June 3, 1930. D. K. WARNER 1,760,972

APPARATUS FOR MANUFACTURING ICE

Filed April 20, 1928 7 Sheets-Sheet 1

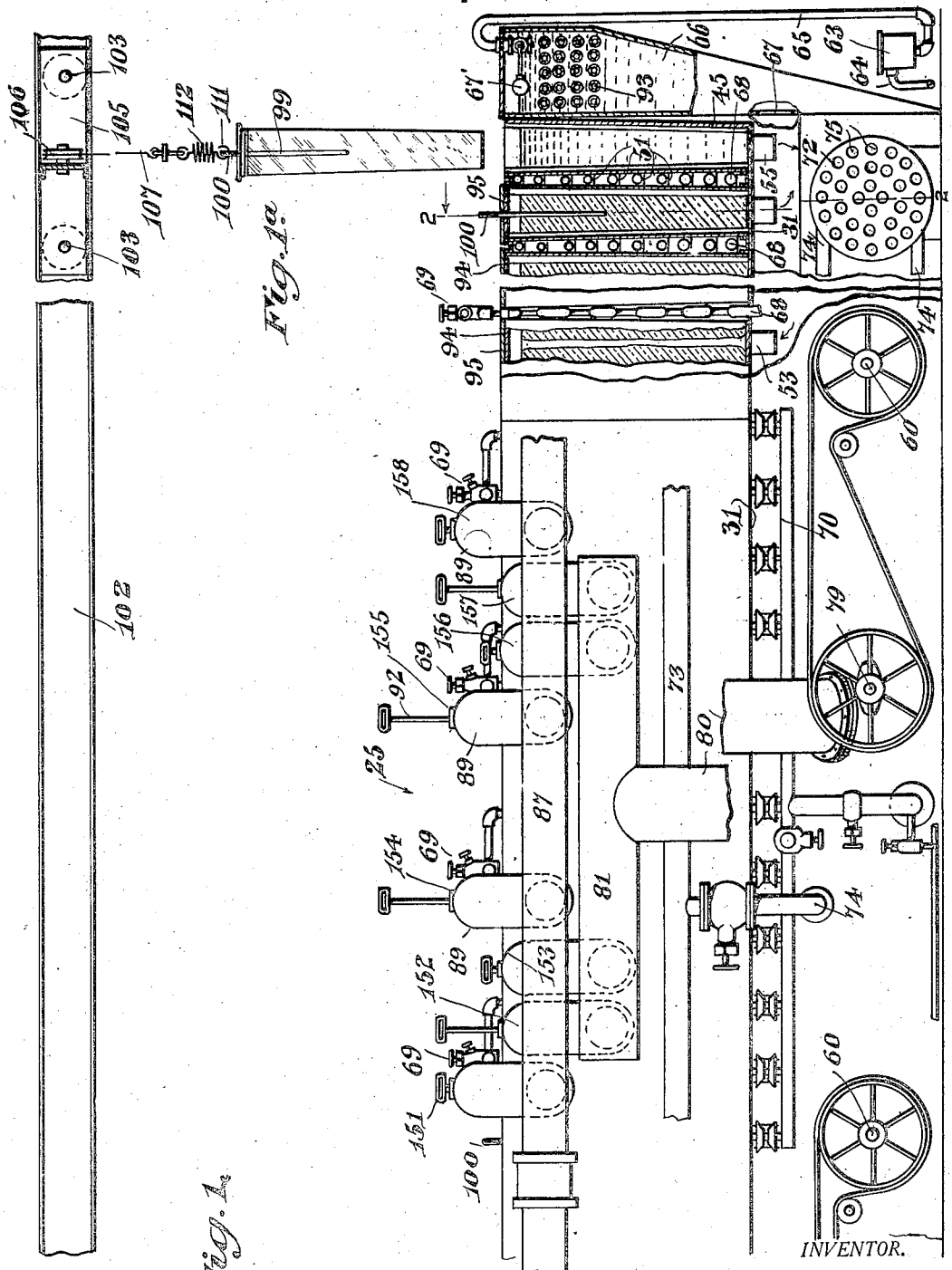


Fig. 1a.

Fig. 1.

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Filed April 20, 1928 7 Sheets-Sheet 2

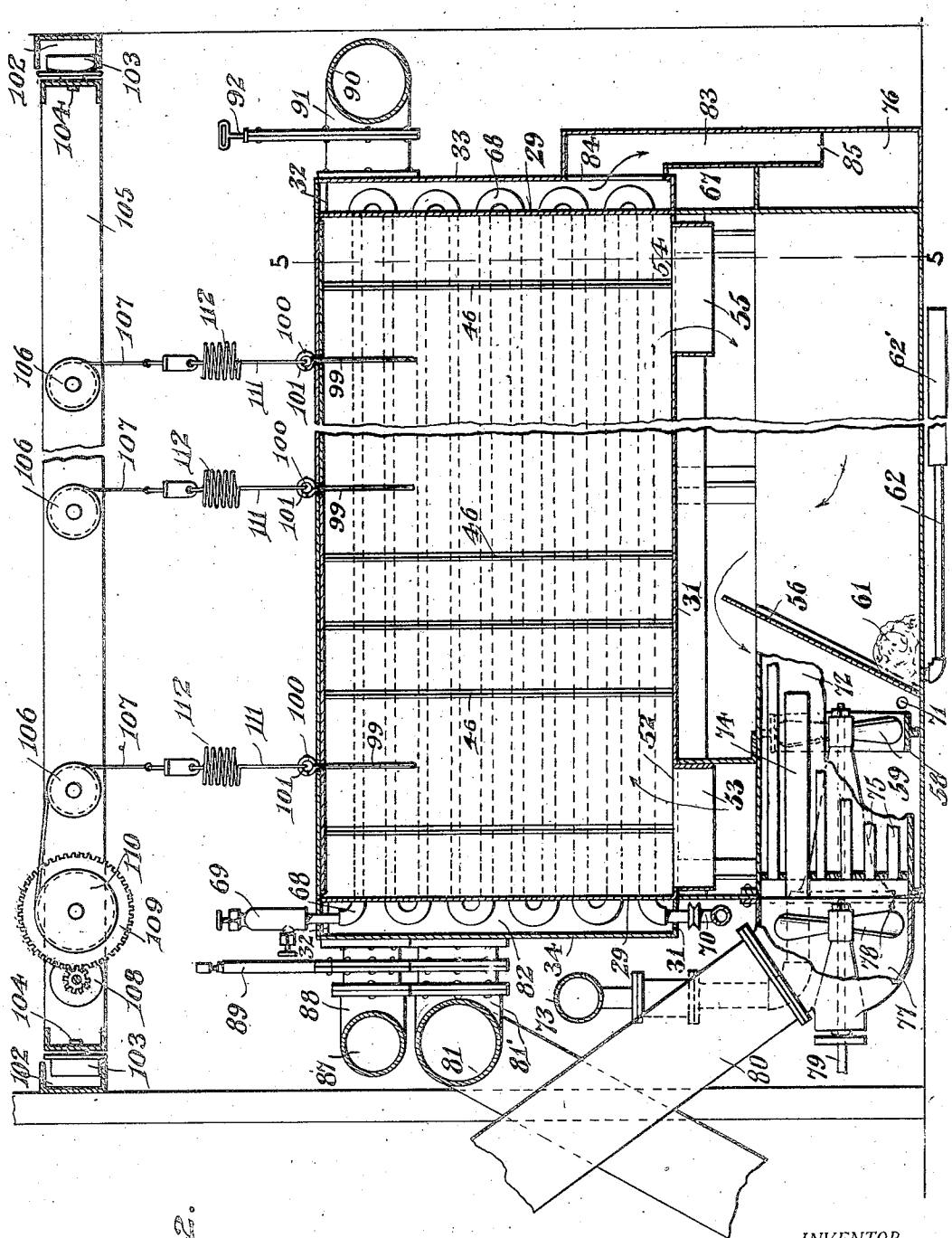


Fig. 2.

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APPARATUS FOR MANUFACTURING ICE

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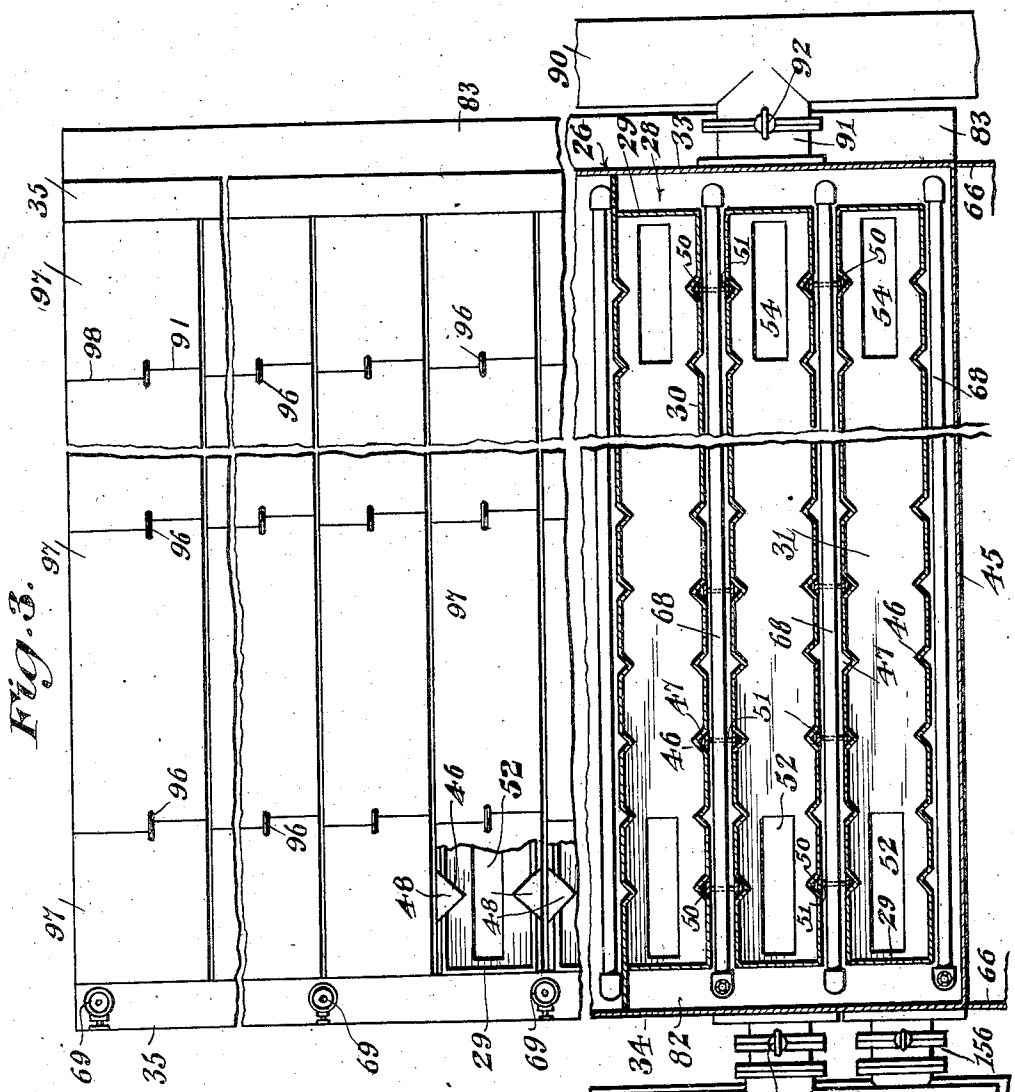


Fig. 3.

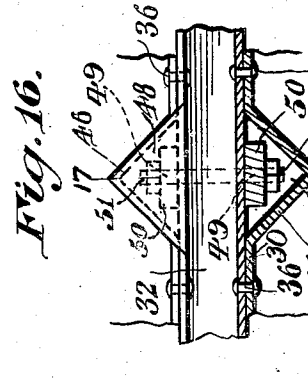


Fig. 16.

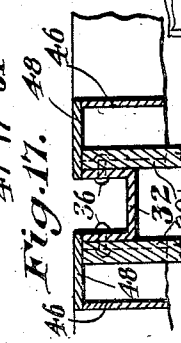


Fig. 17.

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APPARATUS FOR MANUFACTURING ICE

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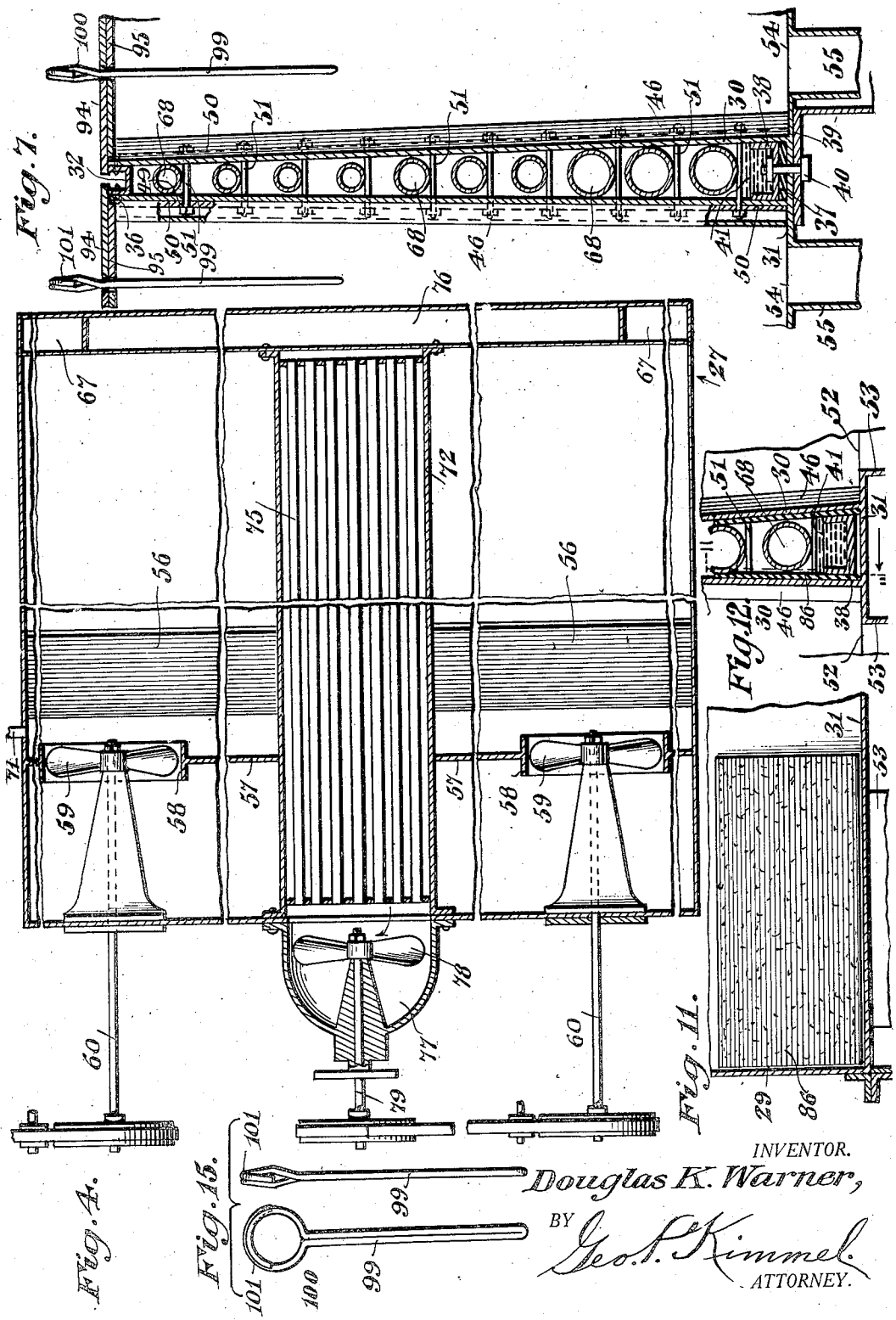


Fig. 1.

Fig. 12.

Fig. 11.

Fig. 4.

Fig. 15.

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APPARATUS FOR MANUFACTURING ICE

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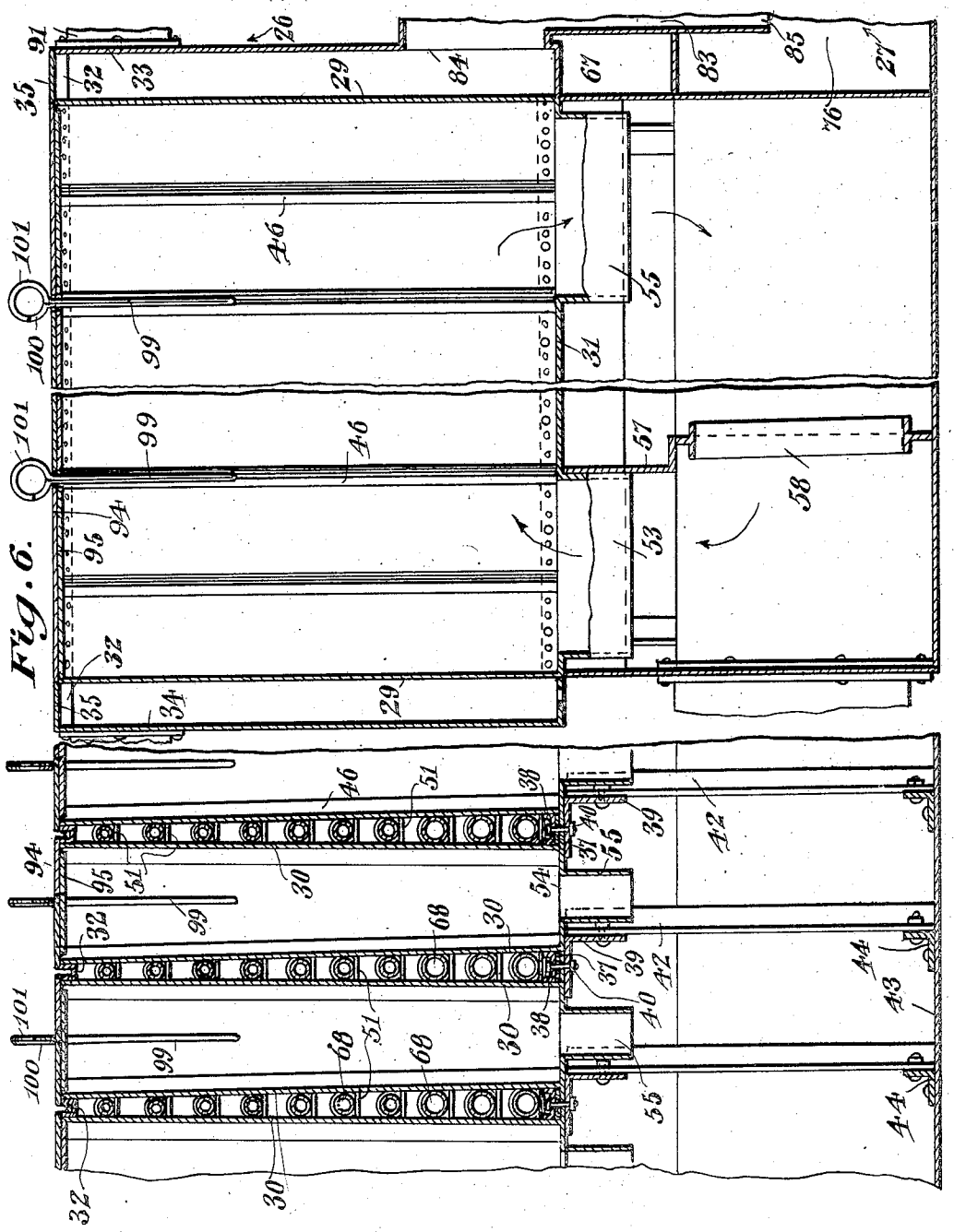


Fig. 6.

Fig. 5.

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June 3, 1930. D. K. WARNER 1,760,972

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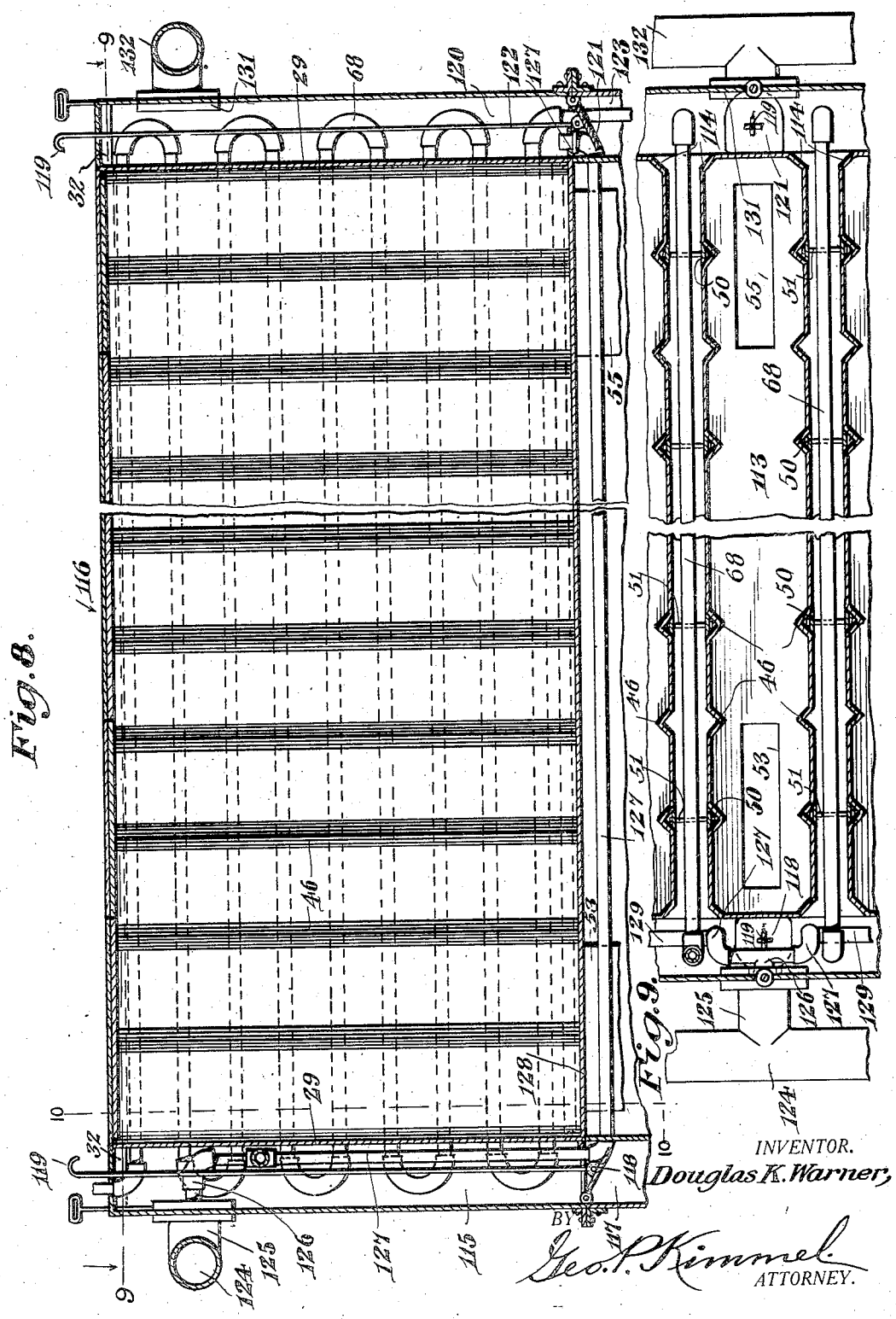


Fig. 8.

Fig. 9.

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June 3, 1930. D. K. WARNER 1,760,972

APPARATUS FOR MANUFACTURING ICE

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Fig. 13.

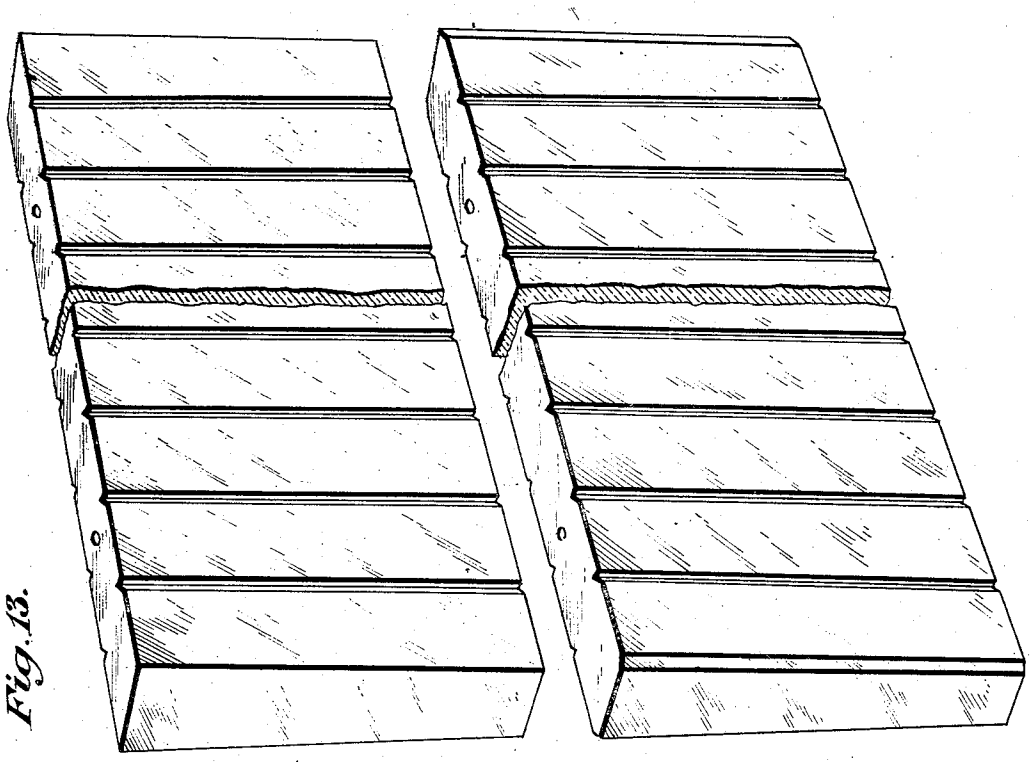


Fig. 14.

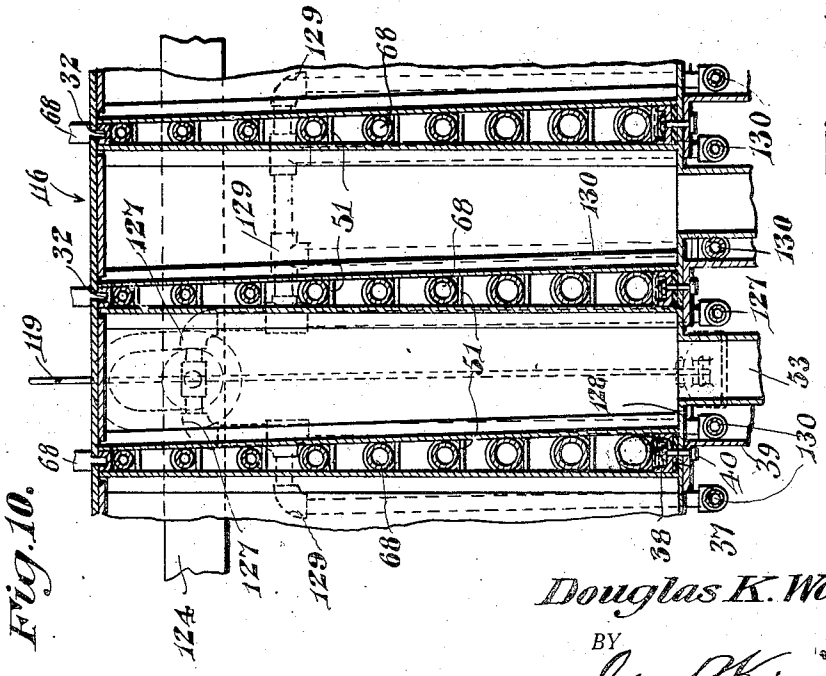


Fig. 10.

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Patented June 3, 1930 1,760,972

UNITED STATES PATENT OFFICE

DOUGLAS K. WARNER, OF BRISTOL, CONNECTICUT

APPARATUS FOR MANUFACTURING ICE

Application filed April 20, 1928. Serial No. 271,633.

This invention relates to improvements in ice making apparatus and has for its primary object to provide, in a manner as hereinafter set forth, a means for producing ice of maximum density, entirely free from the core which is typical of manufactured ice and also free from the customary water impurities and white tops.

A further object of the invention is to provide an apparatus of the class above mentioned, wherein the water is circulated through the cans when manufacturing a cake or block of ice and with the circulation of the water continuous until the cake or block is practically completed.

A further object of the invention is to provide an apparatus for the purpose as aforesaid, wherein the cooling medium may be circulated between the cans continuously during the freezing operation.

A further object of the invention is to provide an apparatus for the purpose as aforesaid, including means for circulating a moderate thawing medium between the cans after the freezing operation is complete to loosen the ice cakes from their respective cans, thereby facilitating the removal of the ice cakes and without damage thereto, such as shattered or cracked ice caused by too warm a thawing medium.

A further object of the invention is to provide a means for lifting the cakes of ice from the cans with a yielding upward pull.

A further object of the invention is to provide a means for automatically removing the cakes of ice from the cans when the cakes have been sufficiently loosened from the inner surfaces of the cans to permit the removal of the cakes without damage to the cans.

A further object of the invention is to provide in a manner as hereinafter set forth, a means for expeditiously removing the cakes of ice from the cans and transferring the cakes to a storage room, platform, or truck, without cracking corners and scarring with tongs.

A further object of the invention is to provide an apparatus for the purpose set forth including means for pre-cooling the water before it is introduced into the circulating system.

A further object of the invention is to provide an apparatus of the class above mentioned, which may be assembled in a minimum of space and with which a maximum output of ice may be handled by one man.

A further object of the invention is to provide an apparatus of the class above mentioned wherein all manual handling of the ice, ice cans, can covers, air agitating equipment and the like is eliminated.

Other objects and advantages will be apparent during the course of the following description.

In the use of ice making apparatus constructed in accordance with my invention, all core sucking and air agitation is eliminated. Also a great deal of the manual labor connected with the operation of an ice plant is eliminated, such as lifting can covers, adjusting air connections, core sucking, filling and handling cans and transferring the ice to the hauling trucks. Where open top trucks are used, the ice cakes may be lifted from their cans with the crane which operates over the freezing tank and loaded directly onto the trucks, thereby reducing the loading time, and the space ordinarily required for a loading platform. As the operator pulls the cakes with the aid of the crane, he can load or store the same unassisted. Where a siding extends to the apparatus, a car may be loaded by the operator of the apparatus with thirty tons of ice in forty minutes. A smaller storage room is required, due to the fact that the ice is kept tiered therein as the cakes are pulled from the freezing tank, consequently a small building may be used.

The ice cakes are more uniform in weight and clearness, and are not subject to occasional white cakes, the usual white tops and cores, and broken off corners. Due to the special shape and thickness of the ice, a heavier cut thereof may be placed in a small ice box than is possible with ice manufactured in the ordinary dimensions.

In the accompanying drawings, in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a fragmentary view in side elevation of an ice making apparatus according to my invention.

Figure 1ª is a fragmentary view in sectional elevation of the apparatus and illustrating a cake of ice removed from one of the cans,

Figure 2 is a vertical, transverse section taken at a point indicated by the line 2—2 of Figure 1ª,

Figure 3 is a fragmentary view partly in section and in top plan of the freezing tank,

Figure 4 is a fragmentary view in horizontal section of the water tank including one of the brine coolers located in the water tank and showing two of the water circulating propellers,

Figure 5 is a fragmentary, longitudinal, vertical section taken on line 5—5 of Figure 2,

Figure 6 is a view similar to Figure 5 taken at right angles thereto,

Figure 7 is an enlarged, fragmentary, longitudinal, vertical section through the freezing tank,

Figure 8 is a view similar to Figure 2 showing a modified form of my invention,

Figure 9 is a section taken on line 9—9 of Figure 8,

Figure 10 is a fragmentary section taken on line 10—10 of Figure 8,

Figure 11 is a section taken on line 11—11 of Figure 12, showing one of the insulating plates in elevation,

Figure 12 is a fragmentary vertical section through the freezing tank, adjacent the water openings of a pair of cans,

Figure 13 is a fragmentary perspective view of an ice cake removed from its can,

Figure 14 is a view similar to Figure 13, of an ice cake produced by the modification shown in Figures 8, 9 and 10,

Figure 15 shows in front and edge elevation an ice cake lifting hook,

Figure 16 is an enlarged, fragmentary view in sectional plan of the covering means for the spaces between the cans,

Figure 17 is a section taken on line 17—17 of Figure 16.

I accomplish the foregoing objects and results among others, by the novel construction, combination and arrangement of parts as hereinafter described and illustrated in the accompanying drawings, wherein the numeral 26 designates generally an engine room which is of usual construction and is fitted with standard equipment.

The freezing tanks, indicated generally at 26 are arranged in a battery of any number desired, each freezing tank 26 being disposed over a water tank, indicated generally at 27, and each freezing tank preferably being of a size to accommodate multiples of twelve ice cans, each can of which is designated generally by the numeral 28.

Each of the ice cans 28 comprises a body having downwardly tapering ends 29 and sides, 29 and 30 respectively, the cans being disposed in spaced relation within the freezing tank 26 and with the bottom 31 of the freezing tank being common to all the cans. The sides 30 of adjacent cans 28 are secured together at their upper edges by means of a channel bar 32 which extends between the ends 33 and 34 of the freezing tank 26, being secured to said ends and terminating beneath the horizontal flanges 35 formed on the upper edge of the freezing tank. The outermost cans are also secured to the sides of the tank in the same manner. The opposing sides 30 of adjacent cans 28 are disposed with their upper portions respectively resting against the outer sides of the channel bar 32 and are securely anchored thereto by means of suitable holding devices such as shown at 36. The cans 28 are secured to their common bottom 31 by means of a channel bar 38 extending between opposing sides of adjacent cans for the entire length of the cans, being seated on a layer of packing 37 interposed therebetween and the bottom 31 and further being riveted to opposing sides 30 of adjacent cans 28, an angle iron 39 which extends for the length of the cans beneath the bottom 31, and clamping bolts 40 which extend through the members 38, 39 and 31 to squeeze the same tightly together. To insure a perfect seal, a layer of pitch 41 is deposited between the adjacent cans 28 sufficiently thick to completely cover the channel bars 38. The bottom 31 is supported by means of legs 42, which are secured to the angle irons 39 and rest on the bottom 43 of the water tank 27, the legs 42 being secured in place on the bottom 43 by means of suitable brackets 44.

With the cans disposed as above described within the freezing tank 26, in spaced relation to the ends 33 and 34 and sides 45 of the tank, and in spaced relation to each other, a space is provided around the entire side and end surface of the cans for the circulation of brine. The sides 30 of the cans 28 are pressed inwardly at regularly spaced intervals, thereby providing vertically extending angular ribs 46 within the cans and corresponding grooves or depressions 47 between the cans. A closure 48 is provided for the top of each groove 47 which consists of a triangular frame member soldered on the upper edges of the walls of the groove.

Formed in the bottom 31, adjacent one end of each can 28, is an opening 52, which has depending therefrom into the water tank 27, a spout 53, said opening 52 and spout 53 forming a water inlet to the can. Formed in the bottom 31 adjacent the oposite end of each can is a similar opening 54 and spout 55 which forms an outlet to the can.

Extending across the water tank 27 from side to side thereof is a rearwardly inclining

baffle plate 56 which divides the lower portion of the water tank into two compartments. The forward portion of the tank 27 is further divided into two compartments for its entire depth by means of a wall 57. An opening 58 is formed in the wall 57, within which is positioned one or more propellers 59, secured to a shaft 60 having intermediate connecting means with the engine room 25 for the rotation of the propeller. The water in the tank 27 is drawn by the propeller 59 through the opening 58 in the wall 57 and forced through the inlets 52 into the cans 28, across the cans and through the outlets 54 back to the rearward portion of the tank 27. The water in or near the bottom of the rearward portion of the tank 27 is relatively quiet, due to the baffle plate 56, permitting the impurities in the water to sink below the upper edge of the baffle plate which obstructs the passage of such impurities to the propeller 59. The impurities are collected immediately in rear of the baffle plate as indicated at 61 and drained through a pipe 62 to a filter 62', and thence pumped back to the tank through pipe 71.

A pipe indicated at 64 which may be connected with a city water supply or the like, leads to another filter 63, and the filtered water passes through a pipe 65 to a float chamber 66 located at one side of the freezing tank 26. The float chamber 66 is provided with an opening 67 into the tank 27 by means of which the float chamber 66 and tank 27 are in constant communication. Since the tank 27 and cans 28 are also in constant communication, the level of the water in the cans may be maintained by the float 67' in the float chamber 66, thereby constantly maintaining the water in the cans 28 at the proper level and at exactly the same level in all of the cans.

A set of expansion coils 68 is disposed within the space on each side of the cans 28, preferably three of such coils being controlled with one expansion valve as 69. The coils consist in all of ten lengths each, which extend for the full length of the cans 28, being looped and returned at each end of the freezing tank 26 as clearly shown in Figure 2. As ammonia flows through the expansion coils 68 the liquid evaporates increasing the amount and velocity of the gas and to prevent pressure drop and loss I employ one-inch piping for the first four lengths, one and one-quarter inch for the next three lengths, and one and one-half inch for the last three lengths of each coil. Each pipe therefore almost completely fills the space between the can walls which must taper to facilitate ice removal. The ammonia passes from the last length of each coil to a common pipe 70 which leads through an opening 71 into a shell 72 which is disposed in the water tank 27 and extends from end to end thereof through the baffle plate 56. A suction pipe 73 is provided with two branches 74 entering the side of the shell 72, through which pipes 74 and 73 the ammonia is returned to the engine room 25 to be condensed and returned as liquid to the expansion valves 69. To support the coils 68, I provide in certain of the grooves 47, preferably alternate ones, vertically extending bars 50, provided with lateral openings 49, for the passage therethrough of the bolts 51, one of the tie bolts being disposed beneath each length of the coil 68.

Disposed within the shell 72 are a plurality of brine tubes 75 which open at their rearward ends into an inlet chamber 76 disposed in the extreme lower and rearward portion of the water tank 27. The opposite ends of the tubes 75 open into an outlet chamber 77 formed exteriorly of the forward wall of the tank 27. Disposed within the outlet chamber is a propeller 78 which is mounted on a shaft 79 having a suitable connection with the engine room 25 for the rotation of the propeller. The brine is drawn by the propeller 78 through the tube 75 into a relatively large pipe 80, through which it may be conducted to an opposite tank where it will be subdivided to pass between the walls of 12 cans of the opposite tank whence it will flow through a passage similar to 84, 83 and 85 back through a brine cooler similar to 72 and drawn by another propeller similar to 78 and back to pipe 81 where it is subdivided to pass through 12 cans of the first tank. Thus if any propeller should stop the opposing propeller keeps the brine in circulation. if any brine cooler or pipe coil fails refrigeration is maintained at almost full capacity.

The cold brine is fed to the freezing tank 26 through a header 81, which is common to and coextensive with 12 cans in the tank. From the header 81 the brine is fed through short valve controlled pipes 81' to four compartments 82, each of which is connected with the spaces surrounding three of the cans 28. The brine is forced through the spaces surrounding the cans under a slight head to eliminate air therefrom and passes into a header 83 common to all the cans 28 and located exteriorly of the rear wall 33 of the freezing tank 26. The header 83 has a valve controlled inlet 84 for each set of three cans and has one outlet 85 leading to the inlet chamber 76 to the brine tubes 75, from where the brine is again subjected to the action of the propeller 78.

The brine is slightly colder where it enters the spaces between the cans 28 at the forward ends thereof causing premature freezing at the forward ends of the cans, thereby freezing the inlet water opening first which prevents flooding over of the low end of ice as would occur if exit opening froze first. As clearly illustrated in Figures 11 and 12, an insulating plate 86 is disposed be-

tween the coils 68 and the lower part of the cans at both openings 52 and 54, so that the passages will remain open and permit water circulation until the core at the top is almost frozen.

Disposed above the header 81 in parallel relation thereto is a warm brine header 87, from which warm brine is fed through short pipes 88 to the brine compartments 82. The short pipes 88 are disposed at one side and over the short pipes 81′ and are controlled by a valve 89. Disposed horizontally of the rear wall 33 of the tank 26 is a warm brine return pipe 90 which is connected with a short pipe 91 for each set of three cans, each of which short pipes may be controlled by a valve 92 if desired. The pipe 90 extends slightly beyond one side 45 of the freezing tank 26, and through the rearward end wall of the float chamber 66. Within the float chamber 66, the pipe 90 is divided into a plurality of tubes 93 which extend through the water in the float chamber to a point adjacent the forward walls of the latter where the tubes 93 are reassembled into the single pipe or header 87 which passes through the forward wall of the float chamber 66 for extension along the forward wall of the freezing tank 26 as above described. Suitable means is provided for the circulation of the warm brine such as a centrifugal pump or the like.

I provide a cover for each of the cans 28 which consists of a top portion 94, preferably of wood, which rest on the upper edges of the end walls 29 and side walls 30 of the can, and a lower insulation portion 95, preferably of balsa wood, which is secured to the under surface of the top portion and fits snugly between the end and side walls of the can. A plurality of suitably spaced longitudinal slots 96 are formed through the cover portions 94 and 95 and at the slotted points, the portions 94 and 95 are divided into sections 97 having offset abutting faces 98. Before the freezing operation the split straight shank 99 of a lifting hook is inserted through each of the slots into the water in the can. The protruding portion of the hook is in the form of an eye 100, having an insulated portion 101, thereby adapting the shank 99 as an electric conductor between opposing side portions of the eye 100 when said portions are connected with any suitable electrical source.

Disposed in parallel relation to the transverse horizontal plane of the freezing tank 26 at a suitable distance above the top of said plane and spaced outwardly from the ends 33 and 34 of the tank, is a pair of tracks 102, each carrying a pair of rollers 103. The rollers 103 are provided with spindles 104, which are journaled into the respective ends of a beam 105, adjacent the sides of the beam. The beam 105 is supported in parallel relation to the longitudinal, horizontal plane of the tank 26 and may be moved between the vertical planes of the sides 45 at will. Carried by the beam 105 is a plurality of spaced pulleys 106, each being adapted to have passed thereover a cable 107. A plurality of pinions 108 and gears 109 is also carried by the beam 105, the gears being provided with drums 110 for the winding thereon of the cables 107. Secured to the free ends of the cables 107 are hooks 111 for engagement with the respective eyes 100 of the lifting hooks having their shanks 109 frozen in the ice. The hooks 111 are formed with helical springs 112, in order that a yielding pull may be exerted on the ice cakes. Each of the pinions 108 is actuated by a conventional motor, not shown, the motor being equipped with a cut-off switch of any well known construction, whereby the motor may be adapted to carry a predetermined load and automatically stop when the load is increased.

In the operation of my apparatus, water is admitted through the float chamber 66 to the tank 27. When the water rises over the baffle plate 56, it is drawn by the propeller 59 into the inlets 52 to the cans 28, and flows through the outlets 54 back into the tank 27. The float 67′ in the float chamber 66 is set to maintain the water in the float chamber at a predetermined level and when the water in the cans 28 reaches the same level as that in the float chamber, the supply to the float chamber is cut off by the float 67′, thereby constantly maintaining the water in all the cans at exactly the same level, preferably two inches below the brine level on the outside of the cans, whereas in all other ice making operations the water level rises during freezing and causes unagitated water to overflow the top of the formed ice and come suddenly in contact with the cold can wall making white tops. In this system the level never rises; due to continuous pulling of ice and continuous readjustment of the water level in all cans by the inlet float valve.

At the beginning of the freezing operation, cold brine is admitted from the header 81 into the freezing tank 26, where it circulates around the sides and ends of the cans 28 to the header 83 in the rear of the tank, thence to the inlet chamber 76 for the brine tubes 75.

At the same time that the cold brine is admitted to the tank 26, ammonia is admitted through the expansion valves 69 into the expansion coils 68. The coils 68 pass between the sides 30 of the cans 28 through the brine in the tank 26 and empty into the shell 72 disposed in the water tank 27. After cooling the brine tubes 75 in the shell 72, the ammonia is sucked through the pipes 74 and 73 to the engine room 25 to be condensed and returned to the expansion valves 69.

The brine enters the tubes 75 from the inlet chamber 76 where it is re-cooled by the ammonia in the shell 72, and is drawn by the propeller 78 into the outlet chamber 77

and forced through the pipe 80 back to the header 81 or to corresponding cans in an adjoining tank where two or more tanks are used. The brine is kept constantly circulating and is admitted to the tank 26 under a slight head to expel all air therefrom, thereby preventing corroding of the metal within the tank and keeping the cans cold for the entire height thereof.

The formation of the ice within the cans starts at the sides of the latter and is facilitated by the grooves 47 formed in the outer surfaces of the cans, which permit a greater surface of the can sides 30 to be attacked by the cold brine and bring the surface nearer the center of the ice, thus decreasing the ice thickness, carrying the heat away, and so greatly accelerating the freezing. Due to rapid circulation of brine and direct expansion coils the freezing time for the entire length of the cans is practically the same, however, the inlet 52 closes slightly in advance of the outlet 54, preventing flooding of the lower end of the can as would happen if outlet closed first. The cans slope approximately an inch and a half to correspond with the water head necessary to produce a rapid flow of water, across the can. The circulation also removes the air bubbles which cling to the ice surface.

When the ice is completely formed, it is preferably pulled from the cans in sets of three. Before pulling the ice, the ammonia valve 69 for the set to be pulled is closed and the ammonia in the coils 68 allowed to drain off to the shell 72. The valve to the header 82 for the set to be pulled is closed and the cold brine shut off. Then the warm brine valve for the header 82 is opened and warm brine is circulated around all surfaces of the cans and out at the rearward end to the pipe 90. The warm brine is cooled by the cold interior of the tank 26 so it is piped through the tubes 93 located in the float chamber 66, where the brine is warmed before being returned to the header 87 and at the same time the water in the float chamber is cooled before being passed to the tank 27.

The operation of valves for pulling one set of 12 cans is shown in Figure 1. The ice in the three cans fed by valves 151 and 152 have just been pulled, the warm brine valve 151 is closed and cold brine valve opened to start freezing of the fresh water which entered the cans as the ice was pulled. In the adjoining tanks governed by the valves 153 and 154, the warm brine is running through valve 154. The first of the three cakes has been pulled before admitting the cold brine to the adjoining chamber since one wall of this cake is part of the adjoining cans brine passage. The handle of the valve 153 is shown down indicating the cold brine shut off. The handle of valve 154 is indicating warm brine entering. At the opposite ends of the cans no valves are essential since if brine flows in from one supply it must flow out to the same supply or the brine levels in the two supplies would vary forcing this to happen. Valves 155 and 156 like wise show the warm brine to be flowing and the cold brine 156 shut off. The operator has just started to thaw these cans. The numeral 157 shows the cold brine still flowing in the next set but the expansion valve 69 has been closed giving a chance for the liquid ammonia in the pipes to drain or be evaporated before entering the warm brine around them. The thawing operation takes about 2 hours and is so gradual as to never injure the ice. In a plant of 120 cans one set of cans is pulled every 50 minutes so that there are no long waiting periods and corresponding peak loads on the motors large quantities of warm water are admitted at once.

After the circulation of the warm brine through the tank 26 has loosened the ice cakes from the inner surfaces of the cans 28 sufficiently to enable the cakes to be pulled, the cables 107 are lowered and the hooks 111 are engaged with the eyes 100 of the shank 99 which have been frozen in one of the ice cakes. The cable actuating motor is then started and if the cake is not sufficiently loosened from the can to permit its removal without damage to the can the motor is stopped by a switch opened by excess stretch of spring 112. When the ice cake is loosened a sufficient degree the ice floats up and the springs collapse, the motor automatically starts and the cake is removed from its can with the cover sections 97 resting on the cake. The springs 112 formed in the hooks 111 break the electric contact for the hoist motor when the stretch caused by the ice clinging to the side walls is too great. As soon as the cake clears the can, the cover sections 97 may be removed from the cake and replaced on the can.

The engine room 25 may be equipped with suitable means for moving the beam 105 with its depending ice cake to a truck, car, platform, or storage room, as desired. After the cake has been deposited where desired, suitable electric terminals may be connected to the side portions of the eyes 100 to loosen the shanks 99 to permit their ready removal from the ice, or if desired, the shanks may be loosened by applying hot water thereto. When the cakes are to be shipped by truck to distant distributing stations, a number of them may be handled as one by passing a bar or the like through the eyes 100 protruding from the respective cakes. In this manner the cakes may be kept together and the loss due to breakage greatly reduced.

In the modification illustrated in Figures 8, 9, and 10, the cans 113 are formed with

rounded corners 114 to form an ice cake as illustrated in Figure 14.

In one form of my invention, a header 115 is provided in the forward end of the freezing tank 116, by means of which cold brine may be supplied to the spaces surrounding a set of cans, preferably three in number. The header 115 is provided at its bottom with an inlet 117, which is controlled by a valve 118, having a valve rod 119 extending upwardly through the tank. A similar header 120 is provided at the rearward end of the tank 116 having a similar valve 121 and valve rods 122 for controlling the outlet 123 to the brine chambers located under headers 115 and 120.

A warm brine header 124 extends along the entire width of the tank 116 at the forward end thereof which has valve controlled outlets 125 leading into tank ends 115 and a pipe opening at end of pipes 126. Opening the outlet 125 also uncovers the end of pipe 126 so that brine will circulate through pipe 126 only when warm brine outlet 125 is open and the pipes leading from 126 will therefore do no freezing but will loosen the ice from the bottom of the can when the thawing is turned on to loosen ice from side walls. The pipe 126 extends into the header 115, where it is divided into a pair of branch pipes 127 which extend downwardly through the bottom 128 of the tank 116 and extend longitudinally of the tank in contact with the lower surface of said bottom and empty into the header 120 at the rearward end of the tank. The branch pipes 127 are disposed in spaced relation and in their disposition along the bottom 128, one of the branch pipes 127 is adjacent each side of one of the cans 113. Each of the branch pipes 127 is tapped by a connection pipe 129 and each of the pipes 129 is divided into two branch pipes 130 which lead to the header 120 in the same manner as the pipes 127, being disposed under cans adjacent to the can over the pipes 127. A valve controlled outlet 131 leads from the header 120 to a warm brine return pipe 132.

The operation of the modified form of my invention is the same as that above described in connection with the first form described except with regard to the circulation of the cold and warm brine. During the freezing operation in the modified form the valves 118 and 121 are left open and the cold brine circulates continuously between and around the tanks 113, entering through the inlet 117 and leaving through the outlet 123.

When it is desired to loosen the ice cakes from the cans prior to pulling the cakes, the valves 118 and 121 are closed. Warm brine is then let into the header 115 where it flows between cans to header 120 and also into the pipe 126, whence it flows through the pipes 127, 129, and 130 to the header 120 at the rearward end of the tank and thence to return pipe 132. Thus it will be seen that, due to being conducted through the pipes contacting with the under surface of the bottom of the cans, the warm brine attacks the bottom of the ice cakes to release the bottom as well as sides.

Due to the great ease of pulling and handling this ice it may be made in thinner blocks than standard without excess labor for additional pieces. This in turn greatly increases the output of a given size plant and moreover makes possible symmetrical dimensions for the small size pieces. Thus a piece measuring 9½ x 10¼ x 10½ is substituted for the present piece, measuring 11¼ x 11 x 6⅞″ which weighs 20% less but will not go into the small ice boxes without lots of time lost in chipping and which melts quickly when put in due to the thin section. As the bulk of the trade requests the smallest piece available and as the expense of the ice consists mostly of putting the ice in the box, a more expensive piece which requires less work and time to install is highly desirable to the manufacturer as well as giving more service to the consumer by lasting over to the next filling time. In the shape used in this system the thinnest section of the final ice cut constitutes the thickness of the whole block so that time, space, cans and power are not wasted in freezing ice to a great thickness and then cutting it off in thin slices.

It is to be understood that the forms of my invention herewith shown and described are to be taken as preferred examples of the same and that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, each of said cans having its bottom formed with an opening adjacent each end thereof, means for continuously circulating water to enter each can through the opening at one end thereof and to leave the can through the opening at the other end thereof, and means for continuously circulating a cooling medium within the tank to surround the cans.

2. An ice making apparatus comprising a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank located under the freezing tank, each of said cans having its bottom provided with an outlet opening and an inlet opening respectively disposed adjacent opposite ends of the cans to establish communication between the water tank and cans, mechanical propelling means for circulating water through the water tank into the inlet openings, through the cans, and out of the outlet openings, and means in the water tank and between the out-

let and inlet openings for the cans for obstructing the passage of impurities through the water tank.

3. An ice making apparatus comprising a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank located under the freezing tank and provided with openings into the bottom of the cans adjacent each end of the latter, and a propeller in the water tank to continuously circulate water into the openings at one end of the cans and out of the openings at the other end of said cans.

4. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank located under the freezing tank and provided with openings into the cans adjacent the ends of the water tank and cans, mechanical propelling means for circulating water from one end of the water tank into one end of the cans and from the other end of the cans into the water tank, and a baffle plate disposed transversely of the water tank between said openings.

5. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank having its interior in communication with the interior of the cans, mechanical propelling means for circulating water continuously through the cans and water tank, a cooling medium receptacle located in the water tank and having its interior in communication with the interior of the freezing tank, and means for continuously circulating a cooling medium through the receptacle and freezing tank to freeze the water in the cans and chill the water in the water tank.

6. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank having its interior in communication with the interior of the cans, mechanical propelling means for circulating water continuously through the cans and water tank, a shell located in the water tank, and a series of ammonia expansion coils disposed between the cans and emptying into the shell.

7. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank having its interior in communication with the interior of the cans, mechanical propelling means for circulating water continuously through the cans and water tank, a shell located in the water tank, a series of ammonia expansion pipes disposed between the cans and emptying into the shell, a brine receptacle disposed within the shell and having its interior in communication with the interior of the freezing tank, and means for continuously circulating brine through the receptacle and freezing tank.

8. An ice making apparatus comprising a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank in communication with opposite ends of the cans, mechanical propelling means for continuously circulating water through the water tank and cans, a cooling medium receptacle located in the water tank and having its ends respectively in communication with opposite ends of the freezing tank, and a propeller in one end of the receptacle to continuously circulate a cooling medium through the receptacle and freezing tank.

9. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, mechanical propelling means for continuously circulating water to enter the cans adjacent one end thereof and leave the cans adjacent the other end thereof, means for continuously circulating brine to enter the freezing tank at one end thereof and leave the tank at the other end thereof, means acting on the brine within the freezing tank to freeze the water within the cans, and means acting on the brine outside of the freezing tank to cool said brine and chill the water outside of the cans.

10. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank located under the freezing tank and provided with openings into the bottoms of the cans adjacent the ends of the latter, means for freezing water within the cans, mechanical propelling means for rapidly circulating water through the water tank, into the opening at one end of the cans and out of the opening at the opposite end of the cans to wash any impurities precipitated by the freezing water into the water tank, means for confining the impurities in the water tank to a portion of the water therein, means for withdrawing said portion of the water from the water tank to be filtered, and means for returning the filtered water to the water tank.

11. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein and adapted to hold a cooling medium forced therein under a head, a water tank located under the freezing tank and provided near its ends with openings into the bottoms of the cans at opposite ends of the cans, mechanical propelling means for continuously circulating water through the water tank and cans and through said openings, and means connecting the water tank with an external water supply to maintain a constant uniform water level in all of said cans below the cooling medium level in the freezing tank.

12. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank disposed beneath the freezing tank, each of said cans having its bottom provided ad-

jacent each end of the can with an opening into the water tank, means for continuously circulating water through the water tank and cans, and a float chamber connecting the water tank with an external water supply to maintain a constant and uniform water level in all of said cans.

13. An ice making apparatus comprising, a water tank and a freezing tank disposed in superposed relation, a plurality of cans disposed in spaced relation within the freezing tank, the top of the water tank and bottom of the freezing tank and cans all being common, a channel bar seated on the bottom and having its sides secured to opposing sides of adjacent cans, an angle iron disposed beneath the freezing tank bottom, and extending beyond the opposed sides of adjacent cans, means for forcing the channel bar and angle iron toward each other, and legs supporting the angle irons on the bottom of the water tank.

14. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, and an insulated cover for each of the cans, said covers being formed of separable sections and being provided with longitudinal slots at the joinders of said sections.

15. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, the bottom of the cans being formed with openings adjacent the ends thereof, means for continuously circulating water through the cans into and out of the openings, means for continuously circulating a cooling medium between adjacent cans from one end to the other of the spaces between the cans, means for re-cooling the cooling medium between successive entrances between the cans, and insulating plates within said spaces to hold the cooling medium out of contact with the cans adjacent the openings in the bottom thereof.

16. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, means for circulating water through the cans, means for circulating a cooling medium between the cans to freeze the water within the cans into cakes of ice, means for circulating a thawing medium between and under the cans to loosen the cakes of ice from the inner surfaces of the cans, and means for exerting a constant pressure on said cakes of ice during the thawing operation to automatically remove the cakes when they are loosened from the inner surfaces of the cans.

17. An ice making apparatus comprising a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank located under the freezing tank and provided with openings into the bottom of the cans adjacent each end of the latter, a propeller in the water tank to continuously circulate water through the water tank and cans into the openings at one end of the cans and out of the openings at the other end of said cans, means for circulating cold brine between the walls of the cans to freeze the water, and means for circulating warm brine therebetween to thaw the ice.

18. An ice making apparatus comprising a freezing tank having a plurality of cans disposed in spaced relation therein, a water tank located under the freezing tank and provided with openings into the bottom of the cans adjacent each end of the latter, and a propeller in the water tank to continuously circulate water into the openings at one end of the cans and out of the openings at the other end of said cans, means for circulating cold brine between the walls of the cans to freeze the water, and means for circulating warm brine therebetween and under the cans to respectively thaw the sides and bottom of the ice.

19. An ice making apparatus comprising a freezing tank and a plurality of cans disposed in spaced relation therein, said cans having downwardly tapering sides provided with inwardly pressed in portions to form projecting ribs within the cans extending vertically for the entire height of the cans and to form corresponding, oppositely disposed lateral extensions to the spaces between adjacent cans, a coil disposed between adjacent cans, vertical supports disposed within the oppositely disposed lateral extensions of certain of said spaces, and tie bolts connecting said supports in pairs and supporting said coils.

20. An ice making apparatus comprising, a freezing tank having a plurality of cans disposed in spaced relation therein, the bottoms of the cans being formed with openings adjacent the ends thereof, means for continuously circulating water through the cans into and out of the openings, means for continuously circulating a cooling medium between adjacent cans from one end to the other of the spaces between the cans, means for re-cooling the cooling medium between successive entrances between the cans, a coil within each space between the cans for cooling the cooling medium within the space, and an insulating plate disposed between each coil and a side of each adjacent can adjacent each opening in the bottom of the latter.

In testimony whereof, I affix my signature hereto.

DOUGLAS K. WARNER.