An air column for an under floor heating and cooling system in which the fan wheel of the plenum fan is located at the bottom of the air column enclosure and is radially aligned with the inlet to the under floor air plenum.
AIR COLUMN FOR UNDER FLOOR HEATING AND COOLING SYSTEM

CLAIM OF PRIORITY

[0001] This application claims priority from U.S. Provisional Patent Application Ser. No. 60/825,649 filed on Sep. 14, 2006, which is incorporated herein in its entirety.

FIELD OF THE INVENTION

[0002] This invention relates to an air column for an under floor heating and cooling system. Particularly, the present invention relates to an air column in which the fan wheel of a plenum fan is located at the bottom of the air column enclosure and is radially aligned with the inlet to the under floor air plenum.

BACKGROUND OF THE INVENTION

[0003] A conventional, prior art air column 120, shown in FIG. 1, forces heated or cooled air into an air plenum 114 located beneath an elevated floor 112 of an occupied space 110. The air column 120 comprises a plenum fan 130 housed in a four-sided sheet metal air column enclosure 122. The air column enclosure 122 has an upper intake section 124 at the top, a discharge section 118 at the bottom, and four side walls 144 interconnecting the intake section 124 and the discharge section 118. The plenum fan 130 draws air from the primary air supply (fresh air) and air from the secondary air supply (return air) into the intake section 124 of the air column enclosure 122 and forces the air out of the air column enclosure 122 through a fan outlet 138 of the discharge section 118. The intake section 124 of the air column enclosure 122 has two or more openings 146 on the vertical sides with the option of another inlet opening 146 at the top. Typically the intake section 124 of the air column enclosure 122 includes air filter panels 126 mounted in the intake section 124. Also, a conventional air column 120 typically has at least one heat exchanging coil 128 located in the intake section 124 for heating or cooling at least a portion of the airflow that enters the air column enclosure 122.

[0004] In a conventional air column, the plenum fan 130 comprises a motor 132 and a fan wheel 136. The fan wheel 136 of the plenum fan 130 is located entirely above the elevated floor 112 of the occupied space 110. Air is drawn downward from the intake section 124 of the air column enclosure 122 and forced into the under floor air plenum 114 by the operation of the plenum fan 130. Because the fan wheel 136 of the plenum fan 130 is located above the floor 112, the plenum fan 130 first produces a horizontal airflow from the fan wheel 136, followed by a downward airflow along the internal side walls 144 of the air column enclosure 122, and followed by a horizontal airflow into an inlet 116 of the under floor air plenum 114. Because of the downward airflow along the internal side walls 144 of the air column enclosure 122, a minimum clearance of at least one half the fan wheel diameter is required between the fan wheel 136 and all four side walls 144 of the air column enclosure 122 to minimize obstruction of the radial airflow produced by the fan wheel 136. The one half diameter requirement is a minimum requirement and is not considered an optimal clearance between the fan wheel 136 and the side walls 144 of the air column enclosure 122. Consequently the width and depth of the air column enclosure 122 must be substantially larger than the diameter of the fan wheel 136.

[0005] Because the air is discharged by the fan wheel 136 in a radial direction, the discharged air impinges perpendicularly on the side walls 144 of the fan column enclosure 122 and must be directed downward toward the plenum inlet 116 of the under floor air plenum 114. Consequently, sound absorbing material must be placed at the discharge point 142 of the fan wheel 136 to absorb sound created by the impact of the air against the side walls 144 of the fan column enclosure 122. In addition, the sound absorbing material must be configured to direct the airflow efficiently toward the plenum inlet 116 of the under floor air plenum 114. Installing and configuring the sound absorbing material adds to the expense of the air column enclosure 122.

SUMMARY OF THE INVENTION

[0006] Therefore, it is an object of the present invention to provide a fan column that is smaller in size than a conventional fan column, that provides optimum airflow, that produces less noise than a conventional fan column, and that requires less horsepower than a conventional fan column.

[0007] The present invention achieves the objects outlined above by locating the fan wheel of the plenum fan below the elevated floor of the occupied space and in radial alignment with the inlet to the air plenum. With the fan wheel of the plenum fan in radial alignment with the inlet to the under floor air plenum, air is directly discharged from the fan wheel horizontally into the under floor air plenum. Therefore, no change in direction of the airflow occurs when the fan wheel discharges the air prior to the air entering the under floor air plenum.

[0008] Because of the air within the air column enclosure does not change direction after discharge from the fan wheel, space between the discharge point of the fan wheel and the sides of the air column enclosure can be kept to a minimum clearance resulting in a smaller air column enclosure. The resultant smaller air column enclosure footprint allows for lower square footage of mechanical room space.

[0009] Moreover, because the fan wheel does not discharge air horizontally against the sides of the air column enclosure, noise is reduced and the need for sound absorbing material, particularly sound absorbing material configured to direct air within the air column enclosure, is eliminated. Further, the static potential of the plenum fan is maintained because the blast area of the fan wheel does not require any abrupt air direction changes with respect to the fan wheel rotation. This more efficient air management will lower the system effect the fan experiences thereby allowing the potential for lower motor horse power and energy use.

[0010] Further objects, features and advantages will become apparent upon consideration of the following detailed description of the invention when taken in conjunction with the drawing and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a front elevation section view of a prior art air column.

[0012] FIG. 2 is a front elevation section view of an air column in accordance with the present invention.
DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0013] Turning to FIG. 2, an occupied space 10 has an elevated floor 12 with an air plenum 14 located beneath the floor 12. An air column 20, comprising an air column enclosure 22 and a plenum fan 30, draws heated or cooled air from a primary air supply (fresh air) and from a secondary air supply (return air) and forces the heated or cooled air into the under floor air plenum 14. The heated or cooled air flowing in the under floor air plenum 14 is distributed through floor diffusers (not shown) to the occupied space 10 to heat or cool of the occupied space 10.

[0014] The air column enclosure 22 comprises an intake section 24, a discharge section 18 with four side walls 44 interconnecting the intake section 24 to the discharge section 18. The air column enclosure 22 is supported by a base 48 below the floor 12. The intake section 18 has enclosure inlet 46 for admitting primary and/or secondary air into the intake section 24 of the air column enclosure 22. As shown in FIG. 2, the intake section has two filter panels 26 mounted so that air passing through the intake section 24 passes through the filter panels 26. In addition, the intake section has a heat exchanging coil 28 positioned so that air passing through the intake section 24 passes through the heat exchanging coil 28 thereby heating or cooling the intake air as required. The discharge section 18 of the air column enclosure 22 includes a fan outlet 38 that is aligned with a plenum inlet 16 of the under floor air plenum 14.

[0015] The plenum fan 30, comprising a fan motor 32, a bell shaped fan intake 34, a fan wheel 36, and a driveshaft 40, is mounted within the air column enclosure 22 so that the fan wheel 36 is radially aligned with the fan outlet 38 and with the plenum inlet 16. The fan motor 32 is coupled to the fan wheel 36 by means of the driveshaft 40. The fan wheel 36 is a conventional squirrel cage fan that draws air axially into the center of the fan wheel through the bell shaped fan intake 34. The rotation of the fan wheel 36 then discharges the air radially at multiple discharge points 42 around the circumference of the fan wheel 36. In order to prevent vibration because of the extended length of the driveshaft 40, the motor bearings, the fan bearings, and the driveshaft 40 are designed to minimize shaft vibration. Rubber or spring mounts are used to prevent transmitting vibration to the supporting base 48.

[0016] In operation, rotation of the fan wheel 36 draws air (primary and/or secondary air) into the air column enclosure 22 through enclosure inlets 46. The air then passes through the filter panels 26 to remove particulate from the air. From the filter panels 26, the air passes through the heat exchanging coil 28 where the air is heated or cooled as required. The fan wheel 36 continues to draw the air down the air column enclosure 22 along the side walls 44 and axially into the bell shaped fan intake 34 of the plenum fan 30. The continuing rotation of the fan wheel 36 radially propels the air from the center of the fan wheel 36 through multiple discharge points 42 around the circumference of the fan wheel 36. The radially discharged air from the fan wheel 36 exits the air column enclosure 22 through the fan outlet 38 and into the plenum inlet 16 of the under floor air plenum 14.

[0017] Because the fan wheel 36 is aligned with the fan outlet 38 which is in turn aligned with the plenum inlet 16 of the under floor air plenum 14, the air at the discharge points 42 around the circumference of the fan wheel 36 does not impinge upon the side walls 44 of the air column enclosure 22. Instead, the air, in an unrestricted fashion, passes directly from the fan wheel 36 into the under floor air plenum 14 without any change of direction. The direct discharge of the air from the fan wheel 36 into the under floor air plenum 14 results in reduced noise and reduced horsepower requirements for the fan motor 32. Because of the reduced noise, the need for sound insulation with in the air column enclosure 22 is reduced.

[0018] While this invention has been described with reference to preferred embodiments thereof, it is to be understood that variations and modifications can be affected within the spirit and scope of the invention as described herein and as described in the appended claims.

We claim:

1. A air column that forces heated or cooled air into a plenum inlet of an under floor air plenum located beneath an elevated floor of an occupied space comprising:

   a. an air column enclosure having:
      i. an intake section with an air inlet;
      ii. a discharge section with a fan outlet; and
      iii. side walls interconnecting the intake section and the discharge section,

   b. a plenum fan mounted within the air column enclosure and having a rotatable fan wheel that when rotated discharges air axially around its circumference through the fan outlet,

   wherein the fan wheel, the fan outlet, and the plenum inlet are radially aligned.

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