

## TEMPERATURE REGULATING MODULE

### Field Of Invention

The present invention relates to temperature regulating module to be installed within  
5 a building to attain temperature regulation through use of condensate and cool  
exhaust air pre-cooling intake air through energy efficiency primary air system. More  
specifically, the disclosed invention adopts more energy efficient pre-cooling module  
and utilizes parallel metal fins installed along the pipe system layered inside the  
panel to condition temperature of an enclosed area where the disclosed panels are  
10 installed.

### Background Of The Invention

Hydronic radiant panels or other heat exchanging panels have been developed and  
put into practical use for years as an alternative tool to attain temperature  
15 conditioning within an enclosed area. Generally, in a large enclosed complex or  
building, the temperature is regulated via a module consisting of compressor,  
condenser, evaporator and the hydronic panels, within each of which having one or  
more continuous running pipelines installed right behind the layer surfacing the  
enclosed area where the conditioning is required. Temperature-regulated medium is  
20 then passed through the pipelines to carry out heat exchange with the enclosed area  
through the surfacing layer. Heat energy can either being absorb or transfer to the  
passing medium that excessive heat energy is then removed from or brought into the  
enclosed area. These panels can be installed as flooring or ceiling structures to attain  
the desired results. Though the medium is most likely a liquid, gases are used in rare  
25 cases.

For instance, United States patent application no. 6092587 discloses a flooring  
structure with heating mechanism composed of pipeline. Some other United States  
patent nos. 6073407 and 6910523B1 describes adhesive depression or longitudinal  
30 groove receiving the pipes. These reception are fabricated to be to ensure efficient

heat-conducting connection between the panels and the pipes. Other prior art are United States patent publication no. 2010/0126707, disclosing metallic holding member holding the pipes. Another United States patent publication no. 2007/0034367A1 disclosed use of angled louvers for dissipation of air as heat transfer medium.

There are as well heat exchanging panels used together with system for providing evaporative cooling using condensate water. For example, liquid refrigerant subcooling combined with evaporative cooling precooling the heat exchanger is disclosed in United States patent no. 7150160B2 and 6070423. Other precooling mechanism is disclosed in United States publication no. 2007/0000274A1 using indoor exhaust air as cooling air for evaporative condenser.

Apart from improving comfortability, temperature conditioning in enclosed area like buildings has become increasingly important in view of drastic change in worldwide weather. Greater adaptation of such panels or system in building is foreseeable. Still, there is one common shortcomings found in such heat exchanging panels that may limit its utilization. The condensed water not only facilitates undesired growth of mold in the given area but slippery floor surface also likely to cause accident in the enclosed area. In view of this, improvement has been made to overcome this problem. Joachim claims in United States patent application no. 5931381 a insulating layer located in between the flooring layer and the pipeline to avoid formation of cool or hot spots on the floor therefore eliminating possible condensation. International patent publication no. WO2010003378 offers another mechanism to avoid vapor condensation by not having direct contact between the surfacing layer and the pipeline. With the presence of insulating material or air layers, the occurrence of vapor condensation in these prior arts maybe significantly reduced at the expense of heat exchange's efficiency. In fact, similar problem can be attended via distributing the heat transferring or heat absorbing properties evenly on the surfacing layer.

Achieving heat equilibrium on the surfacing layer eradicates formation of particular hot or cool spot thereof and prevents potential condensation on these spots.

### Summary Of The Invention

5 The present invention aims to disclose a heat exchanging panels to be installed in an enclosed area to manipulate temperature or heat energy in the enclosed area. Specifically, the panels are coupled to a pipeline or conduit to channel or remove heat energy in the enclosed area using a flowable medium. Preferably, the flowable medium is water or refrigerant.

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Another object of the present invention is to offer a ceiling and/or flooring panels equipped with heat exchanging properties to regulate temperature in an enclosed area.

Further object of the present invention is to disclose a heat exchanging panels  
15 imparted with improved feature to reduce likelihood of vapor condensation onto the surface of the panel exposed to the enclosed environment. More specifically, the disclosed panels avoid formation of discrete cool or hot spots, which facilitate vapor condensation, on the surface of the panels.

20 At least one of the preceding objects is met, in whole or in part, by the present invention, in which one of the embodiments of the present invention is a multilayer heat exchanging panel comprising a heat conductive outer layer having an external and an inner surface; a heat conductive conduit positioned adjacent to the inner surface of the outer layer and running continuously on a plane substantially similar to  
25 the outer layer, a multilayer heat conductive metal fin with void or apertures in each layer through which holding the conduit and each edge of the multilayer metal fin contacts the outer layer; and each layer of the metal fin is adopted at a predetermined distance parallel to each other and perpendicular to the conduit; and a hollow cover fixed to the inner surface around edges of the outer layer forming an enclosure  
30 thereof and containing the multilayer metal fin and the conduit within the enclosure;

wherein the conduit is fashioned in a parallel arrangement or a serpentine arrangement with an inlet and an outlet to channel a temperature-regulated flowable medium. Preferably, the conduit is free from any direct contact with the hollow cover.

- 5 In another aspect, the multilayer metal fin with void or apertures housing the conduit and standing vertically and perpendicular towards the outer layer is configured to provide mechanical support to the outer layer.

In further embodiment the present invention also includes the use of cool exhaust air  
10 from the enclosed area to pre-cool intake air by means of an air to air heat exchanger.

In another aspect, the primary air handling unit is configured to collect condensate as water source to cool down the exhaust air by evaporative cooling to further improve the efficiency of the air to air heat exchanger.

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In some embodiment, the module is integrated with heat conductive outer layer by contemporary art of attachment. Alternatively, the module is configured to support the floor finish and therefore the floor finish sits directly on the module.

- 20 Another object of this present invention is provide the module adapted to have two heat conductive outer layers opposite to each other and the module sits between such two outer layers. In a multi-storey and multi-units complex, the module could save space between the storeys and units by the means that two adjacent storeys and/or units may share one module.

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In another aspect, the module in the present invention is adapted in the form of tubular and the heat conductive outer layer is in circular shape. This tubular module is innovative and fit for modern design in architecture.

- 30 **Brief Description Of The Drawings**

Figure 1 is a perspective view showing the flow and precooling of exhaust air utilizing exhaust air and condensate;

5 Figure 2 is a perspective view showing the respective paths of fresh air and exhaust air;

Figure 3 is a front cross-sectional view of one embodiment of the present invention precooling of exhaust air utilizing condensate;

10 Figure 4 is a side cross-sectional view of precooling exhaust air utilizing condensate;

Figure 5 is a top view of the embodiment of the present invention as a panel to be installed as ceiling or flooring; or, installed adjacent to wall;

15 Figure 6 is a magnified view of the embodiment as shown in Figure 5;

Figure 7 is a side cross-sectional view of one embodiment of the present invention as a panel to be installed as and attaching to ceiling;

20 Figure 8 is a side cross-sectional view of one embodiment of the present invention as a panel to be installed on and detachable to ceiling;

25 Figure 9 is a side cross-sectional view of one embodiment of the present invention as a panel to be installed as and supporting the flooring structure;

Figure 10 is a side cross-sectional view of one embodiment of the present invention as a panel to be installed as and between two walls;

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Figure 11 is a side cross-sectional view of one embodiment of the present invention as a panel, one side of which to be installed as and adjacent to a wall of an enclosed area and the other side with insulation;

5 Figure 12 is a side cross-sectional view of one embodiment of the present invention as a tubular module;

Figure 13 is a bottom view of the embodiment shown in figure 12

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### **Detailed Description Of The Invention**

The most preferred embodiment of the invention is now described with reference to the figures, where like reference numbers indicate identical or functionally similar elements. While specific configurations and arrangements are discussed, it should be  
15 understood that this is done for illustrative purposes only. A person skilled in the art will recognize that the other configurations and arrangements can be used without departing from the scope of the invention.

One embodiment of the present invention includes a multilayer heat exchanging  
20 panel, shown in figure 5, comprising a multilayer heat exchanging panel comprising a heat conductive outer layer having an external and an inner surface; a heat conductive conduit positioned adjacent to the inner surface of the outer layer and running continuously on a plane substantially similar to the outer layer, a multilayer heat conductive metal fin with void or apertures in each layer through which holding  
25 the conduit and each edge of the multilayer metal fin contacts the outer layer; and each layer of the metal fin (201) is adopted at a predetermined distance parallel to each other and perpendicular to the conduit (101); and a hollow cover fixed to the inner surface around edges of the outer layer forming an enclosure thereof and containing the multilayer metal fin and the conduit within the enclosure; wherein the  
30 conduit (101) is fashioned in a parallel arrangement or a serpentine arrangement with

an inlet (111) and an outlet (121) to channel a temperature-regulated flowable medium. Preferably, the conduit is free from any direct contact with the hollow cover.

The multilayer heat exchanging panel disclosed can be prepared in different forms adaptably used as ceiling panels illustrated respectively in figure 7 and 8; or as flooring panel illustrated in figure 9. The disclosed panels are preferably in quadrilateral or rectangular in shape to be installed as ceiling or flooring structure. More preferably, these panels have the outer layer carrying out the heat exchange process for the enclosed area installed with the panels. The multilayer heat exchanging panel disclosed can further be prepared and adaptably used as wall panels illustrated respectively in figure 10 and 11. In one embodiment as shown in figure 11, the hollow cover or the obverse face of the panels on the other side are prepared with insulation materials with aims to minimize the heat exchange process with the external environment.

Referring to figure 7 and 8, the disclosed panel is prepared as the ceiling panels that the bottom layer (301) is the outer layer facing the enclosed area. In figure 7, the multilayer heat exchanging panel is firmly attached to the ceiling itself or the false ceiling structure commonly used in a building complex. Further or alternatively, the outer layer is adapted as ceiling and therefore has direct contact with the enclosed area made to enhance heat exchange. Alternatively, in figure 8, the multilayer heat exchanging panel (411) is detachable to the ceiling itself (401) or the false ceiling structure commonly used in a building complex; and such adaptation may employ adhesive or screw or any other fastening mechanism known in the art and provides convenience to the installation and change to ceiling structure. To facilitate installation of the ceiling panel, the present invention employs at least a pair of inverted L-shaped collars vertically raising from at least a pair of opposing edges of the panel (not shown). This L-shaped collar may serve as anchorage point for the panel to hang as ceiling or alternatively attach to the ceiling. Preferably, in one embodiment, the outer layer is made of metal or alloy with excellent heat

conductivity to promote heat exchange in between the enclosed area and the medium passing through the conduits (101). Good mechanical strength and smooth surface of the metal or alloy-made outer layer also ensure the disclosed panel meets the requirement to be used as construction material. For example, the outer layer can be  
5 an aluminum plate further anodized to render it possessing better resistive against corrosion.

Referring to figure 10 and 11 the disclosed panel is prepared as the wall panels that the heat conductive outer layer (501) is the outer layer facing the enclosed area. In  
10 figure 10, the multilayer heat exchanging panel is firmly attached to two walls (511) and such two walls could be of two separate enclosed areas, for example two units in a building complex. Further or alternatively, the outer layer is adapted as wall and therefore has direct contact with the enclosed area made to enhance heat exchange. Alternatively, in figure 11, the multilayer heat exchanging panel is adapted to have  
15 its heat conductive outer layer (501) on the one side facing the enclosed area and its outer layer on the other side (521) prepared from heat insulating polymer or plastic material.

In another aspect, the temperature regulating module in the present invention is  
20 adapted in the form of tubular bar as illustrated in figure 12. The heat conductive outer layer (601) is in circular shape. In one embodiment as shown in figure 13, it houses continuous running conduits (101), at least one end of which is designated as inlet and at least one the other end is designated as outlet to channel a temperature-regulated flowable medium. This tubular module is innovative and fit for modern  
25 design in architecture.

As in setting forth, the continuous running conduit in the ceiling, flooring and wall panels can be of parallel arrangement or a serpentine arrangement. Shown in figure  
5 is one embodiment with the serpentine or zigzag arrangement that major portion of  
30 the conduit (101) is arranged in parallel direction with the two neighboring parallel

portion are joined by a bent portion (131). In other embodiment wherein the continuous running conduit in tubular bar with tubular arrangement that major portion of the conduit is arranged in parallel direction with the two neighboring parallel portion are joined by a bent portion. Further, the flowable medium of two  
5 neighboring parallel portions of the conduit in the serpentine and tubular arrangement is moving in an opposing direction. In the parallel arrangement, a plurality of parallel running conduits each has one end connected to a medium inlet manifold to receive the flowable medium and another end attached to outlet manifold to channel out the flowable medium. Conduit is made of material with excellent heat  
10 conductivity to allow exchange of heat energy proceeds in an accelerated rate where the heat energy is either absorbed from or by the flowable medium. Preferably, the conduit is produced from copper, aluminum or aluminum alloy. As shown in figure 13, the position of each pair of tubular conduit parallel and opposite to each other can be fixed by predetermined void or apertures (601) in the metal fin or, alternatively,  
15 by a string bundling mechanism (611) using materials like plastic or bakelite.

Accordingly, the flowable medium used in the ceiling panel is water or refrigerant. Though medium in liquid form is more preferably, other embodiments of the disclosed heat exchange panel or tubular bar may employ gases as the medium to  
20 regulate the temperature of the enclosed area.

It was found by the inventors of the present invention that mere radiation is insufficient to significantly promote heat exchange in between the flowing medium and the enclosed area unless the temperature difference is great. Despite having the  
25 conduit direct contacts the outer layer can enhance heat exchange through conduction, such approach tends to create discrete hot or cool spots on the outer layer leading to undesired vapor condensation at the external surface of the outer layer. To avoid creation of hot or cool spots, at least a heat conductive metal fin is disposed in between the conduit and the outer layer. There is no direct contact in between the  
30 conduit and the outer layer in the disclosed panels and tubular bar. Preferably, the

metal fins are multiple-layered and distributed along the conduit at a predetermined distance. Such metal fins also act as a network to absorb heat from or provide heat to the outer layer that substantially entire outer layer is either warmed or cooled to a uniform temperature free from any discrete hot or cool spot. Preferably, the metal fin is made of heat conductive metal or alloy. The void or apertures on the metal fin of the present invention can adopt various form, size and number according to the predetermined arrangement of the conduits. In one embodiment as shown in figure 6, the metal fin (701) are adapted to consist longitudinal hollow tube (711) vertical to each piece of fin (721). The hollow tube housing the conduit increases conductive surfaces and enhance exchange of heat. In preferred embodiment, the length of tube is uniform and the open of the each hollow tube has relatively smaller periphery compared to the flange of the tube of the adjacent metal fin. The projection (731) of each hollow tube of a metal fin may stand against the flat surface (741) surrounding the open of the adjacent metal fin and to correctly align each piece of metal fins along a conduit. With evenly distributed distance between the edges of the metal fins along the conduits, the contact by the edges (751) of the metal fins against the outer layer exchanges heat energy at the optimal through radiation as the heat radiation exposure of these edges (751) of the metal fins against the outer layer is at the optimal as well.

Pursuant to another embodiment involves the flooring panel shown in figure 9, the orientation of various layers are altered compared to the ceiling panel. Preferably, the disclosed flooring panel has the uppermost layer (801) employed as the outer layer facing the enclosed area once the panel is installed onto the floor. The outer layer has direct contact with the enclosed area therefore it is made to enhance heat exchange. Preferably, in one embodiment, the outer layer of the flooring panel is made of metal or alloy with excellent heat conductivity to promote heat exchange in between the enclosed area and the medium passing through the conduits. Moreover, the outer layer can be an aluminum plate further anodized to render it possessing better resistive against corrosion.

Similar to its ceiling panel counterpart, conduit in the flooring panel may adopt either a parallel arrangement or a serpentine arrangement. Shown in figure. 6 is one embodiment with the serpentine or zigzag arrangement that major portion of the conduit is arranged in parallel direction with the two neighboring parallel portion are joined by a bent portion. Further, the flowable medium of two neighboring parallel portions of the conduit in the serpentine arrangement is moving in an opposing direction. In the parallel arrangement, a plurality of parallel running conduits each has one end connected to a medium inlet manifold to receive the flowable medium and another end attached to outlet manifold to channel out the flowable medium. Conduit in the flooring panel is made of material with excellent heat conductivity to allow exchange of heat energy proceeds in an accelerated rate where the heat energy is either absorbed from or by the flowable medium. Preferably, the conduit is produced from copper, aluminum or aluminum alloy. The flowable medium used in the flooring panel is water or refrigerant. Nonetheless, gas medium may use in other embodiment of the flooring panel.

As in the foregoing description, use of the metal fins aims to avoid creation of hot or cool spots at the outer layer that such spots favor vapor condensation on the outer layer. The heat conductive metal fins are disposed underneath the outer layer spacing apart the conduit from the outer layer. There is no direct contact in between the conduit and the outer layer in the disclosed flooring panel. The metal fins also act as a network to absorb heat from or provide heat to the outer layer that substantially entire outer layer is either warmed or cooled to a uniform temperature free from any discrete hot or cool spot.

Preferably, the metal fins are made of heat conductive metal or alloy. The metal fins (201) in one embodiment as illustrated in figure 5 are molded as one piece with multi-layers at predetermined distance and with void or apertures at each layer housing the conduits. Alternatively, the metal fins (701) in another embodiment as

illustrated in figure 6 are arranged as stand-alone parts and detachable and by interlinking a plurality of metal fins together and a combination thereof can improve the flexibility to the length and width of the panels.

According to another embodiment of the flooring panel, the heat exchange in  
5 between the external environment and the enclosed area is preferably at minimal. The external environment contacting the flooring panel preferably refers to geo-structure. To further prevent heat penetration from or emission to the external environment, the disclosed flooring panel may have a heat insulating layer covering the outer layer at the bottom (811) and facing the grounding of the floor. In one  
10 embodiment, the heat insulating layer is actually made of polyurethane or the like plastic or rubber. Adhesive is used in one embodiment to secure the insulating layer to the outer layer at the bottom (811) and facing the grounding of the floor.

In order to serve as flooring structure, the flooring panel of the disclosed invention is  
15 equipped with unique structure to allow the fabricated panel to sustain great pressure or force applied onto the outer layer without being broken. Illustrated in figure 9 is an embodiment of the flooring panel having a plurality of metal fins (822) extending vertically from the bottom heat insulating layer (811) towards the top outer layer (801) facing the enclosed area configured to provide mechanical support to the top  
20 outer layer. It is important to be noted herein that the metal fins can be a singly formed construct or integrated part derived of multiple components arranged to distribute weight evenly. In another embodiment, the projecting beams (831) are installed on the sides of panels. By deploying multiple pieces of panels each equipped with projecting beams (831), and that there are voids or apertures allowing  
25 continuous running of flowable medium among various sections of conduits running through different panels, the panels are fabricated to hold corresponding passageway or throughway to allow the projecting beam (831) to penetrate through without hindrance. These projecting beams (831) also assist in securing position of different panels and add strength to the flooring panels. It is possible to have the outer layer  
30 facing the grounding of the floor prepared from heat insulating polymer or plastic

material in other embodiments of the flooring panels. To attain the desired mechanical strength and long-lasting service life of the disclosed flooring panel, the metal fins (822) are preferably fabricated from aluminium or aluminium alloys.

It is known in the art that the different layers in the disclosed ceiling panels or  
5 flooring panels or wall panels can be attached or mounted using any known fastening or locking mechanism in the art. Any modification thereof shall not depart from the scope of the present invention.

According to another embodiment of the ceiling panel, the heat exchange in between  
10 the external environment and the enclosed area is preferably at minimal. To further prevent heat penetration from or emission to the external environment, the disclosed ceiling panel may have a heat insulating layer covering the outer layer at the top. In one embodiment, the heat insulating layer is actually made of polyurethane or the like plastic or rubber. Adhesive is used in one embodiment to secure the insulating  
15 layer to the outer layer at the top.

In preferred embodiment, a primary air handling unit is deployed and such unit consists of a separate humidity control air conditioning system used to control humidity and carbon dioxide level of the enclosed area at the same time, a thermal  
20 energy recovering system to precool hot and humid fresh air by cool exhaust air through an air to air heat exchanger and an evaporative cooling system to precool the exhaust air to enhance the heat exchange efficiency of the air to air heat exchanger. In such embodiment, as shown in figure 2, an elevation consisting an array of plates divide the interior of the air to air heat exchanger into two passages, one (911)  
25 directing the fresh air intake horizontally through fresh air discharge and the other (921) directing the exhaust air intake vertically descending through exhaust air discharge. One aspect of such embodiment is the use of the damper for additional air flow. Condensation occurs when heat is released. Figure 3 and 4 further shows a series of sprays (931) along a water (932) pipe which are arranged to spray minute  
30 water droplets (933) downwardly through the exhaust air path and it causes the

evaporation of the exhaust air as it passes through the supply air. Further, the condensates collected by the primary air handling unit including the heat exchange coil, as shown in figure 1, is used as water source to cool down the exhaust air by evaporative cooling as disclosed in the foregoing. Another aspect of such sprays engages collecting condensate in sump and driving by pump the condensate to water pipe installed in an evaporative cooling chamber. The adaptation of use of condensate greatly improves the efficiency of the air to air heat exchanger and of the removal of latent heat of the fresh air.

- 10 Besides the above described embodiment, the disclosed panels can be manufactured without the hollow cover. In such embodiment, the multilayer heat exchanging panel comprises a heat conductive outer layer having an external and an inner surface; a heat conductive conduit positioned adjacent to the inner surface of the outer layer and running continuously on a plane substantially similar to the outer layer, and a
- 15 heat conductive metal fin with void or apertures in each layer through which holding the conduit and each edge of the multilayer metal fin contacts the outer layer; and each layer of the metal fin is adopted at a predetermined distance parallel to each other and perpendicular to the conduit; wherein the conduit is fashioned in a parallel arrangement or a serpentine arrangement with an inlet and an outlet to channel in and
- 20 out a temperature-regulated flowable medium.

As setting forth in the abovementioned embodiments, changes therein and other uses will occur to those skilled in the art which are encompassed within the scope of the invention as defined by the scope of the claims.

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## Claims

1. A temperature regulating module comprising
  - 5 a multilayer heat exchange panel;  
a primary air handling unit; and  
a compressor; a condenser coil and evaporator coil.
- 10 2. A temperature regulating module of claim 1, wherein the multilayer heat exchange panel comprising
  - a heat conductive outer layer having an external and an inner surface;  
a heat conductive conduit positioned adjacent to the inner surface of the outer layer and running continuously on a plane substantially similar to the outer layer,  
at least one layer of heat conductive metal fin with void or apertures in each layer  
15 through which holding the conduit and the edge on one side of each layer of the metal fin contacts the outer layer; and each layer of the metal fin is adopted at a predetermined distance parallel to each other and perpendicular to the conduit;  
a hollow cover fixed to the inner surface around edges of the outer layer forming an enclosure thereof and containing both the metal fins and the conduit within the  
20 enclosure; wherein the conduit is fashioned in a parallel arrangement or a serpentine arrangement with an inlet and an outlet to channel a temperature-regulated flowable medium.
- 25 3. A temperature regulating module of claim 1 or 2, wherein the multilayer heat exchange panel further comprising a heat insulating blanket covering the conduit and the metal fins that the blanket is fabricated with a plurality of grooves to accommodate the conduit.

4. A temperature regulating module of claim 1 or 2, wherein the multilayer heat exchange panel further comprising a heat insulating layer covering inner surface of the hollow cover horizontally.
- 5 5. A temperature regulating module of claim 1 or 2, wherein the multilayer heat exchange panel further comprising a heat insulating layer covering inner surface of the hollow cover horizontally and a plurality of projecting beam extending vertically from the heat insulating layer towards the outer layer configured to provide mechanical support to the outer layer.
- 10 6. A temperature regulating module of claim 1 or 2, wherein the multilayer heat exchange panel is arranged that the conduit and the metal fins are free from any direct contact with the hollow cover.
- 15 7. A temperature regulating module of claim 1 or 2, wherein the multilayer heat exchange panel is adapted that the flowable medium is water or refrigerant.
8. A temperature regulating module of claim 1, wherein the multilayer heat exchange panel comprising
- 20 a heat conductive outer layer having an external and an inner surface;  
a heat conductive conduit positioned adjacent to the inner surface of the outer layer and running continuously on a plane substantially similar to the outer layer, and  
and  
at least one layer of heat conductive metal fin with void or apertures in each layer
- 25 through which holding the conduit and the edge on one side of each layer of the metal fin contacts the outer layer; and each layer of the metal fin is adopted at a predetermined distance parallel to each other and perpendicular to the conduit;  
wherein the conduit is fashioned in a parallel arrangement or a serpentine arrangement with an inlet and an outlet to channel a temperature-regulated
- 30 flowable medium.

9. A temperature regulating module of claim 1, 2 or 8, wherein the primary air handling unit comprising an evaporative cooling chamber and air to air heat exchanger.
- 5 10. A temperature regulating module of claim 9, wherein the evaporative cooling chamber in the primary air handling unit comprising a series of sprays along a water pipe spraying minute water droplets downwardly through the exhaust air path.
- 10 11. A temperature regulating module of claim 9, wherein the primary air handling unit is adapted to collect condensate and to utilize such condensate as water source.
12. A temperature regulating module of claim 9, wherein the air to air heat exchanger  
15 in the primary air handling unit comprising an array of plates adapted to divide the interior into two passages, one directing the fresh air intake horizontally through fresh air discharge and the other directing the exhaust air intake vertically descending through exhaust air discharge.
- 20 13. A temperature regulating module of claim 1, wherein the multilayer heat exchange panel comprising  
a heat conductive outer layer in tubular bar shape having an external and an inner surface;  
a heat conductive conduit positioned adjacent to the inner surface of the outer  
25 layer and running continuously; and  
at least one layer of heat conductive metal fin with void or apertures in each layer through which holding the conduit and the edge on one side of each layer of the metal fin contacts the outer layer; and each layer of the metal fin is adopted at a predetermined distance parallel to each other and perpendicular to the conduit;

wherein the conduit is fashioned in a parallel arrangement or a serpentine arrangement with an inlet and an outlet to channel a temperature-regulated flowable medium.