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Perez

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[54] **REPLACEABLE DEFROST HEATER FOR FIN AND TUBE EVAPORATOR AND SPRING RETAINING CLIP FOR SAME**

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[52] **U.S. Cl.** ..... **62/276,** 24/261 B, 165/64, 219/530, 219/531, 219/532, 219/537, 219/540

[51] **Int. Cl.** **B25b 27/14**

[58] **Field of Search** ..... 219/530, 531, 532, 219/535, 536, 537, 540; 165/64, 67, 76; 62/276; 148/54, 68, 74; 85/8.8; 24/139, 261 B, 261 WL

[56] **References Cited**

UNITED STATES PATENTS

2,529,215	11/1950	Hicke	62/276 X
3,063,253	11/1962	Dickson et al.	62/276 X
3,099,914	8/1963	De Witt et al.	62/276
1,176,210	3/1916	Farley	24/139 X
1,222,510	4/1917	Zirkle	24/139
1,446,362	2/1923	Vogel	24/261
2,687,626	8/1954	Bartlowe	62/276
2,749,717	6/1956	Duncan et al.	62/276 X
2,819,858	1/1958	Mittendorf	148/54
3,343,596	9/1967	Kritzer	165/67
3,691,348	9/1972	Kunz	219/532

FOREIGN PATENTS OR APPLICATIONS

561,596	8/1958	Canada	62/276

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[57] **ABSTRACT**

Spring retaining clips maintain an electrical heating wire in contact with the side edges of the fins in a fin and tube refrigeration evaporator coil. The U-shaped spring retaining clips project within the spaced fins with the free ends grasping opposed sides of a longitudinally extending tube carried by the right angle, spaced heat transfer fins.

8 Claims, 2 Drawing Figures

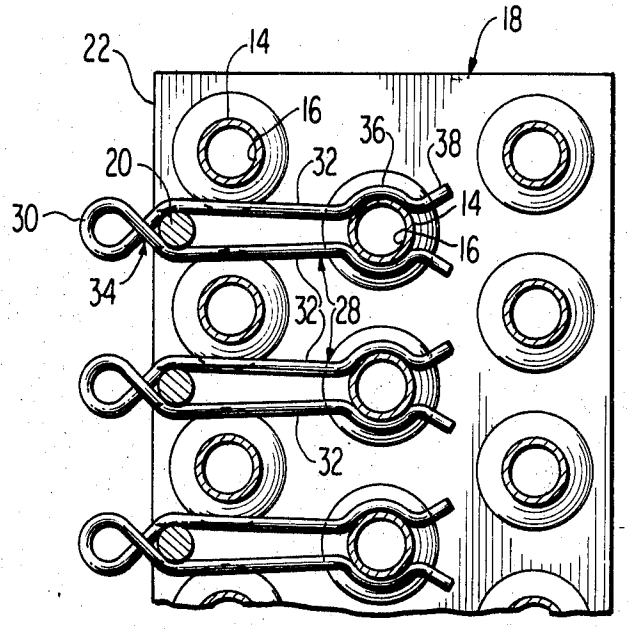
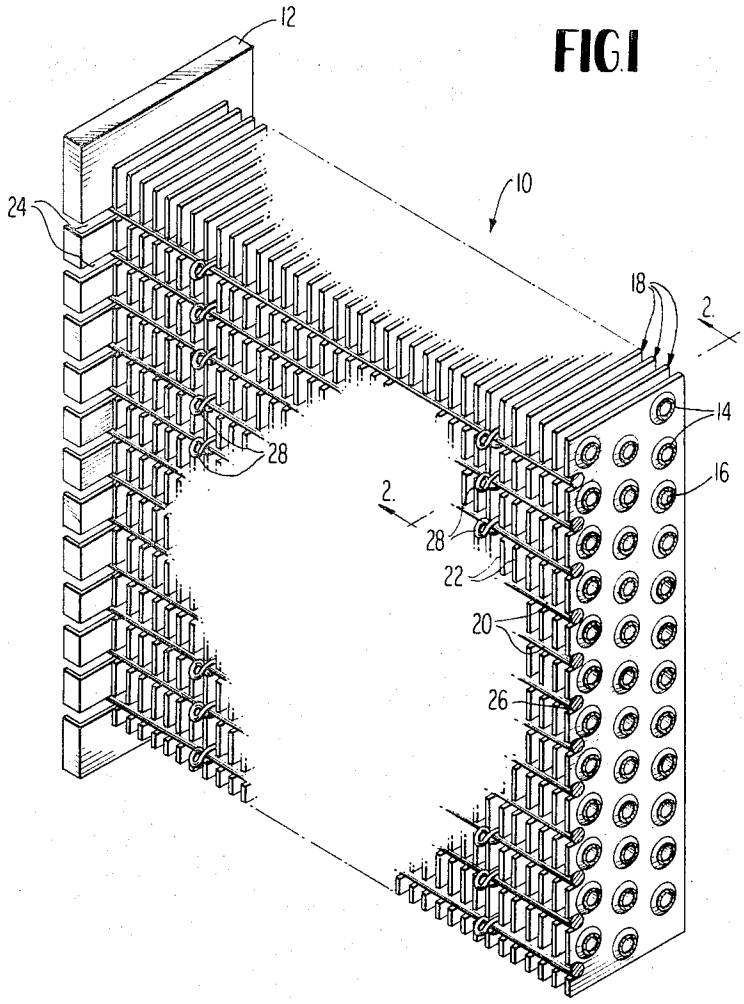


FIG.1


12
10
24
18
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14
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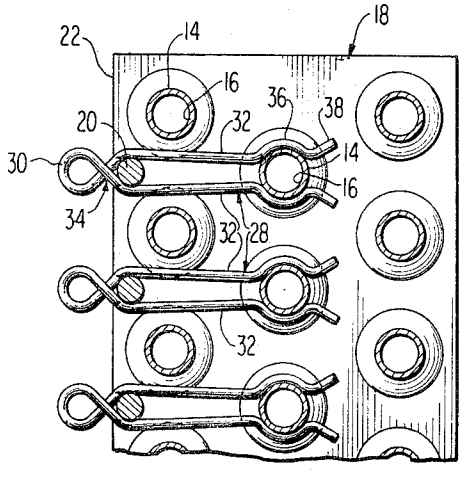
28
22
20
26


22
14
18
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36
38
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FIG.2

REPLACEABLE DEFROST HEATER FOR FIN AND TUBE EVAPORATOR AND SPRING RETAINING CLIP FOR SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to fin and tube evaporator coils, and more particularly to the employment of a plurality of wire spring retaining clips for removably coupling an electrical heater wire to the side edges of the evaporator coil heat transfer fins.

2. Description of the Prior Art

Refrigeration systems for cooling food storage rooms such as meat coolers, are constructed in conventional fashion with a plurality of longitudinally extending spaced rows of refrigerant carrying tubes supported by longitudinally spaced, thin stamped metal fins which define an elongated, rectangular assembly. Air is forced to pass through the spaced fins at right angles to the axis of the tubes carrying the refrigerant.

In order to periodically remove the solidified condensate on the exterior surface of the tubes and on the fins supporting the same, stainless steel sheathed electric heaters constituting essentially resistance wire heaters are conventionally inserted through longitudinally aligned openings or holes in the fins and, upon energization of the heaters, the heat spreads readily through the wires to the tubes to melt the solidified condensate.

Of necessity, the replacement of the electrical heater requires practically complete dismantling of the unit cooler which is time consuming and inordinately expensive.

SUMMARY OF THE INVENTION

The present invention is directed to the employment of spring retaining clips which permits the installation and retention of the electrical heater on the fin and tube evaporator coil without the necessity of tools, while permitting instantaneous replacement of any defective heater or heaters.

Specifically, the invention is directed to a fin and tube evaporator coil for a refrigeration system, in which the coil comprises a plurality of spaced, parallel refrigerant carrying tubes extending through closely spaced thin metal fins which extend generally at right angles to the axis of the tubes and form therewith a longitudinally extending assembly. The improvement comprises a plurality of spring retaining clips which carry the electric wires in contact with the fins, with the clips inserted within the fins at longitudinally spaced positions and removably clamped to the refrigerant carrying tubes. The wires extend parallel to the direction of a tube and the edges of the fins are preferably recessed to receive the wires. The spring retaining clips are preferably formed of spring wire, bent into U-shape, with the closed end carrying the heater wire and the open ends grasping respective sides of the refrigerant carrying tubes. Where the tubes form alternately offset, multiple rows, the clips extend between the tubes of the row closest to the edge of the fins carrying the wire, and have their free inner ends coupled to tubes of a succeeding row. Preferably, the legs of the clips are crossed at their closed ends to provide the resilience necessary to the clip and the wire is captured by the crossed legs and forced into contact with the edge of the fin. The free ends of the legs are given opposed concave curvature and have a radius of curvature corresponding to the radius of the pipe to readily grasp the tubes of the inner row.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a portion of a fin and tube evaporator coil employing the improved readily demountable electric heater defrost arrangement of the present invention.

FIG. 2 is a sectional, elevational view of the evaporator coil of FIG. 1 taken about line 2—2, and illustrating the improved spring retaining clips employed in the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning to the drawings, a fin and tube evaporator coil **10** which may form a major component of a unit cooler for food storage room such as a meat cooler, frozen food locker or the like, is constituted by a rectangular formed metal tube sheet **12**, at its left end, FIG. **1**, and being provided with a similar tube sheet at the opposite end (not shown). The evaporator coil **10** is purposely broken away at its right end to further illustrate the construction of the same. In this respect, the evaporator coil consists essentially of a plurality of refrigerant carrying tubes **14** which pass through spaced, aligned openings **16** in horizontally offset rows within the stamped thin sheet metal fins **18.** Fins **18** are generally rectangular in form and support the refrigerant carrying tubes **14** at right angles to the plane of the fins. Such construction is conventional and the coils formed thereby are conventionally known as fin and tube heat exchangers. It is essential only to note that the expansion of liquid refrigerant within the tubes **14** which changes from liquid state to gaseous state, absorbs heat from the air surrounding the same. The moisture in the air condenses on the evaporator coil **10,** covering the surfaces of the fins and the tubes and may build up to the point where the frozen condensate actually prevents or greatly impairs the passage of air through the fins and around the tubes. Periodically, therefore, means must be employed to defrost this condensate.

In the present invention, this is achieved by a stainless steel sheathed electric heater which comprises spaced parallel heater wires indicated **20.** The small diameter wires **20** extend parallel to the refrigerant carrying tubes **14** and adjacent to or in contact with leading side edges **22** of the heat conducting fins **18.** Preferably, the tube sheet **12** is slotted at **24** and the edges **22** of fins **18** are likewise slotted as at **26,** permitting the heater wires **20** to be located in excellent heat contact position with respect to the fins and, in this case, just outside the first row of refrigerant carrying tubes **14.** It is noted that the illustrated evaporator coil **10** is provided with three parallel rows of vertically spaced refrigerant carrying tubes **14** with the tubes of a given vertical row horizontally offset from the tubes of the adjacent row. The inner row of tubes is offset such that its tubes are centered between the tubes of the first row, and spaced rearwardly from the leading edge **22** of the fins **18** to a greater extent than that of the first row of tubes **14.** In this respect, the electrical heater wires **20** are in horizontal alignment with respective tubes of the intermediate row of tubes as defined by the slots or recesses **26** within the edges **22** of the fins **18.**

The present invention is particularly directed to the employment of a plurality of spring wire retaining clips indicated generally at **28,** which project into the slots

defined by spaced fins **18** to insure the positioning and maintaining of the heater wires **20** within slots **26** of the fins **18.** In this respect, the spring wire clips **28** are preferably formed of stainless steel spring wire on the order of 0.10 inch diameter. They are generally U-shaped in configuration as evidenced in FIG. **2,** consisting of a base **30** and a pair of legs **32** which are crossed as at **34** adjacent the base to provide the desired resiliency to the spring clips. The legs **32** adjacent their free ends are provided with opposed, concave curved portions **36** and terminate in outwardly flared ends **38.** The curved portions **36** are spaced or separated in the relaxed state somewhat less than the outside diameter of the refrigerant carrying tubes **14.** The spacing between the legs **32** adjacent the cross over point **34** is generally on the order of the diameter of the electrical heater wires **20,** such that the wires **20** are closely embraced by the clips adjacent base **30,** with the legs at this point maintaining the wires **20** within the fin slots **26.** The wires **20** are prevented from moving out of the slots **26** in the absence of release of the free ends of the clip from their respective tubes **14** of the intermediate row of tubes. The means for electrically connecting the heater wires **20** in series or in parallel or for energizing the same, as well as the components of the refrigeration system supplying refrigerant to tubes **14** have purposely been eliminated from the drawing, since such means are conventional in the art. Further, while the clips are of such a length and configuration that their inner ends are coupled to the offset, intermediate row of refrigerant carrying tubes **14,** the clips may be modified to permit coupling of the same to the first row of heat exchange tubes, if desired. Further, while two longitudinally spaced clips **28** are shown in the arrangement of FIG. **1** for maintaining each defrost wire **20** within horizontally aligned slots **26** and in good heat transfer relationship to the fins supporting the same, each wire may have one or more clips **28** coupling the same to the evaporator coil **10.** Further, while wires **20** are provided intermediate of each pair of the tubes of the first row, more or less wires may be employed depending upon the capacity of the wires to defrost the evaporator coil under the operating conditions of the refrigeration system. The electrical heaters **20** are described in terms of stainless steel sheathed electrical resistance heaters and illustrated schematically in terms of solid conductors, however, it is obvious that the defrost mechanism may comprise any applicable electrical resistance heater of tubular configuration and compatible with the evaporator coil and which extend in rod or wire like fashion in contact with one edge of the multiple heat conducting fins **18.** While the heaters **20** are indicated as being received within slots **26** within edges **22,** of the fins **18,** since the wires are surrounded by legs **32** of the wire clips, the edges **22** of the fins may be unbroken and the wires merely pressed into good heat transfer contact with the edges of the same, and lie flush with the front edge of the evaporator coil rather than internally of the fins under the bias of clips **28.**

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a fin and tube evaporator coil for a refrigeration system comprising a plurality of spaced parallel refrigerant carrying tubes tubes extending through closely spaced, thin metal fins, positioned generally at right angles to the axis of the tubes and forming a longitudinally extending assembly therewith, and a plurality of sheathed electric heater wires in juxtaposition to said fins and tubes for defrosting the same, the improvement wherein:

said wires extend across the ends of said fins parallel to and spaced from said tubes, and

a plurality of U-shaped, wire spring retaining clips are coupled to said electric heater wires at spaced longitudinal positions with the outer closed ends of said U-shaped clips embracing said wires and with their free inner ends inserted within said fins and removably clamped to said tubes to maintain the wires in heat transfer contact with said fins.

2. The fin and tube evaporator coil as claimed in claim **1,** wherein said fin edges are slotted and receive said wires.

3. The fin and tube evaporator coil as claimed in claim **1,** wherein said refrigerant carrying tubes form multiple rows with the tubes of one row offset from the tubes of another row and wherein said clips extend between tubes of the row closest to said edges carring said wires and are coupled to respective tubes of a succeeding row at their inner ends.

4. The fin and tube evaporator coil as claimed in claim **2,** wherein said refrigerant carrying tubes form multiple rows with the tubes of one row offset from the tubes of another row and wherein said clips extend between tubes of the row closest to said edges carring said wires and are coupled to respective tubes of a succeeding row at their inner ends.

5. The fin and tube evaporator coil as claimed in claim **1,** wherein said U-shaped wire clips have inwardly extending legs, crossed at their closed ends to provide resiliency to the clip, said electric heater wires are captured inside the crossed legs and forced into contact with the fins, and wherein the free ends of the legs are provided with opposed, concave curvatures grasping respective sides of said refrigerant carrying tubes.

6. The fin and tube evaporator coil as claimed in claim **2,** wherein said U-shaped wire clips have inwardly extending legs, crossed at their closed ends to provide resiliency to the clip, said electric heater wires are captured inside the crossed legs and forced into contact with the fins, and wherein the free ends of the legs are provided with opposed, concave curvatures grasping respective sides of said refrigerant carrying tubes.

7. The fin and tube evaporator coil as claimed in claim **3,** wherein said U-shaped wire clips have inwardly extending legs, crossed at their closed ends to provide resiliency to the clip, said electric heater wires are captured inside the crossed legs and forced into contact with the fins, and wherein the free ends of the legs are provided with opposed, concave curvatures grasping respective sides of said refrigerant carrying tubes.

8. The fin and tube evaporator coil as claimed in claim **4,** wherein said U-shaped wire clips have inwardly extending legs, crossed at their closed ends to provide resiliency to the clip, said electric heater wires are captured inside the crossed legs and forced into contact with the fins, and wherein the free ends of the legs are provided with opposed, concave curvatures grasping respective sides of said refrigerant carrying tubes.

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