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CENTRALIZED HEATING AND AIR CONDITIONING SYSTEM

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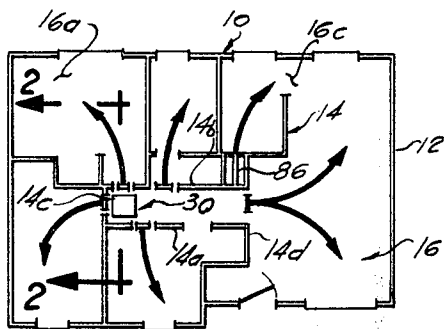


FIG. 1.

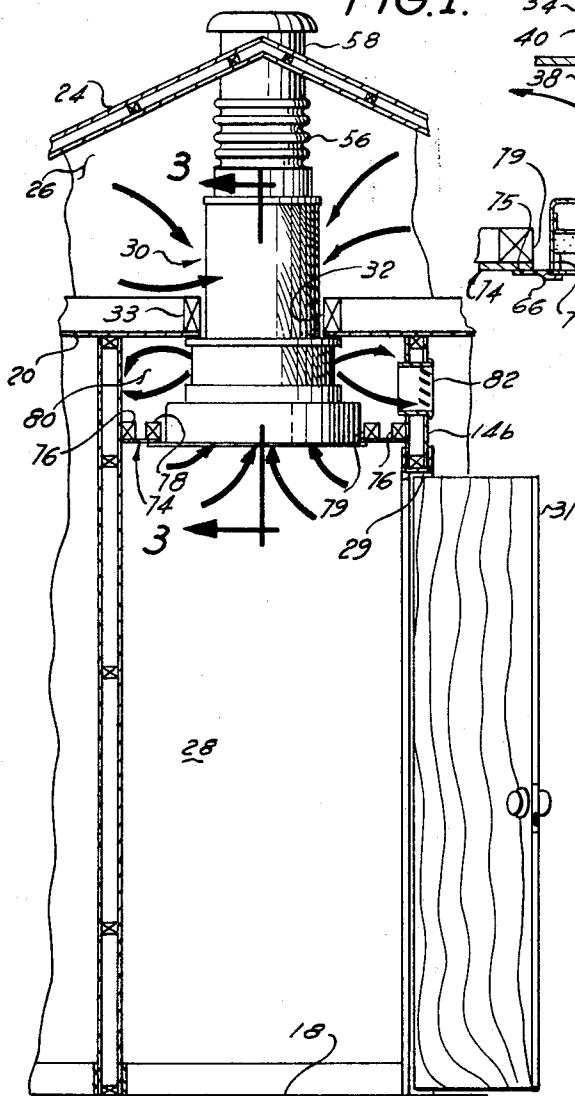


FIG. 2.

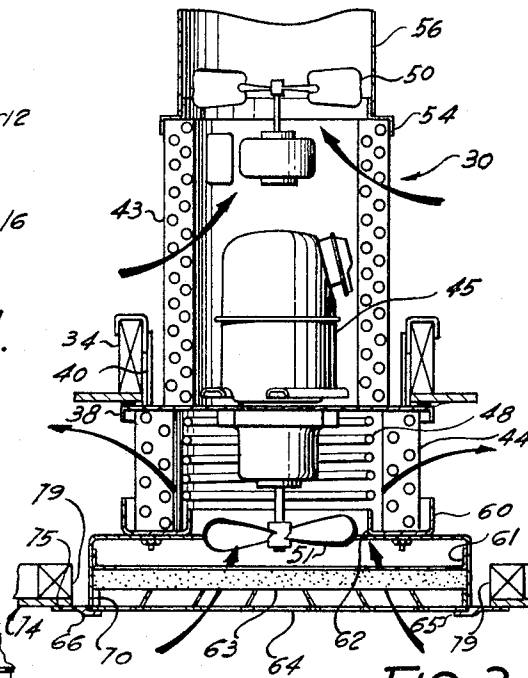


FIG. 3.

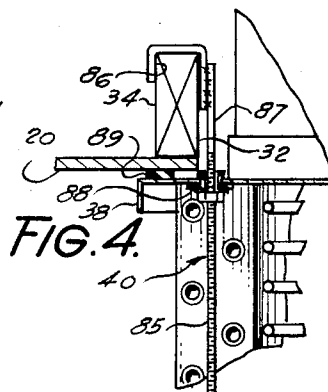


FIG. 4.

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3,267,995 CENTRALIZED HEATING AND AIR CONDITIONING SYSTEM

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5 Claims. (Cl. 165—29)

This invention relates to a centralized heating and air conditioning system for an enclosed dwelling unit.

Most conventional centralized heating and air conditioning systems require special air distribution ducts between the conditioning unit and the separate rooms. These ducts more or less limit the adaptability of such systems to original equipment installations in new dwelling units as compared to supplemental or replacement equipment in used dwelling units. The cost of installation of the special distribution ducts in a used dwelling unit is the major drawback, since frequently the entire interior of the dwelling unit must be remodeled to accommodate the ducts.

Accordingly, the object of this invention is to provide for a dwelling unit a centralized heating and air conditioning system which is economical in cost, is operable without conventional distribution ducts, and is readily adaptable for both new and used dwelling units.

In order that this and other objects will be more fully appreciated, reference is herein made to the accompanying drawings, wherein:

FIG. 1 is a top plan view of a typical floor plan for a single story dwelling unit showing a preferred location of the disclosed heating and air conditioning system;

FIG. 2 is an enlarged elevational view, partly shown in section, as seen generally from line 2—2 of FIG. 1;

FIG. 3 is an enlarged elevational view, partly shown in section, as seen from line 3—3 of FIG. 2; and

FIG. 4 is an enlarged sectional view of the mounting means shown in FIG. 3.

FIG. 1 shows a typical floor plan of a single story dwelling unit 10. The unit 10 includes an enclosure wall 12 and a plurality of separate interior partitions 14 interconnecting one another in a systematic plan to define separate rooms 16 of the dwelling unit. The unit 10 further includes a floor 18 (FIG. 2) and ceiling 20 between which is defined the main dwelling space or enclosure 22 of the unit. The roof 24 defines between it and the opposite side of the ceiling an attic space 26, as is typical in a single story dwelling unit. The dwelling 22 and attic 26 are insulated from one another by the ceiling 20.

The interior partitions 14a and 14b define a centrally located hallway 28 open through archways or doorways directly to most of the various rooms 16. FIG. 2 shows a typical doorway 29 in the partition 14b from the hallway 28 to room 16a, and the cooperating door 31. It is within the hallway 28 that the heating and air conditioning system to be disclosed will be used to best advantage.

A self-contained heating and air conditioning unit 30 is supported at the ceiling 20 and extends through ceiling opening 32 to within both the dwelling enclosure 22 and the attic space 26. The ceiling opening 32 is defined by parallel frame members 33 (FIG. 2) and parallel frame members 34 (FIG. 3). Frequently, the adjacent joist in the ceiling can be used for one set of the frame members without interrupting the continuity of the joist.

The conditioning unit 30 includes a mounting plate 38 supported by hangers 40 from frame members 34, which in turn supports a closed circuit refrigerant-charged heat pump. The heat pump has an attic coil 43, an enclosure coil 44, a compressor 45 connected in circuit between corresponding ends of the coils, and pressure throttling

means (not shown) such as capillary tubes or an expansion valve connected in circuit between the opposite ends of the coils. The heat pump can further include means such as a 4-way valve (not shown) in the circuit between the compressor 45 and the ends of the coils 43 and 44 effective to change the direction of refrigerant flow from the compressor 45 to the respective coils. As is well known the coil having the refrigerant under high pressure from the compressor operates as the condenser coil giving off heat, while the opposite coil operates as the evaporator coil absorbing heat. The conditioning unit 30 further includes an independently energized electric heating element 48 supported adjacent the enclosure coil 44 on the side thereof remote from the adjacent partitions of the hallway 28.

The heat pump coils 43 and 44 are circular and disposed annularly of the compressor 45 and the air circulating blowers 50 and 51. The attic coil 43 extends between the mounting plate 38 and an annular terminal 54 disposed concentrically of the attic blower 50. Flexible duct 56 is secured at its ends to the terminal 54 and to a weatherproof vent 58 mounted on the roof 24. The attic 26 is further provided with an air inlet (not shown) such as a louvered opening in an exterior wall or a vent in the roof similar to vent 58. Thus, outside air is drawn into the attic through the air inlet, circulated over the attic coil 43 and discharged through duct 56 and vent 58 back to the outside.

The enclosure coil 44 extends between the mounting plate 38 and an annular frame 60 disposed concentrically of the enclosure blower 51. An annular sheet metal inlet duct 61 is supported by frame 60 and has an enlarged hollow portion generally square in external dimension. The inlet air is communicated through aligned openings 62 annularly of the enclosure blower 51 to the space defined within the coil 44 and the heating element 48. A filter 63 and grill 64 are supported within the inlet duct 61 and held in place by appropriate means including lip structure 65 on a flange member 66 secured to the lower end of the duct. A resilient strip 70 of rubber or the like is positioned completely around the grill 64 between the interior of the duct 61 and the grill. The grill is positioned inside of the opening by compressing one of its edges against the rubber strip 70 and sliding the opposite edge past the opposite lip 66.

A false ceiling 74 is supported below the original ceiling 20 slightly above an outwardly directed lip 75 on the flange member 66 of the conditioning unit 30. The ceiling 74 extends between the adjacent interior partitions 14a and 14b and overlaps the extending lip portion 75. Appropriate frame structure 76 and 78 at the partitions 14a and 14b and adjacent the unit 30 provide an opening 79 larger than the lower end of the duct 61 but smaller than the lip structure 75. The opening 79 is concentric of the opening 32 in the ceiling. The false ceiling 74 and the conditioning unit 30 are supported independently of one another.

The lower false ceiling 74 extends to the adjacent upper portions of the interior partitions 14a and 14b and to partitions 14c and 14d above the archways typically at the ends of the hallway 28. If the hallway 28 is such that no archways are present, false end partitions flush with the partitions 14c and 14d between the ceiling 20 and the false ceiling 74 are used. An enclosure 80 of small volume as compared to the hallway 28 or the dwelling space 22 is defined by the various false and original ceiling and partition structures.

The enclosure 80 has a plurality of selective openings or registers, one of which is shown at 82 in FIG. 2, that communicate between the enclosure 80 and the adjacent rooms.

The enclosure 80 is closed off from the remainder portion of the dwelling space 22 except for the inlet opening 62 through the filter 63 and grill 64, and the selective outlet registers 82. The blower 51 operates to draw air from the hallway 28 through the grill 64 and filter 63, and to force it across the heating element 48 and the enclosure coil 44 to the exterior portion of the enclosure space 80. The passage of the air over the enclosure coil 44 and the heating element 48 conditions the air in the manner desired, such as either cooling it for air conditioning of the enclosure or heating it for heating of the enclosure space 22. The conditioned air in the enclosure or plenum is at a slightly higher pressure than the normal enclosure air so that it is discharged through the various registers 82 to the rooms communicated thereby. The size and thus the resistance of each register 82 can be varied as required to cause sufficient air flow from the enclosure plenum 80 to the various rooms to condition the room to the degree required.

This distribution of conditioned air requires no special duct work but is, in fact, caused simply by means of the distributor enclosure including the false ceiling structure 74 and a various distributor registers 82 positioned within the interior partitions of the enclosure. However, for a remote room, as for example room 16c, having no direct communication with the hallway 28, a short path conduit 86 can extend between registers communicating with the plenum and with the room for conditioning that room also.

For a cooling cycle, the heat pump operates with the attic coil 43 functioning as the condenser coil and the enclosure coil 44 functioning as the evaporator coil. Conversely, for a heating cycle the refrigerant is directed initially to the enclosure coil 44 which thereby functions as the condenser coil to give off heat to the enclosure, while the attic coil 43 functions as the evaporator coil. The auxiliary heating means 48 can be used to supplement the heat output of the heat pump as desired, or if chosen, can be used independently of the heat pump. For both the heating and cooling, however, the distribution of the outlet conditioned air is caused by the distributor plenum 80 selectively to any individual room 16 of the dwelling enclosure 22.

Since the conditioning unit 30 is supported from the ceiling structure of the dwelling unit special precautions must be taken to avoid transmission of vibration to the ceiling which thereby could act as a sounding board to cause excessive noise. To minimize this, the unit 30 is suspended from the ceiling in a manner which causes no direct connection between its structural components and the ceiling. The support means include the elongated hangers 40 each having its lower end threaded as at 85. The width of the U-shaped slot 86 formed in the hanger is such as to fit snugly over the top of the adjacent support structure. The body of the elongated hanger is spaced, as at 87, from the side of the support to permit a slight free side movement at the bottom end of the hanger. This helps to absorb vibration from the operation of the unit in a highly efficient manner. A rubber bushing 88 is supported at the end of the hanger bolt in an appropriate opening in the mounting plate 38. A sealing element 89 compressed between the frame 38 and the ceiling 20 disposed annularly of the opening 32 prevents direct contact of the structures while further acts to insulate the attic and the enclosure space from one another.

The enclosure 80 can be constructed of typical building materials, such as wallboard, plaster or conventional wood studs, even though such might not be classified as non-combustible materials in building codes, since no heating element of the unit in direct line with such material operates at a high temperature. Thus the heat pump coil 44 in direct line with the enclosure structure operates on the heating cycle at operating temperatures of generally less than 200° F. The auxiliary heating

means 48, on the other hand, can operate at exterior temperatures up to 500° F. to 700° F., since the heating element 48 is located within the heat pump coil 44 on the opposite side thereof remote from the enclosure structure to prevent direct radiation of the heat to the adjacent hallway structure. Thus it will be understood that the heat pump coil 44 is sufficiently dense and staggered to prevent the heating element 48 from seeing any adjacent plenum structure. The actual temperature of discharged air is likewise maintained below 200° F., any increase in heat output from the unit being achieved by increasing the air flow.

The disclosed centralized conditioning system can be installed at a minimum of cost. This is particularly true since the system requires no conventional distribution ducts to communicate with the adjacent rooms. The system is adaptable for either a new or used dwelling unit. Also since the conditioner unit itself telescopes from its largest cross-dimension at its bottom to its smallest cross-dimension at its top, the unit can be installed from the enclosure space 22 by merely raising it vertically into its receiving openings in the fixed and false ceilings. This feature, and the hanger supports 40 which readily fit through openings in the mounting plate of the unit, provide for quick assembly.

The control of the system can be of conventional design. Thus, it would be desirable to stagger starting controls for the various compressor and blower motors, and the electric heating elements to prevent a high surge of current. It might also be desirable to operate the attic blower independently of the others, such as for example to vent the attic in hot weather. A thermostat can be also used to control automatically the operation of the conditioning unit responsive to some set operating temperature.

While only a single embodiment of the subject invention has been disclosed, it will be apparent to those skilled in the art that various modifications can be made without departing from its basic inventive teachings. Accordingly, it is desired that the invention be limited only by the scope of the claims hereinafter following.

What is claimed is:

1. A centralized heating and air conditioning system for a residential dwelling unit having a main dwelling space and an attic space separated from one another by a ceiling and further having the main dwelling space divided by a plurality of interior partitions to the ceiling into separate interior rooms, comprising the combination of the ceiling having spaced from all of said interior partitions generally centrally of the dwelling unit an opening between the main dwelling space and the attic space, support means formed in the ceiling adjacent the opening, a self-contained heating and air conditioning unit including coaxially arranged space condensing and evaporating coils and a compressor encircled by one of said coils and all fixedly carried by a common plate supported by the support means with one of said coils and said compressor being inserted through said opening into said attic space irrespective of the angular position of said one coil and compressor relative to the opening, and said plate adjacent the lower side of said ceiling to suspend the other coil and the conditioned air outlet within the main dwelling space, means to operate the conditioning unit on a cycle for cooling the dwelling space and on a cycle for heating the dwelling space, a centralized distributor enclosure formed around the outlet portion of the conditioning unit for distributing the temperature conditioned air to the rooms of the dwelling unit selectively as desired, said distributor enclosure including a false ceiling structure supported below the first-mentioned ceiling and extended to at least nearby intermediate partitions adjacent the unit, inlet and outlet register means in the distributor enclosure effective to communicate selectively to various separate rooms, and fan means carried by said plate coaxial with said other coil disposed adjacent the outlet of

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the conditioning unit effective to force the temperature conditioned air from the distributor enclosure to the separate rooms.

2. A centralized heating and air conditioning system for a single story dwelling unit having a main enclosure space including a ceiling forming an attic above said main space and a plurality of interior partitions to the ceiling forming separate interior rooms, comprising the combination of the ceiling having therein an opening spaced from all of said interior partitions and generally centrally of the dwelling unit, support means formed in the ceiling adjacent the opening, spaced hangers having U-shaped hooks engaging over said support means and having threaded lower ends depending from said hangers and extending below said support means and ceiling, resilient bushings secured to the threaded ends, a self-contained heating and air conditioning unit received by said depending lower ends, fastening means manipulated from below said ceiling and engaged with said depending lower ends for maintaining said unit and resilient bushings engaged against the lower surface of said ceiling with said resilient bushings between said unit and ceiling, the air conditioning unit having coaxial spaced apart heating and cooling elements with one of said elements being inserted through said opening into said attic irrespective of the angular position of said one element relative said opening and the other element disposed in said enclosure space selectively for heating or cooling the enclosure space, a false ceiling supported below the first-mentioned ceiling between the nearby interior partitions adjacent the conditioned unit to define within the main enclosure space a separate plenum of small volume compared thereto, the elements during the heating cycle in direct adjacent line with any structure defining the plenum having a maximum operating exterior surface temperature of less than 200° F., an air inlet opening in the false ceiling, air outlet openings including registers in the partition structures of the distributor enclosure plenum effective to communicate selectively to the separate rooms of the dwelling unit, and air circulating means coaxial with said coils effective to draw the enclosure air through the inlet opening, circulate it over the elements in the distributor enclosure, and to force it subsequently out the registers to the separate rooms.

3. A centralized heating and air conditioning unit for installation in a ceiling having an opening with a plenum space located below said opening and an attic space above

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said opening, the improvement comprising a pair of spaced apart coaxial coils, a compressor encircled by one of said coils with said one coil and compressor being insertable through said opening in any angular position of said one coil and compressor relative said opening, a respective fan adjacent each coil with each fan having an axis of rotation coaxial with said coils, means for alternatively operating one of said coils as a condenser coil and the other coil as an evaporator coil, and a common support for engagement with said ceiling and carrying said coaxially arranged coils, fans and compressor in fixed relationship with said one coil and respective fan in said attic space, and the other coil and respective fan in said plenum space.

4. For use with the unit claimed in claim 3, a duct coaxially arranged with said one coil for telescopically receiving the respective fan and an end portion of said unit adjacent said one coil.

5. A centralized heating and air conditioning unit for installation in a ceiling having an opening with a plenum space located below said opening and an attic space above said opening, the improvement comprising a pair of spaced apart coaxial coils, a compressor encircled by one of said coils with said one coil and compressor being insertable through said opening in any angular position of said one coil and compressor relative said opening, a respective fan adjacent each coil with each fan having an axis of rotation coaxial with said coils, means for alternatively operating one of said coils as a condenser coil and the other coil as an evaporator coil, a common frame means fixedly carrying said coaxially arranged coils, fans and compressor, and means operable from below said ceiling for securing said common frame means to said ceiling for enabling said unit to be fixed to said ceiling with said one coil and respective fan and compressor in said attic space and the other coil and fan in said plenum space.

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