Oct. 11, 1932. G. A. BRYAN 1,882,116

WATER HEATER

Filed July 16, 1929

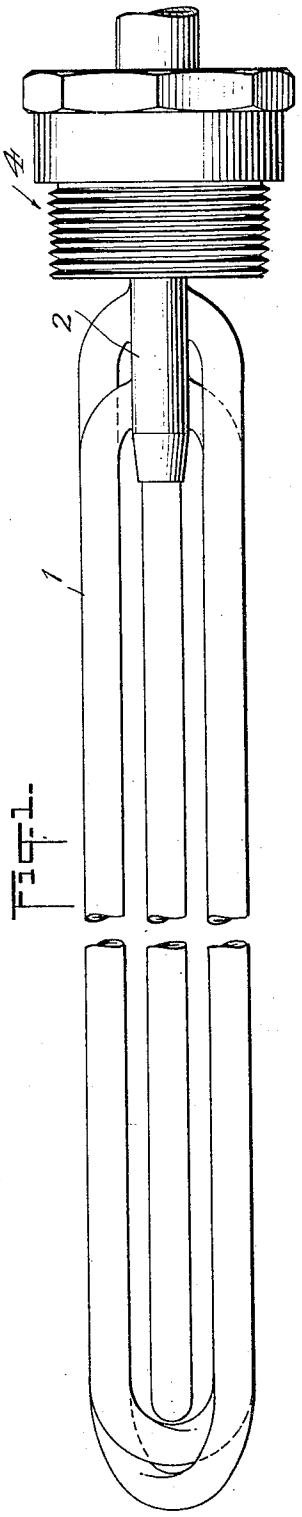


Fig. 1.

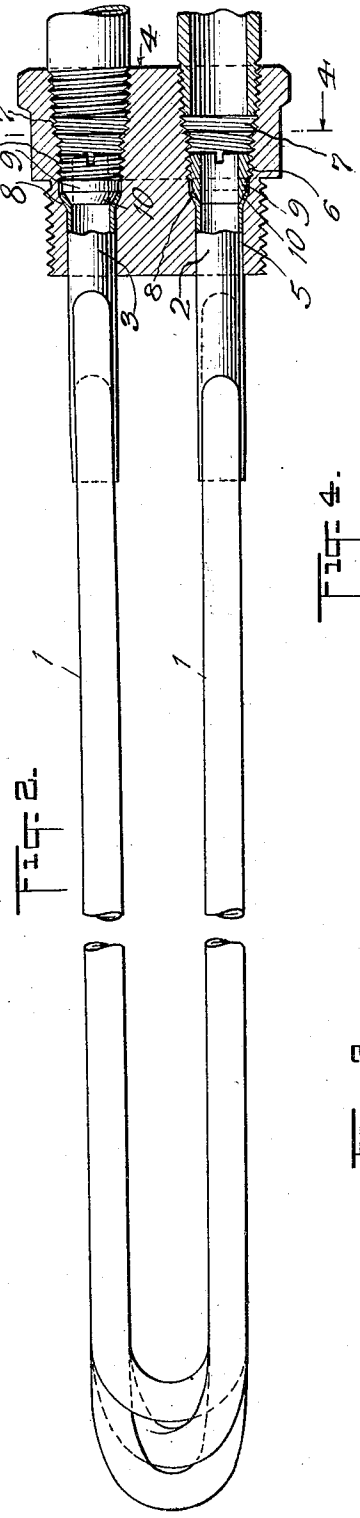


Fig. 2.

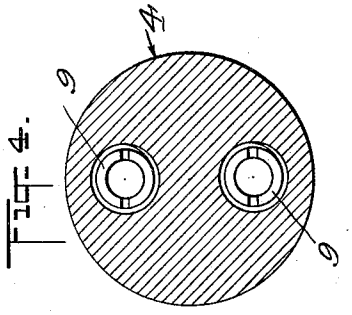


Fig. 4.

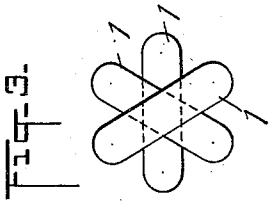


Fig. 3.

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UNITED STATES PATENT OFFICE

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WATER HEATER

Application filed July 16, 1929. Serial No. 378,628.

My invention has reference to water heating coils of the type that are commonly used in conjunction with domestic heating systems, a purpose of the invention being to provide a construction in which the coils are adapted to occupy a minimum of space and are readily and quickly inserted or replaced.

In the method of indirect heating commonly employed in conjunction with heating systems in which the heating coils of the domestic water supply are heated by the medium used in transferring the heat generated in the furnace to the heat radiator units throughout the building, it has been the common practice to divert a portion of the heat transfer medium through coils immediately associated with the domestic water heating coils. Some of the heat carried by the heat transfer medium through the coils associated with the water heating coils is transferred to the water in the domestic water heating coils. In certain prior constructions, for example, that shown in my copending application which became Patent No. 1,745,401, February 4, 1930, the domestic water heating coils in steam and hot water systems have been placed in direct contact with the heat transfer medium in the boiler by inserting the domestic water heating coils within a water space of the boiler. By this method, the efficiency of the transfer of heat to the domestic water is greatly increased. However, this method requires an expensive construction in that a large expensive header is required which when the water tubes are in place, serves as one end of the water leg of the boiler.

My present invention greatly simplifies the construction of coils intended for such use, and renders the assembly much more compact, and materially expedites the operation of assembling.

One of the advantages of the invention is the fact that with a multiple coil construction only two tube ends connect with the header. Another advantage resides in the manner of attaching the tube ends to the header. Other advantages will appear from the description of the illustrated embodiment of the invention.

Specifically, I employ a construction which consists of a circular header and a plurality of U-shape tubes. Each tube occupies substantially a diametral plane of the header and is in symmetrical angular displacement with respect to the others, the tubes being thereby nested together so as to constitute diagonals of a regular polygon. In the construction shown, there are three tubes and they therefore constitute diagonals of a hexagon. The ends of the tubes constituting the inlet thereto, and the outlet therefrom are united to or branch from a single inlet and outlet feeder which feeders are connected to the circular header by a bell joint. The opening in a header in advance of the bell joint is drilled to a diameter equal to the greatest diameter of the flare of the bell. Into this opening, a fitting having a taper corresponding to the taper of the bell is threaded, and presses the flare of the tube in contact with the complementary surface in the header. The fitting is hollow to permit the flow of water therethrough. Into the openings formed in the header, in the end opposite to that from which the feeder tubes extend, inlet and outlet pipes or nipples are threaded, the opening being tapped for that purpose. The circular header is provided with threads by means of which it may be screwed into a tapped opening in the boiler. The diameter of the polygonal figure of which the tubes constitute diagonals is less than the diameter of the circular header so that the coils may pass through the opening provided for the header.

I shall now describe one embodiment of my invention in connection with the accompanying drawing in which:

Fig. 1 is a side elevation of a water heating coil constructed in accordance with my invention;

Fig. 2 is an elevation of the same, parts of the header being broken away to show the internal construction thereof and the coil being rotated through an angle of 90° relative to the position shown in Fig. 1;

Fig. 3 is an end view of the coils; and

Fig. 4 is the section taken on the line 4—4 of Fig. 2.

In the illustrated embodiment of my invention, a plurality of U-shape tubes 1, shown

as three in number, are nested together and angularly displaced relative to each other through equal angles, the bends of the tubes being succesively nested one within another so as to cross one another. The ends of the tubes constituting the inlet thereto are united, as by brazing, to a single inlet feeder 2, the outlet ends being united in a similar manner and communicating with an outlet feeder 3. The feeders 2 and 3 are connected to a header 4 through which they communicate with the inlet and outlet nipples.

The header 4, which is circular in cross-section, is made of solid metal which has inlet and outlet openings drilled therein. Each of these openings comprises three different sections, namely, a tube section 5, a fitting section 6, a nipple or pipe section 7. The inner diameters of the various sections are successively greater in the order mentioned. The end of the tube section 5 is countersunk to provide an engaging surface for a bell or flare 8 on the inlet and outlet feeders 2 and 3. The diameter of the fitting section 6 is approximately equal to the diameter of the flare or bell 8 of the feeders 2 and 3 and is tapped to receive a fitting 9 which is adapted to be threaded therein. The fitting 9 has a taper extension 10 which corresponds to the taper flare 8 of the feeders and is adapted to press the flare in contact with the complementary surface of the header. The nipple section 7 of the bore in the header 4 is of such a diameter as to receive the end of an inlet or outlet nipple which is threaded therein, the section being tapped for that purpose.

The assembled water heating coil constructed as above described is inserted in a circular opening in the boiler which is provided therefor. The domestic water pipes are connected to the inlet and outlet nipples of the heating coil in the usual manner. The cold water flows, for example, through the inlet nipple and hollow fitting 9 to the inlet feeder 2 to the union of the inlet ends of the U-shape coils where it is distributed in equal proportions to each of the coils. In its passage through the U-shape coils, the water in the coils receives heat from the heat transfer medium in the boiler and is delivered through the outlet nipple back to the system.

It is to be noted that in the event the heating coils are not desired, they may be quickly and readily removed, and the opening in the boiler appropriately closed by a standard plug of proper size; and also that if the coils burn out or leak they may readily be replaced by inserting new ones in the same header. It will now be evident that a complete header device is formed for the U-shaped tubes 1 by means of the two tube ends or feeder ends 2 and 3 taken in connection with the outer individual header part 4. That is, in effect or in accordance with the manner of operation, the complete header comprises the outer header part 4 and inner header means shown as the tube ends 2 and 3. Thus the header device has an inlet passage leading from one of the nipples 7 in the outer header part 4 and communicating in multiple relation with the inlet ends only of the three tubes 1. The inner portion of this inlet passage is formed by the tube end 2 while the outer portion thereof is formed by the inlet nipple 7 to which a water inlet pipe is connected, as shown in the drawing. Also this header device has an outlet passage the inner portion of which is formed by the tube end 3 which unites and which is in communication in multiple relation with the outlet ends only of the three tubes 1, this latter passage leading to the outlet nipple 7 in the outer header part 4 to which a water outlet pipe is connected.

The term "boiler" is to be construed as including any chamber or vessel for containing a heat transfer or heat exchange medium.

It is obvious that various changes may be made in the illustrated embodiment of my invention above particularly described within the principle and scope of my invention as expressed in the appended claims.

Claims:

1. A water heater comprising a header connectable to a boiler and having two openings therethrough, a cluster of U-shape tubes, two feeder ends from each of which all of such tubes branch at their respective opposite ends, the two feeder ends entering the two header openings at the inner face and being secured therein, and inlet and outlet water pipes connected with the header openings at the outer face and being secured to the header.

2. A water heater comprising a header connectable to a boiler and having two openings therethrough, a cluster of U-shape tubes having common feeder ends from which they branch, the two feeder ends uniting the tubes and entering the two header openings at the inner face and being secured therein, each tube occupying substantially a diametral plane of the header and being in symmetrical angular displacement with respect to the others, and inlet and outlet water pipes entering the header openings at the outer face and being secured therein.

3. A water heater comprising a header connectable to a boiler and having two openings therethrough, a cluster of U-shape tubes having common feeder ends from which they branch, the two feeder ends uniting the tubes and entering the two header openings at the inner face of the header, the openings in said header having sections of different diameters and a tapered surface joining the sections, a tapered flare on the said feeder ends engaging the tapered surfaces joining the sections of said openings, means for pressing the tapered flare on said feeder ends in contact with the tapered surface in said openings, and in-

let and outlet water pipes entering the header openings at the outer face and being secured therein.

4. A water heater comprising a header connectable to a boiler and having two openings therethrough, a cluster of U-shape tubes having common feeder ends from which they branch, the two feeder ends uniting the tubes and entering the two header openings at the inner face of the header, the openings in said header having sections of different diameters and a tapered surface joining the sections, a tapered flare on said feeder ends engaging the tapered surfaces joining the sections of said openings, threaded fittings having tapered extensions adapted to be screwed into the sections of greater diameter of said openings, the tapered extensions on said fittings pressing the flare on said feeder ends in contact with the tapered surfaces in said openings, and inlet and outlet water pipes entering the header openings at the outer face and being secured therein.

5. In a heat-exchange device, the combination of a group of substantially U-shape rebent nested heat-transfer tubes disposed in radial planes in angular displacement with respect to each other about a common longitudinal axis, with all of the said tubes equally radially spaced from this common axis, the bends of these tubes being successively nested one within another so as to cross each other, two feeder ends each of which supports and unites all of the said tubes in common at their respective opposite ends, and an individual header carrying both of the said feeder ends and having an inlet communicating with one of the feeder ends and having an outlet communicating with the other feeder end.

6. In a heat-exchange device, the combination of a group of three substantially U-shape rebent nested heat-transfer tubes disposed in radial planes in equally angular circular displacement with respect to each other about a common longitudinal axis, so that all of the said tubes are equally radially spaced from this common axis, the U-bends of these tubes being successively nested one within another so as to cross each other, two feeder ends each of which supports and unites all of the said tubes in common at their respective opposite ends, and an individual header which supports both of the said feeder ends and having an inlet opening communicating with one of the feeder ends and having an outlet opening communicating with the other feeder end.

7. A water heater comprising a header connectable to a boiler and having an inlet and an outlet passage therein, a cluster of U-shaped tubes connected to the header at the inner face thereof and being secured thereto with their inlet ends in communication with the header inlet passage and with their outlet ends in communication with the header outlet passage, the said inlet and outlet passages of the header at the outer face thereof being connectable respectively to inlet and outlet water pipes, each tube occupying substantially a diametral plane of the header and such tubes being in symmetrical angular displacement with respect to one another, the bends of these tubes being successively nested one within another so as to cross each other, the said header being individual to the said cluster of tubes.

8. In a heat-exchange device, the combination of a cluster of U-shaped nested heat-transfer tubes disposed in angular displacement with respect to each other about a common longitudinal axis and having U-bends successively nested one within another, and a header individual to the said cluster uniting the ends of and supporting all of the said U-shaped tubes in the cluster, the said header having an inlet passage in communication in multiple distributing relation with the inlet ends only of the said tubes, and the said header having an outlet passage in communication in multiple uniting relation with the outlet ends only of the said tubes, the said header being connectable to the wall of a container with the said cluster of tubes projecting at the inner side thereof and with the outer face of the header exposed at the outer side of said wall, and the said inlet and outlet passages of the header having openings through the outer face of the header to which pipes are respectively connectable.

9. In a water heater of the heat-exchange type, the combination of a group of more than two substantially U-shaped rebent nested heat-transfer tubes disposed in an axially elongated cluster in radial planes in symmetrically angular circular displacement with respect to each other about a common longitudinal axis, the elongated side members of the said U-shaped tubes being straight and being equally radially spaced from the said common axis in any transverse plane normal to said axis, these tubes all having substantially semi-circular U-bends of the same radius and the U-bends of these tubes being successively nested one within another so as to cross each other in line with said axis, and a header device connectable to a boiler so as to be exposed at the outside thereof and with the said elongated cluster of tubes projecting into the boiler, the said header device uniting the ends of and supporting all of the said U-shaped tubes in the cluster, the said header device at the outer face thereof having an inlet connectable to a water inlet pipe and having an outlet connectable to a water outlet pipe, the said header device having an inlet passage leading from its said inlet and the inner portion of this passage being in communication in multiple relation with the inlet ends only of the

said tubes, and the said header device having an outlet passage the inner portion of which is in communication in multiple relation with the outlet ends only of the said tubes and leading to its said outlet, so that thereby the water which is being heated may flow in parallel relation through all of the said nested U-shaped tubes grouped in the said cluster.

10. In a water heater of the heat-exchange type, the combination of a group of three U-shaped rebent nested heat-transfer tubes disposed in an axially elongated cluster in radial planes in symmetrically angular circular displacement with respect to each other about a common longitudinal axis, the elongated side members of the said U-shaped tubes being equally radially spaced from this common axis in any transverse plane normal to said axis, these tubes all having substantially semi-circular U-bends of the same radius and the U-bends of these tubes being successively nested one within another so as to cross each other in line with said axis, and a header connectable to a boiler with the said elongated cluster of tubes projecting into the boiler, the said header comprising inner header means for supporting and uniting in multiple communicating relation all of the said tubes in common at their respective opposite ends only, and the said header further comprising an outer header part connected to said inner header means and having an inlet connectable to a water inlet pipe, the said inlet being in communication in multiple relation with the inlet ends only of the said tubes through the said inner header means, and the said outer header part having an outlet connectable to a water outlet pipe, the said outlet being in communication in multiple relation with the outlet ends only of the said tubes through the said inner header means, so that thereby the water which is being heated may pass from the header inlet in parallel relation through all of the said nested U-shaped tubes grouped in the said cluster and then pass to the header outlet.

In witness whereof, I hereunto subscribe my signature.

GEORGE A. BRYAN.