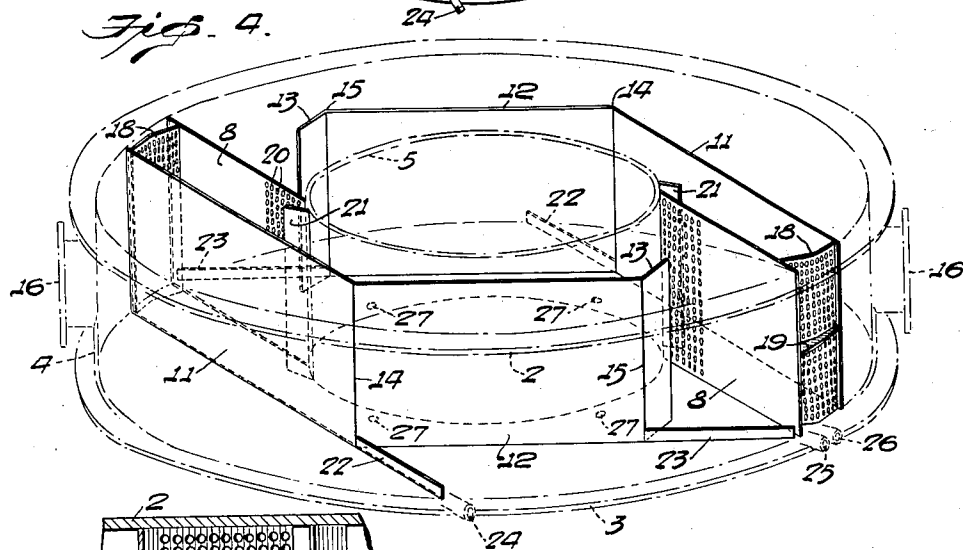
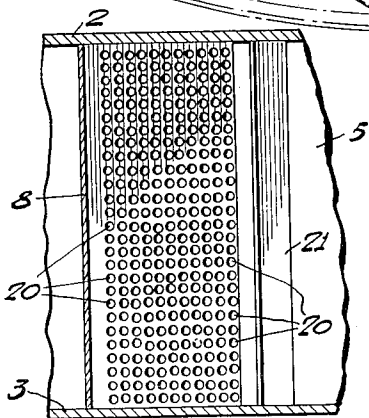
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CALANDRIA

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

1,980,623

CALANDRIA

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Application May 15, 1934, Serial No. 725,792

10 Claims. (Cl. 257—203)

Our invention relates to improvements in calandrias for vacuum pans or evaporators and its principal object is to insure circulation of the heating medium throughout the calandria so as to avoid dead spaces and thus provide for even evaporation over the entire area of the calandria.

Another object of the invention is to cause the heating medium to first circulate around the outer portions of the calandria where the pan or evaporator circulation is upwards and then to cause the heating medium to circulate around the centerwell or inner portions of the calandria where the circulation is downwards.

Still another object of the invention is to increase the efficiency of the calandria by disposing drainage ports or openings at the most advantageous points.

A primary feature of the invention consists in providing the calandria with a plurality of compartments, each having a plurality of circulatory courses for the heating medium, inlet and outlet ports for the heating medium being provided for each compartment and each communicating with a different course in the latter, the end of the course communicating with the inlet port being disposed adjacent the end of the course communicating with the outlet port.

Another feature of the invention consists in providing a calandria having inner and outer shells with walls extending between the shells dividing the calandria into two compartments, each compartment being provided with baffle means dividing it into inner and outer circulatory courses for a heating medium, the outer course communicating with an inlet port for the heating medium and the inner course communicating with an outlet port therefor.

A further feature of the invention consists in providing a calandria with a baffle plate, one end of which terminates inwardly of the outer shell of the calandria, the bottom of the calandria being provided with an upwardly projecting rib extending between the outer shell and the end of the baffle plate in alignment with the latter, so as to direct condensate of the heating medium to a drain opening located adjacent the outer shell.

Other and more specific features of the invention residing in advantageous forms, combinations and relations of parts will hereinafter appear and be pointed out in the claims.

In the drawings, illustrating a preferred embodiment of the invention,

Figure 1 is a vertical sectional view of the

calandria, parts of the heating tubes being broken away, and adjacent portions of any suitable evaporator being illustrated in dotted lines.

Figure 2 is a plan view of the calandria, portions of the top wall thereof being broken away.

Figure 3 is a horizontal sectional view of the calandria, all of the heating tubes being omitted for clarity.

Figure 4 is a perspective view of the baffle plates of the calandria, the inner and outer shells thereof and the top and bottom walls being indicated in dotted lines.

Figure 5 is an enlarged detail sectional view taken on line 5—5 of Figure 2.

Figure 6 is an enlarged detail sectional view taken on line 6—6 of Figure 2.

Figure 7 is an enlarged detail sectional view taken on line 7—7 of Figure 3.

Referring more particularly to the drawings, 1 indicates diagrammatically any suitable vacuum pan or evaporator with which the calandria may be associated. As is customary, the calandria is formed with top and bottom plates 2 and 3, respectively, and outer and inner shells 4 and 5, respectively, the inner shell, as is usual, defining a centerwell or downtake 6. Circulation tubes 7 extend through the heating chamber of the calandria and are connected at their opposite ends to the top and bottom plates.

The heating chamber is divided into a plurality of compartments, preferably two in number, by walls 8 which extend between the inner and outer shells, being preferably connected to the latter and to the top and bottom plates. These walls, instead of being radially disposed, are advantageously arranged so as to form acute angles with lines respectively tangent to the inner shell at the points of connection between the latter and the walls. Moreover, the walls are preferably disposed so that each compartment will be of the same or substantially the same size.

Each heating compartment is provided with baffle means defining inner and outer circulatory courses 9 and 10, respectively, for the heating medium, which may be steam or any other suitable gas. These courses are formed by baffle means, which, in the present embodiment of the invention, comprise a plurality of angularly disposed baffle plates 11, 12 and 13, each of which extends continuously between the top and bottom plates of the calandria. The baffle plates in each compartment may be formed integrally or, if desired, they may be formed separately and then connected together in any suitable man-

ner. The baffle plate 11 may be advantageously disposed parallel with but spaced a suitable distance from the adjacent wall 8 and, at one end, it is connected to the outer shell 4. At its other end, it terminates inwardly of the outer shell at a point designated 14. The baffle plate 12 extends from this point at an angle to the plate 11 to a point designated by the reference numeral 15 also inwardly of the outer shell. The plate 13 extends from this latter point at an angle to the baffle plate 12 toward the compartment wall 8 remote from the baffle 11.

Communicating with the outer course 10 of each compartment at a point adjacent the end of the baffle plate 11, which is connected to the outer shell, is an inlet port or opening 16 for the heating medium and communicating with the end of the inner course 9 is an outlet port or opening 17. The inlet and outlet ports of each compartment are preferably disposed on the same side of the calandria, that is, the outer side as distinguished from the inner side, and they are also preferably arranged adjacent each other. This disposition of the ports causes the heating medium to circulate throughout all portions of the compartments. It is to be observed that the outlet ports of the two compartments are disposed at diametrically opposite points and that the inlet ports are also similarly disposed, for the reason that the compartments are duplicates in size as well as shape. However, it is to be understood that, should it be found desirable to make the compartments unsymmetrical, the inlet and outlet ports of one compartment may be located differently with respect to the corresponding ports of the other compartment.

The heating medium entering through the inlet ports 16 will circulate through the outer courses 10 to the ends thereof, where it will be deflected by the walls 8 into the inner courses 9 through which it circulates to the outlet ports 17. While only one outlet port 17 may be provided for each compartment, it has been found desirable to employ two such ports. It has also been found desirable to dispose diaphragm plates 18 at the end of the inner courses 9 spaced slightly from the outer shell 4 in advance of the outlet openings. These diaphragm plates are provided with perforations so that the heating medium and other gases circulating through the compartments will pass uniformly to the outlet openings and will not converge into streams. It is also to prevent this that two outlet ports are provided and the space between the diaphragm plates 18 and the outer shell 4 is preferably divided into two parts by a horizontal partition 19, each part having communication with one outlet port. This arrangement results in as efficient circulation of the heating medium adjacent the outlet ports as in all other portions of the compartments.

To avoid dead spaces on the centerwell side of the inner course 9 where the walls 8 intersect the inner shell 5, the inner portions of the walls are formed with a plurality of perforations 20 which establish communication between the compartments. To deflect the steam through the perforations, plates 21 may be advantageously employed. These plates are preferably disposed at about a 45° angle to the walls 8 adjacent thereto and they intersect the inner shell 5 at points slightly in advance of the inner ends of the walls.

As some of the heating medium is likely to condense while passing through the compartments

and as the presence of condensate in the calandria reduces the heating efficiency thereof, each compartment is provided with a plurality of drain openings. These drain openings are preferably disposed adjacent the outer shell and means is provided within the compartments for diverting or directing the condensate to them. In the present embodiment of the invention, this means comprises ribs 22 and 23 which project upwardly from the bottom plate 3 of the calandria for a limited distance. The rib 22 extends in alignment with the baffle plate 11 from the end 14 thereof to the outer shell 4 and adjacent the point of intersection of the rib and shell is a drain opening 24. The rib 23 extends from the end of the baffle plate 12 at the point 15 in alignment with that plate to the outer shell 4 and, adjacent the point where it intersects the latter, another drain opening 25 is provided. As the ribs 22 and 23 project upwardly from the bottom plate 3 only a limited distance, they will not hinder the free circulation of the heating medium, but since the condensate will, of course, collect on the bottom plate and be carried therealong by the heating medium, the ribs will effectively function to direct the condensate to the drain openings. An additional drain opening 26 is located at the end of the inner course 9 of each compartment and, as the direction of flow of the heating medium is not deflected at this point but is in a substantially straight line, it is unnecessary to provide ribs for directing the condensate to these drain openings. Other drain openings 27 may be located at points intermediate the ends of the inner course and preferably adjacent the inner shell 5. Each of the several drain openings 24, 25, 26 and 27 are adapted to be connected with suitable means (not shown) for receiving the condensate as it discharges from the calandria.

From the foregoing, it will be perceived that the heating medium is caused to first circulate around the outside of the calandria where the circulation of the fluid being heated in the pan or evaporator is upwards and then caused to pass around the inner side of the calandria where the fluid circulation is downwards. The calandria will, therefore, be found to function most efficiently because the temperature of the heating medium will be highest where the fluid circulation is upwards and will be lowest where the fluid circulation is downwards. The efficiency of the calandria is also materially increased by providing it with a plurality of drain openings and by providing means for directing the condensate to them. Its efficiency is also materially increased, as the arrangement of baffles and disposition of the inlet and outlet ports insure circulation of the heating medium throughout all portions of the calandria and dead spaces or spots are entirely avoided.

What we claim is:

1. A calandria having a heating chamber provided with two compartments, each of said compartments having a plurality of circulatory courses for a heating medium, one course of each compartment having an inlet port for the heating medium and another course thereof having an outlet port therefor, the inlet and outlet ports of each compartment being disposed adjacent the same side of the calandria and the end of the course of each compartment communicating with the inlet port being disposed adjacent the end of the course communicating with the outlet port.

2. A calandria involving inner and outer shells forming a heating chamber; walls respectively ex-

tending between said shells dividing the chamber into a plurality of compartments, each of said compartments having inlet and outlet ports for a heating medium, and baffle means disposed in each compartment dividing the latter into inner and outer circulatory courses for the heating medium, the baffle means of each compartment being connected to the outer shell and being disposed between the inlet and outlet ports thereof.

3. A calandria involving inner and outer shells forming a heating chamber, walls respectively extending between said shells dividing the chamber into two compartments, baffle means disposed in each compartment dividing the latter into inner and outer circulatory courses for a heating medium, the outer course of each compartment having an inlet port for the heating medium and the inner course thereof having an outlet port for the heating medium, the inlet port of each compartment being adjacent the outlet port thereof.

4. A calandria involving inner and outer shells forming a heating chamber, walls respectively extending between said shells dividing the chamber into a plurality of compartments, baffle means disposed in each of said compartments defining a plurality of circulatory courses for a heating medium, said baffle means being connected to the outer shell adjacent one of said walls and extending to a point adjacent the other of said walls, and inlet and outlet ports for the heating medium communicating with each compartment on opposite sides of the baffle means.

5. A calandria involving inner and outer shells forming a heating chamber, walls respectively extending between said shells dividing the chamber into a plurality of compartments, baffle means dividing each compartment into inner and outer circulatory courses for a heating medium, said outer course being defined by the baffle means and the outer shell and said inner course being defined by the baffle means, the inner shell and said walls, an inlet port for a heating medium communicating with one of said courses of each compartment and an outlet port therefor communicating with the other of said courses thereof.

6. A calandria involving inner and outer shells forming a heating chamber, walls respectively extending between said shells dividing the chamber into a plurality of compartments, inlet and outlet ports for a heating medium communicating with each of said compartments, a plurality of angularly disposed baffle plates dividing each compartment into a plurality of circulatory courses for the heating medium, one of said baffle

plates of each compartment being spaced from and extending substantially parallel with one of said walls and the outlet opening of each compartment communicating with the space between said baffle and said wall.

7. A calandria involving inner and outer shells forming a heating chamber, walls respectively extending between said shells dividing the chamber into a plurality of compartments, each of said walls intersecting the inner shell at an acute angle and being provided adjacent said shell with a plurality of apertures establishing communication between said compartments, and inlet and outlet ports for a heating medium communicating with each of said compartments.

8. A calandria involving inner and outer shells forming a heating chamber, baffle means providing said chamber with a plurality of circulatory courses for a heating medium, said baffle means including a baffle plate, one end of which is spaced from said outer shell, and a rib projecting upwardly from the bottom of the chamber and extending outwardly from the said end of the baffle plate to the outer shell, and a drain opening adjacent the outer end of said rib.

9. A calandria involving inner and outer shells forming a heating chamber, baffle means dividing the chamber into a plurality of circulatory courses for a heating medium, said means comprising a plurality of angularly disposed intersecting plates, the point of intersection of two of said plates being spaced from the outer shell, and a rib projecting upwardly from the bottom of the compartment and extending outwardly from said point of intersection to the outer shell in substantial alignment with one of said plates, and a drain opening in the chamber adjacent the outer end of the rib.

10. A calandria involving inner and outer shells forming a heating chamber, baffle means disposed within the chamber defining a plurality of circulatory courses for a heating medium, said baffle means including a plurality of angularly disposed plates, two of said plates terminating in the direction of flow of the heating medium at a point inwardly of the outer shell, and ribs projecting upwardly from the bottom of the chamber and extending between the said ends of the last mentioned plates and the outer shell respectively constituting prolongations of said plates, and drain openings respectively adjacent the ends of the ribs adjoining the outer shell.

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