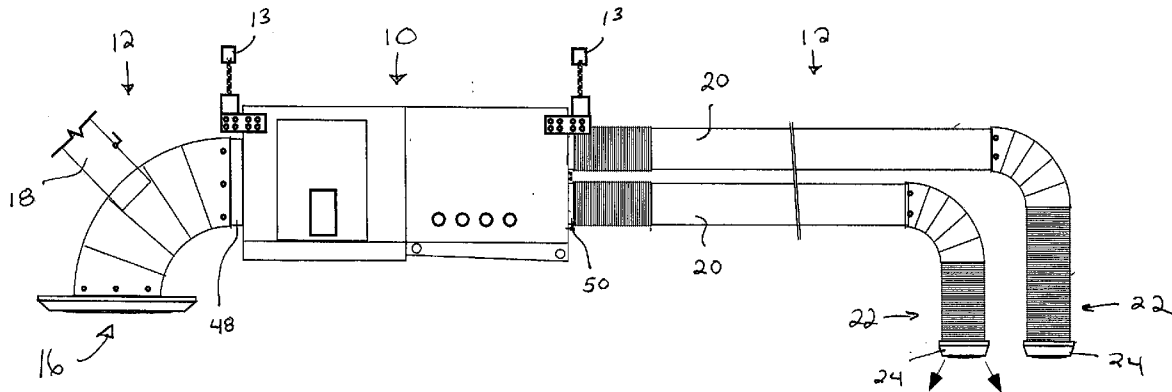




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(19) **United States**(12) **Patent Application Publication**
Jordan(10) **Pub. No.: US 2013/0052936 A1**(43) **Pub. Date: Feb. 28, 2013**(54) **HEATING AND COOLING VENTILATION
SYSTEM**(76) Inventor: **John C. Jordan**, Bay Village, OH (US)(21) Appl. No.: **13/222,239**(22) Filed: **Aug. 31, 2011****Publication Classification**(51) **Int. Cl.**
F24F 7/007 (2006.01)(52) **U.S. Cl.** **454/338**(57) **ABSTRACT**

A heating and cooling ventilation system includes an enclosure including a plurality of walls and a nose plate that are interconnected to enclose an interior volume of the enclosure. An air inlet opening, and a plurality of air outlet openings extending through the nose plate, are in fluid communication with the interior volume. At least one or more heat exchangers and a blower are disposed within the interior volume. At least one airflow damper plate is associated with one of the plurality of air outlet openings and is adjustable relative to said one air outlet opening to thereby adjust an amount of airflow passing through said one air outlet opening. In various examples, the heat exchanger(s) are hydronic and/or utilize other heat transfer fluids in a variety of configurations, and at least one airflow damper plate is adjustable from an exterior of the enclosure, and/or the nose plate is interchangeable.



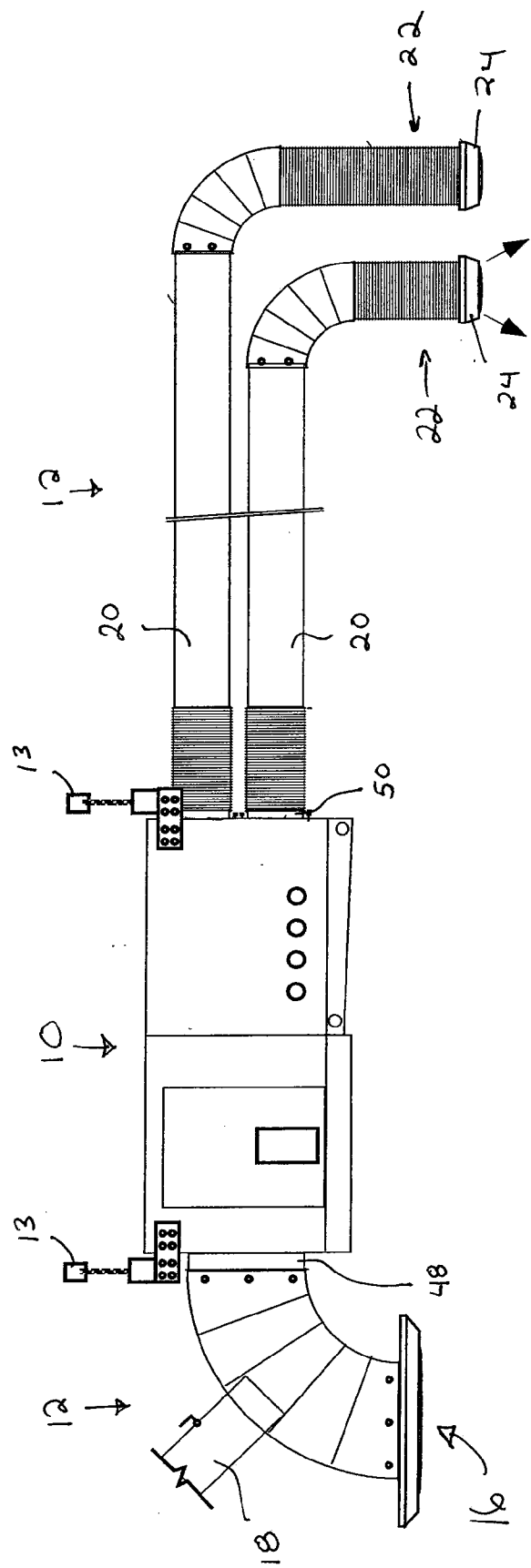
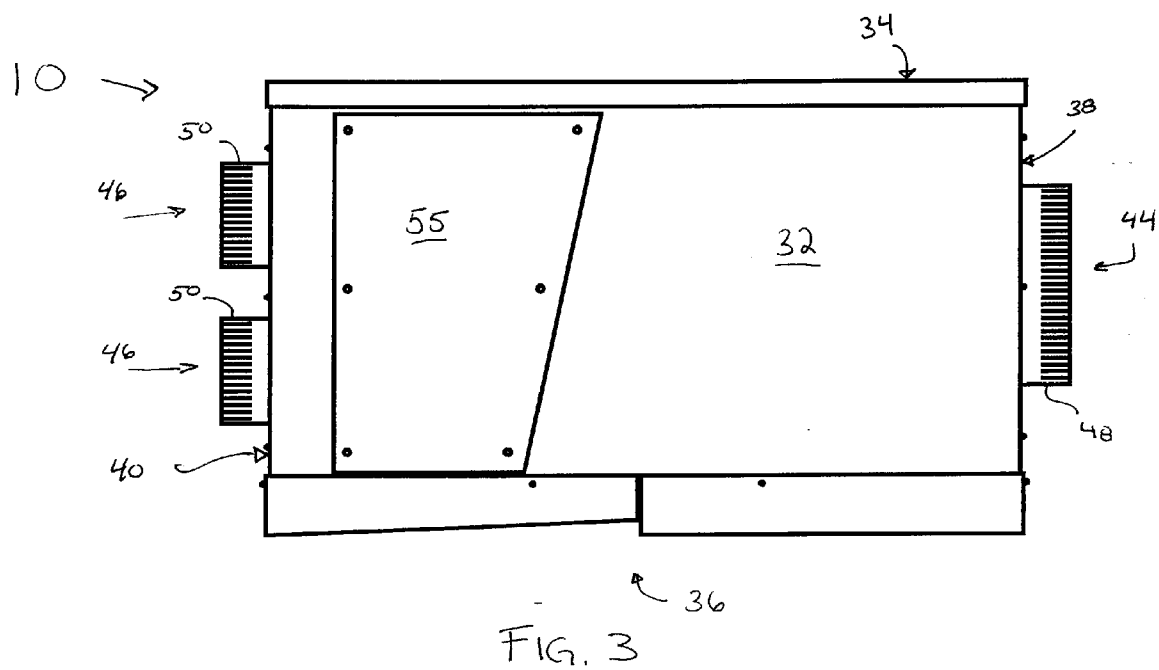
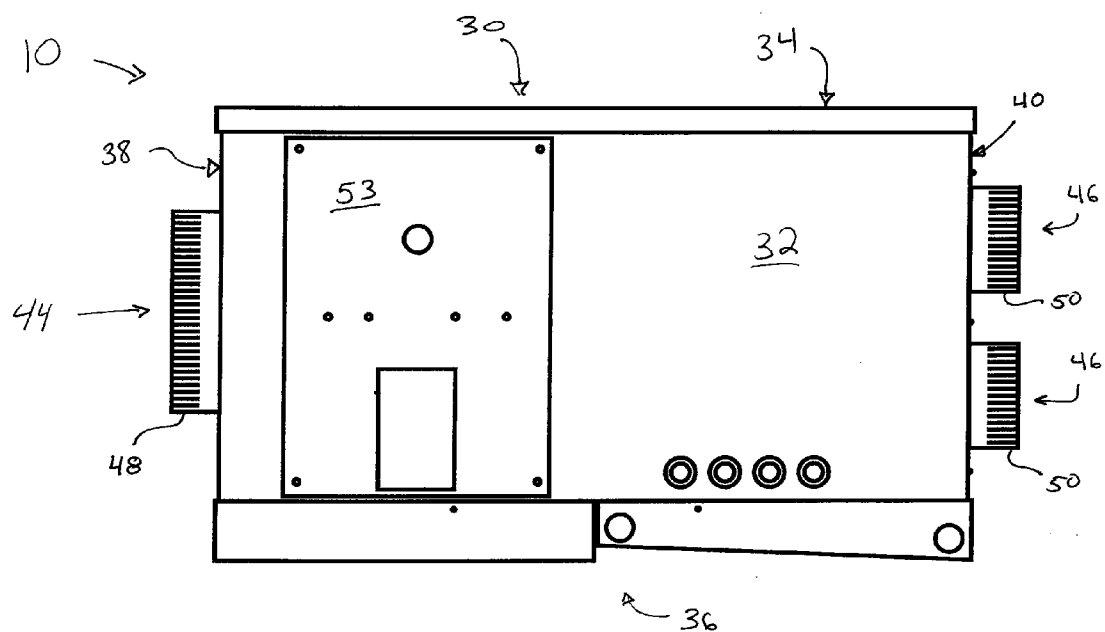


FIG. 1



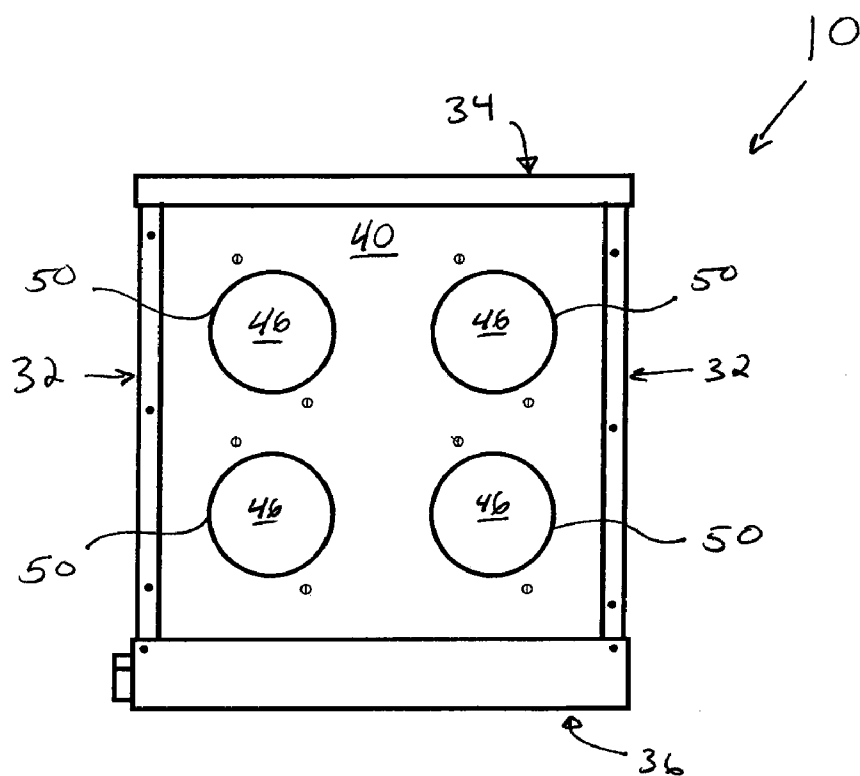


FIG. 4A

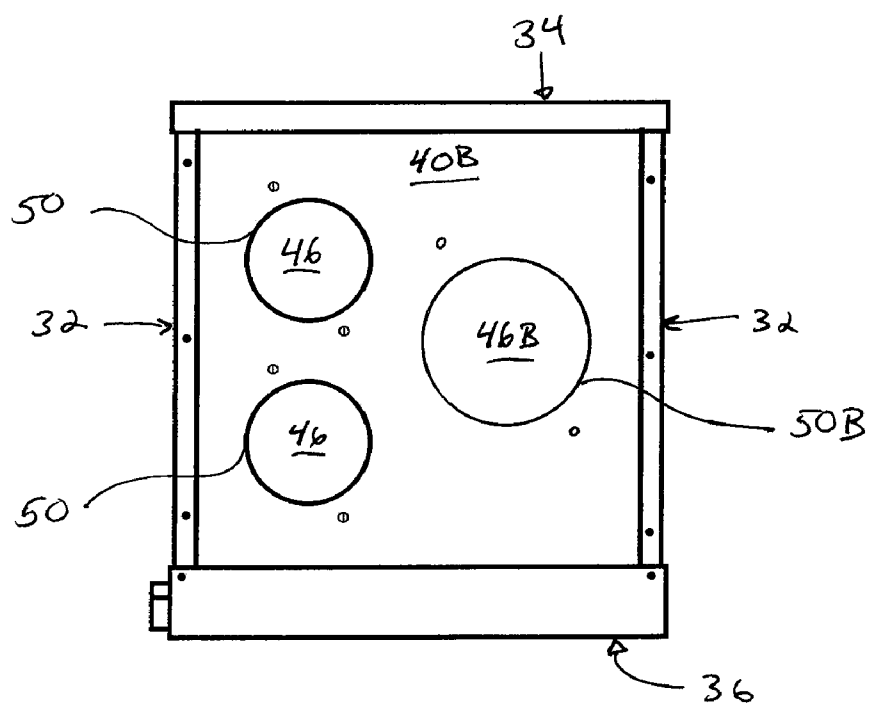
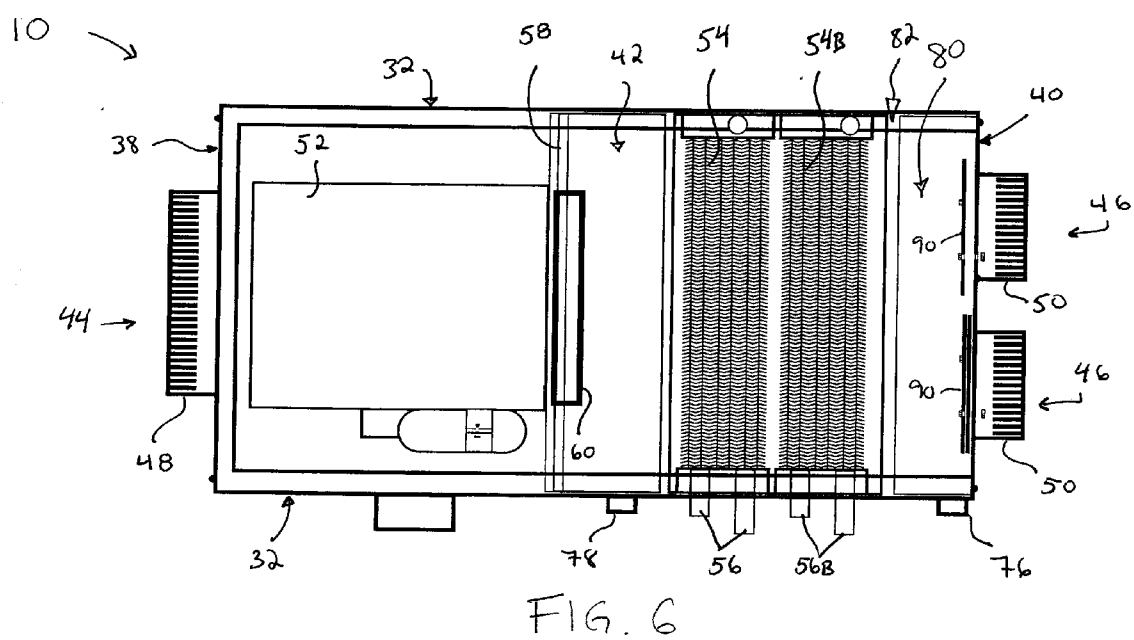
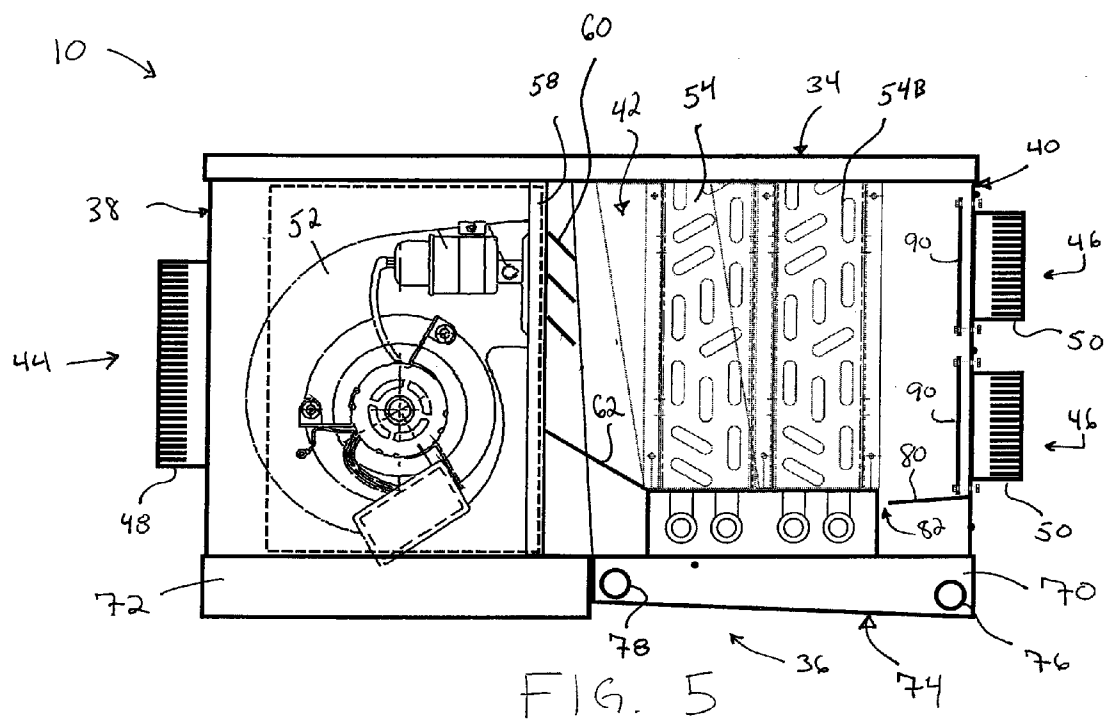


FIG. 4B



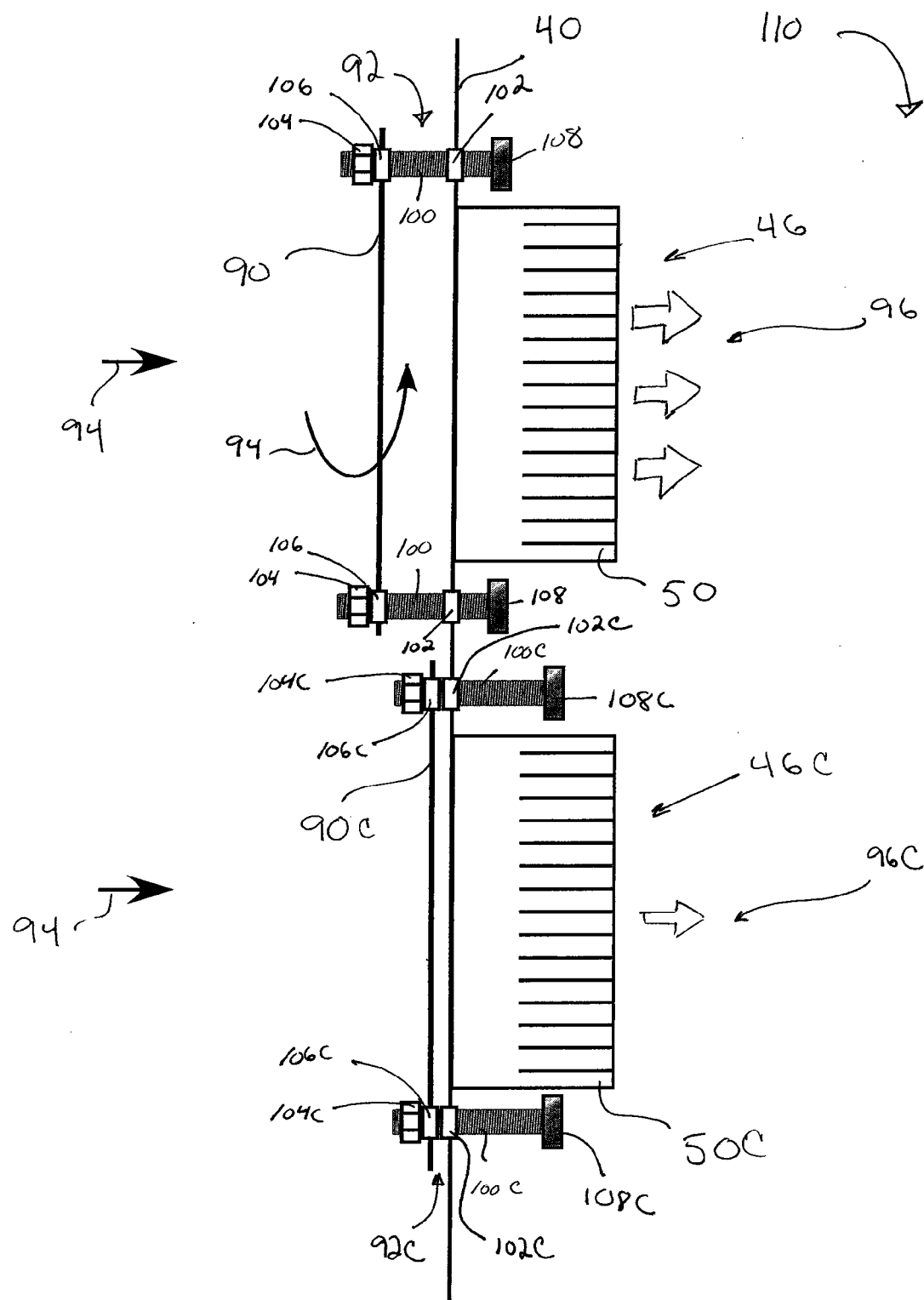
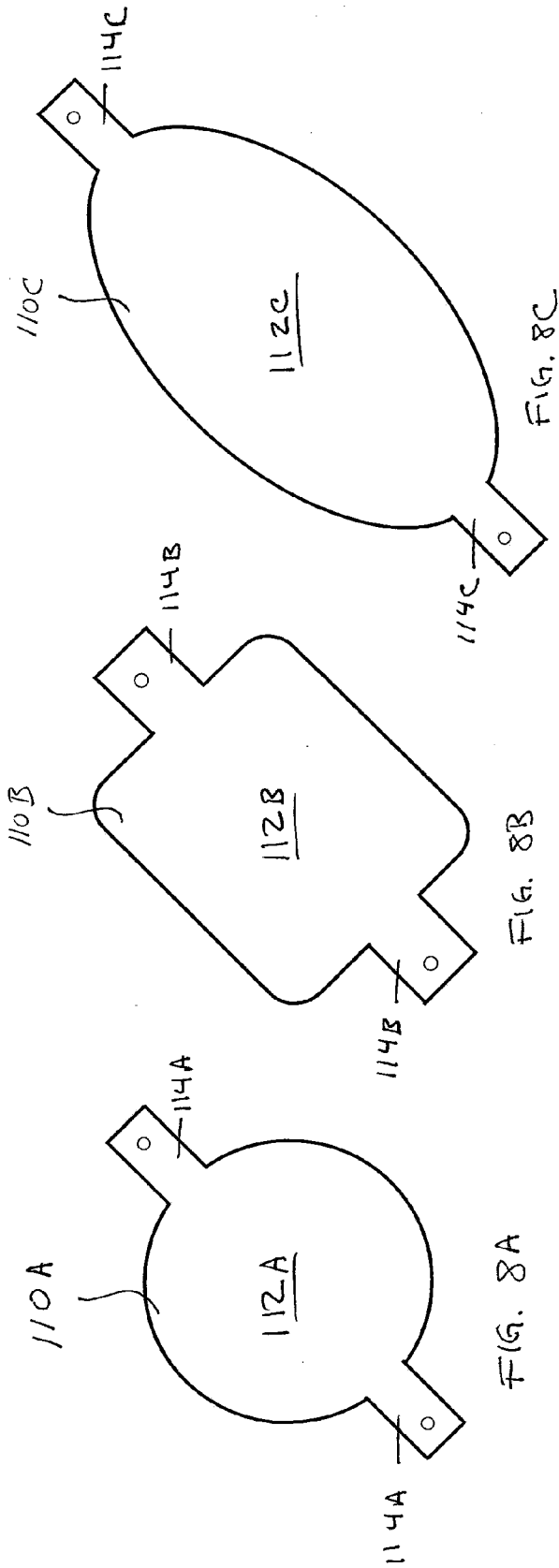


FIG. 7



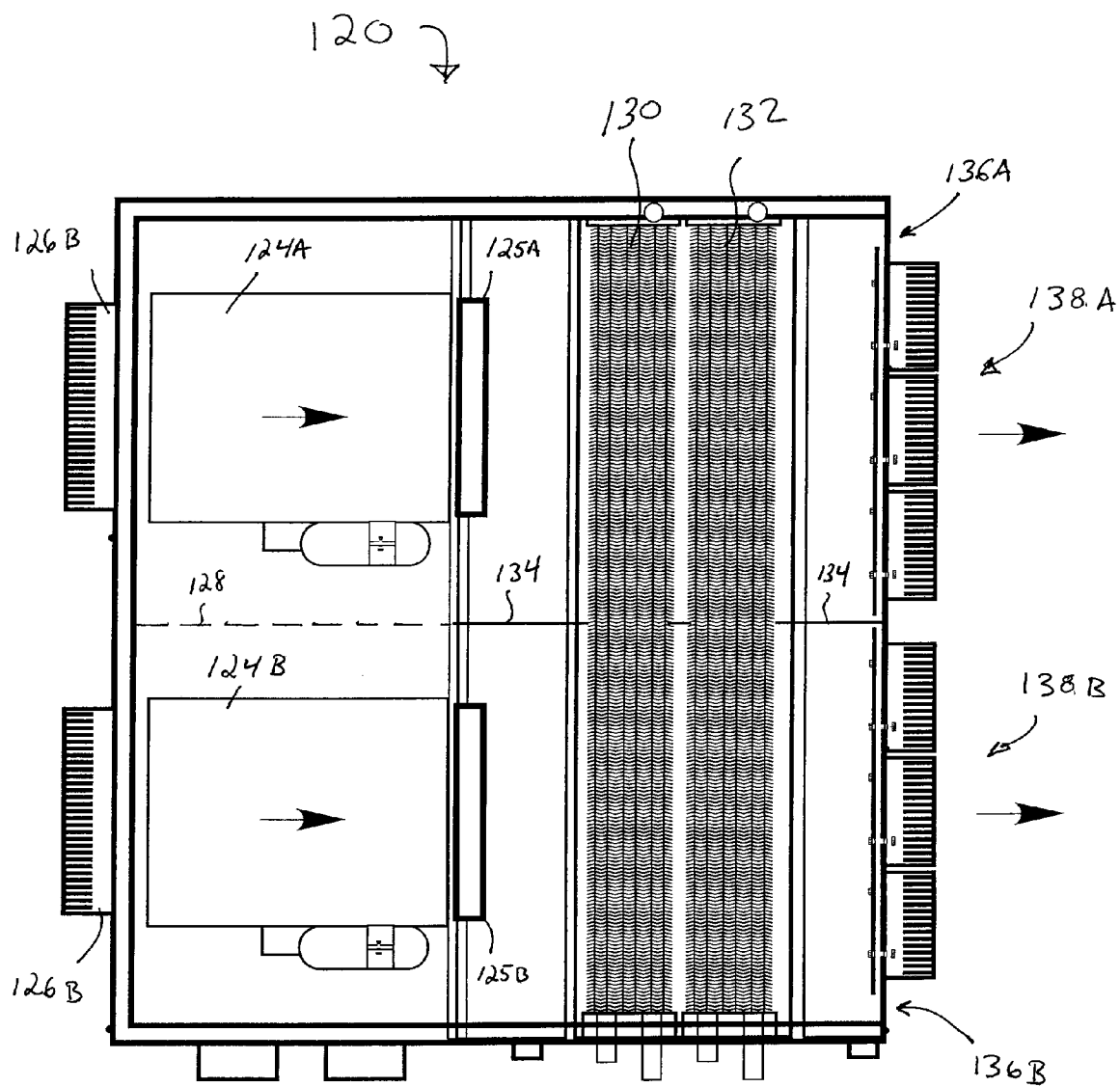


FIG. 9

HEATING AND COOLING VENTILATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not applicable.

FIELD OF THE INVENTION

[0002] The present invention relates generally to an air ventilation system, and more particularly, to an air ventilation system that utilizes at least one or more heat exchangers to heat and/or cool air.

BACKGROUND OF THE INVENTION

[0003] The use of heat exchangers in residences and other buildings is well known. Typically, heat exchangers employed in houses and other buildings incorporate a blower, or other means, which causes air to flow through the heat exchanger at sufficient flow and pressure. Conventional systems include heat pump, or a bifurcated heater and air-conditioner. A packaged small-duct, high-velocity air conditioning is also known.

[0004] The heating and cooling ventilation system described herein is a mid-velocity system (e.g., about 0.4-0.9 inches water column) that uses one or more heat exchangers for heating and cooling of the air stream to provide comfort and performance from a single cabinet to a home or business with a balance of comfort, control and convenience.

[0005] Unlike conventional HVAC systems or typical high velocity systems, mid-velocity systems provide a balanced approach that allows for several thermostatically controlled zones areas throughout a structure. Each zone can be independently operated, allowing the occupants to realize thermal comfort as well as reduced energy bills.

[0006] There are many differences between conventional HVAC, high velocity and mid-velocity system designs. Conventional systems have been around for years and typically use large bulky ducting to deliver conditioned air to a space at relatively low velocity and pressure. These systems are popular because they are generally the lowest cost, but are also considered to be the least comfortable of the options available, primarily because they usually have only a single thermostat to control the temperature of an entire home or other structure. With these systems one usually has to heat every room in the house just to have one room or area comfortable. This sacrifices comfort and carries an energy penalty as well.

[0007] In comparison, well thought out designs for some high velocity systems may provide room conditioning in two areas of a two story home, such as one system for a second floor and one system for the lower floor. This is a step in the right direction, but tends to miss the mark when it is considered that occupants usually tend to use various areas of the home at different times of the day and life styles may require even more desired zoning than just upper and lower floors.

BRIEF SUMMARY OF THE INVENTION

[0008] The following presents a simplified summary of the invention in order to provide a basic understanding of some example aspects of the invention. This summary is not an extensive overview of the invention. Moreover, this summary is not intended to identify critical elements of the invention nor delineate the scope of the invention. The sole purpose of

the summary is to present some concepts of the invention in simplified form as a prelude to the more detailed description that is presented later.

[0009] In accordance with one aspect of the present invention, a heating and cooling ventilation system includes an enclosure including a plurality of side walls, a top wall, a bottom wall, a rear wall and a nose plate that are interconnected to enclose an interior volume of the enclosure. An air inlet opening is in fluid communication with the interior volume, and a plurality of air outlet openings extend through the nose plate that are each in fluid communication with the interior volume. A heat exchanger is disposed within the interior volume, and a blower is disposed within the interior volume. A plurality of airflow damper plates are each associated with a respective one of the plurality of air outlet openings. Each of the plurality of airflow damper plates are linearly movable towards and away from the air outlet openings to thereby adjust an amount of airflow passing through each of the plurality of air outlet openings.

[0010] In accordance with another aspect of the present invention, a heating and cooling ventilation system includes an enclosure including a plurality of side walls, a top wall, a bottom wall, a rear wall and a first nose plate that are interconnected to enclose an interior volume of the enclosure. An air inlet opening is in fluid communication with the interior volume, and a plurality of air outlet openings extends through the first nose plate that are each in fluid communication with the interior volume. A heat exchanger is disposed within the interior volume, and a blower disposed within the interior volume. A second nose plate is interchangeable with the first nose plate, wherein the first nose plate includes a first configuration of the plurality of air outlet openings, and the second nose plate includes a second configuration of the plurality of air outlet openings that is different from the first configuration.

[0011] In accordance with another aspect of the present invention, a heating and cooling ventilation system includes an enclosure including a plurality of side walls, a top wall, a bottom wall, a rear wall and a nose plate that are interconnected to enclose an interior volume of the enclosure. An air inlet opening is in fluid communication with the interior volume, and a plurality of air outlet openings extends through the nose plate that are each in fluid communication with the interior volume. A hydronic heat exchanger cartridge is disposed within the interior volume and in fluid communication with the air inlet opening and the plurality of air outlet openings. A blower is disposed within the interior volume to move air across the hydronic heat exchanger. At least one airflow damper plate is associated with one of the plurality of air outlet openings and is adjustable, within the interior volume, relative to said one air outlet opening to thereby adjust an amount of airflow passing through said one air outlet opening, wherein the at least airflow damper plate is configured to be adjusted from an exterior of the enclosure.

[0012] It is to be understood that both the foregoing general description and the following detailed description present example and explanatory embodiments of the invention, and are intended to provide an overview or framework for understanding the nature and character of the invention as it is claimed. The accompanying drawings are included to provide a further understanding of the invention and are incorporated into and constitute a part of this specification. The drawings illustrate various example embodiments of the invention, and

together with the description, serve to explain the principles and operations of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The foregoing and other aspects of the present invention will become apparent to those skilled in the art to which the present invention relates upon reading the following description with reference to the accompanying drawings, in which:

[0014] FIG. 1 illustrates an example heating and cooling ventilation system with example airflow ducting;

[0015] FIG. 2 illustrates a left side view of the heating and cooling ventilation system of FIG. 1;

[0016] FIG. 3 illustrates a right side view of the heating and cooling ventilation system of FIG. 1;

[0017] FIG. 4A illustrates a front side view of the heating and cooling ventilation system of FIG. 1 with an example nose plate;

[0018] FIG. 4B is similar to FIG. 4A, but illustrates another example nose plate;

[0019] FIG. 5 is similar to FIG. 2, but with a side wall removed;

[0020] FIG. 6 illustrates a top view of the heating and cooling ventilation system of FIG. 1, but with a top wall removed;

[0021] FIG. 7 illustrates an example plurality of airflow damper plates;

[0022] FIG. 8A illustrates one example airflow damper plate geometry;

[0023] FIG. 8B illustrates another example airflow damper plate geometry;

[0024] FIG. 8C illustrates yet another example airflow damper plate geometry; and

[0025] FIG. 9 illustrates a top view of another example heating and cooling ventilation system, but with a top wall removed.

DESCRIPTION OF EXAMPLE EMBODIMENTS

[0026] Example embodiments that incorporate one or more aspects of the present invention are described and illustrated in the drawings. These illustrated examples are not intended to be a limitation on the present invention. For example, one or more aspects of the present invention can be utilized in other embodiments and even other types of devices. Moreover, certain terminology is used herein for convenience only and is not to be taken as a limitation on the present invention. Still further, in the drawings, the same reference numerals are employed for designating the same elements.

[0027] Turning to the shown example of FIG. 1, a modular heating and cooling ventilation system 10 is shown together with associated airflow ducting structure 12. While this system is described as a “mid-velocity” ventilation system, this is not intended to provide a limitation upon the appended claims. The ventilation system 10 is configured to be easily installed and supported by mounting struts 13 or other building support structure via mounting brackets or the like that may include vibration arrestors, etc. The airflow ducting structure 12 can include various ducts, conduits, etc. for the intake and exhaust of air through the ventilation system 10. For example, a standard air return 16 with or without a filter can be provided for intake of air. An optional air inlet 18 with or without a damper can also be provided. The air return 16 can be in fluid communication with the ventilation system 10

via rigid and/or flexible ducting, etc. Additionally, one or more exhaust ducts 20 are provided for exhausting heated or cooled air from the ventilation system 10 and into a desired conditioned space. The exhaust ducts 20 can be generally rigid, and/or can include flexible portions 22. The exhaust ducts 20 can include various duct terminations 24, such as directional balance diffusers or the like. The intake and exhaust ducting can be insulated or non-insulated. It is understood that the illustrated example is a simplified system view, and that more or less components can be utilized, as desired.

[0028] Turning now to FIGS. 2-3, the heating and cooling ventilation system 10 generally includes an enclosure 30 including a plurality of side walls 32, a top wall 34, a bottom wall 36, a rear wall 38, and a nose plate 40 that are interconnected to enclose an interior volume 42 (see FIGS. 5-6) of the enclosure 30. Generally, the enclosure is formed of a rigid material, such as sheet metal and/or polymers, and it is understood that the various walls 32-40 can be independent, or may include multiple walls formed together. The various walls 32-40 can be coupled together in various removable and non-removable manners, including mechanical fasteners, adhesives, welding, etc. It can be beneficial to make the various walls removable to facilitate servicing the various internal elements of the ventilation system 10. Additionally, the enclosure 30 can be insulated, and/or various seals or the like can be provided between adjacent walls to discourage airflow leakage. It is understood that the terms “side”, “top”, “bottom”, “rear”, and “nose” are used for clarity and ease of discussion, and are not intended to provide any limitation hereto.

[0029] The heating and cooling ventilation system 10 supplies fresh air into a home or other building, and can also heat or cool the air. Thus, the enclosure 30 can include at least one air inlet opening 44 and at least one air outlet opening 46, all of which are in fluid communication with the interior volume 42. As shown, the air inlet opening 44 can extend through the rear wall 38 and can include a duct collar 48 that can be rigid, partially flexible, or wholly flexible, and is adapted to be coupled to the airflow ducting 12 leading to the air return 16. Although only a single air inlet opening 44 is described, it is understood that multiple air inlet openings can be provided.

[0030] Similarly, the system 10 can include a plurality of air outlet openings 46 that extend through the nose plate 40 for fluid connection with the airflow ducting 12 leading to the duct terminations 24. In this way, multiple discharge ducting connections can obviate the use of a manifold ducting distribution system. For example, the duct collar(s) 50 can extend away from the nose plate 40 and are adapted to be coupled to the airflow ducting 12 of the exhaust ducts 20. Each air outlet opening 46 can include an associated duct collar 50 that can be rigid, partially flexible, or wholly flexible. In one example, a duct collar 50 can be removably or non-removably integrated together with the nose plate 40. In another example, a duct collar 50 can be rigid, or can have at least a portion that is flexible. In yet another example, a duct collar 50 can be wholly flexible. In still yet another example, a length of flexible ducting can be interconnected between a duct collar 50 and a generally rigid, inflexible portion of the airflow ducting 20. Flexible ducting and/or duct collars can simplify installation and/or isolate sound and vibration. It is further contemplated that the various different duct collars 50 can have similar or different configurations.

[0031] Turning briefly to FIGS. 4A-4B, the enclosure 30 can include a plurality of interchangeable nose plates 40,

40B. In the shown examples, a first nose plate **40** can include a first configuration of the plurality of air outlet openings **50**, and a second nose plate **40B** can include a second configuration of the plurality of air outlet openings **46**, **46B** that is different from the first configuration. There can be many similarities and differences among the plurality of interchangeable nose plates **40**, **40B** so as to accommodate the myriad installation configurations found in new or existing ventilation systems within homes and buildings. During installation, the different interchangeable nose plates **40**, **40B** can be easily installed onto the enclosure **30** to fit the unique ducting setup of each home or building.

[0032] For example, the first configuration shown in FIG. **4A** can include a first number of air outlet openings **46**, while wherein the second configuration includes a second number of air outlet openings **46**, **46B**. The second number is different from the first number: FIG. **4A** illustrates four separate air outlet openings **46**, while FIG. **4B** illustrates three separate air outlet openings **46**, **46B**. It is understood that various numbers of openings can be utilized.

[0033] In another example, the first configuration shown in FIG. **4A** can include at least one air outlet opening **46** having a cross-sectional area in the range of about 3-50 square inches, and the second configuration can include at least one air outlet **46B** opening having a different cross-sectional area in the range of about 3-50 square inches. As shown in FIG. **4B**, the various air outlets **46**, **46B** include two generally similar outlets **46**, and one outlet **46B** of a different size. The various air outlets can have various geometries, such as circular, obround, square, rectangular, polygonal, etc., that can define various cross-sectional areas. Thus, for example, at least one air outlet opening **46** of the first configuration can include a diameter in the range of about 2-8 inches, and wherein at least one air outlet opening **46B** of the second configuration can have a different diameter in the range of about 2-8 inches.

[0034] In the example of FIG. **4B**, the air outlets **46**, **46B** of the second nose plate **40B** can each have a generally circular geometry, with two of the air outlets **46** having a four-inch diameter defining a cross-sectional area of about 12.6 square inches each, and a single larger air outlet **46B** having a six-inch diameter defining a cross-sectional area of about 28.2 square inches. Various numbers, sizes, and configurations of air outlets **46**, **46B** are contemplated. Additionally, it is contemplated that the associated duct collars **50**, **50B** will correspond to the numbers, sizes, and configurations, etc. of air outlets **46**, **46B**.

[0035] Turning now to FIGS. **5** and **6**, internal features of the enclosure **30** will now be described. A blower **52** is disposed within the interior volume **42** adjacent the air inlet opening **44** for drawing intake air into the enclosure **30**. The blower **52** can include any type of airflow generation device adapted to move air at a positive pressure through the enclosure **30** and out of the at least one air outlet opening **46**. Multiple blowers can also be utilized. Additionally, an access plate **53** can be removably provided over an access hole that extends through at least one of the walls of the enclosure **30** for removing, replacing, or repairing the blower **52** without removal of the wall. Electrical service connections can be internal or external.

[0036] Additionally, at least one heat exchanger **54** is disposed within the interior volume **42** in fluid communication with the air inlet opening **44** and the plurality of air outlet openings **46**. Various types of heat exchangers **54** can be

utilized, although a hydronic, water-based type is illustrated that utilizes heated or cooled water flowing in a coiled array of tubing and metal fins to heat or cool airflow passing there-through. Hydronic heat exchangers **54** are beneficial in that they can be relatively simple to install by one who is trained in the plumbing or HVAC trade. When connected to chillers, boilers, water heaters or other alternative energy systems, such as solar thermal panels, geothermal heating and cooling systems, or thermal storage they can easily integrate with virtually any type of system or construction to deliver heated or chilled air to a home, building or other structure. Still, the heat exchangers **54** can be configured to utilize other working fluids. For example, the heat exchanger **54** can be a condensing gas coil or direct expansion evaporator from a heat pump or other refrigeration loop (e.g., evaporator, compressor, condenser, expansion device and even some unit controls, etc.). These types of heat exchangers may utilize R-134a or other commercially available refrigerants. Within this document, the terms refrigerant and hydronic may be used interchangeably to define what could be considered a traditional refrigerant, such as ammonia or other chemical, and a chilled or heated fluid, such as but not limited to, chilled or heated water, brine or glycol solution. Additionally, the system **10** could utilize multiple types of heat exchangers. For example, the system **10** could utilize a hydronic-type heat exchanger to provide heating, and a condensing gas coil or direct expansion evaporator to provide cooling (or vice-versa). Thus, while the following description utilizes hydronic heat exchangers in descriptive examples, it is understood that such language is not intended to be limiting and that various types of heat exchangers and/or connected energy systems may be utilized.

[0037] As shown, a pair of heat exchangers **54** are illustrated, though it is contemplated that one or more heat exchangers **54** can be used. The heat exchanger(s) **54** can be adapted for 2-pipe or 4-pipe water systems. For example, one heat exchanger **54** can be coupled via plumbing **56** to a cool water supply, while another heat exchanger **54B** can be coupled via plumbing **56B** to a hot water supply to independently provide heating and cooling on demand. Still, all of the heat exchangers **54** could be coupled to hot or cold water supplies to thereby increase heating or cooling capacity. Additionally, an access plate **55** can be removably provided over an access hole that extends through at least one of the walls of the enclosure **30** for removing, replacing, or repairing the heat exchanger(s) **54**, **54B** without removal of the wall. Because the heat exchanger(s) **54**, **54B** can have independent plumbing **56**, **56B**, each heat exchanger **54**, **54B** can be independently removed, replaced, or repaired as a cartridge unit without disturbing the remaining heat exchanger **54**, **54B**. The heat exchangers **54**, **54B** can provide a range of heating or cooling, such as between about 12,000 to 84,000 Btu/hours of heating and/or about 1 to 3.5 tons of cooling. In addition or alternatively, a dual coil system may be employed in the same fashion to provide increased capacity in either heating and or cooling. In this embodiment both coils are connected to each other in a parallel fashion and either heated or chilled fluid may be circulated to both coils simultaneously to increase capacity, or external devices can switch heating or chilled water to the dual coil array. It is understood that the capacity of an energy system may not be limited by the capacity of the unit as multiple units are typically employed in a structure to match individual thermostatically controlled areas and thereby can heat, cool and ventilate homes, buildings and other structures of virtually any size.

[0038] The heat exchangers **54**, **54B** are located downstream of the blower **52**. Structure can be provided to direct the airflow through the heat exchangers **54**, **54B**. In one example, a partition wall **58** can separate the interior volume **42** into a first portion that includes the blower **52**, and a second portion that includes the heat exchangers **54**, **54B**. An airflow opening can be provided in the partition wall **58**, and at least one movable louver **60** can be arranged over the airflow opening to adjust an amount and/or direction of air flowing over the heat exchangers **54**, **54B**. The movable louver **60** may also reduce the amount of airflow out of the blower **52**, which can effectively reduce the airflow rate that is experienced by the heat exchanger(s) **54**, **54B**. In addition or alternatively, one or more baffle plates **62** can be provided to direct the air flowing over the heat exchangers **54**, **54B**. The baffle plate(s) **62** can be separate from or combined with a core support plate for supporting the heat exchangers **54**, **54B** within the enclosure **30**. For example, a support plate can provide installation space for the plumbing **56**, **56B** of the heat exchangers **54**, **54B**.

[0039] While being using in a cooling operation, the heat exchanger is capable of producing water condensate from the air flowing therethrough. Thus, it can be beneficial to provide water condensate collection and disposal structure. As shown in FIG. 5, the bottom wall **36** of the enclosure **30** can at least partially define a condensate collection pan **70** that is located to collect condensate produced by the hydronic heat exchanger cartridge(s) **54**. The condensate collection pan **70** can partially or completely occupy the entire bottom of the enclosure **30**. As shown, the condensate collection pan **70** can occupy a portion of the bottom wall **36** generally underneath the hydronic heat exchanger cartridge(s) **54**, with another plate **72** occupying the remaining portion of the bottom wall **36** generally underneath the blower **52**. The condensate collection pan **70** and plate **72** can have generally the same vertical dimensions so that the enclosure **30** can sit level when upon the ground. Where no condensate collection pan is used, it is also contemplated that the bottom wall **36** can be similar to the top wall **34** and extend along the entire bottom of the enclosure **30**.

[0040] The condensate collection pan **70** includes a sloped bottom wall **74**, and at least first and second discharge outlets **76**, **78**. The first discharge outlet **76** is disposed generally towards the lowermost end of the sloped bottom wall **74**, while the second discharge outlet **78** is located towards the uppermost end. Additionally, the first discharge outlet **76** can be arranged at least partially below the second discharge outlet **78**. In one example, a bottommost portion of the second discharge outlet **78** can be arranged to be generally aligned with or overlapping an uppermost portion of the first discharge outlet **76**. Thus, a majority of the collected condensate water will be discharged via the first discharge outlet **76**, while the second discharge outlet **78** remains as a back-up, secondary water outlet (e.g., when the first discharge outlet **76** is clogged or otherwise unavailable).

[0041] Additionally, at least one of the first and second discharge outlets **76**, **78** of the condensate collection pan **70** can be located downstream of the blower **52** so as to be located in a positive air pressure environment that is greater than ambient air pressure. In the shown example, both of the first and second discharge outlets **76**, **78** are located in a positive air pressure environment. As a result, condensate water is encouraged to flow out of the first and second discharge outlets **76**, **78**, while debris is discouraged from col-

lecting in the first and second discharge outlets **76**, **78**. In this way, the condensate discharge outlets **76**, **78** may not utilize a seal (e.g., trapped drain) to prevent the backflow of gasses from connection to an atmospheric water drain. Moreover, the positive air pressure on start-up of the system **10** inhibits recirculation of air or debris trapped in the condensate piping that is often associated with the creation of disease or mold in inappropriately designed condensate piping. Thus, the first and second discharge outlets **76**, **78** can remain generally clog-free during operation.

[0042] In addition or alternatively, the enclosure **30** can include structure to direct the water condensate towards the condensate collection pan **70**. In one example, at least one condensate baffle plate **80** can be located vertically below the plurality of air outlet openings **46**. The condensate baffle plate **80** can be configured to direct water condensate produced by the hydronic or refrigerant heat exchanger cartridge **54** towards the condensate collection pan **70**. The condensate baffle plate **80** can extend at least partially, such as completely, across the interior of the enclosure **30**. For example, the condensate baffle plate **80** can be arranged within the interior volume **42** and between the heat exchanger cartridge **54** and the nose plate **40** such that any water condensate that collects on the nose plate **40** will drain downwards and towards the condensate collection pan **70**. The condensate baffle plate **80** can even be coupled to or formed with the nose plate **40**. Additionally, the condensate baffle plate **80** can be angled generally downwards towards the condensate collection pan **70**. Moreover, the condensate baffle plate **80** can be located so as to provide a gap **82** to provide access for the water to drain down into the condensate collection pan **70**. The gap **82** can be located between a terminal end of the condensate baffle plate **80** and other baffle plates **62** supporting the heat exchanger(s) **54**. Alternatively, the condensate baffle plate **80** can be coupled to or formed with other structure (e.g., other baffle plates **62**, etc.) within the enclosure and include one or more holes for condensate water to flow through. Thus, water condensate that collects on the condensate baffle plate **80** can be directed to flow downwards into the condensate collection pan **70**, and eventually out of the first and/or second discharge outlets **76**, **78**.

[0043] The hydronic heating and air-cooling ventilation system **10** may further include at least one airflow damper plate **90** associated with at least one air outlet opening **46** to thereby adjust an amount of airflow passing therethrough. Turning now to FIG. 7, a plurality of airflow damper plates **90** are provided, each associated with a respective one of the plurality of air outlet openings **46** to provide individualized airflow adjustment for each outlet opening **46**. While only two airflow damper plates **90** are illustrated, it is understood that airflow damper plates **90** can be provided to any or all of the air outlet openings **46** in a particular nose plate **40**. Thus, because each outlet opening **46** can provide a separate supply circuit that is generally used to provide heating or cooling to different locations or zones within a home or building, the system **10** can be adjusted and individualized for each unique installation.

[0044] Each airflow damper plate **90** can be adjusted in various manners. In one example, each of the plurality of airflow damper plates **90** can be linearly movable towards and away from the respective air outlet openings **46** to thereby adjust an amount of airflow passing through each of the plurality of air outlet openings **46**. For example, an increase of the amount of airflow can be accomplished by moving an

airflow damper plate 90 (i.e., as illustrated, the upper plate 90) away from the air outlet opening 46 to thereby increase the width of a gap 92 between the airflow damper plate 90 and the nose plate 40. Conversely, a reduction of the amount of airflow can be accomplished by moving an airflow damper plate 90C (i.e., as illustrated, the lower plate 90C) towards an air outlet opening 46C, to thereby decrease the width of a gap 92C between the airflow damper plate 90C and the nose plate 40C. Thus, as shown in FIG. 7, for the same incoming airflow 94, one airflow damper plate 90 can provide a relatively greater airflow output 96, while another airflow damper plate 90C can provide a relatively lesser airflow output 96C to individual air circuits. It is understood that the amount of airflow can be measured variously, such as by mass, volume, velocity, pressure, etc.

[0045] It can be beneficial to have each of the plurality of airflow damper plates 90 be independently linearly movable, within the interior volume 42, towards and away from respective ones of the plurality of air outlet openings 46 to permit individualized and discrete adjustment. Still, two or more of the airflow damper plates 90 could be movable together, if desired. The adjustment can be accomplished variously. In one example, each of the plurality of airflow damper plates 90 may include at least one adjustment screw 100, 100C or the like to permit the linear movement of the airflow damper plates 90, 90C towards and away from the air outlet openings 46, 46C. The at least one adjustment screw 100, 100C can also mechanically support the airflow damper plates 90, 90C. As such, it can be beneficial to utilize two or more screws or other fasteners to provide a mechanically balanced system. In one example, each of the plurality of airflow damper plates 90, 90C may include at least a pair of opposed adjustment screws 100, 100C. Where two or more screws are used, they may be arranged generally equally about the airflow damper plates 90, 90C, or may also be arranged non-equally in various other relative arrangements. In one example, the pair of opposed adjustment screws 100, 100C may be diametrically opposed.

[0046] The adjustment screws 100, 100C can interface with the airflow damper plates 90, 90C variously. In one example, one or more threaded inserts 102, 102C can be associated with each of the plurality of air outlet openings 46, 46C, and can be adapted for threaded engagement with the at least one adjustment screw 100, 100C. The threaded inserts 102, 102C can be secured to the nose plate 40 in a non-movable fashion (i.e., non-rotating, non-translating), such that rotation of the screws 100, 100C relative to the threaded inserts 102, 102C will cause the advance or retraction of the screws 100, 100C. Additionally, the screws 100, 100C can be coupled to the airflow damper plates 90, 90C in various manners, such as via at least a secure nut 104, 104C or other suitable complementary fastener. Additionally, the airflow damper plates 90, 90C can include a non-threaded sleeve 106, 106C or the like adjacent to the nut 104, 104C to support and/or guide the screws 100, 100C. Utilizing this construction, rotation of the screws 100, 100C relative to the threaded inserts 102, 102C will cause the advance or retraction of the screws 100, 100C to thereby cause the linear movement of the airflow damper plates 90, 90C. Alternatively, the airflow damper plates 90, 90C could have an over-sized hole to receive the screw 100, 100C in place of the sleeve 106, 106C. Moreover, various anti-vibration structure (not shown), stabilizing structure, or even locking structure (e.g., lock nut, etc.) could be provided.

[0047] Additionally, it can be beneficial to permit each of the plurality of airflow damper plates 90, 90C to be adjustable

via the respective adjustment screw(s) 100, 100C from an exterior of the enclosure 30. As a result, each outlet opening 46, 46C be individually adjusted in situ from an exterior of the enclosure 30, either before or after installation of the ventilation system 10, to provide a unique and separate supply circuit for heating or cooling to different locations or zones within a home or building. In one example, each adjustment screw 100, 100C can include an operative head 108, 108C that is operable from an exterior 110 of the enclosure 30. The operative heads 108, 108C can include standard configurations (i.e., flat, phillips, hex head, etc.) or even non-standard configurations, such as a user-operable handle or the like.

[0048] Each of the plurality of airflow damper plates 90, 90C can thus be independently adjustable between a maximum amount of airflow and a minimum amount of airflow. The maximum and minimum amounts of airflow can be simply 100% and 0%, or can be within a preselected range. In one example, the minimum amount of airflow can be greater than zero to provide a protection against the ventilation system 10 harming itself if, during operation, some or all of the airflow damper plates 90, 90C were completely shut off. The range of operation can be selected variously. In one example, the maximum and minimum airflow range can be selected to provide a 60% shift in airflow from one discrete air outlet 46 to another. For example, a minimum airflow can be about 10%, while the maximum airflow can be about 70% (of maximum total airflow), although various other minimums, maximums and ranges are contemplated. Thus, even if one airflow damper plate 90 is completely close, around 10% airflow will still flow therethrough. Similarly, if one airflow damper plate 90 is completely opened, only about 70% airflow will still flow therethrough, which can help to maintain an overall balanced airflow among all of the various air outlet openings 46.

[0049] The minimums, maximums and ranges can be controlled in various manners. In one example, the minimum airflow can be controlled via an abutment between the threaded inserts 102, 102C, and the non-threaded sleeves 106, 106C (or even the airflow damper plates 90, 90C). For example, the lower airflow damper plate 90C of FIG. 7 is illustrated in a minimum condition, which still provides some gap 92C for the minimum airflow. Conversely, the maximum airflow can be controlled via an abutment between the operative head 108, 108C and the threaded inserts 102, 102C (or even the nose plate 40). In addition or alternatively, various nuts or the like can be provided at different positions on the adjustment screws 100, 100C to determine maximum and minimum conditions and ranges. For example, the relative locations of the nuts 104, 104C, non-threaded sleeves 106, 106C on the adjustment screws 100, 100C and/or airflow damper plates 90, 90C can further determine maximum and minimum conditions and ranges. It is understood that the minimums, maximums and ranges can be preset or can even be field adjustable depending upon the individual and unique nature of each installation. While discussed herein as a generally manual adjustment procedure, it is understood that the adjustment of one or more of the various airflow damper plates 90, 90C could be performed semi-automatically or even fully automatically via suitable motors or other drive systems coupled to the adjustment screws, and appropriate control hardware/software, thermostats, etc.

[0050] Turning now to FIGS. 8A-8C, different example airflow damper plates 110A, 110B, 110C are illustrated with different geometries. It is understood that these are intended

to be similar to the airflow damper plates **90**, **90C** described above, but are re-numbered for clarity. As described previously herein, the heat exchanger(s) **54** are capable of producing water condensate when operating in a cooling mode, and the flowing airstream can cause water overspray and misting. Thus, a major surface **112A**, **112B**, **112C** of each of the plurality of airflow damper plates **110A**, **1108**, **110C** can be adapted to inhibit the overspray and misting condensate from being exhausted through the plurality of air outlet openings **46**. For example, the major surface **112A**, **112B**, **112C** of each of the plurality of airflow damper plates **110A**, **1108**, **110C** is configured to at least partially cover an associated air outlet opening **46**. Thus, condensate released into the airflow by the heat exchanger(s) **54** will strike the major surface **112A**, **112B**, **112C** to thereby be blocked from entry into the air outlet opening **46** or the conditioned space. The blocked condensate can then fall by gravity towards the baffle plate **80** and into the condensate collection pan **70**.

[0051] To facilitate this, each of the plurality of airflow damper plates **110A**, **1108**, **110C** includes the major surface **112A**, **112B**, **112C** which defines a major cross-sectional area that is substantially equal to the outlet cross-sectional area of a respective, associated air outlet opening **46**. The major surface **112A**, **112B**, **112C** is sufficiently large to provide the condensate blocking feature. Still, the major surface **112A**, **112B**, **112C** may define a major cross-sectional area that is somewhat larger or smaller (e.g., $\pm 10\%$ or other amount) than the outlet cross-sectional area of a respective, associated air outlet opening **46**, depending upon the desired system operation and performance. As discussed previously herein, the air outlet openings **46** can have various geometries, such as circular, obround, square, rectangular, polygonal, etc., that can define various cross-sectional areas. Similarly, as shown in FIGS. **8A-8C**, the major surfaces **112A**, **112B**, **112C** of the various airflow damper plates **110A**, **1108**, **110C** can also have various geometries (e.g., circular, obround, square, rectangular, polygonal, etc.) to provide the desired cross-sectional areas. It is understood that the geometries of the major surfaces **112A**, **112B**, **112C** can be the same or different from that of the associated air outlet openings **46**, provided that the desired cross-sectional areas ratios are met.

[0052] The airflow damper plates **110A**, **1108**, **110C** can include various other features. For example, each airflow damper plate **110A**, **1108**, **110C** can include one or more support arms **114A**, **114B**, **114C** with appropriate holes for interfacing with the adjustment screws **100**. There can be a single support arm for each adjustment screw, though more or less are contemplated. Additionally, the placement or arrangement of the support arms **114A**, **114B**, **114C** can generally correspond to that of the adjust screws **100**.

[0053] Turning now to FIG. **9**, a modified ventilation system **120** is illustrated that can provide multi-zone functionality in a single unit. The modified ventilation system **120** may include any or all of the features described herein. Additionally, though illustrated as a two-zone system, it is understood that the modified ventilation system **120** could be configured to provide independent operation to three or more zones.

[0054] The modified ventilation system **120** includes a modified enclosure **122** that includes first and second blowers **124A**, **124B** that are fed by at least one air inlet opening. As shown, a pair of independent air inlet openings **126A**, **126B** are shown. An optional baffle plate **128** can be provided between the first and second blowers **124A**, **124B** to keep the incoming air streams separate and inhibit cross flow. Each of

the first and second blowers **124A**, **124B** may also include movable louvers **125A**, **125B**. The first and second blowers **124A**, **124B** can be operated independently or together depending upon the needs of the various connected zones in a home or building.

[0055] One or more hydronic heat exchanges can be provided within the modified ventilation system **120**. As shown, a pair of heat exchangers **130**, **132** can be provided for heating and/or cooling the airflow. The heat exchangers **130**, **132** can extend laterally across the modified ventilation system **120** so as to heat or cool the airflow in both zones, and/or alternatively each zone can include separate heat exchangers. An optional baffle plate **134** can be adapted to separate the airflow moving through the heat exchangers **130**, **132** such that the airflow can be independently conditioned for the separate zones, and undesirable cross flow can be inhibited and/or prevented. The baffle plate **134** can extend longitudinally through the interior to extend between the first and second blowers **124A**, **124B** and the nose plate(s) to keep the conditioned air streams separate.

[0056] The modified ventilation system **120** can include one or more nose plates with a plurality of air outlet openings. For example, a pair of nose plates **136A**, **136B** can each include a plurality of air outlet openings **138A**, **138B** that can be customized for each separate zone in a home or building. Each of the nose plates **136A**, **136B** can be individually removable and replaceable. Still, a single nose plate could be provided to accommodate all of the air outlet openings **138A**, **138B**. Moreover, each of the nose plates **136A**, **136B** can include a plurality of airflow damper plates that can be each individually adjusted per the associated air outlet openings to provide a plurality of highly customizable airflow circuits to the various zones in a home or building.

[0057] The invention has been described with reference to the example embodiments described above. Modifications and alterations will occur to others upon a reading and understanding of this specification. Examples embodiments incorporating one or more aspects of the invention are intended to include all such modifications and alterations insofar as they come within the scope of the appended claims.

What is claimed is:

1. A heating and cooling ventilation system, including:

an enclosure including a plurality of side walls, a top wall, a bottom wall, a rear wall and a nose plate that are interconnected to enclose an interior volume of the enclosure;

an air inlet opening in fluid communication with the interior volume;

a plurality of air outlet openings extending through the nose plate that are each in fluid communication with the interior volume;

a heat exchanger disposed within the interior volume;

a blower disposed within the interior volume; and

a plurality of airflow damper plates each associated with a respective one of the plurality of air outlet openings, each of the plurality of airflow damper plates being linearly movable towards and away from the air outlet openings to thereby adjust an amount of airflow passing through each of the plurality of air outlet openings.

2. The heating and cooling ventilation system of claim 1, wherein each of the plurality of airflow damper plates are independently linearly movable, within the interior volume, towards and away from a respective one of the plurality of air outlet openings.

3. The heating and cooling ventilation system of claim 1, wherein each of the plurality of airflow damper plates includes at least one adjustment screw to permit the linear movement of the airflow damper plates towards and away from the air outlet openings.

4. The heating and cooling ventilation system of claim 3, wherein each of the plurality of airflow damper plates includes at least a pair of opposed adjustment screws.

5. The heating and cooling ventilation system of claim 3, further including a threaded insert associated with each of the plurality of air outlet openings and adapted for threaded engagement with the at least one adjustment screw.

6. The heating and cooling ventilation system of claim 3, wherein each of the plurality of airflow damper plates is adjustable via the respective at least one adjustment screw from an exterior of the enclosure.

7. The heating and cooling ventilation system of claim 1, wherein each of the plurality of air outlet openings defines an outlet cross-sectional area, and wherein each of the plurality of airflow damper plates includes a major surface that defines a major cross-sectional area that is substantially equal to the outlet cross-sectional area of a respective air outlet opening.

8. The heating and cooling ventilation system of claim 7, wherein the heat exchanger is capable of producing condensate, and wherein the major surface of each of the plurality of airflow damper plates is adapted to inhibit the condensate from being exhausted through the plurality of air outlet openings.

9. The heating and cooling ventilation system of claim 7, wherein at least one of the plurality of air outlet openings defines an outlet cross-sectional area that may be different from the remainder of the plurality of air outlet openings.

10. The heating and cooling ventilation system of claim 1, wherein each of the plurality of airflow damper plates are adjustable between a maximum amount of airflow and a minimum amount of airflow, the minimum amount of airflow being greater than zero.

11. The heating and cooling ventilation system of claim 1, wherein the plurality of air outlet openings has a first configuration, and wherein the nose plate is interchangeable with an alternative nose plate having an alternative plurality of air outlet openings that has a second configuration.

12. A heating and cooling ventilation system, including:
an enclosure including a plurality of side walls, a top wall, a bottom wall, a rear wall and a first nose plate that are interconnected to enclose an interior volume of the enclosure;

an air inlet opening in fluid communication with the interior volume;

a plurality of air outlet openings extending through the first nose plate that are each in fluid communication with the interior volume;

a heat exchanger disposed within the interior volume;

a blower disposed within the interior volume; and

a second nose plate that is interchangeable with the first nose plate,

wherein the first nose plate includes a first configuration of the plurality of air outlet openings, and the second nose plate includes a second configuration of the plurality of air outlet openings that is different from the first configuration.

13. The heating and cooling ventilation system of claim 12, wherein the first configuration includes a first number of air outlet openings, and wherein the second configuration

includes a second number of air outlet openings, the second number being different from the first number.

14. The heating and cooling ventilation system of claim 12, wherein the first configuration includes at least one air outlet opening having a cross-sectional area in the range of about 3-50 square inches, and wherein the second configuration includes at least one air outlet opening having a different cross-sectional area in the range of about 3-50 square inches.

15. The heating and cooling ventilation system of claim 14, wherein the at least one air outlet opening of the first configuration includes has a diameter in the range of about 2-8 inches, and wherein at least one air outlet opening of the second configuration has a different diameter in the range of about 2-8 inches.

16. The heating and cooling ventilation system of claim 14, wherein the plurality of air outlet openings of the first and second configurations define a geometry selected from the list including circular, obround, square, and rectangular.

17. The heating and cooling ventilation system of claim 12, wherein each of the plurality of air outlet openings includes a duct collar that extends away from the nose plate and is adapted to be coupled to airflow ducting.

18. The heating and cooling ventilation system of claim 17, wherein the duct collar is integrated together with the nose plate.

19. The heating and cooling ventilation system of claim 17, wherein at least a portion of the duct collar may be flexible.

20. The heating and cooling ventilation system of claim 17, further including a length of flexible ducting interconnected between the duct collar and a generally inflexible portion of the airflow ducting.

21. A heating and cooling ventilation system, including:

an enclosure including a plurality of side walls, a top wall, a bottom wall, a rear wall and a nose plate that are interconnected to enclose an interior volume of the enclosure;

an air inlet opening in fluid communication with the interior volume;

a plurality of air outlet openings extending through the nose plate that are each in fluid communication with the interior volume;

a hydronic heat exchanger cartridge disposed within the interior volume and in fluid communication with the air inlet opening and the plurality of air outlet openings;

a blower disposed within the interior volume to move air across the hydronic heat exchanger; and

at least one airflow damper plate associated with one of the plurality of air outlet openings and being adjustable, within the interior volume, relative to said one air outlet opening to thereby adjust an amount of airflow passing through said one air outlet opening,

wherein the at least one airflow damper plate is configured to be adjusted from an exterior of the enclosure.

22. The heating and cooling ventilation system of claim 21, wherein the at least one airflow damper plate is linearly movable towards and away from said one air outlet opening.

23. The heating and cooling ventilation system of claim 22, wherein the at least one airflow damper plate includes at least one adjustment screw to permit the linear movement of the airflow damper plate towards and away from said one air outlet openings, and wherein the at least one adjustment screw includes an operative head that is operable from an exterior of the enclosure.

24. The heating and cooling ventilation system of claim **21**, further including a plurality of airflow damper plates each associated with a respective one of the plurality of air outlet openings, each of said plurality of airflow damper plates being independently adjustable from an exterior of the enclosure.

25. The heating and cooling ventilation system of claim **24**, wherein each of the plurality of airflow damper plates are independently adjustable between a maximum amount of airflow and a minimum amount of airflow, the minimum amount of airflow being greater than zero.

26. The heating and cooling ventilation system of claim **21**, wherein the heat exchanger is capable of producing condensate, and wherein the bottom wall at least partially defines a condensate collection pan that is disposed to collect condensate produced by the hydronic heat exchanger cartridge.

27. The heating and cooling ventilation system of claim **26**, wherein the condensate collection pan includes at least first

and second discharge outlets, and wherein the first discharge outlet is arranged at least partially below the second discharge outlet.

28. The heating and cooling ventilation system of claim **26**, further including a condensate baffle plate located vertically below the plurality of air outlet openings and being configured to direct condensate produced by the hydronic heat exchanger cartridge towards the condensate collection pan.

29. The heating and cooling ventilation system of claim **28**, wherein the condensate baffle plate arranged between the heat exchanger cartridge and the nose plate, and is angled downwards towards the condensate collection pan.

30. The heating and cooling ventilation system of claim **26**, wherein the condensate collection pan is located downstream from the blower such that the condensate collection pan experiences a positive air pressure greater than ambient air pressure.

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