A method for installing heat transfer panels and a heat transfer panel assembly having angled louvers for greater and more uniform dissipation of a convected heat transfer medium, such as air. The heat transfer panel assembly providing a broader and more uniform heat transfer means to affected surfaces, and the method of installation providing a simpler and quicker means for installation.
FIG. 3
SECTION A-A

2

10
FIG. 4
METHOD AND APPARATUS FOR HEATING AND COOLING

BACKGROUND OF THE INVENTION

[0001] The present invention is directed toward a heat transfer panel which is attached to tubing carrying a heat transfer liquid. More particularly, the present invention is directed to a heat transfer panel that directs the convection heat in specific directions and the heat transfer panel can be easily affixed to either plastic or metal tubing and easily installed into building structures in any available position. As used herein, the term “heat transfer” encompasses heat exchange for both heating and cooling purposes. For example, the heat transfer tubing could contain heated water for heating or a refrigerant for cooling.

[0002] The installation of heat transfer panels attached to heat transfer tubing in walls, floors and ceilings are well known. For example, U.S. Pat. Nos. 5,799,723; 5,743,330; 5,454,428; 5,078,203; and 4,646,814 all disclose installations for heat transfer tubing and heat transfer panels within structures. Of the various types of radiant heating systems, one of the more popular types utilizes a heated liquid such as water which is pumped through a closed loop piping system. The closed loop piping is typically mounted in close contact with a floor for Radiant Floor Heating (RFH) or to a wall for Radiant Wall Heating (RWH). Generally, the piping runs parallel to the floor joists or wall studs. Attached to the piping at various intervals are flat radiant panels that abut the sub-flooring or the inner walls to enhance the radiation of heat from the closed loop piping to the floor or wall.

[0003] The liquid is typically heated by a boiler and when a thermostat indicates the need for heat, a pump forces the heated liquid to travel through the piping. Typically, the boiler heated liquid is mixed with the return liquid at a rate designed to control the heated liquid in the closed loop piping at a predetermined temperature. This necessitates various valves and control systems. As the heated liquid travels through the piping, heat is conducted from the liquid to the piping, from the piping to the radiant panels and from the radiant panels to the flooring or the walls either by direct contact or by convection with the surrounding air.

[0004] U.S. Pat. No. 5,542,603 to Macduff discloses a wall and/or floor hydronic heating system that has the heat tubing and heat radiating panels mounted a short distance below the subflooring or wall surface and running perpendicular to the floor joists or wall studs. According to this patent, mounting the tubing and radiation panels below the flooring obviates the possibility of damage to the tubing by unaware individuals driving fasteners into the floor. This patent also states that mounting the tubing and radiation panels away from the flooring or walls obviates the traditional “hot spots” found on the prior art systems.

[0005] The heat transfer panels of U.S. Pat. No. 5,542,603 consists of two identical parts that are clipped together over the tubing. Each part has a conduit gripping part and a heat radiating part. The conduit gripping part is a groove formed to the contour of one half of a longitudinal section of the tubing. The heat radiating part is louvered to facilitate a circulation of air through the heat radiating part. This heat radiating part promotes circulation of the air in the subfloor space which in turn promotes an even and rapid convection of heat from the radiating fin to the subfloor surface thereby reducing the “hot spots” on the flooring and/or walls. FIG. 6 of U.S. Pat. No. 5,542,603 shows the convection currents from the heat radiating panels to be perpendicular to the heat radiating panel.

SUMMARY OF THE INVENTION

[0006] It is a primary object of the invention to provide a simple and inexpensive heat transfer panel that overcomes limitations in the prior art.

[0007] It is a further object of the invention to provide a heat transfer panel that can direct the flow of air to provide for a greater dissipation of heat or cooling to a structure’s surface.

[0008] It is yet another object of this invention to provide both a broader area and more even heat transfer to a room, floor, wall and/or ceiling.

[0009] It is yet another object of this invention to provide a one piece heat transfer panel that is easily installed onto new and/or existing heating or cooling lines.

[0010] These and other objects are achieved with a heat transfer panel which has a single tube gripping section along the center length of the panel, self contained retaining clips and louvered fins on either side of the tube gripping section. The single tube gripping section being adapted to engage the tubing in close contact in order to promote heat transfer between the tubing and the heat transfer panel. The louvered fins are angled on either side of the tube gripping section in such a manner as to direct the air passing through the louvers to be angled away from the centerline of the tubing and onto a broader area of the surface desired to be heated or cooled.

[0011] The invention therefore provides a simplified heat transfer panel whereby a closed loop system is installed under a floor, in a ceiling or behind a wall. The heat transfer panels being snapped onto the closed loop tubing and the retaining clips bent into place. As the heating or cooling material in the closed loop tubing passes through the tubing, the heat transfer panels attached to the tubing exchange heat with the surrounding air in the direction of the angled louvers thereby either warming or cooling the subfloor, wall and/or ceiling surface over a larger surface area and with more even heat or cold dissipation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The invention is explained in more detail herein below with reference to figures, which merely illustrate exemplary embodiments and in which:

[0013] FIG. 1 shows a perspective view of a heat transfer panel assembly in accordance with the invention,

[0014] FIG. 2 shows a plan view of the end of the heat transfer panel,

[0015] FIG. 3 shows a cross sectional view along A-A through the heat transfer panel of FIG. 1, and

[0016] FIG. 4 shows a schematic of the convection currents promoted by the heat transfer panel shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

[0017] Reference will now be made in detail to the description of the invention as illustrated in the drawings.
Although the invention is described in connection with the drawings, there is no intent to limit the invention to the embodiments disclosed therein. On the contrary, the intent is to include all alternatives, modifications and equivalents included within the scope and spirit of the invention as defined by the appended claims.

**0018** FIG. 1 shows a top isometric view of a heat transfer panel assembly 1 according to the invention. The heat transfer panel assembly 1 consists of a heat transfer panel 2 and a plurality of retainer bars 3. The heat transfer panel 2 is preferably made of an efficient thermal conducting material such as aluminum, steel, copper, plastic or the like. The heat transfer panel 2 consists of a conduit gripping part 4 and a heat exchanger part 5. The heat transfer panel 2 is shaped around the heating and/or cooling conduit 6 at the conduit gripping part 4. The conduit 6 being installed at a distance from a wall, floor and/or ceiling surface (not shown) such that there is an air gap between the installed heat transfer panel 1 and the said wall, floor and/or ceiling surface to allow for the circulation of heated or cooled air. The said heated or cooled air being utilized to heat or cool a wall, floor, ceiling and/or to heat or cool the air in a room.

**0019** Once the heat transfer panel 2 is in position on the heating and/or cooling conduit 6, the retainer bars 3 are placed on the top side of the heat transfer panel 2 extending past the outer edges 7 and 8 of the heat transfer panel 2 and above the outer side of the heating and/or cooling conduit 6. The ends 9 of the retainer bars 3 are then bend over to secure the retainer bars 3 and the heating and/or cooling conduit 6 to the heat transfer panel 2.

**0020** FIG. 2 is a plan view of one end of the heat transfer panel 2. The conduit gripping part 4 may be formed as a 180 degree semi-circle or as a semi-circle greater than 180 degrees as shown in FIG. 2 to aid in retaining the heating and/or cooling conduit 6 in place in the heat transfer panel 2. The end view of the heat exchanger part 5 also show the end view of the heat transfer fins or louvers 10 that are part of the heat exchanger parts 5.

**0021** FIG. 3 shows a cross-sectional view of the heat transfer panel 2 taken along line A-A of FIG. 1. As shown, the fins or louvers 10 are formed at an angle of roughly 60 degrees to the plane of the heat transfer panel 2, although angles other than 60 degrees would be entirely conceivable within the purview of the present invention without detracting from the scope and spirit of the invention.

**0022** By angling the fins or louvers 10 in the heat transfer panel 2, the convection currents 11 shown in FIG. 4 that transfer the heat differential between the surrounding air and the heat transfer panel 2 are directed to flow in a direction other than 90 degrees to the heat transfer panel 2. This enables the heated (or cooled) air to disperse itself in an area greater than would be covered by a heat transfer panel 2 with the fins or louvers 10 set at 90 degrees to the heat transfer panel 2 plane. As such, a larger surface area of a room, floor, wall, ceiling or other structure (not shown) to be heated or cooled is affected. This dispersion of heated or cooled air not only provides a larger surface area of coverage, but also reduces hot spots in the surface area and provides more uniform heating or cooling to the room air or larger surface area to be affected.

**0023** In addition, the fins or louvers 10 can be spaced such that the fins or louvers 10 near the center of the heat transfer panel 2 are spaced farther apart than the fins or louvers 10 near the outer ends of the heat transfer panel 2. This embodiment has the advantage of providing an even amount of convected air being directed at the desired surface area thus providing more uniform heating or cooling over a wider surface area with the additional result of further reducing the occurrence of hot spots.

**0024** The method for installing this invention is also of benefit to the installer. Current methods require two half panels that are fitted about the heat transfer conduit 6 and then manually held in place while the two separate panels are riveted together about the conduit. This existing method requires a multitude of rivets, or other fastening devices, a riveting or fastening tool and the skills required to hold the pieces in place while riveting the pieces together.

**0025** The new method utilizes a flat retainer bar 3, preferably made of the same material as the heat transfer panel. The retainer bar 3 is easily formable with hand and/or finger pressure. During installation, the installer simply places the heat exchanger panel 2 onto the conduit 6 and then places a retainer bar 3 over the conduit 6 and over the sides 7 and 8 of the heat transfer panel 2. The installer then bends the two ends 9 of the retainer bar 3 over the edges 7 and 8 of the heat transfer panel 2 thereby containing and fixing the heat transfer panel 2 to the conduit 6. Two or more retainer bars 3 can be used for each heat exchange panel 2.

**0026** This new method of heat exchanger installation thereby eliminates the use of fasteners or rivets, the fastening or riveting tools, the dual panel halves and the skill required to hold the assembly in place and fasten the unit onto a heat transfer conduit. As such, this method of installation requires less operator skill, fewer parts and tools, is faster and more economical than the existing methods.

What is claimed is:

1. A room, wall, ceiling and/or under floor heat transfer panel connected to a heat transfer pipe that is mounted at a sufficient distance from a said wall, ceiling and/or floor so as to provide an air gap between the said heat transfer panel and the said wall, floor and/or ceiling, the improvement comprising having the heat transfer fins being angled away from the longitudinal center of the said heat transfer panel thereby causing the circulation of air to flow in a direction other than perpendicular to the said heat transfer panel.

2. The improvement according to claim 1, wherein the said air is any other gas or liquid medium utilized for the transfer of heat.

3. A means for attaching a heat transfer panel to a heat transfer conduit comprising the steps of:
   a. pressing the conduit gripping part of the said heat transfer panel onto the said heat transfer conduit;
   b. placing one or a plurality of flat retainer bars on the top of the said heat transfer panel with the said heat transfer conduit contained therein; and
   c. bending the ends of the said flat retainer bars over the sides of the said heat transfer panel thereby securing the said heat transfer panel to the said heat transfer conduit.

4. An apparatus for attaching and transferring heat from a heat transfer conduit to a room and/or a surface area comprising:
a. a heat transfer conduit, said heat transfer conduit having heated or cooled liquid running through the said conduit;

b. a heat transfer panel, said panel having a conduit gripping portion which is placed over the said heat transfer conduit thereby transferring heat to or from the said heat transfer conduit to the said heat transfer panel, said heat transfer panel then transferring heat to or from the said heat transfer panel to the air surrounding the said heat transfer panel, said air then transferring heat to or from the said surrounding air to the said room and/or said surface areas; and

c. retaining bars that are bent to clip over the sides of the said heat transfer panel and secure the said heat transfer conduit into the said heat transfer panel gripping portion.

5. The apparatus according to claim 4, wherein the said heat transfer panel has heat transfer fins formed into the said heat transfer panel, said fins being formed at an angle greater than horizontal to the plane of the said heat transfer panel and less than perpendicular to the plane of the said heat transfer panel and angled away from the horizontal center line of the said heat transfer panel.

6. The apparatus as recited in any one of claims 4 or 5, wherein the said air is any other gas or liquid medium utilized for the transfer of heat.

7. A means for transferring heated or cooled air to a room and/or a surface area that is larger than the surface area of the heat transfer panel, comprising the steps of:

a. forming a heat transfer panel with means for gripping a heat transfer conduit;

b. forming the said heat transfer panel with heat transfer fins angled at greater than zero degrees and less than ninety degrees from the plane of the said heat transfer panel;

c. attaching the said heat transfer panel by the said gripping means to the said heat transfer conduit;

d. securing the said heat transfer panel to the said heat transfer conduit by means of one or more retainer bars that are bent over the sides of the said heat transfer panel thereby trapping the said heat transfer conduit into the said gripping means of the said heat transfer panel; and

e. providing a means for flowing heated or cooled liquid through the said heat transfer conduit, said conduit transferring heat to or from the said heat transfer panel, said heat transfer panel transferring heat to or from the heat transfer fins, said heat transfer fins transferring heat to or from the said air surrounding the said heat transfer fins, said air transferring heat to or from the said air to the said room and/or said surface area.

8. The means according to claim 7, wherein the said air is any other gas or liquid medium utilized for the transfer of heat.

* * * * *