Sept. 18, 1956 F. S. HOLDERLE ET AL 2,763,135

REFRIGERATED DISPLAY CASE

Filed Nov. 18, 1954 2 Sheets-Sheet 1

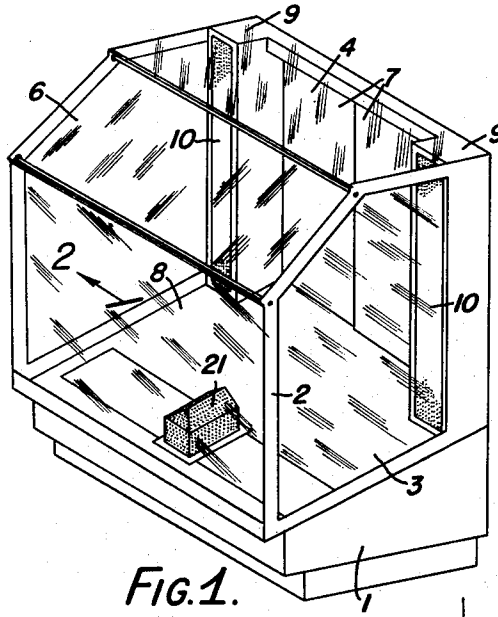


FIG. 1.

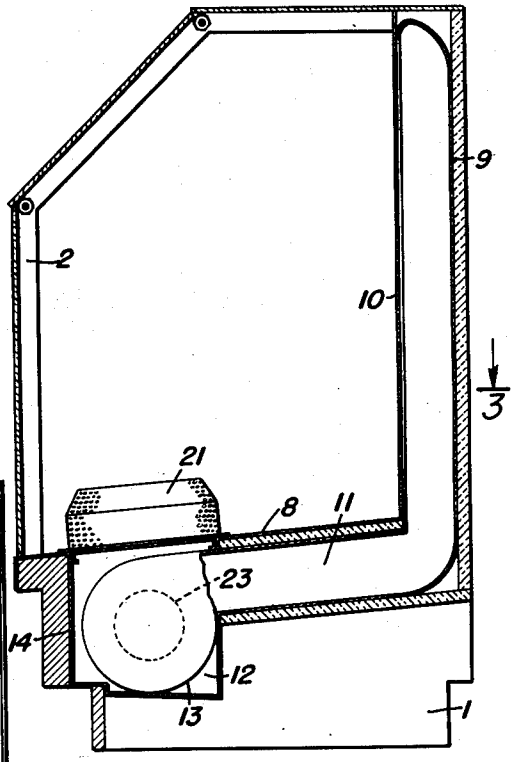


FIG. 2.

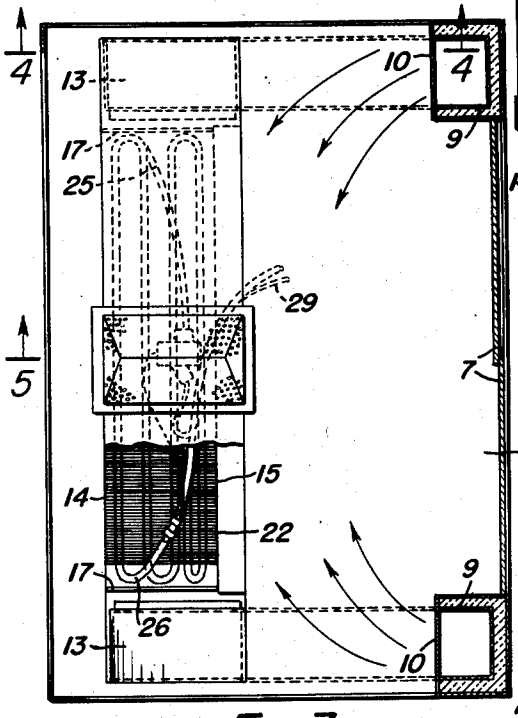


FIG. 3.

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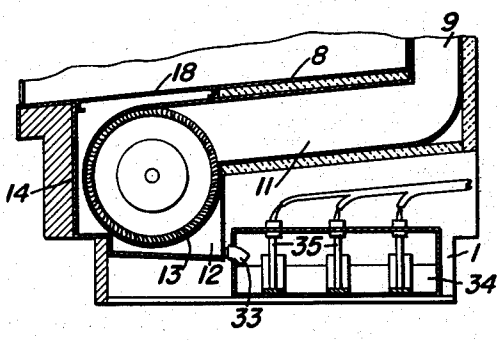


FIG. 4.

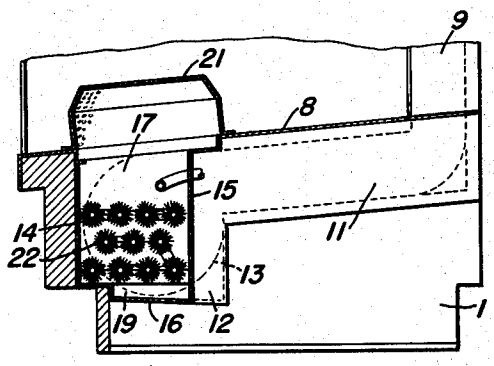


FIG. 5.

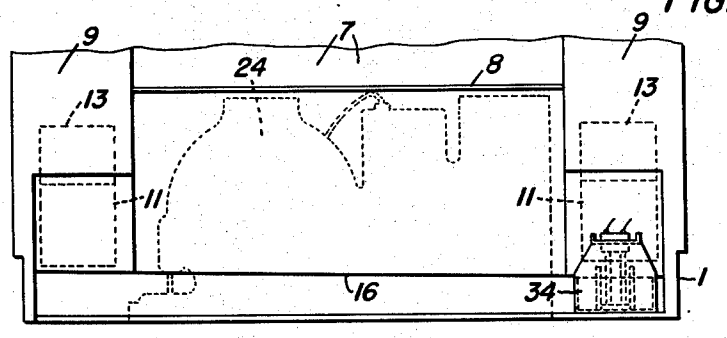


FIG. 6.

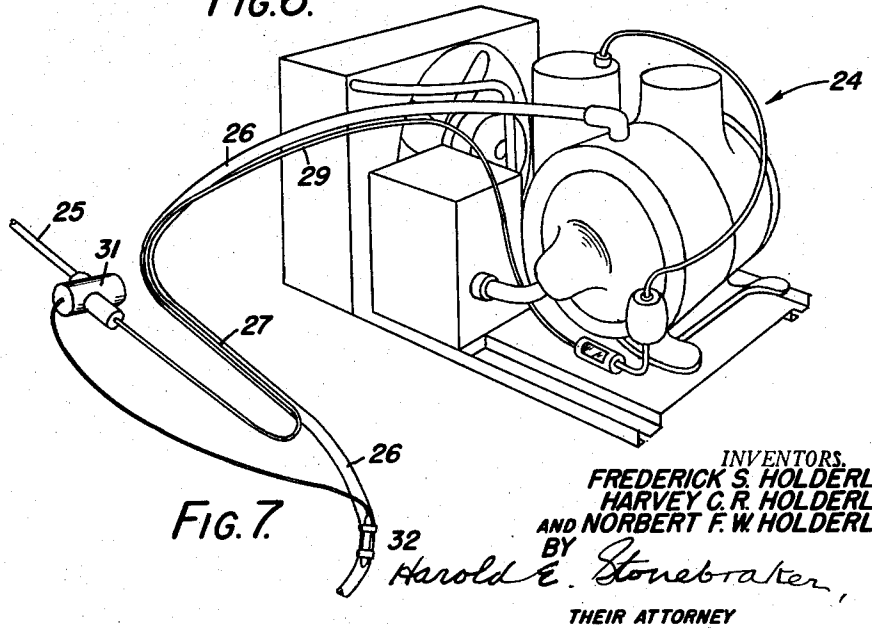


FIG. 7.

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REFRIGERATED DISPLAY CASE

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12 Claims. (Cl. 62—89.5)

This invention relates to a refrigerated display case for housing food products such as baked goods, and other delicatessen products, and has for its purpose to provide a structure that will maintain uniform temperature and humidity conditions at all times within the case, thus keeping the food moist, cool, and in the highest state of preservation.

Refrigerated display cases as heretofore constructed have been open to the objections of excessive frosting on the refrigerating coils and insufficient humidity within the case, with consequent wide variations in humidity and temperature conditions, and it is a particular purpose of the invention to overcome these objections by maintaining more nearly uniform temperature and humidity in the desired range by eliminating excessive frosting on the refrigerating coils, and providing a continuous circulation of air from the interior of the case to the refrigerating coils, thence through fans and cooling ducts to the interior of the case, in such a way as to provide a constant supply of cool air with the desired amount of moisture, and preventing frosting on the refrigerating coils.

In such prior structures, the usual practice has been to cool and circulate air by blowing it through refrigerating coils, causing frosting on the coils and necessitating defrosting at intervals, and another object of the invention is to remove the need for defrosting, by circulating the air from the case to the refrigerating coils, and thence drawing the air through the coils by suction means before returning it to the case, and in this manner, the air strikes the coils at lower speed than where it is blown into the coils, and no frosting of the coils takes place.

An additional purpose of the invention is to provide a construction in which the temperature and humidity conditions are not substantially changed or affected upon opening the doors to the case.

A more particular purpose of the invention is to afford means for maintaining a continuous circulation of cool, moist air within the case in such a way that the cold air with an effectively controlled moisture content is distributed uniformly to all parts of the case, and the temperature and humidity held within close limits.

More particularly, the invention includes upright cooling ducts extending from top to bottom at the rear of the case on opposite sides of the doors, and acting to discharge air toward the front of the case at different elevations, in conjunction with a cooling chamber at the bottom of the case into which air enters at relatively slow speed from the interior of the case, while a continuous circulation of air from the cooling chamber to the cooling ducts is maintained by circulating suction and discharge fans located between the cooling chamber and the cooling ducts, and acting to draw cool air from the cooling chamber and to move it on toward the cooling ducts.

To these and other ends, the invention consists in the construction and arrangement of parts that will appear more clearly from the following description when read in conjunction with the accompanying drawings, the novel features being pointed out in the claims following the specifications.

In the drawings:

Fig. 1 is a perspective view of a refrigerated display case constructed in accordance with a preferred embodiment of the invention;

Fig. 2 is a vertical sectional view taken on line 2—2 of Fig. 1, looking in the direction indicated;

Fig. 3 is a horizontal sectional view taken on line 3—3 of Fig. 2, looking in the direction indicated;

Fig. 4 is a detailed vertical sectional view taken on line 4—4 of Fig. 3, looking in the direction indicated;

Fig. 5 is a detailed vertical sectional view taken on line 5—5 of Fig. 3, looking in the direction indicated;

Fig. 6 is a rear elevation, partially broken away, and

Fig. 7 is a perspective view of the refrigerating unit or compressor.

Referring more particularly to the drawings in which like reference numerals refer to the same parts throughout the several views, and to Fig. 1, the invention is illustrated as embodied in a food display case including a base or bottom 1, a frame 2 mounted thereon, glass or other transparent end walls 3, top wall 4, front wall 5, and inclined front wall 6 connecting the transparent top and front walls, rear doors 7, and floor 8, while 9 designates upright cooling ducts located on opposite sides of doors 7, preferably at the ends and rear of the case, and provided with front walls or panels 10, having a multiplicity of spaced perforations or openings arranged between the top and bottom of the ducts and permitting discharge of cool, moist air into the interior of the case. With this arrangement, a cold air barrier is formed in front of the doors so that when the doors are opened, very little warm air enters the case.

The cooling ducts 9, are closed on the tops and all four sides except for the openings above mentioned in the front walls 10, and each cooling duct is open at its lower end where it connects with an air conductor 11, that leads to an outlet from a fan chamber 12, within which is located a suction and discharge fan 13, that draws air from the cooling chamber and forces it toward the cooling ducts.

The fans 13, and fan chambers 12, are located at the ends of the case at the front thereof beneath the floor 8, and in communication with a cooling chamber now to be described.

The cooling chamber which is shown in Fig. 5 includes a front wall 14, a rear wall 15, and a bottom wall including a downwardly offset portion 16, while 17 designates end walls or barriers that extend downwardly from a top wall 18, to a point slightly above the offset portion 16 of the bottom wall, thus affording an outlet opening 19, through which cold air is drawn from the cooling chamber to the fan chamber.

The top wall 18 of the cooling chamber is provided with an opening at a point intermediate the fans, and arranged over such opening is a perforate hood 21, through which air is drawn from the interior of the case into the cooling chamber, where the air is sucked by fan 13 over and downwardly around the cooling coils 22, at the bottom of the cooling chamber, whence the air is drawn through the air conductor formed by walls 14, 15, 16, and 18, into the fan chamber 12 through opening 23. The fans 13 act to push the air thence through the air conductors or conduits 11 to the upright cooling ducts 9, from which the cool, moist air passes out into the interior of the case through the openings in the vertical front walls 10, the air returning thence slowly to the cooling chamber through the perforate hood 21.

Thus a continuous circulation is maintained in the

case with proper humidity and the returning air enters the cooling chamber and contacts the refrigerating coils at such relatively slow speed and at such temperature and humidity as to prevent frosting on the coils, so that defrosting is not required and a uniform and constant temperature and humidity can be maintained in the case.

The coils **22** in the cooling chamber are connected with a refrigerating unit or compressor located at the bottom of the case in rear of the cooling chamber as indicated generally at **24** and shown in more detail in Fig. 7, in which **25** indicates the gaseous feed pipe leading to the cooling coils **22**, while **26** designates the gaseous return pipe from the cooling coils to the compressor. The feed and return pipes from the compressor are soldered or otherwise adjacently connected as at **27**, to impart a precooling to the liquid coming from the compressor through pipe **29**, as well known in compressor operations, the compressor being of conventional form and governed by the usual liquid expansion valve **31** and controlling thermostat **32**. It will be understood that the details of the compressor form no part of the invention except insofar as they act to supply a refrigerant to the coils in the cooling chamber.

As the returning somewhat warmer air circulating through the cooling chamber contacts the refrigerating coils **22**, there is a certain amount of condensation which falls to the bottom of the cooling chamber and is carried by gravity to one end over the inclined bottom wall **16**, see Fig. 6, and when the liquid of condensation reaches the end of the cooling chamber and air conductor of which the bottom wall **16** forms a part, it flows through a discharge **33**, see Fig. 4, into an evaporating chamber **34**, which is provided with a series of electrodes **35**, that act to heat and evaporate the moisture. The evaporating chamber **34**, is open at the top along its sides and is controlled by suitable means for activating the electrodes when the liquid reaches a predetermined level, as well known in such field of operation.

The operation briefly is as follows: the compressor being set to maintain a given temperature in the cooling coils, air is drawn slowly from the interior of the case through the perforate hood **21**, down around the cooling coils, and thence toward both ends of the case through the air conductors into the fans which then force the air to the rear through the air conductors to the upright cooling ducts. The cool, moist air passes out into the case at the rear, on both sides of the doors at all elevations between the top and bottom, and then travelling to the front and down, is drawn into the hood **21** and around the cooling coils. The cycle is repeated indefinitely with no frost forming on the cooling coils and a uniform temperature and humidity is maintained in the case.

With the arrangement described, air is distributed and dispersed in the case under uniform and accurately controlled temperature and humidity conditions and when the air strikes the cooling coils in the cooling chamber, the temperature, humidity, and speed of the air is such as to prevent frosting on the cooling coils. The relation of the moisture content, temperature and speed of travel of the air at this point is such that the air is effectively cooled while frosting on the cooling coils does not take place.

This is an important and vital accomplishment because in a refrigerated food case, if frosting occurs on the cooling coils, they are quickly encased in frost and no longer function to cool the air passing over them. When such frosting takes place, the compressor must be stopped at intervals for defrosting and it is impossible to maintain a satisfactory and uniform temperature and humidity, whereas with the present structure, by setting the temperature control for the compressor at a selected point, a uniform and constant temperature and humidity content can be maintained within the case, thus keeping food products moist and in a satisfactory state of preservation for longer periods of time than has been possible heretofore. Food does not dry out or spoil as in the case where sudden and substantial changes in temperature and humidity occur from time to time.

Many display cases constructed in accordance with the invention have been operated successfully without frosting of the refrigerating coils, and the air in the case has been maintained within a temperature range steadily between 42° F. and 45° F. and a humidity range between 55% and 70%.

While the invention has been described in relation to the structure herein shown, it is not restricted to the details set forth, and this application is intended to cover such modifications or departures as may come within the purposes of the improvement or the scope of the following claims.

We claim:

1. A display case including a refrigerating unit, a cold air chamber in communication on its top with the interior of the case, said cold air chamber including an end wall extending to near the bottom of the chamber and having an outlet opening of reduced size between the bottom of said end wall and the bottom of the cold air chamber, cooling coils in said chamber connected with said refrigerating unit, a cooling duct at the rear of the case having a multiplicity of outlet openings in its front wall communicating with the interior of the case, a fan acting to draw air from said reduced outlet opening at the bottom of the cold air chamber and force such air to said cooling duct, an air conductor leading from said outlet opening at the bottom of said cold air chamber to said fan, and an air conductor leading from said fan to the bottom of said cooling duct.

2. A display case including a refrigerating unit, a cold air chamber at the bottom of the case in communication on its top with the interior of the case, said cold air chamber including an end wall extending to near the bottom of the chamber and having an outlet opening of reduced size between the bottom of said end wall and the bottom of the cold air chamber, cooling coils in said chamber connected with said refrigerating unit, an upright cooling duct at the rear of the case having a multiplicity of outlet openings in a vertical front wall communicating with the interior of the case, a fan acting to draw air from said reduced outlet opening at the bottom of the cold air chamber and force such air to said cooling duct, an air conductor leading from said outlet opening at the bottom of said cold air chamber to said fan, and an air conductor leading from the fan to the bottom of said cooling duct.

3. A display case including a refrigerating unit at the bottom thereof, a cold air chamber at the bottom and intermediate the ends of the case in communication on its top with the interior of the case, cooling coils in said chamber connected with said refrigerating unit, fans located at the bottom of the case, air conductors leading from the lower end of said cold air chamber to each of said fans, upright cooling ducts at opposite ends of the case each having a multiplicity of openings in a vertical wall communicating with the interior of the case, and air conductors leading from said fans to each of said upright cooling ducts.

4. A display case including a refrigerating unit, a cold air chamber at the bottom of the case in communication on its top with the interior of the case, cooling coils in said chamber connected with said refrigerating unit, a pair of upright cooling ducts at opposite ends of the case each having a multiplicity of openings in a vertical wall communicating with the interior of the case, fans at opposite ends of the case acting to draw air from said cold air chamber and force such air to said upright cooling ducts, air conductors leading from the lower end of said cold air chamber to said fans, and air conductors leading from said fans to said upright cooling ducts.

5. A display case including a refrigerating unit at the bottom thereof, a cold air chamber at the bottom and

intermediate the ends of the case in communication on its top with the interior of the case, cooling coils in said chamber connected with said refrigerating unit, upright cooling ducts at opposite ends of the case each having a multiplicity of openings in a vertical wall communicating with the interior of the case, fans located at the bottom of the case at opposite ends thereof and acting to draw air from the cold air chamber and force such air to said upright cooling ducts, air conductors leading from the lower end of said cold air chamber to said fans, and air conductors leading from said fans to the lower ends of said upright ducts.

6. A display case including a refrigerating unit at the bottom thereof, a cold air chamber at the bottom and intermediate the ends of the case in communication on its top with the interior of the case, cooling coils in said chamber connected with said refrigerating unit, a pair of upright cooling ducts located at opposite ends of the case at the rear thereof and each having a multiplicity of openings in its front wall communicating with the interior of the case, fans at opposite ends of the case at the bottom thereof acting to draw air from said cold air chamber and force such air to the lower ends of the cooling ducts, air conductors leading from the lower end of said cold air chamber to said fans, and air conductors leading from said fans to the lower ends of the cooling ducts.

7. A display case including a refrigerating unit at the bottom thereof, a cold air chamber at the bottom and intermediate the ends of the case in communication on its top with the interior of the case, cooling coils in said chamber connected with said refrigerating unit, fans located on opposite sides of said cold air chamber, air conductors leading from said cold air chamber to said fans, upright cooling ducts at opposite ends of the case, each having a multiplicity of openings in a vertical wall communicating with the interior of the case, and an air conductor leading from each of said fans to one of said cooling ducts and communicating with the lower end thereof.

8. A display case including a refrigerating unit at the bottom thereof, a cold air chamber at the bottom of the case in communication on its top with the interior of the case, said cold air chamber including an end wall extending to near the bottom of the chamber and having an outlet opening of reduced size between the bottom of said end wall and the bottom of the cold air chamber, cooling coils in said chamber connected with said refrigerating unit, an upright cooling duct located at the rear of the case and having a multiplicity of outlet openings in a vertical front wall communicating with the interior of the case, a fan located between said cold air chamber and said cooling duct acting to draw air from said reduced opening at the bottom of the cold air chamber and force such air toward said cooling duct, an air conductor leading from said reduced opening at the bottom of the cold air chamber to said fan, and an air conductor leading from said fan to the bottom of said cooling duct.

9. A display case including a refrigerating unit at the bottom thereof, a cold air chamber in communication on its top with the interior of the case and located at the bottom of the case, said cold air chamber including an end wall having an outlet opening, cooling coils in said chamber connected with said refrigerating unit, an upright cooling duct at the rear of the case having a multiplicity of openings in a vertical front wall communicating with the interior of the case, a fan located at the bottom of the case between said outlet opening of the cold air chamber and said cooling duct, an air conductor leading from said outlet opening of said cold air chamber to said fan, and an air conductor leading from said fan to the lower end of said cooling duct.

10. A display case including a refrigerating unit at the bottom thereof, a cold air chamber in communication on its top with the interior of the case and located at the front bottom portion of the case intermediate the ends hereof, cooling coils in said chamber connected with said refrigerating unit, fans located at the bottom and at opposite ends of the case, upright cooling ducts located at the ends and at the rear of the case, an air conductor leading from the lower end of said cold air chamber to each of said fans, and an air conductor leading from each of said fans to the lower end of one of said upright cooling ducts.

11. A display case including a refrigerating unit at the bottom thereof, a cold air chamber in communication on its top with the interior of the case and located at the front bottom portion intermediate the ends of the case, cooling coils in said cold air chamber conneced with said refrigerating unit, the cold air chamber having openings in its end walls at their lower ends, fans located at the bottom and at opposite ends of the case, upright cooling ducts located at the ends and at the rear of the case, said cooling ducts having front walls with a multiplicity of openings therein arranged between the top and bottom of the case, air conductors leading from said openings at the lower ends of the end walls of the cold air chamber to said fence, and air conductors leading from said fans to the lower ends of said upright cooling ducts.

12. A display case including a refrigerating unit, a cold air chamber located at the bottom of the case and at the front thereof in communication on its top with the interior of the case at the bottom of the case, said cold air chamber including an end wall having an outlet opening of reduced size between the bottom of said end wall and the bottom of the cold air chamber, cooling coils in said chamber connected with said refrigerating unit, a vertically arranged cooling duct at the rear of the case having a multiplicity of outlet openings in its front wall communicating with the interior of the case, said outlet openings being arranged in spaced relation throughout said front wall from the top to the bottom thereof, a fan located between the cold air chamber and said cooling duct and acting to draw air from said outlet opening of the cold air chamber and force such air to the bottom of said cooling duct, an air conductor leading from said outlet opening of the cold air chamber to said fan, and an air conductor leading from said fan to the bottom of said cooling duct.

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