D. L. HOLDEN.

ICE MACHINE.

APPLICATION FILED AUG. 18, 1911.

1,020,759. **Patented Mar. 19, 1912.**

3 SHEETS—SHEET 1.

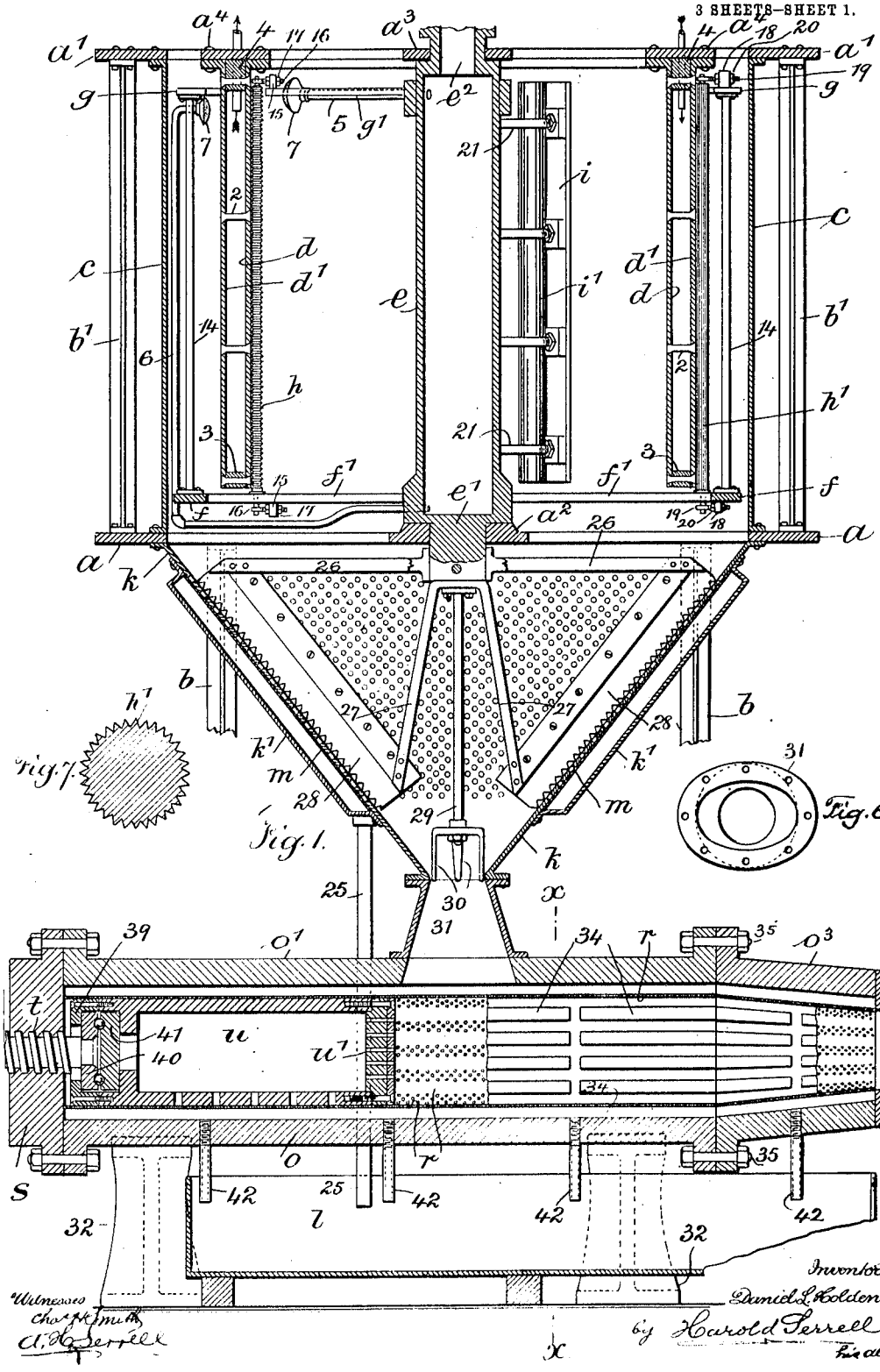

Fig. 1.

Fig. 7.

Fig. 6.

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3 SHEETS—SHEET 2.

Fig. 2.

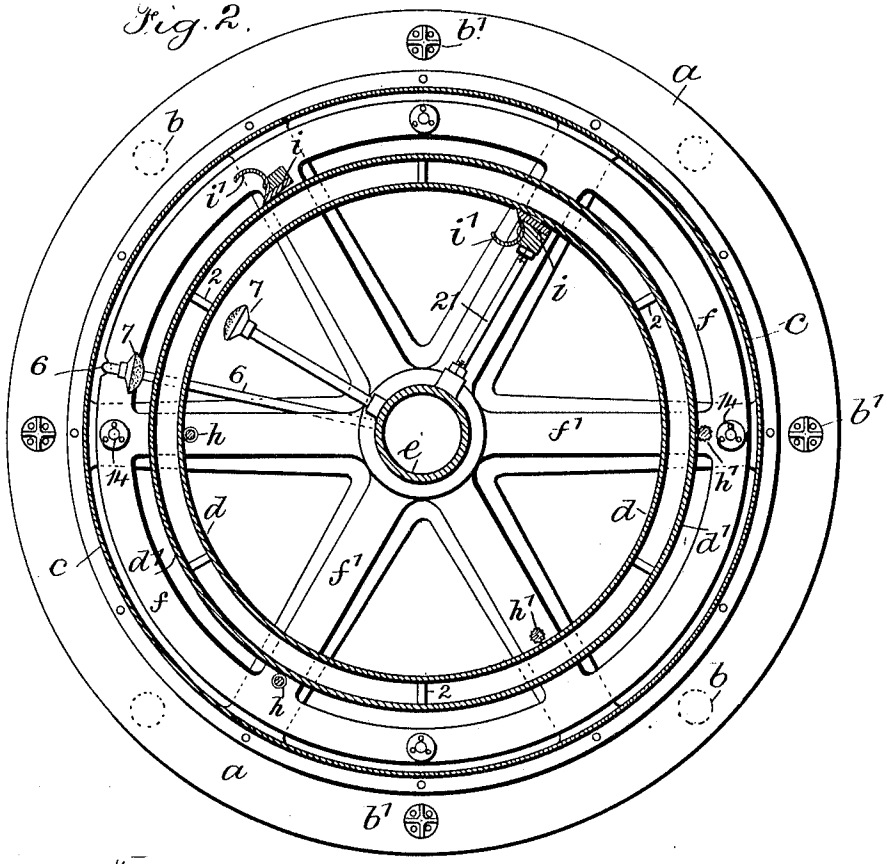


Fig. 8.

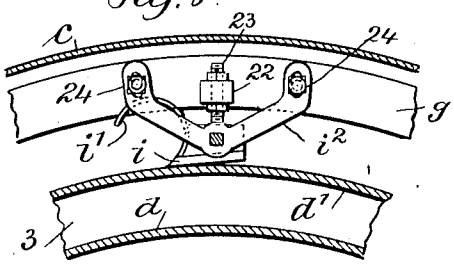


Fig. 9.

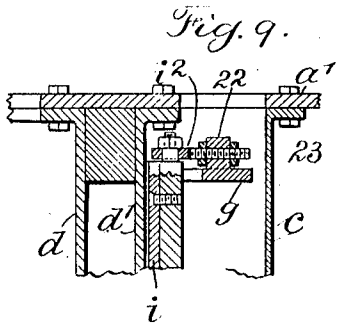
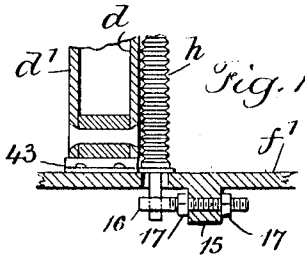


Fig. 10.



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3 SHEETS—SHEET 3.

Fig. 4.

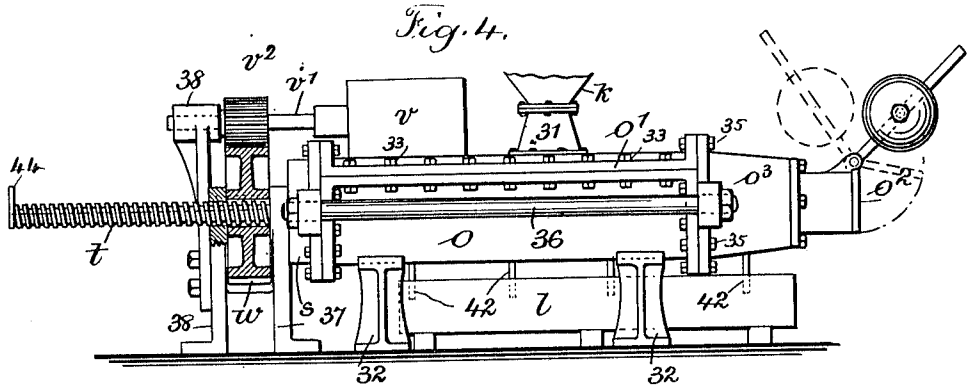


Fig. 5.

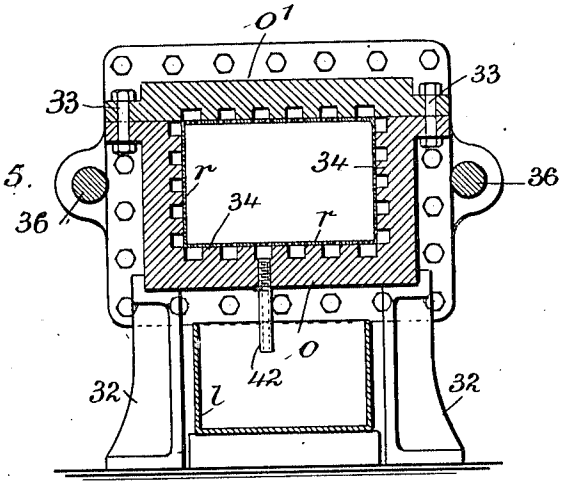
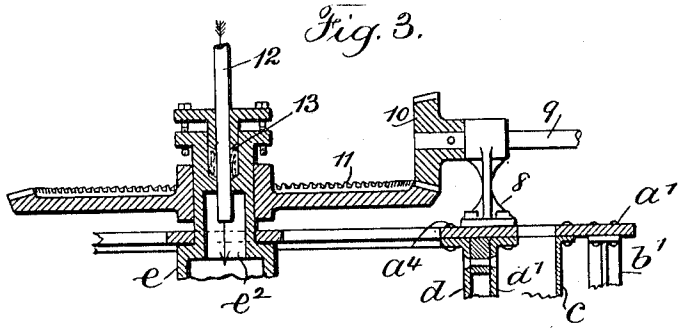


Fig. 3.



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UNITED STATES PATENT OFFICE.

DANIEL L. HOLDEN, OF NEW YORK, N. Y.

ICE-MACHINE.

1,020,759. Specification of Letters Patent. Patented Mar. 19, 1912.

Application filed August 18, 1911. Serial No. 644,767.

To all whom it may concern:

Be it known that I, DANIEL L. HOLDEN, a citizen of the United States, residing at the borough of Manhattan, in the city, county, and State of New York, have invented a new and useful Improvement in Ice-Machines, of which the following is a specification.

My invention relates to a means and method for making artificial ice quickly and cheaply, and in a machine that is smaller, and by a method more quickly carried out than by the machinery and the method employed for making artificial ice in cakes of large size and appreciable weight.

The object of my invention being to produce ice quickly, continuously and in a mass that can, as produced or formed, be cut up into blocks of the desired sizes—within prescribed limits—for immediate consumption.

In the machine of my invention I employ a hollow cylindrical vessel, preferably vertically disposed and containing a refrigerant. The ice is formed on one or both surfaces of this vessel—the inner and outer—as the result of spraying water thereon, preferably by a revolving sprayer. The ice, as formed, is loosened by scoring or crushing, or both, is removed by a suitable scraper, and descends by gravity into a conical hopper in which are revolving scraper plates that work the fine ice downward in the hopper. This hopper is formed with a surrounding water jacket to drain off the water from the ice, the water being delivered into a tank. The ice falls into an ice compressor and former, preferably contracted at the delivery end. A piston in this ice compressor—actuated by suitable devices—keeps constantly and progressively forcing the ice particles to the delivery end of the compressor and former, simultaneously packing the ice into a solid mass of progressing length, in which the ice freezes solid and any free water flows away—by suitable means—into the same tank from which the water is preferably pumped up to be sprayed in the continuous ice forming process, all of which is hereinafter more particularly set forth.

In the drawings, Figure 1 represents a vertical central section and elevation of substantially the complete device of my invention. Fig. 2 is a section on a horizontal line at the upper part of Fig. 1, and in the same proportion. Fig. 3 is a vertical section of operative devices which are placed on top of the machine, as shown in Fig. 1, and have been drawn separate because the sheet holding Fig. 1 lacked the room. Fig. 4 is a side elevation of the ice compressor and former on a smaller scale from Fig. 1. Fig. 5 is a cross section of the ice compressor and former, and on the same scale at about the dotted line x x of Fig. 1. Fig. 6 is an inverted plan of the lower edge of the throat, connecting the ice making device of the ice compressor and former. Fig. 7 is a cross section, in larger size, of one form of cylindrical ice breaker. Fig. 8 is a plan, at the upper end, of the cylinder containing the refrigerant, showing the upper end of one of the scraping devices, and the devices for supporting and adjusting the same. Fig. 9 is a vertical section through the parts shown in Fig. 8, and Fig. 10 is an elevation and partial section at the lower end of the cylinder containing the refrigerant and lower end of one of the cylindrical breakers.

Similar letters of reference and numerals, throughout the drawings, indicate similar parts.

The foundation and support of the ice making devices comprises a fixed ring a and a second fixed ring a^1, in a higher plane, the ring a being supported by columns b upon any suitable foundation, and the rings a and a^1 connected together, and the ring a^1 supported by columns b^1. These columns are generally shown in Fig. 2 and may occupy a staggered relation to one another.

c represents a cylindrical casing secured to both rings a and a^1, and adjacent to the inner edges of said rings. The ring a is provided, as a wheel, with spokes and a central hub a^2. The cylindrical vessel, vertically disposed and containing a refrigerant, comprises the spaced cylindrical walls d d^1. These walls are held together by connecting rivets 2, and are held apart by the annuli 3, 4; certain of the connecting rivets 2 also passing through said annuli. These cylindrical walls d d^1 are flanged at their upper ends, and the upper ring a^1 is provided with arms as spokes with a central neck piece a^3 and ring a^4, and it is to this ring a^4 that the walls of the cylindrical vessel, containing the refrigerant, are secured by suitable bolts or rivets, said vessel being thus suspended from the parts of the upper ring. I provide suitable pipes for conveying the refrigerant into this cylindrical vessel and for the exit also of the said material so as to establish a

circulation. The refrigerant is preferably the usual anhydrous-ammonia. At the center of the aforesaid rings and the cylindrical casing c I employ a hollow, cylindrical axis e. The upper part of this is contracted at e^2 and takes a bearing in the neck a^3. The lower part is also contracted at e^1 and passes through the hub a^2. The lower ring forms a support and guide and the upper ring a guide for the hollow, cylindrical axis e and the parts connected therewith.

Extending out from the member e are water pipes 5 and 6, as arms. The pipe 5 terminates in a spray nozzle 7 within the cylindrical vessel holding the refrigerant, while the pipe 6 extends out from the lower part of the member e and passes to the outside of the cylindrical vessel containing the refrigerant, and the pipe itself rises and terminates in a spray nozzle at 7. From both of said nozzles water is discharged against the inner and outer surfaces of this cylindrical vessel containing the refrigerant, and while I have thus shown the construction, I do not limit my invention in this respect.

Referring particularly to Fig. 3, a standard 8 carries a bearing at its upper end for the shaft 9, which is rotated by any suitable power. On this shaft 9 is a bevel wheel 10 which meshes with a large bevel wheel 11, the hub of which surrounds and is keyed to the tubular end e^2 of the hollow cylindrical axis. At the upper end of this tubular part e^2 there is a water supply pipe 12, passing through a packing 13, and by this pipe water is introduced into the member or cylinder e from any source of supply, and therefrom through either or both the pipes 5 and 6 to one or more spraying nozzles 7. In connection with the hollow cylindrical axis e I employ the rings f g. The ring f is provided with arms f^1 secured to or formed in one with the hub e^1 and secured thereto and between the lower ring f and upper ring g, there are a series of columns or supports 14, and I may prefer to connect the upper end of the pipe 6 at its nozzle 7, to the ring g for additional support.

h and h^1 represent equivalent forms of cylindrical ice breakers. The form h is horizontally scored or grooved, and the form h^1 is vertically scored or grooved, either form serving for the performance of an equivalent function in cracking and more or less breaking off the ice forming upon the inner or outer surfaces of the cylindrical vessel containing the refrigerant. As a means providing for the support of the ice breakers h I have shown lugs 15, one depending from the arm f^1, and the other connected to an arm g^1, extending out from the member e. The respective ends of the breaker h are reduced, and eye-bolts receive these reduced ends, and, in turn, pass through the lug 15 and are held in position by clamping nuts 17 in an adjustable relation, whereby the periphery of the breakers h may be adjusted with reference to the inner surface of the cylindrical vessel containing the refrigerant. For the ice breakers h^1 I have shown lugs 18, one extending below the ring f, and the other rising from the ring g. The respective ends of these breakers are also reduced and are received in eye-bolts 19, passing through the lugs 18 and provided with clamping nuts 20 for holding the same adjustably in position nearer to or farther from the outer surface of the cylindrical vessel containing the refrigerant, as may be desired, in setting the breakers h^1 for the performance of their function.

I have shown a series of arms 21, as projecting from the hollow cylindrical axis e. The devices as scrapers for removing the ice from the inner surface of the cylindrical vessel containing the refrigerant, are connected to a support from the ends of these arms and consist of scraper bars i coming to a sharpened edge at their advancing portions and deflector plates i^1, the edges of the bars i scraping off the ice and the plates i^1 directing the ice away from the center of the machine and below the inner surface from which it is removed. Where scraping devices are also employed against the outer surface of the cylindrical vessel containing the refrigerant, these scraping devices must be carried at their respective ends between the rings f and g, and for this purpose I have shown specially, in Fig. 8, an illustration of a device suitable for such purpose and comprising brackets of substantially U shape i^2 with an integral center screw stem 23, which passes through a lug 22 on the ring g, and is held in position by clamping nuts at opposite sides of said lug. The ends of the bracket i^2 are slotted and receive screw pins upon which are clamping nuts 24; therefore, to adjust the position of these outside scrapers, various clamping nuts may be loosened and the devices given a slightly radial movement to bring the scraping edge nearer to or farther from the outer surface of the member d^1.

Fig. 9 shows a cross section of this construction, which is also preferably employed at the lower end of the outer scrapers with reference to the ring f. Below the ice making devices, just described, I place a conical hopper k, the upper flange edge of which is secured to the under-surface of the fixed ring a, at the inner edge of the ring, and preferably in line with the inner surface of the casing c. This hopper is perforated and provided with a conical jacket k^1 and a gauze lining m. Into this conical hopper all the ice made in and by the devices in the higher plane, and just herein described, falls progressively, together with any water

as surplusage that may not have been turned into ice. The water passes through the perforations of the conical hopper and the gauze lining, into the jacket k^1, and is conveyed away by a vertical pipe 25 into a tank l, the ice passing on down through the hopper and being constantly agitated by scrapers 28. These scrapers 28 are preferably strips of rubber, with to other lower edges secured to a suitable metal frame, the ends of which in turn are secured to horizontal arms 26 and depending arms 27. The arms 26 are in one with a hub secured around and at the lower end of the hub e^1, while the arms 27 are secured to the lower end of the hub e^1. Said arms and said scrapers rotate together with the hollow cylindrical axis e and parts connected therewith. I also provide a rod 29 secured to the lower end of the hub e^1, and this rod carries a forked agitator 30, also rotating with the aforesaid parts at the lower end of the conical hopper and its place of union with the throat 31. This throat 31 increases in area from the lower end of the hopper to its union with the ice compressor and former. This ice compressor and former is supported on standards 32. It generally comprises a body rectangular in cross sections, as shown in Fig. 5, in which the lower part o is of substantially U shape in cross section and o^1 is the top or cover, said parts being held together with bolts 33, at suitable intervals.

The body of the ice compressor and former is scored longitudinally so as to produce the longitudinal internal ribs 34. There is, as shown in Figs. 1 and 4 a parallel sided section and a tapering section o^3 to the ice compressor and former, the said sections being secured together with the bolts 35. The entire ice compressor and former is interiorly provided with a perforated lining r which backs up against the faces of the ribs 34, the lining extending from one end to the other of the ice compressor and former. As shown in Fig. 1, the left-hand end is provided with a large nut s, and longitudinally the several parts are also securely held together by tie rods 36.

t represents a screw shaft passing through the nut s and v represents an electric motor secured upon the ice compressor or former; v^1 the shaft of the motor and v^2 a gear; 37 and 38 are bearing frames at the left-hand end of the ice compressor and former, the end of the shaft v^1 of the motor, distant from the motor, having a bearing in the upper end of the frame 38, and these frames are so positioned as to receive a large gear w between them, which gear is upon the screw shaft t and meshes with the gear or pinion v^2, so that the power and rotation of the motor are communicated through its shaft and gear to the large gear w. The screw shaft t is longitudinally grooved and the hub of the large gear w carries a key or spline secured thereto and moving in a groove of the screw shaft, whereby with the rotation of the large gear the screw shaft t is also rotated, see Fig. 4.

Within the ice compressor and former is a hollow piston u longitudinally movable within the perforated lining r, and the right-hand end of the screw shaft t is secured in the left-hand end of the hollow piston between the ball-bearing heads 40 and 41, which are held to the piston by the collar 39; consequently, as the screw shaft turns, it reciprocates through the nut s, and moves the piston forward and backward in the ice compressor. This piston is made with a head u^1 connected to the tubular body of the piston by long screws, and this head is perforated so that any water in the ice as compressed may flow through the head and discharge into the scoring of the ice compressor through other holes inside the piston, all the water in the scoring eventually advancing by drain pipes 42 into the common tank l, where the water as it collects is pumped out into the pipe 12, to descend into the cylindrical hollow axis e, to be again sprayed against the surface of the cylindrical vessel containing the refrigerant, in the repeating process of forming ice and removing the same.

In the operation of the ice compressor and former, the ice descends within the same through this throat 31. The stroke of the piston is between the position shown in Fig. 1 and the forward end at the tapering section; consequently, as the ice collects, it is periodically pushed forward bodily and forced up against the ice in the tapering section. The water is squeezed out, the ice solidifying and the water advancing through the perforated lining r into the scoring and making its way by the drain pipes 42 into the common tank l. As the ice is forced progressively through the tapering section, it comes into the parallel end of the section back of the weighted cover o^2, the ice meantime freezing together into a substantially solid mass. As the ice emerges from the exit or mouth of the ice compressor and former, this weighted cover is lifted and gradually thrown back and remains back during the continuous ice making process. As the solid rectangular mass of ice emerges from the ice compressor, it may be cut up into sizes, as desired, for immediate consumption, and by any suitable cutting means.

I have shown in Fig. 10, a scraper 43 as secured to the arm f^1, and coming under the lower edge of the cylindrical vessel containing the refrigerant, for the purpose of scraping off the ice which may form on the lower edge of said vessel. I have also shown on the free end of the screw shaft t an upright member or block 44, adapted for employ-

ment in connection with a reversing device for the said shaft which may be electrical or mechanical, but forms no part of my present invention.

I claim as my invention:

1. In an ice making machine and in combination, a stationary cylindrical vessel adapted to contain a refrigerant, revoluble devices turning axially therein for spraying water for the formation of ice therein and for progressively removing the same, a hopper beneath the same receiving the ice, and means for removing any water therefrom, and an ice compressor and former below the hopper receiving the ice, and compressing the same into a continuously ejected mass.

2. In an ice making machine and in combination, a stationary cylindrical vessel adapted to contain a refrigerant, revoluble devices turning axially therein and comprising a receptacle for water, means for delivering and spraying the same upon the surface of said cylindrical vessel for the formation of ice, devices for loosening and scraping the ice from the surface of said cylindrical vessel, a hopper beneath the same receiving the ice removed, a jacket formed with said hopper for draining away the water from said ice, devices within said hopper for moving the ice to free the water and for causing it to descend to the bottom of the hopper, and an ice compressor and former below the hopper receiving the ice, and a throat connected with the same, whereby the ice is delivered from the hopper into the ice compressor and former, for compressing and consolidating the ice into a solid mass and delivering the same.

3. In an ice making machine an ice forming member comprising a stationary cylindrical vessel and suitable supports therefor, a revoluble hollow axial cylinder receiving the water, one or more water pipes and sprinklers connected with said cylinder for spraying water upon the surface of said cylindrical vessel, so as to form ice on the surface thereof, cylindrical ice breakers and suitable supports therefor from the hollow axial cylinder, suitable scraping devices and supports therefrom, also from the hollow axial cylinder, and means for revolving said hollow axial cylinder and the parts connected therewith.

4. In an ice making machine an ice forming member, comprising a stationary cylindrical vessel and suitable supports therefor, a revoluble hollow axial cylinder receiving the water, one or more water pipes and sprinklers connected with said cylinder for spraying water upon the surface of said cylindrical vessel so as to form ice on the surface thereof, cylindrical ice breakers and suitable supports therefor from the hollow axial cylinder, suitable scraping devices and supports therefrom, also from the hollow axial cylinder, and means for revolving said hollow axial cylinder and the parts connected therewith, and other devices extending from the hollow axial cylinder to the outer surface of the aforesaid cylindrical vessel for spraying water against the outer surface of the cylindrical vessel containing a refrigerant for the formation of ice thereon, cylindrical breakers and suitable scraping devices bearing against the outer surface of aforesaid cylindrical vessel, and the said parts also revoluble with the aforesaid parts and hollow axial cylinder.

5. In an ice making machine and in combination, parallel fixed rings, supporting columns between and connected to said rings, other supports beneath the lower ring to a foundation for carrying the structure, a cylindrical casing extending between and secured to said rings, a conical hopper at its large upper end secured to the under surface of the lowest of said rings substantially in line with the inner surface of the cylindrical casing, a jacket for water surrounding the conical hopper, a delivery throat from the lower end of the hopper, and revoluble liquid spraying devices within said cylindrical casing and hopper whereby ice is formed and progressed downward by gravity and the water removed therefrom and the ice particles delivered from the hopper for after treatment.

6. In an ice making machine and in combination, parallel fixed rings, supporting columns between and connected to said rings, other supports beneath the lower ring to a foundation for carrying the structure, a cylindrical casing extending between and secured to said ring, a conical hopper at its large upper end secured to the under-surface of the lowest of said rings substantially in line with the inner surface of the cylindrical casing, a jacket for water surrounding the conical hopper, a delivery throat from the lower end of the hopper, a cylindrical vessel adapted to contain a refrigerant and suitable supports therefor within said cylinder casing, a hollow axial cylinder at the center of said casing and cylindrical vessel and means for rotating the same, devices connected to said axial cylinder for delivering water as a spray, upon one or both surfaces of the said cylindrical vessel, devices occupying a parallel relation to the vertical surface of said cylindrical vessel for cracking and scraping off the ice formed upon the surface thereof, so that the same falls by gravity into the hopper beneath, scrapers and an agitator in said hopper, connected to a revoluble device within the hollow axial cylinder for moving the ice downward in the hopper and permitting the water to escape.

7. In an ice making machine and in com-

bination, parallel fixed rings, supporting columns between and connected to said rings, other supports beneath the lower ring to a foundation for carrying the structure, a cylindrical casing extending between and secured to said rings, a conical hopper at its large upper end secured to the under surface of the lowest of said rings substantially in line with the inner surface of the cylindrical casing, a jacket for water surrounding the conical hopper, a delivery throat from the lower end of the hopper, a cylindrical vessel adapted to contain a refrigerant and means for supporting the same from the ring of the frame in the higher plane, a revoluble and hollow axial cylinder at the center of said rings, a cylindrical casing which forms a bearing therefor, the said axial cylinder receiving water and provided with means for rotating the same, a hub formed at the lower end of said axial cylinder projecting into the hopper, scrapers and an agitator connected to said hub and rotating therewith in the hopper, scrapers and an agitator connected to said axial cylinder and positioned at right angles to the said cylindrical vessel and rotating with the said axial cylinder, and devices connected with said rings and also with the axial cylinder for breaking up the ice formed on the surface of the cylindrical vessel and for scraping off the same for its delivery into the hopper.

8. In an ice making machine and in combination, a cylindrical vessel adapted to contain a refrigerant comprising concentric cylindrical walls d^1 flanged at their upper ends, spaced apart and secured at their flanged upper ends to a suitable member from which they are suspended, an annulus between said walls at both their upper and lower ends, connecting rivets which both hold the walls together and keep them apart and which also pass through the annuli at the respective ends, a pipe for introducing the refrigerant and an exit pipe whereby a circulation is maintained in said cylindrical vessel.

9. In an ice making machine the combination with devices for forming ice particles, of a conical hopper beneath and secured to the same and perforated, a jacket extending around the hopper the walls of which are parallel with the hopper, and a gauze lining to the hopper within the jacket, a discharge pipe for liquid connected to the jacket and revoluble devices within the hopper for moving the particles of ice therein, progressing the same down in the hopper and permitting the water to escape.

Signed by me this 4th day of August, 1911.

DANIEL L. HOLDEN.

Witnesses:
ARTHUR H. SERRELL,
MARY E. LELAND.