

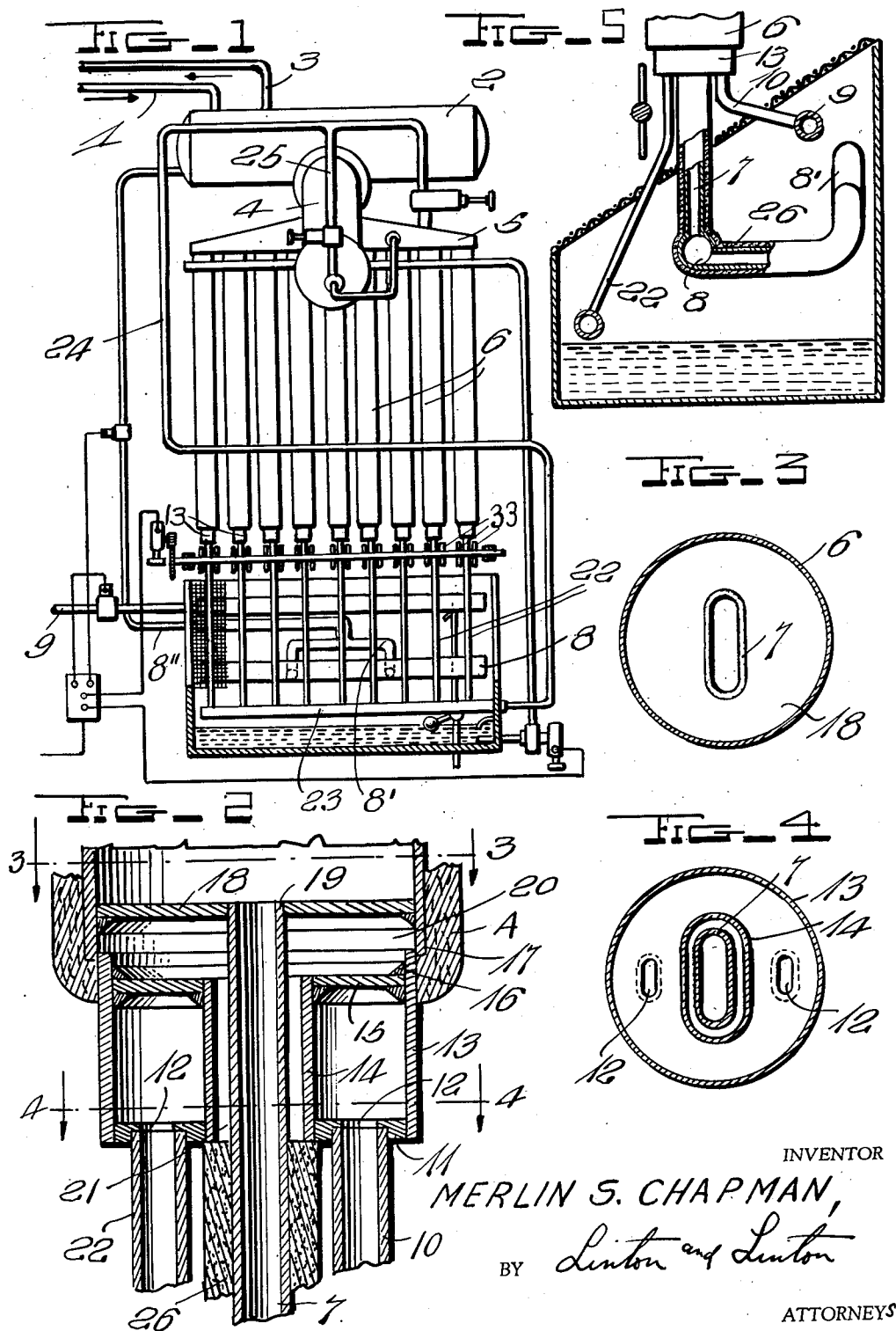
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DEFROSTER FOR AN END OF AN ICE FORMING TUBE

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DEFROSTER FOR AN END OF AN ICE FORMING TUBE

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3 Claims. (Cl. 62—107)

The present invention relates to ice making machines and is more particularly directed to such machines for producing tubes of ice.

In applicant's co-pending application Serial No. 305,534, now Patent No. 2,739,457, granted March 27, 1955, there is shown an ice making machine including a plurality of refrigerant receiving tubes for forming a coating of ice upon each tube. In order to thaw the surface of the ice coating at its area of contact with the tube upon which it has been formed sufficiently to permit its sliding from the tube due to gravity, a hot refrigerant gas is introduced for slightly heating the ice whereupon the same slides as a tube downwardly to be broken up into small pieces by suitable members striking the same. Also shown in the aforementioned application, is a hollow plug mounted in each of said tubes for receiving the hot refrigerant prior to the introduction of a hot gas into the tube for the purpose of initially freeing the lower end of the ice coating while all portions thereof remain frozen to the tube. In actual practice it has been found essential so to free the lowermost portion of the ice from the tube in order to insure that the coating will slide from the tube when the remainder of the tube is heated sufficiently to free the remaining portion of the ice coating.

It is a principal object of the present invention to provide a defroster for the lower end of ice forming tubes which will readily free a portion of the ice formed around the ends of such tubes and yet which defroster is not affected by the cooling refrigerant in or passing from said tubes, nor does the defroster materially affect the temperature of the cooling refrigerant within such tubes.

Further objects of the invention will be in part obvious and in part pointed out in the following detailed description of the accompanying drawing in which:

Fig. 1 is a side elevation of an example of an ice making machine including the present invention.

Fig. 2 is an enlarged detailed cross sectional view of the present defroster as mounted upon an ice forming tube.

Fig. 3 is a cross sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is also a cross sectional view taken on line 4—4 of Fig. 2; and

Fig. 5 is an enlarged side elevation showing the present defroster mounted in the lower end of an ice forming tube.

Referring now more particularly to the accompanying drawings wherein like and corresponding parts are designated by similar reference characters, reference is made first of all to Fig. 1 which discloses an ice making machine, the operation of which is more fully described in the aforementioned application Serial No. 305,534, now Patent No. 2,739,457, and which is included herein only as an example of a machine which can employ the present invention. Reference numeral 1 indicates the pipe leading from a conventional refrigerating apparatus for conveying a liquid refrigerant such as ammonia or the like to a tank 2. Liquid refrigerant rendered gaseous by absorp-

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tion of heat in the process of freezing ice is conveyed from said tank back to the low-pressure side of the aforementioned refrigerating apparatus by means of pipe 3. A control valve is indicated at 4 which connects tank 2 with a header 5 and controls the passage of the refrigerant from said tank to said header. A plurality of refrigerant receiving pipes or tubes 6 are connected to said header and extend substantially vertically downwardly therefrom.

A pipe 9 connected to the exhaust or high-pressure end or side of the refrigerating apparatus compressor receives a hot compressed refrigerant fluid therefrom and conveys the same to a plurality of inlet pipes 10. An annular plate 11 has a pair of diametrically opposite and spaced apart openings 12 formed therethrough and said pipe 10 is connected to said plate at one of said openings. A circular plate 13 extends substantially vertical from the outer periphery of plate 11, while a second plate 14 preferably formed oval in cross section extends substantially perpendicular from the inner edge of said plate 11. A second annular plate 15 extends between said plates 13 and 14 substantially parallel to, but spaced above plate 11. These plates are welded together at their points of contact with one another whereby plate 11 forms the bottom, plates 13 and 14 the side walls and plate 15 the top of an annular closed defroster casing.

Plate 13 extends above top 15 providing a circular flange 16 thereabove, which flange is to be connected by welding or the like to the lower portion 17 of a tube 6. An annular plate 18 extends across the bore of tube 6 above the lower edge thereof with an opening 19, preferably ovate in form from which extends pipe 7 downwardly and exteriorly of tube 6.

By this arrangement, said defroster casing is spaced from plate 18 providing an air space 20 therebetween. Also inner wall 14 of said casing is spaced from pipe 7 providing an air space 21 therebetween.

A plurality of pipes 22 are each connected to the other of said openings 12 of each plate 11 and are also connected to a pipe 23 which in turn is connected to pipe 24 which leads to the header 5 and through the by-pass pipe 25 to valve casing 4.

A tube 26 of heat-insulating material surrounds pipe 7, pipe 8 and outlet 8' as well as the section of pipe 8' beneath tubes 6 to prevent the formation of ice on said pipes and outlet during the presence of liquid refrigerant therein which could freeze water received from thereabove. Pipe 8 is considerably larger than pipes 9 and 23 forming a reservoir-like pipe whereby, when pipes 6 are filled with a hot gas, any liquid that is formed in those tubes by the absorption of heat from ice sleeves in freeing them from the cold walls of tubes 6 will be carried by gravity downward into reservoir pipes 8 and thus will not remain in tubes 6 to delay the freeing of the ice sleeves from the exterior walls of those tubes.

In the operation of the present ice making machine, when valve 4 is open discharging liquid refrigerant from tank 2 through header 5 into tubes 6, water is sprayed on said tubes and becomes frozen thereon due to the absorption of the heat therein by the refrigerant. The refrigerant in turn becomes heated, and partially turns to a gas which passes back to tank 2 through header 5 and thence is returned through pipe 3 to the low-pressure side of the system.

When a layer of ice of a desired thickness is formed on each of the tubes 6, the control valves for pipe 9 is opened admitting a hot gas from the high pressure side of the refrigerating system into pipe 9, thence through pipe 10 and into plugs 13, which are thereby heated sufficiently to thaw the lower portion of the sleeves of ice to free said lower portion of said ice completely from plugs 13 and the lower portion of the tubes 6, while these sleeves or cylinders of ice remain frozen to the upper

portions of the tubes 6. Said hot gas thence passes through pipe 22, pipe 23, pipe 24 and into the chamber 4 where it closes the valve contained therein, thus preventing the reception into header 5 and tubes 6 of any more liquid refrigerant. Said hot gas being under considerably higher pressure than the liquid refrigerant contained in said header 5 and tubes 6, forces the same downwardly into pipe 8 and thence into pipes 8' and 8'' and into the tank 2. When all liquid refrigerant has been so exhausted from tubes 6, the valve in pipe 8'' is closed and the hot gas which has replaced the liquid refrigerant in tubes 6 melts slightly the interior surfaces of the sleeves or cylinders of ice formed upon said tubes, so that they readily fall downwardly and are broken into convenient size in the method explained in applicant's co-pending application hereinbefore mentioned. The timing device controlling the opening and closing of the valves in pipe 9 and pipe 8'' is set to close the valve in pipe 9 and simultaneously open the valve in pipe 8'' as soon as the harvesting of the sleeves or cylinders of ice from the tubes 6 is completed. As soon as the valve in pipe 9 is closed and the valve in pipe 8'' is opened, the pressures throughout the part of the system illustrated in the drawings above the valve in pipe 9 equalize, whereupon the valve in cylinder 4 drops to its open position spilling liquid refrigerant into header 5 and tubes 6 replacing the hot gas which flows upward through pipe 8'' and also bubbles up through the liquid refrigerant through tubes 6, header 5 and into surge drum 2 and thence the hot gas is returned through pipe 3 to the low pressure side of the system, and with the hot gas thus replaced in the tubes 6, they are ready for the beginning of the next freezing cycle. The valve in pipe 8'' may be allowed to remain open during the ice-forming or freezing cycle.

In Fig. 2 the lower end of the ice formed on a tube 6 is indicated at A. This ice forms on the periphery of tube 6 and also on the top portion of the outer wall 13 of the defroster only, as liquid refrigerant does not enter this defroster. Upon the introduction of the hot refrigerant gas through pipes 10, walls 13 are heated causing a slight melting of the ice A on the periphery of said wall and the heat likewise slightly melts the lower portion of the ice on tube 6, as hereinbefore described. Thus, the lower end of the ice tube is freed from these members and when the hot refrigerant thereafter passes into each of the tubes 6 from header 5, it only requires a very slight melting of the ice to cause the same to slide downwardly along and from said tubes.

Spaces 20 and 21, and insulator 26 which cover pipes 7 and 8, prevent the liquid refrigerant from tubes 6 from cooling the defroster and pipes 10 and 22 which would reduce the efficiency of the hot refrigerant to be introduced to the defroster. Similarly, the hot refrigerant in the defroster does not heat the pipe 7 or plate 18 which would further heat the refrigerant in said pipe and in tubes 6, and thereby prevents an increase in the burden upon the refrigerant compressor and condenser. Accordingly, a highly efficient ice making machine is provided which quickly forms ice and discharges the same at a considerably greater rate than generally provided by machines heretofore known.

In order to effect an equal exhausting of the refrigerant from tubes 6 into pipes 7 and 8, it has been found helpful to employ a Y-shaped outlet 8' connected at two or more spaced-apart portions of the bottom of said pipe 8, and leading to pipe 8''. In this manner the refrigerant is equally withdrawn from all the tubes 6 substantially simul-

taneously whereupon the hot refrigerant will contact the entire surface of all of the tubes 6 at about the same time, and the ice will slide from all tubes at the same time and greatly facilitating the operation of the machine. Unless that construction be used, the refrigerant may remain in some of the tubes 6 until the ice has been freed from those which the refrigerant has been exhausted, hence delaying the harvesting of the ice from those tubes 6 from which the exhaustion of the refrigerant has been delayed. Pipe 8'' is connected to tank 2 for returning the liquid refrigerant thereto during the harvest cycle.

The present device for freeing the ice cylinders can readily be applied to ice forming tubes of machines of types other than that shown herein, and accordingly, such changes to the present invention as come within the scope of the appended claims is deemed to be a part of the present invention.

What I claim is:

1. A defroster for an end portion of a cylinder for forming ice on the exterior periphery thereof comprising a pair of concentric spaced apart annular plates forming the side walls of the defroster casing, a ring shaped plate connecting and closing an end portion of said annular plates forming the top of said casing, a second and similar ring shaped plate connecting and closing the opposite end portion of said annular plates forming the bottom thereof, said second ring shaped plate having a pair of spaced apart openings therethrough, a pair of pipes connected to said second ring shaped plate each in communication with one of said openings for the passage of a heating medium to and from said casing and the outer of said annular plates having a portion extending from said first mentioned ring shaped plate for connection to the end of said ice forming cylinder positioning the top of said casing from and below said cylinder providing an insulating air space therebetween.

2. An ice forming cylinder with defroster for ice making machines comprising an elongated tube for receiving a refrigerant to form water into ice on the exterior periphery of said tube, an annular disc extending completely across the lower bore of said tube, but spaced from the end thereof, a pipe connected to said disc in communication with the opening therein and extending from said tube for the discharge of said refrigerant, an annular casing surrounding said pipe and connected to the end of said tube being positioned below and spaced from said disc providing an insulating air space therebetween and a plurality of spaced apart pipes connected to said casing in communication with the interior thereof for conveying a heating medium to and from said casing to defrost an end portion of the ice formed on said tube and casing.

3. An ice forming cylinder with defroster for ice making machines as claimed in claim 2, wherein a heat insulator is positioned between said pipe connected to said disc and said casing and plurality of pipes for preventing the formation of ice therebetween.

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