

Feb. 12, 1952

M. N. GROW
ICE-MAKING MACHINE

2,585,240

Filed Oct. 7, 1948

3 Sheets-Sheet 1

FIG 1

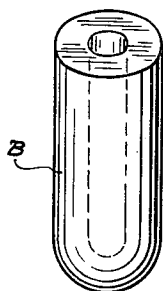
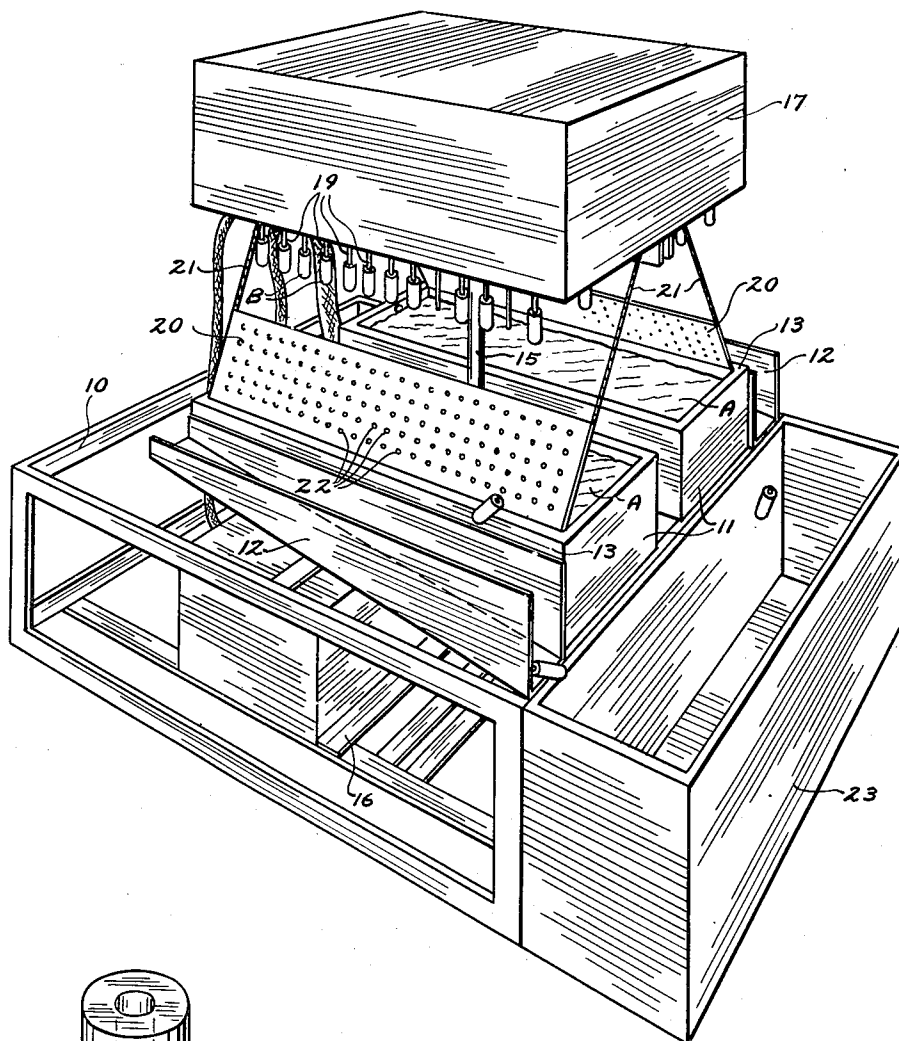


FIG 2

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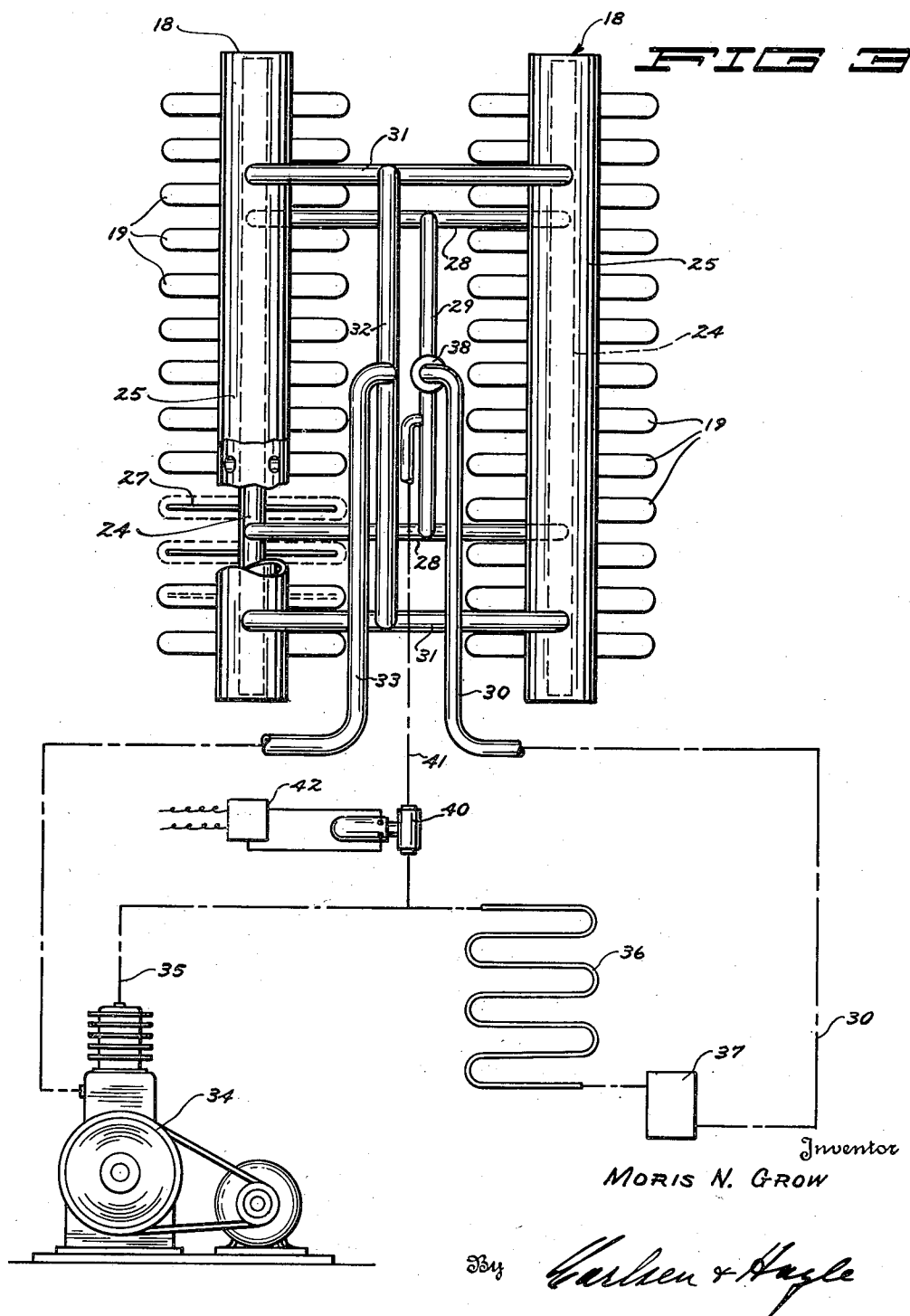
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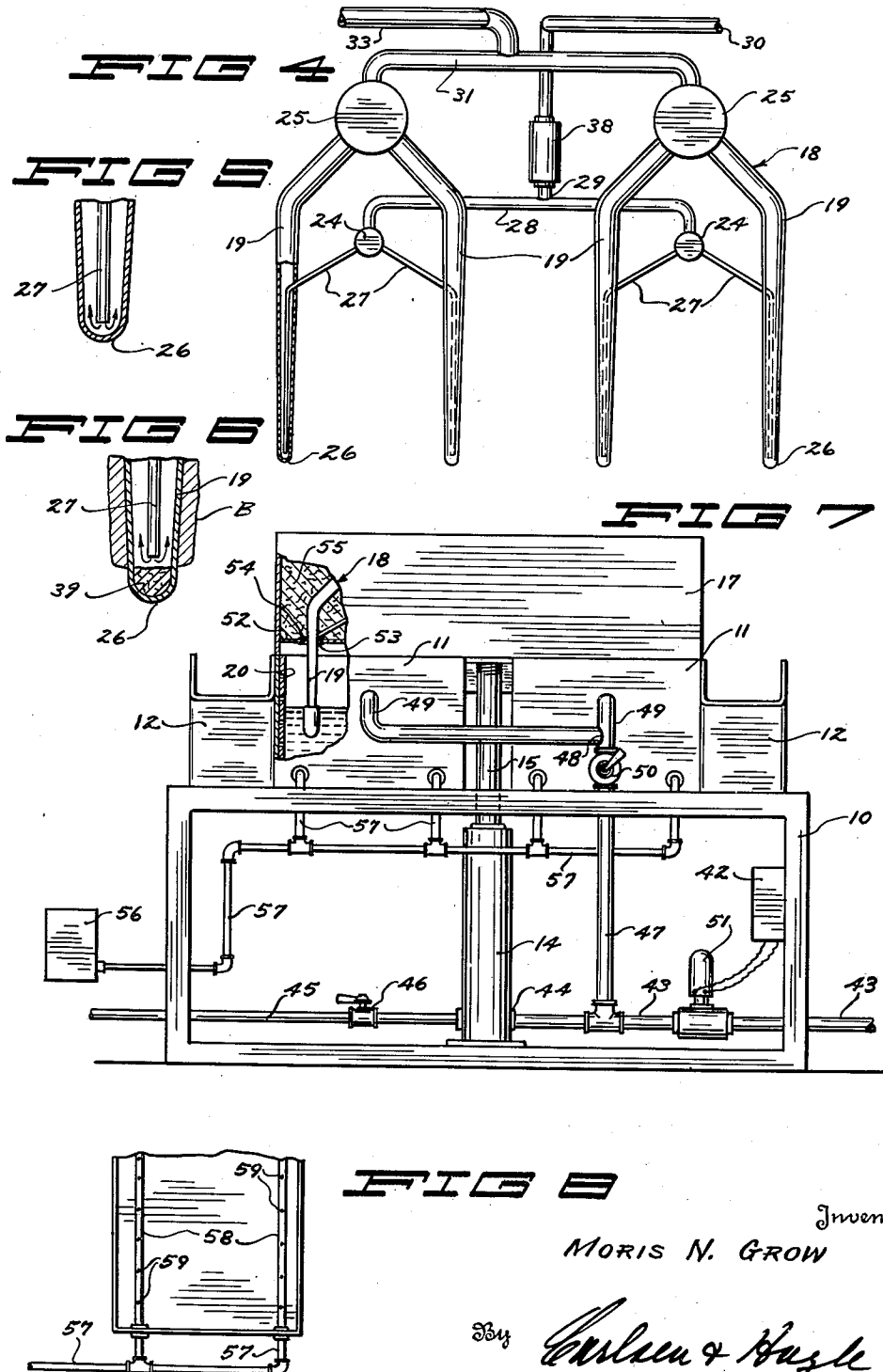
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UNITED STATES PATENT OFFICE

2,585,240

ICE-MAKING MACHINE

Moris N. Grow, Minneapolis, Minn.

Application October 7, 1948, Serial No. 53,307

8 Claims. (Cl. 62-162)

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This invention relates to apparatus and method for manufacturing artificial ice and more particularly to a machine for quickly and efficiently producing ice units of a size comparable with conventional ice cubes for use in the preparation of beverages.

With the inception and evolution of modern refrigeration the use of ice cubes has become increasingly extensive. This is due, in large measure, to the desirability of using ice as a cooling medium for beverages. As a result, business establishments such as hotels, restaurants and bars, which serve cool beverages, use large quantities of ice in the form of cubes. These are generally purchased from outside sources as the expense of on-the-premises manufacture by small machines has usually been prohibitive. Furthermore, the freezing time required for making cubes with small commercial machines has made it difficult, if not impossible, to produce an adequate current supply particularly during rush hours of the day. These cube makers have generally operated on, what is known in the industry, as the "can system." That is, water is placed in cans or molds and some type of refrigerant is circulated around the outside of the mold freezing the water therein. Another method of manufacturing ice is known as the "plate method" whereby a refrigerant is circulated within a hollow plate or similar structure and, the plate being dipped in water, ice forms around the outside of the plate and is subsequently removed for use. The latter method presents the advantage of quicker freezing as the refrigerant is circulated to cool an area in closer proximity to the body of water to be frozen than it does in the can system. This method is utilized in the present disclosure but with a greater degree of efficiency than has heretofore been obtained.

It is therefore the primary object of my invention to provide a relatively inexpensive machine which will quickly and economically produce ice units of approximately the common ice cube size, and in substantial volume.

Another object of my invention is to provide an ice making machine for manufacturing ice units which will automatically collect the frozen units through the use of an improved gathering mechanism and repeat the freezing and collecting operations without manual attention.

Another object of my invention is to provide a means and method of manufacturing small ice units by use of the "plate method" wherein the freezing action is accomplished through direct

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expansion of the primary refrigerant in a plurality of freezing elements dipped in water and which insures an equal distribution of the refrigerant to all of the elements.

Another object is to provide an improved ice making machine adapted to produce ice units of various shapes and sizes.

Still another object is to provide a machine and a method which will manufacture ice units in the form of clear thimble shaped ice jackets having exceptionally large cooling or melting surfaces and which jackets do not have the surface affinity for each other that causes them to stick together as occurs with conventional ice cubes.

These and other more detailed and specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings, in which:

Fig. 1 is a perspective view of my machine with the freezer assembly in its elevated or discharging position.

Fig. 2 is an enlarged perspective view of one of the thimble shaped ice jackets produced by my machine.

Fig. 3 is a plan view of the refrigeration coil and its connections with a somewhat diagrammatic presentation of the complete refrigeration system used therewith.

Fig. 4 is an end view of the coil assembly partially broken away to show the relative location of certain so-called capillary tubes disposed within the freezing elements.

Fig. 5 is an enlarged sectional detail view of the lower end of one of the freezing elements with its inclosed depending capillary tube.

Fig. 6 is similar to Fig. 5 but shows a slightly modified construction for forming a differently shaped ice jacket.

Fig. 7 is a rear elevation of my machine, partially in section, showing one of the water receptacles, and the water agitation systems.

Fig. 8 is a detail plan view of one end portion of one of the water tanks.

Referring to the drawings more particularly and by reference characters, 10 designates a skeleton like base or frame structure upon which are mounted two water containers or tanks 11 that are generally parallel but spaced with respect to each other, as shown in Fig. 1. Along the outer side wall of each of the tanks 11 there is disposed an inclined trough or chute 12 arranged to receive the freshly frozen ice units, as they are discharged from the freezing elements, and direct them into a storage receptacle

23, located at one end of the base frame 10, and which receptacle can be used to carry the ice away while a similar receptacle is substituted to collect more ice units as the machine continues to operate.

Mounted rigidly within the base 11, as upon a cross bar 16 thereof, is the cylinder 14 of a hydraulic jack having a piston 15 which extends up between the water tanks 11 to support a freezer assembly. This assembly is housed within a protecting container 17 and includes refrigeration coil assembly 18 having a plurality of freezing elements in the form of hollow depending fingers 19, which are arranged to dip down into the water A in the tanks 11 when the piston of the hydraulic jack is lowered, as shown in Fig. 7.

The structural details and operation of the freezing apparatus, as such, will presently be set forth in greater detail. For the moment, and with particular reference to the mechanical equipment for releasing and collecting the ice units; it is to be noted that the freezing elements 19 are retained in the water A until such time as the accumulated ice is of sufficient thickness to form ice jackets or units B of predetermined size and weight. The hydraulic jack is then actuated to lift the entire freezer assembly, including the completed jackets B, to the elevated position shown in Fig. 1, where the jackets will drain off any free surface water, and at which elevation the jackets are released from the fingers by the injection of hot gas or liquid into the fingers. As the jackets are thus released they fall upon outwardly inclined drain boards or perforated plates which deflect the ice units into the troughs 12.

These deflector plates 20 are hinged to the upper edges of the outer side walls 13 of the tanks 11 in such a manner that they may be lifted to the sloped or inclined positions shown in Fig. 1, and when released will drop, under the action of gravity, down into the tanks so that they will rest in a depending position against the inner surfaces of the walls 13, as indicated in Fig. 7. The upper inner corners of the plates 20 are connected by flexible elements 21, which may be of cable, rope or chain, to inner points of the casing 17, so that when the freezer assembly is in its uppermost position these elements 21 will hold the plates in their inclined positions. It will be understood that when the freezer assembly is lowered, with the casing 17 resting on the water tanks (Fig. 7) the deflector plates will drop into their down position so as not to interfere with the finger dipping or freezing operations. It will also be seen that perforations 22 in the deflector plates will not only facilitate drainage from the ice jackets but will facilitate the downward swinging movement of the plates through the respective bodies of water.

Having described the mechanical operation of my machine, I will now explain the refrigeration system and automatic timing device used with it. Figs. 3 and 4 show the construction of the coil assembly 18 which is disposed within the housing 17. The coil includes a pair of transversely spaced generally parallel inlet or distributor pipes 24 and a pair of somewhat larger outlet pipes 25 thereabove. The freezing elements 19 are in the form of angular drop legs or hollow fingers which depend from and open into both sides of the two outlet pipes 25. These freezing elements taper gradually downward and are closed at their lower extremities 26. Between

the legs of each pair of freezing elements 19 a pair of small diametered capillary or restrictor tubes 27 branch from each inlet pipe 24 and each of these tubes extends through the wall of one of the freezing elements and downwardly inside the element to a point short of its lower extremity. These tubes 27 are open at their lower extremity to discharge into the member 19. Headers 28 connect the inlet pipes at spaced intervals and these headers are in turn connected by a pipe 29 which is fed by the main gas inlet tube 30. Similarly the outlet pipes 25 are connected by headers 31 and pipes 32 which feed into a return tube or suction line 33.

When the freezing elements 19 are immersed in the water the refrigeration cycle becomes operative. For this purpose a compressor 34 is provided (see Fig. 3) and pumps the refrigerant gas under pressure through a tube 35 to a condenser 36 and a receiver 37. The refrigerant then passes through the tube 38 to an expansion valve 38 which is provided on the tube adjacent its connection with the pipe 29. As the liquid passes through this valve some of the pressure is relieved to start vaporization of the liquid as it passes through pipes 29 and 28 and the inlet pipe 24. The liquid refrigerant then passes downwardly through the tubes 27, being discharged out the lower ends thereof, and boils upwardly in the elements 19 and around the tubes. Vaporization of the refrigerant in each element produces a low temperature causing the element to withdraw heat from the surrounding water to form a jacket of ice around the submerged portion of the element. The gas then returns through outlet pipes 25 and connecting pipes 31 and 32 to the return or suction line 33 and back to the compressor to repeat the cycle.

It is important to note the size and function of the tubes 27. The primary purpose of these tubes is to feed the refrigerant to the various elements 19. It is found, however, that effective distribution can only be accomplished if the tubes 27 have very small diametered passageways, such as in a conventional capillary tube, whereby only such small amounts of the refrigerant are allowed to escape from the distributors 24 as to retain the refrigerant under pressure in the distributors and as it passes into the upper end of each feeder tube. It must be remembered that the pressure is only partially reduced by the valve 38. Accordingly, the pipes 24, 28, and 29 jointly form a chamber in which the refrigerant is held under considerable pressure and the only escape from which is through the tubes 27. Pressure reduction then takes place as the liquid passes downwardly through the tube, the pressure from above operating to force the liquid downwardly so as to actually blow the liquid out the discharge end of the tube. Accordingly the tubes 27, because of their construction are believed to feed the refrigerant to the evaporators in a novel manner. They are in fact short capillary tubes. Furthermore, because of the limited length of these tubes, they are not restrictive to the flow of hot gas admitted to the tubes during the thawing operation to be described.

When the ice jackets have been built up to desired size on the freezing elements and the freezing assembly 18 has been raised, as in Fig. 1, a valve 40 (Fig. 3), connected to the discharge side of the compressor, is opened and the gas in its hot condition follows the path of least resistance through a tube 41, by-passing the condenser 36 and expansion valve 38, and enters the inlet

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system through pipe 29 and passes down into the freezing elements through tubes 27. After forcing the refrigerant remaining in the tubes 27 out into the freezing elements the hot gas immediately raises the temperature of the freezing elements to above 32° F. causing the ice jackets to be released and gathered as heretofore described.

The valve 40 may, of course, be controlled either manually or automatically. In the preferred embodiment of my invention, valve 40 is of the solenoid type and is operated by a timer 42.

It may be here added that the process can be modified somewhat by allowing the cold refrigerant to continue running through the freezing elements for a brief period after the coil head has been elevated. This allows the film of water around the jackets to be frozen or to drain off leaving the jackets relatively dry. The advantage in so doing is to decrease the adhering tendency of the jackets when they are brought into contact with each other and is especially effective when the jackets are stored for some time in a refrigerated container.

Referring now to Fig. 7 for explanation of the water system, the numeral 43 denotes a water supply pipe leading to the hydraulic jack 14. The water under pressure actuates the jack by entering the cylinder 14 at 44. A bleeder tube 45 is open at all times but is set by a valve 46 to allow only a small amount of the liquid entering the jack to pass through it. The excess, of course, raises the piston 15 and the freezer assembly mounted on it. When the assembly has been raised to its uppermost position, and the water pressure is terminated, the jack is bled slowly through tube 45 which connects to a suitable drain and the piston and the freezer assembly are lowered thereby. A pipe 47 branches off from pipe 43 and forks off at 48 to provide two supply pipes 49 extending through one end wall of each of tanks 11 near the top thereof. A manually operated fluid control valve 50 is arranged in pipe 47 to regulate the flow to the tanks. A solenoid valve 51 is located in the pipe 43 and may be operated by the automatic timer 42. This same timer may thus be used to control both the hot gas flow through valve 40 and the water flow through valve 51. When the freezing period has elapsed the timer opens both valves and thus actuates the raising of the coil, the flow of fresh water into the tanks, and the circulation of the hot gas in the freezing elements to release the jackets B. After a predetermined releasing period the timer closes both valves simultaneously and the freezer assembly then descends as the hot gas is turned off so that the machine may again resume the freezing process. Valve 50 is, of course, adjusted to admit to the tank only as much water as is removed in the state of ice during each cycle.

A portion of the coil housing 17 is broken away in Fig. 7 to show the means for securing the coil legs 19. Thus, a plate 52 is anchored in the housing and extends horizontally across the bottom thereof. This plate is provided with apertures 53 lined with cushion washers 54 which support the coil at about the points where the tubes 27 enter the freezing elements 19. The inside of the coil housing above the plate 52 is preferably packed with some suitable insulating material 55. Gas inlet tubes 30 and 41 and return tube 33 enter the coil housing as shown, and are, of necessity, flexible to allow for the raising and lowering of the assembly.

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For best results, I also provide an air compressor 56 (Fig. 7) with pressure lines 57 to air jet tubes 58 disposed longitudinally along the bottom of the tanks (Fig. 8). Each tube has air openings 59 at points just below each freezing element. The air is constantly pumped through the lines 53 and the water around each freezing element is thus agitated vigorously during the entire freezing process. Such agitation serves to produce clear ice. The agitation principle is well known in the industry. However, I do not believe it has been heretofore effectively used in the manufacture of ice cubes or similar size ice units. Clear ice cubes are highly desirable but it has been economically impossible to provide air agitation for individual molds. In my machine each freezing element has an adjacent individual air pressure outlet which aids in producing a crystal clear ice jacket.

It may here be noted that an ice jacket or unit of the thimble shape type, as shown in Fig. 2, has advantages over the conventional square shaped ice cube in that it presents a substantially greater cooling surface with respect to volume, and not having several flat or plane surfaces these jackets will not tend to stick together when packed in a receptacle for storage. It is also found that while these ice jackets or thimbles are sufficiently strong to retain their shape under ordinary circumstances they do not present the resistance to breakage found in conventional cubes, and can therefore easily be broken up when crushed ice is desired. It is also to be noted, with particular reference to Fig. 6, that by insulating the tip 26 of leg 19, as at 39, ice will not form at this area and there will accordingly be formed a tubular ice jacket that is open at both ends. This will give a still greater melting area to the jacket, in proportion to volume, and thus increase the cooling effect on the beverage.

Of course, by varying the freezing periods different sized ice jackets may be produced and experimentation will quickly disclose the discharging or refilling cycle best suited for the particular freezing period where the automatic timer is used.

I thus provide an ice making machine which has many advantages over prior devices. This machine will manufacture ice jackets of the common ice cube size quickly and economically. It provides a simple yet efficient mechanism for gathering the jackets for storage or use. It furthermore can be constructed to operate entirely automatically and yet occupy a minimum of floor space.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. In an ice making machine a container for holding water, a plurality of freezing members adapted to depend in the water, connections for supplying a refrigerant to said members to build up jackets of ice thereon, a mechanism for raising the freezing members out of the water and lowering them into the water along a common path, means for supplying a hot gas to the members for releasing the jackets, and a collecting mechanism including a plate member movable to an inclined position under the jackets when the freezing members are in the raised position.

2. In an ice making machine, a container for holding a body of water, a freezing assembly including a plurality of downwardly extending freezing elements, said freezing assembly being mounted above the container for raising and lowering movements with respect to the container in such a manner that the freezing elements may be immersed in and removed from the water, connections for supplying a refrigerant to the freezing elements to build a jacket of ice thereon when the elements are immersed in the water, connections for supplying hot gas to the elements to release the jackets when the elements are removed from the water, a plate member hinged to the container for covering and uncovering movements with respect to the container, said plate member being connected to the freezing assembly so that as the assembly is raised the plate member is moved to an ice jacket deflecting position.

3. In an ice making machine, a receptacle for water, a freezing apparatus having freezing elements, hydraulically operated means for moving the freezing apparatus with said elements into and out of contact with water in said receptacle, and valve controlled means for supplying liquid to the receptacle and to the hydraulically operated means.

4. In an ice making machine a container for holding water, a freezing apparatus having plurality of freezing elements supported to depend in the water while jackets of ice are formed thereon and adapted to be relatively separated from the water for release of the jackets from the elements, and a plate member hinged to the container and being connected to the freezing apparatus so that as the apparatus is separated from the water it pulls the plate member about its hinge connection with the container to a position where it extends beneath the elements to deflect the released jackets from falling back into the water container.

5. In an ice machine having connection with a water source, a water receptacle, a freezing apparatus mounted above the receptacle and having a plurality of freezing elements supported to depend in the water for the formation of ice units thereon, hydraulically operated means for relatively separating said apparatus and the receptacle to remove the freezing elements and their ice jackets from the water where the jackets may be removed, means connecting the water source and the water receptacle for replenishing the receptacle water supply, and said hydraulically operated means being actuated by water from the water source.

6. In an ice making machine, an open top container member for holding a body of water, a refrigerant carrying member having a plurality of downwardly depending freezing fingers, said latter member mounted over the container in a primary fixed position relative to the container wherein said fingers will hang in the container water and accumulate ice jackets thereon, a raising and lowering mechanism on one of said members for moving said member on a straight vertical path away from the other of said members to bring the members to a secondary fixed rela-

tive position wherein the fingers and jackets are disposed directly over the water, means for heating the fingers in said second relative position to cause release of the jackets therefrom, and a deflection member connected to said refrigerant carrying member and movable by said first mentioned movement to an inclined position under the fingers to deflect the jacket from falling back into the water.

7. In an ice making machine, a container for holding water, a freezing apparatus having a plurality of freezing fingers supported with their lower ends depending in the water, means for circulating a refrigerant through the fingers whereby jackets of ice will accumulate on the lower ends thereof, means for separating the fingers from and replacing them in the water along common paths and whereby after said separation the fingers are disposed over the water, means for heating the fingers to release the jackets when the fingers are separated from the water, and a deflector member connected to the apparatus and moveable on said separation to an inclined position under the fingers to deflect the released jackets from falling into the water.

8. In an ice making machine for manufacturing a plurality of relatively small particles of ice, a container for holding a body of water, a plurality of freezing elements supported to depend with their lower end portions in the water, means for circulating a refrigerant in the elements whereby jackets of ice will form thereon, means for relatively separating the elements and the water, means for supplying a hot gas to the elements when the elements are in said separated position to cause release of the jackets therefrom, a deflector members connected with the elements and moveable to an inclined position under the elements in said position for deflecting the released jackets from falling into the water, and said elements having an elongated finger construction whereby the jackets will form unconfinedly around the end of the element having a minimum surface engagement with the element to facilitate release of the jackets.

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