May 7, 1968 P. H. SMITH 3,381,605

VENDING AND DISPENSING MECHANISMS

Filed July 13, 1966 2 Sheets-Sheet 1

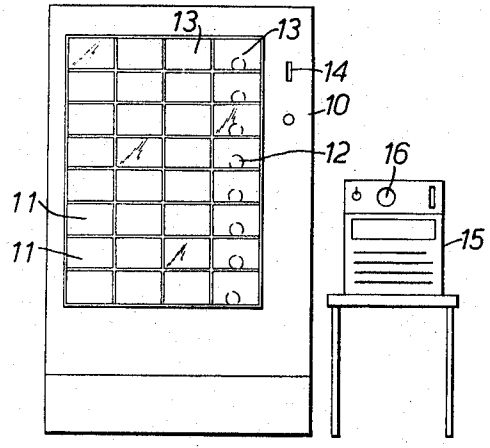

FIG. 1.

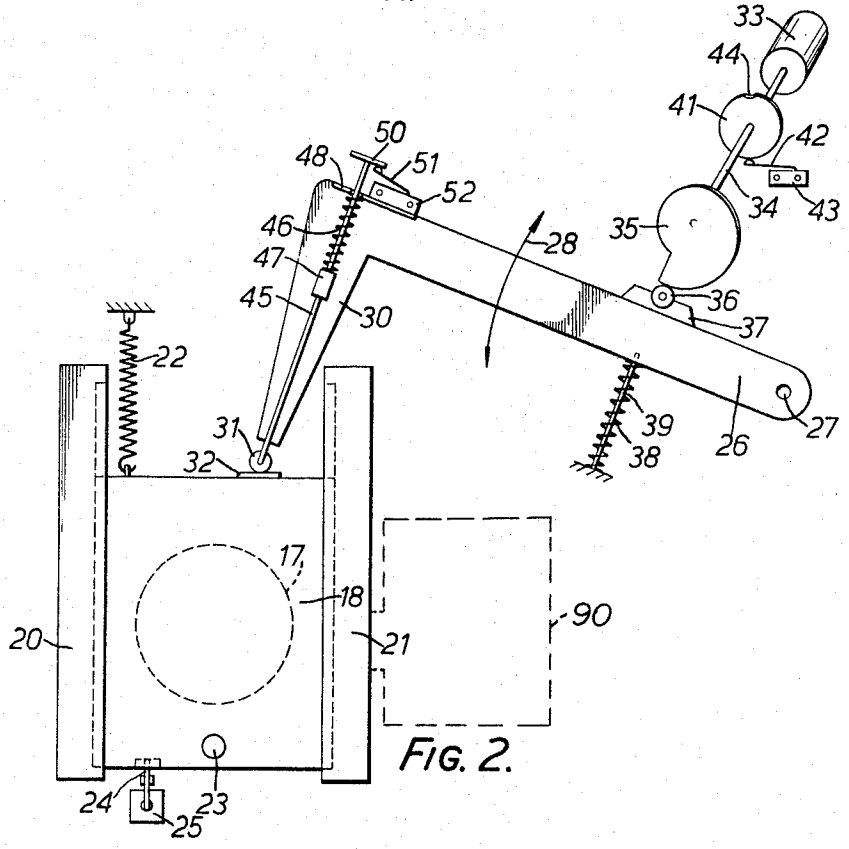

FIG. 2.

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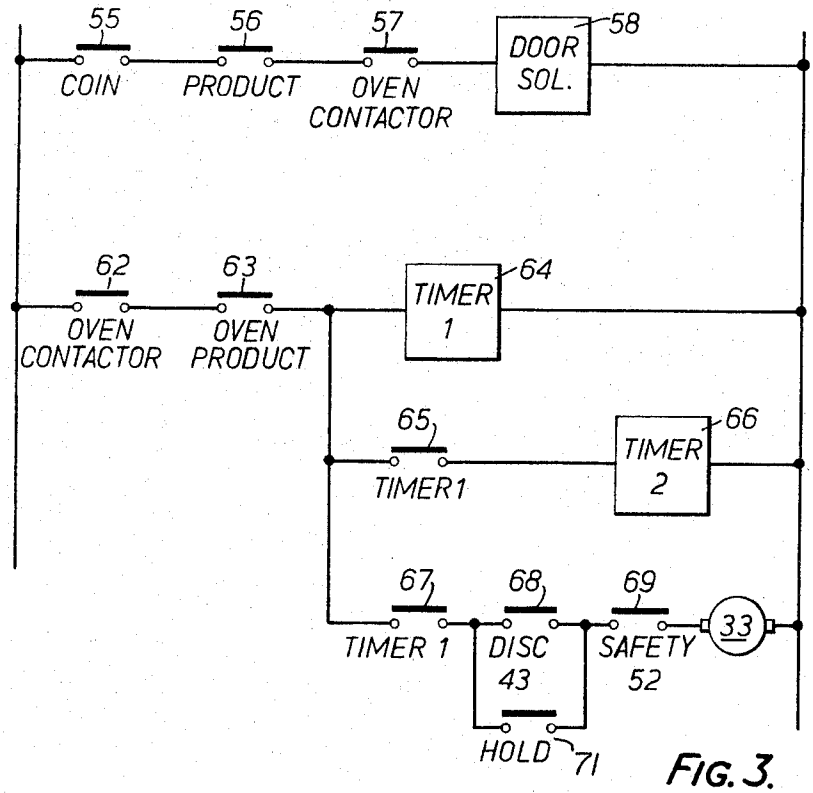

FIG. 3.

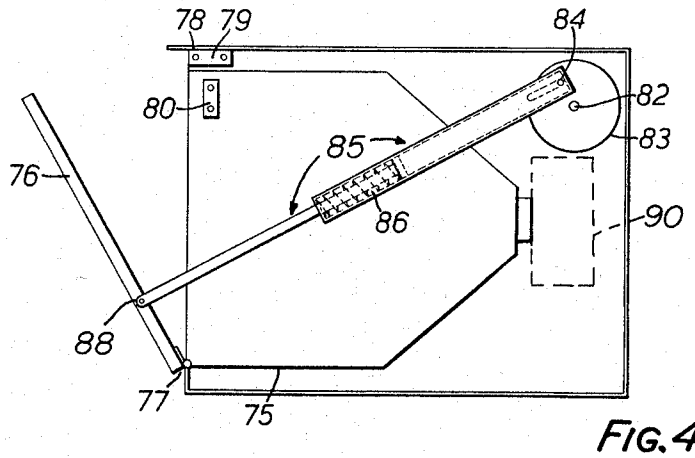

FIG. 4.

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VENDING AND DISPENSING MECHANISMS

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7 Claims. (Cl. 99—332)

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a vending machine having a microwave oven for heating food products dispensed by the machine. The door leading to the microwave oven is opened in response to the dispensing of a food product to permit the insertion of the food product into the oven, and recloses automatically after opening at the end of the heating period.

This invention relates to apparatus of the kind in which articles such as food products stored in a dispensing mechanism can be discharged to an access point and inserted in a heating mechanism, such as a microwave oven.

It is a general object of the invention to provide an improved apparatus of this kind.

It is a particular object of the invention to prevent, or hinder, misuse of the heating mechanism of the apparatus by coupling its operation to the operation of the dispensing mechanism.

In general terms, the invention provides apparatus comprising a dispensing mechanism and a heating device. The dispensing mechanism is arranged to store articles, and deliver the articles to an access point, from whence they can be removed, on insertion of an appropriate coin, token, or other credit item. The insertion of a credit item also unlatches a door to permit access to the heating device, and the dispensed article can then be inserted into the heating device to be heated. After the article has been heated and removed, the oven door is closed automatically.

Features and advantages of the invention will appear from the following description of embodiments thereof, given by way of example, in conjunction with the accompanying drawings, in which:

FIGURE 1 is a diagrammatic front elevational view of a vending mechanism;

FIGURE 2 is a schematic view of a door release and interlock mechanism;

FIGURE 3 is a simplified electrical circuit diagram of the electrical actuation means of the arrangement shown in FIGURE 1, and

FIGURE 4 is a schematic view of an alternative form of door actuating and interlock mechanism.

It is possible with microwave energy to heat very rapidly, in a matter of a few seconds, an article of food which has been stored at a low temperature, and which it is desired to heat to a temperature for immediate consumption. It is, for example, very advantageous to be able to heat articles rapidly in this way at a point of sale. This is so if the articles are sold by an attendant, and no less so if the articles are sold from a vending apparatus. In the latter case, the difficulties that arise in securing rapid and uniform heating substantially complicate the design of a completely automatic vending apparatus.

The apparatus shown in FIGURE 1 consists of a main storage device from which a customer can obtain an article, in chilled form, on insertion of a coin, token or like credit device. The customer can then insert the article in a separate and automatic microwave oven, operation of which is permitted by the same coin or token.

The apparatus comprises a main storage cabinet **10**, having a series of receptacles or compartments **11**, for products indicated diagrammatically at **12**. The cabinet includes a suitable refrigerating system, for maintaining the products in the compartments at an adequately low temperature. The compartments have access doors **13**, normally closed and locked, but one of which is released on insertion of a coin, token or the like into a slot **14**. If the cabinet is adapted to operate in response to the insertion of a coin, then suitable coin testing means can be used, to examine the coin for weight, size, milling, density, ferrous content, electrical properties, and so on. The machine may also operate in response to a token, which may be purchased separately from another machine. The machine can also operate in response to a credit device, a reader being used to detect the identifying marks of the device. When the appropriate coin, token, or credit device has been inserted in the machine, one of the doors **13** is released, conveniently by means of an electro-mechanical device, such as a solenoid releasing a bolt on one of the doors. The user can then open the door and remove one of the products, which will be in its still cold state.

The acceptance of the coin, token or the like by the mechanism at **14** also releases for operation a microwave oven indicated generally at **15**. The user can then insert the product in the oven, so that it will be automatically heated, and then ejected ready for consumption.

Various forms of oven can be used, but a convenient one is that described in Smith application Ser. No. 404,770, filed Oct. 19, 1964, now Patent No. 3,289,570, to which attention is directed for a more complete description of a suitable apparatus. Briefly, however, the oven has heating compartment which is shaped to receive the product. The product mentioned in this earlier application is a so-called hot dog, consisting of a bread roll with a filling, such as a frankfurter sausage. The product may be made substantially cylindrical in form and of uniform cross section throughout its length, which is of advantage in securing uniform heating of the product in the oven. The bread roll portion of the product can be made by the means described in a further Smith application Ser. No. 329,906, filed Dec. 9, 1963 (now abandoned) in which the bread roll is made in two complementarily shaped sections and for the purpose of the present invention it is particularly advantageous if the product is wrapped in a container, in the manner described in another copending application No. 518,578, filed Jan. 4, 1966. Such a product can be factory made, and uniform in shape, so that the product can be hygienically handled and heated rapidly and uniformly throughout for consumption. With such a product, the compartment in the oven is made cylindrical to receive the packaged product.

The product is inserted in the compartment of the oven against spring tension and when fully inserted a door to the compartment is closed. The microwave energy is supplied to the oven by means of the source **90** of microwave energy diagrammatically illustrated in FIGS. 2 and 4 for a predetermined time after which the door is released and the product is automatically partly ejected from the compartment, to enable it to be removed. In using an oven of this kind for the purpose of the present invention, means are provided to prevent wanton misuse or abuse of the apparatus, and in particular to prevent the insertion of any objects in the compartment of the oven except when required for the heating of the product obtained from the cabinet **10**.

A suitable door-operating mechanism is shown in FIGURE 2. The oven **15** has an opening **16** giving access to the heating compartment **17**, a sliding door **18** being provided to close the compartment when the product is being heated. Door **18** moves in vertical slides **20**, **21**

and is biased upwardly by a tension spring **22**, anchored at one end to door **18** and at its other end to a fixed point of the oven. The door has a handle **23** by which it can be pulled down manually into the closed position if desired. When the door is pulled downwardly it is locked in its downward position by a latch mechanism **24**, consisting for example of a hook mechanism which enters a door slot, and which can be released by energisation of a solenoid **25**. When the solenoid **25** is operated, the latch is released and the door tends to move upwardly under the tension of spring **22**, giving access to compartment **17** and, if there is a product in it at the time, causing partial ejection of the product from opening **16**. Partial ejection of the product is accomplished by means of a spring-biased plunger as taught in the aforementioned Smith Patent No. 3,289,570.

Means are also provided for electrically closing the door after it has been used. An L-shaped arm **26** is pivoted at **27**, for movement in the directions indicated by arrow **28**. The extending portion **30** of arm **26** carries at its lower end a ball or roller bearing **31**, engaging a bearing plate **32** on the top edge of the door **18**. The arm **26** can be moved downwardly, to close the door, by means of a drive motor **33**, on the shaft **34** of which is a snail cam **35**. A roller bearing cam follower **36** is carried on a bracket **37** extending from arm **26**, and the cam follower is biased firmly against the cam by means of a compression spring **38** disposed on a guide pin **39**. Associated with shaft **34** is an indexing mechanism including a disc **41**, against the edge of which bears the actuator **42** of a microswitch **43**, the disc **41** having an interruption **44**, into which the actuator **42** can drop.

The door is also fitted with means to detect an obstruction to its downward movement. For this purpose the bearing **31** is carried on an axially slidable rod **45**, biased downwardly by a compression spring **46**, disposed between a stop **47** on the rod **45** and a flanged edge at **48** on the arm **26**.

The compression spring **46** is made strong enough not to yield during normal closing of the door **18**, but to do so if the door should meet some obstruction. Thereupon the spring **46** is compressed, and a projection **50** on the rod moves, thereby to release the actuator **51** of a microswitch **52** carried on the arm **26**. The switch **52** thereby gives indication of the presence of any obstruction to the door.

It is convenient to describe the operation of the machine in conjunction with FIGURE 3, which is a simplified circuit diagram of the apparatus. It is arranged that the door solenoid can be operated only if a coin has been accepted and the machine contains a product and the oven is not already in use. It is assumed that door **18** is closed and that a coin is inserted in slot **14**. One of the doors **13** is released and the customer removes the product **12**. A coin mechanism at **14** closes contacts **55**; if a product is present contacts **56** also close. There is a second circuit associated with the door. Contacts **57** are associated with the main contact door of the microwave oven, these contacts being normally closed and opening only during the heating cycle of the oven. If the coin has been inserted, a product is present and the oven is not then in use, a circuit will be completed for door release solenoid **58** between line terminals L and N. The door can then move upwardly under the tension of spring **22**.

When door **18** is released the customer can insert into the oven the product obtained from the cabinet, and manually close the door **18**. Thereupon the heating cycle of the microwave oven is started, in the manner described in application 404,770, now Patent No. 3,289,570. At the end of the heating period, the door **18** is again released and the product is partly ejected from the compartment of the oven, to allow it to be removed by the customer. At the end of the heating cycle contacts **62** associated with the main contactor of the oven close, preparing a circuit through contacts **63**, which are associated with the oven and which close when there is no product in the oven compartment. Over these contacts a circuit is completed for a first timing device **64**, the interval of this timer, which conveniently can be about five seconds, being estimated to be sufficient to enable the customer to withdraw the product fully from the oven compartment. Timer **64** also closes contact **65**, to complete the circuit of a second timer **66**. Timer **64**, by its contacts **67**, also complete a circuit through contacts **68** of microswitch **43**, contacts **69** of safety microswitch **52** and the winding of motor **25**. In order to enable drive motor **33** to run sufficiently to open disc contacts **68**, timer **64** has contacts **71** in parallel with contacts **68**.

The motor **33** accordingly runs, and after a short time the contacts **71** open, leaving the motor energised through the contacts **68** of switch **43**. The rotation of the snail cam **35** depresses the arm **26** against the tension of spring **38** and thus forces the door **18** down into closing position, against the tension of spring **22**. If the door meets an obstruction, the rod **45** will move axially against the tension of spring **46**, and operate switch **52**. Contacts **69** of switch **52** will open and break the motor circuit.

In normal operation, no such obstruction will be met and so the disc **41** will continue to rotate until the actuator **42** of switch **43** drops into the interruption **44**. Contacts **68** will then open, breaking the motor circuit, with the door in the downmost position, as shown in FIGURE 2.

An alternative form of oven access control mechanism is shown in FIGURE 4. In this case, the oven compartment **75** is shown as closable by means of a door **76**, hinged along its lower edge at **77**. In its upper, closing, position the door can be held by a latch **78** controlled by a solenoid indicated diagrammatically at **79**. A microswitch **80** can be used to detect when the door is closed.

The door is closable by means of a drive motor, not shown, which is geared down to a drive shaft **82**, carrying a disc **83** having on it an eccentric drive pin **84**. A coupling arm **85** is attached at one end to pin **84** and at its other to a pivot point **88** on door **76**. The arm **85** is made yieldable lengthwise, for example, by being in two axially slidable sections with a biasing spring **86**, or by a slot and spring connection between the arm and pin **84**. An indexing mechanism, similar to disc **40** and switch **43**, described in connection with FIGURE 2, can be used to index the shaft **82** and hence the disc **83**. To close the door **76** after the product has been removed, the rotation motor is energised, causing shaft **82** to rotate, and through arm **85**, causes the door to move to its closed position. Should an obstruction be met by the door the two relatively extensible parts of the arm **85** may yield, a microswitch, sensitive to such relative movement, can be associated with arm **85** to stop the motor if an obstruction should be met. If no obstruction is met, the door will move to its closed position and will then be locked by the latch **78**. The shaft **82** will then move through a further 180° back to its starting position.

It will be apparent that variations of the above apparatus are possible. For instance, the dispensing mechanism may contain a variety of products, and then includes a selection device whereby the customer can select one of the products. The operation of the dispensing mechanism after insertion of a coin, and selecting of a product occupies a time interval, and this interval can be used to warm-up the source of electromagnetic power preparatory to heating the article, so that this source need not be permanently energised. A simple switch arrangement in the heater circuits for the source, suffices for this purpose the arrangement being responsive to operation of the selection device after insertion of a coin to energise the heater circuits, and responsive to the automatic door closure at the end of the heating cycle to deenergise the heater circuits. Also, this selection device can be arranged to vary the period of the heating cycle ot cater for the different products.

Moreover, while in the embodiments described above the door is closed automatically at a predetermined time interval after the end of the heating cycle a device responsive to the presence of a partly ejected article in the oven could initiate timing of short predetermined period on removal of the article at the end of which the door is closed.

I claim:

1. Apparatus for dispensing and heating articles, comprising a dispensing mechanism, a heating device, and control means for controlling the operation of said heating device, wherein said dispensing mechanism comprises storage means for storing said articles, delivery means for delivering articles from said storage means to an externally accessible point and registering means for registering the insertion of a credit item and actuating said delivery means, wherein said heating device includes a chamber for receiving articles to be heated, a door for preventing access to said chamber, and door operating means for opening and closing said door, and wherein said control means is responsive to the operation of said dispensing apparatus automatically to actuate said door operating means, whereby the oven door is opened automatically after a credit item has been inserted into said registering means, and is subsequently closed automatically after an article heated in the heating device has been removed.

2. Apparatus as claimed in claim 1 wherein said control means includes first timing means responsive to insertion of a dispensed article into said chamber and manual closure of said door to time a heating period, and second timing means responsive to the end of said heating period to actuate said door operating means at the end of a second period, whereby the door is closed at the end of said second period.

3. Apparatus as claimed in claim 1 wherein said control means includes means responsive to a signal from said registering means on insertion of a credit item to actuate said door operation means, whereby to open said door.

4. Apparatus as claimed in claim 1 wherein said heating device includes means for supplying radio frequency electromagnetic power to said chamber for heating an article therein, wherein said door is mounted for sliding movement relative to an access aperture in the walls of said chamber, and wherein said door operation means comprises spring means for resiliently biasing said door in the open direction, and motor means for moving the door in the opposite direction against the bias of said spring means.

5. Apparatus as claimed in claim 4 wherein said spring means biasses said door towards an open position, wherein said motor means is actuable to move said door to a closed position, wherein said control means includes electrically releasable latch means for retaining the door in said closed position, and wherein the door is manually movable from said open position to said closed position.

6. Apparatus as claimed in claim 5 wherein said control means includes means for deenergising said motor means when said door encounters an obstruction.

7. Apparatus as claimed in claim 1 wherein said door is hinged at one edge for rotation about that edge between open and closed positions, and wherein said door operation means includes motor means linkage means mechanically linking said motor means to said door, said linkage means including lost-motion means whereby the door is manually movable from said open position to said closed position, and electrically releasable means for retaining the door in said closed position.

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