Sept. 20, 1955 L. S. WAIT 2,718,630

AUTOMATIC DOOR LOCKING MECHANISM WITH DELAYED ALARM MEANS FOR DISPENSING MACHINES

Filed Aug. 18, 1954

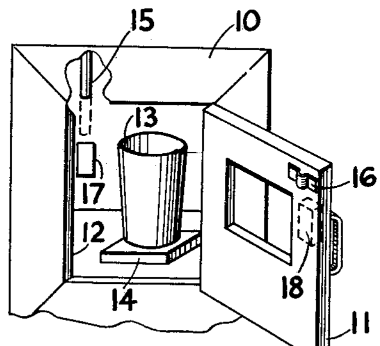

FIG. 1

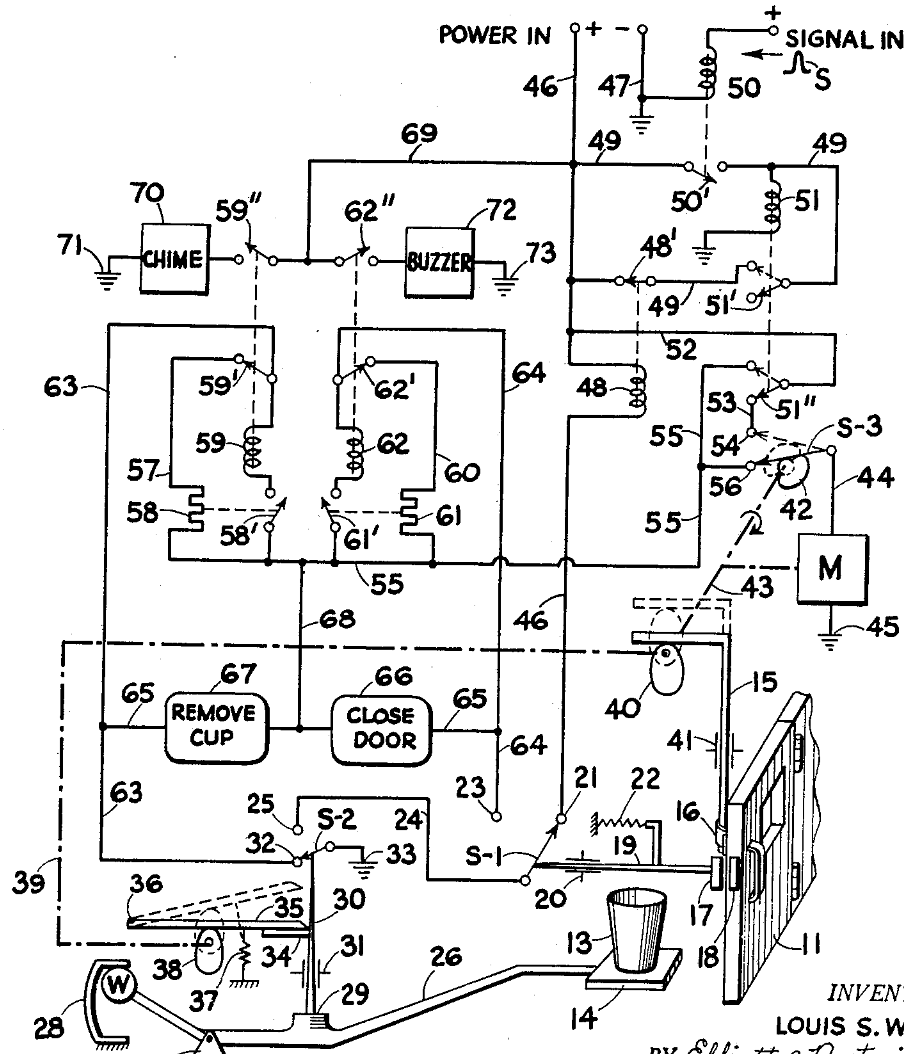

FIG. 2

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United States Patent Office 2,718,630 Patented Sept. 20, 1955

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2,718,630

AUTOMATIC DOOR LOCKING MECHANISM WITH DELAYED ALARM MEANS FOR DISPENSING MACHINES

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Application August 18, 1954, Serial No. 450,637

7 Claims. (Cl. 340—222)

This invention relates to automatic means for unlocking a door in a vending machine to enable a customer to remove the vended article, and for automatically locking the door after the article has been removed to secure the machine against unauthorized tampering. The invention has particular application to bulk dairy product dispensing machines in which the sanitation requirements are relatively strict as compared to conventional soft drink dispensers.

It is important that the operation of all types of vending machines available to the public be as simple as possible and yet substantially foolproof. It is well known that such machines are a constant target of vandals, and unless certain elementary precautions are taken, the machines may be easily contaminated or rendered inoperative. One of the most vulnerable points of attack on such machines is the dispensing mouth or recessed chamber from which the article or drink is removed. Stuffing of these chambers with foreign objects not only contaminates the area, but will prevent the subsequent article from being properly dispensed.

One solution to this problem is to provide a door for covering the recessed area from which the vended article is removed. Such a door must normally be in closed locked position in order to protect the area from contamination and unauthorized tampering. On the other hand, the door must be simple to open and close to enable the dispensed article to be removed when the machine is properly operated by a customer. Further, should the operator not remove the dispensed article, or should he attempt to keep the door open as by some artificial means after the article has been removed, a suitable alarm system or other signal should be provided to inform an attendant of the fact so that the situation can be immediately remedied.

Bearing the above in mind, it is a primary object of the present invention to provide an automatic door unlocking and locking mechanism for vending machines which will overcome the above problems.

More particularly, an object of the invention is to provide a door mechanism of the above type for bulk dairy product dispensing machines which will satisfy all the requirements of local health departments.

Another important object of the invention is to provide an automatic door unlocking and locking mechanism which is initially actuated in response to the operation of the machine and subsequently wholly controlled by the opening of the door, removal of the vended article, and the closing of the door, whereby the provision of external manually operable switches and buttons is entirely unnecessary, and the presence of projections or recessed areas on the front face of the machine in substantially eliminated.

These and other objects and advantages of the invention are attained by providing an actuating means for moving a latch member to lock and unlock the door. A control means cooperating with said actuating means includes a first switch means mechanically operated in response to opening and closing of the door. The operation of this first switch means is accomplished by apparatus preferably concealed within the door and door frame so that tampering of the switch is not possible even when the door is open. The control means also includes a second switch means arranged to be mechanically operated in response to removal of the vended article. The actuating means is initially energized in response to operation of the machine by a customer. Upon removal of the vended article, the second switch means is thrown to a given position, and upon closing of the door, the first switch means is thrown to a given position. When both switch means are in the referred to given positions in response to the above operations, the actuating means is energized to close the latch means and lock the door.

In accordance with a further feature of the invention, first and second alarm circuits are connected in circuit with the first and second switch means. The first alarm circuit includes a delay means energized when a customer initiates operation of the machine. The delay means will operate the alarm after a given period of time if the customer does not open the door to remove the vended article within such period. Opening of the door and removal of the vended article operates the first and second switch means respectively which serve to de-energize the first alarm circuit. Simultaneously, operation of the second switch means will energize delay means in the second alarm circuit. This second alarm circuit will operate after a given period of time if the customer does not close the door within this period. When the door is closed, the first switch means is operated to de-energize the second alarm circuit. These various alarm circuits serve to warn an attendant that the machine is not being properly operated.

A better understanding of the invention will be had by referring to the accompanying drawings, in which:

Fig. 1 is a front perspective view of a door on the front face of a vending machine incorporating the present invention; and,

Fig. 2 is a schematic diagram of the mechanical and electrical circutis for operating the door locking mechanism of the invention shown in Fig. 1.

Referring to Fig. 1, there is shown the front wall **10** of a cabinet forming part of a dispensing machine. Within the cabinet is a receiving chamber adapted to be closed by a door **11**. In closed position, the door **11** preferably fits within door frame **12** so that a substantially flush surface is presented. As shown in Fig. 1, a cup **13** on a cup support **14** is positioned in the receiving chamber for easy removal by a customer when the door is opened.

In accordance with the invention, door **11** is normally locked when in closed position by means of a simple latch member **15** adapted to fit within a receiving bracket **16** secured to the upper inside edge of the door. The latch is temporarily held up in the position shown in solid lines during the period the door is opened, and is automatically lowered to the phantom line position shown in Fig. 1, after the cup has been removed and the door closed. For controlling the latch mechanism as well as the dual alarm system previously described, there are provided first and second switch means. The first switch means is operated by concealed apparatus which, in the particular embodiment disclosed, comprises a permanent magnet **17** disposed adjacent the door frame **12**, and a cooperating magnet **18** concealed within the front edge of the door as indicated by the dotted lines. The arrangement is such that when the door is closed, the magnet **17** adjacent the door frame is attracted to the magnet **18** in the door to throw the first switch means to a given position. When the door is opened, the magnet 18 is withdrawn from the field of the magnet 17 and the latter is therefore free to return to its biased position. Ordinarily, the magnet 17 will be concealed behind a suitable wall near the door frame so that its presence will not be evident to a customer. Such a wall has been omitted from the drawings in order not to obscure the magnet. With magnet 17 suitably concealed, and magnet 18 wholly within the door itself, the apparatus for operating the first switch means is invisible as well as fully protected from vandalism.

The second switch means is arranged to be mechanically actuated when the weight of cup 13 is removed from the support 14 as will become clear as the description proceeds.

The cooperating mechanical and electrical components of the system for operating the latch member and the alarm circuits are shown schematically in Fig. 2. The mechanical system will first be described.

Mechanical system

Referring to the lower right hand portion of Fig. 2, it will be noted that the attracting magnet 17 is coupled to a first switch means S–1 through a coupling rod 19 longitudinally slidable in a guide 20. The switch S–1 is shown in contact with terminal 21, which is its normal position when the door 11 is closed, the magnet 18 pulling the magnet 17 to the right. When the door 11 is opened and magnet 18 removed from the vicinity of magnet 17, a biasing spring 22 pulls the switch S–1 to the left to engage a terminal 23. The arm of switch S–1 is connected through a lead 24 to a normally open terminal 25.

The cup support 14 forms one end of a balanced lever 26, pivoted at 27 to the stationary frame of the cabinet. A counterbalancing weight W is secured to the other end of the lever 26 as shown. The weight W is given a value such that it will not overbalance a filled cup, but will overbalance an empty cup or drop down when the cup is removed. A suitable C-shaped bracket 28, secured to the cabinet frame, checks the extent of the up and down movement of the weight W. At a point on the lever 26 to the right of the pivot 27, there is provided a flat engaging surface 29 upon which normally rests an actuating rod 30 guided for vertical movement by a suitable guide 31 as shown. The upper end of the rod 30 is connected to a second switch means S–2. In its normal position, switch S–2 is in engagement with a terminal 32 and serves to connect the terminal to ground 33. When the filled cup 13 is removed from the support 14, weight W drops downwardly to raise the engaging surface 29 and the rod 30. This action throws the arm of switch S–2 to the open terminal 25 leading from the switch arm S–1 and thereby connects this terminal to ground at 33.

After a filled cup has been removed and the door closed, it is necessary to return the cup support 14 to its original position preparatory to receiving a subsequent cup when the machine is again operated. To this end, there is provided a lateral projection 34 on rod 30 adapted to be engaged by the overlapping end of a bar 35 pivoted to the cabinet frame at its outer end as at 36. A biasing spring 37 holds bar 35 in engagement with a cam 38. As shown, the cam 38 has its axis eccentrically located so that rotation of this cam 180 degrees from the position shown in the drawing will serve to raise the bar 35 to the phantom line position and permit the rod 30 to rise vertically upon removal of the cup. Rotation of the cam wheel 38 another 180 degrees, however, will bring it back to the position shown in the drawing. The spring 37 will act to maintain the bar 35 against the cam wheel so that the overlapping end of the bar will push against the projection 34 and move the rod 30 downwardly. The spring 37 is sufficiently tensioned to overcome the effect of the weight W so that the support 14 will return to its original position although there is no weighted cup resting thereon.

As shown schematically by the dashed line 39 in Fig. 2, cam wheel 38 is mechanically linked to a second cam wheel 40 similarly eccentrically mounted and arranged to operate the latch member 15. This member is guided for vertical movement into and out of the opening in bracket 16 by a guide 41, the upper end of the latch being bent 90 degrees to engage the cam wheel 40. Rotation of the cam 40 180 degrees will thus serve to raise the latch 15 to the phantom line position, thereby unlocking the door.

The operation of the cam wheels 38 and 40 is controlled by a third cam 42 mechanically coupled to the cam 40 as indicated schematically by the dashed line 43. Cam 42 is positioned to operate a switch S–3. The arm of switch S–3 is connected by a lead 44 to a motor M coupled to drive the three cams 38, 40, and 42 simultaneously. The other side of motor M is grounded at 45. The cam 42 comprises a wheel having substantially a 180 degree sector removed so that its radius over half its circumference is less than the radius over the remaining half. With this arrangement, the arm of switch S–3 will remain in one position until the cam has almost completed a 180 degree turn, at which point the arm will be moved to its other position and will stay there until the cam has almost completed a second 180 degrees of rotation. The arm of switch S–3 serves to complete a power circuit for operating the motor M as will become clear as the description proceeds.

Electrical system

Referring now to the upper portion of Fig. 2, the electrical portion of the door locking mechanism will now be described. As indicated, electrical power is supplied to the system between a main power lead 46 and a grounded lead 47. Lead 46 extends downwardly through a series connected relay coil 48 to terminate in terminal 21 of switch S–1. A branch power lead 49 passes to the right from power lead 46 to contact 50′ of a relay coil 50. Relay coil 50 is arranged to be momentarily energized by a signal S initiated by a customer in operating the machine. As shown, this signal may be in the form of a pulse passed through the coil 50 to ground at 47. Closing of the contact 50′ passes power along lead 49 to energize a relay coil 51 connected between the lead 49 and ground. Contact 51′ for relay coil 51 connects the lead 49 back to the power lead 46 through a normally closed contact 48′ associated with the relay coil 48.

After the contact 51′ is closed, the relay coil 51 will remain energized by power passing from power lead 46, through the normally closed contact 48′, contact 51′ and lead 49 through the coil 51 to ground. Relay coil 51 thus acts as a self-locking relay and will remain energized after contact 50′ of relay 50 opens upon termination of the signal S. Operation of the relay coil 51 also serves to actuate its associated relay contact arm 51″. This arm is connected to the power lead 46 through a conductor 52. When the coil 51 is not energized, arm 51″ connects to a jumper lead 53 from an open terminal 54 of the switch S–3. In its other energized position, contact arm 51″ will connect power from lead 52 to lead 55 and the other terminal 56 of switch S–3. This power from power lead 46 and lead 52 is also passed by lead 55 to a dual alarm system shown in the left portion of the drawing.

The dual alarm system comprises a first alarm circuit beginning at the left end of lead 55. As shown, this circuit includes a conductor 57 extending upwardly from lead 55 and including in series a heating coil 58. Conductor 57 passes through a normally closed contact 59′ operated by a relay coil 59. Coil 59 is connected between the base lead 55 and its own contact arm 59′ by a switch 58′ adapted to close in response to heat generated by coil 58 after a given period of time. The second alarm circuit is similar to the first and includes a conductor **60** extending upwardly from the lead **55** and having in series a heating coil **61**. Conductor **60** passes through a normally closed contact **62′** operated by a relay coil **62**. Coil **62** is connected between the base lead **55** and its own contact arm **62′** by a switch **61′** adapted to close in response to heat generated by coil **61** after a given period of time, different from the period of time required for switch **58′** to operate. The upper end of the relay coil **59** is connected by a lead **63** passing downwardly to terminal **32** of switch means S–2. The upper end of relay coil **62**, on the other hand, is connected by a lead **64** passing downwardly to terminal **23** of switch means S–1.

As shown, terminal **23** is also connected through a portion of lead **64** and a branch conductor **65** to conductor **63** and the terminal **32** of the switch means S–2. Branch conductor **65** includes in series a "Close door" light indicator **66** and a "Remove cup" light indicator **67**. A jumper lead **68** connects a point on conductor **65** between indicators **66** and **67**, to the base lead **55** of the alarm circuit. The operation of this portion of the circuit will be described shortly.

Referring to the upper portion of the alarm circuit, it will be noted that relay coils **59** and **62** also operate normally open switch arms **59″** and **62″** respectively. These arms are connected to power through a common power lead **69** extending from the left side of the main power lead **46**. Associated with the switch arm **59″** is a chime circuit **70** one side of which is grounded at **71** and the other side of which is adapted to be connected to the power lead **69** when the switch **59″** is closed. Similarly, a buzzer circuit **72** is associated with the switch **62″**. One side of this buzzer is grounded at **73** and the other side is adapted to be connected to the power lead **69** when the switch **62″** is closed.

Operation

The complete operation of the electrical and mechanical portions of the circuit of Fig. 2 will now be described.

Depending upon the type of dispensing machine, a customer will either insert a coin or depress a suitable switch or button to initiate operation of the machine. The machine will progress through various steps including that of dispensing liquid into the cup **13**. When this last mentioned step has been completed, a suitable pulse or signal will be sent to the door unlocking and locking mechanism of the present invention. This signal is represented by the pulse S shown applied to relay coil **50** in the upper righthand portion of Fig. 2. Momentary energization of coil **50** will close contact **50′** and result in energization of relay coil **51** through the lead **49** from power lead **46**. Energization of coil **51** will close its normally open contacts **51′** and **51″** to the dotted line positions as shown. Closing of contact **51′** applies energy to the coil **51** through normally closed contact **48′**, contact **51′** and conductor **49** through the coil **51** to ground. Thus, as explained previously, coil **51** will remain energized even though contact **50′** opens upon termination of the incoming pulse.

With contact **51″** in the dotted line position as shown in Fig. 2, power will be supplied from main power lead **46** through branch lead **52**, contact **51″**, and lead **55** to terminal **56** of the switch S–3. This power will pass through the switch arm S–3, lead **44**, and motor M to ground at **45** and will start the motor. Operation of the motor M rotates the cam wheels **42**, **40**, and **38** simultaneously. As explained previously, switch arm S–3 will remain in one position until the cam **42** has made almost a 180 degree rotation. When cam wheel **42** has completed 180 degrees rotation, the switch arm S–3 will be moved from terminal **56** to contact the terminal **54**. Since, contact **51″** is now in the dotted line position, terminal **54** is open and the motor M is de-energized stopping all of the cam wheels in their new positions.

Rotation of the cam wheel **40** 180 degrees will lift the latch member **15** out of the bracket **16** thereby unlocking the door **11**. Simultaneously, rotation of the cam wheel **38** will lift the bar **35** to the phantom line position leaving the actuating rod **30** free to rise vertically when the filled cup **13** is removed. However, rod **30** will remain in its down position keeping the arm of switch S–3 on the terminal **32**, as long as the filled cup remains on the support **14**.

It will be noted that closing of the contact **51″** to the dotted line position has placed power on the lead **55**. As shown, this lead **55** extends over to the base of the alarm circuit and thence through lead **68**, the "Remove cup" indicating light **67**, and conductors **65** and **63** to the terminal **32**. Since this terminal is grounded at **33** by switch arm S–2, power will be passed through the indicator **67** to operate this light and inform the customer to "Remove cup." This light will remain on until the cup **13** is actually removed.

It will also be noted that the power from lead **55** will pass through the heating coil **58** of the first alarm circuit, lead **57**, normally closed contact **59′**, and lead **63** to the terminal **32** and ground at **33**. The heating coil **58** and its associated switch arm **58′** constitutes a thermal delay circuit and is adjusted so that the switch **58′** will not close until a given period after coil **58** commences heating. This period may be 10 seconds for example. Accordingly, if the customer does not open the door **11** and remove the cup **13** within 10 seconds, the switch **58′** will close and complete a circuit through relay coil **59**, lead **63** and terminal **32** to ground **33**. Relay coil **59** will be energized to close switch **59″** and open switch **59′**. Closing of switch **59″** energizes the chime **70** by applying power from lead **46** through lead **69**. Opening of the switch **59′** opens the circuit through the heating coil **58** and permits this coil to cool. Cooling of the coil will permit the associated thermally operated switch **58′** to open and thereby de-energize relay coil **59**. De-energization of this coil will permit contact **59′** to close and **59″** to open. Closing of contact **59′** will complete the circuit through lead **57** and start coil **58** heating again, while opening of the contact **59″** will remove power from the chime **70**. Heating of coil **58** will again operate the switch **58′** and the above described cycle will be repeated resulting in the chime being sounded periodically. If the customer still does not open the door **11** and remove the cup, the chime will continue to sound until an attendant is summoned.

Normally, the customer can open the door and remove the cup in a few seconds. Opening of the door **11** will remove the magnet **18** from the field of the magnet **17** whereby the latter magnet is no longer held in position and the biasing spring **22** moves the coupling rod **19** to the left. Movement of rod **19** to the left throws switch arm S–1 from terminal **21** to the terminal **23**. This switching operation connects terminal **23** through conductor **24** to the open terminal **25**, and serves to place the second alarm circuit in a position to be energized.

The customer then removes the cup from behind the door **11**. When cup **13** is lifted from the cup support **14**, the removal of the cup weight results in the counterbalancing weight W dropping downwardly. This action raises the actuating rod **30** in view of the pivoting action of the lever **26** about the pivot point **27**. Upward movement of the rod **30** serves to move the arm of switch S–2 from terminal **32** to terminal **25**. Removal of ground **33** from terminal **32** de-energizes the indicator **67** and the light "'Remove cup" is extinguished. Also, the first alarm circuit lead **63** is disconnected from ground **33** and therefore the heating coil **58** is no longer energized. Connecting of the ground **33** to terminal **25** through operation of the switch S–2, on the other hand, will complete a circuit from the lead **55** (energized from leads **46** and **52** through the contact **51″** now in the dotted line position) through lead 68, the "Close door" indicating light 66, leads 65 and 64, terminal 23, switch arm S–1 (now on terminal 23 since the door 11 is open), conductor 24 to terminal 25 and ground at 33. The indicator 66 will thus be energized. It will also be noted that grounding of the terminal 25 by switch arm S–2 completes a circuit through the second alarm system from lead 55, upwardly extending lead 60, heating coil 61, normally closed contact 62′, and return lead 64 to terminal 23, switch arm S–1, conductor 24, and switch arm S–2 to ground 33. Thus, the moment the cup is removed, the heating coil 58 will be de-energized and the coil 61 will commence heating. Simultaneously, the "Remove cup" indicator 67 will go out and the "Close door" indicator will go on.

The switch 61′ associated with the heater coil 61, constitutes a thermal delay similar to coil 58 and switch 58′. The time period for switch 61′ to operate may be 5 seconds from the time the cup is removed. Otherwise the operation of this second alarm circuit comprising relay coil 62, and associated contacts 62′ and 62″ is entirely the same as operation of the relay coil 59 and associated contacts 59′ and 59″. The second alarm circuit, however, employs a buzzer 72 rather than a chime and therefore, if the customer does not close the door within 5 seconds after the cup is removed, this buzzer will summon an attendant.

The door 11 is normally biased by tension hinges towards a closed position so that during ordinary operation, the door will close by itself after the cup 13 has been removed. The second alarm system will therefore, sound only if the customer or someone else intentionally holds the door open for an appreciable length of time.

Ordinarily it takes no more than a second or two for the door to close after the cup 13 has been removed. When door 11 closes, the magnet 18 is brought sufficiently close to the magnet 17 to attract this magnet to the right and throw switch S–1 from terminal 23 to terminal 21, that is, to the position shown in Fig. 2. This switching action removes ground 33 from the return lead 64 from the second alarm circuit whereby this alarm circuit is de-energized when the door is closed.

Movement of the switch arm S–1 to terminal 21 grounds the power lead 46 through conductor 24, terminal 25, switch arm S–2 and ground 33 since arm S–2 is still on terminal 25 due to the absence of cup 13. Grounding of power lead 46 energizes the series connected relay coil 48 to open its normally closed contact 48′. Opening of contact 48′ removes power from lead 46 to relay coil 51 whereby contacts 51′ and 51″ assume the solid line positions shown.

It will be recalled that the cam wheels 38, 40 and 42 were all previously rotated 180 degrees. Thus, switch arm S–3 is still in the dotted line position on terminal 54. Therefore, when contact 51″ returns to its solid line position on terminal lead 53, power is supplied from lead 46 through lead 52, contact 51″, lead 53, switch arm S–3, conductor 44 to the motor M and ground 45. Motor M is thereby started and will commence rotating the cam wheels 42, 40 and 38. Switch arm S–3 will remain on terminal 54, however, until cam 42 has completed almost 180 degrees of rotation, after which the arm will move to its solid line position on terminal 56. When switch arm S–3 moves to terminal 56, the power to the motor M from terminal 54 is removed, the motor deenergized and the cam wheels stopped. Thus, each cam wheel is returned to its original position. Rotation of the cam wheel 40 serves to lower the latch member 15 into bracket 16 and lock the door 11 closed. Rotation of the cam 38 lowers the bar 35 to force the actuating rod 30 downwardly by the projection 34. The switch arm S–2 is thereby returned to terminal 32 even though no cup is on the support 14, the spring 37 being sufficiently strong to overcome the counterbalancing weight W.

The machine is now ready for operation by another customer, the various cam wheels, relay contacts, and switches all being in their original positions. Upon subsequent operation of the machine by a customer, a new cup will be dropped onto the support 14 and filled with the dispensed product. When this step has been completed a signal in the form of the pulse S will be sent to the relay coil 50 and the cycle of operation described above repeated.

It will be understood that while the invention has been described in connection with a beverage dispensing machine, the principles involving the automatic unlocking and locking of the door and the sounding of alarms if the article is not removed and the door is not closed, are applicable to any type of machine or enclosure having a door and an article of given weight behind the door to be dispensed. The invention therefore, is not to be thought of as limited to the particular application chosen for illustrative purposes.

What is claimed is:

1. In a dispensing machine in which an article having a given weight is disposed within a cabinet behind a door, means for automatically unlocking said door to enable a customer to remove said article in response to operation of the machine by the customer, and for automatically locking said door after said article has been removed, said means comprising: latch means for normally securing said door in locked position; actuating means responsive to a signal generated by operation of the machine for opening said latch means to unlock said door; and control means responsive to closing of said door after said article has been removed for actuating said actuating means to close said latch means, whereby said door is automatically locked.

2. A machine according to claim 1, in which said actuating means includes cam means for moving said latch means to open position in response to said signal and self-terminating means responsive to the position of said cam means for terminating operation of the cam means when said latch means is in open position; and in which said control means includes: a first switch means adapted to be moved from one position to a given position in response to closing of said door; a second switch means adapted to be moved from one position to a given position in response to removal of said article from behind said door, said first and second switch means cooperating together to initiate operation of said cam means to close said latch means only when both said first and second switch means are in their respective said given positions.

3. A machine according to claim 2, including an alarm circuit having delay means adapted to be energized in response to termination of the operation of said cam means when said latch means is in open position, said delay means being connected to operate an alarm in said alarm circuit a given period of time after energization; and means connecting said delay means to said second switch means, whereby movement of said second switch means from its said one position to its said given position, upon removal of said article, de-energizes said delay means.

4. A machine according to claim 2, including an alarm circuit having delay means adapted to be energized when said first switch means is moved from its said given position to its said one position upon opening of said door and said second switch means is moved to its said given position in response to removal of said article; said delay means being connected to operate an alarm in said alarm circuit a given period of time after energization; movement of said first switch means from said one position to said given position, upon closing said door, de-energizing said delay means.

5. A machine according to claim 2, in which said first switch means includes a switch arm; magnetic means coupled to said arm; biasing means urging said arm to said one position; and a concealed magnet positioned

in said door, whereby when said door is closed, said concealed magnet is positioned to attract said magnetic means to move said switch arm from said one position to said given position, and when said door is opened, said concealed magnet is removed from the field of said magnetic means to permit said switch arm to return to said one position.

6. A machine according to claim 2, in which said second switch means includes a switch arm; lever means pivoted to said cabinet; said article having a given weight, resting on one end of said lever; a counterbalancing weight on the other end of said lever; and an actuating rod coupled between said lever and said switch arm whereby removal of said article unbalances said weight and said lever pivots to move said actuating rod and throw said switch arm from said one position to said given position.

7. A machine according to claim 6, in which said cam means includes a cam wheel and coupling means between said cam wheel and actuating rod, whereby initiation of operation of said cam means will operate said cam wheel and coupling means to move said actuating rod in such direction to return said second switch means from its said given position to its said one position.

No references cited.