D. A. QUIGGIN.

APPARATUS FOR CONDENSING STEAM.

APPLICATION FILED MAR. 24, 1910.

962,095. Patented June 21, 1910.

2 SHEETS—SHEET 1.

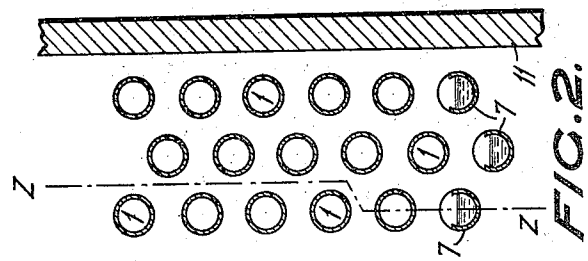

FIG. 2.

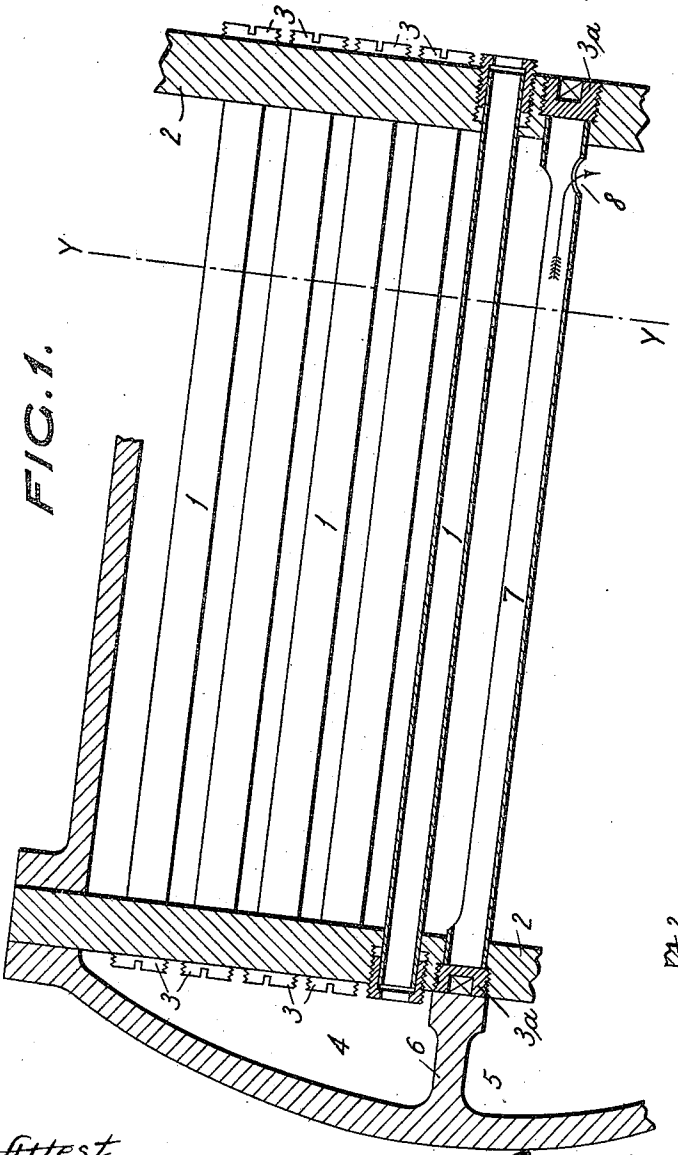

FIG. 1.

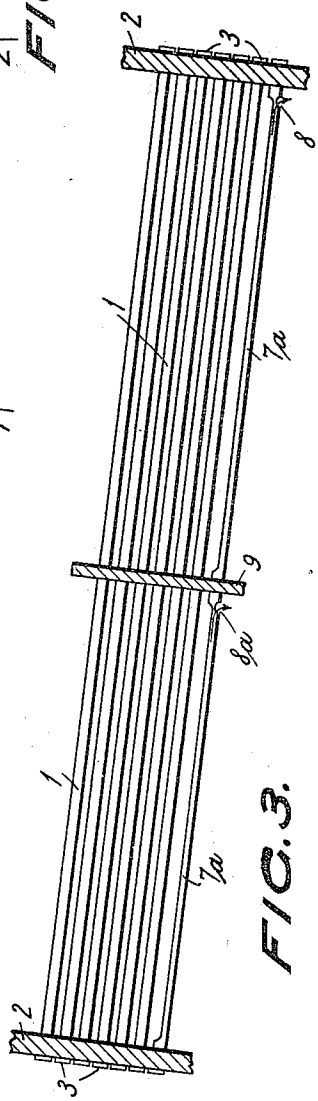

FIG. 3.

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2 SHEETS—SHEET 2.

FIG. 4.

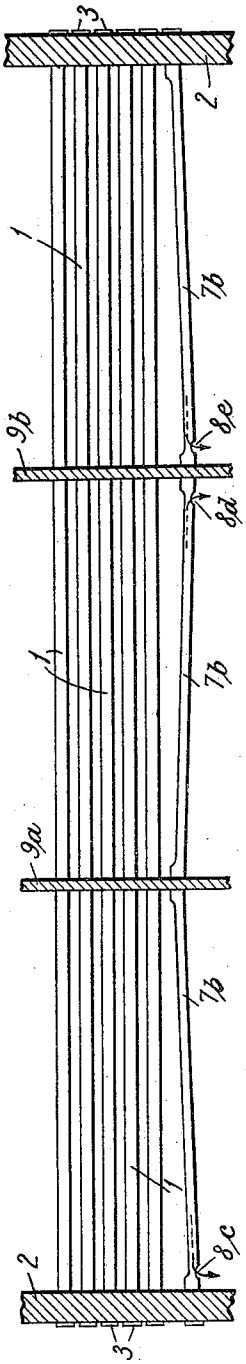


FIG. 6.

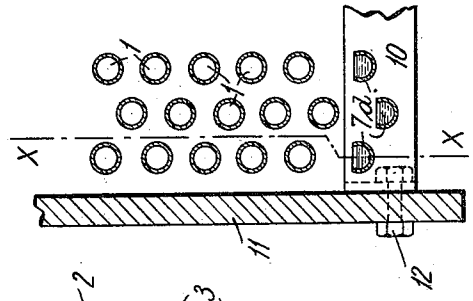
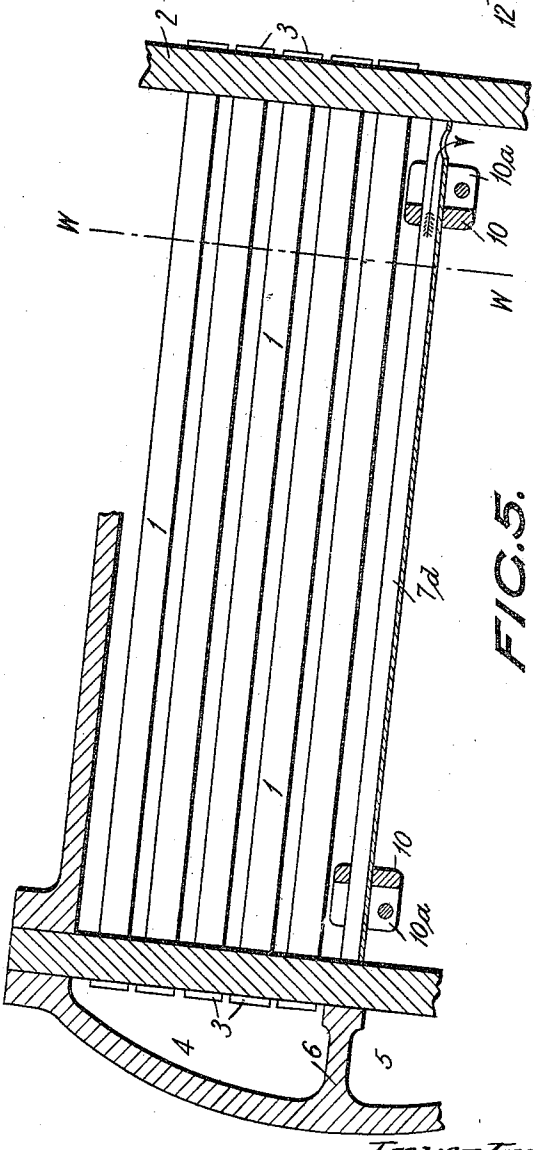


FIG. 5.



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UNITED STATES PATENT OFFICE.

DANIEL ARTHUR QUIGGIN, OF LIVERPOOL, ENGLAND.

APPARATUS FOR CONDENSING STEAM.

962,095. Specification of Letters Patent. Patented June 21, 1910.

Application filed March 24, 1910. Serial No. 551,311.

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 Apparatus for Condensing Steam, of which the following is a specification.

This invention relates to apparatus for condensing steam or for heating or evaporating water by steam, and is an improvement in, or modification of my invention described in the specification to Letters Patent of the United States, No. 925506, dated June 22nd 1909. In this class of apparatus, as generally constructed, water is deposited on the tubes by the condensation of steam, and this water by dripping from tube to tube seriously interferes with the heat transmitting capabilities of the tubes. In order to mitigate this difficulty, various devices have been proposed, such as plain or corrugated plates or deflectors arranged between the tubes and adapted to intercept water dripping from the tubes above and convey it transversely to the tubes toward the sides of the condenser. In my said prior patent this difficulty was overcome by forming the tubes of special cross-section, so that longitudinal grooves or troughs were formed by which the water formed by the said condensation was carried away. I have since found that my invention may be applied to condensers or the like, in which in the main the tubes are of ordinary circular cross-section. In this case instead of forming the trough on the upper side of each tube, and using the tubes so shaped as heat transferring surfaces, special tubes are provided for drainage purposes only; these special tubes, which will be termed drainage tubes, are fitted at intervals in the stack of tubes, and in sufficient numbers to secure proper drainage.

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

Figures 1 and 2 show the drainage tubes fitted to a condenser with comparatively short tubes, and in which therefore no intervening tube-supporting plates are fitted; Fig. 1 being an elevation in section on the line Z, Z, of Fig. 2, the latter being a transverse section on the line Y, Y, of Fig. 1. Fig. 3 is an elevation in transverse section showing the drainage tubes fitted to a condenser having one intervening tube-supporting plate. Fig. 4 is an elevation in transverse section showing the drainage tubes fitted to a condenser having two intervening tube-supporting plates; in this case the condenser tubes are horizontal, and the drainage tubes are accordingly inclined relatively to the condenser tubes. Figs. 5 and 6 show a modified arrangement for supporting the drainage tubes; Fig. 5 being an elevation in section on the line X, X, of Fig. 6, the latter being a transverse section on the line W, W, of Fig. 5.

Referring in the first instance to Figs. 1 and 2,—the condenser tubes 1 are carried in the usual manner from the tube plates 2, the joint between the tube end and the plate being made by ferrules 3 or in any other convenient and suitable manner; the end spaces of the condenser are usually divided into pockets 4 and 5 by feathers 6, in order to direct the flow of circulating water, and as the ordinary tubes 1 cannot be fitted opposite such feathers, the space of the tube plate covered by the feathers is utilized for fitting the drainage tubes 7. The drainage tubes, in Figs. 1 and 2, consist of tubes which may have an external diameter equal to that of the ordinary tubes 1; the upper parts of the tubes 7 are, however, cut away as shown (except at the ends where the full cylindrical shape is retained) so that each tube forms an open-topped duct into which water from the tubes 1 above falls and by which the said water is conveyed to the ends of the condenser, where it is drained from the tubes 7 through holes 8. The tubes 7 are held in position in the tube plates 2 by blind ferrules 3^a; these are sunk into the tube plates so as to be flush with the outer surface thereof, and so permit proper joint between the feathers 6 and the tube plates 2. Drainage tubes 7 are fitted at intervals in each vertical row of condenser tubes 1, the number of condenser tubes above served by each drainage tube depending upon the size and capacity of the condenser; in Figs. 1 and 2 a drainage tube is fitted in each sixth hole and serves to drain the five condenser tubes 1 above it. The drainage tubes either slope toward the one end of the condenser, or are so shaped as to slope from the center to opposite ends of the condenser; where the condenser tubes are exceptionally long, and intervening supporting plates are placed between the tube plates proper, the drainage tubes may be so shaped as to form several

alternately reversely inclined slopes, at the bottoms of which slopes are the tube plates or the intervening plates. At their lowest points the drainage tubes may be provided with holes 8 through which the water is led on to the tube plates, or in other desired direction.

In Fig. 3 there is one intervening tube-supporting plate; in this case the drainage tube 7^a slopes in the one direction from one end plate to the other, passing through the intervening tube-supporting plate 9; the portion of the tube 7^a in the plate 9 may be left of full cylindrical shape, and a drainage hole 8^a may be provided near the plate 9 as well as the hole 8 at the lower end of the tube.

In Fig. 4 the tubes 1 of the condenser are horizontal, and there are two intervening tube-supporting plates 9^a and 9^b; in this case the drainage tubes 7^b are, as they are put in place, bent as shown so as to slope down to the drain holes 8^c, 8^d, and 8^e; as before, the parts of the tubes 7^b are left of full cylindrical shape where they pass through the plates 9^a and 9^b, and where they enter the tube plates 2.

In Figs. 5 and 6 a modified arrangement for supporting the drainage tubes 7^d is shown; in this case the tubes 7^d do not enter the tube plate but are carried by transverse supporting bars 10, which have feet 10^a carried from the sides 11 of the condenser body by bolts 12; this arrangement is adapted for those cases in which the water collected by the drainage tubes is clean; so that the tubes do not require to be frequently cleaned or renewed.

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

1. In heat transferring apparatus of the surface condenser type, in combination with the heat transmitting tubes and the tube plates thereof, a series of inclined drainage tubes extending between the tube plates and arranged at intervals in each vertical row of tubes, each of the said drainage tubes being in the form of an open topped duct into which the water from the heat transmitting tubes above drips and is carried away to one of the tube plates; substantially as described.

2. In heat transferring apparatus of the surface condenser type, in combination with the heat transmitting tubes and the tube plates thereof, a series of inclined drainage tubes extending between the tube plates and arranged at intervals in each vertical row of tubes, each of the said drainage tubes being in the form of an ordinary tube the upper portion of which is cut away except at the parts where the tube fits the tube plates; substantially as described.

3. In heat transferring apparatus of the surface condenser type, in combination with the heat transmitting tubes and the tube plates thereof, a series of inclined drainage tubes extending between the tube plates and arranged at intervals in each vertical row of tubes, each of the said drainage tubes being in the form of an open topped duct, and having a drainage hole at the bottom adjacent to one of the tube plates; substantially as described.

4. In heat transferring apparatus of the surface condenser type, in combination with the heat transmitting tubes and the tube plates thereof, a series of inclined drainage tubes extending between the tube plates and arranged at intervals in each vertical row of tubes, each of the said drainage tubes being in the form of an open topped duct and bent so as to have alternately reversely inclined slopes with the bottoms of the slopes adjacent to the tube plates; substantially as described.

5. In heat transferring apparatus of the surface condenser type, in combination with the heat transmitting tubes and the tube plates thereof, a series of inclined drainage tubes extending between the tube plates and arranged at intervals in each vertical row of tubes, each of the said drainage tubes being in the form of an ordinary tube the upper portion of which is cut away except at the parts where the tube fits the tube plates; holes in the tube plates through which the drainage tubes pass, and means for closing the holes and securing the tubes therein; substantially as described.

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

DANIEL ARTHUR QUIGGIN.

Witnesses:

J. D. PATON.

JOSEPH E. HIRST.