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(54) **USE OF AN AIR-CLEANING BLOWER TO  
KEEP CONDENSER COILS CLEAN**

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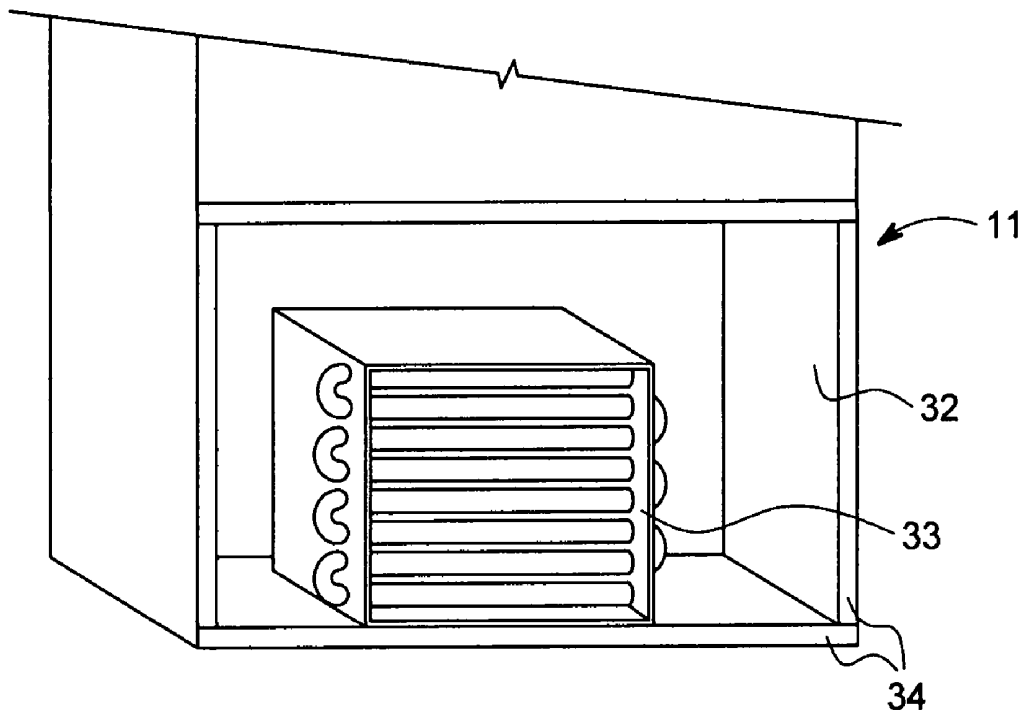
(57) **ABSTRACT**

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Refrigeration apparatus containing condenser coils located within an enclosure are prone to become dirty over time as they come in contact with an incoming air stream intended to promote heat transfer across the coils. This invention relates to an improvement that directs the incoming air stream through an air-cleaning blower apparatus situated on the surface of a cover for the enclosure of the refrigeration apparatus which holds the condenser coils. The air-cleaning blower substantially removes contaminants in the incoming air stream, which would normally give rise to coil clogging or dirtiness, before the air stream enters the enclosure to contact the condenser coils.

**Related U.S. Application Data**

(60) Provisional application No. 62/390,915, filed on Apr. 14, 2016, provisional application No. 62/390,318, filed on Mar. 25, 2016.



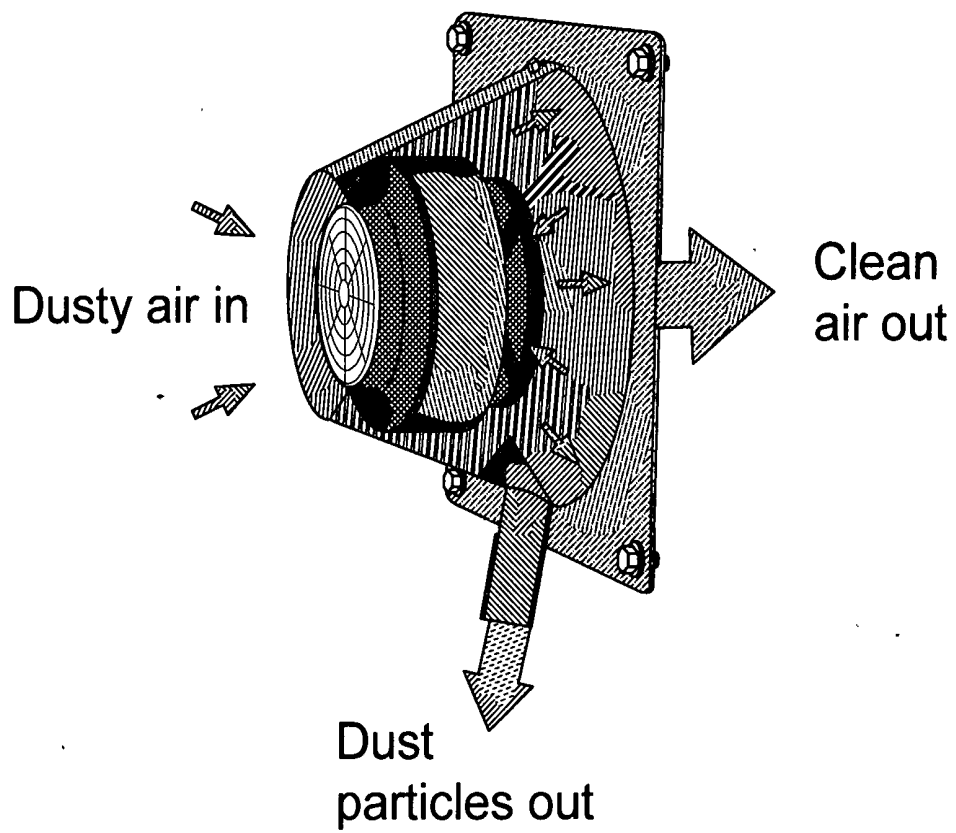


FIG. 1

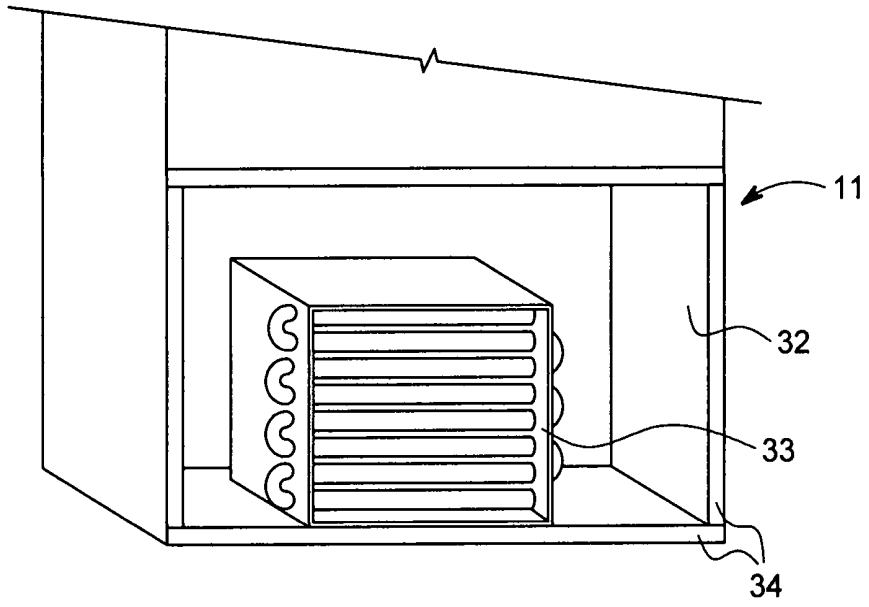


FIG. 2

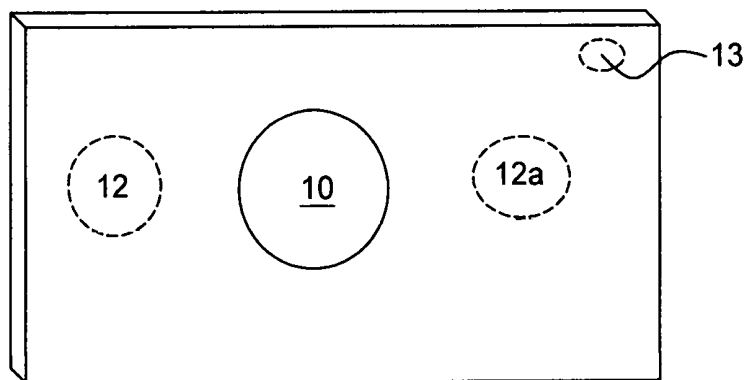


FIG. 3

### USE OF AN AIR-CLEANING BLOWER TO KEEP CONDENSER COILS CLEAN

[0001] This application claims the benefit of the following U.S. Provisional Patent Application Nos. 62/390,318, filed Mar. 25, 2016 and 62/390,915, filed Apr. 14, 2016.

[0002] This invention is applicable to cooling appliances, in general, either those that operate on the conventional refrigerant compression-expansion process or those newer technologies that are thermoelectric in nature.

[0003] Most conventional plug-in cooling appliances, such as refrigerators, freezers, display merchandisers, and the like, that operate on the compression-expansion process have condenser coil units that vent the heat that has been extracted from the chamber intended to be cooled to the atmosphere. These coil units generally sit in an enclosure behind a panel (or grille) having vents that allow air to enter for the needed airflow over the coils for the dissipation of heat therefrom. The condensing unit typically has a fan that draws air across the coils to facilitate the needed heat transfer to insure the unit is operating efficiently.

[0004] It is well-known that severe clogging contamination of the coils, often over a short period of time measured in the space of only a few months, with dust and other debris will rob these coils of their ability to perform their essential heat exchange function. Various solutions have been suggested to solve the problems associated with such "dirty" condenser coils in refrigeration units. Condensing units have been modified to include automated brushing means (see U.S. Patent Publication No. 2007/0062211) or the direction of rotation of the fan has been designed to reverse periodically (see U.S. Pat. Nos. 6,792,769 and 7,024,878). Some persons have recommended placing filter media over the panel or grille containing the vents to trap dust and other debris before it enters the enclosure holding the coils. Other solutions have involved periodic cleaning of dirty coils with appropriate dust containment devices when compressed air is employed (see U.S. Pat. Nos. 6,295,696, 8,182,611 and 8,590,100 and U.S. Patent Publication No. 2013/0160800, which covers the commercially available COILPOD dust containment bag, which is one preferred dust containment product).

[0005] The present invention is directed to a novel way of largely preventing dust contamination of the coils in the first place and is illustrated in the Drawings wherein:

[0006] FIG. 1 is a perspective view of the air cleaning blower which forms an essential component in the practice of the present invention;

[0007] FIG. 2 is a perspective view of the front of a commercial-type refrigeration unit with the cover over the enclosure holding the unit's condenser coil unit removed; and

[0008] FIG. 3 is a perspective view of the type of novel cover that is employed by the present invention to close the opening to the enclosure that is illustrated in FIG. 2.

[0009] The instant invention involves replacing the conventional vented cover now used with a non-vented cover that also comprises an air-cleaning blower, which is shown in FIG. 1. This blower is placed over an orifice in the cover shown in FIG. 3. The orifice is in communication with the interior of the enclosure holding the condenser coils. The cover shown in FIG. 3 would be appropriately dimensioned to fit over the opening of the enclosure 32, depicted in FIG. 2, which holds the condenser coil unit 33 by affixation to surfaces 34 of the refrigeration unit 11.

[0010] One preferred conically-shaped air-cleaning blower unit, as depicted in FIG. 1, is described in U.S. Pat. No. 9,259,675, which is incorporated herein by reference. It is commercially available from Aero Conditioner LLC, Brooklyn, N.Y. 11205 (whose website is [www.aeroconditioner.com](http://www.aeroconditioner.com)). This apparatus intakes air that is contaminated with all types of dust, debris, other particulates, and so forth and induces centripetal forces thereon to cause such contaminants to separate and be expelled from a different outlet located on the blower's periphery. This action is responsible for introduction of the cleansed air stream into the enclosure holding the condenser coils. The blower apparatus comprises an inlet, housing, impeller, and at least one clean air outlet and one particulate outlet.

[0011] The use of this air-cleaning blower unit can obviate the need for a fan assembly, as is conventional, in condensing units now in operation or it could be used in conjunction with such fan depending on the blowing power of the selected air-cleaning blower. It is well within the skill in the art to calibrate the needed blowing power of the blower and appropriately connect its electrical wiring to the condensing unit's fan power source(s) within the enclosure. When the refrigeration unit cycles on, the blower, either with or without the conventional condensing fan now commonly used, can cycle on as well to supply an air flow to promote coil heat transfer.

[0012] FIG. 3 shows an alternative covering plate 13 containing the previously described air-cleaning blower 10, along with optional ports 12 and 12a (which would be covered in normal operation of the refrigeration unit to preserve the vent-less character of the cover). These ports are analogous to the ports contained in the dust containment bag described in U.S. Patent Publication No. 2013/0160800, which is commercially available under the trademark COILPOD. Such ports allow for coil cleaning, without removal of the cover plate, with a combination of sources of compressed air and vacuum, respectively placed in each of the ports once those ports are opened. If desired, an appropriate temperature indicator 13 can also be included, which can signal the presence of dirty coils, either visually or wirelessly. This indicator is connected to the condenser coils as described in U.S. Patent Publication No. 2015/0176932.

[0013] In order that the entire unit functions with the lowest electric energy possible, a preferred embodiment utilizes a special class of electric motor for both the fan in the condensing unit, if that is not deactivated, as well as in the air-cleaning blower. Rather than being either an induction (or shaded-pole) motor or the more recently developed electronically commutated motor, the preferred motor is the type of synchronous motor developed by and commercially available from QM Power and designated the Q-Sync Smart Synchronous Motor. This type motor, unlike an electronically commutated motor, does not require continual conversion between AC and DC power throughout its use to operate. The preferred motor's electronics get the motor to its targeted speed and then efficiently shift the motor to AC power supplied directly from the grid. Further details on this type of motor can be found in the following patent documents, which are incorporated herein by reference: U.S. Pat. Nos. 7,898,135; 8,810,084; 9,231,459; and 9,300,237 and U.S. Patent Publication No. 2016/0094113.

[0014] The other type of refrigeration apparatus that can be improved by the present invention operates thermoelectrically where a voltage of constant polarity is applied to

a junction between two dissimilar electrical semiconductors where the negative one becomes cooler and the positive one hotter. A heat sink is used to dissipate the thermal energy from the positive one into the external environment as is well known to persons in the art. These heat sinks tend to collect dust and debris in an analogous manner to the condenser coils in the previously described compression-expansion refrigeration units. The enclosure holding such heat sink heat dissipation structure(s) will benefit in an analogous manner to the more conventional systems if the enclosure is closed off except for the previously described air cleaning blower being the source of air that is imported into the enclosure to assist in cooling the heat sink.

**[0015]** This invention also involves a new business method: (1) either retrofit or new unit manufacture of refrigeration apparatus, either non-residential or residential, employing the air-cleaning blower installation previously described; (2) coupled with an ongoing preventative maintenance program where the condenser coils (or heat sink) are cleaned, if needed, after being placed in service with a compressed air stream (e.g., compressed air, dry steam, or possibly liquid solvent stream) and vacuum using the previously COILPOD dust containment method and apparatus.

I claim:

1. In a refrigeration apparatus that comprises condenser coils located within an enclosure that are prone to become dirty over time as they come in contact with an incoming air stream intended to promote heat transfer across the coils, wherein the improvement comprises directing the incoming air stream through an air-cleaning blower apparatus situated on the surface of a cover over the enclosure in the refrigeration apparatus that holds the condenser coils to substantially remove contaminants in the incoming air stream that give rise to coil contamination before the air stream contacts the coils.

2. An apparatus as claimed in claim 1 wherein the cover also comprises ports to allow for the introduction of compressed air and vacuum, respectively, to allow for cleaning of the condenser coils should they become dirty.

3. An apparatus as claimed in claim 1 wherein the cover also comprises an indicator to signal the need for cleaning of the condenser coils should they become dirty.

4. An apparatus as claimed in claim 1 wherein the cover also comprises ports to allow for the introduction of compressed air and vacuum, respectively, to allow for cleaning

of the condenser coils should they become dirty and an indicator to signal the need for cleaning of the condenser coils should they become dirty

5. In a cooling appliance designed to cool a space that utilizes the compression and expansion of a refrigerant gas and that has coils designed for heat transfer located within an enclosure with adjacent fan means also within the enclosure to promote air flow over the coils from outside the enclosure, said coils being prone to become dirty with the passage of time due to contaminants in the air flow coming into the enclosure from outside the enclosure, wherein the improvement comprises an air-cleaning blower installed on the outside surface of a cover over the enclosure with communication to the interior of the enclosure and supplying a flow of air from the outside of the enclosure to the inside of the enclosure with removal of contaminants in the air by the air-cleaning blower before the air enters the interior of the enclosure to thereby retard the process whereby the coils become dirty.

6. An apparatus as claimed in claim 1 wherein the cover also comprises ports to allow for the introduction of compressed air and vacuum, respectively, to allow for cleaning of the condenser coils should they become dirty.

7. An apparatus as claimed in claim 1 wherein the cover also comprises an indicator to signal the need for cleaning of the condenser coils should they become dirty.

8. An apparatus as claimed in claim 1 wherein the cover also comprises ports to allow for the introduction of compressed air and vacuum, respectively, to allow for cleaning of the condenser coils should they become dirty and an indicator to signal the need for cleaning of the condenser coils should they become dirty

9. In a refrigeration apparatus that comprises one or more heat sinks, located within an enclosure, that are prone to become dirty over time as they come in contact with an incoming air stream, said one or more heat sinks intended to promote heat transfer from the apparatus, wherein the improvement comprises directing an incoming air stream through an air-cleaning blower apparatus situated on a cover over the enclosure of the refrigeration apparatus holding the one or more heat sinks to substantially remove contaminants in the incoming air stream that would otherwise give rise to contamination with dust or other debris in the air stream before the air stream contacts the one or more heat sinks.

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