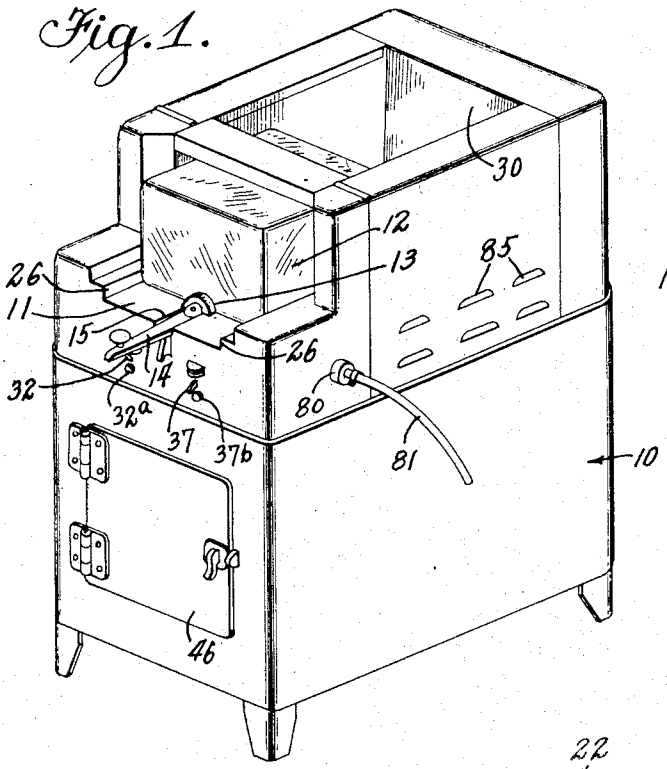
Nov. 3, 1942. R. B. PERRY 2,300,699

ICE-CUTTING MACHINE

Filed May 3, 1940 3 Sheets-Sheet 1

Fig. 1.



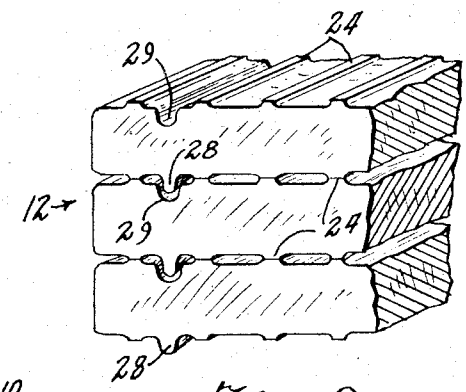


Fig. 9.

Fig. 7.

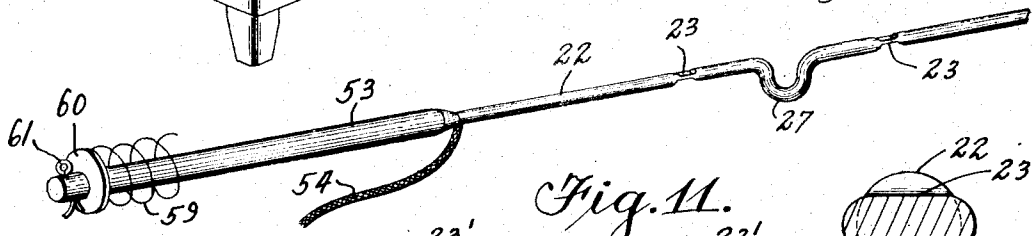


Fig. 11.

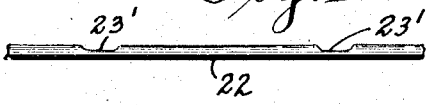


Fig. 8.

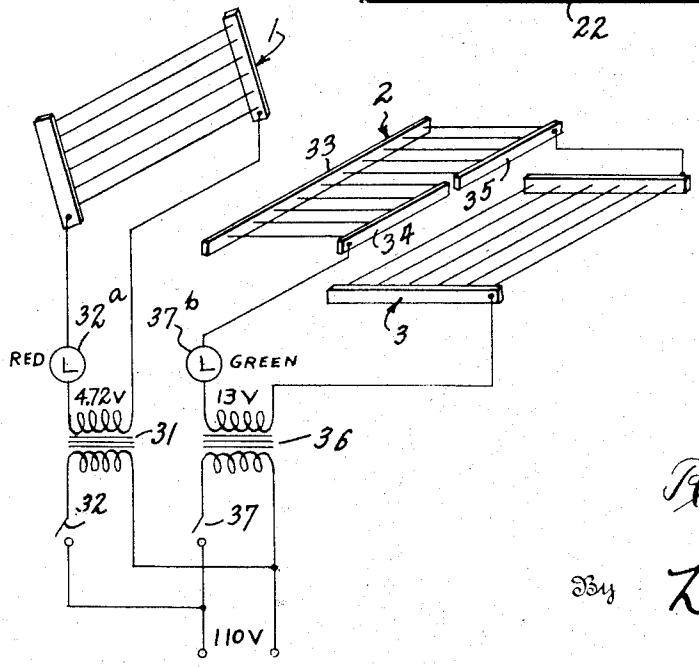


Fig. 10.

Inventor

Robert B. Perry

By Lyon & Lyon

Attorneys

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ICE-CUTTING MACHINE

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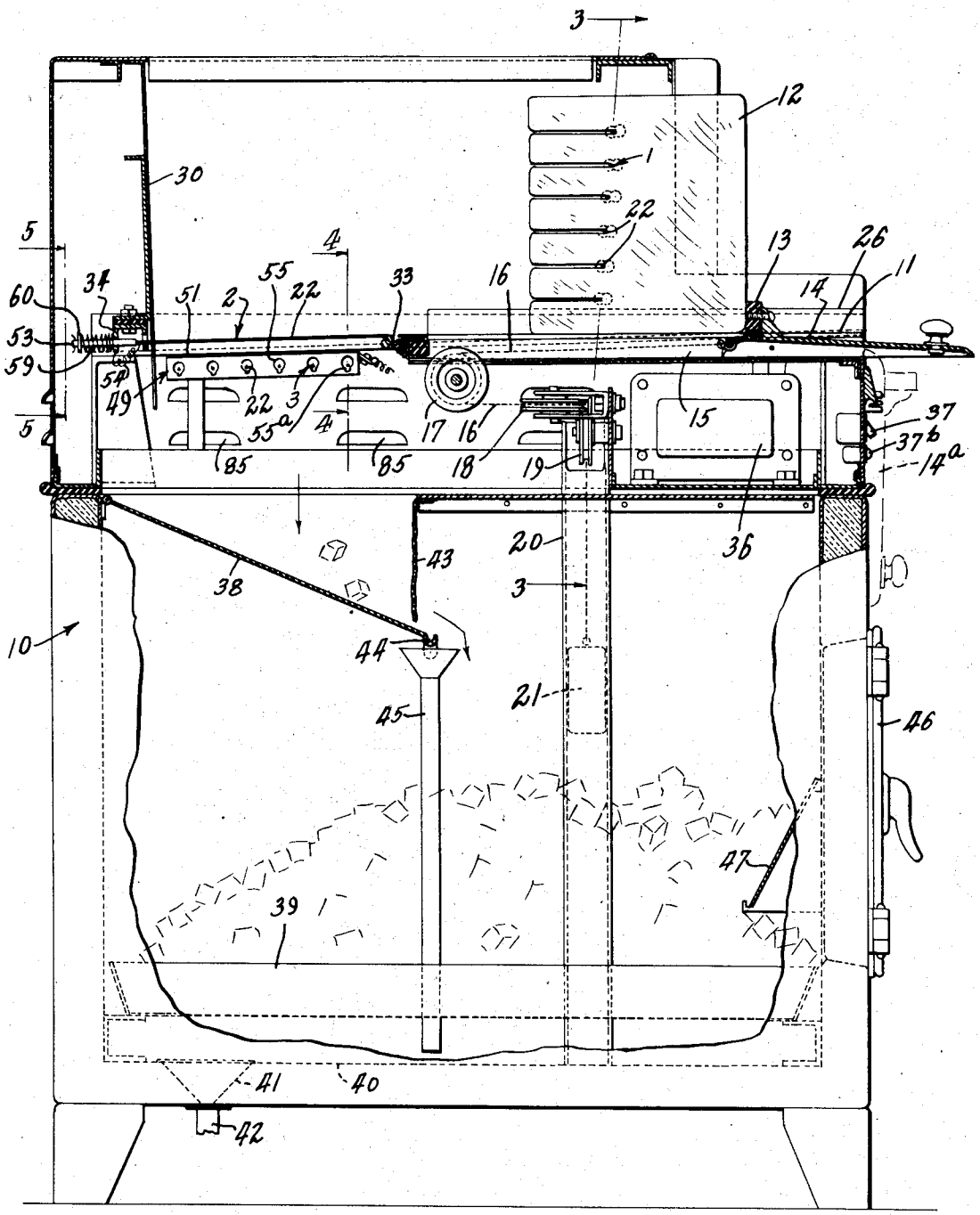


Fig. 2.

Inventor
Robert B. Perry

By Lyon & Lyon

Attorneys

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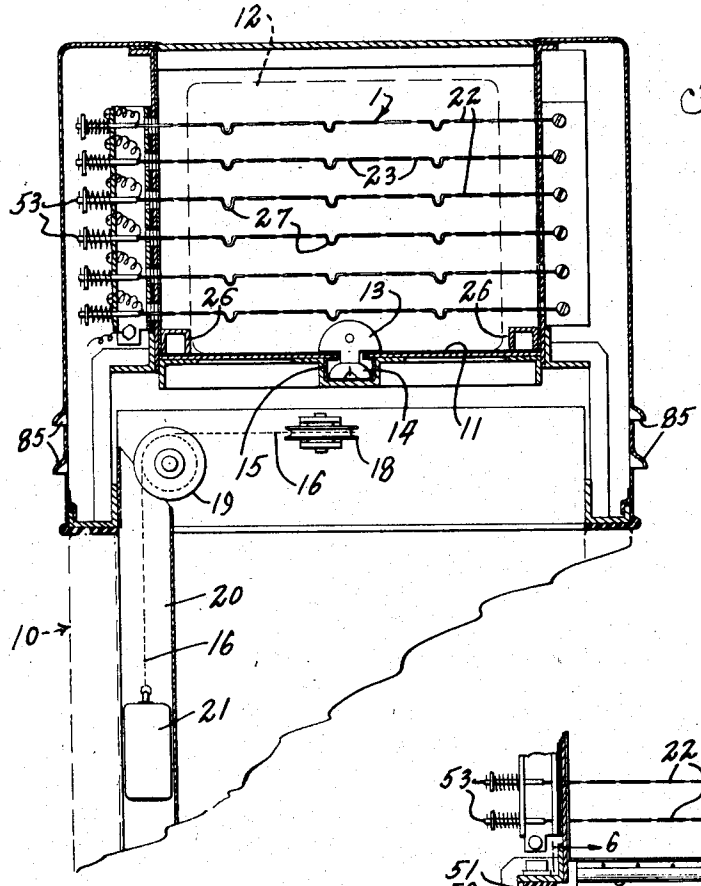


Fig. 3.

Fig. 6.

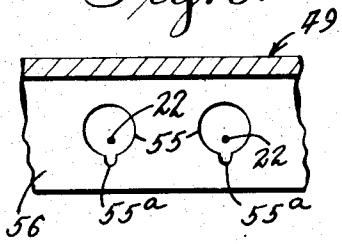


Fig. 4

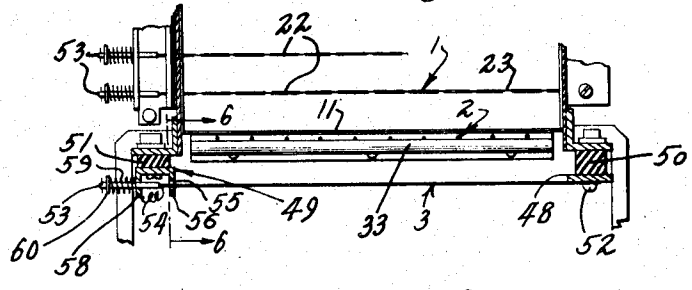
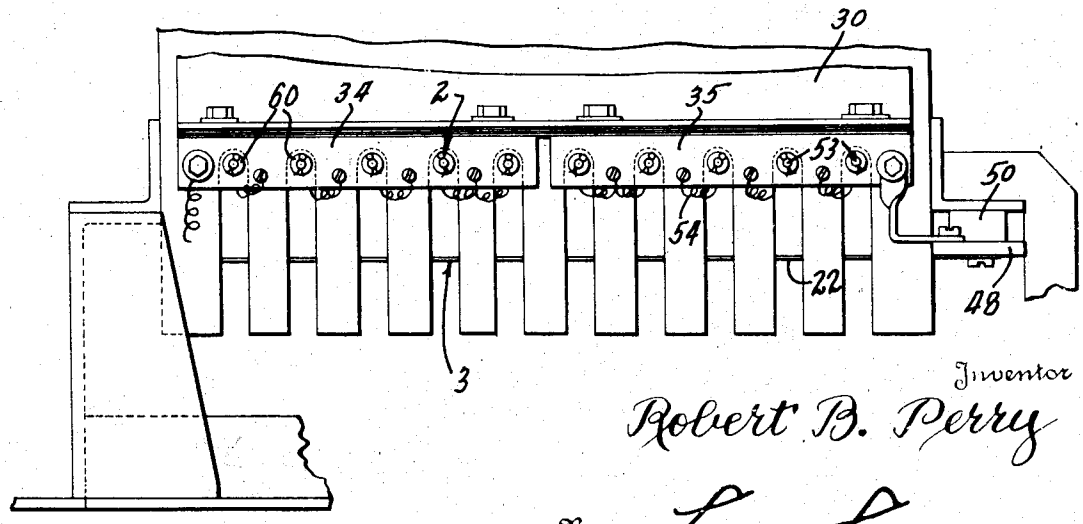


Fig. 5.



Inventor

Robert B. Perry

By Lyon & Lyon

Attorneys

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UNITED STATES PATENT OFFICE

2,300,699

ICE-CUTTING MACHINE

Robert B. Perry, West Los Angeles, Calif., assignor to M. & H. Manufacturing Co., West Los Angeles, Calif., a corporation of California

Application May 3, 1940, Serial No. 333,126

7 Claims. (Cl. 219—19)

This invention relates to devices for cutting ice with heated wires, or the like, and is particularly useful in cutting large cakes of ice into cubes for use in beverages.

Ice-cutting machines of this general type employing heated wires or rods as the cutting elements have been employed before, but a frequent defect of such machines has been that the ice refroze along the cut surfaces, causing the pieces to stick together.

An important object of the present invention is to reduce the sticking of the cut pieces of ice by refreezing along the cut surfaces.

Another object is to improve the durability and reliability of hot wire ice-cutting machines.

Still another object is to reduce wastage of ice by melting, in an ice cubing machine of the hot wire type.

In accordance with the invention, the first-mentioned object is achieved by flattening the cutting wires or rods at spaced intervals along their lengths so that the juxtaposed surfaces produced by the cut are not complementary to each other and therefore do not contact over their entire surfaces; instead, they only contact along ridges or lands left by the flattened portions of the cutting wires.

The manner in which the other listed objects are achieved, together with minor objects and features of the invention not specifically listed, will appear from the following detailed description of a specific embodiment of the invention, as disclosed in the drawings.

In the drawings:

Fig. 1 is a perspective view of a machine in accordance with the invention;

Fig. 2 is a side elevation view of the machine with parts broken away to disclose the interior construction;

Fig. 3 is a cross section taken substantially along the line III—III of Fig. 2;

Fig. 4 is a cross section taken substantially along the line IV—IV of Fig. 2, but showing a modified construction;

Fig. 5 is a cross section taken substantially along the line V—V of Fig. 2;

Fig. 6 is a cross section taken substantially along the line VI—VI of Fig. 4;

Fig. 7 is a perspective view of an end portion of one of the heating wires or rods of the machine;

Fig. 8 is a detailed cross section through one of the heating wires or rods;

Fig. 9 is a perspective view of a portion of a stack of ice slabs as produced in the machine;

Fig. 10 is a schematic diagram showing the electrical connections to the different grids of the machine; and

Fig. 11 is a side view of a modified type of cutting rod.

Referring first to Fig. 1, the machine therein disclosed comprises a housing generally designated 10, having a runway or chute 11 for receiving a cake of ice 12 to be cut into cubes. The cake 12 is urged along the chute 11 by a pusher member 13 which engages the lower rear edge of the ice cake and presses it forwardly. The pusher 13 is mounted on a carrier 14 (Fig. 2), which travels in a groove 15 in the chute 11. The carrier 14 is yieldably urged forwardly by a cable 16 which extends around pulleys 17, 18 and 19, respectively, into a well 20 in one wall of the machine, where it connects to a weight 21.

The pusher 13 is preferably of some material having relatively low heat conductivity so that it does not unduly melt the ice cake at the point of contact therewith.

When the machine is not being used, the carrier 14 is retracted past the end of the groove 15 and permitted to hang vertically against the front wall of the machine, as shown in dotted lines at 14a in Fig. 2.

The cutting elements of the machine consist of a first grid 1, a second grid 2, and a third grid 3, the ice passing through these grids in the order in which they are mentioned and emerging in the form of cubes.

The grid 1 has a plurality of vertically spaced, horizontal cutting rods 22, positioned in the path of a cake of ice pushed along the runway 11 to cut the cake into a plurality of horizontal slabs, each slab having a thickness equal to the dimension of the cubes to be formed. It will be observed from Fig. 2 that the plane of the grid 1 is inclined at an angle slightly less than 90° to the chute 11, on the input side, (the right side in Fig. 2) so that the upper wires of the grid are positioned slightly in advance of the lower wires, and if the cake of ice is substantially rectangular in cross section, the lower wire or rod of the grid will be the last one to cut through the cake. This is important because the force moving the cake past the grid 1 is derived from the pusher 13 which bears against the lower edge of the cake on that portion of the cake which becomes the bottom slab when the lowermost rod has cut through the cake. Obviously, if the bottom slab were cut free before the upper slab were completely cut, the pusher 13 might carry the bottom slab out

from under the upper slabs, leaving the latter hanging on the rods of grid 1.

Obviously, after the cake of ice has passed the first grid and has been completely cut into slabs, these slabs lie upon each other in a vertical stack and it sometimes happens that the slabs, or some of them, are refrozen together along their cut faces. Furthermore, if they do not actually freeze together, they sometimes cohere together with substantial force when the juxtaposed cut surfaces are exactly complementary to each other so that they contact intimately over a large area.

In accordance with the present invention, the described defects of prior machines are substantially eliminated by employing cutting wires or rods of such shape that the contacting surfaces of adjacent slabs are not complementary to each other and therefore cannot contact over very large areas. Thus, referring to Figs. 3 and 7, each of the grid rods or wires 22 has flattened sections 23 at intervals therealong which produce lands 24 in the cut surfaces of the ice slabs, as clearly shown in Fig. 9. It is obvious from Fig. 9 that the slabs can contact each other only at the lands 24, since the remaining portions of the adjacent surfaces are relieved with respect to the lands 24. It will be understood that the view of Fig. 9 is greatly exaggerated to emphasize the lands 24. Actually, it is necessary that the lands stand only a very slight distance above the general surface of the slabs, and the height may be of the order of a sixteenth or a thirty-second of an inch, in the case where the grid wires 22 are of 14-gauge.

The machine shown in Figs. 1 and 3 has a curbing 26 on each margin of the chute 11 to guide the cake along the chute. This curbing 26 is of such a height as to engage only the lowermost slab after the cake has passed the first grid. It is, therefore, sometimes desirable to eliminate any tendency of the upper slabs to slide laterally after they have all been cut free. An effective way of preventing such lateral sliding of the slabs is to cut cooperating longitudinal tongues and grooves in the connecting surfaces of the slabs so that they are restrained against lateral movement. The tongues and grooves can be readily formed by providing loops 27 (Fig. 7) in the cutting wires 22. As shown in Fig. 3, three loops 27 are provided in each cutting wire. However, a lesser number may be sufficient. Fig. 9 illustrates how the loops 27 form tongues 28 and grooves 29 in the slabs, the tongues nesting in the grooves so as to prevent lateral sliding motion.

It is desirable to prevent lateral sliding motion of the slabs on each other to keep them out of contact with the side walls of the chute, since contact usually increases the loss by melting.

However, if desired, the curbing 26 can be eliminated, as shown in Fig. 4, so that the sides of the ice cake contact the side walls of the chute from top to bottom. Under such circumstances, there is no particular occasion for forming the tongues and grooves in the ice slabs to prevent lateral sliding and the grid wires can be formed without loops, as shown in Fig. 4.

When all the wires of grid 1 have melted their way through the cake of ice, the latter is propelled along and off the chute 11 onto the second grid 2 by the pusher 13. The pusher 13 does not carry the ice all the way onto the second grid 2, being stopped short thereof by the end of the groove 15. However, the stack of ice slabs acquires sufficient momentum to carry it fully onto the second grid 2, after it leaves the pusher 13. To insure that the stack of slabs will not slide rearwardly off the second grid 2, the latter is inclined by a very slight angle from the horizontal. Forward motion of the stack of slabs is prevented by contact with an end wall 30. As will be described later, a separate heating circuit is provided for the first grid, but the second and third grids are in a common circuit and are heated simultaneously. Initially, current is supplied only to grid 1, until the ice cake is cut into slabs and delivered onto the second grid 2. Thereafter the current may be cut off the first grid and applied only to the second and third grids. The stack of slabs is then urged downwardly through the second and third grids by gravity as the grid wires melt their way through the slabs.

However, if it is desired to operate the machine to the limit of its capacity the current is left on both the vertical and the horizontal grids and another cake of ice is placed in the chute 11 as soon as the first cake has passed through the first grid. If the second cake is passed by the first grid before the first cake has passed through the second grid, then passage of the second cake onto the second grid is blocked by the first cake and the latter is retained on the chute 11 between the first grid and the second grid until the first cake has passed downwardly and out of the path of the second cake, whereupon the latter is immediately moved onto the second grid by the pusher 13. By repeatedly supplying additional cakes to the chute 11, as soon as the preceding cake has passed through the first grid, the machine may be kept working continuously at full capacity. If desired, the second and third grids can be heated to a higher temperature by increasing the energy dissipated therein to increase the rate of movement of the ice through the second and third grids relative to the rate of movement through the first grid so that ice will never be blocked in its passage through the first grid by a cake on the second grid.

Referring to the schematic circuit of Fig. 10, it will be observed that in the particular embodiment shown, the grid 1 has six wires, all connected in parallel and energized from a transformer 31 adapted to be connected by a switch 32 to the supply line. The transformer 31 is designed to provide a relatively low voltage, since the total voltage applied to the grid need overcome the resistance of only a single length of grid wire.

The second grid 2 has ten wires connected in two banks, but the third grid 3 has one bank of six wires. Thus all of the wires in the second grid are connected at one end to a common bus 33, but five of the wires are connected at the other end to a short bus 34, whereas the other ends of the remaining five wires are connected to a short bus 35. The second and third grids are energized from a second transformer 36, the total current output of which passes through the five wires of grid 2 that are connected to the short bus 34, then through the five wires connected to the short bus 35, and then through the six wires of grid 3, all in parallel.

Assuming that all of the wires in grids 2 and 3 were of the same diameter, the wires of the second grid would be heated to a higher temperature than the wires of the third grid, because of the greater current intensity therein. For reasons to be explained later, it is desirable to heat the wires of the third grid to a higher temperature than the wires of the second grid. I,

therefore, make the wires of the third grid of smaller diameter than those of the second grid, to increase the dissipation of energy in the third grid.

As shown in Fig. 10, the primary winding of the transformer 36 is adapted to be connected to the supply line by a switch 37.

As shown in Fig. 1, the operating handles of the switches 32 and 37 are mounted on the front wall of the machine, and pilot lamps 32a and 37b are mounted immediately below the switches to give a visual indication when the current is being applied to either grid. Electrical connection to the machine from any source of power can be completed by a plug 80 and cord 81, the plug 80 being inserted in a socket in the wall of the machine.

The reason for heating the third grid to a higher temperature than the second grid, is to insure that the ice will move through the third grid faster than it moves through the second grid, and thereby prevent piling up of the ice between the second and third grids. "Piling up" is objectionable, because it sometimes results in the freezing together of vertically superposed ice cubes emerging from the third grid.

It is also desirable, in order to prevent freezing together of the ice cubes, to space the third grid a distance below the second grid somewhat greater than the thickness of the slabs produced by the first grid. This causes the strips of ice emerging from the second grid to drop onto the third grid as they leave the second grid. This dropping sets up a certain amount of vibration, which tends to dislodge the cubes or strips that are cohering together.

As the ice cubes drop away from grid 3 (Fig. 2), they fall upon a sloping shelf 38, along which they slide into a receiving tray 39 in the bottom of the machine. The tray 39 has openings therein for the drainage of water resulting from melting of the cubes, which water is collected in a pan 40 and flows into a funnel 41, leading to a drain 42.

To reduce the free circulation of air in the ice chamber where the cubes accumulate, a curtain 43 may be provided adjacent the lower edge of the sloping shelf 38, as clearly shown in Fig. 2. The cubes displace this curtain as they slide along and off the shelf.

As the grid wires melt their way through the ice, there is considerable water produced, which water is collected by the sloping shelf 38. To prevent the water from running off the shelf 38 onto the pile of cubes on the tray 39, a gutter 44 is provided on the lower edge of the shelf, which gutter carries water flowing down the shelf to one side of the machine, and into a funnel-top drain tube 45, leading down to the pan 40.

Ice may be removed from the tray 39 through a door 46 in the front wall of the machine. A removable baffle 47 may be provided to prevent ice cubes falling out of the doorway when the door 46 is opened.

As has been explained with reference to Fig. 10, the wire or rod of each grid extends between a pair of buses which support and complete electrical connection to that wire independently of the other wires. A particular construction of grid that may be employed is disclosed particularly in Figs. 2, 3, 5 and 7.

Thus referring to Figs. 2 and 4, it will be observed that the third grid 3 comprises two parallel frame members 48 and 49 at opposite ends, respectively, of the grid. Each of these frame members is rigidly supported in the machine by attachment through insulation blocks 50 and 51, respectively. Each wire of the grid is bent into an eye at one end and secured to the frame 48 by a screw 52. At its other end, each wire is brazed to a larger end section 53 (Fig. 7) of material such as brass, having good electrical and thermal conductivity, and also has brazed thereto a flexible pigtail connection 54. The frame member 49 is of channel shape having relatively large holes 55 (Fig. 6) in its inner flange 56 for the passage of the grid wires and having smaller holes in its outer flange 58 for receiving the extensions 53. To tension the wires, a compression spring 59 is compressed between the outer flange 58 and a washer 60 on the rear end of each extension 53, the washer 60 being retained by a cotter pin 61 extended through an aperture in the extension 53. Each pigtail connection 54 is electrically connected to the frame member 49 so that practically all current flows from the wire to the frame through the pigtail connection, thereby eliminating any appreciable electrical heating within the extension 53 itself. This is advantageous in keeping the springs 59 cool, so that they do not lose their resilience.

As shown in Fig. 6, the openings 55 are of substantial diameter to facilitate insertion of the wires during installation. However, each opening 55 has a small recess 55a in its lower edge dimensioned to quite snugly receive the grid wire 22 when the latter is depressed by the weight of ice thereon. This provides good heat conduction between the wire and the flange 56, tending to conduct heat away from that portion of the wire which is not contacted by ice, and thereby prevent it from becoming overheated.

The construction of the second grid is the same as that of the third grid except that the frame member 33 corresponding to frame member 48 of grid 3 is specially shaped to offer no obstruction in the path of ice as it slides onto the wires of the second grid. The two short frame members 34 and 35 are of the same cross sectional shape as the frame member 49 of the third grid.

The details of construction of the first grid are the same as the third grid.

The rear wall 30 extends downwardly past the second and third grids, as clearly shown in Fig. 5, having slots aligned with the grid wires of the second grid.

As shown in Figs. 7, 8 and 9, the grid wire 22 is flattened by indenting it on both the top and the bottom, thereby producing lands on both contacting surfaces of the slabs, as shown in Fig. 9. This construction is satisfactory, particularly when the loops 27 are employed to prevent relative lateral shifting between the different slabs. However, a grid wire construction having all of the advantages of that shown in Figs. 7 and 8, without any of the disadvantages thereof, is shown in Fig. 11. In Fig. 11, the flat portions 23' are produced by indenting the wire only on the upper side, thereby leaving the lower edge of the wire perfectly straight. It will be apparent that if grid wires, such as those shown in Fig. 11, are employed, the upper surface of the slab cut by the wire will be perfectly flat and smooth, whereas the under surface of the next slab above will have lands cut therein, corresponding to the lands 24 of Fig. 9. Because of the fact that the upper surface of the lower slab is perfectly smooth, any lateral shifting of the slab there-

above cannot affect the spacing therebetween, whereas with the land arrangement shown in Fig. 9, the desired separation between adjacent slabs might be destroyed if sufficient relative lateral shifting occurred to carry the lands 24 on two adjacent slabs out of registration with each other.

Although the indentations 23 and 23' may be provided by removing some of the metal of the rod, as by cutting or grinding, it is preferable to form these indentations by pressing. Pressing is not only simpler and cheaper, but does not materially reduce the total cross sectional area of the flattened portion, since the material is bulged out horizontally, as shown in Fig. 8. It is desirable to maintain the full cross sectional area at the flattened portion to maintain electrical conductivity at the flattened portions and prevent excessive heating at those points. Excessive heating at the flattened portions would tend to produce excess meltage of ice, which would, in turn, tend to defeat the production of the lands on the ice slabs.

A certain amount of heat is dissipated by the end portions of the grid wires in grids 2 and 3, where these wires are not in direct contact with the ice. This tends to set up rising air current around the sides of the stack of slabs on these grids. In order to reduce the tendency for these ascending air currents to draw air from the storage chamber where the cut ice cubes are accumulated, and thereby set up circulation in that chamber, louvers 85 may be provided in the side walls of the cabinet immediately below the level of the third grid, these louvers admitting air to replace that which rises around the stack of ice slabs as the result of the heat wastage at the ends of the grid wires.

Although for the purpose of explaining the invention a particular embodiment thereof has been described in substantial detail, it is to be understood that various changes can be made in the particular construction shown without departing from the invention, which is to be limited only to the extent set forth in the appended claims.

I claim:

1. An ice-cutting device comprising a heated rod member adapted to melt its way through a cake of ice, with means for effecting relative movement between said member and a cake of ice as the member melts a path in the ice, in which the said rod member has sections of reduced thickness at spaced points therealong, whereby the two walls of the kerf cut in the ice by said member are non-complementary and are capable of contact only along the strips defined by the paths of movement of the reduced sections of said members relative to said cake of ice.

2. Apparatus as described in claim 1, in which said rod member is electrically heated by the passage of current therethrough, and said sections of reduced thickness are of increased width, whereby the cross sectional area and the electrical resistance are substantially unaltered.

3. Apparatus as described in claim 1, in which said sections of reduced thickness are flush with the remainder of the rod on one side, whereby one of the walls of the kerf cut by the rod is substantially smooth and the other wall has lands produced by the reduced section.

4. An ice-cutting device comprising a heated rod member adapted to melt its way through a cake of ice, with means for effecting relative movement between said member and a cake of ice as the member melts a path in the ice, in which said rod member has a loop section bent in a plane perpendicular to the direction of relative movement of the ice and rod member, whereby it produces a cooperating tongue and groove in the two walls of the kerf cut by the rod.

5. In apparatus for cutting slabs of ice into cubes, a first grid of parallel cutting rods for receiving a stack of slabs of ice and successively cutting them into strips, a second grid, parallel to said first grid but having cutting rods extending at right angles to the rods of the first grid, said second grid receiving said strips from said first grid and cutting them into cubes, and means for heating the rods of said second grid to a higher temperature than the rods of the first grid, whereby the ice moves away from the first grid and through said second grid faster than it feeds through said first grid.

6. In an ice-cutting machine, a runway for a cake of ice to slide along, means for laterally guiding only the lower edges of said cake of ice during movement along said runway, a grid in the path of ice moving along said runway, said grid having vertically spaced, horizontally extending heated rods, said rods having loops therein for cutting cooperating tongues and grooves in the slabs of ice resulting from movement of said cake of ice past said grid, which tongues and grooves prevent relative lateral displacement of said slabs.

7. In an ice-cutting machine, a runway for a cake of ice to slide along, a first grid in the path of ice sliding along said runway, and having a plurality of parallel, heated rods, and means for moving a cake of ice through said grid, whereby the cake is cut into slabs, a second grid having a plurality of parallel heated rods positioned approximately in the plane of said chute for receiving a stack of slabs cut by said first grid and cutting them into strips, a third grid having a plurality of parallel heated rods positioned below and substantially parallel to the second rod with its grids running at right angles to those of the second grid for cutting the strips of ice produced by the second grid into cubes, in which the temperatures of the first, second and third grids are progressively greater in the order specified to progressively increase the rate of movement of the ice through the three different grids.

ROBERT B. PERRY.