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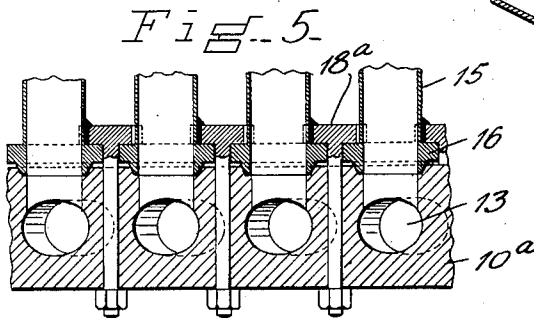
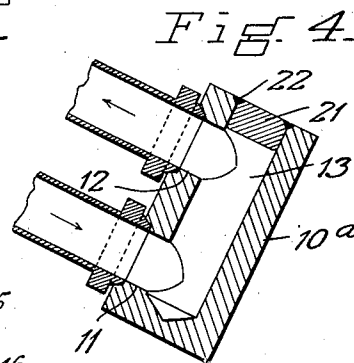
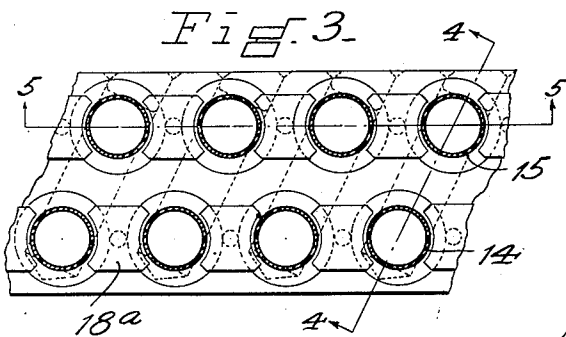
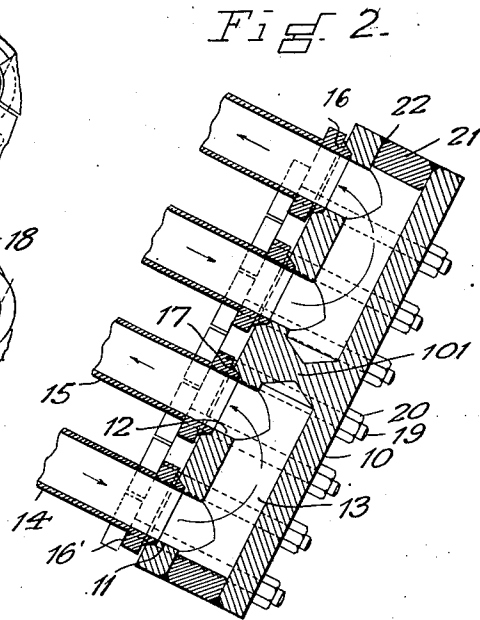
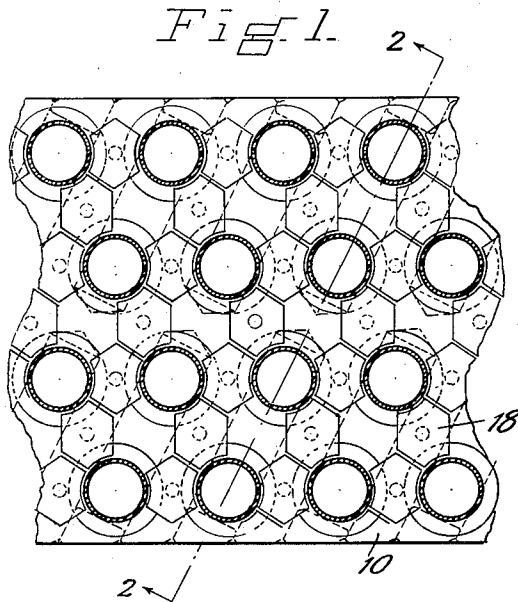
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FLUID HEATER AND METHOD OF OPERATING THE SAME

Filed March 14, 1930

2 Sheets-Sheet 1



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FLUID HEATER AND METHOD OF OPERATING THE SAME

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2 Sheets-Sheet 2

Fig. 6.

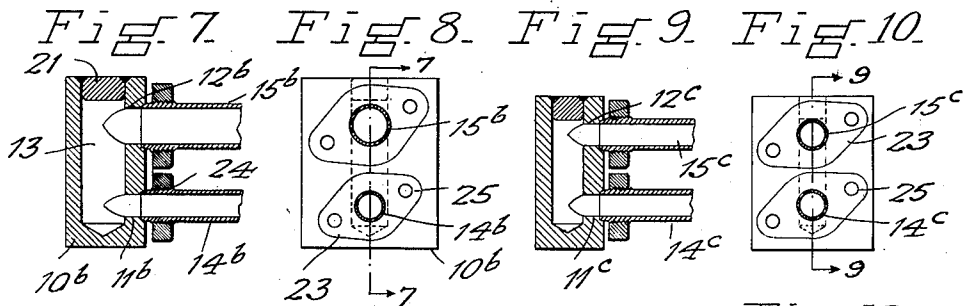
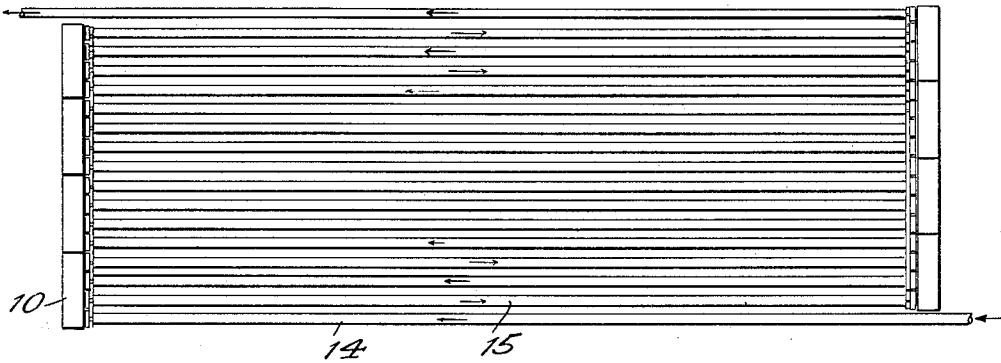


Fig. 12.

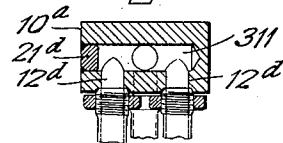


Fig. 13.

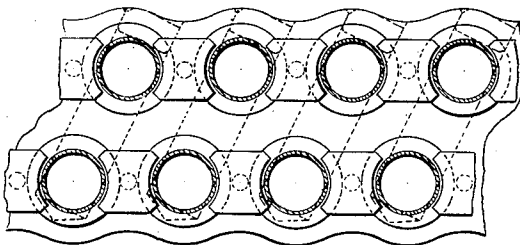
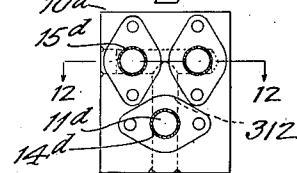


Fig. 11.



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FLUID HEATER AND METHOD OF OPERATING THE SAME

Application filed March 14, 1930. Serial No. 435,754.

My invention more particularly relates to a fluid heater such as an economizer, series boiler, etc., in which the ends of the tubes of the fluid heater are connected to machined headers.

My invention will best be understood by reference to the accompanying drawings, in which I have illustrated certain embodiments thereof, and in which Fig. 1 is a fragmentary sectional elevation of a number of tubes connected at one end to a header in accordance with my invention; Fig. 2 is a section taken on the line 2—2 of Fig. 1; Fig. 3 is a view similar to Fig. 1 illustrating two rows of tubes and slightly modified means for holding the tubes to their seats; Fig. 4 is a section taken along the line 4—4 of Fig. 3; Fig. 5 is a section along the line 5—5 of Fig. 3; Fig. 6 is a side view of a fluid heater embodying my invention; Fig. 7 is a sectional view through the ends of two tubes and the header to which they are connected, the tube openings and the tubes themselves being of different sizes, and is taken along the line 7—7 of Fig. 8; Fig. 8 is a sectional elevation of Fig. 7; Fig. 9 is a view similar to Fig. 7, but illustrating the inlet and outlet openings for the tubes and the tubes themselves of the same size; Fig. 10 is a sectional elevation of Fig. 9; Fig. 11 is a sectional elevation illustrating a single inlet opening and two outlet openings for the header; Fig. 12 is a section taken along the line 12—12 of Fig. 11, and Fig. 13 is a view similar to Fig. 3, but illustrating the header as sinuous in form.

Like reference characters indicate like parts throughout the drawings.

Referring now to the drawings, and first to Figs. 1 and 2, 10 is a header which, in accordance with my invention, is formed from a bar or plate of metal which may be cheaply formed as by rolling. My invention is particularly useful for a fluid heater, which is adapted to withstand high pressures as well as high temperatures.

The plate or bar 10 is drilled with openings as at 11 and 12 to form inlet and outlet openings for the header. In the embodiment of my invention illustrated in Fig.

2, the header is provided with two rows of inlet openings 11 and two rows of outlet openings 12. The plate or bar is also bored to form connecting passages 13 which afford communication between the inlet and outlet openings 11 and 12. In the embodiment of my invention illustrated in Figs. 1 and 2, the plate or bar is bored from opposite edges to form two aligned passages 13 separated by a partition 101. The lower one of these passages provides communication with an inlet tube 14 and an outlet tube 15, while the upper connecting passage 13 affords communication between an upper inlet tube and outlet tube.

Inlet tubes 14 and outlet tubes 15 communicate with openings 11 and 12, respectively, and form fluid-tight joints with walls surrounding the same.

In the embodiment of my invention illustrated in Figs. 1 and 2, the ends of the tubes are upset as at 16, and are preferably formed with flanges 16' and at their ends with conical surfaces 17 which are seated in corresponding conical seats in the header as best shown in Fig. 2. The tubes are held to their seats by plates or members 18 which may be substantially hexagonal in form as indicated in Fig. 1, and which engage the flanges 16'.

The members 18 are provided with studs cooperating with nuts 20 to force the members 18 against the flanges, and thereby hold the tubes to their seats. It will be noted that a sufficient number of the plates 18 engage each of the flanges 16' to produce a symmetrical arrangement and thus produce even distribution of pressure on the flanges 16' and conical surfaces 17.

The ends of the connecting passages 13 are closed as by plugs 21 which may be threaded into the header and then welded as at 22.

In the embodiment of my invention illustrated in Figs. 3, 4, and 5, the header is provided with a single row of inlet openings 11 and a single row of outlet openings 12 of the same character as described in connection with Figs. 1 and 2. The tubes are held to their tube seats by plates or members 18 which as indicated may be welded

along an edge to an associated tube. If desired, this welding may be performed before assembly of the tube with the header.

Fig. 6 illustrates a fluid heater comprising a plurality of headers 10 of the character illustrated in Figs. 1 and 2, laid upon each other and providing a substantially gas-tight wall for a gas flue, the headers at opposite ends of the heater being slightly staggered so that the fluid flows through the tubes and the headers in series in the manner indicated by the arrows.

In the embodiment of my invention illustrated in Figs. 7 and 8, the headers 10^b are bored with openings 11^b and 12^b differing in size, inlet tubes 14^b and outlet tubes 15^b communicating with the respective openings. The provision of different size tubes is particularly advantageous in the case of a steam-ing economizer where the smaller tubes carry the water, and the larger tubes carry the mixture of steam and water. The tubes are also held to their tube seats by flange members 23 of the form shown in Fig. 8, which may be preferably screwed onto the tubes as at 24. Bolts 25 pass through the plates 23 and hold the tubes to the tube seats.

The arrangement illustrated in Figs. 9 and 10 is the same as that illustrated in Figs. 7 and 8, except for the fact that the openings 11^c and 12^c are of the same size as are the tubes 14^c and 15^c.

In the arrangement illustrated in Figs. 11 and 12, the header 10^d is bored with a single inlet opening 11^d with which the inlet tube 14^d communicates, and is bored with two outlet openings 12^d. The bar 10^d is formed with a passage 311 affording communication between the outlet openings, and also a passage 312 indicated in dotted lines in Fig. 11 affording communication between the inlet opening 11^d and the passage 311. All of the passages, as well as the tubes, are preferably of the same size, so that the outlet flow area is greater than that of the inlet flow area.

The arrangement illustrated in Fig. 13 is the same as Fig. 3 heretofore described, except for the fact that the header is sinuous in form.

In the fluid heater made in accordance with my invention, the major operation performed during the manufacture of the tube connectors is that of boring, which is carried out cheaply and at high speed. The heating device, therefore, is cheap as compared, for example, with one employing forged fittings as tube connectors. The different sized openings may be secured in the header merely by changing the size of the drill. Furthermore, it will be noted that the openings and/or passages can readily be rebored to larger size.

I claim:

1. The method of making a fluid heater

which consists in boring inlet and outlet openings of different sizes in a wall of a metal bar, boring a connecting passage in said bar which affords communication between said inlet and outlet openings, closing the open end of said connecting passage, and connecting the fluid heating tubes to the respective inlet and outlet openings of said bar.

2. The method of making a fluid heater comprising a bank of tubes connecting headers at their ends which consists in boring inlet and outlet openings into a plurality of bars, boring connecting passages in said bars which afford communication between the inlet and outlet openings, closing the open end of said connecting passages, laying the headers one upon the other at the ends of the heater, and providing a fluid-tight connection between the ends of the tubes of said bank and the first-mentioned openings in said headers.

3. In a fluid heater, headers at each end of the heater laid one upon the other to form a substantially gas-tight closure, each header being provided with bored inlet and outlet openings and a bored connecting passage affording communication between said inlet and outlet openings, means for closing the ends of said connecting passages, and means for forming a fluid-tight connection between the ends of the tubes and the bored inlet and outlet openings, said headers substantially confining heated gases flowing over said tubes.

4. A header for fluid heat exchange apparatus comprising, in combination, a solid body of metal having substantially co-axial chambers leading into the body from opposite sides thereof and leaving a substantial web of metal separating the adjacent ends of the chambers, a wall of each chamber providing a plurality of transverse passages communicating with the corresponding chamber, and a tube communicating with each passage and held in pressure tight relationship with the body.

5. A header for fluid heat exchange apparatus comprising, a solid metal body of sinuous outline, opposite sides of the body presenting alternately arranged projections near which parallel passages extend part way through the body, portions of the body having oblique chambers formed therein from the side and communicating with a plurality of said passages, means for closing the end of each chamber through which it is formed, and tubes communicating with the passages and joined with the body in fluid tight contact.

6. In fluid heat exchange apparatus, headers piled one upon the other at opposite sides of a gas pass to form furnace gas boundary walls and tube bank supports, the individual headers provided with bored in-

let and outlet openings, tubes extending
across the gas pass and communicating with
the openings in opposite headers, fluid-tight
joints formed between the tubes and the
5 header walls around the openings, through
bolts extending through the walls and acting
upon the joints to maintain them in fluid
tight condition, and means acting on the
bolts and against the exterior sides of the
10 walls to tighten the joints, the individual
headers being also provided with a bored
connecting passage providing communica-
tion between the inlet and outlet openings.

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