

SPECIFICATION

Selection circuit for a vending machine

5 This invention relates to a selection circuit for a vending machine control apparatus. In a typical vending machine the selected product is dispensed by activating an actuator, such as a motor or relay, when various vend criteria
10 such as product availability, customer payment, and correct change availability have been satisfied. The control system is used to identify which product has been selected, ascertain whether the vend criteria have been
15 satisfied, and to accordingly cause the activation of the corresponding actuator to dispense the desired product. Our copending British Patent Application No. 40990/78 (Serial No. 2005892), from which the present application is divided, discloses a control apparatus
20 for a vending machine of this kind.

Prior art vending systems and the vending machine disclosed in the aforesaid application 40990/78 have provided various apparatus
25 for detecting which product has been selected and generating the appropriate identifying signals for use by other elements of the control system. The present invention provides new and advantageous control apparatus for performing this function. In embodiments of this
30 invention, this function can be performed with either isolated systems, i.e. systems employing special measures to isolate the control apparatus electrically from the actuators, or
35 non-isolated systems, such as disclosed in copending application 40990/78.

According to the invention there is provided a selection circuit for a vending apparatus having a plurality of actuators, each of which
40 is operable for the dispensing of a customer's selected product in response to a product selection signal, and a plurality of selection switches for selective activation of the actuators by a customer, the selection circuit comprising a pulse counter with a plurality of
45 output terminals, each corresponding with a selection switch of a vending apparatus and each, when maintained activated, producing a product selection signal, the output terminals being arranged to be sequentially activated in
50 response to the pulses of a clock signal, and further comprising a detecting means associated with the pulse counter output terminals for detecting simultaneous activation of one of
55 the pulse counter output terminals and its corresponding selection switch so as to cause a selection made signal to be produced to halt the pulse counter and thereby maintain activation of that one output terminal.

60 For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:—

65 *Figure 1*, which discloses an embodiment of

our aforesaid patent application 40990/78, shows a vending machine including a control apparatus 12 generally in block diagram, with an alternating current power supply, selection
70 switches, and electric motor;

Figure 2 is a schematic diagram of a step counter selection circuit 222 having a pulse counter, which can be used as the selection circuit 22 of the control apparatus of *Fig. 1*;

75 *Figure 3* is a schematic diagram of a selection circuit 322, a variation of the step counter selector circuit 222 of *Fig. 2*; and

Figure 4 shows a vending machine including a control apparatus 512 which can employ one of the selection circuits 222 or 322.

80 *Fig. 1* illustrates a vending machine 2 having an alternating current power supply 4 in the form of a step-down line transformer, a plurality of selection switches 6 (a-n), a plurality of actuators 8 (a-n) here in the form of
85 alternating current electric motors, a matrix box 10 and control apparatus 12 for controlling the actuators to dispense the selected product.

90 The control apparatus 12 has a price indicating means 14 here in the form of a pricing circuit, for producing a signal indicative of the price of the customer selected product; a calculating section 16, here in the form of a
95 totalizer 18 and a vend processing circuit 20, for comparing the amount of customer credit with the price of the selected product; a selection circuit 22 for generating a selection signal indicating which product category was selected; actuator controls 24 (a-n) for activating the actuator 8 (a-n) corresponding to the
100 selected product to dispense the product; and a vending monitor circuit 50 for indicating when the vending operation is taking place.

105 In operation, a selection switch, such as switch 6a of *Fig. 1*, generates a switch signal in response to selection by a customer of a desired product. While a conventional push-button switch is illustrated in the embodiment
110 of *Fig. 1*, other types of switches and other switching apparatus could be used. The switch signal is carried into a optional matrix box 10 of conventional design wherein the switches 6 (a-n) and actuators 8 (a-n) for products of a common category can be connected to a common output, the outputs carried along lines 28 (a-n). For example, in the
115 illustrated embodiment the actuators 8a and 8a' for products selling for the same price are interconnected within the matrix to a common output, with those actuators associated with a first price being connected to line 28a. Actuator 8n, associated with a second price, is connected to line 28n. Wiring the switches 6
120 (a-n) in series precludes a customer from deceiving the machine into vending too many products of the same category, since the pressing of one button severs the remainder of the buttons from the series circuit.

130 The product category switch signals along

lines 28 (a-n) are carried to the actuator control circuits 24 (a-n) and to the selection circuit 22. The selection circuit 22 receives the switch signal at inputs 21 (a-n) and in response generates a selection signal at outputs 23 (a-n) along lines 30 (a-n) indicative of the category of the selected product. This selection signal is received by the pricing circuit 14 which in response produces a signal indicative of the price of the selected product along line 32 to the totalizer 18. The selection circuit 22 also generates a selection made signal along line 34 to the vend processing circuit 20, indicating that a selection has been made without indication of the nature of the selection.

In the calculating section 16, the vend processing circuit 20 receives the selection made signal from the selection circuit 22 and in response transmits a signal via line 36 to the totalizer 18. In response, the totalizer 18 operates conventionally to calculate the customer credit as, for example, by recording the money paid into the machine or by other means of receiving a credit indication. The credit indicating means is indicated schematically at 15 in the drawings. The totalizer further compares the amount of customer credit with the price of the selected product received from the pricing circuit 14, and if sufficient, transmits a signal via line 36 to the vend processing circuit 20. In response, the vend processing circuit 20 transmits a vend signal along line 38 to the actuator circuits 24 (a-n).

In the Fig. 1 embodiment, the actuator circuits 24 (a-n) each comprise an electronic power switch 40 (a-n) and an NAND gate 42 (a-n). The combination of the vend signal on line 38 from the calculating section 16 and the selection signal on one of the lines 30 (a-n) from the selection circuit 22 switches the corresponding NAND gate 42 (a-n) and activates the corresponding power switch 40 (a-n). For example, a selection signal on line 30a from output 23a of the selection circuit 22 and a vend signal on line 38 would switch NAND gate 42a, causing the activation of the power switch 40a, activating one of the corresponding actuators 8 (a-n) as explained below.

In the illustrated system, the actuators 8 (a-n) are not electrically isolated from the control system 12, and all these elements are powered by the alternating current power supply illustrated as a step down line transformer 4. First output terminal 48 of the transformer output is connected to a common terminal 5, such as to a ground. Similarly, the electronic power switches 40 (a-n) are connected on one side to the common terminal 5 by lines 49 (a-n). Second output terminal 44 of the transformer output is connected by switches 6 (a-n) and, as explained below, by switches 46 (a-n) to the actuators 8 (a-n). When a power

switch, such as 40a, is activated by the switching of its NAND gate, 42a in this example, the corresponding actuator 8a is thereby connected to the common terminal through lines 28a and 49a and the interconnections in the matrix box 10. Assuming that actuator 8a' corresponds through the matrix box 10 to power switch 40a, the activation of power switch 40a in the above example would activate actuator 8a' by completing the electrical connection through the matrix box 10, the actuator 8a', and switch 6a' to output terminal 44 of the power supply. Once the actuator is activated, the corresponding switch 46 (a-n) is mechanically activated by a cam or other conventional means to maintain the electrical connection between the actuator and terminal 44 even after the selected switch among switches 6 (a-n) is released by the customer and returns to its normal position. For example, once actuator 8a' is activated as a result of the customer pressing switch 6a', switch 46a' is activated by the actuator and the actuator 8a' continues to be powered even though the customer thereafter releases switch 6a'.

During the period when the actuator is operating, the vending monitor circuit 50 conventionally by means of relay 51 produces a vending-in-progress signal along line 52 to the vend processing circuit 20 in the calculating section 16. In response, the vend processing circuit 20 instructs the totalizer 18 along line 54 to collect the price of the product being vended and to return any appropriate change. The continuation of the vending-in-progress and selection made signals causes the vend processing circuit 20 to continue to generate the vend signal on line 38 until the product has been completely vended. When the vending is completed, the vending-in-progress signal is terminated, the vend signal along line 38 is terminated, and the activated power switch 40 (a-n) is deactivated. Also, while the power switch 40 (a-n) was activated, the corresponding line of lines 28 (a-n) had been connected to ground, maintaining a ground input into the corresponding terminal 21 (a-n) of the selection circuit 22, thereby maintaining the selection and selection made outputs from the selection circuit 22. When the activated power switch is deactivated at the end of vending, the signal is removed from the corresponding line of lines 28 (a-n), thereby causing the selection circuit 22 to terminate the selection and selection made outputs and preparing the control apparatus 12 to process a new selection.

Several possible circuits can perform the selection circuit 22 function of receiving the switch signals and in response generating a selection signal indicating which product category was selected and a selection made signal indicating that a selection has been made.

Two preferred forms of selecting circuit, form-

ing embodiments of the present invention, are illustrated in Figs. 2 and 3.

In Fig. 2, a selection circuit 222 has selection inputs 221 (a-n) corresponding to inputs 21 (a-n), selection circuit outputs 223 (a-n) corresponding to outputs 23 (a-n) and a selection made output line 234 corresponding to output line 34. The circuit 222 comprises a step counter 224 here in the form of a pulse counter with a plurality of output terminals 226 (a-n) sequentially activated in response to a clock signal input at clock terminal 228. The pulse counter 224 of the illustrated embodiment is of the type 4017 10 stage CMOS counter as made by RCA, Motorola and others.

Each selection circuit input 221 (a-n) has a corresponding optical coupler 229 (a-n) of a light emitting diode (LED) emitter 230 (a-n) and a photo transistor detector 232 (a-n). When a selection switch 6 (a-n) is activated by a customer, the resultant product category switch signal at the corresponding input 221 (a-n) connects that input to one side of the alternating current supply and causes alternating current from wire 235 to flow through and LED portion of a clock optical coupler 236 and through the LED portion 230 (a-n) of the corresponding selection optical coupler, causing both of these LED's to flash at the frequency of the alternating current. The detector portion of the clock optical coupler 236 responds by periodically switching on its transistor portion which functions as a clock pulse source for the counter 224, with the clock pulses at input 228 driving the counter 224 up one number for each cycle of the alternating current.

When the counter 224 counts, it connects its outputs 226 (a-n) to the one side of the alternating current supply in sequence from their normally low, negative voltage state. When the counter 224 reaches its output corresponding to the coupler 229 (a-n) whose LED portion 230 (a-n) is being activated by the presence of a switch signal, a pulse is produced on line 238. This pulse is stretched to approximately 0.1 second in duration by the RC circuit of a 1 megohm series resistor and a 0.1 μ fd capacitor to a - 12 volt source.

This 0.1 second stretched pulse on line 238 is applied to the positive input of a selection made comparator 240 which causes a high signal to appear at the comparator output as the selection made signal on line 234. Specifically, since the 1 megohm resistor in the positive input of the comparator 240 is smaller than the 1.5 megohm resistor from its negative input to ground, the bias on the positive input dominates and the output goes high. A 2 megohm feedback resistor is provided around the comparator to reduce sensitivity to electrical noise.

The selection made signal on line 234 is

also carried on line 242 to enable input 244 of the counter, causing it to stop counting and held at the count corresponding to the selection made. Accordingly, the selection signal at the held terminal 226 (a-n) appears as a high signal on the corresponding line 223 (a-n).

The selection circuit 222 will generate the selection made signal on line 234 and selection signal on one of lines 223 (a-n) so long as one of lines 221 (a-n) remains connected to one side of the alternating current supply. This happens when either a selection switch 6 (a-n) remains activated or an actuator activated switch 26 (a-n) remains activated during the dispensing of the product. When no line 221 (a-n) is connected to one side of the alternating current supply, the selection made and selection signals are terminated and the counter 224 is reset by an input at reset terminal 246 through the operation of reset coupler 248.

Fig. 3 shows a selection circuit 322 which is a variation of the selection circuit 222 of Fig. 3. Elements in the circuit of Fig. 4 which correspond to those in Fig. 3 are similarly numbered except for the substitutions of the prefix "3" for the prefix "2". Since the selection circuit 222 has already been described, only the principal differences between circuit 222 and circuit 322 will be discussed here, as the remainder will be clear from the drawings.

In circuit 322, AND gates 399a-399n have been added between counter outputs 326a-326n and wires 323a-323n to provide a stronger output signal on wires 323a-323n and improve the signal to noise ratio.

The 120 kilohm resistor and 2.2 μ fd capacitor connected in parallel from one input of each of the AND gates 399a-399n form peak detectors which provide a direct current signal to an AND gate input terminal when the corresponding vending machine selection switch 6a-6n is closed. When an output is provided from the counter 322 to the other input of the same AND gate, that AND gate produces an output signal.

The functions of the optical couplers 329a-329n and 336 in the circuit 322 is analogous to that of the optical couplers 229a-229n and 236 in circuit 222.

The output of each of the AND gates 399a-399n is connected to one diode of a set of diodes Da-Dn, which together with the associated 10K resistor to - 12 volts form an OR gate. The output of this OR gate is connected by wire 342 to the enable input 344 of the counter 324, and to the negative input of the selection made comparator 340 in a filter comprising a 0.1 μ fd capacitor and a 470 kilohm resistor. The connection between the 0.1 μ fd capacitor and the 470 kilohm resistor to - 12 volts includes a diode Ds to protect the comparator 340. The diode Dx at the output of the comparator 340 is a

blocking diode used to keep the comparator 340 from loading other signals within the calculating section 16.

Additional power and fast rise time clock pulses are provided in the clock section by the addition of an amplifier comprising comparator 349 operating as a buffer amplifier, and a transistor Q_1 (such as a type 2N4424) following the clock optical coupler 336. The clock input 328 of the counter 324 is isolated from the reset input 346 by blocking diode Dr. The 1 megohm resistor and .47 μ fd capacitor in parallel from the reset input 346 to ground act to stretch the clock pulse as applied to the reset terminal 344, and serves to prevent accidental activation by noise or activation of numerous selection switches.

Fig. 4 shows a vending machine 502 similar to the vending machine 2 shown in Fig. 1. The vending section 503, unlike the vending section 4 of vending machine 3, operates directly from the alternating current line without the isolation and reduction of voltage afforded by transformer 4. The control apparatus 512 is therefore protected from the high voltage in the vending section 503 by the isolation provided in the selection circuit 522 and in the actuator control circuits 524a-524n. The selection circuit 522 can be the same as selection circuit 222 or 322, as described above. The remaining elements of the control apparatus 512 can be substantially the same as the corresponding element of the control apparatus 12 of Fig. 1, applying electrical isolation in the known manner when connections are made between the vending section 523 and the control apparatus 512.

The actuator control circuits 524a-524n employ optical couplers 543a-543n to isolate the NAND gates 542a-542n, corresponding to NAND gates 42a-42n, from the switching devices 540a-540n. When one of the NAND gates 542a-542n produces a signal, it drives the corresponding optical coupler 543a-543n which in turn drives the corresponding transistor 544a-544n which triggers the corresponding switching device 540a-540n.

CLAIMS

1. A selection circuit for a vending apparatus having a plurality of actuators, each of which is operable for the dispensing of a customer's selected product in response to a product selection signal, and a plurality of selection switches for selective activation of the actuators by a customer, the selection circuit comprising a pulse counter with a plurality of output terminals, each corresponding with a selection switch of the vending apparatus and each, when maintained activated, producing a product selection signal, the output terminals being arranged to be sequentially activated in response to the pulses of a clock signal, and further comprising a detecting means associated with the

pulse counter output terminals for detecting simultaneous activation of one of the pulse counter output terminals and its corresponding selection switch so as to cause a selection made signal to be produced to halt the pulse counter and thereby maintain activation of that one output terminal.

2. A selection circuit according to claim 1, wherein the detecting means associated with the pulse counter comprises a plurality of optical couplers with each pulse counter output terminal having an associated optical coupler with an optical emitter responsive to a customer-selected switch signal and a detector responsive to simultaneous activation of the emitter and of the associated pulse counter output terminal to generate the selection made signal.

3. A selection circuit for a vending machine, substantially as hereinbefore described with reference to Fig. 2 or 3 of the accompanying drawings.

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blocking diode used to keep the comparator 340 from loading other signals within the calculating section 16.

Additional power and fast rise time clock pulses are provided in the clock section by the addition of an amplifier comprising comparator 349 operating as a buffer amplifier, and a transistor Q_1 (such as a type 2N4424) following the clock optical coupler 336. The clock input 328 of the counter 324 is isolated from the reset input 346 by blocking diode D_r . The 1 megohm resistor and .47 μ fd capacitor in parallel from the reset input 346 to ground act to stretch the clock pulse as applied to the reset terminal 344, and serves to prevent accidental activation by noise or activation of numerous selection switches.

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pulse counter output terminals for detecting simultaneous activation of one of the pulse counter output terminals and its corresponding selection switch so as to cause a selection made signal to be produced to halt the pulse counter and thereby maintain activation of that one output terminal.

2. A selection circuit according to claim 1, wherein the detecting means associated with the pulse counter comprises a plurality of optical couplers with each pulse counter output terminal having an associated optical coupler with an optical emitter responsive to a customer-selected switch signal and a detector responsive to simultaneous activation of the emitter and of the associated pulse counter output terminal to generate the selection made signal.

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