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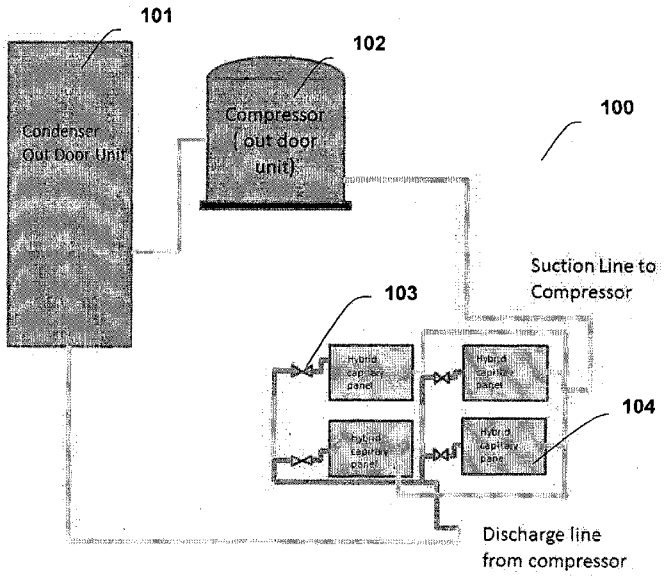

FIG. 1

(57) Abstract: A system and a method for providing effective and efficient air conditioning using plurality of hybrid capillary panels installed. The system includes a compressor and a condenser. The compressor has suction and discharge ports and number of hybrid capillary panel units run between the compressor suction port and the condenser. One or more solenoid valves block and unblock at least one of the panel units. Further the hybrid capillary panel capillary panel units further comprises PCM (phase changing materials) packs.

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HYBRID AIRCONDITIONING MODULE

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention generally relates to a hybrid air-conditioning module. More particularly, the present invention relates to a system and method for providing effective and efficient air conditioning using one or plurality of hybrid capillary panel(s) is/are installed based on the requirement, area and type of air-conditioning.

BACKGROUND OF THE INVENTION

[0002] Most air conditioning systems use the same principle of forced air. In forced air systems, warm room is circulated, chilled and blown back into the space. With the increased use of computers and other office technology, higher and higher heat loads need to be removed from these environments.

[0003] To remove this additional heat, a higher volume of cooler air is blown into the working environment to maintain comfort; making draft-free cooling with chilled, primary air increasingly more difficult. The standard forced air cooling system can carry the airborne spores to other locations in the building. Forced air systems can also expose occupants throughout a building to odors and cold viruses or contribute to unhealthy environment. This high level of recirculation promotes the spread of potentially harmful and/or odour causing organisms.

[0004] The analogy derived for the invention is from the shadow of tree, where in the water from the earth reaches the leaves which will absorbed the heat from above and offering the cool shade to the person standing below. In this process no air is blown, no air is sucked. Only the water content in the leaf is being fed by the earth through roots to stem, stem to branches and then to leaves. The heat from above will be absorbed by the leaves by evaporating the water in the leaf, hence keeping the space below at lower temperatures.

[0005] Another known approach is to use plastic capillary tube mats for cooling and heating rooms and/or water baths (DE 197 51 883 C2), which amongst other things, also contain a spiral- shaped, wound plastic capillary tube mat. Characteristic of this construction is a foil disposed between the capillary tube mats, which have protuberances, by means of which pas-

sages are formed. As one flow of substance flows through the capillary tube mat, the second flow of substance is directed through the passages formed by the foil. From a hydraulic point of view, the high pressure loss which occurs due to the flow resistance on the foil is a particular disadvantage. From a thermodynamic point of view, the solution based on the spiral-shaped winding has various disadvantages. In certain regions, the foil lies against the capillary tubes, which means it is not possible to produce a free flow round them, thereby reducing the external coefficient of heat exchange. The result of an arrangement with a capillary mat with a single inlet for the liquid flow is a cross-counter flow guide system with a low proportion of counter-flow due to the fact that the secondary flow of substance is axially directed. If opting for several inlets, the pressure loss in the capillary tube mat rises sharply. The temperature of the externally directed flow of substance is not uniform across the cross-section of the heat exchanger, which can be a particular disadvantage at the outlet.

[0006] In the light of aforementioned limitations, there exists a need for an hybrid capillary panel based air conditioning system, wherein said panels are installed based on type, area and other

BRIEF SUMMARY OF THE INVENTION

[0007] The following presents a simplified summary of the disclosure in order to provide a basic understanding to the reader. This summary is not an extensive overview of the disclosure and it does not identify key/critical elements of the invention or delineate the scope of the invention. Its sole purpose is to present some concepts disclosed herein in a simplified form as a prelude to the more detailed description that is presented later.

[0008] A more complete appreciation of the present invention and the scope thereof can be obtained from the accompanying drawings which are briefly summarized below and the following detailed description of the presently preferred embodiments.

[0009] An exemplary embodiment of the invention is to efficient and effective when compared to conventional air-conditioning technology.

[0010] An exemplary embodiment of the invention is to store hybrid air conditioning panels inside a building in a secured environment to reduce the cost of operation and maintenance.

[0011] A system and a method for providing effective and efficient air conditioning using one or plurality of hybrid Nano PCM assisted micro channel panels installed. According to a first aspect, the invention involves a system having a compressor and a condenser (either air cooled or water cooled). The compressor has suction and discharge ports. A number of hybrid Nano PCM assisted Micro channel panel units run parallel or sequentially, thus eliminating the need of Air ducts, AHUs and other accessories needed for centralized air conditioning systems. One or more valves block and unblock the flow for the panel units. Also independent control of solenoids will offer the benefit of Zoning.

[0012] Further, the hybrid capillary panel units comprising a Nano PCM (Phase changing materials) wherein said PCM is selected from the group comprising a salt, a salt-based hydrate, a mixture of salt, and/or salt-based hydrate, and/or an organic material and selected metal powders or metal compounds.

[0013] In various embodiments at least of the one or more valves may be a solenoid valve. A switching controller may be coupled to the valves and may be programmed to control the sequence, duty cycle and frequency of the switching ON/OFF of the solenoid valves. A set of temperature controller may be coupled between the compressor and the switching controller.

[0014] another aspect of the invention involves a method for operating such an apparatus. At least temp/pressure parameter is detected. The same are being used for controlling the sequence, duration and frequency of solenoid operation.

[0015] Another aspect of the invention involves a method for operating such an apparatus. At least one operational parameter is detected.

[0016] In various implementations, the at least one operational parameter may be at least one of: saturated evaporating temperature; saturated evaporating pressure; air temperature entering or leaving the evaporator coil; saturated condensing temperature; saturated condensing pres-

sure; air temperature entering or leaving the condenser; compressor current; compressor voltage; and compressor power. The determining may include determining an identity for the specific valve from a number of valves.

[0016] Another aspect of the invention involves a system having plurality of hybrid capillary panel units which may be installed in series or parallel order to provide effective air conditioning throughout the installed area.

[0017] The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description below. Other features, objects, and advantages of the invention will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] Other objects and advantages of the present invention will become apparent to those skilled in the art upon reading the following detailed description of the preferred embodiments, in conjunction with the accompanying drawings, wherein like reference numerals have been used to designate like elements, and wherein:

[0019] FIG.1 is a schematic representation of a system for providing air conditioning using plurality of hybrid capillary panel

[0020] FIG.2 is an illustrative representation of series of hybrid capillary panel units equipped with respective solenoid valves.

[0021] FIG.3 is a schematic representation of hybrid capillary panel unit.

[0022] FIG.4 is a schematic representation of control system controlling the solenoid valves.

DETAIL DESCRIPTION OF THE INVENTION

[0023] It is to be understood that the present disclosure is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the drawings. The present disclosure is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting.

[0024] The use of "including", "comprising" or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. The terms "a" and "an" herein do not denote a limitation of quantity, but rather denote the presence of at least one of the referenced item. Further, the use of terms "first", "second", and "third", and the like, herein do not denote any order, quantity, or importance, but rather are used to distinguish one element from another.

[0025] Referring to FIG.1 is a diagram 100 depicting an overview of a system for providing effective and efficient air conditioning. According to a non-limiting exemplary embodiment of the present subject matter, the system includes a compressor 102 and a condenser 101. The compressor has suction and discharge ports. A number of hybrid capillary panel units 104 run between the compressor suction port and the condenser. One or more valves block and unblock at least one of the panel units.

[0026] In accordance with a non-limiting exemplary implementation of the present subject matter, embodiments at least of the one or more valves may be a solenoid valve 104. A switching controller may be coupled to the valves and may be programmed to control the duty cycle and frequency of the valves. A temperature controller may be coupled between the compressor and the switching controller. Additionally, the system may build intelligence and implement PWPFM (Pulse width Pulse Frequency Modulation) controller to switching circuit.

[0027] Referring to FIG.2 is an illustrative representation of series of hybrid capillary panel units equipped with respective solenoid valves. According to a non-limiting exemplary embodiment of the present subject matter, the hybrid capillary panel units 104 are equipped with respective solenoid valve 103, wherein the hybrid capillary panel units 104 are connected between the suction line and discharge line from the compressor (not shown).

[0028] Referring to FIG.3 is a schematic representation of hybrid capillary panel unit. According to a non-limiting exemplary embodiment of the present subject matter, the hybrid capillary panel units 104 are installed with suctions fans on the standard suspended ceiling.

[0029] Referring to FIG.4 a schematic representation of control system controlling the solenoid valves. According to a non-limiting exemplary embodiment of the present subject matter, plurality of solenoid valves (103a, 103b, 103c, 103d) are connected with temperature controller 105 along with switching controller 106 and which is further connected to the compressor and fan controller 107 which controlling the activity of the solenoid valves.

[0030] In at least some of these modes of operation, the required frequency of modulation may be quite long. If the criterion for opening and closing a valve is a direct variation in indoor temperature, as described for the simpler controller cases, the thermal inertia of the cooled space—the house—may result in many minutes or more of operation with one or another valve combination before temperature changes enough to drive a change in valve open/close states. Also note that as more valves are added to the system and more system capacity increments become available, the required frequency of modulation decreases. This could be much longer than the exemplary 100 seconds identified above

[0031] While specific embodiments of the invention have been shown and described in detail to illustrate the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

[0032] In an alternate embodiment, a more sophisticated control may be used that optimizes the operation of the solenoid as a function of ambient conditions and start up conditions. In a

further embodiment, the liquid level in the vessel may be measured directly and used to control the operation of the solenoid.

[0033] Further, there are various advantageous of the present invention are as follows: saves energy; smaller and more efficient chiller/evaporator; and has good indoor air quality; good zoning capabilities; utilizes room requires less space; and insulation of pipe is not required; testing and balancing is made simpler; has good integration fire suppression and further has low operating cost and reduced maintenance cost; reduced noise; smaller and less conspicuous refrigerant pipes; and no interference with draperies and blinds and the cooling and heating can be simultaneous with 3 pipe system.

[0034] Further, the invention can be applied plaster/drywall or drop ceiling, existing wall ceiling and floor surfaces and each room can be setup having a separate zone and can be used in existing and new construction, residential and commercial areas.

[0035] While only certain features and embodiments of the invention have been shown and described, many modifications and changes may occur to those skilled in the art (e.g., variations in sizes, dimensions, structures, shapes and proportions of the various elements, values of parameters (e.g., temperatures, pressures, etc.), mounting arrangements, use of materials, colours, orientations, etc.) 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 invention. Furthermore, in an effort to provide a concise description of the exemplary embodiments, all features of an actual implementation may not have been described (i.e., those unrelated to the presently contemplated best mode of carrying out the invention, or those unrelated to enabling the claimed invention). 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.

I/We Claims:

1. A system for providing effective and efficient air conditioning, the system comprising: a plurality of hybrid capillary panels configured to be attached to a surface; a compressor; condenser; the compressor has suction and discharge ports; said hybrid capillary panel units run between the compressor suction port and the condenser; and one or more valves block and unblock at least one of the said panel units.

2. The system of claim 1, further comprising a switching controller coupled to the valves and may be programmed to control the duty cycle and frequency of the valves.

3. The system of claim 1, wherein: the one or more valves are a solenoid valve.

4. The system of clam 1, further comprising a temperature controller coupled between the compressor and the switching controller.

5. The system of claim1, wherein said hybrid capillary panel units further comprises PCM (phase changing materials) packs wherein said PCM selected from the group comprising a salt, a salt-based hydrate, a mixture of salt, and/or salt-based hydrate, and/or an organic material.

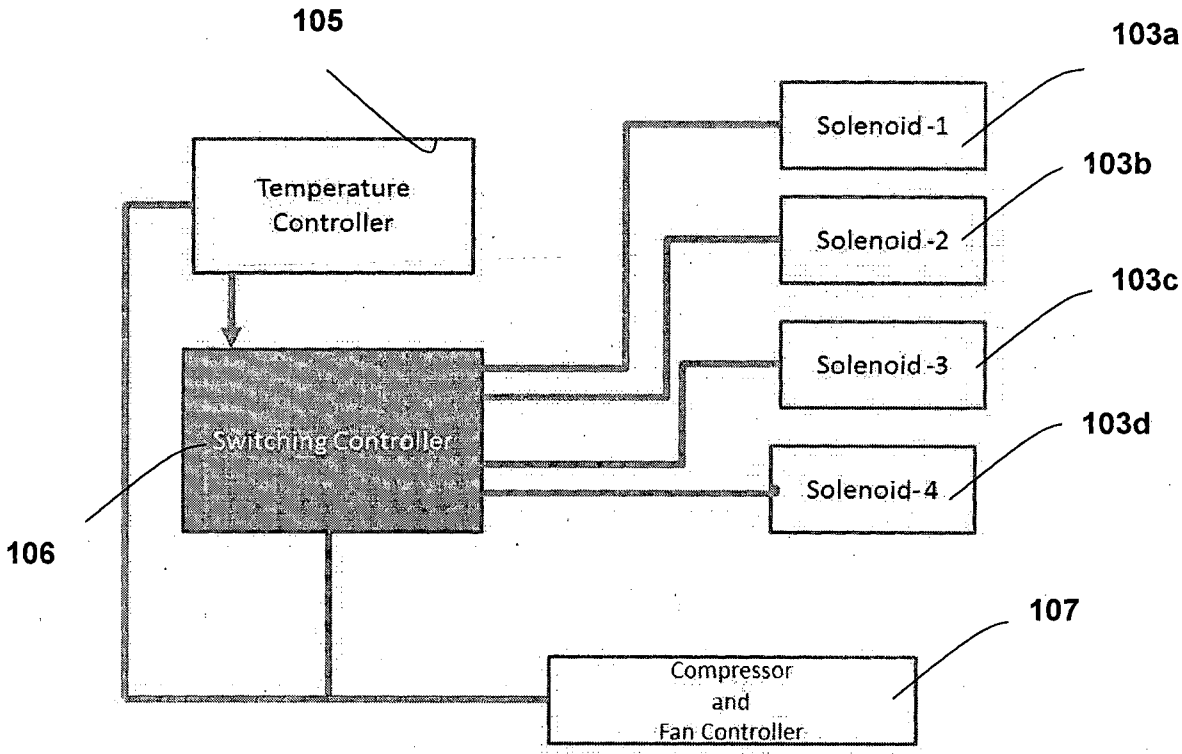
105
103a
Temperature Controller
Solenoid-1
103b
Solenoid-2
103c
Solenoid-3
Switching Controller
103d
Solenoid-4
106
107
Compressor and Fan Controller

FIG. 4

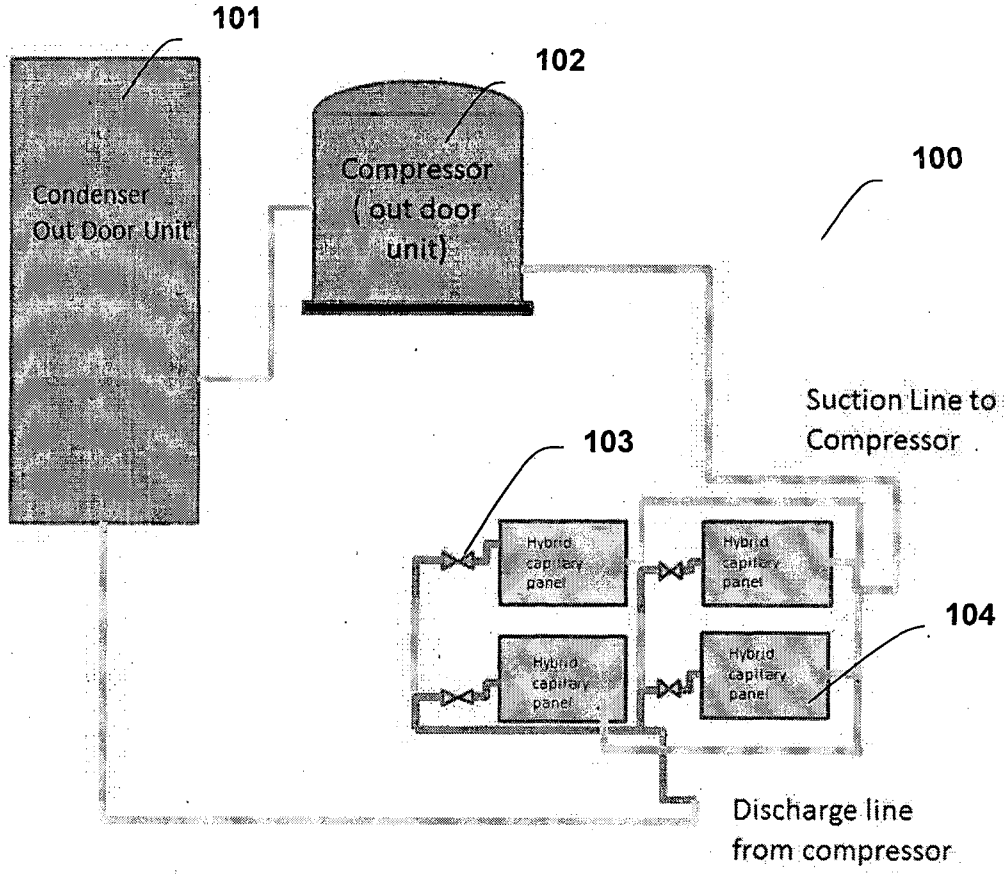
101
102
100
Condenser
Out Door Unit
Compressor
(out door
unit)
Suction Line to
Compressor
103
Hybrid
capillary
panel
Hybrid
capillary
panel
Hybrid
capillary
panel
Hybrid
capillary
panel
104
Discharge line
from compressor

FIG. 1

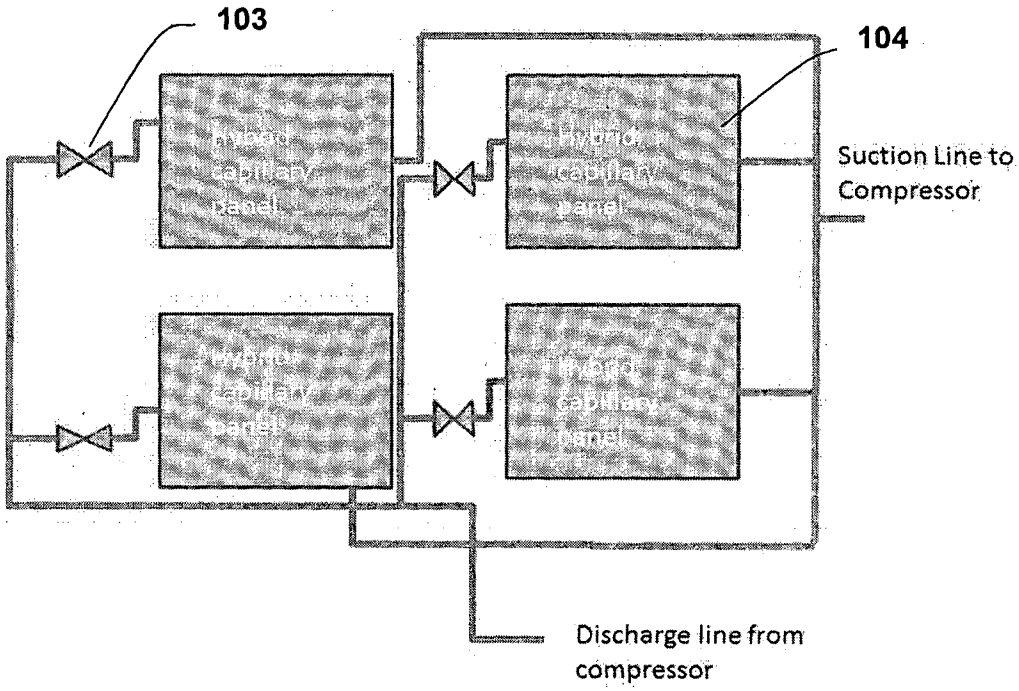
103
104
Hybrid capillary panel
Hybrid capillary panel
Hybrid capillary panel
Hybrid capillary panel
Suction Line to Compressor
Discharge line from compressor

FIG. 2

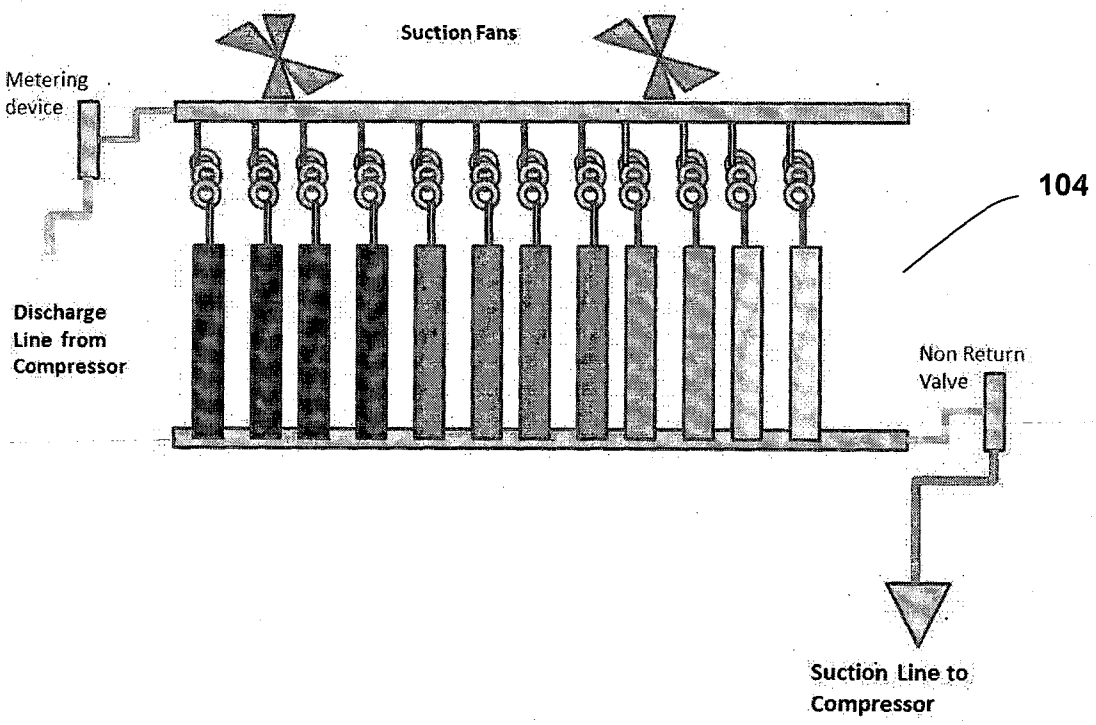
Suction Fans
Metering device
104
Discharge Line from Compressor
Non Return Valve
Suction Line to Compressor

FIG. 3

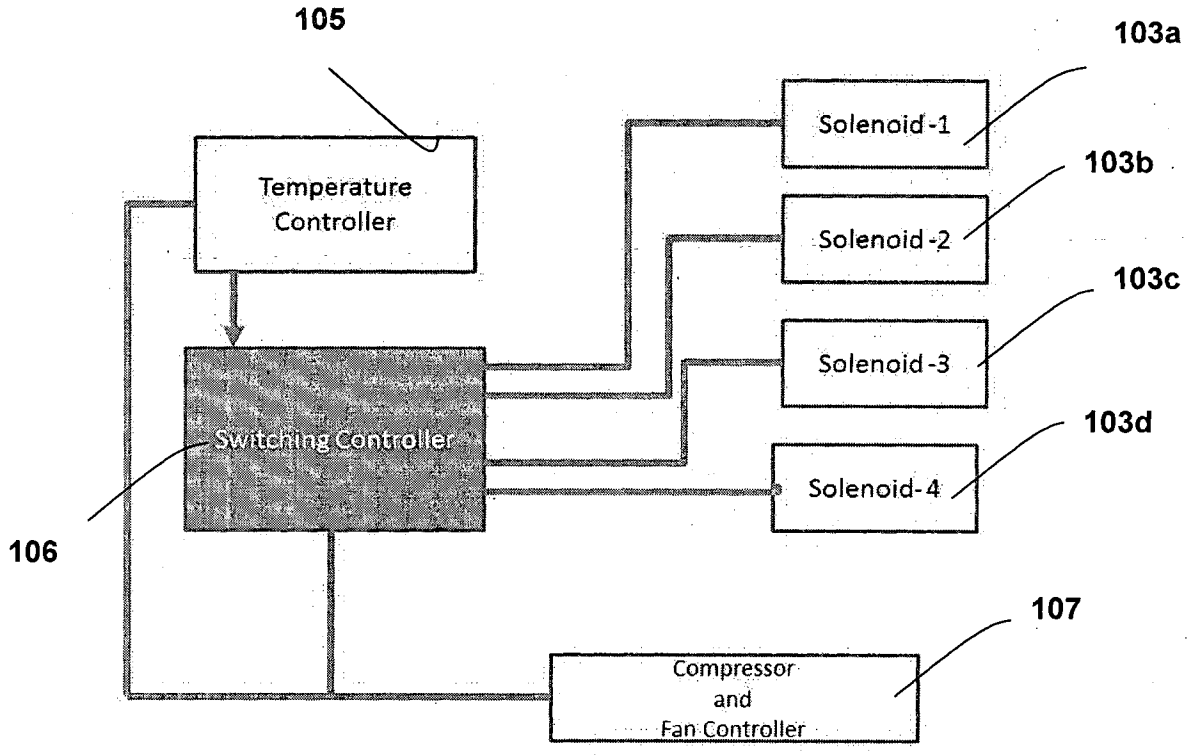
105
103a
Solenoid -1
Temperature Controller
103b
Solenoid -2
103c
Solenoid -3
Switching Controller
103d
Solenoid-4
106
107
Compressor and Fan Controller

FIG. 4