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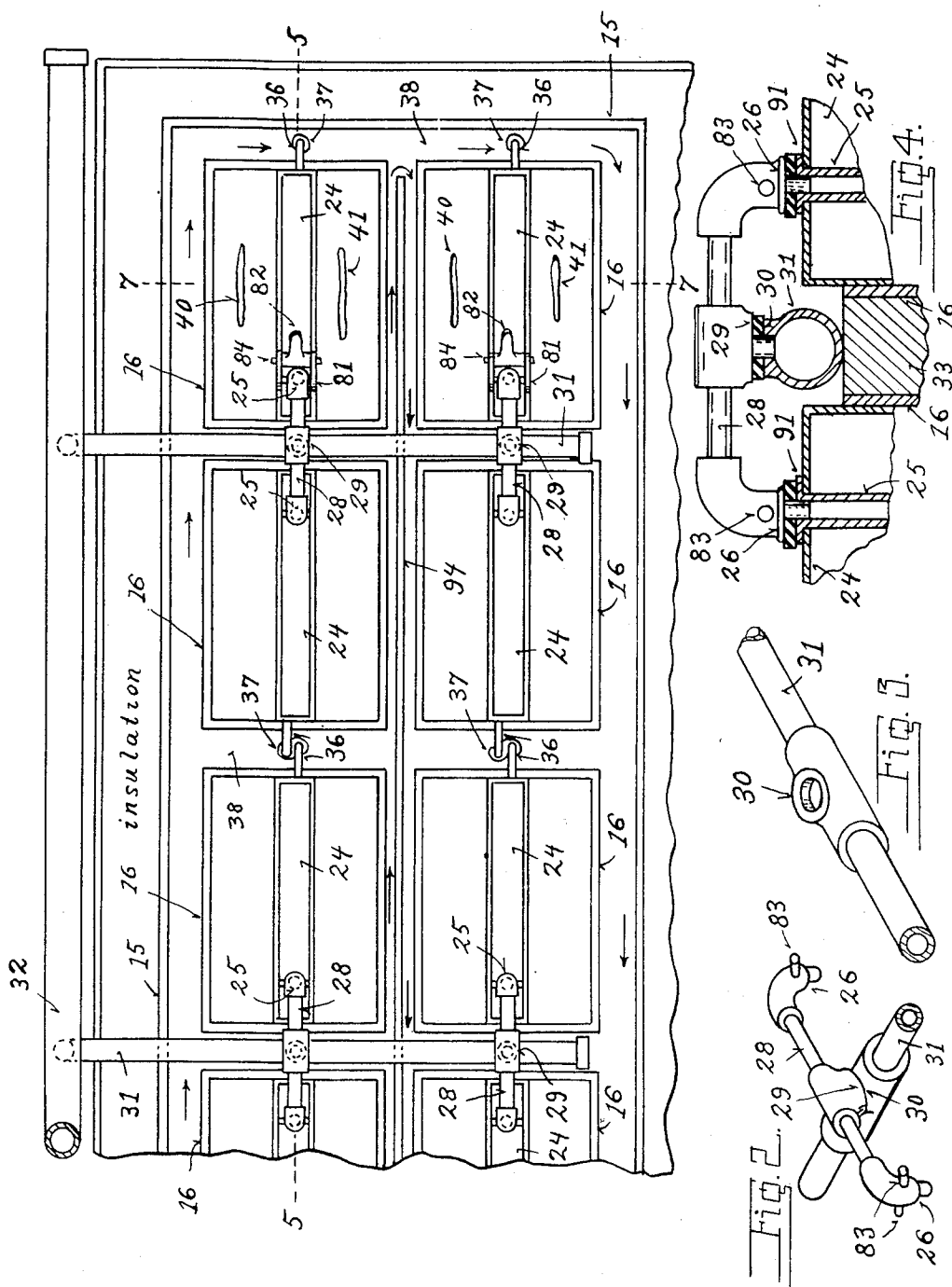
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METHOD OF PRODUCING ARTIFICIAL ICE

Filed June 13, 1929

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

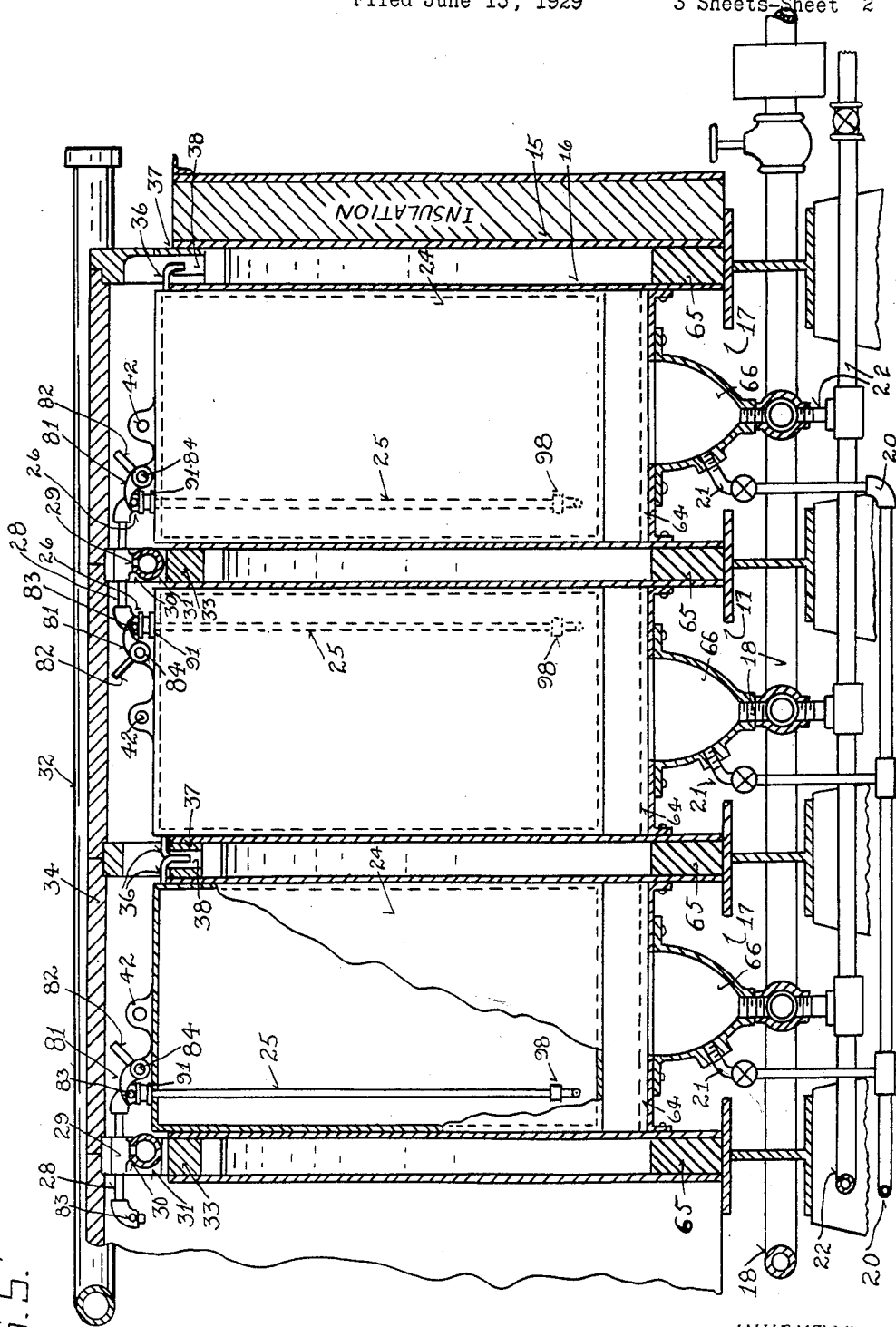


Fig. 5.

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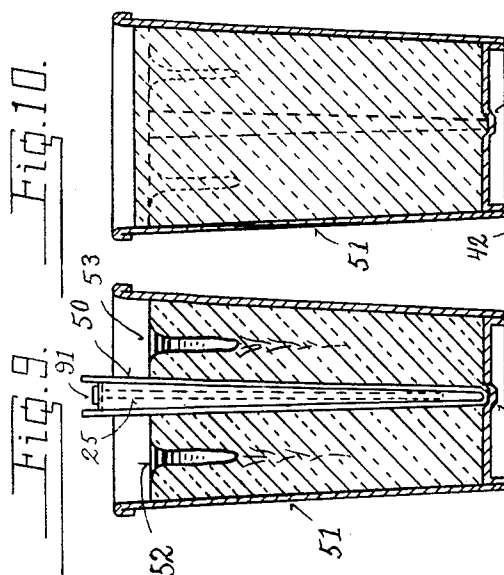
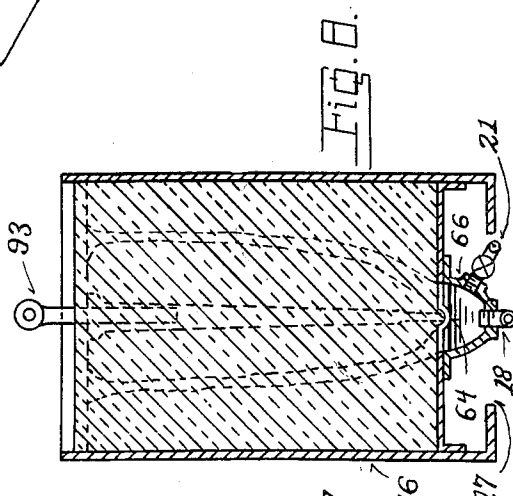
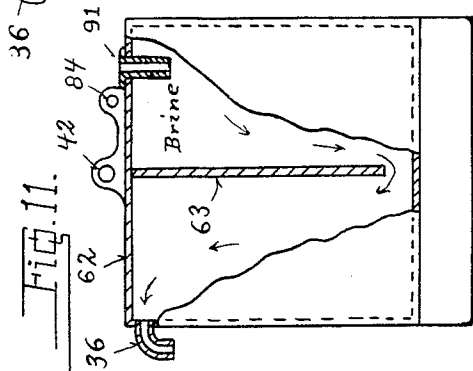
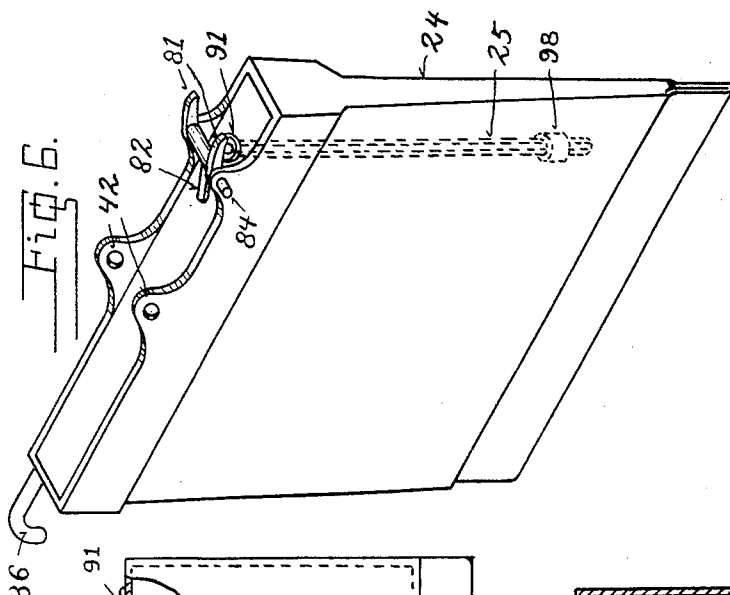
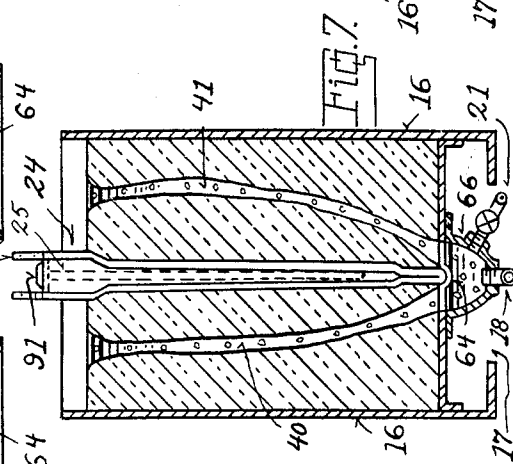
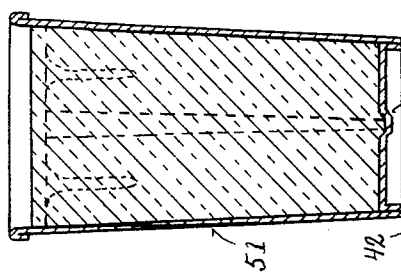


Fig. 10.



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UNITED STATES PATENT OFFICE

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METHOD OF PRODUCING ARTIFICIAL ICE

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21 Claims. (Cl. 62—172)

My invention relates to improved method or process of producing artificial ice. One of its objects is to enable a greater weight of ice to be produced per unit of time and freezing tank equipment than heretofore. Another object is to materially reduce the first cost and the up-keep of the freezing apparatus required to produce in a given time a prescribed amount of artificial ice. Another object is to enable clear, pure and coreless blocks of ice to be more economically produced. My invention also comprises certain details of operation and order of procedure, all of which will be fully set forth in the description of the accompanying drawings illustrating apparatus adapted to the carrying out of my improved method, and its mode of operation, and in which drawings

Fig. 1 is a plan of an ice freezing tank or unit embodying my improvements.

Fig. 2 is a perspective view of a detachable brine circulating pipe connection, detached.

Fig. 3 is a perspective view of another brine circulating pipe connection, detached.

Fig. 4 is a perspective view of another brine circulating pipe connection, detached.

Fig. 5 is a vertical section through the tank or unit shown in Fig. 1, being taken on line 5—5 of Fig. 1.

Fig. 6 is a perspective view of one of the interior freezing members detached.

Fig. 7 is a central vertical section through one of the stationarily mounted freezing cans before the interior freezing member is detached, taken on line 7—7 of Fig. 1.

Fig. 8 is a view similar to Fig. 7 after the interior freezer member has been removed and showing a completed ice block.

Fig. 9 is a view similar to Fig. 7, illustrating a modification in which a detachable ice can is employed.

Fig. 10 is a view similar to Fig. 9 after the interior freezing member has been detached, and showing a completed ice block.

Fig. 11 is a modification of Fig. 6.

The general practice heretofore in the manufacture of artificial ice in cans has been to apply a refrigerant to the exterior of the cans and allowing the freezing operation to proceed from the side walls of the cans progressively inwardly until a single core space is formed near the center of each can. In practice with cans of standard dimensions the freezing operation for each can requires approximately forty-eight hours, with a brine temperature of 14 degrees, and the total number of cans in use would be

sufficient to hold twice the daily capacity or output of the apparatus. If it were made possible to freeze each can in twelve hours instead of forty-eight hours, only one-fourth of the number of cans and brine tank equipment would be required, and hence the first cost of the apparatus, and also its annual up-keep would both be materially reduced. By reducing the thickness of ice through which the negative heat is required to be conducted from the refrigerant to the surface of fresh water being congealed it is possible to reduce the time materially, for instance from forty-eight hours to twelve hours using cans of standard dimensions.

My improved method comprises generically applying a refrigerant to the exterior walls of the ice can or container for the water to be frozen, to thereby provide an outer freezing zone, freezing progressing inwardly from the walls of the container, and also to employ an internal freezing member to which a refrigerant is applied to thereby provide an internal freezing zone, freezing progressing from said internal freezing member outwardly toward said outer freezing zone until nearly the entire contents of the container has been converted into ice, and only two relatively small and narrow core spaces remain unfrozen. The impure core-water is then drained away or removed, and the internal freezing member is warmed sufficiently to be detached and removed upwardly from the ice in the container leaving a removal space between the two core spaces. These three spaces are then filled with fresh water and the freezing operation from the exterior inwardly is continued until the water in said core spaces and said removal space is completely frozen to thereby produce a solid coreless ice block.

In the accompanying drawings I have illustrated apparatus adapted to the carrying out of my improved method or process. Said apparatus comprises a freezing tank or freezing tank unit 15 of the raw-water type, in which tank are either permanently or detachably located a series of ice cans or ice molds 16. The side walls of said ice cans are in contact with the brine contained in the freezing tank 15. The lower ends of the ice cans are seated over openings 17 through the bottom of the tank 15. Pipe connections to the bottom of the ice cans provide for supplying pre-cooled fresh water through a pipe line 18 to refill all the ice cans in a designated tank unit 15 at one operation. Air under pressure is supplied to the lower portion of each ice mold through an air supply pipe 20 and a series of air

until the contents of the can 51 has solidified with the exception of the two small core spaces 52 and 53, which contain the impure core-water. This core water is withdrawn by means of a suction pump, and flexible connection, and the freezing member 50 detached and removed. The core spaces 52 and 53 and the space left by removal of the freezing member 50 are then filled with clean fresh water, and the freezing operation continued until the ice can is filled with a solid block of ice as shown in Fig. 10, whereupon the can and ice block may be withdrawn from the brine tank and the ice loosened and harvested in the usual way, and the can returned to the brine tank for a new operation. It will be noted that the freezing member 24 occupies a minimum amount of space, and hence requires a relatively small volume of water to refill the space from which it is removed, thereby providing for freezing the water employed to refill this space in a relatively short period of time after refilling, due to the relatively small amount of freezing required and a reserve of negative energy stored in the nearly completed ice block.

By or through the use of my improved freezing method I am enabled to produce a designated weight of ice employing one-fourth of the freezing space and equipment as heretofore generally employed, due to the freezing operation proceeding from the interior outwardly as well as from the exterior inwardly, and to provision of means for conveniently and reliably carrying the operation forward, such as agitating the unfrozen water, the removal of the core-water, the withdrawal of brine from the interior freezing member, the release of the interior freezing member, and the convenient supply of brine to said interior freezing member.

Referring to Fig. 1 of the drawings it will be noted that the brine tank 15 is divided by a partition 94, to thereby cause the brine to circulate along one side of the tank past the upper row of cans, and thence returning in the opposite direction past the lower row of cans as indicated by arrows in Fig. 1. In practice freezing entirely from the exterior of the cans the ice in the upper row of cans would freeze measurably faster or sooner than in the lower row of cans, due to the brine entering the brine tank from a brine cooler being cooler than the brine passing out from the tank 15. This freezing sooner in the upper row of cans than in the lower is liable to freeze impurities into the cores of the upper cans before the cores of the lower row of cans are sufficiently frozen to justify draining the entire set of core-spaces. Employing my improved method and apparatus the freezing proceeds with substantial uniformity in each row of ice cans.

In order to hold the internal freezing members in place within the ice cans at their lower ends I preferably provide channels 64 centrally across the bottoms of the cans 16, into which the lower ends of the members 24 enter to retain the members 24 in place.

It will be noted that the water in the chambers below the bottom of the cans 16 is shielded from the refrigerant partly by means of a heat insulator, for instance a body of asphaltum 65 occupying the bottom of the tank below the line of the can bottoms, and hence after the impure core-water has been withdrawn and the internal freezing members have been withdrawn these core-spaces and withdrawal spaces are in communication at their lower ends, and also communicate with the unfrozen water in the chambers 66 below

the can bottoms so that all these spaces may be refilled from the pipes 18 and chambers 66 at one operation. By draining the impure core water before releasing the internal freezing members, no impure core water enters the withdrawal spaces.

In the modification Fig. 11 in place of extending the brine inlet pipe down to the lower end of the internal freezing member 62 corresponding to the members 24 of Fig. 5, a central partition 63 is inserted in the interior chamber of the internal freezing member 62 and the brine circulated down around the lower end of said partition 63 and thence to the outlet member 36. The member 62 is otherwise similar to the member 24.

The improved method herein illustrated and described is capable of considerable modification within the scope of the claims without departing from the spirit of my invention.

What I claim is:

1. The method of producing artificial ice comprising freezing a body of water from the exterior inwardly, freezing said body of water from the interior outwardly for a portion of the freezing operation, removing an interior freezing member and filling from the bottom, the space left by said removal with water to be frozen, and completing the freezing operation from the exterior inwardly to provide a solid ice block.

2. The method of producing solid blocks of artificial ice in place comprising freezing a body of water from the exterior inwardly freezing said body of water from the interior outwardly for a portion of the freezing operation to thereby produce a core space upon each side of the interior freezing zone, removing a freezing member from said interior freezing zone, removing the impure core-water from said core spaces from the bottom thereof, filling said core spaces and the space left by said removal with water to be frozen, and completing the freezing operation from the exterior inwardly to provide a solid ice block.

3. The method of producing artificial ice which comprises freezing a body of water from the exterior inwardly freezing said body of water from the interior outwardly for a portion of the freezing operation to thereby produce a core space upon each side of the interior freezing zone, removing the impure core-water from said core spaces, removing a freezing member upwardly from said interior freezing zone and filling said core-spaces and said removal space from the bottom with distilled water to be frozen therein, and completing the freezing operation from the exterior inwardly to provide a solid ice block.

4. The method of producing artificial ice comprising freezing an external zone of a body of water from the exterior inwardly, freezing an interior zone of said body of water from an internal freezing member outwardly for a portion of the freezing operation, thereby forming core spaces upon opposite sides of the internal freezing zone and between said external and internal freezing zones, removing impure core-water from the bottom of said core spaces, removing said internal freezing member, filling said core-spaces and the removal space from the bottom thereof with pure water and continuing the freezing operation from the exterior inwardly to provide a solid coreless ice block.

5. The method of producing artificial ice comprising encircling a body of water with a freezing member to provide an external freezing zone progressing from the exterior inwardly applying a freezing member interiorly of said body of

tion from the exterior inwardly to provide a solid coreless ice block.

13. The method of producing artificial ice comprising freezing a body of water from the exterior inwardly, setting up a completely dividing refrigerant circulating zone in the interior of said body of water to freeze outwardly, circulating a refrigerant to and from said internal freezing zone and eliminating said internal freezing zone to provide a block of ice with central vacant core.

14. The method of producing artificial ice in place comprising freezing a body of water from the exterior inwardly, setting up a completely dividing refrigerant zone in the interior of said body of water to freeze outwardly, circulating a refrigerant to and from said internal freezing zone, and then eliminating the internal freezing zone to provide two blocks of ice within one container.

15. The method of producing artificial ice in place comprising freezing a body of liquid from the exterior inwardly, setting up a completely dividing freezing zone in the interior of said body of liquid to freeze outwardly, and circulating a refrigerant to and from said internal freezing zone to provide two blocks of ice within one container.

16. The method of producing artificial ice in place comprising freezing a body of water from the exterior inwardly, setting up a completely dividing refrigerant circulating zone in the interior of said body of water to freeze outwardly, circulating a refrigerant to and from said internal freezing zone, then eliminating the internal freezing zone and filling the space left by removal of said internal freezing zone with water to be frozen, and completing the freezing operation from the exterior inwardly to provide a solid ice block.

17. The method of producing artificial ice in place comprising freezing a body of liquid from the exterior inwardly, setting up an interior refrigerant dividing zone in said body of liquid to freeze outwardly, circulating a refrigerant to and from said internal freezing zone, eliminating said internal freezing zone, filling space left by removal of said internal freezing zone with liquid to be frozen, and completing the freezing operation from the exterior inwardly to provide a solid ice block.

18. The method of producing artificial ice in place comprising encircling a body of water with a freezing member to provide an external freezing zone progressing from the exterior inwardly, applying a freezing member interiorly of a body of water to provide an internal freezing zone progressing from the interior outwardly for a portion of the freezing operation, thereby forming progressively narrowing core spaces upon opposite sides of the interior freezing zone, draining the impure core water from the core spaces, removing the interior freezing member from the interior freezing zone, filling the core spaces and removal spaces from the bottom of said body of

water and continuing the freezing operation from the exterior to complete a solid coreless ice block.

19. The method of producing artificial ice in place comprising encircling a series of bodies of fresh water in a freezing unit each with a freezing member to provide an external freezing zone progressing from the exterior thereof inwardly, applying a freezing member interiorly of each of said bodies of water to provide therein an internal freezing zone progressively freezing from the interior outwardly for portion of the freezing operation, thereby forming in each body of water progressively narrowing core spaces upon opposite sides of said interior freezing zone, circulating air upwardly through the core spaces in said bodies, draining the impure water from the core spaces of the several bodies simultaneously, then removing the respective interior freezing members, filling the core and removal spaces of the respective bodies with fresh water and continuing the freezing operation from the exterior inwardly to provide solid coreless ice blocks.

20. The method of producing artificial ice in place, comprising freezing an external zone of a body of water from the exterior inwardly, freezing an interior zone of said body of water substantially entirely across and from top to bottom thereof from an internal freezing member whereby to freeze said body from the interior outwardly for a portion of the freezing operation, thereby forming progressively narrowing core spaces upon opposite sides of said interior freezing zone, agitating the water in said core spaces by the introduction of air into the lower portion of said core spaces, removing the impure core-water from the core spaces before said core spaces are sealed off, removing the interior freezing member from said interior freezing zone, and filling said core spaces and said removal space with water to be frozen therein, and continuing the freezing operation from the exterior inwardly to complete the freezing operation and provide a solid coreless ice block.

21. The method of producing clear artificial ice in place, comprising encircling a body of water with a freezing member to provide an external freezing zone progressing from the exterior inwardly, applying a refrigerant circulating dividing zone in said body of water from top to bottom, to provide an internal freezing zone progressing from the interior outwardly for a portion of the freezing operation, and forming progressively narrowing core spaces upon opposite sides of said interior freezing zone, removing the impure core-water from said core spaces before said core spaces are sealed off, removing the interior freezing member from said interior freezing zone, and filling said core spaces and said removal space with water to be frozen therein, and continuing the freezing operation from the exterior inwardly to complete the freezing operation and to provide a solid coreless ice block.

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