No. 814,115. PATENTED MAR. 6, 1906.

A. CAMPBELL.

ICE MAKING APPARATUS.

APPLICATION FILED MAR. 2, 1905.

2 SHEETS—SHEET 1.

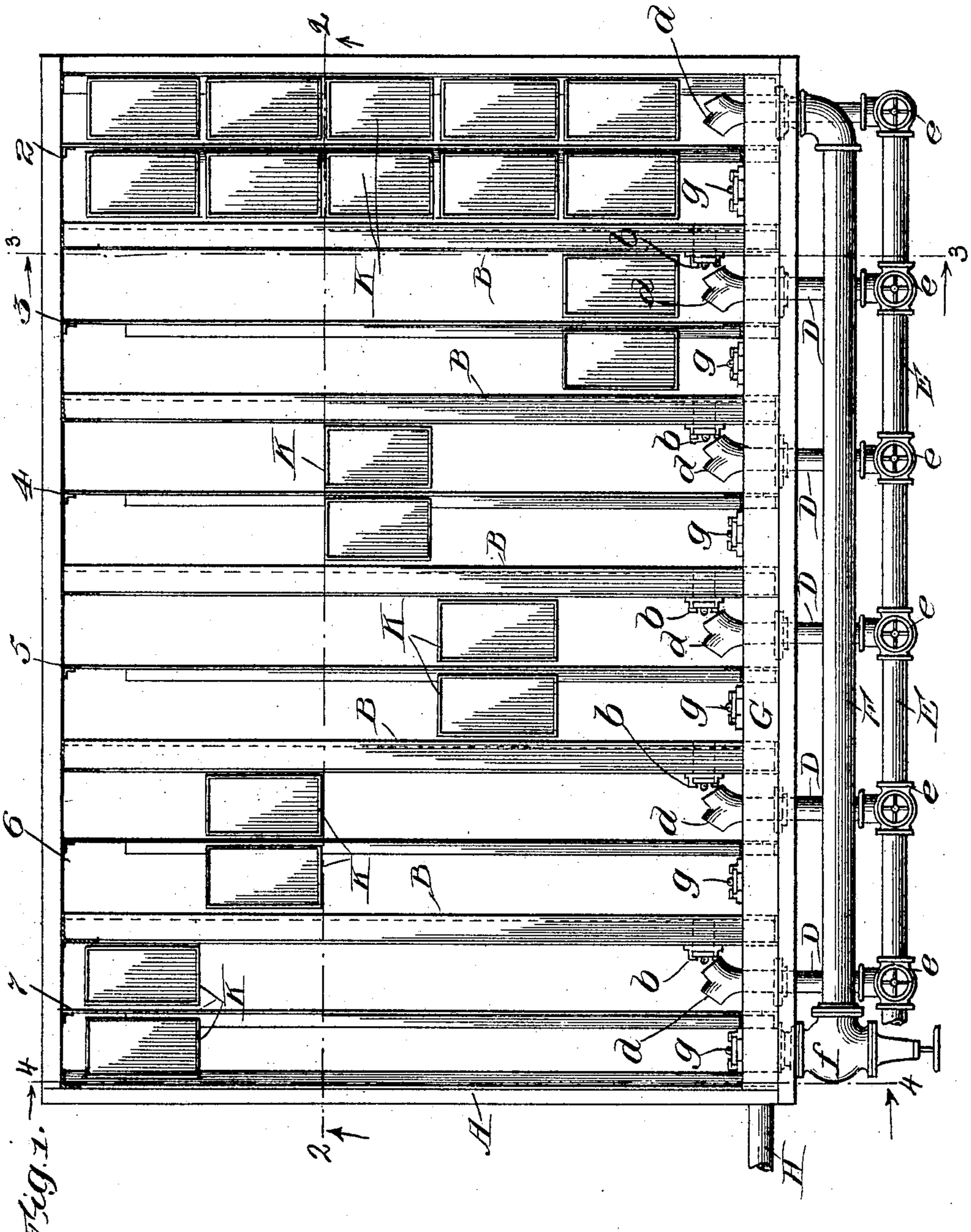

Fig. 1.

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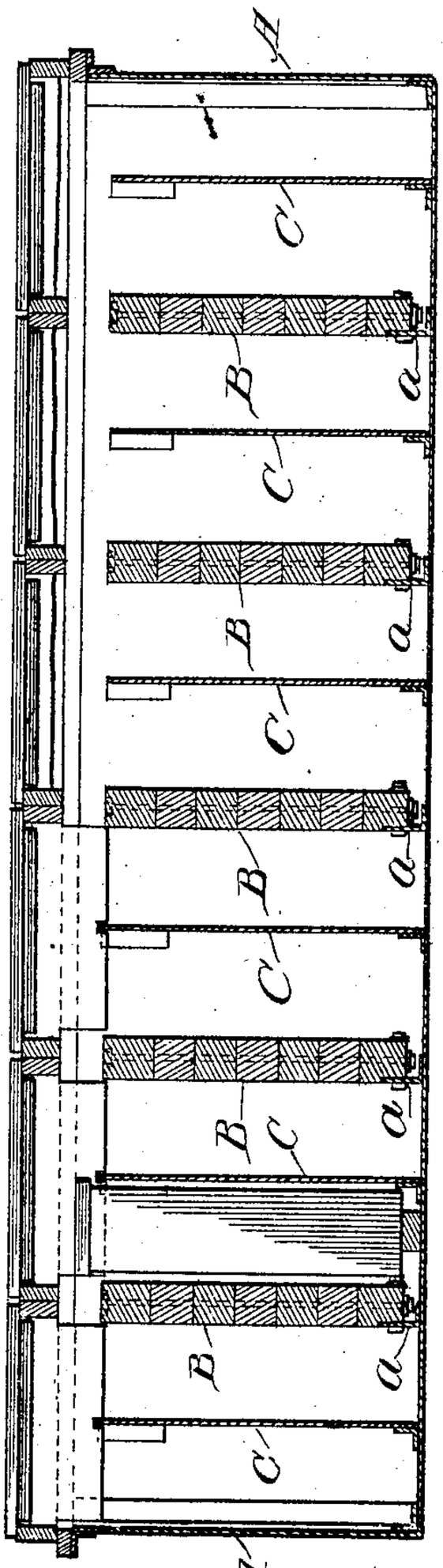

Fig. 2.

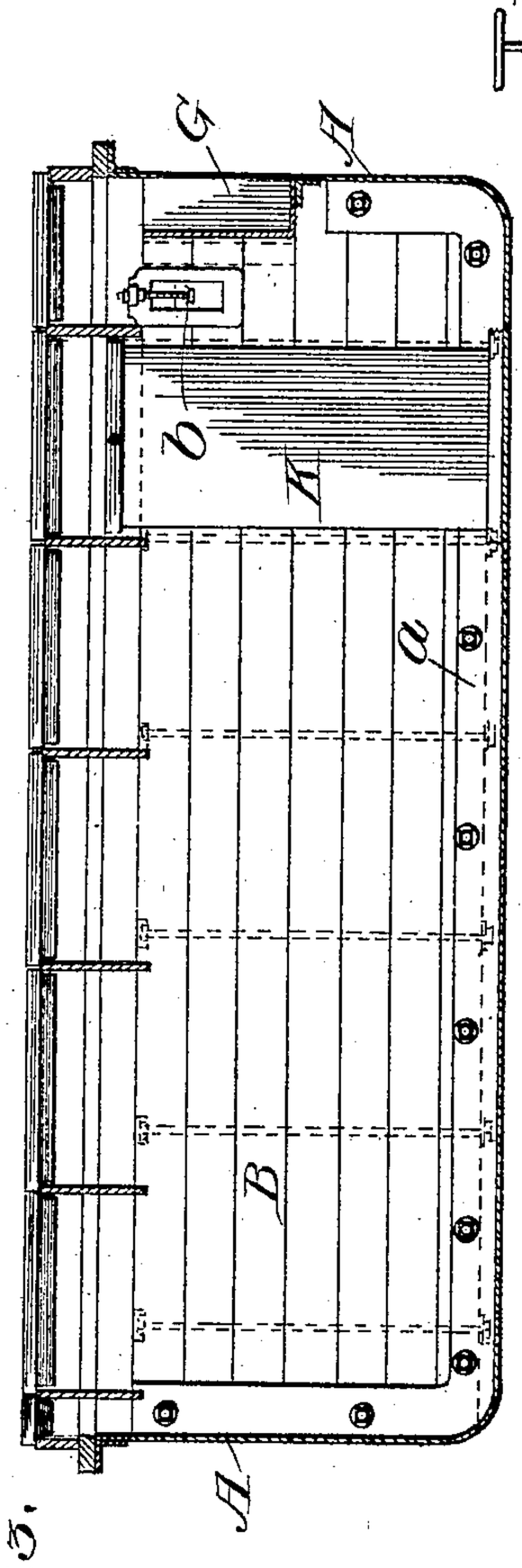

Fig. 3.

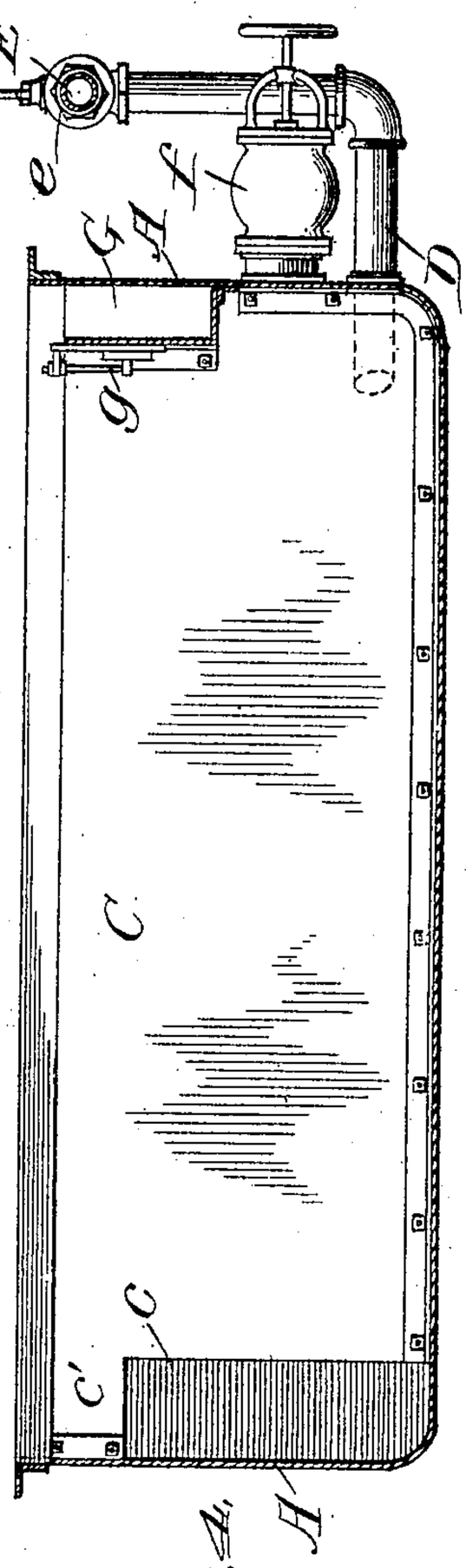

Fig. 4.

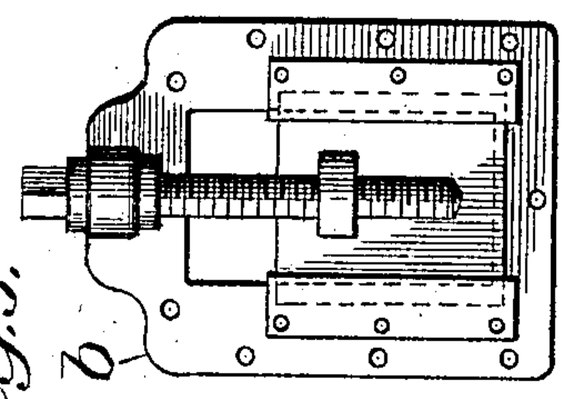

Fig. 5.

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UNITED STATES PATENT OFFICE.

ALLAN CAMPBELL, OF CHICAGO, ILLINOIS.

ICE-MAKING APPARATUS.

No. 814,115. Specification of Letters Patent. Patented March 6, 1906.

Application filed March 2, 1905. Serial No. 248,122.

To all whom it may concern:

Be it known that I, ALLAN CAMPBELL, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Ice-Making Apparatus, of which the following is a full, clear, and exact description.

My invention relates to an apparatus for making ice; and its object is to provide a continuous channel in which cans of water may be placed and which is divided into a series of communicable divisions each of which can, if desired, be used separately or in series. When used in series, the apparatus can be manipulated in such manner that the refrigerant can be introduced into the apparatus commencing with any of said divisions for the refrigerating-coils. This I accomplish by the means hereinafter more fully described and as particularly pointed out in the claims.

In the drawings, Figure 1 is a plan view of an ice-making apparatus embodying my invention with the cover thereof removed. Fig. 2 is a vertical longitudinal section of the same with the cover on, taken on dotted line 2 2, Fig. 1. Fig. 3 is a transverse vertical section thereof, taken on dotted line 3 3, Fig. 1. Fig. 4 is a similar view taken in dotted line 4 4, Fig. 1. Fig. 5 is a detail view of one of the gates used in connection with my invention.

This apparatus is adapted to be used in connection with and to carry out the process described in an application for Letters Patent filed by me May 18, 1905, Serial No. 261,041, and which is a division of this application.

As shown in the drawings, my invention comprises a tank A of suitable length, width, and depth, which is preferably made of metal, but can be made of wood or part wood and part metal, if desired. I prefer to make the tank rectangular and to divide the same into several corresponding compartments 2 3 4 5 6 7 by means of transverse walls or bulkheads B B. These bulkheads are preferably made of wood and have their lower and end edges connected to an angle-iron sill *a*, which latter is secured to the bottom and to the sides of the tank and provides a water-tight joint between said bulkheads and tank. The compartments formed by these bulkheads are divided into a primary and secondary section by a vertical baffle-plate C, which are preferably made of metal and are attached to and extend from one side wall of the tank midway between the sides of the compartment to the opposite side walls, where their lower portions are cut away to form a passage *c*, through which the brine can flow from one of said sections to the other, and thus leaving an upper extension *c'*, by means of which the contiguous end of the baffle-plate is secured to said opposite side walls. Near the side of the tank to which the end edges of the baffle-plate opposite the passages *c* are secured openings are made in the bulkheads, which are opened and closed by suitable gates *b*, preferably of the kind shown in Fig. 5 of the drawings, and near the bottom of the tank the primary section of each compartment farthest from the gate *b*, out from which the brine circulating in said compartment flows, is provided with an inlet-pipe D, the extremity of which is preferably provided with a Y-shaped nozzle *d*. These inlet-pipes D extend horizontally out through the side of the tank and then upward and are connected to a longitudinally-arranged supply-pipe E by means of a suitable valve-controlled connection *e*. The first compartment and the last compartment are connected by a longitudinally-disposed by-pass of suitable construction or return-pipe F, and a valve *f* is employed to connect this return-pipe to the last compartment 7. Extending longitudinally from one end of the tank to the other, preferably next the inner surface of the same above the inlet-pipes D, is a trough G, the depth of which is such that it extends down to a horizontal plane, preferably just above that of the return-pipe or by-pass F. This trough has an opening therein communicating with the secondary section of each compartment, which is closed by a suitable gate *g*, substantially as shown.

The operation of my invention is as follows: The brine coming from the brine-cooler or brine-tank or other brine-cooling device is fed to the tank through the pipe E and enters compartment 2 through the inlet-pipe D, all the valves *e*, controlling the inlet-pipes D, leading to the other compartments being closed. The valve *f* of the by-pass F is also closed at this stage of the process. The gates *b b*, connecting the compartments, are open and the gates *g g* of the trough G are closed, all except the last gate *g* opening into the secondary section of compartment 7, which is open. The brine entering the first compartment 2 is distributed by the nozzle *d* on both sides of the ice-cans K in the primary section

of the said compartment and passes along the sides of said cans to and around the opposite end of the baffle-plate C into the secondary section of said compartment, in which it moves back toward the opposite side of the tank around and along the side of the cans in the secondary compartment, into and through the gate *b* into the second compartment 3. The course of the brine is the same in compartment 3 as in compartment 2, and from thence it passes through gate *b* into the third compartment 4, in which its course, as well as in compartments 5, 6, and 7, is the same as in the first two compartments. The brine as it passes through these several compartments in the manner stated abstracts heat from the cans of water placed therein and by the time it has passed through the last compartment 7 is quite warm, and it issues from thence through gate *g* into the trough G and from the latter by the pipe H back to the original brine-cooling device or machine again. The brine brought into contact with the warm water placed in the stationary cans during the operation of my improved process is of a temperature anywhere between 16° to 24° Fahrenheit or higher, and as ice is formed next the sides of the cans by reason of its being a poor conductor makes it more difficult for the brine at its original temperature to abstract the heat from the water in the cans incased in this shell of ice. The temperature of the brine is lowered from time to time, according to the resistance offered to the action of the brine as the ice becomes thicker and thicker, until the water in the cans is frozen solid, by which time the temperature of the brine will be lowered to about 0° Fahrenheit or lower. By freezing the water in this way the ice will be clear and solid and of the same quality from circumference to core, through and through, and not of different qualities, as is often the case with the ice made by the methods heretofore in use. When the water in the cans in compartment 2 is completely frozen, the inlet-pipe D leading to said compartment is closed by the valve *e* and the inlet-pipe D leading into compartment 3 is opened, and the gate *g*, connecting the trough with the last compartment 7, is closed and the valve *f*, connecting the last compartment and the by-pass, is open, thus forcing the circulation through the compartments, commencing with the second compartment 3 and ending with the last compartment, and from thence through the by-pass back to the first compartment at the temperature to which it was raised as it left compartment 7, from which latter the brine passes through the gate *g* thereof into the trough G and out through the pipe H to the cooling device or machine again. By thus returning the brine to compartment 2 at the temperature to which it had been raised as it left compartment 7 the ice in the cans will be gradually raised in temperature and tempered or toughened and rendered less brittle, and the temperature of the brine will be lowered to the same extent that the temperature of the ice is raised, so that the greater part of the frigoric effect resulting from my process will not be lost, as would be the case if the cans when the ice was formed in them were immediately removed from the compartments, and the power necessary to obtain this frigoric effect (including the fuel necessary to generate the same, and means necessary to generate the same, and means necessary to give expression thereto) is saved. When the compartment 3 is frozen, the inlet-pipe leading into said compartment is closed, its gate *g*, leading into the trough G, is opened, and the gate connecting compartments 3 and 4 is closed, the gate *b*, connecting compartments 2 and 3, is opened, and the inlet-pipe connecting the supply-pipe with said compartment 4 is opened. The brine then flows through compartments 4, 5, 6, and 7, through the by-pass F, then through compartments 2 and 3, and then through the gate *g* of the last-mentioned compartment into the trough G and out through the pipe H to the brine-cooling device again. Thus as the water in the cans in the successive compartments is frozen the warmer brine flowing out of the last compartment of the tank is conducted back into the first compartment or compartments and utilized to temper the ice formed in the cans placed therein and permits said ice to be harvested, and thus while ice is being formed in one part of the tank it can be removed from the other, and thus kept in active operation all the time.

It is evident in this apparatus that by increasing the number of compartments in the tank or by increasing the length of the compartments that the difference between the initial and final temperatures of the brine can be made as great as desired. Incidentally if brine of a low initial temperature and high final temperature is used the quantity of brine circulated to make a certain quantity of ice will be much less than in the ordinary method, as the amount of heat absorbed by one pound of brine will be much more than when the brine is circulated in the usual manner, and consequently a smaller amount will need to be circulated.

The bottom and sides of the tank and all exposed brine-piping are insulated in a proper manner from outside heat. The covers for the tank are made of wood and are similar to some extent to those used in other tanks.

What I claim as new is—

1. In an ice-making apparatus a suitable tank, a plurality of wooden bulkheads B, dividing said tank into a series of compartments; valve-controlled openings in said bulkheads at one end thereof; a sheet-metal

partition C in each compartment mediate their longer sides, which partition is cut away at the end opposite said openings and below the water-level in said tank to enable the two sections to communicate below their upper edges; valve-controlled means for directing the initial intake of the refrigerant into any given compartment after the first without interrupting the flow thereof, a by-pass for conveying the refrigerant from the last to the said first compartment, and a valve-controlled trough communicating with each compartment for returning the spent refrigerant back to the original cooling devices.

2. An ice-making apparatus comprising a suitable tank; a plurality of transverse wooden bulkheads dividing said tank into a series of parallel compartments; valve-controlled openings in said bulkheads at one end thereof; a sheet-metal partition C in each compartment mediate their longer sides, which partition is cut away at the end opposite said openings and below the water-level in said tank to enable the two sections to communicate below their upper edges; valve-controlled means for directing the initial intake of the refrigerant into any given compartment after the first without interrupting the flow thereof nozzles *d* extending from said valve-controlled means into alternate sections of said tank; and a valve-controlled trough G disposed in the upper portion of said tank along one side wall thereof for returning the spent refrigerant to the cooling devices or generator, said trough communicating with the sections not fed by said nozzles.

In testimony whereof I have hereunto set my hand this 23d day of February, A. D. 1905.

ALLAN CAMPBELL.

Witnesses:
J. M. WESTERLIN
E. K. LUNDY.