ABSTRACT: A coin changer for an article vending machine is capable of establishing the price of articles at either 15 cents or 20 cents and accepts nickels, dimes and quarters. A totalizer having two repeating totalization programs is employed to totalize nickel and dime deposits in 5 cents increments, one revolution thereof comprising a plurality of such increments (such as 12) equal in number to integer multiples of the three and four increment programs. The need for totalizing quarter deposits is eliminated by programming the operation of the change payout mechanism, the latter being directly activated by operation of a quarter coin switch when a quarter is deposited. Two position, ganged price-setting switches facilitate changeover from one price to the other.
CONVERTIBLE PRICE COIN CHANGER FOR VENDING MACHINES

In recent years, increases in the price of products such as canned and bottled beverages have established the need for a coin changer for vending machines that permits operation at either a 15-cents or a 20-cents vend price. It is apparent that, both from the standpoint of the manufacturer of vending equipment and the user or operator thereof, the cost of updating present equipment must be held to a minimum. Thus, utilizing mechanical structure similar to that already in widespread use in 10-cents changers is highly desirable and advantageous as compared with retooling for production of modified mechanical structure especially adapted for 15-cents and 20-cents vend prices.

It is, therefore, the primary object of this invention to provide a convertible price coin changer of relatively uncomplicated design which is capable of setting the price of products of a vending machine at either of two levels and which utilizes conventional mechanical components for single price changers without altering the basic mechanical design of the changer unit.

As a corollary to the foregoing object, it is an important aim of the present invention to provide a changer as aforesaid which eliminates the need to totalize the deposit of a coin of greater value than the vend price through the use of programmed operation of the change payout mechanism when such coin is deposited, thereby making it possible to employ a relatively uncomplicated electromechanical totalizer for coins of lesser value which will have a relatively long operating life as compared with electromechanical totalizers which must respond to the deposit of coins of all denominations.

Another important object of the invention is to provide a totalizer having repeating totalization programs for the different prices, wherein the requirement to count back or reset the totalizer before a succeeding vend cycle is obviated by the provision of increments of totalization in a full revolution of the totalizer equal in number to integer multiples of the numbers of such increments in the totalization programs thereof.

Still another important object of this invention is to provide a repeating program totalizer as aforesaid having means preventing the totalizer from accumulating increments in excess of a selected program in the event that a customer does not have the exact coinage equal to the article price, whereby to preclude the establishment of credit in the next succeeding program when the customer is forced to make an excess deposit and receive change in order to effect a purchase.

Furthermore, it is an important aim of this invention to provide a convertible price coin changer optionally operable at either of two price levels that permits field conversion of existing single price changers to update the latter for operation at higher vend prices commensurate with present marketing requirements.

In the drawings:

FIG. 1 is a fragmentary, rear elevational view of the lower portion of coin-changing apparatus embodying the improvements of the present invention, the cover plate normally positioned thereover being removed to show the internal construction;

FIG. 2 is a horizontal sectional view taken along line 2-2 of FIG. 1;

FIG. 3 is a fragmentary, horizontal sectional view taken along line 3-3 of FIG. 1;

FIG. 4 is a diagrammatic illustration of the apparatus showing the relative positions of the coin switches with respect to the various coin paths;

FIG. 5 is a schematic diagram of the electrical circuitry of the apparatus;

FIG. 6 is a chart illustrating the repeating programs of the totalizer and showing the condition of each cam switch of the stepper throughout a revolution thereof; and

FIG. 7 is a timing chart illustrating change payout and portraying the operation of certain switches of the changer circuitry associated with change payout.

The overall coin changing apparatus is broadly designated by the numeral 10 in FIG. 1, only the lower portion of apparatus 10 being illustrated since the upper portion thereof comprises a convertible coin changer as illustrated diagrammatically in FIG. 4. The coin acceptor 11 is capable of separating authentic coins from spurious discs and sorting coins by denomination for ultimate gravitation into the lower changer section of the apparatus 10 illustrated in FIGS. 1—3. The particular changer structure illustrated is adapted to handle nickels, dimes and quarters and is similar in construction to the coin-changing equipment shown and described in Offutt et al., U.S. Pat. No. 3,715,670, granted Mar. 30, 1973.

The main housing 12 of apparatus 10 includes a main bottom wall 14 integral with a rectangular flange 16 and joined to a centrally located, upright dividing wall 18 that is joined to a horizontal upper wall 20, the latter serving to separate the upper, coin acceptor section of apparatus 10 from the changer section thereof illustrated in FIGS. 1—3. An upright sidewall extends upwardly from bottom wall 14 the full height of housing 12, while a relatively short, upright, interior wall 24 is integral with and depends from upper wall 20 in spaced relationship to the right-side margin of housing 12. The interior wall 24 extends the full front-to-back dimension of housing 12 throughout a major portion of the changer section, but terminates in spaced relationship to bottom compartment 26 of housing 12 as is clear in FIG. 1. The rear compartment 26 is bounded on the front by the dividing wall 18 and is normally closed by a cover plate (not shown) which is removed.

A front compartment 28 is thus formed forwardly of dividing wall 18 and is seen in FIG. 2, a nickel and dime switch being mounted adjacent the upper end of wall 14 parallel to dividing wall 18 and spaced forwardly therefrom. A quarter vending switch 34 is disposed in the rear compartment 26 and is mounted on dividing wall 18 just beneath the horizontal upper wall 20. The bodies of the two coin switches 30 and 34 are spaced approximately the same distance from the bottom of housing 12 and thus are directly opposite one another on respective sides of the dividing wall 18.

A second plate 36 and a third plate 38 of shorter horizontal dimension are disposed between plate 32 and dividing wall 18 to form channels for passage of nickels, dimes and quarters from the acceptor 11 to a coin collection box 40 illustrated diagrammatically in FIG. 4. The coin box 40 is located within the vending machine in disposition to receive coins gravitating from a chute (not shown) in the base of the changer section which directs coins through the bottom wall 14. Specifically, two nickel coin channels 42 are formed between plates 32 and 36, a dime coin channel 44 is formed between plates 36 and 38, and a quarter coin channel 46 is formed between plate 38 and dividing wall 18. It is to be understood that the coin acceptor 11 has a flipper therein for causing nickels to gravitate alternately through one of the channels 43 and then the other, so that the nickels may be directed to a pair of coin storage tubes 48 and 50 in the front compartment 28. A portion of each of the tubes 48 and 50 is visible in FIG. 1 through a pair of openings 52 in dividing wall 18, the tubes 48 and 50 being hidden from view in FIG. 2.

The nickel and dime coin switch 30 is operated by a swingable actuating arm 54 having projections 54a and 54b extending rearwardly through plate 32 and into respective nickel coin channels 42. The projection 54a further extends through plate 36 into the dime coin channel 44. The quarter vending switch 34 has an actuating arm 56 that projects forwardly through dividing wall 18 into the quarter coin channel 46.

A quarter payout switch 58 is mounted on dividing wall 18 in the rear compartment 26 and is disposed beneath vend switch 34 and to the left thereof. The body of payout switch 58 is supported on spacers 60, the switch 58 being operated by a swingable element in the form of an actuating arm 62 of irregular configuration. The free end of arm 62 extends forwardly through dividing wall 18 and into the quarter channel 46 at a point along the quarter path beneath actuating arm 56.
of vend switch 34. A quarter first strikes arm 56 and then gravitates therefrom onto arm 62, it being understood that the necessary change in the direction of the quarter coin path hides the tip of arm 62 (engaged in the quarter within channel 46) from view in FIG. 2. A dime switch 64 is mounted on dividing wall 18 directly beneath the quarter payout switch 58 and is operated by an actuating arm 66 that projects into the dime channel 44 below the actuating projection 54c of the nickel and dime switch 30. The quarter payout switch 58 blocks the dime switch 64 (engaged view in FIG. 2).

An oscillating slide plate (not shown) is disposed beneath the two coin tubes 48 and 50 for the purpose of discharging nickel change coins, the slide plate and associated structure being mounted beneath the bottom wall 14 within the base flange 16. The slide plate assembly is illustrated and described in the aforesaid U.S. Pat. No. 3,175,670, the latter being incorporated herein by reference as may be required for a full and complete understanding of the manner in which the slide plate alternately discharges coins from tubes 48 and 50 through the base of housing 12 upon oscillation of the plate.

The slide plate assembly forms a part of a change payout mechanism which further includes an electric motor and gear unit 68 located on the right side of the interior wall 24 in the rear compartment 26. The payout motor 70 of unit 68 is illustrated schematically in FIG. 5. The output shaft 72 (FIG. 1) of unit 68 mounts an eccentric block 74 which rotates with shaft 72. A link 76 is pivotally connected to block 74 in eccentric relationship to the axis of shaft 72, and is also pivotally connected to an upstanding lug 78 that projects upwardly from the slide plate disposed beneath the bottom wall 14, as discussed above. In this manner, rotation of shaft 72 is converted into reciprocal movement for effecting oscillation of the slide plate.

A single-pole, double-throw tube empty switch 80 is mounted on the rear face of dividing wall 18 below the dime switch 64 and is employed to sense the level of coins in the tubes 48 and 50. The switch 80 is provided with a generally L-shaped actuating arm 82 disposed for engagement by the upstanding segments 84 of a pair of generally Z-shaped coin feelers 86 rotatably carried on pivot means 88 mounted on wall 18. Counterelectors 90 on the feelers 86 bias the coin feeler sections 92 thereof toward respective coin tubes 48 and 50. As shown in FIG. 1, each of the tubes 48 and 50 is provided with an upright clearance slot 94 therein for the respective feeler section 92. The segments 84 of feelers 86 shift the contacts of switch 80 if the level of change coins in tubes 48 and 50 falls below a level determined by the height of feeler sections 92 with respect to the coin tubes.

Means for rendering the motor and gear unit 68 operative in response to the deposit of a quarter includes latch structure in the nature of an elongated lever 96 having a main upright section 98 mounted on a pivot pin 100 supported by the wall 18. A laterally extending arm section 102 projects from main section 98 and carries a counterelector 104 thereon which biases lever 96 in a counterclockwise direction about pin 100. The upper end of the main section 98 is provided with a laterally projecting latch segment 106 positioned to engage the projecting, right end portion 62a of the actuating arm 62 of the quarter payout switch 58. The left-hand margin of latch segment 106 is defined by an arcuate surface 108 that normally rests against projecting portion 62a so that, upon swinging of arm 62 from its normal position shown in broken lines to its operated position shown in full lines, the projection 62a rides along surface 108 until it clears the latch segment 106, whereas the counterelector 104 rotates the lever 96 counterclockwise through a small angular displacement to the position of lever 96 illustrated in full lines. Arm 62 is thus latched in its depressed or operated position since latch segment 106 moves beneath the projection 62a.

The lever 96 is returned to its normal position by the action of a triple lobe reset cam 110 carried by a cam shaft 112 driven by shaft 72 through gears 114. As is clear in FIG. 3, the three lobes of cam 110 are spaced at 120° intervals about the axis of cam shaft 112, it being understood that the meshing gears 114 provide a 3:2 drive ratio so that 120° of rotation of cam shaft 112 is effected by 180° of rotation of drive shaft 72.

The lower end of main section 98 of lever 96 is provided with an extension 116 disposed for engagement by each of the lobes of the reset cam 110 to effect swinging movement of lever 96 in a clockwise direction, the broken line illustration of the upper end of main section 98 of FIG. 1 showing the position of the lever 96 at the time of maximum clockwise displacement thereof, i.e., at the time the extension 116 is riding over the outer end of one of the lobes of cam 110.

The payout motor 70 of the motor and gear unit 68 employs a carrier switch 118 (that performs the function of cycle control for the motor 70, the switch 118 being schematically illustrated in FIG. 5 and the body or housing thereof being seen in FIG. 1) behind a second cam 120 carried by cam shaft 112 and disposed beneath the reset cam 110. As may be seen in FIG. 3, cam 120 is of triple lobe configuration with the leading edges of the lobes being spaced at 120° intervals, the cam 120 being employed to operate the carrier switch 118.

A cam switch 122 utilized for payoff/programming is illustrated schematically in FIG. 5 and the body thereof is seen in FIG. 1 directly above and overlying the body of the carrier switch 118. A third cam 124 of triple lobe configuration is carried by cam shaft 112 above the reset cam 110 and is aligned with the actuator button 126 of cam switch 122 as is clear in FIG. 3. The three lobes of the cam 124 are also spaced at 120° intervals. It is to be understood that the lowermost cam 120 for operating the carrier switch 118 is aligned with the actuator button thereof, although not visible in FIG. 3, in the same manner as illustrated for the uppermost cam 124 and associated switch 122.

In the control circuitry shown in FIG. 5, certain of the switches seen in the views of FIGS. 1 and 2 are illustrated schematically and identified by their reference numerals. A 5-cents and 10-cents coin return electromagnet (CREM) 128 and a 25-cents CREM 130 are shown for performing coin return functions in the acceptor 11 once a vend cycle is initiated. The CREMS 128 and 130 operate blocking devices and must be energized in order for coins to gravitate through the acceptor 11 to the changer section and into the appropriate coin channels 42, 44 or 46. The 25-cents CREM 130 also performs the usual "correct change only" function when the coin tubes 48 and 50 are depleted of change coins, a "correct change only" lamp being illustrated at 132. A lamp 134, when energized, instructs a customer to insert either nickels, dimes or quarters.

Exemplary components for effecting the vending function include a vend motor 136, a carrier switch 138 for the vend motor 136, and a credit relay comprising a relay coil 140 and a pair of relay switches 142 and 144. It should be understood that the credit relay and other relays to be subsequently described are all shown with the vending machine in standby.

A pair of power terminals 146 and 148 connect the circuitry to a suitable source of electrical energy, one side of the credit relay coil 140 and the vend motor 136 being directly connected to terminal 146 by a lead 150. A second lead 152 also extends from terminal 146 and is connected to the coil 154 of a payout relay having a pair of relay switches 156 and 158. The lead 152 is further connected to the coil 160 of a timer broadly denoted 162 and comprising a unidirectional, continuous rotation stepper of the nonreset type. The stepper 162 has an armature operated cam and switch assembly, four switches being employed and designated S1, S2, S3 and S4. The timing of the operating cams therefor will be readily understood from a study of FIG. 6 which will be discussed hereinafter. The stepper 162 also includes an armature actuated switch 172 which functions as a vend switch and operates on energization of the stepper coil 160. At the time of deenergization of the coil 160, the stepper vend switch 172 returns to its standby position and the cam switch or switches S1—S4 are operated in accordance with the chart of FIG. 6. Timing is such that the stepper vend switch 172 breaks its normally
open contact on deenergization of coil 160 before the cam switch assembly is indexed. This prevents the production of a false vend command as will be appreciated after the operation of the apparatus is discussed. The stepper 162 may, for example, be a type GM, manufactured by Potter and Brumfield of Princeton, Ind.

The price of articles is set by three ganged single-pole switches 174, 176 and 178 shown in their positions corresponding to 15-cents vend price. Movement of the pointers of these switches 174, 176 and 178 into engagement with their normally open contacts sets the vend price at 20-cents. An inventory switch is shown at 180.

With the apparatus 10 located in a vending machine in the usual manner, coins deposited in the machine are routed by a coin chute to the upper section of the apparatus 10, such upper section comprising the acceptor 11 (FIG. 4) as discussed above. After coin validating and sorting, the legitimate coins exit from the acceptor 11 in different coin paths according to denominational value. The nickels travel through the changer in one of the two paths or channels 42 depending upon the location of the flipper in the coin acceptor 11. If the coin tubes 48 and 50 are full, the nickels are diverted to the coin box 40. As is clearly illustrated in FIG. 4, each nickel actuates the 5-cents and 10-cents coin switch 30 during its travel through the changer. Dimes actuate the 5-cents and 10-cents coin switch 30 and the 10-cents coin switch 64 in that order, and then pass to the coin box 40. Quarters actuate the 25-cents vend switch 34, the 25-cents vend switch 58, and the 10-cents coin switch 64 in that order and then pass to the coin box 40. It will be seen hereinafter, however, that the quarter actuation of the 10-cents coin switch 64 has no effect on the operation of the changer.

Assuming a 15-cents vend price and that a quarter is deposited, actuation of the 25-cents vend switch 34 produces a vend command to the credit relay in the form of a vend pulse through the momentary establishment of the following electrical circuit: From power terminal 148 along a lead 182 to a lead 184, along a connecting lead 186 to the pole of vend switch 34, through the normally open contact of vend switch 34 and along a lead 188 to relay coil 140, and thence to power terminal 146 via lead 150. A holding circuit for the credit relay is then established by the closure of relay switch 142. The relay switch 144 now establishes electrical continuity through its normally open contact which is connected to vend motor 136 as shown in FIG. 156, the vend motor 136 thereby being energized upon return of vend switch 34 to its normal position as the quarter gravitates from the actuator arm 56. The power circuit thus established for the vend motor 136 is as follows: From power terminal 148 along leads 182, 184 and 186 to vend switch 34, along a lead 192 to the stepper vend switch 172, along a lead 194 to the relay switch 144, along lead 190 to vend motor 136, and thence along the lead 150 to power terminal 146. Once the vend motor 136 commences operation, its carrier switch 138 is actuated to directly interconnect leads 182 and 190. This operation of the carrier switch 138 also breaks the holding circuit to the coil 140 of the credit relay, thereby deenergizing coil 140 to effect dropout of the credit relay. The vend motor 136 is now exclusively under the control of its carrier switch 138 which returns to its normal position shown to deenergize vend motor 136 at the end of the vend cycle.

Returning to the time just after the quarter gravitates from the arm 56 of the 25-cents vend switch 34, the quarter then immediately travels to the arm 62 of the 25-cents payout switch 58 to depress arm 62 to its operated position shown in full lines in FIG. 1. The projection 62a rides to the top of latch segment 106 and the counterweight 104 swings the lever 96 in a counterclockwise direction to move the segment 106 beneath the projection 62a and retain the arm 62 in its operated position. This operation of arm 62 causes the contacts of payout switch 58 to change from the normal position of the operated state thereof, thereby pole of switch 58 against its normally open contact to establish the following electrical circuit and effect direct actuation of the payout mechanism: From power terminal 148 along leads 182 and 184 to payout switch 58, along a lead 196 to the coil 154 of the payout relay, and thence to lead 152 and the other power terminal 146. Energization of the payout relay actuates the switches 156 and 158 to energize the payout motor 70 by a start circuit from power terminal 146 to motor 70 via carrier switch 118, the now operated relay switch 158, and a lead 198. The other electrical side of the payout motor 70 is connected to power terminal 148 by a lead 200. It is to be remembered that the article price in the instant example is 15 cents, thus 10 cents in change or two nickels must be paid back to the customer. This requires that the slide plate of the payout mechanism be oscillated through one complete cycle (360° of rotation of the output shaft 72 of the motor and gear unit 68). One complete revolution of the output shaft 72 will cause the cam shaft 112 to rotate through an angular displacement 240°.

The payout timing chart in FIG. 7 shows the timing of the 25-cents payout switch 58, the payout motor carrier switch 118 and the payout motor cam switch 122. Two intervals 202 are illustrated and depict the approximate times that the contacts are discharged from the slide plate assembly. The total time span of the chart of FIG. 7 represents 240° of rotation of the cam shaft 112.

In viewing FIGS. 3 and 7, it may be seen that the carrier switch 118 (operated by cam 120) will be actuated prior to actuation of the switch 122 (by cam 124). Furthermore, the extension 116 of the lever 96 will not be engaged by one of the lobes of the cam 110 until nearly 120° of rotation. When this occurs, the lever 96 is swung in a clockwise direction as shown in FIG. 1 to move the latch segment 106 from beneath the projection 62a, thereby permitting return movement of the arm 62 to its normal position. Manifestly, this returns the contacts of switch 58 to the normal state illustrated in FIG. 5. The release of arm 62 would deenergize the relay coil 154, except that a holding circuit therefore is maintained through switches 122, 178, and 156. Although the holding circuit was opened by actuation of cam switch 122 as seen in FIG. 7, this occurred prior to the release of arm 62 and the return of the 25-cents payout switch 58 to normal. Thus, the payout motor 70 commences a second 120° of rotation to discharge a second nickel. Operation is terminated at the close of 240° of rotation of cam shaft 112 since the breaking of the holding circuit for the relay coil 154 by the cam switch 122 during the second 120° of rotation is now effective to cause dropout of the payout relay, thereby transferring control of the payout motor 70 to its carrier switch 118.

It is significant to note that the CREMS 128 and 130 are deenergized during change payout by the carrier switch 118 or the relay switch 158, this preventing additional coin disposal at that time. Also, since the 25-cents payout switch 58 is actuated and latched prior to the time that the quarter momentarily operates the 10-cent coin switch 64, the 10-cent switch 64 is effectively disabled since the circuit thereto through the normally closed contact of the 25-cent payout switch 58 is interrupted. Furthermore, it is noteworthy that the tube empty switch 80, shown in the position thereof corresponding to the presence of sufficient change, would energize the "correct change only" lamp 132 and deenergize the 25-cent CREM 130 to prevent the deposit of a quarter in the event that nickels were not available for change payout.

From the foregoing, it may be appreciated that the totaling stepper 162 is not employed when a quarter is deposited. Instead, since the quarter is greater in value than either of the possible vend prices (15 cent or 20 cent), a vend command is produced by the 25-cent vend switch 34 and the payout mechanism is programmed for operation in accordance with the selected vend price. To illustrate further, if the 20-cent vend price is selected by operating the ganged price setting switches 174—178 to close the poles thereof against their lower contacts, the available holding circuit through cam switch 122 and relay switch 156 for the payout relay coil 154...
is permanently interrupted. Therefore, at the 20-cent vend price, the relay coil 154 will remain energized only as long as the 25-cent payout switch 58 remains actuated and latched. Referring to FIG. 7, it may be seen that return of the 25-cent payout switch 58 to its normal position occurs just prior to 120° of rotation of cam shaft 112 and that the payout motor carrier switch 111 is operating at the termination of 120° of rotation, thereby deenergizing the payout motor 70 after only one nickel has been paid out to the customer.

Nickel and dime deposits require totalization since either vend price is greater than the values of the coins. The totalizer stepper 162 has two repeating totalization programs, one for each of the two vend prices. The 15-cent program comprises three 5-cent increments of totalization, while the 20-cent program comprises four 5-cent totalization increments. The stepper 162 has a 12-step cycle, i.e., its cam assembly indexes 12 times during each revolution thereof. This is represented by the numerals 1 through 12 at the top of the chart of FIG. 6. The second row of numerals comprises four repeating sets of 1, 2, 3 and 4 illustrating the repeating three-step or three-increment program for the 15-cent vend price. The 12 columns of the chart show the condition of each switch S1 — S4 at each step, the shaded areas representing closed switches and the blank areas representing open switches.

Assuming that the vend price is set at 15 cents and the customer has only nickels to deposit, the first nickel actuates the 5-cent and 10-cent coin switch 30 to stepper cam 160 along lead 184 and through the 25-cent payout switch 58, the 10-cent switch 64, and the now closed 5-cent and 10-cent switch 30 to a lead 204. When the 5-cent and 10-cent coin switch reopens, the circuit is interrupted to the stepper cam 160 causing the armature to drop out and index the stepper cams and switches to the first increment of the 5-cent program. (It is assumed that, in standby position, deposit of the first nickel, the stepper cam and switch assembly was at step 1 of the 12-step cycle.) Switches S1 and S2 are not involved in nickel operation, and the stepper 160 is now at step 2 where both switches S3 and S4 are still open.

The second nickel to be deposited produces the same result as the first nickel, thereby indexing the cams to the third step or the second increment of the program where it will be noted that S3 now closes. Closure of switch S3 upon armature drop out prepares the totalizer for the third nickel deposit. It should be remembered that the stepper vend switch 172 is actuated on the pull-in of the stepper armature and, therefore, by each pulse delivered to the stepper coil 160.

When the dime is deposited, the 5-cent and 10-cent coin switch 30 is again actuated to momentarily energize the stepper coil 160. At this time, however, the armature movement actuates the stepper vend switch 172 as usual but the now closed switch S3 causes a vend command to be delivered to the credit relay coil 140. This circuit is traceable from leads 184 and 186 to the 25-cent vend switch 34, along lead 192 to the stepper vend switch 172, and through switches 174 and S3 to lead 188 and the relay coil 140. When the armature drops out, the cams index to the third increment of the program and switch S3 reopens. Switch S4 is now closed but this switch is not functional at the 15-cent vend price.

For nickel-plus-dime operation or dime-plus-nickel operation the action of the totalizer is essentially the same as when 3 nickels are deposited in succession as discussed above. A difference is in the dime deposit and, if inserted first, the dime actuates the 5-cent and 10-cent coin switch 30 prior to actuating the 10-cent coin switch 64. The stepper switch 52 routes current to the stepper coil 160 from the 10-cent coin switch 64 except when the stepper is in standby. Thus, with S2 closed the stepper coil 160 is energized twice by the two pulses produced by the successive actuation of coin switches 30 and 64.

If a nickel is deposited first, it actuates the 5-cent and 10-cent coin switch 30 as above and the stepper cams index to the first increment of the program. When the dime is then deposited, the cams index to the second increment where it is seen that S2 remains closed so that the pulse from the dime coin switch 64 will reach the stepper coil 160 causing production of the vend command on pull-in and indexing to the third increment of the program on dropout. It is noteworthy at this juncture that no indexing of the stepper is required since the three-increment program repeats itself for each vend cycle.

For a 15-cent vend price and a 2-dime deposit, indexing to the first and second increments of the program occurs as above when the first dime is deposited. The second dime then actuates the 5-cent and 10-cent coin switch 30 to cause the stepper armature to pull in and thereby produce the vend pulse via the stepper vend switch 172 and stepper switch S3. When the 5-cent and 10-cent coin switch 30 deactuates, the armature drops out as before and steps the cams to the third increment of the program which is the standby position. However, the second dime then actuates the 10-cent coin switch 64, but now S2 is open and thus no pulse is delivered to the stepper coil 160. Instead, S1 (not closed) delivers the pulse through switch 176 to lead 196 and the relay coil 154, thereby effecting pull-in of the stepper relay and payout of 1 nickel in change. The holding circuit for the relay coil 154 is under the exclusive control of the cam switch 122; therefore, deenergization of the payout motor 70 is effected by its carrier switch 118 at the end of 120° of rotation of the cam shaft 112.

From the foregoing, it may be appreciated that, by change in price of 15 cents, the electric coil step at the stepper 162 will not index but three increments if the customer does not have exact change and is forced to deposit 2 dimes. The stepper coil 160 is prevented from indexing the cams twice in response to the second dime deposited, this being accomplished by the action of switch S2 which opens when three increments have been accumulated by the totalizer.

The totalizer 162 operates similarly when set for the 20-cent vend price. As set forth above, the price setting switches 174, 176 and 178 have their movable poles in engagement with corresponding lower contacts thereof in the 20-cent price position. Therefore, switch 174 renders switch S4 functional and S3 nonfunctional, and the switch 176 routes all pulses from the coin 10-cent coin switch 64 to the stepper coil 160 and disconnects the totalizer from the payout relay coil 154.

The totalizer 162 now has a four-increment program which repeats 3 times during each complete cycle of 12 steps, the standby positions of the totalizer now being at steps 1, 5 and 9. It is thus apparent from FIG. 6 that four pulses from nickels or dimes will be required to produce the vend command.

Since the stepper totalizer 162 is not operated when quarters are deposited, it is subjected to appreciably less wear and thus has a longer operating life than would be expected if quarters were totaled in addition to nickels and dimes. Furthermore, neither extra stepping forward nor reverse stepping is required to achieve a "home" position, thus further contributing to the life expectancy of the stepper unit.

The changer circuitry of the instant invention is particularly adapted for field conversion of single-price changers of the general type shown and described in the aforesaid U.S. Pat. No. 3,175,670, since the mechanical structure of the changer of such patent and the changer disclosed herein is quite similar and identical in essential characteristics. The quarter support member and return escapement therefore employed in the changer of the aforesaid patent is not utilized. The stepper 162 and the payout relay is installed in available space in the upper section of the changer apparatus behind the actuator structure along with appropriate wiring and other minor changes, such as the addition of the ganged price-setting switches 174 — 178. The changer section is modified by the installation of the 10-cent coin switch 64 and the 5-cent and 10-cent coin switch 30 plus appropriate changes in the cams and switches under the control of the payout motor 70.

We claim:

1. In an article vending machine, coin-operated apparatus for controlling vending and change-making comprising:
Selectively operable price-setting means having a first operational condition establishing the price of articles at a selected amount and a second operational condition establishing a price at a selected, greater amount; first coin-sensing means for sensing the deposit of coins of values less than either of said prices; totalizer means coupled with said first sensing means and responsive to sensing of deposits by the latter for totalizing said deposits, said price-setting means being coupled with said totalizer means and, when the price-setting means is in said first operational condition, causing said totalizer means to deliver a vend command if totaled deposits equal the lesser price or, when the price-setting means is in its second operational condition, causing said totalizer means to deliver said vend command if totaled deposits equal the greater price; payout mechanism for paying change to a customer upon operation thereof; second coin-sensing means coupled with said mechanism and responsive to the deposit of a coin of a denomination greater than either of said prices for both delivering a vend command and directly actuating said mechanism to pay back change; and said price-setting means being coupled with said mechanism and, when the price setting means is in said first operational condition, programming the operation of the mechanism to effect payout of change equal to the difference between the value of said coin of greater denomination and said lesser price or, when the price-setting means is in said second operational condition, programming the operation of the mechanism to effect payout of change equal to the difference between the value of said coin of greater denomination and said greater price.

2. Apparatus as claimed in claim 1, said price setting means, in said first operational condition, causing said totalizer means to effect actuation of said mechanism to pay back a predetermined amount of change when said deposits sensed by the first sensing means exceed said lesser price.

3. Apparatus as claimed in claim 1, said second sensing means including:

coin switch means operable by said coin of greater denomination upon said deposit thereof;
a said mechanism being electrically responsive and said switch means being electrically coupled thereto for effecting said actuation thereof to initiate operation of the mechanism upon operation of the switch means by said coin of greater denomination;

said mechanism having cycle control means for maintaining the mechanism in payout operation until the termination of a predetermined time duration of said payout operation; and
said price setting means, in said first operational condition, causing said mechanism to continue said payout operation after termination of said predetermined duration until said change equal to the difference between the value of said coin of greater denomination and said lesser price is paid out or, in said second operational condition, permitting said cycle control means to cease said payout operation at the termination of said predetermined duration back said change equal to the difference between the value of said coin of greater denomination and said greater price.

4. Apparatus as claimed in claim 3, said totalizer means, when said price-setting means is in said first operational condition, effecting electrical actuation of said mechanism to pay back a predetermined amount of change when said deposits sensed by the first sensing means exceed said lesser price.

5. Apparatus as claimed in claim 4, said price setting means, in said first operational condition and upon said actuation of the mechanism by said totalizer means, permitting said cycle control means to cease payout operation of said mechanism at the termination of said predetermined duration.

6. Apparatus as claimed in claim 1, said second sensing means including:
bistate coin switch means operable by said coin of greater denomination upon said deposit thereof; said mechanism being electrically responsive and said switch means being electrically coupled thereto for effecting said actuation thereof to initiate operation of the mechanism upon operation of the switch means by said coin of greater denomination; shiftable latch structure operably associated with said switch means for holding the latter in its operated state; said mechanism having reset means engageable with said structure to release the switch means for return to its normal state after a period of mechanism operation, and cycle control means for maintaining the mechanism in payout operation until the termination of a predetermined time duration of said payout operation; and said price-setting means, in said first operational condition, causing said mechanism to continue said payout operation after termination of said predetermined duration until said change equal to the difference between the value of said coin of greater denomination and said lesser price is paid out or, in said second operational condition, permitting said cycle control means to cease said payout operation at the termination of said predetermined duration to pay back said change equal to the difference between the value of said coin of greater denomination and said greater price.

7. Apparatus as claimed in claim 6, said switch means having:
a shiftable actuating element disposed for engagement by said coin of greater denomination upon said deposit thereof for movement from a normal position to an operated position to actuate the switch means; and said structure being engageable with said element to latch the latter in said operated position thereof until actuation of the structure by said reset means.

8. Apparatus as claimed in claim 1, said totalizer means having:
two repeating totalization programs and effecting the totalization of deposits sensed by said first sensing means in increments no greater than the lowest denomination of coins received for sensing by said first sensing means, a first predetermined number of said increments corresponding to the lesser price and comprising the first of said programs, a second predetermined number of said increments corresponding to the greater price and comprising the second of said programs; said totalizer further having an operational cycle comprising a plurality of said increments equal in number to integer multiples of said first and second predetermined numbers of increments respectively; and said price-setting means, in said first operational condition, effecting a selection of said first program or, in its second operational condition, effecting a selection of said second program.

9. In a machine for vending articles of a predetermined price, coin-operated apparatus for controlling vending and change-making comprising:
payout mechanism for paying change to a customer upon operation thereof;
first coin-sensing means for sensing the deposit of coins of values less than said price; totalizer means coupled with said mechanism and said first sensing means and responsive to sensing of deposits by the latter for totalizing said deposits and delivering a vend command when totaled deposits equal said price, and effecting actuation of said mechanism to pay back change if deposits sensed by said first sensing means exceed said price; and second coin-sensing means coupled with said mechanism and responsive to the deposit of a coin of a denomination greater than said price for both delivering a vend command and directly actuating said mechanism to pay back
change equal to the difference between the value of said coin of greater denomination and said price.

10. Apparatus as claimed in claim 9:
said mechanism being electrically responsive;
said totalizer means effecting electrical actuation of said mechanism to initiate operation thereof is deposited by said first sensing means exceed said price;
said second sensing means electrically effecting said direct actuation of the mechanism to initiate operation thereof in response to said deposit of said coin of greater denomination; and
payout-programming means coupled with said mechanism for continuing said operation thereof initiated by either said totalizer means or said second sensing means to cause change equal to the excess of deposits sensed by said first sensing means over said price to be paid out when actuation of the mechanism is effected by said totalizer means, and said change equal to the difference between the value of said coin of greater denomination and said price to be paid out when the mechanism is directly actuated by said second sensing means.

11. Apparatus as claimed in claim 10, said second sensing means including bistable:
coin switch means electrically coupled with said mechanism and operable by said coin of greater denomination upon said deposit thereof;
holding means operably associated with said coin switch means for maintaining the latter in its operated state;
said mechanism having reset means for actuating said holding means to return the coin switch means to its normal state; and
said programming means having switching structure operating in a predetermined time sequence with the return of the coin switch means to the normal state thereof to maintain the mechanism in payout operation for a longer time than when actuation of the mechanism is effected by the totalizer means, whereby greater change is paid out in response to the deposit of said coin of greater denomination than when said coins of values less than said price are deposited and totaled.

12. Apparatus as claimed in claim 9, said second sensing means including:
a coin switch having a shiftable actuating element disposed for engagement by said coin of greater denomination upon said deposit thereof for movement from a normal position to an operated position to actuate said switch;
a said mechanism being electrically responsive and said switch being electrically coupled thereto for effecting said direct actuation thereof to initiate operation of the mechanism upon said movement of said element to its operated position by engagement of said coin of greater denomination therewith;
there being shiftable latch structure engageable with said element for holding the latter in said operated position,
said mechanism having reset means engageable with said structure to release said element for return movement to its normal position after a period of mechanism operation;
said totalizer means effecting electrical actuation of said mechanism to initiate operation thereof if deposits sensed by said first sensing means exceed said price; and
payout-programming means coupled with said mechanism for continuing said operation thereof to cause change equal to the excess of deposits sensed by said first sensing means over said price to be paid out when actuation of the mechanism is effected by said totalizer means, and said change equal to the difference between the value of said coin of greater denomination and said price to be paid out when the mechanism is directly actuated by said second sensing means.

13. In a machine for vending of articles of a predetermined price, coin-operated apparatus for controlling vending and change-making comprising:
means for sensing the deposit of coins of a plurality of denominations;
a totalizer having a repeating totalization program, and being coupled with said sensing means and responsive to sensing of deposits by the latter for totalizing said deposits in increments no greater than the lowest coin denomination, a predetermined number of said increments corresponding to said price and comprising said program;
means coupled with said totalizer and responsive thereto for delivering a vend command when said deposits at least equal said price;
payout mechanism for paying change to a customer upon operation thereof;
said totalizer having means preventing the totalizer from accumulating increments in excess of said predetermined number thereof when a coin having a value greater than a single increment is deposited, whereby to prevent credit from being established on the next program when a customer does not have exact coinage equal to said price; and
said accumulation-preventing means being coupled with said mechanism for actuating the latter to pay back change when said coin of greater value is deposited and the total deposits exceed the credit represented by said predetermined number of increments.

14. Apparatus as claimed in claim 13, said totalizer comprising a unidirectional, continual rotation stepper having a plurality of increment-representing steps equal in number to an integer multiple of said predetermined number of increments.

15. In an article-vending machine, coin-operated apparatus for controlling the vending of articles comprising:
Selectively operable price-setting means having a first operational condition establishing the price of articles at a selected amount and a second operational condition establishing said price as a selected, greater amount;
means for sensing the deposit of coins of a plurality of denominations;
a totalizer having two repeating totalization programs, and being coupled with said sensing means and responsive to sensing of deposits by the latter for totalizing said deposits in increments no greater than the lowest coin denomination, a first predetermined number of said increments corresponding to the lesser price and comprising the first of said programs, a second predetermined number of said increments corresponding to the greater price and comprising the second of said programs;
said totalizer further having an operational cycle comprising a plurality of said increments equal in number to integer multiples of said first and second predetermined numbers of increments respectively; and
said price-setting means being coupled with said totalizer and, when the price-setting means is in said first operational condition, effecting a selection of said first program and conditioning the totalizer for delivery of a vend command when totaled deposits equal the lesser price or, when the price-setting means is in its second operational condition, effecting a selection of said second program and conditioning the totalizer for delivery of said vend command when totaled deposits equal the greater price.

16. Apparatus as claimed in claim 15, and payout mechanism for paying change to a customer upon operation thereof;
said totalizer having means preventing the totalizer from accumulating increments in excess of said first predetermined number thereof when said price-setting means is in said first operational condition and a coin having a value greater than a single increment is deposited, whereby to prevent credit from being established on the next of said first programs when a customer does not have exact coinage equal to said lesser price; and
said accumulation-preventing means being coupled with said mechanism for actuating the latter to pay back
change when said coin of greater value is deposited and the total deposits exceed the credit represented by said first predetermined number of increments.
17. Apparatus as claimed in claim 15, said totalizer comprising a unidirectional, continual rotation stepper having a plurality of steps defining said plurality of increments equal in number to integer multiples of the first and second predetermined numbers of increments respectively.