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Hale et al.

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[54] **CONTROL MEANS INCLUDING DISABLED SELECTION LOCK-OUT FOR VENDING MACHINE**

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[52] **U.S. Cl.** **194/10,** 221/15

[51] **Int. Cl.** **G07f 5/18**

[58] **Field of Search** ..... 194/9 T, 10, 9 R; 221/15

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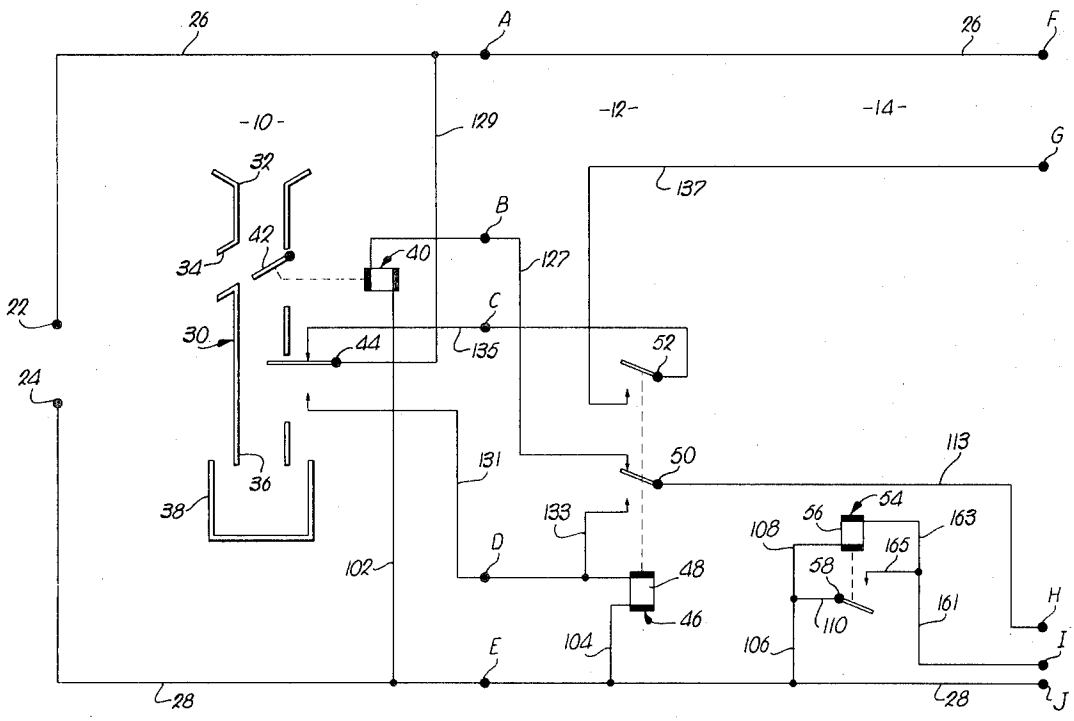
[57] **ABSTRACT**

Improved control means are provided for operating an automatic product vending machine of the general class employing separate drive motors and associated product releasing mechanisms for dispensing each of a plurality of types of customer-selectable products in response to the deposit of coinage and the actuation of a product selection switch button or the like by the customer. Control functions are essentially effected on an individual product type basis and in a manner such that, despite one or more product types becoming exhausted or the releasing mechanisms therefor becoming jammed, any one or more remaining product selections that are still functional will continue in readiness for normal operation thereof. Furthermore, the control means will provide a signal to subsequent customers that a disabled selection is "sold out," when a selection is either depleted or jammed, and also accomplishes more effective protection against pilfering and jackpotting than has been achieved in former machines of this general type. The improved control means employs a pair of latchable control switches for each product selection of which one has a customer warning and credit control function and the other has a motor energization interrupting function and is coupled with the energizing circuit for the corresponding drive motor, which switches both are actuatable either by a corresponding product depletion sensing means of a machine or by a corresponding lockout solenoid of the control means that is, in turn, controlled by a time delay relay common to all of the product selections and having a delay interval of length longer than a normal operating cycle of the product releasing mechanisms.

13 Claims, 3 Drawing Figures



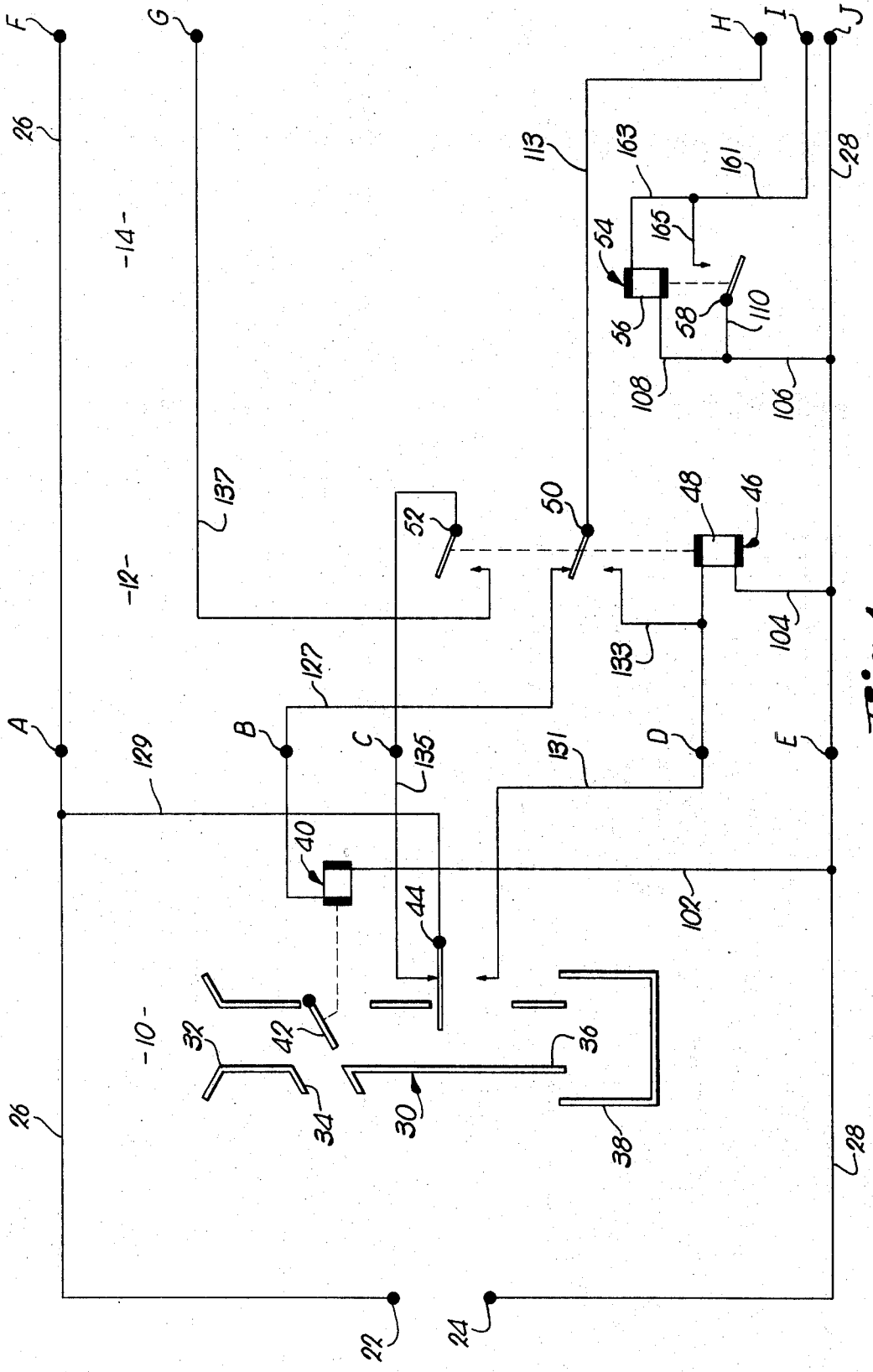

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Fig. 1.

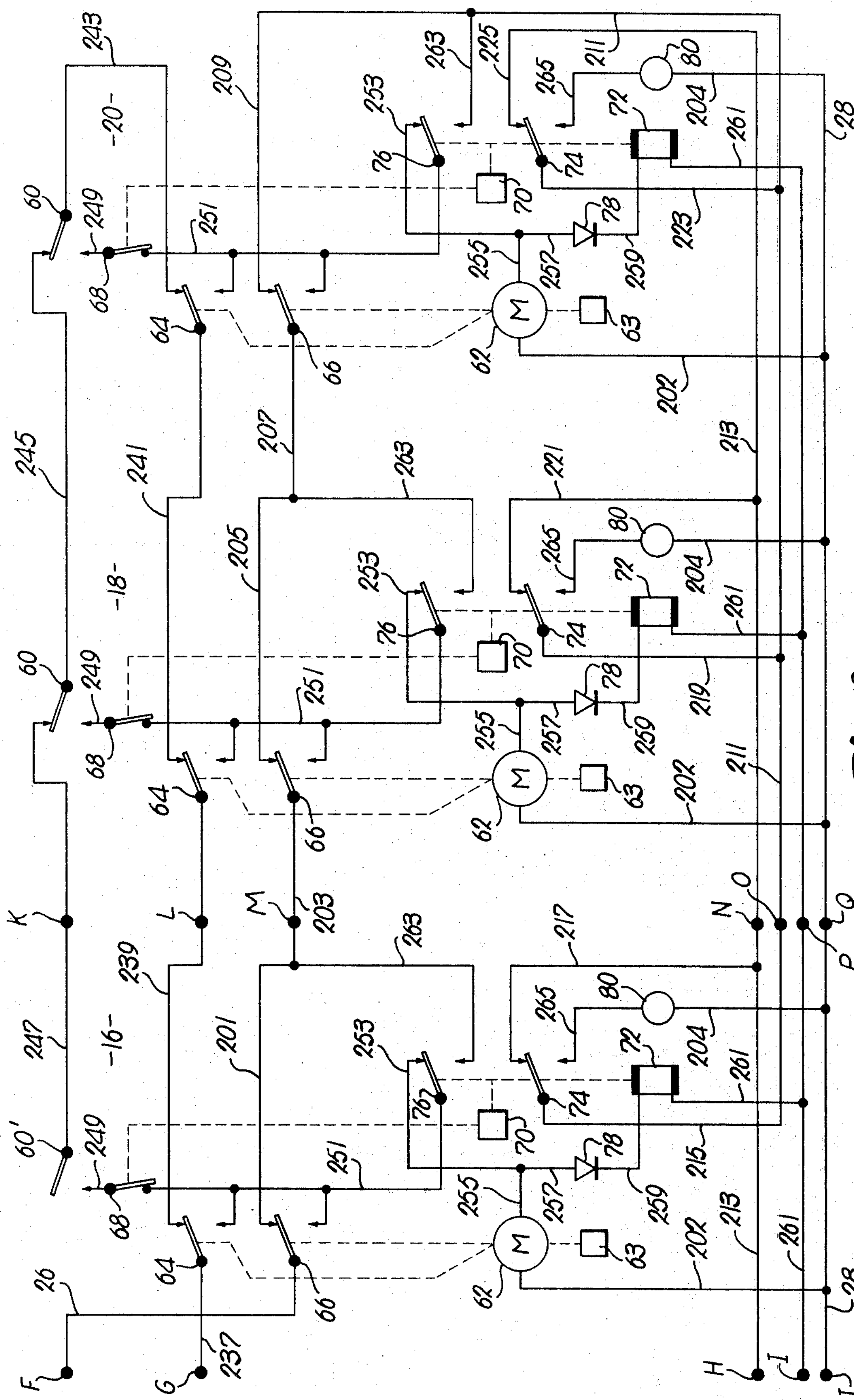

Fig. 2.

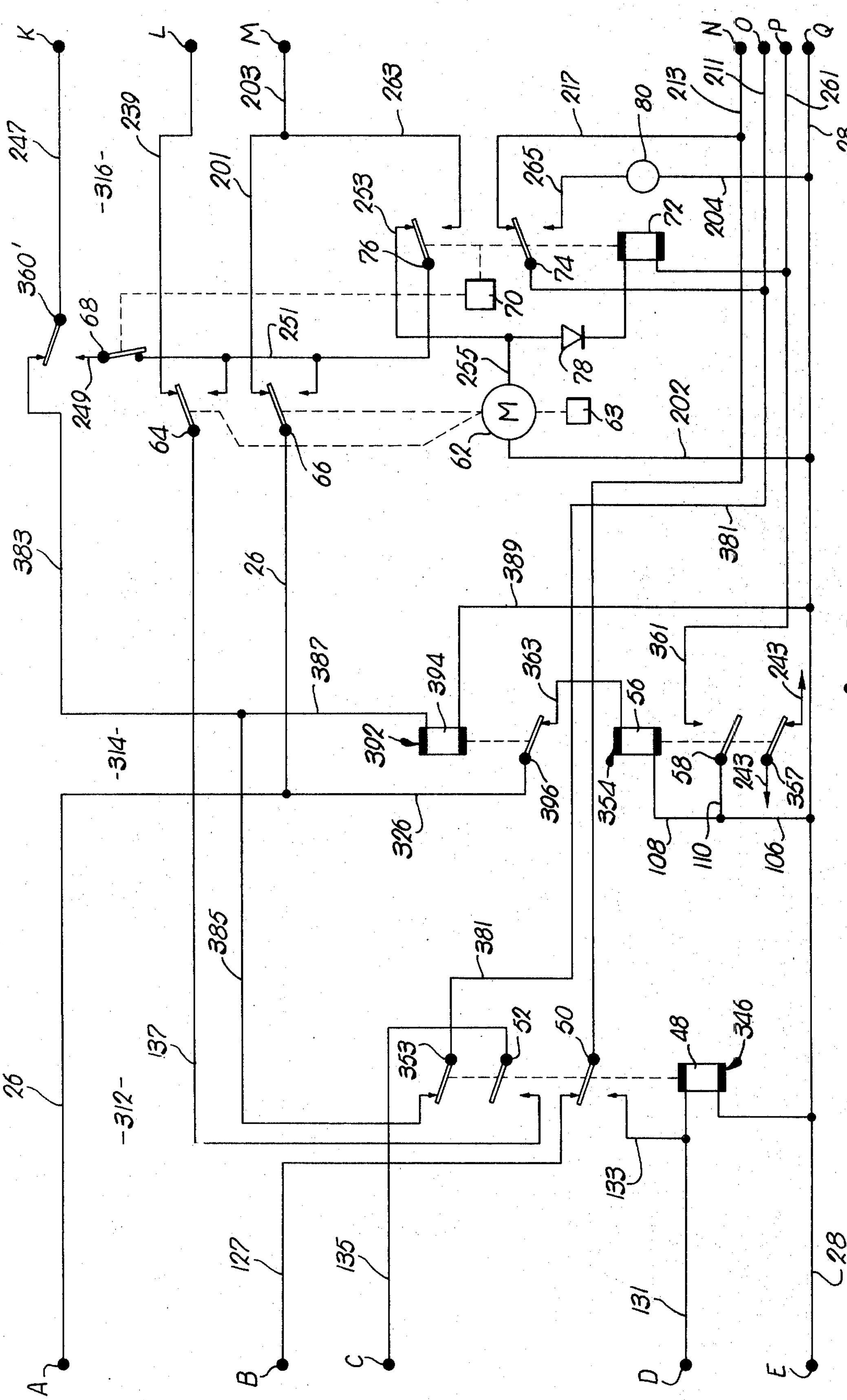
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Fig.3.

CONTROL MEANS INCLUDING DISABLED SELECTION LOCK-OUT FOR VENDING MACHINE

This invention relates to improved electrical means for controlling the operation of a vending machine offering a plurality of product types on a selective basis and, more specifically, for controlling such a machine having an individual electric vend motor and an associated product releasing mechanism for dispensing each respective type of selectable product in an improved manner such that selections for which a supply of products remains and whose vend motors and associated dispensing mechanisms remain functional can be normally and selectively operated and so operated with full protection thereof against jackpotting, while any selections for which the supply of products has been exhausted or whose vend motors and associated dispensing mechanisms have become jammed or otherwise rendered non-functional will be indicated to be no longer available for selection and will be automatically locked-out from further attempted operation thereof.

Although the applicability of the control means of the invention is not restricted to any particular vending machine of the general class mentioned, a typical example of such vending machines is disclosed in copending application for U.S. Pat. Ser. No. 346,692, filed Mar. 30, 1973, now U.S. Pat. No. 3,799,393 issued Mar. 26, 1974, entitled "Staggered Stack Vending Machine," John W. Baxendale, inventor, which is assigned to the same assignee as this application. Although the machine of such copending application is of relatively sophisticated mechanical and functional nature for which the control means of this invention is ideally adapted, it should be appreciated that the basic operational problems solved by our improved control means are essentially common to all machines of the general class mentioned and that the present invention is, therefore, beneficially applicable to a variety of specific vending machine types including those of considerably less mechanical complexity and capabilities than the example found in such copending application.

There are several primary requirements or problems encountered with optimizing the control of selective, automatic product vending machines, which have heretofore, to the best of our knowledge, never all been fully and concurrently satisfied. First, in order to keep the action required by a customer to a minimum, the means provided for permitting the customer to make a product selection after deposit of appropriate coinage should preferably be restricted to a single instrumentality or step, such as pushing a switch button corresponding to the type of product selected. Secondly, such single action on the part of the customer in evidencing his product selection must not only give effect to that selection from among the various product types available, but also should serve both to prevent the customer from then making a further selection and to initiate an automatic vend cycle of the machine for dispensing a product of the selected type and then restoring the machine to its standby condition in readiness for the next coinage deposit, product selection and product dispensing cycle. Thirdly, the control means for the machine should desirably provide protection against the possibility of the machine malfunctioning in a manner known in the trade as jackpotting, in which, after only a single coinage deposit and product selection, the machine continues to cycle repetitively to dispense a plurality of products due to failure of a cut-off switch in the energizing circuit for a vend motor failing to open at the end of a normal dispensing cycle. Fourthly, the control means for the machine should provide for recognizing depletion of the supply of products, preferably as to each particular type thereof, and for automatically altering the condition of the control means to advise a customer that particular selections are no longer available and to prevent any futile attempts to operate the vending mechanism for a product whose supply has been exhausted. Fifthly, the control means should provide for automatically recognizing a jammed condition of the product releasing mechanism or its associated power train, preferably on an individual product type basis, and for automatically altering the condition of the control means to advise a customer of the unavailability of selections that are jammed, to prevent attempted further operation of the jammed vending mechanisms, and to protect the machine in the event of a jammed condition by interrupting energization of the affected vend motor. Sixthly, the machine should be maintained operative to continue normal vending of products of any selections that remain available, i.e., neither sold out nor jammed, despite others having become non-functional.

Historically, the earlier commercially accepted vending machines for dispensing a variety of types of products on a selective basis (for instance, bottled beverages of different flavors) employed a single vend motor for providing mechanical power that could be selectively coupled with any of a plurality of releasing mechanisms associated with storage magazines for individual products through electrically controlled clutches or the like. In such machines, the duration of electrical energization of the single drive motor was usually controlled by a so-called motor carrier switch electrically coupled in a holding circuit for the motor and operated by a cam driven by the motor itself, in such manner as to deenergize and stop the motor at the end of each vending cycle during normal operation of the machine. Although such machines did provide for individual product selection, for initiation of each vend cycle responsive to customer actuation of a product selection switch, and, when operating normally, for automatic termination of each vend cycle, such machines were vulnerable to jackpotting in the event of failure of the motor carrier switch to open at the end of a vend cycle and, perhaps even more significantly, it was necessary to shut down the entire machine in the event of jamming of the mechanism for dispensing products of any single type.

Consequently, it is becoming conventional practice to provide smaller, individual, electric, vend motors for driving the product releasing mechanism associated with each product type being selectively handled in the machine, in order to maintain the machine operative as long as any selections remain available. However, the control means heretofore employed in such machines have not been fully satisfactory. For example, upon the occurrence of a condition involving jamming of the vend motor or its associated product releasing mechanism for any single product selection before a vend cycle thereof has been completed, the stalling of the motor for a jammed selection in its mid-cycle condition could seriously damage it if electric power were continued to be applied for any appreciable period of time.

Moreover, conventional machines and control means of the type employing a separate vend motor for each selection have continued to be susceptible to jackpotting in the event of failure of a control component and to pilfering through mischievous manipulation of controls during some portion of the vend cycle.

Although various expedients have been proposed to individually deal with one or more of the above-noted problems, insofar as we are aware, no one has previously provided integrated control means adapted to reliably and economically accomplish a concurrent solution to all of the noted problems and requirements for the full and proper control of automatic vending machines of the class described.

Accordingly, it is the primary object of this invention to provide improved control means for such selective, automatic vending machines having separate vend motors for each available product selection, in which all of the above-noted problems are satisfactorily solved and all of the above-noted requirements are fully met.

It is another important object of the invention to provide such improved control means which is adapted, not only for accomplishing all of the required normal control functions, but also for providing reliable protection against needless shut down of the machine in response to a fault condition, such as jamming, specifically involving only certain of the product selections handled by the machine.

It is another important object of the invention to provide such improved control means for maintaining the selective vending machine with which the control means is associated in an operable condition capable of vending those types of products whose supply is not exhausted and whose vending mechanisms remain functional, as long as even a single product selection remains in such functional condition, even though other and possibly all of the remaining selections have become non-functional due to jamming or product exhaustion.

It is another important object of the invention to provide such control means which not only accomplishes the aforementioned functions, but also effectively protects the machine against jackpotting and against unauthorized dispensing of products from malicious manipulation of controls during any portion of the vend cycle, with respect to each individual product selection handled thereby.

It is another important object of the invention to provide such control means which employs a lockout solenoid actuated on a time delayed basis after an interval somewhat longer than the period required for a single normal vend cycle, in conjunction with novel circuitry, for responding to and protecting against a variety of possible fault conditions by both warning a customer when a particular selection has become non-functional and positively locking out that selection from interfering with sales of other selections.

Still other specific but significant objects of the invention, including various advantageous details of construction, will be made clear or become apparent from the drawings and the detailed description of the preferred and alternative embodiments of the invention that follows.

By way of general summary, it may be noted that the invention in its most comprehensive manifestation, achieves its objectives essentially through the provision and employment in the improved control means and the vending machine being controlled thereby of the combination of a coinage deposit preventing coin return electromagnet; a coin deposit responsive, credit sensing or "vend" switch; a credit registering relay having associated switches; a time delay relay having an associated switch; a customer actuable selection switch for each product to be selectively handled by the machine; a vend motor, an associated product releasing mechanism and product depletion sensing means for each product selection to be handled; a motor start switch for each vend motor; a motor carrier switch for each vend motor; a lockout solenoid for each product selection to be handled; a pair of sold out/lockout switches for each product selection to be handled (which are actuatable in response to either sensing of exhaustion of the supply of products by the machine's product depletion sensing means for the corresponding product type or to operation of the corresponding lockout solenoid); a sold out/lockout indicator for each product selection to be handled; and a plurality of interrelated electrical circuit paths between the aforementioned components. Although such circuit paths may be categorized or grouped in various manners and certain of same may not be essential in some applications, from the standpoint of the individual functions optimumly provided in a full embodiment of the invention, they may include a standby condition circuit path for supplying power, through the unoperated motor carrier switches for each product selection, one of the sold out/lockout switches of any pair thereof that is not operated, and one of the switches of the unoperated credit relay, to the coin return electromagnet for maintaining the latter energized to permit coinage deposit by a customer; a circuit path through the momentarily operated credit sensing switch for initiating operation of the credit relay in response to a coinage deposit (which also breaks the aforementioned standby condition circuit path for energizing the coin return electromagnet to prevent the deposit of further coinage until a product vending cycle has occurred to use the credit established by the initial coinage deposit); a circuit path, through the unoperated motor carrier switch for each product selection, said one of the sold out/lockout switches of any pair thereof that remains unoperated, and one switch of the operated credit relay for maintaining the credit relay in operated condition after the credit sensing switch has returned to its standby condition following coinage deposit; a circuit path, through the other switch of the operated credit relay, the unoperated motor start switch for each product selection, possibly certain unoperated product selection switches, an operated product selection switch, and the unoperated other sold out/lockout switch for the selected product, for initially energizing the vend motor of the selected product and the delay time measuring function of the time delay relay; a circuit path, through the other switch of the operated credit relay, possibly certain unoperated motor start switches for unselected product types, and the operated motor start switch for the selected product type (which is operated as soon as the corresponding vend motor is energized to break the energizing circuit for the product selection switches) for continuing energization of the vend motor for the selected product and the timer assembly of the time delay relay until the motor carrier switch for the selected product has been actuated by rotational advancement

of the motor for the selected product; a circuit path, through the operated motor carrier switch for the selected product and the corresponding unoperated other sold out/lockout switch, to maintain the selected vend motor and the delay measuring function of the time delay relay in operation during the remainder of a normal vend cycle; a circuit path, through the operated motor carrier switch for the selected product, the unoperated other sold out/lockout switch for the selected product, and the operated switch of the time delay relay, when the motor carrier switch of the selected product abnormally remains operated (due to a jam or the like) after the delay period of the time delay relay, for operating the lockout solenoid and the sold out/lockout switches for the selected product, thereby de-energizing the vend motor of the malfunctioning selection and activating the corresponding customer warning indicator; and a circuit path, through the operated other sold out/lockout switch of such non-functional product selection and the corresponding abnormally operated motor carrier switch to maintain energizing power for the coin return electromagnet of the machine so that the other product selections which are still operational will remain functional.

In the drawings:

FIG. **1** is a schematic diagram of a portion of the components and circuitry of a currently preferred embodiment of our improved operating and control means, including the credit sensing, credit registering and time delay control parts thereof;

FIG. **2** is a schematic diagram of the remaining portion of the components and circuitry of said preferred embodiment, including the product selection, product dispensing and lockout control parts thereof (for an exemplary machine shown as adapted to handle three types of products, although commercial machines will normally offer a greater number of product selections, which would involve merely successive duplication or extension of the components and circuitry shown in manner that will be apparent to those skilled in the art); and

FIG. **3** is a schematic diagram of a portion of the components and circuitry of an alternate embodiment, including only the credit registering, time delay control and the "first stage" product selection, product dispensing and lockout control parts thereof, since the credit sensing and the remaining product selection, product dispensing and lockout control parts of the alternate embodiment are the same as shown in FIGS. **1** and **2** for the preferred embodiment.

THE STRUCTURE OF THE PREFERRED EMBODIMENT

Broadly, the improved operating and control means contemplated by the invention involves credit sensing means **10**, credit registering means **12**, time delay control means **14** and a plurality of selection, dispensing and lockout means sufficient to provide one such latter means for each product type to be handled by the machine (including a first such means **16**, a last such means **20** and any required number of intermediate such means **18**), together with electrical circuitry for effecting the various circuit paths hereinafter noted.

The primary components of the various means **10–20** of the preferred embodiment will first be identified and briefly described. Since the electrical connections between the components are clearly shown in the drawings, individual identification thereof will be deferred until the significant circuit paths are traced in the course of explaining the operation of the invention with reference to various functional states thereof. To avoid cluttering the drawings with unnecessary reference numerals, switches will usually be marked with a single number and parts thereof then identified when necessary in the written description of the invention by such terms of reference as "pole," "normally open contact," "normally closed contact," etc., as should be clear to those skilled in the art. It should also be observed that all switches and the like are illustrated in the drawings in their power-off standby conditions, with their operated conditions being opposite to that shown.

Referring initially to FIG. **1**, the reference numerals **22** and **24** represent a pair of electrical connection points for coupling of the control means to a source of electrical power, and electrically conductive leads **26** and **28** respectively coupled therewith represent the two "lines" or "sides" of an electrical power circuit. Leads **26** and **28** are hereinafter sometimes respectively referred to as the "high side power lead" and the "low side power lead," it being further assumed that the power source to which the connection points **22** and **24** are coupled will usually be of the alternating current type.

The credit sensing means **10** may be of essentially any type known to the industry which includes means for receiving coins or other credit-establishing media from a customer, means for sensing each establishment by a customer of credit appropriate for vending of a product and for temporarily providing a special path of electrical continuity or an electrical pulse commemorating each such establishment of said credit, and electrically responsive means for controllably permitting or preventing a customer deposit of credit-establishing media which would be retained by the machine. The means **10** also preferably includes means for providing a normal path of electrical continuity, which is interrupted during the temporary effectuation of the above-mentioned special path, then is restored immediately thereafter during normal operation of the sensing means **10.** Those skilled in the art will understand that the noted functions provide for detecting the customer's credit-establishing deposit, for providing a temporary electrical control signal therefrom, and, in conjunction with appropriate control means, for permitting credit to be established when the machine is in standby condition and functionally able to dispense products, but for preventing attempted establishment of credit (or at least returning the attempted deposit to the customer) when the machine is engaged in a dispensing operation.

The credit sensing means **10** now commonly in use usually include coin testing mechanisms for accepting genuine coins and rejecting slugs, totalizing mechanisms for accumulating the credit value of deposited coins of smaller denomination than the price at which products are to be vended, and changer mechanisms for returning change to a customer whose deposit is in excess of the price required for vending of a product. Since such mechanisms are conventional and do not per se constitute a distinguishing aspect of the present invention, however, the credit sensing means **10** is herein illustrated in simplified form only and is represented in the drawings as involving a coin-handling chute **30** having an inlet **32**, a coin return outlet **34** for

return of coins to the customer and an accepted coin outlet **36** leading to a coin collection container **38**; a coin return electromagnet (CREM) **40** operably coupled with shiftable coin-blocking means **42** arranged to divert deposited coins into the return outlet **34** when the CREM **40** is de-energized and to permit deposited coins to proceed toward the accepted coin outlet **36** when the CREM **40** is energized; and a single pole double throw credit sensing switch **44** such as often referred to in the industry as a "vend switch" or "coinage switch," adapted to be temporarily actuated into its operated condition with the pole thereof engaging the normally open contact thereof (either by virtue of momentary engagement of such pole by a deposited coin or by other credit responsive means conventional to the coin handling art) and then to return to its standby position illustrated in the drawing. Thus, a normal path of electrical continuity is provided through the pole and normally closed contact of the credit sensing switch **44** when it is in its standby condition, and a special temporary continuity path is momentarily provided through the pole and normally open contact of the switch **44** when it is temporarily actuated into its operated condition upon the establishment of credit by a customer.

In passing, it is noted that the credit sensing means **10** may be the same in both the preferred and alternate embodiments of the invention. Accordingly, the showing of the means **10** is not repeated in FIG. **3** relating to the alternate embodiment. In lieu thereof, points labeled as A, B, C, D and E are identified in the circuitry of both FIG. **1** and FIG. **3** and will be understood to represent the points at which the circuitry shown in FIG. **3** joins the portion of the circuitry of FIG. **1** to the left of said points in the alternate embodiment. The points A, B, C, D and E are otherwise not essentially significant from the standpoint of representing any physical structure.

Referring again particularly to FIG. **1**, the credit registering means **12** is shown to comprise what is commonly referred to in the industry as a "credit relay," herein broadly designated **46.** In the preferred embodiment of FIG. **1**, the relay **46** includes an operating coil element **48**, a single pole double throw relay switch **50** and a normally open single pole single throw relay switch **52**, it being understood that the switches **50** and **52** are actuated from their illustrated standby conditions into their opposite operated conditions whenever the operating element **48** is energized. As will be apparent to those skilled in the art, with the operating element **48** deenergized and the switches **50** and **52** in their standby conditions, the only action of the relay **46** is that the continuity of a circuit coupled with the CREM **40**, for energizing the latter as hereinafter explained, is preserved through the pole and normally closed contact of switch **50**; upon energization of the operating element **48**, however, the switches **50** and **52** are shifted to their operated conditions, thereby interrupting the mentioned circuit for energizing the CREM **40**, making a connection for the hereinafter traced holding circuit for the operating element **48** through the pole and normally open contact of the switch **50**, and making a connection with upper side power lead **26** through the pole and normally open contact of switch **52** and the credit sensing switch **44.**

Still referring to FIG. **1**, the time delay control means **14** of the preferred embodiment will be seen to comprise a time delayed relay unit generally designated **54**, which includes a delay and operating coil element assembly **56** and a normally open single pole single throw delayed relay switch **58.** The delayed action relay **54** may be of various commonly known and commercially available types, of the direct current responsive type for the preferred embodiment, which include some suitable internal mechanism that is responsive to application of electrical current thereto and is associated with the delay and operating assembly **56** for delaying the energization of the coil element of the latter to close the switch **58** until a predetermined period of time after energizing power is applied to the assembly **56.** For purposes of this invention, the delay relay **54** should be chosen from those available so as to provide a period of time delay between initial energization of the assembly **56** and closing of the switch **58** that is somewhat longer than the period of time required for completing one normal product dispensing cycle after credit has been established and a product type has been selected, but somewhat shorter than the total time which would be required for the product releasing mechanism of the machine to normally vend such first product and then also perform a second dispensing cycle for releasing an additional product. Selection of a time delay relay **54** having the preferred delay characteristics just mentioned permits the relay **54** to be associated with other operating components and circuitry yet to be described without interfering with normal operation in any way, while still being adapted to reliably perform its intended functions in connection with providing both an appropriate vend cycle related time reference for operation of the lockout means hereinafter described and improved protection against jackpotting.

It will be understood that FIGS. **1** and **2** represent portions of the same overall schematic diagram, which have been separated in the drawings only because of the impracticality of squeezing a representation of all of the structure, with reference numerals, onto a single sheet. Accordingly, the points labeled F, G, H, I and J in both FIGS. **1** and **2** represent merely an identification of points at which it was necessary to divide the diagram for drafting purposes. Insofar as actual physical layout of components and circuitry is concerned, those skilled in the art will appreciate that the various components will normally be located in various parts of the vending machine in accordance with convenience and any necessary mechanical couplings or associations, and that the circuit connections shown and described may be effected in any suitable manner and with or without some desired degree of modularization, intra-circuit terminal boards, releasable plug connectors or the like, as may best suit manufacturing considerations.

Referring next to FIG. **2**, the portion of the preferred circuitry therein shown includes, for purposes of illustration, a first, one intermediate and a last selection, dispensing and lockout means **16, 18** and **20,** respectively. There is one such means **16, 18** or **20** provided for each product type to be selectively handled by the machine with which the improved operating and control means of the invention is employed. In a typical selective vending machine offering, say, eight product types, there would be one first means **16,** six intermediate means **18,** and one last means **20.** However, the utility of this invention extends from machines having as few as two product type selections (in which case, only

the first and last means **16** and **20** would be required) to machines having any desired larger number of product type selections (in which cases there would be provided, in addition to a means **16** and a means **20**, an intermediate means **18** for each product type in excess of two).

It should next be generally observed that the components utilized for each of the means **16, 18** and **20**, that is, for each product type provided for, are identical (except that one of the contacts provided in the hereinafter-identified product selection switches of the intermediate and last means **18** and **20** is not required in the first means **16** of the preferred embodiment and may be omitted or not used in the latter). This identity of the components required for the means **16, 18** and **20** is very advantageous from the standpoint of manufacturing economy and convenience, since they may be purchased in quantity and also since a particular manufacturer may desire to apply the invention to various models of vending machines having differing numbers of product selections.

Moreover, it may be noted by those skilled in the art, even from initial inspection of FIG. **2**, that, aside from the "leftmost" connections to the first means **16** identified with the circuit points F, G, H and I and certain hereinafter-described "rightmost" bridging connections to the last means **20**, the circuitry for each of the means **16, 18** and **20** is identical, both as to the intra-means connections between the components thereof and the inter-means connections between adjacent means **16, 18** or **20**. In particular, it should be observed that intermeans connections with adjacent means for each of the intermediate means **18** are identical, both "to the left" and "to the right" so that any number of additional intermediate means **18** may be inserted and connected, for example, at the zone of the circuitry represented by the points labeled for identification in FIG. **2** as K, L, M, N, O, P and Q (which points are also shown and similarly labeled in FIG. **3** relating to the alternate embodiment, since the components and circuitry for the means **18** and **20** are the same for both embodiments). The advantages of these identities from the standpoints of manufacturing convenience and economy should be apparent to those skilled in the art.

Thus, the primary components of each of the selection, dispensing and lockout means **16, 18** and **20** include: a customer actuatable product selection switch **60**, which is of the single pole double throw type (except that such switch **60'** for the first means **16** does not require a normally closed contact in the preferred embodiment, so that either a normally open single pole single throw switch component may be used or, for manufacturing convenience, a single pole double throw switch may be provided, like in the means **18** and **20**, but the normally closed contact thereof simply left without any connection being made thereto in the switch **60'** of the first means **16**); an electric drive or "vend" motor **62** that it will be understood is suitably operably coupled in an appropriate fashion with the machine's product releasing mechanism for the corresponding product type (which mechanisms are generally represented schematically as at **63**, one for each product type, the details of which are not per se a part of this invention, since such mechanisms **63** form a conventional part of the types of selective product vending machines with which this invention is to be employed and may be of various constructions adapted to dispense a single product from a corresponding supply thereof stored in the machine whenever the corresponding motor **62** is operated through the extent of rotation thereof required in the particular machine for a full normal product-dispensing cycle having a predetermined normal period of time duration from the initial energization of the motor **62** until the completion of said rotation thereof required for one normal dispensing cycle of the releasing mechanism **63**); a single pole double throw so-called "motor start" switch **64** operably coupled with (or often provided as a part of) the corresponding motor **62**, usually by electromagnetic coupling, in such manner that the start switch **64** is shifted to its operated condition opposite to that illustrated in the drawings whenever the corresponding motor **62** is electrically energized; and a single pole double throw so-called "motor carrier" switch **66** operably coupled in any suitable fashion (usually and most conveniently by conventional cam means not specifically detailed in the drawings) with the corresponding motor **62** in such manner that the carrier switch **66** is shifted to its operated condition opposite to that illustrated whenever the corresponding motor **62** has commenced to rotate away from the standby or between-cycle position thereof and is then held in such operated condition until the motor **62** has been rotated sufficiently to drive the corresponding product releasing mechanism **63** of the machine through a full normal product-dispensing cycle of the latter. In passing, it should perhaps be noted at this juncture that, if a product-releasing mechanism **63** of the machine jams due to skewing of products or other mechanical causes during the progress of an attempted dispensing cycle thereof, the corresponding carrier switch **66** (and/or the start switch **64**) will remain in its operated condition and thereby, absent protection such as provided by this invention, the entire machine will be shut down. Furthermore, absent the protection provided by this invention, the jammed motor **62** may remain energized with consequent risk of damage to it or its associated mechanism **63**.

The components thus far noted as included in each means **16, 18** and **20** are, apart from their relationship with components still to be identified and the manner of connecting the same in the overall circuitry of the operating and control means of this invention, essentially conventional per se. Also in the same category, is a normally closed single pole single throw auxiliary sold-out switch **68**, for each means **16, 18** and **20**, which may be omitted or "bridged across" in most selective vending machines of modern design; however, the inclusion of such switches **68** may be desirable in most conveniently adapting our improved control means to certain older types of selective vending machines, as hereinafter more fully explained.

The blocks designated with the reference numerals **70** in FIG. **2** and shown as associated with each of the selection, dispensing and lockout means **16, 18** and **20** schematically represent the sold out or product depletion sensing means conventionally provided as a part of the vending machine itself to which the improved control means of this invention is to be applied. Such product depletion sensing means **70** assume various forms in different vending machine designs and, since the details of construction thereof are not per se regarded as a part of this invention, such means **70** are depicted in

the drawings only in block or schematic form. As indicated by dotted lines, however, and as further explained hereinafter, each of the sold out sensing means **70** is operably coupled in any suitable fashion with the corresponding sold out/lockout switch **74** and also with either the sold out/lockout switch **76** or the auxiliary sold out switch **68** (if the latter is provided).

The remaining components of each of the selection, dispensing and lockout means **16, 18** and **20,** like the time delayed relay unit **54** of the time delay control means **14,** are either uniquely employed by this invention as a part of the control means for a selective product vending machine, or perform different or enhanced functions as utilized in the control circuitry of this invention. In this category, and included in each of the means **16, 18** and **20,** are a lockout solenoid **72** (adapted for direct current operation in the preferred embodiment); a pair of latchable, single pole double throw, sold out/lockout switches **74** and **76**; a diode **78** used to restrict current flow to one direction in the preferred embodiment, in which direct current type components are employed for providing the time delayed relay **54** and the lockout solenoid **72,** in circuitry otherwise normally to be operated from an alternating current power source coupled with the connection points **22** and **24**; and a combination sold out/lockout indicator lamp **80.**

The sold out/lockout switches **74** and **76** (and the auxiliary sold out switch **68,** if provided) each employ switching components, such as commercially available, wherein the pole of such switches, once actuated from its standby condition engaging the normally closed contact thereof to its operated condition, is latched or held in such operated condition until reset to its standby condition through the intervention of service personnel concurrently with correction of the fault condition which occasioned actuation of the switches **74** and **76** (or **68**) to their operated condition. The primary sold out/lockout switches **74** and **76** are both operably coupled with the corresponding lockout solenoid **72** for actuation by the latter, it being understood that such couplings may be effected in any suitable fashion appropriate to the particular vending machine design to which the improved control means of the invention is applied. It will be further understood that the sold out/lockout switch **74** is thus adapted to be actuated from its standby to its operated condition responsive to either sensing of a sold out or product exhaustion condition for the corresponding product type by the corresponding sensing means **70** or upon actuation of the corresponding lockout solenoid **72** by virtue of the operating energization of the latter, and the same is also true of the sold out/lockout switch **76** in applications of the invention to most modern vending machines; however, when an auxiliary sold out switch **68** is employed for the purposes hereinafter noted, it will be coupled for actuation only by the depletion sensing means **70,** and the switch **76** will then be coupled for actuation only by the lockout solenoid **72.**

In the preferred form of the invention illustrated in FIGS. **1** and **2,** and as will become further apparent from the description hereinafter of the operation of such preferred embodiment, the lockout solenoid **72** should be selected from commercially available D.C. solenoid components, in conjunction with the similar selection of the component to be employed for the time delayed relay unit **54,** such that when the solenoid **72** and delay and operating coil element assembly **56** are electrically coupled in series the solenoid **72** will pass a sufficient but limited electrical current for initiating actuation of the assembly **56** without passing a sufficient electrical current for operation of the solenoid **72** to actuate the switches **74** and **76** until the series impedance of the assembly **56** has been shunted by operation of the delayed relay switch **58** after a suitable delay interval, as will become more apparent from the description of operation set forth hereinafter. It may be further noted, in passing, that the sold out/lockout indicator lamp **80** for each product type is so associated with the corresponding sold out/lockout switch **74** that the lamp **80** will indicate either a product depletion condition or a jam or other fault condition requiring lockout of the means **16, 18** or **20** for the corresponding product type, thus serving to indicate any fault condition which would render that particular product type non-functional for further product dispensing operations.

When the improved control circuitry of this invention is applied to most selective product vending machines of modern design, there is no difficulty in arranging the required operable couplings through suitable mechanical means from each product depletion sensing means **70** to the sold out/lockout switches **74** and **76** in such manner that the switches **74** and **76** will not be actuated until the last item of the corresponding product type remaining in storage within the machine has been fully released; however, where the invention is to be applied to certain older types of selective product vending machines in which the product depletion sensing means **70** provided therein are of nature such that they may operate prior to full commitment of the last product from storage to a condition for intermediate dispensing thereof by the corresponding product releasing mechanism **63,** in order to prevent possible premature deenergization of the motor **62** prior to product release, it may be most expedient and economical to provide the optional auxiliary sold out switch **68** as previously described. As will become further apparent from the description of normal operation of our improved control means set forth hereinafter, when an auxiliary switch **68** is employed, it is actuated to and latched in an open condition, along with actuation and latching of the sold out/locknut switch **74,** upon sensing by the means **70** that the last product from storage is in the process of being dispensed, thereby preventing further selection of that product type, but it does not interrupt the hereinafter traced energizing circuit for the corresponding vend motor **62** so as to deactivate the latter prior to completion of its cycle for dispensing of the last product of the corresponding type. In machines of more modern design, however, the switches **68** are normally not required.

It should be noted that the points labeled K, L, M, N, O, P and Q in FIG. **2** merely represent reference points for identifying the manner in which the portion of the alternate embodiment shown in FIG. **3** relates to and is associated with the portion of the control means depicted to the right of such points in FIG. **2.** In passing, it may also be observed that, in the case of the last selection, dispensing and lockout means **20,** certain of the rightwardly extending circuit leads forming a part of the first means **16** and each of the intermediate means **18** for connecting to the next means **18** or **20** are either bridged or not required, since there is no

next selection, dispensing and lockout means following the last such means **20.**

CIRCUIT PATHS AND OPERATION OF THE PREFERRED EMBODIMENT

In describing the electrical couplings and operation fo the above-identified arrangement of components of the preferred embodiment of the invention, it is believed those skilled in the art will most readily comprehend such subject matter if the explanation is keyed to the various sequential states of functioning of our improved control means and the vending machine to which it is applied, with appropriate reference to the particular circuit paths that are especially significant to such state or a transition to a subsequent state.

Logically, the first state to be considered is that illustrated in FIGS. **1** and **2,** in which all components are shown in their normal, power-off conditions, such as would obtain before electrical power is applied to the connection points **22** and **24** and assuming that no product depletion, jamming or other fault has previously occurred to actuate and latch any of the sold out/lockout switches **74** and **76** (or **68,** if provided). In this state, the CREM **40,** the credit relay **46,** the time delayed relay **54,** the vend motors **62,** the lockout solenoids **72** and the indicating lamps **80** are manifestly all deenergized, and the switches **44, 50, 52, 58, 60, 60', 64, 66 (68,** if provided), **74** and **76** are all in their illustrated standby conditions. By virtue of the deenergized condition of the CREM **40,** the blocking means **42** is also in its illustrated position for refusing a credit establishing deposit by a potential customer, and thereby preventing loss to the customer of such attempted deposit when the machine is inoperative; and, of course, any manipulation of any of the selection switches **60'** and **60** by bystanders has no functional effect in the absence of electrical power being supplied to the control means.

The second state to be considered is when electrical power is applied to the connection points **22** and **24,** but the machine and control means are in a standby condition such as between operations thereof, and still assuming that no fault condition exists. In this state it will be noted that the energized low side power lead **28** (see reference point J for transition from FIG. **1** to FIG. **2**) is coupled with the corresponding terminal of each of the CREM **40** through lead **102,** the operating element **48** of the credit relay **46** through lead **104,** the delay and operating assembly **56** of the time delayed relay unit **54** through leads **106** and **108,** the delayed relay switch **58** through leads **106** and **110,** each of the vend motors **62** through a corresponding lead **202,** and each of the indicator lamps **80** through a corresponding lead **204.** The only electrical component that is immediately energized in this second, or normal standby state, however, is the CREM **40,** which is energized "on the high side" through a circuit path from the high side power lead **26** through the unoperated motor carrier switch **66** of the first selection, dispensing and lockout means (hereinafter sometimes abbreviated as "SDLM") **16;** lead **201;** the lead **203,** unoperated carrier switch **66** and lead **205** of each intermediate SDLM **18** in turn; the lead **207,** unoperated carrier switch **66** and lead **209** of the last SDLM **20;** the lead **211;** thence to the lead **213** through any one or more of the parallel paths (a) lead **215,** unoperated sold out/lockout switch **74** and lead **217** of the first SDLM **16,** (b) lead **219,** unoperated switch **74** and lead **221** of any intermediate SDLM **18,** or (c) lead **223,** unoperated switch **74** and lead **225** of the last SDLM **20;** thence from lead **213** through reference point H, in transition from FIG. **2** to FIG. **1,** to lead **113;** through unoperated credit relay switch **50** and lead **127** to the high side terminal of the CREM **40.** Energization of the CREM **40** results in shifting the blocking member **42** to its deposit accepting position, so that a customer may establish appropriate credit by making the required deposit. It should be emphasized that, by virtue of the parallel nature of the above-noted segments of the energizing circuit for the CREM **40** passing through the various unoperated sold out/lockout switches **74,** the CREM **40** will be energized and the machine will be permited to accept credit and proceed with the vending of products of any type or types that can be effectively dispensed, as long as even a single product type selection remains functional; but conversely, if all product selections were depleted and all of the switches **74** thereby shifted into their operated conditions by their associated sensing means **70** (or by their associated lockout solenoids **72** in the event of jam type faults), then the above traced energizing circuit for the CREM **40** would be interrupted and no customer deposit would be accepted. It should be further noted, however, that with the apparatus in such second or standby state thereof (prior to any establishment of credit by a customer), no paths exist for "high side energization" of the selection switches **60'** and **60** or any of the vend motors **62,** so that any manipulating of the selection switches **60'** and **60** prior to the establishment of proper credit will have no functional effect.

The third state to be considered is that which occurs in response to a customer establishing credit appropriate for the vending of a product, which must occur before a product type may be effectively selected and a dispensing operation thereby initiated. The coinage deposit (or other credit establishing act) by a customer momentarily actuates the credit sensing switch **44** from its illustrated standby condition to its opposite operated condition. This results initially in a pulse of "high side energization" being applied to the operating coil element **48** of the credit relay **46** through a circuit path traceable from the high side power lead **26** through lead **129,** operated sensing switch **44** and lead **131** to the high side terminal of the operating element **48.** Energization of the credit relay **46** immediately results in the actuation of the credit relay switches **50** and **52** from their standby to their operated conditions. Such actuation of the relay switch **50** has two effects: firstly, it interrupts the above-traced energizing circuit for the CREM **40,** so that the latter is forthwith deenergized and the blocking means **42** is shifted back to its illustrated position for preventing any further deposit until the established credit has been used; and secondly, it completes a "high side" holding circuit for maintaining energization of the operating element **48** of the credit relay **46** when the credit sensing switch **44** returns to its standby condition (as it will momentarily after actuation thereof). Such holding circuit is traceable from the high side power lead **26** through the same identical path traced above for energizing the CREM **40,** except for the credit relay switch **50** being in its operated condition and thereby connecting lead **113** with the high side terminal of operating element **48** through a lead **133,** rather than to the CREM **40** through lead **127.**

The actuation of the relay switch **52** upon energization of the credit relay **48,** and as soon as the sensing switch **44** returns to its standby condition after momentary actuation thereof by the credit deposit, completes a circuit path for "high side energization" of the product selection switches **60'** and **60,** which is traceable from the high side power lead **26** through lead **129**; the then unoperated credit sensing switch **44**; lead **135**; the operated credit relay switch **52**; lead **137**; interfigure transition point G; lead **237**; the unoperated motor start switch **64** of the first SDLM **16**; lead **239**; the unoperated start switch **64** and lead **241** of each intermediate SDLM **18** in turn; the unoperated start switch **64** and the bridging lead **243** of the last SDLM **20**; to each unoperated product selection switch **60** and **60'**, successively, via interconnecting leads as at **245** and **247** between the normally closed contact of each switch **60** and the pole of the adjacent switch **60** or **60'**.

The fourth and next state of normal operation of the apparatus to be considered is that arising upon customer actuation of one of the product selection switches **60** or **60'**, after proper credit has been established. It will be noted in FIG. **2** that the manner of interconnecting the above traced energizing circuit for the selection switches **60** and **60'** is such that, if a customer should attempt to simultaneously actuate more than one of such product selection switches, the switch **60** or **60'** nearest to the incoming high side power (i.e., nearest to the lead **243**) would control the product type effectively selected, since the actuation of any switch **60** interrupts energization of the remaining switches **60** and **60'** that are further removed from the incoming power on lead **243.** Assume that the customer selects the product type associated with the last SDLM **20** and manually actuates the corresponding selection switch **60** from its illustrated standby condition to its operated condition. Thereupon, "high side energization" is immediately applied to the corresponding vend motor **62** through a circuit traceable from the actuated select switch **60** through a lead **249**; the closed auxiliary sold out switch **68** (if provided); lead **251**; the unoperated sold out/lockout switch **76**; lead **253** and lead **255** to the high side terminal of the vend motor **62.** Concurrently, an activating high side energization circuit path for the delay and operating coil element assembly **56** of the time delayed relay unit **54** is completed along the same path just traced to the lead **253,** and thence through lead **257**; the diode **78**; lead **259**; the internal winding of solenoid **72**; lead **261**; transitional reference point I; and leads **161** and **163** to the high side terminal of the delay and operating coil element assembly **56,** a branch connection also being made by lead **165** to the normally open contact of the then unoperated delayed relay switch **58.** Identical circuitry is provided and identical functions occur for each of the intermediate SDLM's **18** and the first SDLM **16,** if their product selection switch **60** or **60'** is chosen by the customer for actuation, it being particularly noted that the branch of the traced circuit extending through diode **78** and the lockout solenoid **72** for each of the SDLM's **16, 18** and **20** all lead to the assembly **56** of the time delayed relay **54** which is common to all of the product selections.

As previously noted, the components employed for the assembly **56** of the time delayed relay **54** and for each of the lockout solenoids **72** are so selected that the above noted series circuit therethrough will pass sufficient electrical current for initiation of the internal time delay means within assembly **56** and for ultimate energization of the coil operating element of such assembly **56,** but will not pass a sufficient current through the assembly **56** and any solenoid **72** in series for actuating energization of the latter; those skilled in the art may properly anticipate that actuating energization of a solenoid **72** for operating the associated sold out/-lockout switches **74** and **76** may occur only upon the shunting of the assembly **56** out of the series circuit by the actuation of the time delayed relay switch **58** to its operated condition at the completion of the predetermined period of delay of the relay unit **54.** Assuming alternating current energization of the power leads **26** and **28** and the employment of alternating current type vend motors **62,** it will be perceived that th diodes **78,** by limiting the current through the series circuit involving a solenoid **72** and the assembly **56** to uni-directional flow also effectively prevent degradation of the operation of the motor **62** that might otherwise occur due to the shunting effect of the series circuit through a solenoid **72** and the assembly **56.**

Another functional occurrence involved in the third operational state is that, as soon as the vend motor **62** for a selected product type is energized via the circuit path above traced, the normally electromagnetic coupling between such motor **62** and the associated motor start switch **64,** as indicated in the drawings by dotted lines therebetween, will cause such motor start switch **64** to be actuated from its illustrated standby position to the opposite operated condition thereof and to remain in such operated condition so long as the corresponding motor **62** remains energized. Such actuation of any motor start switch **64** for a selected product type will be perceived to interrupt the previously traced circuit path leading to the lead **243** and the various product selection switches **60** and **60'**, which further assures that, as soon as the dispensing cycle for any selected product type has been initiated to the point of energizing the corresponding vend motor **62,** thereafter any attempt by a customer to actuate a second product selection switch **60** or **60'** would be without functional effect because of the high side energization to the selection switches **60** and **60'** having by then been cut off.

The fourth operational state of the apparatus to be considered, although it actually occurs virtually concurrently with that portion of the third operational state involving the actuation of the motor start switch **64** for a selected product type, involves the alteration of the energizing circuit path for the selected vend motor **62** by bypassing the portion thereof that was initially completed through the corresponding selection switch **60** while the corresponding motor start switch **64** remained in its unoperated standby condition. Thus, referring to the last SDLM **20** as the one assumed to have been selected for operation, as soon as the motor start switch **64** is shifted to its operated condition upon energization of the corresponding vend motor **62,** the energizing circuit for the latter may then be traced starting from the lead **241,** through the operated motor start switch **264,** and then to the lead **251,** etc. (rather than through the unoperated switch **64,** lead **243,** operated selection switch **60,** lead **249,** and unoperated switch **68** to lead **251,** as previously traced). The operation of the motor start switch **64** for the selected product type, therefore, essentially completes a holding circuit for energization of the corresponding vend motor

62 (and the assembly 56 of the time delayed relay 54), as long as the sold out/lockout switch 76 remains in its unoperated standby condition.

The fifth operational state to be considered also follows very closely, in point of time, after the initiation of the third and fourth states described above. Such fifth state involves the actuation of the motor carrier switch 66 for the selected product type from its illustrated standby condition to its opposite operated condition, which occurs as soon as the energized vend motor 62 has commenced to rotate sufficiently to actuate the cam or other operable coupling means illustrated in the drawings by a dotted line. Up until the time of such actuation of the motor carrier switch 66 for a selected product type, the credit relay 46 has continued to remain energized through the holding circuit therefor previously traced; upon actuation of motor carrier switch 66, however, such holding circuit for the credit relay 46 is interrupted and the credit relay 46 is deenergized, thereby permitting the credit relay switches 50 and 52 to return to their standby positions illustrated in the drawings. The interruption of that circuit, however, does not result in the CREM 40 being again energized at this time, despite the return of the credit relay switch 50 to its standby condition, because of the interruption of the portion of that circuit that must pass through all of the motor carrier switches 66 while the latter are all in their unoperated condition. Similarly, the return of the credit relay switch 52 to its standby condition is not of functional significance, since the interruption thereby of the above traced energizing circuit for the product selection switches 60 and 60' is redundant, by virtue of such circuit path already having been interrupted by actuation of the motor start switch 64 for the selected product type. Actuation of the motor carrier switch 66 for the selected product type does, however, complete a somewhat different high side energizing path for the selected motor 62, and through the corresponding lockout solenoid 72 to the assembly 56 of the time delayed relay 54, which is now traceable from the high side power lead 26 through (assuming that the last SDLM 20 has been selected) the unoperated motor carrier switch 66 of the first SDLM 16; lead 201; lead 203, the unoperated carrier switch 66, and lead 205 of each intermediate SDLM 18; lead 207; the operated carrier switch 66 of the last SDLM 20; and lead 251 to the unoperated sold out/lockout switch 76, the lead 253, etc. It will be observed that this holding circuit will be maintained until the selected motor 62 has rotated through an extent representing a full cycle for its associated product releasing mechanism 62, since the cam or other operable coupling between the motor 62 and its carrier switch 66 will not return the latter to its standby condition until that extent of rotation of the motor 62 has been completed. Thus, with a motor 62 energized through the circuit last traced, it will be apparent to those skilled in the art that, aside from a power failure or the like, the only manner in which the motor 62 can be deenergized prior to completing a full product dispensing cycle would be upon actuation of the associated sold out/lockout switch 76 to its operated condition.

Presuming normal operation of the SDLM 16, 18 or 20 for the selected product type, as previously described, the next and sixth operational state is automatic return to the second or standby state, which is brought about by the actuated vend motor 62 and the cam or other means operably coupling it with its associated carrier switch 66 returning the latter to unoperated standby condition just after the corresponding releasing mechanism 63 will have completed its dispensing of a product of the selected type, thereby interrupting the last traced circuit for energizing the motor 62. During the operation of the selected motor 62 through its normal product dispensing cycle, which is of predetermined time duration dependent upon the particular kind of motors 62 and dispensing mechanisms 63 employed in the machine, the internal delay means of the assembly 56 will have continued to measure the passage of time but will not have yet energized the time delayed relay 54, because the delay period for the latter is somewhat longer than the duration of a single normal operating cycle of the motors 62. Upon return of the carrier switch 66 for the operated motor 62 to its standby condition, not only will such motor 62 be deenergized, but the energization for the assembly 56 of the time delayed relay 54 will be concurrently cut off and the latter thereby automatically reset for a subsequent operation thereof. Deenergization of the operated motor 62 also causes its start switch 64 to be concurrently returned to its standby condition. Return of the previously operated carrier switch 66 to its standby condition also restores the previously traced energizing circuit for the CREM 40, thereby permitting another credit deposit to be made. Thus, after a normal dispensing operation, all components and circuits are automatically returned to the conditions thereof described above for the second operational state, in which the apparatus is ready to handle another cycle of credit establishment, product selection and product dispensing.

Attention is next turned to the advantageous manner in which our invention provides for various fault conditions. Those skilled in the art will appreciate that the manner of dealing with any single type of fault condition must not vitiate the effectiveness of the means provided for controlling either normal operation of the handling of any other individual type of fault condition. Thus, our improved control means is believed to be unique, not only in the advantageous provisions it makes for coping with certain individual types of faults, but, perhaps even more significantly, because of the manner in which it provides for the effective, coordinated and economic handling of virtually every type of common fault condition, without impairment of normal operation in any way. The three general categories of fault conditions provided for are depletion of product supply, jams and jackpotting, each of which may affect one or more product types. The operation of our control means will now be considered with respect to each of such categories.

First, assume that during a normal dispensing cycle of one of the SDLMs, say the first SDLM 16, the last product of the corresponding type is dispensed from the supply thereof. Unless appropriate action is automatically taken by the control means of the machine, it is apparent that customers may be both cheated and alienated by subsequent attempts by them to purchase products of the type whose supply has been exhausted. Initially, further assume that the control means involved in our example follows the preferred construction for application to machines of modern design in which no auxiliary sold out switch 68 is needed, the lead 246 is connected directly with the lead 251, and both of the sold out/lock out switches 74 and 76 are ac-

tuated by either the product depletion sensing means **70** or the sold out solenoid **72.** Upon sensing of the dispensing of the last stored product from SDLM **16,** the associated sensing means **70** will actuate both of the corresponding switches **74** and **76** to their operated conditions, in which they will remain latched until manually reset. Such actuation of switch **74** serves the dual function of energizing the fault warning indicator lamp **80** for the SDLM **16** and of interrupting that one of the parallel branch paths **211, 215, 74, 217, 213** of the circuit for energizing the CREM **40** traced above in connection with the second state of normal operation. It will be noted that interruption of such branch paths through the switches **74** for any one or for any number less than all of the product selections respectively served by the SDLM's **16, 18** and **20** has no effect on the operation of the CREM **40,** but that, if all of the switches **74** should become operated (indicating a fault condition rendering every selection non-functional), then the CREM **40** is prevented from being energized to permit acceptance of any further credit deposit and the machine is thereby effectively shut down, as would be appreciated under such circumstances. The mentioned actuation of the switch **76** of the SDLM **16** primarily serves to interrupt the selection and energizing circuits for the corresponding motor **62** and the initiating circuit through the SDLM **16** for the assembly **56** of the time delayed relay **54** traced above in connection with the fourth and fifth normal operational states. Such interruption of the energizing circuits for the motor **62** by the actuation of the switch **76** will, as noted, preferably be brought about by the depletion sensing means **70** acting upon the switch **76** substantially concurrently with the releasing mechanism **63** and motor **62** completing their normal operating cycle, including the return of the associated carrier switch **66** to its standby condition; however, in the event that the motor **62** should be deenergized while its carrier switch **66** still remains in operated condition, actuation of the switch **76** performs the important second function of by-passing the still operated carrier switch **66** to permit normal operation of other SDLMs during subsequent cycles thereof. For the SDLM **16,** the mentioned by-passing path for the carrier switch **66** stalled in its operated condition by the deactivation of such SDLM **16** due to a sold out condition may be traced from point F through lead **26,** the operated switch **66,** lead **251,** the operated switch **76,** lead **263,** and lead **203** to the carrier switches **66** of the other SDLMs **18** and **20.** The operation for a sold out fault is similar in applications of the invention wherein the auxiliary sold out switch **68** is employed, with the operation and functions of the switch **74** being identical, but with the exception that the auxiliary switch **68,** rather than the switch **76** is actuated and latched. The switch **68** is so located in the circuitry that, upon operation thereof even prior to completion of the normal product releasing cycle of the corresponding motor **62** and mechanism **63,** the product selection switch **60** or **60'** will be interrupted to prevent any subsequent selection of the sold out product type, but the final energizing hold circuit for the motor **62** through its carrier switch **66** will not be interrupted until the dispensing cycle is completed to finish releasing the product and to restore the carrier switch **66** to its standby condition (thereby also restoring the series circuit through the switches **66** for normal operation of the other SDLMs during subsequent machine cycles).

Secondly, assume that, during an attempted cycle of one of the SDLMs **16, 18** or **20** to dispense a product therefrom, the mechanism **73** becomes jammed due to a mechanical malfunction or, as is more common, because of a defective or skewed product received by the mechanism **63** for storage, thereby physically preventing the corresponding motor **62** from continued rotation to complete its cycle and maintaining the associated motor carrier switch **66** (and/or motor start switch **64**) in its operated condition. Absent the provisions made by our invention for the handling of such a fault condition, two immediate consequences are suffered. First, since the physically jammed motor **62** would continue to have electrical energization applied thereto, by virtue of its carrier switch **66** (and/or start switch **64**) being also locked in its operated condition, and overload will occur as the fault state continues, which is likely to damage the jammed motor **62** and/or associated mechanism **63,** to "blow" a main electrical fuse rendering the entire machine inoperative, or to "blow" a separate fuse for the individual motor **62,** if such is even provided, without warning subsequent customers that the corresponding selection has become non-functional. Secondly, even apart from the mentioned damage or "fuse blowing" and their effects in machines of different designs, since the usual energizing holding circuits for the various vent motors **62** in this class of machine are normally completed through the unoperated carrier switches **66** (and/or start switches **64**) of the motors **62** for one or more other product selections (as part of the overall protection against simultaneous operation of more than one motor **62** under any circumstances), it is clear that, as long as the carrier switch **66** (and/or start switch **64**) of the first SDLM **16** remains locked in its operated condition by the jamming of its associated motor **62,** none of the motors **62** for the product selections could be operated. No additional credit can then be established due to the deenergized condition of the CREMS **40.**

Because of the interrelationships of the components and certain circuit paths necessary for normal operation of the control means provided in machines of the class in question, the provision of proper means for dealing with jam conditions, especially when also properly handling sold out and jackpotting conditions, has long remained a serious and unsatisfactorily solved problem. The solution provided by this invention, though relatively straight-forward, is most effective, as well as involving only minimum additional expense in manufacture. In the event of occurrence of a fault arising from jamming of a mechanism **63** and its associated motor **62,** our improved control means copes with the situation by virtue of the time delayed relay **54,** the above traced circuit paths for initiating its timing function concurrently with energization of any of the vend motors **62,** and the fact that the delay period of the relay **54** is selected to be somewhat longer than a single normal operating cycle of the motors **62** and **63.** As soon as the delay period of the relay **54** has expired, the assembly **56** thereof will close the time delayed switch **58.** Upon initial closing of the switch **58,** the internal impedance of the assembly **56** of relay **54** is shunted across, and the lock out solenoid **72** for the jammed SDLM **16, 18** or **20** is immediately fully energized and actuated through a circuit traceable, for SDLM **16,** for

example, from the high side power lead **26** through the operated carrier switch **66**, lead **251**, unoperated sold out/lock out switch **76**, lead **253**, lead **257**, diode **78**, lead **259**, solenoid **72**, lead **261**, transition point I, lead **161**, lead **165**, operated time delay switch **58**, lead **110**, and lead **106** to low side power lead **28**. Actuation of the solenoid **72** operates both of the sold out/lock out switches **74** and **76**, which thereby perform the same functions for a jam condition as above noted for a sold out condition, including the significant immediate deenergization of the jammed motor **62** to prevent damage to it or its associated mechanism **63**, the continuing lock out of the jammed SDLM against subsequent attempted operation thereof until service personnel have remedied the fault and reset the switches **74** and **76**, and the establishment of a circuit path for bypassing the operated carrier switch **66** of the jammed selection to permit normal operation of other selections (such as from lead **26** through the operated carrier switch **66** of SDLM **16**, lead **251**, the operated sold out/lock out switch **76** and leads **263** and **203** to the carrier switch **66** of the next SDLM **18**). It should also be noted that, if a jam occurs prior to operation of the corresponding carrier switch **66**, upon operation of the corresponding sold out/lock out switch **76**, the motor **62** will be deenergized returning the start switch **64** to its normal condition, thereby permitting the customer to make another selection. As with sold out conditions, the jamming of any one or more, but less than all, of the SDLM's, **16**, **18** and **20** results in deactivation of only the affected selections, while permitting any non-jammed and non-depleted selection or selections to continue to operate normally. Of course, if all of the SDLM's **16**, **18** and **20** become either jammed or sold out, the CREM **40** is deenergized and the machine is properly shut down from further acceptance of credit or attempted operation until service personnel have corrected the fault condition for one or more product types. The time delay relay **54** is, of course, automatically reset by the interruption of its energizing circuit when the switch **76** is operated. The closing of the switch **58**, in shunting the assembly **56**, also assures resetting of the relay **54**; however, the components **54** and **72** are so selected that the switch **58** will not reopen upon shunting of the assembly **56** until after the solenoid **72** has been actuated.

Thirdly, the fault condition known in the trade as "jackpotting" is conveniently also protected against by essentially the same structural means needed and provided to handle jamming types faults. Jackpotting can typically be caused by the failure of a carrier switch **66** to return to its standby condition upon the completion of an otherwise normal dispensing operation. When this occurs, the energizing hold circuit path for the motor **62** associated with the malfunctioning carrier switch **66** remains energized, and the motor **62** will continue to run and recycle its product releasing mechanism **62** until all products of the corresponding type stored in the machine have been dispensed, without any further credit being established. This is prevented in our improved control means by selecting the delay period of the time delayed relay **54** to be somewhat greater than the time required for one normal product dispensing cycle, but less than the time required for two such cycles. Thus, upon the commencement of such a jackpotting type malfunction, after the first product has been appropriately dispensed, but before a second product can be improperly released, the assembly **56** will close the time delay switch **58** of the relay **54** to actuate the solenoid **72** and switches **74** and **76**, thereby locking out the malfunctioning SDLM **16**, **18** or **20** in the same manner and with the same effect as for a jammed condition type fault.

THE ALTERNATE EMBODIMENT

The portions of the alternate embodiment of our control means, which are changed from the preferred embodiment of FIGS. **1** and **2**, are shown in FIG. **3** and serve both to illustrate the types of minor constructional details that may be modified without departing from the invention and to show an embodiment which, although it requires certain additional components, may have some advantages for applications in which it is not desired (because of unusual power line fluctuations or the like) to employ the series connected, current sensitive arrangement of the solenoids **72** with the time delayed relay **54** employed in the preferred embodiment for simplicity and economy. In FIG. **3**, components and connections which are the same as those for the preferred embodiment are indicated by the same reference numerals, and components and connections that are different or constitute additions are identified by reference numerals between **300** and **399**.

In the alternate embodiment, the credit registering means **312** differs from the credit registering means **12** of FIG. **1**, in that, the credit relay **346** is provided with an additional and normally closed single pole single throw relay switch **353** and connections thereto hereinafter noted. In the time delay means **314** of the alternate embodiment, the high side connections to the assembly **56** and switch **58** of the time delayed relay **354** are somewhat different than in the preferred embodiment, and there is provided an additional timer start relay **392** having an operating coil element **394** and a normally closed single pole single throw switch **396**, together with connections thereto as hereinafter noted; also, the time delayed relay **354** includes an additional single pole single throw relay switch **357**, which is normally closed and is coupled in series with the lead **243** associated with the last SDLM **20** shown in FIG. **2** (this series connection of switch **357** in lead **243** is indicated only in FIG. **3**, since it is believed sufficiently clear to those skilled in the art as not to require a complete copy of the means **20** of FIG. **2** with only such minor alteration). In the first SDLM **316** of the alternate embodiment, there is a lead **381** connecting the lead **211** back to one terminal of the added credit relay switch **353**, and the product selection switch **360'** is provided with a normally closed, as well as a normally open, contact connected by leads **383** and **385** with the other terminal of the added credit relay switch **353** and by leads **383** and **387** with the high side terminal of the operating element **394** of the added timer start relay **392**, the low side terminal of which is connected with the low side power lead **28** by a lead **389**. The other variations in electrical connections in the alternate embodiment are a lead **326** from the high side power lead **26** to one side of the added timer start relay switch **396**, a lead **363** from the other side of the switch **396** to the high side terminal of the assembly **56** of the time delayed relay **54**, and the fact that the normally open contact of the time delay relay switch **58** is connected by lead **361** to lead **261** only (but is not also coupled

to the high side terminal of the assembly **56**, as in the preferred embodiment).

Those skilled in the art will recognize forthwith that, in lieu of the series arrangement of the assembly **56** of the time delayed relay **54** with the paralleled solenoids **72** employed in the preferred embodiment for initiating the timing function of the relay **54**, the alternate embodiment utilizes the separate timer start relay **392** to initiate the relay **354**. The manner in which this aspect of the alternate embodiment operates and certain other attributes of the alternate embodiment will be pointed out hereinafter. It should be understood, however, that, with the exceptions noted, the operation of and results achieved by the alternate embodiment (both in normal operation and in the handling of fault conditions) are otherwise essentially the same as previously described for the preferred embodiment and, therefore, will not be reiterated.

The primary difference in operation of the alternate embodiment is that, in the power-on standby or second normal operating state of the apparatus, the timer start relay **392** (as well as the CREM **40**) is energized. The standby state circuit path for energizing the timer start relay **392** is traceable from the high side power lead **26** through the unoperated carrier switch **66** of the first SDLM **316**; lead **201**; lead **203**, transition point M; the unoperated carrier switch **66** and lead **205** of each intermediate SDLM **18**; lead **207**, unoperated carrier switch **66** and lead **209** of the last SDLM **20**; lead **211** (and transition point **0**); lead **381**; unoperated switch **353** of credit relay **346**; lead **385**; lead **387**; operating element **394**; and lead **389** to low side power lead **28**. Upon energization of the operating element **394** of timer start relay **392**, the timer start switch **396** is opened thereby interrupting what will be perceived to be the only circuit path for later energizing the timing and operating assembly **56** of the time delayed relay **354** (i.e., from high side power lead through lead **326**, switch **396** when closed, lead **363**, assembly **56**, lead **108**, and lead **106** to the low side power lead **28**). Upon the establishment of credit and the actuation thereby of the credit relay **346**, the above noted circuit for standby energization of the timer start relay **392** is interrupted by the opening of credit relay switch **353**; however, an alternate circuit for holding the timer start relay **392** energized is concurrently established through a high side path traceable from the high side power lead **26** through lead **129**, credit sensing switch **44** in its restored standby condition, lead **135** and transition point C (in FIG. 1); operated credit relay switch **52**; lead **137**; unoperated motor start switch **64** and lead **239** of the first SDLM **316**; transition point L; unoperated motor start switch **64** and lead **241** of each intermediate SDLM **18**; unoperated motor start switch **64**, lead **243**, including the switch **357** interposed therein (shown in FIG. 3 only) and the unoperated selection switch **60** of the last SDLM **20**; lead **245**, the unoperated selection switch **60**, lead **247** (and transition point K) of each intermediate SDLM **18**; lead **247** and unoperated selection switch **360'** of the first SDLM **316**, lead **383'** and lead **387** to the high side terminal of operating element **394**. The last traced circuit is broken, however, as soon as a customer actuates any of the selection switches **60** or **360'** to energize the corresponding motor **62** and actuate its associated motor start switch **64**; this deenergizes the timer start relay **392**, thereby restoring the timer start switch **396** to its closed condition to complete the above noted circuit path for initiating the timing function of assembly **56** of the time delayed relay **354**. When the selected SDLM **316**, **18** or **20** has completed a normal dispensing cycle, during which the credit relay **346** will have been deenergized, and at the completion of which the corresponding motor start switch **64** will have been returned to its standby condition, the operating element **394** of the timer start relay **392** will again be energized through the standby state circuit traced above, thereby opening the switch **396** and deenergizing and resetting the assembly **56** of the time delayed relay **354**. It may be noted that the added switch **353** on the credit relay **346** permits the standby state circuit for holding the timer start relay **392** in its between cycle energized condition that is not vulnerable to interruption by customer or bystander actuation of a selection switch **360'** or **60** prior to the establishment of credit; and, after credit is established, the interruption of the subsequent holding circuit for the timer start relay **392** through the selection switches **360'** and **60** employs the actuation of one of the latter to effect the desired deenergization of the timer start relay **392** to start the timing function of the assembly **56** of time delayed relay **354**.

Secondly, the purpose and operation of the additional switch **357** of the time delayed relay **354** of the alternate embodiment should be explained. The switch **357** serves to cut-off high side energization to the selection switches **60** and **360'** of the alternate embodiment when the time delay relay **354** is actuated. This is desirable in the alternate embodiment because, otherwise, under certain circumstances, a malicious person might be able to substantially disable the machine by intentionally following a course of manipulation for locking out selections of the machine that were in reality functional. Those skilled in this art are aware that vending machines are unfortunately subjected to such mischief. No purpose would appear to be served by setting forth in detail the procedure by which such vandalism might be practiced by unscrupulous persons on machines not equipped with the improved control means of this invention. Suffice it to here observe, therefore, that the switch **357** does reliably accomplish its noted protective function, as will be apparent to those skilled in the art from the fact that it manifestly precludes high side energization of any solenoid **72** of a functional selection at the same time that a low side connection to such solenoid **72** could be provided by the time delayed relay switch **58**.

We claim:

1. In a vending machine normally adapted for selectively dispensing any of a plurality of different types of products:

separate, electrically actuatable means for dispensing each of said types of products,

each of said dispensing means normally being functional to operate through a normal dispensing cycle thereof having a predetermined period of time duration for dispensing a single product of the corresponding type whenever said dispensing means is electrically energized for at least said period of time, said dispensing means being subject to the possible occurrence of a fault condition in which a dispensing means becomes jammed in manner preventing completion of a normal dispensing cycle despite continued electrical energization thereof;

electrical means for selectively energizing said dispensing means individually, including first switching means for each dispensing means responsive to operation of the latter for normally interrupting energization of the corresponding dispensing means upon completion of a normal dispensing cycle thereof, said first switching means being subject to the possible occurrence of a fault condition in which a first switching means malfunctions and fails to interrupt energization of the corresponding dispensing means upon completion of a normal dispensing cycle of the latter;

electrically responsive, time delayed means, including timing means coupled with said electrical means for initiation of operation of said timing means upon the energization of any of said dispensing means, said timing means being operable to actuate said second switching means in manner such that said interval is related to the length of said period of a normal dispensing cycle to limit jackpotting involving uncontrolled repetitive dispensing of products by any dispensing means that has suffered said switching malfunction type of fault condition;

second switching means for each dispensing means coupled with said electrical means and operably coupled with said timing means for actuation by the latter a predetermined interval of time after initiation of operation of said timing means for interrupting energization of any dispensing means that has suffered said jamming type fault condition prior to completion of an attempted normal dispensing cycle thereof, whereby possible damage from continued energization of a jammed dispensing means is prevented;

separate means for sensing the depletion of each product type;

means operably coupling each sensing means with a corresponding second switching means for actuating the latter upon sensing of a product depletion condition;

means for releasably latching each of said second switching means in its actuated condition upon any actuation thereof, whereby the dispensing means for any product type that has suffered a fault condition is deactivated against further attempted operation thereof until said latching means has been released by personnel responsible for first remedying said fault condition;

means for receiving, sensing and registering the establishment of credit appropriate for the dispensing of a product operably coupled with said electrical means for rendering the latter inoperative until said credit has been established;

electrically responsive means for preventing said credit means from receiving credit;

third switching means for each product type which are operated to an actuated condition thereof whenever the corresponding second switching means is in its actuated condition; and

means coupling said third switch means with said preventing means to operate the latter to refuse receipt of credit only when all of said third switching means are in their actuated conditions.

2. The invention of claim **1**, wherein is provided separate means for each dispensing means for giving a warning indication whenever the corresponding second switching means is in its actuated condition.

3. In a machine normally adapted for selectively dispensing any of a plurality of different types of products from separate supplies thereof stored in the machine and provided with separate releasing means for each product type for dispensing a single product of the corresponding type from the supply thereof whenever a releasing means is operated through a normal dispensing cycle thereof having a predetermined period of time duration, improved operating and control means including:

separate, electrically actuatable, drive means for each of said releasing means and operably coupled with the latter for normally driving the corresponding releasing means through one of said dispensing cycles thereof whenever the corresponding drive means is operated for at least said predetermined period of time;

separate, manually actuatable, product selection switching means for each of said drive means;

separate carrier switching means for each of said drive means and operably coupled with the latter for actuation thereby, each carrier switching means being arranged for actuation by the corresponding drive means responsive to initiation of operation of the latter and for return to its unactuated condition by the corresponding drive means responsive to the latter completing the operation thereof required for one of said dispensing cycles of the corresponding releasing means;

lockout switching means for each of said drive means;

electrically responsive actuating means for each lockout switching means and operably coupled with the latter for actuating each lockout switching means upon operation of the corresponding actuating means;

time delayed switching means, including an electrically responsive timing and operating assembly and a time delayed switch that is actuated by said assembly following initiation of operation of said assembly by an interval of time greater than said predetermined period of time;

electrical selection and drive initiating circuit means for each of said drive means electrically coupled with the latter and having the corresponding selection switching means electrically coupled therein for electrically energizing the drive means for a selected product type to initiate operation thereof;

electrical timer starting circuit means for electrically coupling said timing and operating assembly of said time delayed switching means with each of said selection and drive initiating circuit means for initiating operation of said timing and operating assembly substantially concurrently with initiation of operation of any of said drive means;

electrical holding circuit means for each of said drive means electrically coupled with the latter and having a corresponding carrier switching means and a corresponding lockout switching means electrically coupled therein for continuing operation of a selected drive means after actuation of the corresponding carrier switching means and while the corresponding lockout switching means remains unactuated; and

electrical lockout circuit means electrically coupling said time delayed switch with said actuating means for each lockout switching means for actuating the electrically responsive means for a selected drive means to actuate the corresponding lockout switching means and de-energize the corresponding drive means in the event that said drive means becomes jammed and is unable to complete a normal dispensing cycle within said interval of time.

4. The invention of claim **3,** wherein each of said drive means comprises an electrical motor mechanically coupled with the corresponding releasing means.

5. The invention of claim **3,** wherein each of said lockout switching means is releasably latched in its actuated condition upon any actuation thereof.

6. The invention of claim **3,** wherein each of said actuating means comprises an electromagnetic component operable to actuate the associated lockout switching means upon passage of an electrical current of at least a predetermined magnitude therethrough.

7. The invention of claim **3,** wherein is provided means, including credit receiving means and credit switching means, responsive to the establishment of credit appropriate for the dispensing of a product and coupled with said selection and drive initiating circuit means for rendering the latter inoperable until said credit has been established.

8. The invention of claim **7,** wherein is provided electrically responsive preventing means operably coupled with said credit receiving means for preventing the latter from receiving credit when said preventing means is in one condition thereof, and means electrically coupling said presenting means with said lockout switching means for actuating said preventing means to said one condition thereof only when all of said lockout switching means are actuated.

9. The invention of claim **8,** wherein is provided on indicating means for each lockout switching means coupled with the latter for operation of each indicating means whenever the corresponding lockout switching means is in said one condition thereof.

10. In a vending machine of the selective product dispensing class, which is normally adapted for dispensing any of a plurality of different types of products in response to the establishment of appropriate credit and the selection of a particular desired product type by a customer and is provided with means for sensing and registering the establishment of said credit, means for storing a separate supply of products of each of said types, customer actuatable means for evidencing selection of a particular product type, separate means for releasing products of each of said types each effective when actuated through a normal operating cycle of predetermined time duration for dispensing a single product of the corresponding type, separate electrically operable drive means for each of said product releasing means and operably coupled therewith for actuating the latter through said cycle thereof, electrical circuit means having a separate path for each of said product types for energizing any of said drive means when said credit has been established and the corresponding of said selection means has been actuated, and means for interrupting the electrical continuity of said path of said circuit means for the selected product type upon normal completion of said operating cycle of said releasing means for the selected product type, the improvement of which comprises:

separate, normally closed lockout switching means interposed in series with each of said paths of said circuit means; and

electrically responsive, time delayed means, including a time delayed relay timing and operating assembly and a separate lockout switch operating solenoid for each of said drive means, said solenoids each being electrically coupled in parallel with the corresponding drive means, electrically coupled in series with said assembly, and operably coupled with the corresponding lockout switching means for opening the latter a predetermined period of time after energization of the corresponding drive means,

said period of delay of said time delayed means being longer than the duration of said normal operating cycle of said releasing means, whereby jackpotting is controlled and electrical power is removed from a drive means whose corresponding releasing means is jammed.

11. In a vending machine normally adapted for selectively dispensing any of a variety of different types of products in response to establishment of appropriate credit and selection of a desired product type by a customer, improved operating and control means for maintaining the machine operative to permit vending of a product of any type which the machine remains capable of dispensing even during the existence of a condition preventing dispensing of one or more other individual types of products and for otherwise affording protection against undesirable consequences of an occurrence of such a condition, said operating and control means comprising:

means for providing a pair of connection points to a source of electrical power;

means for sensing the establishment by a customer of appropriate credit for the vending of a product, said sensing means including credit sensing switching means having a normal standby condition and an operated condition that is assumed momentarily whenever said credit is established;

means for registering each establishment of said credit, said registering means including first and second credit registering, switching means each having a normal standby condition and an operated condition, and an electrically responsive operating element operably coupled with said first and second credit registering switching means for altering the condition thereof from said standby to said operated condition thereof whenever said operating element is energized;

separate product selection means for each of said types respectively, each selection means including selection switching means having a normal standby condition and an operated condition that is assumed whenever said selection switching means is actuated by a customer;

separate product dispensing means for each of said product types respectively, each dispensing means being operable to dispense a product of corresponding type during normal operation thereof through an operating cycle of predetermined time duration, each dispensing means including an electrically energizable drive motor therefor;

separate motor start switching means for each of said product types respectively, each start switching means being operably coupled with a corresponding motor and having a normal standby condition and an operated condition that is assumed whenever the corresponding motor is energized;

separate motor carrier switching means for each of said product types respectively, each carrier switching means being operably coupled with a corresponding motor and having a normal standby condition and an operated condition that is assumed responsive to commencement of operation of the corresponding motor and continued until the corresponding dispensing means has completed the ensuing operating cycle thereof;

separate protective means for each of said product types respectively, each protective means including first and second lockout switching means each having a normal standby condition and an operated condition, and means for altering the condition of said first and second lockout switching means from said standby to said operated condition thereof in response to occurrence of a condition of the corresponding dispensing means preventing the latter from dispensing any further products of the correspondence type, said first and second lockout switching means including means for maintaining the same in their operated condition once that condition has been assumed until released therefrom by service personnel;

first electrical circuit means, including said credit sensing switching means, for coupling said operating element of said registering means with said connection points whenever said sensing switching means is in said operated condition thereof;

second electrical circuit means, including said first and second lockout switching means and said first credit registering switching means, for coupling said operating element of said registering means with said connection points whenever said first and second lockout switching means are in said standby condition thereof and said first registering switching means is in said operated condition thereof;

third electrical circuit means, including said first credit registering switching means, each of said motor start switching means, at least, one of said product selection switching means corresponding to a selected product type, and one of said first lockout switching means corresponding to said selected product type, for coupling said motor with said connection points whenever said second credit registering switching means is in its operated condition, said motor start switches are all in their standby condition, said product selection switching means for the selected product is in its operated condition and said first lockout switching means is in its standby condition;

fourth electrical circuit means, including said second credit registering switching means, the motor start switching means for a selected product, and the first lockout switching means for the selected product, for coupling said motor for the selected product with said connection points when said second registering switching means is in its operated condition, said motor start switch for the selected product is in its operated condition, and said first lockout switching means for the selected product is in its standby condition;

fifth electrical circuit means, including said motor carrier switching means for a selected product and said first lockout switching means for the selected product, for coupling said motor for the selected product with said connection points when said motor carrier switching means for the selected product is in its operated condition and said first lockout switching means for the selected product is in it standby condition, said electrical circuit means being normally interrupted at the completion of an operating cycle of the corresponding sensing means by return of the corresponding motor carrier switching means to its standby condition, but otherwise being also interruptable for protective purposes whenever said first lockout switching means is in its operated condition; and

sixth electrical circuit means, including the motor carrier switching means and the first lockout switching means for any disabled product type and the remaining motor carrier switching means for each functional product type, for coupling the motor for any functional product type with said connection points whenever the lockout switching means for said functional product type is in its standby condition and either said motor start switching means or said motor carrier switching means for said functional product is in its operated condition, despite said first lockout switching means for one or more of said disabled product types being in its operated condition.

12. In a vending machine of the selective product dispensing class, which is normally adapted for dispensing any of a plurality of different types of products in response to the establishment of appropriate credit and the selection of a particular desired product type by a customer and is provided with means for storing a separate supply of each of said types of products, separate means for sensing depletion of the supply of each of said types of products, and separate means for releasing products of each of said types from the supply thereof for normally permitting dispensing of a single product of any of said types upon operation of the corresponding releasing means through a normal operating cycle thereof, the improvement of which comprises operating and control means for maintaining the machine operative to continue normal dispensing of products of any type which the machine remains capable of dispensing even after the occurrence of a condition preventing the machine from dispensing one or more other of said types of products, said improved operating and control means including:

means for providing a pair of connection points to source of electrical power;

means for sensing the establishment by a customer of appropriate credit for the dispensing of a product,

said credit sensing means including credit sensing switching means having a standby condition and an operating condition that is temporarily assumed thereby upon and in response to each establishment of said credit;

means for registering each establishment of said credit,

said credit registering means including an electrically responsive operating element actuated by and dur-

ing energization thereof and credit registering switching means having a standby condition and an operated condition that is assumed thereby whenever said operating element of said credit registering means is being actuated;

separate customer actuatable product selection means for each of said types of products,

each of said product selection means including product selection switching means having a standby condition and an operated condition that is assumed thereby whenever the corresponding product selection means is being actuated by a customer;

separate drive means for each of said types of products,

each of said drive means including electric motor means operably coupled with said releasing means for the corresponding product type for normally operating the latter through said normal cycle of operation thereof whenever said motor means is energized for a period of time sufficient to complete said cycle;

separate motor start switching means for each of said motor means,

each of said motor start switching means being operably coupled with the corresponding motor means and having a standby condition and an operated condition that is assumed thereby whenever said corresponding motor means is energized;

separate motor carrier switching means for each of said motor means,

each of said motor carrier switching means being operably coupled with the corresponding motor means and having a standby condition and an operated condition that is assumed thereby responsive to operation of said corresponding motor means during a period commencing after initial starting of said motor means and continuing until said normal cycle of operation of the corresponding product releasing means has been completed;

separate fault condition handling means for each of said types of products,

each of said fault condition handling means including lockout switching means operably coupled with said product depletion sensing means for the corresponding product type and having a standby condition and an operated condition that is assumed thereby upon and responsive to sensing of depletion of the supply of products of the corresponding type and maintained during the existence of said condition;

first electrical circuit means for electrically coupling said operating element of said credit registering means and said credit sensing switching means in a series circuit coupled between said connection points for initiating actuation of said operating element of said credit registering means whenever the condition of said credit sensing switching means is altered to said operated condition thereof by the establishment of said credit;

second electrical circuit means for electrically coupling said product selection switching means in a series circuit with each other whwn they are all in said standby condition thereof;

third electrical circuit means for electrically coupling said motor start switching means in a series circuit with each other when they are all in said standby condition thereof;

fourth electrical circuit means for electrically coupling said motor carrier switching means in a series circuit with each other when they are all in said standby condition thereof;

fifth electrical circuit means for electrically coupling said operating element of said credit registering means, said credit registering switching means when in said operated condition thereof, and said fourth circuit means in a series circuit coupled between said connection points for holding said operating element actuated after said initial actuation thereof by said first circuit means and until the condition of any one of said motor carrier switching means is altered to its operated condition;

sixth electrical circuit means for electrically coupling said motor means for any of said product types, the corresponding product selection switching means when in its said operated condition, said third circuit means, said credit registering switching means when in its said operated condition, and the corresponding lockout switching means when in its standby condition in a series circuit coupled between said connection points for initially energizing said motor means for a selected product type when said credit has been established, a customer has actuated said selection switching means for a particular product type and that product type is capable of being dispensed;

seventh electrical circuit means for electrically coupling said motor means for a selected product type, the corresponding motor start swtiching means when in its said operated condition, said credit registering switching means when in its operated condition and the corresponding lockout switching means when in its standby condition in a series circuit coupled between said connection points for continuing energization of said motor means for the selected product type after a customer has ceased to actuate the corresponding selection switching means and until said credit registering switching means returns to its standby condition upon the interruption of said fourth circuit means upon the corresponding motor carrier switching means assuming its operated condition;

eighth electrical circuit means for electrically coupling said motor means for the selected product type, the corresponding motor carrier switching means when in its said operated condition and the corresponding lockout switching means when in its standby condition in a series circuit coupled between said connection points for continuing energization of said motor means for the selected product type until said normal cycle of operation of the corresponding product releasing means has been completed and said corresponding motor carrier switching means returned to its said standby condition; and

ninth electrical circuit means for bypassing portions of said fourth circuit means corresponding to product types whose lockout switching means are in said operated condition thereof by coupling said lockout switching means that are in said operated condition and the corresponding carrier switching means when in said operated condition thereof in series across said interruptions of said fourth cir-

cuit means, whereby the machine will continue to operate normally for the dispensing of product types whose lockout switching means remain in said standby condition thereof.

13. In a coin operated selective vending machine of the type utilizing pushbutton-switch actuated individual vend motors to power the dispensing mechanisms of the various selections and having coin directing means in the coin mechanism which must be electrically energized to permit coin acceptance for a purchase credit, the improvement consisting of:

a first switch for each vend motor sensitive to the magnetic field generated by a corresponding motor when energized for instantaneously opening the initial motor actuating circuit and simultaneously establishing a first motor holding circuit independently of the selector switches,

a second switch for each vend motor and associated therewith such that it is actuated thereby to open the previously established said first motor holding circuit and simultaneously provide a second motor holding circuit independently of said first circuit, said second switch being normally reoperable by the said motor to terminate the dispensing cycle and simultaneously reestablish the normal standby circuit for energizing said coin directing means,

time delay means energized simultaneously when any vend motor is energized and operable for a period longer than a normal dispensing cycle unless earlier deenergized by normal cycle termination, and

a third switch associated with said time delay means and operable thereby should a dispensing cycle fail to terminate normally as aforesaid, the operation of said third switch establishing a circuit for energizing said coin directing means through said actuated condition of said second switch and simultaneously opening said second motor holding circuit whereby power is removed from a jammed dispensing motor, or one which would otherwise remain energized to cause jackpotting of product in the event of failure of either said first switch or said second switch in its actuated condition, and whereby all continuing functionable selections of the machine will remain operable for the same or a successive customer.

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