

O. FOX.
WATER HEATER.
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1,025,389.

Patented May 7, 1912.
3 SHEETS—SHEET 1.

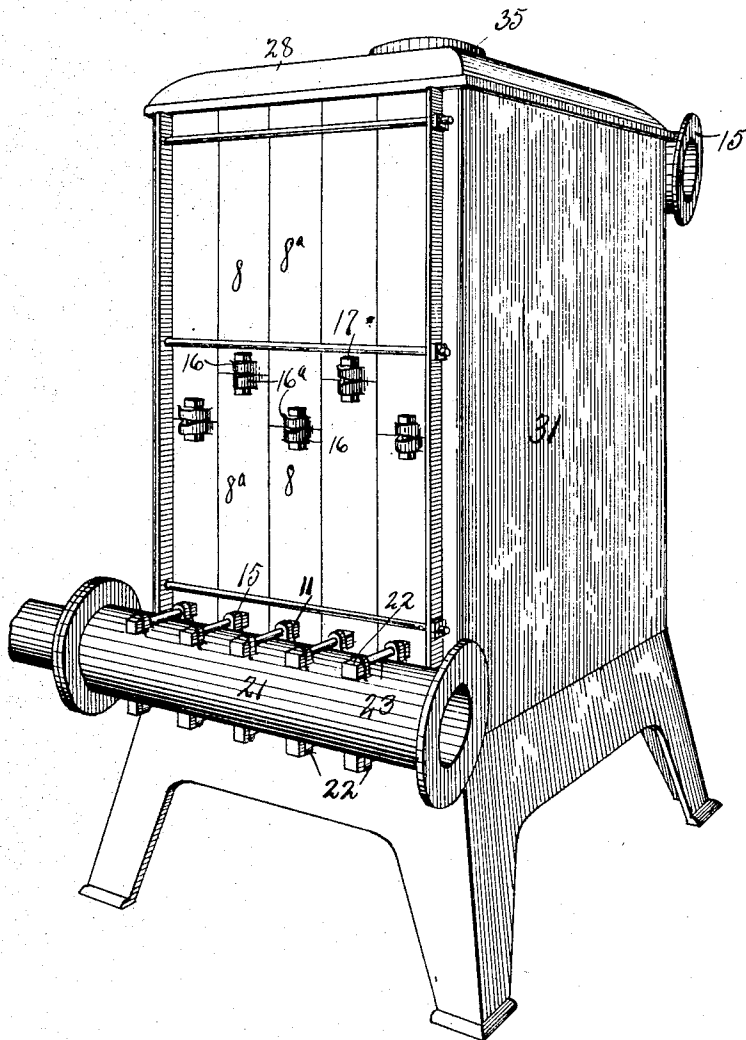


Fig. 1.

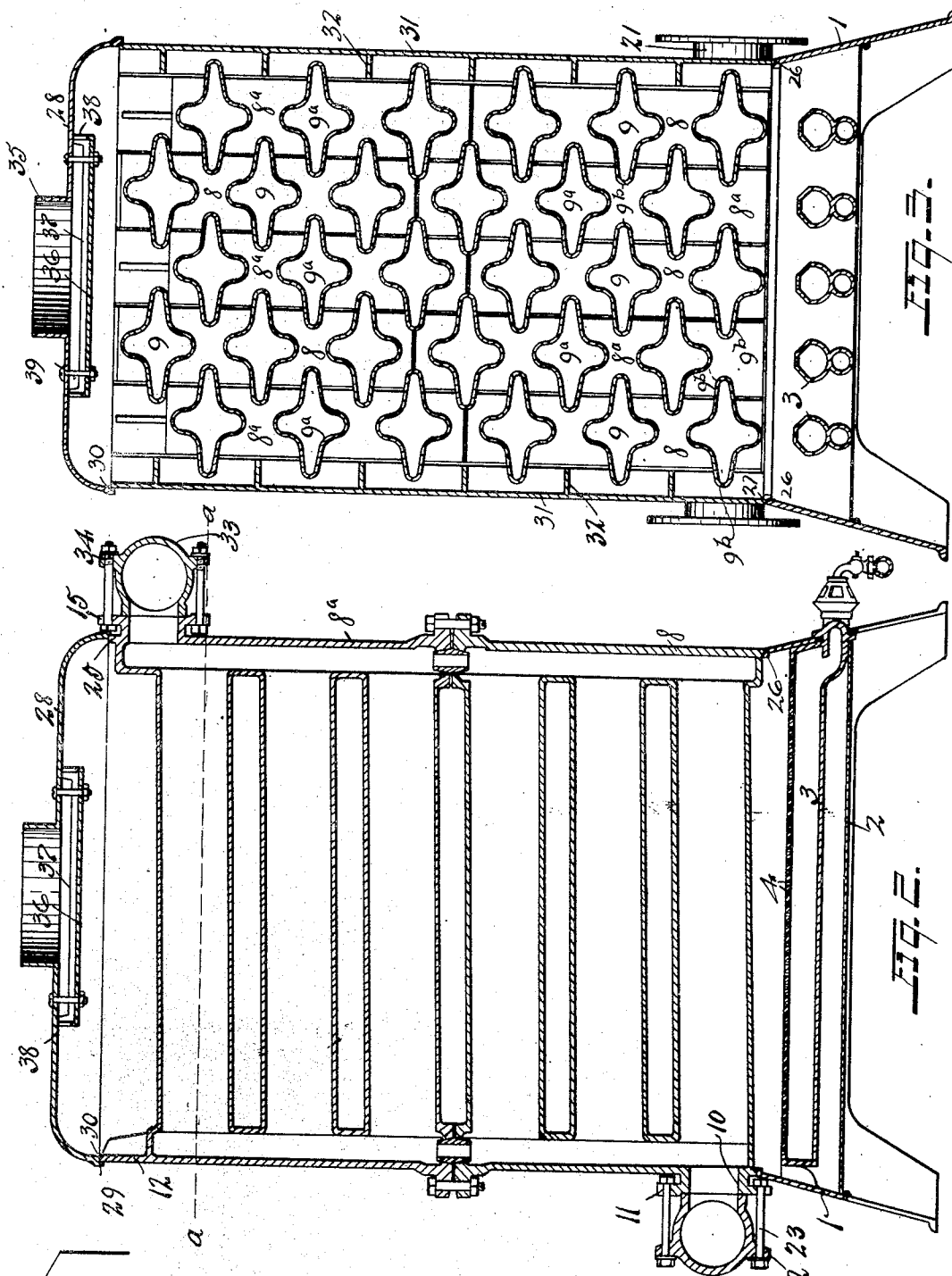
Witnesses.
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3 SHEETS—SHEET 2.



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3 SHEETS-SHEET 3.

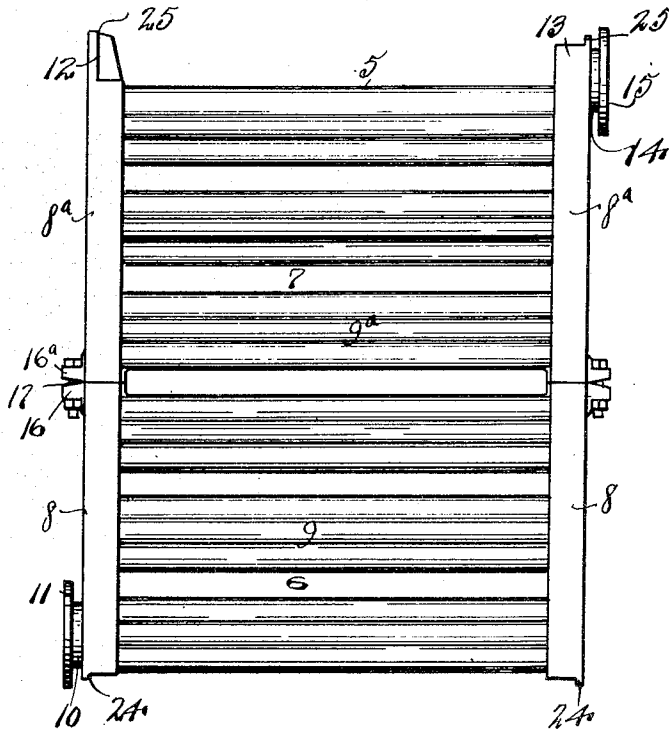
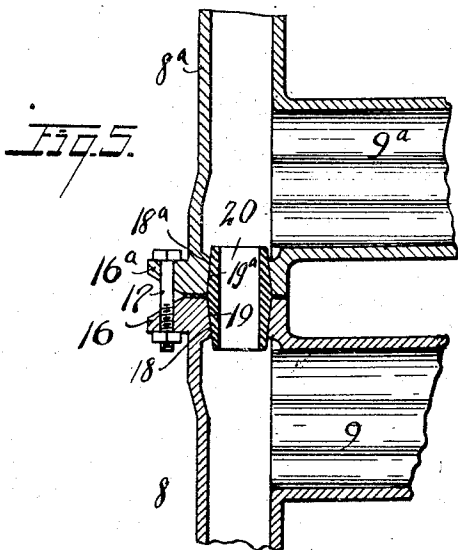


Fig. 4.



Witnesses

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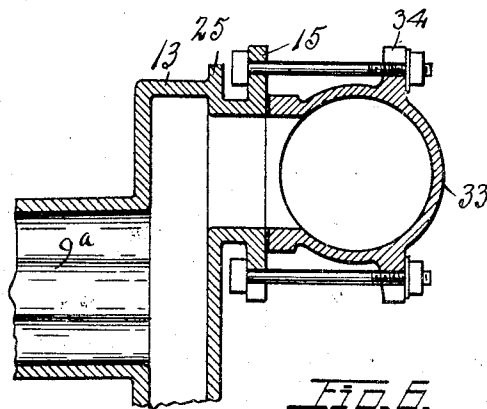


Fig. 6.

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1,025,389. WATER-HEATER. Otto Fox, Cleveland, Ohio, assignor to The Bryant Heater and Manufacturing Company, Cleveland, Ohio, a Corporation of Ohio. Filed Oct. 3, 1910. Serial No. 584,974.

To all whom it may concern:

Be it known that I, Otto Fox, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Water-Heaters, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to water heaters, and more especially to heaters of the type that are employed in connection with systems for heating buildings.

The objects of the invention are to provide a construction of a heater which is extremely cheap of production while securing great efficiency in heating. I accomplish these objects by the construction illustrated in the drawings, wherein—

Figure 1 represents a perspective view of a water heater constructed in accordance with my invention; Fig. 2 represents a vertical sectional view through such a heater; Fig. 3 represents a similar view taken at right angles to Fig. 2; Fig. 4 is a side elevation of one of the complete heating elements; Fig. 5 is a sectional detail illustrating the manner of connecting a pair of sections comprising an element; and Fig. 6 is a sectional detail of one end of one of the elements, showing the manner in which the header is connected thereto.

The heater exemplified herein consists generally of a series of water circulating

elements, each element comprising a pair of sections detachably connected and each section consisting of a pair of parallel conduit portions connected by transverse ducts or tubes, together with an inlet manifold or header common to all the elements, an outlet manifold or header common to all the elements, together with casing walls and burners arranged to heat the aforesaid elements.

Describing the various parts in the drawings by reference characters, 1 denotes the base of the heater, said base being provided with a plate 2 above which there is located a series of burners 3. Each burner is provided in its top with suitable orifices 4 through which the mixture of gas and air may escape and above which it may be ignited. The base 1 supports at its upper end the heater proper, which will now be described.

5 denotes generally one of the water circulating elements, such element being shown in Fig. 4. This element comprises a plurality of sections, two of such sections being shown and one of such sections being longer

than the other, for a purpose to be explained. The shorter section is shown at 6 and the longer section at 7. In Fig. 4, the shorter section is shown at the bottom and the longer section at the top, but this arrangement is reversed in the adjacent element. Each section comprises a pair of parallel conduit portions 8, connected by transverse corrugated ducts 9, said ducts being of a greater width than the conduits 8, whereby, when the various elements are assembled side by side, the lateral portions of the ducts of one element project into the space between the parallel side conduits of the adjacent elements and overlap the ducts thereof. One end of each conduit portion 8 is closed and one of said portions is provided with a tubular connection 10, adjacent its closed end and projecting laterally therefrom and having a flange 11, by means of which the element may be secured to and placed in communication with a header (either the inlet or the outlet, as the case may be). The opposite ends of the conduits 8 are open.

The section 7 is similar to section 6 except that the closed ends of the conduit portions 8 are provided with feet or extensions, one of such extensions being shown at 12 and the other extension at 13. The extension 13 is hollow and is provided with a lateral tubular connection 14 having a flange 15 by means of which this section may be connected to a header (either outlet or inlet), the header being arranged on the reverse side of the heater from that which carries the connection 10.

The conduit portions 8 and 8^a are provided at their adjacent ends with flanges 16,

16^a, said flanges being connected by means of bolts 17. The adjacent portions of the portions 8 and 8^a are contracted, as shown more particularly in Fig. 5, and these contracted ends are provided each with an outwardly flared bore 18, 18^a, respectively, adapted to engage correspondingly tapered surfaces 19 and 19^a of a double frusto-conical nipple 20, the construction providing a particularly effective knock-down connection between the two sections. When the sections have been assembled, as shown in Fig. 4, the conduit portions 8 and 8^a are secured together at their open ends so as to form in effect but a single vertical conduit, having both ends closed, one of said conduits having a lateral connection at its upper end, and the other having a similar connection at its lower end.

The water circulating element next adjacent to the element described is constructed in identical manner, with the exception that the sections 6 and 7 are reversed, the section 6 being placed on top and the section 7 below, with their connections 10 and 14 also reversed.

In the construction shown herein, 21 denotes the inlet header. This manifold is located at the bottom of the series of elements and is provided with a pair of vertical flanges 22 for each element, said flanges corresponding to the flanges 11 or 15 which may be on the heating element adjacent thereto and being connected to the latter flanges by bolts 23.

The closed ends of the conduit portions 8 are provided each with a flange 24 and the extensions of the closed ends of the conduit portions 8^a are provided each with a similar flange 25. The flanges 24 and 25 are adapted to rest upon a shoulder 26 extending around the top of the base outside of the vertically extending flange 27 and are also adapted to receive and support the cover 28, said cover being provided with a downwardly projecting flange 29 and a seat or shoulder 30 within said flange, which seat or shoulder rests upon the projections 24 and 25.

It will be noted that the transverse ducts 9 and 9^a are equidistantly spaced when two sections are assembled. The member next adjacent to that shown in Fig. 4 will have the sections 6 and 7 reversed. Such being the case, the conduit portions 8^a carried by the lower section 7 of such adjacent element will be elevated with respect to those carried by the element just described, such elevation being caused by the extensions 12 and 13. It therefore follows that the transverse ducts 9 will be elevated in like manner. This arrangement appears clearly in Fig. 3. The third element is assembled in the same manner as is the first, the fourth element in the same manner as the second, and so on, for any number of elements that may be used in a heater.

The manner of constructing and assembling the elements insures the provision of spaces between the transverse ducts of each element into which the wings or side projections of the similar ducts on the adjacent sections may extend. The conduits 8, 8^a, placed side by side constitute one pair of opposed walls for the heater casing, the other pair of opposed walls consisting of casing members 31 adapted to be inserted between the seats 26 and 30. Each of these members is provided with a series of ribs or flanges 32 projecting inwardly therefrom into the space provided between the adjacent transverse ducts 9, and 9^a, the wings of said ducts overhanging said ribs or flanges.

33 denotes the outlet header or manifold. This is located at the top of the heater and is provided with vertically arranged pairs of flanges 34 which are adapted to be secured to the flanges 11 and 15 at the upper end of the heater in the same manner as the manifold 21 is secured to the flanges 11 and 15 at the bottom of the heater.

The cover 28 is provided with a central outlet flue 35, said flue being provided with a draft-equalizing plate 36. This plate is analogous in construction to an inverted table, being provided with a short skirt 37 and with short legs 38. The legs are adapted to bear against the cover 28 to space the draft equalizer therefrom, said equalizer being secured to the cover by means of bolts 39.

With a device constructed as described, the operation is as follows: The water flows from the inlet manifold 21 into the lower ends of the vertical conduits 8, 8^a, and through the transverse ducts 9, 9^a, into the rear series of vertical conduits, being discharged from those conduits into the outlet manifold 33. It will be noted that each burner 3 is arranged directly beneath a heater element and beneath the downwardly extending portion of the duct 9 or 9^a thereabove. The products of combustion from each burner rise against the downwardly directed portion of the duct thereabove and are divided thereby, passing outwardly around the wings 9^b and passing into the narrow spaces between the wings of the ducts thereabove and the overlapping wings of the ducts of the adjacent series. Part of the products of combustion from the burners located at opposite ends of the series pass between the outwardly projecting wings 9^b of the ducts and the casing walls 31, the ribs 32 of which cause the products passing up in proximity to said walls to take substantially the same course as those which pass up on the other side of the transverse ducts.

The construction provides a series of tortuous passageways through which the products from the burners pass upwardly to the outlet 35, the arrangement being such that the heat units developed from the combustion are largely absorbed before the products are discharged through the flue and an extremely efficient heating of the water is secured. As there will be a tendency for the products from the burners nearest to the middle of the heater to pass up with greater rapidity to the central flue 35, the draft equalizer 36 is provided. This causes the products passing upwardly from the central burners to be deflected outwardly around the edges of the plate before they may pass to the outlet flue, thus securing practically the same rate of speed for the products of combustion from all of the burners and through all the passageways, with substantially uniform heating of all of the elements of the heater. The provision of the skirt 37 forms, with the plate 36, a shallow cup or receptacle in which water of condensation may collect.

It will be noted that the ducts 9 and 9^a have a slight upward inclination from the inlet side of the heater toward the outlet

side. This inclination prevents the water from being pocketed in the heater, reduces friction, and facilitates the circulation therethrough. When the heater is used in connection with a vapor heating system, the water will stand at about the height indicated by the line *a-a* on Fig. 2. Under the influence of the heat from the burners, the water circulates through the inclined ducts 9 and 9' from the inlet side toward the outlet side, the colder water dropping back to the bottoms of the vertical conduits on the inlet side of the heater, a continuous circulation occurring. When the heater is filled with water, the carrying of the outlet vertical conduit to a higher point than the conduit on the other or inlet side prevents the accumulation and pocketing of air at the upper end of the latter conduit.

The heater above described is simple and economical of construction, the parts thereof being easily made as castings; the parts are easily and quickly assembled and disassembled, and the heater as a whole is extremely efficient in operation.

Having thus described my invention, what I claim is:

1. In a water heater, the combination of a series of heating elements, each element comprising a pair of substantially parallel vertically extending conduits with corrugated transverse ducts extending therebetween and of greater width than the conduits, said elements being placed side by side and the transverse ducts of adjacent elements being staggered, side walls coop-

erating with said elements and each provided with ribs projecting into the spaces between the adjacent transverse ducts, the vertical ducts at one side of the heater being provided each with an inlet connection near its lower end and those at the other side of the heater being provided each with an outlet connection near its upper end.

2. In a water heater, the combination of a series of heating elements, each element comprising a pair of substantially parallel conduits with transverse ducts extending therebetween, said elements being placed side by side and the transverse ducts of adjacent elements being staggered, side walls cooperating with said elements and each provided with ribs projecting into the spaces between the adjacent transverse ducts, the conduits at one side of the heater being provided each with an inlet connection and those at the other side of the heater being provided each with an outlet connection.

3. In a water heater, the combination of a plurality of water circulating elements placed side by side and each comprising a pair of opposed vertical conduits, said conduits being connected by transversely arranged ducts of greater width than the

width of the vertical conduits, the ends of said conduits being closed and the ends of opposite conduits being substantially in the same plane but said ducts being differently spaced from such planes at the opposite ends of said conduits, one of each pair of vertical conduits being provided with an inlet connection and the other being provided with an outlet connection, alternate elements being inverted so as to bring the transverse ducts of adjacent elements into staggered relation while keeping the closed ends of said conduits in the same plane, and vertical plates secured to the sides of the outside elements and forming with said vertical conduits a closed chamber.

4. A water circulating section for a water heater comprising a pair of substantially parallel conduits, each conduit being closed at one end and having a lateral connection at the other end communicating with the interior thereof, one of said conduits being provided with an extension beyond its closed end, the end of said extension being disposed in substantially the same transverse plane as the end of the opposite conduit, and said connections being disposed at opposite ends of their respective conduits, and a plurality of transverse ducts connecting the said conduits, the terminal ducts being spaced a less distance from one end of said conduits than from the other end thereof, said conduits being provided with securing means.

5. In a water heater, in combination, a plurality of elements each element having a

pair of substantially parallel conduits connected by a plurality of transverse ducts, each of said conduits having a lateral connection at one end communicating with the interior thereof, and said connections being disposed at diagonally opposite points of said elements, said ducts being inclined as regards said conduits, and the terminal ducts being nearer to one end of said conduits than to the other end thereof, alternate elements being inverted as regards the intermediate elements, and said connections being secured to common distributing pipes or headers, whereby the ends of all said conduits are maintained in substantially the same plane, and said ducts are maintained in staggered relation.

6. A built up water circulating element comprising a plurality of sections, each section having a pair of substantially parallel conduit portions connected by a plurality of inclined ducts, each of the first mentioned conduit portions having an open end and a closed end, and one of the conduit portions of each section being provided adjacent to its closed end with a fluid connection, said ducts being disposed at different distances from the two ends of the conduits which

they connect, means for securing said sections together through their open ends, headers to which said fluid connections are secured, and side pieces for closing the space between said conduits, adjacent sections being inverted so as to bring the ducts thereof into staggered relation.

7. A water circulating section for a water heater comprising a pair of substantially parallel end members of substantially equal length, inclined transverse ducts connecting said end members, said end members having longitudinal passageways establishing communication between all said ducts, and said end members being also provided with lateral connections communicating with said passages, said connections being equidistantly spaced from diagonally opposite ends of opposite end members, and similar ducts being unequally spaced from the opposite ends of said end members.

8. A water heater comprising a plurality of juxtaposed vertical circulating elements, each of said elements comprising a pair of sections of unequal lengths, each section having a pair of substantially parallel conduits of substantially equal length connected by one or more transverse ducts and said sections being assembled by placing the conduits end to end, said elements being assembled with alternate elements inverted to bring the joints between the sections into staggered relation, side plates clamped against the terminal elements, top and bottom members associated with the ends of said elements, and said elements having in-

let and outlet connections communicating with the lower and upper portion of opposite conduits respectively.

9. A water circulating element for a water heater comprising a pair of substantially parallel end members of substantially equal length, inclined transverse ducts connecting said end members, each of said end members being formed in a plurality of detachably connected sections, and the width of said ducts being greater than that of said end members, said end members having longitudinal passageways establishing communication between all of said ducts, and said end members being also provided with lateral connections communicating with said passageways, said connections being equidistantly spaced from diagonally opposite ends of opposite end members, whereby said connections will be maintained in alinement when the ends of adjacent elements are supported in the same plane.

10. In a water heater, the combination of a plurality of circulating elements placed side by side, each element comprising a pair of substantially parallel conduits connected by transverse ducts, an inlet connection projecting from one of the first mentioned ducts to each element, near one end thereof, an

outlet connection projecting from the opposite end of the other duct of each element, a manifold operatively connected with all of the inlet connections, and a manifold operatively connected with all the outlet connections.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

OTTO FOX.

Witnesses:

BRENNAN B. WEST,
HAROLD E. SMITH.