An air conditioning system includes a condenser coil and a fan situated adjacent the condenser coil. The fan driven by a motor, which is reversed to change the rotational direction of the fan in response to a predetermined condition. The fan is operated in a first direction to cool a condenser coil, and reversed to blow away collected debris, thus cleaning the condenser coil. The fan is reversed in response to one or more predetermined conditions.

Diagram:
- Normal Airflow
- Condenser Coils
- Dirt and Debris
- 100, 110, 112, 120

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Abstract
- An air conditioning system includes a condenser coil and a fan situated adjacent the condenser coil. The fan driven by a motor, which is reversed to change the rotational direction of the fan in response to a predetermined condition. The fan is operated in a first direction to cool a condenser coil, and reversed to blow away collected debris, thus cleaning the condenser coil. The fan is reversed in response to one or more predetermined conditions.
FIG. 3

Normal Airflow

101

110

Condenser Coils

120

Dirt and Debris

Self Cleaning Cycle

101

110

Condenser Coils

Dirt Blown Away

Dirt and Debris

FIG. 4
SELF-CLEANING CONDENSER
CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a non-provisional application of U.S. Provisional Application Ser. No. 60/522,610, filed on Oct. 20, 2004, which is incorporated by reference.

BACKGROUND

[0002] The present disclosure relates generally to condenser coils, and more particularly, to condenser coils for air conditioning systems.

[0003] Air conditioning systems typically include a compressor that forces a refrigerant through a condenser coil, where the refrigerant vapor liquefies. A fan is situated to provide airflow over the coil to cool the condenser coil. Metal fins are attached to the coil to aide in the heat dissipation.

[0004] The condenser coil is often located outside, such as in a roof air conditioning system and as such, is exposed to the elements. Condensers can become clogged due to the vacuuming tendencies of the fan. Debris can get sucked in the condenser's cooling fins, and moisture and dirt can create a "glue" that sticks debris to the cooling fins. A dirty condenser coil greatly reduces the cooling ability of the air blowing across the condenser coils, increasing the operating costs of the system.

[0005] Frequent servicing to clean the condenser also adds to operating costs, and if the cleaning is done improperly, damage can occur.

SUMMARY

[0006] In accordance with certain aspects of the present disclosure, an air conditioning system includes a fan situated adjacent condenser coils to provide air flow through the coil. The fan is operated in a first direction to cool a condenser coil, and operated the fan in a second direction to clean the condenser coil. The fan is driven by a motor, and a motor controller is operable to reverse the rotational direction of the fan in response to a predetermined condition.

[0007] In certain exemplary embodiments, the motor controller reverses the rotational direction of the fan in response to various measured system parameters. For example, in some embodiments, the motor controller receives an output of a timer and the motor controller reverses the rotational direction of the fan in response to the timer. Alternatively, the motor controller may reverse the rotational direction in response to other parameters, such as predetermined temperature or motor torque.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings in which:

[0009] FIGS. 1 and 2 illustrate a horizontal flow condenser in accordance with certain teachings of the present disclosure.

[0010] FIGS. 3 and 4 illustrate an up flow condenser in accordance with certain teachings of the present disclosure.

[0011] FIG. 5 is a block diagram illustrating additional aspects of the condenser systems shown in FIGS. 1-4.

[0012] FIGS. 6 and 7 are circuit diagrams illustrating connections to reverse the rotation direction of a three-phase and single-phase motor, respectively.

[0013] While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and are herein described in detail. For example, some of the drawing figures include exemplary dimensioning. It should be understood, however, that the description herein of specific embodiments is not intended to limit the invention to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention.

DETAILED DESCRIPTION

[0014] Illustrative embodiments of the invention are described below. In the interest of clarity, not all features of an actual implementation are described in this specification. It will of course be appreciated that in the development of any such actual embodiment, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which will vary from one implementation to another. Moreover, it will be appreciated that such a development effort might be complex and time-consuming, but would nevertheless be a routine undertaking for those of ordinary skill in the art having the benefit of this disclosure.

[0015] FIGS. 1-4 illustrate condenser systems 100, 101 in accordance with the teachings of the present disclosure. A compressor (not shown) forces a refrigerant through a condenser coil 110, where the refrigerant vapor liquefies. A fan 112 is situated to provide airflow over the coil 110 to cool the condenser coil 110. Metal fins are attached to the coil to aide in the heat dissipation.

[0016] FIGS. 1 and 3 show cooling airflow for typical horizontal and up-flow condensers, respectively. In FIG. 1, the cooling air flows from right to left as illustrated, and in FIG. 3, the cooling air flows from below the condenser coil 110 to above the coil 110. In typical systems, the air is always blown in the same direction, causing dirt and debris 120 to collect and stick to the fins of the condenser coil 110.

[0017] FIGS. 2 and 4 illustrate a self-cleaning operation of the fan 112 in accordance with certain teachings of the present disclosure. In general, the fan 112 is reversed to blow the air in the opposite direction, dislodging the dirt and debris 120 from the condenser coil 110. By periodically reversing the direction of the airflow, at least a portion of the dirt and debris 120 is continuously dislodged, thereby reducing or eliminating the need for manual cleaning of the coil 110.

[0018] FIG. 5 is a simple block diagram illustrating further aspects of a condenser system such as the condenser systems 100, 101. As shown in FIGS. 1-4, a compressor 111 is connected to the condenser coil 110 to force refrigerant therethrough. The fan 112 is situated adjacent the condenser coil 110 and is driven by a motor 200. A controller 202 controls operation of the motor to cause the fan to turn in the
desired direction, among other things. A measurement device 204 communicates with the motor controller 202 to provide information about various system parameters, such as temperature, pressure, elapsed time, etc.

[0019] FIGS. 6 and 7 are simple circuit diagrams showing exemplary connections for a three-phase 210 and a single-phase 212 motor, respectively, that may be used to reverse the rotation direction of the fan 112. In FIG. 6, two of the three motor phases are reversed to change the rotation direction, and in the single-phase motor shown in FIG. 7, the line and neutral connections to the motor capacitor 214 are reversed.

[0020] In certain embodiments, the fan 112 is reversed to achieve the cleaning airflow at predetermined times. For example, the measurement device 204 may include a clock or a timer and in response thereto, the motor controller 202 reverses the fan periodically. The airflow can be reversed for some predetermined time period each time the compressor 111 shuts off (one minute, for example), regardless of the ambient temperature.

[0021] In other embodiments, the cleaning airflow may be used during times when the ambient temperature is likely to be lower, such as at night. Accordingly, the fan is reversed at some predetermined time when the ambient temperature is expected to be relatively lower. In still further embodiments, the measurement device 204 includes a thermometer and the controller 202 reverses the direction of the fan 112 only when the ambient temperature is below a predetermined level, so the maximum condenser efficiency can be achieved with the fan 112 running only in the cooling direction when the ambient temperature is high. Other parameters may be measured to determine when to reverse the fan 112 for cleaning action. For example, the measurement device 204 can include a pressure measurement device and the fan 112 can be reversed in response to pressure, which provides an indication of the amount of debris 120 collected on the coil 110. Alternatively, motor torque may be measured to provide an indication of pressure, eliminating the need for a separate pressure measurement device.

[0022] The particular embodiments disclosed above are illustrative only, as the invention may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular embodiments disclosed above may be altered or modified and all such variations are considered within the scope and spirit of the invention.

What is claimed is:

1. A method of operating a condenser fan, comprising:
   operating the fan in a first direction to cool a condenser coil; and
   operating the fan in a second direction for a predetermined time period to clean the condenser coil.

2. The method of claim 1, wherein operating the fan in the second direction includes operating the fan in the second direction in response to a predetermined condition.

3. The method of claim 2, wherein the predetermined condition includes a predetermined time.

4. The method of claim 2, wherein the predetermined condition includes ambient temperature.

5. The method of claim 2, wherein the predetermined condition includes pressure.

6. The method of claim 2, wherein a compressor is connected to the condenser coil, and wherein the predetermined condition includes the compressor turning off.

7. The method of claim 2, further comprising monitoring torque of a motor driving the fan, wherein the predetermined condition includes the torque.

8. The method of claim 1, wherein the fan is driven by a three-phase motor, and wherein operating the fan in the second direction includes reversing two of the three motor phases.

9. The method of claim 1, wherein the fan is driven by a single-phase motor having a motor capacitor, and wherein operating the fan in the second direction includes reversing line and neutral connections to the motor capacitor.

10. An air conditioning system, comprising:
   a condenser coil;
   a fan situated adjacent the condenser coil, the fan driven by a motor;
   a motor controller programmed to operate the fan in a first rotational direction to cool the condenser coil and to reverse the rotational direction of the fan for a predetermined time period in response to a predetermined condition.

11. The air conditioning system of claim 10, wherein the motor controller reverses the rotational direction of the fan at a predetermined time.

12. The air conditioning system of claim 10, further comprising a temperature measurement device, wherein the motor controller reverses the rotational direction of the fan in response to the temperature measurement.

13. The air conditioning system of claim 12, wherein the motor controller reverses the rotational direction of the fan in response to the temperature being below a predetermined level.

14. The air conditioning system of claim 10, wherein the motor controller monitors motor torque, and wherein the motor controller reverses the rotational direction of the fan in response to the torque.

15. The air conditioning system of claim 10, further comprising a compressor connected to the condenser coil, wherein the predetermined condition includes the compressor turning off.

16. The air conditioning system of claim 10, wherein the airflow created by the fan is generally horizontal.

17. The air conditioning system of claim 10, wherein the airflow created by the fan is generally vertical.

18. The air conditioning system of claim 10, wherein the motor is a three-phase motor, and wherein the motor controller reverses two of the three phases to reverse the rotational direction of the fan.

19. The air conditioning system of claim 10, wherein the motor is a single-phase motor, and wherein the motor controller reverses line and neutral connections to the motor capacitor to reverse the rotational direction of the fan.

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