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HVAC CONTROL SYSTEM FOR ELECTRIC HEATING SYSTEM

Abstract

A heating, ventilation, and air conditioning (HVAC) system includes a housing defining a chamber configured to receive an air flow and a heating system disposed within the housing. The heating system includes a heating coil disposed within the chamber and configured to transfer heat to the air flow within the chamber and a power supply control system configured to control supply of an electric current to the heating coil. The power supply control system includes power supply control circuitry disposed at least partially external to the chamber and a switch disposed along the power supply control circuitry. The switch is configured to open to interrupt supply of the electric current to the heating coil and to close to enable supply of the electric current to the heating coil based on an operating parameter indicative of the air flow within the chamber.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application claims priority to and the benefit of U.S. Provisional Application No. 63/555,830, entitled "HEATER CONTROL THROUGH AIR FLOW DETECTION IN HEATING, VENTILATION AND/OR AIR CONDITIONING SYSTEM," filed Feb. 20, 2024, which is hereby incorporated by reference in its entirety for all purposes.

BACKGROUND
[0002] This section is intended to introduce the reader to various aspects of art that may be related to various aspects of the present disclosure and are described below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present disclosure. Accordingly, it should be noted that these statements are to be read in this light, and not as admissions of prior art.
[0003] Heating, ventilation, and air conditioning (HVAC) systems are utilized to control environmental properties, such as temperature and humidity, for occupants of residential, commercial, and industrial environments. The HVAC systems may control the environmental properties through control of an air flow delivered to the environment. For example, an HVAC system may include one or more blowers configured to generate an air flow and to direct the air flow across one or more heat exchangers configured to transfer heat to and/or from the air flow. Unfortunately, in existing HVAC systems, heat exchangers may be oriented and/or arranged in a manner that causes uneven transfer of heat between the air flow and the heat exchangers. In some instances, heat exchangers may be susceptible to overheating, which may render the HVAC system vulnerable to operational interruptions and/or other inefficiencies. Accordingly, it is now recognized that improved control systems for HVAC systems are desired.
SUMMARY
[0004] A summary of certain embodiments disclosed herein is set forth below. It should be noted that these aspects are presented merely to provide the reader with a brief summary of these certain embodiments and that these aspects are not intended to limit the scope of this disclosure. Indeed, this disclosure may encompass a variety of aspects that may not be set forth below.
[0005] In one embodiment, a heating, ventilation, and air conditioning (HVAC) system includes a housing defining a chamber configured to receive an air flow and a heating system disposed within the housing. The heating system includes a heating coil disposed within the chamber and configured to transfer heat to the air flow within the chamber and a power supply control system configured to control supply of an electric current to the heating coil. The power supply control system includes power supply control circuitry disposed at least partially external to the chamber and a switch disposed along the power supply control circuitry. The switch is configured to open to interrupt supply of the electric current to the heating coil and to close to enable supply of the electric current to the heating coil based on an operating parameter indicative of the air flow within the chamber.
[0006] In another embodiment, a heating system for a heating, ventilation, and air conditioning (HVAC) system includes an electric heating coil configured to transfer heat to an air flow directed through the HVAC system and a power supply control system configured to control supply of a first voltage to the electric heating coil. The power supply control system includes an electrical contactor configured to transmit the first voltage from a power source to the electric heating coil and a relay including a coil and a set of relay contacts. The set of relay contacts is configured to transmit a signal indicative of a call for heating from a control system of the HVAC system to the

electrical contactor in a closed configuration of the set of relay contacts, and the coil is configured to transition the set of relay contacts from a normally open configuration to the closed configuration in response to receipt of a second voltage. The power supply control system further includes a switch configured to transmit the second voltage to the coil of the relay in a closed configuration of the switch and configured to interrupt transmission of the second voltage to the coil of the relay in an open configuration of the switch. The switch is also configured to transition between the open configuration and the closed configuration based on a detected parameter indicative of the air flow directed through the HVAC system.
[0007] In a further embodiment, a heating, ventilation, and air conditioning (HVAC) system includes a housing defining a blower section, a supply air section, and a power component section, a blower disposed within the blower section and configured to direct an air flow into the supply air section, an electric heating coil disposed within the supply air section and configured to transfer heat to the air flow, a partition disposed within the housing and extending between the supply air section and the power component section, and a power supply control system configured to control supply of a first voltage to the electric heating coil. The power supply control system includes an electrical contactor configured to transmit the first voltage from a power source to the electric heating coil in response to receipt of a call for heating from a control system of the HVAC system, a relay configured to electrically couple the control system of the HVAC system and the electrical contactor in response to receipt of a second voltage, and an air proving switch configured to transition from an open configuration to a closed configuration to enable transmission of the second voltage to the relay in response to detection of a pressure differential between the supply air section and the power component section greater than a threshold value.

Description

BRIEF DESCRIPTION OF DRAWINGS
[0008] Various aspects of this disclosure may be better understood upon reading the following detailed description and upon reference to the drawings in which:
[0009] FIG. **1** is a perspective view of a building having an embodiment of a heating, ventilation, and air conditioning (HVAC) system for environmental management in a commercial setting, in accordance with an aspect of the present disclosure;
[0010] FIG. **2** is a perspective view of an embodiment of a packaged HVAC unit, in accordance with an aspect of the present disclosure;
[0011] FIG. **3** is a cutaway perspective view of an embodiment of a residential, split HVAC system, in accordance with an aspect of the present disclosure;
[0012] FIG. **4** is a schematic illustration of an embodiment of a vapor compression system that may be used in an HVAC system, in accordance with an aspect of the present disclosure;
[0013] FIG. **5** is a perspective view of a portion of an embodiment of an HVAC system including a heating system and a power supply control system, in accordance with an aspect of the present disclosure;
[0014] FIG. **6** is a cross-sectional, schematic side view of a portion of an embodiment of an HVAC system including a heating system and a power supply control system, in accordance with an aspect of the present disclosure;
[0015] FIG. **7** is a schematic diagram of a portion of an embodiment of an HVAC system including a heating system and a power supply control system, in accordance with an aspect of the present disclosure;
[0016] FIG. **8** is a schematic diagram of an embodiment of a power supply control system for a heating system of an HVAC system, in accordance with an aspect of the present disclosure; and
[0017] FIG. **9** is a perspective view schematic of a portion of an embodiment of a heating system

and a power supply control system of an HVAC system, in accordance with an aspect of the present disclosure.

DETAILED DESCRIPTION

[0018] One or more specific embodiments will be described below. In an effort to provide a concise description of these embodiments, not all features of an actual implementation are described in the specification. It should be noted that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which may vary from one implementation to another. Moreover, it should be noted that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

[0019] When introducing elements of various embodiments of the present disclosure, the articles “a,” “an,” and “the” are intended to mean that there are one or more of the elements. The terms “comprising,” “including,” and “having” are intended to be inclusive and mean that there may be additional elements other than the listed elements. Additionally, it should be noted that references to “one embodiment” or “an embodiment” of the present disclosure are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features.

[0020] As used herein, the terms “approximately,” “generally,” and “substantially,” and so forth, are intended to convey that the property value being described may be within a relatively small range of the property value, as those of ordinary skill would understand. For example, when a property value is described as being “approximately” equal to (or, for example, “substantially similar” to) a given value, this is intended to mean that the property value may be within +/−5%, within +/−4%, within +/−3%, within +/−2%, within +/−1%, or even closer, of the given value. Similarly, when a given feature is described as being “substantially parallel” to another feature, “generally perpendicular” to another feature, and so forth, this is intended to mean that the given feature is within +/−5%, within +/−4%, within +/−3%, within +/−2%, within +/−1%, or even closer, to having the described nature, such as being parallel to another feature, being perpendicular to another feature, and so forth. Further, it should be understood that mathematical terms, such as “planar,” “slope,” “perpendicular,” “parallel,” and so forth are intended to encompass features of surfaces or elements as understood to one of ordinary skill in the relevant art, and should not be rigidly interpreted as might be understood in the mathematical arts. For example, a “planar” surface is intended to encompass a surface that is machined, molded, or otherwise formed to be substantially flat or smooth (within related tolerances) using techniques and tools available to one of ordinary skill in the art. Similarly, a surface having a “slope” is intended to encompass a surface that is machined, molded, or otherwise formed to be oriented at an angle (e.g., incline) with respect to a point of reference using techniques and tools available to one of ordinary skill in the art.

[0021] As briefly mentioned above, a heating, ventilation, and/or air conditioning (HVAC) system may be used to thermally regulate a space within a building, home, or other suitable structure. For example, the HVAC system may include a vapor compression system that transfers thermal energy between a working fluid, such as a refrigerant, and a fluid to be conditioned, such as air. The vapor compression system includes heat exchangers, such as a condenser and an evaporator, which are fluidly coupled to one another via one or more conduits of a working fluid loop or circuit. A compressor may be used to circulate the working fluid (e.g., refrigerant) through the conduits and other components of the refrigerant circuit (e.g., an expansion device) and, thus, enable the transfer of thermal energy between components of the working fluid circuit (e.g., between the condenser and the evaporator) and one or more thermal loads (e.g., an environmental air flow, a supply air flow).

[0022] In many applications, HVAC systems also include a heating system configured to transfer heat to an air flow directed through the HVAC system. For example, the heating system may be configured to heat the air flow as the air flow is directed across heating coils of the heating system. In some embodiments, the heating coils may be arranged in a packaged outdoor unit or a rooftop unit configured to both heat and cool the air flow, such as a supply air flow that is conditioned and directed to a conditioned space (e.g., a building). For example, the heating coils may be electric heating coils configured to convert electrical energy passing therethrough into thermal energy. Indeed, the HVAC system may include multiple heating coils configured to exchange heat with one or more air flows directed through the HVAC system. The HVAC system may also include one or more blowers configured to direct the air flow across the heating coils, thereby placing the air flow in a heat exchange relationship with the heating coils. As the air flow is directed across the heating coils, the air flow may be heated and a temperature (e.g., surface temperature) of the heating coils may be reduced via transfer of heat from the heating coils to the air flow.

[0023] As will be appreciated, it may be desirable to utilize certain working fluids (e.g., refrigerants) with HVAC systems, such as working fluids having a low global warming potential (GWP). Traditional refrigerants, while effective to transfer heat between components of HVAC systems and/or between other fluids, may have a high GWP. Therefore, more environmentally-friendly working fluids, such as A2L refrigerants or other low GWP refrigerants, may be utilized as a working fluid of the HVAC system to reduce potential impact on an environment surrounding the HVAC system. However, some low GWP refrigerants may be reactive (e.g., mildly flammable), such as when exposed to certain elevated temperatures.

[0024] In some instances, working fluid (e.g., refrigerant) may inadvertently escape from the HVAC system (e.g., working fluid circuit). For example, working fluid may escape from a coupling or joint between components of a heat exchanger, from tubing of the heat exchanger, from conduits of the working fluid circuit, from another portion of the heat exchanger, and/or from other components of the working fluid circuit. In some circumstances, the escaped (e.g., leaked) working fluid may mix with the air flow and/or other fluids circulating through the HVAC system. For HVAC systems that utilize a low GWP refrigerant as a working fluid of the working fluid circuit, it is desirable to ensure escaped (e.g., leaked) working fluid is not exposed to certain elevated temperatures (e.g., within the HVAC system) that may otherwise induce a reaction of the working fluid (e.g., low GWP refrigerant).

[0025] Existing approaches that modify operation of HVAC systems to avoid undesired exposure of escaped working fluid to other components of the HVAC system are susceptible to various drawbacks. For example, certain existing systems may incorporate a refrigerant detection sensor (RDS) configured to detect the presence of working fluid that has escaped from the working fluid circuit and is external to the working fluid circuit. In response to a detection of escaped working fluid and/or a working fluid leak via the refrigerant detection sensor, operation of the HVAC system may be modified (e.g., suspended, shut down). Unfortunately, utilization of refrigerant detection sensors may present challenges, for example, due to variations in positioning of the refrigerant detection sensors within the HVAC system, reliance on complicated control schemes, increased manufacturing and/or operating costs, and so forth.

[0026] Accordingly, present embodiments are directed to improved HVAC systems configured to enable utilization of low GWP refrigerants as a working fluid, while also avoiding exposure of the working fluid (e.g., inadvertently escaped working fluid) to elevated temperatures that may otherwise render the working fluid susceptible to undesired reactions. More specifically, the present techniques enable utilization of low GWP refrigerants as a working fluid of a working fluid circuit in an HVAC system having an electric heating system while also avoiding, blocking, mitigating, and/or preventing exposure of the working fluid to components of the electric heating system that may produce elevated temperatures during operation. As discussed in further detail below, the HVAC system may include a power supply control system configured to selectively enable and disable supply of power to the electric heating system based on one or more detected parameters indicative of an air flow directed across heating coils of the electric heating system. The power supply control system may include a switch, such as an air proving switch and/or a pressure switch, configured to enable supply of power to heating coils of the electric heating system in response to detection of adequate (e.g., suitable, sufficient) air flow across the heating coils and to disable supply of power to the heating coils in response to detection of inadequate (e.g., unsuitable, insufficient). In this way, the present techniques advantageously avert exposure of the working fluid to the heating coils during instances in which a temperature of the heating coils may approach certain elevated temperatures. Indeed, present embodiments may provide the benefits described herein with increased reliability, reduced costs, and reduced complexity, as compared to certain existing systems. It should also be appreciated that the present techniques may be incorporated with HVAC systems to satisfy and comply with one or more regulatory standards.

[0027] Turning now to the drawings, FIG. **1** illustrates an embodiment of a heating, ventilation, and/or air conditioning (HVAC) system for environmental management that employs one or more HVAC units in accordance with the present disclosure. As used herein, an HVAC system includes any number of components configured to enable regulation of parameters related to climate characteristics, such as temperature, humidity, air flow, pressure, air quality, and so forth. For example, an "HVAC system" as used herein is defined as conventionally understood and as further described herein. Components or parts of an "HVAC system" may include, but are not limited to, all, some of, or individual parts such as a heat exchanger, a heater, an air flow control device, such as a fan, a sensor configured to detect a climate characteristic or operating parameter, a filter, a control device configured to regulate operation of an HVAC system component, a component configured to enable regulation of climate characteristics, or a combination thereof. An "HVAC system" is a system configured to provide such functions as heating, cooling, ventilation, dehumidification, pressurization, refrigeration, filtration, or any combination thereof. The embodiments described herein may be utilized in a variety of applications to control climate characteristics, such as residential, commercial, industrial, transportation, or other applications where climate control is desired.

[0028] In the illustrated embodiment, a building **10** is air conditioned by a system that includes an HVAC unit **12** in accordance with present embodiments. The building **10** may be a commercial structure or a residential structure. As shown, the HVAC unit **12** is disposed on the roof of the building **10**; however, the HVAC unit **12** may be located in other equipment rooms or areas adjacent the building **10**. The HVAC unit **12** may be a single package unit containing other equipment, such as a blower and/or integrated air handler. In other embodiments, the HVAC unit **12** may be part of a split HVAC system, such as the system shown in FIG. **3**, which includes an outdoor HVAC unit **58** and an indoor HVAC unit **56**.

[0029] The HVAC unit **12** is an air-cooled device that implements a refrigeration cycle to provide conditioned air to the building **10**. Specifically, the HVAC unit **12** may include one or more heat exchangers across which an air flow is passed to condition the air flow before the air flow is supplied to the building. In the illustrated embodiment, the HVAC unit **12** is a rooftop unit (RTU) that conditions a supply air flow, such as environmental air and/or a return air flow from the building **10**. After the HVAC unit **12** conditions the air, the air is supplied to the building **10** via ductwork **14** extending throughout the building **10** from the HVAC unit **12**. For example, the ductwork **14** may extend to various individual floors or other sections of the building **10**. In certain embodiments, the HVAC unit **12** may be a heat pump that provides both heating and cooling to the building with one refrigeration circuit configured to operate in different modes.

[0030] A control device **16**, one type of which may be a thermostat, may be used to designate the temperature of the conditioned air. The control device **16** also may be used to control the flow of air through the ductwork **14**. For example, the control device **16** may be used to regulate operation of one or more components of the HVAC unit **12** or other components, such as dampers and fans, within the building **10** that may control flow of air through and/or from the ductwork **14**. In some embodiments, other devices may be included in the system, such as pressure and/or temperature transducers or switches that sense the temperatures and pressures of the supply air, return air, and so forth. Moreover, the control device **16** may include computer systems that are integrated with or separate from other building control or monitoring systems, and even systems that are remote from the building **10**.

[0031] FIG. **2** is a perspective view of an embodiment of the HVAC unit **12**. In the illustrated embodiment, the HVAC unit **12** is a single package unit that may include one or more independent refrigeration circuits and components that are tested, charged, wired, piped, and ready for installation. The HVAC unit **12** may provide a variety of heating and/or cooling functions, such as cooling only, heating only, cooling with electric heat, cooling with dehumidification, cooling with gas heat, or cooling with a heat pump. As described above, the HVAC unit **12** may directly cool and/or heat an air stream provided to the building **10** to condition a space in the building **10**.

[0032] As shown in the illustrated embodiment of FIG. **2**, a cabinet **24** encloses the HVAC unit **12** and provides structural support and protection to the internal components from environmental and other contaminants. In some embodiments, the cabinet **24** may be constructed of galvanized steel and insulated with aluminum foil faced insulation. Rails **26** may be joined to the bottom perimeter of the cabinet **24** and provide a foundation for the HVAC unit **12**. In certain embodiments, the rails **26** may provide access for a forklift and/or overhead rigging to facilitate installation and/or removal of the HVAC unit **12**. In some embodiments, the rails **26** may fit into “curbs” on the roof to enable the HVAC unit **12** to provide air to the ductwork **14** from the bottom of the HVAC unit **12** while blocking elements such as rain from leaking into the building **10**.

[0033] The HVAC unit **12** includes heat exchangers **28** and **30** in fluid communication with one or more working fluid circuits (e.g., refrigerant circuits). Tubes within the heat exchangers **28** and **30** may circulate a working fluid (e.g., refrigerant), such as R-454B and/or R32, through the heat exchangers **28** and **30**. The tubes may be of various types, such as multichannel tubes, conventional copper or aluminum tubing, and so forth. Together, the heat exchangers **28** and **30** may implement a thermal cycle in which the working fluid undergoes phase changes and/or temperature changes as it flows through the heat exchangers **28** and **30** to produce heated and/or cooled air. For example, the heat exchanger **28** may function as a condenser where heat is released from the working fluid to ambient air, and the heat exchanger **30** may function as an evaporator where the working fluid absorbs heat to cool an air flow. In some embodiments, the HVAC unit **12** may operate in a heat pump mode where the roles of the heat exchangers **28** and **30** may be reversed. That is, the heat exchanger **28** may function as an evaporator and the heat exchanger **30** may function as a condenser. While the illustrated embodiment of FIG. **2** shows the HVAC unit **12** having two of the heat exchangers **28** and **30**, in other embodiments, the HVAC unit **12** may include one heat exchanger or more than two heat exchangers.

[0034] The heat exchanger **30** is located within a compartment **31** that separates the heat exchanger **30** from the heat exchanger **28**. Fans **32** draw air from the environment through the heat exchanger **28**. Air may be heated and/or cooled as the air flows through the heat exchanger **28** before being released back to the environment surrounding the HVAC unit **12**. A blower assembly **34**, powered by a motor **36**, draws air through the heat exchanger **30** to heat or cool the air. The heated or cooled air may be directed to the building **10** by the ductwork **14**, which may be connected to the HVAC unit **12**. Before flowing through the heat exchanger **30**, the conditioned air flows through one or more filters **38** that may remove particulates and contaminants from the air. In certain embodiments, the filters **38** may be disposed on the air intake side of the heat exchanger **30** to prevent contaminants from contacting the heat exchanger **30**.

[0035] The HVAC unit **12** also may include other equipment for implementing the thermal cycle. Compressors **42** increase the pressure and temperature of the working fluid before the working fluid enters the heat exchanger **28**. The compressors **42** may be any suitable type of compressors, such as scroll compressors, rotary compressors, screw compressors, or reciprocating compressors.

In some embodiments, the compressors **42** may include a pair of hermetic direct drive compressors arranged in a dual stage configuration **44**. However, in other embodiments, any number of the compressors **42** may be provided to achieve various stages of heating and/or cooling. As may be appreciated, additional equipment and devices may be included in the HVAC unit **12**, such as a solid-core filter drier, a drain pan, a disconnect switch, an economizer, pressure switches, phase monitors, and humidity sensors, among other components.

[0036] The HVAC unit **12** may receive power through a terminal block **46**. For example, a high voltage power source may be connected to the terminal block **46** to power the equipment. The operation of the HVAC unit **12** may be governed or regulated by a control board **48**. The control board **48** may include control circuitry connected to a thermostat, sensors, and alarms. One or more of these components may be referred to herein separately or collectively as the control device **16**. The control circuitry may be configured to control operation of the equipment, provide alarms, and monitor safety switches. Wiring **49** may connect the control board **48** and the terminal block **46** to the equipment of the HVAC unit **12**.

[0037] FIG. **3** illustrates a residential heating and cooling system **50**, also in accordance with present techniques. The residential heating and cooling system **50** may provide heated and cooled air to a residential structure, as well as provide outside air for ventilation and provide improved indoor air quality (IAQ) through devices such as ultraviolet lights and air filters. In the illustrated embodiment, the residential heating and cooling system **50** is a split HVAC system. In general, a residence **52** conditioned by a split HVAC system may include working fluid conduits **54** (e.g., refrigerant conduits) that operatively couple the indoor HVAC unit **56** to the outdoor HVAC unit **58**. The indoor HVAC unit **56** may be positioned in a utility room, an attic, a basement, and so forth. The outdoor HVAC unit **58** is typically situated adjacent to a side of the residence **52** and is covered by a shroud to protect the system components and to prevent leaves and other debris or contaminants from entering the unit. The working fluid conduits **54** transfer working fluid between the indoor HVAC unit **56** and the outdoor HVAC unit **58**, typically transferring primarily liquid working fluid in one direction and primarily vaporized working fluid in an opposite direction.

[0038] When the system shown in FIG. **3** is operating as an air conditioner, a heat exchanger **60** in the outdoor HVAC unit **58** serves as a condenser for re-condensing vaporized working fluid flowing from the indoor HVAC unit **56** to the outdoor HVAC unit **58** via one of the working fluid conduits **54**. During such operation, a heat exchanger **62** of the indoor unit functions as an evaporator. Specifically, the heat exchanger **62** receives liquid working fluid, which may be expanded by an expansion device, and evaporates the working fluid before returning it to the outdoor HVAC unit **58**.

[0039] The outdoor HVAC unit **58** draws environmental air through the heat exchanger **60** using a fan **64** and expels the air above the outdoor HVAC unit **58**. When operating as an air conditioner, the air is heated by the heat exchanger **60** within the outdoor HVAC unit **58** and exits the unit at a temperature higher than it entered. The indoor HVAC unit **56** includes a blower or fan **66** that directs air through or across the heat exchanger **62**, where the air is cooled when the system is operating in air conditioning mode. Thereafter, the air is passed through ductwork **68** that directs the air to the residence **52**. The overall system operates to maintain a desired temperature as set by a system controller. When the temperature sensed inside the residence **52** is higher than the set point on the thermostat, or the set point plus a small amount, the residential heating and cooling system **50** may become operative to refrigerate additional air for circulation through the residence **52**. When the temperature reaches the set point, or the set point minus a small amount, the residential heating and cooling system **50** may stop the refrigeration cycle temporarily.

[0040] In some embodiments, the residential heating and cooling system **50** may also be configured to operate as a heat pump. When operating as a heat pump, the roles of heat exchangers **60** and **62** are reversed. That is, the heat exchanger **60** of the outdoor unit **58** will serve as an evaporator to evaporate working fluid and thereby cool air entering the outdoor HVAC unit **58** as the air passes over the heat exchanger **60**. The heat exchanger **62** will receive a stream of air blown over it and will heat the air by condensing the working fluid.

[0041] In some embodiments, the indoor HVAC unit **56** may include a heating system **70**. For example, the indoor HVAC unit **56** may include the heating system **70** when the residential heating and cooling system **50** is not configured to operate as a heat pump. Alternatively, embodiments of the residential heating and cooling system **50** configured to operate as a heat pump may also include the heating system **70** to provide supplemental heating of an air flow supplied to the residence **52**. The heating system **70** may include one or more heating coils (e.g., electric heating coils), among other components, inside the indoor HVAC unit **56**. As air is directed across and/or through the heating system **70** (e.g., across heating coils) by the blower or fan **66**, heat may be transferred from the heating coils to the air, and the heated air may then be routed from the heating system **70** to the ductwork **68** for heating the residence **52**.

[0042] FIG. **4** is an embodiment of a vapor compression system **72** that can be used in any of the systems described above. The vapor compression system **72** may circulate a working fluid through a circuit (e.g., working fluid circuit) starting with a compressor **74**. The circuit may also include a condenser **76**, an expansion valve(s) or device(s) **78**, and an evaporator **80**. The vapor compression system **72** may further include a control panel **82** that has an analog to digital (A/D) converter **84**, a microprocessor **86**, a non-volatile memory **88**, and/or an interface board **90**. The control panel **82** and its components may function to regulate operation of the vapor compression system **72** based on feedback from an operator, from sensors of the vapor compression system **72** that detect operating conditions, and so forth.

[0043] In some embodiments, the vapor compression system **72** may use one or more of a variable speed drive (VSDs) **92**, a motor **94**, the compressor **74**, the condenser **76**, the expansion valve or device **78**, and/or the evaporator **80**. The motor **94** may drive the compressor **74** and may be powered by the variable speed drive (VSD) **92**. The VSD **92** receives alternating current (AC) power having a particular fixed line voltage and fixed line frequency from an AC power source, and provides power having a variable voltage and frequency to the motor **94**. In other embodiments, the motor **94** may be powered directly from an AC or direct current (DC) power source. The motor **94** may include any type of electric motor that can be powered by a VSD or directly from an AC or DC power source, such as a switched reluctance motor, an induction motor, an electronically commutated permanent magnet motor, or another suitable motor.

[0044] The compressor **74** compresses a working fluid vapor and delivers the vapor to the condenser **76** through a discharge passage. In some embodiments, the compressor **74** may be a centrifugal compressor, a scroll compressor, a screw compressor, a rotary compressor, or any other suitable type of compressor. The working fluid vapor delivered by the compressor **74** to the condenser **76** may transfer heat to a fluid passing across the condenser **76**, such as ambient or environmental air **96**. The working fluid vapor may condense to a working fluid liquid in the condenser **76** as a result of thermal heat transfer with the environmental air **96**. The liquid working fluid from the condenser **76** may flow through the expansion device **78** to the evaporator **80**.

[0045] The working fluid delivered to the evaporator **80** may absorb heat from another air flow, such as a supply air flow **98** provided to the building **10** or the residence **52**. For example, the supply air flow **98** may include ambient or environmental air, return air from a building, or a combination of the two. The liquid working fluid in the evaporator **80** may undergo a phase change from the liquid working fluid to a working fluid vapor. In this manner, the evaporator **80** may reduce the temperature of the supply air flow **98** via thermal heat transfer with the working fluid. Thereafter, the vapor working fluid exits the evaporator **80** and returns to the compressor **74** by a suction line to complete the cycle.

[0046] In some embodiments, the vapor compression system **72** may further include a reheat coil in addition to the evaporator **80**. For example, the reheat coil may be positioned downstream of the evaporator **80** relative to the supply air flow **98** and may reheat the supply air flow **98** when the supply air flow **98** is overcooled to remove humidity from the supply air flow **98** before the supply air flow **98** is directed to the building **10** or the residence **52**.

[0047] It should be appreciated that any of the features described herein may be incorporated with the HVAC unit **12**, the residential heating and cooling system **50**, or other HVAC systems. Additionally, while the features disclosed herein are described in the context of embodiments that directly heat and cool a supply air flow provided to a building or other load, embodiments of the present disclosure may be applicable to other HVAC systems as well. For example, the features described herein may be applied to mechanical cooling systems, free cooling systems, chiller systems, or other heat pump or refrigeration applications.

[0048] As briefly discussed above, present embodiments are directed to improved HVAC systems configured to enable utilization of low GWP refrigerants as a working fluid of a working fluid circuit, while also avoiding exposure of the working fluid (e.g., working fluid inadvertently released from the work-in fluid circuit) to elevated temperatures that may otherwise render the working fluid susceptible to undesired reactions. In accordance with the present techniques, the HVAC system includes a heating system (e.g., electric heating system) having one or more heating coils configured to transfer heat to an air flow directed across the heating coils. During operation of the heating system, the air flow directed across the heating coil may cause a reduction in a temperature of the heating coils (e.g., a surface of the heating coils). However, in some circumstances, an amount (e.g., flow rate) of air flow directed across the heating coils may be insufficient to absorb heat output by the heating coils and thereby reduce the temperature of the heating coils. In such instances, the temperature of the heating coils may be greater than desired. For example, the temperature of the heating coils may rise to approach a temperature value (e.g., threshold value) at which the working fluid may be more susceptible to reaction. Accordingly, present embodiments include a power supply control system of the heating system that is configured to selectively enable and disable supply of power (e.g., voltage, electric current) to the heating coils based on an operating parameter (e.g., detected operating parameter) indicative of the air flow directed across the heating coils. More specifically, the power supply control system may be configured to interrupt, suspend, or otherwise inhibit supply of power to the heating coils based on a detection and/or a determination that an amount (e.g., flow rate) of air flow directed across the heating coils is insufficient, less than desired, and/or otherwise incompatible with operation of the HVAC system incorporating a working fluid, such as a low GWP refrigerant.

[0049] With this in mind, FIG. **5** is a perspective view of an embodiment of an HVAC system **100** (e.g., rooftop unit, air handling unit, HVAC unit) includes one or more of the features disclosed herein. The HVAC system **100** may be or include any suitable HVAC system and/or HVAC system components, such as the HVAC unit **12**, the residential heating and cooling system **50**, and/or any of the components described above. In the illustrated embodiment, the HVAC system **100** includes various components enclosed within an internal volume of a housing **102** of the HVAC system **100**. The HVAC system **100** may be configured to circulate air through the housing **102** via operation of a blower assembly **104** having a first blower **106** and a second blower **108** disposed within a blower section **110** of the housing **102**. That is, the blower assembly **104** may be configured to direct (e.g., force, draw) an air flow **112** along an air flow path **114** through the housing **102** of the HVAC system **100**. For example, the housing **102** of the HVAC system **100** may include a return air section **116** configured to receive an air flow, such as a return air flow from the building **10** of FIG. **1**, and a supply air section **118** (e.g., discharge section, heating section, chamber) configured to output or discharge a supply air flow **120** conditioned by the HVAC system **100**. In the illustrated embodiment, the housing **102** includes a discharge outlet **122** (e.g., supply air outlet) formed in a lateral side **124** of the housing **102** to enable discharge of the supply air flow **120** from the supply air section **118**. Thus, the configuration of the HVAC system **100** (e.g., housing **102**) may be described as a side flow or side discharge configuration. However, it should be appreciated that, in other embodiments, the discharge outlet **122** may be formed in a base **126** of the housing

102 and may therefore be configured in a downflow or downward discharge configuration.

[0050] During operation, the blower assembly **104** may draw an air flow (e.g., air flow **112**) into the return air section **116** of the housing **102** and direct the air flow into the supply air section **118**, from which the air flow may be discharged as the supply air flow **120** toward a conditioned space. In other words, the air flow path **114** of the HVAC system **100** may be defined at least partially by the return air section **116**, the blower section **110**, and the supply air section **118**. As an example, the HVAC system **100** (e.g., housing **102**) may be installed in an outdoor or ambient environment, such as on a rooftop of a building, and may be fluidly coupled to ductwork that directs air to and/or from rooms or other areas within the building. Ductwork may be fluidly coupled to the return air section **116** to direct a return air flow into the housing **102**, and ductwork may be fluidly coupled to the supply air section **118** to receive the supply air flow **120** from the housing **102**. In this manner, the blower assembly **104** may circulate air through the HVAC system **100** and a conditioned space. It should be appreciated that the HVAC system **100** may additionally or alternatively be configured to receive and/or discharge other air flows. For example, the HVAC system **100** may be configured to receive an air flow from an outdoor environment (e.g., an ambient air flow), to discharge an air flow to the outdoor embodiment (e.g., discharge return air flow as an exhaust air flow), and so forth. In some embodiments, the HVAC system **100** may receive and combine a return air flow and an ambient air flow to generate the supply air flow **120**. Accordingly, the air flow **112** illustrated in FIG. **5** may include a return air flow, an ambient air flow, or a combination thereof.

[0051] In addition to circulating air through the housing **102**, the HVAC system **100** may be configured to adjust one or more operating parameters of the one or more air flows (e.g., air flow **112**) directed therethrough. For example, the HVAC system **100** may be configured to adjust a temperature, pressure, humidity, particle content, or other operating parameter of the air flow **112** directed therethrough. Indeed, the HVAC system **100** may operate in multiple different operating modes, such as a cooling mode, a heating mode, a dehumidification mode, and so forth. In some embodiments, the HVAC system **100** may include a working fluid circuit (e.g., vapor compression system **72**, refrigerant circuit) configured to circulate a working fluid therethrough, and one or more components of the working fluid circuit may be placed in thermal communication with one or more of the air flows directed through the HVAC system **100**. In particular, the working fluid circuit may include one or more heat exchangers configured to place the working fluid in thermal communication with one or more of the air flows to adjust an operating parameter of supply air flow **120**.

[0052] The illustrated embodiment of the HVAC system **100** includes an evaporator coil **128** (e.g., cooling coil) configured to circulate the working fluid therethrough to absorb heat from one or more air flows directed across the evaporator coil **128**, thereby reducing a temperature of the one or more air flows, in a cooling mode of the HVAC system **100**. Thus, the working fluid within the evaporator coil **128** may be heated as the one or more air flows are directed across the evaporator coil **128**. In the illustrated embodiment, the evaporator coil **128** is positioned downstream of the return air section **116** and upstream of the blower section **110** relative to a direction of the air flow **112** along the air flow path **114**. Accordingly, the blower assembly **104** may operate to draw an air flow from the return air section **116** and across the evaporator coil **128** and may force the air flow through the blower section **110** and into the supply air section **118**.

[0053] The HVAC system **100** may also be configured to increase a temperature of one or more air flows directed through the housing **102** in a heating operating mode of the HVAC system **100**. Thus, the supply air flow **120** may be discharged from the housing **102** and directed toward a condition space to **100** to heat the conditioned space. To this end, the HVAC system **100** includes a heating system **130** (e.g., electric heating system, heating assembly) including heating coils **132** (e.g., heaters, electric heating coils) configured to transfer thermal energy to the air flow **112** directed through the housing **102** via the blower assembly **104**. In some embodiments, the heating coils **132** may be electric heating coils coupled to a power source and configured to convert electrical energy to thermal energy. In the illustrated embodiment, the heating coils **132** of the heating system **130** are disposed within the supply air section **118** of the HVAC system **100**. Thus, during a heating mode of the HVAC system **100**, the blower assembly **104** (e.g., first blower **106**, second blower **108**) may direct one or more air flows into the supply air section **118**, and the one or more air flows may be directed across or through one or more of the heating coils **132**. While the heating system **130** is shown as including four heating coils **132**, it should be appreciated that the heating system **130** may include any suitable number of heating coils **132** and implement the present techniques to achieve the benefits described herein.

[0054] As mentioned above, the HVAC system **100** may be configured to utilized a low GWP refrigerant, such as R-454B, as a working fluid circulated through a working fluid circuit of the HVAC system **100**. The low GWP refrigerant may therefore be circulated through the evaporator coil **128** disposed within the air flow path **114** extending through the housing **102**. For example, during operation of the HVAC system **100** in a cooling mode, the low GWP refrigerant may absorb heat from the air flow **112** to cool the air flow **112** before the air flow **112** is discharged from the housing **102** as the supply air flow **120**. During non-operation of the HVAC system **100** and/or during operation of the HVAC system **100** in a heating mode (e.g., operation of the heating system **130** to heat the air flow **112**), at least a portion of the low GWP refrigerant may remain within the evaporator coil **128**. In some instances, the working fluid (e.g., low GWP refrigerant) may inadvertently escape from the working fluid circuit, such as at or proximate to the evaporator coil **128**. For example, low GWP refrigerant may escape from a coupling or joint between components of the evaporator coil **128**, from tubing of the evaporator coil **128**, from conduits of the working fluid circuit, from another portion of the evaporator coil **128**, and/or from other components of the working fluid circuit. Therefore, a potential exists for escaped low GWP refrigerant to enter the air flow path **114**. Operation of the blower assembly **104** may cause escaped low GWP refrigerant within the air flow path **114** to mix (e.g., become entrained) with the air flow **112**. During operation of the heating system **130** (e.g., in a heating mode of the HVAC system **100**), escaped low GWP refrigerant within the air flow path **114** may therefore be directed with the air flow **112** across the heating coils **132**, for example, due to the positioning of the heating coils **132** within the supply air section **118** downstream of the blower section **110** and the evaporator coil **128** (e.g., relative to a flow direction of the air flow **112** along the air flow path **114**).

[0055] It is desirable to ensure that any escaped low GWP refrigerant, which may be reactive upon exposure to certain elevated temperatures, does not contact surfaces, components, and/or other features that may approach certain elevated temperatures (e.g., 700 degrees Centigrade, 1292 degrees Fahrenheit) in order to avoid inadvertent reaction of the low GWP refrigerant. During operation of the heating system **130**, surfaces **134** of the heating coils **132** (e.g., surfaces of heating elements) are increased in order to enable heat transfer to the air flow **112** directed across the heating coils **132**. As mentioned above, flow of the air flow **112** across the heating coils **132** (e.g., via operation of the blower assembly **104**), and the resulting transfer of heat from the heating coils **132** to the air flow **112**, may inhibit the surfaces **134** of the heating coils **132** from approaching or reaching certain elevated temperatures at which the low GWP refrigerant may be susceptible to reaction. However, operation of the heating coils **132** without adequate and/or sufficient flow of the air flow **112** across the heating coils **132** may render the heating coils **132** more susceptible to approaching or reaching certain elevated temperatures at which the low GWP refrigerant may be susceptible to reaction. In order to avoid such occurrences, present embodiments include a power supply control system **136** of the heating system **130** that is configured to block operation of the heating coils **132** in response to a detection and/or a determination indicative of a characteristic of the air flow **112** across the heating coils **132**. In particular, the power supply control system **136** is configured to block supply of power (e.g., electrical power, electric current, voltage) to the heating coils **132**, and thereby inhibit operation of the heating coils **132**, in response to a detection and/or a determination indicative of insufficient, inadequate, and/or undesired flow of the air flow **112** across the heating coils **132**.

[0056] As shown in the illustrated embodiment, the power supply control system **136** (e.g., at least a subset of components of the power supply control system **136**) may be disposed within the housing **102**. In particular, the components of the power supply control system **136** may be disposed within a power component section **138** defined within the housing **102**. The power component section **138** may be disposed adjacent to the supply air section **118** (e.g., heating section) and may be separated from the supply air section **118** by a partition **140** (e.g., wall, panel, divider) extending between the power component section **138** and the supply air section **118** (e.g., from the blower section **110** to the base **126** of the housing **102**). The partition **140** may generally fluidly separate the power component section **138** from the supply air section **118** (e.g., to block flow of the air flow **112** into the power component section **138**). In some embodiments, components of the heating system **130**, such as one or more of the components of the power supply control system **136**, the partition **140**, and the heating coils **132** may be assembled together to form a heating system assembly **142** configured to be collectively installed within the housing **102** and/or removed from the housing **102**, such as via translational (e.g., sliding) actuation. Details of the power supply control system **136** are described further below.

[0057] FIG. **6** is a cross-sectional, schematic side view of a portion of an embodiment of the HVAC system **100** including the heating system **130** having the power supply control system **136**, in accordance with the present techniques. The illustrated embodiment includes certain elements and element numbers similar to those discussed above with reference to FIG. **5**, including the blower assembly **104**, the heating coils **132** (e.g., electric heating coils, electric heaters) disposed within the supply air section **118**, components of the power supply control system **136** disposed within the power component section **138**, the partition **140** separating the supply air section **118** and the power component section **138**, and so forth. The illustrated embodiment is intended to focus on certain features that enable the functionalities and benefits of the presently disclosed techniques, but it should be appreciated that the HVAC system **100** and/or the heating system **130** may include additional features, such as one or more of the components described above with reference to FIGS. **1-5**.

[0058] As shown, the HVAC system **100** may include a control system **150** (e.g., controller, automation controller, control circuitry) configured to enable operation of the HVAC system **100** and the components thereof. For example, the control system **150** may include an embodiment of the control board **48** described above, an embodiment of the control panel **82** described above, one or more controllers of a rooftop HVAC unit, an air handler, an indoor HVAC unit, and/or an outdoor HVAC unit, a thermostat, a system controller, a dedicated controller, a standalone controller, another suitable control device or component, or any combination thereof. For example, the control system **150** may be configured to operate the HVAC system **100** in a particular operating mode (e.g., heating mode, cooling mode) to satisfy a call for conditioning (e.g., call for heating, call for cooling). To this end, the control system **150** may be communicatively coupled to one or more sensors configured to provide data indicative of one or more operating parameter of the HVAC system **100** and may be communicatively coupled to components of the HVAC system **100**, such as one or more of the components described above.

[0059] One or more control transfer devices, such as wires, cables, wireless communication devices, and the like, may communicatively couple the blower assembly **104**, the heating system **130**, the control device **16** (e.g., thermostat), and/or any other suitable components of the HVAC system **100** to the control system **150**. That is, one or more components of the HVAC system **100** may each have one or more communication components that facilitate wired or wireless (e.g., via a network) communication with the control system **150**. In some embodiments, the communication components may include a network interface that enables the components of the HVAC system **100** to communicate via various protocols such as EtherNet/IP, ControlNet, DeviceNet, or any other communication network protocol. Alternatively, the communication components may enable the components of the HVAC system **100** to communicate via mobile telecommunications technology, Bluetooth®, near-field communications technology, and the like. In other embodiments, operational control of certain components of the HVAC system **100** may be regulated by one or more relays or switches (e.g., a 24 volt alternating current [VAC] relay).

[0060] The control system **150** includes processing circuitry **152**, such as a microprocessor, which may execute software for controlling components of the HVAC system **100**. The processing circuitry **152** may include multiple microprocessors, one or more "general-purpose" microprocessors, one or more special-purpose microprocessors, and/or one or more application specific integrated circuits (ASICS), or some combination thereof. For example, the processing circuitry **152** may include one or more reduced instruction set (RISC) processors. The control system **150** may also include a memory **154** (e.g., memory device) that may store information, such as instructions, control software, look up tables, configuration data, etc. The memory **154** may include a volatile memory, such as random access memory (RAM), and/or a nonvolatile memory, such as read-only memory (ROM). The memory **154** may store a variety of information and may be used for various purposes. For example, the memory **154** may store processor-executable instructions including firmware or software for the processing circuitry **152** to execute, such as instructions for controlling components of the HVAC system **100**. In some embodiments, the memory **154** is a tangible, non-transitory, machine-readable-medium that may store machine-readable instructions for the processing circuitry **152** to execute. The memory **154** may include ROM, flash memory, a hard drive, or any other suitable optical, magnetic, or solid-state storage medium, or a combination thereof. The memory **154** may store data, instructions, and any other suitable data.

[0061] The HVAC system **100** is configured to receive power (e.g., electrical power, voltage, electric current) from a power source **156** (e.g., power supply). The power source **156** may be a utility grid, a battery, a generator, a solar panel, another suitable source of electrical power, or any combination thereof. The power source **156** may be configured to supply electrical power having any suitable type of electrical power, such as 240 volt alternating current (VAC), 220 VAC, 208 VAC, 120 VAC, or any other suitable type of electrical power. In some embodiments, the HVAC system **100** may also include a transformer **158** configured to modify a voltage of alternating current provided by the power source **156**. For example, the transformer **158** may decrease (e.g., step down) the voltage (e.g., from 240 VAC, 220 VAC, 208 VAC, 120 VAC) to 24 VAC. In some embodiments, the reduced voltage (e.g., 24 VAC) may be provided from the transformer **158** to the control system **150**, such as to a thermostat of the control system **150**. The control system **150** may direct a signal **160** (e.g., electrical signal, current, voltage), such as a 24 volt (V) signal, to the power supply control system **136**, in accordance with the present techniques. Additionally, one or more components of the power supply control system **136** may be configured to receive electrical power **162** (e.g., electric current, voltage, 240 VAC, 220 VAC, 208 VAC, 120 VAC) from the power source **156**. The electrical power **162** output by the power source **156** and received by the power supply control system **136** may be suitable for use by the heating coils **132** to generate heat for transfer to the air flow **112**. In the manner described below, the power supply control system **136** is configured to regulate supply of the electrical power **162** to the heating coils **132**, and thereby control operation of the heating coils **132**, based on a detection and/or a determination indicative of a quality, quantity, and/or characteristic of the air flow **112** directed through the supply air section **118** (e.g., across the heating coils **132**).

[0062] The illustrated embodiment also shows certain components of the power supply control system **136** that may be incorporated in accordance with the present techniques. For example, the power supply control system **136** includes power circuitry **164** (e.g., power supply control circuitry, power management circuitry, electrical circuit, electrical path, power supply path) configured to control supply of the electrical power **162** to the heating coils **132**. The power circuitry **164** may include a variety of components (e.g., electrical components) disposed along an electrical path that are configured to enable and/or disable flow of the electrical power **162** to the heating coils **132**. In particular, the power supply control system **136** includes a switch **166** incorporated with the power circuitry **164**. As described further below, the switch **166** is configured to selectively enable and disable flow of the electrical power **162** to the heating coils **132** based on a detected parameter associated with the air flow **112** directed through the supply air section **118** and across the heating coils **132**.

[0063] The detected parameter may be a pressure differential between the supply air section **118** (e.g., high pressure region, high pressure section) and the power component section **138** (e.g., low pressure region, low pressure section), and the switch **166** may be an air proving switch and/or a pressure switch (e.g., differential pressure switch) configured to enable and disable flow of the electrical power **162** to the heating coils **132** based on the pressure differential relative to a threshold value. To this end, in some embodiments, the switch **166** may be fluidly coupled to the supply air section **118** and the power component section **138**. For example, as shown, the switch **166** may be disposed within the power component section **138** and may be exposed (e.g., fluidly coupled) to a pressure (e.g., first pressure, low pressure) within the power component section **138**. Additionally, the switch **166** may be fluidly coupled to the supply air section **118**, such as via a conduit system **168**, to expose (e.g., fluidly couple) the switch **166** to a pressure (e.g., first pressure, high pressure) within the supply air section **118**. Accordingly, based on the pressure within the power component section **138** and the pressure within the supply air section **118**, the switch **166** may be configured to detect a pressure differential between the supply air section **118** and the power component section **138**.

[0064] As will be appreciated, the switch **166** may be configured to open and/or close based on a value of the pressure differential detected by the switch **166** relative to a threshold value. The threshold value (e.g., threshold differential pressure value) may be indicative of and/or associated with a lower limit (e.g., minimum, baseline, lower threshold amount) of the air flow **112** directed through the supply air section **118**, such as to enable sufficient heat transfer from the heating coils **132** to the air flow **112** to maintain a temperature (e.g., surface temperature) of the heating coils **132** at or below a desired value (e.g., threshold temperature value, sufficiently below a particularly elevated temperature at which a low GWP refrigerant may be more susceptible to reaction, below a temperature value associated with a regulatory standard). During normal, expected, intended, and/or adequate operation of the blower assembly **104**, the air flow **112** directed through the supply air section **118** and may cause the pressure within the supply air section **118** to increase, whereas the pressure within the power component section **138** may not rise during operation of the blower assembly **104**, because the power component section **138** is generally fluidly separated from the supply air section **118** via the partition. Accordingly, during normal, expected, intended, and/or adequate operation of the blower assembly **104**, the pressure differential between the supply air section **118** and the power component section **138** detected by the switch **166** may be equal to or greater than the threshold value. In such instances, the switch **166** may remain in and/or may transition to a closed configuration that enables supply of the electrical power **162** to the heating coils **132**.

[0065] However, in some instances, the blower assembly **104** may not operate as intended and/or another operational interruption (e.g., blockage, obstruction) may cause the air flow **112** to flow through the supply air section **118** at a reduced and/or insufficient rate (e.g., that may render the heating coils **132** more susceptible to greater increases in temperature). For example, the blower assembly **104** may not operate properly (e.g., may not receive power, may operate deficiently, may malfunction) and may not direct the air flow **112** through the supply air section **118** at an intended flow rate and/or at or above a lower limit flow rate determined to enable sufficient heat transfer from the heating coils **132** to the air flow **112**. In such instances, the pressure differential between the supply air section **118** and the power component section **138** detected by the switch **166** may be less than the threshold value. As a result, the switch **166** may remain in and/or may transition to an open configuration that interrupts and/or disables supply of the electrical power **162** to the heating coils **132**. In this way, the heating coils **132** may not be operated under circumstances that may otherwise result in elevated temperatures (e.g., temperatures at or undesirably approaching a threshold temperature value) of the heating coils **132**, and exposure of low GWP refrigerant (e.g., inadvertently escaped from a working fluid circuit of the HVAC system **100**) to surfaces that may have a temperature at or undesirably approaching a threshold temperature value (e.g., 600 degrees Centigrade, 650 degrees Centigrade, 700 degrees Centigrade) may be effectively avoided.

[0066] As shown, the power supply control system **136** further includes a plurality of electrical contactors **170** (e.g., contactors) disposed within the power component section **138**. The electrical contactors **170** may also be disposed along and/or incorporated with the power circuitry **164**. As will be appreciated, the electrical contactors **170** may be configured to receive the electrical power **162** from the power source **156** and, upon activation and/or actuation of the electrical contactors **170**, may be configured to supply the electrical power **162** to the heating coils **132** to enable operation of the heating coils **132** (e.g., generation of heat via the electrical power **162**). One or more of the electrical contactors **170** may be actuated (e.g., energized) in response to receipt of a signal (e.g., 24V signal, indicative of a call for heating) from the control system **150**. As described further below, the switch **166** may operate to interrupt transmission of a signal (e.g., energizing signal) from the control system **150** (e.g., thermostat) to one or more of the electrical contactors **170** in an open configuration of the switch **166** (e.g., based on a pressure differential between the supply air section **118** and the power component section **138** being less than a threshold value, which may be indicative of insufficient flow of the air flow **112** across the heating coils **132**).

[0067] FIG. **7** is a schematic diagram of a portion of an embodiment of the HVAC system **100** including the heating system **130**, the control system **150**, and the blower assembly **104**. The illustrated embodiment includes certain elements and element numbers similar to those discussed above with reference to FIGS. **5** and **6**, such as the blower assembly **104**, the heating system **130**, and the control system **150**. As described above, the control system **150** may include the processing circuitry **152** and the memory **154**. The control system **150** may also include a communication bus **180**, an input/output (I/O) interface **182**, and a network interface **184**, in some embodiments. The communication bus **180** may be a communication system (e.g., data transmission system) that may enable communication between various components of the processing circuitry **152** and/or other components of the control system **150**. For example, the communication bus **180** may include a bridge, a message queue, a multi-core message-passing scheme, another suitable communication architecture (e.g., wires, fibers, traces, etc.). In some embodiments, the communication bus **180** may include multiple buses, such as a data bus, an address bus, and/or a control bus.

[0068] The I/O interface **182** may include an interface configured to enable communicatively coupling between the control system **150** (e.g., processing circuitry **152**) and one or more components of the HVAC system **100**, such as any or multiple of the components described herein. For example, the I/O interface **182** may include one or more pins, sockets, I/O devices, ports, I/O devices (e.g., touchscreen, slider, scroll wheel, keypad, etc.), another suitable feature to enable communication with the control system **150** and/or one or more components of the HVAC system **100**, or any combination thereof. The network interface **184** may include wired and/or wireless interfaces (e.g., jacks, antennas, transmitters, receivers, transceivers, wire terminals, etc.) configured to transmit data communications with various external systems, devices, and/or networks. For example, the network interface **184** may include an Ethernet card and port for sending and receiving data via an Ethernet-based communications network and/or a Wi-Fi transceiver for communicating via a wireless communications network. The network interface **184** may be configured to communicate via local area networks or wide area networks (e.g., the Internet, a building WAN, etc.) and may use a variety of communication protocols (e.g., BACnet, IP, LON, IDNAC, Modbus, etc.). The network interface **184** may be a communication interface configured to facilitate electronic data communication between the processing circuitry **152** (e.g., control system **150**) and various internal and external systems or devices.

[0069] The HVAC system **100** further includes a user interface **186** communicatively coupled to the control system **150**. The user interface **186** may be associated with an electronic device of a user (e.g., system administrator, technician, installer, authorized personnel). The user interface **186** may be a smart phone, a mobile device, a desktop computer, a laptop, a tablet computing device, a digital media device, a personal digital assistant (PDA), a wearable device (e.g., optical head mounted display, smartwatch, etc.), a thermostat, another device having communication capabilities and/or processing capabilities, or any combination thereof.

[0070] As similarly described above, the blower assembly **104** includes a blower **188** (e.g., first blower **106**, second blower **108**) configured to force a flow of air (e.g., air flow **112**) through the HVAC system **100** and across the heating coils **132** of the heating system **130**. The blower **188** may be driven (e.g., rotated) by a motor **190** operatively coupled to the blower **188**. For example, the motor **190** may drive rotation of the blower **188** at various speeds to generate and/or induce the air flow **112** directed through the HVAC system **100** (e.g., housing **102**). In some embodiments, the motor **190** may be an electronically commutated motor (ECM). In some embodiments, the motor **190** may be a three-phase, brushless alternating current motor. As shown, operation of the motor **190** may be controlled by a motor controller **192**. The motor controller **192** may be configured to regulate one or more inputs to the motor **190** (e.g., electrical input, control signals) to control a speed and/or rotation direction of the blower **188**. As will be appreciated, operation of the blower assembly **104** may be controlled by the processing circuitry **152** (e.g., control system **150**). For example, the processing circuitry **152** may regulate operations of the motor **190** and therefore the blower **188**, for example, by providing speed settings and/or rotation settings to the motor controller **192**.

[0071] Operation of the heating system **130** (e.g., heating coils **132**) may also be regulated by the control system **150**. For example, the processing circuitry **152** may be configured to output one or more signals (e.g., 24V signals, one or more voltages, control signals) toward the heating system **130** to enable actuation of one or more of the heating coils **132**. In some embodiments, the processing circuitry **152** may output one or more signals to the heating system **130** based on data received by the control system **150**, such data indicative of a temperature (e.g., detected by a sensor) of a conditioned space and/or a set point temperature of the conditioned space (e.g., received via a thermostat). The processing circuitry **152** may determine one or more signals to output to the heating system **130** based on a comparison of the data indicative of the temperature of the conditioned space and the set point temperature of the conditioned space. Some embodiments of the control system **150** and/or the heating system **130** may be configured to enable multi-stage operation of the heating system **130**. For example, the heating system **130** may be configured for two-stage operation and, in response to a determination that a temperature differential between the temperature of the conditioned space and the set point temperature of the conditioned space is less than a threshold value (e.g., threshold temperature differential value), the control system **150** may output a first control signal to the heating system **130** to enable first stage operation of the heating system **130** (e.g., operate a subset of the heating coils **132**). In response to a determination that the temperature differential between the temperature of the conditioned space and the set point temperature of the conditioned space is greater than the threshold value, the control system **150** may output a second control signal or multiple control signals to the heating system **130** to enable second stage operation of the heating system **130** (e.g., operation of all heating coils **132**).

[0072] In any case, the heating system **130** includes an embodiment of the switch **166** (e.g., air proving switch), which is configured to enable and disable operation of the hating coils **132** (e.g., supply of the electrical power **162** to the heating coils **132**) based on a detected parameter indicative of an air flow (e.g., air flow **112**) directed across the heating coils **132**, such as via operation of the blower **188**. In response to a detection of a parameter (e.g., parameter value) indicative of the air flow **112** being sufficient (e.g., equal to or above a threshold value) to absorb heat from the heating coils **132** and inhibit an increase in temperature of surfaces of the heating coils **132** to and/or beyond a particular threshold (e.g., threshold temperature value, elevated temperature threshold value), the switch **166** may transition to and/or remain in a closed configuration (e.g., closed state). In the closed configuration, the switch **166** may enable supply of the electrical power **162** to the heating coils **132**. However, in response to a detection of the parameter indicative of the air flow **112** being insufficient (e.g., below a threshold value) to absorb heat from the heating coils **132** and inhibit an increase in temperature of surfaces of the heating coils **132** to and/or beyond the particular threshold, the switch **166** may transition to and/or remain in an open configuration (e.g., open state), which may block supply of the electrical power **162** to the heating coils **132**. In this way, the switch **166** blocks generation of undesired temperatures (e.g., surface temperatures, elevated temperatures) of the heating coils **132** that may otherwise render any inadvertently escaped low GWP refrigerant within the air flow path **114** from reacting upon exposure to the undesired temperatures and/or surfaces of the heating coils **132**.

[0073] It should be appreciated that the detected parameter indicative of the air flow (e.g., air flow **112**) directed across the heating coils **132** may be any suitable parameter value, such as a differential pressure value between the supply air section **118** (e.g., high pressure section) and the power component section **138** (e.g., low pressure section) of the heating system **130**. Alternatively, the detected parameter may be a single value detected by the switch **166**, such as a pressure value within the supply air section **118**, and air flow rate of the air flow **112** directed across the heating coils **132**, or another suitable value. Based on a particular parameter detected by the switch **166**, a corresponding threshold value may be determined (e.g., via testing, via experimental data) that is indicative of an adequate amount of the air flow **112** directed across the heating coils **132** to block a temperature (e.g., surface temperature) of the heating coils **132** approaching and/or reaching a particular temperature threshold value (e.g., upper limit value).

[0074] The threshold value (e.g., differential pressure threshold value, actuation value, transition value, threshold pressure value) to which the detected parameter value indicative of the air flow (e.g., detected by the switch **166**) is compared to determine whether the switch **166** is in the closed configuration or the open configuration may be a fixed value. In such embodiments, the threshold value may be based on a capacity (e.g., heating capacity) of the heating coils **132**, a capacity (e.g., air flow capacity) of the blower assembly **104**, a tonnage of the HVAC system **100** (e.g., HVAC unit), a physical arrangement and/or layout of components of the HVAC system **100** (e.g., blower assembly **104**, heating system **130**), another suitable parameter or characteristic of the HVAC system **100**, or any combination thereof. In other embodiments, the threshold value may be an adjustable value. For example, the threshold value (e.g., switch **166** actuation value, switch **166** transition value) may be adjusted via modification of a physical configuration and/or component of the switch **166**.

[0075] FIG. **8** is a schematic diagram of an embodiment of a portion of the HVAC system **100** including the power supply control system **136** for the heating system **130**, in accordance with aspects of the present disclosure. The illustrated embodiment also includes embodiments of the control system **150**, the transformer **158**, and the power source **156** described above, which may operate in a similar manner as that previously described.

[0076] The HVAC system **100** further includes a thermostat **200** (e.g., control device) configured to receive electrical power (e.g., 24V signal, voltage, electric current) from the transformer **158**. In some implementations, the thermostat **200** may be considered a component of the control system **150**. The thermostat **200** (e.g., user interface, controller) may be disposed within a conditioned space serviced by the HVAC system **100**. As briefly discussed above, the thermostat **200** may be configured to receive a user input indicative of a set point temperature (e.g., a desired temperature) for the conditioned space. The thermostat **200** may also be configured to receive data or feedback indicative of a measured temperature associated with the conditioned space. In particular, the thermostat **200** may be communicatively coupled to a sensor **202** configured to detect the measured temperature. In some embodiments, the sensor **202** may be positioned within the conditioned space and be configured to detect a temperature (e.g., air temperature) within the conditioned space. In other embodiments, the sensor **202** may be positioned within ductwork or within the HVAC system **100** and be configured to detect a temperature of return air received by the HVAC system **100** from the conditioned space.

[0077] In operation, the thermostat **200** may compare the set point temperature (e.g., received via user input) and the measured temperature detected by the sensor **202**. Based on a determination that the measured temperature deviates from (e.g., is less than) the set point temperature (e.g., by a threshold percentage, by a threshold amount), the thermostat **200** may output a signal **204** (e.g., electrical signal, 24V signal, voltage, call for conditioning signal, call for heating signal) indicative of a call for conditioning (e.g., a call for heating). The signal **204** may be directed to one or more components of the HVAC system **100** communicatively coupled to the thermostat **200** to enable operation of the HVAC system **100** to provide a supply air flow (e.g., supply air flow **120**) to the conditioned space and cause the measured temperature to approach the set point temperature. In some embodiments, the signal **204** output by the thermostat **200** may be directed to the control system **150** (e.g., control board **48**, control panel **82**, HVAC unit control board) and/or to another component of the HVAC system **100**, such as the transformer **158**, which may output the signal **204** and/or another signal (e.g., 24V signal) to the control system **150** (e.g., HVAC unit control board). Additionally or alternatively, the thermostat **200** may output the signal **204** to a relay of the HVAC system **100** (e.g., power supply control system **136**), an electrical contactor of the HVAC system **100**, another suitable component, or any combination thereof. In any case, the signal **204** may be received by the control system **150** and, in response, the control system **150** may output the signal **160** (e.g., 24V signal) to the power supply control system **136**.

[0078] As described above, present embodiments of the power supply control system **136** include the power circuitry **164** (e.g., power supply control circuitry) configured to enable and disable supply of the electrical power **162** to the heating coils **132**. More specifically, the illustrated embodiment of the power circuitry **164** includes a power supply control circuit **206** (e.g., power supply path, electrical path, electrical circuit) configured to enable the functionalities and achieve the benefits described herein. The power supply control circuit **206** includes various components (e.g., electrical components) disposed along the power supply control circuit **206**, such as the switch **166** (e.g., pressure switch, air proving switch, pressure differential switch, vane switch, sail switch, paddle switch, flow switch, etc.), limit switches **208**, and a heating system relay **210** (e.g., relay, heater relay, heating coil relay).

[0079] As shown, the limit switches **208**, the switch **166**, and the heating system relay **210** may be arranged in series along the power supply control circuit **206**. For example, relative to a direction of an electrical signal along the power supply control circuit **206**, the limit switches **208**, the switch **166**, and the heating system relay **210** may be sequentially arranged (e.g., in series) along the power supply control circuit **206**. However, other embodiments of the power supply control circuit **206** may include an alternative arrangement of the components described herein that enables supply of the electrical power **162** to the heating coils **132** in response a detection of the air flow **112** directed across the heating coils **132** being sufficient, as described herein, and disables supply of the electrical power **162** to the heating coils **132** in response a detection of the air flow **112** directed across the heating coils **132** being insufficient, as described herein. It should also be appreciated that the power circuitry **164** and the power supply control circuit **206** may include additional or alternative components different from those shown in the illustrated embodiment and nevertheless provide the functionalities and benefits described herein.

[0080] The signal **160** (e.g., 24V signal, supply voltage, first voltage) may be directed from the control system **150** to the power supply control circuit **206** via an input node **212** of the power supply control circuit **206**. The signal **160** may flow along the power supply control circuit **206** from the input node **212** to the limit switches **208**, which are arranged in series along the power supply control circuit **206** (e.g., between the input node **212** and the switch **166**). The limit switches **208** may be configured to detect undesirable (e.g., unexpected, abnormal) operating conditions associated with operation of the heating system **130**. Upon detection of an operating parameter value (e.g., temperature value, air temperature value) that deviates from an expected operating parameter value range and/or from an expected operating parameter value (e.g., exceeds a threshold value, exceeds a predetermined limit), one or more of the limit switches **208** may be tripped (e.g., transition to an open configuration or open state) to block flow of the signal **160** along the power supply control circuit **206** and inhibit operation of the heating coils **132** (e.g., inhibit supply of the electrical power **162** to the heating coils **132**). In some embodiments, one or more of the limit switches **208** may include a bimetallic strip configured to deform in response to differential expansion of two metals in the bimetallic strip. The deformation may result in the limit switch **208** transitioning to an open configuration or open state to interrupt transmissions of the signal **160** along the power supply control circuit **206**.

[0081] For example, the limit switches **208** include a first set of limit switches **214** including a first limit switch **216** and a second limit switch **218**. The first limit switch **216** and the second limit switch **218** may each be configured to detect a temperature of air, such as a temperature of the air flow **112** within the supply air section **118**, a temperature of the supply air flow **120**, an air temperature within a duct (e.g., ductwork) of the HVAC system **100**, or any other suitable temperature. To this end, the first limit switch **216** and the second limit switch **218** may be arranged in any suitable location to enable detection of a particular temperature within and/or associated with the HVAC system **100**. For example, the first limit switch **216**, the second limit switch **218**, or both may be positioned within the supply air section **118** (e.g., heating section) adjacent or near the heating coils **132**. Indeed, installed locations of the first set of limit switches **214** may vary in different embodiments of the HVAC system **100**. In response to detection of an air temperature greater than a first threshold value (e.g., first threshold temperature value, 200 degrees Fahrenheit), one or more of the first set of limit switches **214** may be tripped and may transition to a respective open position, thereby blocking further transmission of the signal **160** along the power supply control circuit **206** (e.g., to the switch **166**, to the heating system relay **210**). To this end, the first limit switch **216** and the second limit switch **218** may be arranged in any suitable location to enable detection of a particular temperature within and/or associated with the HVAC system **100**.

[0082] With the first limit switch **216** and the second limit switch **218** in respective closed configurations, the signal **160** may be transmitted along the power supply control circuit **206** to a second set of limit switches **220**, which include a third limit switch **222** and a fourth limit switch **224**. In some respects, the third limit switch **222** and the fourth limit switch **224** may be similar to the first limit switch **216** and the second limit switch **218**. For example, the third limit switch **222** and the fourth limit switch **224** may also be configured to detect a temperature of air within the HVAC system **100** and/or associated with the HVAC system **100**, as similarly described above. In response to detection of an air temperature greater than a second threshold value (e.g., second threshold temperature value, 160 degrees Fahrenheit), different from the first threshold value associated with the first set of limit switches **214**, one or more of the second set of limit switches **220** may be tripped and may transition to a respective open position, thereby blocking further transmission of the signal **160** along the power supply control circuit **206** (e.g., to the switch **166**, to the heating system relay **210**).

[0083] In some embodiments, the second set of limit switches **220** may be implemented (e.g., function, operate) as primary limit switches, while the first set of limit switches **214** may be implemented (e.g., function, operate) as backup limit switches. Accordingly, the second set of limit switches **220** may be positioned along the power supply control circuit **206** between (e.g., in series with) the first set of limit switches **214** and the switch **166**, and the first set of limit switches **214** may be positioned along the power supply control circuit **206** between (e.g., in series with) the input node **212** and the first set of limit switches **214**. Additionally, in such configurations of the power supply control system **136**, the second threshold value at which an air temperature detected by one or more of the second set of limit switches **220** is tripped (e.g., transitioned to an open configuration) may be less than the first threshold value at which an air temperature detected by one or more of the first set of limit switches **214** is tripped (e.g., transitioned to an open configuration). Therefore, the first set of limit switches **214** may be configured to trip (e.g., open) when the second set of limit switches **220** do not operate as intended (e.g., open in response to a detected air temperature equal to or greater than the second threshold value). As implemented and intended, one or more of the second set of limit switches **220** may be configured to trip (e.g. open) in response to a detected air temperature equal to or greater than the second threshold value, while the first set of limit switches **214** may remain closed (e.g., based on a detected air temperature exceeding the second threshold value but not exceeding the first threshold value).

[0084] In the illustrated embodiment, the first set of limit switches **214** (e.g., backup limit switches) are electrically coupled to a backup set of electrical contactors **226**. In response to transition of one or more of the first set of limit switches **214** to an open configuration (e.g., tripping), transmission of the signal **160** to the backup set of electrical contactors **226** may be blocked, which may inhibit actuation of the backup set of electrical contactors **226** to supply the electrical power **162** to the heating coils **132**. Further, in some embodiments, one or more of the limit switches **208** may be electrically coupled to the control system **150** (e.g., processing circuitry **152**) to enable transmission of a signal (e.g., alert signal) to the control system **150** in response to transition of one or more limit switches **208** to an open (e.g., tripped) configuration to indicate detection of an abnormal (e.g., elevated) air temperature (e.g., within the HVAC system **100**).

[0085] With each of the limit switches **208** in a respective closed configuration, the signal **160** may be transmitted along the power supply control circuit **206** to the switch **166** (e.g., air proving switch), which is arranged along the power supply control circuit **206** between (e.g., in series with) the limit switches **208** and the heating system relay **210**. As described above, the switch **166** may be in a closed configuration or an open configuration based on a parameter indicative of the air flow **112** directed across the heating coils **132** detected by the switch **166**. For example, based on a value of the detected parameter being greater than a threshold value, which may correspond to a lower limit value of the air flow **112** that is sufficient to enable heat transfer from the heating coils **132** to the air flow **112** to maintain a temperature (e.g., surface temperature) of the heating coils **132** at or below a desired value (e.g., associated with reaction of a low GWP refrigerant), the switch **166** (e.g., a switching contact **228** of the switch **166**) may transition from an open configuration (e.g., normally open configuration) to a closed configuration. Accordingly, operation of the power supply control system **136** may demand establishment of a normal, expected, intended, and/or adequate amount of the air flow **112** directed across the heating coils **132** before the switch **166** is closed to enable supply of the electrical power **162** to the heating coils **132** and initiate operation of the heating coils **132**. However, based on a value of the detected parameter being less than the threshold value, the switch **166** (e.g., switching contact **228**) may remain in the open configuration, and transmission of the signal **160** along the power supply control circuit **206** to the heating system relay **210** may be interrupted and/or blocked.

[0086] Transmission of the signal **160** along the power supply control circuit **206** to the heating system relay **210** (e.g., via the switch **166** and/or switching contact **228** in the closed configuration) enables supply of the electrical power **162** to the heating coils **132** and thereby enables operation of the heating coils **132** to heat the air flow **112**. The heating system relay **210** includes a coil **230** that may be energized via the signal **160** directed to the heating system relay **210**. When the signal **160** (e.g., 24V) is not directed to the heating system relay **210** (e.g., due to the switch **166** being in an open configuration) the coil **230** may be de-energized.

[0087] The heating system relay **210** also includes a first relay contact **232** and a second relay contact **234**. The first relay contact **232** is disposed along a first signal path **236** (e.g., stage one call signal path) extending between the control system **150** (e.g., processing circuitry **152**) and a first set of electrical contactors **238** (e.g., first primary electrical contactors, electrical contactors **170**), and the second relay contact **234** is disposed along a second signal path **240** (e.g., stage two call signal path) extending between the control system **150** (e.g., processing circuitry **152**) and a second set of electrical contactors **242** (e.g., second primary electrical contactors, electrical contactors **170**). In response to receipt of a call for heating from the thermostat **200** indicative of a call for first stage heating, the control system **150** may output a first stage signal **244** along the first signal path **236** toward the first set of electrical contactors **238**. For example, the thermostat **200** may output a call for first stage heating in response to a determination that a detected temperature within a conditioned space serviced by the HVAC system **100** is less than a set point temperature by a first amount less than a threshold amount. In response to receipt of a call for heating from the thermostat **200** indicative of a call for second stage heating, the control system **150** may output the first stage signal **244** along the first signal path **236** toward the first set of electrical contactors **238** and may also (e.g., concurrently, simultaneously) output a second stage signal **246** along the second signal path **240** toward the second set of electrical contactors **242**. The thermostat **200** may output a call for second stage heating in response to a determination that the detected temperature within the conditioned space serviced by the HVAC system **100** is less than the set point temperature by a second amount greater than the threshold amount.

[0088] The first relay contact **232** and the second relay contact **234** may each be configured as normally open contacts and/or normally open switches. Upon energization of the coil **230** via the signal **160** directed along the power supply control circuit **206** from the switch **166** to the heating system relay **210**, the coil **230** (e.g., electromagnet) may draw the first relay contact **232** and the second relay contact **234** to respective closed configurations, thereby enabling transmission of the first stage signal **244** (e.g., 24V signal) along the first signal path **236** to the first set of electrical contactors **238** and enabling transmission of the second stage signal **246** (e.g., 24V signal) along the second signal path **240** to the second set of electrical contactors **242**.

[0089] The first stage signal **244** may be received by the first set of electrical contactors **238** and, in response, the first set of electrical contactors **238** may transition to a closed circuit configuration to enable supply of the electrical power **162** to a first subset of the heating coils **132**. Thus, in response to a call for first stage heating received from the thermostat **200**, the first subset of the heating coils **132**, instead of all heating coils **132**, may be operated via the electrical power **162** to transfer heat to the air flow **112**. Similarly, the second stage signal **246** may be received by the second set of electrical contactors **242** and, in response, the second set of electrical contactors **242** may transition to a closed circuit configuration to enable supply of the electrical power **162** to a second subset of the heating coils **132**. Thus, in response to a call for second stage heating received from the thermostat **200**, the first subset of the heating coils **132** and the second subset of the heating coils **132** (e.g., all heating coils **132** of the heating system **130**) may be operated via the electrical power **162** to transfer heat to the air flow **112**. In some embodiments, each of the first set of electrical contactors **238** and the second set of electrical contactors **242** may include a respective coil (e.g., electromagnet) configured to energize in response to receipt of the first stage signal **244** and/or the second stage signal **246**, which may cause the first set of electrical contactors **238** and the second set of electrical contactors **242** to transition to closed circuit configurations to enable supply of the electrical power **162** to the respective subsets of heating coils **132** associated with the first set of electrical contactors **238** and the second set of electrical contactors **242**. However, in response to detection of an operating parameter value (e.g., differential pressure value, pressure value) less than a corresponding threshold value, the switch **166** may transition to an open configuration, which may de-energize the coil **230** of the heating system relay **210**, cause the first relay contact **232** and the second relay contact **234** to transition to respective open configurations (e.g., normally open configurations), and interrupt transmission of the first stage signal **244** to the first set of electrical contactors **238** and transmission of the second stage signal **246** to the second set of electrical contactors **242**. In this way, operation of the switch **166** may interrupt and/or block transmission of the electrical power **162** to the heating coils **132** in response to detection of the air flow **112** being less than desired (e.g., less than a threshold amount, less than a threshold value).

[0090] In some embodiments, the power supply control system **136** may be configured to transmit feedback to the control system **150**, such as feedback indicative of a state or configuration of the switch **166**. For example, the power supply control system **136** may include a feedback path **248** (e.g., trace, circuit, connection) extending from the power supply control circuit **206** (e.g., switch **166**) to the control system **150** (e.g., processing circuitry **152**). In response to transition of the switch **166** from one configuration to another configuration (e.g., from closed to open, tripping) and/or in response to detection of the signal **160** along the power supply control circuit **106** (e.g., between the fourth limit switch **224** and the switch **166**), the power supply control circuit **206** may transmit feedback to the control system **150** via the feedback path **248**. In some instances, the feedback may be indicative of the switch **166** being in an open configuration (e.g., indicative of insufficient air flow within the supply air section **118**) in conjunction with an existing call for conditioning (e.g., signal **160**, signal **204**) that may not be satisfied due to interrupted and/or blocked operation of the heating system **130** (e.g., via the switch **166** in the open configuration).

[0091] As described above, the switch **166** may be configured to detect a pressure differential indicative of an amount of the air flow **112** directed across the heating coils **132** and through the supply air section **118**. To this end, the switch **166** may be fluidly coupled to the supply air section **118** (e.g., a first pressure within the supply air section **118**) and be fluidly coupled to the power component section **138** (e.g., a second pressure within the power component section **138**).

[0092] FIG. **9** is a perspective view schematic of a portion of an embodiment of the heating system **130**, illustrating an arrangement of components of the heating system **130** described herein. For example, the illustrating embodiment includes the supply air section **118** having the heating coils **132** disposed therein and components of the power supply control system **136** disposed within the power component section **138**. In particular, the switch **166** and the heating system relay **210** are disposed within the power component section **138**. In some embodiments, the switch **166**, the heating system relay **210**, or both may be mounted to a surface **260** of the partition **140** facing (e.g., exposed to) the power component section **138**.

[0093] To enable the functionalities and benefits described herein, some embodiments of the switch **166** may be configured to detect a pressure within the supply air section **118** and a pressure within the power component section **138** to detect a pressure therebetween that is indicative of an amount of the air flow **112** directed across the heating coils **132** within the supply air section **118**. To this end, the switch **166** (e.g., air proving switch) may include a first pressure port **262** fluidly coupled to an internal volume **264** of the power component section **138** and a second pressure port **266** fluidly coupled to an internal volume **268** of the supply air section **118**. As the switch **166** is mounted to the partition **140** within the power component section **138**, the switch **166** may be implemented with one or more additional features to enable fluid coupling of the second pressure port **266** with the internal volume **268** of the supply air section **118**. For example, in the illustrated embodiment, a conduit **270** (e.g., tube, hose) is fluidly coupled to the second pressure port **266** and is secured to the switch **166**. The conduit **270** from the second pressure port **266** to a fitting **272** (e.g., fluid connector, barbed fitting, connector port, grommet, bushing, conduit connector) secured to and extending through the partition **140** (E.g., through an opening or aperture formed in the partition **140**). The fitting **272** may be configured to establish a sealing engagement with the partition **140** to block inadvertent flow of air (e.g., air flow **112**) between the partition **140** and the fitting **272**. Thus, the fitting **272** and the conduit **270** may enable fluid coupling of the second pressure port **266** to the internal volume **268** of the supply air section **118** without undesired bypass or escape of the air flow **112** through the partition **140** and into the power component section **138**. However, it should be appreciated that other embodiments of power supply control system **136** may include other arrangements of components (e.g., switch **166**, heating system relay **210**) within the power component section **138** and/or elsewhere within the HVAC system **100**.

[0094] While certain features and embodiments have been illustrated and described, many modifications and changes may occur to those skilled in the art, such as variations in sizes, dimensions, structures, shapes and proportions of the various elements, values of parameters, such as temperatures and pressures, mounting arrangements, use of materials, colors, orientations, and so forth, without materially departing from the novel teachings and advantages of the subject matter recited in the claims. The order or sequence of any process or method steps may be varied or re-sequenced according to alternative embodiments. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the disclosure.
[0095] Furthermore, in an effort to provide a concise description of the exemplary embodiments, all features of an actual implementation may not have been described, such as those unrelated to the presently contemplated best mode, or those unrelated to enablement. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation specific decisions may be made. Such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure, without undue experimentation.
[0096] The techniques presented and claimed herein are referenced and applied to material objects and concrete examples of a practical nature that demonstrably improve the present technical field and, as such, are not abstract, intangible or purely theoretical. Further, if any claims appended to the end of this specification contain one or more elements designated as “means for [perform]ing [a function] . . . ” or “step for [perform]ing [a function] . . . ”, it is intended that such elements are to be interpreted under 35 U.S.C. 112(f). However, for any claims containing elements designated in any other manner, it is intended that such elements are not to be interpreted under 35 U.S.C. 112(f).

Claims

1. A heating, ventilation, and air conditioning (HVAC) system, comprising: a housing defining a chamber configured to receive an air flow; and a heating system disposed within the housing, wherein the heating system comprises: a heating coil disposed within the chamber and configured to transfer heat to the air flow within the chamber; and a power supply control system configured to control supply of an electric current to the heating coil, wherein the power supply control system comprises power supply control circuitry disposed at least partially external to the chamber and a switch disposed along the power supply control circuitry, wherein the switch is configured to open to interrupt supply of the electric current to the heating coil and to close to enable supply of the electric current to the heating coil based on an operating parameter indicative of the air flow within the chamber.
2. The HVAC system of claim 1, wherein the housing comprises a power component section, and the power supply control circuitry and the switch are disposed within the power component section.
3. The HVAC system of claim 2, wherein the housing comprises a partition extending between and separating the chamber and the power component section.
4. The HVAC system of claim 3, wherein the switch comprises an air proving switch.
5. The HVAC system of claim 4, wherein the air proving switch comprises a first port fluidly coupled to the chamber and a second port fluidly coupled to the power component section.
6. The HVAC system of claim 5, comprising: a conduit connector coupled to and extending through the partition; and a conduit extending from the conduit connector to the first port of the air proving switch, wherein the second port is fluidly coupled to the chamber via the conduit connector and the conduit.
7. The HVAC system of claim 2, wherein the operating parameter comprises a pressure differential between the chamber and the power component section.

8. The HVAC system of claim 7, wherein the switch is configured to close in response to detection of the pressure differential being greater than a threshold value.
9. The HVAC system of claim 7, wherein the switch is configured to open in response to detection of the pressure differential being less than a threshold value.
10. The HVAC system of claim 1, wherein the power supply control system comprises: an electrical contactor configured to transmit the electric current from a power source to the heating coil; and a heating system relay comprising a set of relay contacts, wherein the set of relay contacts is configured to transmit a signal indicative of a call for heating from a control system of the HVAC system to the electrical contactor in a closed configuration of the set of relay contacts.
11. The HVAC system of claim 10, wherein the set of relay contacts comprises a normally open configuration.
12. The HVAC system of claim 11, wherein the heating system relay comprises a coil, the switch is configured to transmit a voltage to the coil in a closed configuration of the switch, the coil is configured to transition the set of relay contacts to the closed configuration in response to receipt of the voltage.
13. The HVAC system of claim 12, wherein the power supply control circuitry comprises at least one limit switch, the at least one limit switch is configured to open in response to detection of temperature of air within the chamber above a threshold temperature, the at least one limit switch, the switch, and the heating system relay are arranged in series along the power supply control circuitry, and the switch is disposed between the at least one limit switch and the heating system relay relative to a direction of the voltage along the power supply control circuitry.
14. A heating system for a heating, ventilation, and air conditioning (HVAC) system, comprising: an electric heating coil configured to transfer heat to an air flow directed through the HVAC system; and a power supply control system configured to control supply of a first voltage to the electric heating coil, wherein the power supply control system comprises: an electrical contactor configured to transmit the first voltage from a power source to the electric heating coil; a relay comprising a coil and a set of relay contacts, wherein the set of relay contacts is configured to transmit a signal indicative of a call for heating from a control system of the HVAC system to the electrical contactor in a closed configuration of the set of relay contacts, and the coil is configured to transition the set of relay contacts from a normally open configuration to the closed configuration in response to receipt of a second voltage; and a switch configured to transmit the second voltage to the coil of the relay in a closed configuration of the switch and configured to interrupt transmission of the second voltage to the coil of the relay in an open configuration of the switch, wherein the switch is configured to transition between the open configuration and the closed configuration based on a detected parameter indicative of the air flow directed through the HVAC system.
15. The heating system of claim 14, wherein the electric heating coil is configured to be disposed within a supply air section of the HVAC system, the power supply control system is configured to be disposed within a power component section of the HVAC system, the heating system comprises a partition configured to extend between the supply air section and the power component section.
16. The heating system of claim 15, wherein the switch is a pressure switch comprising a first port configured to fluidly couple to the supply air section and a second port configured to fluidly couple to the power component section, and the detected parameter comprises a pressure differential between the supply air section and the power component section.
17. The heating system of claim 16, wherein the relay, the switch, or both are configured to be mounted to the partition within the power component section.
18. The heating system of claim 16, wherein the pressure switch is configured to transition from the open configuration to the closed configuration in response to detection of the pressure differential being greater than a threshold value.
19. The heating system of claim 14, wherein the power supply control system comprises a circuit

configured to transmit the second voltage, the circuit is configured to receive the second voltage from a control board of the HVAC system, and the relay and the switch are arranged in series along the circuit.

20. A heating, ventilation, and air conditioning (HVAC) system, comprising: a housing defining a blower section, a supply air section, and a power component section; a blower disposed within the blower section and configured to direct an air flow into the supply air section; an electric heating coil disposed within the supply air section and configured to transfer heat to the air flow; a partition disposed within the housing and extending between the supply air section and the power component section; and a power supply control system configured to control supply of a first voltage to the electric heating coil, wherein the power supply control system comprises: an electrical contactor configured to transmit the first voltage from a power source to the electric heating coil in response to receipt of a call for heating from a control system of the HVAC system; a relay configured to electrically couple the control system of the HVAC system and the electrical contactor in response to receipt of a second voltage; and an air proving switch configured to transition from an open configuration to a closed configuration to enable transmission of the second voltage to the relay in response to detection of a pressure differential between the supply air section and the power component section greater than a threshold value.
