April 8, 1930. C. B. TULEY 1,753,955

CONDENSER

Filed Sept. 27, 1928

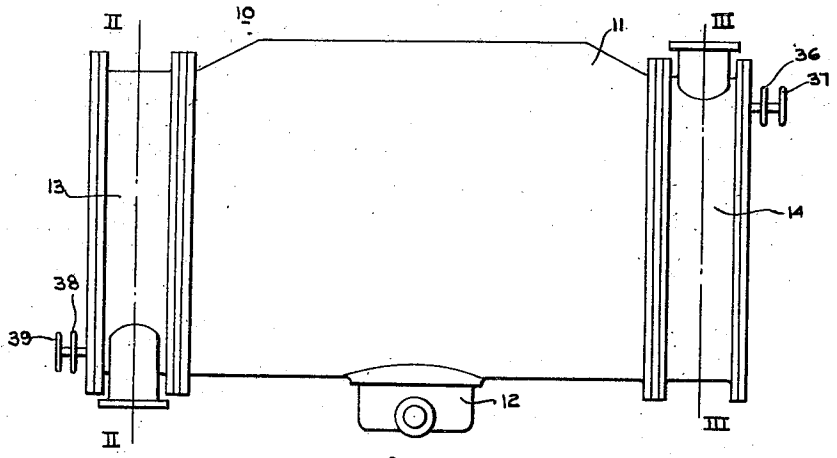


Fig. 1.

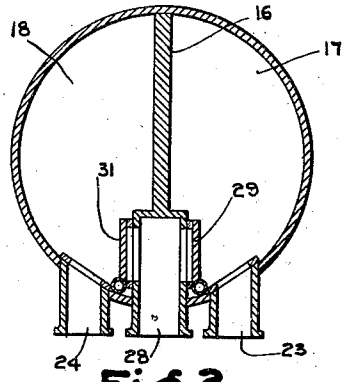


Fig. 2.

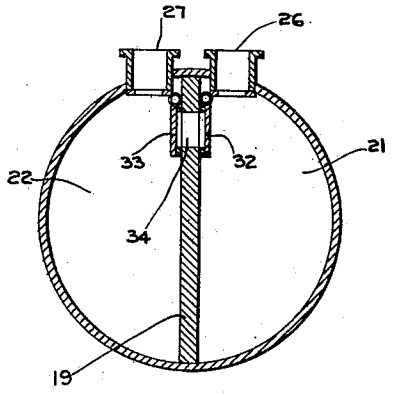


Fig. 3.

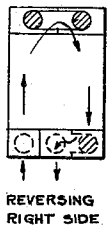


Fig. 4.

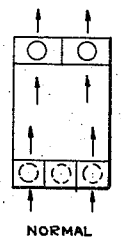


Fig. 5.

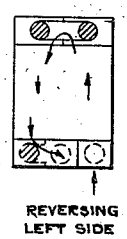


Fig. 6.

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UNITED STATES PATENT OFFICE

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CONDENSER

Application filed September 27, 1928. Serial No. 308,750.

My invention relates to tubular heat exchangers, and more particularly to surface condensers, and it has for an object to provide for improving the efficiency of apparatus of this character.

Tubular heat exchangers, such as surface condensers, are frequently provided with water boxes which are divided by means of partitions, or the like, into separate chambers which are arranged to provide independent circulating systems for passing cooling media through the tubes in parallel, one advantage of this arrangement being that the tubes associated with one circulating system may be cut out of service by merely closing the valves supplying circulating media to the chambers, and the water boxes associated with this portion of the apparatus may be entered for cleaning the tubes, or for making other repairs while the circulating media is being passed through the tubes associated with the other chambers in the water boxes. While such an operation is being carried on, the active side of the tube nest, through which the circulating media is being passed, is depended upon to produce sufficient vacuum to permit the operation of the prime mover at partial load. While a very thorough cleaning of the tubes or even replacement of the tubes is permitted by this construction, there are many occasions when the heat transfer of a tubular heat exchanger might be considerably improved by merely reversing the flow through the tubes, as this has been found to be an effective means of removing deposits of silt, débris, and the like, which accumulate from time to time.

It is a more particular object of the present invention, therefore, to provide a divided water box condenser with means for reversing the flow of circulating media through the tubes for back-washing, or cleaning the same.

This 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 an elevation of a surface condenser;

Fig. 2 is a section on the line II—II of Fig. 1;

Fig. 3 is a section on the line III—III of Fig. 1; and,

Figs. 4, 5 and 6 are diagrammatic views showing the manner of operation of my improved heat exchangers.

According to my invention, a tubular heat exchanger, which is equipped with water boxes having partitions arranged therein for passing the circulating media through the tubes in parallel, is provided with suitable valves in the partitions, the valves being so arranged in the inlet water box as to provide for controlling the flow through the inlets associated with the respective chambers in said water box, and also from the respective chambers to a common discharge connection. Valves are also disposed in the partition in the discharge water box so as to control the flow through an opening in the partition and also through the discharge connections which are associated with the respective chambers of the discharge water box. Preferably, these valves are all arranged within the respective water boxes so that no exterior piping connections are required, and hence, no additional space is required for such equipment.

The valves in the discharge water box are preferably arranged so that in normal operation the opening through the partition is closed and the discharge connections are both open, and when it is desired to reverse the flow through the tubes associated with one of the chambers of this box the valves are swung to a position to close both of the discharge connections and to uncover the opening in the partition and, at the same time, one of the valves in the inlet water box is swung to a position to close one of the inlet connections and to open a passage leading to a common discharge connection, which is arranged to serve both of the chambers formed by the partition in the inlet water box. In this way, a single-pass heat exchanger may be operated as a two-pass unit, and a reversal of flow through the tubes of one pass may be thereby effected. When operated as a two-pass unit the exchanger will not give quite as good performance, or over-all heat trans-

fer as when operated as a single-pass unit, but it will have a greater heat transfer than would be the case if half of the tubes, for example, were shut off entirely from the circulating system.

In Figs. 1, 2 and 3 of the drawings I show a preferred form of my invention embodied in a surface condenser, indicated generally at 10, and comprising a shell 11, which is provided with the usual hotwell 12. The inlet and discharge water boxes are indicated at 13 and 14, respectively, the inlet water box being provided with a partition 16 which separates this water box into separate chambers 17 and 18, respectively, while the discharge water box is provided with a partition 19 which separates this water box into chambers 21 and 22, respectively, the latter corresponding to the chambers 17 and 18 of the water box 13.

During normal operation of the apparatus, cooling media is passed through the inlets 23 and 24 into the chambers 17 and 18 of the inlet water box 13 and thence through the tubes to the chambers 21 and 22 and out through the discharge connections 26 and 27 of the discharge water box 14. This condition of operation is shown diagrammatically in Fig. 5. In Fig. 5, and also in Figs. 4 and 6, the shaded openings are closed.

In order to provide a simple and convenient means for reversing the flow through the tubes, I arrange a discharge connection 28 in the lower portion of the inlet water box 13 so that it may serve to discharge circulating media from either of the chambers 17, or 18, and I provide suitable valves, such as the pivotally mounted flap valves 29 and 31, which are arranged in normal operation to close the discharge connection 28, and which may be operated to close the inlet connections 23 and 24, respectively. I provide similar flap valves 32 and 33, preferably in the upper portion of the partition 19 of the discharge water box 14, and these valves are arranged to close the opening 34 in the partition 19 during normal operation, and when it is desired to reverse the flow through the tubes associated with either the chamber 21 or the chamber 22, these valves are swung to a horizontal position to close the discharge connections 26 and 27 and to uncover the opening 34. At the same time one of the flap valves 29 or 31, as, for example, the valve 29 is swung to its lower position to close the inlet connection 23. Circulating media will then pass through the tubes in the manner shown diagrammatically in Fig. 4, entering through the inlet connection 24 to the chamber 18 and through the tubes associated with this chamber to the chamber 22 in the discharge water box, through the opening 34 to the chamber 21 of the discharge water box, and through the tubes associated with the latter chamber to the chamber 17 in the inlet water box, whence it passes out through the discharge connection 28. It will be apparent that, by operating the valves 32 and 33 to close both of the discharge connections 26 and 27 of the discharge water box and by swinging the valve 29 to a position to close the discharge connection 28, and by swinging the valve 31 to a position to close the inlet connection 24, circulating media will be passed through the tubes in the manner shown diagrammatically in Fig. 6. In this condition the circulating media would enter the inlet water box through the connection 23 to the chamber 17 and then pass through the tubes communicating with this chamber, from whence it would issue into the chamber 21 in the discharge water box and then pass through the opening 34 to the chamber 22 and back through the remaining tubes to the chamber 18 in the inlet water box, from whence it would be discharged through the discharge connection 28.

While the opening 34 may be located in any portion of the partition 19 of the discharge water box, this opening is preferably located in the upper portion thereof so as to assure flooding of all the tubes and hence, good circulation before the circulating media is passed from the chamber 21 to the chamber 22. The valves 32 and 33, as well as the valves 29 and 31 in the inlet water box, may be operated in any suitable manner as, for example, by means of the handwheels 36 and 37, which are provided for the valves 32 and 33, and the handwheels 38 and 39, which are provided for operating the valves 29 and 31 in the inlet water box.

It will readily be seen, therefore, that I have provided a simple and efficient arrangement for back-washing the tubes of a tubular heat exchanger and thereby improving their efficiency, and that the arrangement of the opening 34 in the upper portion of the partition 19 assures complete circulation through all of the tubes and, hence, a good heat transfer for the unit while operating as a two-pass condenser. Furthermore, by my novel arrangement of the common discharge connection 28 and the flap valves 29 and 31, I am able to provide for discharging the circulating media from either of the members 17 or 18 of the inlet water box with a minimum number of valves and only one discharge connection. It will also be obvious that by arranging the various flap valves within the respective water boxes a considerable saving in space, which would ordinarily be required outside of the unit, is effected.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limita-

tions 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. The combination with a tubular heat exchanger comprising a shell, a nest of tubes therein, inlet and discharge water boxes for the tubes, and partitions arranged in the water boxes to provide independent circulation systems for passing circulating media through the tubes in parallel, of means for passing circulating media through the independent circulating systems in series, and a common discharge connection on the inlet water box arranged to convey circulating media from either of the independent circulating systems.

2. The combination with a tubular heat exchanger comprising a shell, a nest of tubes therein, and inlet and discharge water boxes for the tubes, of partitions arranged in the water boxes to provide independent circulating systems for passing circulating media through the tubes in parallel, the partition in the discharge water box having an opening provided therein, means for controlling the flow of circulating media through said opening, and a common discharge connection on the inlet water box arranged to convey circulating media from either of the independent circulating systems.

3. The combination with a tubular heat exchanger comprising a shell, a nest of tubes therein, and inlet and discharge water boxes for the tubes, of partitions arranged in the water boxes to provide independent circulating systems for passing circulating media through the tubes in parallel, the partition in the discharge water box having an opening provided therein, means for controlling the flow of circulating media through said opening, a common discharge connection on the inlet water box arranged to convey circulating media from either of the independent circulating systems, and means for controlling the flow of circulating media from either of the circulating systems to said discharge connection.

In testimony whereof, I have hereunto subscribed my name this 12th day of September, 1928.

CHARLES B. TULEY.