July 10, 1951 A. K. SMITH 2,560,488

COMBINATION SODA FOUNTAIN AND ICE CREAM CABINET

Filed Sept. 17, 1949 3 Sheets-Sheet 1

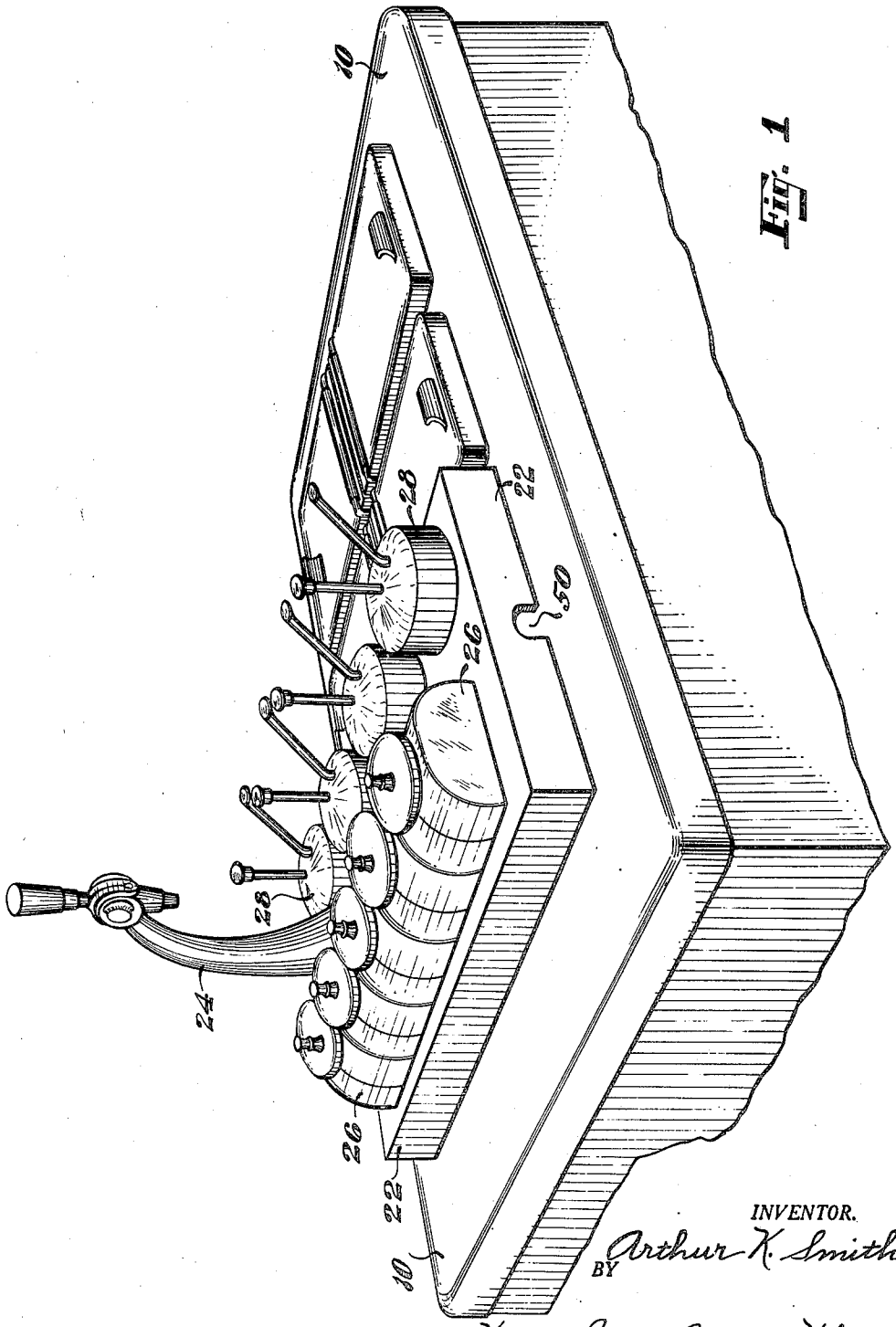


Fig. 1

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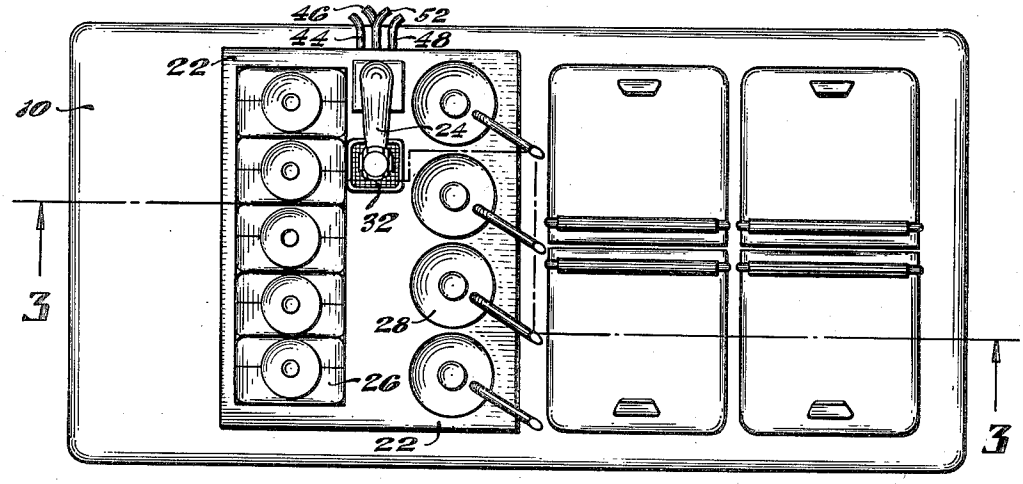


Fig. 2

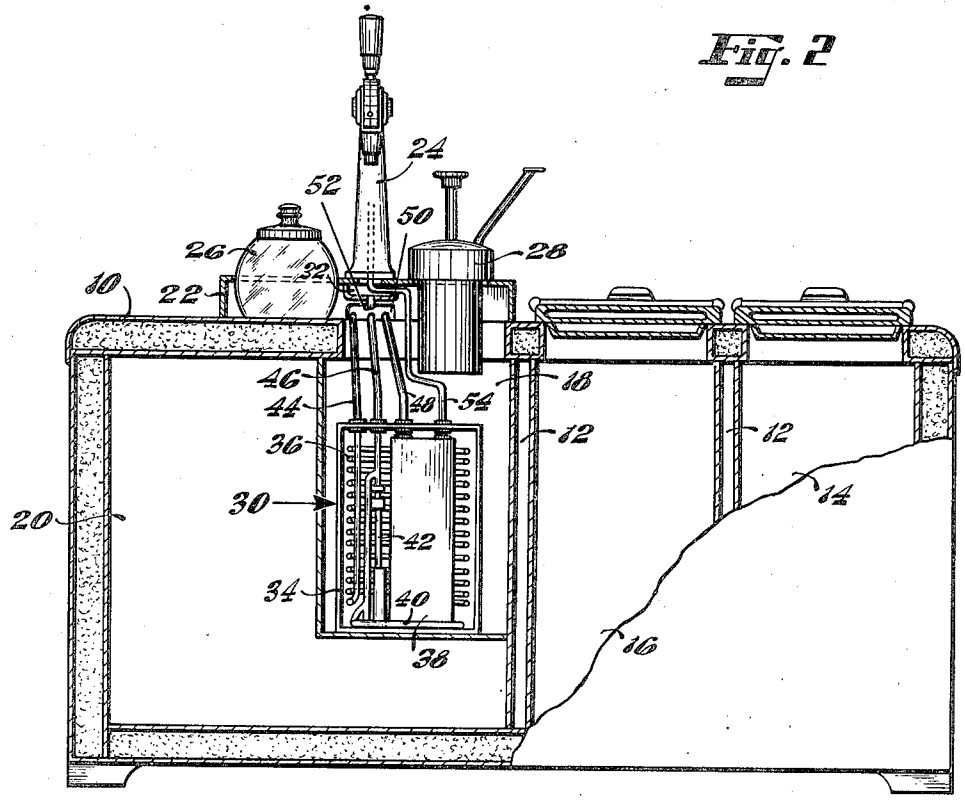


Fig. 3

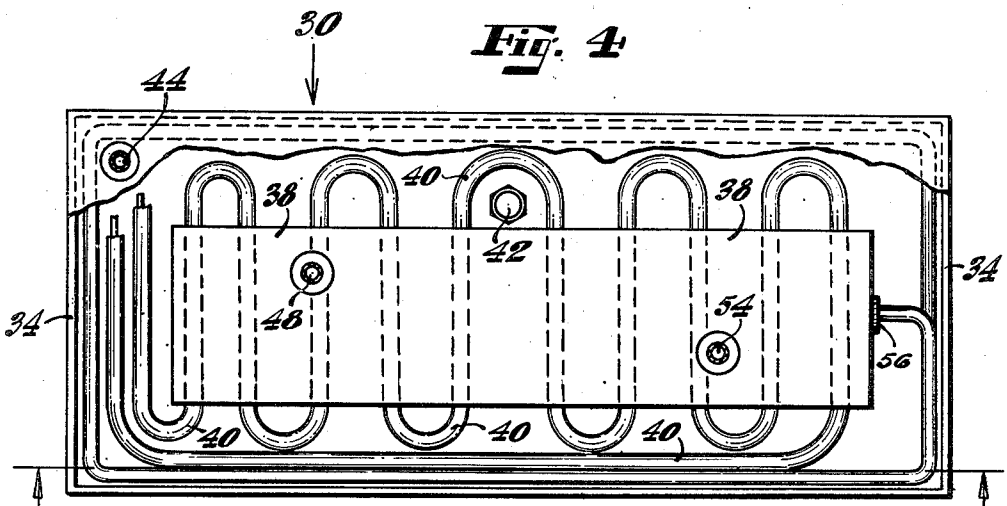
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Fig. 4



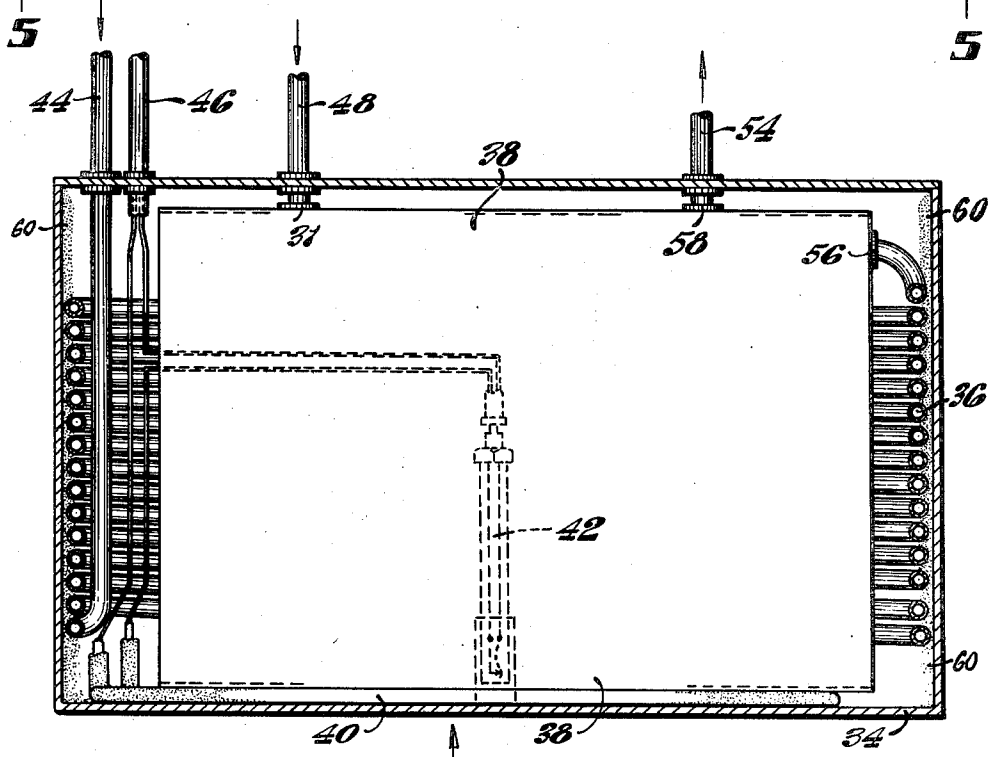


Fig. 5

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COMBINATION SODA FOUNTAIN AND ICE-CREAM CABINET

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4 Claims. (Cl. 257—3)

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This invention relates to refrigeration cabinets and more particularly to improvements in refrigeration cabinets for maintaining different temperatures in separate spaces within the same cabinet. In one aspect this invention relates to a combination cabinet for simultaneously cooling carbonated water to near freezing temperature and refrigerating other articles requiring temperatures substantially below the freezing point of water.

In general, combination soda fountain and ice cream cabinets are not available to small establishments, such as country stores, delicatessens and the like. This is because the hitherto known designs for such combination cabinets include complicated machinery and auxiliaries rendering them too expensive and too bulky for convenient use on a small scale. The necessity for such costly and inconvenient design stems from the fact that in combination cabinets of this sort, two or more different refrigeration compartments must be kept at different temperatures. The ice cream should be kept in the vicinity of 0° F. and the soda water should be kept near 32° F. but, of course, it should not be allowed to freeze. Furthermore, the requirements as to cooling rate vary in the different compartments. Carbonators require rapid cooling mechanisms because, when they are in use, they introduce large quantities of comparatively warm water into the cooling compartment which water must be brought down to below 38° F. prior to leaving the cooling compartment for the best results in mixing cool drinks. Since the circulatory tract of the water cooling apparatus generally has a relatively small volume, the water passes through it rapidly and must be cooled accordingly. On the other hand, refrigerating ice cream, for storage purposes, need not be extremely rapid. The introduction of heat due to opening the cabinet top for access to the ice cream is negligible in comparison to the heat introduced by the feed water for the carbonation system.

Generally, two separate refrigeration systems are used, one with a high instantaneous capacity to cool the feed water and carbonation system, and the other with a low instantaneous capacity to cool the ice cream. Various attempts have been made to use a single refrigeration system for this purpose. Thermostatically controlled valves have been employed governing the admission of the refrigerant into the compartments with the refrigeration system connected in series to the compartments. This latter method generally provides successively warmer compartments and has the disadvantage of being unable to handle rapid cooling in one of the compartments

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at the end of the series without a corresponding decrease in the temperature of the compartments in the first part of the series, whether they need to be further cooled or not. Separate piping systems connected in parallel to the same refrigeration source have been constructed, employing thermostatically controlled valves at the entrance to each system. Such apparatus has the disadvantage of requiring complicated piping systems and valves not feasible in the cheaper and more available refrigeration cabinets.

Lastly, conventional refrigeration systems are not satisfactory for maintaining temperatures close to but not below 32½° F. In operation, the conventional systems usually have a span of from 10 to 15 degrees in temperature between the cut on point and the cut off point of the valves which control admission of the refrigerant. Furthermore, even after the refrigerant ceases to enter the coils, the temperature in the cabinet will continue to drop due to unavoidable lags in the conduction and convection of heat within the cabinet surrounding the thermostatic control. Thus, in a conventional cabinet, the carbonated water must be kept at an average temperature of around 40° F. in order to avoid the risk of freezing the water, with the result that such conventional cabinets do not approach the optimum cooling desired.

It is an object of my invention to provide a method and apparatus for maintaining separate spaces in a refrigeration cabinet at different temperatures which method can be easily performed with one refrigeration system and without the necessity for providing expensive, complicated or bulky apparatus. It is another object of my invention to provide apparatus for maintaining separate spaces within a refrigeration cabinet at different temperatures, employing a single refrigeration system and adapting certain spaces for rapid cooling. It is a further object of my invention to provide a multi-compartment cabinet wherein the temperature in the compartments may be maintained in the vicinity of 0° F. and the temperature in a container within one of the compartments may be maintained in the vicinity of but not below 32½° F.

In the accomplishment of these objects I provide a small carbonation unit immersed in a liquid, in a non-insulated, metal cooling tank. Passing through the cooling tank and likewise immersed in the liquid is a large surface feed water conduit leading up to the carbonator. The cooling tank is placed bodily within one of the compartments of a conventional ice cream cabinet. It is a feature of my invention that the cooling tank and the carbonator unit within it

are cooled by the ice cream cabinet, the heat being transferred through the walls of the tank and the medium of the liquid.

It is a further feature of my invention that the cooling tank and carbonator unit are maintained above freezing temperature during idle periods by a thermostatically controlled introduction of of heat into the container, whereby a high degree of accuracy can be attained in maintaining the feed water at temperatures near freezing but yet preventing it from freezing. Such an introduction of heat into a refrigerating cabinet for purposes of regulating temperatures is opposed to universally held opinions on the subject of refrigeration, but yet constitutes one of the important contributions of this invention to the art.

It is a still further feature of my invention that the thermostatically controlled introduction of heat into cooling tank employs an extremely accurate thermocouple connected in series with an electric heating coil. Thus the introduction of heat into the tank may be controlled to within one degree of the critical 32½° F.

While it is an accepted proposition that heat transfer through a wall takes place at a uniform rate depending upon the temperature differential of the surrounding media, it is an extremely important feature of my invention that I am able to slow down the transfer of heat out of the cooling tank during periods of idleness. During periods of constant use, heat is extracted as fast as the walls of the tank are capable of conducting it, but the elements of my novel system are so arranged and controlled that during periods of idleness, a thin layer of ice builds up on the inside walls of the tank and effectually reduces the transfer of heat through the tank walls by eliminating the convection of the water adjacent to the surface of the tank walls on the inside. When the apparatus again undergoes repeated use, the ice layer melts and rapid heat transfer through the walls of the tank again takes place. This feature is responsible for reducing the amount of heat introduced by the above mentioned heating coils while the carbonator is idle and means that the cooling tank may readily be left in the cabinet overnight without causing the refrigeration system to work needlessly against the heating coil.

Further objects and features of my invention will best be understood and appreciated from the following description of a preferred embodiment thereof, selected for purposes of illustration, and described in the accompanying drawings in which:

Fig. 1 is a view in perspective of the combination cabinet of my invention,

Fig. 2 is a plan view of the combination cabinet,

Fig. 3 is a sectional view in side elevation of the combination cabinet of my invention along the line 3—3 of Fig. 2,

Fig. 4 is a plan view from above of the carbonator unit and feed water cooling tank with cover removed, and

Fig. 5 is an exposed view of the inside of the cooling tank in side elevation along the line 5—5 of Fig. 4.

In the preferred embodiment of my invention, I employ a conventional refrigeration cabinet 10 having appropriately insulated walls and a single internal refrigeration system. The cabinet 10 is divided into compartments by suitably spaced partition walls 12 which are not fully insulated members, but which present some resistance to the passage of heat.

In this illustrative example the compartments are indicated at 14, 16 and 18, respectively, with a space for the refrigeration mechanism indicated generally at 20. The refrigeration mechanism space 20 extends underneath the compartment 18 and therefore compartment 18 is not as deep as compartments 14 and 16. In order to save the compartments having larger volume for the storage of ice cream, I have herein selected compartment 18 for use in cooling the soda water of my combination cabinet but it will be understood that my invention is not dependent upon details of cabinet design nor the convenience of the compartment selected.

The soda fountain unit includes in its general organization a preserve and syrup rack 22, a soda faucet 24 mounted on the rack 22, preserve jars 26 and syrup dispensers 28 inserted in appropriate perforations in the rack, and a soda water cooling and carbonating unit indicated at 30. The cooling and carbonating unit 30 is inserted into compartment 18, resting on the bottom thereof, and the rack 22 is placed over the compartment opening. Of course, the cover for compartment 18 is discarded during the combined operations herein described.

It is desirable to maintain the syrup relatively cold preferably below 40° F. in order not to introduce unnecessary warmth into the drinks, and it is further desirable to keep the preserves below 50° F. to deter flies from alighting thereon. Therefore it will be seen that the rack 22 supports the jars 26 and dispensers 28 with their lower portions in position to be cooled by the cabinet 10. The rack 22, however, extends beyond the margin of the compartment 18 on the side where the jars 26 are located with the result that they rest on the cabinet top adjacent to the entrance to compartment 18, while the deeper dispensers 28, extend part way down into compartment 18. Thus the dispensers 28 are maintained below 40° F. and the jars 26 are about 50° F.

At one end of the rack 22, the faucet 24 is permanently mounted and provided with a screened drain 32 appropriately located centrally in the rack below the faucet outlet.

The cooling and carbonating unit 30 will now be described and includes, in its general organization, an enclosed metal tank 34 completely filled with water or other suitable liquid, a feed water cooling coil 36, a carbonator unit indicated generally at 38, an electric heating coil 40, and a thermocouple 42.

The feed water cooling coil 36 may preferably consist in copper tubing, and is connected to a suitable water supply line 44, which enters over the top of the cabinet 10, through a notch 50 in the side of the rack 22, down into compartment 18 and into the tank 34 through a suitably sealed aperture. After passing into the tank 34 the supply line 44 connects with the cooling coil 36 which follows a coiled path many times around the interior of the tank adjacent to its side walls, and finally connects to the carbonator unit 38 at 56 (see Fig. 5).

The carbonator unit 38 is located within the tank 34 and rests upon the heating coil 40 at the bottom of the tank. A supply line 48 for carbon dioxide gas is connected to the carbonator at 31 and enters compartment 18 through suitably sealed apertures in the same manner as the feed water supply line 44 described above.

Carbonated water is drawn off through a pipe 54 connected to the carbonator at 58. The pipe 54 leads upward through the top of the tank 34 and connects to the faucet 20.

The rack 22 is provided with a notch 59 in each side (see Fig. 1) to accommodate the supply lines on either side. In addition to the water supply line 44, and CO_2 supply line 48, an electrical lead 46 and a drain pipe 52 pass through the notch 59.

Since the temperature of the refrigeration compartment 18 surrounding the tank 22 will be maintained in the vicinity of 5° F., it will be evident that the feed water in the coil 36 would soon freeze if left standing. In order to prevent this, a heating coil 40 is provided arranged in broad loops across the bottom of the tank 34. The coil 40 may preferably be waterproof, lead insulated cable having a suitably resistant heating element for a core. 110 volt alternating current may provide a convenient source of power. The operation of the coil 40 is controlled by a conventional waterproof thermocouple 42 connected in series to the said coil, located in the tank 34 between one of the loops of the coil, and adjusted to pass current to the coil when the temperature of the water in the tank drops below 32½° F. Conventional thermocouples of the type employed herein may readily be adapted to respond accurately to slight temperature differentials, and in this preferred embodiment the thermocouple 42 is adapted to break the heating circuit when the temperature of the water in the tank 22 reaches 33° F. It is to be noted that such accuracy of control cannot be obtained with the conventional temperature responsive valve systems.

While it might be thought that the presence within compartment 18 of the tank 34 maintained at a temperature near the freezing point of water by the introduction of heat, would cause an excessive load upon the refrigeration system, such however, is not the case. During idle periods, the water in the tank 34 freezes as indicated at 60 on the surface of the tank walls on the inside and provides something similar to an insulational blanket interferring with the rapid transfer of heat. At such times convection of heat directly to the metal tank wall by water circulation is eliminated, and the heat passes through the metal wall only after conduction through the ice. Since ice is a poor conductor of heat, the loss is not substantial. Experiments have shown that if the thermocouple is adjusted to admit heat accurately when the temperature of the tank 34 is in the vicinity of the freezing point of water, that it will admit heat only several times an hour but for a total time of less than two minutes per hour. In view of this, efficiency loss in the entire system during idle periods is negligible.

During periods of use, when the introduction of water into the supply line 44 tends to bring the temperature of the water in the tank 34 several degrees above the freezing point of water, the ice blanket 60 will rapidly melt and heat will commence to be drawn off rapidly by direct convection of heat to the metal tank wall by water circulation. Thus, during extended use, the unit 30 can handle rapid cooling, while during periods of idleness its rate of heat transfer is much slower.

While minor variations such as using liquids other than water, etc., will be apparent to those skilled in the art, it is not intended to confine

the invention to the precise limits of the preferred embodiment herein shown, but rather to measure it in terms of the appended claims.

Having thus described an illustrative embodiment of my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. A combination ice cream and carbonated water refrigeration cabinet having in combination, insulated walls forming compartments, a single refrigeration mechanism adapted to maintain the cabinet at a temperature substantially below the freezing point of water, metal walls forming a separate container adapted to fit into one of the said compartments, water filling the said container, a conduit having a large surface area conveying feed water for carbonation through the said liquid in the said container, a heating means within the said container, and temperature responsive means controlling the said heating means whereby heat is admitted to the said container to maintain the temperature of the said liquid above the freezing point of water.

2. Apparatus for cooling water without freezing it comprising, a refrigeration compartment adapted to maintain temperature substantially below the freezing point of water, a tank located within the said compartment, water filling the tank, a cooling coil serving as a conduit for the water to be cooled and being immersed in the water in said tank, means introducing heat into the tank, and a sensitive thermocouple adapted to control the introduction of heat by said means to commence at the freezing point of the water and to cease within one half degree thereabove, whereby during periods of idleness when the refrigeration load is low a thin blanket of ice will build up on the inside of the tank and retard the transfer of heat, but during periods of extended use when rapid transfer of heat is desired, a rise of temperature in the tank will cause the ice blanket to melt and permit rapid transfer of heat.

3. Apparatus for refrigerating a liquid comprising, a heat exchanging coil containing the liquid, a tank, a liquid refrigeration medium in the tank, the said coil immersed in the said medium in the tank adjacent to the wall thereof, refrigeration means adapted to extract heat through the wall of the said tank and to maintain a temperature below the freezing point of the said liquid refrigerating medium, heating means adapted to introduce heat into the said medium, and a thermocouple control for the said heating means adapted to actuate the heating means only when the temperature of the said medium is substantially at its freezing point.

4. The apparatus described in claim 3 further characterized by the said coils being arranged in close proximity to the walls of the said tank, whereby convection of the medium adjacent to the walls of the tank is substantially opposed.

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