

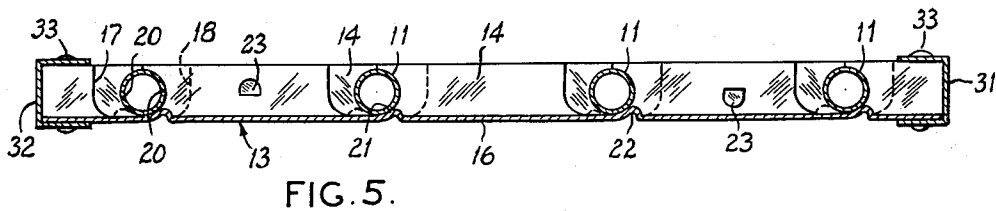
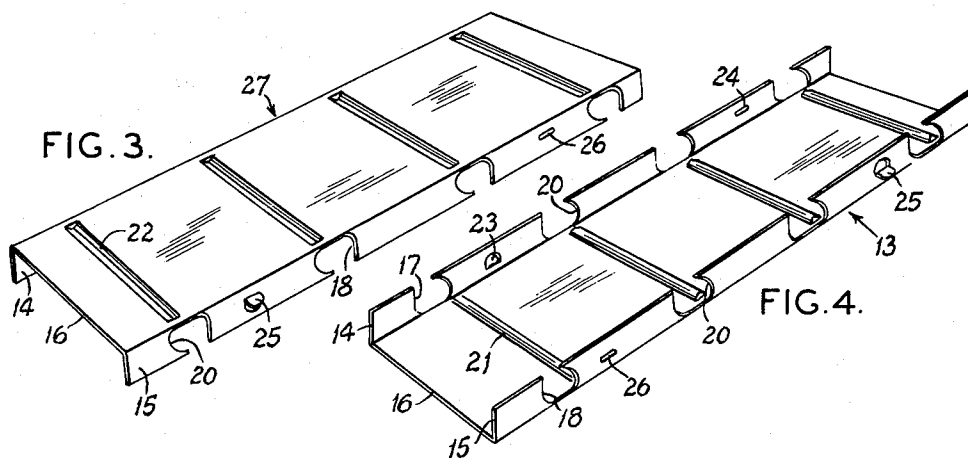
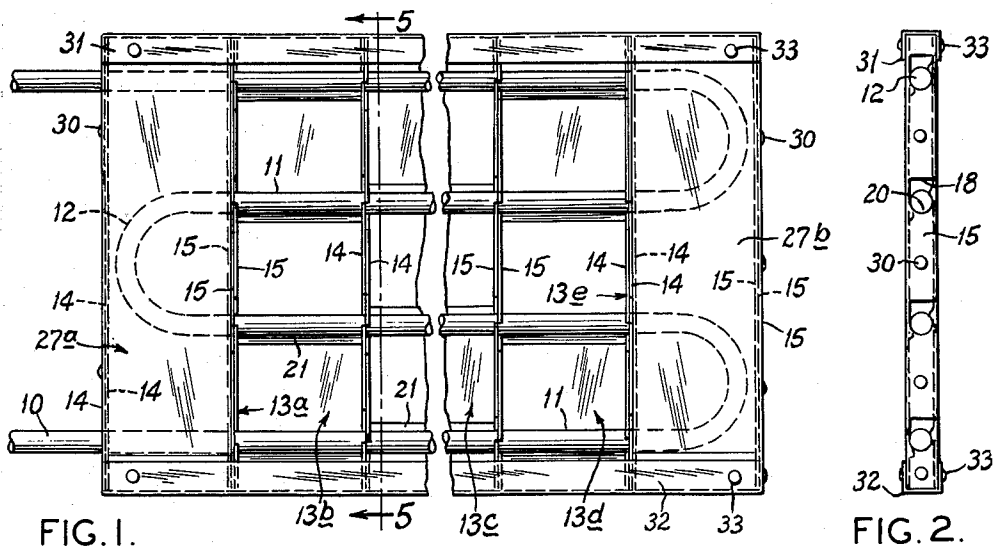
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EVAPORATOR PLATE COIL UNIT

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EVAPORATOR PLATE COIL UNIT

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This invention relates generally to improvements in a plate coil unit, and more particularly to an improved assembly of a coil with interconnected individual plate members to provide an assembly that can be advantageously utilized as an evaporator plate structure in a refrigeration system.

It is an important object to achieve an evaporator plate structure that can be readily assembled, and which has an extremely efficient conductance or transference of cold from the coil to the plate members.

An important objective is realized by the structural arrangement and interconnection of the component parts of the evaporator plate coil which adapts the device to be constructed in any desired lengths depending upon the lengths of the evaporator coil merely by connecting an appropriate number of individual plate members. These evaporator plate coils can be and are used in the refrigeration system of refrigerated beverage coolers and the like, to keep items cold, as partitions to separate the various items in the cooler, and as shelves on which items can be placed.

Another important object is afforded by the provision of a coil bent in a side to side serpentine shape having a plurality of adjacent substantially parallel lengths interconnected by reverse bends, and a plurality of plate members located and secured in side by side relation across the coil lengths, each plate member including a flange provided with a plurality of recesses for receiving and holding the transverse coil lengths.

Still another important object is provided in that the recesses of adjacent plate members receiving the same coil length cooperate to substantially enclose the circumference of the coil length so as to fix the plate members to the coil.

An important object is achieved by the unique manner of connecting the coil lengths to the plate flanges. Each recess of each plate flange is at least partially defined by a margin conforming substantially to a part of the circumference of the coil length, and the recesses of adjacent plate members receiving the same coil length are relatively reversed so that the margins face in opposite directions. These recess margins of adjacent plate members cooperate to substantially enclose the circumference of the coil lengths extending therebetween so as to fix the plate members to the coil.

Another important objective is attained by the provision of bearing surfaces extending transversely of each plate member and engaging a considerable part of the coil lengths in order to effect a large area contact for most efficient cold transfer. These bearing surfaces are advantageously formed by depressed or grooved portions in the plate member.

Yet another important object is realized in that the bearing surfaces of each plate member are aligned with the conforming recess margins in the side flanges so that the bearing surfaces of one plate member engage the coil lengths on one side while the bearing surfaces of the next adjacent plate member engage the coil lengths on the opposite side.

An important objective is afforded by constructing the plate members of U-shaped channels having spaced side flanges interconnected by an intervening web, the U-shaped plate members being disposed in side by side

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relation across the coil lengths with one side flange of each plate member contiguous with one side flange of the next adjacent plate member. The contiguous side flanges have the recess structure for holding and receiving the coil lengths, and the webs of the plate members have the conforming bearing surfaces extending along and engaging the transverse coil lengths, all as mentioned previously.

Another important object is to provide an evaporator plate coil that is simple and durable in construction, economical to manufacture and assemble, and highly efficient in operation.

The foregoing and numerous other objects and advantages of the invention will more clearly appear from the following detailed description of a preferred embodiment, particularly when considered in connection with the accompanying drawing, in which:

FIG. 1 is a front elevational view of the evaporator plate coil with the center portion broken away;

FIG. 2 is an end elevational view as seen from the right of FIG. 1;

FIG. 3 is a perspective view of an inverted end plate member;

FIG. 4 is a perspective view of an upwardly facing plate member, and

FIG. 5 is an enlarged cross sectional view as seen along line 5—5 of FIG. 1.

Referring now by characters of reference to the drawing, and first to FIG. 1, it is seen that the evaporator plate coil structure includes a tubular coil 10 formed in a serpentine shape from side to side to provide a plurality of adjacent and parallel coil lengths 11 interconnected by reverse bends 12. The coil 10 is adapted to receive and transfer refrigerant flow in a refrigeration system. In the preferred embodiment, the coil 10 is of a circular cross section as is best illustrated in FIG. 5. Of course, any suitable cross section can be utilized.

A plurality of plate members generally indicated by 13 in FIGS. 4 and 5 are operatively interconnected together and to the coil 10. Each of these plate members 13 are of identical construction so that a detailed description of one will suffice for the other.

From FIGS. 4 and 5, it is seen that the plate member 13 is constructed of a substantially U-shaped channel having spaced side flanges 14 and 15 integrally interconnected by an intervening web 16. Each of the side flanges 14 and 15 is provided with a plurality of spaced recesses 17 and 18 respectively. The recesses 17 and 18 are of the same configuration and are aligned directly opposite each other. These recesses 17 and 18 are open through the flanges 14 and 15 respectively so as to receive the coil lengths 11 extending across the plate member 13.

Each of the recesses 17 and 18 is at least partially defined by a margin 20 that is offset to one side of the entrance to such recesses. The recess margin 20 conforms substantially to a part of the circumference of the coil length 11 received in the recess 17 or 18 and cooperates with a similar margin 20 in an aligned, but relatively reversed recess in a next adjacent plate member to fix the coil length to the plate members, all as will be later described.

As mentioned previously, the conforming recess margin 20 is offset from the recess entrance so that the coil lengths can be shifted relative to the side flanges 14 and 15 in the recesses in order to bring the peripheral surface of the coil lengths against the conforming recess margins 20. In view of the fact that the coil lengths 11 are circular in cross section, the conforming recess margins 20 are substantially semi-circular so that when the margins 20 abut the coil lengths 11, portions of the side flanges defining the recess margins 20 will overlap the coil lengths 11 and preclude withdrawal from the recesses.

Extending across the web 16 between the side flanges 14 and 15 are a plurality of bearing surfaces 21 having a shape that conforms to the circumferential configuration of the coil lengths 11. In the present embodiment, the bearing surfaces 21 are arcuate to conform to the circular cross section of the coil lengths 11. As is best seen in FIGS. 4 and 5, the arcuate bearing surfaces 21 are aligned directly with the conforming recess margins 20 of the opposed flange recesses 17 and 18 so that when the coil lengths 11 are brought into contact with the recess margins 20 the arcuate bearing surfaces 21 will engage a substantial portion of the coil length circumference in order to provide a large area contact between the coil length 11 and the plate web 16 for most efficient conductance of cold from the coil 10 to the plate member. The arcuate bearing surfaces 21 are formed by striking a depression or groove 22 in the back side of the web 16.

The side flange 14 is provided with an outstruck tab 23 near one end of the plate member 13 and is provided with a compatible slot 24 at the opposite end. Similarly, the side flange 15 is provided with an outstruck tab 25 at one end of the plate member 13 directly opposite the slot 24 in the other side flange 14. Provided in side flange 15 is a compatible slot 26 aligned directly opposite the tab 23 formed in the opposite side flange 14. These tabs and slots are utilized to connect the plate members 13 together in side by side relation.

The plate members 13 are arranged one at a time in a row in side by side relation across the coil lengths 11. The plate members 13 are arranged so that they all open in the same direction. Every other plate member 13 is reversed endwise relative to the next adjacent plate member so that the arcuate recess margins 20 in contiguous side flanges 14 or 15 face in opposite directions.

First, one plate member 13a (FIG. 1) is located under and across the coil 10 and the coil lengths 11 are disposed in the recesses 18 of side flange 15, the reverse coil bends 12 being located over the web 16 and between the side flanges 14 and 15. Then, the plate member is shifted endwise to bring the periphery of the coil lengths 11 into engagement with the arcuate recess margins 20. Then, the next adjacent plate member 13b is relatively reversed endwise and is located under the coil 10 and parallel to the next preceding plate member 13a so that side flanges 15 are in contiguous side by side relation, and the coil lengths 11 are located in the flange recesses 17 and 18. This last plate member 13b is then shifted endwise in the opposite direction to bring the coil periphery into engagement with the recess margins 20. Because the flanges 15 of adjacent plate members 13a and 13b are disposed in contiguous relationship, the recesses 18 of such contiguous side flanges 15 are relatively reversed so that the arcuate margins 20 form a substantial circle and grip the circumference of the coil lengths 11 securely to preclude removal of the coil lengths 11 from the recesses 18.

When the adjacent plate members 13a and 13b are relatively shifted to bring the oppositely facing recess margins 20 into engagement with the periphery of the coil lengths 11, as described, tabs 25 of abutting and contiguous side flanges 15 will interfit the coating slots 26. A tool is fitted over the contiguous flanges 15 and is pressed down to bend the tabs 25 over in order to secure these adjacent plate members 13a and 13b together.

Of course, the next adjacent plate member 13c added to the assembly described previously will be located endwise so that the side flanges 14 will abut. The coil lengths 11 are located in the recesses 17 and this plate member 13c is shifted endwise in a similar manner to bring the recess margins 20 into engagement with and overlapping relation to the periphery of the coil lengths 11 to preclude removal of the coil lengths 11 from the recesses 17. When the side flanges 14 are located in contiguous relationship, the tabs 23 will interfit the coating slots 24, the tabs 23 being bent over to secure the adjacent plate members 13b and 13c together.

The plate members 13a through 13e are added one at a time in this manner until the appropriate length of the evaporator plate unit is realized. It will be noted that upon such assembly, the arcuate bearing surfaces 21 of each alternate plate member 13a, 13c and 13e, for example, will engage the coil lengths 11 extending between the side flanges along one side. The bearing surfaces 21 of each other alternate and next adjacent plate member 13b and 13d, for example, will engage the coil lengths 11 along the opposite side.

This arrangement provides the most efficient cold transfer from the coil lengths 11 to the webs 16 of the plate members 13. The arcuate bearing surfaces 21 provide the maximum amount of surface contact area between the coil lengths 11 and the plate webs 16, and avoid the inefficient line contact between the coil and plate of the heretofore conventional evaporators. Moreover, transfer of the cold is made from the coil lengths 11 to the plate members 13 first along one side of the coil and then along the other side for most efficient conductance, rather than having the plate members engage the coil only on one side or in a straight line contact.

After the plate members 13, arranged in side by side relation, have been secured together and have been fastened to the coil 10 to provide an evaporator unit of the appropriate length, an end plate member 27 (FIG. 3), identical in construction to the plate member 13 (FIG. 4) but with the projecting tabs 23 and 25 straightened, is inverted and placed over the upwardly facing plate members 13a and 13e at each end of the unit. For example, as shown in FIG. 1, the inverted end plate member 27a is disposed so that its respective side flange 14 is arranged in contiguous relation to the side flange 14 of plate member 13a and its side flange 15 is arranged in contiguous relation to the contiguous side flange 15 of adjacent plate members 13a and 13b. The other end plate member 27b is disposed so that its side flange 15 is arranged contiguous to the side flange 15 of the plate member 13e, and so that its side flange 14 is arranged contiguous to the side flanges 14 of the adjacent plate members 13d and 13e. Again, it will be noted that by inserting the coil lengths 11 in the recesses 17 and 18 of these inverted end plate members 27a and 27b and shifting such plate members endwise to bring the periphery of the coil lengths 11 against the recess margins 20, the coil lengths 11 are precluded from being withdrawn from recesses 17 and 18.

When the inverted end plate members 27a and 27b are disposed in this manner, the contiguous flanges 14 or 15 at the extreme ends of the evaporator plate unit are fastened together as by rivets 30.

Side channel strips 31 and 32 are located over the edges of the plate members 13 and the end plate members 27 and are secured in place by rivets 33. These side channels 31 and 32 provide protection against the sharp edges of the plate members 13 and are utilized if needed. In some instances, only one of the side channels 31 or 32 is desirable, and in other instances no such protective side channels are required.

From the above disclosure it is seen that the evaporator plate structure provided by this unique connection of individual plate members 13 to each other and to the coil 10 is extremely durable and rigid. It is made of relatively few parts and is quickly and easily assembled. It is noted that the coil 10 is secured to the plate members 13 automatically upon placing of the coil lengths 11 in the flange recesses 17 and 18 and upon relative shifting of the plate members to move the coil lengths 11 in the recesses 17 and 18 against arcuate or conforming recess margins 20 so that contiguous side flanges of adjacent plate members 13 completely enclose and overlap the coil lengths 11 to rigidly secure the coil to the plate members. When the plate members 13 and the coil 10 are interconnected in this manner, the tabs 23 or 25 automatically interfit the coating slots 24 or 26 of the contiguous side flanges 14

or 15, and such tabs can be quickly and easily bent over to secure the plate members 13 in place.

The evaporator plate coil unit when completed can be conveniently and advantageously utilized in a refrigerated cooler. The evaporator plate coil unit can be disposed along the sides or ends of the cooler compartment or can be placed transversely or lengthwise wherever desired to provide partitions or shelves.

Although the invention has been described by making detailed reference to a single preferred embodiment, such detail is to be understood in an instructive, rather than in any restrictive sense, many variants being possible within the scope of the claims hereunto appended.

I claim as my invention:

1. A plate coil unit comprising:

- (a) a coil having a plurality of adjacent lengths interconnected by reverse bends, the coil lengths having a predetermined cross section,
- (b) a plurality of plate members located in adjacent side by side relation across the coil lengths,
- (c) each plate member including a flange provided with a plurality of recesses, each recess having an entrance and partially defined by a margin offset to one side of the entrance, the offset margin conforming substantially to a part of the cross section of the coil length received in such recess and providing a portion overlapping the coil length received in the recess,
- (d) the associated coacting recesses of adjacent plate members receiving the same coil lengths being relatively reversed so that the said offset margins face in opposite directions, the said offset margins of associated coacting recesses of adjacent plate members cooperating to embrace and overlap the predetermined original cross section of the coil length extending therebetween so as to fix the plate members to the coil, the entrances of associated coacting recesses of adjacent plate members being displaced out of alignment relative to each other, and

(e) means securing the plate members together.

2. A plate coil as defined above in claim 1, in which:

- (f) each plate member includes a bearing surface conforming to a part of the predetermined original cross section of the coil length extending across the plate member, and engaging the coil length out of the plane of the plate member for efficient conductance therebetween.

3. A plate coil comprising:

- (a) a coil of substantially circular cross section bent back and forth to provide a plurality of adjacent lengths interconnected by reverse bends,
- (b) a plurality of plate members located in adjacent side by side relation across the coil lengths,
- (c) each plate member including a flange provided with a plurality of recesses, each recess having an entrance and partially defined by an arcuate margin offset to one side of the entrance providing a portion overlapping the coil length received in the recess,
- (d) the associated coacting recesses of adjacent plate members receiving the same coil lengths being relatively reversed so that the offset arcuate recess margins of one plate member face in one direction while the offset arcuate recess margins of the next adjacent plate member face in the opposite direction, the offset arcuate recess margins of associated coacting recesses of adjacent plate members cooperating to embrace and overlap the coil lengths extending therebetween so as to fix the plate members to the coil, the entrances of associated coacting recesses of adjacent plate members being displaced out of alignment relative to each other, and

(e) means securing the plate members together.

4. A plate coil as defined above in claim 3, in which:

- (f) each plate member includes a depressed portion having an arcuate bearing surface aligned trans-

versely with its arcuate recess margin, the arcuate bearing surfaces of adjacent plate members engaging alternate sides of a coil length extending across the plate members out of the plane of the plate members.

5. A plate coil comprising:

- (a) a coil having a plurality of adjacent lengths interconnected by reverse bends the coil lengths having a predetermined cross section,
- (b) a plurality of substantially U-shaped plate members, each plate member having spaced side flanges interconnected by an intervening web,
- (c) the plate members being disposed in side by side relation across the coil lengths with one side flange of each plate member contiguous to one side flange of the next adjacent plate member,
- (d) the contiguous side flanges being provided with a plurality of recesses receiving the coil lengths extending across the plate members,
- (e) each recess in each contiguous side flange having an entrance and partially defined by a margin offset to one side of the entrance, the offset margin conforming substantially to a part of the cross section of the coil length and providing a portion overlapping the coil length received in the recess,
- (f) the associated coacting recesses of contiguous side flanges being relatively reversed so that the said offset recess margins face in opposite directions, and the said offset recess margins of associated coacting recesses in contiguous side flanges cooperating to embrace and overlap the predetermined original cross section of the coil length located therein so as to fix the plate members to the coil, the entrances of associated coacting recesses of contiguous side flanges being displaced out of alignment relative to each other, and

(g) means securing the contiguous side flanges together to hold the plate members in assembly.

6. A plate coil as defined above in claim 5, in which:

- (h) each plate member includes a plurality of depressed portions forming bearing surfaces conforming substantially to the cross section of the coil lengths extending between the side flanges, the bearing surfaces of each plate member being aligned transversely with the said aligned and conforming recess margins in the side flanges, the bearing surfaces of adjacent plate members engaging the coil lengths extending across the plate members on alternate sides out of plane of the webs to provide an effective conductance between the coil and plate members.

7. A plate coil unit comprising:

- (a) a coil having a plurality of adjacent lengths interconnected by reverse bends,
- (b) a plurality of plate members located in adjacent side by side relation across the coil lengths,
- (c) each plate member including a flange provided with a plurality of recesses,
- (d) each recess having an entrance and a margin offset to one side of the entrance providing a portion overlapping the coil length that is received in the recess and which is offset from the entrance in a direction toward the offset margin,
- (e) the associated coacting recesses of adjacent plate members receiving the same coil length being relatively reversed so that the offset margins of associated coacting recesses of adjacent plate members cooperate to overlap the coil length extending therebetween so as to fix the plate members to the coil,
- (f) the entrances of the associated coacting recesses of adjacent plate members being displaced out of alignment relative to each other to preclude withdrawal of the coil length through said entrances, and
- (g) means holding the plate members in assembly.

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