July 29, 1941. R. H. GUYTON ET AL 2,250,952

COOLER WITH WET AND DRY STORAGE

Filed Feb. 27, 1939 6 Sheets-Sheet 1

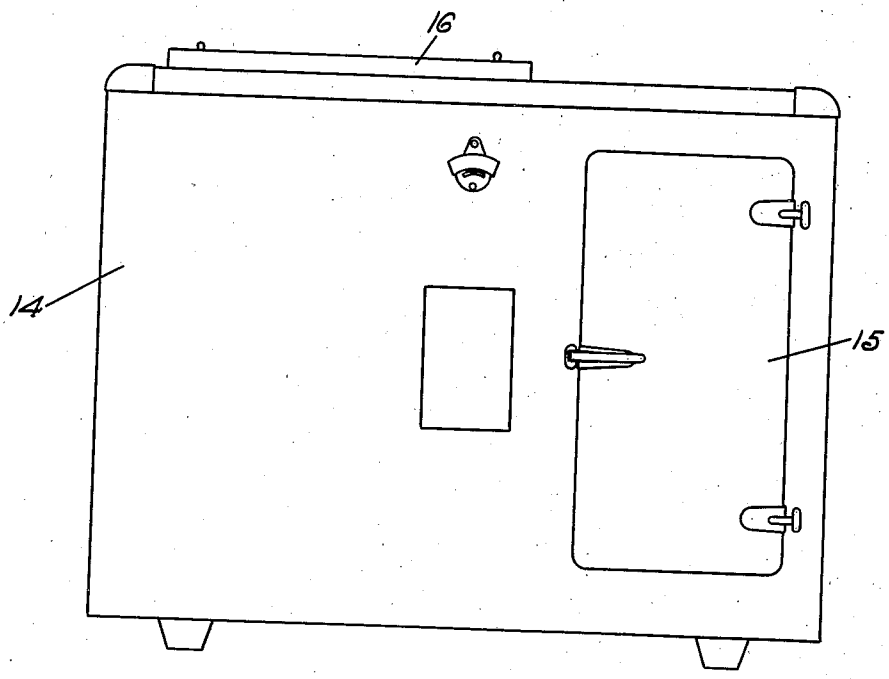


FIG. 1

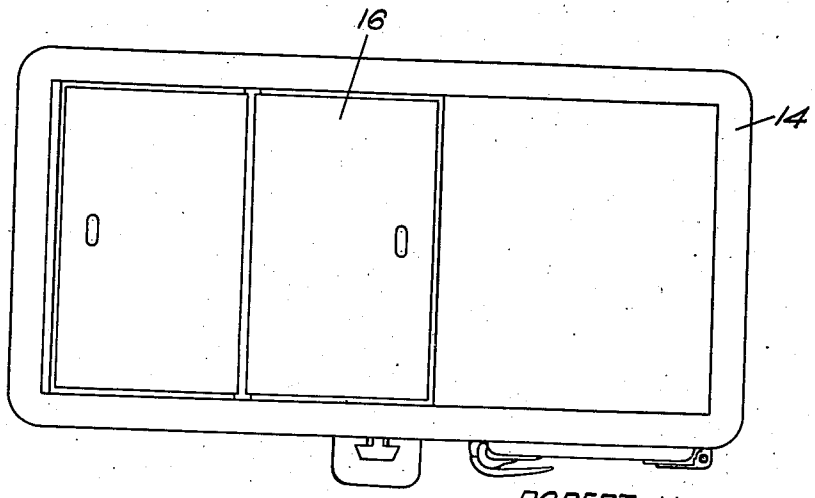


FIG. 2

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COOLER WITH WET AND DRY STORAGE

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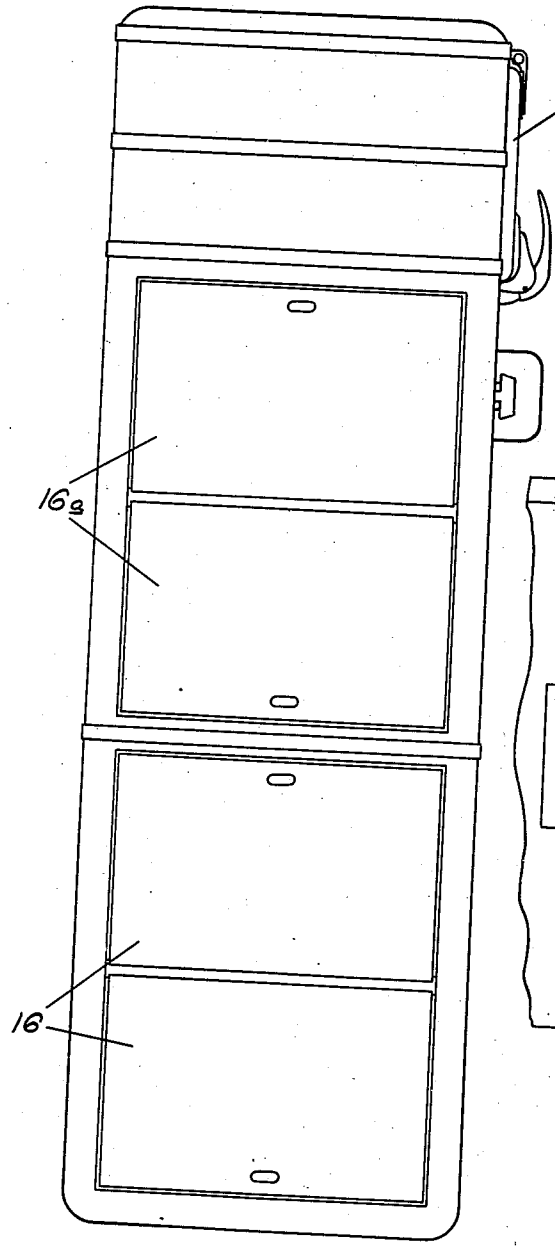


FIG. 3

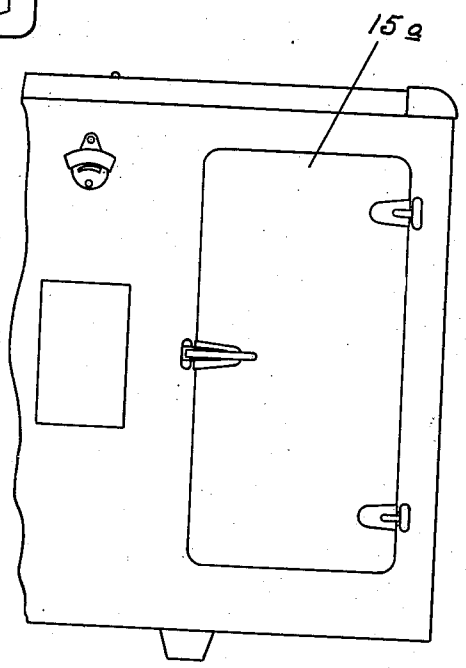


FIG. 4

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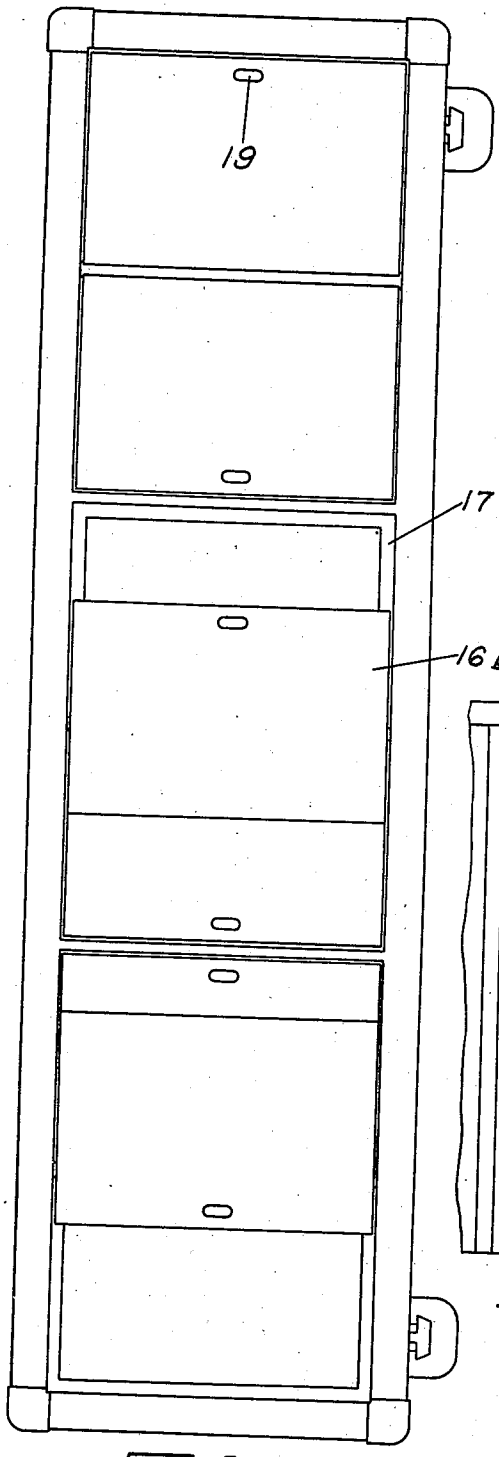


FIG. 5

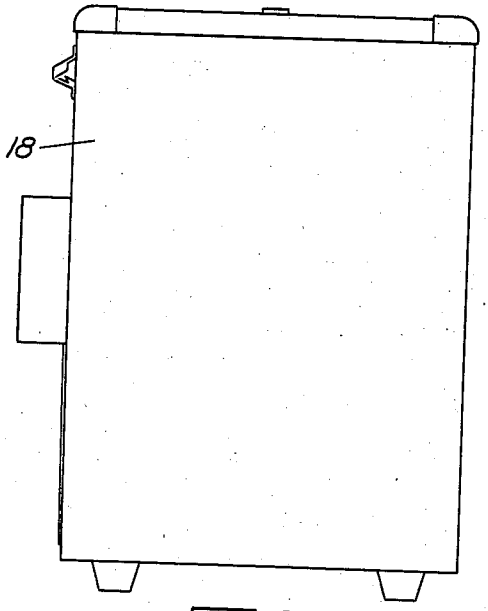


FIG. 6

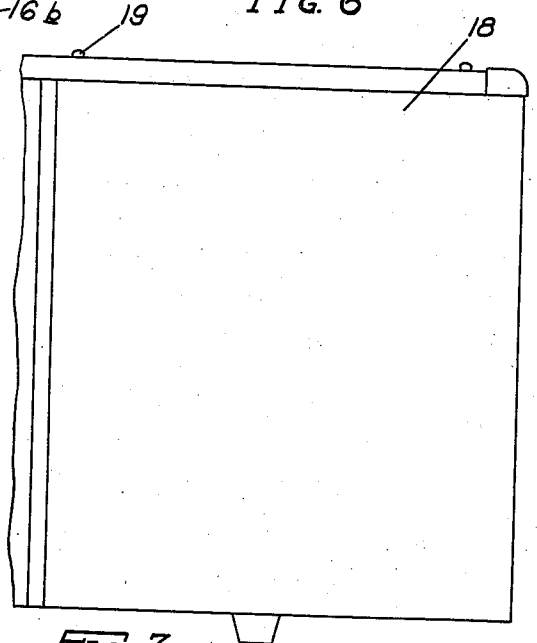


FIG. 7

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COOLER WITH WET AND DRY STORAGE

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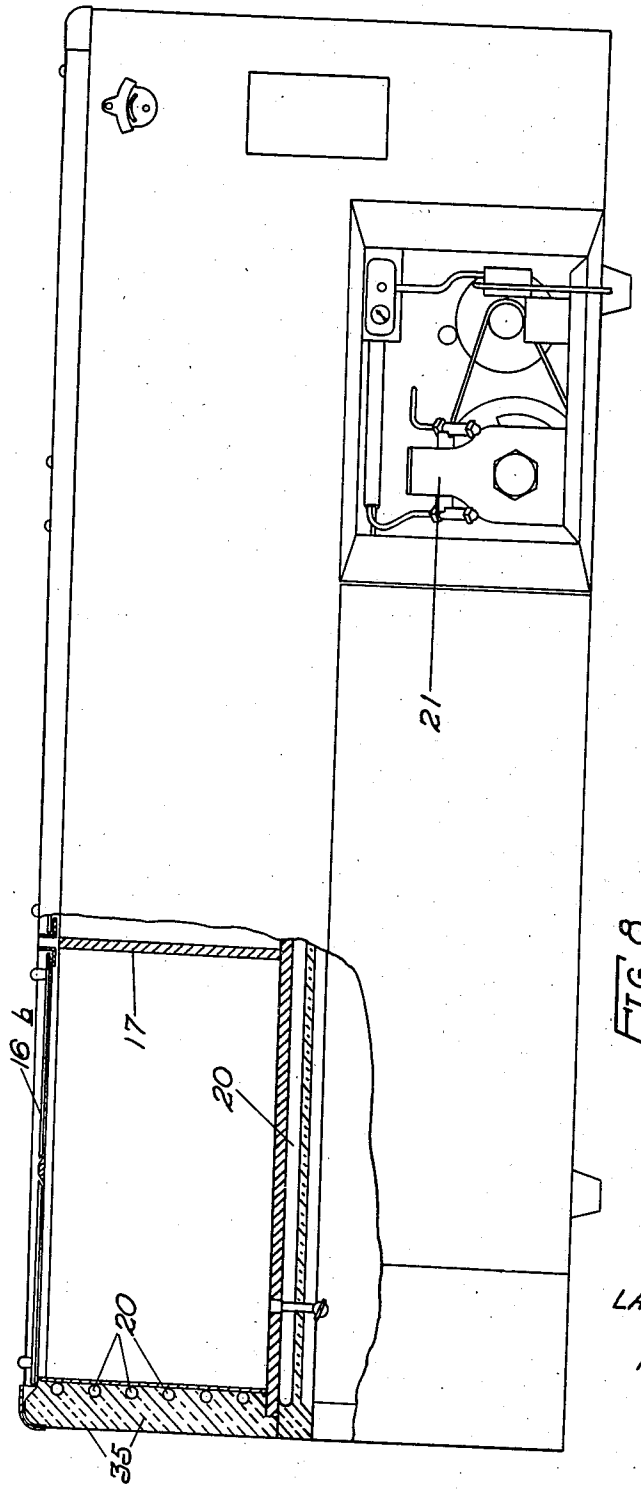


FIG. 8

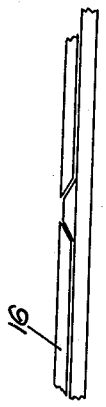


FIG. 9

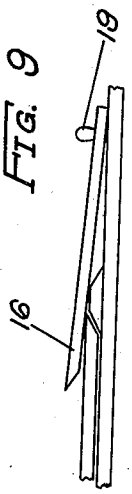


FIG. 10

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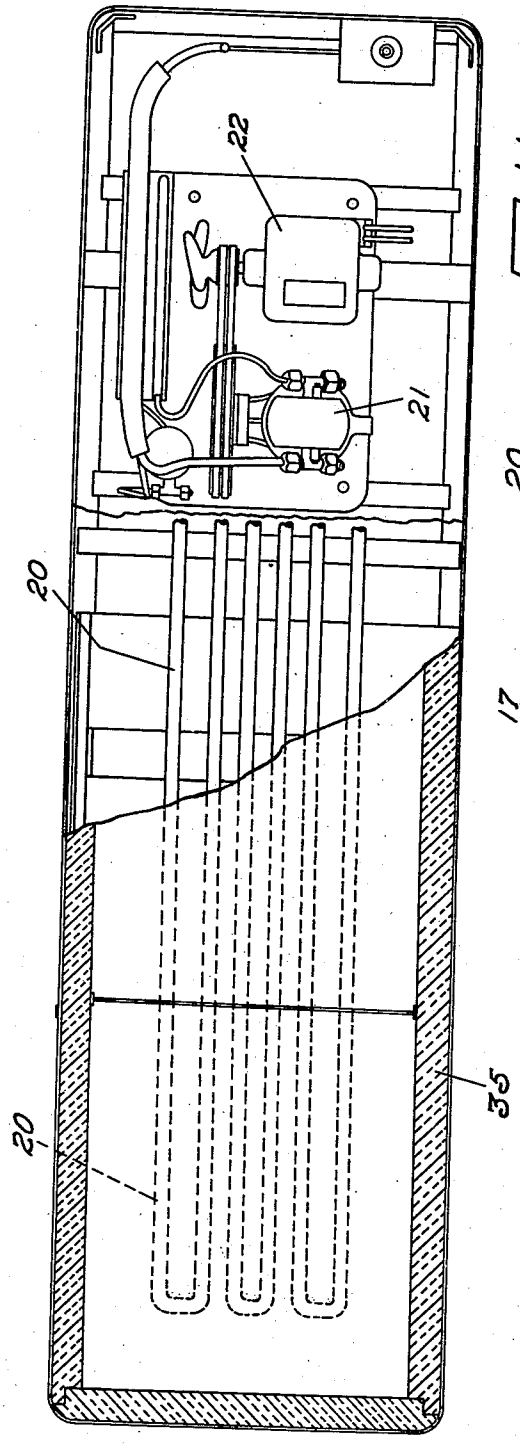


FIG. 11

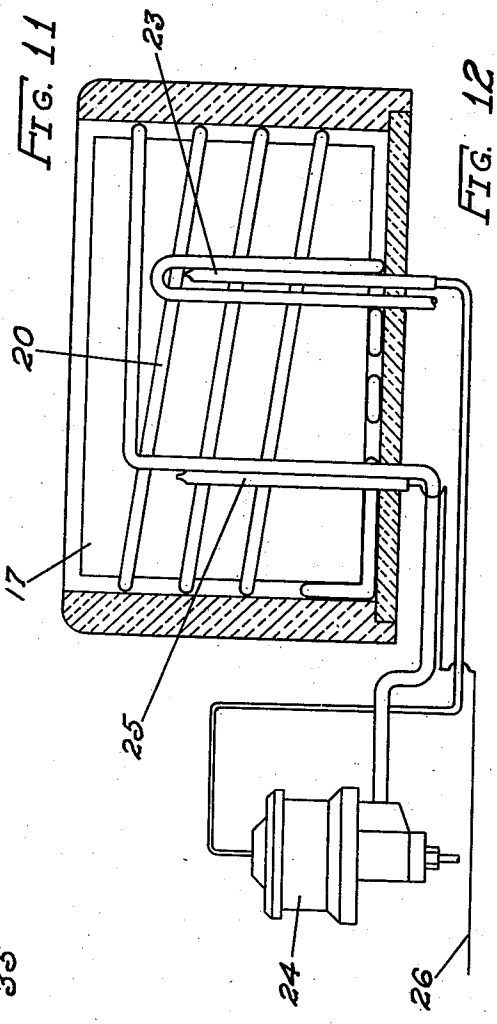


FIG. 12

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COOLER WITH WET AND DRY STORAGE

Filed Feb. 27, 1939 6 Sheets-Sheet 6

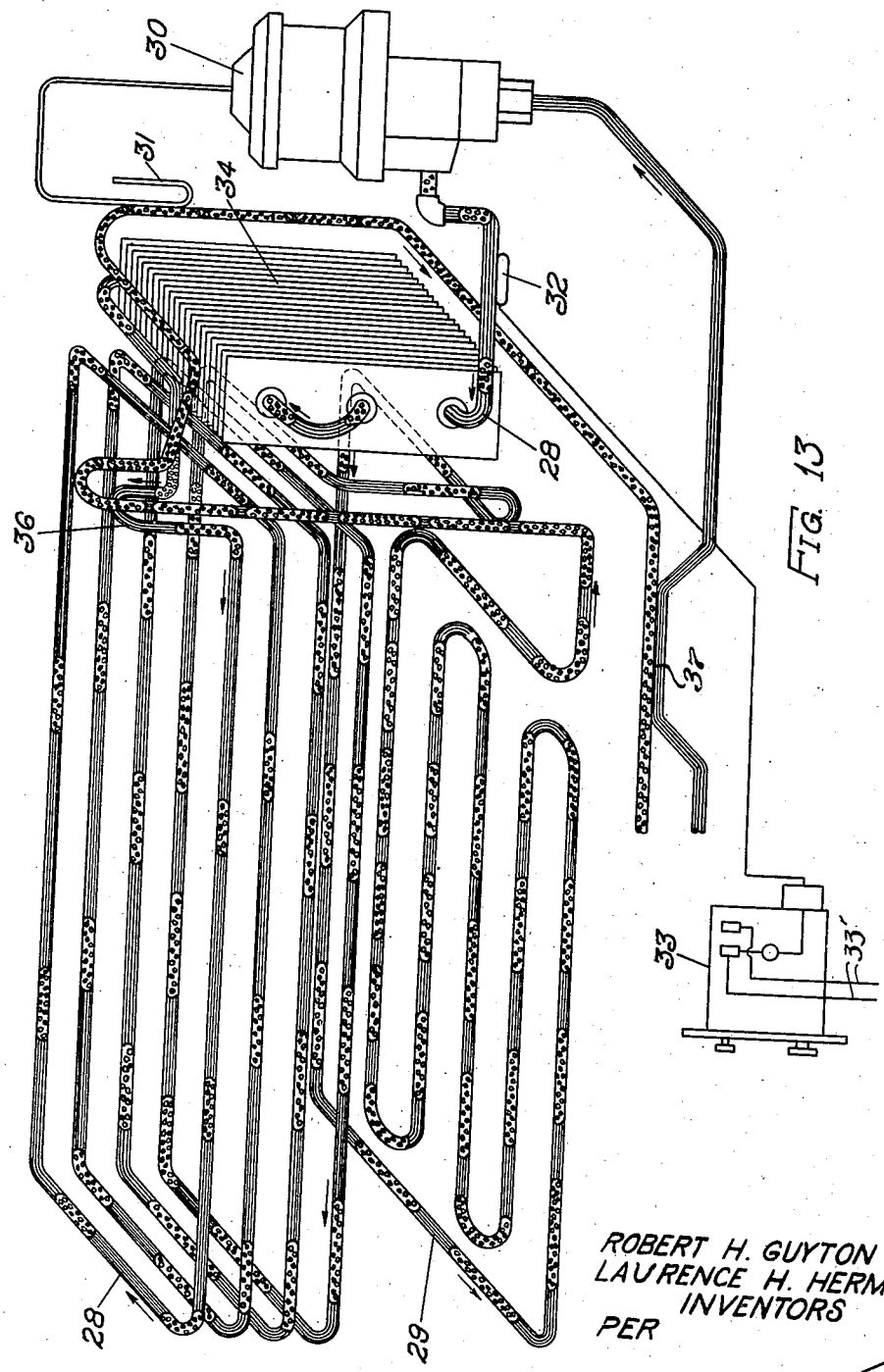


FIG. 13

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Patented July 29, 1941 2,250,952

UNITED STATES PATENT OFFICE

2,250,952

COOLER WITH WET AND DRY STORAGE

Robert H. Guyton and Laurence H. Herman, Muskegon, Mich., assignors to The Brunswick-Balke-Collender Company, Chicago, Ill., a corporation of Delaware

Application February 27, 1939, Serial No. 258,651

9 Claims. (Cl. 62—4)

This invention relates to an improved cooler, with wet and dry storage, and has for one of its principal objects the provision of a cooler or refrigerator which can be conveniently used for cooling and dispensing bottled drinks and which, furthermore, can also be employed for the refrigeration, preservation and handling of various food items.

This application constitutes a continuation, in part, of a prior application for patent, by Robert H. Guyton, one of the joint inventors herein, entitled "Bottle cooler," the same having been filed on May 7, 1936, Serial No. 78,332.

One of the important objects of this invention is the provision of a specific control for the cooling of the tank in which the bottled beverages are immersed, this tank preferably containing a supply of fresh water, which water is brought to a point just below freezing, whereby the formation of ice may take place on the sides of the tank in the event this particular condition is desired during operation.

Another important object of the invention is the construction of a system of cooling coils in combination with a tank, the said tank adapted to contain a cooling liquid such as water, whereby a positive temperature differential is maintained between the top and bottom of the tank so that while ice will form on the sides and at the uppermost level of the water in the tank, any bottles in the tank will not freeze to the bottom thereof.

A still further object of the invention is the provision of a positive temperature control both as regards the tank and its contents, known as the wet storage, and the other compartment of the cooler, which is known as the dry storage, the whole being accomplished from one cold control and one thermostat expansion valve.

In an improved embodiment of this invention the method of control comprises a contact of the control bulb for the compressor motor immediately after the first expansion of the thermostatic expansion valve, whereby a closer temperature control is accomplished.

Another object is to provide means for actually cooling the air above the wet storage tank by placing the coldest part of the refrigeration circuit adjacent this part of the refrigerator casing.

A still further object resides in the provision of means whereby an increase in temperature of the refrigerant is accomplished as the refrigerating coils encircle the lower portions of the wet storage compartment, finally making the bottom thereof approximately four to seven degrees warmer than the top. This provides for the natural convection of water to cool the sides of bottles of beverages in the wet storage tank.

Other and further important objects of the invention will be apparent from the disclosures in the accompanying drawings and following specification.

The invention, in a preferred form, is illustrated in the drawings and hereinafter more fully described.

In the drawings—

Figure 1 is a side elevation of a bottle cooler showing one embodiment of our invention;

Figure 2 is a top plan view of the cooler illustrated in Figure 1;

Figure 3 is a top plan view of a cooler showing another embodiment of the invention;

Figure 4 is a front view of one end of the device shown in Figure 3;

Figure 5 is a top plan view of a further embodiment of the invention, showing certain of the sliding doors open for ready access to the interior of some of the cooling compartments;

Figure 6 is an end view of the device shown in Figure 5;

Figure 7 is a side view of one end of the structure of Figure 5;

Figure 8 is a front view, parts being broken away, showing certain of the interior construction of the cooler of Figure 5, and also showing the compressor and other parts of the refrigerating apparatus;

Figures 9 and 10 are detail views illustrating the construction and operation of the slidable covers;

Figure 11 is a top view, parts being broken away and other parts being shown in section, illustrating various interior arrangements and appurtenances;

Figure 12 is an end view showing the positioning of some of the refrigerating coils with respect to what is known as the wet tank, and also illustrating the positioning of some of the controls;

Figure 13 is a diagrammatic view showing the arrangement of the cooling coils in connection with both the wet and dry compartments, the expansion valve, its control, and the further control together with its electrical connections for the compressor motor.

As shown in the drawings—

The reference numeral 14 indicates generally the casing of the improved wet and dry cooler of this invention, the same having a door 15 for entrance to the dry storage compartment and a pair of slidable doors 16 in its top for entrance to the wet cooling compartment.

In Figures 3 and 4 the doors 16 are duplicated at 16—*a*, this being for a larger construction, and the entrance to the dry storage compartment is indicated at 15—*a*.

The sliding doors are further illustrated at 16—*b* in Figure 5, this particular embodiment of the invention, however, including three wet compartments, as illustrated at 17, and no dry com-

partment. The casing of this particular construction is indicated at 18 in Figure 6. It will be noted that the sliding doors are manipulated by means of knobs or the like 19.

The wet tank or cooling water receptacle is shown in more detail at 17 in Figure 8, the same being surrounded by means of coiled pipes 20, each carrying refrigerant from a compressor indicated at 21.

It will be further noted that the pipes 20 extend beneath the tank 17, this being for the purpose of cooling the bottom thereof. This arrangement appears in more detail in Figure 11 and in this figure certain of the connections between the compressor 21, the motor 22 and other parts are illustrated.

An end view of the refrigerant pipes of Figure 11 is shown in more detail in Figure 12.

A control 23 for the expansion valve 24 is located at a point on the coils 20 where the refrigerant has practically assumed a gaseous state under normal operation; this system, however, comprising what is known as the flooded type. A further control 25, which leads by means of a wire 26 or the like to the motor 22, is positioned on the coils 20 at a point closely adjacent to the expansion valve.

In the system illustrated at Figure 13 the coils 28 surround the wet tank 17 (not shown); a further continuance 29 of these same coils underlying the tank. The expansion valve 30 is controlled by means of a bulb or similar device 31 mounted on that portion of the return part of the device 20 where the refrigerant has practically assumed a gaseous state, and a control 32, connected to govern a thermostatic switch 33 in turn connected by electrical leads 33' to the compressor motor, is positioned on the refrigerant pipe 28 at a point closely adjacent to the expansion valve. This coil then enters and runs back and forth through a series of fins or plates, as shown at 34, which are positioned in the dry storage compartment of any of the devices of Figures 1, 2, 3 and 4. The course of the refrigerant is indicated by arrows in Fig. 13.

This particular construction provides a unique method of cold control, which operates on a closer temperature range than has heretofore been considered possible. Additionally, the temperature differential between the top and bottom of the wet tank, as well as the positive temperature control in both the wet and dry storage compartments, is maintained from one cold control and one thermostatic expansion valve. There is no necessity for placing a cold control inside, or even in contact with, the wet tank.

The coils around the wet tanks are embedded in some insulating material, as illustrated at 35 in Figures 8 and 11 and this excludes any possibility of moisture ever freezing in this insulating material, which otherwise would cause trouble by bulging the tank walls. This also has a certain physical strengthening effect on the walls of the tank, whereby a lighter gauge metal can be used.

Furthermore a certain amount of refrigerating effect is stored in the insulating material itself, this having a tendency to level out the change of temperature caused by the periodical operation of the compressor. The use of the insulating material, which may be asphalt or some other suitable composition, eliminates undesirable repeated starting and stopping of the compressor.

Ordinarily the contents of the wet tank are kept at a temperature a few degrees above the freezing point, but ice can be formed on the side walls, and will be so formed if the refrigerator is not being used to its fullest capacity. No ice is ever formed on the bottom of the tank, because the refrigerant temperature automatically is at a higher level than that which would be required to form ice in the tank, at least when the refrigerant reaches that portion of the coils 29 which are adjacent the under surface of the tank, this being best shown in Figure 13 where the proportion of liquid refrigerant to expansion refrigerant in the coils 28 and 29 is graphically illustrated. However ice can be formed on the tank bottom, if such a condition is desired, simply by an adjustment of the cold control. It will be noted that upon leaving the expansion valve 30 the refrigerant is largely in a liquid condition, but as it traverses the coils, through the fins 34, it assumes more of a gaseous condition and then enters that portion of the coils 28 which are around the tank 17 adjacent the bend or loop indicated by the reference numeral 36. At this point there is still a good deal of liquid refrigerant, as compared to vapor, therefore the cooling effect on the sides of the tank is greater than it is on the bottom where the refrigerant is in the coils 29 and comprises a larger proportion of the vapor phase. This feature also provides a dryer for the refrigerant. To further vaporize the refrigerant before reaching the compressor, the liquid line and suction line are soldered together as seen at 37 in Figure 13, thereby transferring the heat from the liquid to the suction refrigerant. The liquid is practically all vapor at the point where the expansion valve bulb 31 is attached.

The dry storage compartment can be used for quite a variety of purposes, the same being mainly for the preservation of food stuffs in a dry state, and the tank 17 may also be used to preserve food stuffs in a dry state.

The method of control of the motor, as exemplified at 32 and 33 in Figure 13, is one of the most salient features of this invention and makes possible the use of this combination beverage cooler and dry storage compartment or beverage cooler alone, with a much better control of temperatures and a positive functioning under any and all conditions, together with the additional advantage of temperature control for both the wet and dry storage tanks, and even when the so-called wet tank is used dry for the preservation of foods.

In the construction illustrated in Figures 8 and 11, one or more of the tanks 17 can be used as a wet storage and the remaining tanks used as a dry storage, or vice versa, in any combination, and satisfactory functioning will still result.

The positive operating control of the wet and dry storage compartments is due in a great measure to the placing of the cold control bulb 32 at the beginning of the expansion circuit and in the dry storage compartment, as best illustrated in Figure 13, whereby this control is operating practically the same as a low pressure control. Accordingly if the dry storage compartment needs refrigeration, this is taken from the wet storage until a balance is arrived at, considering of course the desired temperature differential, and it is at this point that the compressor starts. It does not again stop until both compartments have been reduced to the proper desired operating temperature. Therefore it makes no difference as to whether the wet or dry storage compartments are used excessively. Even if the wet

storage is used excessively, the dry storage will not be accordingly reduced, but greater in temperature; and the reverse is also true. Furthermore, the addition of a relatively large number of warm bottles, or other warm objects, to the wet compartment, or to the dry compartment for that matter, will not have a tendency to unduly raise the temperature of other objects which are already in either or both of these compartments.

The combination of a refrigerating system operated by one thermostatic control which gives different temperatures in two compartments is novel in this field; the main essential being preliminary refrigeration of the dry storage and intermittent cooling of the sides of the wet tank and a final cooling at the bottom thereof. In other words, the coil 29 under the bottom of the tank 17 is the dryest coil in the refrigerating system. This provides continuous cooling, as compared with the so-called batch cooling heretofore known in the industry.

The tubing 20, 28 and 29 is preferably soldered to the walls of the tank 17, this soldering being substantially solid throughout the length of the connection. The fin coil 34 can be soldered to the end of the wet tank, or there may be a sheet of insulating material between the wet and dry compartments.

The one point where the tubes 28 which surround the tank 17 need not be buried in the insulating medium or asphaltic compound is on that end adjacent the fin coil where this coil projects into the dry storage compartment and this end of the wet storage compartment forms part of the side wall of the dry storage. This section can be left open to the action of the dry storage inasmuch as when the compressor is not running, refrigeration which has been stored up in the wet storage is then accordingly available for assisting in cooling the dry storage compartment. This prevents a continuous intermittent operation of the condensing unit even though the doors 15 and 15—*a* to the dry storage compartments are opened a considerable number of times.

The coldest refrigerant will be delivered to the dry storage, this being later transferred to the wet storage after the dry storage has had the necessary amount of heat extracted. The wet storage will then store up considerable cold, which can be later drawn upon by the dry storage while the compressor is not in operation. This balances out the refrigerating system.

By the use of this invention, which distinguishes from the previous coolers known as batch coolers, a case of warm bottles of beverage can be placed in the wet storage without unduly raising the temperature of previously contained bottles to a point where the contents are not palatable. This undesirable raising of temperature of previously cooled bottles in batch coolers often occurs on hot summer days.

In the device of this invention, when a new case of warm bottles at a temperature of around 100° F. is placed in the cooler, the outside temperature being also around 100° F., the temperature of the contents of the bottles previously cooled in the cooler is not raised above a desirable or palatable temperature during the time the temperature of the bottles which have just been placed in the cooler is brought down to a desirable temperature. This is the prime difference between batch cooling and individual cooling and depends entirely on the proper placing of the refrigerating coils on the sides and bottom of the tank, and the method of control.

The cold control is adjustable to enable the user to regulate temperatures as desired, and the temperature can be brought down to the point where considerable ice will form on the inside walls of the wet tank.

In the embodiments of the invention shown in Figures 5, 6, 7, 8, 11 and 12 there is no dry storage cavity, the cooler shown in these figures comprising one or more wet storage tanks, all surrounded by the refrigerating coils, and portions of the coils under-lie the bottoms of these tanks, as best illustrated in Figures 11 and 12.

The multiplicity of tanks in the top coolers of Figures 5 to 8, inclusive, provides accommodations for beverage cooling and also for the dry preservation of foods, inasmuch as any one or more of these tanks can be used in the dry state as well as in the wet state, with no change in the equipment.

When used as a beverage cooler the liquid in the tank is in direct contact with the metal walls of the tank, which walls are practically a part of the refrigerating circuit. Therefore the device is not dependent upon an intermittent medium, like water, for the transmission of all of the heat from the beverage to be cooled to the refrigerant. When warm bottles are put into a tank containing water and cooled bottles, there is practically no inter-communicating heat transferred from the cold bottles to the warm bottles, because due to the contact of the bottles with the bottoms and sides of the tanks, and accordingly the refrigerant coils, the heat is taken directly away from the warm bottles by the refrigerating system, which is always lower in temperature than the water in the tank or the previously cooled bottles.

The refrigeration action on five sides of a tank or similar compartment is one of the most important features of this invention and could further be expanded to the refrigeration of a confined space with a certain cubicle content, and this could be carried on to a point where the temperature of the space or cavity would approximate the saturation temperature of the refrigerant. One method of accomplishing this would be to include the five sides of a compartment as the fin area of the evaporator. In this manner foods could be stored at a higher relative humidity than is already possible, on account of the fact that the average evaporator temperature would be approximately that of the cavity.

Various materials can be preserved in these tanks when used as dry storage compartments, better than by direct contact with ice, such as for example, fresh fish. Also a more even temperature can be continuously maintained, even in view of adverse conditions such as continual opening and shutting of the lids. This is due to the fact that cold air remains in the tank even though the lid is opened, and a higher relative humidity is maintained than by any other cooler.

We are aware that many changes may be made and numerous details of construction varied throughout a wide range without departing from the principles of this invention, and we therefore do not propose limiting the patent granted thereon otherwise than as necessitated by the prior art.

We claim as our invention—

1. A cooler comprising a main cabinet, a dry cooling compartment and a wet refrigerating compartment in the cabinet, a separate closure for each compartment, a portion of the wall of the wet cooling compartment also forming a

partition between the wet and dry compartments, a refrigerating system including a compressor, a motor therefor, an expansion valve and a coil surrounding and below the wet compartment, a portion of said refrigerating coil positioned in the dry compartment, and control means in the dry compartment for regulating the operation of the cooling coil with respect to both compartments, said control means comprising pressure bulbs, one of said pressure bulbs connected to the expansion valve and the other of said bulbs connected to the motor of the refrigerating system, the control bulb for the motor positioned on the refrigerating coil adjacent the outlet of the expansion valve, and the control bulb for the expansion valve positioned on the coil at a point between its contact with the walls of the wet refrigerated compartment and a suction line by which the refrigerant returns to the compressor; and a soldered connection between the liquid line and suction line of the refrigerator.

2. A refrigerator comprising a cabinet, a plurality of compartments in the cabinet including a wet compartment, a refrigerating unit including a motor, compressor, expansion valve and coils, said coils positioned around the sides and beneath the bottom of the wet compartment, and control means for both the motor and the expansion valve of the system positioned on the coils at one end of the cabinet, the motor control positioned on the coil a comparatively short distance beyond the outlet through which refrigerant is fed to the coils by the expansion valve and the expansion valve control positioned on the coil at a point where the refrigerant in the coil is preponderantly gaseous when in normal operation.

3. A bottle cooler comprising a casing, a wet storage compartment in the top of the casing, a refrigerating system in the casing including an expansion valve and coils surrounding the sides and underlying the bottom of the wet storage compartment, the beginning portion of the refrigerating coils adjacent the outlet of the expansion valve of the system extending adjacent the top of the wet storage compartment, together with a cold control bulb at the beginning of the coils and an expansion valve control bulb adjacent the end of the coils.

4. A bottle cooler comprising a casing, a wet storage compartment in the top of the casing, a refrigerating system in the casing including an expansion valve and coils leading therefrom and surrounding the sides and underlying the bottom of the wet storage compartment, that portion of the refrigerating coils adjacent the expansion valve of the system extending adjacent the top of the wet storage compartment, together with a cold control bulb at the beginning of the coils and an expansion valve control bulb adjacent the end of the coils, the refrigerator coils being soldered to the outer faces of the walls of the wet storage compartment throughout their length; and an asphalt layer surrounding the wet storage tank and in which the refrigerator coils are embedded; together with a heat exchanger between the suction line and the liquid line.

5. A bottle cooler comprising a casing, a wet storage compartment in the top of the casing, a refrigerating system in the casing including an expansion valve and coils leading therefrom and surrounding the sides and underlying the bottom of the wet storage compartment, that portion of the refrigerating coils adjacent the expansion valve of the system extending adjacent the top of the wet storage compartment, together with a cold control bulb at the beginning of the coils and an expansion valve control bulb adjacent the end of the coils, the refrigerator coils being soldered to the outer faces of the walls of the wet storage compartment throughout their length; and an asphalt layer surrounding the wet storage tank and in which the refrigerator coils are embedded; together with a heat exchanger between the suction line and the liquid line, said heat exchanger comprising a soldered connection between said lines at a point ahead of the connection between the suction line and the compressor unit.

6. In a cooler having a dry storage compartment and a wet storage compartment, a refrigerating system comprising a motor, a compressor driven by the motor, an expansion valve, expansion coils disposed to surround the sides and underlying the bottom of the wet storage compartment, and control means for both the motor and the expansion valve of the system comprising a cold control governing the operation of the motor positioned on the coil at a point beyond the expansion valve where the refrigerant is preponderously liquid when the system is in normal operation, and an expansion valve control positioned on the coil at a point where the refrigerant in the coils is preponderously gaseous when in normal operation.

7. In a cooler, a refrigerating system comprising a motor, a compressor driven by the motor, an expansion valve, a refrigerant circulating system connected between the expansion valve and the compressor, and control means for both the motor and the expansion valve of the refrigerating system comprising a cold control governing the operation of the motor mounted in direct contact with the refrigerant circulating system a comparatively short distance beyond the expansion valve, and an expansion valve control mounted on the system near the end of the system.

8. A cooler comprising a cabinet, a dry storage compartment, a wet storage compartment, and a refrigerating system for the compartments comprising a motor, a compressor driven by the motor, an expansion valve and expansion coils connected between the valve and the compressor, a first and last portion of said coils disposed within the dry storage compartment, the intermediate and major portion of said coils disposed about the wet storage compartment to cool the same, and control means for the refrigerating system comprising a cold control connected to govern the operation of the motor mounted on a portion of said coils immediately following said expansion valve, and a control for said expansion valve mounted on the last portion of said coils disposed in the dry storage compartment.

9. In a cooler, a refrigerating system comprising a motor, a compressor driven by the motor, an expansion valve, a refrigerant circulating system connected between the expansion valve and the compressor, means controlling operation of the compressor and responsive to the temperature of the refrigerant substantially as it leaves the expansion valve, and means controlling operation of the expansion valve and responsive to the temperature of the refrigerant at the end of the circulating system adjacent the compressor.

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