Dec. 31, 1968 P. B. SALIMBENI VIVAI 3,418,823

CYCLIC MOVABLE ICE MAKER

Filed May 15, 1967 Sheet 1 of 3

Fig.1

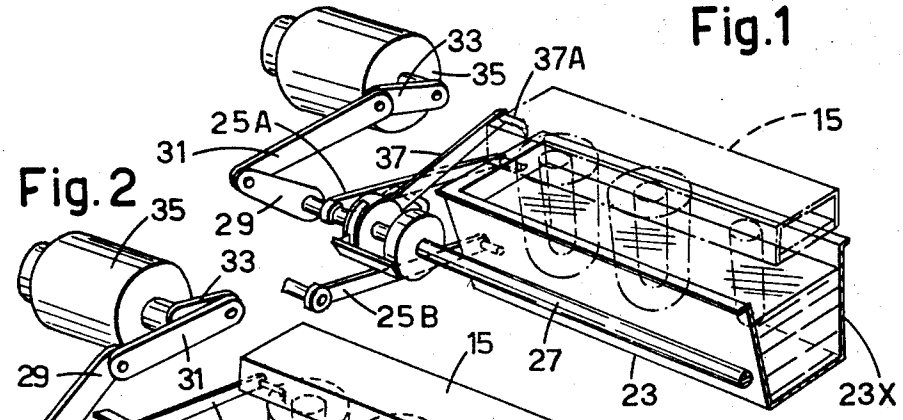


Fig.2

Fig.3

INVENTOR
PIETRO B. SALIMBENI VIVAI
BY Maulsaw and Torrens
ATTORNEYS

Fig. 4

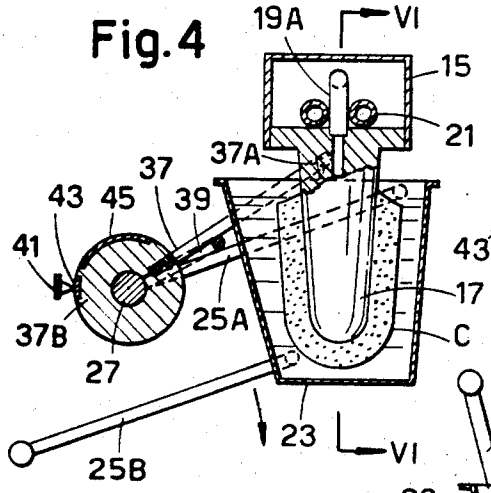
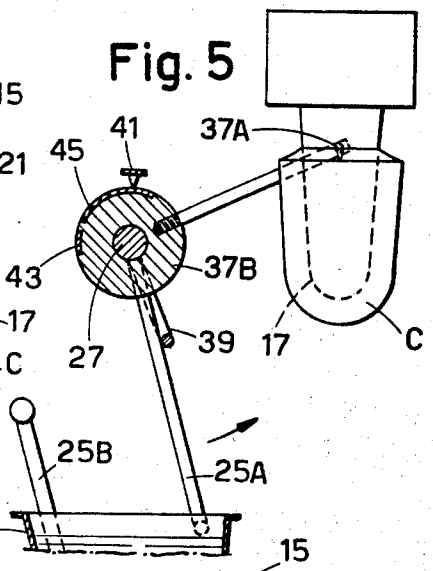


Fig. 5



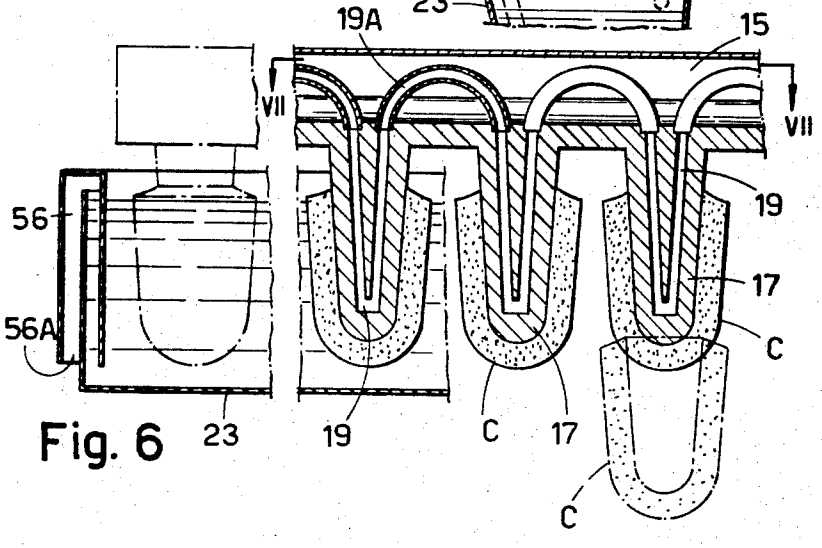
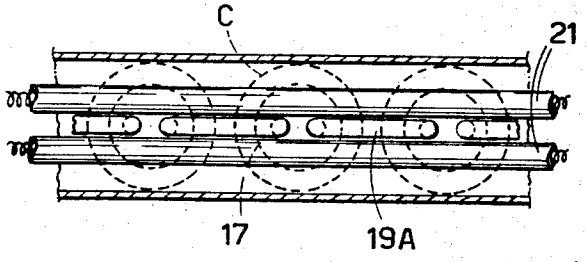


Fig. 6

Fig. 7



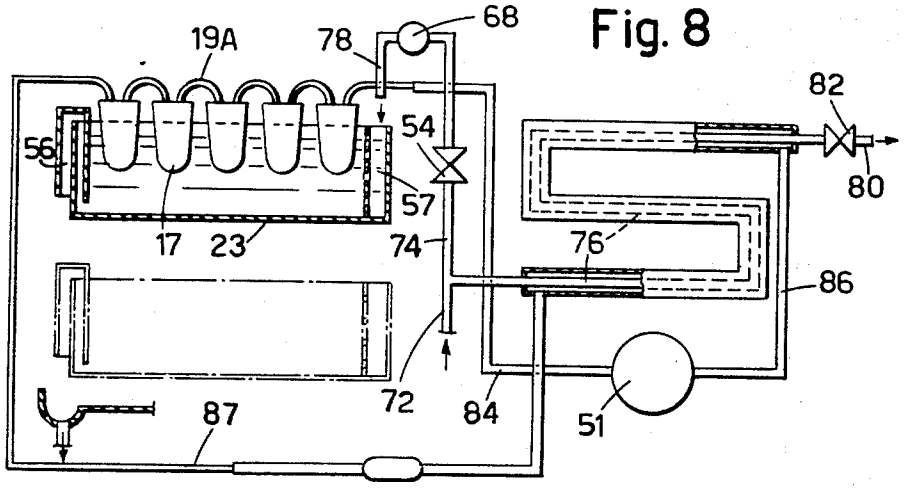
INVENTOR
PIETRO B. SALIMBENI VIVAI
By Mueller and Toren
ATTORNEYS

Dec. 31, 1968 P. B. SALIMBENI VIVAI 3,418,823

CYCLIC MOVABLE ICE MAKER

Filed May 15, 1967 Sheet 3 of 3

Fig. 8



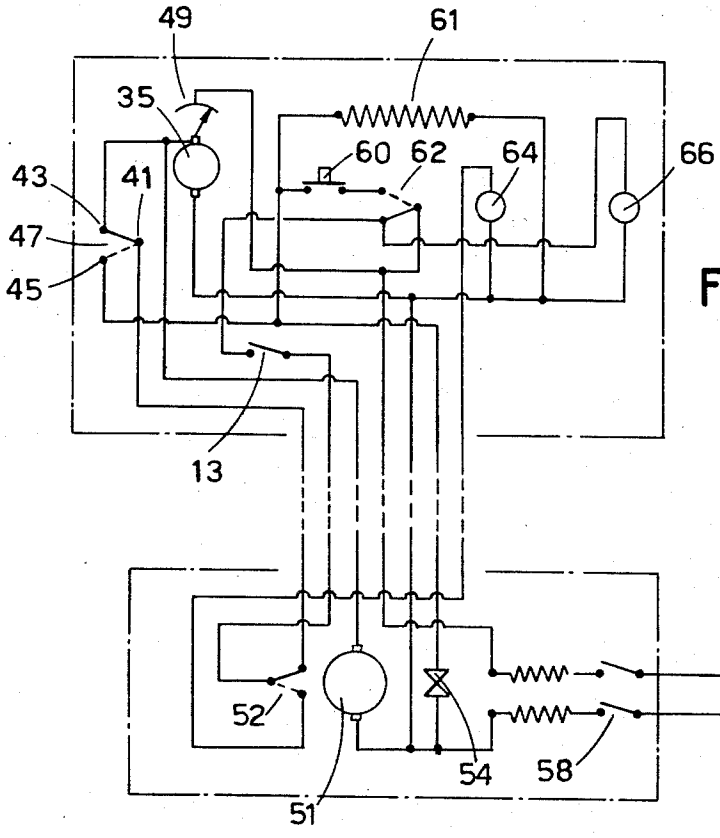


Fig.9

INVENTORS
PIETRO B. SALIMBENI VIVAI
By Mulglow and Tower
ATTORNEYS

United States Patent Office 3,418,823
Patented Dec. 31, 1968

3,418,823

CYCLIC MOVABLE ICE MAKER

Pietro Bartolini Salimbeni Vivai, Via Verdi 1, Florence, Italy

Filed May 15, 1967, Ser. No. 638,396
Claims priority, application Italy, May 20, 1966, 11,578/66
7 Claims. (Cl. 62—138)

ABSTRACT OF THE DISCLOSURE

Apparatus for making small ice blocks, which can be used for cooling beverages, comprising a plurality of elongate refrigerated moulds dependent from the roof of a casing. A water containing tray is sequentially and cyclically moved from a position below and to one side of the moulds to a position in which the moulds are immersed in the water in the tray. Consequently, transparent ice layers are formed on the moulds and the formed ice blocks are removed from the moulds by heating the interior of the moulds.

This invention relates to apparatus for making ice blocks. More particularly, but not exclusively, the invention relates to apparatus for making small ice blocks which can be used for cooling beverages in glasses or decanters.

It has previously been proposed to make ice blocks which are substantially transparent, i.e. crystalline, by eliminating the gases and salts present in the water which are the cause of the milky opacity of ice. Previously, it has been proposed to make such transparent ice by vigorously stirring the water to be frozen, with airstreams along the surface of the ice being formed, and by appropriate adjustment of the freezing time. Such proposals lead to structural complications in the ice-making apparatus, necessitate large dimensioned ice-making apparatus and require the cooling of a large amount of water during the freezing time with a resulting loss in efficiency since the residual water, which has a high amount of impurity, has to be eliminated during each cycle.

It has also been proposed previously to provide a small tank or tray which is provided with a stirrer and made separable from the small ice block matrix. The tank or tray is tilted to eliminate residual water, the separation and tilting taking place at the end of the ice forming cycle.

The present invention provides a simplified ice-making apparatus of increased efficiency and smaller dimensions than previously proposed apparatus. Furthermore, the forming of the ice blocks may be made visible from the outside by means of transparent screens. Apparatus in accordance with the invention, due to its relatively small size, may be housed in a household refrigerator.

According to the present invention there is provided apparatus for making ice blocks comprising at least one matrix around which an ice block is formed, a liquid containing tray, means to cyclically and sequentially move the tray from a position remote from the matrix to a position in which the matrix is at least partially immersed in the liquid in said tray, means operable to arrest the cyclic movement of the tray when an ice block of predetermined size has been formed around the matrix, means operable to cause an ice block of predetermined size to be removed from the matirx, and means disposed below the matrix to collect said ice block removed from the matrix.

The invention will now be described by way of example with reference to the accompanying diagrammatic drawings, in which:

FIGURES 1 and 2 are perspective views of certain features of apparatus in accordance with the invention;

FIGURE 3 is a side view partly in section of apparatus in accordance with the invention;

FIGURES 4 and 5 show details of the apparatus shown in FIGURE 3;

FIGURE 6 is a section taken along the line **6—6** of FIGURE 4;

FIGURE 7 is a section taken along the line **7—7** of FIGURE 6; and

FIGURES 8 and 9 illustrate hydraulic and electrical circuits respectively for use with apparatus in accordance with the present invention.

Referring now to the drawings, particularly to FIGURE 3 there is provided a housing **1** having a pivotable door **3** which together define a chamber B into which formed ice blocks C are introduced from a casing **5** disposed above the housing **1**. As ice blocks C are admitted into the chamber B in the direction indicated by arrow f_1, the ice blocks cause a strip **7** to pivot downwardly against the action of a spring to the position shown in broken line **7***x*. The spring tends to return the strip **7** to its original position as shown in full line. When the chamber B is full of ice blocks, further ice blocks passing from the casing **5** cause the strip **7** to remain in its lowered position **7***x*. In this lowered position, the cycle of making ice blocks is interrupted. In order to effect this interruption a cam **11** is secured to a spindle **9** which is integral with the strip **7**, the cam **11** acting to operate an overflow switch **13** (see FIGURE 9) when the strip **7** is in the position **7***x*.

A set of matrices or moulds **17** around which the elongated cup shaped ice blocks C are formed, are supported in a box structure **15** secured to the upper wall of the housing **5**. The matrices **17** as shown are elongate members having rounded ends, but may be of any other suitable shape, and are made of materials having good heat conductive qualities. As can be seen from FIGURE 6, the matrices **17** are provided with V-shaped passages **19** which are interconnected by pipes **19***a* for the flow of refrigerating fluid. In the box **15** adjacent the upper surfaces of the matrices **17** are provided heat generating means **21** (for example, electrical resistances) which provide a brief and controlled heating of the matrices for effecting removal of formed ice blocks C from the matrices **17**. The heating may alternatively, or in addition, be obtained by passing a hot gas at a high pressure, by means of a suitable by-pass and an electro-magnetic valve, in the passages **19** and pipes **19***a* of the matrices. Alternatively, tray renewal water may be caused to pass through channels similar to the tubes **21**.

The ice blocks C are formed by successive ice layers generated by dipping the matrices, and subsequently the blocks being formed around the matrices, into a tray containing water. The formation of several layers of ice ensures that the ice blocks will be transparent, provided that the water into which the matrices are dipped is kept at least restrictedly stirred, and provided that the ice blocks are built up of relatively thin layers of ice which are continuously exposed to the air, and that the air is stirred.

As can be seen from the drawings, the matrices **17** remain stationary and cooperate with a tray **23** provided with a reciprocal motion whereby it can move between the postions **23X** and **23Y** shown in FIGURES 1 and 2, wherein the matrices are alternately immersed within the liquid in the tray **23** as shown at **23X** in FIGURE 1 and are out of contact with the tray as shown at **23Y** in FIGURE 2. The tray **23** is supported by mechanical means which permits cyclic movements thereof between said two positions to obtain relatively short immersions of the matrices in the fluid in the tray, the tray in its lowered position being in a position in which it does not interfere with the ice blocks C as they fall due to gravity in the direction indicated by arrow f_1 when the matrices are internally heated.

The tray **23** is carried by pairs of parallel cranks **25***a*, **25***b*. The upper cranks **25***a* are mounted on a shaft **27** movement of which is controlled by a crank lever **29** and a connecting rod **31**, the rod **31** being connected at its end remote from the crank lever **29** to an eccentric crank lever **33** of an electric motor **35**. Alternate movement of the tray **23** between the positions **23X** and **23Y** permits cyclic immersion of the matrices and thus the formation of thin ice layers on the matrices and the stirring of both the tray water and the air.

A feeler **37** is mounted on the shaft **27** and includes a flexible member **37***a* which is positioned adjacent to one of the ice blocks C being formed. An arm **39** (see FIGURE 4) integral with the shaft **27** supports the feeler **37**, the arrangement being such that the feeler **37** follows, during lowering of the tray **23**, movement of the arm **39**, and is raised by the arm **39** during upward movement of the tray, thereby cyclically maintaining a relative constant arrangement between the shaft **27** and a core **37B** by which the feeler **37** is idly mounted on the shaft **27**. Under these conditions, a contact **141** integral with the shaft **27** rests against a contact block **43** formed in the periphery of the core **37B** during any angular movement of the shaft **27** and consequently, the links **25A** **25B** and the arm **39**. When a sufficient ice layer has been formed on the matrices **17**, that is when the blocks C are considered to be completed, the flexible member **37A** of the feeler **37** rests on top of one of the blocks **17** such that the feeler **37** is no longer free to be lowered together with the arm **39**. The matrix of the ice block with which the feeler member **37A** cooperates is provided with a roughness or the like to assure that the block which cooperates with the feeler is the last to fall. When the feeler **37** and its core **37B** remain in the raised position and do not follow the arm **39**, the contact **41** is offset with respect to the contact **43** (see FIGURE 5) and instead makes contact with a contact **45**. The feeler **37** may be adjusted, for example, by axial movement of the core **37B**. The members **41**, **43**, **45** form in effect a switch which in the circuit shown in FIGURE 9, is indicated at **47**. This switch switches the operation of the apparatus from the generation of ice blocks to the discharge of the formed blocks, causing at the same time the simultaneous stoppage of the tray motion and the commencement of the filling of the tray for a new cycle. It is to be noted that the inertia of the motor rotor, the influence of gravity on the tray **23** and an appropriate additional brushing contact **49** (see FIGURE 9) or the like cause the motor **35** to stop in a position in which the tray is in its lowered position **23Y** as shown in FIGURE 2. When the ice block felt by the feeler member **37A** (and thus all the other ice blocks) has been removed from the matrix **17** by internal heating of the matrix, the feeler is again lowered to a position in which it makes contact with the arm **39** and thereby controls the initiation of a new ice making cycle.

In FIGURE 9 there is shown a control circuit for the apparatus described above. In the figure there is shown a motor compressor unit **51**, a switch **52** actuated by a water pressure static valve which interrupts the cycle of operation in the absence of pressure in the water mains, a solenoid valve **54** which permits filling of the tray with water through a nozzle **78** (see FIGURE 8), the tray being maintained at a constant level by a grazing or overflow device **56** as shown in FIGURE 6, through which water is discharged through an outlet **56***a* for the elimination of any excess of water after the filling of the tray **23**. In this way a removal of residual water from a previous cycle is assured and consequently any concentration of salts in the water at the end of an ice production cycle is eliminated. In FIGURE 9 there is also shown a fuse switch **58**, a push-button switch **60** for the initial operation of the apparatus, that is for the manual filling of the tray before the first cycle, a resistor **61** for the detachment of the formed ice blocks, which resistor corresponds to the previously described heating means **21**, an operating switch **62** for the initiation of the automatic operation of the apparatus, a pilot lamp **64** for indicating feed water absence controlled by the pressure static valve **52**, and a lamp **66** which illuminates the ice forming zone for the direct visibility of the apparatus operation. The lamp **66** may be a germicide lamp to assure the pureness of the ice of the blocks.

After contact has been established by means of the general fuse switch **58** and the operating switch **62** has been placed in the "off" position (shown dotted in FIG. 9), the solenoid valve **54** is operated by means of push button switch **60** for initially filling the tray **23** with liquid, or in order to change the water contained in the tray after the apparatus has been inactive for a period of time. With the tray filled with liquid, the switch **62** is moved into the "on" position (shown by a full line in FIG. 9), and current is fed to the lamp **66** which illuminates the ice forming zone in the apparatus, and, as indicated earlier, also may light a germicide lamp. Further, the switch provides current to the contact **41** of the switch **47** through the switch **52** which initially is in the position denoted by the full line in FIG. 9. Accordingly, the feed to switch **47** is discontinued when the ice container or chamber B is filled, that is by the action of switch **13**, and also when, due to the absence of water, the switch **52** is displaced into the dotted position shown in FIG. 9. With the switch **52** in the dotted line position, the pilot lamp **64** is lighted. The switch **47** is connected to the feeler **37** and until the feeler is in its rest position, current is fed to the motor **35** through its contacts **41**, **43**, thereby operating or cyclically moving the tray. At the same time current is also supplied to the compressor **51**. However, when the feeler **37** is retained by a predetermined thickness of the ice block formed on the matrix, the contacts **41**, **43** of switch **47** are opened and contacts **41**, **45** are closed, shown dotted in FIG. 9, and the motor and compressor cease to be operated. During this period the solenoid valve **54** is actuated for filling the tray with water and the resistor **61** is operated for defrosting and detaching ice blocks from the matrices **17**.

The moving contact **49** supplies current to the motor **35** independently from and in parallel with the operating switch **62**. Accordingly, when a tray is in the raised position, it continues to receive current and the moving contact is disengaged in the lower position whereby the tray can only come to a stop position in its lower position, that is where it is displaced from the matrices.

FIGURE 8 illustrates the water and refrigerating circuit of the apparatus described above. In the drawing there is shown a feed water inlet **72** which communicates with a tube **74** which in turn communicates via a solenoid valve **54** and a governor **68** with the nozzle **78** through which feed water is admitted to the tray **23**. Water is removed from the apparatus through a port **80** which is disposed just downstream of a pressure static adjustment valve **82**, which adjusts the condensation water, and is provided with an overload switch. A compressor **51** is disposed within the refrigerating fluid circuit which includes a branch pipe **84** and a high pressure pipe **86** which communicates with a counter-flow condenser **76** which in turn communicates with a capillary tube **87** through which refrigerant water is admitted to the passages **19** and pipes **19***a* of the matrices **17**.

During operation a portion of the feed water from the conduit **72** passes through the counterflow condenser **76** and then passes through the discharge port **80** which is controlled by a pressure static valve **82** provided with a maximum pressure switch. The other portion of the water passes through the pipe **74** to the nozzle **78** for filling and washing the tray **23** and it is controlled by the electromagnetic valve **54** and by the adjustment cock **68**.

The compressor **51** supplies compressed gas into the pipe **86** and the gas flows through the condenser **76** in counter-flow relationship with the water passing through the condenser, then through a filter and a capillary tube

87 before it reaches the refrigerating circuit **19–19***a* which affords the ice-forming means for the matrices **17**. After its passage through the refrigerating circuit **19–19***a*, the gases are returned through the pipe **84** into the compressor.

The nozzle **78** feeds water to a zone **57** of the tray **23** which is separated from the tray **23** by means of a perforated diaphragm. This arrangement permits a uniform feed of water without excessive vortices in the streams of liquid admitted to the tray.

The apparatus may be made dimensionally small and have transparent casing walls **5** and housing walls **1** to render the ice block forming operation visible. The apparatus may be installed on a bench or board of a bar or the like or may be installed in a household refrigerator.

I claim:

1. Apparatus for making ice blocks comprising at least one matrix arranged to have an ice block formed thereon, a tray arranged to contain a liquid for forming the ice block on said matrix, means for cyclically moving said tray between a first position where the matrix is at least partially immersed in the liquid and a second position where said matrix and the ice block formed thereon are completely removed from the liquid in said tray during the formation of the ice block whereby successive layers of ice are formed on the exterior of said matrix, means operable to arrest the cyclic movement of the tray when an ice block of a predetermined size has been formed on said matrix, said means operable to arrest the cyclic movement of the tray arranged to locate the tray in a position displaced laterally from the path of an ice block falling by gravity from said matrix, means operable to cause an ice block to be displaced from said matrix, and means disposed below said matrix to collect the ice blocks displaced therefrom and falling under the effect of gravity.

2. Apparatus as claimed in claim **1** further comprising means for filling the tray at the completion of each ice block making cycle, baffle means in said tray for reducing vortices in the fluid fed to the tray, and an overflow device to ensure a predetermined liquid level in said tray before the initiation of each ice block making cycle.

3. Apparatus as claimed in claim **1** in which the means to cyclically and sequentially move the tray comprises two pairs of parallel links, each pivotally secured at one end to the tray.

4. Apparatus for making ice blocks comprising

a housing comprising a top panel and side panels;

a collecting chamber disposed below said housing;

a plurality of elongate mould members around which ice blocks are formed dependent from said top panel of said housing;

a liquid containing tray;

link means operable to move the tray sequentially and cyclically between positions in which the mould members are immersed in the liquid in the tray and in which the tray is disposed below and to one side of the mould members;

means operable to arrest the cycilc movement of the tray when an ice block of predetermined size has been formed around one of said mould members;

heating means operable to cause ice blocks of predetermined size to be detached from said mould members, ice blocks detached from said mould members falling due to gravity into said collecting chamber;

a pivotable strip member disposed in the path of such falling ice blocks and operable to pivot downwardly on contact with said ice blocks;

resilient means to return the strip member to its original position;

and control means to interrupt the operation of the apparatus if the strip member is restrained from returning to its original position.

5. Apparatus as claimed in claim **4** comprising a feeler member movable into and out of contact with an ice block being formed on one of said mould members, said feeler member being arranged such that when an ice block of predetermined size has been formed on said one mould, the feeler member is restrained from movement out of contact with said ice block, and further comprising means to operate said heating means upon said feeler member being restrained.

6. Apparatus as claimed in claim **4** in which said heating means comprises a passage formed in each mould member, which passage is in communication with a heating medium.

7. Apparatus as claimed in claim **6** in which said heating medium is the liquid in the tray.

References Cited

UNITED STATES PATENTS

2,542,892	2/1951	Bayston	62—352 X
2,585,240	2/1952	Grow	62—344
2,718,125	9/1955	Horvay	62—137 X

ROBERT A. O'LEARY, *Primary Examiner.*

WILLIAM E. WAYNER, *Assistant Examiner.*

U.S. Cl. X.R.

62—353