Feb. 1, 1949. J. F. GRACE 2,460,499

REVERSIBLE CIRCULATION CONDENSER

Filed July 16, 1945 3 Sheets-Sheet 1

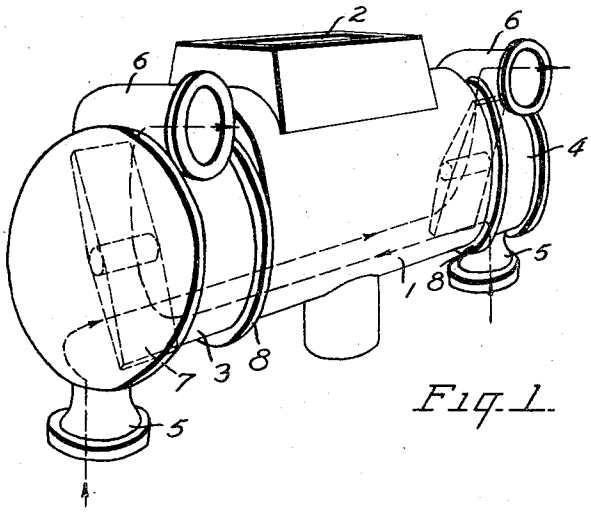


Fig. 1.

Fig. 4.

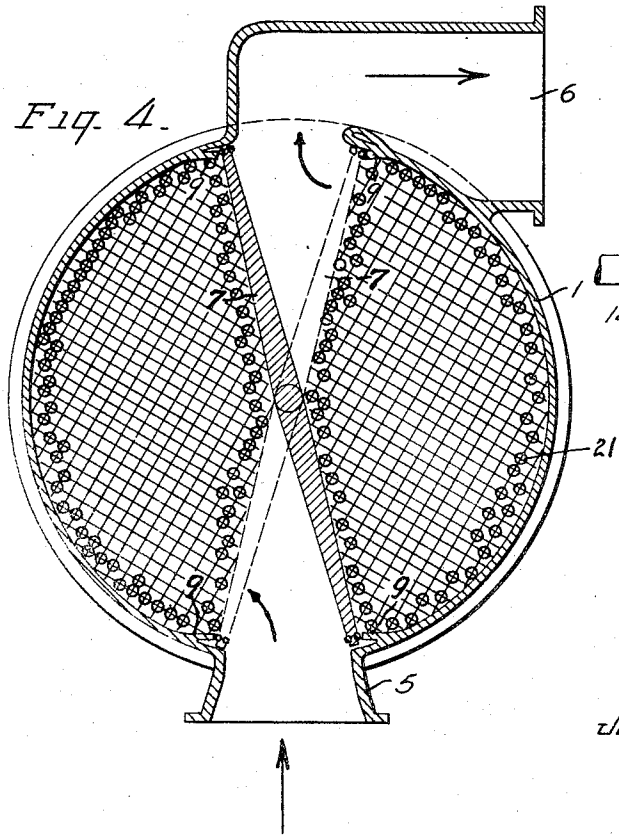
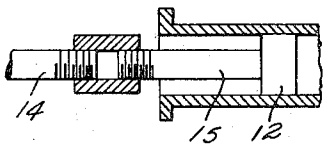


Fig. 5.



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REVERSIBLE CIRCULATION CONDENSER

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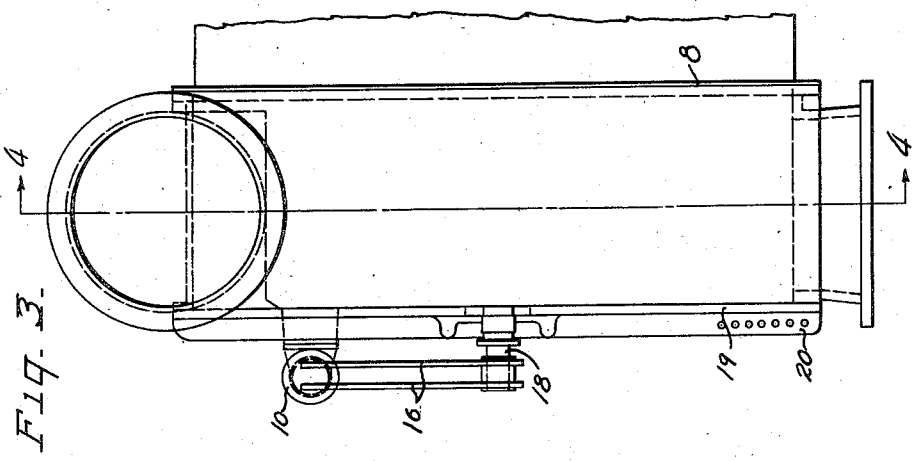


Fig. 3.

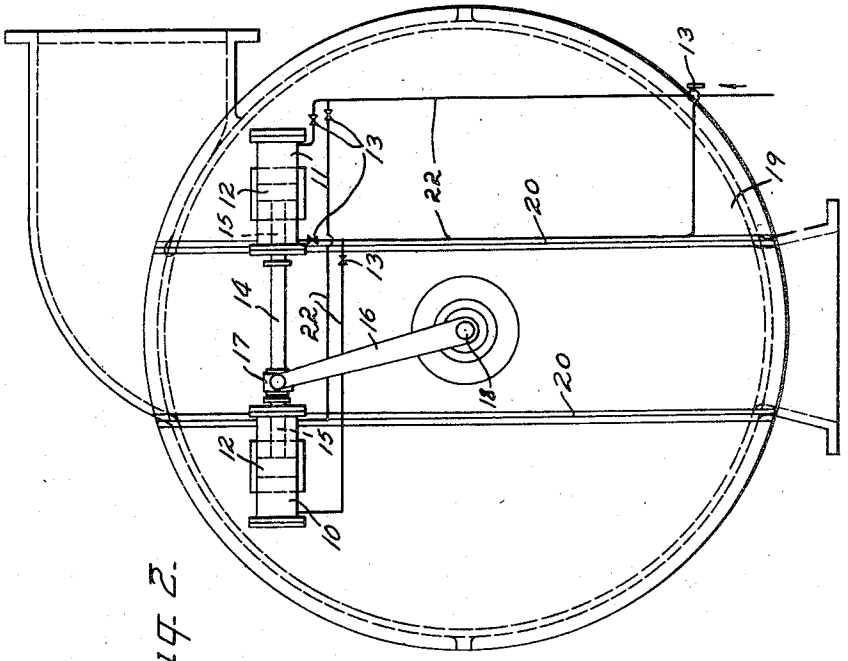


Fig. 2.

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REVERSIBLE CIRCULATION CONDENSER

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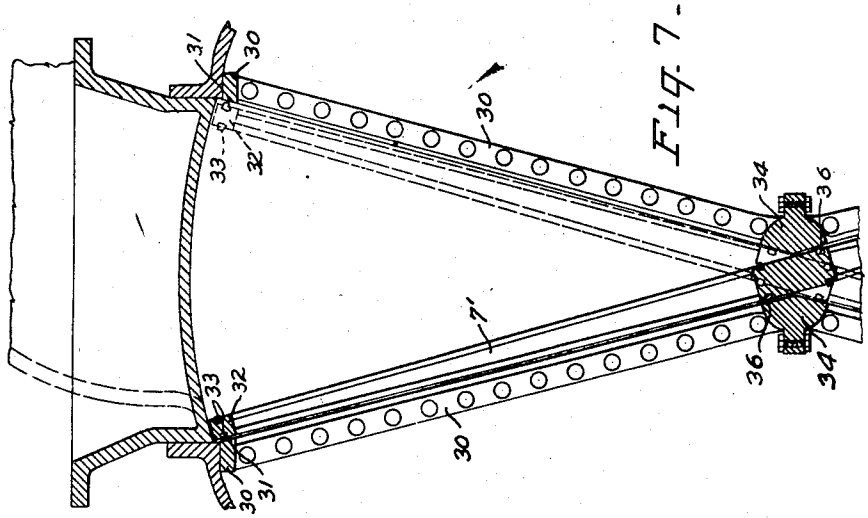


Fig. 7.

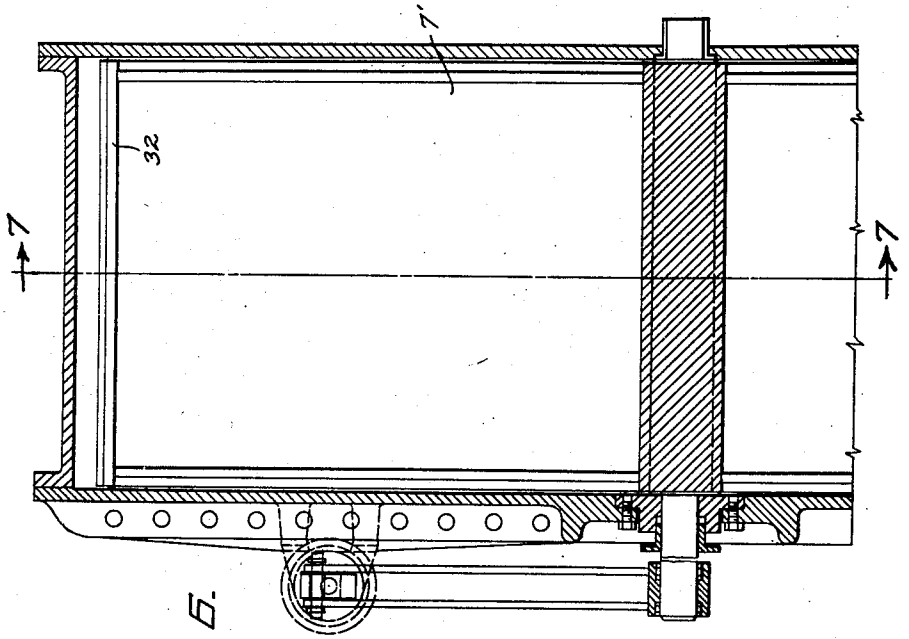


Fig. 6.

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REVERSIBLE CIRCULATION CONDENSER

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Application July 16, 1945, Serial No. 605,413

5 Claims. (Cl. 257—43)

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This invention relates to steam condensers of the type known as surface condensers, wherein the steam to be condensed is passed into the shell of the condenser about a plurality of tubes extending through the shell while a condensing medium such as water is circulated through the tubes.

In many installations of surface condensers the condensing water is taken from rivers, ponds or other sources of cheap water supply, with the result that the water contains foreign matter, such as algae etc. and when circulated through the relatively small tubes of the surface condenser the algae or other foreign matter accumulates at the tube entrances or inlets causing a partial or complete blocking of the tubes, with a resultant reduction of water circulation through the condenser which in turn reduces the heat transfer action in the condenser and fails to provide condensation of steam to the maximum ability or rating of the condenser.

It is an object of the present invention to provide a condenser structure wherein the directional flow of the condensing water through the tubes of the condenser may be reversed as desired so as to wash away the accumulation of foreign material at the entrance or inlets of the tubes.

More specifically the invention comprises, in a single pass condenser means providing two oppositely flowing parallel paths for the circulating cooling water, and a novel form of valves whereby the directional flow of water through the paths may be reversed.

With these and other objects in view as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts which will be first described in connection with the accompanying drawings, showing a surface 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 diagrammatic view in perspective of the condenser.

Figure 2 is an end view of the condenser.

Figure 3 is a fragmentary side elevation taken at one end of the condenser.

Figure 4 is a vertical section through one of

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the water boxes of the condenser taken on line 4—4 of Figure 3.

Figure 5 is a fragmentary vertical section through a part of the operating structure of the condenser.

Figure 6 is a fragmentary vertical section through the water box of a modified form of the invention.

Figure 7 is a vertical section on the line 7—7 of Figure 6.

Referring more particularly to the drawings the improved condenser comprises a shell 1 into which the steam to be condensed passes through an exhaust inlet 2 and which has water boxes 3 and 4 at its ends. Each of the water boxes 3 and 4 has two water connections 5 and 6 formed thereon one of which serves as an inlet for incoming water while the other serves as an outlet for water after it has passed through the tubes 21 in the condensing space in the condenser shell 1 between the water boxes 3 and 4.

Each water box 3 and 4 has a water flow directing valve 7 therein. The valves 7 are large butterfly valves being pivotally supported at their transverse centers at the axes of the water boxes 3 and 4 so that they divide the interior of the water boxes into two sections one of each of which has communication with the water connection 5 and the other of which has communication with the water connection 6, thus the water circulation of the condenser is divided into two parallel paths. When the valves 7 are positioned as shown in Figure 1 of the drawings the water connection 5 of the water box 3 is the inlet for water to one of the flow path sections of the condenser while the water connection 6 of the water box 4 is the outlet for the same path. The water connection 5 of the water box 4 is the inlet for water to the other flow path and the water connection 6 of the water box 3 is the outlet of this pass, thus water flows through the condenser in two parallel paths but in opposite directions in the paths, providing in effect a single pass condenser, in that the cooling water flows only once through the condenser. Maintaining the water flow to the water connections in the same manner and swinging the valves 7 to their other position as indicated in dotted lines in Figure 4 of the drawings will reverse the direction of water flow through the two paths in the condenser shell

1 thus converting the inlet of the respective paths into their outlets and washing away any foreign matter which may have accumulated on the tube heads 8 of the condenser or at the inlet ends of the tubes 21.

Suitable stops 9 are provided in the water boxes 3 and 4 to limit the pivotal movement of the valves 7.

The valves 7 being quite large and heavy may be moved by any suitable type of moving means such as electric motors, reciprocating pressure fluid operated motors or the like and in Figures 2 and 3 of the drawings such valve moving means is shown as reciprocating-type motors wherein a pair of cylinders 10 and 11 are provided for each valve. The cylinders 10 and 11 have pistons 12 reciprocal therein and these pistons are operated by any suitable type of pressure fluid such as pressure air, steam or the like. The flow of the pressure operating fluid to the cylinders 10 and 11 is under control of a series of valves 13 in the supply lines 22 to the cylinders so that by manipulation of the valves 13 the valves 7 may be moved in either direction on their pivots, as desired.

The pistons 12 have connecting rod 14 detachably connected to the facing ends of their respective piston rods 15 so that the two pistons 12 move in unison. Shifting arms 16 are connected to the shifting rod 14 by a suitable coupling 17 and they are connected to the ends of the trunnions of the valves 7 for swinging the valves upon movement of the pistons 12.

As shown in Figures 2 and 3 of the drawings the cover plates 19 of the water boxes 3 and 4 are made in sections connected together by bolted flanges 20 and the connecting rod 14 is detachably connected to the piston rods 15 as clearly shown in Figure 5 of the drawings so that by shutting off the flow of circulating water through one of the water flow paths of the condenser, one of the cover plate sections may be removed from each of the water boxes 3 and 4 and one half of the condenser be repaired, or worked upon while the other half is operating.

In Figures 6 and 7 of the drawings a modified form of the condenser is shown. This modified form includes the valves 7' which operate and are moved in the same identical manner as the valves 7 shown in and described in connection with Figures 1 to 5 inclusive, the modifications residing in the specific construction of the valves and their movement limiting stops.

In Figures 6 and 7 the movement limiting stops for the valves are shown as rings 30 which are attached in any suitable manner such as by bolting to the inner surfaces of the circular walls of the water boxes, and they have their inner edges facing the valves inclined as shown at 31 to snugly fit against the rims 32 of the valves 7'.

The faces of the rims 32 of the valves 7' have resilient inserts 33 in their faces which contact the angled or inclined edges of the stop rings 30 so as to form fluid tight engagement between the valve rings 32 and the stop rings 30 to prevent leakage of water past the valves, when one half of the condenser is not operating and is down for repairs, or cleaning.

Guide stops 34 are also provided near the axes of the water boxes and provide guiding stop supports and water seals for the valves 7' at and near their pivotal points. These guiding, supporting, or bracing stops 34 have their inner surfaces cut at obtuse angles to form oppositely inclined surfaces against which the valves rest. As shown in Figure 7 of the drawings one side of each

valve 7' rests against one inclined face of one of the stop supports 34 while the opposite side of the valve rests against the parallel inclined side of the other stop, thus providing support at each side of the pivotal axis of the valve.

The valves 7' have resilient inserts 36 of rubber or analogous material inserted in their surfaces which contact the inclined inner surfaces of the stop supports 34, so as to provide fluid tight joints between the valves and stops.

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

What is claimed is:

1. In a condenser having a shell with a multiplicity of horizontal tubes, a water box at each end of the shell in communication with the tubes, each of the water boxes having an inlet at the bottom and an outlet at the top, a movable diametral partition having fluid tight engagement with the inner wall of the water box pivotally mounted in the center of each water box, said partitions being inclined in opposite directions with respect to the lines through the centers of their respective inlets and outlets whereby the inlet of each water box is connected to the outlet of the other but is prevented by the diametral partition from having communication with the outlet in its own waterbox.

2. The invention of claim 1 and means for moving each partition about its pivoted center to reverse its inclination with respect to the line through the center of its inlet and outlet.

3. In a condenser having a shell with a multiplicity of horizontal tubes, a waterbox at each end of the shell in communication with the tubes, each of the waterboxes having a first fluid transfer opening at the bottom and a second fluid transfer opening at the top, a movable diametral partition having fluid tight engagement with the walls of the water box pivotally mounted in the center of each waterbox, stop means in each water box for limiting the pivotal movement of the partitions to no less than the angles included by radii from the centers of the water boxes to the opposite edges of the larger openings therein, said partitions being inclined in opposite directions with respect to lines through the centers of their respective waterbox openings and abutting the stop means whereby the first opening of each water box is connected to the second opening of the other but is prevented by the partition from having communication with the second opening in its own water box, and means for moving each partition about its pivoted center to reverse its inclination with respect to the line through the centers of its openings.

4. In a condenser having a shell with a multiplicity of horizontal tubes, a water box at each end of the shell in communication with the tubes, each of the water boxes having a first fluid transfer opening at the bottom and a second fluid transfer opening at the top, movable diametral plates in each water box having fluid tight engagement with the walls thereof, means providing a pivotal mounting of the plates at the axes of the water boxes comprising a bearing block having a neck of substantially the width of the plate and sides diverging from the neck so that the included angle therebetween is at least equal to that included by radii from the box axes to the edges of the larger fluid transfer opening in each box, said blocks being mounted in the

boxes so that the necks lie in horizontal planes through the box axes, said partitions being inclined in opposite directions to engage opposite block sides in each water box whereby the first fluid opening of each water box is connected to the second opening of the other but is prevented by the partition from having communication with the second opening of its own water box.

5. The invention of claim 4 and means for reversing the positions of the partitions.

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