DUCT SYSTEM FOR MOBILE HOME

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ABSTRACT

A duct system for a mobile home wherein a system of air ducts extends beneath the mobile home between a pair of parallel support beams and communicates with the interior of the mobile home. A furnace is located within the interior of the mobile home and its hot air exhaust communicates with an opening in the upper portion of a plenum chamber. Side openings in the plenum chamber communicate with the system of air ducts. An external air conditioning unit has its cold air exhaust in communication with a bottom opening in the plenum chamber. A butterfly valve in the plenum chamber alternately closes the cold air inlet opening or the hot air inlet opening and deflects the moving air toward the air outlet openings and to the system of air ducts.

5 Claims, 4 Drawing Figures
DUCT SYSTEM FOR MOBILE HOME

BACKGROUND OF THE INVENTION

Heating and air conditioning systems for mobile homes must be small and inexpensive in order to conserve space and be economical, yet the systems must function to properly heat and air condition the interior of a mobile home. Some of the common problems with heating and air conditioning systems for mobile homes are poor air distribution, noise, and poor air circulation. In some instances, condensation of moisture from the cold air from the air conditioner is a problem, especially when the cold air flows through the furnace heat exchanger and causes condensation and rust on the heat exchanger. In some systems, certain seasonal adjustments must be made by the home owner to convert the system from a heating system to an air conditioning system. For example, certain vent openings must be opened or closed in order to redirect the air flow, and if such adjustments are not made, the system will not function properly and is likely to be damaged by improper operation.

SUMMARY OF THE INVENTION

Briefly described, the present invention comprises a duct system for mobile homes wherein the system automatically adjusts in response to the flow of air through between a heating system and a cooling system. A plenum chamber communicates through an opening in one side thereof with the furnace exhaust and through an opening in the other side thereof with the air conditioning unit exhaust, and through openings in opposite side walls with the system of air ducts extending about the mobile home. A butterfly valve moves in response to the flow of air into the plenum chamber to alternately block either the opening communicating with the furnace exhaust or the opening communicating with the air conditioning unit exhaust and diverts the flow of air coming into the plenum chamber into the side air outlet openings and the system of air ducts.

When the system is used with a "double wide" mobile home, wherein two or more sections of a mobile home are put in abutting side-by-side relationship, the plenum chamber communicates with cross-over ductwork located within or above the floor level of a mobile home, and the cross-over ductwork communicates with the system of air ducts for each section of the mobile home at a level below the floor joists, between the parallel support beams for each section of the mobile home.

Thus, it is an object of the present invention to provide a duct system for mobile homes or the like which functions automatically to accommodate either hot air from a furnace or cold air from an air conditioning unit and which provides improved air flow throughout the mobile home and which is economical to manufacture.

Other objects, features and advantages of the present invention will become apparent upon reading the following specification, when taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic illustration of a portion of a mobile home, showing the furnace, air conditioning unit and system of air ducts.

FIG. 2 is a schematic illustration of portions of a double wide mobile home, showing the furnace, air conditioning unit and system of air ducts.

FIG. 3 is a partial end sectional view of a double wide mobile home, showing the cross-over ductwork, plenum chamber, furnace and system of air ducts for each one-half section.

FIG. 4 is a perspective view of the plenum chamber.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now in more detail to the drawing, in which like numerals indicate like parts throughout the several views, FIG. 1 illustrates a mobile home 10 which includes a pair of parallel, horizontal support beams 11 and 12 to which the wheels (not shown) are attached. Joists 13 fabricated from wooden two-by-fours, etc., rest on and extend across support beams 11 and 12. Sheets of particle board 14 are attached to the joists 13 and form the subfloor over which carpet, etc., can be laid. The studding, exterior and interior walls, electrical system, and other components of the mobile home are constructed in the conventional manner.

Furnace closet 16 is located within the interior of the mobile home, and furnace 17 is normally enclosed within closet 16. Furnace closet 16 is substantially hemi-rectangularly sealed from the interior portion of the mobile home. Plenum chamber 18 is located beneath furnace 17, and a system of air ducts 19 extends along the length of the mobile home, beneath joists 13 and between parallel support beams 11 and 12. A layer of insulating material 20 is positioned between joists 13 and parallel support beams 11 and 12, and the insulation material 20 is recessed at 21 between parallel support beams 11 and 12 to form a basement chamber 22 beneath the floor and between the parallel support beams. Basement chamber 22 extends substantially the entire length of the mobile home and is closed at its ends. Subfloor 14 covers basement chamber 22 and an opening or register 23 in the subfloor is defined at the furnace closet, causing the furnace closet 16 to be in open communication with the basement chamber 22.

Air conditioning unit 25 is located externally of the mobile home and includes a cold air supply duct 26 and a return air duct 27. Both ducts 26 and 27 are connected at one of their ends to air conditioning unit 25, and the other end of cold air supply duct 26 passes upwardly through insulation material 20 and vertically through basement chamber 22 and communicates with the bottom wall of plenum chamber 18. The other end of return air duct 27 extends upwardly through insulation material 20, through the basement chamber 22 and into the furnace closet 16. Thus, cold air supply duct 26 communicates with plenum chamber 18 while return air duct 27 communicates with the furnace closet. Thus, all the return air from the mobile home enters the furnace closet 16 through the floor register 23.

The system of air ducts 19 extends longitudinally through basement chamber 22 and branch ducts 29 extend upwardly from the main ducts through openings in the subfloor 14 so as to provide communication between a system of air ducts and the interior of the mobile home. Vent openings 30 are formed along subfloor 14 over basement chamber 22 so as to allow communication from the interior of the mobile home with basement chamber 22.
As is illustrated in FIG. 4, plenum chamber 18 comprises side walls 31, 33, 34, and 39, a top wall 36, bottom wall 37, and cylindrical stub 37. Side walls 31 and 33 are substantially impervious while side walls 32 and 34 define openings 38 and 39 which function as air outlet openings. Top wall 35 is formed from outwardly extending flange 40 which functions as a base for furnace 17 and conforms to the bottom portion of the furnace. Top wall 35 defines hot air inlet opening 41, while bottom wall 36 defines cold air inlet opening 42. Top wall 35 can be a part of the furnace as provided by the furnace manufacturer. Thus, the other elements of the plenum chamber are proportioned to fit the top wall or furnace base 35.

Butterfly valve 44 is positioned in plenum chamber 18 and includes hinge 45 extending horizontally across the internal portion of the plenum chamber and supported at its ends by impervious side walls 31 and 33 at an elevation approximately at the middle level of the air outlet openings 38 and 39. Butterfly valve 44 includes flat plate valves 46 and 47 connected to hinge 45. U-shaped valve seats 49, 50, 51, and 52 are connected to the side walls of plenum chamber 18. Valve seats 49 and 50 have the open ends of their U shapes located just below the ends of hinge 45 and the bases of their U shapes located above air outlet openings 38 and 39. Valve seats 51 and 52 have the open ends of their U shapes located just below the ends of hinge 45 and the bases of their U shapes located just below air outlet openings 38 and 39. Felt strips 54 are adhesively connected to the lower surfaces of valve seats 49 and 50, while similar felt strips 54 are adhesively connected to the upper surfaces of valve seats 51 and 52. The arrangement of the butterfly valve 44 is such that the valve plates 46 and 47 will normally rest under the influence of gravity upon valve seats 51 and 52 in the manner illustrated, with the valve plates lying flat against the valve seats and thus closing cold air inlet opening 42 while leaving hot air inlet opening unblocked. It will be noted that the valve plates 46 and 47 in each slope in a downward direction from hinge 45 when in this position. When the valve plate 46 and 47 are urged in an upward direction about hinge 45, they will seat upon valve seats 49 and 50, thus closing hot air inlet opening 41 while opening cold air inlet opening 42. When in this position, valve plates 46 and 47 each slope upward from hinge 45.

As is illustrated in FIG. 1, plenum chamber 18 is located beneath furnace 17. Furnace 17 includes air return opening 56 in its upper portion, and the furnace hot air exhaust (not shown) is at the lower portion of the furnace and is arranged to move hot air from the furnace in a downward direction into hot air inlet opening 41 of plenum chamber 18. The hot air flowing into the plenum chamber will urge valve plates 46 and 47 of butterfly valve 44 in their downward directions about hinge 45 so as to close cold air inlet opening 42. Hinge plates 46 and 47 slope downwardly from hinge 45 and tend to divide and guide the downwardly flowing hot air from the furnace in opposite lateral directions through air outlet openings 38 and 39 toward the system of air ducts 29. The air flowing through the system of air ducts is exhausted in an upward direction through the plurality of branch ducts 29 into the interior of the mobile home and the hot air heats the mobile home. Air is returned to the furnace from the interior of the mobile home through air vents 30 to base-ment chamber 22, upwardly through register 23 in furnace closet 16, to the air return openings 56 of the furnace 17.

When furnace 17 is off and air conditioning unit 25 is energized, cold air supply ducts 26 carries air from the unit 25 beneath the mobile home, then upwardly through basement chamber 22 into cold air inlet opening 42 of plenum chamber 18. The air flowing in an upward direction to the plenum chamber causes valve plates 46 and 47 of butterfly valve 44 to shift from their positions illustrated to their upwardly inclined positions where the edges of the valve plates 46 and 47 are urged against and sealed with respect to valve seats 49 and 50, thus closing hot air inlet opening 41. When valve plates 46 and 47 are in this position, they slope upwardly on opposite sides of hinge 45 and function to divide and direct the upwardly flowing cold air from the air conditioner in opposite lateral directions through air outlet openings 38 and 39 to the system of air ducts 29. The cold air flowing through the system of air ducts passes to the interior portion of the mobile home through the plurality of branch ducts 29 to cool the mobile home. Return air passes downwardly through vents 30 into basement chamber 22 and then to the furnace base through register 23. Return air duct 27 of air conditioning unit 25 communicates with the furnace closet 16 and the return air passes through return air duct 27 to the air conditioning unit 25.

A double-wide mobile home or sectional home 60 is illustrated in FIG. 2 and includes two sections 61 and 62 placed in abutting side-by-side relationship. Each mobile home section includes a pair of parallel support beams 63 and 64, and floor joists 65 extending across the support beams. Insulation material 67 is located between the floor joists 65 and the parallel support beam 63 and 64 of each section and defines a basement chamber 68. A system of air ducts 69 extends along each section within the basement chamber and includes branch ducts 70 which communicate with the interior of the home. Return air vents 71 provide communication between the interior of each section and its basement chamber 68.

Furnace closet 73 is located in one of the sections, and furnace 74 is positioned within the furnace closet. Plenum chamber 75 is located beneath furnace 74, and cross-over air supply ducts 76 and 77 extend from the air outlet openings of the plenum chamber across the floor of each mobile home section to positions above a system of air ducts in each section, and then turn downwardly and extend through the floors and join the systems of air ducts in the basement chambers 68 of each section. Plenum chamber 75 is similar to the plenum chamber illustrated in FIG. 4, and cold air supply duct 80 from air conditioning unit 81 communicates with the bottom of the plenum chamber. Air return duct 82 communicates with furnace closet 73. Air return cross-over ducts 84 and 85 each extend from furnace closet 73 outwardly over the floors of the sections and then turn downwardly and extend through the floors and into open communication with the basement chambers 68 of each section. The air return cross-over ducts 84 and 85 are optional and can be eliminated since the return air can flow from the basement chambers 68 through open floor areas such as between the floor joists located beneath the furnace closet 73. Usually, a raised floor section, built in cabinet or other structure is located about the cross-over ducts.
5 When furnace 74 is in operation, the hot air exhaust from the furnace flows in a downward direction and is divided and guided toward the opposite lateral directions through supply cross-over ducts 76 and 77, and then to the systems of air ducts 69 in each mobile home section. The air communicates with the interior of each section through the plurality of branch ducts 70. The return air flows from the interior of the mobile home downwardly through the vents 71 to the basement chamber 68, then from the basement chamber through the return cross-over ducts 84 and 85 to furnace closet 73, then back through the return air openings of the furnace. When the air conditioning unit 81 is energized and the furnace 74 is not in operation, the cold air from the air conditioning unit 81 flows through the cold air supply duct 82 in an upward direction into plenum chamber 75, whereupon the valve plates shift to their upwardly inclined positions and divide and guide the cold air toward the supply cross-over ducts 76 and 77 to the system of air ducts 69 in each mobile home section. The cold air communicates with the interior of the mobile home through the branch ducts 71, and the return air flows downwardly through the vents 71 to the basement chamber 68, then through the return cross-over ducts 84 and 85 to furnace closet 73. The return air flows in a downward direction from the furnace closet through the floor of the furnace closet and through the return air duct 82 to the air conditioning unit 81. The butterfly valve of the air plenum chamber substantially blocks any air flow through the furnace 74 while the air conditioning unit is in operation.

While this invention has been described in detail, with particular reference to preferred embodiments thereof, it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinbefore and as defined in the appended claims.

1. A heating and air conditioning system for a mobile home or the like comprising a system of air ducts extending about the mobile home and communicating with the mobile home interior, a furnace in the mobile home and including a hot air exhaust, an air conditioning unit including a cold air exhaust, a plenum chamber defining a hot air inlet opening in one wall portion in communication with the hot air exhaust of said furnace, a cold air inlet opening in another wall portion in communication with the cold air exhaust of said air conditioning unit, and at least one outlet opening in another wall portion in communication with said system of air ducts, and valve means including a movable valve plate constructed and arranged to move toward and close the hot air inlet opening in response to the flow of air from the cold air exhaust of said air conditioning unit against said valve plate and to divert the air from its direction flowing from the cold air exhaust toward said outlet opening or to move toward and close the cold air inlet opening of said plenum chamber in response to the flow of air from the hot air exhaust of said furnace against said valve plate and to divert the air from its direction flowing from the hot air exhaust toward said outlet opening, so that air flowing from the cold air exhaust of the air conditioning unit will not flow through the furnace and air flowing from the hot air exhaust of the furnace will not flow through the air conditioning unit.

2. In a heating and air conditioning system for a mobile home or the like including a system of air ducts extending about the mobile home and communicating with the mobile home interior, a furnace in the mobile home and including a hot air exhaust, an air conditioning unit including a cold air exhaust, the improvement comprising a plenum chamber defining a hot air inlet opening in a first wall portion for communication with the hot air exhaust of the furnace, a cold air inlet opening in a wall portion opposite to said first wall portion for communication with the cold air exhaust of the air conditioning unit, outlet openings in opposite side wall portions for communication with the system of air ducts, and butterfly valve means including a pair of valve plates hingedly mounted on a hinge member centrally of said plenum chamber and arranged to move in response to the flow of cold air from the air conditioner through the cold air inlet opening to positions extending away from said cold air inlet opening to close the hot air inlet opening and to divert the flow of cold air from the air conditioner in opposite lateral directions through the outlet openings, and arranged to move in response to the flow of hot air from the furnace through the hot air inlet opening to positions extending away from said hot air inlet opening to close the cold air inlet opening and divert the flow of hot air from the furnace in opposite lateral directions through the outlet openings, so that the cold air will not flow from the plenum chamber through the furnace and the hot air will not flow from the plenum chamber through the air conditioner.

3. In a mobile home or the like including a system of air ducts extending about the mobile home and communicating with the mobile home interior, a furnace including a hot air exhaust arranged to exhaust hot air in a downward direction, and an air conditioning unit including a cold air exhaust, the improvement therein comprising a plenum chamber positioned beneath said furnace and defining a hot air inlet opening in its upper portion in communication with the hot air exhaust of said furnace, a cold air inlet opening in its lower portion in communication with the cold air exhaust of said air conditioning unit, and air outlet openings in its opposite side walls in communication with said system of air ducts, and a butterfly valve including valve plates mounted on a common laterally extending hinge member and arranged to move downwardly about opposite sides of said hinge member to downwardly inclined positions to close the cold air inlet opening of said plenum chamber and divert the downward flow of hot air from the furnace in opposite lateral directions through the air outlet openings, and arranged to move upwardly about opposite sides of said hinge member to upwardly inclined positions to close the hot air inlet opening of said plenum chamber and divert the flow of cold air from the air conditioning unit in opposite lateral directions through the air outlet openings.

4. The mobile home of claim 2 and further including a basement chamber extending along the length of the mobile home and substantially closed from the atmosphere, a furnace closet in the interior of the mobile home surrounding the furnace and substantially hemispherically sealing the furnace from the interior of the mobile home, said furnace closet and said basement chamber being in open communication with each other, and air return vents extending between the interior of the mobile home and said basement chamber so that air
passes from the interior of the mobile home through the air vents and basement chamber to the furnace.

5. In a mobile home or the like including an air flow system with air ducts communicating with the interior of the mobile home, a furnace in the mobile home and including a hot air exhaust arranged to pass hot air from the furnace in a downward direction, a plenum chamber beneath said furnace and defining a hot air inlet opening in its upper portion in communication with said furnace hot air exhaust and air outlet openings on opposite sides thereof in communication with said air ducts and a cold air inlet opening in its lower portion, an air conditioning unit including a cold air exhaus arranged to pass cold air from said air conditioning unit in an upward direction to said cold air inlet opening of said plenum chamber, and butterfly valve means in said plenum chamber including valve plates hingedly mounted on a hinge member, said valve plates normally closing the cold air inlet opening in said plenum chamber and being responsive to the flow of cold air from said air conditioning unit in an upward direction against said valve plates to shift said valve plates upwardly about said hinge member to open the cold air inlet opening and to close the hot air inlet opening.

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