Nov. 21, 1939. H. A. THRUSH 2,180,620

WATER HEATER AND METHOD OF MAKING SAME

Filed Jan. 31, 1939 2 Sheets-Sheet 1

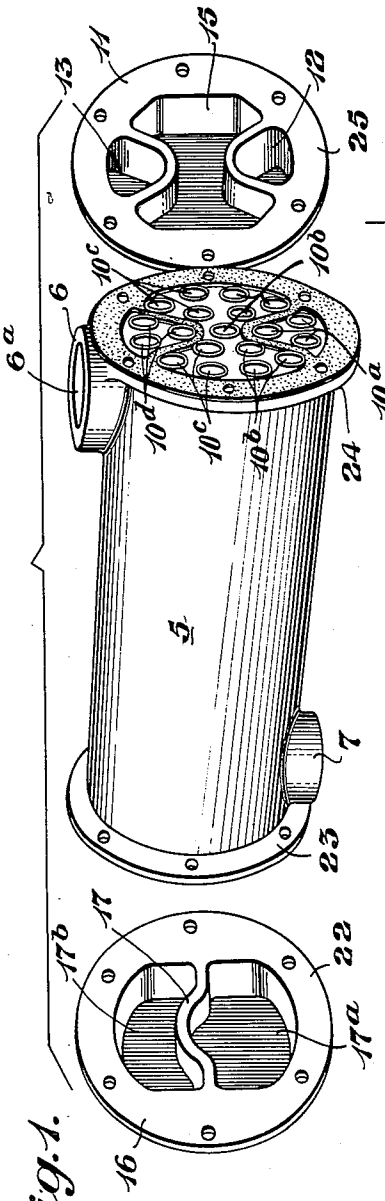


Fig. 1.

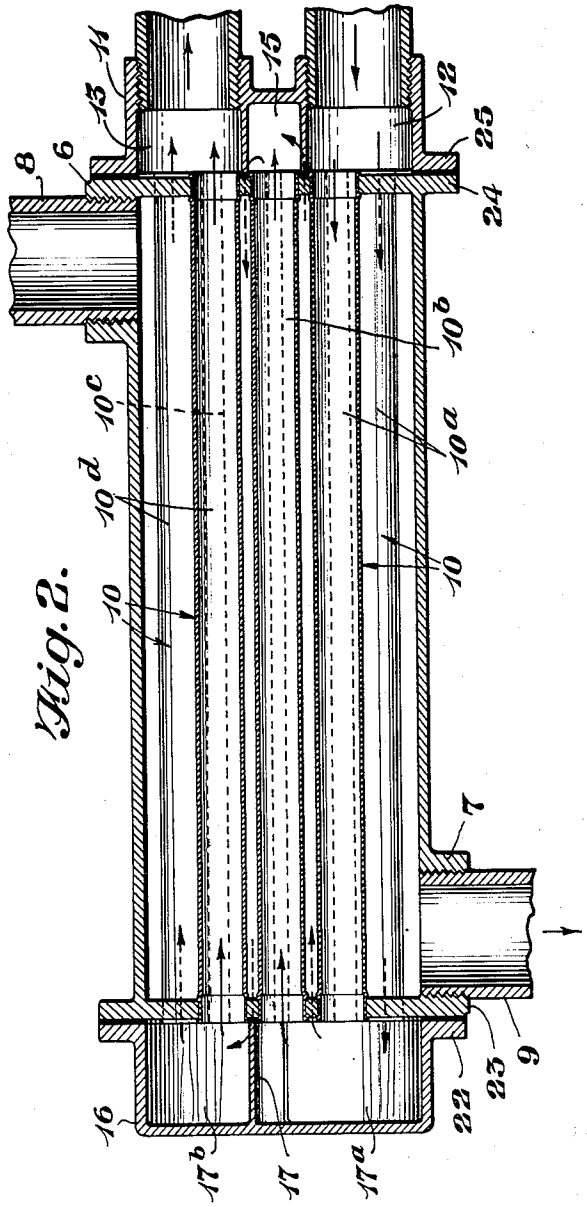


Fig. 2.

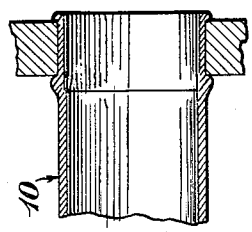


Fig. 3.

Inventor
H. A. Thrush

By Wyatt Dowell
Attorney

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WATER HEATER AND METHOD OF MAKING SAME

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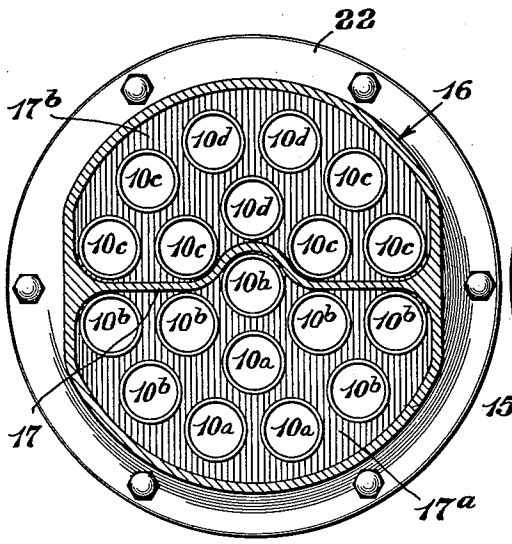


Fig. 4.

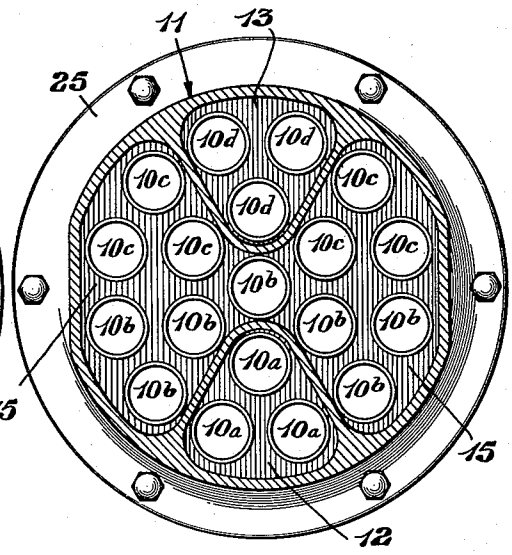


Fig. 5.

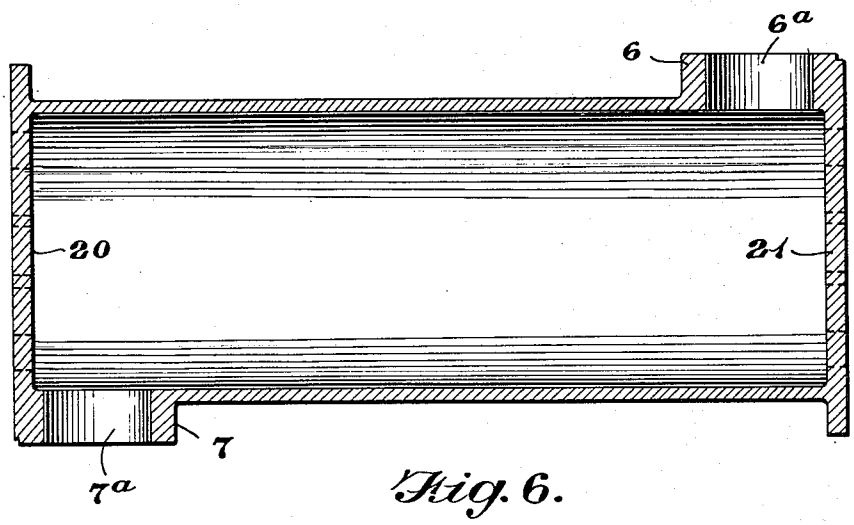


Fig. 6.

Inventor
H. A. Thrush

By Ryalls Dowell.
Attorney

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UNITED STATES PATENT OFFICE

2,180,620

WATER HEATER AND METHOD OF MAKING SAME

Homer A. Thrush, Peru, Ind., assignor to H. A. Thrush & Co., Peru, Ind., a corporation of Indiana

Application January 31, 1939, Serial No. 253,938

5 Claims. (Cl. 29—157.3)

This invention relates to heat exchange devices broadly and is particularly concerned with heaters of the indirect type for use in connection with hot water or steam boilers for heating the domestic or service water supply.

The primary object of the invention is to provide a heater of marked simplicity in construction yet unusually strong and resistant to pressure and therefore capable of long life, which may be easily rendered accessible for cleaning and easily cleaned, and which at the same time embodies maximum heat exchange efficiency. Accordingly, the improved heater is of the straight tube type constructed in a manner such that all soldered joints are eliminated and in which frictional resistance to free flow of water through the tubes as well as through the jacket and headers surrounding the tubes is reduced to a minimum.

The invention also contemplates a novel method of making a heater of the type specified and which method is conducive to reduction in costs, lightness in weight, long life or service without repairs, and high efficiency in operation.

With the foregoing and other objects and advantages in view the invention consists in the preferred construction and arrangement of the several parts which will be hereinafter more fully described and claimed.

In the drawings:

Fig. 1 is a disassembled view in perspective of a heater assembly constructed in accordance with the features of the present invention;

Fig. 2 is a longitudinal section through the heater of Fig. 1 with the parts in assembled position;

Fig. 3 is an enlarged detail sectional view showing the manner in which the heater tubes are connected to the end walls of the heater shell or jacket;

Figs. 4 and 5 are, respectively, sectional views taken transversely through the end caps at each end of the heater shell looking toward the end of the shell in Fig. 2; and

Fig. 6 is a detailed longitudinal sectional view of the heater shell or jacket.

Referring in detail to the drawings, the improved heater comprises a main shell or jacket generally indicated at 5 which is preferably of cast construction, as will be more fully hereinafter explained, and is provided with an internally threaded boss 6 providing an inlet port 6a and another boss 7 providing a discharge or outlet port 7a. Connected to these ports are pipes 8 and 9, the pipe 8 representing the circulating line from a heating boiler, not shown, and the pipe 9 the circulating line to such boiler.

Inserted lengthwise through the jacket are a plurality of straight tubes 10 designated in groups 10a, 10b, 10c and 10d according to the flow of water therethrough. These tubes are preferably of burnished copper or material having similar characteristics so as to produce maximum heat transfer efficiency and at the same time offer the least frictional resistance to the flow of fluid therethrough. As will be understood, the domestic or service water supply is passed through the tubes 10.

The one end of the jacket has applied thereto a head or header 11 formed with partitions defining an intake port 12 and an outlet or discharge port 13, the partitions also providing a chamber 15 in the head.

The opposite end of the shell or jacket 5 is provided with a head or header 16 formed with a single partition or baffle wall 17 defining chambers 17a and 17b which coact with the chamber 15 to direct the water in the desired circulatory path through the tubes.

These heads 11 and 16 when applied to the opposite ends of the heater cause water or other fluid flowing in through pipe 18 to circulate through tubes 10a into chamber 17a, then back through bank of tubes 10b into chamber 15, then reversing flow back through tubes 10c into chamber 17b and then returning through tubes 10d and out through pipe 19.

The boiler water or other fluid from which heat is extracted comes in through port 6a and flows around the tubes 10 to the opposite end of the heater and out through port 7a.

The heater thus constructed consists essentially of four parts, the cast jacket 5, the tubes 10, and the heads or headers 11 and 16.

The preferred method of making the heater in order to attain the desired objects is as follows:

The jacket 5, as heretofore stated, is preferably a casting. When the casting is made, the end walls 20 and 21, note Fig. 6, are cast solid and integral with the jacket, the core disintegrating during casting and after casting may be extracted through the openings which provide the ports 6a and 7a. The tubes 10 are preferably of burnished copper or material having similar characteristics, as heretofore noted, and to mount these tubes, the end walls 20 and 21 are formed with the desired number of holes to accommodate a predetermined number of tubes and the latter are then inserted through these holes and at their opposite ends expanded radially out-

wardly into firm engagement with the metal of the end walls which bound the holes or openings. The holes are preferably bored and machined to ensure a snug fit. The ends of the tubes are preferably projected slightly beyond the end walls 20 and 21, so that when expansion takes place, the metal of the tubes will be firmly anchored to the said walls to ensure against endwise displacement. In this manner, all soldered joints are eliminated, while at the same time a light, yet strong and rugged job results which is capable of long life without need of repairs and with a minimum of rust or scale formation.

Any conventional method of expansion may be used. In practice, the tubes are "rolled" to bring about the desired expansion.

The head or headers 11 and 16 are also preferably cast, the jacket and headers being formed with cooperating bolting-on flanges 22—23 and 24—25 to facilitate the mounting operation.

The resultant heater has been found through actual experience to embody high efficiency and can be manufactured at a relatively low cost. Despite the low cost of manufacture, the heater possesses great strength, ruggedness and safety.

It will be understood that certain changes in construction and design may be adopted without departing from the spirit or scope of the invention as defined by the appended claims.

What is claimed is:

1. A water heater comprising a shell body of cast metal having end walls formed integrally therewith and provided with substantially aligned openings, a plurality of substantially straight tubes of relatively thin gauge material of a heat conductivity considerably higher than that of the shell body located in substantially parallel relation with their opposite ends extending through said openings and expanded into engagement with the walls of the body around said openings to form a fluid-tight joint, said tubes being upset on opposite sides of each of the end walls to provide firm contact and anchorage of the tubes in the end walls, headers at opposite ends of the tubes, said shell being formed with an inlet port at one extremity and an outlet port at the opposite extremity for the circulation of heating water through the shell and around the tubes, one of said headers being formed with partitions defining inlet and discharge passages into and from certain of the tubes and an intermediate chamber sealed off from the inlet and outlet ports operating to reverse the flow of water back to the opposite header through other of the tubes, the latter header being formed with a partition defining sealed chambers arranged to reverse the flow of water first back to said first-named chamber and then back to said outlet passage.

2. The method of making a water heater that includes the steps of casting a shell body with integral end walls, providing substantially aligned openings in said end walls, providing a plurality of substantially straight tubes of relatively thin gauge material of a heat conductivity considerably higher than that of said shell locating said tubes in substantially parallel relation and extending through said openings expanding the ends of said tubes into engagement with the walls of the body around said openings to form fluid-tight joints therebetween, upsetting said tubes on opposite sides of each of said end walls to provide firm contact and anchorage of the tubes in the end walls; providing headers at opposite ends of the tubes; providing said shell with an inlet port at one extremity and an outlet port at the opposite extremity for the circulation of heating water through the shell and around the tubes; forming one of said headers with partitions defining inlet and discharge passages into and from certain of the tubes, and with an intermediate chamber sealed off from the inlet and outlet ports operating to reverse the flow of water back to the opposite header through other of the tubes; and forming said latter header with a partition defining sealed chambers arranged to reverse the flow of water first back to said first-named chamber and then back to said outlet passage.

3. In a water heater, a metal housing presenting substantially plane end surfaces comprising end walls integral with said housing and provided with aligned openings; substantially straight tubes of a material having characteristics similar to those of copper tubing located in said aligned openings with the opposite ends of said tubes extending into said openings and expanded into intimate engagement with the walls of the metal around the openings to form a fluid tight joint, said expanded portion of the tubes being upset on opposite sides of each of the end walls to provide solid contact and anchorage of the tubes in the end walls, headers at opposite ends of the shell for confining water passing through the tubes within the housing, said housing being formed with inlet and outlet ports for the circulation of water through the housing and around the tubes, one of said headers being partitioned to define inlet and discharge passages into and from certain of the tubes; and an intermediate chamber sealed off from the inlet and outlet ports operating to reverse the flow of water back to the opposite header through other of the tubes, the latter header being formed with a partition defining sealed chambers arranged to reverse the flow of water first back to said first-named chamber and then back to said outlet passage.

4. The method of making a water heater that includes the steps of casting a metal housing presenting substantially plane end surfaces comprising end walls integral with said housing, providing said end walls with aligned openings; locating substantially straight tubes of a material having characteristics similar to those of copper tubing in said aligned openings, extending the opposite ends of said tubes into said openings and expanding them into intimate engagement with the walls of the metal around the openings to form a fluid tight joint, upsetting said expanded portion of the tubes on opposite sides of each end wall to provide solid contact and anchorage of the tubes in the end walls, applying headers at opposite ends of the shell for confining water passing through the tubes within the housing, providing said housing with inlet and outlet ports for the circulation of water through the housing and around the tubes, providing one of said headers with a partition to define inlet and discharge passages into and from certain of the tubes and with an intermediate chamber sealed off from the inlet and outlet ports operating to reverse the flow of water back to the opposite header through other of the tubes, and forming the latter header with a partition defining sealed chambers arranged to reverse the flow of water first back to said first-named chamber and then back to said outlet passage.

5. In a water heater, a metal housing presenting substantially plane end surfaces comprising end walls integral with said housing and

provided with aligned openings; substantially straight tubes of a material having characteristics similar to those of copper tubing located in said aligned openings with the opposite ends of said tubes extending into said openings and expanded into intimate engagement with the walls of the metal around the openings to form a fluid tight joint, said expanded portion of the tubes being upset to provide solid contact and anchorage of the tubes in the end walls, headers at opposite ends of the shell for confining water passing through the tubes within the housing, said housing being formed with inlet and outlet ports for the circulation of water through the housing and around the tubes, one of said headers being partitioned to define inlet and discharge passages into and from certain of the tubes; and an intermediate chamber sealed off from the inlet and outlet ports operating to reverse the flow of water to the opposite header through other of the tubes, the latter header being formed with a partition defining sealed chambers arranged to reverse the flow of water first to said first-named chamber and then to said outlet passage.

HOMER A. THRUSH.