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(54) **MODULAR REFRIGERATION UNIT**

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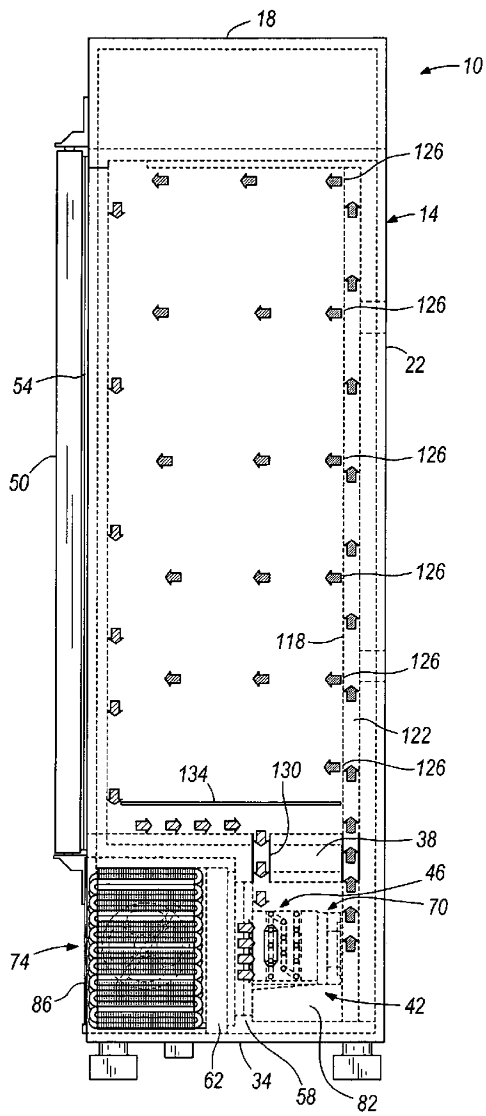
(57) **ABSTRACT**

A modular refrigeration unit for use in an accessible compartment of a cooler, a cooler comprising a modular refrigeration unit, and a method for a modular refrigeration unit. The modular refrigeration unit can include a gas cooler assembly mounted to a support and positioned on one side of a dividing wall, and an evaporator assembly mounted to the dividing wall and positioned on the opposite side of the dividing wall from the gas cooler assembly. The modular refrigeration unit can include CO_2 refrigerant adapted to be circulated between the evaporator assembly and the gas cooler assembly.



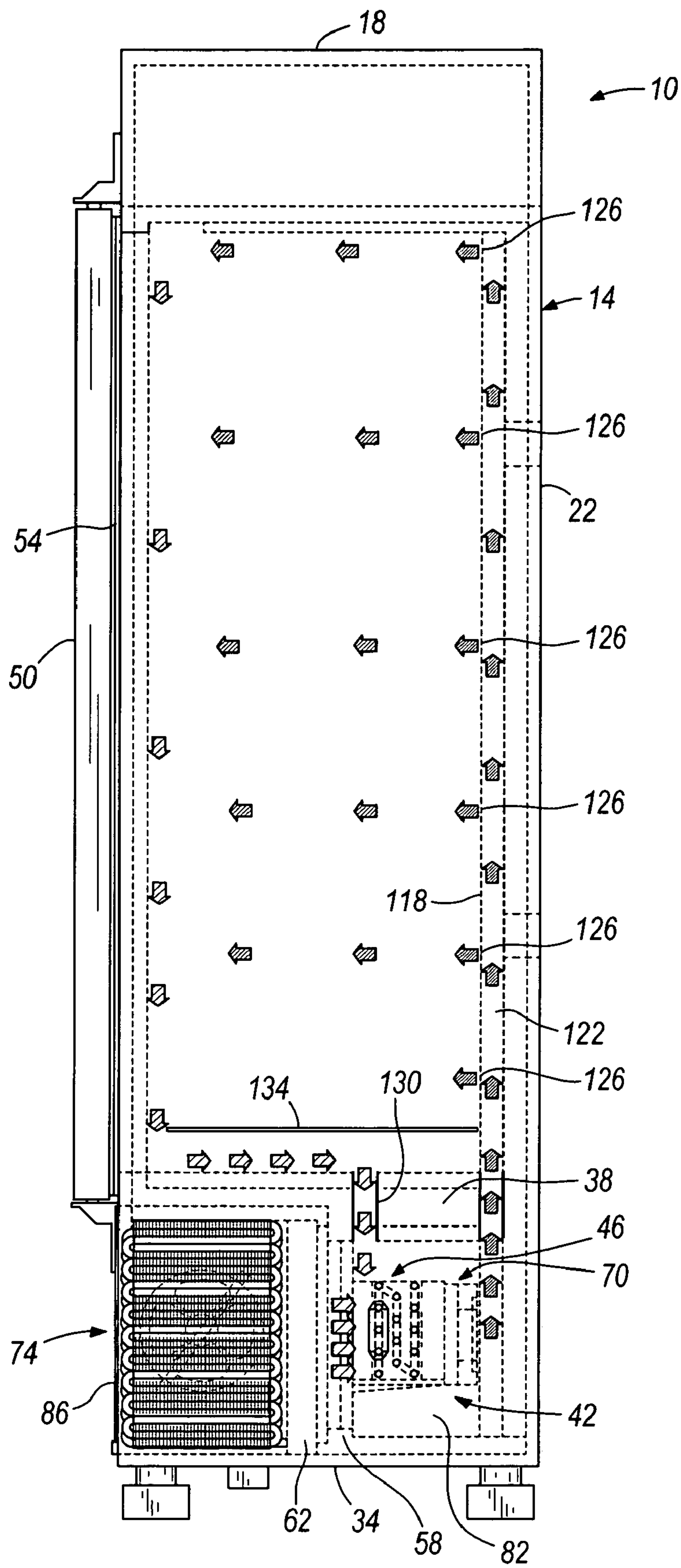

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FIG. 1

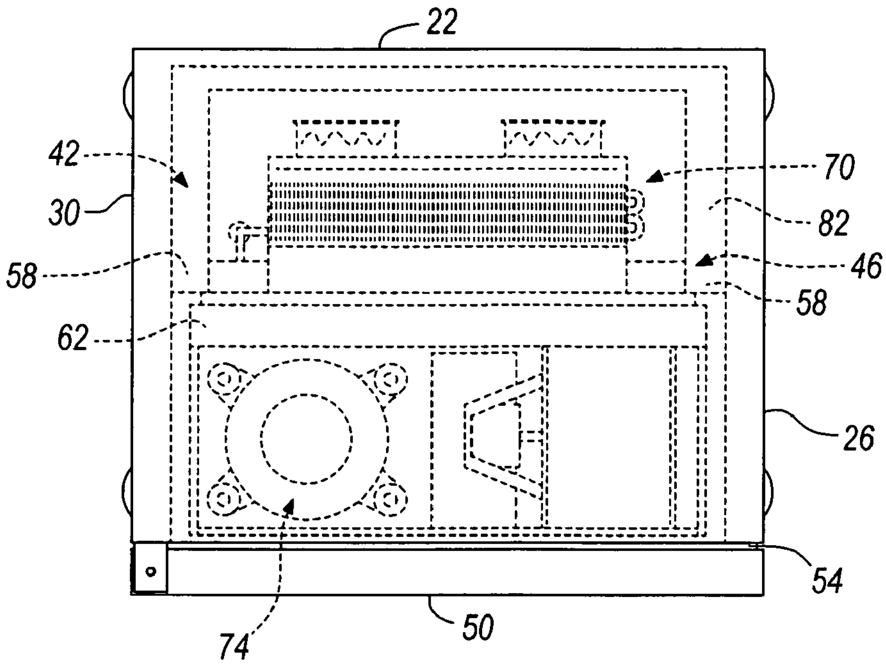
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FIG. 2

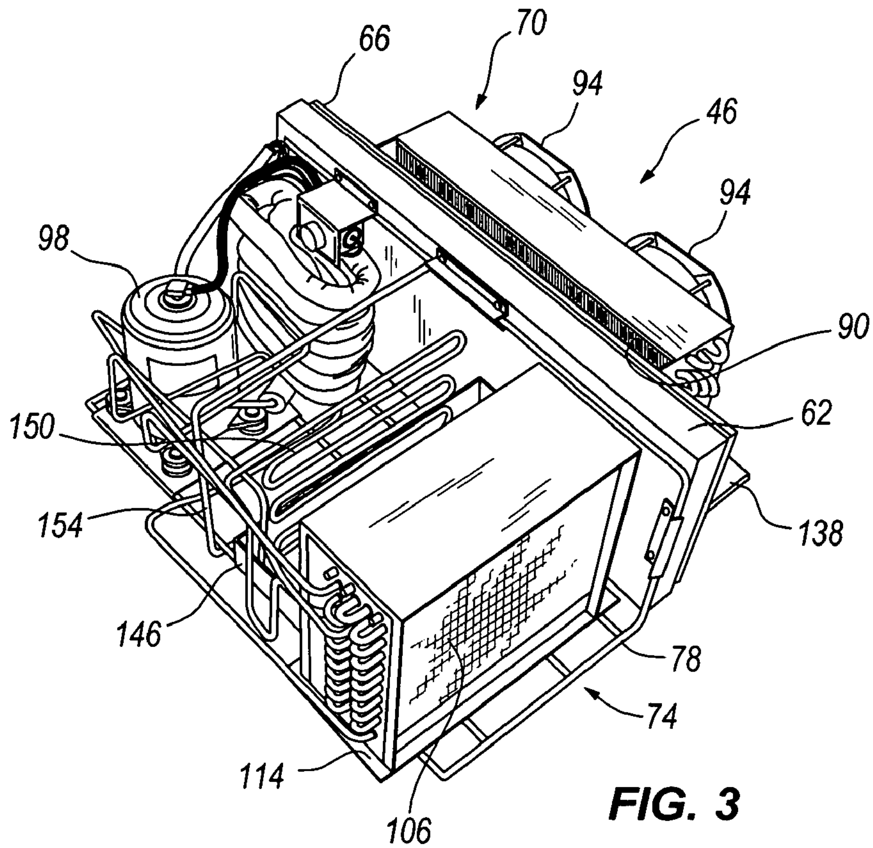
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FIG. 3

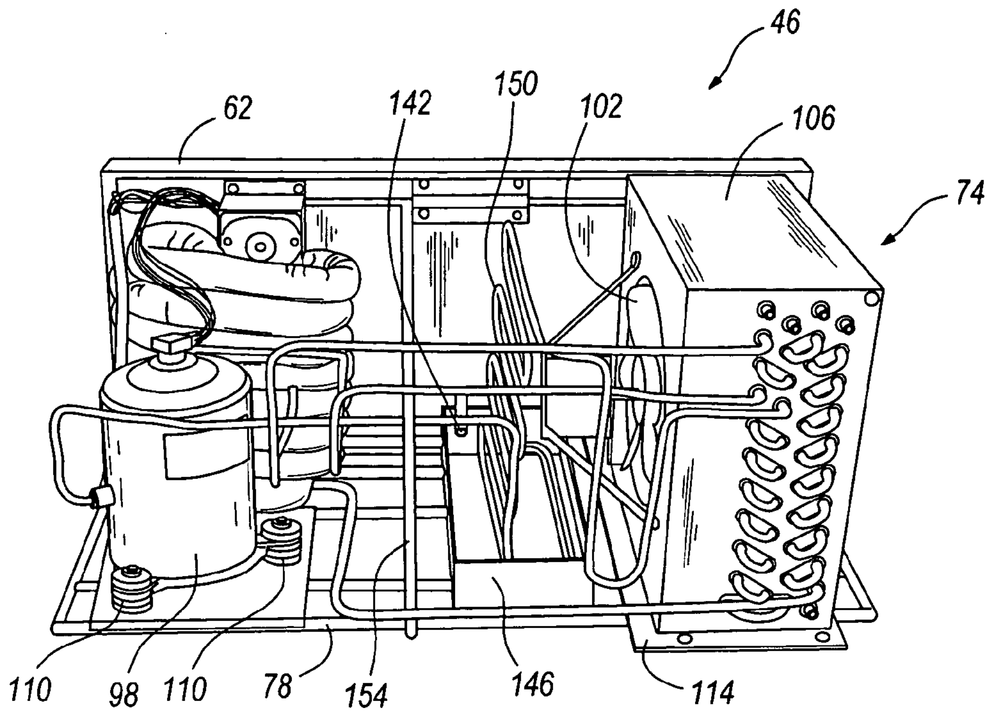
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FIG. 4

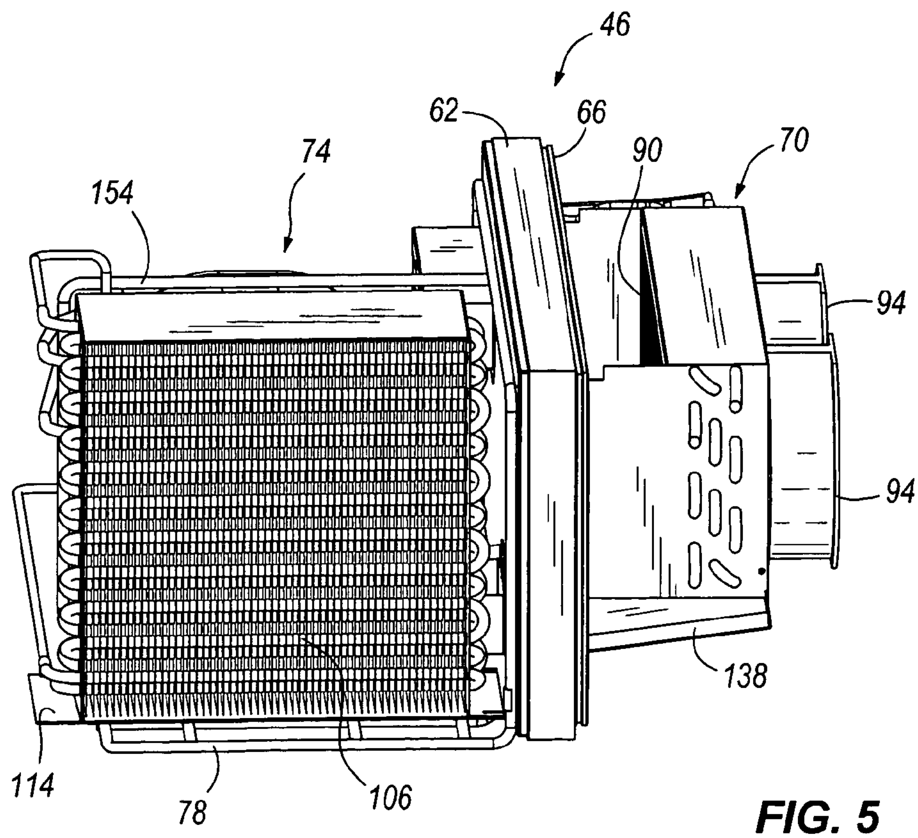
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FIG. 5

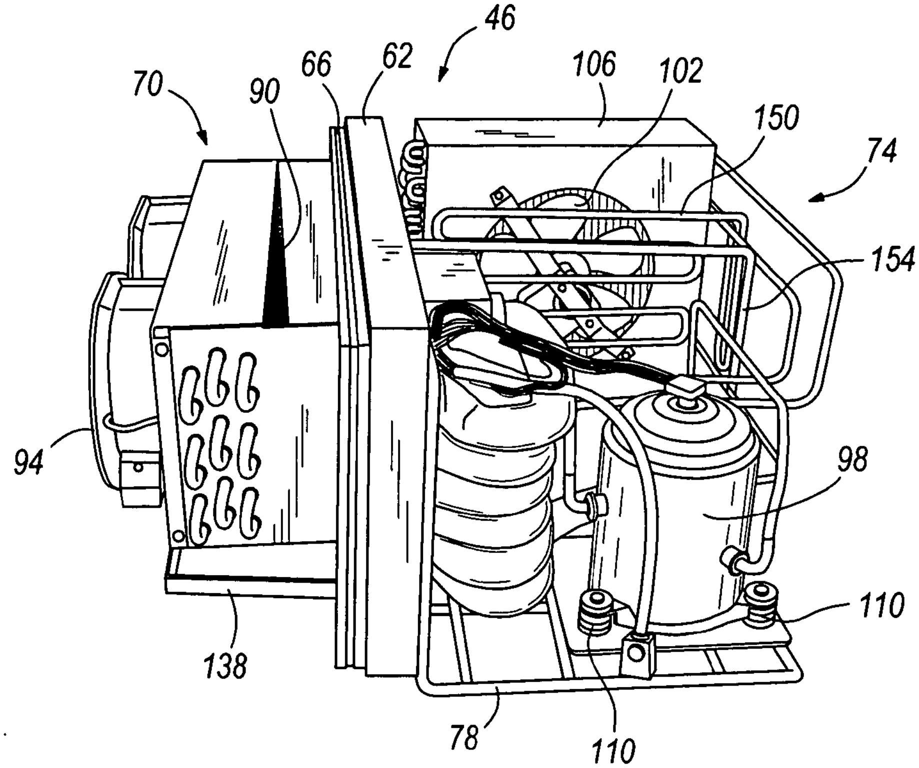
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FIG. 6

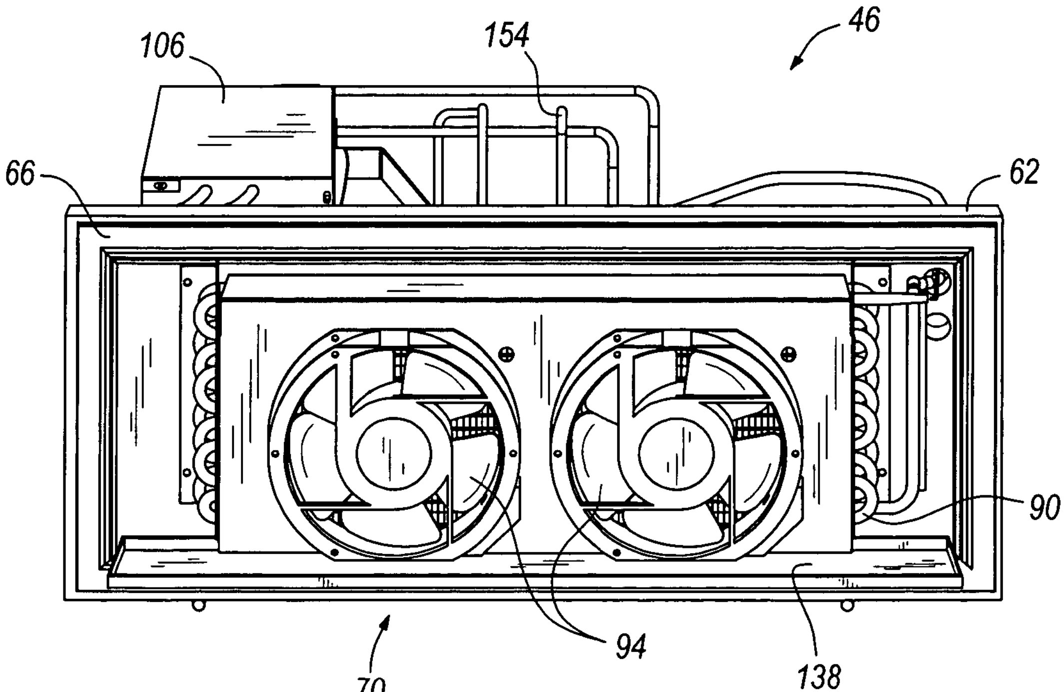
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FIG. 7

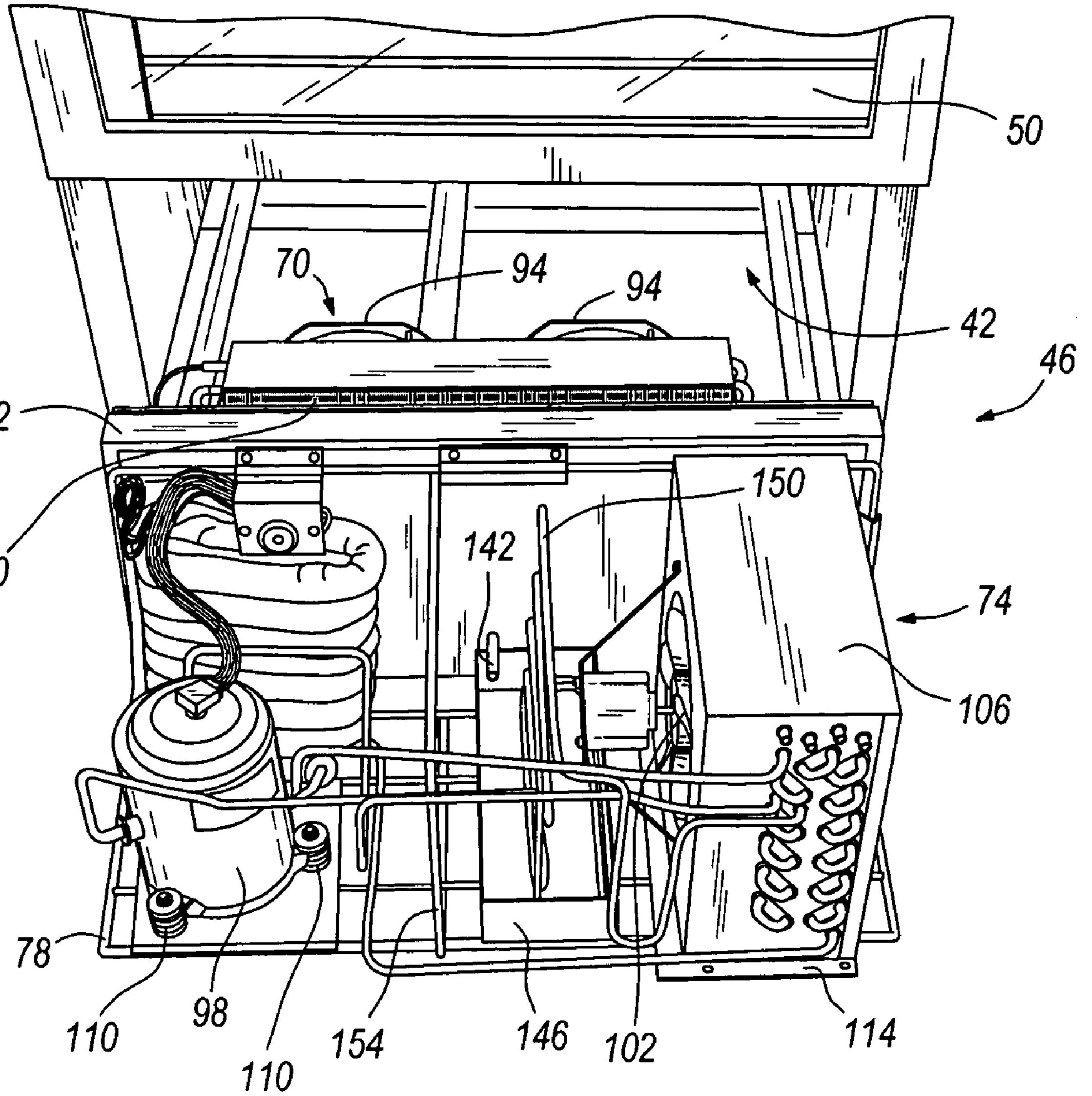

FIG. 8

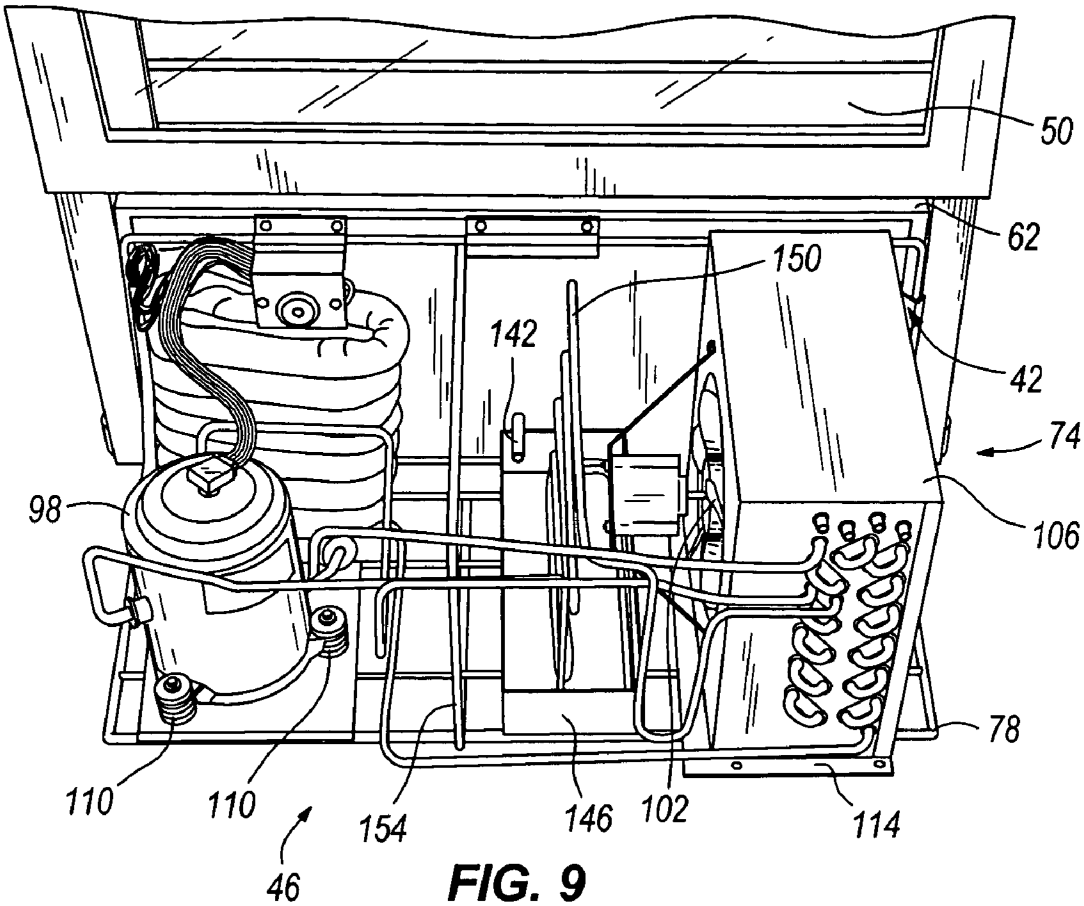
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FIG. 9

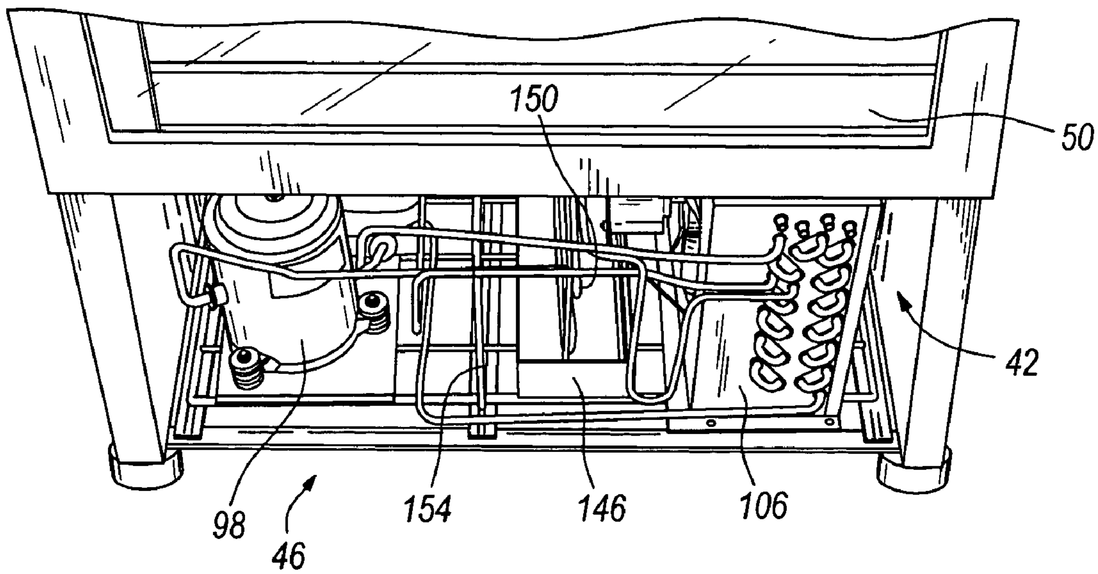
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FIG. 10

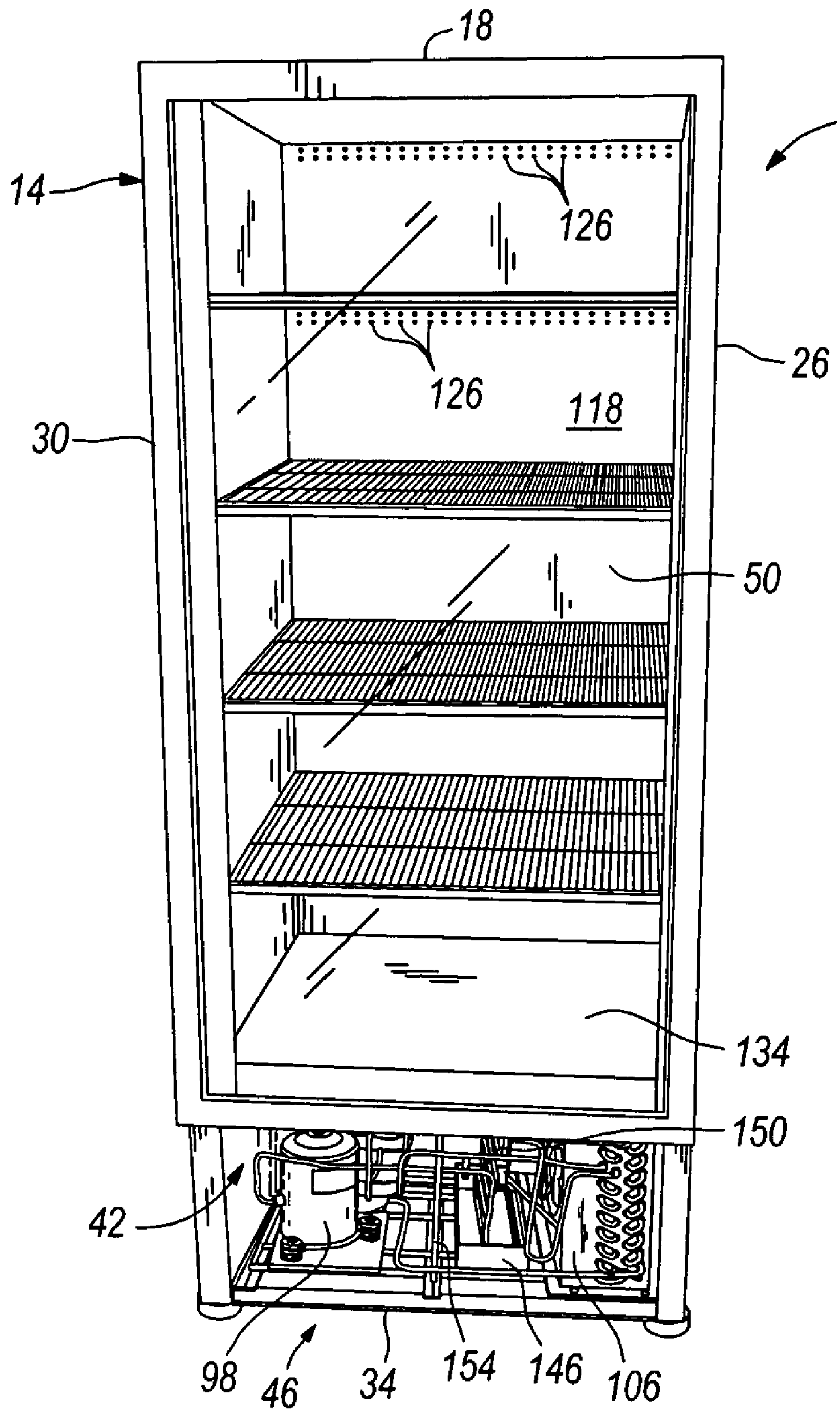

FIG. 11

MODULAR REFRIGERATION UNIT

FIELD OF THE INVENTION

[0001] This invention relates to a merchandising display cooler of the type used in convenience stores, snack bars and restaurants for storing and cooling drinks, particularly carbonated beverages provided in cans and bottles. More particularly, this invention relates to the refrigeration unit used for cooling the merchandiser and to the resultant air-flow distribution in the merchandiser.

BACKGROUND OF THE INVENTION

[0002] Typically, merchandising coolers have a vertical display area which is visible to the consumer through glass doors which may be hinged or which may slide for easy access to the display shelves positioned within the refrigerated compartment. The refrigerated compartment is cooled by a refrigeration unit typically consisting of an evaporator, a compressor, a condenser, and an expansion device (typically a capillary tube) arranged in a closed circuit refrigeration system and charged with a suitable refrigerant (e.g., R134a).

[0003] Merchandising coolers typically utilize a reverse-Rankine thermodynamic cycle refrigeration system, in which refrigerant vapor is compressed by the compressor to an elevated pressure and discharged into the condenser. While passing through the condenser, heat is rejected from the refrigerant, and the high-pressure refrigerant changes phase from a vapor to a liquid. The high-pressure liquid refrigerant is then throttled through the expansion device to a lower pressure, resulting in a phase change to a two-phase refrigerant (i.e., a liquid-vapor mixture). The low-pressure, two-phase refrigerant flows then passes through the evaporator where it absorbs heat and boils to a vapor. A fan typically draws air through the evaporator, where it is cooled as a result of the absorption of heat into the two-phase refrigerant. The cooled air is then routed to the interior of the refrigerated compartment. From the evaporator, the low pressure vapor is drawn into the compressor to repeat the reverse-Rankine thermodynamic cycle.

[0004] Conventionally, condenser and evaporator assemblies are positioned separately and remotely from each other within the walls of the cooler. Typically, the condenser assembly is located in the base of the cabinet and the evaporator assembly is located in the top of the cabinet. This was previously done to simplify the design of the insulated cabinet and minimize ducting of the refrigerated air.

[0005] This "split system" has inherent disadvantages which are apparent during assembly and servicing of the cooler cabinet. It will be appreciated that the condenser and evaporator assemblies cannot be tested until fully installed in the cabinet and that, if any problems are discovered, the cabinet must be at least partially disassembled to gain access to the assemblies, repair the assemblies, and retest the assemblies. Similarly, when a cooler which has been in use is found to be defective, the cooler must be put out of service in order to carry out the appropriate repairs.

SUMMARY OF THE INVENTION

[0006] Some embodiments of the present invention provide a modular refrigeration unit for use in an accessible compartment of a cooler, the accessible compartment including a first portion in communication with a display cabinet of the cooler and a second portion in communication with the environment. The modular refrigeration unit can include a support removably positioned within the accessible compartment, and a dividing wall mounted to the support and positioned between the first and second portions. The dividing wall can be adapted to sealingly engage a portion of the accessible compartment to insulate the first and second portions from one another. The modular refrigeration unit can further include a gas cooler assembly mounted to the support and positioned on one side of the dividing wall, and an evaporator assembly mounted to the dividing wall and positioned on the opposite side of the dividing wall from the gas cooler assembly. The gas cooler assembly can be positioned within the second portion of the accessible compartment, and the evaporator assembly can be positioned within the first portion of the accessible compartment. The modular refrigeration unit can further include CO_2 refrigerant adapted to be circulated between the evaporator assembly and the gas cooler assembly.

[0007] In some embodiments of the present invention, a cooler having a refrigerated display cabinet is provided. The cooler can include a display cabinet, and an accessible compartment including a first portion in communication with the display cabinet and a second portion in communication with the environment. The cooler can further include a modular refrigeration unit removably positioned within the accessible compartment. The modular refrigeration unit can include an evaporator assembly adapted for use with a CO_2 refrigerant, and a gas cooler assembly adapted for use with a CO_2 refrigerant. The evaporator assembly can be positioned within the first portion such that the evaporator is in communication with the display cabinet. The gas cooler assembly can be positioned within the second portion such that the gas cooler is in communication with the environment when the modular refrigeration unit is positioned within the accessible compartment.

[0008] Some embodiments of the present invention provide a method for replacing a modular refrigeration unit of a cooler. The method can include providing a first modular refrigeration unit removably positioned in an accessible compartment of the cooler, and providing a second modular refrigeration unit adapted to be removably positioned in an accessible compartment of the cooler. The first modular refrigeration unit can include a first gas cooler assembly and a first evaporator assembly adapted for use with a CO_2 refrigerant, and the second modular refrigeration unit can include a second gas cooler assembly and a second evaporator assembly adapted for use with a CO_2 refrigerant. The method can further include removing the first modular refrigeration unit from the accessible compartment, and inserting the second modular refrigeration unit into the accessible compartment. The method can further include operating the second modular refrigeration unit to circulate the CO_2 refrigerant through the second gas cooler assembly and the second evaporator assembly in a transcritical CO_2 refrigeration cycle.

[0009] In order to overcome the previously-stated problems, the present invention provides a modular refrigeration unit that utilizes carbon dioxide (CO_2) as a refrigerant. The modular refrigeration unit includes a gas cooler assembly having a gas cooler, and an evaporator assembly having an evaporator mounted on a common frame that is easily removable from the cooler for more efficient repair or replacement.

[0010] The CO_2 refrigeration cycle operates in a similar fashion to the reverse-Rankine refrigeration cycle, except the vapor CO_2 refrigerant is compressed to a pressure above the thermodynamic critical point of the CO_2 refrigerant. Consequently, when heat is rejected in the gas cooler (previously called the condenser), the vapor CO_2 refrigerant is cooled but does not change phase to a liquid. The cooled, high-pressure vapor CO_2 refrigerant is then throttled through an expansion device where, similar to the reverse-Rankine refrigeration cycle, the low-pressure vapor CO_2 refrigerant changes phase to a liquid-vapor mixture and boils to a vapor in the evaporator. While a transcritical CO_2 refrigeration cycle is somewhat less efficient than a traditional R134a reverse-Rankine refrigeration cycle, CO_2 is a desirable refrigerant because it is more environmentally friendly than R134a due to its lower global warming potential.

[0011] In accordance with one aspect of the invention, there is provided a modular refrigeration unit for use in an accessible compartment of a cooler. The modular refrigeration unit includes a wire-frame support, a dividing wall mounted to the wire-frame support, a gas cooler assembly mounted to the wire-frame support on one side of the dividing wall, and an evaporator assembly mounted to the opposite side of the dividing wall. The wire-frame support includes a forward portion that provides a convenient gripping location such that the modular refrigeration unit can be easily installed into and removed from the accessible compartment by an operator lifting and manipulating the modular refrigeration unit by the gripping location.

[0012] The dividing wall is adapted to sealingly engage a portion of the accessible compartment to define an insulated compartment for containing the evaporator assembly separate from the gas cooler assembly, which remains within a portion of the accessible compartment that is in fluid communication with the atmosphere. The gas cooler assembly includes a compressor, motorized fan, gas cooler, and collecting tray. The gas cooler assembly generally operates to receive the refrigerant from the evaporator assembly, cool the refrigerant, and return the refrigerant to the evaporator assembly. The evaporator assembly includes an evaporator coil associated with a fan that draws warmer return air from the refrigerated cabinet through the evaporator coil so that the emerging cooled air is forced into the cabinet for distribution.

[0013] In accordance with another aspect of the invention, a back wall of the cabinet is spaced from an inner back panel which extends along the height of the interior of the cabinet. The space between the inner back panel and the back wall defines a vertically extending air passage for cooled air flow. The air passage discharges cooled air into the cabinet at selected locations defined by openings formed in the inner back panel. The cooled air is discharged into the cabinet from the air passage and is directed toward the front of the cabinet, and then redirected down and around the forward portion of a lower plate of the cabinet. Once the return air bypasses the lower plate, it is redirected to a return air passage that is located in the interior floor.

[0014] Other features of the invention will become apparent to those skilled in the art upon review of the following detailed description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] **FIG. 1** is a side view of a merchandising display cooler utilizing a modular refrigeration unit of the present invention.

[0016] **FIG. 2** is a top view of the merchandising display cooler of **FIG. 1**.

[0017] **FIG. 3** is a perspective view of the modular refrigeration unit utilized in the merchandising display cooler of **FIG. 1**.

[0018] **FIG. 4** is a front perspective view of the modular refrigeration unit of **FIG. 3**.

[0019] **FIG. 5** is a right side perspective view of the modular refrigeration unit of **FIG. 3**.

[0020] **FIG. 6** is a left side perspective view of the modular refrigeration unit of **FIG. 3**.

[0021] **FIG. 7** is a rear perspective view of the modular refrigeration unit of **FIG. 3**.

[0022] **FIG. 8** is a top perspective view of the modular refrigeration unit of **FIG. 3** being aligned with an accessible compartment of the cooler of **FIG. 1**.

[0023] **FIG. 9** is a top perspective view of the modular refrigeration unit of **FIG. 3** being inserted into the accessible compartment of the cooler of **FIG. 1**.

[0024] **FIG. 10** is a top perspective view of the modular refrigeration unit of **FIG. 3** being completely installed into the accessible compartment of the cooler of **FIG. 1**.

[0025] **FIG. 11** is a front perspective view of the cooler of **FIG. 1** with the installed modular refrigeration unit.

[0026] Before any features of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. The use of letters to identify elements of a method or process is simply for identification and is not meant to indicate that the elements should be performed in a particular order.

DETAILED DESCRIPTION

[0027] Referring to **FIGS. 1 and 2**, a merchandising display cooler **10** made in accordance with the invention comprises a cabinet **14** having a top wall **18**, back wall **22**, right side wall **26**, left side wall **30**, and bottom wall **34**. An insulated interior floor **38** is vertically spaced from the bottom wall **34** so as define an accessible compartment **42** accommodating a refrigeration unit **46** (see **FIGS. 3-7**). A transparent door **50** is hinged to one of the side walls **26**, **30** and covers the front opening of the cabinet **14**. A peripheral seal **54** is mounted to the door **50** to keep the interior of the cabinet **14** airtight.

[0028] In the accessible compartment 42, the bottom wall 34, interior floor 38, and side walls 26, 30 each include a respective raised portion 58 that extends inwardly from the walls 26, 30, 34, 38. An insulated dividing wall 62 includes a peripheral seal 66 (as shown in FIG. 3) that sealingly engages the raised portions 58 within the accessible compartment 42.

[0029] The refrigeration unit 46 is comprised of an evaporator assembly 70 and a gas cooler assembly 74. The dividing wall 62 is mounted to a wire-frame support 78 (as shown in FIG. 3). The evaporator assembly 70 is mounted to one side of the dividing wall 62 to extend rearwardly toward the back wall 22 inside an insulated compartment 82. The gas cooler assembly 74 is mounted on the wire-frame support 78 on the opposite side of the dividing wall 62 such that the gas cooler assembly 74 extends forwardly of the dividing wall 62 toward the front of the accessible compartment 42. The gas cooler assembly 74 is thus accommodated beneath the forward portion of the interior floor 38. A cosmetically-pleasing, removable grill 86 is disposed beneath the door 50 and conceals the accessible compartment 42 and the modular refrigeration unit 46 from view.

[0030] With reference to FIGS. 3 and 7, the evaporator assembly 70 comprises an evaporator coil 90 mounted to the dividing wall 62 and an expansion device (e.g., a capillary tube, not shown). Two motorized fans 94 are mounted to the evaporator coil 90 to move air through the evaporator coil 90. As shown in FIGS. 3, 4, 6, 8 and 9, the gas cooler assembly 74 comprises a compressor 98, a motorized fan 102, and a gas cooler 106. The compressor 98 is mounted to the wire-frame support 78 through vibration damping mounts 110. The gas cooler 106 is mounted to the wire-frame support 78 through a support tray 114, and the fan 102 is mounted to the gas cooler 106 (as shown in FIGS. 4, 8 and 9).

[0031] CO_2 refrigerant is circulated in a closed circuit between the evaporator assembly 70 and the gas cooler assembly 74 in a transcritical CO_2 refrigeration cycle. The transcritical CO_2 refrigeration cycle operates in a similar fashion to the reverse-Rankine refrigeration cycle, except the vapor CO_2 refrigerant is compressed to a pressure above the thermodynamic critical point of the CO_2 refrigerant. Consequently, when heat is rejected from the CO_2 refrigerant in the gas cooler 106, the vapor CO_2 refrigerant is cooled to a cooled vapor rather than changing phases to a liquid. The cooled, high-pressure vapor CO_2 refrigerant is then throttled through the expansion device where, similar to the reverse-Rankine refrigeration cycle, the low-pressure vapor CO_2 refrigerant changes phase to a liquid-vapor mixture. The liquid-vapor mixture then boils to a vapor in the evaporator coil 90 due to heat exchange with the airflow passing through the evaporator coil 90, before being drawn back into the suction port of the compressor 98 for recirculation.

[0032] As used herein, the terms "evaporator assembly 70" and "evaporator coil 90" do not imply the use of any particular refrigerant (i.e., a two-phase refrigerant or a single-phase refrigerant). Rather, the terms should be generally construed to describe a heat exchanger assembly/coil functioning to transfer heat from an airflow passing through/over the heat exchanger assembly/coil to a refrigerant flowing through the heat exchanger assembly/coil.

[0033] To obtain desirable refrigeration characteristics from the CO_2 refrigerant, the transcritical CO_2 refrigeration cycle requires higher operating pressures compared to a reverse-Rankine refrigeration cycle using R134a, for example. In some applications, the pressure experienced in the gas cooler 106 in a transcritical CO_2 refrigeration cycle can exceed the pressure experienced in a condenser in a reverse-Rankine refrigeration cycle using R134a by as much as eightfold. Also, the corresponding pressure experienced in the evaporator coil 90 in a transcritical CO_2 refrigeration cycle can exceed the pressure experienced in an evaporator coil in a reverse-Rankine refrigeration cycle using R134a by as much as fifteenfold. As a result, the gas cooler 106 and evaporator coil 90 employ a heavy-duty construction to withstand the increased pressure of the transcritical CO_2 refrigeration cycle. Such heavy-duty construction may comprise an increased thickness of the walls of the tubing in the evaporator coil 90 and gas cooler 106. In addition, the thickness of the walls of the conduit utilized in the refrigeration unit 46 to fluidly connect the refrigeration components may also be increased to accommodate the increased pressure of the transcritical CO_2 refrigeration cycle.

[0034] In the closed circuit travel of the CO_2 refrigerant, CO_2 refrigerant exits the evaporator coil 90 as a low pressure vapor and is drawn into the suction port of the compressor 98. The compressor 98 pressurizes and discharges the vapor CO_2 refrigerant into the gas cooler 106 via a serpentine path of conduit. In the gas cooler 106, the high-pressure CO_2 vapor is cooled to a lower temperature as a result of the forced airflow generated by the fan 102. The cooled, high-pressure CO_2 vapor is then throttled to a low-pressure, two-phase (i.e., liquid-vapor) mixture by an expansion device. The low-pressure, two-phase CO_2 refrigerant then boils to a vapor as it is passed through the evaporator coil 90 as a result of the forced airflow generated by the fans 94. In other words, the low-pressure CO_2 refrigerant passing through the evaporator coil 90 absorbs the heat from the airflow as it is passed through the evaporator coil, thereby cooling the airflow.

[0035] Referring again to FIG. 1, the interior floor 38 is spaced from the back wall 22 and an inner back panel 118 extends along the height of the interior of the cabinet 14 from the interior floor 38 toward the top wall 18. The space between the inner back panel 118 and the back wall 22 defines an air passage 122. The evaporator assembly 70 is disposed inside the cabinet 14 so that cooled air emerging from the evaporator coil 90 will enter the air passage 122. The inner back panel 118 includes openings 126 (as also shown in FIG. 11) that discharge the cooled air from the air passage 122 into the refrigerated compartment.

[0036] A return air passage 130 is defined in the interior floor 38 and is in communication with the insulated compartment 82 of the evaporator assembly 70. The return air passage 130 receives warmed air from the refrigerated compartment and draws the warmed air through the evaporator coils 90 to cool the air and discharge it once again into the air passage 122.

[0037] In use, cooled air emerging from the evaporator coil 90 is forced into the air passage 122 and is discharged through the openings 126 into the refrigerated compartment of the cabinet 14. There is sufficient pressure in the emerging cooled air for at least some of this air to reach the front of the cabinet **14** adjacent the door **50**. The return air flows towards the interior floor **38** along the door **50**. The air flows rearwardly along the interior floor **38** and below an interior plate **134** where it enters the return air passage **130** and is drawn by the evaporator fan **94** into the insulated compartment **82** containing the evaporator assembly **70**.

[**0038**] Thus, as shown in **FIG. 1**, a circulatory air flow is created with cooled air rising along the back wall **22**, discharged forwardly into the refrigerated compartment, and returned on the interior floor **38** where it is returned to the evaporator assembly **70** to repeat the cycle. The openings **126** deliver cooled air directly to the bottom rear zone of the refrigerated compartment and afford better temperature control in that area.

[**0039**] It will be appreciated that the evaporator assembly **70** is enclosed by the insulated compartment **82** defined by the insulated interior floor **38**, the bottom wall **34**, the insulated dividing wall **62**, the insulated back wall **22** and the side walls **26, 30**. By virtue of its function, the evaporator coil **90** is very cold, and moisture carried by return air drawn through the return air passage **130** may be condensed upon passing through the evaporator coil **90**. Effectively, the evaporator coil **90** operates to dehumidify the air in the refrigerated compartment of the merchandising cooler **10**.

[**0040**] As shown in **FIGS. 3, 5, 6** and **7**, an evaporator pan **138** is mounted to the wire-frame support **78** and is positioned beneath the evaporator coil **90**. The pan **138** is shaped to collect any condensed moisture dripping from the evaporator coil **90**. A drain hole is formed into the evaporator pan **138** and is connected to a drain conduit **142** (as shown in **FIGS. 8 and 9**). The drain conduit **142** extends through the dividing wall **62** to discharge the collected moisture into a removable collection tray **146** (as shown in **FIGS. 3, 4**, and **8-10**).

[**0041**] Condensed moisture accumulated in the collection tray **146** can be used to define a pre-cooling stage to assist in cooling heated refrigerant emerging from the compressor **98** and passing through a serpentine coil **150** (as shown in **FIG. 4**) prior to entry into the gas cooler **106**. Conversely, the heated refrigerant flowing through the gas cooler **106** assists in evaporating any condensed moisture accumulated in the collection tray **146**. Other liquids and condensed water vapor from the refrigerated compartment of the cabinet **14** can also be drained into the collection tray **146**. Evaporation of the liquids accumulated in the collection tray **146** is further assisted by a forced airflow generated by the fan **102**. The airflow enters the accessible compartment **42** through the grill **86** at a location adjacent the right side wall **26**, then passes through the gas cooler **106** before exiting the accessible compartment **42** through the grill **86** at a location adjacent the left side wall **30**.

[**0042**] It will be understood that several variations may be made to the above-described embodiment of the invention. In particular, it will be understood that the nature of the refrigeration assembly as defined by the evaporator assembly **70** and the gas cooler assembly **74** may vary considerably. The relative proportions of the air passage **122** and the return air passage **130** may vary, as well as the location of the cold air outlets and return air outlets provided in the inner back panel **118** in accordance with the particular application for which the cabinet **14** is being used. Other variations may be apparent to those skilled in the art, the structure defined for cold air passages and warm air passages being inherently flexible to create a cooling environment adapted for any selected application.

[**0043**] The modular refrigeration unit **46** can be easily removed from the accessible compartment **42** by removing the grill **86** and sliding the unit **46** from the accessible compartment **42** (as shown in **FIGS. 8-11**). The wire-frame support **78** includes a forward gripping portion **154** (as shown in **FIGS. 3-10**) that provides the operator with a convenient gripping surface for moving the unit **46** into or out of the accessible compartment **42**. The forward gripping portion **154** is a substantially vertical member that is positioned forwardly of the gas cooler assembly **74**. The gripping portion **154** could also be oriented differently and could also be recessed within the gas cooler assembly **74**, however it is preferable for the forward gripping portion **154** to be accessible from the front of the unit **46**. Simple quick disconnect connections can be made to connect the unit **46** to a power source and a temperature sensor in the refrigerated compartment. The quick disconnect connections can be easily disconnected prior to removal and easily connected after installation.

[**0044**] During operation of coolers in the field, it is not uncommon for a refrigeration unit to need replacement or repair. Typically, a serviceperson is called, and the serviceperson is required to travel to the location of the cooler to examine the refrigeration unit. If major repairs are necessary, the serviceperson may not be able to repair the unit on location which could lead to the cooler being inoperable for an extended period of time. The present invention allows easy replacement of a damaged unit with an operable unit without the assistance of a serviceperson allowing store operators to self-service their own coolers. When a store operator determines that the unit needs repair or replacement, the store operator can request a replacement unit from an authorized replacement location. A replacement unit will be sent to the store operator via overnight courier or the like, and when received by the store-operator, the store operator can independently exchange the replacement unit for the old unit. The replaced unit can then be shipped back to a designated location by the store operator in the same packaging that the replacement unit was shipped. The returned unit can then be refurbished and repaired for reuse. This type of replacement program could be offered to store operators as part of an insurance program offered with the sale of the cooler.

[**0045**] The foregoing description of the present invention has been presented for purposes of illustration and description. Furthermore, the description is not intended to limit the invention to the form disclosed herein. Consequently, variations and modifications commensurate with the above teachings, and the skill or knowledge of the relevant art, are within the scope of the present invention. The embodiments described herein are further intended to explain best modes known for practicing the invention and to enable others skilled in the art to utilize the invention in such, or other, embodiments and with various modifications required by the particular applications or uses of the present invention.

[**0046**] Various aspects of the present invention are set forth in the following claims.

1. A modular refrigeration unit for use in an accessible compartment of a cooler, the accessible compartment including a first portion in communication with a display cabinet of the cooler and a second portion in communication with the environment, the modular refrigeration unit comprising:

a support removably positioned within the accessible compartment;

a dividing wall mounted to the support and positioned between the first and second portions, the dividing wall adapted to sealingly engage a portion of the accessible compartment to insulate the first and second portions from one another;

a gas cooler assembly mounted to the support and positioned on one side of the dividing wall, the gas cooler assembly positioned within the second portion of the accessible compartment;

an evaporator assembly mounted to the dividing wall and positioned on the opposite side of the dividing wall from the gas cooler assembly, the evaporator assembly positioned within the first portion of the accessible compartment; and

CO_2 refrigerant adapted to be circulated between the evaporator assembly and the gas cooler assembly.

2. The modular refrigeration unit of claim 1, wherein the support is a wire-frame support.

3. The modular refrigeration unit of claim 1, wherein the gas cooler assembly includes a compressor mounted to the support, a gas cooler mounted to the support, a motorized fan mounted to the gas cooler, and a collecting tray mounted to the support, the gas cooler in communication with the environment.

4. The modular refrigeration unit of claim 1, wherein the evaporator assembly includes an evaporator coil mounted to the dividing wall, and a fan mounted to the evaporator coil, the evaporator coil in communication with the display cabinet.

5. The modular refrigeration unit of claim 1, wherein the CO_2 refrigerant is circulated in a transcritical CO_2 refrigeration cycle.

6. A cooler having a refrigerated display cabinet, the cooler comprising:

a display cabinet;

an accessible compartment including a first portion in communication with the display cabinet and a second portion in communication with the environment; and

a modular refrigeration unit removably positioned within the accessible compartment, the modular refrigeration unit including

an evaporator assembly adapted for use with a CO_2 refrigerant, the evaporator assembly positioned within the first portion such that the evaporator is in communication with the display cabinet, and

a gas cooler assembly adapted for use with a CO_2 refrigerant, the gas cooler assembly positioned within the second portion such that the gas cooler is in communication with the environment when the modular refrigeration unit is positioned within the accessible compartment.

7. The cooler of claim 6, wherein the modular refrigeration unit includes:

a support coupled to the evaporator assembly and the gas cooler assembly, and

a dividing wall mounted to the support to separate the evaporator assembly and the gas cooler assembly.

8. The cooler of claim 7, wherein the evaporator assembly includes an evaporator coil mounted to the dividing wall and a fan mounted to the evaporator coil.

9. The cooler of claim 7, wherein the gas cooler assembly includes a compressor mounted to the support, a gas cooler mounted to the support, a fan mounted to the gas cooler, and a collecting tray mounted to the support.

10. The cooler of claim 6, further comprising an additional modular refrigeration unit adapted to replace the modular refrigeration unit for at least one of repair and disposal of the modular refrigeration unit.

11. A method for replacing a modular refrigeration unit of a cooler, the method comprising:

providing a first modular refrigeration unit removably positioned in an accessible compartment of the cooler, the first modular refrigeration unit having a first gas cooler assembly and a first evaporator assembly adapted for use with a CO_2 refrigerant;

providing a second modular refrigeration unit adapted to be removably positioned in an accessible compartment of the cooler, the second modular refrigeration unit having a second gas cooler assembly and a second evaporator assembly adapted for use with a CO_2 refrigerant;

removing the first modular refrigeration unit from the accessible compartment;

inserting the second modular refrigeration unit into the accessible compartment; and

operating the second modular refrigeration unit to circulate the CO_2 refrigerant through the second gas cooler assembly and the second evaporator assembly in a transcritical CO_2 refrigeration cycle.

12. The method of claim 11, further comprising:

disconnecting the first modular refrigeration unit from at least one of a power source and a temperature sensor using quick disconnects; and

connecting the second modular refrigeration unit from at least one of a power source and a temperature sensor using quick disconnects.

13. The method of claim 11, further comprising:

determining that the first modular refrigeration unit requires at least one of repair and replacement;

requesting the second modular refrigeration unit from a replacement location;

receiving the second modular refrigeration unit in packaging; and

shipping the first modular refrigeration unit to at least one of a repair location and a replacement location.

14. The method of claim 13, wherein shipping the first modular refrigeration unit includes shipping the first modular refrigeration unit in the packaging of the second modular refrigeration unit.

15. The method of claim 11, further comprising repairing the first modular refrigeration unit for reuse.

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