# United States Patent

**Breeden**

[15] **3,669,235**

[45] **June 13, 1972**


## [54] MALFUNCTION ISOLATION APPARATUS FOR SELECTIVE VENDING MACHINES


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[22] Filed: **Jan. 14, 1970**

[21] Appl. No.: **2,830**

[52] **U.S. Cl.** ..... **194/10,** 221/13

[51] **Int. Cl.** ..... **G07f 11/00**

[58] **Field of Search** ..... 221/13, 14; 194/9, 10



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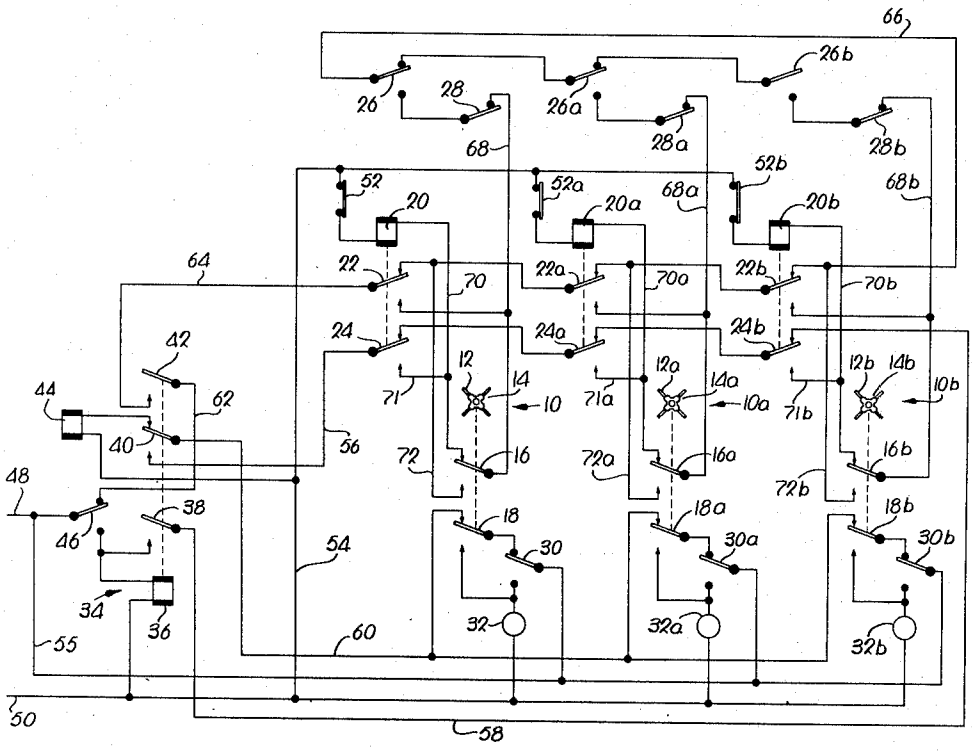
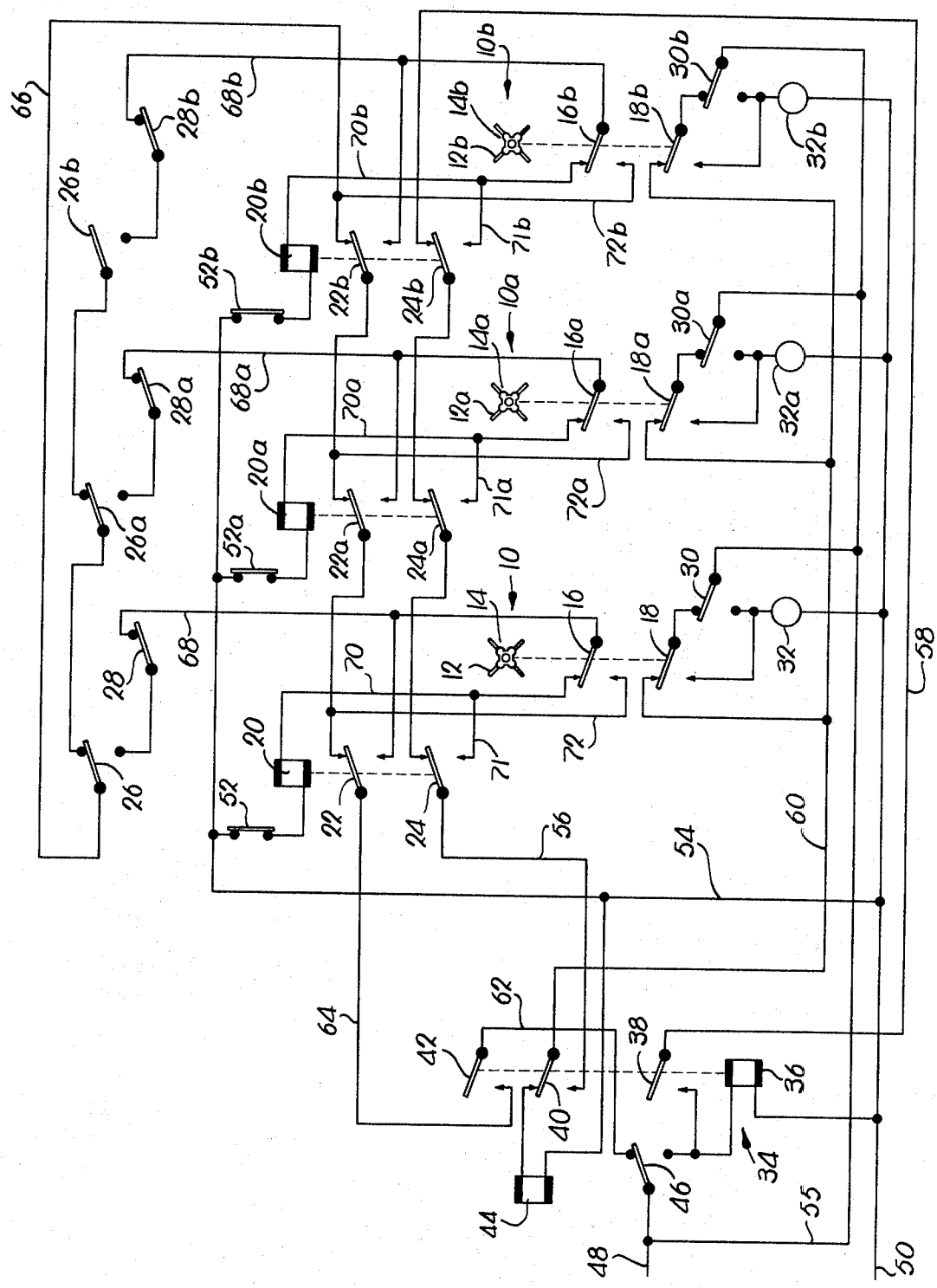
[57] **ABSTRACT**

A selective vending machine having switching circuitry which permits the continued purchase of other selections in the event that the dispensing mechanism of one or more selections malfunctions due to jamming or component failure. The circuitry is responsive to the operational condition of the dispensing mechanisms of the various selections and, if a particular mechanism malfunctions, the operating circuit to customer actuatable selection switches is reestablished although the normal cycle is not completed due to the malfunction. Additionally, the vend solenoid of the malfunctioned mechanism is disconnected from its associated selection switch to prevent energization thereof until the malfunction is corrected.


**4 Claims, 1 Drawing Figure**



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# MALFUNCTION ISOLATION APPARATUS FOR SELECTIVE VENDING MACHINES

This invention relates to apparatus for isolating a malfunctioned dispensing mechanism of a selective vending machine in order to permit the continued purchase of other selections.

Multiple selection vending machines employ a number of product dispensing mechanisms, each of which is independently operable in response to the desires of a customer. In an electrically controlled machine, once credit is established, a selection is commonly made by manually actuating a selection switch which effects energization of a selection or vend solenoid forming a part of the particular mechanism that dispenses the selected product. In order to prevent multiple selections before credit is cancelled, an electrical interlock may be provided that effectively disables the remaining selection switches once one switch is actuated. However, in some types of mechanisms the occurrence of a malfunction due to product jamming or component failure prevents the completion of the normal machine cycle, thus the switches remain disabled and the entire machine is out of order until the malfunction can be corrected.

It is, therefore, the primary object of the present invention to provide apparatus that permits the continued purchase of products from a vending machine although one of the dispensing mechanisms thereof malfunctions.

As a corollary to the foregoing object, it is an important aim of this invention to provide apparatus as aforesaid which reestablishes an operating circuit for the vend solenoids of the operational dispensing mechanisms of the machine in the event of failure of a selected mechanism to complete its normal cycle and reestablish such circuit.

Another important object of the invention is to provide, in a selective vending machine having customer actuatable selection switches, apparatus as aforesaid which reestablishes electrical continuity to such switches in the event of failure of a selected dispensing mechanism to complete its normal cycle and restore the electrical control system of the machine to standby in readiness for another vend.

Still another important object is to provide apparatus as aforesaid which disconnects the vend solenoid of a malfunctioned dispensing mechanism from its associated selection switch to prevent energization thereof until the malfunction is corrected.

Yet another important object is to provide apparatus as aforesaid which automatically prevents the establishment of credit in the machine in the event that a total malfunction of all dispensing mechanisms occurs.

In the drawing:

The single FIGURE is an electrical schematic diagram and diagrammatic illustration of an exemplary electrical control system for a selective vending machine, incorporating the apparatus of the present invention.

Referring to the FIGURE, three dispensing mechanisms of the paddle wheel type are illustrated diagrammatically and broadly denoted **10**, **10***a*, and **10***b*. Each of the mechanisms, and the manner and control of operation thereof, is identical and includes a paddle wheel **12** for controlling the release of products from a respective column. The paddle wheel **12** is provided with a cam **14** which actuates a lockout switch having a pair of movable poles **16** and **18**. A vend solenoid **20** forms a part of the mechanism **10** and, upon energization thereof, operates a solenoid hold switch **22** and a credit cancelling switch **24**. Corresponding components of the other two mechanisms **10***a* and **10** *b* are designated by like reference numerals with the addition of the "*a*" or "*b*" notation.

Three selection switches **26**, **26***a*, and **26***b* (which would each be push-button operated) are associated with the respective dispensing mechanisms **10**, **10***a*, and **10***b*. Additionally, a pair of sold out switches **28** and **30** are associated with the mechanism **10**, as are sold out switches **28***a*, **30***a* and **28***b*, **30***b* with the mechanisms **10***a* and **10***b* respectively. Sold out lamps **32**, **32***a*, and **32***b* are energized by respective sold out switches **30**, **30***a*, and **30***b* in response to depletion of a particular column.



A credit relay **34** has a coil **36** which operates three relay switches **38**, **40**, and **42**. A coin return electromagnet (CREM) **44** serves the usual purpose of returning deposits to the customer unless energized. A coin switch **46** is illustrated as an exemplary means of sensing a deposit of sufficient value to permit the purchase of a product from any of the three columns or mechanisms **10**, **10***a*, or **10***b*.

Power for the control system is obtained at a pair of lines **48** and **50** which are connected with a suitable electrical power source. Line **50** is the common to which the credit relay coil **36** and the sold out lamps **32**, **32***a*, and **32***b* are connected. Additionally, each of the vend solenoids **20**, **20***a*, and **20***b* is connected to line **50** through a separate circuit breaker **52**, **52***a*, or **52***b* via a lead **54**.

The line **48** is directly connected to the movable pole of the coin switch **46** and, via a lead **55**, to the movable poles of the sold out switches **30**, **30***a*, and **30***b*. It may be seen that a lead **56** connects the normally open contact of relay switch **40** to the movable pole of the cancel switch **24**. The cancel switches **24**, **24***a*, and **24***b* are connected in series through their normally closed contacts and movable poles, a lead **58** extending from the normally closed contact of cancel switch **24***b* to the pole of relay switch **38**. A lead **60** interconnects the normally closed contacts of the poles **18**, **18***a*, and **18***b* of the lockout switches and the pole of the relay switch **40**. The normally closed contact of the coin switch **46** is connected by a lead **62** to the pole of relay switch **42**, the normally open contact of coin switch **46** being directly connected to the credit relay coil **36** and the normally open contact of relay switch **38**.

A lead **64** extends from the normally open contact of relay switch **42** to the pole of solenoid hold switch **22**, and a lead **66** extends from the normally closed contact of hold switch **22***b* to the pole of selection switch **26**. The three hold switches **22**, **22***a*, and **22***b* also execute a control function and are interconnected in series, laddered relationship, as are the three selection switches **26**, **26***a*, and **26***b*, thus an operating circuit through the hold and selection switches to a selected vend solenoid is established when the customer makes a selection, as will be discussed in detail hereinafter. The sold out switch **28** is normally closed and, together with a lead **68**, connects the normally open contact of the selection switch **26** to the pole **16** of the lockout switch, the normally closed contact thereof being connected to vend solenoid **20** by a lead **70** and to the normally open contact of cancel switch **24** by a lead **71**. A lead **72** interconnects the normally open contact of lockout switch pole **16** and the normally closed contact of hold switch **22**, the latter also having a normally open contact which is connected to the lead **68**. The lockout switch poles **16***a* and **16***b* and associated contacts are interconnected with their respective selection switches, vend solenoids, cancel switches and hold switches in the same manner.

## OPERATION

To illustrate the operation of the present invention, it will first be assumed that the illustrated control system is not provided with the malfunction isolation apparatus of the invention. As is customary in control systems of this general type, a deposit at least equal to the price of the selected product momentarily actuates the coin switch **46** to energize the credit relay coil **36** which then holds through the relay switches **38** and **40**. Manifestly, the credit circuitry is simplified herein since deposit totalization and change pay back are not directly germane to the invention. When the coil **36** is energized, relay switch **40** breaks its normally closed contact to de-energize the CREM **44** to thereby preclude the deposit of further coinage. Relay switch **42** closes, thereby connecting line **48** to the solenoid hold switch **22** via coin switch **46** (now returned to normal) and leads **62** and **64**. Therefore, power is available to the selection switches **26**, **26***a*, and **26***b* through the series circuit formed by the laddered hold switches **22**, **22***a*, and **22***b*.

The customer may now make a selection and, assuming that selection switch **26** is actuated, the vend solenoid **20** is ener-

gized by a circuit extending along lead **68**, through the pole **16** of the lockout switch, and thence along lead **70** to the solenoid **20**. Initial movement of the solenoid armature operates the hold switch **22** to maintain the solenoid **20** energized through pole **16** although the selection switch **26** is released after only momentary actuation. As the solenoid armature continues its stroke, the cancel switch **24** momentarily breaks its normally closed contact just before the armature seats. The operation of the cancel switch **24** causes the credit relay **34** to drop out since the holding circuit to its coil **36** is interrupted; therefore, power is removed from the hold switch **22** and the solenoid **20** is also de-energized, causing its armature to commence return movement. It should be appreciated that the laddered relationship of the hold switches and selection switches permits only one selection before credit is cancelled and thus provides an electrical interlock to prevent a customer from obtaining additional products without first making the appropriate deposit.

The armature of the solenoid **20** by a clutch (not shown) or other suitable means releases the paddle wheel **12** to permit the latter to rotationally index and dispense a product. Rotation of the paddle wheel **12** commences on the return stroke of the solenoid armature. If for some reason the paddle wheel **12** does not rotate through a sufficient displacement to dispense the product, the solenoid armature will not completely return to its normal position due to the mechanical connection between such armature and the paddle wheel **12**. Therefore, if a product should jam in the mechanism **10** or a component should fail and preclude rotational indexing, the hold switch **22** will not return to its normal position illustrated. This occurrence would cause the entire machine to malfunction since the series circuit through the hold switches to the selector switches would not be reestablished and thus a selection could not be made from any of the columns until the malfunction is corrected.

For an illustration of a dispensing mechanism of the paddle wheel type having the operational sequence discussed above, reference may be made to the co-pending U.S. Pat. application of John W. Baxendale, Ser. No. 832,093, filed June 11, 1969, and entitled "Article Release Device Having Ball Lock and Indexing Mechanism," owned by the assignee herein. In such application the vend solenoid armature, during its return stroke after releasing the paddle wheel clutch, actuates a drive pawl to rotate the paddle wheel in the event that the wheel does not commence rotation under the weight of the products. Thus, the armature is locked with the mechanism and prevented from completing its return stroke in the case of a malfunction.

Attention is now directed to the operation of the lockout switch **16**, **18** actuated by the cam **14** that rotates with the paddle wheel **12**. When the wheel **12** commences rotation, the poles **16** and **18** are shifted into engagement with their lower, normally open contacts and remain in this position until the completion of indexing of the wheel **12**. The wheel **12** rotates in 90° increments in the exemplary mechanism illustrated herein, thus the cam **14** has four lobes corresponding to the four increments of rotation that comprise 1 revolution. In the event that a product jams in the mechanism once rotation of the wheel **12** commences, or a component failure permits only partial rotation, then the poles **16** and **18** remain actuated by the cam **14** and are not permitted to return to the normal positions shown. Since the solenoid hold switch **22** in such case is also maintained in its actuated position, a circuit is completed through the lower, normally open contact of the hold switch **22** to the lead **68**, through the lower contact of the actuated pole **16**, and a long lead **72** to the pole of the next hold switch **22***a*. In this manner, the series circuit through the hold switches is reestablished by by the action of the lockout switch pole **16** in cooperation with the actuated hold switch **22** so that a customer may subsequently, after making the proper deposit, select products from either of the mechanisms **10***a* or **10***b*. If a malfunction does not occur, of course, the series circuit through the hold switches is reestablished in the usual manner by the return of the switch **22** to its normal position. Therefore, it may be appreciated that the malfunctioning of one mechanism as indicated by its failure to complete a normal operational cycle does not cause the entire machine to be rendered inoperative, so that sales may be made by any of the other columns which are not depleted.

A second aspect of the isolation of the malfunctioned mechanism is the disconnecting of its vend solenoid from the associated selection switch. With the pole **16** in its actuated position, the electrical continuity between leads **68** and **70** is interrupted so that the solenoid **20** cannot again be energized if a customer should subsequently depress the selection switch **26** after making the appropriate deposit. This is important to prevent the inadvertent loss of credit by operation of the cancel switch **24** which could otherwise occur.

Furthermore, the pole **18** of the lockout switch, during the vend cycle, closes against its lower contact to energize the sold out lamp **32**. Thus, the lamp **32** will remain constantly energized if a malfunction should occur to thereby indicate to the customer that products cannot be obtained from that column. It should be understood that the sold out switches **28** and **30** operate in the usual manner in response to product depletion to disconnect the selector switch **26** from the solenoid **20** and energize the sold out lamp **32**.

It is also important to note that each of the poles **18**, **18***a*, and **18***b* comprises an electrically independent section of the respective lockout switch, the poles **18**, **18***a*, and **18***b* being arranged in parallel relationship between the leads **55** and **60**. With the credit relay coil **36** de-energized, operating current for the CREM **44** is obtained via the lead **60**; therefore, although malfunctioning of one column will in no way affect the subsequent re-energization of the CREM **44**, a total malfunction of the machine involving all of the columns thereof disconnects lead **60** from lead **55** to preclude re-energization of the CREM **44** and thereby prevent the further deposit of coinage in the machine.

It is to be understood that a malfunction of either of the mechanisms **10***a* or **10***b* will cause that mechanism to be isolated from the remaining mechanisms in the same manner as discussed above for mechanism **10**. Furthermore, although three columns are illustrated herein, the teachings of the present invention are equally applicable to machines having a greater number of columns since this merely involves the adding of selection switches, hold switches, and cancel switches in series with the illustrated arrangement, together with the provision of a lockout switch for each additional column.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

**1.** In an electrically controlled, selective, product vending machine:

a plurality of product dispensing mechanisms, there being a first mechanism and a series of successor mechanisms including a last mechanism,

each of said mechanisms having shiftable parts normally operable, upon each actuation of the corresponding mechanism, to cycle through a product dispensing operation in which said parts shift from a standby product retaining disposition into an intermediate disposition for dispensing a single product and then again into a standby product retaining disposition;

a two terminal, electrically operable, actuating means for each mechanism respectively,

each of said actuating means being operably coupled with a corresponding mechanism for actuating the latter whenever said actuating means is operated;

a manually operable, selection switching means for each actuating means respectively, there being a first selection switching means and a series of successor selection switching means including a last selection switching means,

each of said selection switching means except said last section switching means having a first, a second and a third terminal, a standby condition in which the first terminal

thereof is coupled with the second terminal thereof and a temporary selecting condition in which said first terminal thereof is coupled with the third terminal thereof, said last selection switching means having a first and a third terminal, a standby condition in which said first terminal thereof is uncoupled from said third terminal thereof and a temporary selecting condition in which said first terminal thereof is coupled with said third terminal thereof,

a three terminal, hold switching means for each mechanism respectively, there being a first hold switching means and a series of successor hold switching means including a last hold switching means,

each of said hold switching means being operably coupled with a corresponding actuating means for operation of said hold switching means by said actuating means whenever the latter is operated,

each of said hold switching means having a standby condition in which a first terminal thereof is coupled with a second terminal thereof and an operated condition in which said first terminal thereof is coupled with a third terminal thereof, each of said hold switching means being operably coupled with said shiftable parts of the corresponding mechanism and remaining in its said operated condition in the event of a malfunction of the corresponding mechanism in which said shiftable parts of the latter fail to complete their said operating cycle by returning to said standby product retaining disposition after an attempted product dispensing operation;

a three terminal, primary lockout switching means for each mechanism respectively, there being a first primary lockout switching means and a series of successor primary lockout switching means including a last primary lockout switching means,

each of said primary lockout switching means being operably coupled with said shiftable parts of a corresponding mechanism for operation of said primary lockout switching means by said mechanism whenever and while said shiftable parts of the latter are shifted out of said standby product retaining disposition thereof,

each of said primary lockout switching means having a standby condition in which a first terminal thereof is coupled with a second terminal thereof and an operated condition in which said first terminal thereof is coupled with a third terminal thereof, each of said primary lockout switching means remaining in its said operated condition in the event of a malfunction of the corresponding mechanism in which said shiftable parts of the latter fail to complete their said operating cycle by returning to said standby product retaining disposition after an attempted product dispensing operation;

a pair of power input terminals adapted for coupling with a source of electrical power;

credit controlled means common to the mechanisms and operable in response to deposit of coinage of predetermined value in the machine to present a first closed electrical circuit path through said credit controlled means;

first electrical circuit means coupling one of said power input terminals with one terminal of each of said actuating means;

second electrical circuit means coupling said circuit path of said credit controlled means in series between the other of said power input terminals and said first terminal of said first hold switching means;

third electrical circuit means coupling said second terminal of each of said hold switching means other than said last hold switching means with said first terminal of the next in said series of said successor hold switching means;

fourth electrical circuit means coupling said second terminal of said last hold switching means with said first terminal of said first selection switching means;

fifth electrical circuit means coupling said second terminal of each of said selection switching means other than said last selection switching means with said first terminal of the last in said series of said successor selection switching means;

a sixth electrical circuit means for each mechanism respectively,

each of said sixth electrical circuit means coupling said third terminal of a corresponding selection switching means with said first terminal of the corresponding primary lockout switching means;

a seventh electrical circuit means for each mechanism respectively,

each of said seventh circuit means coupling said second terminal of the corresponding primary lockout switching means with the other terminal of the corresponding actuating means;

an eighth electrical circuit means for each mechanism respectively,

each of said eighth circuit means coupling said third terminal of the corresponding primary lockout switching means with said second terminal of the corresponding hold switching means; and

a ninth electrical circuit means for each mechanism respectively,

each of said ninth circuit means coupling said first terminal of the corresponding primary lockout switching means with said third terminal of the corresponding hold switching means.

2. The invention of claim 1, wherein said credit controlled means includes a credit registering relay having an operating coil and at least one normally open relay switch adapted to be closed when said coil is energized, said one relay switch being coupled in series with said first circuit path through said credit controlled means; and there are provided means, including coinage deposit controlled means and tenth electrical circuit means, for momentarily electrically coupling said coil with said power input terminals for initially energizing said coil in response to operation of said coinage deposit controlled means upon deposit of coinage of predetermined value in said machine; and means, including a second normally open relay switch adapted to be closed when said coil is energized and eleventh electrical circuit means having said second relay switch interposed in series therewith, presenting a second circuit path through said credit controlled means for electrically coupling said coil with said power input terminals for continuing energization of said coil upon initial energization thereof.

3. The invention of claim 2, wherein are provided a normally closed credit cancel switching means for each mechanism respectively, each credit cancel switching means being operably coupled with the corresponding actuating means for opening of said credit cancel switching means whenever the corresponding actuating means is operated, said credit cancel switching means being electrically coupled in series with each other and with said eleventh circuit means for interrupting said second circuit path when any mechanism is operated.

4. The invention of claim 3, wherein are provided a normally closed, auxiliary, lockout switching means for each mechanism respectively, said auxiliary, lockout switching means being electrically coupled in parallel with each other and, as a group, in series with said eleventh circuit means.

* * * * *