Nov. 18, 1930. W. A. DALEY 1,782,380

UNRESTRICTED RETURN WATER HEATER

Filed April 23, 1927 2 Sheets-Sheet 1

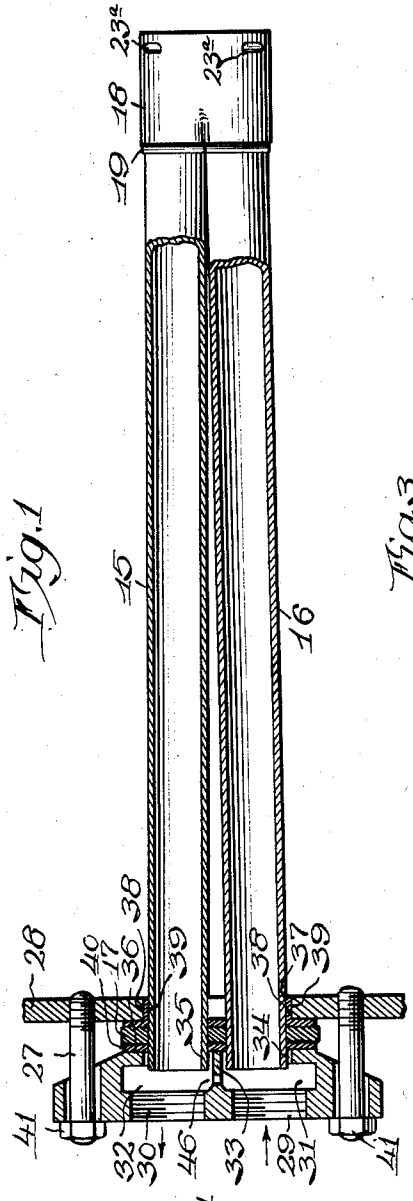

Fig. 1

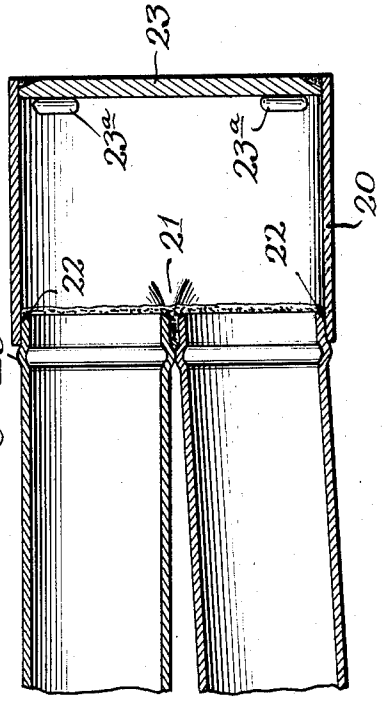

Fig. 3

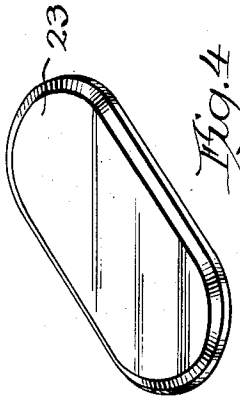

Fig. 4

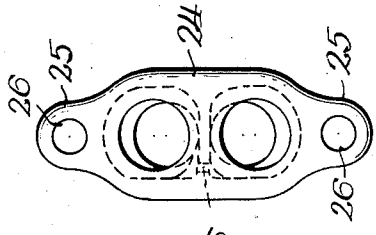

Fig. 2

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UNRESTRICTED RETURN WATER HEATER

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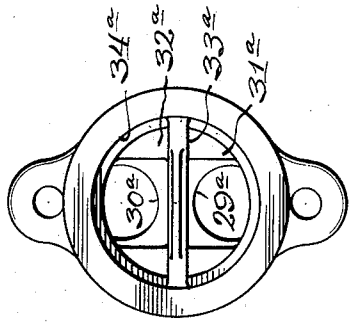

Fig. 7

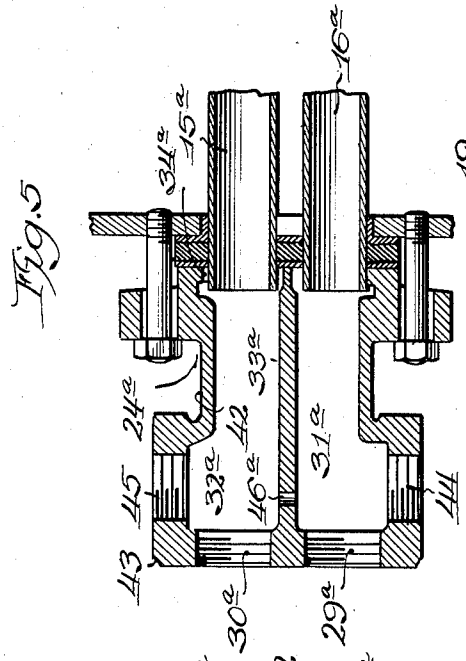

Fig. 5

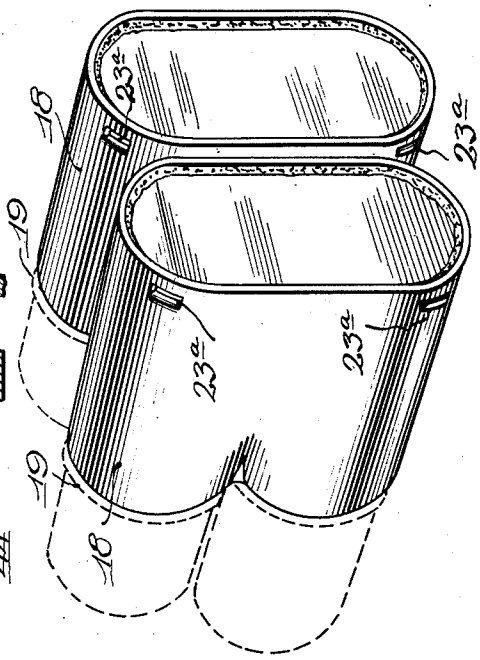

Fig. 9

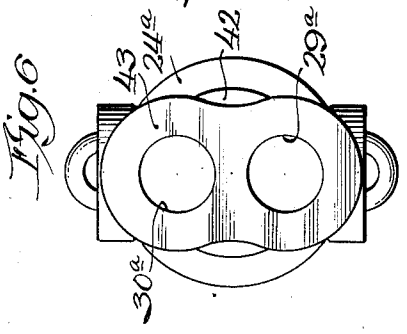

Fig. 6

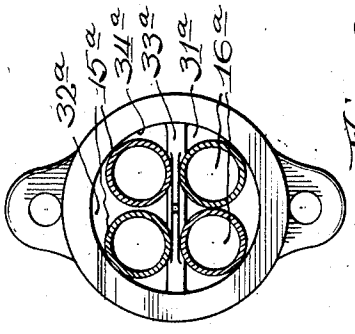

Fig. 8

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Patented Nov. 18, 1930

1,782,380

UNITED STATES PATENT OFFICE

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UNRESTRICTED-RETURN WATER HEATER

Application filed April 23, 1927. Serial No. 186,061.

My present invention relates to the provision of a type of water heater in which the heat transfer elements consist of one or more groups of converging or diverging tubes communicating at their converging ends and secured in a transverse plate at their diverging ends. The heat transfer elements are associated either in a single group or in a plurality of groups with an exterior head to receive the exterior connections for supplying water to and conveying it from the heat transfer elements, and means are provided for securing the head and the transverse plate of the heat transfer element or elements about the edge of a suitable aperture in a boiler or other chamber in which water or other heated element is contained so that the tubes of each group will be disposed vertically with respect to each other.

The divergent arrangement of the tubes of the heat transfer elements at their outer ends facilitates both a gravitational and pressure circulation therethrough. I have also secured a juncture between the tubes of the heat transfer elements at their converging ends by means of a structure or fitting, the parts whereof are brazed or otherwise sealed together and to the ends of the tubes so as to provide even a greater capacity at the place of juncture than either tube separately or both together would afford. Such a fitting may be made of a thickness of metal no greater than that of the heat transfer tubes themselves so as not to diminish the heat transference during the passage of water through the fitting, and can be made to conform very closely to the shape of the tubes without any kind of machine work, and will slide into a more restricted space than any return bend pipe or cast fitting. This arrangement is important as this unavoidable bend in the path of travel of the water during the heat transfer process offers the greatest impediment to a gravitational circulation, and by making the juncture between the ingoing and outgoing tubes of the heat transfer portion of greater capacity I have both improved the circulation through the system and improved the juncture portion as a heat transfer element in itself.

Accordingly as one or more groups of heat transfer tubes are assembled at their diverging ends with a single transverse plate they may be employed with a number of different exterior heads to facilitate assembly with a particular hot water circulating system and for the purpose of increasing the capacity of the apparatus for furnishing hot water.

The design of structure heretofore referred to is illustrated in the accompanying drawing, in which—

Fig. 1 is a side elevation, largely in central, longitudinal, vertical, section, of a complete assembly of a group of heat transfer tubes with an exterior head and boiler plate;

Fig. 2 is a front elevation of the structure shown in Fig. 1;

Fig. 3 is a central, longitudinal section through the converging ends of the heat transfer tubes and the means for securing a juncture between them;

Fig. 4 is a perspective of the rear end plate of the structure for forming a juncture between the heat transfer tubes;

Fig. 5 is a central, longitudinal section of a different form of external head than that shown in Fig. 1, shown in assembly with a boiler plate and the heat transfer element;

Fig. 6 is a front elevation of the structure shown in Fig. 5;

Fig. 7 is a rear elevation of the exterior head shown in Fig. 6;

Fig. 8 is also a rear elevation of the structure shown in Fig. 6 indicating the relation of two groups of heat transfer tubes thereto;

Fig. 9 is a perspective showing the relation of the rear ends of two groups of heat transfer units when used together.

Similar reference characters have been employed throughout the several views to designate similar parts.

A single unit or heat transfer element consists of two tubes, 15 and 16, of equal length disposed vertically, that is, one above the other, and held in slightly converging or diverging relation by means of an anterior or front plate, 17, and a posterior or remote juncture fitting, 18.

The anterior plate, 17, is bored or other-

wise perforated for the passage of the forward ends of the heat transfer tubes therethrough and is secured to the tubes a short distance back to their front ends by brazing or sweating or in any other desired manner.

The remote, or posterior, ends of the heat transfer tubes are provided a short distance in front of their rear ends with an exterior bead, 19. The member for securing a juncture between the rear ends of the heat transfer tubes is formed by taking a suitable length, 20, of a much larger tube and deforming it until it is of an oblong outline. The centers of the forward edges of this length of tube 20 are inwardly compressed, as shown at 21 in Fig. 3, to enter between the converging ends of the heat transfer tubes 15 and 16. The rear edges of the heat transfer tubes are beveled as shown at 22 in Fig. 3, and when the heat transfer tubes are inserted in the front end of the length of tube 20 up to the beading 19, spelter is placed in the recess formed by the bevel 22 and the whole is heated until the above described parts are sweated together. It will, of course, be understood that a like sealing of the parts together may be attained by the use of any metal which may be similarly melted and flowed into place. A very good and dependable joint can be formed as above described, whereas if this operation is attempted by flooding the joint from the outside it will probably result in dissolving and removing some of the metal of the tubes 15, 16 or 20 in the hot spelter or fused metal which usually acts as a solvent for copper of which metal the heat transfer tubes are usually made.

After this interior brazing or sealing has been done, a beveled rear end plate, 23, is inserted in the length of tubing 20, against inwardly extending bosses 23^a provided to support the plate 23 while it is being sealed in position, and spelter is again placed in the cavity formed by the bevel, when a final heating secures the entire structure in a unitary or integral mass of ample strength and large capacity, relative to the capacities of the tubes, and a somewhat more extended surface to which the surrounding heated medium transmits heat by conduction.

In Figs. 1 and 2 is shown a form of head which is extremely simple and which is arranged to take the feed and discharge pipes directly into its face. This form of head comprises a casting 24 extended to provide ears 25 at its two opposite ends, which ears are perforated, as at 26, for the passage of stud bolts 27 tapped into the boiler plate 28. The forward face of the casting 24 is substantially flat and this is bored and tapped at 29 and 30 for assembly with the supply and discharge pipes. The bores 29 and 30 communicate with interior chambers 31 and 32, separated by a partition, 33, which extends rearwardly into the plane of the rear of the head. The chambers 31 and 32 open rearwardly through apertures 34 and 35 and the rear face 36 of the casting 24 substantially registers with the forward face of the plate 17 heretofore described.

The boiler plate is apertured at 37 for the passage of the tubes 15 and 16 and a gasket 38 is employed between the rear face of the plate 17 and the boiler plate.

Another gasket or washer, 40, is interposed between the forward face of the plate 17 and the rear face 36 of the casting 24. Nuts 41 on the outer ends of the stud bolts 27 hold the castings 24, plate 17, and washers 38 and 40, firmly to the boiler plate, 28, with any degree of force which may be desired.

The head shown in Figs. 5 to 8 inclusive, is similar to that shown in Figs. 1 and 2 in all essential details except the body portion of the head 24^a has extending therefrom a neck 42 on the outer end whereof is an enlargement 43, bored and tapped in its face at 29^a and 30^a, and also laterally both in its bottom and top at 44 and 45.

In the head shown in Figs. 5 to 8 inclusive, it appears how, by merely enlarging the rear opening 34^a, the same head may be used for one or a plurality of groups of heat transfer tubes 15^a and 16^a.

It should be noted that in each form of head the internal transverse partition 33 and 33^a is transversely bored as at 46 and 46^a to provide a bleed hole so as to permit the flow of any air released from the water from lower compartments 31 and 31^a to upper compartments 32 and 32^a from which any such air is immediately discharged through the discharge connection.

In Fig. 9 is shown in fragmental detail the relation of the juncture fittings 18, when two groups of heat transfer units are employed in a single head.

As will be seen from the foregoing description taken in connection with the drawings, the tubes in each group of heat transfer tubes 15 and 16 are disposed vertically with respect to each other and at a slight angle to each other, so that when the axis of these tubes is arranged horizontally the conduit provided by the tubes and their juncture fitting 18 either rises or falls throughout its entire length: This facilitates both the gravitational and pressure circulation through these tubes, and the juncture fitting 18, having a capacity larger than either of the tubes taken separately or combined, does not act as a deterrent to circulation at the bend or change of direction in the flow.

Having described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a water heater a heat exchange unit comprising a group of tubes one end of which tubes being united in a casing, comprising a

deformed length of tubing with a closure for its rear end and the other ends of which tubes are united by a transverse plate.

2. A fitting for joining a group of heat transfer tubes comprising a length of tubing deformed at one end to conform with the non-contiguous surfaces of said heat transfer tubes which it receives and provided with a closure at the rear end.

3. A fitting for joining a group of heat transfer tubes comprising a length of tubing deformed at one end to conform with the non-contiguous surfaces of the heat transfer tubes which it receives and having interior projections at its other end co-operating with a closure for said end.

4. A fitting for joining a group of heat transfer tubes comprising a length of tubing deformed at one end to conform with the non-contiguous surfaces of the heat transfer tubes which it receives and means at its other end for locating and co-operating with a closure plate for said end.

5. Means for effecting a juncture between a group of heat transfer conduits comprising a length of tube deformed at one end to the non-contiguous forms of said conduits, a closure plate for the other end thereof, and means on said latter end for locating and co-operating with said closure plate.

6. In a water heater, a heat exchange unit comprising a group of tubes inclined and having their contiguous portions sealed directly together at one end, a length of tubing deformed at one end to conform to the non-contiguous surfaces of said tubes which it receives, a closure for the other end of said deformed tube, and means for securing the other ends of said group of tubes in spaced relation.

WALTER A. DALEY.