

March 24, 1959

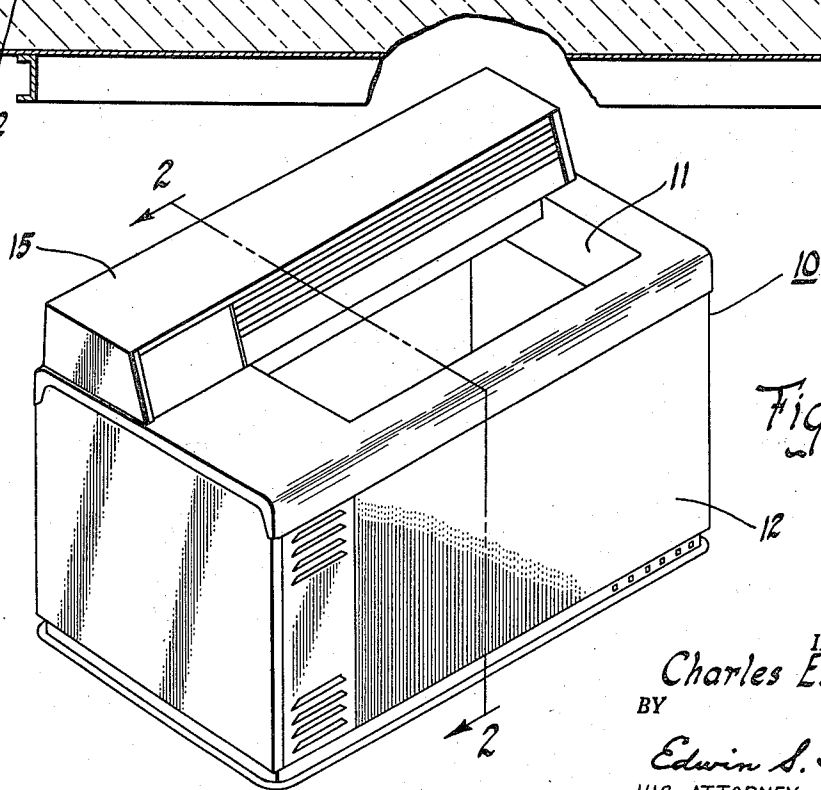
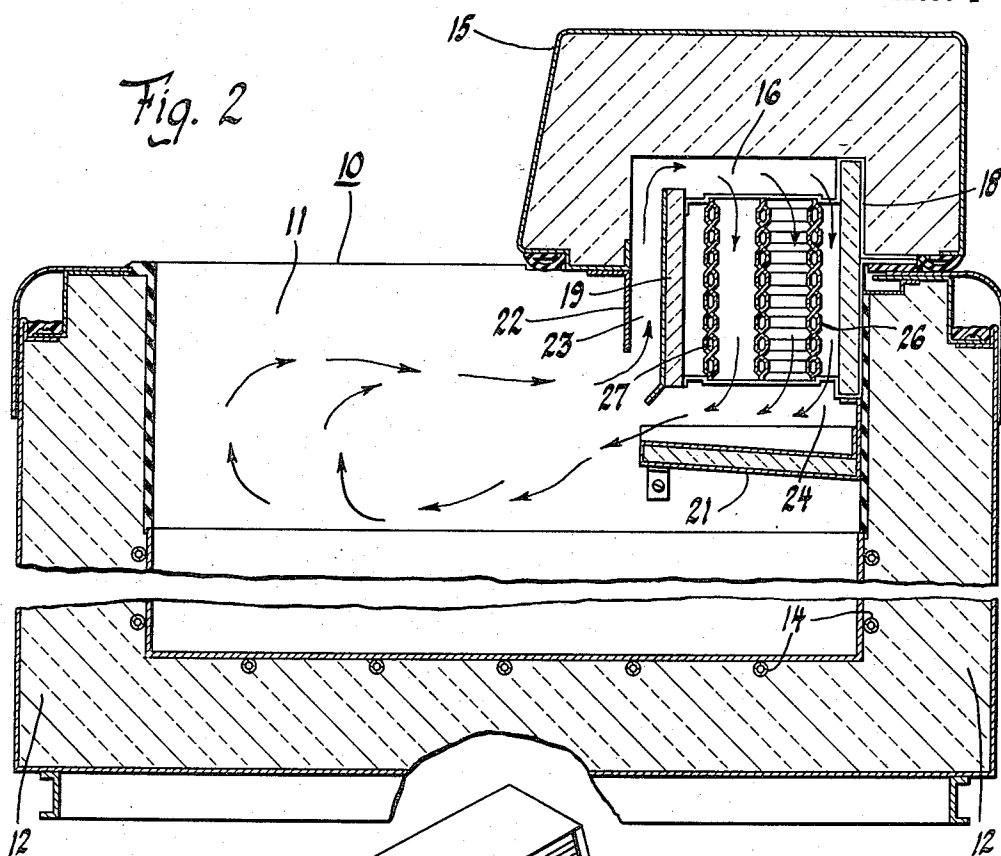
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REFRIGERATED DISPLAY CASE

Filed Aug. 22, 1956

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

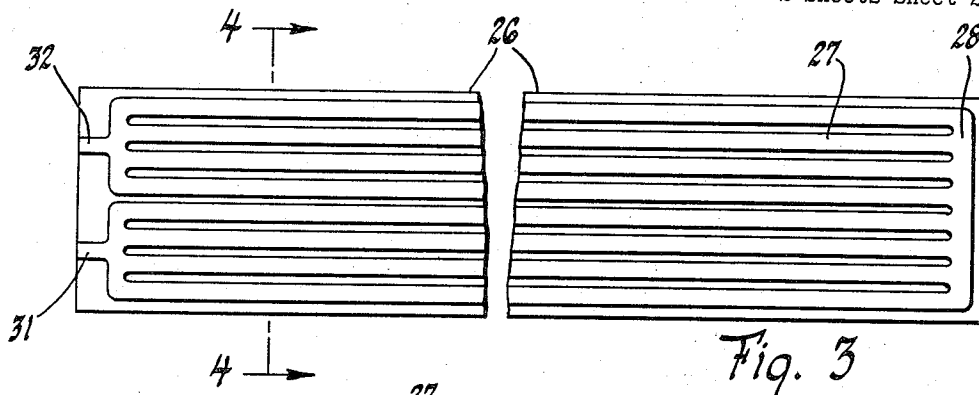


Fig. 3

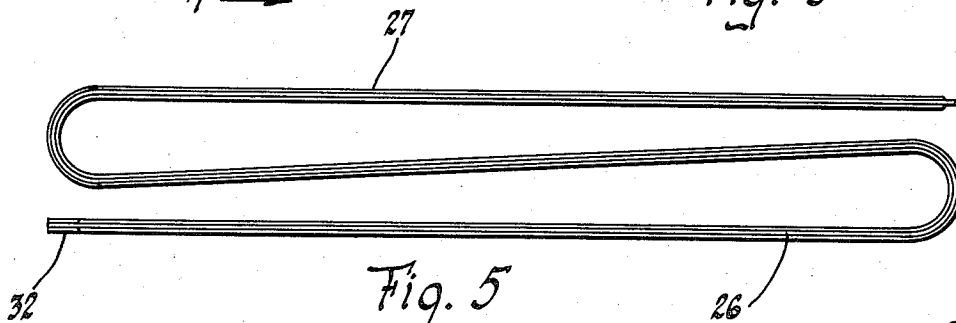


Fig. 5

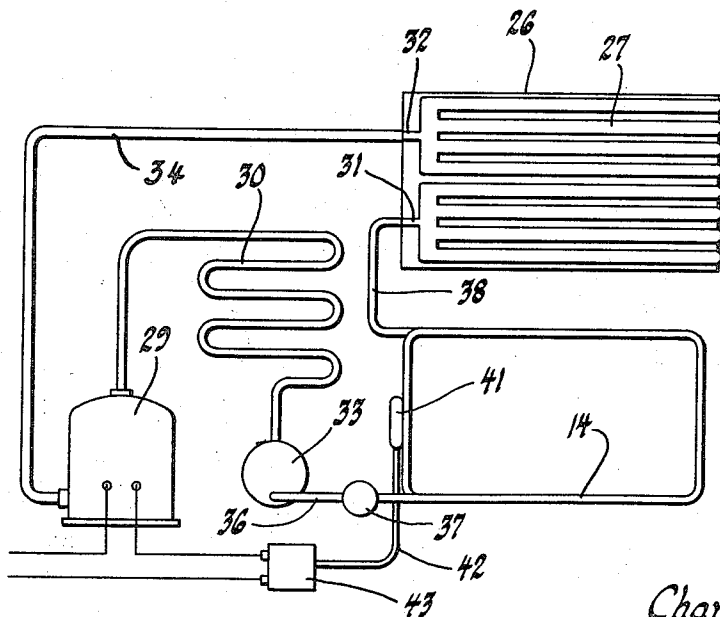


Fig. 6

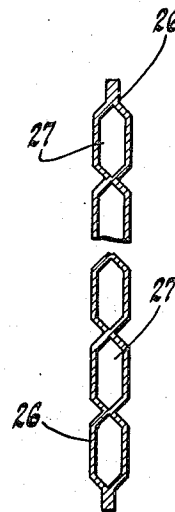


Fig. 4

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REFRIGERATED DISPLAY CASE

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1 Claim. (Cl. 62—256)

This invention relates to refrigerated display cases or cabinets and particularly to cases of the open top self-serve type.

It is well known that in open top display cabinets or cases having a food storage compartment below the top thereof food products stored in the compartment can be sufficiently cooled to a low temperature and preserved by conduction around the bottom and upright walls of the compartment. However, packaged food products located in the central upper part of the food storage compartment cannot, due to their exposure to air ambient the cabinet at its open top, be maintained at the same low temperature without some auxiliary cooling means. It is of course desirable to maintain the entire load of food products stored in an open top compartment of a refrigerated display case at a uniformly low temperature irrespective of the location of part or parts of the food load in the compartment. My invention is therefore specifically directed to the provision of means for cooling packaged ice cream, frozen meats and fish or the like stored in spaced relationship to refrigerated walls of an open top compartment in a display case, particularly in the top central portion of a horizontally elongated compartment, to the same low temperature as food products stored elsewhere in the compartment.

An object of my invention is to provide an improved and inexpensive arrangement in an open top refrigerated display cabinet or case for creating the flow of and maintaining a stream or blanket of cold air over the central upper part of a refrigerated food storage compartment in the case.

Another object of my invention is to provide, in addition to refrigerating food products stored in an open top compartment of a refrigerator by conduction through walls of the compartment, a means for cooling the products intermediate said walls and immediately below the compartment open top by convection currents of air.

A further object of my invention is to provide a sheet metal plate-like evaporator, preferably of the roll-forged type, with refrigerant evaporating or expansion passages which extend along and occupy the major portion of exposed wall surfaces of the evaporator, to bend portions of the plate-like evaporator intermediate ends thereof into a serpentine-shape and to dispose the same in a narrow elongated chamber of a refrigerator cabinet whereby integral portions of the evaporator form a plurality of refrigerated walls of upright air passageways in the chamber closed throughout the height of the evaporator whereby a convection current of air is readily created and maintained over the top of food products stored in the refrigerator.

In carrying out the foregoing objects it is a still further object of my invention to provide in a refrigerated display cabinet or case an open top compartment with a hooded section along the rear of the open top thereof in which air contained in a chamber in the section is cooled and caused to circulate through a novel duct arrangement in which the outlet and inlet of the ducts are disposed one

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above the other below the compartment open top and spaced inwardly from the rear of the compartment so as to create a somewhat stratified layer or blanket of cold air over the upper central part of food products stored in the compartment and wherein the return air duct is isolated or insulated from the cold temperature of an evaporator of a refrigerating system in the cooling chamber to augment flow of air back into the chamber without substantial admixture with air ambient to the food compartment.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is a perspective view of an elongated display case or cabinet having an open top refrigerated food storage compartment therein in which my invention is embodied;

Figure 2 is an enlarged broken vertical sectional view of the display case shown in Figure 1 and taken on the line 2—2 thereof;

Figure 3 is a broken view showing a flat plate-like evaporator of a refrigerating system employed in the present invention;

Figure 4 is an enlarged broken sectional view taken on the line 4—4 of Figure 3 showing refrigerant expansion passages formed in the plate-like evaporator;

Figure 5 shows the plate-like evaporator disclosed in Figure 3 bent into a serpentine-shape in which form it is mounted in the display case; and

Figure 6 is a diagrammatic view illustrating a refrigerating system associated with the present display case.

Referring to the drawings, for illustrating my improved invention, there is shown in Figure 1 thereof a refrigerating apparatus of the type which comprises a horizontally elongated self-serve display case or cabinet, generally represented by the reference numeral 10, having an open top compartment 11 therein for the storage of packages of frozen meats, fish or the like and other frozen products. The compartment 11 is provided by a plurality of insulated walls 12 and its metal inner liner has a first evaporator of a refrigerating system in the form of a conduit 14 coiled or wrapped therearound and secured thereto (see Figure 2). A machine compartment at one end of cabinet 10 at a side of compartment 11 may house the refrigerant translating unit of a refrigerating system associated with the present refrigerated display case. An insulated hooded section 15 having a chamber 16 therein is mounted on the back portion of cabinet 10 and is substantially coextensive with the compartment 11 therein. A plurality of strap-like brackets 18 are secured to the top wall of compartment 11 and are spaced apart along the length of chamber 16. These brackets 18 are bent to locate and form supports for supporting slabs of suitable insulating material, such for example as the slab 19, a drain pan 21 and the S or serpentine-shaped evaporator shown in Figure 5 within the case 10. The insulated slab 19 is spaced from the front wall of chamber 16 and forms with a depending baffle 22 a vertical return air duct 23 for the chamber 16. Drain pan 21 provides the bottom of a substantially horizontal air discharge duct 24. The outlet opening of duct 24 is spaced inwardly of the rear wall of compartment 11, it is disposed below the open top of food compartment 11 and faces the front of cabinet or case 10. The inlet opening of duct 23 is also disposed below the top of compartment 11 immediately above the outlet of duct 24 and faces the front of cabinet 10.

Referring now to Figure 3 of the drawings the second or flat plate-like evaporator 26 employed in the refrigerating system within cabinet 10 is of the sheet metal

variety and includes metal sheets which are brazed to one another or are preferably roll-forged together into a one-piece plate and made in accordance with the disclosures in the G. R. Long Patent No. 2,662,273 dated December 15, 1953 and the E. C. Simmons Patent No. 2,740,188 dated April 3, 1956, both assigned to the assignee of the present application. The plate-like evaporator 26 has flat walled refrigerant expansion or evaporating passages 27 formed therein (see Figures 3 and 4). The passages 27 communicate with one another at one end thereof through a header 28 and with a refrigerant inlet 31 and an outlet 32 respectively at their other ends. The long flat plate-like evaporator 26 shown in Figure 3 has integral portions thereof bent intermediate its ends or coiled into a serpentine-shape and specifically into a substantially S-shape as shown in Figure 5 of the drawings. Since it is desired to provide a compact evaporator and a concentrated refrigerated area in chamber 16 it will be noted that the flat walled passages 27 occupy substantially all or the major portion of the evaporator 26 and therefore the greater part of walls thereof are prime refrigerating surfaces. The evaporator 26 after being formed into the shape as shown in Figure 5 and provided with suitable refrigerant conduit connections is installed or mounted in the long relatively narrow chamber 16 of the display case and supported therein by the brackets 18. The turns or convolutions of evaporator 26 provide spaced apart partitions which divide chamber 16 into a plurality of upright or vertical air passageways and form both walls of at least two of the passageways (see Figure 2). Ordinarily one would not expect a substantially flat walled evaporator of the type herein disclosed to have sufficient heat transfer surfaces to effectively cool air moving thereacross but I have discovered that by confining such an evaporator in a given space within a chamber and forming air passageways which are closed throughout the height of the evaporator and free of obstructions it is very efficient in cooling air and creating convection currents of the air. Others have heretofore deemed it necessary to employ finned conduits to provide an evaporator for the purpose herein disclosed and such conduits in addition to forming obstructions to air flow are expensive and thus increase the cost of the evaporators which reflects in the ultimate selling price of a display case or cabinet.

The air passageways formed in chamber 16 by the spaced apart integral wall portions of the serpentine-shaped evaporator 26 mounted therein communicate at their upper ends with the return air duct 23 and at their lower ends with the discharge air duct 24. In reality the evaporator 26 is located partly above and partly below the open top of compartment 11. Since the major area of walls of the air passageways are prime refrigerated surfaces the evaporator 26 cools air in chamber 16 and effectively sets up convection currents thereof in the passageways. The cool air circulates downwardly through the passageways in chamber 16 into duct 24 from which the air egresses through its discharge outlet in the form of a forwardly moving stream or blanket, inwardly of the rear wall of compartment 11 below the compartment open top, and over food products stored in the upper central portion of compartment 11. The air rises as it nears the front wall of compartment 11 and has its direction of flow reversed whereupon it circulates rearwardly into the inlet of return air ducts 23 and upwardly therein to the top of the plurality of air passageways between spaced apart portions of the S or serpentine-shaped evaporator 26. This convection air flow is confined within the compartment 11 and is maintained below the open top thereof. Thus while packaged food products in compartment 11 remote from its open top are cooled by evaporator 14 the packages of food in the upper central part of the compartment are, by virtue of the convection air circulation created by evaporator 26 in the novel duct arrangement disclosed, substantially iso-

lated from air ambient the display cabinet and particularly warm air above the open top of compartment 11 and efficiently cooled.

In Figure 6 of the drawings I diagrammatically show a closed refrigerating system which is associated with the present display cabinet or case 10 and in which the evaporators 14 and 26 are connected. This system includes a refrigerant translating device comprising a motor-compressor unit 29, a condenser 30 and a receiver 33. A conduit 34 connects the outlet of evaporator 26 with the unit 29 for conveying evaporated or vaporous refrigerant into the compressor. Refrigerant compressed by the compressor in unit 29 is forwarded to the condenser 30 where it is cooled in any suitable or conventional manner, liquified and directed into the receiver 33. A conduit 36 has a restrictor or expansion valve 37 interposed therein for controlling flow or liquid refrigerant from receiver 33 into evaporator 14 and another conduit 38 connects the outlet of evaporator 14 to the inlet of the serpentine-shaped plate-like evaporator 26. The evaporators 14 and 26 are connected one after the other respectively in series relationship with restrictor 37 and sufficient liquid refrigerant flows from the evaporator 14, which cools walls of compartment 11, into the evaporator 26 to cause this plate-like evaporator to cool and set up the convection air circulation hereinbefore described. The motor-compressor unit 29 may be caused to operate and/or stop operating by any suitable or conventional control means. For example, a fluid charged sealed means including a bulb 41, a pipe 42 and an expandable and contractible bellows within an electric switch 43 may be employed. The fluid in this means is responsive to the temperature of evaporator 14 and provides the motive power for actuating switch 43 to make and/or break an electric power circuit leading to the motor in unit 29 whereby the temperature of evaporator 14 and consequently evaporator 26 will be maintained between predetermined limits as is conventional in the art.

It should, from the foregoing, be apparent that I have provided an improved self-serve open top display case or cabinet wherein a low cost evaporator in a chamber having a novel duct arrangement associated therewith cooperate to set up a convection circulation of cold air over frozen food products located centrally of the open top of a storage compartment in the display case. The air circulation created in the present display case reduces to a minimum the temperature gradient between frozen food packages stored in various localities within a storage compartment and insures that packages of frozen foods removed from the upper central portion of the open top compartment will be of the same quality and substantially of the same temperature as packages of food removed from the other portions of the compartment. Factors which contribute to the creation and maintenance of the controlled or guided convection air circulation as herein disclosed reside in the air passageways being unobstructed and closed throughout the height of the evaporator, the specific location of the air ducts with respect to one another and to the cooling chamber, the arrangement of openings of the air ducts relative to the open top compartment and of insulating the return air duct from the low temperature of the evaporator in the hooded section of the display case. This combination in addition to providing an improved, compact and simplified construction together with the use of a roll-forged plate-like evaporator reduces the manufacturing cost of a display case or cabinet. By virtue of mounting the serpentine-shaped evaporator so that part thereof is disposed below the open top of the food compartment the openings of air ducts can also be located below this open top and the convection circulation of air thereby confined to the interior of and beneath the open top food storage compartment where eddy currents are not likely to be formed and interrupt

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or retard an air blanket or stream moving over food products.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claim which follows.

What is claimed is as follows:

In combination, a display case of a predetermined length having an open top food storage compartment therein and a chamber separate from said compartment but communicating therewith, a refrigerating system associated with said case including an evaporator within said chamber, said evaporator comprising rectangular sheets of metal bonded together to form, without the aid of additional means, a unitary one-piece structure having refrigerant expansion passages therein and being substantially longer than said predetermined length of the display case, said unitary evaporator structure having a part bent over another part thereof in substantially parallel spaced relationship, a drain pan extending continuously along the length of said case below the evaporator in said chamber providing a horizontal air duct having a discharge outlet spaced below the open top of said compartment and facing the front of said case, baffle means between said evaporator and the front of said chamber providing same with a substantially vertical air return passage having an inlet located above the forwardly fac-

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ing discharge outlet of said duct, the parallel parts of said one-piece unitary evaporator structure being spaced from said baffle means and the rear wall of said chamber for dividing same into flues on each side of the evaporator, said parts of said evaporator and the bent portion thereof forming another flue intermediate said side flues closed at one of its ends and open at the other end thereof, said flues communicating at their top with said vertical passage and at their bottom with said horizontal duct, and said evaporator cooling and causing air in said chamber to flow downwardly in the flues into said duct whereby said drain pan directs the cooled air laterally from said duct through the forwardly facing outlet thereof in a horizontal stream over food products stored in the bottom of said compartment to provide a stratified layer of cold air across the compartment immediately below its open top.

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