United States Patent

[11] 3,628,599

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[21] Appl. No. **30,676**
[22] Filed **Apr. 22, 1970**
[45] Patented **Dec. 21, 1971**

[54] **VALANCE HEATING AND COOLING DEVICE**
8 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** **165/22,** 165/28, 165/48
[51] **Int. Cl.** **F24f 3/00**
[50] **Field of Search** 165/48, 50, 26, 140, 56, 57, 27, 33, 49

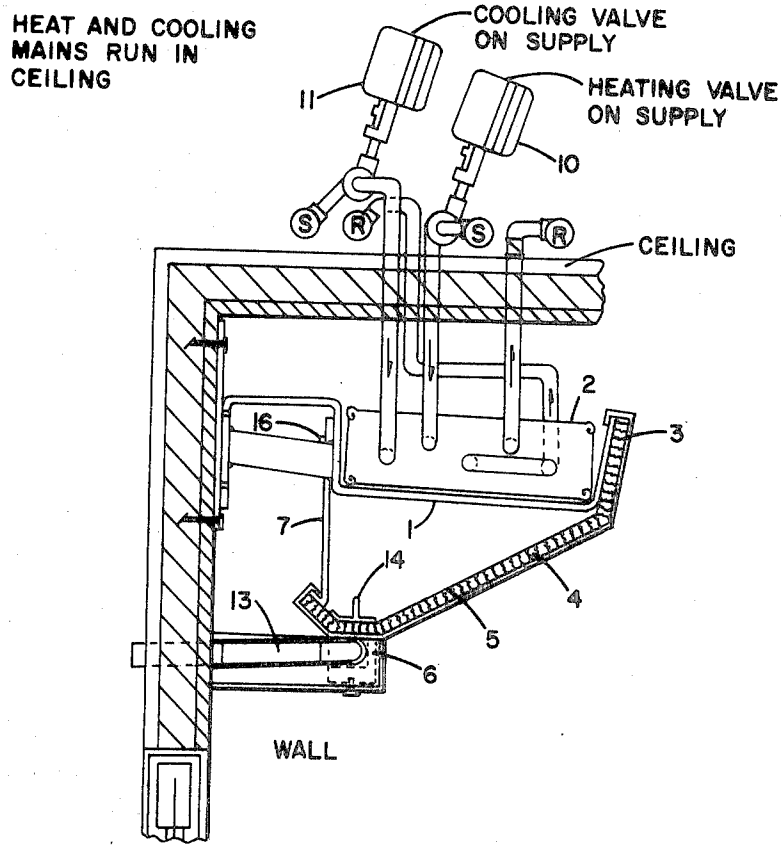
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ABSTRACT: This invention relates to a device for regulating the temperature in an enclosure to a desired predetermined degree regulated by a manually set thermostat in the enclosure or room, and heats or cools the enclosure entirely by convection or a combination of convection and radiation, and further embodies a single valance unit embodying a finned tube structure including both heating medium conducting tubes and cooling medium tubes in a single unit, together with thermostatically controlled motorized valves for controlling the flow of a heating medium or a cooling medium through the finned tube unit. The valance structure containing the finned tube unit may be attached to the ceiling or a sidewall near the ceiling of the enclosure and contains suitable flow directing means to direct cooled air downwardly along the wall, and heated air in horizontally flowing blankets across the ceiling of the enclosure.



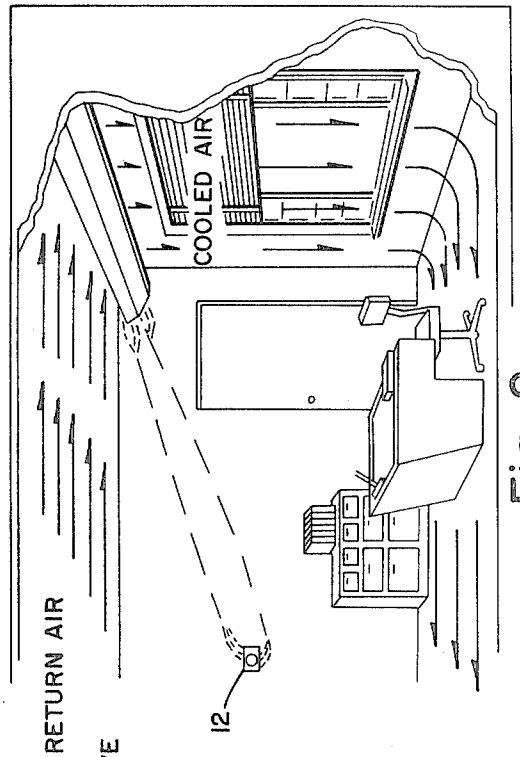


Fig. 2

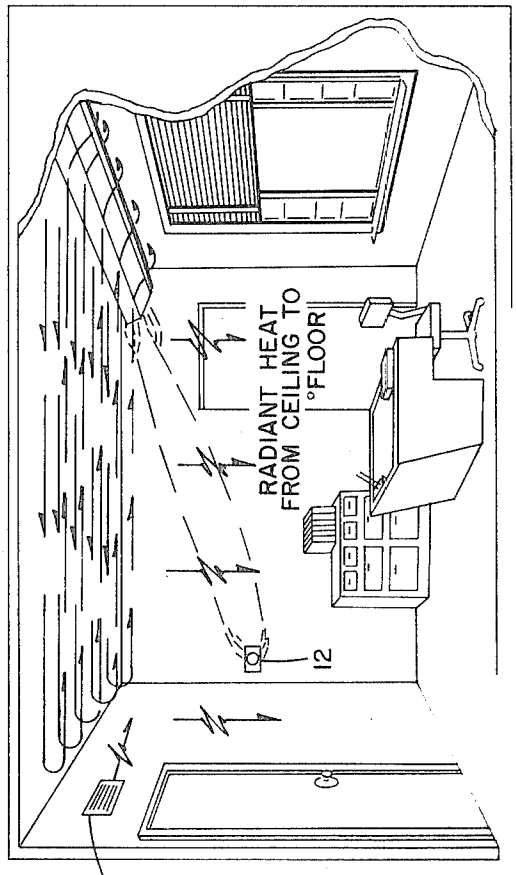


Fig. 3

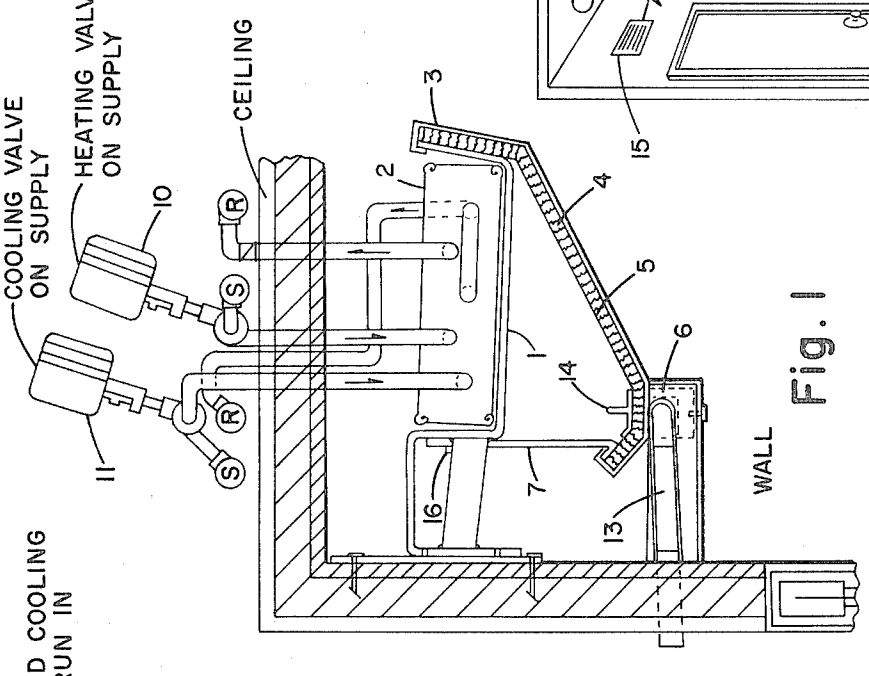


Fig. 1

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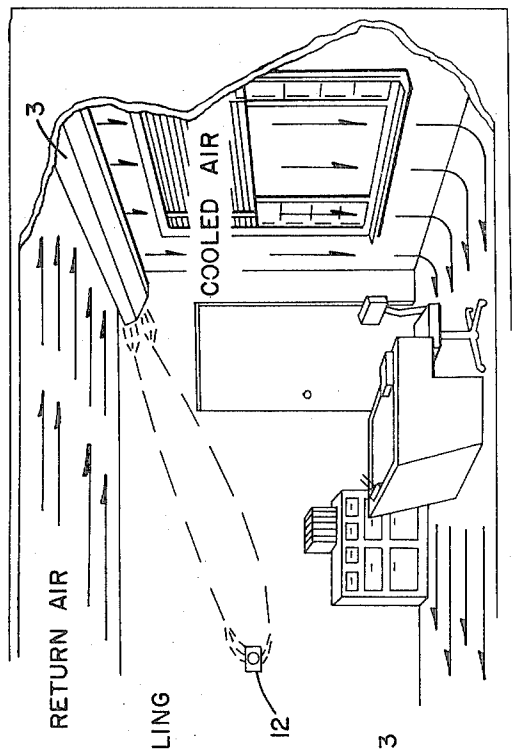


Fig. 9

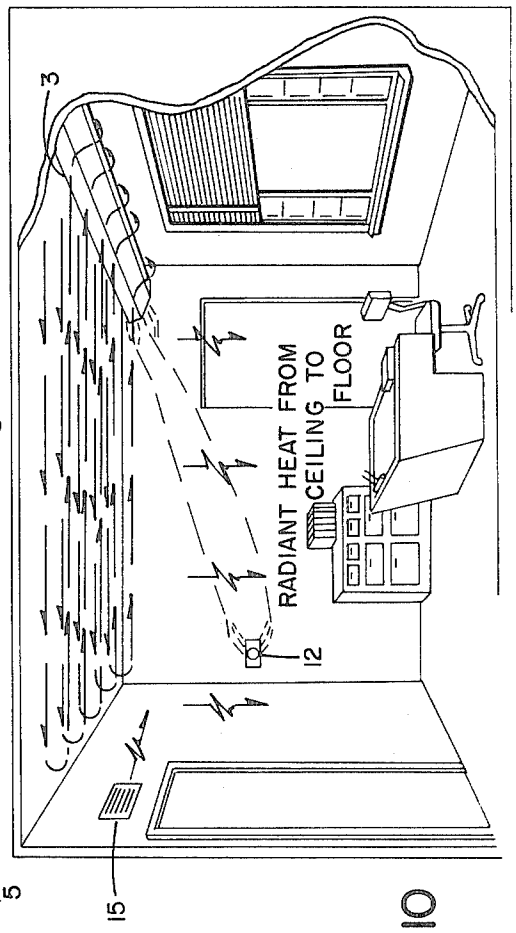


Fig. 10

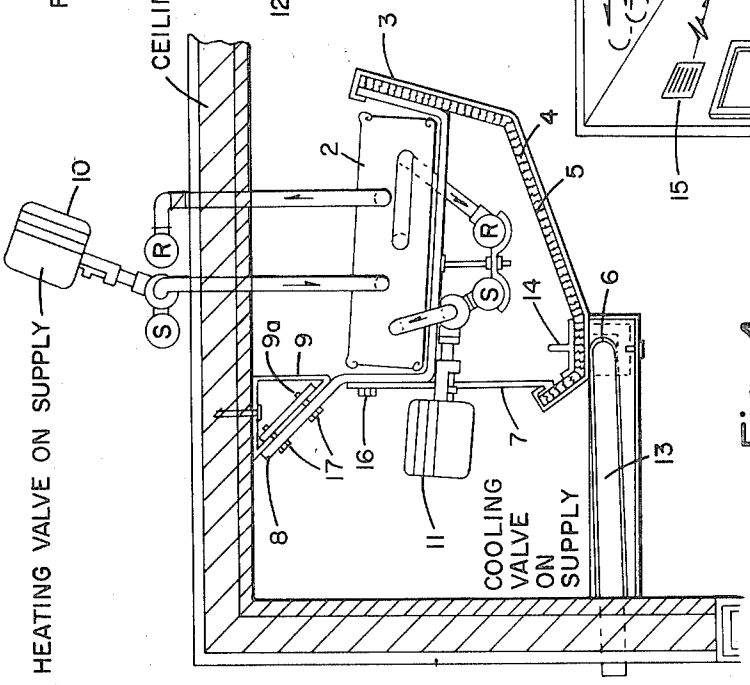


Fig. 4

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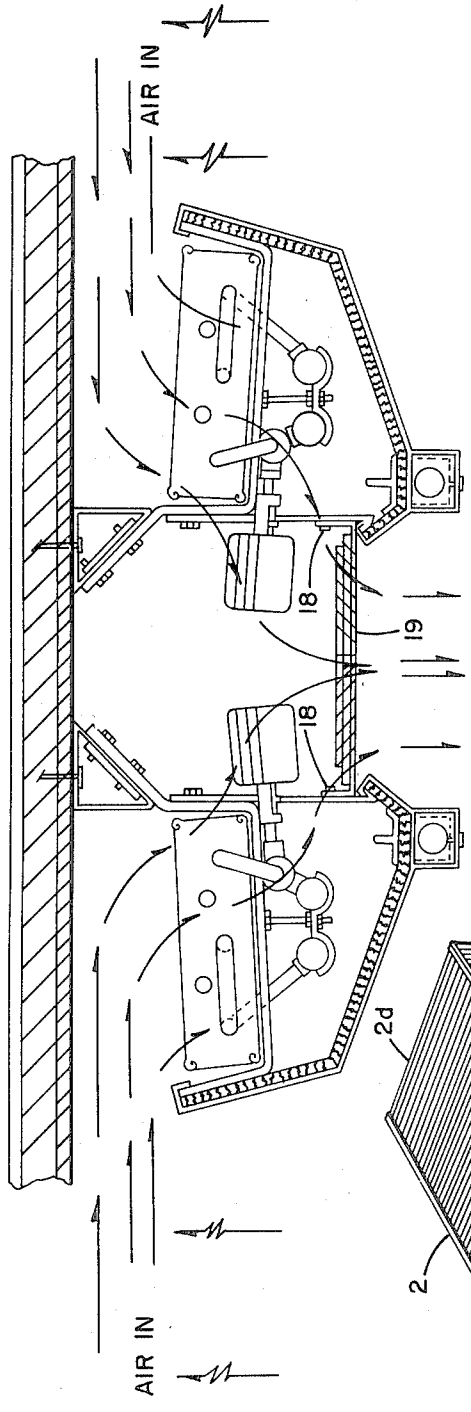


Fig. 8

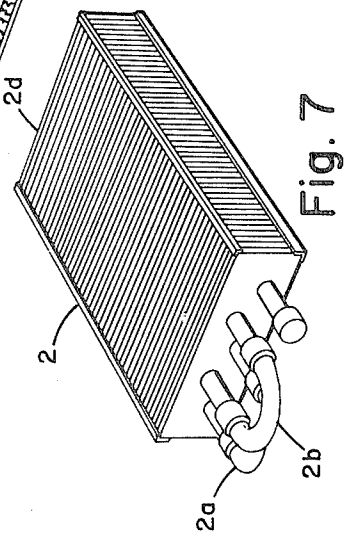


Fig. 7

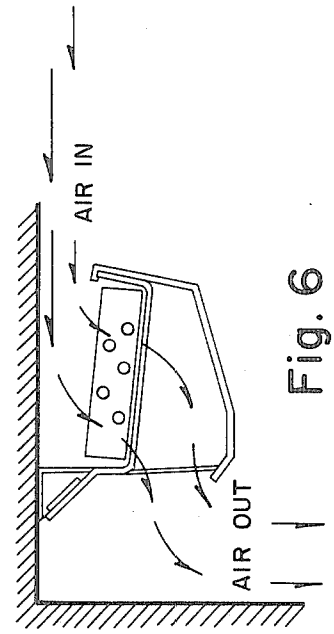


Fig. 6

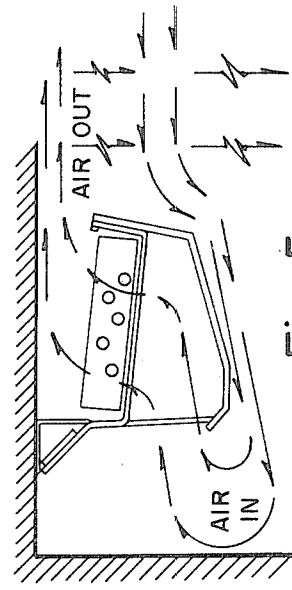


Fig. 5

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VALANCE HEATING AND COOLING DEVICE

The present invention provides a device for conditioning the air in an enclosure or enclosures, such as the rooms in a dwelling, a motel or in any suitable enclosure wherein it is desired to maintain a predetermined temperature, and it further lends itself particularly to individual control of temperature in each room of a multiple roomed structure by use of manually set thermostats for each individual room.

A primary object of the present invention is to provide a single valance unit to be attached to the ceiling or to the wall of a room or enclosure, which valance unit embodies therein a finned tube structure embodying a plurality of tubes for conveying a heating fluid through the finned tube structure, as well as a plurality of tubes for conducting a cooling fluid through the finned tube structure, thus providing either heating or cooling by a single finned tube unit, together with motorized valves, operation of which is controlled by a manually set thermostat to control the flow of either heating or cooling fluid through the finned tube unit.

Another object of the invention is to provide means for heating and cooling an enclosure which is both noiseless and draft-free in its operation, in that it embodies no moving mechanical parts, such as fans, filters, electric motors, etc., and provides means for directing the flow of heated or cooled air in such manner and paths as will prevent the creation of drafts in the enclosure.

A distinct advantage of the present invention other than its noiseless, draft-free operation is that it provides a single unit for both heating and cooling a room and may be installed in a room or enclosure without the requirement of any ducts in the building or vents in the walls or ceilings and will provide comfortable heating and cooling of a room with a single unit, thereby materially reducing the cost of installation.

The present invention can be installed in a room without upsetting or detracting from the appearance of the room, and it further includes the distinctive advantageous feature of dehumidifying the room or enclosure in which it is installed.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a valance heating and cooling device of a preferred form embodying the invention and the features forming the invention will be specifically pointed out in the claims.

IN THE DRAWINGS:

FIG. 1 is a cross section of the heating and cooling device showing it attached to a wall.

FIG. 2 is a view showing the location of the valance heating and cooling unit as placed in a room and showing the flow path of cooling air.

FIG. 3 is a view similar to FIG. 2 only showing the flow path of heated air in a room or enclosure.

FIG. 4 is a cross section through the valance heating and cooling unit showing it attached to the ceiling of the room or enclosure.

FIG. 5 shows the valance in cross section and illustrates the flow of warm air through the valance during the heating cycle.

FIG. 6 is a cross section of the valance showing the flow of air during the cooling cycle.

FIG. 7 is a fragmentary perspective view of the finned tube heating and cooling unit.

FIG. 8 is a sectional view through a modified form of the heating and cooling unit showing two units arranged in back-to-back relationship.

FIG. 9 is a view showing the flow path of cold air from the modified heating and cooling device as shown in FIG. 8.

FIG. 10 is a view showing the paths of heating air flowing from the modified heating unit shown in FIG. 8.

Referring more particularly to the drawings, the heating and cooling device is attached as shown in FIG. 1 to the wall of the room to be treated by means of hangers 1 (shown in FIG. 1) attached to the wall which are spaced at suitable distances at approximately 3 or 4 feet along one wall of the room, and the heating and cooling valance unit 2 is supported by these hangers.

The heating or cooling unit 2 comprises a finned tube structure composed of a plurality of smooth flat fins 2^d which are of sufficient size to permit passage through the fins of a plurality of tubes. In FIG. 7 of the drawings there are shown two heating fluid conducting tubes 2^a connected in the form of a coil which in the installation of the heating and cooling device are connected to a source of heating fluid (not shown) which may be of any approved type readily purchaseable upon the open market. A plurality of cooling fluid conducting tubes 2^b (shown in FIG. 7) also pass through the fins and in installation these tubes are also connected in coil form and are connected to a source of cooling fluid (not shown) such as a chiller which may also be of any approved type purchaseable upon the open market. The cooling fluid circulating tubes pass through the fins below the heating fluid conducting tubes. The unit 2 may be provided at its corners with silencing plastic strips such as shown in U.S. Pat. No. 3,493,038, dated Feb. 2, 1970 for the purpose of silencing noises created by movement of unit 2 due to expansion or contraction under heating or cooling operation. A pan 3 is placed beneath the unit 2 with its lip attached to the hanger 1 and the back of the pan is hooked or attached to a adjustable hanger 7.

A motorized valve 10 of any approved construction is placed in the line which circulates the heating fluid through the tubes 2^b and a second motorized valve is placed in the line which circulates the chilled cooling fluid through the tubes 2^b. These motorized valves are readily purchaseable upon the open market and are well known to the trade.

The operation of the motorized valves is controlled by a thermostat 12 mounted on a wall of the room. The thermostat 12 should be so located that it is not directly under the valance so that airflow of cold or warm air on or around the valance will not affect the operation of the thermostat. The thermostat is of the type which opens the heating motorized valve on a drop in temperature, or opens the cooling valve on a rise in temperature. Between the operation of the heating valve and the cooling valve, there is a dead section in the thermostat control band which calls for neither heating nor cooling. The temperature of the hot water in the valance need not be too high and a satisfactory heating can be obtained with temperature ranging from 100 to 180 degrees Fahrenheit.

It is recommended that the source of hot water for heating be equipped with an outdoor-indoor compensating thermostat (not shown). With an outdoor-indoor compensating thermostat control, the hot water being fed to the valance for heating the room is modulated in accordance with the outdoor temperature. It is important that this be considered because, if the coil has been in the cooling position and is covered with condensate, the condensate will be vaporized into the room if an excessively hot source of heating water is fed to the coil on the heating cycle. If the coil is wet with condensate and extremely hot water is fed into the room heating coil, there is a possibility that the moisture driven from the coil will condense on neighboring cool surfaces. It is for this reason that we recommend the use of an indoor-outdoor compensating control on the hot water heating source.

The fins of the unit 2 are so designed and constructed that they are made of very smooth straight metal with no indentations or protuberances. The purpose of this flat construction is to minimize the holdup of condensate during the cooling cycle. During this cooling cycle, cold chilled water is passed through the lower coil formed of the tube 2^b. FIG. 6 clearly illustrates the operation of the valance unit during the cooling cycle. Warm air, which lies at the ceiling, is drawn into the coil and, as it passes through the coil, it is cooled. As it leaves the coil, the cool air deposits condensed moisture on the coil which flows down the coil surface and into the pan 3. The cool air then drops toward the pan 3 and out of the aperture between the coil and the pan on the wall side of the unit. The

cool air then drops down the wall of the room. As this cool air drops down the wall, more uncooled warm air is drawn into the coil from above.

The valance heater and cooling device of the present invention is an excellent device for dehumidifying the air in the room. As the air in the room passes through the coil, it is rapidly cooled, and the moisture in the air is deposited on the finned surfaces. The moisture on the finned surfaces collects in large droplets which then move to the bottom of the coil where they drop into the pan 3 and down the drain line 13 out of the building. The valance device has proven to be an excellent dehumidifying device.

The operation of the valance during the heating cycle is illustrated in FIGS. 3 and 5 of the drawings. During the heating cycle, warm air rises from the coil, travels across the ceiling of the room from one side of the room to the other. The thickness of the hot layer leaving the valance is approximately as thick as the discharge opening of the valance as shown in FIG. 5. After the warm air has traveled all the way across the room at the ceiling level, and strikes the wall at the far side of the room, it turns back on itself and returns to the valance in a layer directly below the heated layer above. The lower heated layer travels back toward the valance and when it reaches the valance, it turns under the valance, goes toward the wall, goes back into the valance and then back to the ceiling again. This clearly illustrated in FIGS. 3 and 5.

During the normal operation in a typical home, motel or apartment room, the temperature of the air travelling back and forth across the ceiling will be approximately 90 to 120 degrees Fahrenheit. This temperature is sufficient to warm the ceiling, whereupon the ceiling radiates heat down to the floor. The floor picks up the heat and, as extensive research has shown, the temperature of the floor will be approximately the same as the temperature at the 6-foot level. In fact, the temperature at the floor level will be warmer than experienced with baseboard and almost any other heating other than radiant ceiling panels.

During the heating cycle, the valance heating and cooling device heats the room through a radiation effect. The valance heating and cooling device heats the room by blanketing the ceiling with a warm layer of air which warms the ceiling, radiating heat from the ceiling area toward the floor. This is a very desirable form of heating and is an extremely comfortable one. In a room with this valance heating and cooling, it is possible to run the normal air temperature at a lower level in the occupancy zone than usually needed for heating spaces.

If one were to be lying in a bed, the heating effect can prove to be very delightful because the warm ceiling radiates down onto the bed and makes it possible for the sleeping occupant of the space to be comfortable with only a sheet, or at most, one blanket. The occupant will also find that his shoulders and head are quite warm because of the radiant effect from the ceiling.

One of the big advantages of this system is the use of only a single or common coil for both heating and cooling. This eliminates the necessity for a second coil. The elimination of this second coil is made possible by the tremendous flat clean area of the valance coil fins. There is ample room for more than one set of tubes in a bank of finned surfaces. There is no attempt in the valance device, to provide any ventilation. Ventilation should be brought into the conditioned space through a separate opening 15. It should be clearly understood that the purpose of the valance is for both heating and cooling only and no attempt is being considered as a ventilation device.

Since the valance heating and cooling device in the heating cycle recirculates the air only at the ceiling level, it is an extremely clean device. To our knowledge at this time, there has not been any wall streakage or ceiling streakage occuring with the use of the valance as a heating device.

The valance pan 3 can be made of metal, plastic, wood or any other suitable material. The valance pan is provided with an inner coating of insulation 4 which is of extreme importance because, when the cold air during the cooling cycle strikes the valance pan, it may overcool the pan metal if there is no insulation. If the valance pan 3 becomes too cold, condensate from the air would form on the underside of the pan 3 and drip onto the floor. This condensation on the pan 3 surface is prevented by the installation of the proper amount of insulation.

The pan liner 5 is a plastic or waterproof lining which covers the insulation. It is important that the insulation not be permitted to become water-soaked with condensate dripping down from the coil.

The pan 3 supported by the adjustable hanger 7 is tilted by adjustment of the hanger 7 to cause condensation which drips therein to run to one end of the pan where it drains from the pan through a drain line 13 located in the wall into a suitable dry well or drainage system (not shown).

The position of the hanger 7 is adjusted by means of a locking bolt 16. With the locking bolt, the position of the hanger 7 may be adjusted in an upward and downward direction. The purpose of this adjustment is to pitch the pan 3 at the bottom level so that the condensate will drain from one end of the room to the other, thereby leaving the drain without causing a puddle in the pan.

When a mechanic installs the drain fitting 6, he first drills a hole in the pan 3. He then inserts the drain fitting handle 14 into the hole and holds the position of this fitting firmly with his left hand. Then he takes the drain fitting 6 and screws it onto the protruding drain fitting handle which passes through the hole. He tightens up the drain fitting 6 until he gets the proper orientation on the direction in which the condensate should drain. The drain is so constructed that the condensate can either go toward the inner wall, or toward the sidewall.

The drain line 13 is a plastic hose which can be used to move upward and downward so that it is not absolutely imperative that the mechanic make a perfect fit between the wall and the pan.

After installation, the unit operates in the following manner. If the temperature in the room rises, the thermostat 12 will open the cooling valve 11. Chilled water passes through the lower coil in the finned tube construction, thus cooling the air in the room. If the temperature in the room gets too cold, the cooling valve 11 then closes. If it continues to get colder, and after passing through a dead center of one or two degrees, the thermostat 12 will cause the heating valve 10 to open and hot water will pass through the upper coil. As soon as the room is sufficiently warm, the thermostat 12 will shut off the heating valve 10. Therefore, it is apparent that by the use of this thermostat, valance and two motorized valves, it is possible to heat and cool a room on a noiseless, draft-free manner.

The ceiling baffle strip 9 (See FIG. 4) is a metal device that is fastened to the ceiling and runs the full width of the room. This baffle 9 prevents the passage of air directly past the coil and forces the air to go through the coil. Also, it acts as a light stop from the window side of the room. The baffle 9 has two lips 9^a on its wallward side, and to these two lips, a ceiling hanger 8 can be fastened. The construction of the baffle is such that the hanger can be moved along to any location in the room, whereupon the two bolts 17 on the hanger can be tightened to hold the hanger securely to the ceiling baffle strip. In contrast, the wall hanger 1 involves no baffle strip and is merely fastened directly to the wall.

From the foregoing description and FIGS. 1 to 7 of the drawings, it will be apparent that the valance heating and cooling device may be fastened to the wall or ceiling of a room or enclosure and operate on a convection cycle to cool the room and a combined convection and radiation cycle to heat the room, and that it may be placed in such manner as to be relatively inconspicuous and will not deteriorate the estatic value of the room materially, and also that by the use of the single coil unit embodying the relatively large fins which permit their use both in the heating and cooling action, the cost of manufacture, as well as installation of the device will be materially less than such costs of devices now in use for performing the same functions.

FIG. 8 shows a modification of the valance heating and cooling device, wherein two of the units comprising the heating and cooling unit 2 and pans 3 are placed in back to back relation and suspended from the ceiling. A grill 19 is shown over the air outlet of this modified form of unit, which grill is supported by a suitable grill hanger 18. In other respects the modified form shown in FIG. 8 is the same in construction as that hereinabove described.

FIG. 9 illustrates by arrows the flow path of air through and from the modified form shown in FIG. 8 during cooling cycle operation of the device for cooling the room, while FIG. 10 illustrates by means of the arrows the flow path of the air during the heating cycle operation of the modified form of the valance heating and cooling device.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be modified within the invention defined by the claims.

What is claimed is:

1. In a valance heating and cooling device for conditioning air in an enclosure, including a ceiling and a sidewall, a heating and cooling unit including a tubular coil for circulation of a cooling fluid and a second tubular coil for conducting a heating fluid placed above said coil for circulation of cooling fluid, a thermostatically controlled valve for controlling flow of cooling fluid through said cooling coil, a thermostatically controlled valve for controlling flow of heating fluid through said heating coil, means for supporting said heating and cooling unit in close proximity to the ceiling of the room, said heating and cooling unit including means for directing air from the room over said cooling coil and against the wall of the room causing the air to flow downwardly along the wall in a relatively thin blanket and through the enclosure to cool the enclosure, said valance heating unit including means for directing air through the unit over said heating coil and outwardly from the unit against the ceiling in a blanket of heated air which will heat the room by radiation from the ceiling.

2. A valance heating and cooling device as claimed in claim 1, a plurality of flat fins on said tubes, said fins being free from indentations and protuberances to permit free flow of condensation therefrom and a condensation receiving pan located beneath said fins.

3. A valance heating and cooling device as claimed in claim 2, adjustable means for supporting and tilting said pan to cause condensate collected therein to flow to one end of the pan and means for conducting condensate from the pan to a place of disposal.

4. A valance heating and cooling device as claimed in claim 3, including a layer of insulation in said pan and a waterproof covering over said insulation.

5. A valance heating and cooling device as claimed in claim 2, wherein said pan has a portion thereof formed to cooperate with the unit to provide airflow directing path of air through and out of the unit.

6. A valance heating and cooling device as claimed in claim 5, including a baffle for preventing air to be cooled passing over the heating coil and forcing it to flow over the cooling coil.

7. A valance heating and cooling device as claimed in claim 1, including a baffle for preventing air to be cooled passing over the heating coil and forcing it to flow over the cooling coil.

8. A valance heating and cooling device as claimed in claim 1, including means for heating fluid for circulation through the heating coil, means for cooling fluid for circulation through the cooling coil, a thermostat for controlling operation of said thermostatically controlled valves, and an outdoor-indoor thermostat connected to and controlling operation of said fluid heating means to modulate the heating of the heating fluid in accordance with the outdoor temperature independently of the thermostat controlling the flow of heating fluid through the heating coil.

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