Oct. 9, 1956 R. F. ADAMS ET AL 2,766,019

HEAT EXCHANGER ASSEMBLY

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FIG. 1

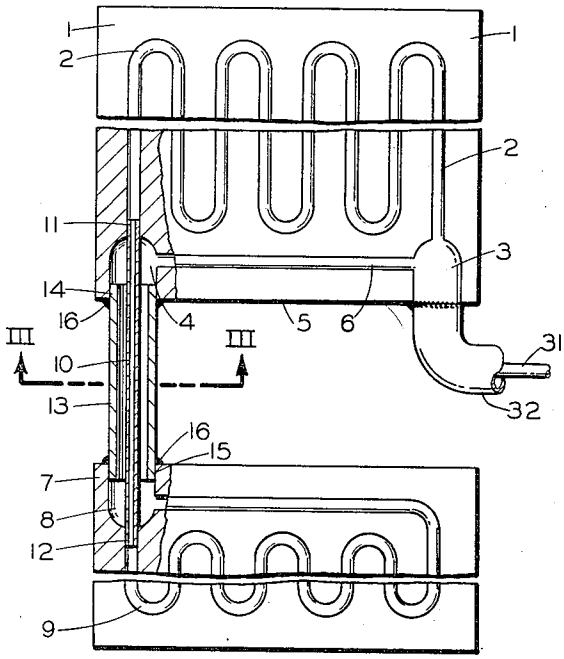


FIG. 2

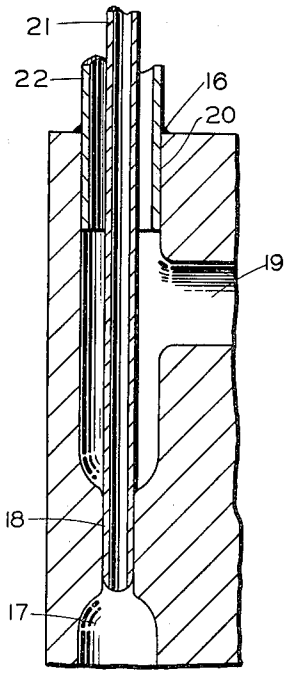
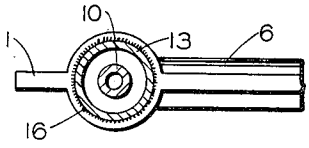


FIG. 3



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FIG. 4

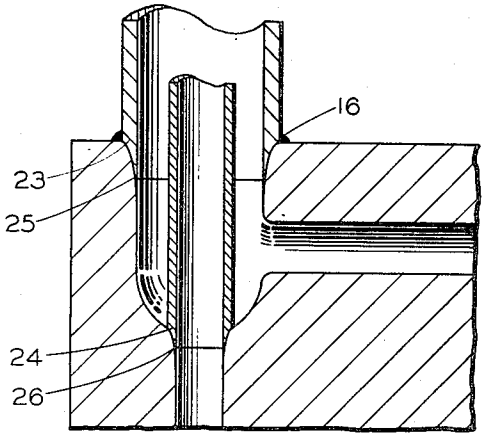
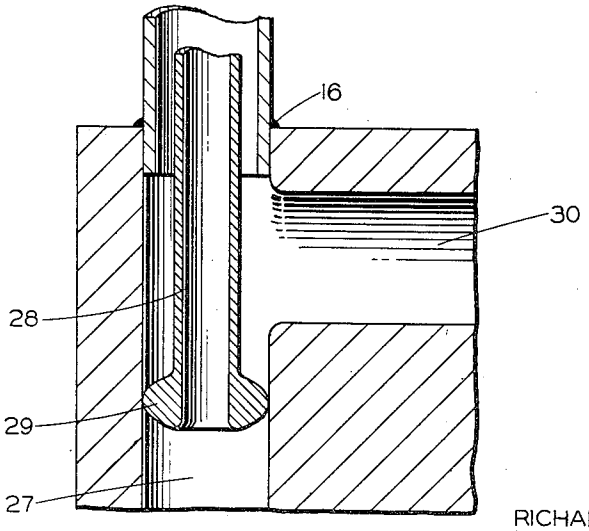


FIG. 5



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HEAT EXCHANGER ASSEMBLY

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Application March 23, 1955, Serial No. 496,213

6 Claims. (Cl. 257—256)

This invention relates to structural fabrication and more specifically to means for connecting hollow units such as heat exchangers.

It has previously been the practice in connecting the units of a heat exchanger system to provide an entirely separate return system with external piping from the last unit of the system back to the supply source. In systems which attempted to incorporate a portion of the return system integrally with evaporator plates of the type disclosed in U. S. Patent 2,690,002 it was necessary to provide an external peripheral opening into the plates for both the supply and return systems. This has the obvious disadvantages in the fabrication and assembly of the system of requiring additional external joint openings in the units and the connection of the additional joints, as well as tending to permit excessive ice formation in refrigeration units at the supply system joints.

It is therefore an object of this invention to reduce the number of external connections required in each heat exchanger unit, thereby reducing the possibility of external leaks. Another object of this invention is to reduce the number of positive connections, such as welded, threaded or bolted joints required to join the connecting conduits such as pipes or tubes to the units. Another object of this invention is to eliminate, so far as possible, exposed piping and to make practicable the use of flexible or pliable tubing which is easier to work with and more resistant to breakage. Another object of this invention is to achieve a substantial reduction in the undesirable, uneven heat conditions at the joints between the units. Another object of this invention is to provide a heat exchanger system made up of individual units, which is inexpensive to fabricate and assemble. Other objects and advantages will become apparent from the description and accompanying drawings in which:

Figure 1 is a plan view partially in section of one embodiment of the invention.

Figure 2 is a sectional plan view of a modified form of an individual joint.

Figure 3 is a cross-sectional view taken on the line III—III in Figure 1.

Figure 4 is a sectional plan view of another modified form of an individual joint.

Figure 5 is a sectional plan view of still another modified form of an individual joint.

The foregoing objects are accomplished by a novel assembly of connecting tubing and a plurality of heat exchanger units. These units preferably are of the type disclosed in U. S. Patents Nos. 2,662,273 or 2,690,002, although any type unit may be adapted for use in conjunction with this invention. The first unit of the system has a fluid passageway or conduit the two ends of which each, in one modification, open into one of two special tube connection cavities each of which is of greater diameter than the diameter of the conduit at the point of juncture with the cavity. The first unit

is joined to a second unit by an inner conduit such as a pipe or tube which passes through one connection cavity in each unit and frictionally engages one of the passageway openings in the respective connection cavity to provide a substantially fluidtight joint. In a similar manner any intermediate units are connected between the first and last units of the series. Obviously the heat exchanger units may also be connected in parallel to a supply source. The only variation between the first, intermediate and last units is that in the last unit the passageway which opens into a connector cavity, as previously described, has its other end opening into a side of the same cavity rather than into a second cavity as in the first or intermediate units. A larger outer conduit encases and is spaced from each inner conduit and has each end received in the adjacent cavity of each unit through which an end of the smaller conduit passes. The larger conduit is welded to the mouth of the cavity, or otherwise positively attached thereto. The larger conduit may merely frictionally engage the inner surface of the cavity, if desired. As a main supply and discharge connection, a conduit is received in the remaining connection cavity in the first unit and is frictionally seated in a passageway in this cavity to form a substantially fluidtight joint while another larger conduit encases and is spaced from the inner conduit and is received in the adjacent connection cavity in the first unit. If desired an additional heat exchanger unit may be attached in place of the above described supply and discharge piping, with the supply and discharge connections being made to the initial unit of the series. The first unit and each intermediate unit is provided with a second integrally formed conduit opening into the two cavities to complete a fluid circuit through all the units of the series.

The invention will be better understood from the following detail description:

In Figures 1 and 3, heat exchanger units such as unit 1, which may be fabricated from any suitable material, but preferably aluminum or copper, are provided with a fluid carrying passageway, or conduit 2, having a configuration resembling a heat exchanger coil. One end of the conduit 2 opens into and joins a peripheral connection cavity 3 while the other end opens into and joins a peripheral connection cavity 4. Connection cavities 3 and 4 open out through a peripheral edge 5 of unit 1. Connecting the cavities 3 and 4 is a second passageway or pipe 6 which opens into both the cavities 3 and 4 at a point spaced from the peripheral opening and intermediate the sheet periphery 5 and the heat exchange passageway or pipe 2.

A return unit 7 is provided with a conduit 9, one end of which opens into the cavity 8 in the same manner as conduit 2 opens into either cavity 3 or 4. The basic difference between the return unit 7 and the first unit is that the other end of conduit 9 opens into the side of cavity 8 rather than into a second cavity in the unit. As will be noted, the return unit has only one passageway or pipe. The connection between the units 1 and 7 is shown in section. A conduit 10 passes through the cavities 4 and 8 in units 1 and 7, respectively. The ends 11 and 12 of conduit 10 are slip-fitted into the open ends of conduits or passageways 2 and 9 respectively. The ends of the conduit and the open ends of the respective passageways are of the same cross-sectional configuration, varying in size just sufficiently to provide a tight slip-fit and a substantially fluidtight joint. After the ends 11 and 12 of conduit 10 have been seated in the open ends of the passageways 2 and 9, the outer surfaces of the passageways may be deformed in the area of their inner contact surface with the ends 11 and 12 of the conduit 10 to provide a more secure and

fluidtight joint. The deformation may be provided by any conventional means, such as a hammer blow transmitted to the conduit through a suitable blunt shaped punch or similar tool. A larger second conduit **13** encases and is spaced from the first conduit **10** and has its ends **14** and **15** fitted in the cavities **4** and **8**, respectively. The ends of conduit **13** may be received in the openings **4** and **8** by a fluidtight slip-fit, with or without deformation of the connection cavity, or the ends may be secured in the cavity by welding as shown at **16** or by a threaded connection (not shown) or other positive securing means. Supply and discharge conduits **31** and **32** are seated in the passageway **2** and the adjacent connection cavity **3**, respectively, in the same manner as conduits **10** and **13** described above.

Figure 2 shows a modified form of the joint shown in Figures 1 and 3. Here the end portion **20** of passageway **17** opens out through the peripheral edge **5** of the unit, and the passageway is provided with a restricted portion **18**. A second passageway **19**, similar to passageway **6** of plate **1**, opens into the side of the conduit end portion **20**. Conduits **21** and **22** engage the restricted passageway portion **18** and the end portion **20**, respectively, in the same manner as in the joints previously described. The conduit **22** may be welded or otherwise positively secured to the cavity mouth as shown at **16**.

Figure 4 shows another modification of the joint structure wherein the ends **23** and **24** of the two conduits, and the conduit receiving portions **25** and **26** of the unit are provided with mating wedging surfaces rather than with the straight slip-fitting surfaces shown in Figures 1 and 3. The larger conduit may be welded or otherwise positively secured to the cavity mouth, as at **16**.

One other modification of the individual joint should be noted. In Figure 5 the conduit **27** is of the same diameter throughout its length but has a taper beginning slightly inwardly of the opening of passageway **30** into passageway **27** and increasing in diameter toward the peripheral opening. The smaller conduit **28** is provided with an enlarged portion of any conventional type, such as a flange **29** formed on an end of the conduit, which is forced into the passageway sufficiently far to pass opening **30**.

As should be apparent from the above description, the units can be quickly assembled by inserting an end of the smaller conduit through the connection cavity in one of the units, until it seats in the passageway opening and then inserting the larger conduit into the peripheral opening of the connection cavity. Similarly, the other ends of the conduits may be inserted into the second unit. The larger conduit may be welded or otherwise positively joined to the peripheral edges of the units. As is most clearly seen in the sectional portion of Figure 1, by welding the ends of the larger conduit **13** to the mouth of the cavities **4** and **8**, the smaller conduit **10** is secured in place between the ends of conduits **2** and **9**. The units **1** and **7** are integrally joined in fixed relationship by the conduit **13**, the smaller conduit **10** is protected from damage by being encased in the larger conduit, and the fluid circuit is completed with a minimum of external openings in the units.

When the inner connecting conduits are of flexible or pliable material they provide several advantages. Primarily they will bend or twist rather than snap or break as they expand or contract because of changes in temperature. Also flexible or pliable conduit facilitates assembly when it is necessary to provide bends in the conduits, as shown at **31** and **32**.

The fluid circuit is as follows. Fluid which may be introduced through the small conduit **31**, flows through the passageway **2** and out through the small conduit **10** into passageway **9** in the second unit **7**, into cavity **8**, through conduit **13** into cavity **4** of unit **1**, then through passageway **6** into cavity **3** and out through the conduit **32**. As many intermediate heat exchanger units as are desired may be inserted between units **1** and **7**, utilizing connections, for example, such as illustrated at **10** and **13**, and **31** and **32**.

The use of heat exchanger units formed in this manner and connected to each other as described above, materially reduces the cost of fabrication by eliminating the necessity of additional external openings through the units. Furthermore, by fabricating the return passageways, such as **6**, integrally with the plates the additional expense of separate piping is eliminated. Ease of assembly is facilitated by the use of slip or wedge fitted joints on the smaller connecting conduits, as **10**. The number of external joints is substantially reduced which reduces the possibility of external leaks. By having the supply and return conduit joints related in the manner described the temperature at the joint will remain more nearly the same as the temperature of the remainder of the unit. For example, the joint herein described will tend to prevent the formation of excessive frost if the joint is in a refrigerating system.

It is to be understood that although this invention is intended for use primarily in conjunction with units as described in the aforementioned patents, it is not to be limited to this embodiment and is equally well adapted to use in coils formed of conventional tubing. It is also to be understood that this invention is not to be limited to any particular material nor is its application limited to use in heat exchangers. Although several specific modifications and details are set forth in the foregoing, it will be understood that various changes may be made without departing from the spirit and scope of this invention, and that this invention is therefore not to be limited to such specific modifications and details except as set forth in the appendent claims.

We claim:

1. An assembly comprising a plurality of heat exchanger units, each unit having a passageway with an open end portion, a pipe having an end entering said open end portion of the passageway in each unit and substantially fluidtight means connecting the pipe end and said passageway in each unit, a second pipe encasing said first pipe and having an end adjacent each open end portion and substantially fluidtight means connecting said second pipe ends and the respective open end portions of said passageways, and a second passageway opening into each open end portion.

2. The assembly of claim 1 wherein said second passageway opening is between said means.

3. The assembly of claim 1 wherein the inside diameter of said second pipe is substantially greater than the outside diameter of said first pipe.

4. The structure of claim 1 wherein said second means comprises a welded joint.

5. A heat exchanger assembly comprising at least one basic unit and a return unit, a basic unit comprising a pair of connecting portions and a pair of passageways each opening into and interconnecting said connecting portions; said return unit comprising a connecting portion and a passageway having end portions opening into said connecting portion; fluid conveying means interconnecting each unit of said heat exchanger assembly with another unit, said means comprising a first conduit having ends each received in a connecting portion of interconnected units and means providing a substantially fluid tight connection between each of said conduit ends and one of said passageways opening into each of the respective connecting portions, a second conduit encasing said first conduit and having ends opening into the respective connecting portions which receive said first conduit, a fluid conveying space between said first and second conduits and means providing a substantially fluid tight connection between each end of said second conduit and the adjacent connecting portion, whereby a fluid conveying circuit is completed throughout the units with the

passageways which open into one of said connecting portions providing an inlet and outlet, respectively, in the heat exchanger assembly.

6. The heat exchanger assembly of claim 5 and a service conduit received in the last said connecting portion, a second service conduit encasing said first service conduit and a fluid conveying space between said first and second service conduits, means providing a substantially fluidtight connection between said first service conduit and a passageway opening into the last said connecting portion and means providing a substantially fluidtight

connection between said second service conduit and said connecting portion whereby a continuous fluid circuit is established between said service conduits.

References Cited in the file of this patent

UNITED STATES PATENTS

708,900 Murgatroyd ---------- Sept. 9, 1902

FOREIGN PATENTS

10,924 Great Britain ---------- May 12, 1904