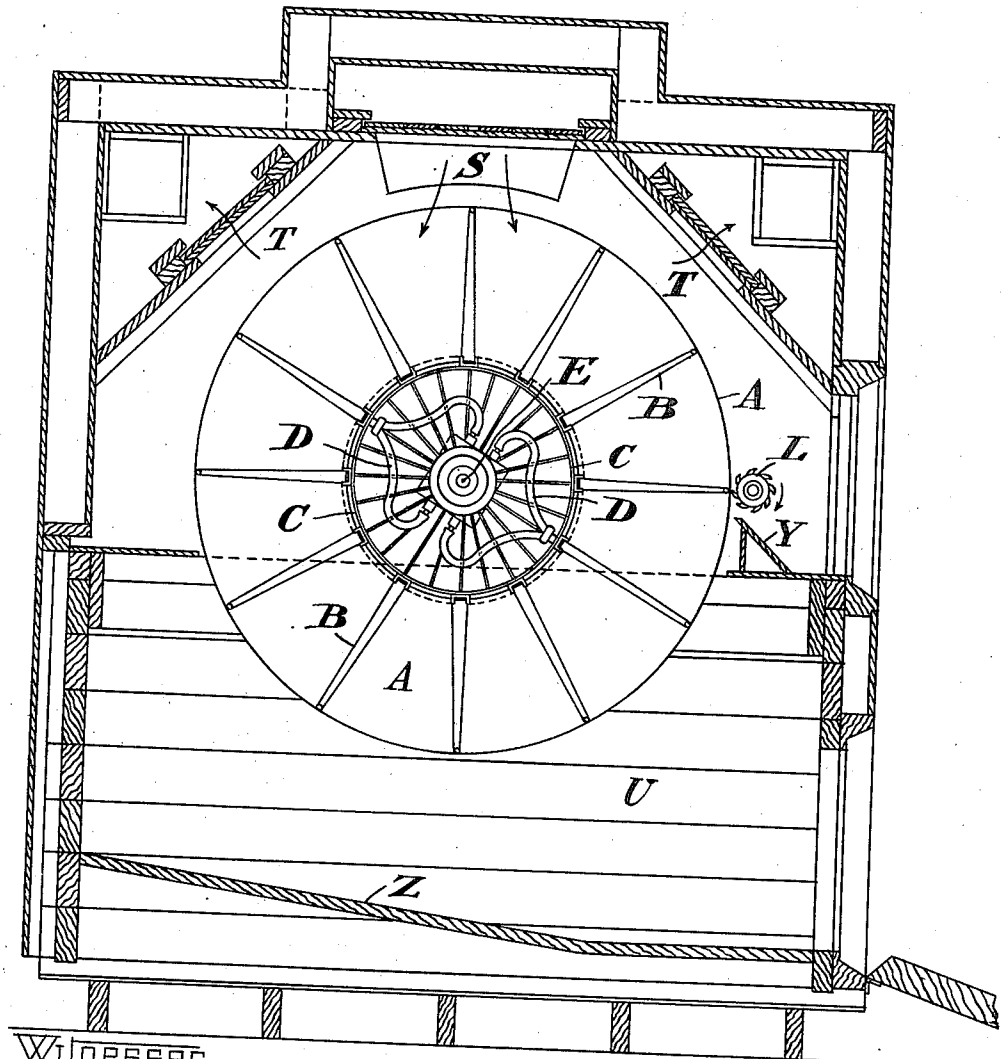
M. C. J. BANNISTER.
PROCESS OF FORMING ICE.
APPLICATION FILED SEPT. 6, 1911.

1,044,972.

Patented Nov. 19, 1912.

4 SHEETS—SHEET 1.

Fig. 1.



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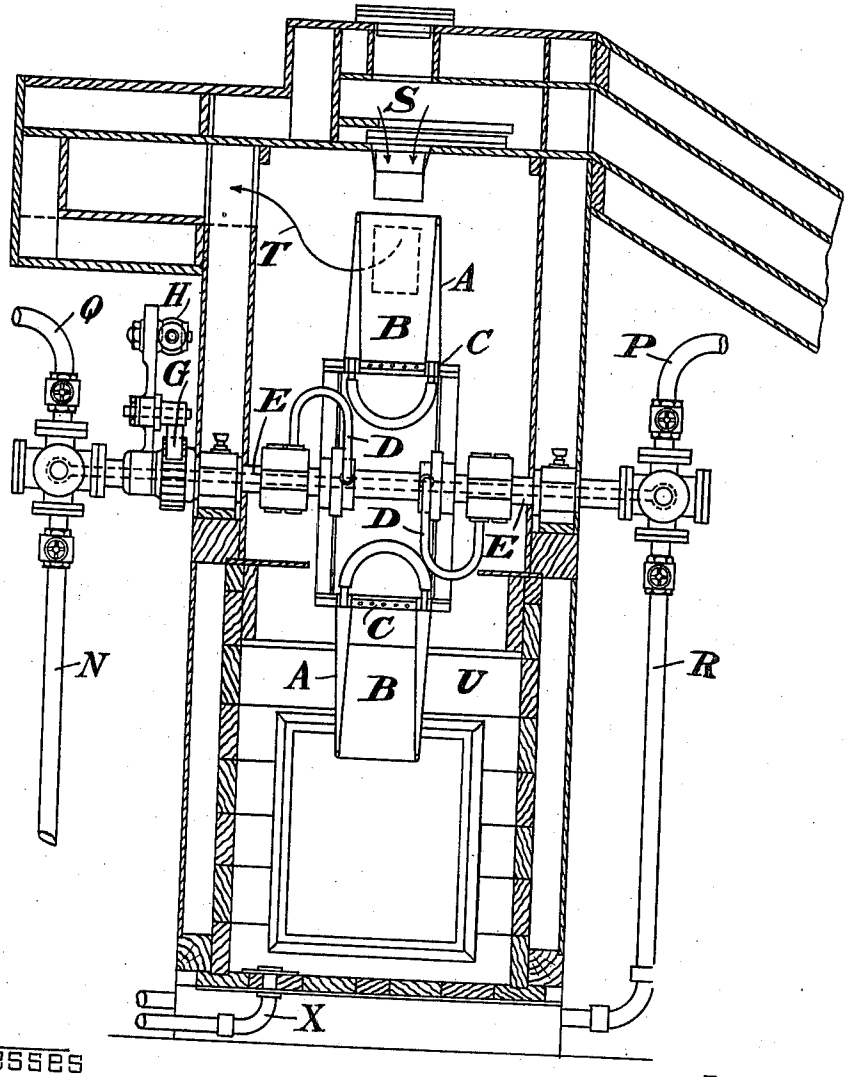
4 SHEETS—SHEET 2.

Fig. 2.



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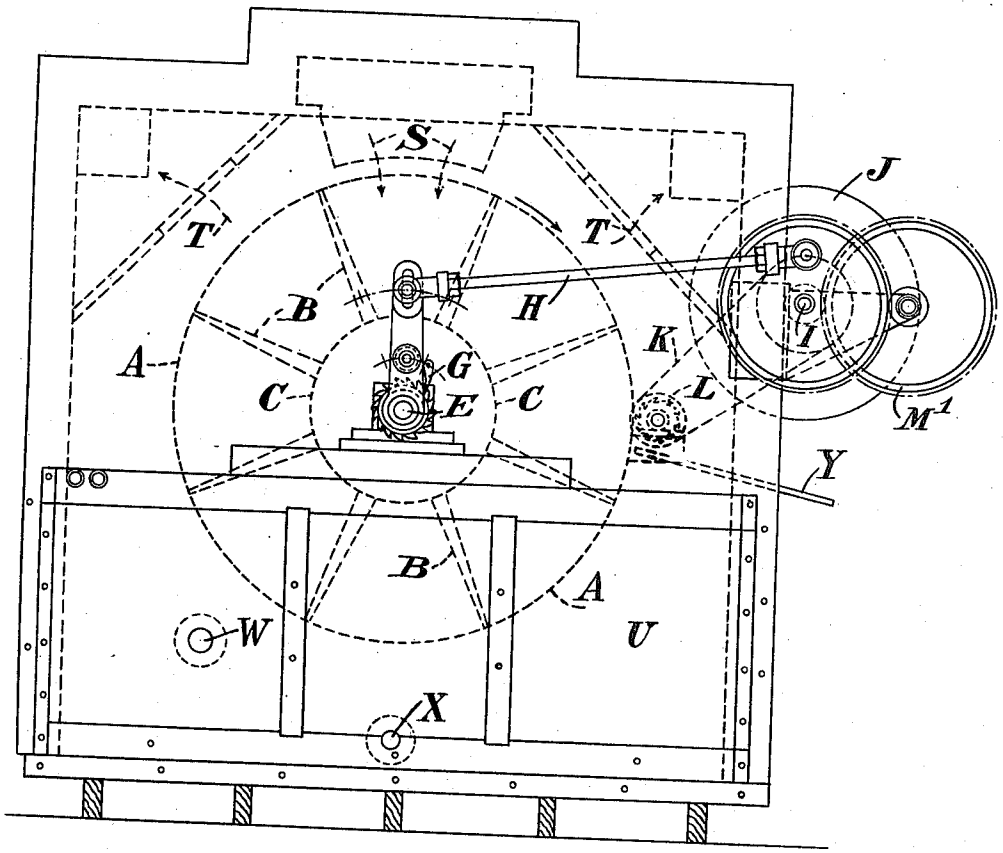
4 SHEETS—SHEET 3.

Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 4.

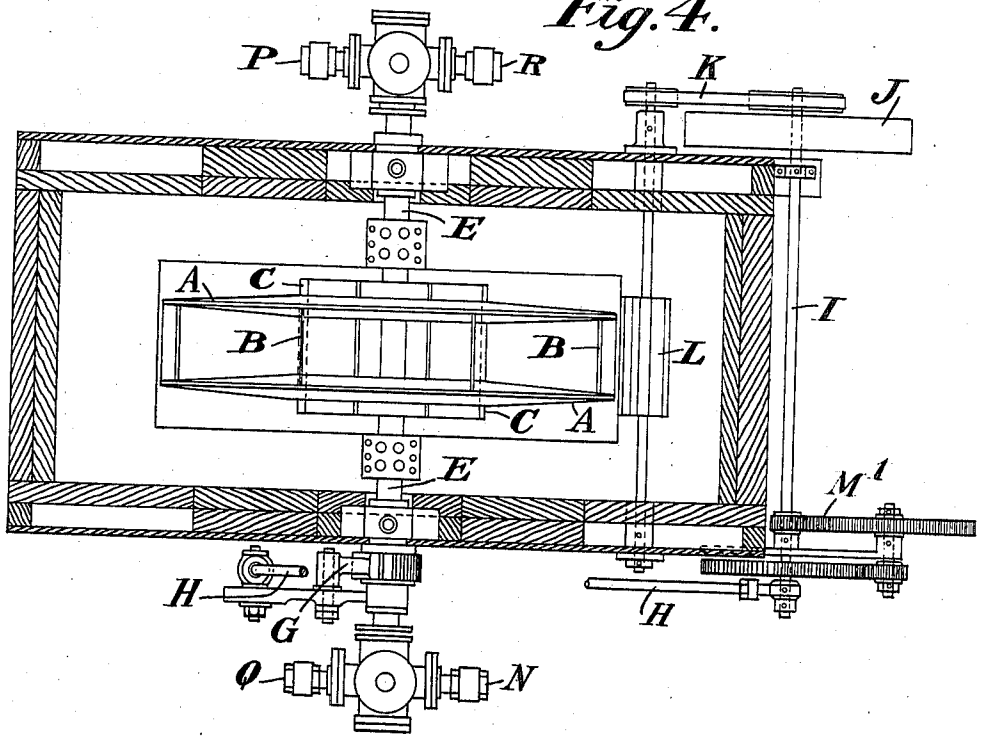
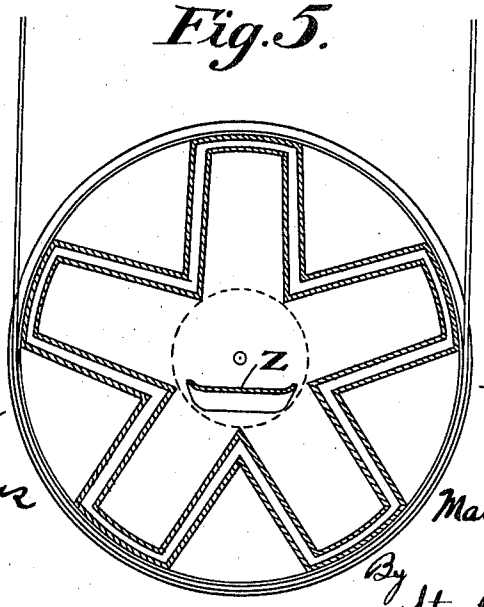


Fig. 5.



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UNITED STATES PATENT OFFICE.

MAUNSEL C. J. BANNISTER, OF DUBLIN, IRELAND.

PROCESS OF FORMING ICE.

1,044,972. Specification of Letters Patent. Patented Nov. 19, 1912.

Application filed September 6, 1911. Serial No. 647,943.

To all whom it may concern:

Be it known that I, MAUNSEL CASWELL JOHN BANNISTER, subject of the King of Great Britain, residing at Dublin, in the county of Dublin, Ireland, have invented certain new and useful Improvements in Processes of Forming Ice, of which the following is a specification.

This invention has for its object a process of forming ice and cooling liquids by a combination of (*a*) the present cell ice making process such as Siddeley & Makay's patent, and other like process, by which ice is formed and liquids cooled by the circulation of confined refrigerating fluids on the opposite side of metal walls when exposed to and in contact with the liquids to be cooled or frozen, and (*b*) simultaneously or intermittently cooling or freezing the liquids by the direct application of previously refrigerated air or other neutral gas acting directly upon the surfaces coming into periodic contact with the liquids to be cooled or frozen thereon according to the type set forth in my English Patents Nos. 8092 and 19698 of 1909 with means for preventing the formation of ice at other points where such would be injurious.

The defects and disadvantages arising from the old cell process are first, great initial cost of plant, secondly exceedingly and progressively slow formation of ice after an initial layer has been formed upon the surfaces exposed to freezing action; third, the retarding effect upon the ice formation, by reason of such formation being constantly in contact with the warm water which is being formed into ice; fourth, the large power necessary for keeping the body of water that is being frozen in constant motion for the purpose of eliminating the formation of air bubbles upon the ice surface in the manufacture of clear ice blocks; fifth, the great expense and difficulty incurred in the removal from the tanks of the ice blocks after their formation necessitating the freezing in the ice blocks of hooks or loops for lifting purposes together with the costly gear and labor for the purpose as well as loss of time. Lastly exactly in proportion to the thickness of the ice which is a poor conductor of heat so the formation of ice becomes more slow in proportion to the thickness necessitating very extended surfaces equal to three or four times the daily tonnage capacity of the refrigerating machine when ice blocks say twelve inches in thickness are made and with every greater thickness this defect is exaggerated in geometric ratio.

Now by my invention I can obtain any thickness of ice of a clear transparent quality in very much less time, as in my process the previously refrigerated air always acts upon or freezes directly all the liquid being cooled or frozen no matter how previously thick the previous layer of ice may be. At the same time I obtain by my new arrangements the undoubted advantage of the old cell process in cheaply and quickly forming thin layers of ice at the commencement of the process and obtaining a cold foundation for the continuous and expeditious formation of ice thereon. Thus when ice first begins to form the old process is as economical or more so than my own and consequently I get the advantage of its economy at the commencement, but as the ice thickens however the old process becomes more and more ineffective. The circulation of the internally confined freezing fluids is therefore discontinued or reduced without materially retarding the rapid formation of the ice blocks, while being completed by my process. The removal of the air bubbles from the ice surfaces during the formation of the ice I effect simultaneously and without any superfluous gear by the operation of my device for the manufacture of ice and with minimum power and expense. The loosening of the ice blocks from the metallic plates is effected by means of a circulation of warm brine or fluids in the place of the cold or freezing brine used in the first part of the process in forming the ice. By this means the ice is released from contact with the metallic plates and falls by its own gravity on to an inclined plane placed below where it is placed on runners without mechanical power or excess of labor to a store or sales platform for disposal.

My invention is best described by aid of the accompanying drawings of my actual installation, in which,

Figure 1 is a longitudinal sectional elevation of my apparatus; Fig. 2, a transverse sectional elevation; Fig. 3, a side elevation; Fig. 4, a plan; and Fig. 5, a diagram of a variation.

In these, A is a wheel or skeleton drum

formed of a pair of, or any number of, hollow disks required, B hollow division plates in the said drum. These are not absolutely necessary, but are desirable, as by this means they form radial divisions and thus divide the blocks into truncated pyramidal structures of a useful size and shape. The arms B and the sides A are attached to the cylindrical annular drum C. This annular drum is supplied with brine by the pipes D from the hollow shaft or trunnion E. These trunnions are rotated by means of the ratchet pawl device G actuated by the shaft H from the driving shaft I by means of reducing gear M'. This driving shaft I is driven by the pulley J and by means of belt gear K drives a cutter L when required, which shaves the outside of the block of ice when near completion, and thus causes an even surface. In action the brine may be passed through the shaft E through the nozzles N and R, and steam or warm brine when required through the nozzles P and Q. The air from an air cooler on the other hand enters at the arrow S and escapes through the passages back to the air cooler in the direction of the arrow T, shown in Fig. 2 as dotted. O and T' are behind partition B, which is solid. The tank U is kept normally full of water up to the surface of the interior drum C through opening W. This tank can be emptied through exit X.

The mode of action of this apparatus is as follows:—The tank is filled to the requisite height with water, preferably slightly warm, the wheel is caused to slowly revolve. The speed is comparatively immaterial, it might be one revolution a minute. Freezing brine is passed through the axle and the pipes D into the arms B and the sides A. As the wheel slowly revolves it gets wet in the tank and the cold brine passing through it congeals this water into ice. Further, as the wet partitions rise up the cold air passing through the wheel from S to T refrigerates it still more until the part of the wheel, revolving, enters the tank with the ice thereon very much below freezing point. This ice accordingly on entering the water at once congeals the water around it, and this goes on until all the pockets in the wheel are full of ice. In the meantime the cutter or cutters L cuts off any protuberances which are carried away by the chute Y. Similar cutters driven off same shaft may be used if desired to keep other parts clear of ice.

In thus describing my device, I wish to point out that the radial divisions are not absolutely necessary, but are extremely desirable, as forming pockets. The air entering at S blows right into these pockets, passes down to the bottom, and up the opposite side. The walls of the tank may be of metal and hollow, and a circulation of water above the freezing point passed around them in order to keep the water in the tank slightly above freezing point, consequently no ice can form in the tank except on the layer of ice already formed on the revolving wheel. The warm make up water can be used for circulating in these hollow walls. In place of this arrangement I may keep the surface of the water in the freezing tank in constant motion by any stirring mechanism or by spray pipes or kept from freezing by surface attemperating coils insulated from the cold air. In order to concentrate the cold freezing fluids and air upon the block of ice to be formed I insulate all other surfaces by suitable non-conducting substances such as timber or wood pulp. Timber saturated in oil or paraffin wax or granulated compressed cork slabs secured to the surfaces by mastic are very useful for this purpose. I maintain the level of the water in my freezing tank except when the tank has to be emptied to take out the blocks when all the water is pumped out of the working tank into the supply which can be artificially cooled.

The temperature of the ice making water in the tank can be controlled in any desirable manner so as to be just a little above freezing point. The motion of the wheel for making the ice can be intermittent, revolving or even oscillating or reciprocating but I prefer the apparatus as set forth. It is obvious that though I have shown the water on the outside of the drum, this process can be applied to drums in which the water is carried in the drum itself, and the drum is formed of a series of troughs. The air in such case enters near the center of the drum on one side and escapes at the other above the divisions of the troughs ending a considerable distance from the center for this purpose. In this instance the partitions of the troughs are triangular substantially as shown in diagrammatic section in Fig. 5. In this instance the brine enters the hollow drum and the hollow partitions and when the ice is sufficiently formed the wheel is stopped, the brine is run off through a cock not shown, and warm brine admitted. When the blocks of ice are loose the wheel is allowed to slowly revolve and the blocks fall onto the slide Z and are thus removed. The slide Z can be left in position but is preferably removed. The drum is supported on belts, (and therefore does not require an axle), or on an axle as desired.

I declare that what I claim is:—

1. The process of forming ice consisting in refrigerating one side of a metal structure, on the other side of which the ice is to be formed, passing refrigerated air or gas over the ice or ice forming surfaces, and alternately covering such surfaces with the liquid to be frozen, and exposing them to the refrigerated air.

2. The process of forming ice, consisting

in cooling the inner surface of a suitable metal container with a suitable refrigerant alternately supplying water to the outer surface of such container and exposing such surface to a blast of cold air, whereby successively thin layers of ice are formed, in such container through the combined action of the refrigerant inside the container and the blast of cold air.

3. In the process of forming ice by means of refrigerating air or gas passed over the surface on which the ice is formed and over the surface of the ice itself as the latter is alternately immersed in water and exposed to cold air, keeping the main body of the water to be frozen a little above the freezing point, whereby no ice is formed in the main body of the water, but only on the surface of the moving parts, and thus crackly and hummocky ice is prevented from being formed.

4. The process of forming ice, which consists in exposing the surfaces on which the ice is to be formed alternately to very cold gaseous matter, and to the water to be frozen, and preventing ice from forming in other parts of the water by keeping the main body of the water above freezing point.

In witness whereof, I have hereunto signed my name this 29th day of August 1911, in the presence of two subscribing witnesses.

M. C. J. BANNISTER.

Witnesses:
ALBERT EDWARD CLEGGS,
ROBERT WOODS.