Sept. 10, 1963 J. E. KRUG ETAL 3,103,109

HOME APPLIANCE

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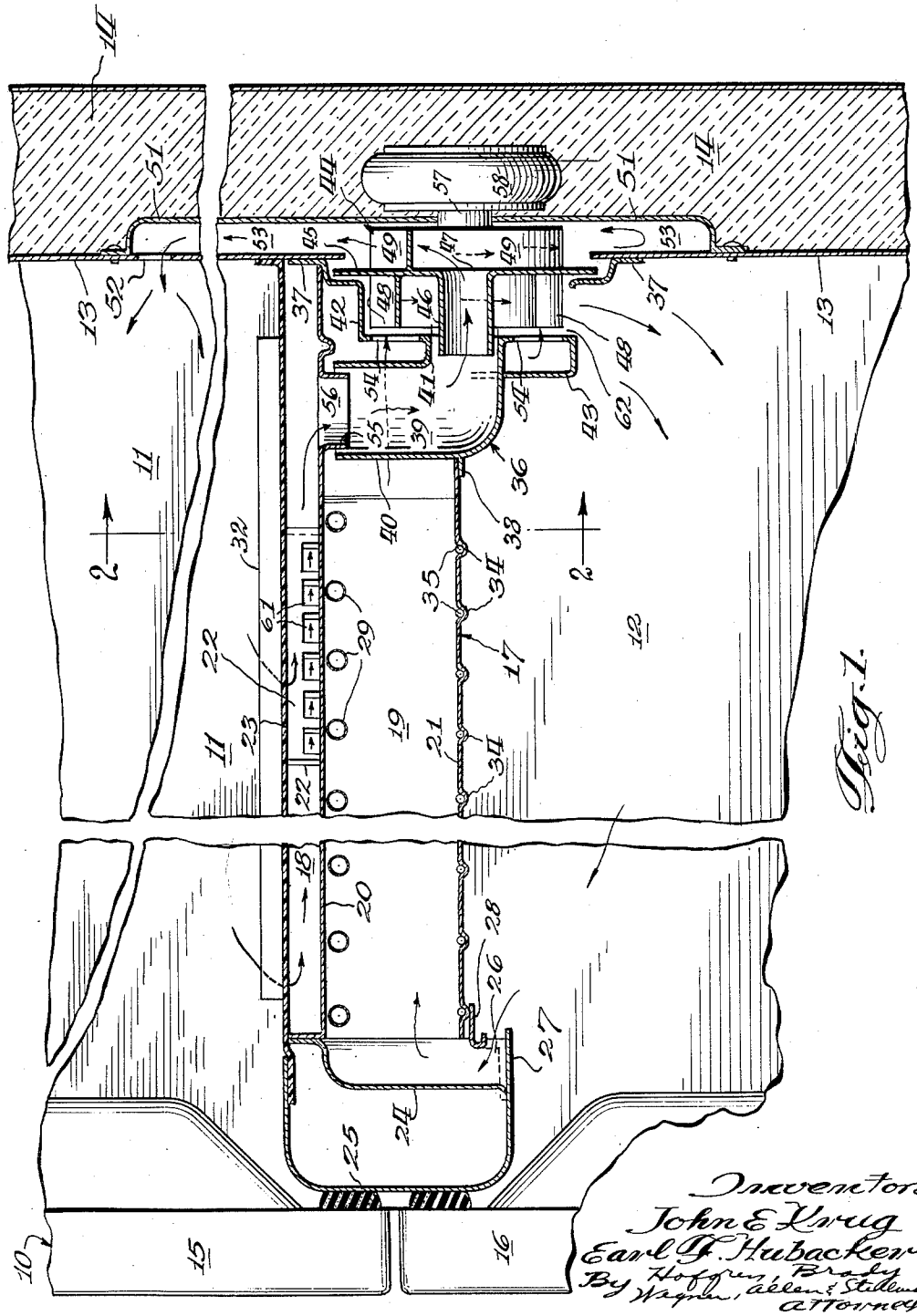


Fig. 1.

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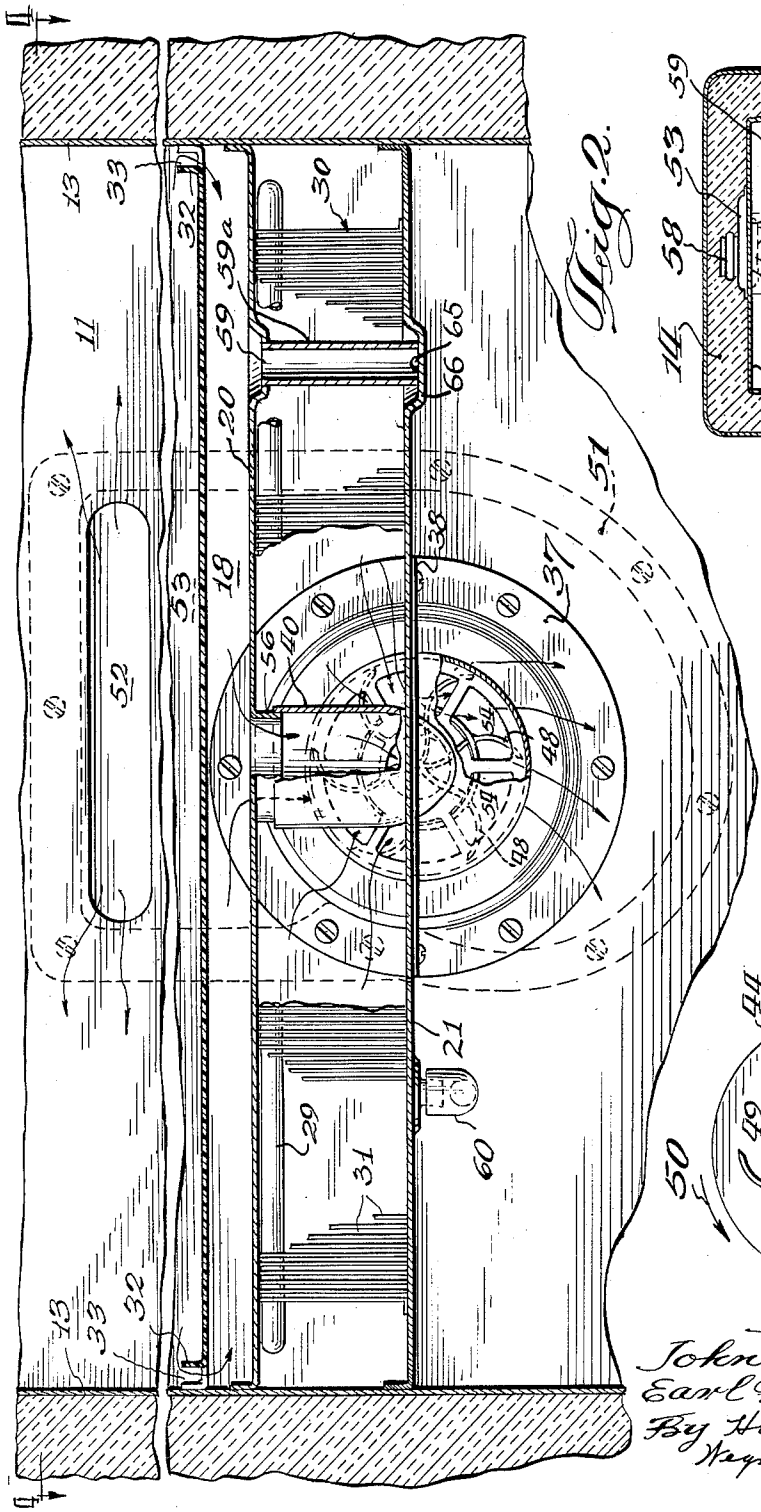


Fig. 2.

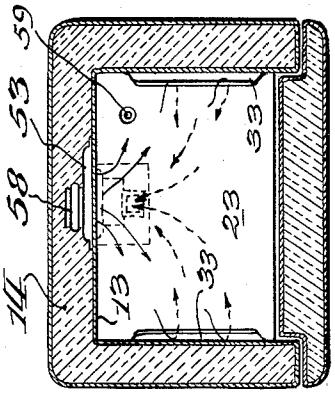


Fig. 4.

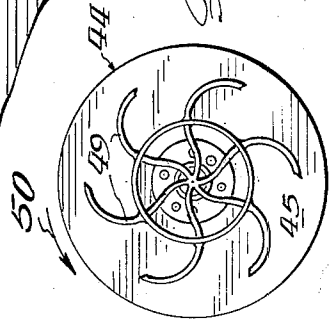


Fig. 3.

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# HOME APPLIANCE

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This invention relates to a refrigerating apparatus.

In certain types of refrigerating apparatus such as refrigerators having both an above freezing storage or refrigerator compartment and a below freezing storage or freezer compartment, it is customary to provide refrigerating means such as refrigerant evaporators for cooling each of these compartments separately. It has been proposed to provide a single evaporator structure for cooling the two compartments to different temperatures. In the apparatus of this invention improved single refrigerating means are provided for cooling both compartments in an efficient manner. One of the features of this invention is to provide an improved refrigerating apparatus in which first and second fluid passages are provided with a refrigerating means cooling the first passage to a lower temperature than the second passage.

A further feature of the invention is to provide an improved apparatus of the above type having first and second blower chambers communicating with respective first and second passages in combination with a rotatable blower having separate elements in each of said chambers for propelling air in separate streams therethrough.

A further feature of the invention is to provide an improved refrigerating apparatus comprising separate relatively low temperature and relatively high temperature chambers, a structural element between these chambers separating the chambers from each other, means forming a first fluid passage in said element, means forming a second fluid passage in said element, a refrigerating means associated with the element for cooling the one fluid passage to a lower temperature than the other fluid passage and means for propelling fluid through said passages and into the respective chambers.

Other features and advantages of the invention will be apparent from the following description of one embodiment of the invention as disclosed in the accompanying drawings. Of the drawings:

FIGURE 1 is a fragmentary vertical section through a refrigerator-freezer of the domestic type embodying the invention.

FIGURE 2 is a fragmentary vertical section taken substantially along line 2—2 of FIGURE 1.

FIGURE 3 is a detailed view in elevation of one side of the blower of this invention.

FIGURE 4 is a reduced sectional view taken substantially along line 4—4 of FIGURE 2.

In the embodiment shown in the accompanying drawings the apparatus is a two temperature refrigerator **10** having an upper first compartment **11** for storing fresh foods and the like at an above freezing temperature and a lower or second compartment **12** for storing frozen foods and the like. The two storage compartments **11** and **12** are formed from a single liner **13** that is insulated on the top, rear and sides by the usual insulation as indicated at **14** with the two compartments being closed by the customary insulated doors **15** and **16**.

Serving to separate the first and second compartments **11** and **12** is a structural element **17** arranged substantially horizontally. This element **17** contains a first air passage **18** at the upper portion thereof and a second air passage **19** therebeneath. The air passages **18** and **19** have a common dividing wall **20** of aluminum or other heat conducting material while the other side of the second passage **19** has a similar heat conducting wall **21**.



The wall **20** is provided with spaced baffles **22** on top of which rests a sheet **23** of a plastic material, such as polystyrene, defining the top of the first air passage **18**. The front of the element **17** or the edge adjacent the doors **15** and **16** is provided with an air deflector plate **24** and forwardly thereof with a decorative cover plate **25** enclosing the plate **24**. The forward edge of the bottom wall **21** is spaced from the air deflector plate **24** to provide an air inlet **26** which is bounded on the bottom by a rear horizontal edge portion **27** of the decorative plate **25** and on its top by trim strip **28** attached to the bottom of the forward edge of the wall **21**. Located within the second air passage **19** and adjacent the bottom of the wall **20** are the tubes **29** of a refrigerant evaporator **30** having parallel fins **31** of the customary type extending between the top and bottom walls **20** and **21** as shown in FIGURE 2.

The sheet **23** has its side and rear edges adjacent the liner **13** with its front edge joined to the decorative plate **25**. The side edges **32** are recessed as shown in FIGURES 2 and 4 in order to provide side air passages **33** through which air may flow from the upper or first chamber **11** into the first air passage **18**.

Press fitted within grooves **34** extending downwardly within the bottom wall **21** of the second passage **19** is a single tinsel wire heater **35** for defrosting purposes. Grooves **34** are embossed in plate **21** and are preferably sinusoidal.

The structural element **17** carries on its rear portion rearwardly of the evaporator **30** a blower housing **36**. This housing is secured to the back of the liner **13** by means of a flange **37** and to the rear edge portion of bottom wall **21** by means of the flange **38**. The housing **36** includes a downwardly and rearwardly extending air passage **39** formed by the vertical walls of a conduit **40** which is joined at its bottom to a rearwardly extending conduit **41**. The two conduits **40** and **41** are joined to form the downwardly and rearwardly extending air passage **39**. The conduit **41** rearwardly of the conduit **40** is essentially circular and is formed integrally with a generally cylindrical forward portion **42** of the housing **36**. The housing **36** has a secondary scroll element defined by member **43** which is located below flange **38**.

A double inlet blower wheel **44** is located within the scroll portion **42**. This blower wheel **44** includes a generally circular divided plate **45** which is provided with a tubular section **46** extending forwardly of the plate **45**. This tubular portion **46** extends forwardly to within the horizontal conduit **41** forming the bottom and rear end of the passage **39**. This tube **46** communicates through a rear opening **47** with the portion of the scroll rearwardly of the divider plate **45**.

A first series of scoop shaped vanes **48** is located on the front of the divider plate **45** within the scroll portion **42** while a similar set of vanes **49** is located on the rear surface of the divider plate **45**. The vanes **48** and **49** are of similar shape and the rear vanes **49** are shown in detail in FIGURE 3. The blower wheel **44** is rotatable in the direction indicated by the arrow **50** in FIGURE 3.

The rear portion of the blower wheel **44** including the rear vanes **49** is enclosed by a shroud **51** which is recessed into the insulation **14**. As is indicated in FIGURE 1, this shroud **51** extends from a point below the rear edge of the blower wheel **44** upwardly along the rear of the structural element **17** and to adjacent the top of the freezer first compartment **12**. The space between the shroud **51** and the liner **13** provides an air passage **53**.

The scroll portion **42** defines the rear portion of the second air passage **19** and is provided with a plurality of openings **54** in its forward wall so that air may flow from the second air passage **19** into the scroll portion **42**. In

order to provide for air flow from the first passage **18**, the wall **20** is provided with a downwardly extending flange **55** that is telescopically received within the upper edge of the conduit **40** to provide an air opening **56** into this conduit **40**.

The blower wheel **44** is mounted on a shaft **57** that extends through the rear of the shroud **51**. The shaft **57** is rotated by an electric motor **58** located within the insulation **14**.

The heater wire **35** in the bottom wall **21** is used for periodic defrosting and is operated at timed intervals in the customary manner to provide for automatic defrosting. Because the bottom wall **21**, the top wall **20** and the fins **31** are of heat conducting material heat from these wires readily defrosts all portions of the structure. The defrost water from within the passage **18** flows down the plate **20** and through a drain opening **59** that includes a vertical pipe **59***a* extending between the top wall **20** and bottom wall **21**. From the bottom of the pipe **59***a* the water flows through an opening **65** into a sump **66** which when filled with water causes the water to flow over the top surface of the bottom wall **21** and out the conduit **60** for disposal in the customary manner. The provision of the sump **66** prevents mingling of air streams in passages **18** and **19** as the water (not shown) remaining in sump **66** results in an ice plug forming therein when the apparatus is operating in its normal manner so that this ice plug blocks the opening **65**. In this regard it should be noted that the top of this opening **65** is beneath the top of the sump **66**. The actual defrosting apparatus and its operation are purely conventional and for that reason are not further illustrated.

The operation of the refrigerating apparatus is as follows. With the motor **58** operating the blower wheel **44** in the manner described, air within the first compartment **11** is drawn through the side openings **33** into the first air passage **18**. The air is drawn through a path directed by the baffles **22** having a plurality of openings **61** into rear air opening **56**. The air flows through this opening and downwardly in air passage **39**. From the bottom of this air passage the air is drawn rearwardly through the tube **46** to the rear side of the divider plate **45**. This flow of air is set up by the rotating vanes **49**. These rotating vanes propel the air outwardly within the shroud **51** and then upwardly to the top of the shroud **51**. The air then flows forwardly through the top opening **52** in the passage **53** and back into the first compartment **11** to be recirculated through the cooling passage **18**.

While the air from the first compartment **11** is flowing through the air passage **18** it gives up heat to the cold passage wall **20** and then to the evaporator **30** therebeneath. However, as this air does not directly contact the evaporator it is cooled only to an above freezing temperature so that the compartment or chamber **11** may be used for the storage of fresh food.

The rotation of the blower wheel **44** causes the air in the second compartment **12** to be drawn through the opening **26** into the forward end of the second air passage **19**. The air is then drawn rearwardly in this passage **19** in direct contact with the evaporator tubes **29** and the fins **31** where it is chilled to a below freezing temperature. The air then flows around the conduits **40** and **41** and through the openings **54** into the scroll portion **42**. The rotating vanes **48** then propel the air downwardly through an opening **62** in the bottom of the scroll portion **42** and back into the second compartment or chamber **12** to complete the circuit.

Thus, with this invention a single evaporator **30** is used to cool both the above freezing chamber **11** and the below freezing chamber **12**. Furthermore, the evaporator and the necessary air passages are located in a structural element **17** which is used to separate the two chambers. In addition, this structural element **17** also carries the blower **44** which propels the air not only through the passages for cooling but also directs it through the



two compartments **11** and **12**. The structural element **17** being a self-contained unit may be located as desired within the apparatus to define the dimensions of the two chambers and if desired more than one such element may be used.

The baffles **22** cause air to be distributed over the upper wall **20** for better heat transfer.

The structure of this invention results in a less than normal deposition of frost. This is true because the only air that contacts the evaporator **30** directly is relatively dry air from the freezer or second chamber **12**. The air from the above freezing chamber **11** which is relatively moist does not directly contact the evaporator as this air is confined to the passage **18** during the cooling of this air. This also results in the air in the chamber **11** being relatively humid at all times as it is not dehumidified by the heavy deposition of frost therefrom so that food kept within the chamber **11** is maintained in a much fresher condition than where the air contacts the evaporator directly.

The blower wheel **44** operates as a single blower to move two separate streams of air and to prevent the streams of air from substantial intermingling. This permits a more compact construction so that the operating parts except the motor **58** are easily mounted on the structural element **17**.

As can be seen in FIGURE 2, air entering the openings **33** for flow into the upper passage **18** scrubs the adjacent sides of the inner liner **13** in the areas adjacent the structural element **17**. This aids in preventing the accumulation of frost on this portion of the liner **13** which would normally occur because of this portion of the liner being cooled more than other portions of the liner by reasons of heat conduction through the metal parts to the evaporator **30**.

Having described our invention as related to the embodiment shown in the accompanying drawings, it is our intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1. Refrigerating apparatus, comprising: a structural element; means including a conductive plate forming a first fluid passage in said element; means including said plate forming a second fluid passage in said element; a refrigerating means in thermal transfer association with said passages for cooling said first passage to a subfreezing temperature and said second passage to an above-freezing temperature; and a housing carried on said structural element defining two blower chambers communicating respectively with said first and second fluid passages.

2. Refrigerating apparatus, comprising: insulative wall means defining a space to be refrigerated; and a unitary assembly installed as a unit in said space to divide the space into two portions, said assembly including a structural element, means forming a first fluid passage in said element, means forming a second fluid passage in said element, said passages being in thermal conducting relationship with each other, refrigerating means in said first passage in thermal conducting relationship with said second passage, means carried by said structural element forming a first blower chamber, a first blower in said first blower chamber, means carried by said structural element forming a second blower chamber in said element communicating with said second passage, a second blower in said second blower chamber, and a motor carried in said wall means and provided with a shaft carrying each of said blowers.

3. Refrigerating apparatus, comprising: a structural element; means forming a first air passage in said element; means forming a second air passage in said element, said passages being in thermal conducting relationship with each other; a refrigerating means associated

with said element for cooling said first passage to a lower temperature than said second passage; means forming a first blower chamber in said element communicating with said first passage; means forming a second blower chamber in said element adjacent said first blower chamber communicating with said second passage; and a rotatable blower located in said first and second blower chambers including first blower elements in said first blower chamber for propelling air therethrough, second blower elements in said second blower chamber for propelling air therethrough and a dividing element separating said first and second blower chambers to prevent substantial mixing of air therebetween.

4. Refrigerating apparatus, comprising: a structural element; means forming a first air passage in said element; means forming a second air passage in said element, said passages being in thermal conducting relationship with each other; a refrigerating means in said first passage for cooling said first passage to a lower temperature than said second passage; means forming a first blower chamber in said element communicating with said first passage; means forming a second blower chamber in said element adjacent said first blower chamber communicating with said second passage; and a rotatable blower located in said first and second blower chambers including a dividing element separating said first and second blower chambers to prevent substantial mixing of air therebetween, first blower elements on said dividing element in said first blower chamber for propelling air therethrough, second blower elements on said dividing element in said second blower chamber for propelling air therethrough and an air conduit communicating with said second air passage and extending through said first blower chamber and said dividing element into said second blower passage.

5. Refrigerating apparatus, comprising: means forming a relatively low temperature first chamber; means forming a relatively high temperature second chamber; a structural element between said chambers separating said chambers from each other; means forming a first air passage in said element communicating with said first chamber; means forming a second air passage in said element communicating with said second chamber; a refrigerating means associated with said element for cooling said first passage to a lower temperature than said second passage; first means integrally associated with said element for moving fluid through said first passage and through said first chamber; second means integrally associated with said element for moving fluid through said second passage and through said second chamber; and a single drive means integrally associated with each of said fluid moving means for operating said first and second fluid moving means concurrently.

6. Refrigerating apparatus, comprising: means forming a relatively low temperature first chamber; means forming a relatively high temperature second chamber; a structural element between said chambers separating said chambers from each other; means forming a first air passage in said element communicating with said first chamber; means forming a second air passage in said element communicating with said second chamber; means forming a first blower chamber in said element communicating with said first passage and with said first chamber; a first blower in said first blower chamber; means forming a second blower chamber in said element communicating with said second passage and with said second chamber; a second blower in said second blower chamber; a single drive means for operating said blowers concurrently; and a refrigerating means in said first passage in thermal conducting relationship with said second passage for cooling said first passage to a lower temperature than said second passage.

7. Refrigerating apparatus, comprising: means forming a relatively low temperature first chamber; means forming a relatively high temperature second chamber; a structural element between said chambers separating said chambers from each other; means forming a first air passage in said element communicating with said first chamber; means forming a second air passage in said element communicating with said second chamber; means forming a first blower chamber in said element communicating with said first passage and with said first chamber; means forming a second blower chamber in said element adjacent said first blower chamber communicating with said second passage and with said second chamber; and a rotatable blower located in said first and second blower chambers including first blower elements in said first blower chamber for propelling air therethrough, second blower elements in said second blower chamber for propelling air therethrough and a dividing element separating said first and second blower chambers to prevent substantial mixing of air therebetween.

8. Refrigerating apparatus, comprising: means forming a relatively low temperature first chamber; means forming a relatively high temperature second chamber; a structural element between said chambers separating said chambers from each other; means forming a first air passage in said element communicating with said first chamber; means forming a second air passage in said element communicating with said second chamber; means forming a first blower chamber in said element communicating with said first passage and with said first chamber; means forming a second blower chamber in said element adjacent said first blower chamber communicating with said second passage and with said second chamber; and a rotatable blower located in said first and second blower chambers including a dividing element separating said first and second blower chambers to prevent substantial mixing of air therebetween, first blower elements on said dividing element in said first blower chamber for propelling air therethrough, second blower elements on said dividing element in said second blower chamber for propelling air therethrough and an air conduit communicating with said second air passage and extending through said first blower chamber and said dividing element into said second blower passage.

9. The refrigerating apparatus of claim 2 wherein said blowers are mechanically interconnected for simultaneous operation.

10. Refrigerating apparatus, comprising: means forming a relatively low temperature first chamber; means forming a relatively high temperature second chamber; a structural element; means forming a first air passage in said element communicating with said first chamber; means forming a second air passage in said element communicating with said second chamber; a refrigerating means associated with said element for cooling said first passage to a lower temperature than said second passage; first means integrally associated with said element for moving fluid through said first passage and through said first chamber; second means integrally associated with said element for moving fluid through said second passage and through said second chamber; and a single drive means integrally associated with each of said fluid moving means for operating said first and second fluid moving means concurrently.

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