

[54] **NOVEL HEATING, VENTILATING AND AIR-CONDITIONING SYSTEM**

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[56] **References Cited**

UNITED STATES PATENTS

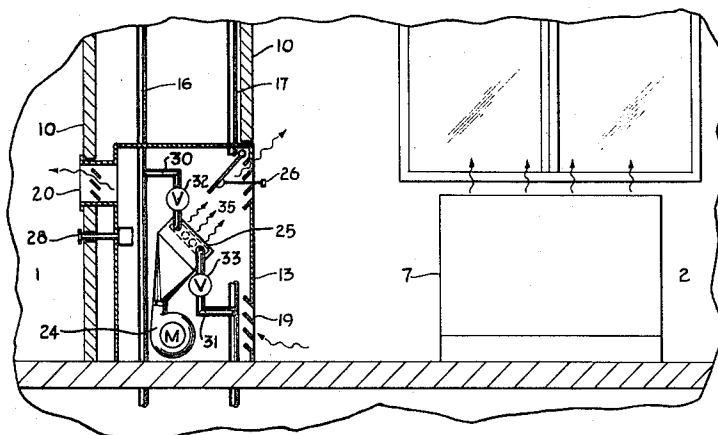
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[57] **ABSTRACT**

Disclosed herein is an economical new system for providing heating, ventilating and air-conditioning, and is particularly advantageous in multi-unit, multi-level structures. It permits maximum choice of temperature and the like by each unit occupant. Each unit contains at least one central room having an oversized wall-type air-conditioner and, in a wall between the central room and a satellite room not having an air-conditioner, an air-transfer means and a heat exchanger.

6 Claims, 3 Drawing Figures



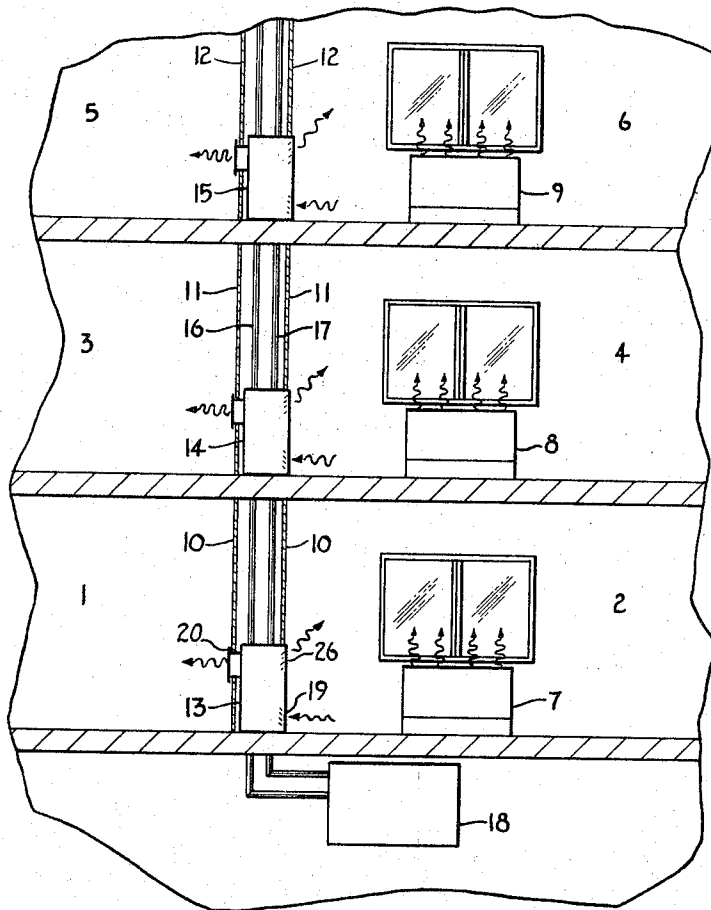


Fig. 1.

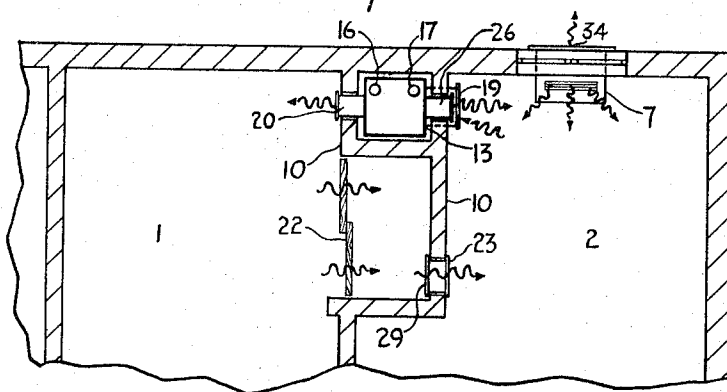


Fig. 2.

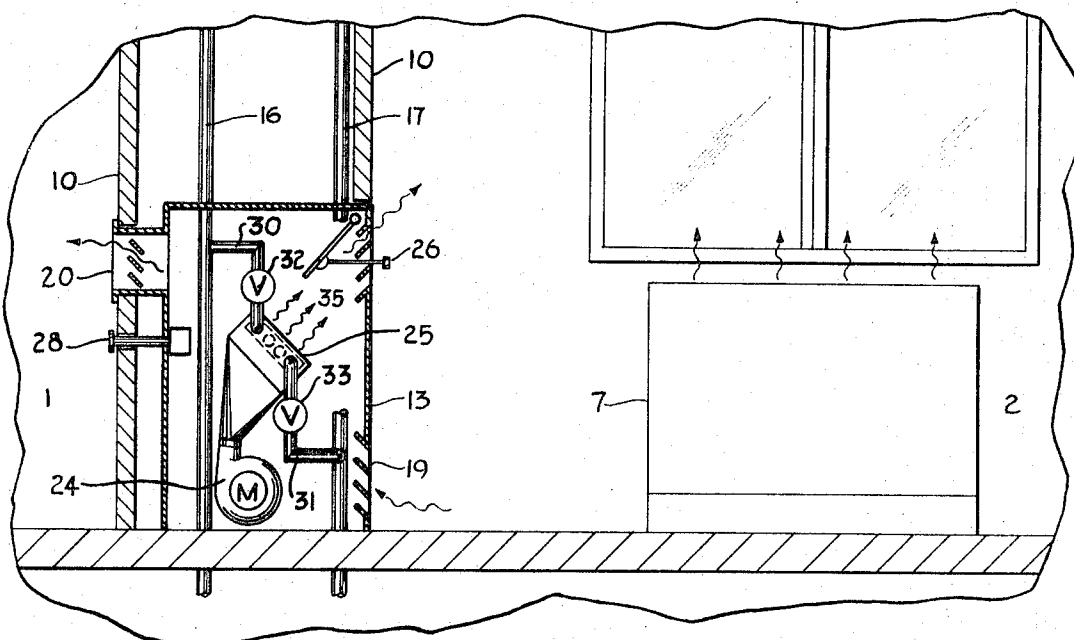


Fig. 3.

NOVEL HEATING, VENTILATING AND AIR-CONDITIONING SYSTEM

This invention relates to a novel system for comfort-conditioning units of a multi-unit structure. As the term is used, "comfort-conditioning" encompasses means for heating, cooling, filtering, and ventilating the air within an enclosure. It can also include humidifying, dehumidifying, sound-insulating, purifying and otherwise treating the air to meet the comfort and health requirements of the occupants of the enclosure. Increasingly, people demand that their living and working units be so comfort-conditioned.

As used herein, "unit" connotes a subdivision of a structure having common access points and a plurality of rooms defined by interior walls and generally assigned to specified occupants. Typical of such units are apartments, office suites, hotel suites, shipboard suites, floors of single family houses and the like.

The escalating material and labor costs render it particularly desirable that the comfort-conditioning system be inexpensive to purchase, install, operate and repair. Further, in view of the growing energy shortage, it is in the societal interest that comfort-conditioning minimize energy waste as well as the concomitant pollution attendant energy generation.

Central cooling and heating is well known, particularly in modern high-rise buildings. Such central cooling requires an extensive amount of ductwork and pipes which wastes space and is expensive to purchase, install and repair. Furthermore, the unit occupant has no choice as to the nature of the air coming through the central air transfer medium. Thus on a warm spring day in a building in which the central forced air supply is still supplying heat, the occupant has no system for forced air cooling or ventilating of the unit. Similarly, on a cool fall day the occupant in a building in which the central forced air supply is still connected to the air cooling system has no system for warming his unit. Furthermore, one might desire to have the unit heated, yet ventilated with fresh air or exhaust at the same time, which also is not within the capability of this centralized system. Moreover, in such a centralized cooling system serving diverse units (tenants), the cooling costs are not apportioned according to use and thus negligent tenants may tend to keep the units operating even during times of prolonged absence since the costs to them are minimal even though the energy waste is substantial.

Another common approach to providing air cooling to such multi-unit buildings, particularly of inexpensive construction, is to install small air cooling units in the wall (including window) in each of the major rooms of each unit and to either include heating means within said wall unit (e.g., electric coils) or to independently supply heat in the conventional manner. Such an approach is wasteful and expensive in that the cost of each small air cooling unit is only slightly less than the cost of a unit having sufficient cooling power to cool a plurality of rooms. Furthermore, the installation costs of such units are comparatively high. From an architectural standpoint such a multiplicity of cooling units visible from outside the building seriously interferes with design patterns. The use of heater-containing wall units requires the use therein of twin-motors, which are expensive. Similarly, heat exchangers, e.g., radiators, in each room are expensive and may detract from the appearance and/or space utilization of the room. More-

over, the temperature in such a room tends to be significantly and undesirably uneven. The zone around the operating heat exchanger will be significantly hotter than a more remote zone. Similarly, there is a pronounced temperature gradient as one moves further away from the air-conditioning means in the standard systems.

According to my invention there is provided in a central room of each unit air cooling, filtering and ventilating means sufficient to cool and ventilate a plurality of rooms and means to draw the cooled air from said central room into a second room not having such air cooling means. This forced air transfer means, typically a fan, also serves as the means to circulate heated air. A heat exchanger is located proximate to said air transfer means and is connected to a central heat energy source in the building. This central heat energy source can either directly provide a hot fluid which has been heated in a central boiler or furnace area, e.g., steam, hot water, or hot air; or it can provide an energy source which can be converted into heat in situ, e.g., electric cables wired into appropriate resistance coils or gas or oil connectable to a tiny furnace.

This system is more economical, efficient and better serves the comfort needs of the occupants. For example, one can ventilate and heat the unit at the same time and can air-cool it at will. It similarly tends to cut down the owner's operating costs and conserve energy since the air cooling costs can be more readily apportioned according to use, and thus it is more likely to be used only when needed. It saves the builder large construction costs by requiring fewer air cooling units, both in the "hardware" savings and in the significant labor savings in installing fewer of such cooling units in the wall. As discussed further below, cooling units of the common-motor type can be used instead of those of the more expensive twin-motor types. It furthermore requires less interruption of the exterior building face (as well as interior wall space) than does a wall unit in each room.

My concept can be more formally described as follows:

In a structure having at least one unit having common access points and a plurality of rooms defined by interior walls, a system for comfort-conditioning the air in said unit comprising, in a central room of said unit means for cooling, filtering and ventilating the air in said unit while venting exhaust air to the atmosphere through an exterior wall of said unit and a combination of forced air-transfer means and a heat exchanger located adjacent a first opening in at least one wall between said central room and a second room of said unit not having air-cooling means, said forced air-transfer means being capable of drawing cooler air from said central room through said first opening and heat exchanger and passing in into said second room, and a second opening in a wall between said second room and said central room or an area communicating therewith to permit an equivalent amount of air to pass from said second room to said central room; said heat exchanger being operatively connectable to a heat energy source.

Maximum advantage of this system can be realized where the structure is a multi-unit one, and preferably multi-level, and one in which the heat exchanger is operatively connectable to the heat energy source

through a conduit extending through a plurality of levels of said building.

The system of my invention can be illustrated by reference to the appended Figures:

FIG. 1 is a schematic cross section of a multi-level building showing two rooms of each of three units;

FIG. 2 is a plan view of part of one unit utilizing the comfort-conditioning system of this invention;

FIG. 3 is a schematic side elevational view depicting a typical air transfer unit used in the system of this invention.

In FIG. 1 each of the three depicted units has two rooms 1 and 2, 3 and 4, and 5 and 6, respectively. Central rooms 2, 4 and 6, respectively, are supplied with standard wall air-conditioning units (7, 8 and 9) of sufficient capacity to cool more than the central room, whereas satellite rooms 1, 3 and 5 do not have independent air-conditioning means. Typically the air-conditioning units are located beneath windows, but obviously other locations in the wall will be satisfactory. Located in the partitions (10-10', 11-11', 12-12') separating the rooms of each unit are cabinets containing air transfer units (13, 14 and 15).

16 and 17 are heating risers connected to a heat energy source 18. These heat risers can contain an electrical conduit, hot water, steam, natural gas, hot air or the like. If the heat source is electricity, for example, only one riser is necessary, whereas if the heat source is steam or hot water, a second riser can be employed for condensate return although a combined (single) steam and condensate return riser can also be used.

Referring, for convenience, only to unit 1-2, air is drawn from room 2 through grill 19 and exits through port 20. As described below, air can optionally be directed to leave via damper 26 back into room 2. Air returns from satellite room 1 to central room 2 through a grill or register in walls 10-10' (not shown).

In FIG. 2 a variant is shown to provide quicker air communication where the central and satellite rooms are large. This unit is equipped with the standard air-conditioning unit 7 as well as the cabinet 13 and heat risers 16 and 17. Cool air is drawn from room 2 through port 19 and out into room 1 through port 20. In this variant the cabinet is closeted between walls 10 and 10' which are also sufficiently separated to provide for closet area 21. One or both doors 22 of the closet area 21 are undercut. 23 is a transfer grill in the upper part of partition 10'. 29 is a transfer grill in the lower part of partition 10'. This arrangement permits return air from room 1 to return to room 2 utilizing the partition studs as air ducts and a sound trap. 26 is the register permitting the air within the cabinet to return to room 2 (when open).

FIG. 3 is a cross-sectional view of cabinet 13. The air from central room 2 enters air inlet 19 and is blown by fan 24 through heat exchanger 25. Means are provided to tap the heat energy source in riser 16 and pass it through the heat exchanger. In the illustrated case wherein hot water is the energy source, pipes 30 and 31 provide such means. Obviously if electric heating means are employed, standard electrical circuitry is utilized instead of pipes. In this illustrated and preferred embodiment cabinet 13 has a discharge air grill damper 26 located in central room 2. During the cooling cycle, this damper 26 is closed, allowing all the air handled by cabinet 13 to flow through outlet 20. During heating operation, discharge outlet 26 will be open to allow for

a suitable amount of balanced heated air flow. Such opening can either be manual (as shown) or automatic, utilizing standard circuitry.

Illustrating a hot-water based heating system, hot water feed ascends from the boiler area 18 in riser 16 while it returns to the boiler area in riser 17. When the occupant of unit 1-2 desires a higher room temperature, he turns control 28 to the appropriate setting. Control means 28 is connected by standard electrical circuitry (not shown) to valve 32 in pipe 30. If the thermostat in control 28 is not at the set temperature, valve 32 is appropriately opened or closed. When opened, a portion of the hot water from boiler 18 passes through the open coils of heat exchanger 25 and back through pipe 31 to return riser 17 to the boiler area to be reheated and recirculated. The air being forced by blower 24 through the coils of the heat exchanger becomes heated in known fashion. Manually operable shutoff valve 33 provides means along with valve 32 for isolating heat exchanger 25 from the system for removal for cleaning and repair purposes. Access to the cabinet 13 for repair or cleaning purposes can be had through an access door (not shown) in wall 10 below outlet 26, for example.

The fan of blower 24 can be controlled by a switch of standard construction conveniently placed near temperature control 28. The fan speed determines the rate at which air is circulated. If room 1 will not be occupied for a long period of time, the unit occupant could shut off the fan to conserve money and energy.

Because of the means of operation of the comfort-conditioning system of this invention, it can be seen that the occupants of each of the three units can independently control the air within their unit to their own desires. If the occupants of unit 1-2 wish it to be cooler or ventilated with fresh air, they can turn the control on air-conditioner 7 to the appropriate setting and turn on the fan motor 24 in cabinet 13, and turn the heat exchanger 25 control to the "off" position. With an electric heat source, for example, the latter would require merely keeping the circuit open. If it is desired to heat unit 1-2, the air-conditioner 7 is turned off and the air-transfer fan turned on.

If on a cool spring or fall day, for example, the occupants want fresh air but still require heat, they can set unit 7 on for ventilation, turn control 28 to an appropriate heat setting and set the blower fan 24 at an appropriate speed. Obviously, the air in room 2 is being continually vented to the atmosphere through an opening 34 in unit 7. The same setup would be desirable to quickly rid the unit of undesirable odors, e.g. fresh paint. If it is desired to keep room 1 significantly warmer than room 2 (e.g., an infant is sleeping in room 1 while a crowded party is in progress in room 2), then damper 26 is closed and unit 7 can be set to ventilation or even cooling.

Since unit 7 is utilized in the cooling cycle only, the choice of type of unit is wide without sacrificing operating expense. Two basic types of through-the-wall cooling packaged units exist. The twin-motor type has one motor for the indoor evaporator fan and one for the outdoor condenser fan. In the common-motor type one motor operates both the evaporator and condenser fans. The first type is a considerably more expensive unit. If such a wall unit has to provide heat during winter, e.g. is equipped with electric heating coils, then the evaporator fan will have to operate. With the common-

motor unit, both fans (evaporator and condensate) will move air. Of course, the condenser fan does not have to operate to provide heating, but rather, because one motor operates both fans, this is wasted energy. My system permits the installation of a common-motor type unit for unit 7 since unit 13 and not unit 7 supplies the heat. Therefore, by installing a common-motor type unit for unit 7, no waste of operating energy will occur and saving in installation cost will be realized.

Although only one central room and one satellite room has been illustrated to simplify the explanation of my system, it is obvious that one or more additional cabinets of type 13 could be present in other walls between the central room and other satellite rooms. Similarly, if the unit is sufficiently large, it could have several "central" rooms, each unit with its own air-conditioning means. The principle of operation would be identical. In like fashion, if the unit is so constructed as to have alcoves or the like which do not receive adequate normal air circulation, then another outlet duct could be provided in the air transfer cabinet. In the latter embodiment the cabinet preferably extends to the ceiling and simple ductwork conducts the air to the alcove area.

In some units supplementary heating may be desired in certain areas, for example, "cold spot" areas not in the normal air circulatory pattern but so seldom used as not to justify an outlet of this invention. Other cold spots may be due to unusual exposure to high winds. Individual taste or need may dictate that certain areas be unusually warmer than the rest of the unit. For such purposes simple electric heating units, e.g., baseboard or space-type heaters, can be employed. The system of this invention still supplies the major heating, ventilating and air-conditioning means for such a unit.

In another variant, the air transfer cabinets can be provided with conventional humidifying means (35) situated between the heat exchanger and discharge outlet. For such purposes, the humidifying means could tap water off one of the heat risers in a hot water system. If a different heat source is used, then a separate water riser could be utilized running parallel to the heat riser. The degree of humidification could optionally be determined by a control, adjacent the temperature control.

Each of the cabinets can be provided with air filtering means, e.g., a filter pad in port 19. This is in addition to the filter normally found in the wall air-conditioning unit. Similarly the cabinets should preferably have sound-absorbing means, numerous types of which are known, e.g., foam, baffles, etc. In a further embodiment the walls are provided with a closeable aperture, e.g. near the fan motor but not in the direct fan blast

path, to provide a constant background noise. Some people prefer such steady background noise at bedtime in order to "drown out," i.e., avoid hearing, disturbing random noise such as street or airplane traffic, "on-off" cycling of the air-conditioner and noise from neighboring units or common passageways or even from other rooms of the unit.

Numerous other variants of the system and its components, as described above, will be apparent to one skilled in the art within the spirit of my invention.

I claim:

1. In a structure having at least one unit characterized by a common access point and a plurality of rooms defined by interior walls, a system for comfort-conditioning the air in said unit comprising

a. in a central room of said unit means for cooling, filtering and ventilating the air in said unit while venting exhaust air to the atmosphere through an exterior wall of said unit and

b. located adjacent a first opening in at least one wall between said central room and a second room of said unit not having air-cooling means, a casing with associated damper means housing a combination of forced air-transfer means and a heat exchanger;

whereby cooler air can be drawn by said forced air-transfer means from said central room through said first opening, casing, and heat exchanger and passed in into said second room, and an equivalent amount of air can pass from said second room to said central room through a second opening in a wall between said second room and said central room or an area communicating therewith, and said damper means can direct part of said air drawn into said first opening and heat exchanger back into said central room; said heat exchanger being operatively connectable to a heat energy source.

2. A system according to claim 1 wherein said structure has a plurality of vertically adjacent levels.

3. A system according to claim 2 wherein said heat energy source is operatively connected to said heat exchanger through a conduit extending through a plurality of said vertically adjacent levels.

4. A system according to claim 1 additionally containing humidifying means between said heat exchanger and the air outlet.

5. A system according to claim 1 wherein closeable aperture means are provided between said air-transfer means and the wall of said second room.

6. A system according to claim 1 wherein said means for cooling, filtering and ventilating the air has a single motor.

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