

March 15, 1932.

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1,849,874

HEAT INTERCHANGER

Filed Sept. 1, 1928

2 Sheets-Sheet 1

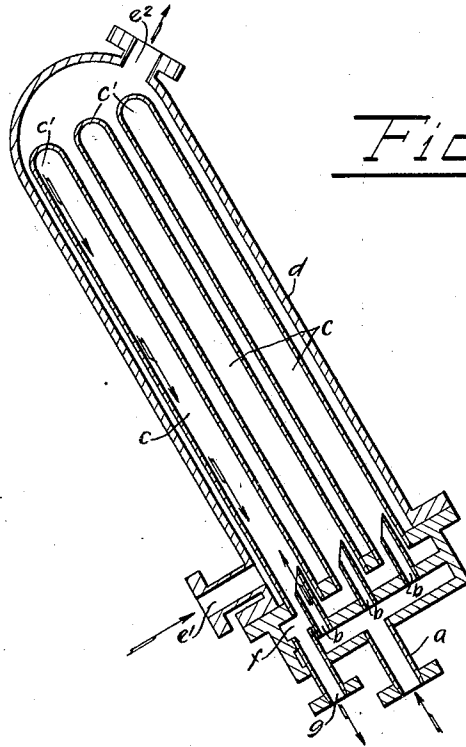


Fig. 1.

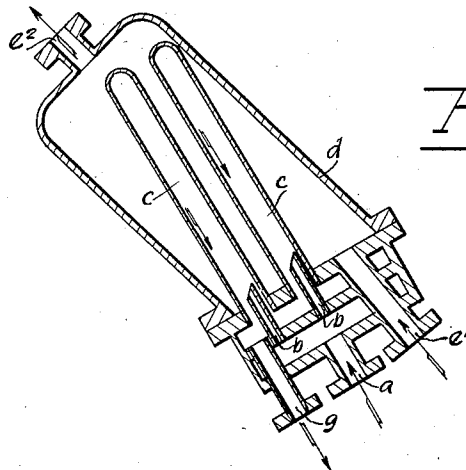


Fig. 3.

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Fig. 2.

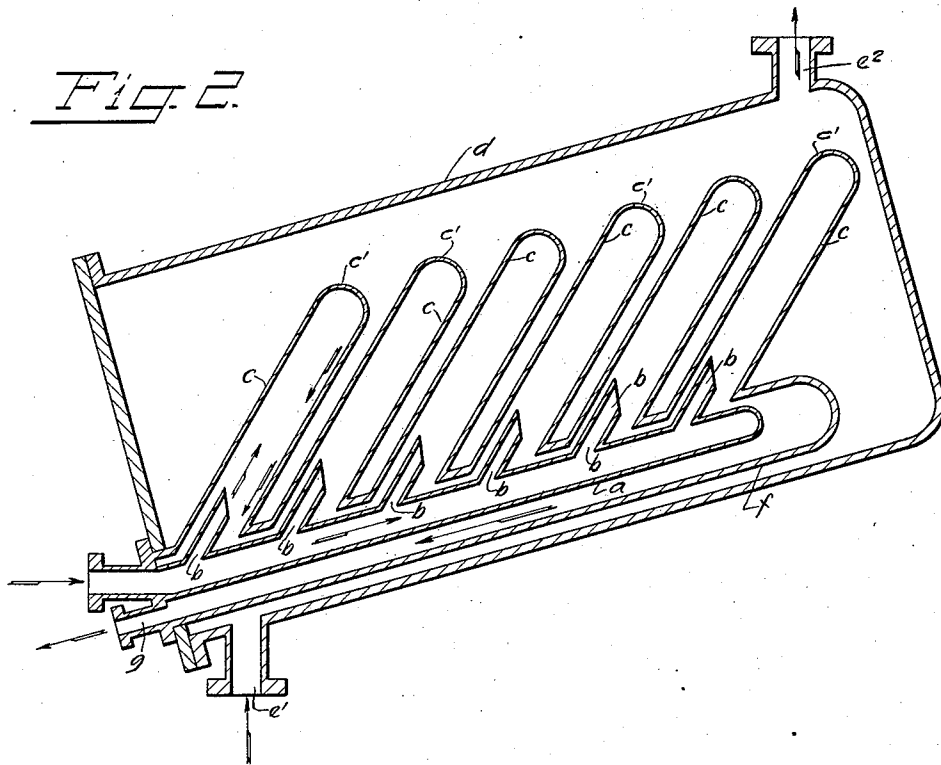
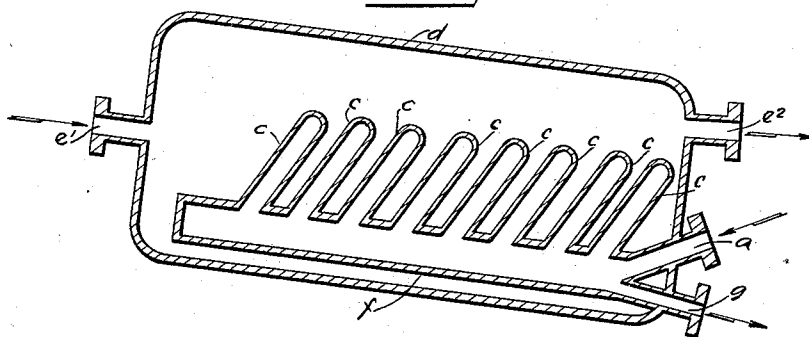


Fig. 4.



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HEAT INTERCHANGER

Application filed September 1, 1928, Serial No. 303,473; and in France April 2, 1928.

The present invention has for its object the provision of a condenser comprising a bundle of tubes placed in a shell through which a cooling fluid circulates, the characteristic of the invention consisting in the fact that said tubes have their upper ends entirely closed and are inclined to the vertical, the fluid to be condensed and the condensed fluid entering and leaving by the other end.

This arrangement has the advantage that it assures a uniform temperature in the condenser bundle and that it thus avoids the differences of expansion between the several parts of the bundle.

The condenser tubes are arranged in a position with enough inclination so that for one thing the condensate may as rapidly as possible flow into the "thalweg" of the tube and that the thalweg itself has a slope favoring prompt discharge of the condensate. In this way one avoids having a large portion of the surface of the condenser tube covered with water of condensation, which would interfere to a considerable extent with the heat transmission between the vapor to be condensed and the cooling fluid. Moreover, to insure the greatest possible efficiency of the bundle, the inclination of the condenser tubes will preferably be such that the cooling fluid strikes it at a certain angle and on the face opposite the thalweg down which the water of condensation is flowing, whereby the interchange of heat is facilitated.

The following description which is to be read in connection with the accompanying illustrative drawings will make clear the manner in which my invention can be put into practice.

Figs. 1, 2, 3 and 4 show in longitudinal section different forms of the condenser tubes in their natural inclination to the vertical.

The fluid to be condensed arriving at *a* (Figs. 1, 2 and 3) is directed along the upper sides of the condenser tubes by small tubes *b* at the lower portion of the condenser tubes *c* arranged in the shell *d* in which circulates the cooling fluid entering at *e*¹ and leaving at *e*². The condenser tubes *c* are completely closed at their upper ends *e*¹ and the inclina-

tion of the tubes makes the water of condensation flow quickly into the thalweg of the tube, flow down the latter and arrive at the chamber *f*, whence it is finally withdrawn through *g*. It will be understood that the vapor tubes *b* must be sufficiently high to open above the level of the water of condensation which may occur in the chamber *f*.

The form of the invention in Fig. 2 differs from that of Fig. 1 only in the arrangement of the conduit *a* by which vapor is supplied, the tubes *b* branching out on its upper side, and the tube *a* being coaxial with the tube *f* which carries away the water of condensation.

In Fig. 3 the entrance *e*¹ and the exit *e*² of the cooling fluid are so arranged with respect to the condenser tubes *c* that said cooling fluid strikes them at a certain angle and on a face opposite the thalweg whereby the heat exchange is facilitated. Finally in the arrangement shown in Fig. 4 the tubes *b* extending into the lower part of the condenser tubes *c* are omitted, the condensed fluid flowing directly into the lower part of the collector *f* from which also the steam flows into the tubes *c*. The arrangements of the entry tube *e*¹ and the exit tube *e*² of the cooling fluid are again such that the fluid strikes the tubes *c* on the side opposite the thalweg.

It is evident that modifications of the details may be introduced to the condenser bundle which has just been described, without falling outside of the frame of the invention.

In particular the arrangement of the inclination of the condenser tubes relatively to the shell for the circulation of the condensing fluid may be varied so that the cooling fluid may have its density diminished or increased as it becomes heated.

I claim:

1. In apparatus of the class described, the combination of a casing, means to admit and to remove a cooling medium to and from said casing, a plurality of tubes extending up into said casing, said tubes being inclined to the vertical and closed at their upper ends, means including small tubes projecting into the mouths of said closed tubes to admit fluid to

be condensed into the lower ends thereof, and means to receive the condensate from the lower ends of said closed tubes.

2. In apparatus of the class described, the
5 combination of a casing, means to admit and to remove cooling medium to and from said casing, a plurality of tubes extending upward in said casing, said tubes being inclined to the vertical and closed at their upper ends, means
10 including small tubes projecting into the mouths of said closed tubes and lying relatively closer to the upper sides of the closed tubes for admitting the fluid to be condensed into the lower ends thereof, and means to receive
15 the condensate from the lower ends of the closed tubes.

3. Apparatus in accordance with claim 1 and in which the upper ends of the small tubes are cut off so as to make acute angles with the
20 generatrices of the sides of the closed tubes.

4. Apparatus in accordance with claim 2 and in which the upper ends of the small tubes are cut off so as to make acute angles with the generatrices of the sides of the closed tubes.

5. Apparatus in accordance with claim 1 and in which the upper ends of the small tubes project above the level of the condensate in the apparatus.

30 In testimony whereof I have signed this specification.

ANDRÉ HUET.

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