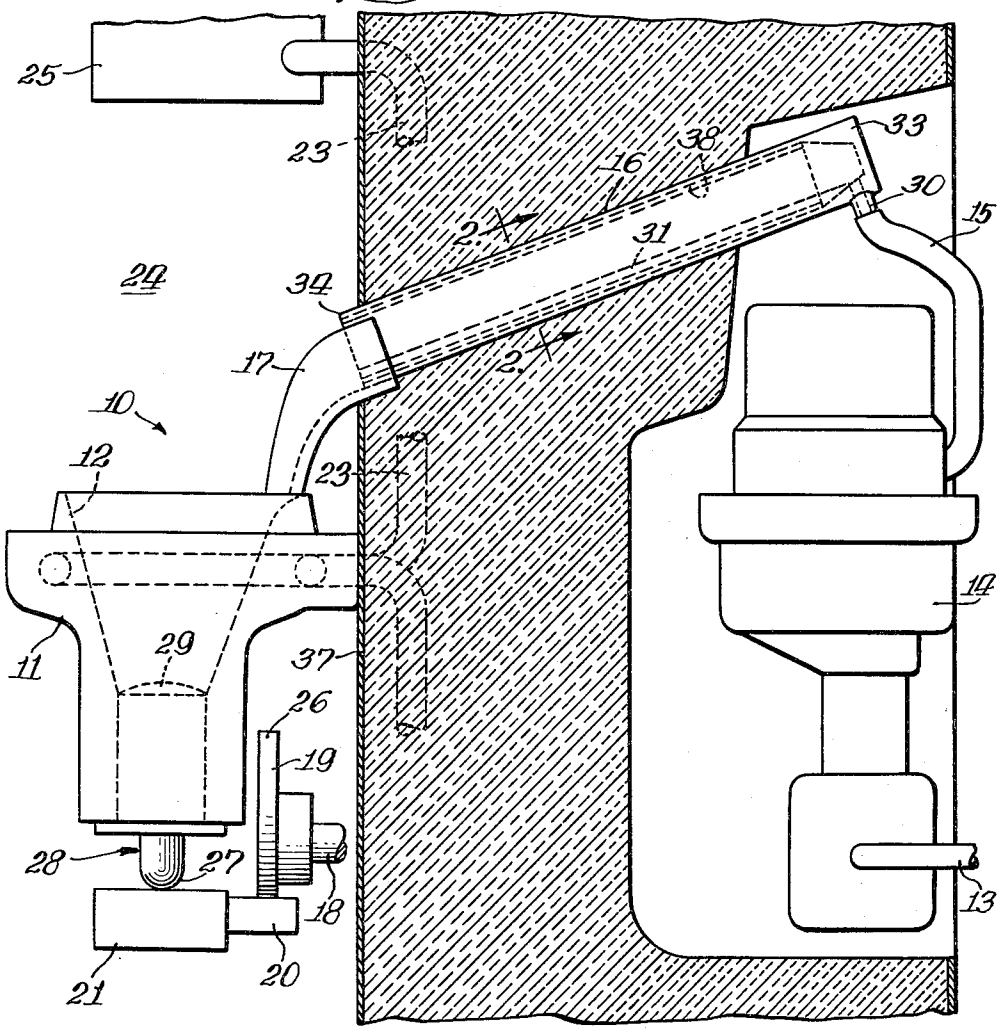
Nov. 14, 1961 W. J. LINSTROMBERG ET AL 3,008,307

HOME APPLIANCE

Filed Nov. 4, 1959

Fig. 1.



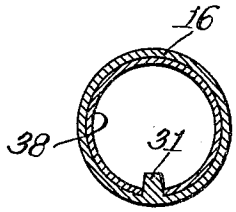


Fig. 2.

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HOME APPLIANCE

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This invention relates to automatic ice makers and particularly to means for preventing the freezing of water in a water line leading to the ice mold of an automatic ice maker.

This invention may be considered an addition to the ice maker disclosed and claimed in the co-pending Linstromberg application Serial No. 790,557, filed February 2, 1959, and owned by the common assignee. Briefly, the co-pending application discloses an ice maker, in which a body of ice is formed in a frusto-conical cavity of a freezing mold and when frozen is ejected therefrom to be collected in a suitable container. The ejection of the ice body is affected by a spring-urged block which is cam operated to snap against a plunger defining the lower boundary of the cavity. The cam is rotated by a suitable drive motor so that the ejection cycle is affected only after water delivered to the cavity is properly frozen therein. Immediately after the ejection of an ice body, a water supply valve is actuated to provide a measured amount of water into the mold cavity by means of a conduit.

The principal feature of the instant invention is the provision of a new and improved means for preventing the freezing of water in the water conduit supplying an automatic ice maker.

Earlier devices for automatically providing bodies of ice have used complicated and expensive methods in an attempt to prevent the freezing of water in the water supply conduit leading to the ice mold. Some of these devices used diverters or drains in the water line, or electric resistance heater wires wrapped around the water conduit and energized at periodic intervals to maintain the conduit at above freezing temperatures.

In accordance with the present invention, there is provided a simple, practical and inexpensive means for preventing the formation of ice in a water line leading to the ice mold of an automatic ice maker. Specifically, a plastic conduit is provided which have a very low heat conductivity value to minimize the transmission of heat from outside a refrigerated space to inside the space. A thin metallic inner lining extending substantially the entire length of the conduit has a heat conductivity value considerably higher than that of the plastic conduit. Sufficient heat is transferred by means of the lining, first, from the water passing therethrough, and second, from the warmer inlet end to the outlet end, so that all of the interior of the conduit is maintained substantially free of ice formations to allow water to flow therethrough. Thus, there is provided a means to maintain the water supply conduit of an automatic ice maker completely free of any ice which would block the conduit and prevent the satisfactory operation of the ice maker.

Other features and advantages of the invention will be apparent from the following description, taken in connection with the accompanying drawing, wherein

FIGURE 1 is a partial view of an automatic ice maker within a refrigerator, incorporating one embodiment of our invention; and

FIGURE 2 is a section taken along line II—II of FIGURE 1.

As seen in the drawing, an ice maker apparatus, generally designated **10**, is provided with a freezing mold **11** having a frusto-conical cavity **12** in which are frozen a plurality of ice bodies. Water is delivered to cavity **12** from a supply line **13** through a valve **14**, valve outlet

line **15**, through a conduit **16**, and through a chute **17**. The valve **14** is operated automatically to fill mold cavity **12** by means of a motor (not shown) which rotates a shaft **18**. Mounted on shaft **18** is a cam **19** which engages a cam follower block **20** attached to lever **21**. Lever **21** is pivotally mounted from ice mold **11**, as more specifically described in the co-pending application. The mold **11** may be refrigerated by a refrigerant carrying evaporator tube **23** connected as a part of a conventional refrigeration system (not shown). The temperature of evaporator tube **23** is such that water within mold cavity **12** is quickly frozen into ice. Further, compartment **24** is maintained at below freezing temperatures by means of an evaporator coil **25**. It will be apparent that mold **11** may be provided with finned surfaces to provide cooling of the mold by a forced stream of cold air as from evaporator coil **25**.

Rotation of shaft **18** and cam **19** causes a gradual downward deflection of the pivoted lever **21** which is under spring tension. When the high point **26** of cam **19** moves beyond cam follower block **20**, the block and lever **21** are allowed to fly immediately upwardly so that the lever strikes the lower end **27** of plunger **28**. The curved upper end portion **29** of plunger **28** defines the lower end surface of mold cavity **12**. The sudden striking of plunger **28** by lever **21** causes the plunger to move quickly upwardly and eject the ice body upwardly from cavity **12**.

Shortly after ice ejection, the water valve **14** is energized to provide a measured amount of water via line **15**, conduit **16** and chute **17**. Line **15** is connected to water conduit **16** at an integral right-angle projection **30** of the conduit. The purpose of this is to substantially reduce the pressure of the water to minimize the velocity of the stream of water passing through conduit **16**. Should water line **15** be connected in parallel with the longitudinal axis of conduit **16**, there may be sufficient velocity of the water stream to over-shoot the mold cavity **12**. Because of the right-angle entrance, water falls substantially by gravity down conduit **16** and chute **17** into mold cavity **12**. To prevent swirling of the water within the conduit, there is provided a longitudinal inwardly projecting rib **31** extending substantially from inlet end **33** to outlet end **34** of conduit **16**. Thus, the entry of the water at right angles to the longitudinal axis of the water conduit **16** and longitudinal rib **31** therein combine to provide a measured amount of water flowing through the conduit at a reduced velocity and with substantially no swirling motion.

Water conduit **16** is formed of polyethylene plastic, or other suitable material having a low heat conductivity. This property is necessary in order that a minimum amount of heat will be transferred from outside the refrigerator to inside compartment **24** which is held at a below-freezing temperature. Compartment **24** is encased by walls as indicated at **37**.

On early experimental ice maker models, it was found that water conduit **16**, when provided only as described above, would occasionally freeze closed at outlet end **34** adjacent the mold **11**. Close investigation indicated that the conduit would not drain completely dry following each passage of water, and small water droplets would remain along the bottom of the inner surface of the outlet end of the conduit. Occasionally, water droplets or even water vapor would condense on the top of the inner surface of the conduit near the outlet end and would remain and become frozen. Obviously, this collection of frozen water would build up over a number of cycles, and completely close off outlet end **34** of conduit **16**.

To prevent this freezing of water within conduit **16** a thin brass lining **38** was placed substantially from the inlet end **33** of the conduit to the outlet end **34** and circumventing the inner diameter of the conduit, the ends

of the lining being adjacent the longitudinal rib **31**, as best seen in FIGURE 2. Brass lining **38**, which is approximately .003 inch thick, provides for the transmission of a sufficient amount of heat from the inlet end of the conduit to the outlet end, so that the interior of the conduit **16** is maintained substantially free of ice formation at all times. Further, the lining, which has a much lower surface tension than does the polyethylene conduit, provides for easier draining of the inclined conduit **16**.

Lining **38** actually performs a double function in maintaining the inner surface of conduit **16** substantially free of ice formations. First, part of the interior of conduit **16** may remain at a temperature colder than freezing, and this could allow ice to build up at or near the outlet end, most likely at the top, during the period when no water is flowing through the conduit. A small quantity of water flow might not remove this ice accumulation. In the present invention, even though the quantity of water is such that only a shallow stream flows along the bottom of conduit **16**, sufficient heat is quickly transferred from the water through the entire circumference of lining **38** so that any accumulated ice may be quickly removed.

Secondly, since a quantity of water passing through conduit **16** may be sufficiently small so that not enough heat is available to completely remove all of the accumulated ice, lining **38** is extended substantially completely from inlet end **33** to outlet end **34**. This provides for the transfer of sufficient additional heat from the substantially warmer inlet end, to maintain the interior of the conduit at sufficiently high temperature so that passage of water may quickly remove all the accumulated ice. Thus, the addition of an inner lining having high heat conductivity to a water supply conduit purposely having low heat conductivity provides a novel device for maintaining the interior surface of the conduit substantially free of ice under all conditions.

By way of example, the heat conductivity value of the polyethylene water conduit may be approximately 2.3 B.t.u. in./hr. sq. ft. ° F., and of the brass lining may be approximately 600 B.t.u. in./hr. sq. ft. ° F. Of course it will be apparent that other materials may be selected for use as long as the relative differential in heat conductivity values is maintained.

While we have shown and described one embodiment

of our invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. In a refrigerator, walls defining a space, means for maintaining said space at sub-freezing temperatures, a heat insulating fluid conduit having an inlet located outside of said space and an outlet located within said space, and a heat conducting liner within said conduit for keeping said outlet substantially free of ice, said lining being formed of thin metal and extending at least partially circumferentially and substantially from said inlet to said outlet.

2. A heat insulating liquid conduit having an inlet connected to a source of liquid and an outlet located in a sub-freezing atmosphere, means within said conduit for keeping said outlet substantially free of ice, said means comprising a heat conducting liner extending at least partially circumferentially within said conduit and extending substantially from said inlet to said outlet, said lining being formed of a material having higher heat conductivity than that of said conduit.

3. A liquid transporting heat insulating conduit having an inlet and an outlet, said conduit comprising; right angle entrance means to reduce velocity of liquid supplied thereto, an inwardly projecting rib to maintain substantially axial flow of liquid passing therethrough, and a heat conducting liner therewithin to effect the temperature of the outlet of said conduit relative to the temperature of the inlet of said conduit.

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