

Jan. 28, 1936.

L. M. KEIGHLEY

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REFRIGERATING APPARATUS

Filed Nov. 18, 1933

2 Sheets-Sheet 1

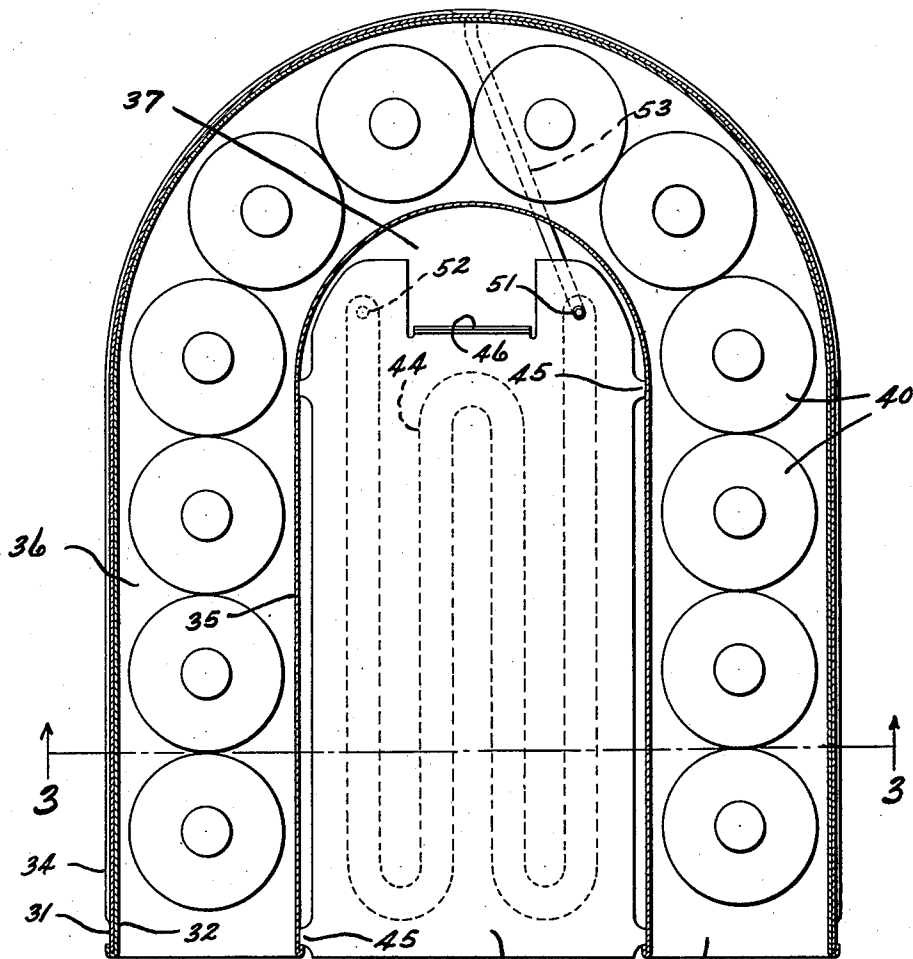


Fig. 2

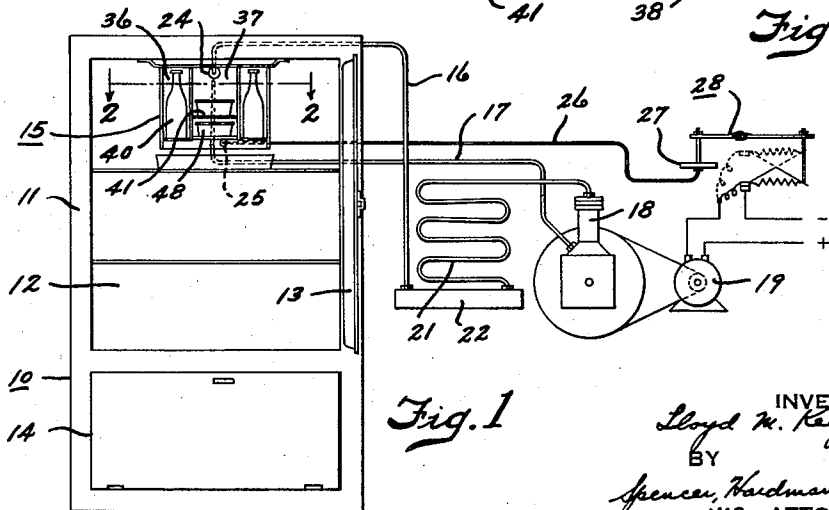


Fig. 1

INVENTOR  
Lloyd M. Keighley.  
BY  
Spencer, Hardman, and Fehr.  
HIS ATTORNEYS.

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2 Sheets-Sheet 2

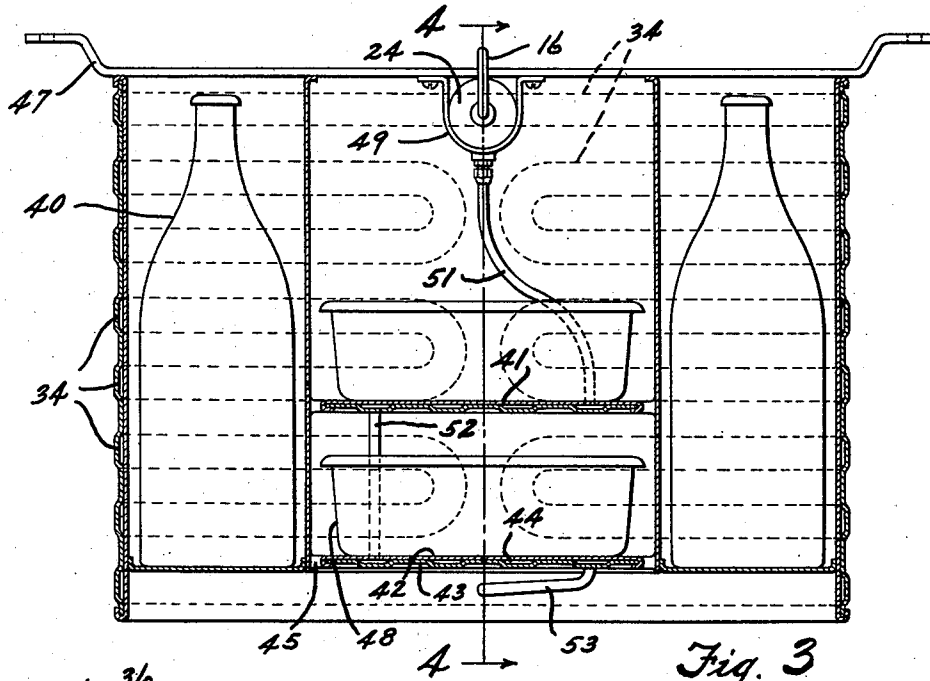


Fig. 3

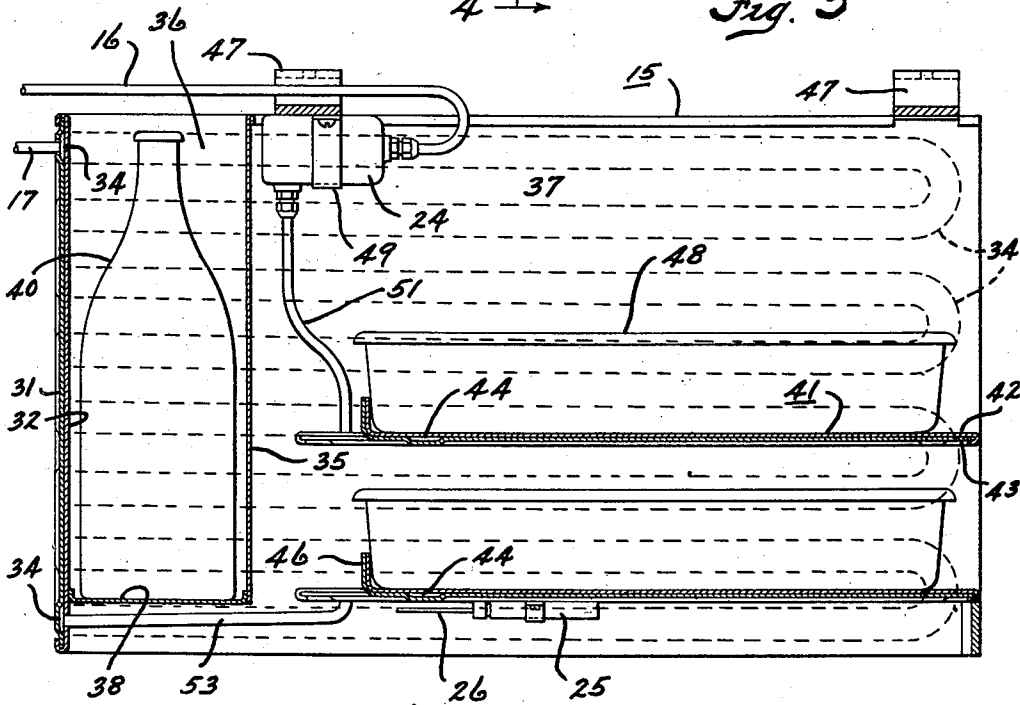


Fig. 4

INVENTOR  
*Lloyd M. Keighley.*  
BY  
*Spencer, Hardman, and Lake.*  
HIS ATTORNEYS.

# UNITED STATES PATENT OFFICE

2,029,263

## REFRIGERATING APPARATUS

Lloyd M. Keighley, Dayton, Ohio, assignor to  
General Motors Corporation, Dayton, Ohio, a  
corporation of Delaware

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19 Claims. (Cl. 62—126)

This invention relates to household refrigerating apparatus, and particularly to a cooling unit for use in such apparatus including means for properly cooling bottled beverages and for permitting the easy removal of the properly cooled bottled beverages from the refrigerator, in addition to the usual requisites of such a cooling unit.

In mechanical household refrigerators it has been customary to provide a cooling unit including refrigerated surfaces for cooling the interior of the refrigerator and for providing a sharp freezing compartment to quickly congeal or freeze substances contained in trays adapted to be placed in thermal contact with the cooling units. The ordinary and preferred temperature to be maintained by a conventional cooling unit as described, in household refrigerators, usually varies in different localities within the food storage compartment of the refrigerator between 45° F. and 55° F., while the temperature of the sharp freezing zone of the cooling unit is maintained below 32° F. The maintenance of such temperatures in household refrigerators has been somewhat standard and has been found to be unsatisfactory for cooling certain types of bottled beverages and the like to a predetermined desired temperature. For example, certain brands of beer, ale or the like beverages are known to be most pleasingly palatable when maintained at a temperature of between 35° F. and 45° F.

Thus household refrigerators employing a conventional cooling unit of the type described are not entirely satisfactory for cooling certain bottled beverages such as various brands of beer and ale to the required or most desirable temperature. Furthermore, it has been customary to stack or place bottled beverages to be cooled wherever convenient within a refrigerator cabinet and these bottles are usually placed adjacent the cooling unit therein. While such a practice may result in properly cooled beverages at times nevertheless it is at best merely a hit or miss arrangement for cooling such beverages. Such arrangement for cooling bottled beverages, also very often interferes with or retards circulation of air in the food storage compartment of a refrigerator cabinet. Generally the cooled bottles having been located within the refrigerator for a long period of time, have been gradually moved to the rear of the refrigerator so that when properly cooled, they are almost invariably in an inaccessible position. This results in the warm bottles, or the last bottles to be placed in the refrigerator, being more accessible than the properly cooled bottles,

usually being withdrawn from the refrigerator in order that their contents may be consumed and the properly cooled bottles are consequently permitted to remain unused within the refrigerator.

My invention overcomes these difficulties heretofore enumerated by providing a method of and means for properly and efficiently cooling bottled beverages and at the same time providing for the easy removal of the properly cooled bottles.

It is a further object of the invention to provide a method of and means for supporting and guiding bottled beverages into intimate thermal contact with the cooling unit located within a household refrigerator and retaining the cooled bottles in a location or position easily accessible from the exterior of the refrigerator.

A still further object of the invention is to provide an improved cooling unit or evaporator for refrigerating apparatus having, in addition to the conventional refrigerated surfaces for cooling air in the food storage compartment of a cabinet and for reducing the temperature of substances to be congealed or frozen, a means for arranging and maintaining bottled beverages therein in the order in which they are placed in the cooling unit so that the coldest bottle is readily accessible at all times.

Another object of the invention is to provide a unitary cooling unit or evaporator structure which will be efficient to produce a suitable food storage temperature, a quick freezing temperature and an intermediate temperature in order to carry out the foregoing enumerated objects.

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 will be clearly shown.

In the drawings:

Fig. 1 discloses a refrigerator cabinet of the household type having a cooling unit disposed therein and connected with a refrigerant liquefying and condensing unit shown diametrically;

Fig. 2 is an enlarged horizontal sectional view of the cooling unit taken on the line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view of the cooling unit taken on the line 3—3 of Fig. 1; and

Fig. 4 is a vertical sectional view of the cooling unit taken on the line 4—4 of Fig. 3.

Referring to the drawings, for illustrating my invention and particularly to Fig. 1 thereof, there is shown a refrigerator cabinet 10 having insulated outer walls 11 which enclose a food storage

compartment 12 provided with a door 13 for affording access to the compartment. The cabinet 10 also includes a lower machine compartment closed by the door 14 and in which  
 5 compartment the refrigerant liquefying and condensing unit, to be presently described, is ordinarily housed. Within the food storage compartment 12 there is mounted closely adjacent the top thereof a cooling unit or evaporator 15.  
 10 Evaporator 15 is connected by a liquid refrigerant pipe line 16 and a gaseous refrigerant suction pipe line 17 to a refrigerant liquefying and condensing unit. This unit as herein disclosed includes a compressor 18 operated, through a belt  
 15 and pulley connection, by a motor 19. The compressor draws gaseous or vaporized refrigerant from the evaporator 15 through the suction pipe 18 and compresses same and forwards the compressed refrigerant under pressure to the condenser 21 where it may be liquefied by being  
 20 cooled in any suitable manner and deposited in liquid form in a receiver 22. Liquid refrigerant flows from receiver 22, through the liquid pipe 16 to refrigerant expansion passages provided in the cooling unit, under the control of an expansion  
 25 valve 24 of any conventional design. A thermostat 25 is operatively connected to a fluid pipe line connection 26 to a diaphragm or bellows 27 incorporated in the control switch 28 which may also be of any conventional design, but preferably of the snap acting type. The control  
 30 switch 28 is actuated by expansion or contraction of the diaphragm or bellows 27, caused by the temperature and pressure of a volatile fluid in thermostat 25, pipe 26 and diaphragm 27, to control the electric circuit leading to the motor  
 35 19 for causing cyclical operations of the compressor 18. A refrigerating system of the type disclosed is well known to those skilled in the art and being of conventional form needs no further  
 40 description herein.

The cooling unit or evaporator 13 includes a corrugated sheet metal portion 31 which is secured to a flat sheet metal portion 32 which portions after  
 45 being secured together are formed into a substantially U-shaped structure. The corrugations formed in sheet 31 are arranged to provide the refrigerant expansion or evaporating passage 34 between the metal portions 31 and 32 and thus  
 50 these metal portions of the cooling unit serve as a refrigerating surface for cooling and causing circulation of air within the food storage compartment 12 of cabinet 10. A partition 35 is disposed within the U-shaped structure and extends  
 55 parallel to and continuously with the refrigerated surfaces of the cooling unit.

This partition divides the space between the legs of the U-shaped structure into a plurality of chambers or compartments 36 and 37. A plate  
 60 38, shaped to correspond to the curvature of the chamber 36, is secured to the U-shaped refrigerated surface and to the partition 35 to provide a support or track upon which a plurality of bottled beverages may be located or guided through the  
 65 cooling unit. The partition 35 and the plate 38 may, if desired, be formed integrally from a single piece of metal. One or more horizontally disposed refrigerated shelves or supports 41 are mounted within the chamber or compartment 37.  
 70 Each of these shelves or supports 41 are formed of sheet metal portions 42 and 43 secured together and one of which is corrugated to provide a refrigerant conveying or expansion passage 44 between the metal portions 42 and 43.  
 75 The shelves are secured in limited thermal con-

tact only to the partition 35 by welding narrow outwardly extending fingers 45 (see Fig. 2) thereto so as to reduce to a minimum the conduction or transfer of heat from the shelves to the partition 35. Brackets 47 extend across the top of the structure and the partition 35 together with the sheet metal portions 31 and 32 are soldered and otherwise secured to these brackets which brackets provide a mounting device for securing the cooling unit 15 in the cabinet 10.

The shelves 41 serve to provide the evaporator with sharp freezing zones or supports and are adapted to receive and support a receptacle 48 containing a substance to be congealed or frozen. The expansion valve 24 is secured in any suitable manner such as by a bracket 49 to one of the supporting brackets 47. It will be noted that a portion of each shelf 41 is turned upwardly, as at 46, at the rear thereof and this upturned portion provides a stop for the tray or receptacle 48. A refrigerant conduit 51, (see Figs. 3 and 4) connects the expansion valve 24 with the refrigerant passage 44 formed in the upper shelf 41. A conduit 52 connects the refrigerant passage 44 in the upper shelf 41 to the refrigerant passage 44 in the lower of the shelves 41 (see Fig. 3). The pipe 53 communicates with the refrigerant passage 44 in the lower of the shelves 41 and is connected to the passage 34 formed between the metal sheets 31 and 32 (see Figs. 3 and 4).  
 80 Having described the refrigerant connections with the various refrigerated surfaces of the cooling unit it will be obvious to those skilled in the art that refrigerant admitted to the cooling unit 15, by the expansion valve 24, flows through 35 the pipe 51, passage 44 formed in the upper of the shelves 41, pipe 52, to the refrigerant passage 44 formed in the lower of the shelves 41 and thence through pipe 53 to the refrigerant passage 34 of the air cooling portion of cooling unit 15.  
 40 The path of flow of the refrigerant from the expansion valve 24 through the shelves 41 is a single or series path of flow. The lowermost and the uppermost refrigerated passages 34, in sheet metal portions 31 and 32, extend continuously 45 throughout the length of the sheets 31 and 32, while the portions of passages 34 intermediate these continuously extending portions are divided into two sets, each set extending from a point adjacent the ends of the sheet metal portions at the front of the unit to a point near the center of the metal portions disposed at the rear of the cooling unit. Since pipe 53 connects with the lower of the passages 34 and since this passage extends continuous throughout the length of the  
 55 sheets 31 and 32 it will be obvious that refrigerant is circulated in both horizontal directions from the point of communication of the pipe 53 of the passage 34, and thence upwardly through the two sets of the passages 34 to the point of communication of the gaseous refrigerant outlet pipe 17.

The thermostat 25 may be located or secured to the cooling unit at any desired point to insure that the temperature of the shelves 41 is maintained below 32° F., so that substance contained in the trays 48 disposed on the shelves 41 will be frozen, and to insure that only a predetermined small amount of liquid refrigerant is permitted to flow to the refrigerant expansion passages 43 so that there will be a substantial difference in the temperature of the refrigerated surface formed by the metal sheets 31 and 32 and the refrigerated shelves. This temperature difference may be predetermined in accordance with  
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the size of the refrigerated air cooling surface of the unit, provided by metal sheets 31 and 32, and/or by the proper location of the thermostat 25 relative to the sensibility of the charge of fluid contained in the thermostat. The temperature difference is preferably sufficient to insure quick freezing of a substance contained in the trays 48 while at the same time affording a suitable temperature in the refrigerant passages 43 of the refrigerated air cooling surfaces to chill air within the refrigerator food compartment to a temperature sufficient to properly preserve food stored therein. In order to carry out the objects of the invention and to render an apparatus suitable to meet the foregoing requirements other modified structure are, of course, desired to be within the realm of my invention. For example, I am aware of the construction of a structure wherein insulation may be employed between the freezing zone, the bottle cooling compartment and the box or air cooling portion of the cooling unit to insure the proper temperature difference between these zones or compartments and such structures are desired to be considered within the scope of this invention so long as there is provided a unitary cooling unit structure.

In the structure disclosed the refrigerated surface provided by the metal portions 31 and 32 is preferably maintained at between 35° F. and 45° F., so that the air passing thereover and circulating within the food storage compartment and upon absorbing heat leaking into this compartment will be maintained by this refrigerated surface at between 45° F. and 55° F. By maintaining the box cooling or air cooling surfaces of the cooling unit between 35° F. and 45° F. it is obvious that the bottle cooling compartment 36 of the cooling unit will be maintained somewhere in the neighborhood of this temperature, which is desirable and preferable for cooling the bottled beverages disposed in the compartment 36 to the proper temperature of between 35° F. and 45° F. The temperature within or of the sharp freezing zone which is normally always maintained below 32° F. will not readily reduce the temperature of the bottle compartment 36 because the refrigerated shelves 41 are in limited contact only with the partition 33. It is to be understood that this partition may, if desired, be formed of a metal having low heat conducting properties as compared to the properties of the metal of the refrigerated shelves 41 and the portions 31 and 32. In order to carry out the objects of the invention it is to be further understood that a limited circulation of the air in the food storage compartment in contact with the bottles within the bottle cooling compartment of the cooling unit may be provided while at the same time preventing circulation of this air through or in contact with the freezing zone.

The bottled beverages to be cooled may be placed in one side of the U-shaped bottle compartment 36 of the cooling unit 15 and, after this compartment has been filled with bottles, the act of placing another bottle into the compartment will progressively move all the bottles in the compartment. Thus the coldest bottle will be moved forward in the opposite side or leg of the compartment where it is readily accessible from the front of the cabinet and can be removed from the cooling unit.

It is apparent from the foregoing therefore that I have provided an improved cooling unit for household refrigerators and in addition my improved cooling unit obviously overcomes the

conditions herein enumerated relative to the coldest bottle of beverages stored in the household refrigerator cabinet being rendered inaccessible. Furthermore, my improved cooling unit provides for the quick and efficient cooling of bottled beverages and also permits the storage thereof in a household refrigerator cabinet in a manner which prevents the bottled beverages from interfering with or impeding circulation of air within the food storage compartment of the cabinet.

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, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A unitary cooling unit structure for a household refrigerator comprising, a refrigerated surface providing said unit with an air cooling portion, a second refrigerated surface within said air cooling portion of said unit providing a sharp freezing zone for receiving and supporting a receptacle adapted to contain a substance to be congealed or frozen, means interposed between said refrigerated surface of said freezing zone and the refrigerated surface of said air cooling portion of the cooling unit and forming an elongated support for the reception of a plurality of bottles to be cooled, said means also including a vertically disposed portion forming a wall between the freezing zone and the air cooling portion of the cooling unit, and means for supplying refrigerant to the refrigerated surface of said freezing zone and to the refrigerated surface of the air cooling portion of the cooling unit.
2. A unitary cooling unit structure for a household refrigerator comprising a vertically disposed refrigerated surface providing said unit with an air cooling portion, a second refrigerated surface disposed horizontally within said air cooling portion to provide said unit with a sharp freezing support for receiving a receptacle adapted to contain a substance to be congealed or frozen, means interposed between and spacing said air cooling portion of the unit from said sharp freezing support and providing a vertical wall of a compartment for receiving and supporting a plurality of bottles to be cooled, and means for supplying refrigerant to the refrigerated sharp freezing support and to the refrigerated surface of said air cooling portion of the cooling unit.
3. A unitary cooling unit structure for a household refrigerator comprising, sheet metal portions having parts thereof spaced apart and certain other parts thereof secured together to provide refrigerant conveying passages therebetween, said sheet metal portions being arranged to provide said unit with a refrigerated air cooling portion, other sheet metal portions having parts thereof spaced apart and certain other portions thereof secured together to provide a refrigerant conveying passage therebetween, said other sheet metal portions being disposed horizontally within said air cooling portion of the unit to provide a sharp freezing support for receiving a receptacle adapted to contain a substance to be congealed or frozen, means interposed between said air cooling portion and said sharp freezing support of the unit and providing a compartment for receiving and supporting a plurality of bottles to be cooled, means for supplying refrigerant directly to the refrigerated sharp freezing support, and means for conducting refrigerant directly from the refrigerated sharp freezing support to

the refrigerated surface of said air cooling portion of the cooling unit.

4. A unitary cooling unit structure for a household refrigerator comprising, sheet metal portions having parts thereof spaced apart and certain other parts thereof secured together to provide refrigerant conveying passages therebetween, said sheet metal portions being vertically disposed and arranged to form a substantially U-shaped refrigerated air cooling portion for said unit, other sheet metal portions having parts thereof spaced apart and certain other parts thereof secured together to provide a refrigerant conveying passage therebetween, said other sheet metal portions being disposed horizontally within said air cooling portion of the unit to provide a sharp freezing support for receiving a receptacle adapted to contain a substance to be congealed or frozen, means interposed between said air cooling portion and said sharp freezing support of the unit and providing a substantially U-shaped compartment for receiving and supportingly guiding a plurality of bottles to be cooled around said sharp freezing support and within the U-shaped air cooling portion of the unit, and means for supplying refrigerant to the refrigerated sharp freezing support and to the refrigerated surface of said air cooling portion of the cooling unit.

5. A shelf for a cooling element of a refrigerating apparatus comprising, superimposed sheet metal portions secured together at certain points and spaced apart at certain other points to form a refrigerant expansion passage therebetween, said shelf including a portion extending angularly therefrom inwardly of the end thereof and forming a stop for a receptacle adapted to be received by the shelf.

6. A unitary cooling unit structure for a household refrigerating apparatus comprising, a refrigerated surface providing said unit with an air cooling portion, another refrigerated surface providing said unit with a sharp freezing zone, said freezing zone being horizontally disposed within said air cooling portion of the unit for receiving and supporting a receptacle thereon adapted to contain a substance to be congealed or frozen, means adjacent one of said refrigerated surfaces and forming a support on said unit for the reception of bottles to be cooled, means for supplying refrigerant directly to the refrigerated surface forming said freezing zone, and means for conducting refrigerant directly from the refrigerated surface of the freezing zone to the refrigerated surface forming said air cooling portion of the cooling unit.

7. A unitary cooling unit structure for a household refrigerator comprising, a refrigerated surface providing said unit with an air cooling portion, another refrigerated surface providing said unit with a sharp freezing zone, said freezing zone being horizontally disposed for receiving a receptacle thereon adapted to contain a substance to be congealed or frozen, means forming a support on said unit for the reception of bottled beverage to be cooled, and said support being extended around three sides of the refrigerated surface forming said sharp freezing zone to permit the passage of bottled beverages therearound.

8. A unitary cooling unit structure for a household refrigerator comprising, a refrigerated surface providing said unit with an air cooling portion, another refrigerated surface providing said unit with a sharp freezing zone, said freezing zone being horizontally disposed for receiving a re-

ceptacle thereon adapted to contain a substance to be congealed or frozen, means forming a support on said unit for the reception of bottled beverage to be cooled, and said support being in the form of a U-shaped track extending around three sides of the refrigerated surface forming said sharp freezing zone.

9. A combined unitary cooling unit and bottled beverage support for household refrigerators comprising, a vertically disposed substantially U-shaped portion having parts thereof refrigerated and providing an air cooling surface for said unit, and a horizontally disposed substantially U-shaped track for the reception of the bottled beverages carried by said air cooling surface.

10. A unitary cooling unit for household refrigerators comprising, a refrigerated vertically disposed reverse turned portion providing said unit with an air cooling surface, and means carried by said air cooling surface and forming a horizontally disposed reverse turned track for receiving and supporting bottled beverages thereon.

11. A unitary cooling unit for household refrigerators comprising, a refrigerated vertically disposed reverse turned portion providing said unit with an air cooling surface, another refrigerated portion providing said unit with a sharp freezing zone, said freezing zone portion being horizontally disposed within said air cooling portion of the unit for receiving a receptacle thereon adapted to contain a substance to be congealed or frozen, and means separating the refrigerated surface of said sharp freezing zone from the refrigerated surface forming the air cooling portion of the unit, said means forming a reverse turned horizontally disposed track extending around said freezing zone for receiving and supporting bottled beverages thereon.

12. The combination of a refrigerator cabinet having a cooling element of a refrigerating system disposed therein for cooling and causing circulation of air within said cabinet, means forming a supporting and guiding structure on said cooling element for a plurality of containers, said structure having a bottom supporting surface and upright guide parts forming a track for directing the containers, said track having a curved portion and relatively straight leg portions, and said structure permitting the containers to be pushed by hand around the track.

13. Apparatus as set forth in claim 12 in which a refrigerated support for an ice tray is disposed between the leg portions of the track.

14. Apparatus as set forth in claim 12 in which a refrigerated support for an ice tray is disposed between the leg portions of the track and in which at least one of the upright guide parts of the track is refrigerated and forms the air cooling portion of the cooling element.

15. Apparatus as set forth in claim 12 in which at least one of the upright guide parts of the track is refrigerated and forms the air cooling portion of the cooling element.

16. Apparatus as set forth in claim 12 constructed to permit the containers to be pushed around the track in either direction.

17. In a refrigerator, walls defining a food storage space having a given depth, a cooling element of a refrigerating system disposed in said food storage space for cooling and causing circulation of air therein, means forming a supporting and guiding structure on said cooling element for a plurality of substantially cylindrical containers, said structure having a bottom sup-

porting surface and upright guide parts forming a track for directing the containers, said track having a curved portion and relatively straight leg portions, and said track being disposed depthwise of the refrigerator whereby a container may be pushed at the front of the refrigerator to cause all the containers to travel in the track guided by said upright parts thereof, the containers on one side of the track moving rearwardly and on the other side thereof forwardly, the con-

tainers acting as rollers with respect to each other.

18. Apparatus as set forth in claim 17 in which a refrigerated support for an ice tray is disposed between the leg portions of the track.

19. Apparatus as set forth in claim 17 in which at least one of the upright guide parts of the track is refrigerated and forms the air cooling portion of the cooling element.

LLOYD M. KEIGHLEY. 10