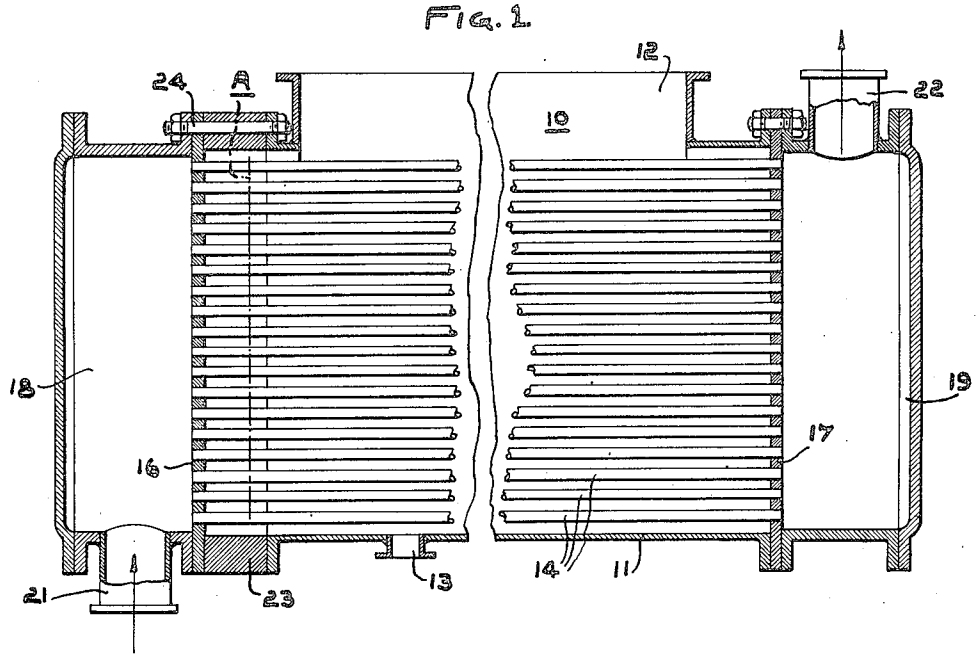
Oct. 17, 1939. U. A. TADDIKEN 2,176,475

CONDENSER APPARATUS

Filed June 10, 1938 2 Sheets-Sheet 1

FIG. 1.



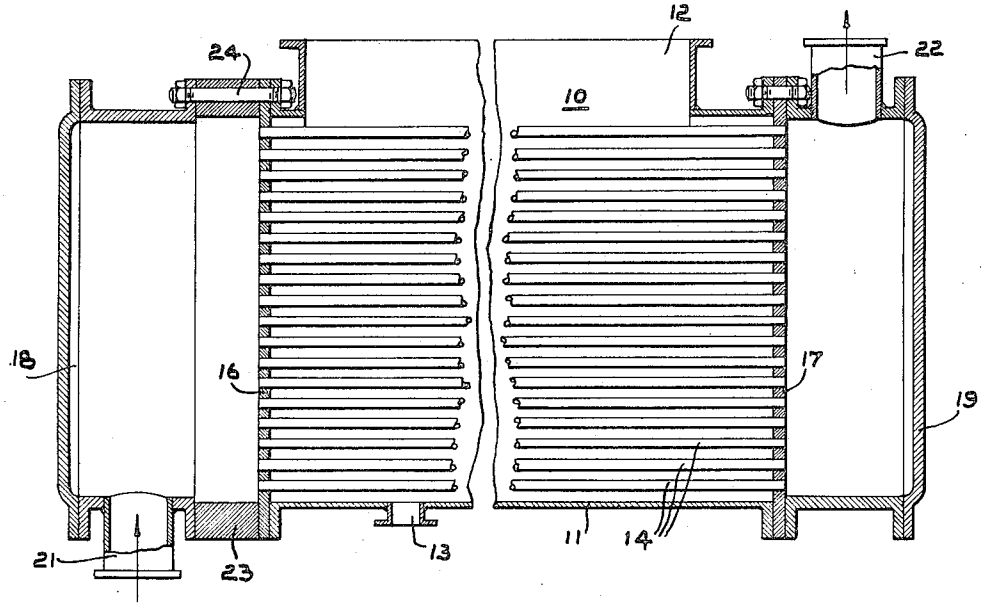


FIG. 2.

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CONDENSER APPARATUS

Filed June 10, 1938 2 Sheets-Sheet 2

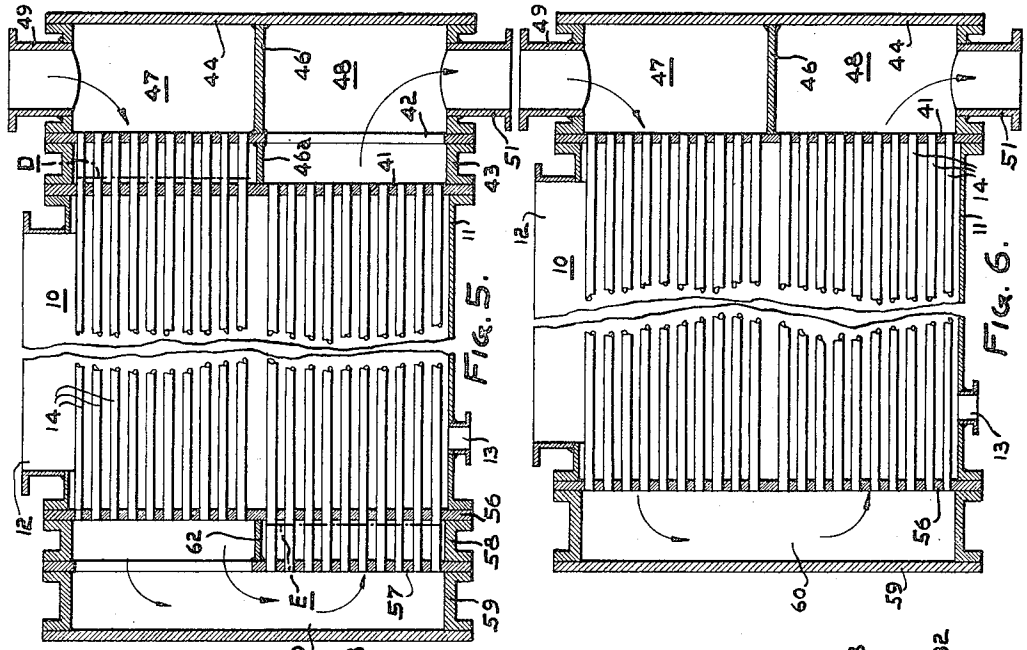


Fig. 5.

Fig. 6.

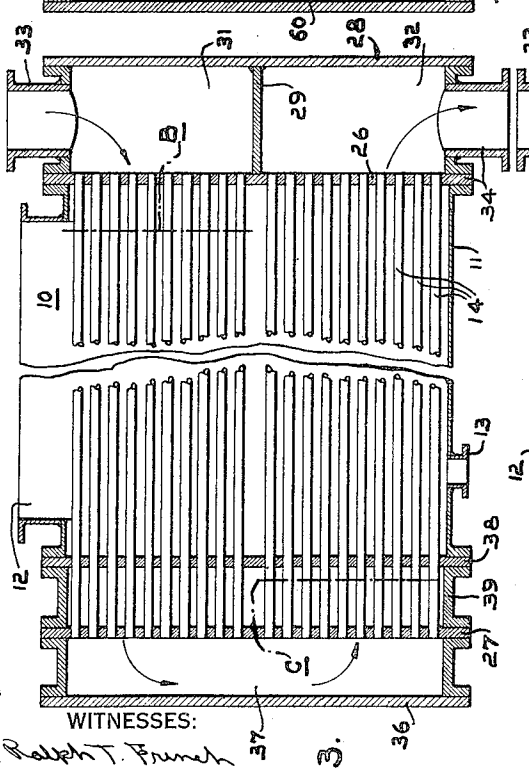


Fig. 3.

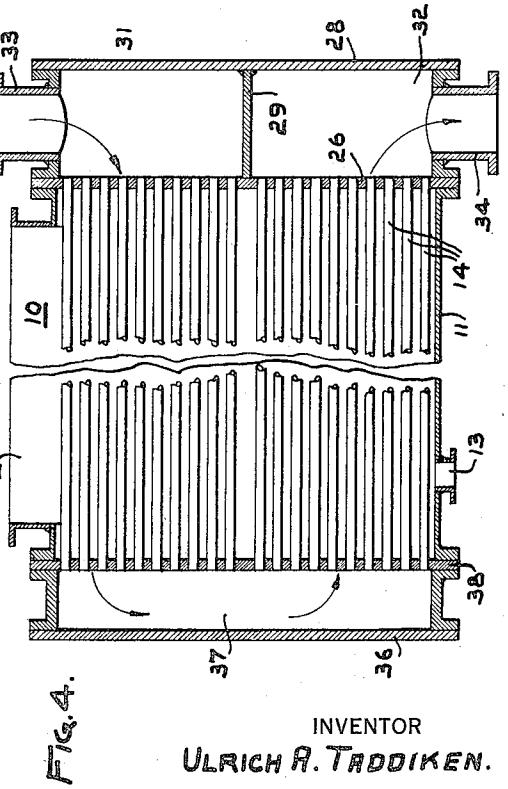


Fig. 4.

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UNITED STATES PATENT OFFICE

2,176,475

CONDENSER APPARATUS

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Application June 10, 1938, Serial No. 212,949

8 Claims. (Cl. 257—43)

This invention relates to surface condensers and more particularly to the tubes thereof.

A large item of expense in the maintenance of surface condensers is the replacement of the tubes constituting the condensing surface, and through which the cooling water is circulated. By far the greatest deterioration of the tubes occurs in the first few inches of the inlet ends thereof, due to the turbulence of the entering water and the foreign matter carried thereby, such as sand particles, etc. The remaining portions of the tubes are capable of prolonged use over a period several times the life of the inlet ends. Heretofore, it has generally been necessary to discard the entire tubes upon the erosion of a few inches at the inlet end. It is an object of the present invention to provide means for continuing the main portion of the tubes in use after removal of the eroded portions thereof.

Another object of the invention is the provision of a condenser so constructed that the inlet ends of the tubes may be removed when eroded, without affecting the piping connections of the condenser.

A further object of the invention is the provision, in a surface condenser, of spacer members between the water boxes and the tube plates, which may be removed upon removal of the eroded inlet ends of the tubes.

Yet another object of the invention is the provision of a surface condenser wherein the above features and advantages are attained with the use of a minimum of additional material.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a longitudinal sectional view of a single-pass condenser embodying the invention, prior to shortening of the tubes thereof;

Fig. 2 is a view similar to Fig. 1, but showing the arrangement after the tubes have been shortened;

Figs. 3 and 4 are views similar to Figs. 1 and 2, respectively, but showing a modification of the invention applied to a multi-pass condenser; and,

Figs. 5 and 6 are views similar to Figs. 3 and 4, respectively, but illustrating a further modification.

In the drawings there is shown a surface condenser, at 10, comprised by a shell 11, having an exhaust steam inlet 12 and a condensate outlet 13. A plurality of tubes 14 extend longitudinally through the shell, and have their terminal portions mounted in tube plates 16 and 17.

Water boxes 18 and 19 are associated with the tube plates 16 and 17, respectively, the box 18 having an inlet connection 21, and the box 19 having an outlet connection 22, whereby cooling water enters the box 18 through the inlet 21 and flows through the tubes 14 to the box 19, for discharge through the outlet 22.

A spacer ring 23 is positioned between the inlet tube plate 16 and the adjacent end of the shell 11, and, preferably, the inlet water box 18, the tube plate 16, the spacer ring 23, and the shell 11 are held in assembled relation by suitable means, such as bolts 24.

When the inlet ends of the tubes have become eroded to such an extent as to necessitate repairs, the tubes may be cut along the dot-and-dash line A, indicated in Fig. 1, the short eroded inlet portions of the tubes removed, the new terminal portions thereof mounted in the inlet tube plate 16, and the spacer ring 23 placed outside of, or to the left as viewed in Fig. 2, of the inlet tube plate, the relocation of the spacer ring with reference to the tube plate, assuming cutting off of tube ends of suitable length, making it unnecessary to disturb the inlet water connection; however, it is obvious that the spacer ring may be omitted when the tubes are shortened and appropriate adjustment of the inlet water connection made.

It will be noted that by this arrangement the shortening of the tubes does not affect the spacing or positioning of the steam and water connections of the condenser. In arrangements involving multiple-pass types of condensers, where the inlet and outlet connections are in a single water box, and the other water box has no external connections, the spacer ring 23 may, obviously, be omitted entirely from the assembly upon shortening of the tubes.

In Figs. 3 and 4, there is illustrated a modified embodiment of the invention, particularly adapted for use with two, or multiple-pass, condensers. In this construction there are provided end tube plates 26 and 27; an inlet water box 28 being associated with the tube plate 26, and having a partition 29 therein, providing inlet and outlet chambers 31 and 32, respectively, the former being provided with an inlet connection 33 and the latter with a discharge connection 34.

The tube plate 27 has associated therewith a water box 36, providing a reversing chamber 37. A special tube plate 38 is located inwardly of the

plate 27, and is separated therefrom by a spacer ring 39.

When the inlet ends of the tubes of the two passes become eroded, they may be cut off along the dot-and-dash lines B and C and removed, together with the tube plate 27 and spacer ring 39. Thereupon, the tubes of the first pass may be moved to the right, as shown in Figs. 3 and 4, until their terminal portions are supported by the tube plates 26 and 38. The new inlet ends of the second pass tubes may be secured in place without being moved.

In the modification illustrated in Figs. 5 and 6, the condenser is provided with spaced pairs of tube plates at either end. The inlet end tube plates 41 and 42 are separated by a spacer ring 43, the outer plate 42 having associated therewith a water box structure 44 provided with a partition 46, forming inlet and outlet chambers 47 and 48, respectively, the former having an inlet connection 49 and the latter, an outlet connection 51.

A supplemental partition 46*a* is provided between the tube plates 41 and 42, in alignment with the main partition 46 of the water box 44 to prevent leakage of water from the outlet chamber 48 to the steam space within the shell, at the points of passage of the first-pass tubes through the tube plate 41. Preferably, the portion of the outer tube plate 42 that is aligned with the second pass is cut away to permit unobstructed flow of water from the tubes of that pass.

At the other end of the condenser, tube plates 56 and 57 are separated by a spacer ring 58, the outer tube plate 57 having associated therewith a water box 59, providing a reversing chamber 60. An auxiliary partition 62, corresponding in design and function to the partition 46*a*, is positioned between the tube plates 56 and 57, between the two passes. Preferably, the portion of the outer tube plate 57 that is aligned with the first pass is cut away to permit unobstructed flow of water from the tubes of that pass.

Upon erosion of the inlet ends of the tubes, the same may be removed, together with the outer tube plates 42 and 57 and the spacer rings 43 and 58, by cutting along the dot-and-dash lines D and E (Fig. 5), as in the previously described embodiments.

While there have been illustrated in the drawings only enough spacer rings to provide for one cutting of eroded tube ends, it will be obvious to those skilled in the art that additional rings may be provided whereby further erosion of the tubes may be treated in a similar manner.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. A surface condenser comprised by a shell having an exhaust steam inlet and a condensate outlet, a plurality of tubes extending longitudinally through the shell, tube plates supporting the ends of the tubes, water boxes associated with the tube plates, and an annular spacer member between one of the tube plates and the shell said spacer member being of sufficient axial length to provide, upon removal of eroded inlet ends of the tubes, for corresponding reduction of the distance between the tube plates by removal of said spacer member.

2. A surface condenser of the single-pass type comprised by a shell having an exhaust steam inlet and condensate outlet, a plurality of tubes extending longitudinally through the shell, tube plates supporting the ends of the tubes, inlet and outlet water boxes associated with the tube plates, and an annular spacer member between one of the tube plates and the shell, said spacer member being of sufficient axial length to provide, upon removal of eroded inlet ends of the tubes and attachment of the associated tube plate directly to one end of the shell, for corresponding reduction of the distance between the tube plates while maintaining the original spacing of the exhaust steam inlet and water boxes by repositioning of said spacer member between said one tube plate and its associated water box.

3. A structure as specified in claim 2 wherein the water box associated with said one tube plate is the inlet water box.

4. A surface condenser of the multi-pass type comprised by a shell having an exhaust steam inlet and a condensate outlet, a plurality of tubes extending longitudinally through the shell, a pair of tube plates supporting the ends of the tubes, a water box associated with one of said tube plates and having a partition therein providing inlet and outlet chambers, a water box associated with the other tube plate and providing a reversing chamber, and an annular spacer member between one of said tube plates and the shell, said spacer member being of sufficient axial length to provide, upon removal thereof and of eroded inlet ends of the tubes for direct attachment of the associated tube plate to one end of the shell.

5. A structure as specified in claim 4, wherein the annular spacer member is located between the tube plate associated with the reversing chamber and the shell.

6. A surface condenser comprised by a shell having an exhaust steam inlet and a condensate outlet, a plurality of tubes extending longitudinally through the shell, first and second tube plates supporting the ends of the tubes, a third tube plate intermediate the second tube plate and the shell, water boxes associated with the first and second tube plates, and an annular spacer member disposed between the second and third tube plates, said spacer member being of sufficient axial length to provide, upon removal of eroded inlet ends of the tubes and the second tube plate, for corresponding reduction of the distance between the associated water box and the third tube plate by removal of said spacer member and directly attaching the water box to the third tube plate.

7. A structure as specified in claim 6, wherein the water box associated with the second tube plate constitutes a reversing chamber.

8. A surface condenser of the multi-pass type comprised by a shell having an exhaust steam inlet and a condensate outlet; a plurality of tubes extending longitudinally through the shell and constituting a plurality of water passes; a pair of tube plates at each end of the shell, the outer plate at one end and the inner plate at the other end supporting the ends of the tubes through which water flows from said one end to said other end, and the inner plate at said one end and the outer plate at said other end supporting the ends of the tubes through which water flows from said other end to said one end; a water

box associated with the outer plate of each of said pairs of tube plates; and an annular spacer member separating the plates of each of said pairs, said spacer members being of sufficient axial length to provide, upon removal of the eroded inlet ends of the tubes and the outer plates of each pair of tube plates, for a corresponding reduction of the distance between the water boxes and the inner plates of each pair of tube plates by removal of said spacer members.

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