Feb. 4, 1930. C. E. LUCKE 1,745,857

CONDENSER

Filed Feb. 8, 1927

Fig. 1.

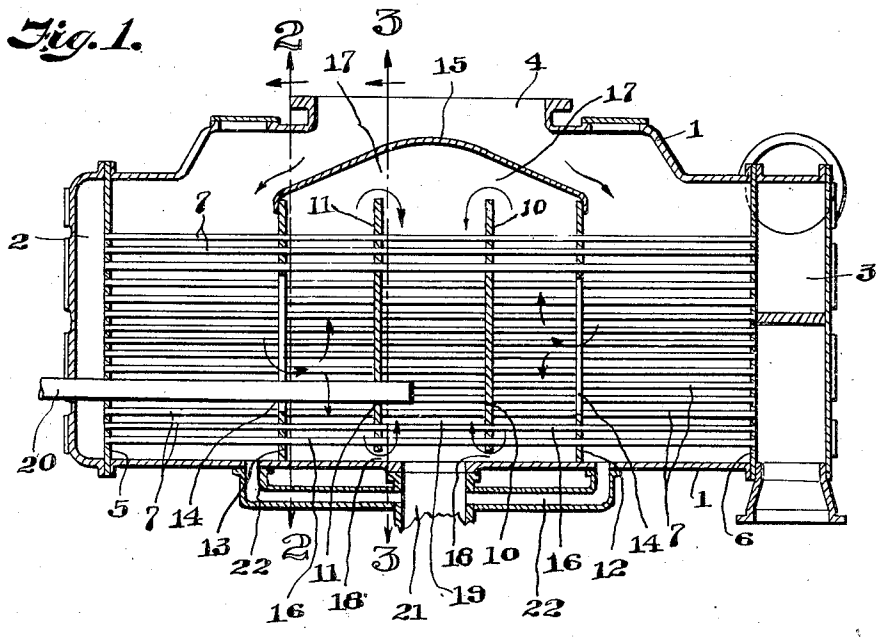


Fig. 2.

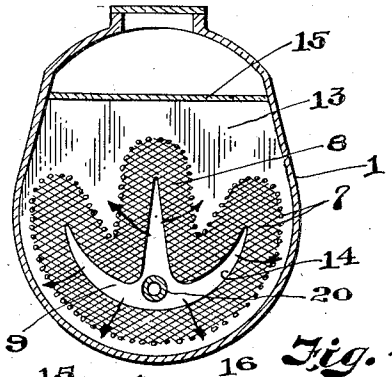


Fig. 3.

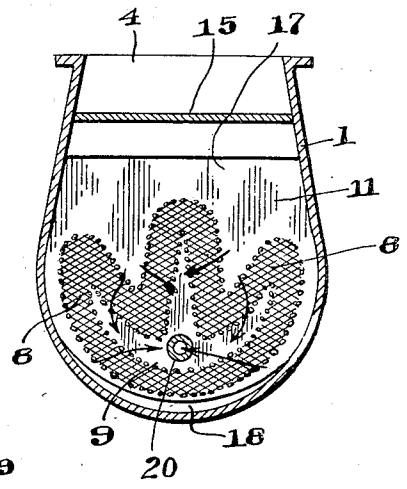
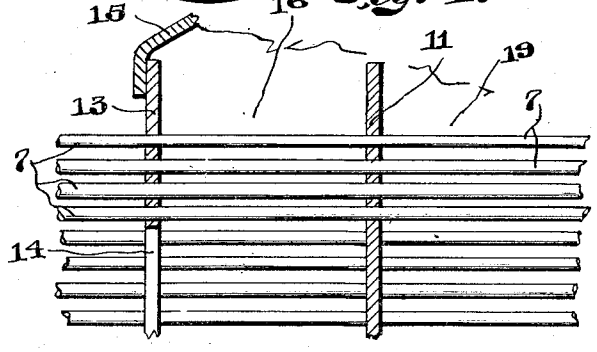


Fig. 4.



CHARLES E. LUCKE.
INVENTOR

BY Robert Meyer

ATTORNEY

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UNITED STATES PATENT OFFICE

CHARLES E. LUCKE, OF NEW YORK, N. Y., ASSIGNOR TO WORTHINGTON PUMP AND MACHINERY CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF VIRGINIA

CONDENSER

Application filed February 8, 1927. Serial No. 166,781.

This invention relates to steam condensers of the surface type and an object of the invention is to provide a construction of high vacuum surface condenser adapted especially for large sizes, in which the condenser tubes contribute the maximum area possible to active condensation of steam, and thus reduce to a minimum the total tube surface required for a given weight of steam per hour.

In carrying out the invention it is aimed especially to provide effective use of all the tubes and tube surfaces in a condenser. In condenser of the type as disclosed in my companion application filed August 3rd, 1925, Serial Number 47,675, the tubes are arranged in a belt of uniform flow resistance from steam inlet side to air exit side of the belt, and the flow resistance is fixed by the number of tubes across the belt and by size and spacing. To insure the least possible loss of vacuum across the condenser between air pump connection and steam entrance, the flow resistance must be as small as possible, that is, not too many tubes across the belt nor too close a spacing. However, on the other hand it is necessary that all parts of the belt should receive a proper share of the steam and to this end the flow resistance of the belt must be high enough to force the steam to distribute itself over all of the entrance area of the belt, and to this end the tubes across the belt must not be too few or be too widely spaced.

One of the objects of the present invention is to provide another way of securing the desired flow resistance across the belt so as to secure the necessary compromise between too high and too low a value and give as small a flow loss as is consistent with good distribution of steam. This improvement is especially suited for condensers attached to turbines or engines that tend to deliver the steam to the condenser, concentrating flow toward both ends and away from the middle, or toward the middle and away from the ends, or toward one end or otherwise unequal longitudinally. The desired result is accomplished by providing diametrically extending direction plates or baffles which are spaced apart a distance less than the distance between the outermost or end plates and ends of the condenser. The tube belt is folded so as to provide a central air space entirely surrounded by tubes and the two end direction plates are connected by an exhaust guiding plate which extends across the steam inlet of the condenser so as to guide the steam towards the ends of the condenser and prevent any entering between the plates. The steam first passes from the outside or entrance side inwardly through the folded belt of tubes at the ends of the condenser and into the air space. It then passes longitudinally through the end direction plates which are cut out or provided with openings corresponding to the air space, and into that part of the air space between the central and end direction plates, and outwardly from the air space through the tube belt, passing longitudinally around the edges of the central direction plates into the central section formed by the central direction plates and finally inwardly through tube folds into the air space of the condenser from which it is drawn off by an ejector or vacuum air pump of any approved design.

With these objects in view, the invention consists in various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a condenser of the preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings—

Figure 1 is a longitudinal section through the condenser constructed in accordance with the present invention.

Figure 2 is a cross-section through the condenser taken on the line 2—2 of Figure 1.

Figure 3 is a cross-section through the condenser taken on the line 3—3 of Figure 1.

Figure 4 is a fragmentary longitudinal section through the condenser similar to Figure 1 only on an enlarged scale.

Referring more particularly to the drawings a condenser of the type known as two-pass condenser is shown but it is to be understood that the present invention is equally applicable to single pass condensers.

The condenser comprises the shell 1 having the usual water boxes 2 and 3 at its opposite ends, and provided with the steam inlet 4. Tube sheets or heads 5 and 6 are also provided in the condenser which carry and support the tubes 7. As clearly shown in Figures 2 and 3 of the drawings the tubes are arranged in a folded continuous belt 8 completely enclosing the substantially pick-shaped air space 9 which extends longitudinally through the condenser, being interrupted only by the central or intermediate direction guiding plates 10 and 11 which extend across the interior of the condenser shell. The outermost or end directional plates 12 and 13 are provided with openings or cut out portions 14 corresponding to the shape of the air space and these end or outermost direction plates are connected by the steam guiding plate 15 which bridges or covers the space within the condenser between the direction plates 12 and 13 and extends across the exhaust inlet 4 inclining inwardly and downwardly from the center of the inlet for guiding the steam towards the ends of the condenser and preventing steam entering the tube layer except at the ends. The steam entering the condenser at its end portion passes through the belt of tubes into the air space 9 and passes through the openings 14 in the end or outermost direction plates 12 and 13 into the spaces 16 between the inner plates 10 and 11 and the respective outer plates 12 and 13. Within the spaces 16 the steam travels outwardly through the belt of tubes and about the edges of the plates 10 and 11. Spaces 17 and 18 are provided at the upper and lower edges of the plates 10 and 11 to permit passage of the steam across these plates into the central space 19 between the inner direction plates 10 and 11. In the central space 19 the steam again passes inwardly through the tube belt 8 into the air lane 9 from which the air is drawn off through a suitable air outlet 20 by means of an ejector or vacuum pump of any approved design.

By particular references to Figure 1 of the drawings it will be noted that the direction plates or baffles 10, 11, 12 and 13 are spaced apart a distance less than the distance between the plates 12 and 13 and the adjacent ends of the condenser and also that the plates 12 and 13 extend to the inner surface of the shell 1 at the lower portions of the plates so as to confine the passage of exhaust steam from the spaces at the ends of the condensers into the spaces 16 through the openings 14 in the plates 12 and 13 which openings correspond in shape and size to the air lane 9. Any suitable means may be provided for draining the condensate from the end spaces in the condenser to the hot well 21, one form of such construction being the pipes or passages 22.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown but that these may be modified widely within the invention defined by the claims.

What is claimed is:

1. In a surface condenser, tubes arranged in a belt of uniform flow resistance about an air space, and a plurality of direction plates extending across the condenser for directing the steam inwardly through the tube belt over a portion of the longitudinal length of the tubes and then outwardly from the central space through the tube belt.

2. In a surface condenser, a steam guiding plate for guiding the steam entering the condenser in a pre-determined direction, a plurality of direction plates extending across the condenser for directing the steam in a sinuous path longitudinally through the condenser, said guiding plate attached to certain of said direction plates and forming a closure for the space between the direction plates and the steam inlet.

3. In a surface condenser, a tube belt arranged to form an air space surrounded by the tube belt, a steam guiding plate for guiding the steam entering the condenser towards its ends, and a plurality of direction plates extending across the condenser for directing the steam in a sinuous path longitudinally through the condenser.

4. In a surface condenser, a tube belt arranged to form an air space surrounded by the tube belt, a steam guiding plate for guiding the steam entering the condenser towards its ends, and a plurality of direction plates extending across the condenser for directing the steam through the condenser whereby the steam will alternately pass inwardly through the tube belt into the air space and outwardly through the tube belt from the air space.

5. In a surface condenser, a tube belt arranged to form an air space surrounded by the tube belt, a steam guiding plate for guiding the steam entering the condenser in a pre-determined direction, a plurality of direction plates extending across the condenser, certain of said direction plates being provided with cut out portions corresponding in shape to the shape of the air space and other of said direction plates provided with cut away portions to form spaces at their edges whereby the steam passing longitudinally through the condenser will be directed in a sinuous path.

6. In a surface condenser, a tube belt arranged to form an air space surrounded by the tube belt, a steam guiding plate for guiding the steam entering the condenser in a predetermined direction, a plurality of direction plates extending across the condenser, certain of said direction plates being provided with cut out portions corresponding in shape to the shape of the air space and other of said direction plates provided with cut away por-

tions to form spaces at their edges whereby the steam passing longitudinally through the condenser will be directed in a sinuous path, and an air offtake for the condenser communicating with the space between the innermost direction plates.

7. In a surface condenser, a tube belt arranged to form an air space surrounded by the tube belt, a steam guiding plate for guiding the steam entering the condenser towards its ends, a plurality of direction plates extending across the condenser for directing the steam in a sinuous path longitudinally through the condenser, and an air offtake communicating with the space between the innermost direction plates.

8. In a surface condenser, tubes arranged about an air space, and means for directing steam across the tubes into the air space over predetermined portions of the tube lengths and across the tubes outwardly from the air space over other predetermined portions of the tube lengths.

9. In a surface condenser, means for directing steam entering the condenser towards its ends, and means for directing the steam in sinuous paths from its ends towards its transverse centre.

In testimony whereof I affix my signature.

CHARLES E. LUCKE.