D. A. QUIGGIN.

SURFACE CONDENSER.

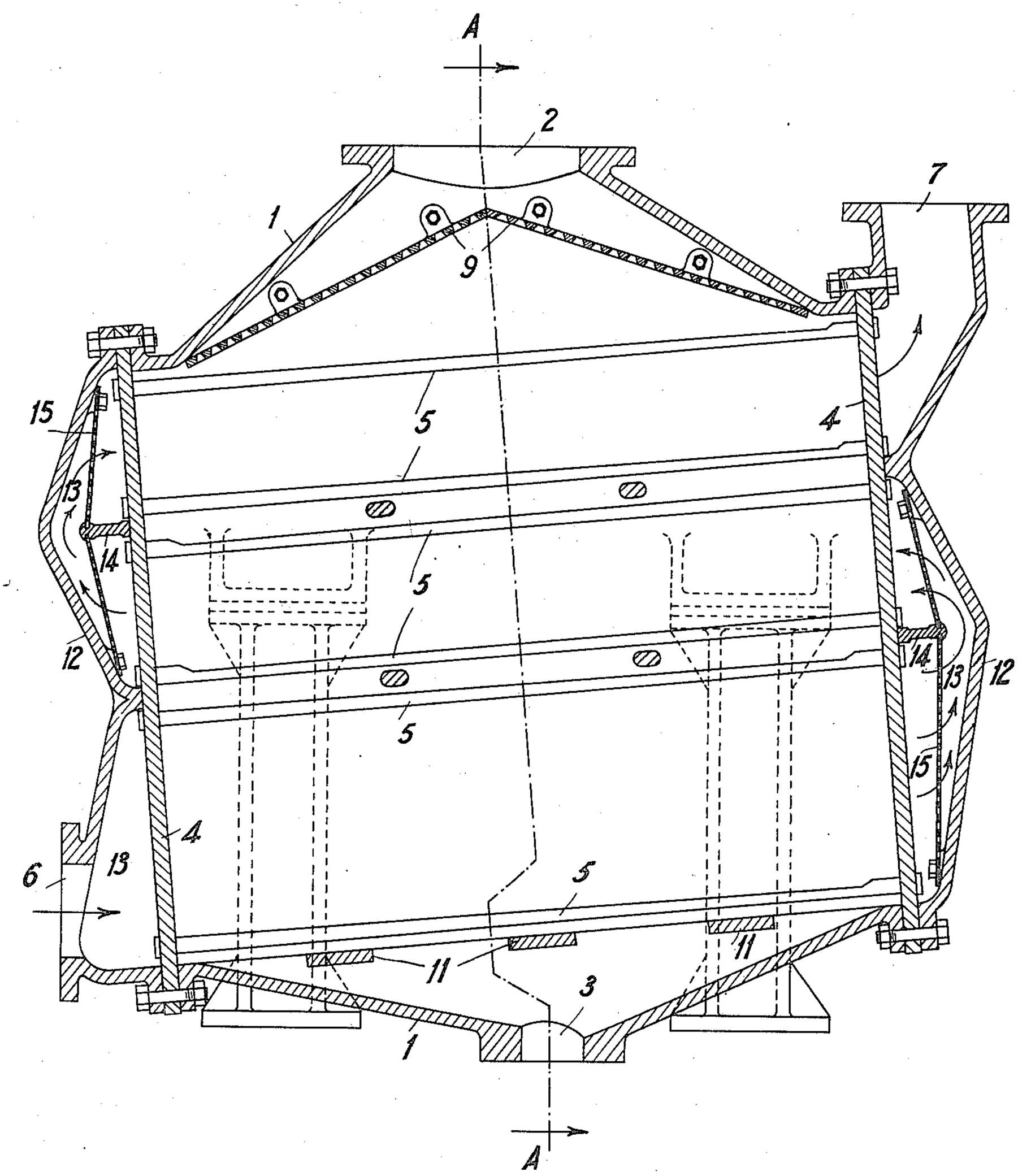
APPLICATION FILED MAY 2, 1908.

989,415.

Patented Apr. 11, 1911.

3 SHEETS—SHEET 1.

FIG. 1.



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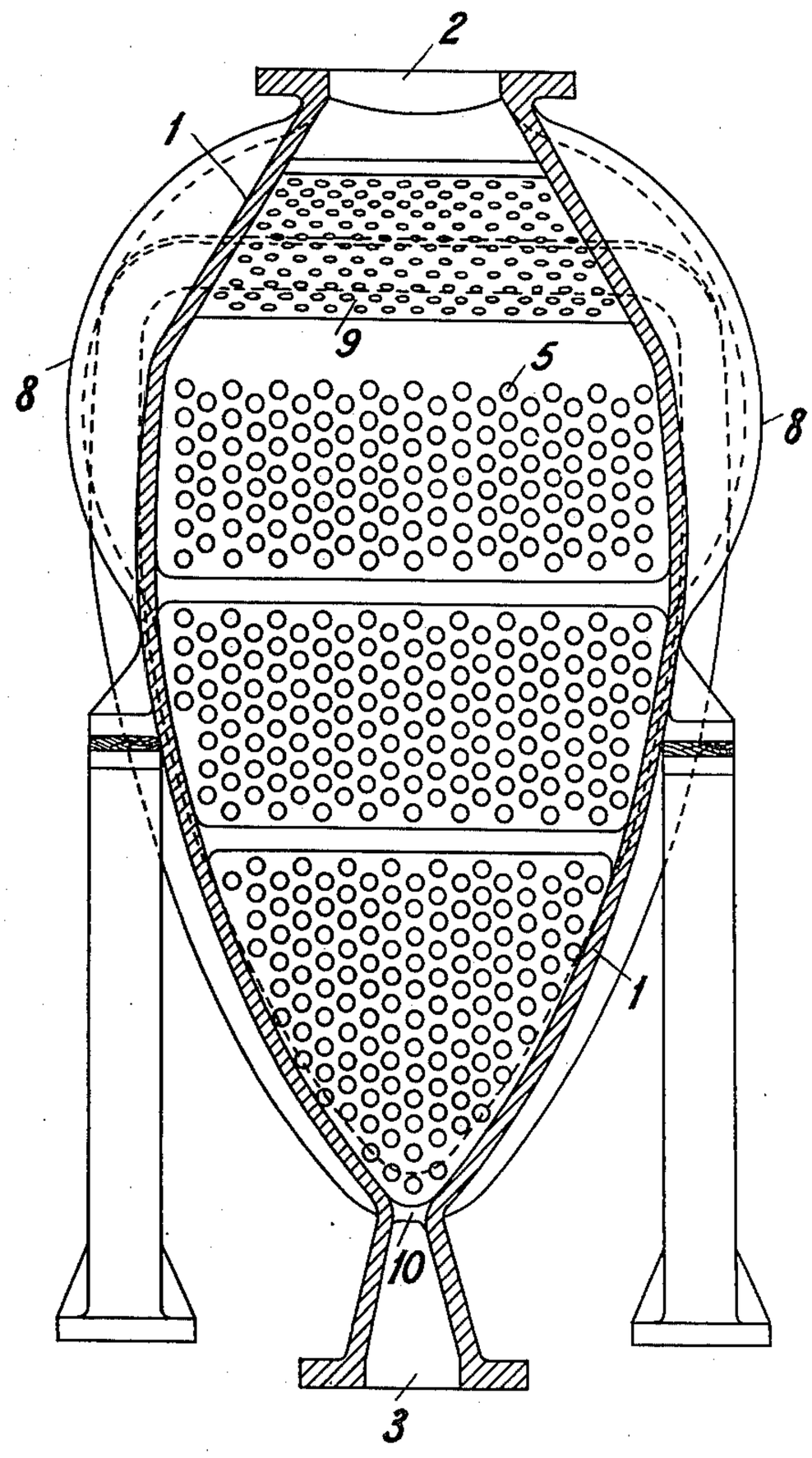
3 SHEETS—SHEET 2.

FIG. 2.



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3 SHEETS—SHEET 3.

Fig. 5.

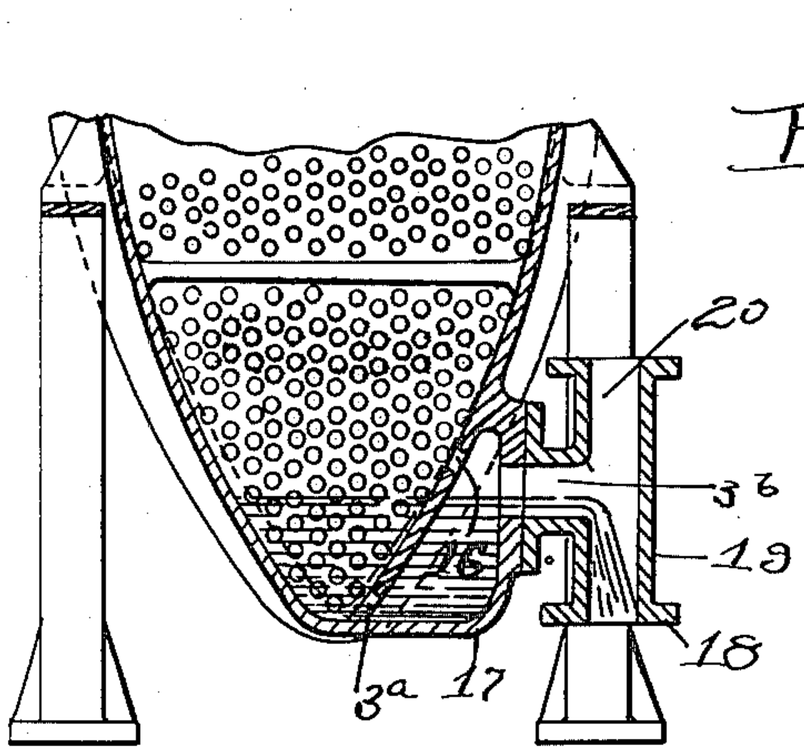
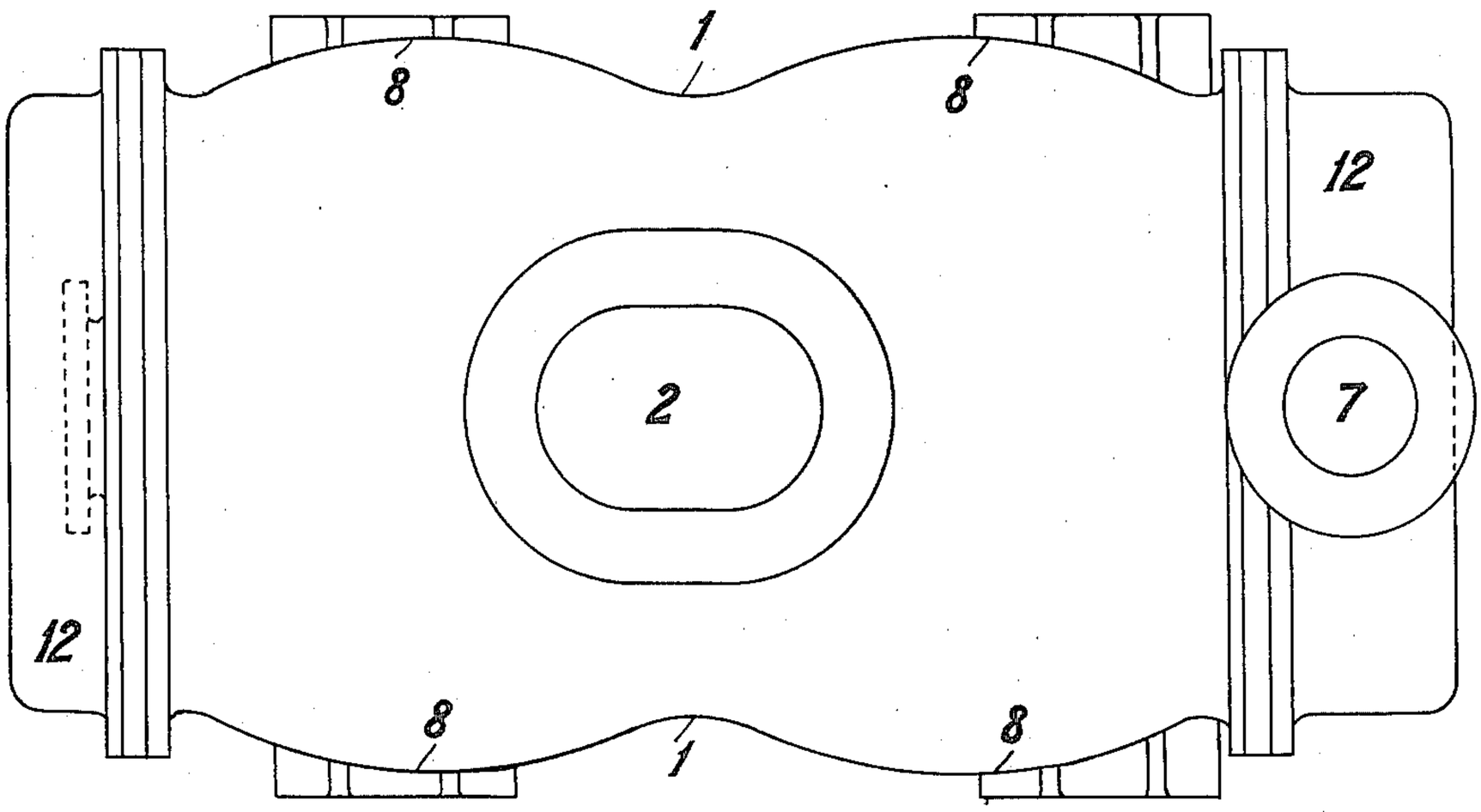


Fig. 3.



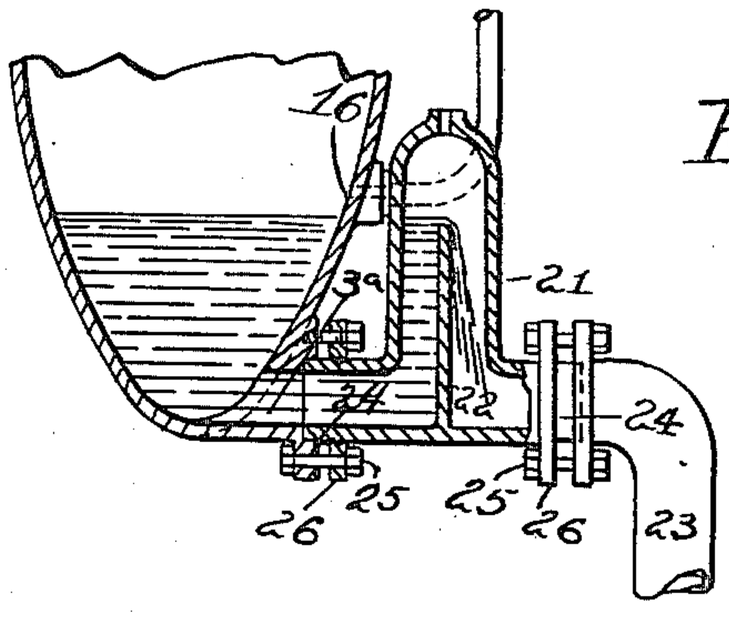


Fig. 4.

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UNITED STATES PATENT OFFICE.

DANIEL ARTHUR QUIGGIN, OF LIVERPOOL, ENGLAND.

SURFACE CONDENSER.

989,415. Specification of Letters Patent. Patented Apr. 11, 1911.

Application filed May 2, 1908. Serial No. 430,591.

To all whom it may concern:

Be it known that I, DANIEL ARTHUR QUIGGIN, a subject of the King of Great Britain, and residing in Liverpool, in the county of Lancaster, England, have invented certain new and useful Improvements in Surface Condensers, of which the following is a specification.

This invention has reference to surface condensers, the object being to increase their efficiency generally, and it is specially applicable in the case of condensers required to maintain a high degree of vacuum. Such condensers comprise broadly a main casing through which the condensing tubes extend, with an inlet for the steam and an outlet or outlets for the condensed steam and air, a tube plate at each end of the casing in which the condensing tubes are fixed, and water chambers beyond the tube plates with the necessary passages for the flow of the circulating water.

One of the chief features of my invention is to so shape the main casing that the steam shall have very free access to the condensing surfaces, and that the air shall be carried by its momentum or kinetic energy toward the air outlet, so as to acquire a higher pressure thereat than prevails generally within the casing.

The condensing tubes are preferably of the self-draining or cresent section type described in the specification of my prior application for Letters Patent Serial No. 399564, filed October 28th 1907 granted June 22, 1909, No. 925,506.

I have illustrated my invention in the accompanying drawings, in which—

Figures 1 and 2 show in longitudinal and transverse sectional elevation on the line A. A. respectively, a condenser suitable for maintaining a high degree of vacuum, and Fig. 3 is a plan thereof. Figs. 4 and 5 are views analogous to Figs. 1 and 2, showing a form of condenser suitable in cases where it is desired to deliver the water of condensation at comparatively low temperature. Fig. 6 is a fragmentary detail view to enlarged scale.

Referring in the first place to Figs. 1, 2, and 3, 1 is the main casing, 2 the steam inlet, 3 the outlet for air and water of condensation, 4 are the tube plates, 5 the tubes, 6 is the circulating water inlet, and 7 the circulating water outlet. In giving the casing 1 the special form shown the objects are broadly,—to provide for the dynamic action due to the momentum of the air as described, to provide very free access of the steam to the condensing surfaces, and to effect the distribution of the steam so that all the heating surfaces are as far as possible equalized in efficiency, as in condensers of ordinary form the steam tends to short-circuit toward the outlet, leaving much of the heating surface comparatively ineffective. With these objects in view the casing diverges rapidly from the steam inlet 2 about the level of the top of the stack of tubes, and the walls are preferably made bulbous toward each end of the casing as indicated at 8, so that the steam has access not only to the top of the tube stack but to the sides also for some depth, so that very free access is provided. The bulbous portions or pockets 8 tend to distribute the steam toward the ends of the condenser, counteracting the tendency to pass mainly down the center, and for the same reason the perforated and inclined deflectors 9 are fitted in the entrance way of the steam, and the outlet 3 communicates with the interior of the casing through the slit 10 extending the whole length, the cross bars 11 being fitted to break the flow and strengthen the casing.

I have found that the flat water chambers usually employed in apparatus of this class do not guide and distribute the circulating water in a satisfactory manner into the tubes, as the water flows transversely to the tube ends. I accordingly curve the doors 12, forming (in conjunction with the tube plates) the water chambers 13, so that the water is guided with a wheeling motion out of the one stack of tubes into the next. For the same purpose I fit deflectors 14, (preferably cast on the doors), to prevent the direct transverse flow of the water, and I also in some cases fit perforated plates such as 15 to further guide and distribute the flow of water. Where the special form of condensing tubes already referred to is used, the tubes are generally arranged, for the reason stated in specification of my U. S. Letters Patent before referred to, so that the circulating water in passing through the tubes flows from the larger toward the smaller cross-section. Where it is desired to pass the circulating water more than once through the length of the condenser, but it is not desired to reverse the direction of the flow through the tubes, I

provide return passages along the outside of the main casing so that the water may flow in the same direction through all the tubes. Where it is desired not to cool the water of condensation further than necessary to obtain the desired degree of vacuum, the tubes are preferably laid at a slope so that the drainage runs off quickly at the tube ends.

Referring now to Figs. 4 and 5; the construction here is broadly similar to that already described, except that the air outlet 16 is arranged separate from and at a higher level than the water outlet 3^a, the combined air and water outlet 3^b being arranged on the side of a pocket 17 at such a level that it traps the water above the level of the lowermost tubes, so that the latter are always submerged in the water of condensation with a corresponding cooling effect thereon. The lower flange 18 of the tee piece 19 attached to the outlet 3^b is connected usually to a pump, and the upper branch 20 is left open to the atmosphere for the escape of air if it is not desired to maintain a vacuum, or otherwise it is connected to the air pump.

Fig. 6 shows a modified form of device for the water delivery whereby the depth of submergence of the tubes may be varied to suit circumstances. The trap 21 is made with an internal weir 22 and it is connected to the condenser and the delivery pipe 23 by swiveling joints. The projecting spigot 24 of the trap makes metallic joint with the condenser and is drawn into position by the studs 25 passing through the flange 26 which is screwed freely over the branch of the trap. By slacking the bolts 25 and turning the trap out of the vertical, the effective height of the weir 22 can be reduced at will so as to give the desired depth of submergence.

The tubes are in general laid with a slope, but where it is desired to cool the water of condensation, they may be laid horizontally, so that the drainage flows slowly along the troughs of the tubes and so is subjected to a more prolonged cooling effect of the circulating water.

Having now fully described my invention, I declare that what I claim and desire to secure by Letters Patent is:—

1. In a condenser having an inlet and an outlet end in which the tubes are arranged transversely to the flow of the steam; condensing tubes arranged in a stack of wedge-like form with its base lying uppermost toward the steam inlet and its apex lying downward toward the outlet; and a casing inclosing said tubes, divergent from the steam inlet down to the top of the tube stack, and thence converging toward the outlet in conformity with the tube stack, substantially as described.

2. In a condenser having an inlet and an outlet end in which the tubes are arranged transversely to the flow of the steam; condensing tubes arranged in a stack of wedge-like form with its base lying uppermost toward the steam inlet and its apex lying downward toward the outlet; and a casing inclosing said tubes, divergent from the steam inlet down to the top of the tube stack and thence converging toward the outlet in conformity with the tube stack, and having a narrow outlet opening extending along the bottom of the casing, substantially as described.

3. In a condenser having an inlet and an outlet end in which the tubes are arranged transversely to the flow of the steam; condensing tubes arranged in a stack of wedge-like form with its base lying uppermost toward the steam inlet and its apex lying downward toward the outlet; and a casing inclosing said tubes, divergent from the steam inlet down to the top of the tube stack and thence converging toward the outlet in conformity with the tube stack, said casing having bulbous portions 8 adapted to give the steam free access to the sides of the tube stack and to distribute the steam throughout the length of the casing, substantially as described.

4. A surface condenser comprising a casing, stacks of tubes in said casing, water channels at each end of the casing for connecting the stacks of tubes together, the end walls of the casing being of curved form, deflectors in said chambers acting with the curved form of the end walls to guide the circulating water from one stack of tubes to the next with a whirling motion, and perforated plates in said chambers.

In testimony whereof I have hereunto set my hand in the presence of subscribing witnesses.

DANIEL ARTHUR QUIGGIN.

Witnesses:

J. E. Lloyd Barnes,

Joseph E. Hirst.