

Sept. 25, 1951

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2,568,906

TIMER

Filed June 9, 1948

2 Sheets-Sheet 1

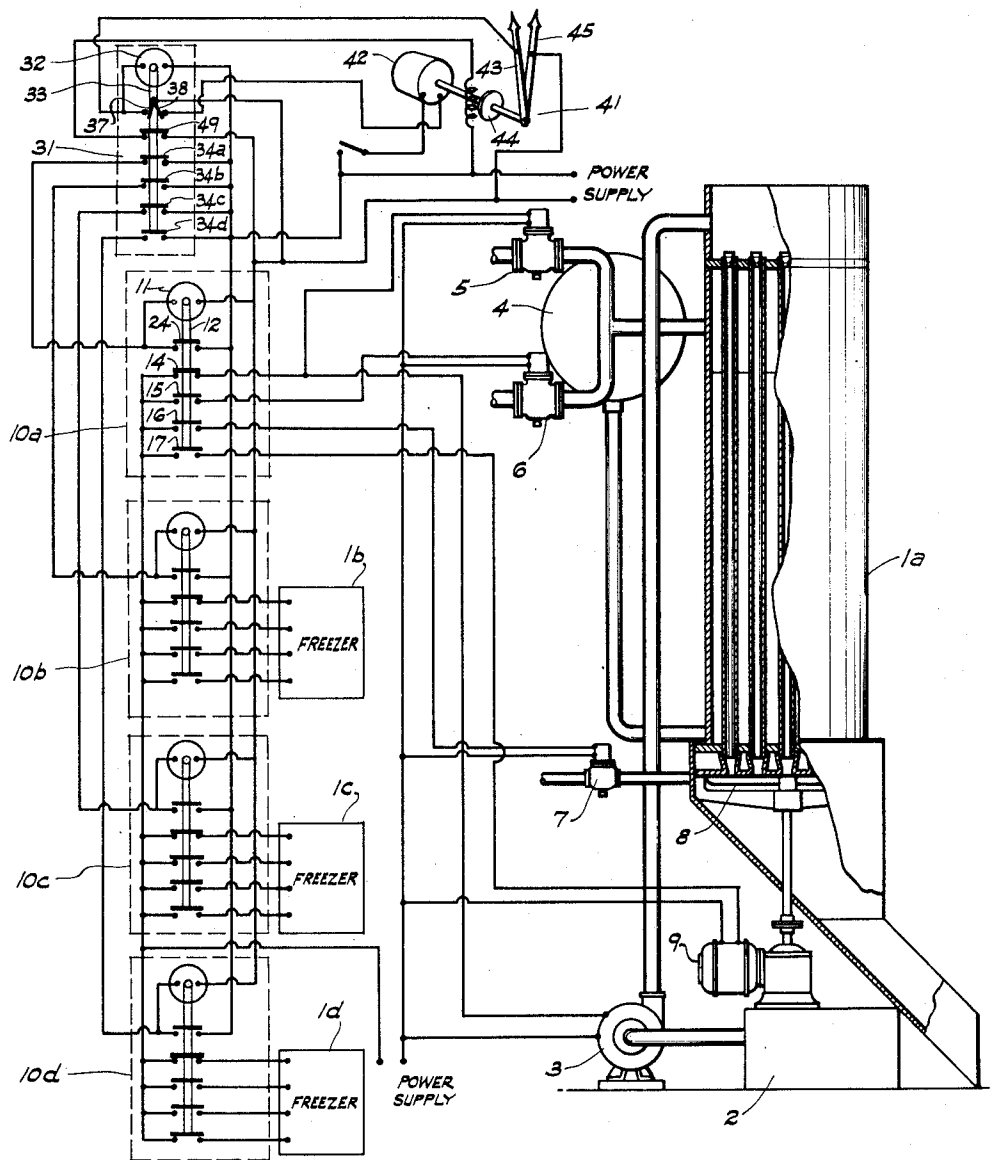


Fig. 1

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2 Sheets-Sheet 2

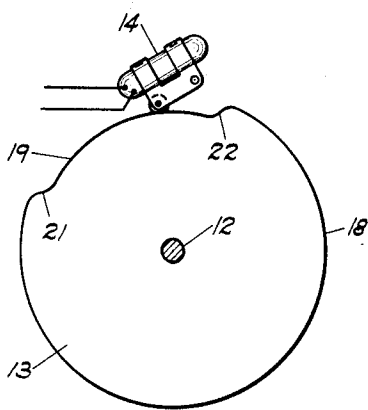


Fig. 2

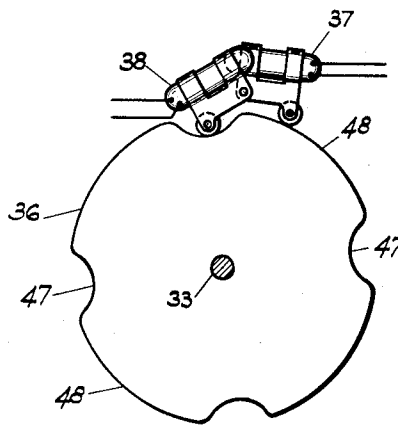


Fig. 3

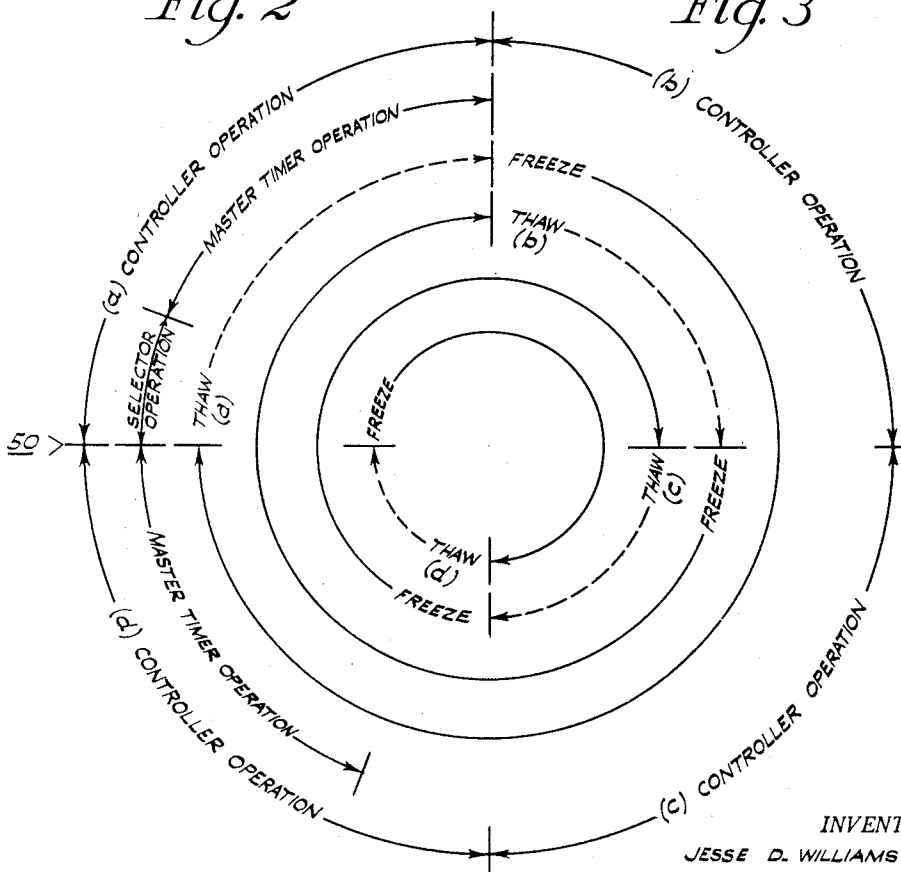


Fig. 4

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TIMER

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In ice making machines, such as that disclosed in Kubaugh Patent No. 2,239,234, granted April 22, 1941, a variation in the freezing period determines the shape and size of the ice fragments obtained. Thus, for example, a long freezing period will produce solid rods of ice, while a shorter period of freezing produces hollow ice rods, with a resulting change in form of the fragments when the rods are broken. The timing apparatus disclosed in my Patent No. 2,396,308 is not suitable, without changes, for operating a plurality of ice making machines and if modified, is not readily adaptable for changing the freezing period when employed to control a plurality of machines. Accordingly, the present invention relates to an improvement on the construction disclosed in my above mentioned patent, and it is an object of the invention to provide a control for a plurality of ice making machines which is adjustable to vary the freezing period of the machines.

A further object is the provision of a timing system for a plurality of ice making machines which enables the machines to be operated with overlapping operating cycles.

A further object is the provision of a timing system for a plurality of ice making machines which enables the machines to be operated with overlapping operating cycles and which enables adjustment or changing of the freezing period.

In accordance with the present invention the beginning and end of the thawing period of each ice making machine are regulated by controllers which sequentially energize or actuate the instrumentalities that control the phases in the operating cycle of each machine, and the controllers are selectively and sequentially energized at timed intervals corresponding to an operating phase of each machine. The selecting means, which determines the sequence of operation of the respective controllers, preferably is separate from the timing means which determines the length of the freezing period of each ice making machine. Where the ice making machines are operated so that their freezing cycles overlap, the selecting means is energized by the timing means at substantially equal time intervals throughout the operating cycle of a machine. This time interval will be equal to the total operating cycle of one machine divided by the number of machines, and the timing means is adjustable to actuate the control means at any desired intervals. Thus, where the timing means has an idling or resetting period its operating time is set so that the sum of its operating time and re-

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setting time equals the total time cycle divided by the number of machines.

The selecting means may have a fixed period of operation including the resetting period of the timing means, and may serve to deenergize the timing means for automatic resetting and to reenergize the timing means, so that the timing means thus embodies a substantially fixed idling or resetting period. Or, the selector means may have an operating period dependent upon the number of freezers employed therewith.

The timing means may energize the controllers directly after the selection has been made, or may energize the selector which in turn energizes a selected controller. The timer may be reset or energized for another timing operation during the selecting period. However, the resetting need not be instantaneous because any time interval between deenergizing of the timer and reenergization of the reset timer overlaps the thawing cycle of the selected machine, and thus does not cause any change in the freezing time. Also, after making a selection, the selector is inactivated and placed in readiness for reactivation by the timer, as the particular controller then takes over the control of its particular machine.

In tube ice making machines to which the invention is particularly adapted, although not limited thereto, the duration of the thawing phase is substantially independent of the freezing time and is substantially constant, and the individual operations in the thawing phase comprise, stopping the flow of water to the tubes; closing the valve connecting the refrigerant chamber to the suction side of the refrigerant compressor; opening a valve to admit hot refrigerant gas to the freezer; opening the thawing water valve; and starting the cutter in operation. These steps may be carried out practically simultaneously, although for practical reasons I prefer to carry them out more or less in sequence. The controller thus actuates the above described operations at beginning of the thawing cycle and reverses the operations at the end of the thawing cycle to thus begin the freezing phase of the operating cycle.

The invention will be described in greater detail in connection with the accompanying drawings illustrating an embodiment of the invention by way of example and wherein,

Figure 1 is a partly diagrammatic view illustrating the invention;

Figures 2 and 3 show details, and

Figure 4 diagrammatically shows the relation of the operating cycles of the machines.

Referring to the drawing there is diagrammatically shown a tube ice making machine 1a of the type disclosed in said Kubaugh patent embodying a freezer unit providing water tubes surrounded by refrigerant, water being supplied to the tubes from a tank 2 by means of a motor operated pump 3 which supplies water to a distributing head at the top of the freezer unit. Refrigerant is supplied to the freezer from a reservoir 4, and the freezer unit communicates with the suction side of the refrigerant compressor through an electrically operated valve 5. During the thawing phase hot refrigerant gas may be supplied to the freezer through an electrically operated valve 6, and thawing water is admitted to the lower portion of the freezer through an electrically operated valve 7. During the thawing cycle, the cutter 8 is operated by a motor 9.

During the freezing phase of operation the valve 5 is open and the water tubes are surrounded by cold liquid refrigerant, while motor operated pump 3 supplies a flow of water through the tubes, and cutter motor 9 is inactive. At the completion of the freezing phase valve 5 is closed and substantially simultaneously valve 6 is opened to admit hot gas to the freezer to drive the liquid refrigerant from the freezer into the reservoir 4, suitable provision being made to prevent the hot refrigerant gas from following the cold refrigerant into the reservoir. Substantially simultaneously pump 3 is stopped and valve 7 is opened to admit thawing water to the water compartment at the lower ends of the tubes. Thereafter motor 9 is operated to drive the cutter and break the ice rods or tubes as they fall out of the freezer. It is to be understood that the operation of the three valves and two motors may be in any desired sequence or may occur substantially simultaneously as desired. At the end of the thawing cycle, valve 6 is closed and valve 5 is substantially simultaneously opened to draw liquid refrigerant from the reservoir into the freezer, and valve 7 is closed, pump 3 is started and motor 9 is deenergized, these operations occurring in any desired sequence. The apparatus for timing the foregoing described operations now will be described.

A mechanism designated herein as a controller is indicated at 10a which functions directly (or through relays or other interposed controls) to control the operation of the freezer illustrated. This controller comprises a motor 11 preferably of the shaded pole type, which drives a timer shaft 12 about which are suitably arranged switches and switch actuators or cams 13 (Figure 2). Switches 14, 15, 16 and 17, which are diagrammatically shown in Figure 1, are alike in construction and may be of the mercury type, a cam 13 and switch 14 being more fully illustrated in Figure 2. The cam 13 may be of disc form having a dwell portion 18 for holding the switch 14 open, a second dwell portion 19 for holding the switch closed, and suitably curved connecting portions 21 and 22 at which points the switch is operated. The four cams may be circumferentially displaced to secure the desired sequence of operation of each switch. Switch 14 controls the starting and stopping of pump 3 as well as the opening and closing of suction valve 5, switch 15 controls the opening and closing of the hot refrigerant valve 6; switch 16 controls the opening and closing of thawing water valve 7; and switch 17 controls the starting and stopping of cutter motor 9.

Any desired number of ice machines may be provided, and a controller is provided for each machine. The drawing shows four controllers 10a, 10b, 10c and 10d, which are identical in construction, and each controls the operation of a tube ice machine. Although only one tube ice machine is illustrated, it is to be understood that the switches of the controllers 10b, 10c and 10d are connected to their respective machines 1b, 1c and 1d in a similar arrangement. In addition to the cams and switches so far described, each controller has a similar cam to control a holding switch 24, the purpose of which presently will be explained.

A selector 31 is provided for determining the sequence of operation of the controllers. The selector comprises a suitable motor 32 operating a cam shaft 33 upon which are located a plurality of cams similar to cam 13 each of which operate a switch 34a, 34b, 34c and 34d respectively which energize one of the controllers 10a, 10b, 10c and 10d respectively. The number of such cams and switches 34a, 34b, 34c, in the selector depends upon the number of freezer units to be controlled, and they are circumferentially arranged to provide substantially equal intervals between actuation of the respective switches. Thus, for example, where four controllers are employed, the switches 34a, 34b, etc. are arranged to be actuated upon each 90° rotation of the cam shaft 33. In addition, the selector cam shaft carries a cam 36 which actuates a pair of switches 37 and 38 which may be of the mercury type. Switch 37 is a holding switch for selector motor 32 and the purpose of switch 38 presently will be described.

Selector 31 is periodically energized by a master timer 41 which may be of any suitable construction. The timer illustrated comprises a motor 42 which drives a pointer 43 through clutch 44 which is electrically disengaged. A manually adjustable pointer 45 carries one electrical contact, the other contact being carried by pointer 43, and when the two pointers substantially coincide the circuit for selector motor 32 is closed to thereby actuate the selector. If desired, a timer may be employed in which the two pointers are settable together and coincide at zero, and the pointer 43 moves away from pointer 45 and closes the circuit of selector 33 at the end of the pointer movement.

The switch 38 operated by the selector serves to deenergize the master timer motor. The cam 36 may have a plurality of notches 47 separated by dwell portions 48, the number of notches being the same as the number of ice making machines to be controlled. In addition the selector controls a switch 49 by a cam similar to cam 36, which serves to energize and deenergize the electrical control for clutch 44. Thus, when the master timer energizes the selector, the selector cam 36 substantially simultaneously closes switch 37 to hold the selector motor energized, and the dwell portion opens switch 38 to deenergize the master timer motor. Switch 49 also is closed to energize the electrical control for clutch 44 and disengage the clutch, and a spring (not shown) returns the pointer 43 to its starting position. Continued operation of the selector closes switch 34a to energize the controller 10a, and thereafter, while the controller is operating, the cam 36 opens selector holding switch 37 to deenergize the selector and closes switch 38 to reenergize the master timer motor. In the meantime, pointer 43 has returned to starting position and switch 49 has been opened

to allow clutch 44 to engage, so that upon reenergization of the master timer motor the pointer 43 commences to travel to measure off another timing cycle.

The operation of the apparatus now will be explained, on the assumption that four ice making machines are to be controlled. The complete operating cycle of a machine is composed of a freezing phase and a thawing phase. The freezing time depends on whether the freezer is being operated to produce solid ice rods or hollow ice cylinders, a lesser time being required to produce thinner wall ice cylinders. However, the thawing period in each case is substantially the same, because it is required only to thaw enough of the outer periphery of the ice rods to free them from the enclosing tubes. Also, the thawing time is less than the minimum practical freezing time. It is thus possible to conduct the freezing phase of one freezer during or overlapping the thawing operation of one or more of the other freezer units.

The explanation of operation can be simplified and made clearer by reference to Figure 4 where the total operating cycle comprising a thawing period and a freezing period, is represented as a complete circle. In operating four machines the beginning of the thawing operation on each machine is timed to occur successively at one fourth, two fourths, three fourths and four fourths of the operating cycle, and the sum of the operating period of the master timer and the selector operating period (which is the resetting period of the master timer) equals one fourth the operating cycle. Each controller 10a, 10b, 10c and 10d controls its respective machine by initiating the thawing phase, and upon completion thereof resets its machine for the freezing phase.

In Figure 1 the master timer is measuring off a time period near the end thereof and the selector and controllers are all deenergized. Machines 10a, 10b and 10c are in their freezing phase, and machine 10d has just completed its thawing phase and is starting the freezing phase. This corresponds to the position of arrow 50 in Figure 4. When the pointers 43 and 45 are juxtapositioned at this position to energize the selector, motor 32 causes the cams thereon to operate the following switches: 34a closes to energize controller 10a; 37 closes to hold the selector motor energized; 38 opens to deenergize timer motor 42; 49 closes to disengage the clutch 44; while switches 34b, 34c and 34d remain open. Controller 10a thereupon closes its own holding switch 24 and becomes independent of the selector. The master timer resets itself and thereafter, selector shaft 33 having completed a quarter turn, the following switches are operated at the end of the selector operation: switch 34a opens without affecting controller 10a (as controller 10a is being held in operation by its own holding switch); switch 49 is opened to reengage the clutch 44; switch 38 is closed to reenergize the master timer; and switch 37 is opened to deenergize the selector, whereupon the selector assumes a neutral position. This action takes place substantially at the end of the selector operation, and the master timer now commences operation to measure off a time period. The selector stops in neutral position in readiness to close switch 34b.

Meanwhile, controller 10a is operating to actuate switches 14, 15, 16 and 17 to close suction valve 5; open valve 6 to admit hot gas to the freezer and drive out the refrigerant; stop pump 3; open valve 7 to admit thawing water; and energize cutter motor 9. At about the time the

master timer is ready to again energize the selector, the thawing phase of freezer 10a is completed and the controller again operates switches 14, 15, 16 and 17 to restore the freezer 1a to the freezing phase, whereupon holding switch 24 is opened to deenergize the controller motor 11. Now, upon operation of the selector 31 by the master timer, motor 32 closes switch 34b to energize controller 10b, which thereupon closes its holding switch, switches 34a, 34c and 34d remaining unchanged, and the cycle of operations of the selector is repeated as above described, ending with the selector in a neutral position.

Various modifications in the invention may be made without departing from the principles or scope hereof, and the above description, therefore, is merely illustrative of the invention.

I claim as my invention:

1. In combination: a plurality of freezer units, each having an operating cycle including a freezing phase and a thawing phase; a plurality of control means, each being adapted to govern the duration of the freezing and thawing phases of each freezer unit, respectively; self-limiting selector means for sequentially initiating operation of said control means; a resettable master timer for initiating operation of said selector means and including releasable power transmission means; said selector means including means operative upon energization of the selector means to deenergize the timer, release and reengage said power transmission means, and reenergize the timer.

2. In combination: a plurality of freezer units, each having an operating cycle including a freezing phase and a thawing phase; a plurality of control means, each being adapted to govern the duration of the freezing and thawing phases of each freezer unit, respectively; self-limiting selector means for determining the order of operation of said control means; and a master timer for initiating operation of said selector means at timed intervals; said selector means including means for deenergizing said timer to enable resetting of said timer after each operation, and means for reenergizing said timer after each resetting operation.

3. In combination: an electrical timer comprising a motor, a switch operated thereby, and means releasably coupling said motor and switch; a selector actuated by the timer and including a self-limiting switch, a timer motor deenergizing switch, and switch means for controlling said releasable coupling; and a plurality of self-limiting control means, each being adapted to govern the duration of the operating phase of a machine; said selector including switch means for sequentially energizing said control means.

4. The combination comprising: a plurality of freezer units having an operating cycle including a freezing phase and a thawing phase; a plurality of control means, each governing the duration of the freezing and thawing phases of said freezer units; self limiting selector means for determining the order of actuation of said control means; and timer means for periodically actuating said selector means to actuate the control means in the selected order.

5. In combination: a plurality of freezer units, each having an operating cycle including a freezing phase and a thawing phase; a plurality of electrically energized control means, each including means to govern the duration of the freezing and thawing phases of one freezer unit; selector means for sequentially energizing said

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control means; means for deenergizing said control means at the end of the operating cycle of the respective freezer unit controlled thereby; a resettable timer for periodically energizing said selector means at timed intervals; means for deenergizing said selector means after each energization of a control means; and means operated by said selector means to reset said timer each time said selector means is energized.

6. The combination as specified in claim 4 having means to vary the periodical actuation of the selector means.

7. The combination as specified in claim 5 having means to adjust the resettable timer for changing the timed intervals.

8. In combination: a plurality of freezer units having an operating cycle including a freezing phase and a thawing phase; a plurality of self-limiting control means, each governing the respective freezing and thawing phases of a freezer unit; an electrical timer comprising a motor; a timer switch operated by said motor at one limit of said timer; means releasably coupling said motor and switch; a self-limiting selector actuated by said timer switch to sequentially energize

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said control means for governing the operating cycles of the freezer units; a timer motor deenergizing switch and a coupling control switch operated upon energization of said selector to deenergize the timer motor and release said releasable coupling means, respectively, whereby the timer returns to starting position; and a timer motor reenergizing switch operated by said selector.

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