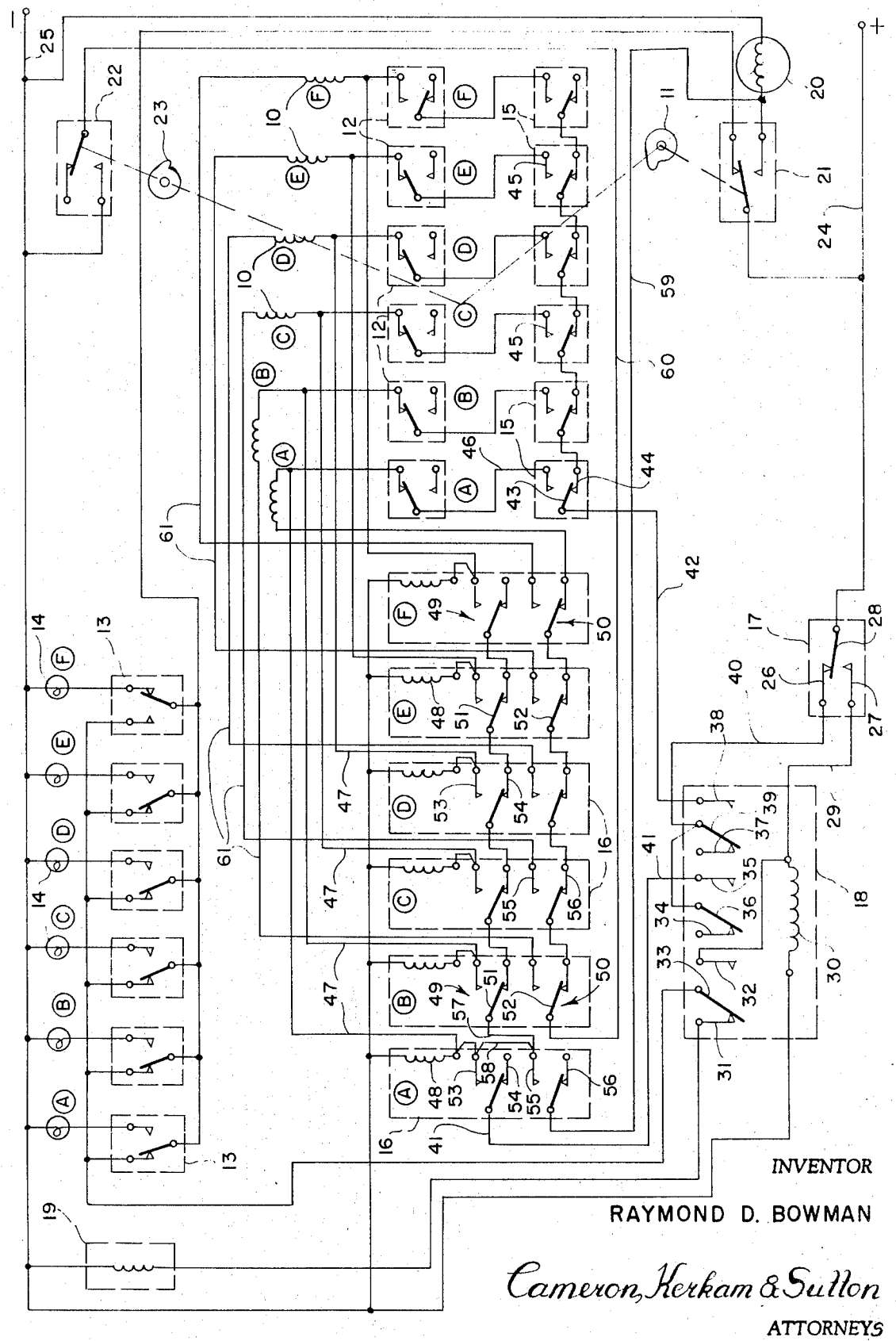
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VENDING CYCLE CONTROL CIRCUIT

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VENDING CYCLE CONTROL CIRCUIT

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ABSTRACT OF THE DISCLOSURE

A control circuit for the vend cycle of a multi-selection, coin operated vending machine is provided wherein dispensing from a plurality of columns is controlled by a separate solenoid for each column and a vend motor common to all columns. A selector relay is provided for each selection, with one of the selector relays being arranged to establish the power circuit to the vend motor.

The present invention relates to a control circuit for a coin operated vending machine having a multiplicity of stacks or columns, each of which is adapted to receive a plurality of articles to be selectively dispensed. Selected articles are dispensed, one at a time, from one of the stacks in response to a selection by a customer. A solenoid is used individually for each selection, and a vend motor is common to all selections. The vend motor which controls the vending cycle is arranged to drive a pair of associated timer switches, one of which serves to break the initial holding power circuit to a vend or credit relay and establish an alternate energizing circuit for the vend motor. The other timer switch serves to ground the energizing coil of the solenoid for controlled dispensing from a selected column. Each column has associated therewith a selector relay which is arranged to be energized for an individual selection. One of the selector relays is connected in circuit to establish an initial energizing circuit to the vend motor for all selections. The control circuit of the present invention removes established credit at the proper time so as to insure delivery of only one article per established credit and allows alternate selection of articles when one selection is sold out.

BACKGROUND OF THE INVENTION

Coin operated vending machines for selectively dispensing articles, one at a time, from a plurality of sources are well known. Such vending machines generally comprise a plurality of stacks of articles which may be arranged in columns in side by side relationship. Upon deposit of a suitable coin, credit is established and a dispensing cycle is initiated according to a selection by the customer which causes a vend motor to be cycled and a solenoid actuated dispensing mechanism to be actuated to cause an article to be dispensed from the selected stack.

While various mechanical and electrical arrangements are known in the prior art for controlling delivery of articles, one at a time, from a stack, the vending industry has been continually searching for improved and simplified electrical control circuits. Preferably, such circuits are characterized by minimum requirements of power of operation, minimum interferences of elements and simplicity in design, thereby allowing a flexibility in construction and operation which reduces cost of manufacture, operation and maintenance.

Accordingly, it is a primary object of the present invention to provide an improved vending cycle control circuit for a vending machine.

Another object of the present invention is to provide an improved vending cycle control circuit for a vending machine which prevents "jack-potting" of the machine.

Another object of the present invention is to provide an

improved vending cycle control circuit for a multi-selection vending machine which will prevent placing the entire vending machine out of order in the event of a sold out selection, and which will allow operation of the vending machine with any number of selections sold out so long as there is at least one selection that is not sold out.

The present invention is particularly adapted for use with a coin operated vending machine having a multiplicity of stacks or columns each of which may be provided with articles of different characteristics such as, for example, bottle beverages of different flavors and having a solenoid actuated dispensing arrangement for selectively dispensing articles one at a time according to the choice of the customer. To this end, dispensing from each column is controlled by a separate solenoid which is arranged to be energized during the vend cycle through a cam operated switch driven by the vend motor. A second cam operated switch is operably connected to break the initial holding power circuit to the vend relay corresponding to the selection and establish an alternate holding or power circuit for the vend motor. The selected solenoid remains energized as long as the associated cam operated switch is maintained in its actuated position. When the switch is released, the solenoid is deenergized, but the vend motor continues to run through the alternate power circuit until the second cam switch is returned to its original position. Each column has associated therewith a selector relay arranged to be energized for an individual selection. One of the selector relays also serves to establish the initial vend motor energizing circuit for all selections. The dual function of said relay results in a simplification of the control circuit over known arrangements having the same sequence and results in a reduction in manufacturing cost, while simultaneously providing increased reliability.

BRIEF DESCRIPTION OF THE DRAWING

Other objects and the attendant advantages of the present invention will be apparent from the following description taken in connection with the accompanying drawing. Although one specific form of invention is illustrated, it is to be expressly understood that this drawing is for the purpose of illustration only and is not intended to represent the full scope of the invention as defined by the appended claims.

The accompanying drawing is a schematic diagram of the improved vending cycle control circuit of the present invention.

Since the inventive concept of this invention resides in the improved electrical control circuit and is independent of the cabinet in which it is located or the mechanical means for delivery of the article that is dispensed, the invention will be hereinafter descibed with reference only to the schematic of the control circuit, its method of operation and control. However, reference may be made to U.S. Pat. 3,158,290, issued Nov. 24, 1964 and assigned to the assignee of the present invention, for a general description of a dispensing mechanism with which the improved control circuit of the present invention may be used.

Referring to the drawing, there is illustrated schematically the improved vending cycle control circuit of the present invention. The control circuit is illustrated in connection with a coin operated vending machine having six (6) columns or stacks (A–E) of articles; however, it will be apparent that more or less than 6 columns may be utilized and the operating sequence for dispensing and article from each column is substantially the same. The circuit is illustrated in a condition in which column A is sold out. Each component in the operating circuit of one column corresponding to a like component in the operating circuit of other columns is designated with a

like numerical reference character which is followed by an alphabetical character designating the particular column with which the component is associated.

Each column, has associated therewith a solenoid **10**, a pair of sold out switches **12** and **13**, a sold out indicator light **14**, a selector switch **15** and a selector relay **16**. Switches **12**, **13** and **15** are all of the single pole double throw type.

In addition to the components associated with a particular column, a number of common control components are provided including coin operated vend switch **17**, vend relay **18**, coin reject electromagnet **19**, vend cycle motor **20** and a pair of cam operated switches **21** and **22** adapted to be actuated by associated cams **11** and **23** driven by motor **20**.

Power to the the circuit is applied across a pair of supply conductors **24** and **25** which may be connected to a conventional supply source (not shown). The positive (+) terminal of line **24** designates the "hot" line, while the negative (—) terminal connected to line **25** designates the ground return line.

Credit is established by energization of vend relay **18** which occurs upon insertion of a proper coin into a coin mechanism (not shown) and actuation of the associated coin switch **17**. The coin mechanism may be a conventional coin operated device adapted to receive coins of greater value than the cost of an article to be selected and dispense change accordingly, while momentarily closing the normally open pair of contacts of switch **17** upon actuation of the movable contact arm **28** when the proper amount of coins has been received.

Briefly, describing the operating sequence for a vend cycle, the vending machine coin mechanism cannot accept coins to operate the vend or coin switch **17** unless its coin reject electromagnet mechanism **19** is energized. When the machine is ready for operation in a stand-by condition, the coin reject electromagnet is energized. Momentary actuation of the coin switches establishes credit, which corresponds to the energization of the vend relay **18**. Upon return of the movable contact arm **28** of the coin switch to its initial position, an enabling circuit is established to the customer selection switches for post selection through a set of contacts of the vend relay.

Upon actuation of a selector switch **15**, a corresponding selector relay **16** is energized and the vend motor power circuit is established. This initiates a vend cycle to cause delivery of an article from a selected column. To this end, the vend motor **20** drives or actuates a pair of cam operated switches **21** and **22**, one of which breaks the power or holding circuit to the vend relay which was energized upon insertion of the proper coinage and establishes an alternate power circuit to the vend motor, while the other cam operated switch esablishes the circuit through selector relay contacts to ground the solenoid of the selected column dispensing mechanism and cause the desired article to be dispensed.

Referring to the drawing, switch **17** includes a pair of fixed contacts **26** and **27** and a movable contact arm **28** adapted to be momentarily displaced from a first position to a second position and returned to its first position when the proper amount of coins have been received. Movable contact arm **28** is connected to supply conductor **24** and, upon displacement of the arm from its first to its second position, establishes an energizing circuit to the energizing coil **30** vend relay **18** through contacts **27**, **28** and conductor **29**. The other end of the energizing coil **30** is connected to supply conductor **25** which forms a common return or ground line for each of the sold out indicator lights **14A–14F**, the energizing coils of selector relays **16A–16F**, energizing coil of reject electromagnet **19** and the fixed contact of switch **22**.

Coin reject electromagnet **19** provides a conventional coin blocking function through operation of a cooperating armature (not shown). In its normally energized condition, the armature is actuated so as to permit a coin to be inserted for establishing credit; however, once the coin operated vend switch **17** is closed or actuated and vend relay **18** energized, the coin reject electromagnet is deenergized to prevent the insertion of another coin. The energizing circuit for electromagnet **19** may be traced from line **24**, through the normally closed contacts of switch **21** and one or more of parallel connected sold out switches **13A–13F**, through the normally closed contacts **31**, **33** of vend relay **18** to one side of the electromagnet coil, the other side of the coil being connected directly to line **25**.

Vend relay **18** includes an energized coil **30**, a first set of fixed contacts **31**, **32** and an associated movable contact arm **33**, a second set of fixed contacts **34**, **35** and an associated movable contact arm **36** and a third set of fixed contacts **37**, **38** and an associated movable contact arm **39**. Movable contact arms **36** and **39** are connected to line **24** through conductor **40** and normally closed contacts **26**, **28** of coin switch **17**, while movable contact arm **33** is connected between one side of the electromagnet coil and the power line **24** as hereinbefore described.

Vend relay **18**, prior to insertion of the proper coinage in the machine, is deenergized. In this condition, input power through the coin switch terminates at contacts **34** and **37** which are dead-ended. When coin switch **17** is momentarily actuated, power is applied to conductor **29** and coil **30** is energized causing movable contacts **33**, **36**, **39** to switch to the energized condition position establishing connection with contacts **32**, **35** and **38**, respectively. A first circuit forming holding circuit for coil **30** is established through conductor **29**, fixed contact **32** and contact arm **33** which is returned to power line **24** through the normally closed contacts of switch **21**.

Switching of contacts **36** and **39** to their second position establishes second and third circuits through conductors **41** and **42**, respectively. The second circuit through conductor **41** is a holding circuit for selector relays **16**. To this end, the conductor **41** is connected to the upper movable contact arm **51**, as viewed in the drawing, of selector relay **16A**. The third circuit established upon energization of vend relay **18** is an enabling circuit for the selector relays. To this end, conductor **42** is connected to the movable contact arm **43** of selector switch **15A**.

Power to contact arm **36** is maintained through the coin switch when it is returned to its original position. In this manner, coin switch **17** provides an anti-jackpot feature since neither the enabling circuit nor the holding circuit of the selector relay can be established until the vend relay is energized and the coin switch is returned to its normally closed position. If the coin switch should be stuck in its open position, due to a bent coin or for some other reason, actuation of a selector switch does not cause the associated selector relay to be operated.

Each selector switch **15B–15F** has its movable contact arm **43** connected to the lower fixed contact **44** of the preceding switch. The series connected contacts are dead ended at fixed contact **44** of switch **15F**. The other fixed contact **45** of each switch **15A–15F** is individually connected through a conductor **46**, the normally closed contacts of a corresponding sold out switch **12** and conductor **47** to one end of the energizing winding of the corresponding selector relay **16**.

Advantageously, selector switches **15A–15F** may be of the momentary, push-button type biased to their open position. Momentary closure of switch **15** completes the energizing circuit to the corresponding selector relay, if credit has been established, which is then maintained energized by the holding circuit established through one of its sets of contacts and energized conductor **41**.

Each selector relay **16A–16F** includes an energizing coil **48** and upper and lower sets of contacts **49** and **50**, respectively. Each set of contacts **49** and **50** comprise a movable contact arm **51** and **52**, respectively, and a pair of corresponding fixed contacts **53**, **54** and **55**, **56**.

The holding circuit for the selector relays is established through the upper set of contacts **49**. Each fixed contact **53** is electrically connected to the lower end, as viewed in the drawing, of the energizing winding of the corresponding selector relay. The normally closed lower contacts **51, 54** of selector relays **16B–16F** are serially connected with contact **54** of relay **16F** being dead-ended. Movable contact **51** of relay **16B** is electrically connected through suitable jumper leads **57, 58** to the fixed contact **53** of relay **16A**.

Also connected to the movable contact arm **51** of relay **16B** through jumper **57** is fixed contact **55** of relay **16A**. This connection serves to provide an initial energizing circuit for vend motor **20** when a selection is made. One side of the energizing winding of the vend motor is connected to the ground return line **25**. The other side of the energizing winding of the vend motor is connected to the movable contact arm **52** of selector relay **16A** through conductor **59**.

The lower sets of contacts **50** of relays **16B–16F** provide the ground return connection for the solenoid energizing coils of each column A–F. The coil of each solenoid **10B–10F** has one end returned through conductor **61** to the fixed contact **55** of the corresponding selector relays **16B–16F**. The corresponding end of the coil of solenoid **10A** is connected through conductor **62** to fixed contact **56** of relay **16F**. Contacts **52** and **56** are normally closed when the selector relays are deenergized and the movable contact **52** of each selector relay, starting with **16F**, is connected to the fixed contact **56** of the preceding relay, ending with relay **16B**. The movable contact arm **52** of selector relay **16B** is connected to the ground return line **25** through conductor **60** and the closed contacts of cam actuated switch **22**.

Timer switch **21** and solenoid ground switch **22** are arranged to be actuated by cams **11** and **23** which are rotatably driven by vend motor **20** in a well known manner. In its normal or first position, switch **21** establishes the holding circuit for the vend relay as hereinbefore described. In its second position, which corresponds to a fixed time after start of the vend motor, switch **21** establishes a second energizing circuit for the vend motor through its normally opened, now closed contacts. Thus, the vend motor is energized for a fixed period corresponding to the contour of cam **11** through switch **21**.

Briefly describing a sequence of operation, the vend circuit is illustrated in a stand-by condition with the F column sold out. Switch **12F** is down and solenoid **10F** cannot be energized. Coin reject electromagnet **19** is energized and the machine is in a condition ready to accept coins to operate the coin switch **17** which in turn establishes credit by energization of vend relay **18**. Once the coin switch is operated and credit has been established the machine is ready for a selection to be made. If the coin switch sticks in the normally open position because of a bent coin or for some other reason, the circuit will not operate because the circuit through the selector switches cannot be established due to failure of the contract **28** to return to its original normally closed posiion. This provides an anti-jackpot feature.

Assuming credit to be established and the customer operates selector switch **15B**, selector relay **16B** is energized. Closure of contacts **51, 53** of relay **16B** also causes the energizing coil of relay **16A** to be energized which establishes the initial energizing circuit for vend motor **20** through its contacts **52, 55**. A holding circuit for both relays is maintained through contacts **51, 52** and the return lines through contacts **35, 36** of relay **18** and contacts **26, 28** of switch **17**.

As the vend motor begins its cycle, timer switch **21** is soon actuated by cam **11** to its second position to establish the timed motor energizing circuit and deenergize the vend relay. However, selector relays **16A** and **16B** remain energized by virtue of the position of contacts of switch **21** and the power circuit now maintained through contacts **52, 55** of relay **16A**. It should be noted that EMF feedback from the vend motor **20** is sufficient to keep the energizing coils of relays **16A** and **16B** energized during the brief instance that timer switch **21** is operating.

The vend motor continues to run through its time cycle while the timer switch contacts are held in their second position by the timer cam. The solenoid ground switch **22** is operated next by cam **23**. This grounds the solenoid corresponding to the selected column through contacts **52, 55** of relay **16B** causing the solenoid to operate. The solenoid remains energized as long as the solenoid ground switch **22** is held in a closed position by its timer cam **22**. When the timer cam **22** releases the solenoid ground switch **22**, the vend motor continues its cycle until the timer switch **21** is operated through its cam **11** to remove power from the vend motor and selector relays, thus, returning the circuit to the stand-by position.

When a selection is made in the A column, selector relay **16A** is energized, but the ground return for solenoid **10A** is made through the serially connected, normally closed contacts **52, 56** of selector relays **16B–16F** and the actuated solenoid ground switch **22**. The remainder of the vend cycle is the same as previously described for a selection obtained in column B.

While the control circuit of the present invention has been described with reference to a particular embodiment, changes or modifications to the illustrated embodiment may now be suggested to those skilled in the art without departing from the present inventive concept. Reference should therefore be had to the following claims to determine the full scope of the invention.

I claim:

1. In a control circuit for a coin operated vending machine having a plurality of columns of stored articles, a plurality of solenoid operated actuators, each of which corresponds to a separate column and is arranged to be selectively actuated upon energization of its solenoid to dispense articles from the corresponding column, one at a time, according to the choice of a customer, a pair of input line conductors adapted to be connected to a power circuit, first circuit means including a selector switch and a selector relay for each column, each selector relay having an operating and a plurality of circuit making contacts, said selector switch being arranged upon selective actuation by a customer to energize a corresponding operating winding of a selector relay the energization of which effects the energization of a corresponding solenoid, a vend relay having an operating winding and a plurality of contacts for establishing an enabling circuit to the selector switches, coin operated means for connecting the operating winding of the vend relay across the line conductors, a vending cycle motor, the improvement comprising means for connecting the operating winding of at least one of said selector relays for energization upon activation of any selector switch such that there is an initial energizing circuit for said vending cycle motor established by said one of said selector relays upon actuation of any one of said selector switches and timing means establishing a second energization circuit for said motor, said timing means being controlled by said motor.

2. In a control circuit as set forth in claim **1** wherein said timing means comprising a switch adapted for actuation between a first and a second position, a cam driven by said motor for actuating said switch between said first and second position, said switch in its second position being serially connected with said motor.

3. In a control circuit as set forth in claim **2** further including a second switch, said second switch being adapted for actuation between a first and a second position, cam means driven by said motor for actuating said second switch, said switch in its second position establishing the energizing circuit for the solenoid of a selected column.

4. In a control circuit for a coin-operated vending machine having a plurality of columns of stored articles,

a plurality of solenoid operated actuators, each of which corresponds to a separate column and is arranged to be selectively actuated upon energization of its solenoid to dispense articles from the corresponding column, one at a time, according to the choice of a customer, a pair of input line conductors adapted to be connected to a power circuit, first circuit means including a selector switch and a selector relay for each column, each selector relay having an operating winding and a plurality of circuit making contacts each selector switch being arranged upon selective actuation by a customer to energize a corresponding operating winding of a selector relay the energization of which establishes an enabling circuit of a corresponding solenoid, a vend relay having an operating winding and a plurality of circuit making contacts for establishing an enabling circuit to the selector switches, coin-operated means for connecting the operating winding of the vend relay across the line conductors, a vending cycle motor, the improvement comprising means for connecting the operating winding of at least one of said selector relays in an energization circuit for energization upon activation of any selector switch, a first and a second cam operated timer switch, a first and a second timing cam driven by said vend motor for actuating said first and said second switches, respectively, between a first and a second position, said first timer switch in its first position being connected in series circuit with the energized operating winding of the vend relay and establishing the holding circuit therefor and in its second position in series circuit with the vend motor, said last named series circuit being connected across the input line conductors, said second timer switch in its second position being connected electrically in series with the solenoid winding of a selected column for energization thereof and an initial energizing circuit for said vend motor established by said one of said selector relays upon actuation of any one of said selector switches.

5. A control circuit for a coin-operated vending machine having a plurality of columns of articles adapted to be selectively dispensed and a plurality of solenoid operated actuators, each of which corresponds to a separate column and is arranged to be selectively actuated upon energization of its solenoid to dispense articles from the corresponding column, one at a time, according to the choice of a customer, comprising a pair of input line conductors adapted to be connected to a power circuit, a selector switch for each column adapted upon selective actuation by a customer to energize a corresponding solenoid, a plurality of selector relays, one for each column, each having its operating winding connected so as to be selectively energized upon actuation of a corresponding selector switch from said line conductors, a vend relay having an operating winding, and a plurality of sets of contacts adapted upon energization of said vend relay operating winding to establish a first and a second circuit, means for connecting said vend relay operating winding across the line conductors for energization thereof including a coin operated vend switch, said coin-operated vend switch being electrically connected in series with one of the line conductors and adapted to be momentarily actuated from a first to a second position upon insertion of a coin for energization of said vend relay operating winding, said second circuit establishing a holding circuit for a selected selector relay upon energization thereof, a vend motor, means for connecting the operating winding of at least one of said selector relays to said second circuit for energization upon activation of any selector switch, a first and a second cam operated timer switch, a first and a second timer cam driven by said vend motor for actuating said first and said second switches, respectively, between a

first and a second position, said first timer switch when in its first position being connected in said first circuit in series with the energized operating winding of the vend relay and establishing the holding circuit therefor and in its second position in series circuit with the vend motor, said second timer switch in its second position being connected electrically in series with the solenoid winding of a selected column for energization thereof and an initial energizing circuit for said vend motor established by said one of said selector relays upon actuation of any one of said selector switches.

6. A control circuit as set forth in claim 5 wherein said plurality of sets of contacts of said vend relay form a third circuit upon energization of said vend relay said third circuit including said selector switches and normally open contacts of selector relays, corresponding selector switches and operating winding of selector relays being connected in series such that actuation of any one selector switch energizes the corresponding selector relay.

7. A control circuit as set forth in claim 5 wherein each of said selector relays includes a first and a second set of contacts operable upon energization of a selector relay from a first to a second position, the first set of contacts of all but one selector relay in the first position being connected in series, the second set of contacts of all but said one selector switch being connected in series, the first set of contacts of each selector switch in the second position being connected in said third circuit, the second set of contacts of all but said one selector relay being serially connected with the corresponding solenoid winding and said second timer switch, the first set of contacts of said one selector relay in the second position being serially connected with the second set of contacts of said one selector relay in the second position to establish said initial energizing circuit for the vend motor.

8. A control circuit for the vend cycle of a multiselection, coin-operated vending machine having a plurality of columns of articles adapted to be selectively dispensed one at a time comprising solenoid actuating means for each column for controlling the release of articles from the columns, a vend motor common to all columns, selecting means for each column including a selector relay and a switch, a vend relay common to all columns for establishing an energizing circuit to a selector relay through a corresponding selector switch upon energization of said vend relay, coin operable means connected for establishing an energizing circuit to said vend relay, a first and a second switch, means responsive to operation of said vend motor for actuating said switches between a first and a second position, a first circuit including an energized selector relay establishing a first energizing circuit to said vend motor, a second circuit including said first switch in its second position establishing a second energizing circuit for said motor and a third circuit including said second switch in its second position for energizing the solenoid actuating means corresponding to a selection.

9. A control circuit as set forth in claim 8 including means connecting said energized selector relay for energization upon actuation of any one of said selector switches.

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