

July 11, 1939.

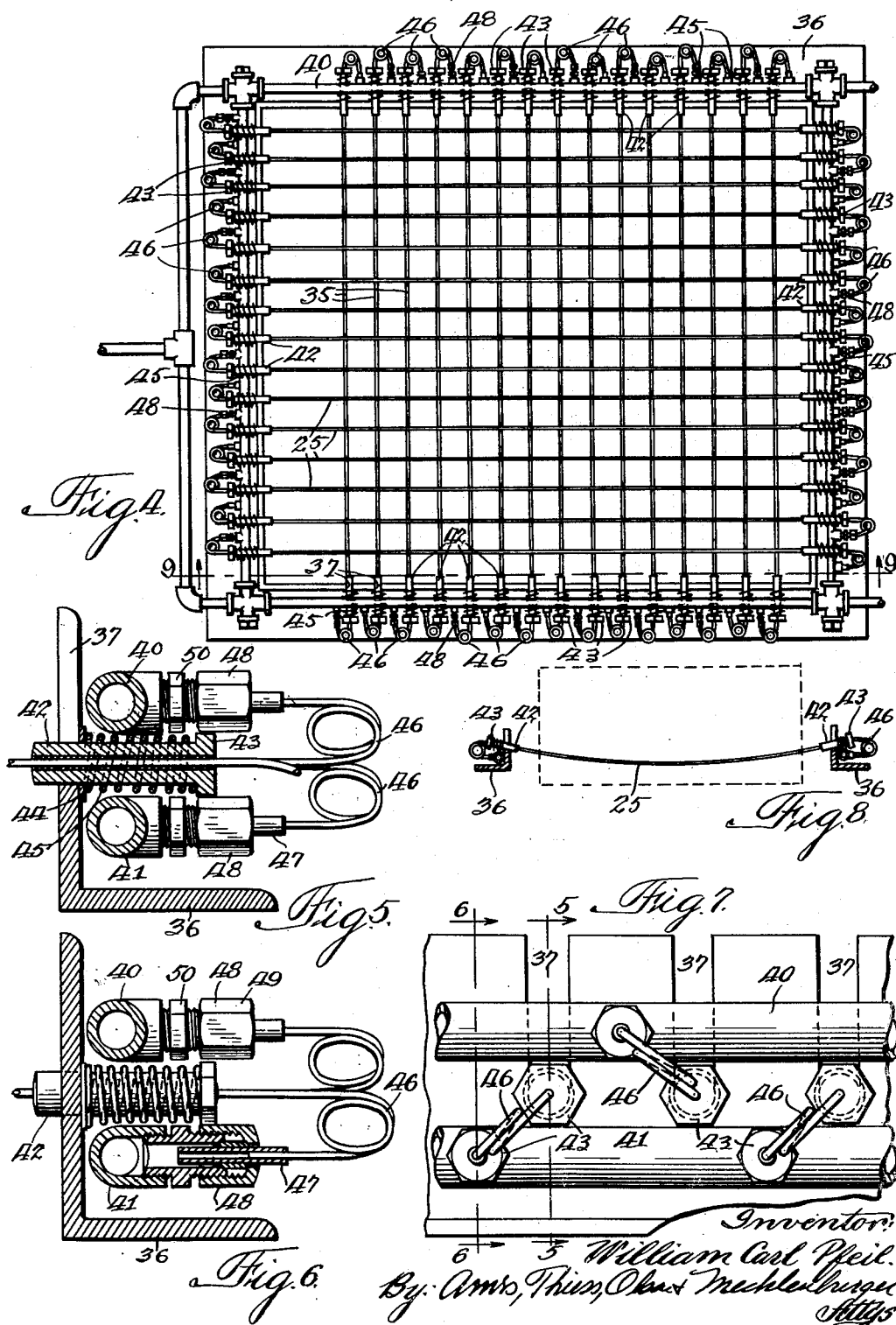
W. C. PFEIL

2,165,573

METHOD OF AND APPARATUS FOR CUBING ICE

Filed Sept. 8, 1938

3 Sheets-Sheet 2



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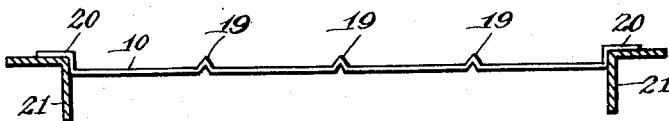
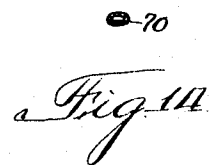
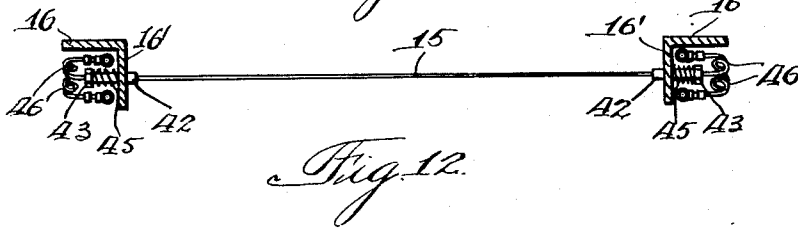
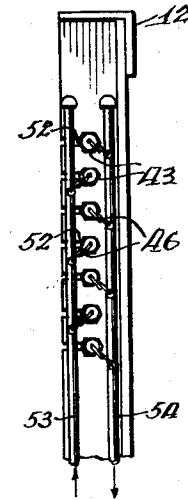
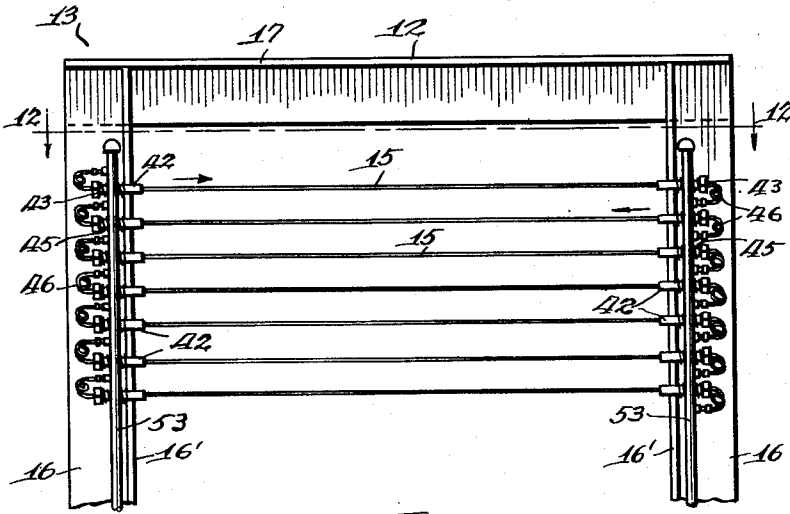
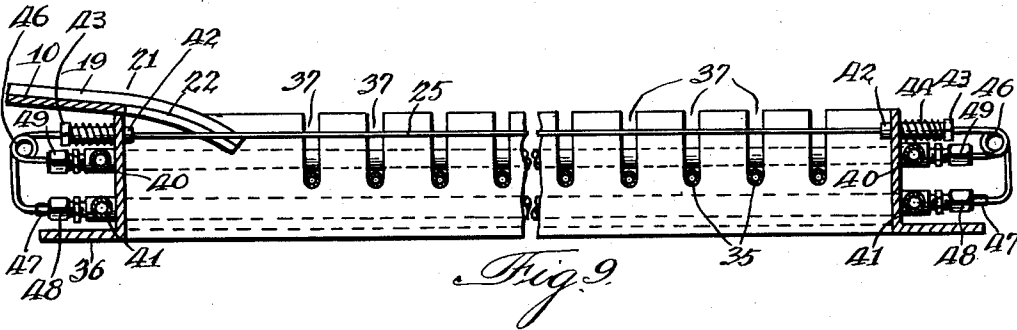
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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR CUBING
ICE

William Carl Pfeil, Chicago, Ill.

Application September 8, 1938, Serial No. 228,895

20 Claims. (Cl. 62—112)

This invention relates to a new and novel method of and apparatus for cubing ice.

The invention is particularly directed to certain valuable improvements providing a practical and commercial machine capable of cubing large quantities of ice with minimum waste.

Machines of this type have heretofore been generally unsatisfactory and have not been commercially successful. Blocks of ice that are to be cut into small cubes must be handled quickly if unnecessary loss in the cutting is to be prevented and a sufficient quantity is to be cut, warranting the cost of the construction and operation of a machine of this type. Moreover, the construction must be of a character that the cutting elements will not be distorted as the result of the weight and low temperature of the ice coming into contact therewith. The cutting elements or tubes must be capable of uniformly producing sufficient heat to effect uniform cutting and should be arranged so that they will not be permanently distorted and yet be readily replaceable, if necessary. Electrically heated elements have been proposed. While certain features herein disclosed lend themselves to a machine employing electrically heated elements, the latter generally cool rapidly and lose their heat when brought into contact with ice. They are of small cross section and tend to retain a permanent stretch when expanded or flexed. On the other hand, where fluid heated tubes have been used, end headers rigidly carrying the tubes have prevented any possibility of compensating for the expansion and stretching of the tubes or for the rapid contraction when the cold ice would be brought into direct contact with the hot tubes. Moreover, the heated fluid has been forced to flow from the inlet header to the outlet header in the same direction throughout all the heated tubes. The absence of uniform distribution of heat when all the hot inlet ends are on one side, has caused large blocks to be cut more rapidly along this hot side with the result that the cutting has been uneven and a greater loss sustained.

An object of the invention is to provide a machine overcoming the above difficulties by means of a structure which will receive a cake of ice at one end and cause the same to move forwardly through the machine, passing first through a grid of cutting elements to cut the cake into, say horizontal slabs, and then to continue the movement of these slabs forwardly along an apron until they slide upon a second grid of cutting elements under which a third grid may be located, whereby the slabs are cut into cubes and allowed

to drop between the cutting elements and into a receptacle.

A further object of the invention is to provide an improved type of cutting element adapted to be suitably carried upon a frame so that it may be readily removed for replacement or repair, if necessary.

A still further object of the invention is to provide an improved form of resilient mounting for the cutting elements to compensate for expansion, contraction or flexing movements thereof and to prevent thereby any tendency toward permanent distortion.

Another object of the invention is to provide an improved resilient connection for the tubes between the mountings and the heat supply and return connections whereby these resilient mountings carrying the tubes may readily function without placing any strain upon the end connections of the tubes.

A still further object of the invention is to provide means for supplying the heating medium to the cutting tubes to secure substantially even distribution of heat over the entire cutting area whereby the block of ice will be cut relatively uniformly from side to side.

Moving parts are eliminated in the operation of the machine. The cake of ice is initially placed upon an inclined apron. The weight of the ice moves it forwardly against the first grid having its cutting elements preferably horizontally arranged which cut the ice into horizontal slabs as its weight forces it therebeyond. The inclined apron causes the ice to continue its own movement until the ice drops upon a second grid, which, while its cutting elements are likewise horizontally arranged relatively speaking, places these cutting elements transversely with respect to the cutting elements of the first grid. A third grid with horizontal cutting elements is disposed below the second grid whereby the continued movement of the ice slabs along the apron and upon the second grid will cause these slabs to be quickly cut into cubes. There are no swinging or moving parts which must change position so as to slow up the cutting operation of successive cakes of ice placed upon the apron at the starting end or cause unevenly cut cubes.

Other objects and advantages of the invention will be apparent from the following specification when taken in connection with the accompanying drawings.

In the drawings:

Figure 1 is a top plan view of a machine embodying the invention;

Fig. 2 is a side elevation of this machine;

Fig. 3 is a detail sectional view illustrating the sloping apron;

Fig. 4 is an enlarged detail view looking downwardly upon the cutting elements disposed at the end of the apron for cubing the ice after it has been cut into horizontal slabs;

Fig. 5 is a sectional detail view taken on line 5—5 of Fig. 7 illustrating the resilient mounting provided at the ends of each cutting element;

Fig. 6 is a similar view taken on line 6—6 of Fig. 7 to illustrate a resilient connection provided between the resilient mounting and the inlet and outlet headers circumscribing the grid frame;

Fig. 7 is a detail view of a portion of a side of one of the grids carrying the cutting elements;

Fig. 8 illustrates diagrammatically the action of the resilient mountings when the cutting elements are caused to flex by the weight of the ice;

Fig. 9 is an enlarged sectional detail taken on line 9—9 of Fig. 4;

Fig. 10 is a detail view of the cutting elements for first slabbing the cake of ice horizontally;

Fig. 11 is a detail view illustrating the mountings of these cutting elements at one end and the resilient connections provided between these mountings and the inlet and outlet headers;

Fig. 12 is a detail sectional view taken on line 12—12 of Fig. 10;

Fig. 13 is a view of the forward end of the apron; and

Fig. 14 is a cross-sectional view of a modified form of cutting element.

Any suitable frame may be employed to support the parts to be hereinafter described. The drawings illustrate, however, vertical uprights 2 and 3 at the front and rear ends, respectively, and intermediate vertical uprights 4 and 5. Lower and upper longitudinal irons 6 and 7 and transverse corner irons 8 connect these uprights into a suitable framework. An apron 10 is supported by the framework to slope or tilt downwardly from the front end of the machine. Apron 10 may be suitably secured at the front end, say to a transverse iron 11, supported by the end uprights 2 that may extend above longitudinal iron 7 a distance to give apron 10 the proper pitch. Intermediate uprights 4 likewise extend above longitudinal irons 7 to support a frame 12 of a grid 13 carrying a series of cutting elements 15. Frame 12 may have vertical side members 16 and a top cross member 17, all of suitable angle iron, to permit the mountings of cutting elements 15 to be carried in one leg of each side member 16. No specific form of attachment between frame 12 and the frame of the machine is necessary.

Apron 10 is preferably ribbed at 19 and provided with side flanges 20, as illustrated in Fig. 13. Flanges 20 may rest upon angle frames 21, suitably carried by the frame of the machine and supported upon the uprights 2, 4 and 5 as illustrated in Fig. 2. Ribs 19 eliminate surface contact between the ice cake and apron 10, and thereby facilitate movement of the ice cake downwardly along apron 10 to bring it into quick contact with heated cutting elements 15. The weight of the ice tends to force the cake into cutting elements 15 so as to allow these cutting elements rapidly to perform their work of slicing the cake into horizontal slabs, which has been illustrated in dotted lines in Fig. 2. At the discharge end 21, the apron is preferably curved downwardly, as illustrated particularly in Fig. 9, and is cut

away at 22 so that a portion of the end may lie between and extend below cutting elements 25.

This second set of cutting elements 25 are arranged as a grid positioned at the end of apron 20 and arranged to lie in the same general direction as apron 10 so as to readily receive the cake of ice sliding along the apron after it has been slabbed by cutting elements 15. In other words, the position of cutting elements 25 allows the cake of ice to slide forwardly, drop from the end 21 of apron 10 upon these cutting elements 25, and, if necessary, cause the cake to move forwardly along these cutting elements until it rests completely thereon, as illustrated by the dotted lines at 30 in Fig. 2. Heated elements 25 will immediately cut into the ice by reason of the weight of the ice forcing it therebeyond. This second cutting causes these slabs of ice cut by elements 15 to be cut into long bars. To cube the ice, a third set of cutting elements 35 are provided below cutting elements 25. Cutting elements 35 are, of course, arranged transverse to cutting elements 25.

These cutting elements 25 and 35 form a grid with a frame 36. Frame 36 is rectangular and is provided with a series of spaced slots 37 that are open at the top and disposed in the vertical leg of frame 36 on all four sides. The frame of the machine may be arranged to receive the horizontal leg of frame 36 as the means of mounting this grid unit of two sets of cutting elements upon the machine at the end of apron 10. Slots 37 may be cut along the top of frame 36 so as to admit of ready removal of either of the cutting elements 25 or 35 without disturbing the mounting of the frame itself or any of the other structural parts.

Inlet and outlet connections between the source of heat supply and cutting elements 25 and 35 may be any simple form of piping. Such piping may include the inlet pipe 40 supplying heated fluid to cutting elements 25 and 35, and an outlet pipe 41 acting as a return. The mounting carrying the ends of these tubes for heated elements 25 and 35 in open slots 37 and the connections between these mountings and the inlet and outlet pipes 40 and 41 are shown in detail in Figs. 5, 6 and 7, and will now be described.

Fig. 8 illustrates diagrammatically the manner in which heating elements of the diameter herein disclosed and used in my machine will tend to bow or flex when hot and the weight of the ice is carried thereby. In Fig. 8, a cake of ice is shown in dotted lines and partially passed beyond the cutting element to illustrate how the cutting element will tend to bow during the cutting action. The mounting herein disclosed allows the cutting elements to flex in the manner illustrated without permitting a permanent distortion to occur. These cutting elements are in the form of a thin walled tube of small diameter through which steam (superheated if desired) is passed. The thin walled tube will allow rapid heat transfer and a more efficient and rapid cutting action. The small diameter will effect a very definite cut with minimum loss of material. Each tube is fixedly secured within a bushing 42 lying in a slot 37 and having an enlarged head 43 at the outer end to form a shoulder at this end which cooperates with a washer 44 at the slot to confine a spring 45 therebetween. The tube continues beyond bushing 42 and is coiled at 46, the end of the tube being fixedly secured within a sleeve 47 that forms a part of the detachable connection 48 in the form of a nut 49 threaded upon

one end of a nipple 50. Nipple 50 has the other end threaded into either inlet pipe 40 or outlet pipe 41, as the case may be. In other words, connection 48 may be the same for the end of a tube whether the end connects with inlet 40 or with outlet 41.

A resilient mounting formed by bushings 42 and springs 45 allows such freedom at the end of each tube by the tilting of the bushings 42 in slots 37, as illustrated in Fig. 8, when the tube is flexed, that no permanent distortion will result and the tube will be readily permitted to return to its original position.

Cutting elements 15 are mounted substantially in the same manner as cutting elements 25 and 35. Vertical members 16 of frame 12 have their inside legs 16' slotted, as indicated at 52 in Fig. 11, to receive the tube mountings. Slots 52 are similar to slots 37 in frame 36. Inlet and outlet pipes 53 and 54 are similar to inlet and outlet pipes 40 and 41. The mountings likewise comprise bushings 42 having heads 43 thereon between which and legs 16' springs 45 are disposed so as to permit cutting elements 15 to flex against the action of springs 45 and thereby permit their return to normal position without causing a permanent distortion. The ends of cutting elements 15 extend through bushings 42 and are coiled at 46, the extremities thereof being similarly secured in a sleeve 47, as illustrated in Fig. 6, which is detachably connected by a connection 48 to either the inlet or outlet pipes 53 and 54 as the case may be. Any suitable source of heat supply may be provided.

For the purpose of illustration only, a steam generator 60 is disclosed in Fig. 2. Inlet connections 53 having cutting elements 15 are connected to a pipe 61 leading to generator 60. Inlet connections 40 of cutting elements 25 and 35 are connected to a pipe 62. The return connections 41 that extend about frame 36 have cutting elements 25 and 35 connected at 63 to a pipe 64. Return connections 54 on opposite sides of frame 12 having cutting elements 15 are connected to a pipe 65. Pipes 64 and 65 are connected to a common return pipe 66 leading to generator 60. It will be understood that inlet connections 61 and 62 may receive their heat supply from any suitable source and that return connection 66 may be likewise connected. Generator 60 is merely disclosed for the purpose of illustration.

It will be understood that the novel type of mounting exemplified by the springs 45 and the bushings 42 removably resting in open slots, together with the coiled ends 46, may be advantageously used in connection with electrically heated cutting elements, and consequently, in so far as these features are concerned, the disclosure is not to be limited to a fluid heating medium.

Any of the cutting elements 15, 25 and 35 may be readily replaced, if desired, by detachably connecting the ends thereof at 48 and lifting the bushings 42 out of slots 37 or 52. If these cutting elements are to be heated by steam or other suitable fluid, they may be tubes of exceptionally small diameter which is desirable in order to reduce waste due to melting when the ice is being cut. It is found that the type of resilient mounting, herein disclosed, permits the use of tubes of minimum diameter consistent with adequate circulation of the heating fluid and efficient heat distribution.

It will also be understood that the cutting elements may be in different shapes cross sectionally. For example, in order to obtain a cutting element of increased strength and cutting capacity but

with minimum thickness in the direction of the cut whereby a minimum cutting edge will be provided, a substantially circular tube may be somewhat flattened in one direction as indicated at 70 in Fig. 14.

The structure herein disclosed further admits of a novel form of heat distribution with respect to the cutting area covered by the cutting elements. By arranging the inlet and outlet connections in parallel arrangement about the frames of each grid, say pipes 53 and 54 on each side of frame 12, and pipes 40 and 41 about the frame 36, the ends of the cutting elements may be alternately connected along one side to the inlet and outlet connections. For example, as illustrated in Fig. 10, the uppermost cutting element 15 may have its right-hand end connected to outlet pipe 54, as shown in Fig. 11, while its left-hand end will be connected to the inlet pipe 53 on the left-hand side of frame 12 so that the flow of the heating medium will be from left to right as shown by the arrow. The second uppermost cutting element will then have its right-hand end connected to the inlet pipe 53, as shown in Fig. 11, and its left-hand end connected to the outlet pipe 54 on the left-hand side of frame 12, so that the flow of the heating medium will be from right to left as shown by the arrow. This method of connection of the ends of the cutting elements 15 with respect to the inlet and outlet connections 53 and 54 on opposite sides of frame 12 may be continued for all these cutting elements whereby the final result will be to have the heating medium flowing in opposite directions with respect to adjacent cutting elements. Consequently, if there is any tendency for the end of the cutting element, attached to the inlet connection, being hotter than the end attached to the outlet connection, a uniform distribution of heat will be obtained over the entire area covered by all the cutting elements of one grid. One side of the block of ice will not be cut at a great rate so as to result in uneven cutting. The same method of attaching the ends of cutting elements 25 and 35 will be noted in Figs. 4 to 7, inclusive.

By referring to Fig. 13, it will be observed that side flanges 20 of apron 10 may be somewhat higher than ribs 19 so that they form shoulders to guide the ice as it travels downwardly along the sloping apron 10. Due to the sliding movement of the block of ice that readily occurs when resting upon ribs 19, the ice by its own weight is forced against cutting elements 15. These elements being tubular and of thin metal allow a rapid transfer of heat so that they will be sufficiently hot to slab the ice horizontally, as illustrated in dotted lines in Fig. 2. When the entire block of ice has been slabbed, it will slide from the curved end 21 of apron 10 on to the second or upper set of cutting elements 25, it being noted that these cutting elements 25 are longitudinally disposed with respect to apron 10. The weight of the ice will force the cutting elements 25 therethrough so that the ice will drop downwardly upon the third set of cutting elements 35. The same action of cutting will occur in order to produce cubes of ice that drop into a receptacle 65.

The arrangement disclosed permits the use of heated cutting elements of minimum diameter, so as to eliminate excessive waste but provides a very rapid cutting action in order to secure maximum capacity. I have found that a 200 pound cake of ice may be completely cubed in three minutes by the machine disclosed herein, as compared to a period of fifteen minutes for a 50

pound cake of ice by a machine having electrically heated resistance wires as the cutting elements. Moreover, the three sets of cutting elements are arranged with respect to apron 10 to assure self movement of the cake of ice throughout the machine after it has been placed upon the forward end of apron 10.

Without further elaboration, the foregoing will so fully explain the gist of my invention that others may, by applying current knowledge, readily adopt the same for use under varying conditions of service, without eliminating certain features, which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to me by the following claims.

I claim:

1. In an ice cutting machine, the combination of a frame, a table carried by said frame and arranged for feeding a cake of ice forwardly, a grid interposed in the normal path of travel of such cake of ice and substantially perpendicular to such path, said grid comprising a plurality of parallel pipes for conducting a heating medium therethrough to divide such cake into a set of superimposed slabs, a second grid including a plurality of parallel pipes for conducting a heating medium therethrough and arranged to receive said set of slabs and convert the same into a plurality of ice cubes, each of said grids including a frame, and means for resiliently supporting the respective parallel pipes of the grid by the frame thereof to compensate for expansion caused by heating and for bowing caused by the weight or pressure of the ice against the grids.

2. In an ice cutting machine, the combination of a frame, a table carried by said frame and arranged for feeding a cake of ice forwardly, a grid interposed in the normal path of travel of such cake of ice and substantially perpendicular to such path, said grid comprising a plurality of parallel pipes for conducting a heating medium therethrough to divide such cake into a set of superimposed slabs, a second grid including a plurality of parallel pipes for conducting a heating medium therethrough and arranged to receive said set of slabs and convert the same into a plurality of ice cubes, means for supplying a heating medium to said pipes, and resilient connections between said supply means and said pipes.

3. In an ice cutting machine, the combination of a frame, a table carried by said frame and arranged for feeding a cake of ice forwardly, a grid interposed in the normal path of travel of such cake of ice and substantially perpendicular to such path, said grid comprising a plurality of parallel pipes for conducting a heating medium therethrough to divide such cake into a set of superimposed slabs, a second grid including a plurality of parallel pipes for conducting a heating medium therethrough and arranged to receive said set of slabs and convert the same into a plurality of ice cubes, means for supplying a heating medium to said pipes, resilient connections between said supply means and said pipes, each of said grids including a frame, and means for resiliently supporting the respective parallel pipes of the grid by the frame thereof to compensate for expansion caused by heating and for bowing caused by the weight or pressure of the ice against the grids.

4. In an ice cubing machine, the combination of a frame, a table carried by said frame and arranged for feeding a cake of ice forwardly, a

grid interposed in the path of travel of such cake of ice, said grid comprising a plurality of parallel pipes for conducting a heating medium therethrough, a second grid including a plurality of parallel pipes for conducting a heating medium therethrough, the pipes of both said grids being arranged to perform cutting operations converting the cake of ice into a plurality of cubes, each of said grids including a frame, and resilient means for mounting the respective pipes of each grid upon the frame thereof, said resilient means including springs at opposite ends of each pipe to compensate for any tendency of said pipes to expand or bow.

5. In an ice cubing machine, the combination of a table for feeding a cake of ice forwardly, a grid interposed in the normal path of travel of such cake of ice and substantially perpendicular to such path, said grid comprising a plurality of parallel pipes for conducting a heating medium therethrough, a second grid including a plurality of parallel pipes for conducting a heating medium therethrough, connections for supplying a heating medium to said pipes, the pipes of said grids being arranged to perform consecutive cutting operations converting the cake of ice into a plurality of cubes, each of said grids including a frame, mounting means for resiliently suspending the respective parallel pipes of each grid upon the frame thereof, and resilient means in said supply connections to compensate at said supply connections for any movement at said mounting means.

6. In an ice cubing machine, the combination of a frame, a plurality of pipes for conducting a heating medium therethrough to convert a cake of ice into a plurality of cubes, means for yieldably supporting said pipes upon said frame whereby they are held under tension in their operating relation upon said frame, and structure for supplying a heating medium to said pipes, said structure including resilient means yieldable to any movement of said pipes at their said yieldable supporting means.

7. In an ice cubing machine, the combination of a plurality of pipes to which a cake of ice is fed for a cutting operation, a frame, means for yieldably supporting said pipes under tension upon said frame, inlet and outlet headers adjacent said frame for supplying a heating medium to said pipes, and yieldable means so connecting said inlet and outlet headers to said pipes that the heating medium may flow in one direction through alternate pipes and in the opposite direction through the rest of the pipes and thereby provide substantially the same cutting heat at said pipes relative to a crosswise dimension of the cake of ice whereby to secure uniform cutting without any tendency for the cake to twist and crack by too rapid cutting at one side.

8. In an ice cubing machine, the combination of means for feeding a cake of ice forwardly, a grid comprising a plurality of parallel pipes to which such cake of ice is fed for a cutting operation, a second grid comprising a plurality of parallel pipes to which the ice is fed for further cutting, connections for supplying a heating medium to said pipes, said connections feeding the heating medium to said pipes of each grid so that they act as a whole to apply substantially uniform heat crosswise of the cake to prevent thereby any tendency of the cake to shift sideways during the cutting operation, and supporting means for said pipes acting to keep said pipes substantially uniformly spaced from each other

at all times whereby uniform cutting may be obtained.

9. In an ice cubing machine, the combination of means for feeding a cake of ice forwardly, a plurality of grids each containing a plurality of pipes to which such cake of ice is fed for a cutting operation, means for so providing a substantially uniform heat to said pipes of each grid that they acting as a whole will apply substantially uniform heat to the cake crosswise of the grid to prevent thereby any tendency of the cake to shift sidewise during the cutting operation, and means tending to keep said pipes substantially equally spaced lengthwise of each other by compensating for expansion and bowing of said heated pipes.

10. In an ice cubing machine, the combination of a grid comprising a plurality of pipes for cutting a cake of ice, means for so supplying a substantially uniform heat to said pipes that they as a unit will apply substantially uniform heat to the cake crosswise of the grid to prevent thereby any tendency of the cake to shift sidewise during the cutting operation.

11. In an ice cubing machine, the combination of a grid comprising a plurality of pipes for cutting a cake of ice fed thereto, means for so supplying a substantially uniform heat to said pipes that they as a unit will apply substantially uniform heat to the cake crosswise of the said pipes to prevent thereby any tendency of the cake to shift sidewise during the cutting operation, and supporting means for said pipes acting to keep said pipes spaced a predetermined distance from each other whereby uniform cutting may be obtained.

12. In an ice cubing machine, the combination of a grid comprising a plurality of pipes for cutting a cake of ice fed thereto, connections for supplying a heating medium to said pipes, said connections including a pair of inlet headers positioned on opposite sides of said grid receiving the ends of said pipes, and means for connecting one of said headers on each side to alternate pipes, and means for connecting the other header to the rest of the pipes whereby to cause the heating medium to flow in opposite directions in adjacent pipes and provide thereby a substantially uniform cutting action crosswise of the grid to prevent any tendency of the cake of ice being fed to the grid to shift sidewise during the cutting operation.

13. In an ice cubing machine, the combination of a grid comprising a frame and a plurality of pipes for cutting a cake of ice fed thereto, connections for supplying a heating medium to said pipes, said connections including inlet and outlet headers, there being looped portions between said inlet and outlet headers and the ends of said pipes, said looped portions being yieldable to movement caused by expansion or tendency of said pipes to bow during the cutting operation, and yieldable means for supporting said pipes upon said frame to compensate for said expansion or tendency of said pipes to bow.

14. In an ice cubing machine, the combination of a grid comprising a plurality of pipes for cutting a cake of ice fed thereto, connections for supplying a heating medium to said pipes, said connections including inlet and outlet headers positioned on opposite sides of said grid for connecting to the ends of said pipes, and means on each side for connecting said inlet header to alternate pipes and said outlet header to the rest

dium to flow in opposite directions in adjacent pipes and provide thereby a substantially uniform cutting action crosswise of said grid as the cake is fed thereto, said means including a yieldable portion adapted to compensate for movement of said pipes.

15. In an ice cubing machine, the combination of a grid comprising a plurality of pipes for cutting a cake of ice fed thereto, connections for supplying a heating medium to said pipes, a frame, means for carrying said pipes upon said frame comprising spring means at the ends of each of said pipes for holding the latter under tension upon said frame whereby to compensate for expansion due to heat and for any tendency of said pipes to bend when subjected to the pressure of the ice being cut thereby, said pipes thereby being held substantially uniformly spaced during the cutting operation.

16. In an ice cubing machine, the combination of a grid comprising a plurality of pipes for cutting a cake of ice fed thereto, connections for supplying a heating medium to said pipes, a frame, there being means upon said frame for removably supporting said pipes, and means along the sides of said frame and at the ends of said pipes for holding said pipes under tension upon said grid whereby to keep said pipes substantially parallel to each other in a predetermined spaced relation.

17. In an ice cubing machine, the combination of a grid comprising a plurality of parallel pipes for cutting a cake of ice fed thereto, connections for supplying a heating medium to said pipes, a frame, there being means upon said frame for removably supporting said pipes, means along the sides of said frame and at the ends of said heated pipes for holding said pipes under tension upon said grid whereby to keep said pipes substantially parallel to each other in a predetermined spaced relation, said supply connections including means adapted to compensate for any movement of said heated pipes.

18. In an ice cutting machine, a grid unit comprising a frame defining an opening through which ice to be cut may be moved, two sets of parallel pipes, the pipes of one set being arranged at right angles to the pipes of the other set for conducting a heating medium therethrough, means for carrying said pipes upon said frame over said opening, an inlet header and an outlet header, each being arranged substantially in four communicating sections, there being a section on each side of said frame for connection with the ends of certain of the pipes, means for connecting both said inlet and outlet headers in a predetermined order to said pipe ends, a source of supply for the heating medium, and means for connecting said source of supply substantially at the corners of said sections of said inlet header where they are joined.

19. In an ice cutting machine, a grid unit comprising a frame having four sides which define a substantially rectangular opening through which ice adapted to be cut is moved, two sets of parallel pipes, the pipes of one set being arranged substantially over said opening at right angles to the pipes of the other set for conducting a heating medium therethrough, means for supporting the opposite ends of each set of parallel pipes upon opposite sides of said frame, outlet and inlet headers for said pipes, said inlet header extending about the four sides of said frame, a source of supply for the heating medium, and means for connecting said source of supply to said inlet

header substantially at the four corners of said frame.

20. In an ice cutting machine, a grid unit comprising two sets of parallel pipes, the pipes of one set being arranged at right angles to the pipes of the other set, a frame for supporting said pipes

substantially at their ends, a pair of inlet header sections for the ends of the pipes of each set, and a connection for supplying a heating medium to each header section from each end thereof.

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