A. E. BEALS.

SYSTEM FOR MAKING ICE.

APPLICATION FILED MAR. 26, 1910.

983,017.

Patented Jan. 31, 1911.

2 SHEETS—SHEET 1.

Fig. 2

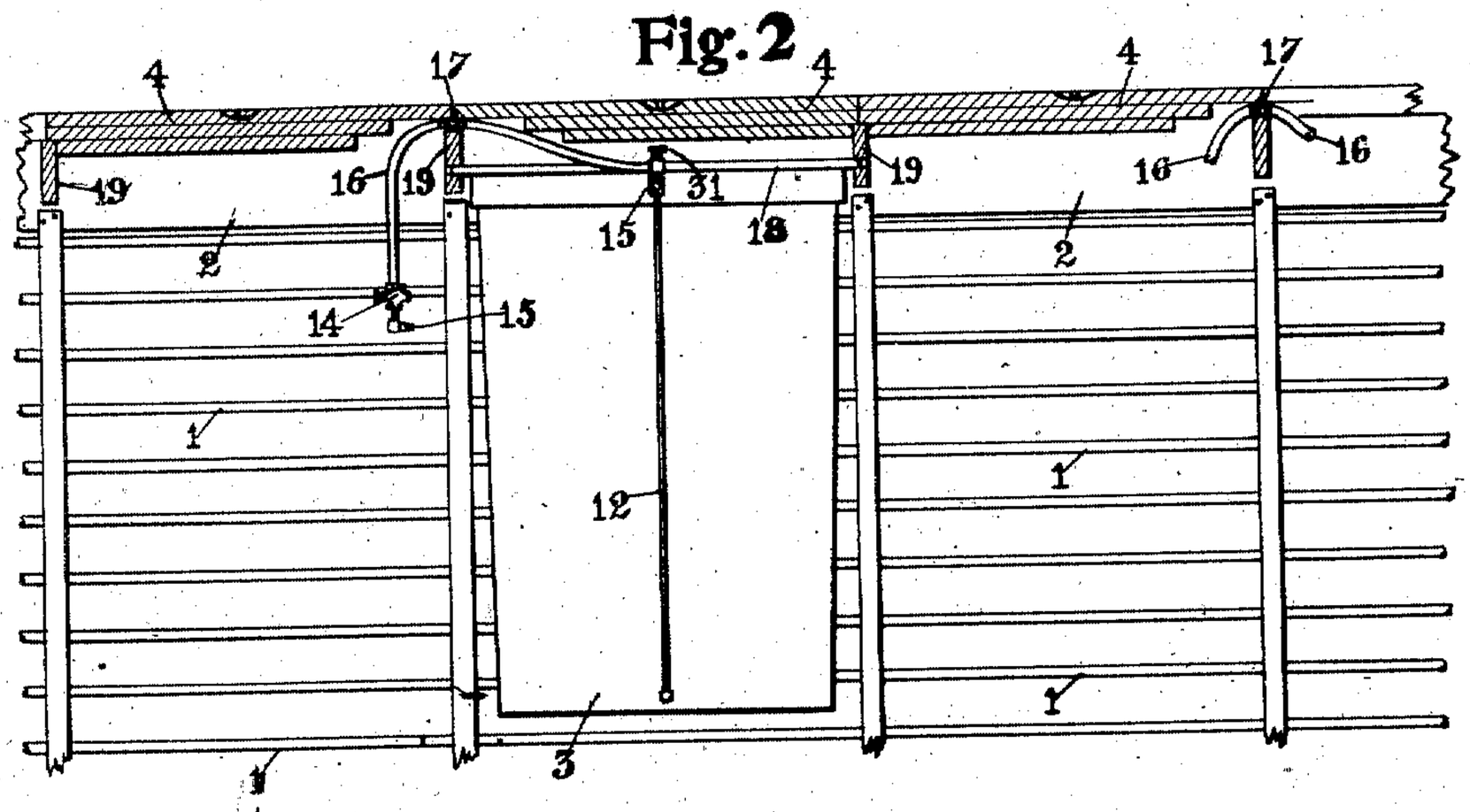
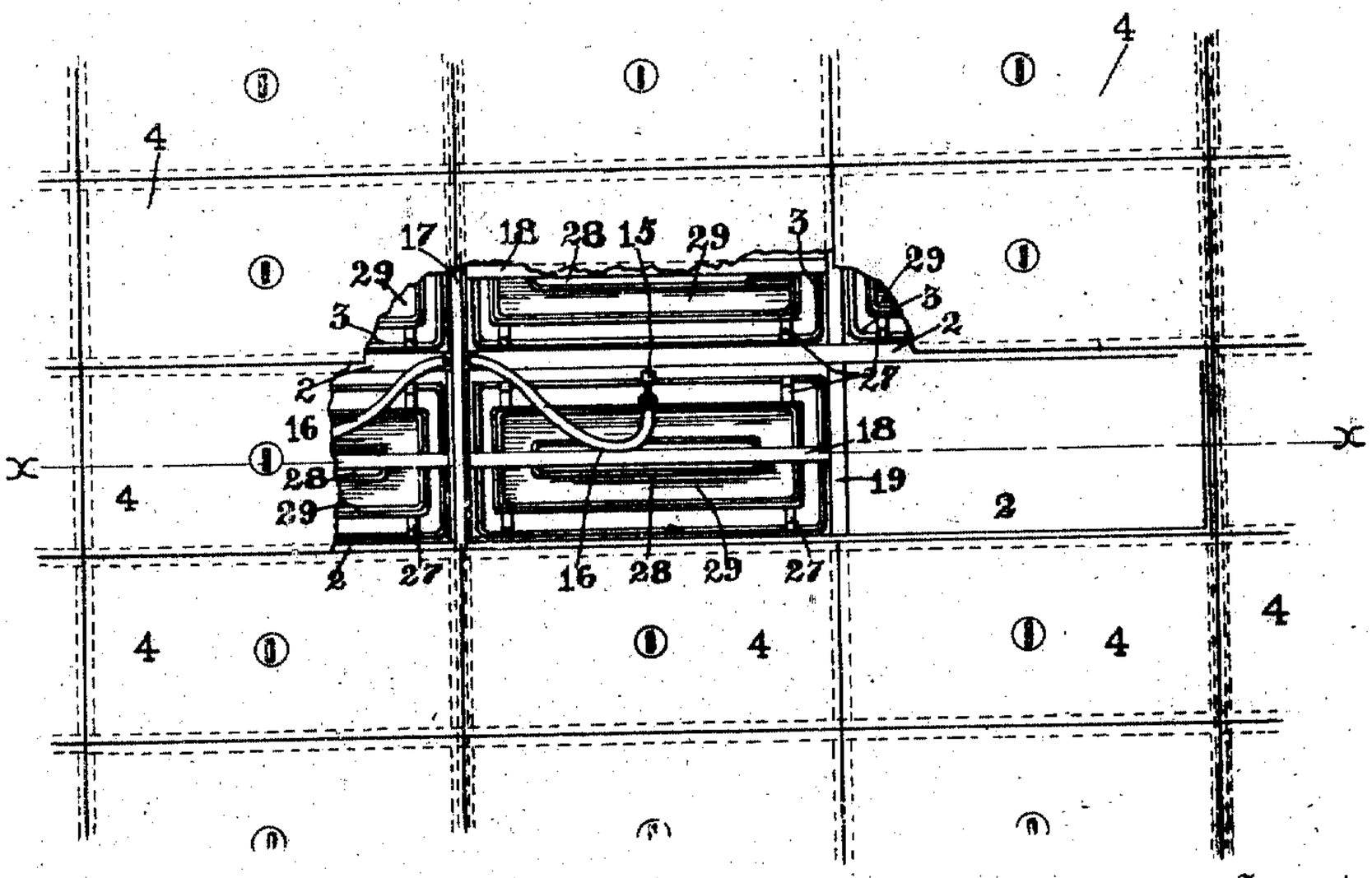


Fig. 1



Witnesses

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Fig. 3

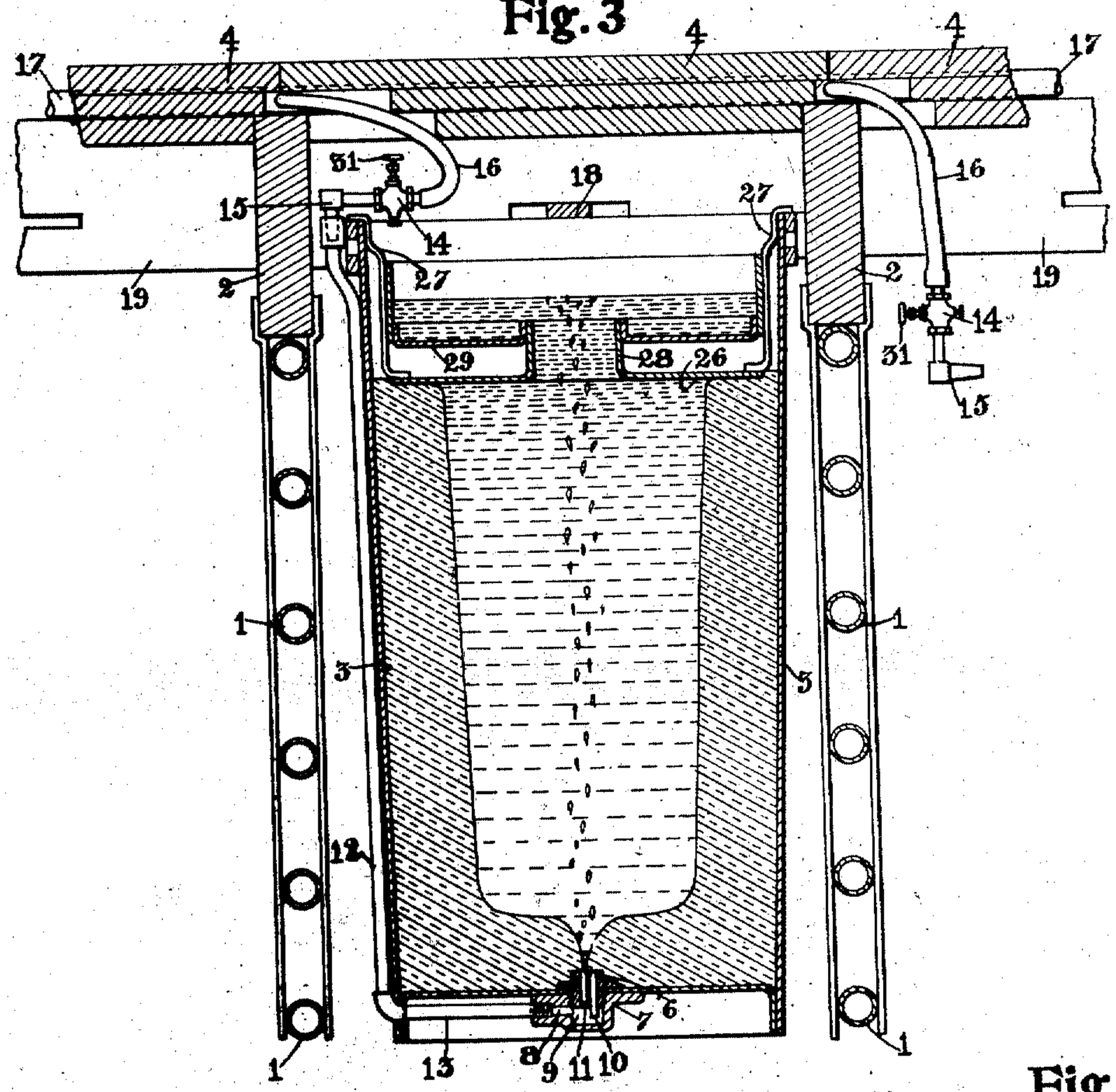


Fig. 4

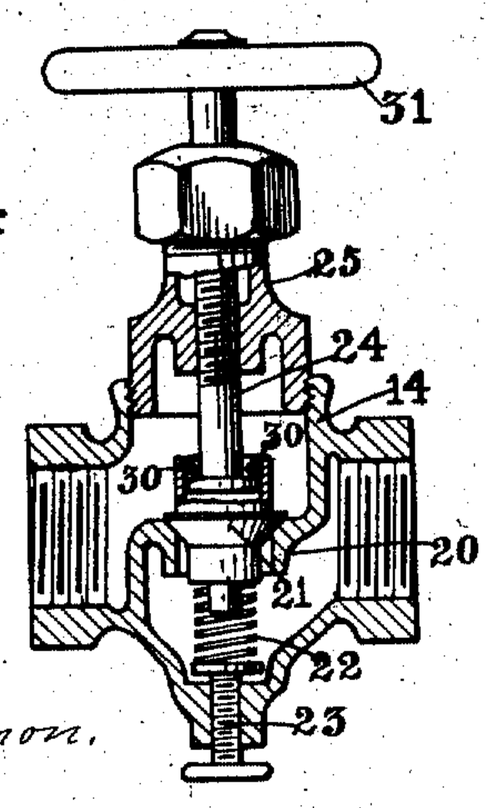
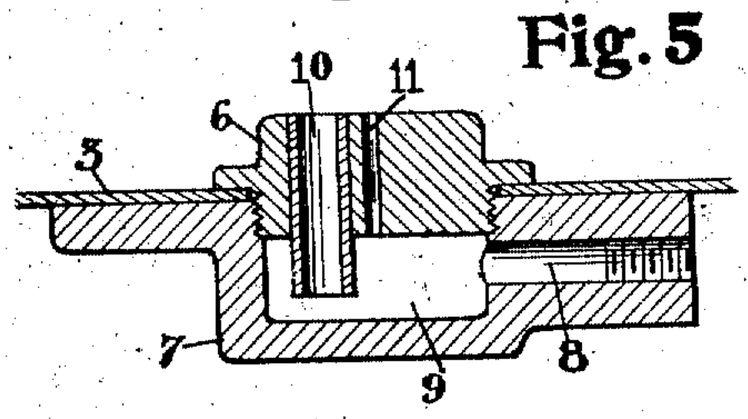


Fig. 5



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UNITED STATES PATENT OFFICE.

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SYSTEM FOR MAKING ICE.

983,017. Specification of Letters Patent. Patented Jan. 31, 1911.

Original application filed November 23, 1908, Serial No. 463,985. Divided and this application filed March 26, 1910. Serial No. 551,644.

To all whom it may concern:

Be it known that I, ALBERT E. BEALS, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Systems for Making Ice, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to apparatus for manufacturing ice in casts or molds by means of mechanical refrigeration and more particularly to an arrangement thereof whereby water in its natural or "raw" state is made into ice which is clear of air particles and of other impurities which are always held in solution and are in suspension in undistilled or unfiltered water.

The invention forms one means for carrying out the process described in my application Serial No. 463,985, filed Nov. 23, 1908, for a "process of making ice" of which this is a divisional application.

The invention consists in the matters hereinafter set forth, and more particularly pointed out in the appended claims.

Referring to the drawings, Figure 1 is a plan view of a part of the freezing tank or floor of a refrigerating system adapted to carry out the process comprising the invention; Fig. 2 is a view in section thereof, on line *x*—*x* of Fig. 1; Fig. 3 is a view in vertical section of one of the cans of the system, showing adjacent connections; Fig. 4 is a view in detail of an automatic regulating valve; and Fig. 5 is a view in detail of an air pipe connection and discharge nipple.

Referring to the drawings, 1 indicates the coils of refrigerating pipe in the brine or freezing tank of a refrigerating plant disposed in the usual manner beneath girders or floor beams 2 at such intervals that cans 3 of proper proportions may be placed between them, removable cover blocks 4, one over each can, forming the floor as in the usual conventional arrangement of a plant of this nature.

The can itself is of metal, rectangular in section and is slightly tapered as shown. A nipple or boss 6 is secured centrally in the bottom of the can in screwthreaded engagement with an outer cap 7 having a lateral inlet 8 into a central chamber 9 whose base lies at an interval below the level of the inlet. A short tube 10 in an aperture of the boss 6 extends just below the level of the air inlet 8 and there is an air vent 11 placed substantially in the center of the can through the boss at one side of the tube. An air pipe 12 having a lower horizontal arm 13 screw-threaded into the inlet 8 of the cap, extends across the bottom and up the side of the can to which it is secured by any convenient means. The casing 14 of an automatic regulating valve is secured at its outlet end to a fitting 15 removably supported in the upper end of the pipe 12. The inlet of the valve is connected by any preferred means, as for example, a short length of flexible tubing 16, with one of a series of trunk lines 17 of piping laid on the sills 2, underneath the covers as shown in any preferred and conventional manner. The trunk lines are supplied with air under pressure from any suitable compressor or like available means. The can floats in the brine or freezing mixture in the tank, usually being held immersed to the proper depth by a removable cross-bar 18 engaging slots in spreader blocks 19 between the sills.

The casing 14 of the valve has an apertured seat 20 provided with a movable closure 21 whose upper face is of greater area than the lower face. A spring 22 between the closure and a regulating screw 23 in the bottom of the casing tends to force the closure away from the seat 20 but is resisted by the inlet air pressure on top. The closure has reciprocable motion on the lower end of a stem 24 that is defined or limited by suitable stops 30. The stem is screw-threaded through or otherwise longitudinally adjustable in a bonnet 25 on the casing and provided with a hand wheel 31 whereby the valve may be positively closed, or opened and whereby the flow of air through the valve may be regulated to produce the required agitation in the water. The intake end of the casing which is secured to the hose 16 admits air above the seat and closure and the outlet end connected to the fitting 15 or like connection opens from below the seat and closure.

A horizontal plate 26 somewhat smaller than the upper end of the can is detachably secured in the upper end thereof as by suitable brackets 27 or the like. The plate is centrally apertured and is preferably provided with an upright flange 28 around the opening. An overflow basin or trap 29 is

supported on the flange at an interval above the plate. Or the plate may be simply a block of wood or like non-conducting material, with a central aperture. In such construction, the freezing quickly seals the intervals between the edges of the blocks and the can sides.

In operation, the can is filled to the required depth with "raw" water and immersed in the tank. Air is immediately introduced to the nipple through the automatic valve and pipe and injected into the bottom of the body of water, thus setting up and maintaining a continuous movement of the water against the face of the forming ice. As the air enters the chamber 9 of the cap, the pressure therein must equal the sum of the pressure due to the static head of water above the jet plus that due to the velocity head of the air flowing through the jet which forces the water out of the chamber down to the mouth of the tube 10 thus freeing the air passages of all water which would otherwise freeze up and stop the flow. Ice forming in the bottom of the chamber permanently seals the piping 10 and the air continues to flow through the jet 11. As the ice thickens on the bottom of the can it increases the pressure against which the air must escape and this increased back pressure in conjunction with the action of the spring opens the valve to a proportionate extent and thereby maintains the required flow of air. A constant agitation of the water in the center of the can by the ascending bubbles of air prevents the lodgment of air and impurities upon the surface of the forming ice and produces a clear and transparent block. At the same time the expansion due to formation of ice forces the aforementioned extra amount of water up through the top plate or block into the trap or into the space above the block and the impurities which otherwise would collect and be deposited in the center of the block are carried up over the upper edge of the flange into the trap where they settle, or into the space where they are retained. As the trap is insulated in a measure by the air space around its margin and also between it and the cover plate, the water in the trap does not freeze and consequently all impurities are held there and thus removed automatically from the block of ice up to the completion of the freezing process. If the insulating block be used the same result is obtained, the impurities settling above the block. By thus forcing a volume of air at a pressure which automatically increases in direct proportion to the resistance encountered in the freezing block, and thereby maintaining a continuous movement of the water until the final stop of the freezing process, all the air and other impurities in solution and in suspension are removed from the block and commercially pure and clear ice is obtained.

Obviously changes in the details of construction may be made without departing from the spirit of the invention and I do not care to limit myself to any particular form or arrangement of parts.

What I claim as my invention is:—

1. A freezing can having a cover provided with means for suspending the same within the mouth of a can, a short upright tube secured in the center of the cover, and a receptacle around the mouth of the tube above the cover constituting in connection with the tube a trap.

2. In a system for making ice a freezing tank, a series of cans adapted to be immersed therein, means for forcing compressed air upwardly through each can, and means for automatically varying the pressure of air admitted to each can in proportion to the resistance of the congealing contents.

3. In a system for making ice, a freezing tank, a series of cans adapted to be immersed therein, means for maintaining a body of water in liquid state in each can in communication with the contents thereof, and means for maintaining a current in the contents of each can across the formed ice into the auxiliary body of water until said contents is completely frozen.

4. In a system for making ice, a freezing tank, a series of cans adapted to be immersed therein, means for maintaining a body of water in liquid state in each can above and in communication with the contents thereof, means for maintaining an upward current of air in the contents of each can into the upper body of water, and means for preventing the return into the can of matter in suspension carried into said body of water.

5. In a system of making ice, a freezing tank, a series of cans immersed therein each provided with an air inlet in the base, compressed air trunk pipes, and detachably connected means between the air inlet of each can to an adjacent trunk pipe for automatically admitting air to the can under pressure proportionate to the resistance to the air afforded by the resistance of the congealing contents thereof.

6. In a system for making ice, a freezing tank, a series of cans immersed therein, an air pipe on each can discharging upwardly through the can base, compressed air trunk distributing pipes, and means thereon connecting the air pipe of each can with a trunk pipe for automatically maintaining air pressure in the can pipe in proportion to the resistance of the air afforded by the contents of the can as it is gradually congealed.

7. In a system for making ice, a freezing tank, a series of cans immersed therein, an air pipe on each can discharging upwardly through the base thereof, compressed air

trunk pipes, and an automatic valve and connection detachably coupling each can pipe with a trunk pipe, for admitting air to the can under a pressure proportionate to the resistance to the air afforded by the contents of the can as it is gradually congealed.

8. In a system for making ice, a freezing tank, a series of cans immersed therein, an air pipe on each can discharging upwardly through the base thereof, compressed air trunk pipes, and an automatic valve and connection detachably coupling each can pipe with a trunk pipe, the valve for admitting air to the can under a pressure proportionate to the resistance to the air afforded by the contents of the can as it is gradually congealed, and forming a shut-off cock adapted to be closed manually.

9. In a system for making ice, a freezing tank, a series of cans immersed therein, an air pipe on each can discharging upwardly through the base thereof, compressed air trunk distributing pipes, connecting means thereon detachably engaging the air pipe of an adjacent can and automatically maintaining air pressure in the can pipe in proportion to the resistance to the air afforded by the contents of the can as it is gradually congealed and means for maintaining a body of water in liquid state above and in communication with the contents of each can until the latter is completely frozen.

10. In a system for making ice, a freezing tank, a series of cans adapted to be immersed therein, an air pipe on each can discharging upwardly through the base thereof, compressed air trunk distributing pipes, connecting means thereon each adapted to detachably engage the air pipe of an adjacent can for automatically maintaining air pressure in the can pipe in proportion to the resistance to the air afforded by the contents of the can as it is gradually congealed, means for maintaining a body of water in liquid state above and in communication with the contents of each can until the latter is completely frozen, and means for trapping against return into the vessel matter in suspension carried into the upper body.

11. In a system for making ice, a freezing tank, a series of cans adapted to be immersed therein, a cover for each can provided with a trap adapted to maintain a body of water above and in communication with the contents of the can until the latter is completely congealed, and means for maintaining an upward current in the uncongealed portion of the contents of the can into the upper body of water.

12. In a system for making ice, a freezing tank, a series of cans adapted to be immersed therein, a cover for each can provided with a trap adapted to maintain a body of water above and in communication with the contents of the can until the latter is completely congealed, and means for maintaining an upward current of air through the congealed portion of the contents of the can into the upper body of water.

13. In a system for making ice, a freezing tank, a series of cans adapted to be immersed therein, a cover for each can consisting of a plate adapted to be secured at the surface of the can contents and provided with a central aperture having an upwardly extending flange, a trap basin encircling the flange above the plate, and means for maintaining an upward current in the uncongealed portion of contents of the can into the upper body of water.

14. In a system for making ice, a freezing tank, a series of cans adapted to be immersed therein, a cover for each can provided with a trap adapted to maintain a body of water above and in communication with the contents of the can until the latter is completely congealed, an air inlet in the can base beneath the cover plate aperture, an air pipe extending therefrom, compressed air trunk pipes on the tank, and an automatic air valve on the trunk pipe adjacent to each can adapted to be detachably coupled to the can pipe, the valve so constructed as to admit air to the can at a pressure proportionate to the resistance afforded by the congealing contents of the can.

15. In a system for making ice, a freezing tank adapted to be filled with a refrigerating liquid, a series of cans adapted to float therein with their open tops above the level of the tank liquid, a cover plate for each can removably supported therein, a flange extending upwardly around a central opening in the plate, a trap basin encircling the flange at an interval above the plate and below the upper margin of the flange, and means for forcing air continuously upward through the can from the base thereof into the trap.

16. In a system for making ice, a freezing tank adapted to be filled with a refrigerating liquid, a can adapted to float therein with its open top above the level of the tank liquid, a centrally apertured cover plate smaller than the can removably suspended therein at substantially the level of the can contents, an upwardly extending flange around the plate opening, a trap basin encircling the flange above the plate and below the upper margin of the flange, and means for forcing air from the bottom of the can upwardly through the contents of the can and the plate opening, the plate being disposed so that ice forming on the can walls seals the opening between the cover plate and surrounding can sides and forces the water up through the cover into the trap basin.

17. In a system for making ice, a freezing tank, compressed air trunk pipes therein,

cans adapted to be immersed in the tank contents, each provided with an air pipe discharging upwardly through the can contents, and an automatic air valve secured to a trunk pipe for each can consisting of a casing having an apertured valve seat mediate its ends, a conical closure reciprocable thereon with its larger face toward the casing inlet, a regulating screw in the casing opposite the smaller face of the closure, a spring in compression between the closure and regulating screw, and a longitudinally adjustable stem in the casing in substantially axial alinement with the seat opposite the larger face of the closure, the closure having limited play longitudinally on the extremity of the stem, and the casing being adapted at its outlet end to detachably engage the can air pipe.

18. In a system for making ice, a block can, a central boss in the can bottom having an air vent therethrough, a chambered cap on the lower side of the bottom connected to the boss, an air tube through the boss extending downwardly into the chamber of the cap, a lateral opening into the cap above the lower end of the tube, an air pipe extending from said lateral opening along the bottom and side to the upper part of the can, and an automatic valve for the pipe consisting of a casing having an apertured valve seat mediate its ends, a conical closure reciprocable thereon with its larger face toward the casing inlet, a regulating screw in the casing in axial alinement with the valve seat opposite the smaller face of the closure, a spring in compression between the closure and regulating screw, and a longitudinally adjustable stem in the casing in axial alinement with the seat opposite the larger face of the closure, the closure having limited play longitudinally on the extremity of the stem and the casing being adapted at its outlet to detachably engage the can air pipe.

19. In a system for making ice, a freezing tank adapted to be filled with a refrigerating liquid, a series of cans adapted to float therein with their open tops above the level of the tank liquid, a cover plate for each can removably supported therein, and provided with an opening, and means for forcing air continuously upward through the can from the base thereof through the cover opening.

In testimony whereof I affix my signature in presence of two witnesses.

ALBERT E. BEALS.

Witnesses.

C. R. STICKNEY,

OTTO F. BARTHEL.