Nov. 18, 1952 R. C. SHIPMAN 2,618,127

MILK COOLER

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Fig. 1.

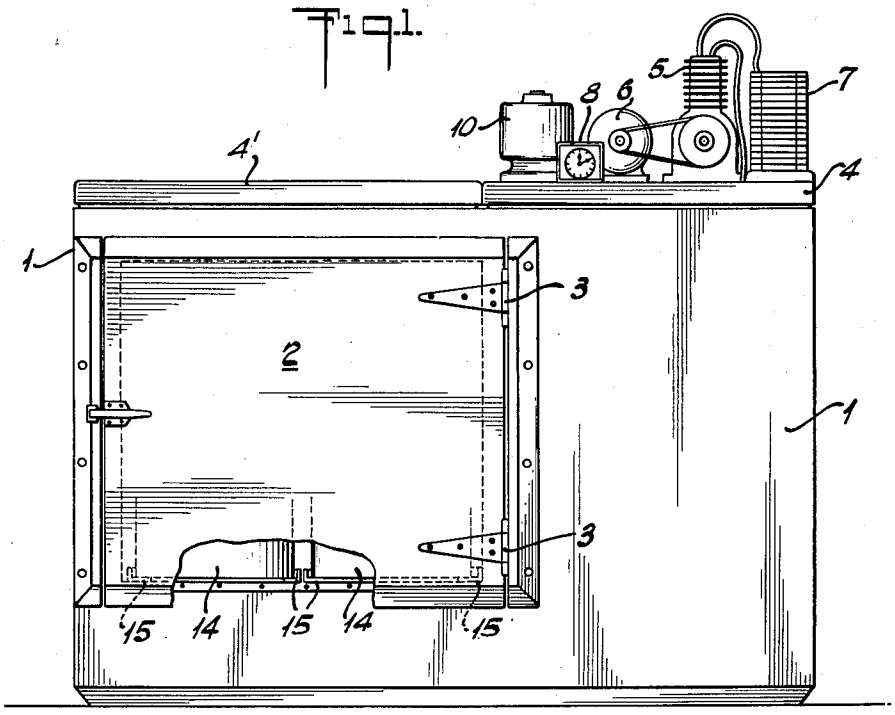
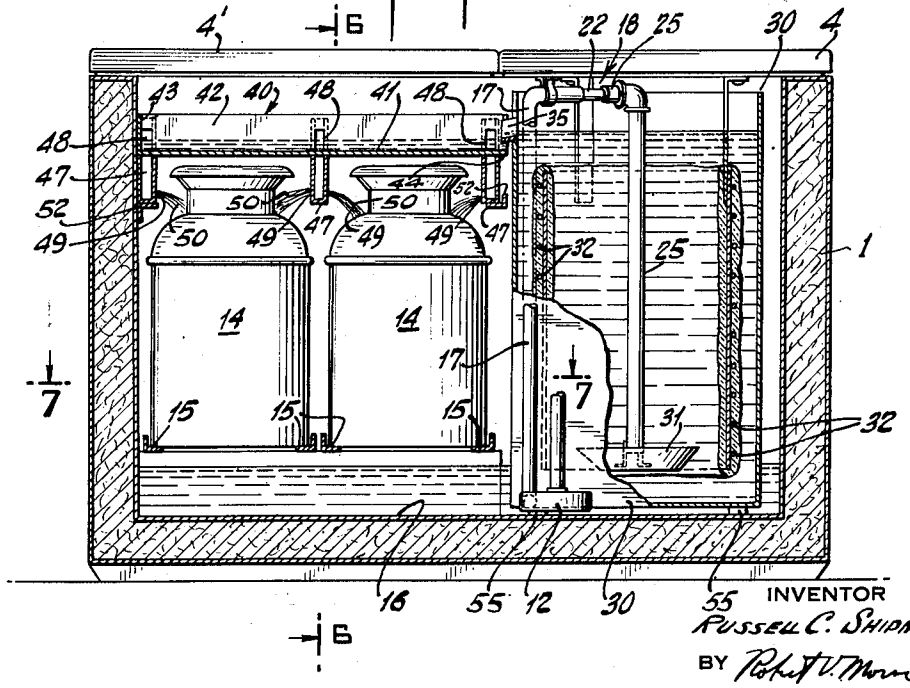


Fig. 2.



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Fig. 3.

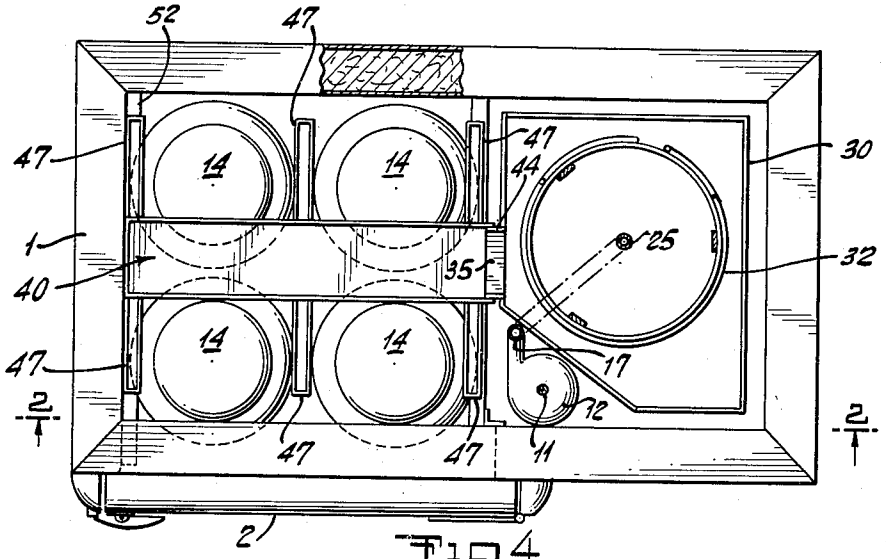


Fig. 4.

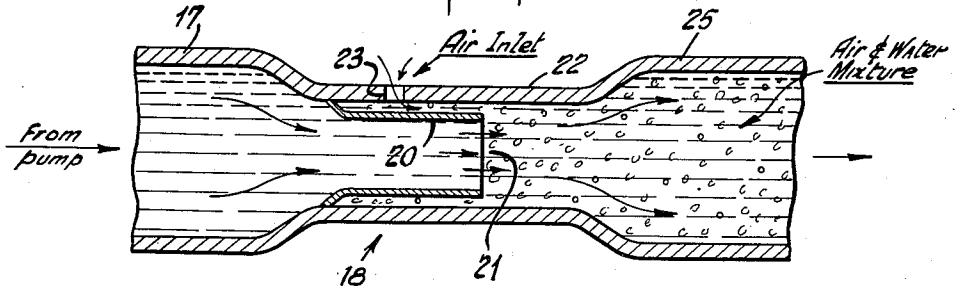
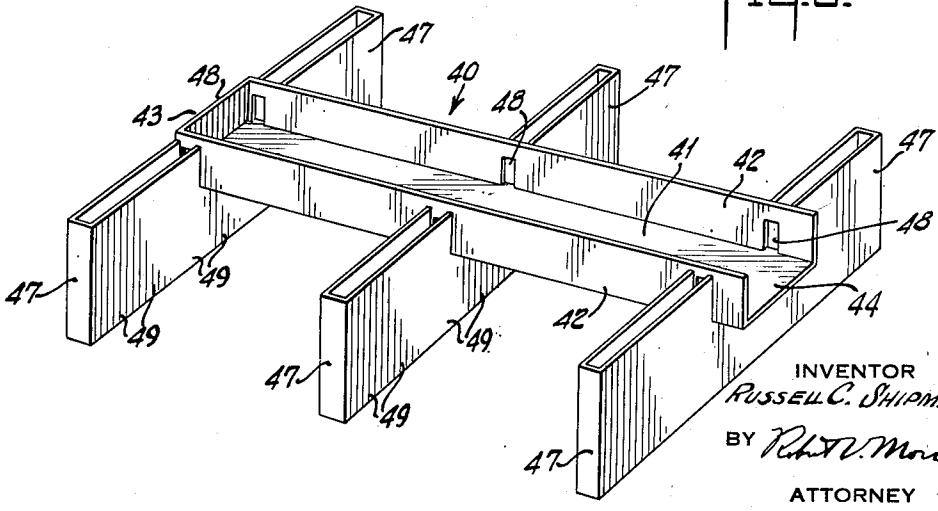


Fig. 5.



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Fig. 6.

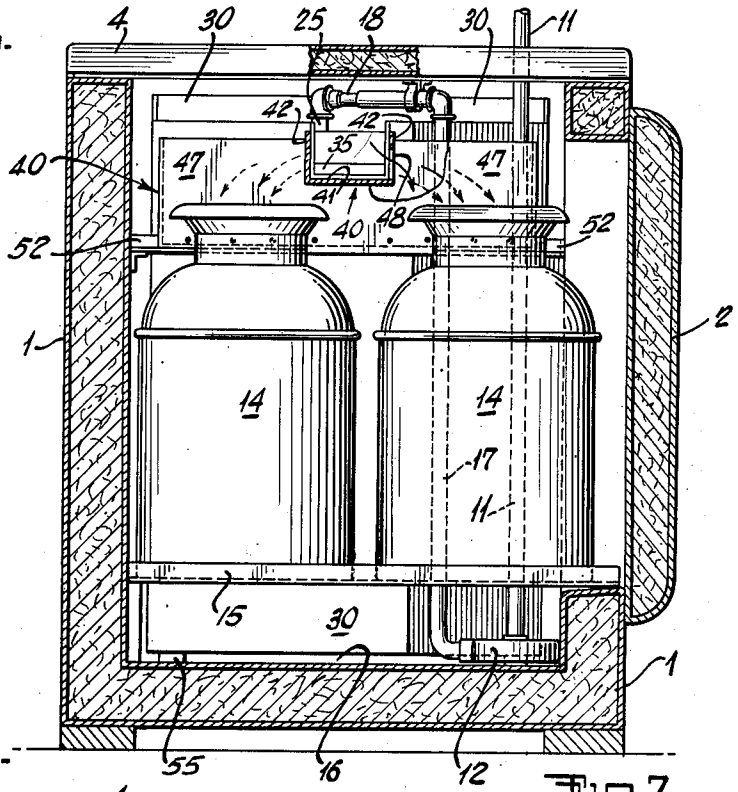


Fig. 8.

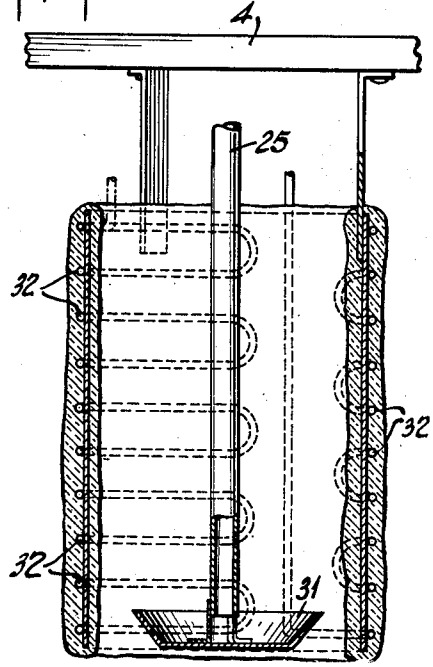
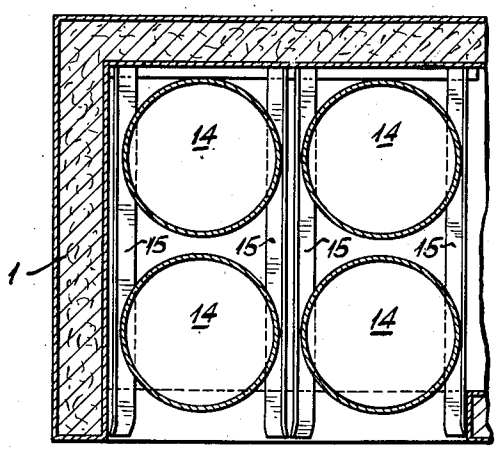


Fig. 7.



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2,618,127

UNITED STATES PATENT OFFICE

2,618,127

MILK COOLER

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Application June 29, 1949, Serial No. 102,031

4 Claims. (Cl. 62—61)

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This invention relates to the cooling of liquids in containers, as for example cooling milk at the dairy in milk cans, where good practice requires chilling the warm milk to below 50° F. as soon as possible after it is drawn. This calls for the extraction of a large amount of heat in a short period of time, and would normally require a large motor and compressor installation. To avoid this, various systems have been developed in which a moderate sized refrigerator mechanism builds up a reserve of ice during the hours between milkings which can be rapidly melted by circulating water to cool the warm milk cans when needed. The present invention is of that general type, and is intended to overcome certain defects and difficulties that have developed in such devices.

It has been found that cooling tanks loaded from the top are hard to use, since they require the lifting in and out of the heavy cans; and side loaders either required collars to be placed on the cans—an extra operation—or used spray heads from which water might splash in under the lid of the can. Their orifices tended to become plugged with bits of straw common in barns, and were difficult to clean. On the refrigeration side it has been known that air bubbles mixed with the circulating water would help speed up the action on the ice, but they required a special air pump, adding to the expense. Other side loaders used a two-compartment cabinet separated by a partition, permitting heat loss directly from the water tank thru the cabinet wall to the outside.

The present invention seeks to overcome these difficulties by providing a single cabinet side-loader, in which the cold water tank is separated from the cabinet walls, and in which the cans can be easily rolled in and out without lifting or fitting of collars; and it also insures that the cooling streams will flow over the cans without spraying or splashing, so that there is no danger of water reaching the milk. The water distribution system is non-plugging and readily removable for cleaning; and the refrigerating effect of the ice is accelerated by means of air bubbles without requiring the use of an air pump. All the basic units are readily removable for servicing and cleaning. The purpose of these improvements is to make a more practical and serviceable apparatus adapted to use on the farm. Various other detail objects will become apparent as the description proceeds.

Referring now to the drawings forming part of this specification,

Fig. 1 is an external front elevation of the machine, showing the unitary cabinet, the loading door, and the pump motor, the compressor, compressor motor, radiator, and various external controls and connections.

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Fig. 2 is an internal view of the apparatus as though the front wall of Fig. 1 were removed, showing the unitary cabinet, the milk cans, water distribution system, pump, air intake, and the refrigerating and ice melting system.

Fig. 3 is a horizontal view with the top of the cabinet removed, showing in plan the water distribution system, the cans, and the ice system with the water tank spaced from the cabinet walls.

Fig. 4 is a cross-sectional view of the anti-siphon air intake, by which bubbles are introduced into the water before it strikes the ice.

Fig. 5 is a detail perspective view of the removable channels, troughs, weirs and laterals of the water distribution system by which the flow of water over the cans is effectively controlled.

Fig. 6 is a vertical cross-sectional view taken on the line 6—6 of Fig. 2.

Fig. 7 is a fragmentary plan section taken on the line 7—7 of Fig. 2, showing the rails supporting the cans.

Fig. 8 is an enlarged vertical cross-section of the freezing coil and ice cake.

Similar reference numerals refer to similar parts thruout the various views.

Referring first to Fig. 1, the cooler is of the side-loading type, with a unitary insulated cabinet 1 having a loading door 2 hinged at 3. It is provided with a removable top 4 on which is mounted the usual artificial refrigeration mechanism including the compressor 5, its driving motor 6, radiator 7, time control switch 8, and other accessories common to mechanical refrigeration. Of course a gas or oil type refrigerating mechanism might also be used instead of electric, since its function in either case is merely to accumulate a block of ice in the cooling water tank 30 as will be described. Also mounted on the top 4 is a pump motor 10 driving the vertical shaft 11 which extends down into the cabinet 1 to drive the water circulating pump 12 as shown in Fig. 2, Fig. 3, and Fig. 6. Adjacent to the top 4 is another top section 4' covering that portion of the cooler which contains the milk cans. Each top section 4 and 4' is separately removable—the top 4 carrying the refrigerating mechanism and the top 4' giving access to the cooling water troughs and adjacent parts for cleaning. This permits the device to be serviced with a minimum of effort.

Referring now more especially to Fig. 2 and

Fig. 7, the milk cans 14 are easily rolled up to the door opening and slid on to the rails 15, which like other parts of the apparatus can be removed for cleaning. The rails 15 are about level with the bottom of the door 2 shown in Fig. 1, so that there is a space below them in which some water may stand, sufficient to form a sump 16 to prime the circulating system and permit its operation, but not enough water for cans to stand therein. This sump water extends thruout the lower parts of the cabinet, there being no partition. The circulating pump 12 is immersed in this water with its intake below, and when running it forces the water up the pipe 17 to the anti-siphon air mixer 18 which is shown more in detail in Fig. 4.

In Fig. 4 the pipe 17 from the water circulating pump 12 is shown turned into a venturi by reducing its diameter to form a nozzle 20 to produce a high-velocity jet 21. Surrounding the nozzle 20 and jet 21 is the pipe 22 having an air-inlet hole 23. The partial vacuum induced by the high-velocity jet 21 draws air into the pipe 22, where it becomes mixed with the water and is carried on in the form of bubbles down the pipe 25. When the pump motor 10 is not running the air inlet hole 23 also serves to admit air to break any tendency to form a siphon. Otherwise the water in the tank 30 might siphon back into the sump 16, filling it to overflowing and pouring out of the loading door.

The pipe 25 extends down into the water tank 30 to a return bend or baffle 31 so that the ultimate discharge is upward—the bubbles thus assisting the rising force of the water. The refrigerating mechanism on the top of the cabinet previously mentioned, when operated over a period of time, produces a thick wall of ice over the freezing coils 32, as is customary in such devices—the coils 32 being connected to the refrigerating machine on the top of the case in the usual manner. This mass of ice which forms on the coils 32 is utilized to quickly chill the milk by rapidly circulating water between the ice and the cans. To melt the ice more rapidly, various forms of agitation or scrubbing have been used, including water pumps and air pumps. The present invention obtains the beneficial effect of air bubbles without requiring a rotary air pump. The water rubs upward over the inside of the ice cylinder and down over the outside of the ice cylinder, maintaining a vigorous circulation.

The net effect of operating the pump 12 is to draw water from the sump 16 and discharge it into the tank 30, together with bubbles—all of which raises the water level in the tank 30 so that the chilled water overflows thru the spout 35. Unless great care is taken the water will splash and work its way into the milk. It is not practicable to regulate the pump directly without complexity and expense; and so under the present invention there is devised a self-regulating system of weirs and channels that operate to produce a steady flow of smooth and solid water jets having such a velocity and body that they will cool efficiently without splashing into the milk. This system remains steady regardless of any surges or accelerations in the tank or pump.

The water distribution system above referred to is shown in Fig. 2, Fig. 3, and in detail in Fig. 5. It consists of a distributing main or trough 40 having a flat bottom 41, side walls 42 and a terminal wall 43 at the far end. The end 44—near where the incoming water falls from the spout 35 on the tank 30—is open so that excess water may spill back and down into the sump 16. This spill-back is a counter-flow which is opposed to the main fall from the tank 30 thru the spout 35; and the result is that there is maintained a fair depth of water—about an inch—in the main trough 40 when the pump 12 is running.

Branching from both sides of this main trough 40 are lateral troughs 47, preferably rather narrow and rectangular, which are open at the top. These laterals 47 are provided with openings 48 serving as weirs to control the flow of water from the main trough 40 to the lateral troughs 47. The long sides of the laterals 47 near the bottom are pierced by several rather large holes 49—about a quarter of an inch in diameter—these holes serving as orifices for the cooling jets 50 which fall upon the milk cans 14 as shown in Fig. 2. The holes 49 are sufficiently large and smooth so that solid, clear and gentle streams flow from them without the velocity or agitation normally associated with jets or sprays. This is important to avoid splashing which might work into the can under the cover. If any hole 49 should become plugged it can readily be cleaned, since the laterals 47 are open at the top; and the whole distribution system of the main 40 and the laterals 47 is supported on rails 52 and can be slid out of the door 2 for servicing. Due to the weirs and overflows, the total hydraulic head cannot vary more than about an inch; and the volume of the laterals is so great in comparison to the orifices that a very steady flow results.

The water tank 30 does not touch the side walls of the cabinet 1, so that there is an air space all around the tank between it and the cabinet walls. This prevents a direct loss of cold from the water thru the cabinet walls, with the chilled air and the sump water remaining to keep the milk cans at a suitable temperature after the pump has stopped running. This gives an improved efficiency over the two-compartment side-loaders, since there is less loss from the water to the outside than is the case with the two-compartment types where the cabinet wall is also the water tank wall. The tank 30 may either rest on the floor of the cabinet or on small blocks or feet 55, so that there will be some water under it. In either event the principal loss, which is thru the side walls of the cabinet, will be reduced.

A cooler for milk or other cans constructed in accordance with the principles above described overcomes some of the difficulties in previous coolers of the water transfer type, and is characterized by improved efficiency—due to the unitary cabinet and the separation of the water tank from the walls—a reduced construction cost, principally due to the elimination of a special pump for introducing air bubbles—and a reduced expense for upkeep due to the reduction in clogging in the water distribution system and the fact that the mechanical and electrical portions of the device are removable for servicing without disturbing the water distribution system, and vice versa. The Venturi system also effectively prevents accidental siphoning of the water out of the tank onto the floor.

While I have in the foregoing described certain specific forms by way of example, it will be understood that they are merely for purposes of illustration to make clear the principles of the invention, which is not limited to the particular forms shown but is susceptible to various modifications and adaptations in different installations as will be apparent to those skilled in the art without departing from the scope of the invention as stated in the following claims.

What I claim is:

1. In a can cooler, the combination of a cabinet, side loading doors for said cabinet thru which cans may be placed to be cooled, a cold water tank in one side of the interior of said cabinet, said tank having an overflow, a system of troughs fed by said overflow for leading water to cool the cans, said system comprising a main trough extending from below the overflow toward the other side of the interior of the cabinet, cross troughs on said main trough extending between the cans, said cross-troughs having box-like sections of sufficient volume to induce quiet flow and provide a steady head, said cross-troughs having final orifices located below the top of the cans to deliver solid streams of cold water to the neck and body of the cans, said troughs being open at the top to assist in cleaning, whereby plugging by bits of foreign matter may be reduced.

2. In a can cooler, the combination of a cabinet, a cold water tank within said cabinet, said tank having an overflow spout, a main trough under said spout, said trough being open at its end under said spout to provide a reverse spillway of the counter-flow type, laterals on said main trough, said laterals having orifices by which water may be discharged on the cans in the cooler.

3. In a can cooler, the combination of a water tank, a block of ice within said tank, a pump for circulating water rapidly over said ice to chill the water by melting the ice, a discharge pipe from said pump carrying water, a Venturi air inlet admitting air bubbles to said water from the discharge pipe above the water level in the tank, a downflow pipe carrying the mixture of water and air bubbles down to near the lower part of the block of ice, a reverse discharge element to direct the flow of water and air bubbles in an upward direction across the ice block, whereby the air bubbles assist the water flow to melt the block of ice.

4. In a can cooler, the combination of a cabinet, side loading doors for said cabinet thru which cans can be placed to be cooled, a cold water tank within said cabinet, said tank having an overflow, a system of troughs fed by said overflow for leading water to cool the cans, said troughs being open at the top to assist cleaning whereby plugging by bits of foreign matter may be reduced, a block of ice within said tank, a water pump and piping for circulating water over the ice to chill the water before it leaves the overflow, and a suction air intake of the Venturi type connected to said water pump piping above the level of the water in the tank to introduce air bubbles to the water before it reaches the ice, whereby the ice may be more vigorously scrubbed, said air intake above the water level of the tank serving to admit atmospheric air to the water pump piping to break a reverse syphon action when the pump is not in operation.

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