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[54] **FORCED AIR FREEZER**
9 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **62/408,** 62/419
[51] **Int. Cl.** **F25d 17/04**
[50] **Field of Search** 62/408, 419

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ABSTRACT: A refrigeration apparatus that has substantially uniform temperature throughout a storage enclosure in the apparatus comprising boundary walls defining the enclosure, an air duct substantially coextensive with a major portion of one of the walls and having edges adjacent others of the walls that are adjacent the one wall, peripheral discharge means at the air duct edges for directing air from the duct along the adjacent wall and toward a second wall that is directly opposite the one wall for flow of the discharge air along this second wall also, an air inlet adjacent one end of the duct for receiving air from the enclosure including the air that flows into the enclosure from along the second wall, means for forcing air through the air duct and means for refrigerating the duct air.

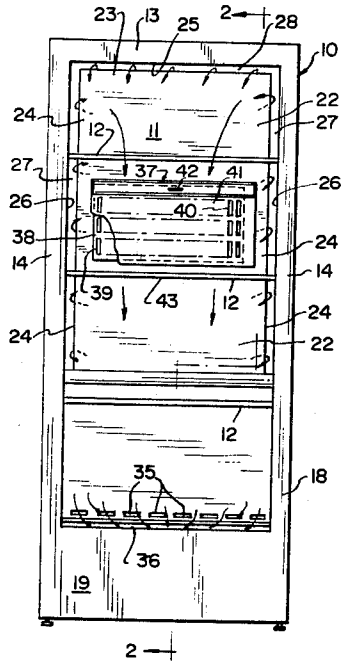


FIG. 1

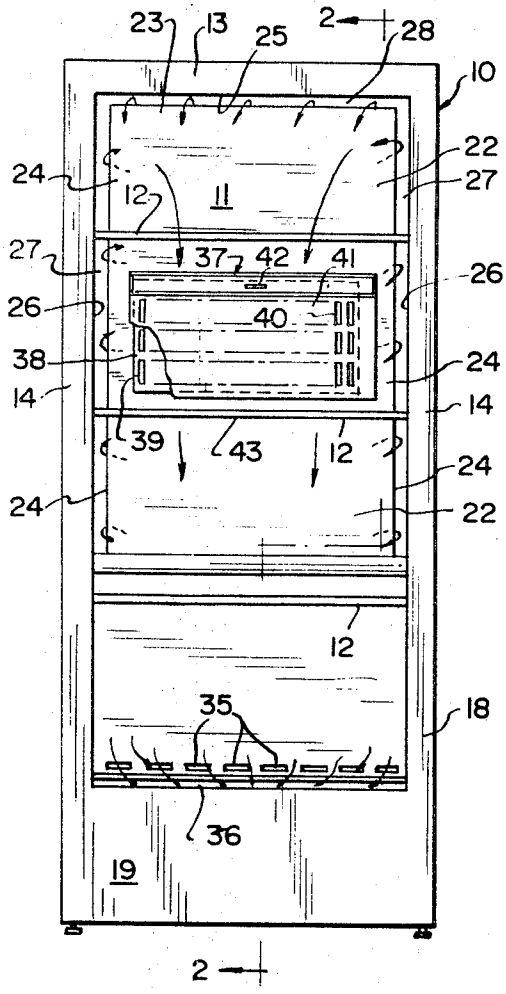
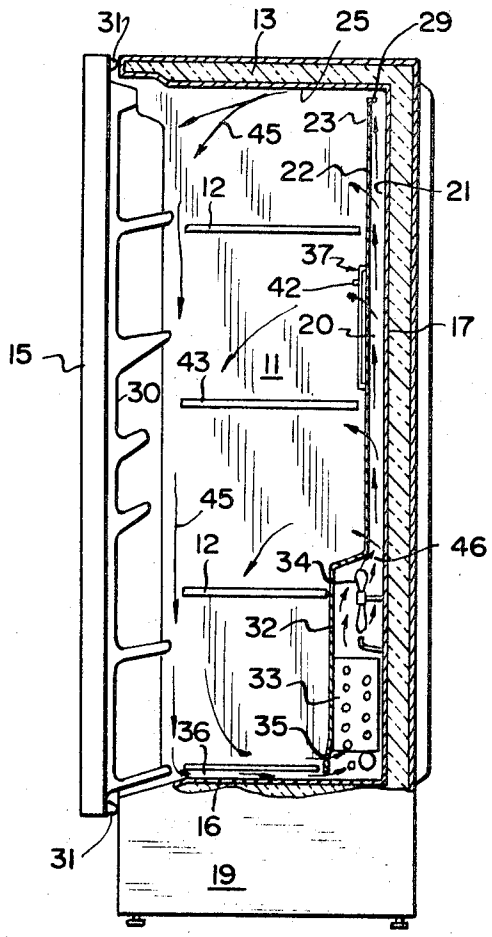


FIG. 2



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FORCED AIR FREEZER

One of the features of this invention is to provide a refrigeration apparatus, including an air duct means, that distributes the air along the inner surfaces of walls defining the storage enclosure in the apparatus so that the temperature throughout the storage enclosure is substantially uniform with a very small temperature difference between any portion of the enclosure space and any other portion of this space.

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

FIG. 1 is a semidiagrammatic front elevational view of an upright household freezer embodying the invention but omitting the door that closes the usual front access opening.

FIG. 2 is a vertical sectional view substantially along line 2–2 of FIG. 1 but including the front access door.

In the embodiment illustrated in the drawings the freezer **10** is an upright freezer that comprises boundary walls defining a storage enclosure space **11** that may be separated into sections in the usual manner by the usual shelves **12**. These boundary walls that define the enclosure **11** comprise a top wall **13**, a pair of opposite sidewalls **14**, a front wall **15**, a bottom wall **16** and a rear wall **17**. These walls together comprise a cabinet **18** in the bottom of which is the usual machinery compartment **19**.

Located to be substantially coextensive with a major portion of one of the walls **15—18**, here illustrated as the rear wall **17**, is an air duct means **20** that is defined by the interior surface **21** of the rear wall **17** and a baffle **22** spaced forwardly of the surface **21**. The baffle **22** which as shown in FIG. **1** is generally rectangular, has top **23** and side **24** edges spaced from the corresponding surfaces **25** and **26** of the top **13** and side **14** walls to provide the spaces **27** and **28** that comprise peripheral discharge means at these edges.

The top and side edges **23** and **24** of the baffle **22** are provided with right angle flanges illustrated at **29** in FIG. **2** that extend toward the rear wall surface **21**, and are closely spaced therefrom to partially restrict air discharge from duct **20** in order to ensure an even discharge of air around the periphery of baffle **22**.

As is evident from FIGS. **1** and **2**, the spaces **27** and **28** which comprise the peripheral discharge means for the air duct are located adjacent the top **13** and side **14** wall corners so that the angular relationship of these walls with the rear wall **17** serves to direct the air exiting around the edges of the baffle **22** along the inner surfaces of the top and sidewalls and toward the front wall **15** as indicated by the air flow arrows in the FIGS. This produces a wiping action not only along the inner surfaces of the top **13** and side **14** walls but also directs this air toward the inner surface of the front wall **15** and down this wall toward the bottom of the enclosure space **11**.

Thus, the flow of air through the air duct **20** and along the wall surfaces **21**, **25** and **26** as illustrated by the arrows **44** and past the region of the door gasket **31** and the inner surface of door **30** comprising wall **15** as illustrated by the arrows **45** serves to wipe the inner surfaces of the walls and immediately pick up and intermingle warm air from the interior warm spots along these walls. As can be noted from the drawings, this pickup of warm air created by the warm spots is immediate.

The duct **20** is provided with an air inlet means **46** adjacent one end of the duct for receiving air from the enclosure **11** including the air from along the second or front wall **15**. This air inlet means in the embodiment illustrated is adjacent the lower end of the duct **20** which communicates directly with a housing **32** that is spaced a greater distance forwardly of the rear wall surface **21** than is the baffle **22** in order to provide space for a lower finned refrigerant evaporator **33** and an upper power driven blower means **34** in the form of a fin as illustrated.

The bottom of the housing **32** beneath the evaporator **33** communicates with the enclosure space **11** to receive air therefrom by way of openings **35** which are adjacent the bottom wall **16** of the cabinet. Air is also received into the bottom

of the housing **32** from a passage **36** along the inner surface of the bottom wall **16** that communicates with the bottom edge of the door **30**.

As stated earlier, the refrigerated air duct **20** is substantially coextensive with a major portion of the rear wall surface **21** in order to achieve uniform distribution of the refrigerated air through the enclosure **11**. This major portion is more than 50 percent of this surface so that there will be no great temperature gradient between any pair of spatial portions within the enclosure **11**. In one embodiment of the invention the temperature difference between any pair of portions of the interior space was never more than about 2° or 3° F. once the space **11** had reached a stable temperature condition, that is, once the interior and items stored therein had reached a fixed refrigeration temperature. In this embodiment the major portion of the one wall with which the air duct was coextensive was about 70 percent of the wall surface.

Even when the storage space **11** contains a considerable amount of stored material such as frozen food the air flow conditions which as described contribute to the even temperature through the space **11** are not changed because the stored food does not materially interfere with the air flow pattern. This is true because the air flow is along and wipes the wall surfaces rather than being primarily through the center of the space. In the illustrated air flow pattern the air in the duct **20** of course wipes the rear wall surface **21** first before flowing along and wiping the surfaces of the top **13** and side **14** walls. Any warm spot surfaces along these walls due to heat leaks through the walls are immediately refrigerated and the heat leakage nullified by immediate mingling with the flowing refrigerated air stream. Heat leaks of course are present in all refrigerated structures because perfect insulation from the exterior is impossible to attain. Then the flowing air is directed by the walls themselves past the gasket **31**, down along the interior of the door **15** and finally along the surface **36** of the bottom wall **16** and from there back into the bottom of the housing **32** for flow upwardly through the evaporator **33** and back to the fan **34** for recirculation.

In the illustrated embodiment which is an upright food freezer there is provided a flow control valve means **37** in the duct defining baffle **22** that is movable between open and closed positions for passing refrigerated air directly from the air duct **20** into the enclosure space **11** where it can be used for direct contact with unfrozen materials such as foods in order that they will be frozen rapidly and completely. In the illustrated embodiment this valve means comprises a slidable shutter or plate **38** that is slidable back and forth horizontally to align a series of openings **39** in the shutter **38** with a similar series of openings **40** in the portion **41** of the baffle **22**. As can be seen, the shutter **38** is behind the baffle portion **41** and is operated by means of a protruding handle **42**. When the shutter **38** is moved to align its openings **39** with the openings **40** then refrigerated air flows directly through the aligned openings into the enclosure space **11**. Unfrozen food placed on a shelf **43** in front of these openings will be immediately frozen. After this has occurred the shutter **38** may then be moved to the right, in the illustrated embodiment, so that the openings **39** and **40** are out of alignment with the result that the air duct and air distribution means function in the described manner to maintain the substantially uniform temperature throughout the interior of the cabinet.

We claim:

1. Refrigeration apparatus having substantially uniform temperature throughout a storage enclosure therein, comprising: boundary walls defining said enclosure; an air duct means substantially coextensive with a major portion of one of said walls and having edges adjacent to but spaced from others of said walls; peripheral discharge means at said air duct means edges for providing streams of air at said edges directed along said adjacent walls and toward a second wall that is directly opposite said one wall for flow along said second wall; an air inlet means adjacent one end of said duct means for receiving air from said enclosure including air from along said second

wall; means for forcing air through said air duct; and means for refrigerating said duct air.

2. The apparatus of claim 1 wherein said second wall comprises an access door having edge sealing means past which said air flows thereby carrying with it any exterior air leakage past said sealing means.

3. The apparatus of claim 1 wherein said means for forcing air through said duct means comprises blower means adjacent said duct air inlet means.

4. The apparatus of claim 1 wherein said means for refrigerating said duct air comprises a refrigerant evaporator, a housing therefor communicating with said storage enclosure and with said duct means entrance, and blower means in said housing for forcing air over said evaporator and into and through said duct means.

5. The apparatus of claim 4 wherein said evaporator, housing and blower means are positioned at said one wall adjacent said major portion of said one wall and adjacent said air inlet means to the duct means.

6. The apparatus of claim 2 wherein said one wall is a rear wall, said adjacent walls are top and sidewalls and said other wall is a front wall.

7. The apparatus of claim 6 wherein said means for refrigerating said duct air comprises a refrigerant evaporator, a housing therefor communicating with said storage enclosure and with said duct means entrance, and blower means in said housing for forcing air over said evaporator and into and through said duct means, and said evaporator, housing and blower means are positioned at said one wall adjacent said major portion of said one wall and adjacent said air inlet means to the duct means and above a bottom wall of said enclosure.

8. Refrigeration apparatus having substantially uniform temperature throughout a storage enclosure therein, comprising: boundary walls defining said enclosure; an air duct means substantially coextensive with a major portion of one of said walls and having edges adjacent others of said walls; peripheral discharge means at said air duct means edges for directing air from said duct along said adjacent walls and toward a second wall that is directly opposite said one wall for flow along said second wall; an air inlet means adjacent one end of said duct means for receiving air from said enclosure including air from along said second wall; means for forcing air through said air duct; means for refrigerating said duct air; and air flow control valve means in said duct means movable between open and closed positions for passing refrigerated air directly into said storage enclosure.

9. The apparatus of claim 8 wherein said valve means comprises a slidable plate having openings adapted to register with openings in said duct means.