Feb. 8, 1955 R. M. HENDERSON 2,701,453

ICE-MAKING MACHINE

Filed Dec. 10, 1949 7 Sheets-Sheet 1

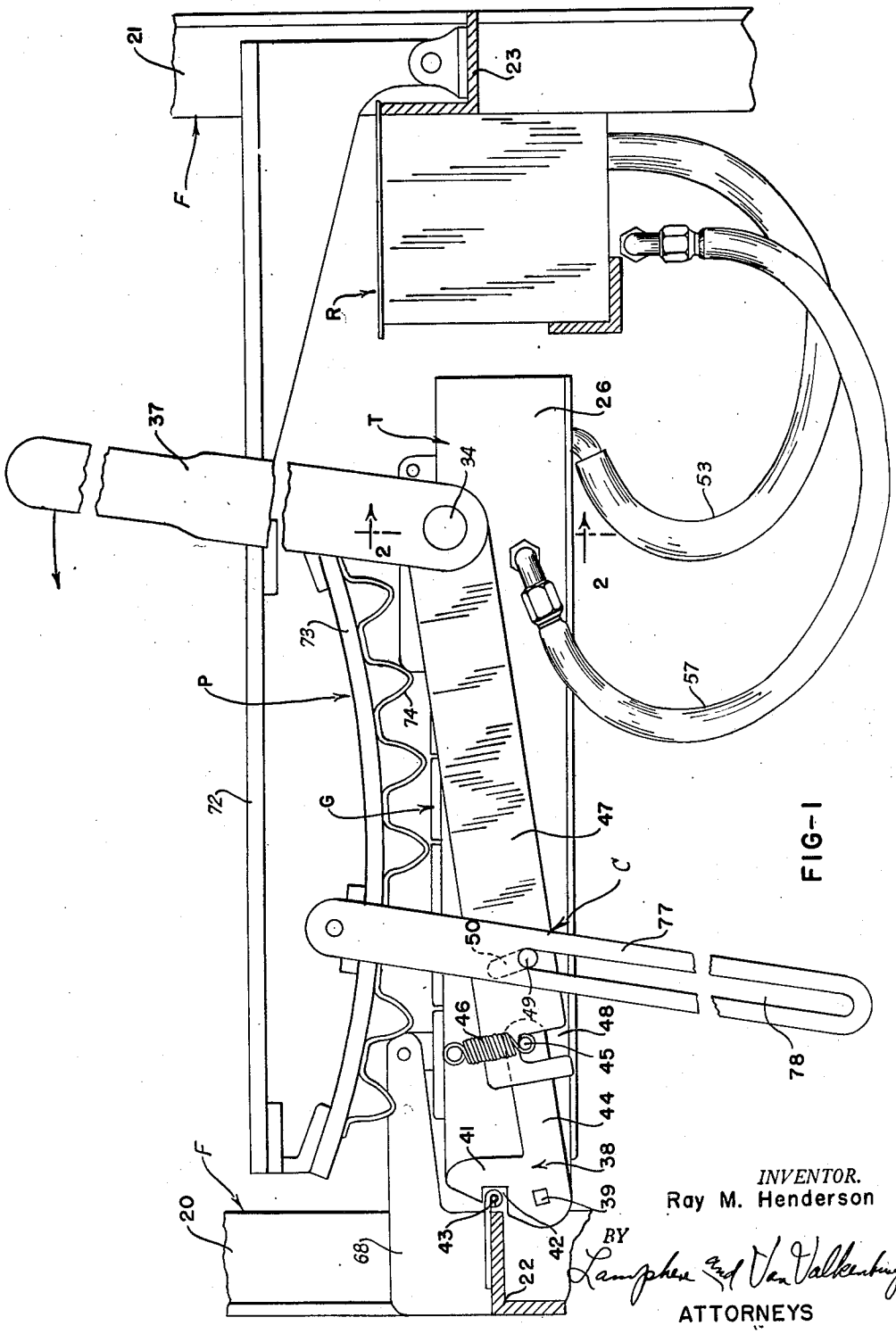


FIG-1

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ICE-MAKING MACHINE

Filed Dec. 10, 1949 7 Sheets-Sheet 2

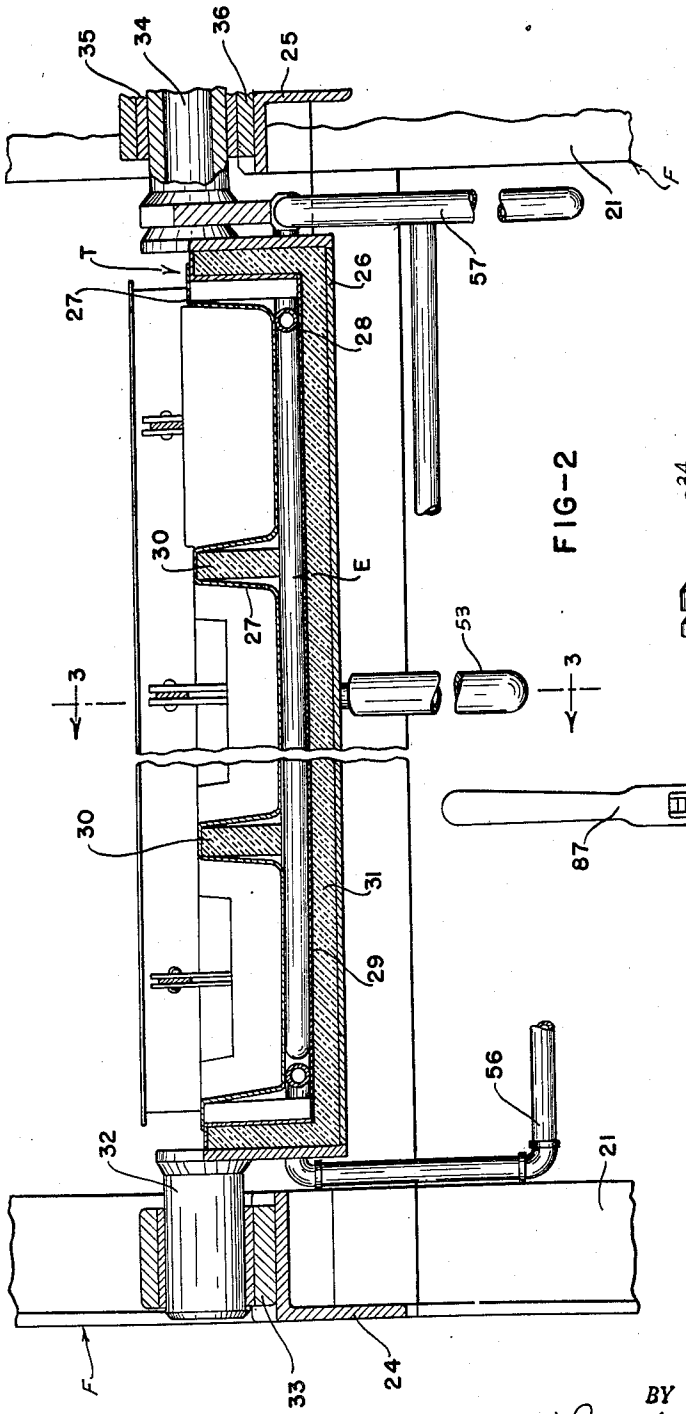


FIG-2

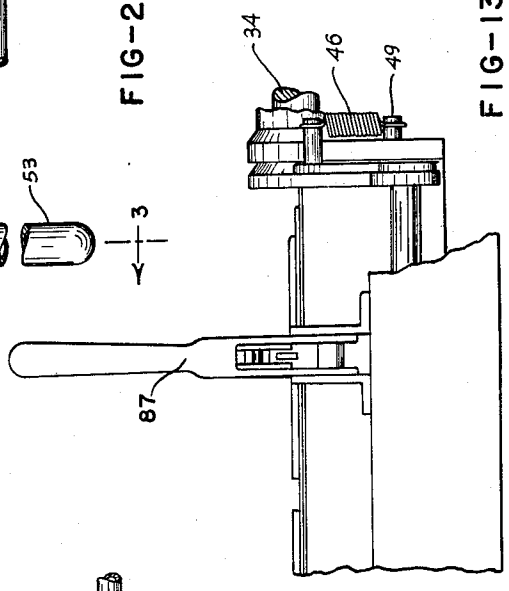


FIG-13

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Feb. 8, 1955 R. M. HENDERSON 2,701,453

ICE-MAKING MACHINE

Filed Dec. 10, 1949 7 Sheets-Sheet 3

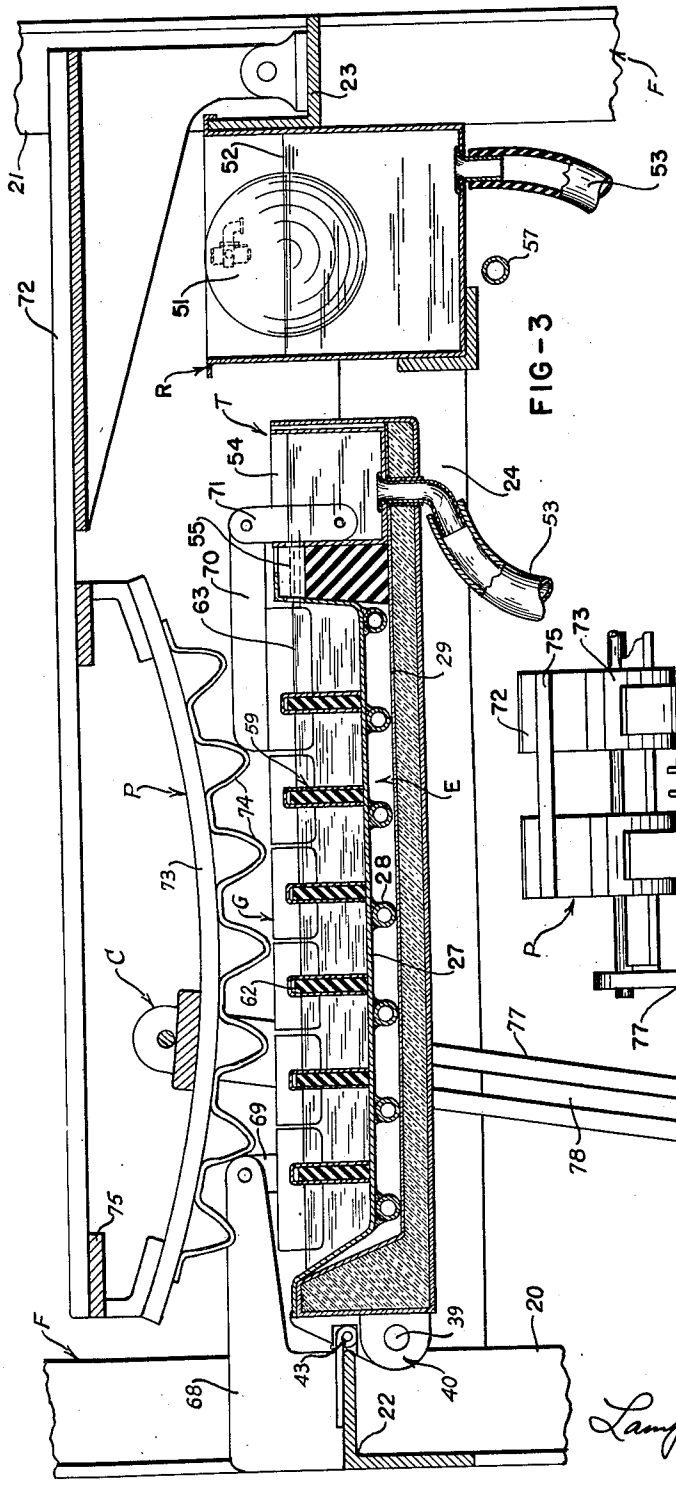


FIG-3

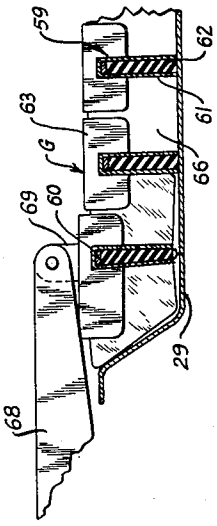


FIG-7

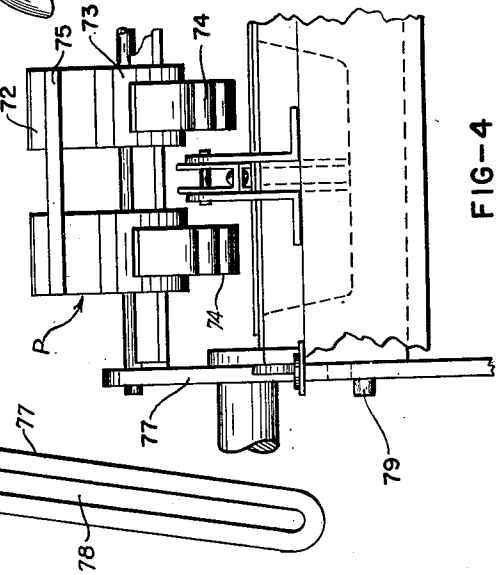


FIG-4

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Feb. 8, 1955 R. M. HENDERSON 2,701,453

ICE-MAKING MACHINE

Filed Dec. 10, 1949 7 Sheets-Sheet 4

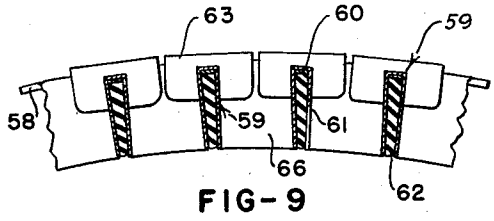


FIG-9

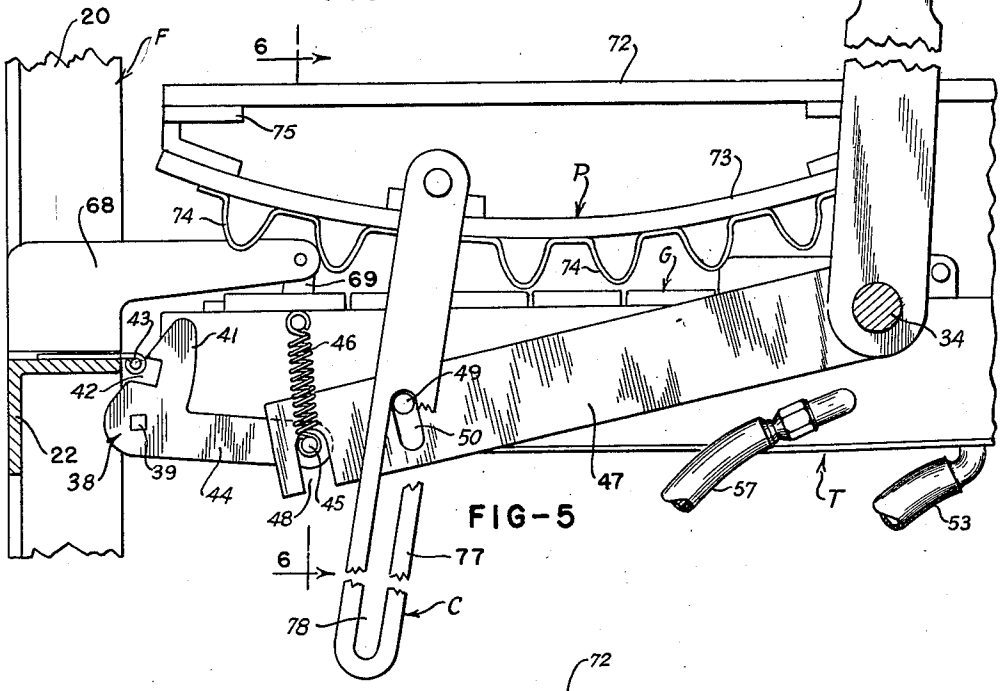


FIG-5

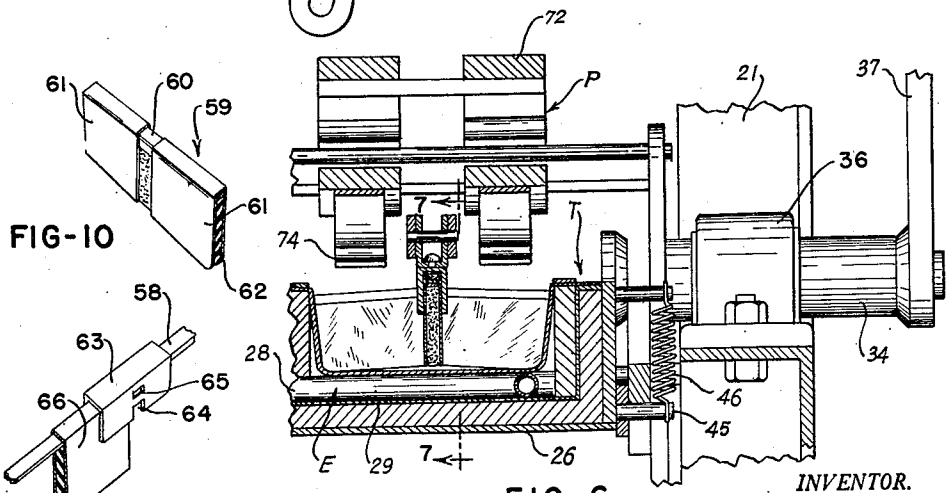


FIG-10

FIG-11

FIG-6

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Feb. 8, 1955 R. M. HENDERSON 2,701,453

ICE-MAKING MACHINE

Filed Dec. 10, 1949 7 Sheets-Sheet 5

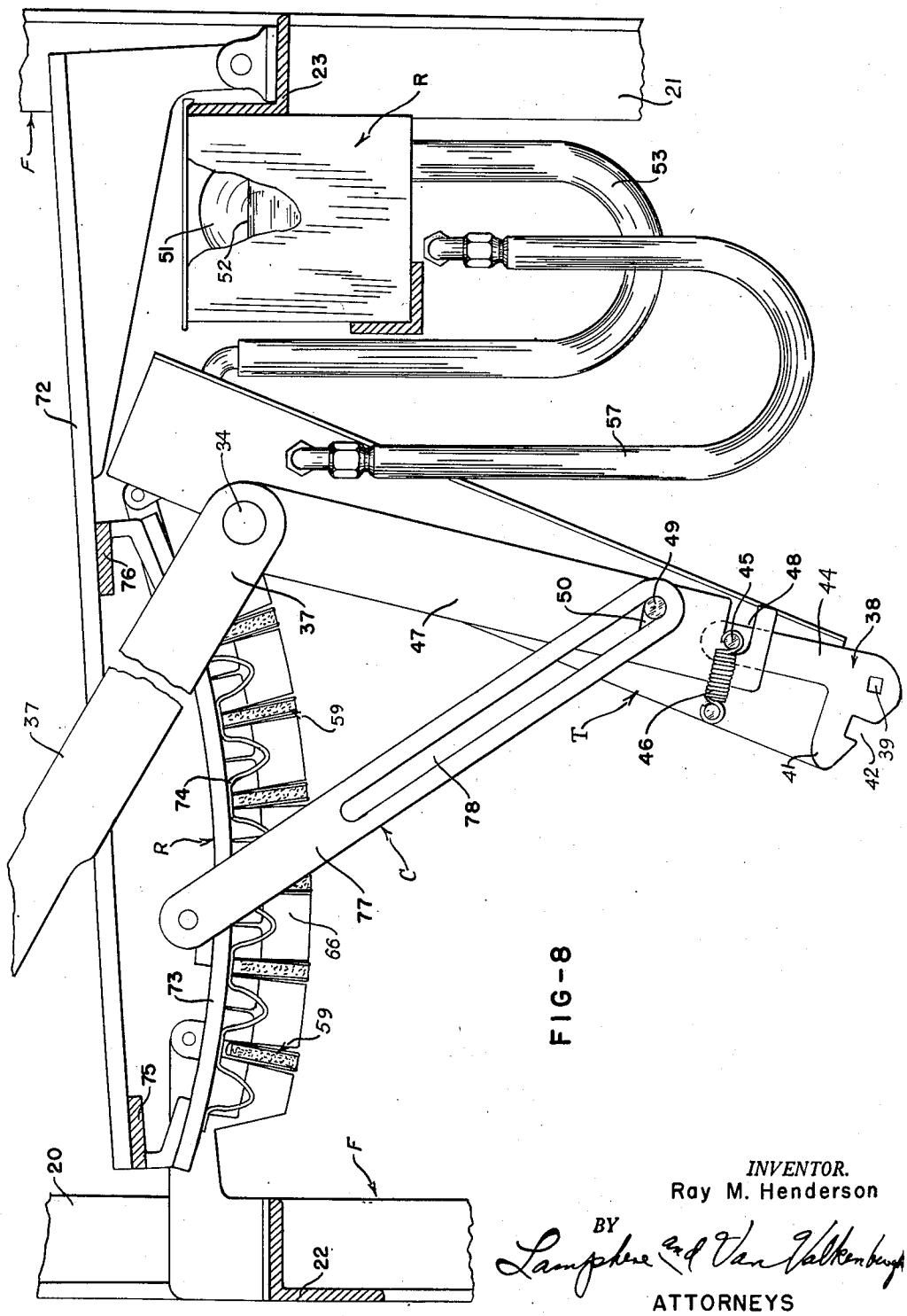


FIG-8

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ICE-MAKING MACHINE

Filed Dec. 10, 1949 7 Sheets-Sheet 6

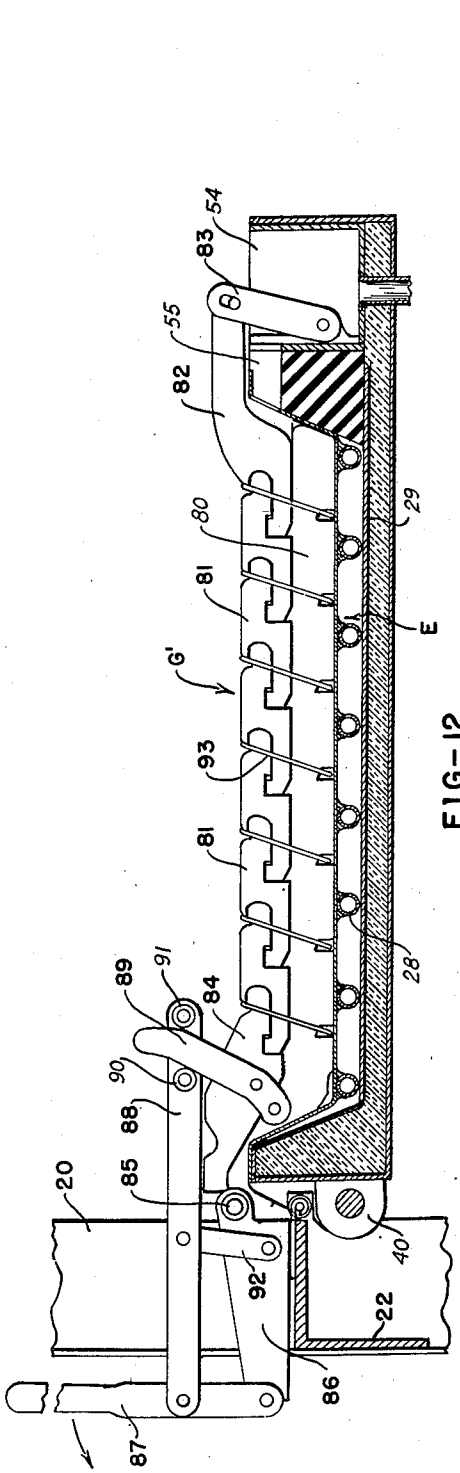


FIG-12

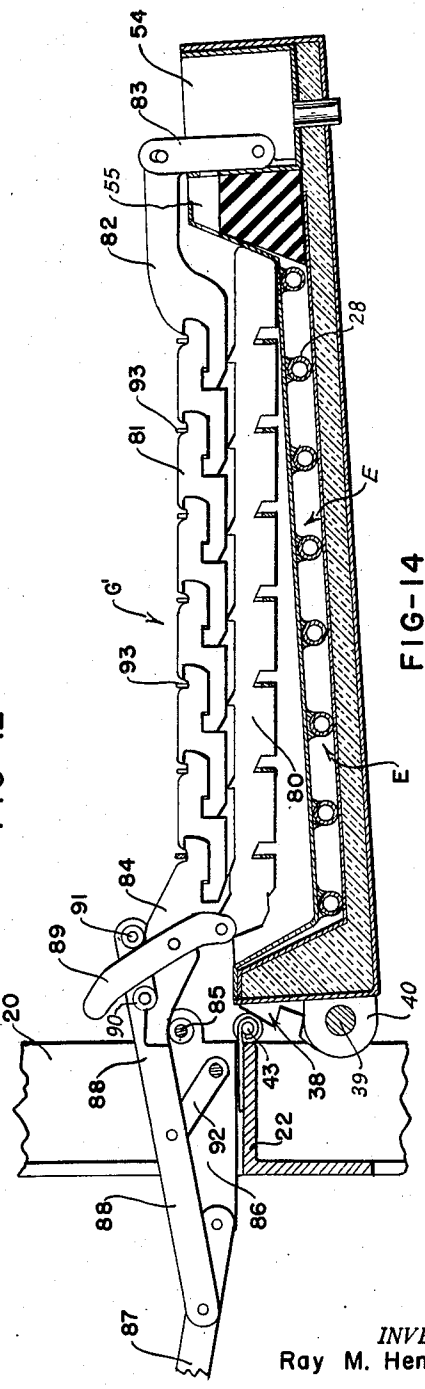


FIG-14

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ICE-MAKING MACHINE

Filed Dec. 10, 1949 7 Sheets-Sheet 7

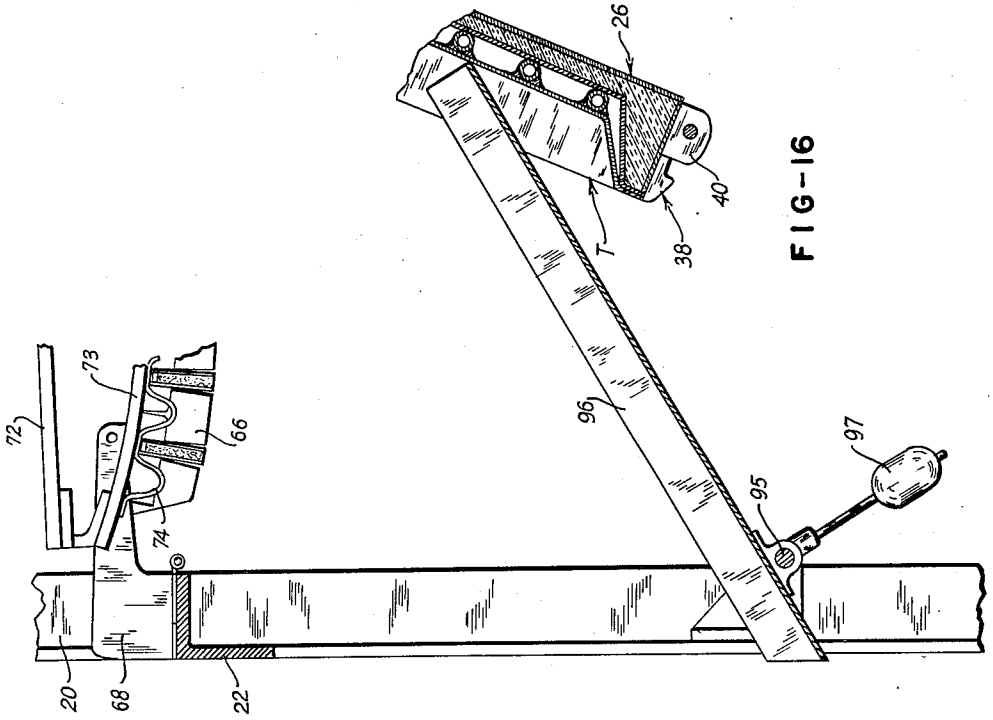


FIG-16

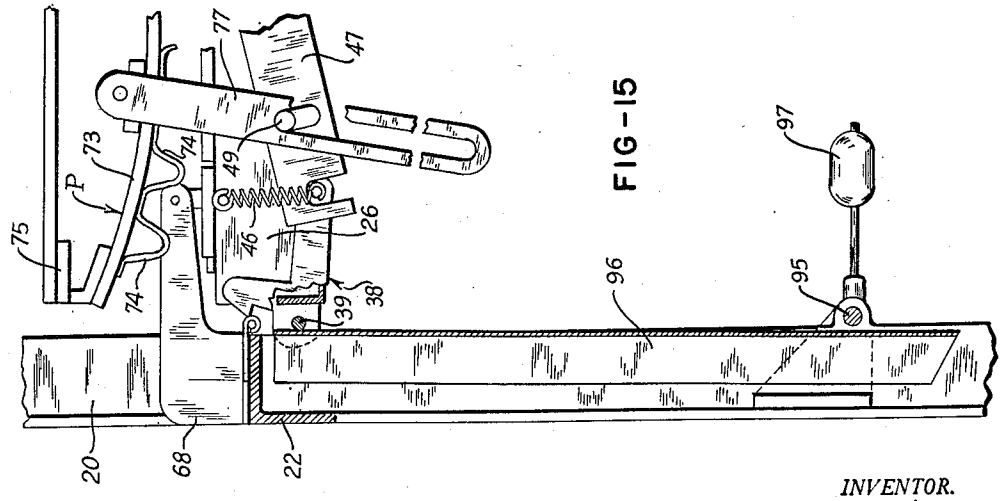


FIG-15

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United States Patent Office 2,701,453 Patented Feb. 8, 1955

2,701,453

ICE-MAKING MACHINE

Ray M. Henderson, Waco, Tex.

Application December 10, 1949, Serial No. 132,300

16 Claims. (Cl. 62—106)

This invention relates to ice making apparatus and more particularly to an apparatus for making blocks or cubes of ice in trays and removing such therefrom when formed.

One of the objects of my invention is to produce an improved ice making apparatus whereby ice will be frozen in trays having grids to thereby produce pieces, blocks or cubes of ice and which will embody means for quickly and easily removing the ice and then automatically refill the trays with water for the producing of additional ice.

Another object is to produce an ice making machine embodying trays and grids so constructed and arranged that the blocks or cubes of ice frozen therein can be efficiently and quickly removed from the trays while in the machine by mechanical means and without the use of heat.

Still another object is to so embody ice freezing trays in an ice making machine that the ice can be removed therefrom without removing the trays from the machine or altering their relationship with the evaporator.

A further object is to construct an ice making machine in which ice is frozen in trays permanently associated with an evaporator as an inseparable unit.

Still a further object is to produce a tray type of ice making machine in which mechanical means are employed to remove ice from the trays and after removal thereof water will automatically be supplied to properly refill the trays, said water supply also being so automatically controlled without the use of cut-off valves that no water will be supplied to the trays during removing of the ice therefrom.

Yet a further object is to so construct a tray type ice making machine that removal of ice can be accomplished with a pivotal movement of trays and further this pivotal movement employed in a manner to automatically control the proper supplying of water to the trays.

A further object is to produce an ice making machine of the tray and grid type in which the ice can be removed in a mechanical manner while the trays, grids and ice are being maintained below freezing temperature.

A further object is to so construct an ice making machine of the tray and grid type that the evaporator can be permanently associated with the tray, yet the tray and grid can both be movable to accomplish removal of ice and automatic control of the refilling of the tray with water for the making of additional ice.

A further object is to produce improved means for mechanically removing a grid and formed ice from a freezing tray and the formed ice from the grid without removal of the grid and tray from the machine.

A further object is to produce improved grid means for association with an ice freezing tray which will permit the grid and formed ice to be removed from the tray in an easy and simple manner while the tray, grid and ice are maintained below freezing temperature.

A further object is to produce an improved grid means for freezing ice blocks in a tray which will have its parts flexibly arranged in such manner as to permit the grid and formed ice to be removed from the tray with a minimum of applied force and by a "peeling" action.

Another object is to produce a grid means for freezing ice blocks in a tray which will be so constructed as to cause the ice blocks to be moved generally transversely with respect to the position in which they are frozen when force is applied to lift the grid means from the tray.

Another object is to produce a flexible grid means for freezing ice blocks in a tray which when caused to be lifted from the tray will so operate on the blocks as to move them toward or away from each other without binding action or excessive forces on the sides of the tray.

Another object is to so construct a grid means for freezing ice blocks in a tray that the walls thereof can be caused to move relatively to each other when the grid means and tray are separated.

Another object is to so construct a flexible grid means for freezing ice blocks in a tray and associate therewith removing means that the grid means, together with the blocks of ice, can be easily removed from the pan and after removal the grid means can be flexed to accomplish removal of the blocks.

Still a further object is to so construct an ice making machine of the type having a tray and grid means to form ice blocks that the grid means and ice blocks can be lifted upwardly from the tray, the blocks of ice removed from the grid means when in lifted relationship and the tray so angularly positioned that the ice blocks falling therein can be slidably discharged therefrom.

Another object is to provide for use in an ice making machine a flexible type of grid means for freezing blocks of ice in a tray, mechanical means for removing the grid means from the tray and other means for cooperation with the grid means and ice blocks for both flexing the grid means and punching out the ice blocks after the grid means and blocks are removed from the tray.

Yet another object is to produce an ice making machine structure for automatic operation which will permit ice blocks to be formed in a tray by use of a grid, said grid and ice being removed from the tray, the blocks dislodged while the grid is in removed position, and then the grid replaced in the tray and the tray caused to be filled with water under control of tray pivotal movement, which movement will also be employed to dispose of the blocks removed from the grid and caught by the tray.

Other objects of the invention will become apparent from the following description taken in connection with the drawing disclosing an ice making machine embodying the invention.

In the drawings:

Figure 1 is a side view of parts within an ice making machine with certain portions of the frame being shown in section;

Figure 2 is a cross-sectional view of the parts, said view being taken on the line 2—2 of Figure 1;

Figure 3 is a longitudinal sectional view through one of the trays showing details of construction of some of the parts, said view being taken on the line 3—3 of Figure 2;

Figure 4 is a front view of the left hand portion of the ice making machine parts;

Figure 5 is a side view similar to Figure 1, but showing the parts in the position assumed at the beginning of the lifting of the grids and ice blocks from the tray;

Figure 6 is a across-sectional view of a portion of the parts as viewed on the line 6—6 of Figure 5;

Figure 7 is a longitudinal sectional view taken on the line 7—7 of Figure 6;

Figure 8 is another side view showing the position of the parts after the ice blocks have been extracted from the grids and the tray has been fully tilted;

Figure 9 is a side view of a portion of the grid showing its flexibile construction and the manner in which it can bow during separation of the grid from the tray to free the formed ice;

Figures 10 and 11 are perspective views showing the parts forming the walls of the grid;

Figure 12 is a longitudinal section view through a freezing tray and modified grid means which enables the ice blocks to be freed from the tray by operation of a lever or other means independently of the tray swinging lever;

Figure 13 is an end view showing the mounting of the operating lever for the grid means of Figure 10;

Figure 14 is a longitudinal sectional view similar to

Figure 12 but showing the grid means in its condition after being operated by the lever to free the ice blocks; and

Figures 15 and 16 are views showing an ice chute that can be employed with the trays, if desired, to transfer the ice to the exterior of the machine.

Referring to the drawings in detail and first to Figures 1 to 11, inclusive, the ice making machine which is illustrated as embodying my invention comprises a suitable frame structure F in which is mounted the essential elemetns of the machine comprising a freezing tray structure T, an evaporator means E, a grid structure G therefor, a punch means P for punching out blocks of ice formed in the trays, a control mechanism C whereby the ice which is to be frozen in the trays can be freed therefrom and then subsequently be caused to be removed from the grid means, and a reservoir means R from which water will be automatically supplied to the tray means after the ice blocks have been removed.

As shown in Figures 1 and 2 and also in several of the other figures, the frame structure shown comprises front and back upright supports **20** and **21** with the front supports being connected together by cross stringers **22** and the rear posts by cross stringers **23**. Also extending between corresponding side pairs of front and back upright supports are additional longitudinal stringers **24** and **25** (see Figure 2). The tray structure T comprises an outer box-like structure **26** in which is positioned any desired number of trays **27**, three being shown by way of example. Beneath the trays and within the tray box **26** is the evaporator means E for accomplishing the freezing of the water which is to be contained in the trays. The evaporator shown in a pipe **28** formed into coils so as to lie below all the bottoms of the trays. The coils are in direct contact with the bottom walls of the trays and may, if desired, be welded or otherwise secured to the bottom walls of the said trays. The coils are arranged to rest on a false bottom **29** spaced about the bottom wall of the box. The trays and coils are suitably insulated with insulation blocks **30** between the trays and on the outer sides of the two end trays and between the ends of the trays and the end walls of the tray box. A sheet of insulating material **31** is also placed beneath the evaporator coils and in the bottom of the box in the space provided by the false bottom so as to prevent the coils from absorbing heat from the outside of the box through the bottom wall thereof and also keep the box from frosting.

The box **26** containing the trays is arranged to be pivoted to the longitudinal stringers **24** and **25** forming part of the framework. This pivoting is accomplished by laterally extending pivot pins and bearings. A pin **32** is secured to one side of the box and mounted in a bearing **33** carried by the cross stringer **24** which is on the far side of the box as the said box is viewed in Figure 1. The near side of the box, as seen in Figure 1, is provided with another pivot pin **34** which is arranged to be received for rotation in a surrounding sleeve **35**, said sleeve being journaled for rotation in a bearing **36** carried by the longitudinal stringer **25**. The axes of the two pivot pins **32** and **34** are in alignment and thus the box containing the freezing trays is capable of being swung on the pivot pins.

The sleeve **35**, in which the pivot pin **34** is journaled, has secured to its outer end a hand lever **37** by means of which the sleeve can be rotated relatively to the pivot pin **34**. This hand lever **37** is preferably placed on the exterior of the machine, that is, exterior of the case or cabinet which will enclose the whole ice making machine but is not shown for the purpose of clarity. The support formed pivot pins **32** and **34** are adjacent the rear end of the tray containing box **26** and thus, in order that the trays may be in a normal horizontal position so water can be held and frozen in the trays, the forward end of the box **26** is provided with an additional supporting means. As best shown in Figures 1 and 5, the supporting means for the front end of the box is in the form of a latch means which will permit said forward end to be freed of support in order that the tray containing box can be swung about its pivotal mounting, all for purposes as will later become apparent. The latch means consists of a latch **38** pivotally mounted on each side of the box at its forward end with the latches connected together for simultaneous operation by means of a cross rod **39**. This shaft is suitably journaled in prongs **40** extending from the forward end of the box. Each latch has one arm **41** provided with a notch **42** for hooking over a latch pin **43** carried on the cross support **22** at the front end of the frame structure. Each latch also has a second arm **44** extending alongside of the box and at the rear end of this arm is a pin **45** to which a light spring **46** is connected to thereby normally bias the latch to a locking position.

The pin **45** on the latch **38**, which is on that side of the box **26** as viewed in Figure 1, is of sufficient length to be engageable by an arm **47** which is employed to unlatch both of the latches **38**. As will be seen in Figure 1, the arm **47** has a notch **48** which receives the pin with a "sloppy" fit. This arm **47** has its rear end secured to the inner end of the sleeve **35** which has already been referred to as surrounding the pivot pin **34**. Thus, arm **47** can be rotated by the hand lever **37** and the two latches unlatched whenever the hand lever is rotated in the direction indicated by the arrow in Figure 1. The arm **47** is arranged to have only such a limited movement with respect to the tray box **26** as to perform the unlatching and this is accomplished by providing the box with a pin **49** which is arranged to extend through a slot **50** in the arm **47**. After the latches are disengaged, the upper end of the slot **50** will engage pin **49** and thereafter any movement of the arm **47**, resulting from a swinging movement of the hand lever in the direction of the arrow of Figure 1, will result in the forward end of the tray box **26** being swung downwardly about its pivotal mounting.

The reservoir R, already referred to, is suitably mounted on the framework rearwardly of the box **26** for the trays. This reservoir extends across the framework and is supplied by water from a water distributing system. The water is arranged to be maintained in the reservoir at a predetermined level by means of well known float controlled valve mechanism. The particular valve mechanism is not disclosed, but there is shown the float **51** for controlling the valve so that water will run into the reservoir until it reaches the indicated level **52**. The reservoir R is connected by a flexible conduit **53** with an auxiliary reservoir **54** which is positioned at the back end of the trays in the tray box **26**. This auxiliary reservoir is arranged to be connected with each tray by a trough **55**. The auxiliary reservoir **54** contained in the tray box will be insulated from the trays so the water in said auxiliary reservoir will not become frozen. The mounting of the tray box **26** and the main reservoir R will be such that when the tray box is in its latched horizontal position the water from the main reservoir can flow through the conduit **53** into the auxiliary reservoir and from there through the trough **55** into the trays. When the trays are filled up to the proper height, flow of water into the trays will cease as the water level in the trays will then correspond to the maximum level **52** that is permitted in the main reservoir, as determined by the float **51** and the controlled inlet valve. The levels of the water in the trays, the auxiliary reservoir **54** and the main reservoir R, when the trays are properly filled, are shown in Figure 3.

With the auxiliary reservoir in the rear of the tray box positioned rearwardly of the pivotal axis of the tray box, it will be seen that if the tray box is unlatched and the forward end swung downwardly, the rear end of the box containing the auxiliary reservoir will be swung upwardly. This will cause the connection of the flexible conduit **53** with said auxiliary reservoir, which is through the bottom thereof, to be so moved upwardly that the inlet to the auxiliary reservoir will be raised above the maximum level line **52** of water in the main reservoir R. It will then be impossible for any water to flow from the main reservoir to the auxiliary reservoir. This condition is clearly shown in Figure 8 wherein the tray box has been unlatched and caused to be swung downwardly at its forward end by operation of hand lever **37**.

Since the tray box is arranged to be pivotally mounted so that its forward end can be swung downwardly and upwardly and said tray box carries the evaporator, flexible connections are necessary for connecting the high and low sides of the coil with the compressor (not shown) of the refrigeration system. As shown in various figures and particularly in Figure 2, the evaporator coil connections include the flexible conduits **56** and **57**.

In order that the ice formed in each tray will be in the form of blocks, the previously referred to grid structure G will be employed. This grid structure may take different forms, but in the machine shown in Figures

1 to 11 a special flexible type of grid is employed in order that the ice frozen in each tray can be freed from the tray surfaces by a peeling action, thus making the freeing of the ice as simple and easy as possible. The details of this flexible grid structure is best shown in Figures 8, 9, 10 and 11. The grid structure has a longitudinally extending flexible flat rod **58** on which are mounted cross partitions **59**. Each one of these cross partitions has a flexible rod **60** to which is secured in inverted position a U-shaped member **61** between the legs of which is yieldable insulating material such as rubber **62**. The cross partitions are arranged to be attached to the longitudinally extending rod **58** by U-shaped clips **63**, said clips being provided with slots **64** in their legs to receive the top portions of the U-shaped members of the cross partitions. The clip legs are also provided with openings **65** through which the flexible rod **60** of the cross partitions can extend. When the flexible rod **60** is extending through openings **65**, the rod will be below the longitudinal rod **58**, thus holding the clip **63** to the longitudinal rod **58**. Between the cross partitions and carried on the longitudinally extending rod **58** are other partitions **66** at right angles to the cross partitions. These partitions are also of U-shaped construction and are positioned on the longitudinally extending rod **58**. Between the legs of each partition **66** is yieldable insulating material **67** which can be in the form of rubber. The partitions **66** will be held on the rod **58** by the clip **63**, said clip extending over the partition **66** in the manner best illustrated in Figure 11. With this construction of the grid structure, it will be seen that it is entirely flexible, not only in the longitudinal direction, but in the lateral direction.

The forward end of the grid is arranged to be connected in a fixed condition and this is accomplished by an arm structure **68** which is secured to the front cross stringer **22** of the frame structure. This arm structure has a portion extending over and pivotally connected to a lug **69** carried by the first clip **63** which is at the front end of the flexible grid structure. The rear end of each grid structure is arranged to be pivotally connected to the tray box. This is accomplished in a manner as best shown in Figure 3. The clip **63** at the rear end of the grid has secured thereto a rearwardly extending rod **70** to which, at the rear end thereof, is pivotally connected a link **71** for pivotally connecting said link to the tray box, the link being pivoted to the tray box in the auxiliary reservoir **54**.

After ice has been frozen in the trays, the blocks of ice will be freed from the trays by the operation of the hand lever **37**, causing a pivotal movement of the tray box. When the lever **37** is first moved forwardly in the direction of the arrow, as shown in Figure 1, the latches **38** will be operated, thus disconnecting the front end of the box from the frame structure in a manner illustrated in Figure 5. After the latches have been unlatched, the arm **47** will engage the pin **49** on the side of the tray box and pull the front end of the box downwardly. This pulling of the box downwardly will, of course, cause the forward end of the trays to move with the box as they are secured therein. The forward end of the grids at the front clips, however, cannot move downwardly with the trays, due to the fact said forward ends are connected to the frame structure by means of the arms **68**. Consequently, the forward central part of each grid will begin to be separated from the tray in which it is positioned, as indicated in Figures 6 and 7, and the result will be that the ice cubes will be peeled off from the trays, first at the center part of the grid and then laterally therefrom along the bottom of the trays towards the side walls. The ice blocks will be peeled from the tray surfaces instead of the surfaces of the grid structure because there is less surface of each block congealed to tray surface than there is to grid surfaces.

To best understand the peeling action that takes place to free the blocks of ice from the tray surfaces, reference is had to Figures 6 and 7. As the tray initially moves downward at the forward end there will be relative movement between the tray and the first clip **63** at the front of the grid structure which is fixed to the arm **68** and thus held stationary. Since the held clip is at the center of the grid, the cross partition **59** associated therewith will be held stationary at its center top. Since the cross partition is flexible due to the flexible rod, then the outer ends of the cross partition can move downwardly with the tray, which is what will occur due to these ends being held in the tray by the congealed blocks. The partitions **66**, which are associated with the stationary clip, will also be held stationary at their ends connected to the clip, whereas the other ends will be pulled downwardly with the tray, which is permitted due to the flexible connection provided by the flat flexible rod **58**. The result will be that the corners of the first four blocks which are beneath the stationary point at the center of the clip **63** will be pulled away from the bottom of the tray and peeling action begins. For this peeling action to begin there must be a slight shifting of portions of the blocks relative to each other and this is permitted by the yieldable material in the partitions. As the blocks peel from the bottom surface of the tray, peeling will also take place at the side surfaces of the tray, the peeling being from the bottom upwardly. After the first four blocks peel, then additional blocks will begin to peel progressively toward the rear of the tray in somewhat the same manner as the removing of adhesive tape from a surface.

The peeling action which initially takes place on the first four blocks can be likened to the lifting of a piece of cloth from the bottom of a box. Let it be assumed that there is a square box and placed on the bottom thereof is a piece of cloth the exact size of the bottom. If this cloth is now lifted at its center, it will be noted that it peels off the bottom surface of the box from the lifted central point outwardly and also the edges will subsequently be moved away from the side walls of the box.

As the ice blocks are peeled off from the tray surface, the rear wall of the tray will swing towards the grid structure and apply force at the rear end of the grid. Consequently, with the forward end of the grid held against movement, the grid will tend to arch upwardly at its center. This arching will be slight. The manner of arching is illustrated in exaggerated condition in Figure 9. Arching upwardly of the grid is permitted by the rubber insulating material which is positioned between the legs of the cross partition members **61** and from Figure 9 it is readily apparent how the flexing is accomplished. In other words, there will be a compressing of the rubber material **62** between the legs of the partition member **61** which will allow for the upward arching or flexing of the grid structure in a longitudinal direction. After the ice blocks have been peeled from the trays, a continued downward swinging of the tray box will completely free the trays from the ice blocks and leave the blocks still held by the flexible grids. It will be noted that because of the particular relationship between the pivotal axis of the tray and the rear pivot of the grid the rear end of the grid will be moved upwardly out of the tray as the tray swings downwardly at its front end.

In order that the ice blocks held by the grids may now be free from the grids, a special punch means is provided which is best disclosed in Figures 1, 3, 5, 6, 7 and 8. Pivotally mounted to the rear cross stringer **23** of the frame structure are arms **72** which extend forwardly, there being two arms for each grid structure. Each arm is of such length as to extend completely to the front end of each grid structure. Attached to each arm **72** over a grid structure is a curved member **73**, the curvature thereof being such that the central part of the member is closer to the grid than the ends which are attached to the arm **72**. On the lower side of the curved member **73** is a toothed member **74**, there being a tooth for each block of ice formed by the grid. The various curved members **73** and the arms **72** are arranged to be connected together by cross pieces **75** and **76** which also provide for the connection between the arms and the curved members. On the outsides of the arm structures **72** and the curved members **73** are pivoted links **77** which extend downwardly alongside the tray box. Each link is provided with a slot **78** of considerable length. The slot of the link **77** on the side of the tray box adjacent the arm **47** (see Figure 1) which is employed to swing the forward end of the tray box downwardly is arranged to have received therein the pin **49** projecting from the side of the tray box. The slot of the other link **77** at the opposite side of the tray box receives a pin **78** (see Figure 4). The pins **49** and **79**, when they are caused to reach the lower ends of the slots **78** in the

links as a result of the downward forward swinging of the tray box, will then act on the links and pull the various arms 72 downwardly. This will cause the tooth members to engage the blocks of ice carried in the grid. When the blocks of ice are engaged by the teeth, they will push the blocks of ice downwardly and also cause the flexible grid to be flexed from its upwardly arched position to a downwardly curved position as best shown in Figure 7. The result will be that the blocks of ice will be peeled away from the cross partitions and then punched out of the grid structure. As the blocks of ice fall out of the grid, these blocks will drop into any suitable storage bin (not shown). Any blocks of ice which fall into the trays will slide down the trays and over the front end thereof due to the sloping position of the trays.

From the foregoing detailed description of my ice making machine, it is believed to be obvious how it will operate. When the ice trays and the tray box are in their horizontal position and latched, as illustrated in Figure 1, water will flow to the desired height into the trays with the grids therein. The heat in the water in the trays will then be absorbed by the evaporator through the bottom of the trays. When the ice blocks have been formed, it will only be necessary to pull the lever 37 forwardly in order to free the ice cubes and cause them to drop into a storage bin. The trays will automatically be refilled with water whenever the trays are again placed in horizontal position by a return of the lever 37 to its postition where the tray box will be latched horizontally. In freeing the ice blocks, the first forward movement of the lever 37 from the position shown in Figure 1 will cause the latches 38 to be freed by the downward movement of the arm 57. When the latches are unlatched, the arm 47 will engage the pin 49 and further movement of the lever 37 forwardly in the direction of the arrow will cause the arm 47 to swing the forward end of the tray box downwardly and cause the tray box to pivot on its pivot pins 32 and 34. This will free the trays from the grids in the manner already described and leave the blocks of ice still held in the grids. When the downward swinging of the tray box reaches a position where the two pins on the sides thereof will engage the ends of the slots in the links 77, the toothed punching members will be pulled downwardly and as a result grids will be flexed and the blocks will be punched out of the grids in a manner shown in Figure 8. When the tray box reaches a downwardly inclined position where the punches are about to be operated, the rear end of the tray will be so raised that water can no longer flow from the main reservoir R to the auxiliary reservoir 54, due to the position of the inlet to the auxiliary reservoir being above the level line of any water in the main reservoir R. With flow of water to the auxiliary reservoir no longer possible, water will also cease to run into the trays. There will, however, be some spilling of water which is in the auxiliary reservoir at the time the trays are moved to their downwardly inclined position. This water will not be detrimental, but probably beneficial, because it will be above freezing temperature and will tend to wash any pieces of ice out of the trays which might have been stuck to the trays when the blocks of ice were peeled off.

After the lever 37 has been pulled forwardly as far as possible and the blocks of ice punched out of the grid means, the lever 37 will be returned to its position as shown in Figure 1. This will result in the tray box being brought back to its horizontal position and latched in such position. The return of the tray box to its horizontal position will also result in the grid means being placed back in the trays. Also as the tray box is brought back to its original horizontal position, the inlet to the auxiliary reservoir will move below the level of the water in the main reservoir R and water will then begin to flow from the main reservoir into the auxiliary reservoir. As the water flows out of the main reservoir, the float will fall and then such additional water will flow into the reservoir until the water level in the auxiliary reservoir and the trays reaches the same level as will be permitted by the float controlled inlet valve of the main reservoir.

It will be noted that during the removal of the ice blocks from the trays and the grid means, there will be no disconnection of the evaporator, and when the tray box is again placed in horizontal position the evaporator will immediately function to begin freezing the water in the trays to produce more blocks of ice. When these new blocks are made, they can be removed in the manner already described.

The removing of the ice from the ice trays by a downward swinging of the forward end of the tray box is illustrated as being accomplished by the hand operated lever 37. However, in place of the lever 37, other means can be employed to accomplish the downward swinging of the forward end of the tray box. For example, an electric motor can replace the lever 37. This motor could be started under the control of a suitable switch which would be closed only when the ice in the trays is fully frozen. The motor would be stopped when the forward end of the tray box reaches its fully inclined position and the ice cubes have been knocked out by the punches. A reversal of the motor would then recondition the trays and grid for the making of additional blocks of ice.

In Figures 12, 13 and 14 there is disclosed a different type of grid means for the trays of an ice making machine embodying my invention, said grid means being so constructed as to permit, if desired, the ice blocks to be freed from each tray by a member operable independently of any pivotal movement of the tray or tray box and the control means which functions to unlatch and swing the tray box on its pivot. The construction of the trays, the tray box, the auxiliary reservoir at the pivoted end thereof, the latch means at the forward end of the tray box and the control means for performing the unlatching and pivoting of the tray box may all be the same as already described in connection with the ice machine shown in Figures 1 to 11 inclusive. These similar parts disclosed in Figures 11 to 13 are indicated by the same reference numerals. The grid means G', which takes the place of the grid means G shown in Figures 1 to 11, is of the type in which various parts are caused to be relatively movable when it is desired to free the blocks of ice. Each grid means G' has a central longitudinally extending plate member 80 which forms a longitudinal divider in the lower part of a tray. Above this plate member 80 is a series of articulated members 81. The rear articulated member is connected by a member 82 with a link 83 which has its lower end pivotally mounted in the auxiliary reservoir 54. The forward articulated member 84 extends to cooperate with a roller 85 carried by a support structure 86 which is secured to the front cross stringer 22 of the frame structure. Also pivotally mounted on this support structure 86 at its front end is a hand lever 87. Links 88 pivotally connect this hand lever above its pivot with an arm 89 which is pivoted to both the longitudinally extending plate member 80 of the grid means and the member 84 which is arranged to cooperate with the roller 85. The connection between the link 88 and the arm 89 is accomplished by providing two rollers 90 and 91 between the links 88 for receiving the upper end of the arm 89. There is thus provided a "sloppy" connection permitting the arm 89 to slide relatively to the links 88 as it is pivoted. In order to support the links 88 so they will always be connected to the top end of the arm 89, there is provided a short link 92 which pivotally connects the central part of the link 88 to the support member 86.

The grid means, in addition to comprising the single longitudinally extending plate member 80 and the articulated members 81, also has cross partitions 93. These cross partitions, the articulated members and the longitudinally extending member 80 together form cells in which the blocks of ice can be formed. The partitions 93 have central openings through which the articulated members and the plate member 80 extend as illustrated. When the grid means is positioned in a tray, as shown in Figure 12, so as to be in condition for freezing blocks of ice in the tray, the articulated members will be so positioned relative to the longitudinal member 80 that the cross partitions 93 are angularly disposed. When it is desired to free the blocks of ice from the grid means, such will be accomplished by pulling outwardly on the lever 87, as indicated by the arrow, and moving this lever from the position shown in Figure 12 to the position shown in Figure 14. As the lever is moved outwardly the arm 89 will be pulled forwardly by the links 88. This forward movement of the arm 89 will cause it to swing about its pivotal connection with the forward end of the plate member 80 and as a result thereof the forward articulated member 84, together with all the other articulated members 81, will be pulled forwardly. The member 84 will then be caused to ride up and rest on the top of roller

85 carried by the support structure 86. The moving of the articulated members 81 forwardly relative to the longitudinally extending member plate 80 will result in the cross partitions 93 of the grid means being moved from their angular positions shown in Figure 12 (assumed during the freezing operation to produce the blocks of ice) to a substantially vertical position as shown in Figure 14. This movement of the articulated members and the cross partitions will cause the blocks of ice to be freed from congealed relation with all the parts of the grid means. Also, the blocks will be freed from the inner side walls of the tray. With the blocks now freed, they can be removed from the tray by unlatching the tray box in a manner already described in connection with the ice machine shown in Figures 1 to 11, and then swinging the tray box downwardly to the position shown in Figure 8. This is all accomplished by pulling forwardly on the hand lever 37. The freed ice blocks will then drop from the grid means into the tray as the tray is swung downwardly, and when the tray reaches such an angle that the ice will slide out of the forward end of the tray by gravity, the tray will be emptied. During pivoting of the tray box, water will be prevented from flowing into the tray from the auxiliary reservoir, due to the raising of the water inlet of this auxiliary reservoir. After the tray has been emptied of ice it can be swung back to its horizontal position and its forward end relatched. When it assumes its horizontal position, water will flow into the tray and fill it to the desired level. The grid means G' can be placed back into the tray to form new blocks by swinging the lever 37, shown in Figure 14, to the position shown in Figure 12.

With the grid means shown in G' it is not necessary to operate the lever 87 to free the ice from a tray unless such is desired. The ice blocks can be freed from the tray by first unlatching the forward end of the tray and swinging the grid box downwardly to a position such as that shown in Figure 14. The ice will then be peeled off the tray as the forward end of the tray moves downwardly. If it is later desired to free the ice blocks from the grid means, the hand lever 87 can be moved from the position shown in Figure 12 to the position shown in Figure 14. The ice blocks will then drop down into the tray and if the tray is at a sufficient angle the ice blocks will slide by gravity out of the forward end of the tray into a suitable compartment below the tray. This method of operation, that is, first freeing the blocks from the tray by unlatching the tray box and swinging the forward end of the tray box downwardly, will permit emptying any desired number of trays without disturbing the ice blocks in other trays. Any trays which are desired to be emptied can be emptied after the tray box is swung downwardly merely by operating the desired levers 87 for each tray which is desired to be emptied. If certain levers 87 are not pulled, the ice blocks will continue to be held in the grid means during tilting of the trays. When the trays again assume horizontal positions, the blocks not loosened from the grid means will go back into the trays.

In some machines it may be desired to convey the removed blocks of ice to the exterior of the machine directly from the trays. A chute arrangement for accomplishing this is disclosed in Figures 15 and 16. The front supports 20 may have mounted thereon, a distance below the front cross stringer 22, a pivot rod 95 to which is pivoted a chute 96. There will be a chute for each tray 27. The upper end of the chute extends to a point just below the cross stringer and will rest against the cross rod 39 on which the latches are mounted. Each chute at its pivotal mounting on pivot rod 95 has secured thereto a laterally extending weight 97. This weight will normally tend to swing the chute to which it is connected in a clockwise direction, as seen in Figures 15 and 16, which will be toward the tray. When the tray is latched in its horizontal position, the cross rod 39 will prevent the chute from moving and maintain it in its vertical position as seen in Figure 15.

If the box 26 should be unlatched in a manner already described and caused to swing downwardly so as to free the blocks of ice and punch them out of the grids, the upper end of each chute will enter its corresponding tray at the front end thereof and then move into the tray as the tray swings downwardly. The movement of the tray is effected by the weight 97, as can be readily understood from Figure 16. Consequently, as the blocks are freed and drop from the grid, they will enter the chute and be conveyed thereby to the exterior of the machine. As the chute swings to the position shown in Figure 16, the lower end will swing outwardly and if a suitable opening is provided in the housing of the machine the ice will slide to the exterior of the machine. When the box 26 is returned to horizontal latched position the chutes will assume their vertical position as shown in Figure 15.

Being aware of the possibility of modifications in the ice machine structure shown and described as embodying my invention, without departing from the fundamental principles of the invention, I desire it to be understood that my invention is not to be limited except in accordance with the appended claims.

What is claimed is:

1. In an ice making machine, a tray, a grid means for the tray, means for making ice in the tray which will be separated into blocks by the grid means, means for freeing the tray from the grid means and the formed ice, means for pivotally mounting the tray adjacent one end for swinging to a position where ice falling from the grid means can move by gravity away from the tray, means for pivoting the tray, and means operable by the last named means for substantially simultaneously punching out all the ice blocks congealed to the grid means by the application of a direct force to the ice blocks.

2. In an ice making machine, a receptacle in which water can be frozen, means for pivoting the receptacle adjacent one end, a flexible grid for the receptacle to thereby cause the ice to be formed in blocks, means for separating the grid together with the ice from the receptacle by pivoted movement of the receptacle, and means for flexing the grid after its separation from the receptacle to thereby free the ice therefrom.

3. In an ice making machine, a tray for making ice, a flexible grid for the tray, means including means for swinging the tray downwardly about a pivot for causing the grid with ice congealed thereto to be separated from the tray, and means normally positioned above the grid for causing the grid to be flexed from its planar position assumed during ice making to a curved condition.

4. In an ice making machine, a receptacle for water and in which ice is to be formed therefrom by freezing, a grid for the receptacle to thereby form the ice in blocks, means for supporting the grid at least at one end independently of the receptacle, means for freeing the ice from the receptacle by causing parts of the grid to move relatively to other parts thereof, and means for pivotally swinging the receptacle to a position where one end is extending downward to thereby allow the freed ice to fall by gravity to a place below the receptacle.

5. In ice making apparatus, a tray for containing water and in which ice is to be frozen, an evaporator means secured to the tray, means for pivotally mounting the evaporator means and tray adjacent one end so that by movement of the other end there will be pivotal movement from and to a water containing position for the tray, means for freeing ice in the tray from a congealed relation with the tray, and means for pivotally swinging the tray and evaporator means downward to a position where the tray bottom is at a substantial sloping angle and the ice which has been freed from the tray may fall by gravity to a place below the tray.

6. In an ice making machine, a receptacle for water to be frozen, means for pivotally swinging the receptacle from a horizontal position, a water reservoir, means for maintaining water from a source in the reservoir at a predetermined level therein, conduit means between the reservoir and receptacle, said receptacle being so arranged with respect to the reservoir that when the receptacle is in its horizontal position water will flow by gravity from the reservoir and fill the receptacle to a predetermined height the level of which will correspond to the predetermined level of the reservoir, and means including the pivoting of the receptacle for removing ice therefrom and permitting it to fall by gravity to a place below the receptacle, said receptacle being so pivoted and said conduit means being so connected with the receptacle that upon pivoting of the receptacle during ice removal a portion of the conduit means will be caused to be positioned above the predetermined water level of the reservoir.

7. In ice making apparatus, a tray in which ice is to be frozen, an evaporator means secured to the tray to form a unitary structure, means for pivotally mounting one end of the tray and evaporator so that the tray can

be swung from a horizontal position to a position where the bottom slopes to one end and then returns to horizontal position, a source of water, means for automatically supplying water to the tray to a predetermined height therein when the tray assumes horizontal position, means including the pivoting of the tray from horizontal position for removing ice from the tray and permitting it to fall by gravity to a place below the tray, and means functioning as a result of the tray pivotally moving from its horizontal position for preventing water from the source from flowing to the tray.

8. In ice making apparatus, a tray for containing water and in which ice is to be frozen, an evaporator means secured to the tray, means for mounting the evaporator means and tray for pivotal movement from and to a horizontal position for the tray, means associated with the tray when in its horizontal position for holding the ice and permitting the tray to be separated from the ice, and means for pivotally moving the tray and evaporator relatively to the ice holding means from the tray's horizontal position to thereby separate the tray from the ice and permit the ice to be held by the said holding means.

9. In ice making apparatus, a tray for containing water and in which ice is to be frozen, an evaporator means secured to the tray, means for mounting the evaporator means and tray for pivotal movement from and to a horizontal position for the tray, means including relatively movable parts associated with the tray when in its horizontal position for holding the ice frozen therein and permitting the tray to be separated from the ice, means for pivotally moving the tray and evaporator relatively to the holding means from the tray's horizontal position to thereby separate the tray from the ice and permit the ice to be held by the said holding means, and means for positively freeing the ice from the holding means by causing relative movement between parts thereof.

10. In ice making apparatus, a tray for containing water and in which ice is to be frozen, an evaporator means secured to the tray, means for mounting the evaporator means and tray for pivotal movement from and to a horizontal position for the tray, flexible grid means associated with the tray when in its horizontal position for holding the ice frozen therein and permitting the tray to be separated from the ice, means for pivotally moving the tray and evaporator from the tray's horizontal position to thereby separate the tray from the ice and permit the ice to be held by the said grid means, and means for flexing the grid means to thereby free the ice therefrom.

11. In ice making apparatus, evaporator means, a tray secured to the evaporator, means for mounting the evaporator means and tray for pivotal movement from and to a horizontal position, a grid means for the tray, means for so mounting the grid means that said grid means and the frozen ice can be separated from the tray by a pivotal movement of the tray and evaporator means, means for supplying a predetermined volume of water to the tray when it is in horizontal position, means functioning when the tray is pivoted from the horizontal position for preventing water from being supplied to the tray, and means operable by the pivotal movement of the tray for punching ice out of the grid means.

12. In ice making apparatus, evaporator means, a tray secured to the evaporator, means for mounting the evaporator means and tray for unitary pivotal movement from and to a horizontal position, a grid means for the tray, mechanical means for freeing the grid means and ice from the tray while the tray remains in upright position, means pivotally moving the unitary evaporator means and tray from horizontal position so that freed ice can fall by gravity to a place below the tray, and means for supplying water to the tray, said last named means being controlled by the pivotal movement of the tray.

13. In an ice making machine, an evaporator provided with a surface exposed upwardly and being in heat transfer relation therewith, means for mounting the evaporator and surface at one end for pivotal movement as a unit, means for supplying water to the surface so it can be frozen, said ice being frozen while the evaporator and surface are in a substantially horizontal position, means for freeing formed ice from the surface while the surface remains upward in substantially the horizontal position, and means for pivotally swinging the evaporator and surface as a unit to a position where the surface slopes downwardly from the pivoted end.

14. In an ice making machine, an evaporator provided with a surface exposed upwardly and being in heat transfer relation therewith, means for mounting the evaporator and surface for movement from a position where the surface is substantially horizontal to a sloping position, means for confining water on the top of the surface while horizontal so ice will be formed, means for freeing the ice from the surface and water confining means while both remain in their water confiing relationship, and means for moving the evaporator and surface as a unit to a sloping position of the surface.

15. In an ice making machine, a receptacle in which water can be frozen, means for freezing the water, a flexible grid for the receptacle to thereby cause ice to be formed in blocks, means for separating the grid together with the ice from the receptacle, means for punching the formed blocks from the grid means, said punching means being mounted independently of the grid means and when inoperative being separated therefrom, and means for moving the punching means relatively to the grid means to bring the punching means and blocks together to accomplish the freeing of the blocks from the grid means, said punching means and grid means being so related that during punching operation the grid means will be flexed to thereby aid in freeing the ice blocks.

16. In an ice making machine, a receptacle in which water can be frozen, means for freezing the water, a grid for the receptacle to thereby cause ice to be formed in blocks, means for separating the grid together with the ice from the receptacle by a movement of the receptacle, means for punching the formed blocks from the grid means, said punching means being mounted independently of the grid means and when inoperative being separated therefrom, and a single operable means for first moving the receptacle to free the ice blocks from the receptacle and then moving the punching means relatively to the grid means to bring the punching means and blocks together to accomplish the freeing of the blocks from the grid means.

References Cited in the file of this patent

UNITED STATES PATENTS

1,757,033	Wolcott	May 6, 1933
2,054,074	Field	Sept. 15, 1936
2,269,184	Dalton	Jan. 6, 1942
2,320,534	Osborn	June 1, 1943
2,378,845	Hallock	June 19, 1945
2,403,275	Gilliam	July 2, 1946
2,407,058	Clum	Sept. 3, 1946
2,431,916	Caesar	Dec. 2, 1947
2,444,789	Reeves	July 6, 1948
2,466,831	Van Vleck	Apr. 12, 1949
2,487,408	Askin	Nov. 8, 1949
2,493,900	Schaberg	Jan. 10, 1950
2,496,210	Henderson	Jan. 31, 1950
2,508,625	Smith	May 23, 1950
2,516,257	Sampson	July 25, 1950
2,522,651	Van Vleck	Sept. 19, 1950
2,526,262	Munshower	Oct. 17, 1950
2,545,558	Russell	Mar. 20, 1951
2,563,093	Bayston	Aug. 7, 1951
2,583,294	Erickson	Jan. 22, 1952
2,586,588	Weseman	Feb. 19, 1952
2,606,427	Kirkpatrick	Aug. 12, 1952