Sept. 24, 1957 M. S. CHAPMAN 2,807,150

TEMPERATURE CONTROL FOR ICE MAKING MACHINE DEFROSTING GASES

Filed April 1, 1955 3 Sheets-Sheet 1

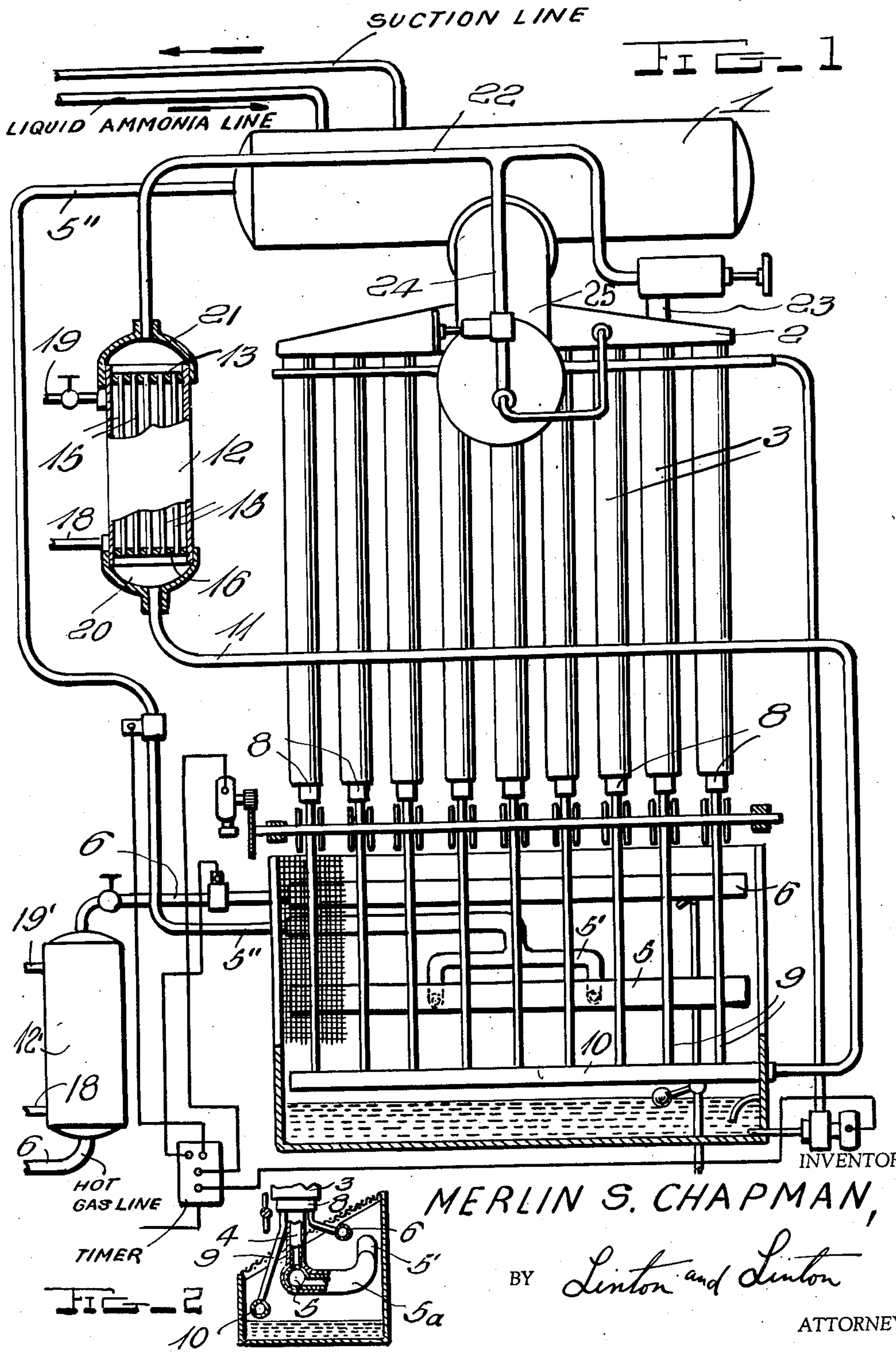

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FIG-3

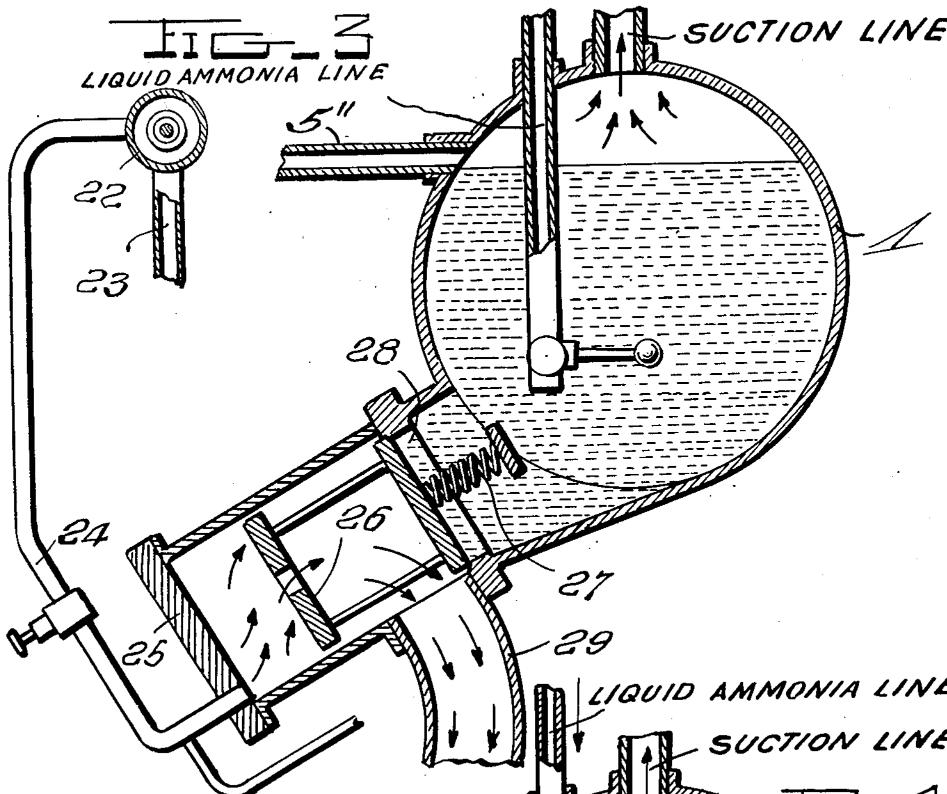
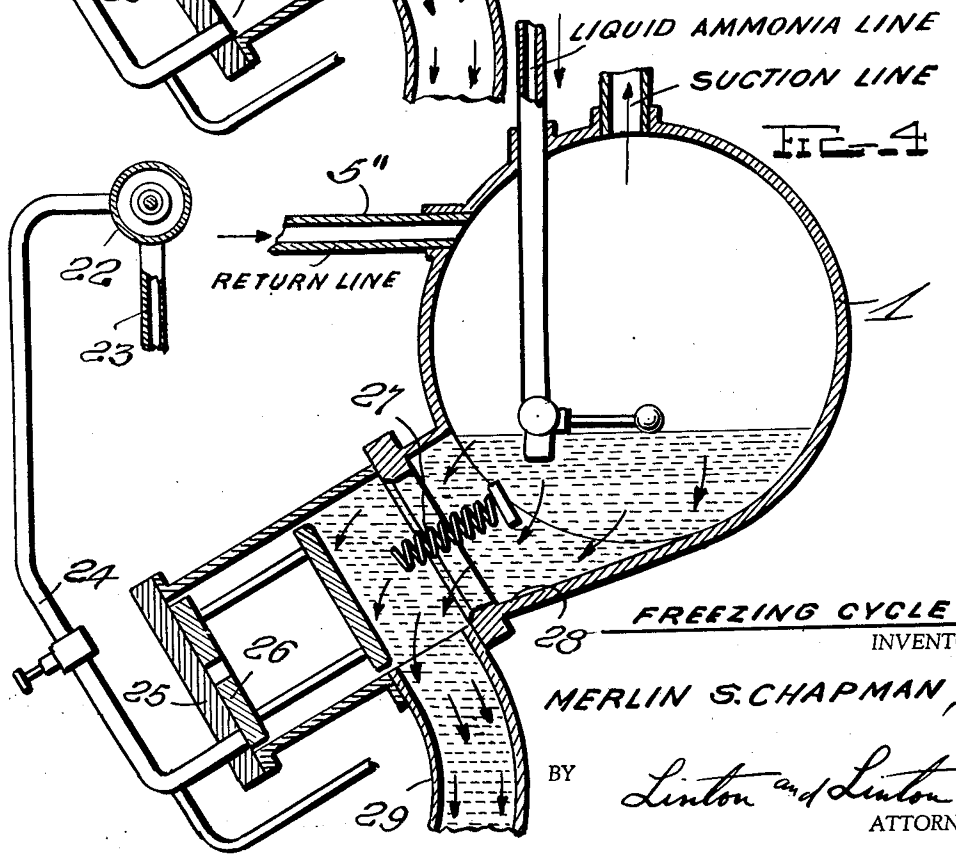


FIG-4



FREEZING CYCLE

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FIG. 5

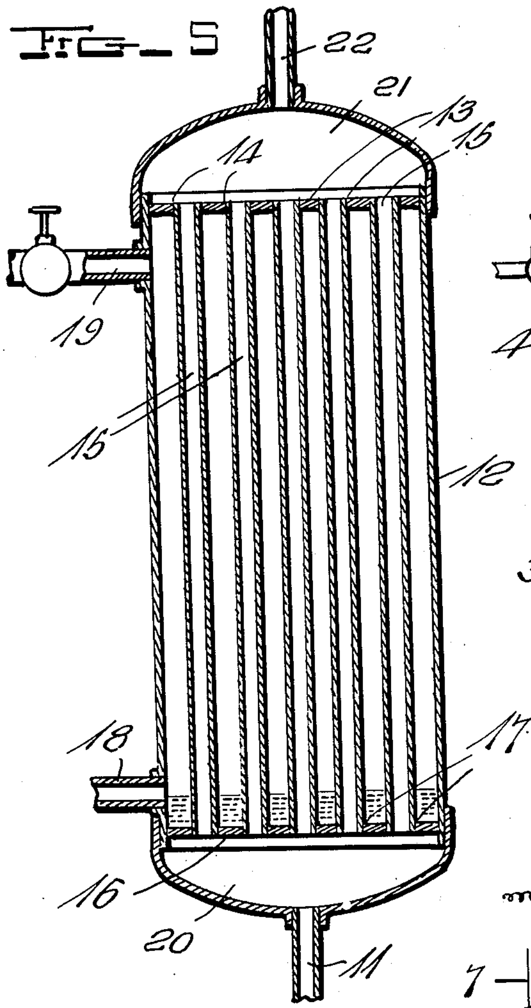
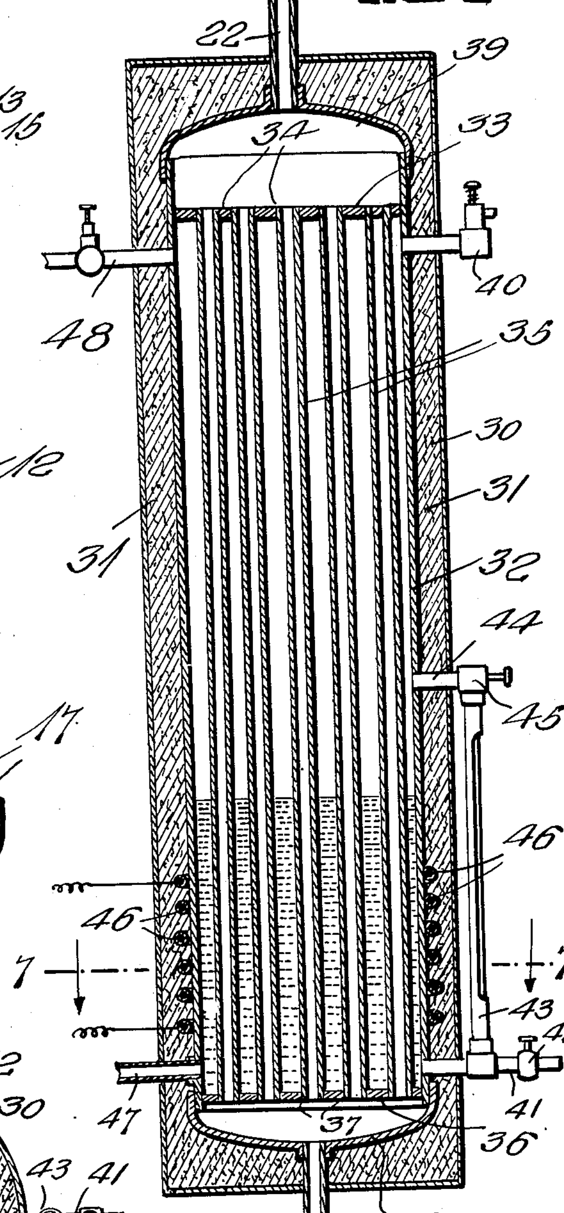


FIG. 6



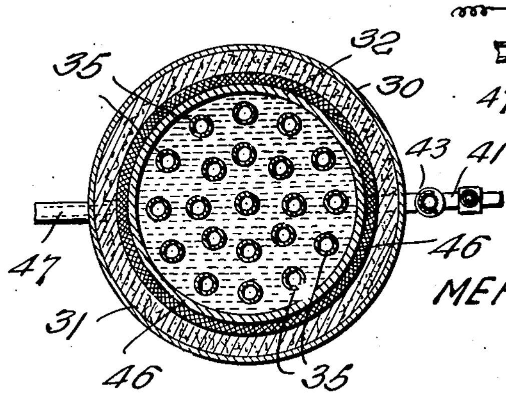


FIG. 7

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TEMPERATURE CONTROL FOR ICE MAKING MACHINE DEFROSTING GASES

Merlin S. Chapman, Wheeling, W. Va.

Application April 1, 1955, Serial No. 498,582

2 Claims. (Cl. 62—7)

The present invention relates to ice making machines and is more particularly concerned with the means for freeing ice from the surface against which it is formed by a slight thawing of its adjacent surface only.

In known ice making machines a liquid refrigerant is is employed which is introduced into one or more chambers while water is positioned or sprayed against the opposite side of the wall forming said chambers which water then becomes frozen due to the absorption of the heat by the refrigerant which then turns into a gas. This gas is withdrawn from the chamber, compressed and condensed back to the liquid form for reintroduction into said chambers for further freezing purposes. The gas leaving the compressor in such machines is relatively hot and in some machines is introduced into said chambers for freeing the ice from the tubes upon which it is formed to assist in its removal between the introduction of the liquid refrigerant for forming the ice. Examples of such machines are shown in U. S. Patents Nos. 2,598,430; 2,590,499; 2,595,588 and applicant's co-pending application for patent Serial No. 305,534, now Patent No. 2,739,457, granted March 27, 1955.

However, in such known machines the temperature of the hot gas is not controlled and, accordingly, efficient defrosting of the ice is not effected, nor can the temperature of the defrosting gas be varied as required due to the variation in the temperature surrounding said machine.

It is, accordingly, the principal object of the present invention to include in ice making machines means for increasing the temperature of the hot refrigerant gas employed for defrosting purposes.

Further objects of the invention will be in part obvious and in part pointed out in the following description of the accompanying drawings wherein,

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

Fig. 2 is a cross sectional view showing the refrigerant pipes from the bottom of an ice making chamber.

Fig. 3 is a cross sectional view of the refrigerant introducing means for the exemplary ice making machine of Fig. 1 during the defrosting cycle.

Fig. 4 is similar to Fig. 3 except the elements are shown during the freezing cycle.

Fig. 5 is a vertical section through a superheater for carrying out the present invention.

Fig. 6 is a vertical section through a modified form of superheater; and,

Fig. 7 is a horizontal section taken on line 7—7 of Fig. 6.

Referring now more particularly to the accompanying drawings, wherein like and corresponding parts are designated by similar reference characters, there is shown by way of example only, an ice making machine incorporating the present invention and which machine is more fully described in applicant's co-pending application Serial No. 305,534, now Patent No. 2,739,457, in order that the operation of the present invention can be

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understood. Referring first to Fig. 1, there is shown a tank **1** for receiving a liquid refrigerant such as ammonia or Freon from the conventional refrigerant compressor and condenser for storing this refrigerant which by way of example is indicated as being ammonia, although other known refrigerants can equally as well be employed.

Below tank **1** there is positioned a hollow header **2** from which extend a plurality of tubes **3**. A plurality of pipes **4** extend from the bottom of each of said tubes and they are all connected to a pipe **5** which passes back to said tank **1**.

Pipe **6** is connected to the exhaust end of the refrigerant compressor for receiving hot compressed refrigerant gas therefrom and conveys this hot gas in the present example into a superheater **12′** which for example, is the same as shown in Fig. 5 or Figs. 6 and 7 and a plurality of pipes **7** each leading into a hollow plug **8** closing one end of a tube **3**, while a corresponding plurality of pipes **9** connect said plug **8** to a pipe **10** which in turn is connected by a pipe **11** connected to a superheater **12** similar to those shown in Figs. 5 and 6. Using the superheater of Fig. 5 as an example of one type of device which can be employed for the present purpose, this superheater consists of a cylinder **12** having a disc **13** extending across one end forming a partition. Said disc has a large plurality of openings **14** formed therethrough from each of which extends a tube **15** down to a second disc **16** having a like plurality of openings **17** and forming a partition at the opposite end of said cylinder. A pair of inlet and outlet pipes **18** and **19** extend through said cylinder between said discs. A cover **20** having pipe **11** connected thereto closes the lower end of cylinder **12** while a similar cover **21** closes the upper end. A pipe **22** is connected to said cover **21** and extends to pipe **23** connected to said header **2**. A by-pass pipe **24** connects pipe **22** to the base of the outlet cylinder **25**, and extends to header **2**. Within said outlet cylinder is positioned a closure piston **26** while a spring **27** is positioned within the outlet **28** of said tank. A pipe **29** extends from the lower side of said cylinder **25** to header **2**.

In the operation of the present machine, liquid refrigerant is fed from the conventional refrigeration condenser to tank **1** while refrigerant gases are drawn into the compressor for being recondensed. This liquid refrigerant passes from tank **1** through outlet **28** to pipe **29** through header **2** to each of the tubes **3** where water sprayed on said tubes freezes into ice due to the absorption of the heat in the water by the refrigerant. The portion of the refrigerant turning into a gas passes upwardly in tubes **3** to tank **1** and thence through the suction line therefrom, and the liquid refrigerant remaining is discharged, during the harvest cycle, through pipes **4** into pipe **5**, Y-shaped outlet **5′** and pipe **5″** back to tank **1**.

At the same time hot gas under pressure from the high-pressure side of the refrigeration system is in pipes **6** and upon the opening of the control valve to this pipe the hot gas therein and in superheater **12′**, passes into pipe **7**, and plugs **8** where the ice thereon and around the lower ends only of the tubes **3**, is initially and slightly melted whereupon this gas continues through pipe **9** and **10** to pipe **11** into superheater **12**, where its temperature is raised to the extent desired.

The resultant superheated gas from superheater **12**, during the harvesting cycle, passes through pipes **22**, **24** into cylinder **25** where, because it is held under a much higher pressure than that in tank **1**, it pushes piston **26** against spring **27** into tank outlet **28** whereupon this superheated gas under high pressure, passes downwardly through pipe **29** into header **2** and tubes **3** forcing out the liquid refrigerant therein through pipes **4**, **5**, etc., as described in applicant's co-pending application hereinbefore mentioned. While the liquid refrigerant is being so expelled from tubes **3**, the valve for pipe **5″** is opened for the passage of the refrigerant. When the hot gas has replaced the refrigerant in tubes **3**, the ice on tubes **3** has its adjacent surfaces thawed sufficiently to allow the tubes of ice to slide downwardly from said tubes **3**. After the ice sheaths have been removed from the tubes **3** and so harvested, the timer closes the valve in pipes **6**. Shortly thereafter the pressure beyond that point in the device illustrated in Fig. 1 equalizes, whereupon the valve **26** opens spilling refrigerant from the tank **1** into the tubes **3** and intermediate parts, thus beginning another freezing cycle. The freezing and the harvesting cycles can be alternated by controlling the valves for pipes **5** and **6**.

Steam, generated by means not shown, may be introduced through the pipes **19** and **19′** into cylinders **12** and **12′**. By this means the gas passing through the tubes **15** is heated to the desired temperature in a manner well understood.

By controlling the temperature of the steam in cylinders **12** and **12′**, the temperature of the hot gas can likewise be controlled so that a hotter than normal gas can be used to decrease greatly the time of the harvesting cycle and also to compensate for the loss of heat escaping from the pipes conveying the gas. Furthermore, these ice making machines are generally housed in a building without heat and in the winter it is especially desirable to increase the heat of the gas at one or both of the points indicated by the positions of the superheaters shown in Fig. 1.

In the superheater shown in Figs. 6 and 7, a casing **30** has a heat insulating material **31** therein with a cylinder **32** encased thereby. Said cylinder has a disc **33** partitioning off the top of said cylinder, while said disc has a plurality of openings **34** from each of which extends a tube **35** down to a similar disc **36** closing the lower end of said cylinder and having corresponding openings **37**.

A cover **38** connected to pipe **11** closes the lower end of said cylinder while a cover **39** connected to pipe **22** closes the upper end. A safety valve **40** is connected to the medial portion of said cylinder, while an outlet pipe **41** having a control valve **42** is likewise connected to said cylinder. A water gauge **43** extends from pipe **41** to pipe **44** having a valve **45** and is likewise connected to said cylinder. Electrical heating coils **46** connected to a source of electrical current surround the lower ends of said cylinder **32**. A valve water inlet pipe **47** also is connected to said cylinder while an air outlet pipe **48** is positioned adjacent disc **33** which outlet pipe is closed when all the air in said cylinder is exhausted.

In the operation of this superheater the hot refrigerant gas from pipe **6** or **11** entering cover **38** passes through pipes **35** to cover **39** and through pipe **22**. Water is introduced through pipe **47** to the desired height as indicated by the water gauge **43**. The heating element **46** heats the water in cylinder **32** turning the same to steam. The valve in pipe **48** remains open until the steam has driven all air from the interior of the superheater and when that has been done the valve is closed. The steam within the superheater then heats the tubes **35** and the gas passing through or contained therein. Safety valve **40** automatically releases steam if the pressure rises above the point at which said valve is set to operate. Thus it

will be understood, the temperature within cylinder **32** can be controlled by controlling the current of heating elements **46**.

Superheater **12′** also may be interconnected to the hot gas line **6** for increasing the temperature of the gas in that line since it is important that the ice be melted around the plugs **8** and adjacent end portion of tubes **3** before it is thawed from the remainder portions of the tubes **3**. Either superheater **12** or superheater **12′** or both can be employed, depending upon the conditions under which the machine is operating, and as experience may indicate is desirable. Also other types of superheaters such as superheater **31** can be used in place of superheater **12′**.

It is to be appreciated that the ice making machine disclosed herein as well as the particular forms of superheaters are merely by way of example only. Superheaters can equally as well be included in other types of ice making machines for controlling the temperature of the defrosting gas in view of the teachings disclosed herein. Likewise conventional forms of superheaters can be employed for heating the gas to the temperature desired.

Accordingly, the present invention is capable of a variation and changes thereto as come within the scope of the appended claims are deemed to be a part of the present invention.

What I claim is:

1. In an ice making machine having at least one upright cylinder for producing ice on the exterior thereof including a chamber connected to the lower end of said cylinder, a pipe for conducting a heating fluid to said chamber for loosening ice formed around the lower end of said cylinder and said chamber, a closed casing having said pipe connected at opposite ends thereof, a partition in said casing, a plurality of pipes extending through said partitions for the passage of fluid from said first mentioned pipe, controlled means for supplying steam at desired temperatures between said partitions and exteriorly of said plurality of pipes for superheating the fluid passing therethrough whereby fluid at a controlled high temperature will reach said chamber for loosening ice around said chamber and the lower end of said cylinder.

2. In an ice making machine as claimed in claim 1, a controlled pipe connecting said cylinder and said chamber for feeding said fluid from said chamber to said cylinder, and means for superheating said fluid passing through said pipe whereby said fluid at a given temperature will be fed into said cylinder for melting ice therearound sufficient to cause said ice to slide from said cylinder.

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