July 8, 1947. E. L. GARFIELD 2,423,697

METHOD OF ASSEMBLING HEADERS AND TUBES

Filed Dec. 24, 1943

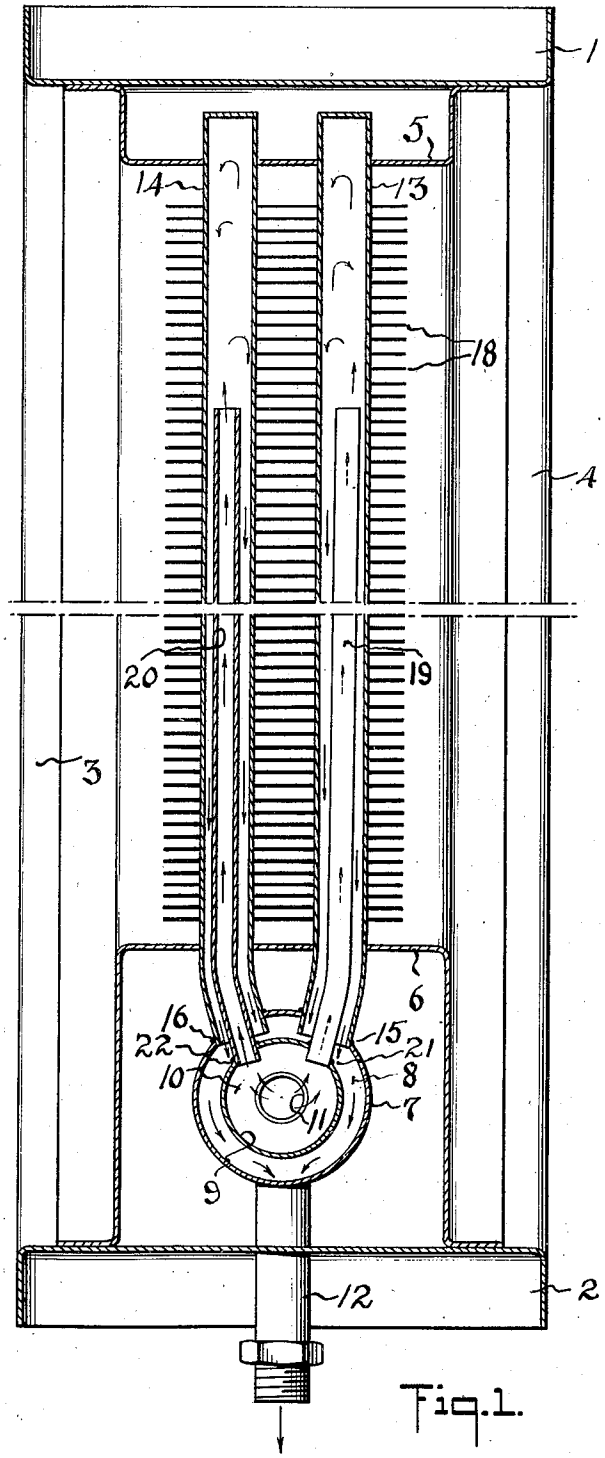


Fig. 1.

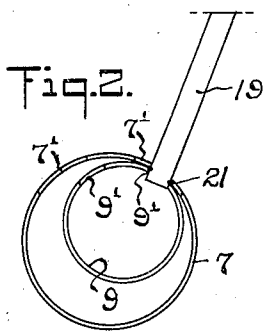


Fig. 2.

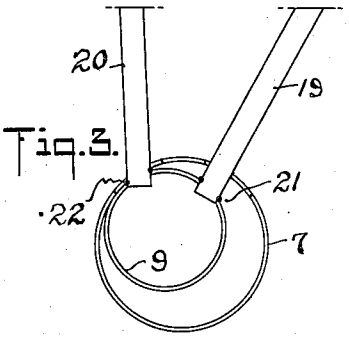


Fig. 3.

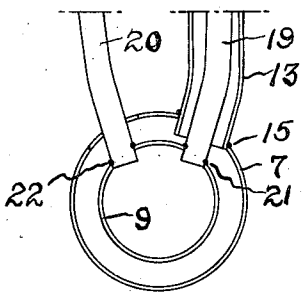


Fig. 4.

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Patented July 8, 1947 2,423,697

UNITED STATES PATENT OFFICE

2,423,697

METHOD OF ASSEMBLING HEADERS AND TUBES

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Application December 24, 1943, Serial No. 515,521

3 Claims. (Cl. 29—157.3)

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This invention relates to improvements in heat exchangers and an improved method of manufacture and assembly thereof.

An object of this invention is to provide a heat exchange device having a plurality of finned tubes forming steam passages secured in fluidtight relation to concentric headers and mounted in a supporting frame.

Another object of this invention is to provide a novel method of assembly of the tubes and headers.

Other and more detailed structural and procedural objects are successfully secured by means of the invention herein disclosed as will be apparent from the following description of one embodiment of the invention and method of assembly thereof.

This invention resides substantially in the combination, construction, arrangement, relative location of parts, steps and series of steps, all as disclosed herein.

In the accompanying drawings,

Figure 1 is a vertical, cross-sectional view through a heat exchanger embodying the subject matter of this invention;

Figures 2, 3 and 4 are diagrammatic views illustrating the method of assembly of the tubes and headers.

The heat exchanger herein disclosed while of a construction suitable for use in cooling systems, is particularly adapted for use in heating systems. Heat exchangers for heating systems of the type herein disclosed have heretofore frequently employed cast iron headers into which the steam tubes are expanded, with the inevitable result that as expansion and contraction continue leaks develop at the expanded joints. In accordance with the construction herein set forth, cast iron headers have been eliminated and standard tubes of suitable material such as copper, brass, steel and the like are employed, into which the steam tubes are secured, as for example by soldering, brazing or welding. The result is a permanently fluidtight construction which cannot readily develop leaks as the result of expansion, contraction, evaporation and other deteriorating forces.

Furthermore, in accordance with the construction herein disclosed, the steam supply and return conduits are telescoped and are not physically connected, except at the ends, so that deteriorating stresses due to expansion and contraction cannot easily develop.

In addition there is provided a novel method of assembly of the headers and tubes, which makes

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it possible to use ordinary cylindrical tubing for them.

In the construction illustrated in the drawings the heat exchanger is of the type through which cold air is driven at relatively high velocities for the purpose of heating it on its way to the space to be heated. As illustrated, it comprises a framework which may be of rectangular configuration composed of transverse top and bottom members 1 and 2 connected together by vertical members 3 and 4 in any suitable manner, as by welding or brazing. Within the framework thus formed is mounted an inner frame composed of somewhat similarly shaped channel members in which case, however, the top transverse channel member 5 is shallower than the bottom transverse channel member 6. The inner channel members are secured to the outer channel members in any suitable manner as by welding or brazing. As is clear from the drawings, all of these channel members may be made of sheet material of suitable characteristics such as for example galvanized sheet steel of suitable gauge. This material can be readily worked to shape, punched with openings as required, and otherwise manipulated in accordance with standard practice.

Extending transversely of the framework and within the housing 6 thus formed are the headers comprising a pair of plain cylindrical tubes 7 and 9, each of which is closed or sealed at the end to form a fluidtight casing. As illustrated in Figure 1, the end of the tube 7 is closed by a disc 8 as would be the other end of the tube, not shown. Likewise, one end of the tube 9 is closed by a disc 10 as is the other end. Extending through the disc 8 in fluidtight relation and into the disc 10, likewise in fluidtight relation, is the steam supply connection 11. The outer header 7 contains the condensate return connection 12.

In the structure illustrated each of the headers is provided with two rows of tubes lying in parallel planes, which in turn intersect the planes of the drawing. Thus the outer header 7 is provided with two rows of tubes 13 and 14 which are respectively brazed or welded or otherwise secured thereto at the joints 15 and 16 respectively. The outer or upper ends of the tubes 13 and 14 are closed off in any suitable manner, as by means of discs attached thereto to form fluidtight joints. Telescoped to the tubes 13 and 14 are the inner tubes 19 and 20 which extend into openings in the inner header 9 and are attached thereto by brazing, welding or the like, as indicated at 21 and 22 respectively. The outer or upper ends of the tubes 19 and 20 are open to

the interior of the tubes 13 and 14. As is clear from the drawings, the tubes 19 and 20 are not connected to the tubes 13 and 14 and are free to move relatively thereto under expansion, contraction, evaporation and the like, so that no stresses are set up therein likely to break the seals 21 and 22.

Likewise the tubes 13 and 14 are relatively free for movement with respect to the framework. Thus they project through apertures in the channel 5 and are not attached thereto so that they can easily move under the stresses developed. The header assembly is supported within the box 6 in any suitable manner, not shown, and desirably the inner header 9 is supported in spaced relation with respect to the outer header 7 by any suitable form of spacing devices likewise not shown.

This construction involves a problem of assembly, the solution of which involves an unobvious method of procedure. Heretofore structures of this general type were made up in accordance with rather intricate specifications in order to provide a general relationship of parts as illustrated. Thus in one construction the header corresponding to the header 7 has been made of generally oval cross-section to which the outer tubes corresponding to tubes 13 and 14 are attached. In this construction the inner tubes extend through aligned holes in the opposite sides of the oval tube, so that the lower ends of the inner tubes corresponding to the tubes 19 and 20 extend through the oval header and project from the opposite sides from which they enter. A half tube of suitable cross-section is then welded longitudinally along its edges to the side of the oval tube so that the inner tubes open thereinto. This construction is but illustrative of the complicated and expensive method heretofore employed to provide a structure generally like that illustrated herein. Obviously such a construction is expensive because of the special parts required, and particularly because of the number of manual operations involving a plurality of joints, requiring brazing or welding to get a tight construction.

In accordance with the novel method herein disclosed it is first to be noted that ordinary plain tubing may be employed both for the headers and the tubes or coils. As illustrated in Figure 2, the outer header is provided with two rows of large holes 7' properly placed, and the inner header is provided with two rows of smaller holes 9'. In assembling the construction these two tubes are telescoped as illustrated in Figure 2, the inner tube is shifted to one side and held so that its row of holes 9' are exposed through the larger row of holes 7' in the outer header 7. The tubes 19 are then welded or brazed into the tube 9 to form the seals 21, as illustrated. The inner tube 9 is then shifted so that its other row of holes 9' are exposed through the larger holes 7' of the other row in the outer tube 7, as illustrated in Figure 3. The inner tubes 20 are then welded or brazed to the tube 9 through the holes 7' to form the seals 22. As is clearly illustrated in Figures 2 and 3 of the drawings, the tubes 19 are straight at the time they are mounted in the header 9 and welded therein.

The two rows of outer larger tubes 13 and 14 are then successively welded or brazed to the outer header 7 to form the seals 15 and 16 respectively. If spacers are employed to hold the tubes 7 and 9 in spaced relation they can then be inserted through the open ends of the larger

tubes 7 whose ends may then be closed off in any suitable manner. After all the tubes 19 and 20 are welded in place the inner header 9 is fastened in a central position with respect to the outer header 7, as indicated in Figure 1, and in any suitable manner, as for example by means of the end discs 8. The outer tubes 13 are likewise straight at the time they are positioned on the header 7 and welded thereto. After all the tubes are in place and the inner header is properly positioned, they will radiate from the headers in an angular relationship, as is clear from Figure 3. The upper ends of the tubes are then forced towards each other to cause them to bend slightly, as is clear from Figures 1 and 4, so as to bring them into parallel relation. The welding of the tubes in place while they are straight facilitates ready access to the points of welding without interference with the welding operation. Thus by a relatively simple and yet, it is believed, unobvious procedure, the assembly of Figure 1 can readily be made from plain ordinary tubing as distinguished from the use of specialized parts and expensive operations such as the one described above. The assembly of the complete structure is otherwise conventional, although it may be noted, because it is not clear from the drawings that the fins 18 on the outer tubes 13 and 14 are actually already attached to these tubes at the time they are secured to the header 7. In other words, finned tubes are available as an article of commerce, and are used in preference to the procedure of satisfactorily attaching fins to these tubes after they are mounted in place.

The use of a device of this type is well known. It may be noted however that live steam is introduced through the connection 11 so that it may flow upwardly through the inner tubes 19 and 20 to discharge at their open ends into the outer tubes 13 and 14. The steam and the condensation formed as the heat is extracted therefrom, flows downwardly around the inner tubes and within the outer tubes back to the header 7, from which it is withdrawn through the condensate return 12. As is well known, a construction of this type is employed so that sufficient heat from the fresh incoming steam traveling up through the inner tubes keeps the lower parts of the outer device sufficiently warm to prevent freezing of the condensate therein as would otherwise occur when, for example, any cold fresh incoming air flows through the tubes to be heated.

In view of the fact that there is no satisfactory general term for use in the claims which will include soldering, brazing or welding, the attachment of the tubes to the headers will be defined as by welding with the intention, however, that this term is to include as well as welding attachment by soldering or brazing.

From the above description it will be apparent to those skilled in the art that the structure hereindisclosed is novel in certain features as set forth in the appended claims, as well as the method of assembly. While some variations in the construction and method of procedure may be devised, I contemplate that some of them will be within the skill of the ordinary mechanic and the resulting product and procedure will therefore be included within the scope of the appended claims. I desire therefore to be limited only as required by the claims, rather than by the illustrative disclosure herein set forth.

What is claimed is:

1. A method of assembling headers and tubes

comprising the steps of telescoping a pair of said seamless header tubes, said header tubes each having at least two rows of holes in the wall thereof, positioning the inner header with respect to the outer header so that the holes of the inner header are exposed by the holes of the outer header, welding tubes extending through the holes of the outer header in the holes of the inner header by operating through the holes of the outer header, shifting the inner header so that holes of its other row are exposed to respective ones of the holes of the other row of the outer header, positioning the inner header with respect to the outer header so that the holes of the inner header are exposed by the holes of the outer header, welding tubes extending through the holes of the outer header in the holes of the inner header by operating through the holes of the outer header, telescoping the larger tubes with said smaller tubes, and welding the larger tubes to the outer header at the holes therein.

2. A method of construction and assembly as described comprising telescoping a pair of header tubes each having at least two rows of holes in the wall thereof, positioning the inner header so that one row of its holes are aligned with one row of holes of the outer header, welding tubes in the holes of the inner header through the holes of the outer header, shifting the inner header so that its other row of holes are aligned with the other row of holes in the outer header and welding tubes in the holes of the inner header through the holes of the outer header.

3. The method of assembling headers and tubes comprising the steps of telescoping a pair of seamless headers, said headers each having at least two rows of holes in the walls thereof, positioning the inner header with respect to the outer header so that the holes of the inner header

are exposed by the holes of the outer header, welding tubes extending through the holes of the outer header into the exposed holes of the inner header, said welding being performed through the holes of the outer header, shifting the inner header so that the holes of its other row are exposed through respective ones of the holes of the other row of the outer header, welding tubes in the holes of the inner header by operating through the holes of the outer header, telescoping larger tubes over the so welded smaller tubes of the inner header, welding the larger tubes to the outer header at the holes therein, positioning the inner header concentrically with respect to the outer header with the tubes of the two rows extending angularly with respect to each other and bending the telescoped tubes into parallel relationship to form two parallel rows of telescoped tubes extending from the concentric headers.

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