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HEAT EXCHANGER FOR REFRIGERATING SYSTEMS

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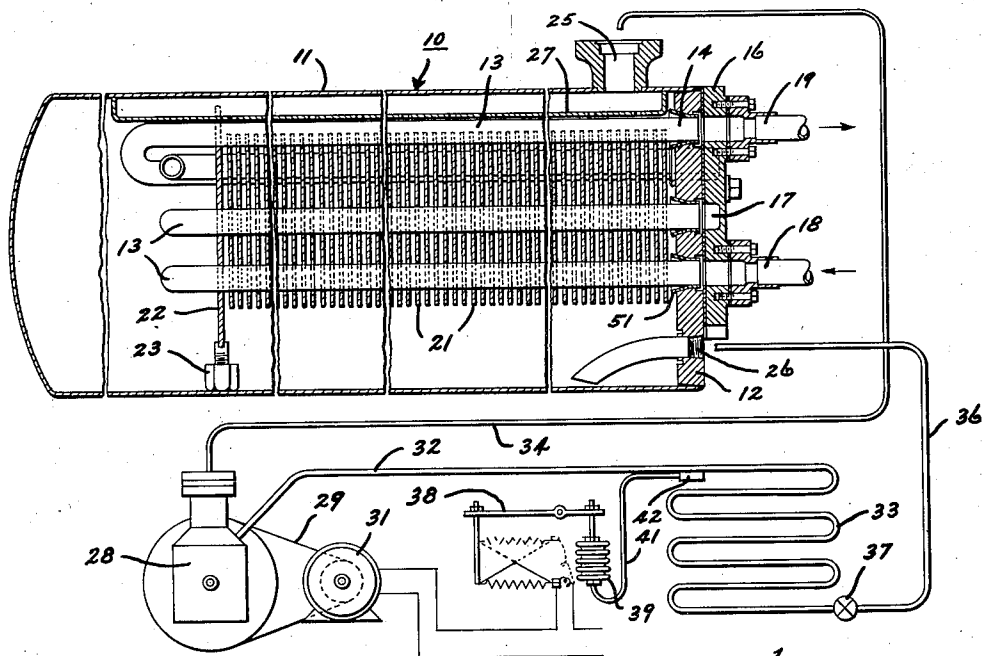


Fig. 1

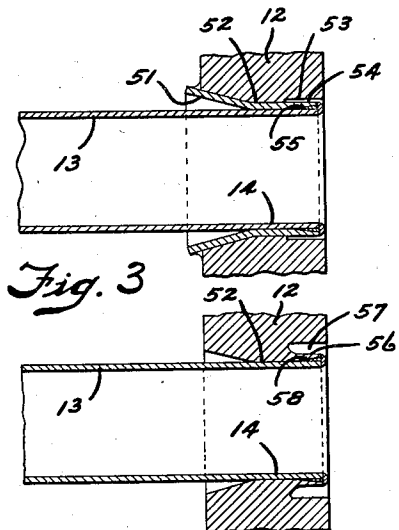


Fig. 3

Fig. 4

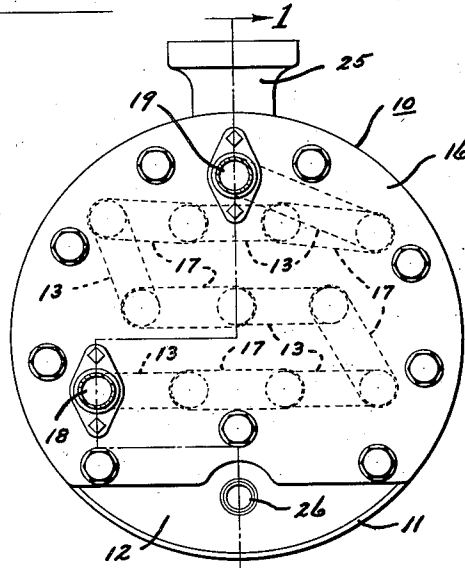


Fig. 2

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HEAT EXCHANGER FOR REFRIGERATING SYSTEMS

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This invention relates to heat exchangers and particularly to the bonding of a plurality of pipes or tubes to a header of such exchangers.

Heretofore, in the construction of water cooled condensers of refrigerating systems for example, considerable difficulty has been experienced in securing the ends of water circulating pipes or tubes to a heavy metal header which serves as a closure for a container into which compressed refrigerant is deposited and adapted to be cooled and liquefied. This difficulty was occasioned by the fact that the thick metal header caused heat being applied thereto at the ends of a tube adapted to be bonded to the header, to be dissipated or carried away from the points or surfaces to be bonded together more rapidly than would cause fluid-tight bonding of the tube to the header. My invention is therefore directed to overcoming the difficulty heretofore encountered in the bonding of ends of tubes or pipes to a metal header.

An object of my invention is to provide an improved low cost heat exchanger construction.

Another object of my invention is to provide an improved construction of a header for a heat exchanger to which header a plurality of fluid conveying pipes or tubes are secured.

A further object of my invention is to provide a header of a heat exchanger with thin walled tube-attaching portions remote from the thick main body portion of the header so as to permit rapid and efficient fluid-tight bonding of the ends of tubes to the header.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a sectional view taken on the line I—I of Fig. 2 through a heat exchanger of a refrigerating system shown diagrammatically connected with the exchanger;

Fig. 2 is an end elevational view of the heat exchanger;

Fig. 3 is an enlarged fragmentary sectional view showing a portion of the heat exchanger constructed in accordance with the present invention; and

Fig. 4 is a view similar to Fig. 3 showing a modified construction.

Referring to the drawing, for the purpose of illustrating my invention, I have shown diagrammatically in Fig. 1 thereof a closed refrigerating system including a heat exchanger or condenser generally designated by the reference character

10. The condenser or heat exchanger 10 comprises an elongated cup-shaped metal member 11 having its open end closed by a relatively heavy or thick metal end plate or header 12 which is welded thereto. A plurality of substantially U-shaped lengths of pipe or copper tubing 13 have their ends 14 secured to end plate or header 12 in a manner to be more fully described hereinafter. An outer plate 16 is secured to header 12 by bolts or any other suitable securing means. The outer plate 16 is provided with a plurality of hollowed-out portions 17 forming passages each of which interconnect one end of one of the U-shaped tubes 13 with an end of another adjacent tube 13. The communication of passages 17 together with the arrangement of tubes 13 provide a series path of flow for a fluid, such as water, to be circulated through the tubes 13 of condenser 10. The series path of flow through tubes 13 and passages 17 includes an inlet connection 18 and an outlet connection 19 provided on the end plate 16. A plurality of fins 21 are secured to and extend transversely to tubes 13 for increasing the heat transfer surface thereof. A heavy plate 22 located near the yoke portions of the U tubes 13 has an extending portion or device 23 which rests against the inner wall of member 11 to support the tubes and fins therein. The elongated metal cup-shaped member 11 forms a tank around the tubes 13 and this tank is provided with a fluid inlet connection 25 and an outlet connection 26 adapted to be connected with a refrigerating system. A baffle 27 located beneath the inlet connection 25 of the exchanger is provided with a plurality of small openings for distributing refrigerant circulated to the exchanger 10 along the length of the tubes 13.

The refrigerating system includes in addition to the condenser 10 a compressor 28, operatively connected through suitable belt and pulley connections 29, to an electric motor 31. The compressor 28 upon being operated by motor 31 withdraws gasified or evaporated refrigerant, through pipe 32, from an evaporator or cooling element 33. The evaporated refrigerant is compressed and circulated under pressure, through pipe 34 and the inlet connection 25 on member 11, into the tank or heat exchanger 10. Any suitable cooling fluid such as water is circulated from the inlet connection 18 through one of the passages 17 in plate 16 (see Fig. 2) to one of the tubes 13. As before stated the circulation of water through heat exchanger 10 is a series path of flow between the water inlet 18 and outlet 19 thereof. The circulation of water through the

exchanger 10 therefore cools and causes condensation of the compressed refrigerant flowing through the openings in baffle 27 and distributed over the length of tubes 13. Refrigerant thus liquefied accumulates or collects in the bottom of tank 10 and is stored therein until admitted to evaporator 33 through the pipe or conduit 36 under control of a suitable expansion device or valve 37. The motor 31 and consequently compressor 28 is intermittently operated by any suitable control switch 38 interposed in the electric power lines leading to motor 31. Switch 38 is actuated by a bellows 39 connected, by a pipe 41, to a thermostat bulb 42 located in thermal relation with the evaporator 33. It is to be understood that the bellows 39, pipe 41 and bulb 42 form a conventional and well-known thermostatic system containing a volatile refrigerant for controlling operation of the refrigerant circulating means.

Since my invention relates to the heat exchanger or condenser 10 and particularly to the construction of that portion of header 12 to which the tubes 13 are to be secured, I will now refer to Figs. 3 and 4 of the drawing for describing my improvement. It will be noted that the header 12 of condenser 10 (see Fig. 3) has tubular inserts 51, preferably of copper material, brazed to the walls 52 of the tube receiving openings provided therein. The outer face of header 12 is counterbored as at 53 adjacent the walls 52 of the opening and the ends 54 of inserts 51, adapted to receive the ends 14 of the U-shaped tubes 13, extend beyond the wall 52 into the space provided by the counterbore 53. The ends 54 of inserts 51 have a tapered inner surface 55 providing a space between the outer wall of the tube 13 and the insert. The extension of the end 54 of insert 51 into the space provided by the counterbore 53 thus locates the portions of tube 13 and insert 51 to be bonded together remote from the main thick body portion of header 12 and thereby permits heating and bonding of the portions to be secured together with solder without danger of the heat being rapidly dissipated away from the points to be bonded by the body portion of header 12. Upon heating the end 54 of insert 51 and the end of the tube 13 solder will freely flow between same along the taper 55 and form a fluid-tight connection therebetween. The inserts 51 are brazed to header 12 prior to assembling the tubes 13 thereto and it is obvious that the construction permits rapid heating of the ends 54 of inserts 51 and the ends of the tubes 13 located therein to cause bonding together thereof at a point spaced from the main body portion of header 12. Tubes 13 may therefore be readily and quickly soldered to header 12 and the header together with the tubes 13 secured thereto may then be inserted in the elongated cup-shaped member 11 through the open end thereof. The header 12 is then brazed or welded to the walls of member 11 to form a closed tank. The end plate 16 is adapted to be bolted to header 12 so that the grooves or passages 17 provided therein afford communication between certain ends of tubes 13 to form a series path of flow for the cooling fluid to be circulated through the closed tank heat exchanger or condenser 10.

In Fig. 4 of the drawing I have shown a modified form of construction which permits the ends of the tubes 13 to be soldered or bonded directly to the metal header 12. In this form of the invention a flange 56, formed on header 12

by cutting a groove 57 inwardly from the face of the header, is tapered as at 58 for receiving solder to be applied between the outer wall of tube 13 and flange 56. The end of tube 13 and the flange 56 in this modified form of construction can be readily heated to a sufficient temperature to cause melting and flow of solder between the flange 56 and tube 13 for bonding the parts together since the points to be heated and bonded are remotely spaced from the main thick body portion of header 12.

It will be seen from the foregoing that I have provided an improved method or process of securing the ends of tubes or pipes to a heavy metal header. The improved construction insures that parts to be secured together can be heated to a soldering temperature without danger of heat being dissipated by the thick body portion of one of the metal parts from the points to be bonded together. My improvement greatly facilitates the manufacture and assembly of condensers or heat exchangers while at the same time reducing the cost of producing same.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A heat exchange structure comprising in combination, a plurality of substantially parallel tubes, a header having a plurality of openings therein for receiving the ends of said tubes, flange means extending parallel with and laterally from the walls of said tube-receiving openings and forming one wall of a hollowed-out portion provided in the face of said header adjacent said tube-receiving openings, and said tubes extending parallel with said flange means and having their ends terminating adjacent the outer ends of the flange means and below the face of said header to thereby provide a joint located remote from the main body portion of said header adapted to be heated to cause bonding of the tubes to said header.

2. A heat exchange structure comprising in combination, a plurality of substantially parallel tubes, a header having a plurality of openings therein for receiving the ends of said tubes, flange means extending parallel with and laterally from the walls of said tube-receiving openings and forming one wall of a hollowed-out portion provided in the face of said header adjacent said tube-receiving openings, and said tubes extending parallel with said flange means and having their ends terminating adjacent the outer ends of the flange means and below the face of said header to thereby provide a joint located remote from the main body portion of said header adapted to be heated to cause bonding of the tubes to said header, said flange means having its surface adjacent the outer wall of a tube tapered to provide a space between the wall of the tube and said flange for the reception of a bonding material.

3. A heat exchange structure comprising in combination, a plurality of substantially parallel tubes having a plurality of fins extending transversely thereto, a header having a plurality of openings therein, said header having its face counterbored adjacent each of said openings, a tubular insert secured in each of said openings, said inserts adapted to receive said tubes and having their ends extending from the walls of said openings

into the space provided by said counterbores to form a wall of a groove surrounding the ends of said inserts, each of said tubes having its end terminating adjacent the end of its cooperating insert, and the ends of said tubes and said inserts being disposed below the face of said header and providing surfaces remote from the main body portion of said header to be heated and bonded together.

4. A heat exchange structure comprising in combination, a plurality of substantially parallel tubes having a plurality of fins extending transversely thereto, a header having a plurality of openings therein, said header having its face counterbored adjacent each of said openings, a tubular insert secured in each of said openings, said inserts adapted to receive said tubes and having their ends extending from the walls of said openings into the space provided by said counterbores to form a wall of a groove surrounding the ends of said inserts, each of said tubes having its end terminating adjacent the end of its cooperating insert, the ends of said tubes and said inserts being disposed below the face of said header and providing surfaces remote from the main body portion of said header to be heated and bonded together, and said inserts having their surface adjacent the outer wall of said tubes tapered to provide a space between the wall of the tubes and said inserts for the reception of a bonding material.

5. A heat exchange structure comprising in combination, a plurality of tubes, a header having a plurality of openings therein for receiving the ends of said tubes, flange means extending parallel with and laterally from the walls of said tube receiving openings and forming one wall of a hollowed-out portion provided in the face of said header adjacent said tube receiving openings, at least a portion of said tubes extending parallel with said flange means and having their ends terminating adjacent the outer ends of the flange means and below the face of said header to thereby provide a joint located remote from the main body portion of said header adapted to be heated to cause bonding of the tubes to said header, and a closure member for said heat exchange structure adapted to be clamped upon the

face of said header, said closure member having passages formed therein providing communication between certain of said plurality of tubes.

6. A heat exchange structure comprising in combination, a plurality of tubes, a header having a plurality of openings therein for receiving the ends of said tubes, flange means extending parallel with and laterally from the walls of said tube receiving openings and forming one wall of a hollowed-out portion provided in the face of said header adjacent said tube receiving openings, at least a portion of said tubes extending parallel with said flange means and having their ends terminating adjacent the outer ends of the flange means and below the face of said header to thereby provide a joint located remote from the main body portion of said header adapted to be heated to cause bonding of the tubes to said header, said flange means having its surface adjacent the outer wall of a tube tapered to provide a space between the wall of the tube and said flange for the reception of a bonding material, and a closure member for said heat exchange structure adapted to be clamped upon the face of said header, said closure member having passages formed therein providing communication between certain of said plurality of tubes.

7. A heat exchange structure including a conduit and an end plate having an opening in its main body portion receiving the conduit, flange means extending from the wall of said conduit-receiving opening of said end plate and terminating inwardly of one face of said end plate, said flange means having its inner wall diverging laterally from the wall of the conduit-receiving opening in a direction toward said one face of said end plate, said flange means forming a wall of a hollowed-out portion provided in said one face of said end plate adjacent said conduit-receiving opening, and said conduit extending along said flange means and having its end terminating adjacent the outer end of the flange means and below said one face of said end plate to thereby provide a joint located remote from the main body conduit-receiving portion of said end plate adapted to be heated to cause bonding of the conduit to said end plate.

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