

PATENT SPECIFICATION

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(54) AIR TEMPERATURE CONTROL SYSTEM FOR A ROOM HAVING AN OUTSIDE WALL

(71) We, JOSEF GARTNER & CO., a company of the Federal Republic of Germany, of 8883 Gundelfingen/Donau, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns an air temperature control system for a room having an outside wall.

The majority of prior art control systems are so-called induction systems. These systems have a number of drawbacks both in their use and construction. Each include a number of induction devices, one of which is placed in every room of the building in which the system is installed. Each device is connected with a central control system by way of a multiplicity of pipes. The multiple pipe connections are necessary in order to provide the required forward and return path for the means used for heat transfer as well as a supply line for primary air. These prior art systems are further complicated by the fact there must be two systems for providing the primary air, since within the outer zones of a building the primary air must be supplied under a very high pressure and within the inner zones of the building air must be supplied under a low pressure. Moreover, the air discharge nozzle on every induction device must be capable of simultaneously drawing used air from the room in which it is located. A particular requirement is that the pressure of the primary air being delivered must be great enough to cause the air within the room being controlled to be circulated at least six to seven times.

By reason of the multiplicity of pipes or conduits required in the individual rooms not

only is the construction of such systems very complex but, since these pipes or conduits must be under cover, the rooms to which the system is applied must be relatively high. As will be obvious, the operation of an induction control system requires the use of a very large amount of energy. A most objectionable feature of an induction system is that in the operation thereof any dirt existing in the individual rooms will be continuously stirred up.

A further disadvantage of an induction system is that it is not capable of overcoming the problem of so-called radiation holes. A radiation hole is a wall region of a room the temperature of which differs substantially from the average room temperature. Typical radiation holes occur in such areas of a room as are walled by large glass window surfaces. To understand the importance of this, it must be understood that an individual located in a room radiates heat in all directions. In turn heat radiates back from the room walls onto the individual. The walls of a room, because of their heat storage capability will normally assume, in essence, room temperature. Where the heat radiation from these walls is uniform, an occupant of the room can be comfortable. However, where the walls of the room have radiation holes the heat radiation back to the individual occupant in such areas may be too little or too great, in which event the individual occupant can become uncomfortable.

A more recent prior art system which attempts to overcome some of these problems is described in German Offenlegenschrift 2132921. In this system the outside walls of a room are heated by constructing the walls with hollow stanchions and coupling these stanchions to hot water pipes. Hot water is supplied firstly to the hollow stanchions and

is then afterwards circulated through a pipe disposed within a channel or duct located at floor level. Air entering the channel is heated by the pipe and discharged through openings in the channel to flow upwardly over glass panes in the outside wall.

One drawback of this prior art system is that the stanchions may become uncomfortably hot. A further disadvantage is that it is difficult to control the room temperature at a predetermined level independently of any disturbances.

In accordance with the present invention there is provided a method of controlling temperature in a room having an outside wall, the method comprising effecting an initial heat exchange between a heat exchange fluid and a flow of air, subsequently directing the air into the room across the inner surface of a facade element of the outside wall, and then effecting a second heat exchange between the same heat exchange fluid and a structural support member mounting and/or bounding one edge of the facade element.

The heat exchange fluid may, for example, comprise water and/or air. In one embodiment of the invention the initial heat exchange is effected in a substantially horizontal duct arranged at floor level, the duct including means defining separate flow paths for the heat exchange fluid and the air, and an opening for directing the flow of air across the facade element after the first heat exchange has been effected.

The structural member is preferably hollow and the flow path for the heat exchange fluid in the duct is preferably defined by a pipe or conduit which communicates with the hollow interior of the structural support member. The heat exchange fluid thus passes first through the pipe in the duct and then through the structural support member. Since the second heat exchange between the hollow support and the heat exchange fluid takes place after the first heat exchange between the same fluid and the flow of air, a system is provided with first stage convection heating (or cooling) which can respond rapidly to an interruption in the supply of heat exchange fluid to the pipe in the duct. Such interruptions can be thermostatically controlled, for example, in response to the room temperature.

It has been found that this first stage convection heating (or cooling) responds very quickly as a consequence of the nominal volume of the pipe. By interrupting the flow of say, warm or cold water in such pipe, there can be obtained very quickly the desired warmer or cooler air necessary to compensate for a local change in room temperature. On the other hand, since the resulting flow can be passed across the outer side of the hollow structural supports as well as across the surfaces of the facade elements, and in view of the fact that very large quantities of water are maintained in the hollow

structural supports 20 that the second stage of the system has a much greater heat capacity than the first stage, the second stage only very slowly permits changes of the overall room temperature.

A further advantage of the present invention is that the hollow supports do not become too hot (or too cold) to touch. Moreover, the relatively large surfaces of the structural supports mounting and/or bounding the facade elements serve as highly efficient conductive mediums through which heat can be supplied to or carried away from a room.

A temperature control system embodying the invention does not require separate induction devices and complex plumbing so that there is no need for buildings in which the system is installed to have the additional height which is necessary for the installation of an induction system.

A system embodying the invention is particularly suitable for use in large buildings. In such buildings the facade of the building is subdivided to provide on every floor or level thereof identical function fields or regions, each of which includes a fixed number of the hollow structural support elements with facade elements located therebetween, an air duct (with a hot or cold water pipe) for connection to an air delivery means, and at the bottom of such fields or regions, a passage for discharge of air from the room being controlled.

With the apparatus in the foregoing system, externally located rooms of a building can be heated or cooled in an extremely simple and uncomplicated manner. For heating of the rooms water is supplied to pipes provided in the air ducts at such a temperature that the temperature of the hollow supports will be somewhat above the desired room temperature while the air supplied to the air ducts will have a temperature which lies below the desired room temperature. This has the advantage that if temperature disturbances should arise, for example, in a room where suddenly a number of people enter or suddenly lamps are turned on, the desired room temperature can be maintained by interrupting the flow of water through the pipes. Since the heat which will be stored in the water in the pipe is quite small as a consequence of its small volume or mass, the water quickly cools and produces a corresponding fall in the temperature of the air flowing into the room until the air in the room is cooled to the desired value. Even if the thermostat fails to restore the flow of water when the room temperature drops to the present level, further cooling of the room occurs only in an extremely slow manner, since the air continues to draw heat from the hollow structural elements which comprise a large heat storage mass. This means that the cooling off of an especially susceptible location, as for example a glass surface, and accordingly the formation of radiation holes, becomes effectively precluded.

In the absence of temperature disturbances due to localized heat sources, the temperature of the air supplied for heating purposes can be somewhat above the room temperature.

- 5 For cooling rooms, water supplied to the pipes in the air ducts will be provided at such a temperature that the temperature in the hollow structural elements will lie somewhat below the desired room temperature. The air is supplied, however, at a temperature con-
10 templating temperature disturbances above the desired room temperature. By interrupting water flow in the pipes of the system, the warmer air which is immediately supplied will move with positive convection of the air along the cooler hollow elements to compensate for such disturbances. When no disturbances are contemplated in the rooms to be cooled, the air can be supplied at a temperature which in
20 this case is below the desired room temperature.

- The foregoing description shows that a system embodying the invention is especially suitable for both heating and cooling purposes by way of a quickly responding first stage
25 having a small heat capacity and a relatively slowly responding second stage having a larger heat capacity, in the use of which a quick compensation of localized temperature disturbances in any room becomes attained and as a result of which the constancy or base value of the room temperature can only be changed very slowly. Finally attention is directed to the fact that as a consequence of the heat storage effect of the water in the
30 hollow structural elements, the facade elements supported thereby are maintained at a desired temperature in the summer on the sunny side since as a consequence of the large masses a good deal of heat or warmth can be stored. Additionally, as a consequence of the circulation of the water in the hollow elements, there occurs a heat dissipation transporting heat to hollow element portions not located on the sunny side.

- 45 A system embodying the invention operates with high efficiency since the heat transfer by way of convection and by way of radiation are coupled to produce optimum results.

- By way of example only, one embodiment of the present invention will now be described with reference to the accompanying drawings in which:

- Figure 1 is a schematic showing a portion of an air temperature control system including two
55 fields or regions of a building facade arranged side by side;

Figure 2 is a section taken longitudinally of the line II-II of Figure 1;

- Figure 3 is a section taken longitudinally of
60 line III-III of Figure 1;

Figure 4 shows in detail a use of a thermostat control valve in the system of Figure 1;

- Figure 5 shows, in cross section, details of one form of hollow strut or support for use in
65 the system of Figure 1;

Figure 6 shows a second form of hollow strut or support for use in the system of Figure 1 and Figure 7 shows a third form of hollow strut or support for use in the system of Figure 1.

- In figure 1 facade surfaces 21, 22, 23 of an
70 outside wall of a building are bounded by hollow vertical spaced apart supports 1, 2 and 3 of a first control unit as well as by the hollow vertical support 1' of the next adjoining unit which would include corresponding elements 1'
75 2' and 3'. In the first unit illustrated, the upper ends of the vertical supports 1 and 2 are bridged by a transversely extending hollow structural element 4 which communicates with a similar element 5 bridging the upper ends of the vertical supports 2 and 3. Also, the lower ends of the elements 1 and 2 are transversely bridged by a hollow beam 6 which communicates with the corresponding beam 7 bridging the lower ends of the support elements 2 and 3.
80 It should be noted that there is provided interiorly of the hollow vertical support 1 adjacent and spaced from the lower end thereof, a plate 13 which divides the space in the vertical support 1 into an upper chamber and a lower chamber of much shorter vertical extent.
85 The latter communicates with the space in the elements 6 and 7 and thereby with the space in the lower ends of the vertical elements 2 and 3 with which the elements 6 and 7 are in free and open communication. The upper ends of the elements 2 and 3 are similarly in free and open communication with the space defined in the hollow elements 4 and 5. With the arrangement provided, for purposes of this description it may be considered that a facade element or elements will be applied to the outermost surface of the frame structure portion defined by the elements 1, 2, 4 and 6 and the facade element will provide an inner surface identified as 23. A second facade surface 22 is similarly created in the area bounded by the hollow elements 2, 3, 5 and 7. A third facade surface 21 is formed in the area bounded by the hollow vertical support element 3 and the hollow vertical support element 1' forming part of the next adjoining unit. The upper limit of this third facade surface 21 is defined by a blind tie bar or beam element 8 and its lower limit by a hollow bar or beam element 9 the function of which is different from that of the elements 6 and 7. This will be further described.

- As shown in Figure 2 and 3 of the drawings, two glass panes 27 are held to form part of each facade surface. The panes are secured by means of insulating connectors 28 onto the outer or facade side surfaces of the vertical supports, between vertically spaced bounding wall segments 29 which may be of pre-cast concrete or other suitable materials resistant to ready heat transfer. As seen in cross section in Figure 2, the facade element and the surrounding frame structure an outer wall of a room the vertical limits of which correspond
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to the vertical limits of the control unit. Intermediate the vertical limits of and disposed transverse to, the vertical support elements is a hollow duct 15, there being one section thereof between each adjacent pair of vertical supports. The adjacent sections are joined by connector pipe means 25 extending through intervening vertical supports. As will be seen in Figure 3, every section of the duct 15 has a removable wall portion 24 on the room side thereof. In the uppermost surface of each section, between each adjacent pair of vertical supports, there is formed a nozzle-like longitudinally extending air exit 16. Centered within and extending longitudinally of the duct 15 is a pipe 11. Between the adjacent vertical supports, the pipe 11 is provided with longitudinally extending ribs 26 which are arranged about the pipe in a star form, the ribs radiating outward of the outer periphery of the pipe. At the end of the pipe 11 which is adjacent to the vertical support 1 it is diverted and extended to have its discharge extremity connected into the lower chamber of the vertical support. Inserted in the pipe line 11 immediately prior to its connection into the lower chamber of the vertical support 1 is valve 12. The opposite or inlet end of the pipe 11 is connected to a delivery conduit 10.

Noting Figure 1, there is a delivery line 14 for air to be introduced into the duct 15. A return line 18 is connected with its inlet end communicating with the interior of the hollow elements 1, 2, 3, 4, 5, 6 and 7 at the junction of the elements 1 and 4. It is here noted that the valve 12 is a thermostat type valve.

It will be seen from the showing in Figures 1-3 that water (which is heated or cooled for heat transfer purposes) will be delivered by way of the line 10 to pass through the pipe 11 and by way of the valve 12 into the lower chamber of the hollow support 1 and, from there, through the entire area of the building facade defined by support elements 1, 2 and 3 and the connecting elements 6, 7, 5 and 4, to eventually be drawn or directed to and through the return line 18. The water so routed from the delivery line 10, having been previously heated or cooled, will through the medium of the ribbed pipe 11 give up heat to, or extract heat from the air channelled through the duct 15. In the process portions of the heated or cooled air will escape into the room through the nozzle-like slots 16 to move upwardly over the facade surfaces 21, 22 and 23 and the hollow support elements 1, 2, 3 and 1'. When this air has served its function of heating or cooling the facade surfaces which it contacts, it will be carried away, as shown in Figure 2, by way of a vent 31 in the ceiling structure of the room being climatized. Noting Figure 2, the element 9, which is sealed from communication with the interior of the vertical support elements 3 and 1', includes a slot 30 in the side thereof facing inwardly of the room being

controlled. This slot provides an exit for air discharging from the room. Such air, upon moving into the member 9, will exit therefrom by way of a discharge line 19. The discharge lines 19 of the various control units are commonly routed to a collecting conduit leading to a device in which heat exchange takes place between this used air being discharged and fresh air being supplied to the system from outside the building. After being subjected to this heat exchange the fresh air will be supplied to the respective delivery lines 14. In a similar manner the delivery lines 10 for the respective units and the return lines 18 are connected to common collecting conduits to serve similar purposes.

Figures 5 to 7 show alternative constructions for the hollow vertical supports as represented by the support 2 there illustrated. In Figure 5, which is a view in cross section of the support 2 from above the duct 15 (as shown in Figure 1), the hollow support 2 is encased in a U-shaped sleeve which provides on the walls of the support, parallel to the facade, a series of parallel perpendicularly projected ribs. Beneath the ribs are slots 17 in the duct 15, which slots are at right angles to the glass panes 27. The arrangement is such that any air blown out of the slots 17 will flow longitudinally of the ribs 40 to enhance the heat transfer from the hollow support represented by the element 2 into the environment or surrounding locations.

A modification of the external rib-like sleeve structure for the element 2 is shown in Figure 6. In this case also, the ribs are embodied in a sleeve-like structure enclosing the three sides of the vertical support 2 to the inner side of the facade elements defined by the window panes 27. As may be seen, the lateral sides of this sleeve-like structure encasing the element 2 are wall elements 41 which extend in parallel spaced relation to the adjacent sides of the element 2 and connected therewith in a heat conductive manner by spacing or support ribs 43. The spaces between the element 2 and the respective wall elements 41 each define chambers exits from which are provided by openings 42 in the wall elements 41. Projected from the outermost surfaces of the wall elements 41 in a sense perpendicular thereto and to the sides of the element 2 are ribs 40. With the arrangement here provided the slots 17 opening from the interior of an air conveying conduit 15 enable that air under pressure be forced from the conduit and between the side walls 41 and the adjacent side surfaces of the element 2 to enhance its ability to produce a heat transfer effect with respect to the contents of the element 2 and this air will escape thereafter by way of openings 42 to pass along and between the ribs 40.

In the embodiment shown in Figure 7, in contrast to the arrangement in Figure 6, the

ribs are directed only inwardly from the wall elements 41. The wall elements 41 have apertures intermediately of such ribs for escape of air to the exterior of the structure so provided.

The following examples illustrate how the system of Figure 1 can be used to maintain the temperature of a room either above or below the outside temperature.

10 EXAMPLE 1: Heating

Thermoplane plates are used as facade elements having a heat passage resistance of $0.172 \text{ m}^2 \text{ h grd C/kcal}$. The heat transfer surface provided by the hollow vertical support elements and the transversely connected hollow bar or beam elements has an exposed area of 2.64 m^2 . The heat transfer surface of the ribbed pipe amounts to 3.8 m^2 . Air is supplied to the duct 15 in a quantity flow of $630 \text{ m}^3/\text{h}$. The temperature outside of the room being climatized is -6.8°C . The heating water supplied under these conditions by way of the delivery conduit to the ribbed pipe has a temperature of 54°C (150 l/h) and leaves the ribbed pipe with a temperature of 40°C . The heating water with this temperature enters into the space defined by the hollow vertical support elements and the transversely connected hollow bar elements and on discharge from the space to the return line has a temperature of 28°C . The temperature of the hollow vertical elements drops in the flow direction from 38°C to 35°C . The air is supplied to the duct 15 at a temperature of 7.9°C and is discharged out of the slots with a temperature between 29.2 and 23.1°C . In space there is a resulting temperature of 19.5°C . The temperature of the glass surface at the room side is 17°C and the temperature at the outer surface of the thermoplane plates is 5.7°C . From this data there can be calculated that the heat supplied by way of the ribbed pipe to the chamber or room is only nominally greater than the heat quantity given off from the frame structure comprised of the hollow vertical supports and their interconnecting transversely disposed hollow bars or beams.

45 EXAMPLE 2: Cooling

Thermoplane plates are used in this case as in the Example 1 having the same heat passage resistance. The cooling surface provided by the frame structure comprised of the hollow vertical supports and the interconnecting transversely disposed beam or bar elements has an area of 2.64 m^2 . The air quantity supplied to the room amounts to $300 \text{ m}^3/\text{h}$ and the outer temperature is 44.3°C . When cooling water used is delivered at a flow of 164 l/h with a delivery temperature of 14.4°C , it discharges from the ribbed pipes at a temperature of 15.3°C and at that temperature enters the frame structure comprised of the hollow vertical supports and the hollow interconnecting bar or beam elements. The water leaving the frame structure has a return tem-

perature of 18.2°C and the exposed surface temperature of the frame changes in the direction of the return from 16.6°C to 17.6°C . There results a room temperature on the room side of the glass which is 29.7°C . There is brought about a cold delivery to the outside amounting to 68 kcal/h as well as a room side cooling output of 407 kcal/h . The heat passage number or figure from supports and structure surrounding the thermopane can be calculated at $17.4 \text{ kcal/m}^2 \text{ grd C}$.

WHAT WE CLAIM IS:—

1. A method of controlling temperature in a room having an outside wall, the method comprising effecting an initial heat exchange between a heat exchange fluid and a flow of air, subsequently directing the air into the room across the inner surface of a facade element of the outside wall, and then effecting a second heat exchange between the same heat exchange fluid and a structural support member mounting and/or bounding one edge of the facade element.

2. A method according to Claim 1 further comprising selectively interrupting the flow of heat exchange fluid to maintain the temperature in the room at a predetermined level.

A method according to Claim 1 or Claim 2 in which the initial heat exchange is effected in a duct located adjacent the facade element, the duct including means defining separate flow paths for the heat exchange fluid and the air.

4. A method according to Claim 3 in which the duct further includes an opening which directs the flow of air across the facade element after the first heat exchange has been effected.

5. A method according to Claim 3 or Claim 4 in which the duct is interconnected with the structural support member and bounds one edge of the facade element.

6. A method according to Claim 3 in which the flow path for the heat exchange fluid comprises a conduit in the duct, the air flowing through the duct around the conduit and emerging through an opening in the duct to flow over the facade element.

7. A method according to Claim 4 in which the duct is substantially horizontal and is arranged at floor level such that the air subsequently flows upwardly across the facade element.

8. A method according to any one of the preceding claims in which the said structural support member is hollow, the heat exchange fluid being circulated through the hollow member to effect the second heat exchange.

9. A method according to Claim 8 in which the hollow member is substantially vertical and forms one side of a substantially rectangular frame bounding the facade element, the other members of the frame also being hollow such that the heat exchange fluid is circulated around the frame.

10. A method according to Claim 9 in which the heat exchange fluid is heated or cooled after



ribs are directed only inwardly from the wall elements 41. The wall elements 41 have apertures intermediately of such ribs for escape of air to the exterior of the structure so provided.

The following examples illustrate how the system of Figure 1 can be used to maintain the temperature of a room either above or below the outside temperature.

10 EXAMPLE 1: Heating

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EXAMPLE 2: Cooling

Thermoplane plates are used in this case as in the Example 1 having the same heat passage resistance. The cooling surface provided by the frame structure comprised of the hollow vertical supports and the interconnecting transversely disposed beam or bar elements has an area of 2.64 m^2 . The air quantity supplied to the room amounts to $300 \text{ m}^3/\text{h}$ and the outer temperature is 44.3°C . When cooling water used is delivered at a flow of 164 l/h with a delivery temperature of 14.4°C , it discharges from the ribbed pipes at a temperature of 15.3°C and at that temperature enters the frame structure comprised of the hollow vertical supports and the hollow interconnecting bar or beam elements. The water leaving the frame structure has a return tem-

perature of 18.2°C and the exposed surface temperature of the frame changes in the direction of the return from 16.6°C to 17.6°C . There results a room temperature on the room side of the glass which is 29.7°C . There is brought about a cold delivery to the outside amounting to 68 kcal/h as well as a room side cooling output of 407 kcal/h . The heat passage number or figure from supports and structure surrounding the thermopane can be calculated at $17.4 \text{ kcal/m}^2 \text{ grd C}$.

WHAT WE CLAIM IS:—

1. A method of controlling temperature in a room having an outside wall, the method comprising effecting an initial heat exchange between a heat exchange fluid and a flow of air, subsequently directing the air into the room across the inner surface of a facade element of the outside wall, and then effecting a second heat exchange between the same heat exchange fluid and a structural support member mounting and/or bounding one edge of the facade element.

2. A method according to Claim 1 further comprising selectively interrupting the flow of heat exchange fluid to maintain the temperature in the room at a predetermined level.

A method according to Claim 1 or Claim 2 in which the initial heat exchange is effected in a duct located adjacent the facade element, the duct including means defining separate flow paths for the heat exchange fluid and the air.

4. A method according to Claim 3 in which the duct further includes an opening which directs the flow of air across the facade element after the first heat exchange has been effected.

5. A method according to Claim 3 or Claim 4 in which the duct is interconnected with the structural support member and bounds one edge of the facade element.

6. A method according to Claim 3 in which the flow path for the heat exchange fluid comprises a conduit in the duct, the air flowing through the duct around the conduit and emerging through an opening in the duct to flow over the facade element.

7. A method according to Claim 4 in which the duct is substantially horizontal and is arranged at floor level such that the air subsequently flows upwardly across the facade element.

8. A method according to any one of the preceding claims in which the said structural support member is hollow, the heat exchange fluid being circulated through the hollow member to effect the second heat exchange.

9. A method according to Claim 8 in which the hollow member is substantially vertical and forms one side of a substantially rectangular frame bounding the facade element, the other members of the frame also being hollow such that the heat exchange fluid is circulated around the frame.

10. A method according to Claim 9 in which the heat exchange fluid is heated or cooled after

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passing through the hollow frame members and is then returned to the means for effecting the initial heat exchange.

11. A method according to Claim 7 as dependant on any one of the claims 3 to 7 in which each hollow vertical member of the frame is provided with external ribs extending parallel to the interior surface of the facade element, and in which the duct includes at least one slot oriented perpendicular to and beneath the ribs such that air emerges from the duct through the slot and flows upwardly between the ribs.

12. A method according to Claim 11 in which the ribs form part of a sleeve for the vertical member, and predetermined ribs further act as spacers between the sleeve and the vertical member.

13. A method according to Claim 12 in which the sleeve includes openings between the spacers.

14. A method according to Claim 9 in which the air is directed over at least three adjoining facade elements of the outside wall, two of the elements being fully bounded by hollow structural members having internal passages communicating with one another such that the heat exchange fluid flows around the two elements to effect the second heat exchange, the third element being bounded on two opposing sides by hollow vertical structural members bridged at the top by a hollow member closed at both ends and at the bottom by a hollow member sealed from the hollow members bounding the other two elements and providing a return passage for used air extracted from the room being conditioned.

15. A method according to Claim 2 in which the heat capacity of the means for effecting the initial heat exchange is less than the heat capacity of the means for effecting the second heat exchange whereby the temperature of the air responds rapidly to an interruption in the supply of heat exchange fluid to the initial heat exchanging means while the temperature of the structural support member responds more slowly to such an interruption.

16. A method of regulating the temperature in a room having an outside wall, comprising feeding air through a duct located within the room adjacent a facade element of the outside wall, passing water at a predetermined temperature through a conduit in the duct to change the temperature of the air therein, discharging the heated or cooled air into the room across the inner surface of the facade element, and thereafter passing the same water through hollow structural support members mounting and/or bounding the facade element to heat or cool said support members.

17. A method according to Claim 16 in which the air extracts heat from the water

flowing through the conduit such that the water enters the conduit at a first temperature and leaves the conduit at a second temperature lower than the first temperature, both the first and second temperatures being above the desired room temperature and the flow of water being interrupted whenever the room temperature reaches or exceeds the desired temperature.

18. A method according to Claim 16 in which the air gives up heat to the water flowing through the conduit such that the water enters the conduit at a first temperature and leaves the conduit at a second temperature higher than the first temperature, both the first and second temperature being below the desired room temperature and the flow of water being interrupted whenever the room temperature reaches or falls below the desired temperature.

19. A method according to Claim 1 substantially as herein described with reference to the accompanying drawings.

20. Apparatus for controlling the temperature in a room having an outside wall, the apparatus comprising a structural frame including hollow vertical support members disposed between adjacent facade elements of the outside wall, a horizontal duct extending beneath the facade elements, a pipe disposed within the duct and communicating with the interior of the hollow support members, means for circulating a heating or cooling fluid initially through the pipe and then subsequently through the support members, means for delivering air to the duct such that air flows around the pipe to effect an initial heat exchange between the air and the fluid flowing in the pipe, the duct having an opening which directs the heated or cooled air upwardly into the room across the facade elements to provide convection heating or cooling of the room, and means responsive to the room temperature for selectively interrupting flow of fluid in the pipe to maintain the temperature at a predetermined level, the volume of the pipe being less than that of each of the said vertical support members whereby the said convection heating or cooling responds rapidly to a said interruption whereas the temperature of the vertical support members responds more slowly to such an interruption.

21. Apparatus according to Claim 20 and substantially as herein described with reference to the accompanying drawings.

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ERRATUM

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