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L. L. PRUEHS

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CONTROL BULB CLAMP

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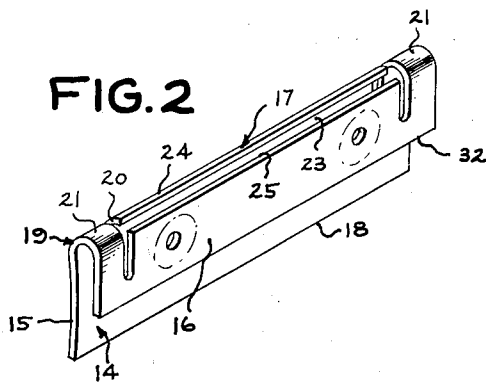
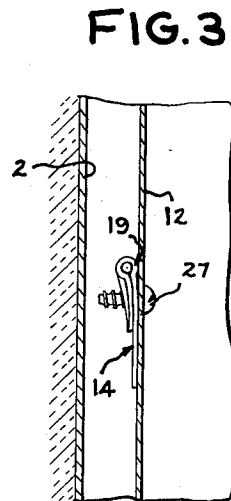
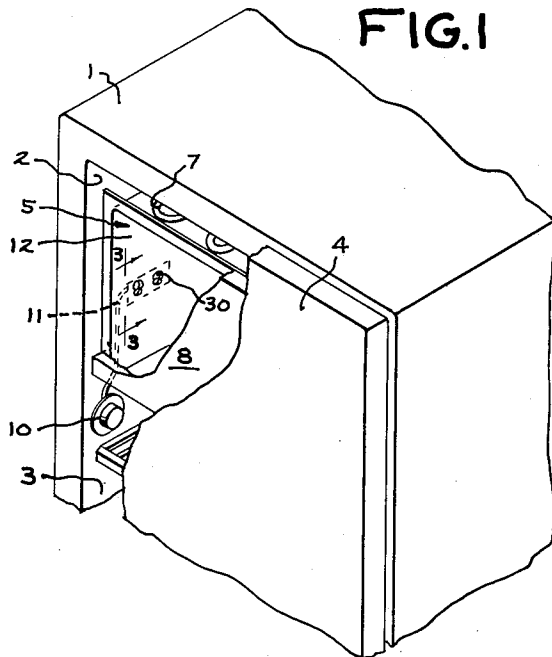


FIG. 5

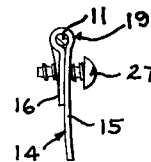
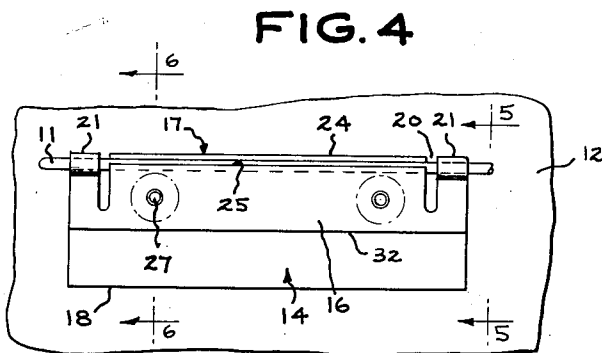
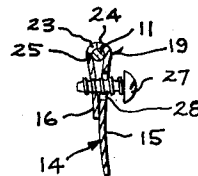


FIG. 6



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CONTROL BULB CLAMP

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The present invention relates to a clamp for clamping a tubular member in heat exchange relation with a flat surface and is more particularly concerned with an improved clamping means for holding a predetermined length of the control capillary tube of a refrigerator thermostat in uniform heat exchange relationship with the evaporator component of the refrigerator.

Household refrigerators of the single door type which have both the fresh food storage compartment and a frozen food storage compartment are usually cooled by a single evaporator forming part or all of the wall structure of the frozen food compartment. Such refrigerators normally comprise a cabinet including spaced inner and outer shells with the inner shell forming the main walls of a fresh food storage compartment. The freezer compartment is generally a box-like metal structure extending across the upper portion of the fresh food compartment with the walls thereof spaced from the main cabinet walls. For maximum storage capacity, it is desirable that the walls of the freezer compartment be positioned as close as possible to the adjacent walls of the cabinet inner shell or liner or in other words that the space between, for example, the side walls of the freezer compartment and the side walls of the cabinet liner be held to a minimum. The single evaporator is associated with one or more walls of the freezer compartment and constitutes the sole means for cooling the contents of the two compartments. The operation of the refrigerating system including the evaporator is controlled by the temperature of the freezer compartment and is designed to maintain that compartment at freezing temperatures. This requires that the sensing bulb for the control thermostat be positioned in heat exchange relationship with a portion of the freezer compartment, as for example in heat exchange relationship with one of the metal side walls thereof. To protect the control bulb during normal use of the refrigerator, it is common practice to mount the control bulb on the exterior surface of one of the walls that is between the wall of the freezer compartment and the adjacent cabinet liner wall.

The present invention has as one object thereof the provision of an improved clamp for the semi-blind assembly of a control bulb to the exterior surface of a freezer compartment evaporator.

Another object of the invention is to provide an improved means for clamping the control bulb to an evaporator surface, which clamping means is designed to be preassembled with the control bulb and thereafter mounted on a relatively inaccessible portion of an evaporator or freezing surface.

Further objects and advantages of the invention will become apparent from the following description thereof, reference being made to the accompanying drawings, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In the drawings:

FIGURE 1 is a perspective view of a portion of a refrigerator cabinet, partly in section, illustrating the manner in which the control bulb is clamped to an evaporator surface employing the clamp of the present invention;

FIGURE 2 is a perspective view of the improved clamp of the present invention;

FIGURE 3 is a sectional view taken generally along line 3—3 of FIGURE 1;

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FIGURE 4 is an elevational view of the clamp taken generally along line 4—4 of FIGURE 3;

FIGURE 5 is a sectional view of the clamp and control bulb taken along line 5—5 of FIGURE 4; and

FIGURE 6 is a sectional view similar to FIGURE 5 taken along line 6—6 of FIGURE 4.

With reference to FIGURE 1 of the drawings, there is shown a portion of a household refrigerator cabinet comprising an outer shell 1 and an inner shell or liner 2 spaced from one another. In accordance with the usual practice, the spaces between the two shells is filled with suitable heat insulating material. The shell or liner 2 primarily defines a fresh food or main storage compartment 3 within the cabinet and the access opening to this compartment is closed by means of a single insulated door 4. A freezer compartment 5 for the storage of frozen foods is positioned in the upper portion of the storage compartment 3 and the single evaporator 7 for cooling the contents of both compartments is associated with the walls of the freezer compartment 5. The access opening to the freezer compartment 5 is closed by an inner door 8. It will be understood that the evaporator 7 forms part of a refrigerating system including a compressor and a condenser (not shown) adapted to supply condensed refrigerant to the evaporator 7 when the compressor is operating. By operating the evaporator 7 at below freezing temperatures the contents of the freezer compartment 5 are maintained at below freezing temperatures by the direct contact of the evaporator with the freezer compartment walls while the contents of the main storage compartment 3 are maintained at above freezing temperatures by air circulation around the walls of the freezer compartment 5.

The operation of the compressor is controlled by means of a temperature responsive control device or thermostat of a gas filled expansible bellows type generally indicated by the numeral 10 mounted within the insulated space between the inner and outer shells 1 and 2 and including a feeler or control bulb 11 of the capillary tube type clamped in heat exchange relationship with a wall portion of the freezer compartment 5. This control is designed so that the compressor will operate to maintain the freezer compartment 5 continuously at below freezing temperatures.

In order to protect the control bulb 11 from damage during normal use of the refrigerator, it is desirable that it be mounted on the exterior surface of one of the walls defining the freezer compartment 5 as for example on the exterior surface of the wall 12 where it is protected during normal usage of the refrigerator. It is important however that regardless of where or how the control bulb 11 is secured to the freezer or evaporator compartment wall it must be securely and accurately clamped over its full intended contact area to obtain accurate temperature control.

When the freezer compartment is designed to provide maximum storage capacity, the walls thereof are spaced as closely as possible to the walls of the main liner 2, this spacing being sufficient only to provide the required temperature differential between the walls of the freezer compartment 5 and the walls of the liner 2. With these spaces reduced to a minimum, it is difficult to assemble the control on the outer surface of the freezer wall such as the freezer wall 12 with the usual clamps employed for this purpose. This problem is compounded by the fact that for uniform temperature calibration for cabinets of the same type, it is necessary that the same predetermined length of the control bulb be fastened in heat exchange relationship with the freezer or evaporator wall in each cabinet and that this entire length be firmly clamped into heat exchange relationship with that wall.

In accordance with the present invention there is provided a clamping means which is particularly suited for the assembly of a control bulb or capillary to a relatively inaccessible surface in such a manner that a uniform temperature calibration can be obtained. More specifically the clamp of the present invention is designed for preassembly on a control capillary followed by assembly thereof on a flat evaporator or freezing surface.

As illustrated in the drawing and with particular reference to FIGURE 2 thereof, the clamp of the present invention comprises a single sheet of metal having good heat conducting properties, such as a sheet of aluminum, bent longitudinally thereof to form a clamping member 14 of U-shaped cross-section and including a front face 15 and a rear wall 16 connected by a return bend 17 extending longitudinally of the clamp member 14. The length of the member 14 determines the length of capillary which will be held in heat exchange relationship with the wall surface. The face 15 of the member is of arcuate cross-section in a transverse direction but flat in a longitudinal direction. In other words, the lower edge 18 thereof and the upper area 19 on the front side of face portion 15 are relatively straight and parallel so that when concave face portion 15 of the clamp is placed in contact with a flat freezer or evaporator surface, the face 15 will engage the flat evaporator surface at least along the longitudinal lines comprising the upper area 19 adjacent the return bend 17.

Slots 20 spaced from the opposite ends of the member 14 and extending through the bend 17 and a substantial distance into the front and rear face portions provide loops at each end of the clamp which can be deformed independently of the remaining portions of the clamp. A longitudinal slit 23 connecting the slots 20 divides or separates the front and rear face portions. More specifically the slit 23 is provided in the rear section of bend 17 and provides in this part of the clamp, a tube retaining portion 24 in the form of a reverse lip on the face of the clamp. One edge of slit 23 forms the straight upper edge 25 of the rear wall portion 16.

The clamp also includes one or more screws 27 which extend loosely through suitable openings 28 provided in the face portion 15 of the clamp and threadably engage the rear wall 16 of the clamping member 14.

In the use of this clamp for the blind assembly of a control bulb capillary on a freezer or evaporator surface, the control capillary 11 is inserted into the clamping member 14 in a position to be enclosed by the return bend portion of the member 14 and to be in contact with the loops 21 and the return lip 24 forming part of the clamping member 14. After the bulb 11 is so positioned, the two return loops 21 at the opposite ends of the clamping member 14 are crimped or compressed about the tube 11 to lock the clamp member 14 on the tube 11 as indicated in FIGURES 4 and 5 of the drawing. With the clamping member 14 thus pre-assembled on the control capillary tube 11 and securely held thereon by compression of the loops 21, the clamp can be moved into the desired position on the outer surface of a freezer wall such as the freezer wall 12 by grasping the control capillary 11 at a point remote from the clamp and inserting the clamp and the control capillary into the space between the wall 12 and the liner wall 2.

The evaporator or freezer wall 12 is provided with key-hole slots 30 as indicated in FIGURE 1 of the drawing which are adapted to receive the heads of the screws 27. After the screws have been inserted through and positioned in these slots 30, tightening of the screws 27 securely fasten the clamp and the capillary 11 to the wall 12. As the screws are tightened the clamp is drawn into uniform engagement along line 19 with that wall and the rear wall 16 of the clamp is drawn into engagement with the capillary 11 to hold it in full engagement with the face portion 15 of the clamp. To this end the clamping member 14 or more specifically the return lip portion 24

forming part of the return bend 17 preferably extends about 90° about the circumference of the capillary tube 11 and the upper edge 25 of the rear wall 16 of the clamping member is designed to contact the capillary tube 11 slightly below its horizontal diameter so that this edge, when brought into firm engagement with the tube 11 upon tightening of the screws 27, will press the capillary 11 forwardly into firm engagement with the front wall 15 of the clamping member 14 and at the same time provide a slight upward thrust on the capillary to bring the capillary into complete linear engagement with the return lip portion 24 of the clamping member. The entire length of capillary contained within the clamp is thereby brought into firm engagement and hence good heat transfer relationship with the face portion 15 of the clamp. The arcuate contour of the face portion 15 also assures a linear engagement of the entire area 19, which is opposite the bulb 11, with the outer surface of the wall 12 when the screws 27 are tightened.

The lower edge 32 of the rear wall 16 of the clamp is also arranged to contact the face portion 15 along a line approximately half-way between the top and bottom edges thereof, that is along a section of the arcuate face 15 spaced from wall 12 so that as the screws 27 are tightened the arcuate face 15 tends to flatten into engagement with the wall 12 and also assures a line engagement of the portion 19 with the wall 12.

From the above description it will be seen that there has been provided a clamp for a tubular member which permits a blind clamping of the tubular member on a flat surface and which assures a good heat exchange relationship between the tube and that surface in the final assembly. The clamp is of simple and low cost construction and is so designed that it can be readily preassembled on the capillary tube and also easily assembled in heat exchange relationship with the flat surface.

While there has been shown and described a specific embodiment of the present invention, it is to be understood that the invention is not limited thereto and it is intended by the appended claims to cover all such modifications as come within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A clamp for clamping a tube in heat exchange relation with a surface and adapted to be preassembled on said tube,

said clamp being formed of a single sheet material member transversely bent to a substantially U-shape cross section to provide a transversely concave face portion and a rear portion, and a return bend portion between said face and rear portions adapted to receive said tube, said member including means defining a loop at each end of said member adapted to be bent into clamping engagement with said tube for holding said clamp on said tube,

fastening means for securing said clamp to said surface extending loosely through said face portion and threadably engaging said rear portion,

said member including a longitudinal slit in the return bend portion thereof separating said rear and front portions and defining a curved retaining lip on said face portion and a substantially flat straight edge on said rear portion for engaging and clamping said tube into engagement with said face portion and said lip upon tightening of said fastening means.

2. A clamp for clamping a tube in heat exchange relation with a surface and adapted to be preassembled on said tube,

said clamp being formed of a single sheet material member transversely bent to a substantially U-shape cross section providing a rectangular transversely concave face portion, a rear portion narrower than said face portion, and a return bend portion between

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said face and rear portions adapted to receive said tube,
said member including slots extending through said return bend and into said face and rear portions adjacent the ends of said face and rear portions defining a loop at each end of said member adapted to be bent into clamping engagement with said tube for holding said clamp on said tube,
fastening means for securing said clamp to said surface extending loosely through said face portion and threadably engaging said rear portion,
said member including a longitudinal slit in the return

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bend portion thereof and between said slits separating said rear and front portions and defining a rearwardly curved tube retaining lip on said face portion and a substantially flat straight edge on said rear portion for engaging and clamping said tube into engagement with said face portion adjacent said lip upon tightening of said fastening means.

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