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R. C. ROE
AIR CONDITIONING
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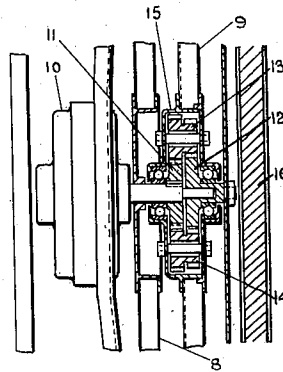
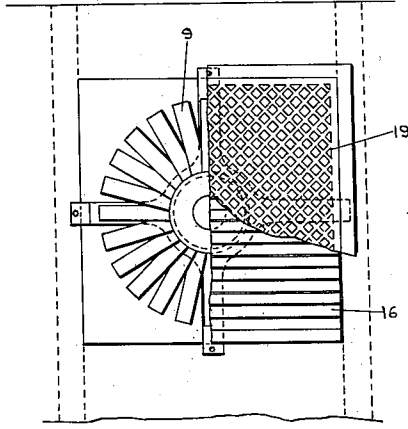
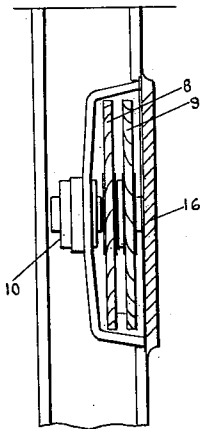


Figure 4.

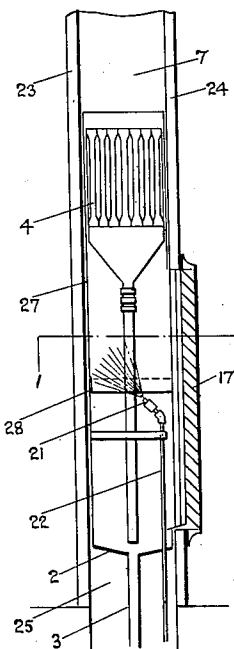


Figure 1.

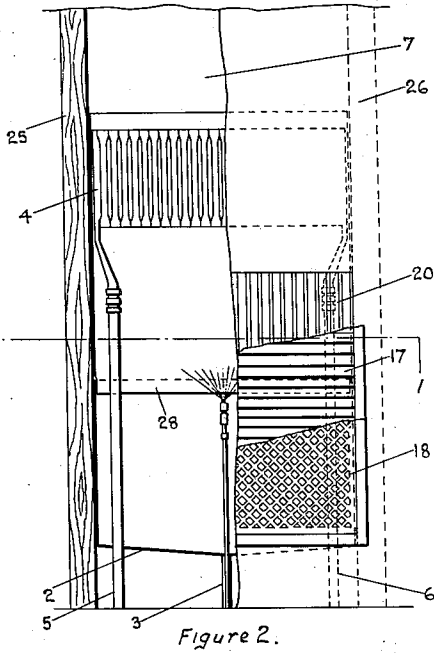


Figure 2.

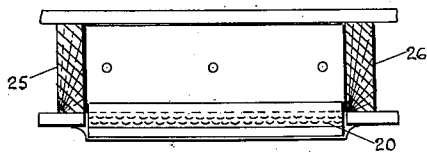


Figure 3.

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UNITED STATES PATENT OFFICE

1,989,337

AIR CONDITIONING

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8 Claims. (Cl. 257—9)

My invention relates to improvements in the art of air cooling and air heating and of humidifying and dehumidifying air in rooms, and more particularly to devices of this character contained within the wall structures of the rooms. Other objects of my invention become apparent as the specifications appear and proceed.

The present methods of heating rooms essentially consist of various radiating devices within or without the rooms with air flowing over them by thermo circulation means and of cooling rooms consist of similar radiating devices, in some cases with forced circulation of air.

In my invention, I propose to use a new method for accomplishing this purpose with the same apparatus and the same air circulating means and in addition I propose to provide means for humidification and dehumidification, all in the interest of greater comfort in the rooms and more sightly appearance.

Referring to the drawing, Figure 1 is a side elevation partially in cross section of my arrangement, Figure 2 is a front elevation partially in cross section, Figure 3 is a plan view of Figures 1 and 2 through lines 1—1, Figure 4 is a detail view of a portion of the mechanism involving details of drive.

In the figures, 2 is a drip pan, 3 is a waste conduit, 4 is a radiator, 5 and 6 are conduit connections to radiator 4, 7 is a space in a partition, in this case illustrated as stud and lath construction, 8 and 9 are impeller fans running in opposite directions, 10 is a motor driving fans 8 and 9, 11 is a rotating gear, 12 is a stationary gear, 13 and 14 are rotating gears, 15 is a housing or hub, 16 and 17 are louvers, 18 and 19 are grilles 20 is a moisture eliminator, 21 is an atomizing water jet, 22 is a conduit, 23 and 24 are sides of space 7, 25 and 26 are joists, 27 is a metal lining and 28 is a joint in metal lining 27. Motor 10 is arranged to operate in either direction and to have a speed control as may be necessary.

It is noticed that the partition of which space 7 is a part is broken for the sake of shortening the length of Figure 1 and 2, but in practice will be a continuous partition or a continuous opening from a point near the bottom of the room to a point near the top of the room.

In operation for heating, a heated fluid, such as hot water, is pumped through conduit 5, returning by conduit 6, through radiator 4. Air is drawn in through grille 19, louvers 16 by action of fans 8 and 9 driven by motor 10, these fans being preferably of the blade screw type

developed by Dr. George DeBothezat, which are essentially properly proportioned fans preferably running in close clearance with enclosing rims on their perimeters and with a dead zone in the center blocked off to prevent backward flow of air through the center and with the blades arranged in approximately a screw or thread type position to the center or core of said fans, fans 8 and 9 being fans of such a type. The air then passes downward through space 7 in the forementioned partition, over radiator 4, through moisture eliminator 20, louvers 17 and grille 18, and thence to the room. In thus passing over radiator 4, it absorbs a portion of the heat of the fluid in radiator 4 in the form of specific heat of air, raising the temperature of the air and thereby heating the room. In case the humidity of the air is low, this humidity is increased by a momentary spraying of water through jet 21 from pipe 22 usually connected to city water supply under the control of a hydrostat, the hydrostat usually being of the electrical type connected to an electrically operated valve and the water supply from line 22. The electrical circuit controlling this valve is usually also connected in series with a timing device permitting water to flow by actuation of said valve for any predetermined period per hour or per day, and as before explained, only when higher humidity is called for by the hydrostat. The water issuing from jet 21 in a finally atomized state by action of the water pressure therein is intimately mixed and absorbed by the air, passing downward around said jet 21, increasing the humidity of said air in proportion to the amount of water absorbed thereby, the temperature of the air having been increased by radiator 4, the ability of that air to absorb moisture is thereby enhanced and hence the moisture presented to it in a finally atomized state is readily absorbed in the form of increased humidity. Any free moisture remaining is eliminated by impingement against moisture eliminators 20 over which the air passes at high velocity and must turn in order to avoid striking the eliminator plates, whereas the water in the form of free moisture being heavier will continue on in a straight line and impinge on said plates and by surface adhesion will flow off said plates into drip pan 2 and thence through drain conduit 3 to the waste. The louvers 17 being placed at an angle to the horizontal in a downward direction depress the air stream downward where it is distributed around the room near the floor level and rises through the room

for heating the same. The amount of air passing can be controlled by the speed of motor 10 which in turn controls the speed of fans 8 and 9.

For cooling purposes, motor 10 is reversed and air flow is in through grille 18, passing louvers 17, moisture eliminators 20, radiator 4 up through space 7, outward through fans 8 and 9 and louvers 16 and grille 19. In the case of cooling, the fluid, such as water, passing through radiator 4 by means of conduits 5 and 6 will be a cooled fluid as distinguished from a heated fluid in the heating operation. The result of the air passing over radiator 4 is to absorb a portion of the specific heat of air into the fluid in radiator 4 and to cool the air thereby after which it passes as before described through louvers 16 and grille 19 to the room. Louvers 16 being at an angle to the horizontal in an upward direction, deflects the air toward the ceiling where it is distributed about the room and gradually filters downward on account of the higher specific gravity of the cool air, thereby cooling the room.

If the humidity of the air is such that in cooling, in passing through radiator 4, it is lowered below its dew point, a portion of the moisture in the air will be condensed on the surface of radiator 4 and will flow by gravity thence downward into drip pan 2 and out through drain conduit 3. In this manner, by controlling the temperature of the fluid in radiator 4 at a proper and predetermined point, together with the other factors entering into heat transfer, such as velocity and surface, the humidity of the room air passing through the apparatus can be controlled during the cooling period to a predetermined maximum.

The space in the partition utilized by this device may be an interior partition and may be the usual stud and joist lath or clapboard construction, or may be hollow tile or other building units of a suitable character. In this way it is seen that normal structures of a building are used as a duct which in the heating period conveys air downward for reheating and distributes hot air in the lower part of the room where it naturally rises to warm the room by its lower specific gravity, whereas in the cooling period the air is drawn in from the bottom of the room, is cooled and distributed near the top where it naturally distributes downward by its higher specific gravity to cool the room. During the heating period when the humidity is likely to be low, means are provided to increase the humidity by the addition of water and if desirable can also be done during the cooling period. Also, during the cooling period when the humidity is likely to be high, means are provided to decrease the humidity by condensation of the water from the air by lowering the air below its dew point.

In room type heating and cooling outfits, it is very desirable to have quiet operation. Quiet operation is best procured by a multiplicity of fan blades of proper shape and design running at slow speeds. The air pressure losses, however, passing through a radiator of the type of radiator 4 and through the corresponding partition as duct work with the entrance and exit losses in the grilles, etc. are in some cases greater than can be procured with a slow speed multi-vane propeller type fan in which case it is often desirable to use two fans running in opposite directions, each one accelerating the pressure of the other, thereby keeping the total speed down and thence the noise, and producing a quiet, smooth running outfit that is not objectionable.

To accomplish this, I have provided, as illustrated in Figure 4, one fan mounted directly on the motor shaft whereas the second fan runs in a reverse direction through a system of internal gearing briefly described as follows: 11 is a gear on the motor shaft and rotating with said shaft, 13 and 14 are pinions enmeshed in gear 11 and supported and rotating in fan housing or hub 15, 12 is a stationary gear fastened so that it does not rotate, also in mesh with pinions 13 and 14. It will be noted that pinions 13 and 14 are in reality double pinions with two different pitch diameters and two different numbers of teeth. In order to get the same rotating speed in a reverse direction on the reversed fan as on the fan fastened to the motor shaft, one arrangement would be to have the number of teeth on gear 11 as thirty teeth, the number of teeth on the portion of pinions 13 and 14 in mesh with gear 11 thirty teeth, the number of teeth on stationary gear 12 forty teeth and the number of teeth on the portion of pinions 13 and 14 in mesh with stationary gear 12 twenty teeth. Other gear ratios can be arranged to produce the same speed or gear ratios can be arranged to produce a different speed if desired. In operation, gear 11 drives pinions 13 and 14 which are integral with hub 15 of fan 9. These pinions in operation rotate themselves around gear 12 and thence carry hub 15 in fan 9 around gear 12, which is stationary, in an opposite direction to the rotation of fan 8. Therefore, one set of fans runs in one direction and one set of fans runs in the opposite direction by the above described simple method of integral gearing and the speeds of the fans can be controlled by the motor and the gear ratio can be such that fan 9 will run at the same speed in the opposite direction, or at some different speed as may be desired.

In practice, the partition holding the above described apparatus is usually metal lined up to and including the top of radiator 4 as illustrated in lining 27 and arrangements are made to put this lining in in two sections through the opening occupied by grilles 18 and louvers 17, etc. It is therefore seen that this apparatus can be installed in buildings already existing from its inherent construction and is not only applicable to new buildings but to already existing buildings. In some cases of new work, metal lining 27 will extend the entire length of that portion of the partition being used as a duct.

Whereas water has been used as an illustration of a fluid to be circulated through radiator 4, both for cooling and heating, it is understood that not only a circulating but also a condensing fluid as steam can be used for heating and an evaporating fluid as sulphur dioxide can be used for cooling, alternately but not simultaneously.

Having described one embodiment of my invention according to patent statutes, it is understood that my invention is capable of embodiment in a variety of forms of apparatus and that I am not limited to the specific form of arrangement or structural parts shown and described but that the scope of my invention is to be gauged by the accompanying claims taken in connection with prior art.

I claim:

1. A heating and cooling device comprising a hollow partition as part of a building, being a portion of the enclosure of a room contained in said building, said partition having openings near the floor and ceiling each leading from said room to said hollow partition, radiating means

installed within said hollow partition, reversible power drivable air circulating means, consisting of two blade screw impellers in pressure accumulative relation with each other, moving room air through said partition in heat transfer relation with said radiating means, in a downward direction for heating and in an upward direction for cooling said air.

2. A heating device comprising a hollow partition as part of a building, being a portion of the enclosure of a room contained in said building, said partition having openings near the floor and ceiling each leading from said room to said hollow partition, radiating means installed within said hollow partition, power drivable air circulating means, consisting of two blade screw impellers in pressure accumulative relation with each other, moving room air in a downward direction through said partition in heat transfer relation with said radiating means.

3. A cooling device comprising a hollow partition as part of a building, being a portion of the enclosure of a room contained in said building, said partition having openings near the floor and ceiling each leading from said room to said hollow partition, radiating means installed within said hollow partition, power drivable air circulating means, consisting of two blade screw impellers in pressure accumulative relation with each other, moving room air in an upward direction through said partition in heat transfer relation with said radiating means.

4. A heating and cooling device comprising a hollow partition as part of a building, being a portion of the enclosure of a room contained in said building, said partition having openings near the floor and ceiling each leading from said room to said hollow partition, radiating means installed within said hollow partition, reversible and speed controllable power drivable air circulating means, consisting of two blade screw impellers in pressure accumulative relation with each other, moving room air through said partition in heat transfer relation with said radiating means in a downward direction for heating and in an upward direction for cooling said air.

5. A heating and cooling device comprising a hollow partition as part of a building, being a portion of the enclosure of a room contained in said building, said partition having openings near the floor and ceiling each leading from said room to said hollow partition, radiating means

installed within said hollow partition, humidifying means in said partition, power drivable air circulating means, consisting of one impeller rotating in one direction and one impeller rotating in the opposite direction in inter-gear relation with each other and driven by a single motor moving room air through said partition in humidifying relation with said humidifying means.

6. A cooling device comprising a hollow partition as part of a building, being a portion of the enclosure of a room contained in said building, said partition having openings near the floor and ceiling each leading from said room to said hollow partition, radiating and dehumidifying means installed within said hollow partition, power drivable air circulating means consisting of one impeller rotating in one direction and one impeller rotating in the opposite direction in pressure accumulative relation with each other and power drivable from the same source moving room air through said partition in dehumidifying relation with said dehumidifying means.

7. A heating and cooling device comprising a hollow partition as part of a building, being a portion of the enclosure of a room contained in said building, said partition having openings near the floor and ceiling each leading from said room to said hollow partition, radiating means installed within said hollow partition, power drivable air circulating means consisting of one impeller rotating in one direction and one impeller rotating in the opposite direction in inter-gear relation with each other and driven by a single motor moving room air through said partition in heat transfer relation with said radiating means.

8. A heating device comprising a hollow partition as part of a building, being a portion of the enclosure of a room contained in said building, said partitions having openings near the floor and ceiling each leading from said room to said hollow partition, radiating means installed within said hollow partition, humidifying means in said partition, moisture eliminating means, power drivable air circulating means consisting of one impeller rotating in one direction and one impeller rotating in the opposite direction in pressure accumulative relation with each other and power drivable from the same source moving room air through said partition in humidifying relation with said humidifying means.

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