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(54) **SYSTEM AND APPARATUS FOR ACCOMPLISHING PRODUCT DETECTION**

SYSTEM UND VORRICHTUNG ZUR ERKENNUNG EINES PRODUKTS

SYSTEME ET DISPOSITIF POUR DETECTER UN PRODUIT

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(56) References cited:
WO-A-99/56255 **DE-U- 20 006 317**
US-A- 4 252 250 **US-A- 4 359 147**

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Description

BACKGROUND OF THE INVENTION

Technical Field

[0001] The present invention relates to the vending arts generally and more specifically to vending machine delivery systems for determining whether a product has actually been delivered to the consumer after a customer order.

Background

[0002] Currently, vending machines lack the ability to detect and confirm whether an ordered product has been actually delivered to a customer after an ordered vend event by the customer has occurred Present methods, referred herein as the home switch method, always assume that the ordered product is available for delivery and that the product is successfully delivered upon completing one vend cycle.

[0003] However, vending machines often fail to deliver the product after the vend cycle for various reasons, including improper installation of the products by the vendor's sales representative or obstructions in the delivery path. Thus, presently, after paying for the product and a vend cycle occurring, the customer fails to receive the ordered product, resulting in the customer becoming frustrated with the vending company, affecting customer relations and vending sales.

[0004] WO 99/56255 discloses a vending machine in which a vending motor will operate until a product has descended through a vending-space and passed through an optical beam. The beam is created using a diffuser to produce a plane of electromagnetic radiation.

[0005] Aspects of the invention can be seen from the attached claims

[0006] A fuller understanding of embodiments of the invention may be had by referring to the following Detailed Description of the Preferred Embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

Figure 1 is an overview of the methodology utilized in the present invention;
Figure 2 shows a schematic diagram of the present invention;
Figure 3A shows the emitter arm portion of the monitoring system;
Figure 3B shows the detector arm portion of the monitoring system;
Figure 4 shows the operation of the monitoring system when a customer places an order;
Figure 5 shows the steady state calibration mode of the monitoring system;
Figure 6 shows a typical detector arm attached to a vending machine; and
Figure 7 shows light beam patterns for the emitters in the monitoring system.
Figure 8 shows an exemplary feedback method for delivering a product.

DETAILED DESCRIPTION

[0008] The present invention is a vending system that verifies that an actual delivery of an ordered product is made. If the actual delivery fails for a set number of delivery attempts, then the customer is offered one or more alternative choices, including without limitation, choosing an alternative product, or a refund.

[0009] **Figure 1** is an overview of the methodology utilized in the present invention. The monitoring system is in calibration mode in its normal steady state configuration mode as shown in step 100. Calibration mode is discussed in greater detail in **Figure 5** below. The customer orders a product after placing money in the ordering system by depressing a keypad or similar device in step 102. The vending machine's ordering system sends a customer order event signal in step 103 to the monitoring system informing the sensing/monitoring system that an order event has occurred in step 102. The monitoring system subsequently completes its last calibration cycle in step 104 and transitions from steady state calibration mode to the monitoring cycle in step 106. Upon transitioning, the monitoring system commences its sensing/monitoring cycle by monitoring the product delivery path and sends a ready signal to the product delivery system in step 110. The monitoring cycle is described in more detail in **Figure 4**, herein below. After receiving a ready signal from the monitoring system, the product delivery system attempts to deliver a product through the product delivery path in step 120. If the monitoring system senses or detects the product passing through the delivery path in step 125, it reports the delivery event to the ordering system in step 130. Upon receiving the report, the ordering system concludes the transaction with the customer and sends a completion signal to the monitoring system, which returns to steady state calibration mode in step 135, whereupon the monitoring system enters into calibration mode in step 140.

[0010] If the monitoring system does not detect a product in the first delivery attempt in step 125 then it will not send a signal to the ordering system after the step 125. The invention allows the delivery system to attempt delivery three times or a preset option. In step 150, if the number of attempted delivery cycles is less than the preset option, then the ordering system thereupon attempts to deliver the product again in step 120. If the attempted delivery cycles equal the preset option, then in step 155 the customer is granted alternatives to purchasing the first ordered product. Step 155 allows the customer to either ask for a refund or make a selection of a second, different product for delivery and step 153 marks the first

ordered product as empty.

[0011] Step 153 prevents future vend attempts for the first ordered product until the vending machine is visited by a service person. This helps to prevent cheating of a customer if the vending machine reverts to the home switch operation, and helps to prevent further tampering if tampering was the cause of the first vend failure.

[0012] If the customer chooses a refund, then the present invention delivers a signal to make a refund, in step 160, whereupon a signal is sent to the monitoring system that the order is complete in step 135 and to the monitoring system to enters into steady state calibration mode in step 140. If the customer choose a second, different product, then the present invention returns to 120 and the process proceeds as described above, until the operation is complete.

[0013] **Figure 2** shows a schematic diagram of the present invention installed in a vending machine 205. In **Figure 2** various products 210 are placed in the vending machine's delivery system 215. Prior to a customer making a purchase, the monitoring system 217 is in calibration mode. When a customer makes an order through the order system 220, the monitoring system completes the calibration mode and enters into its monitoring mode. Thereupon, the ordering system allows for an attempted delivery of the ordered product 210, typically through a helical delivery system 215. When ordered, product 270 is delivered into delivery space 222, falling through the delivery path 225 past monitoring system 217. As it passes the monitoring system, the product momentarily breaks the continuity of the monitoring system's monitoring devices. If the monitoring system utilizes an optical monitoring system, then as the product passes through the monitoring system's light plane 234, be it infrared or otherwise, it momentarily breaks the light continuity and prevents a portion of the light from reaching at least one detector on the opposite side of the monitoring path. The logic circuit on the detecting arm 235 will note the momentary blockage of light and report it as a delivery event.

[0014] The monitoring system is comprised of an emitter arm 240 upon which are located a set number of one or more emitters 242, and a detector arm 250 comprising of one or more detectors 252 and located directly across delivery path 225 from the emitter arm 240. Emitter signals, the total of which comprise light plane 234 are sent from the emitters 242 to the detectors 252 across the delivery path 225, during both monitoring mode and calibration mode. Furthermore, the emitter arm 240 and the detector arm 250 may be located in various positions. For example, the arms may be in a position that mirrors the one shown, among others. The emitter arms and detector arms are described in more detail in **Figures 3A**, and **3B.**

[0015] **Figure 3A** shows the emitter arm portion of the monitoring system. In **Figure 3A**, emitting arm 310A transverses along one side of the delivery path in the vending machine. Emitters, 315A, are attached to arm 310A. The horizontal and vertical placement of emitters 315A on arm 310A is determined by the size of the smallest product that crosses the delivery path, and by the type and accuracy of the emitters utilized in the present invention.

[0016] The emitters may comprise of an optical monitoring device. The spacing of optical emitters is determined by five factors: emitter size, optical diffusion, ambient light, product size and the reflected light. Emitter size and optical diffusion is fixed at the time of construction, however, ambient and reflective light may vary over the course of use of the emitter. Infrared light may be used to help to reduce these effects. However, it is clearly understood and contemplated by the present invention that other types of light sources can be used, including various lasers or white light sources.

[0017] The body 320A of the arm 310A is made of suitable material able to contain the electronic control components 325A necessary to operate the emitter, including, a power source 330A, and logic circuitry 335A. Additionally, holes 340A are provided to securely fasten and adjust the positioning of the arm 310A to the vending machine.

[0018] **Figure 3B** shows the detector arm portion of the monitoring system. The shape and construction of the detecting arm 350B is related to the shape and construction of the emitting arm 310A. The detecting arm 350B is placed on the same plane, parallel to and across the delivery path from arm 310A (see **Figure 2** for more details). The detectors 355B are arranged so that their vertical spacing and horizontal arrangement mirror the emitter's arrangement on arm 310A. Likewise, the body 360B of 350B is constructed of material suitable to contain detection and logic circuitry 365B, attachment holes 370B, and a power source 375B. The choice of the type of detector is directly related to the type of emitter being utilized in the present invention.

[0019] However, the emitting arm 310A and the detector arm 350B may or may not have power sources, electronic control components, and logic circuitry. In one exemplary embodiment, the detector arm may have a power source, electronic component, and logic circuitry that connects to the emitters thereby eliminating the power source and logic circuitry on the emitter arm. Similarly, the emitter arm may have the power source, electronic components, and logic circuitry and the detector arm not. Further, the power sources, electronic control components, and logic circuitries may be located separately from, together with, or in various combinations with the arms.

[0020] **Figure 4** shows the operation of the monitoring system when a customer places an order. Prior to placing an order, the monitoring system is in calibration mode in step 400. Upon placement of the order in step 405, the monitoring system transitions from its steady state calibration mode 400 into its monitoring mode in step 407. Once in monitoring mode, the monitoring system begins cycling each emitter by pulsing the emitter individually in step 410. The monitoring system uses a pulse strength

determined when the system was in the calibration mode.

[0021] In step 410 an emitter pulses its signal to the corresponding detector across from the emitter, and the two detectors on either side of the detector. Upon pulsing the light, the detector circuitry determines whether the detectors detected the light from the emitter in step 415. (If the emitter is either the first emitter or the last emitter on the emitter arm, then only the detector across from the emitter and the detector on the non-wall side of the detector is scanned.)

[0022] If the detector directly across from the pulsing emitter or the side detectors detects the signal in 415, then the emitter's logic circuit sequences to the next emitter in line and sends a pulse from that emitter in step 420. The emitter's logic circuit continues until it completes the pulsing of the last detector whereupon, the monitoring system repeats the process, and begins again at the first emitter until the detector's logic circuit receives a detect signal and/or the monitoring system receives a signal to cease monitoring.

[0023] If at least one of the three detectors fails to detect a light beam from the emitter during the monitoring cycle, then the logic circuit reports a product delivery to the ordering system in step 425. Once a report of delivery is made to the ordering system, the ordering system returns a signal to the monitoring system to return to steady state calibration mode in step 430. Otherwise, the monitoring system continues to monitor until it receives a return to steady state calibration signal from the ordering system.

[0024] **Figure 5** shows the steady state calibration mode of the monitoring system. During the steady state calibration mode, the monitoring system is constantly calibrating itself for optimum performance because temperature, humidity, dust, and alignment conditions fluctuate over the course of system usage.

[0025] The calibration mode adjusts the light intensity from each emitter as necessary so that each set of three detectors serviced by that emitter receives only enough intensity, plus a small safety margin, to be active in the unblocked condition. This minimizes the adverse affects of reflected light from the emitters and allows for a wider detector aperture (which makes system alignment easier) and reduces the overall power requirements of the system. In step 505, the logic circuit in the monitoring system determines whether an order has been placed. If an order has not been placed, then the monitoring system proceeds to send a series of pulses to the first of the one or more emitters in step 510. Upon sending a pulse, the monitoring system queries the emitter's corresponding detector and each detector on either side of the corresponding detector to determine if those detectors detected the pulsed signal in step 515. If a signal was detected in each of the three detectors then the monitoring circuitry sequences to the next emitter in step 520. The emitter's typically have adjustable signal power levels associated with the type of emitter used. The calibration mode will attempt to maintain the power level at the level needed to provide just enough signal, plus a safety margin, such that the corresponding detectors detect the signal. If any one of the three detectors does not detect the pulsed signal from the emitter, then in step 530, the monitoring circuitry determines whether the emitter is operating at its maximum power intensity. If the emitter is not, then the emitter will step increase the signal power level in step 560 and re-send a pulsed signal to the detectors again in step 510. If the power intensity for that emitter is at its maximum intensity, then the detector will send an error message to the monitoring system in step 540. The monitoring system will then follow a pre-coded routine to shut down the entire vending operation, shut down the monitoring system or rely on prior art ordering systems (the home switch method) in step 550.

[0026] **Figure 6** shows a typical detector arm attached to a vending machine. Because of the reflective surfaces 610 in the vending machine, small apertures 620 are used to minimize the reflective light from adjacently reflective surfaces 610. The apertures are narrowed holes located in front of the detectors, 625, on the detector side of sensing system 630. The holes inhibit unwanted reflections from adjacent surfaces by blocking much of the light beams that reflect back to the detector arm at wider angles than the apertures allow.

[0027] Apertures 620 keep the majority of the unwanted light from reaching the detection side of the monitoring system. In addition, the detectors 630 have a usable 60-degree horizontal/30 degree vertical reception angle. Light arriving at the detector at angles greater than these is rejected. Additionally, infrared optical detectors contain optical frequency filters, which reject visible light frequencies, but pass the infrared frequencies of interest. Modulation techniques, whereby the detector only responds to certain signal frequencies from the infrared emitters may also be used to allow the detectors to distinguish between the ambient light and the desired point source light frequency from the emitter.

[0028] As mentioned above, product detection may be accomplished by utilizing infrared emitter/detector pairs that can monitor and detect when a signal path is broken. In typical a vending machine's delivery paths, a set of ten infrared emitter/detector pairs are used to cover the delivery path much like a light curtain.

[0029] **Figure 7** shows a representative example of a light curtain 730 that may be utilized in the present invention. Typically, nine sets of emitters/detectors are used to cover the main delivery path, while the tenth set is used to cover a gum/mint area. The nine sets that cover the main delivery path implement a technique, which, other than for the first and last emitter, requires that, a minimum of three detectors are active for each individual emitter monitor cycle. For those vending machines without a gum or mint section, the tenth emitter may be used for the main delivery area, provided that proper alignment of the ten sets is taken into consideration.

[0030] This arrangement is illustrated in **Figure 7**, which shows the light beams 710 of interest for each

emitter 720 and detector 725. The spacing of the emitter/detector sets are chosen to assure that the smallest size traditional product breaks the path of at least one beam when it crosses the light curtain during delivery. The technique of servicing three detectors for each emitter, allows the monitor to read multiple light beams, which further reduces this spacing in the majority of the delivery area. A logic circuit determines whether a light beam has been broken.

[0031] In the monitoring system, the infrared emitter/detector sets are controlled by a microcontroller located on the detector arm. During the monitoring mode, it is necessary to monitor each of the emitter/detector sets separately because of the potential for light bleed-over from adjacent emitters. The timing sequence for each set monitor cycle used during the monitoring mode must be fast enough to ensure that the smallest product will be detected by any one of the detectors when the product passes the monitor plane as it falls from the product storage area.

[0032] The control software may further provide the vending operator options to revert to home switch operation, to use a delivery method other than home switch operation, or to place the vending machine out of service in the event the monitoring system is inoperative. For example, the operator may chose to revert to go out-of service and prevent erred delivery of the ordered product, all product, or some combination of products. In this manner, theft may be prevented. Alternately, the customer may be offered a refund or the option of selecting another product.

[0033] Another option may provide for the machine to return to home switch operation. If the monitoring system malfunctions, returning to home switch operation may permit continued service by the machine.

[0034] A further option may provide for the machine to operate in a manner other than home switch operation. For example, upon a first delivery failure, the machine may move from a home position until a product is delivered and stop.

[0035] Figure 8 depicts an exemplary embodiment of a method other than home switch operation. In this exemplary method, the machine may wait for an order. As seen in a block 810, once the order is detected, the delivery mechanism may move to the home position. In normal operation, the machine may rest at a home position, moving from the home position and returning to the home position. For example, in a helical delivery mechanism seen in Figure 2, product may typically be delivered with each turn of the helix. In this example, the helix rests at a home position and turns one revolution to deliver the product, returning to the home position.

[0036] If a delivery is detected, the machine returns to waiting for another order, as seen in a block 804. However, if a delivery is not detected, the machine may gradually or at a continuous speed move from the home position until a delivery is detected or the delivery mechanism returns to the home position. As seen in the blocks 808 and 810, if a delivery is detected while the delivery mechanism is moving, the mechanism is stopped and the machine awaits another order. If another order is made, the machine returns to the home position. In this manner, if a first item is stuck, a second item may move it forward causing a delivery. By stopping the mechanism, delivery of the second item may be prevented.

[0037] However, if a delivery is not detected and the machine returns to home position, an error or delivery failure may be detected as seen in a block 814. Alternately, the machine may count the number of passes through the home position and disable delivery of the product, all products, and/or offer a refund or credit once a preset number of passes is exceeded.

[0038] Further, various other methods may be envisaged which use the monitoring system to ensure delivery of the product and/or prevent theft.

[0039] The monitoring system controller printed circuit board uses flash memory to store the firmware. This gives the option to perform firmware updates in the field.

[0040] The vending system may have several operating options. In one exemplary embodiment, These may be viewed and programmed by pressing the PRODUCT CONFIG service key on the keypad located on the inside of the vending machine and pressing the down arrow until the appropriate option is reached. The keypad has an associated display device, such as an led screen or such other typical devices that allow the operator to view the code and results stored within the system.

[0041] In this exemplary embodiment, by depressing the EDIT key, the vendor can choose between "SURE.V ON" or "SURE.V OFF". "SURE.V OFF" is chosen by the operator only if the monitoring system is not installed or if the operator does not wish it to use it at the present time. The remaining options for the PRODUCT CONFIG mode are only visible if "SURE.V ON" is selected and the monitoring system is available.

[0042] When "SURE.V ON" is selected, the operator may then choose between "OPT'N SURE.V" or "MUST SURE.V". If "OPT'N SURE.V" is selected, the vending machine operation reverts to home switch operation if the monitoring system is not operating normally because, for example, of an obstruction or loss of communication. If "MUST SURE.V" is selected by the operator, the vending machine operates only if the monitoring system is available for use for the main delivery area. (The gum and mint area does not affect operation of the main area, unless the programmer decides otherwise.) Otherwise, the vending machine becomes temporarily out-of-service until the blockage or other error is corrected.

[0043] When the operator uses the number keys to program "ANTI.JP xx", the anti-jackpot protection option against unforeseeable cheating of the vending machine's monitoring system is activated. "xx" represents the number of empty conditions that disables the entire delivery system for a time period as programmed and decided by the operator (described below). A empty condition occurs when product delivery is not detected and the

customer's money is restored or returned. An "xx" value of "00" disables this anti-jackpot feature.

[0044] The assumption of this option is that very few system failures to the vending machine's delivery system occurs. If a significant number of failures, represented by "xx", do occur then it is assumed that it is because of tampering. Upon reading "xx", the delivery system is deactivated for a certain amount of time so that money can no longer be refunded because of a vend failure and to discourage a potential thief from attempting to steal either product or money.

[0045] In this condition, the vending machine either reverts to home switch operation if "OPT'N SURE.V" is active, or the system deactivates and the vending machine goes out of service if "MUST SURE.V" is active. If in "Must Sure.V", once the programmed deactivation time has elapsed the system is re-enabled and the count towards "xx" is restarted. The total number of system empty selections, the number of anti-jackpot occurrences, and the date and time of the last occurrence are recorded as noted below.

[0046] The operator programs the number of minutes that the vending system remains disabled because of an anti-jackpot occurrence by selecting the "AJP.TMR xxM" option where "xx" is the time in minutes. If "99" is programmed, then the system remains disabled until the main door closes at the end of the next service call. Closing the main door also resets any anti-jackpot time remaining.

[0047] Certain system data can be reviewed in the PRODUCT CONFIG mode:

"SV.EMPTY xx" returns the number of times that credit was restored or returned because the monitoring system failed to detect a product delivery.

"**.SV xxxx" returns the total number of corrected vends, viewable by selection. These are the vends, which normally would not have delivered product if the present invention was not active.

"WO.SV xxxx" returns the number of vends, viewable by selection, made while the monitoring system was disabled for some reason.

[0048] The MACHINE CONFIG list provides additional options related to the present invention. If the operator selects "FAIL=CASH", the customer's money is automatically returned on any failed vend. If "FAIL=CRDT" is selected, the credit is restored to the vending machine for another selection. The customer may press the coin return to retrieve his money.

[0049] The TEST list provides the test screen for the system. If the operator keys in "SV.TST xxx", the following options are provided:

"SV.TST OK" indicates that the monitoring system is operating properly.

"SV.TST xx" indicates a block in sensing zone 1-9 with 1 being closest to the glass. "H" indicates the gum & mint is blocked if it is configured. This number is displayed real-time and beeps as it changes. This may be used to test the product coverage of the monitoring system's sensors, although the accuracy is somewhat less than in actual vend situations because of the data being presented.

"SV.TST CAL" indicates calibration values that are high. "EDIT" may be used to view the calibration values. A high calibration may be caused by dirt, misalignment of the system sensors, or a partial blockage of a sensor.

[0050] A calibration value of "0" indicates a shorted detector. This normally requires a new detector assembly.

[0051] A calibration value of "1" indicates that zone could not be calibrated. It indicates a blocked or damaged sensor.

[0052] Calibration values above "A" are abnormal and may require adjustment of the alignment or cleaning of the sensors.

[0053] "SV.TST COMM" indicates loss of communication with the monitoring system, and allows the operation to check the harness connections between the vending machine controller and the monitoring system's controller.

[0054] Diagnostics related to the present invention:

"SV.EMPTY nn" shows that selection "nn" was marked as empty because product delivery was not detected.

"SV.TST xx" automatically enters the system test screen as a diagnostic message if any blocked sensor, communication error, or calibration error is detected.

"AJP.TMR xx.xM" is in the diagnostic list if the anti-jackpot timer is active. It shows the time remaining.

"AJP xxX MN/DY HR.MN" is the total number of times the anti-jackpot feature occurred plus the date and time of the last occurrence.

[0055] However, other options and coding methods may be envisaged.

[0056] As such, a system and method for ensuring delivery of product and preventing theft is described.

Claims

1. A vending system for verifying the delivery of an ordered product, the system comprising:

an ordering system (220) for receiving a customer order of a product (210, 270);

a product delivery system (215) for sending the product (210, 270) located in a first product storage position through a delivery path (225) to a second product receiving position;

a monitoring system (217) located along the delivery path (225) for detecting when the product passes through the delivery path (225) from the first position to the second position, the monitoring system (217) optically scanning the delivery path (225) for the product transition; and
a reporting circuitry (235) electronically coupled to the monitoring system (217) wherein the reporting circuitry (235) reports the result of the customer order;
CHARACTERISED IN THAT:

the monitoring system (217) comprises a set of light emitters (242, 720) located along the delivery path and sequentially emitting a light signal, and a set of light detectors (252, 725) located across the delivery path from the set of light emitters, each light detector being aligned with a corresponding light emitter, wherein the light signal from a light emitter is detected by a corresponding light detector (252, 725) aligned with the activated emitter and a detector adjacent the corresponding light detector unless interrupted by passage of the product (210, 270), said monitoring system arranged to sequence to a next emitter until at least one of a corresponding detector and its adjacent detector fails to detect a light signal from a respective activated light emitter.

2. The vending system of claim 1 wherein the monitoring system (217) comprises:

three or more light-emitters (242,720); and
three or more light detectors (252, 725).

3. The vending system in claim 2 wherein each of the light emitters emits infrared light.

4. The vending system in claim 2 further comprising:

an optical detection aperture (620) for each of the light detectors, wherein each aperture is used to reduce the range of incident angles of light that may be detected by the corresponding one of the light detectors.

5. The vending system in claim 2 wherein the light emitters (242, 720) and the light detectors (252, 725) are aligned such that the spacing between detectible beams accounts for the smallest product that transitions through the delivery path (225).

6. The vending system of claim 5 wherein the detectible beams comprise light emitted from the activated one of the light emitters (242, 720) and detected by said aligned detector and two detectors adjacent to the aligned detector.

7. The vending system in claim 2 wherein the power of the light emitters (242, 720) is adjusted to compensate for ambient light effects.

8. The vending system in claim 2 wherein the power of the light emitters (242, 720) is adjusted to compensate for reflected light effects.

9. The vending system in claim 1, wherein the reporting circuitry (235) further comprises a logic circuit (325B) for determining whether to offer another vend attempt to the customer based upon a comparison between the result and a predetermined rule.

10. The vending system of claim 1, wherein delivery of all products is prevented if a product delivery is not detected.

11. The vending system of claim 9 wherein the delivery of a set of products is prevented if a product delivery is not detected.

12. An apparatus for monitoring an operation of a vending machine (205) comprising an ordering system (220) for accepting a customer order and a delivery path (225) through which a product ordered by a customer from the ordering system travels, the apparatus comprising:

a set of signal emitting devices (242, 720) located along the delivery path (225);
a set of signal detecting devices (252, 725) located across the delivery path (225) from the set of signal emitting devices (242, 720); and
a logic circuit (235) connected to the set of signal detecting devices (252, 725), the logic circuit (235) determining whether a product is delivered along the delivery path (225) from an output of the set of signal detecting devices (252, 725);
CHARACTERISED IN THAT:

the set of signal emitting devices (242, 720) is arranged to each sequentially emit a pulsed light signal;
each signal detecting device (252, 725) of the set of signal detecting devices (252, 725) being aligned with a corresponding signal emitting (242, 720) device of the set of signal emitting devices (242, 720); and
the at least one signal detecting device (252, 725) and at least one adjacent signal detecting device (252,725) are operable to receive the signal from the corresponding activated signal emitting device (242, 720), wherein the at least one signal detecting device (252, 725) and its at least one adjacent

signal detecting device (252, 725) are activated corresponding to the activated corresponding signal emitting device (242, 720), unless interrupted by passage of the product, said apparatus being arranged to sequence to a next signal emitting device until at least one of a corresponding detecting device and its at least one adjacent detecting device fails to detect a signal from a respective activated signal emitting device.

Patentansprüche

1. Verkaufssystem zur Überprüfung der Lieferung eines bestellten Produkts, wobei das System Folgendes umfasst:

ein Auftragssystem (220) zum Empfang einer Kundenbestellung für ein Produkt (210, 270),
ein Produktliefersystem (215) zum Senden des Produkts (210, 270), das sich in einer ersten Produktlagerposition befindet, durch einen Lieferpfad (225) an eine zweite Produktempfangsposition,
ein Überwachungssystem (217), das sich am Lieferpfad (225) entlang befindet, zur Feststellung, wann das Produkt durch den Lieferpfad (225) von der ersten Position zur zweiten Position geht, wobei das Überwachungssystem (217) den Lieferpfad (225) optisch auf die Produktüberragung abtastet, und
einen Berichtsschaltkreis (235), der am Überwachungssystem (217) elektronisch angekuppelt ist, wobei der Berichtsschaltkreis (235) über das Ergebnis der Kundenbestellung berichtet,
DADURCH GEKENNZEICHNET, DASS
das Überwachungssystem (217) einen Satz Lichtemitter (242, 720) umfasst, der an einem Lieferpfad entlang angeordnet ist und sequenziell ein Lichtsignal ausstrahlt, und einen Satz Lichtdetektoren (252, 725), der sich gegenüber dem Lieferpfad von dem Satz Lichtemitter befindet, wobei jeder Lichtdetektor mit einem korrespondierenden Lichtemitter ausgerichtet ist, wobei das Lichtsignal von einem Lichtemitter von einem korrespondierenden Lichtdetektor (252, 725) erkannt wird, der mit dem aktivierten Emitter ausgerichtet ist, und einen Detektor, der an den korrespondierenden Lichtdetektor angrenzt, außer wenn er vom durchgehenden Produkt (210, 270) unterbrochen wird, wobei das Überwachungssystem so angeordnet ist, dass es sequenziell an einen nächsten Emitter weitergegeben wird, bis mindestens einer von einem korrespondierenden Detektor und seinem angrenzenden Detektor kein Lichtsignal von einem entsprechenden aktivierten Lichtemitter feststellt.

2. Verkaufssystem nach Anspruch 1, wobei das Überwachungssystem (217) Folgendes umfasst:

drei oder mehr Lichtemitter (242, 720), und
drei oder mehr Lichtdetektoren (252, 725).

3. Verkaufssystem nach Anspruch 2, wobei jeder der Lichtemitter ein Infrarotlicht ausstrahlt.

4. Verkaufssystem nach Anspruch 2, das ferner Folgendes umfasst:

eine optische Detektionsöffnung (620) für jeden der Lichtdetektoren, wobei jede Öffnung zum Reduzieren des Bereichs der Lichteinfallswinkel verwendet wird, der von dem korrespondierenden der Lichtdetektoren festgestellt wird.

5. Verkaufssystem nach Anspruch 2, wobei die Lichtemitter (242, 720) und die Lichtdetektoren (252, 725) so ausgerichtet sind, dass der Raum zwischen den erkennbaren Strahlen auf das kleinste Produkt eingestellt ist, das durch den Lieferpfad geht (225).

6. Verkaufssystem nach Anspruch 5, wobei die erkennbaren Strahlen Licht umfassen, das vom aktivierten der Lichtemitter (242, 720) ausgestrahlt wird und vom ausgerichteten Detektor und zwei Detektoren, die an den ausgerichteten Detektor angrenzen, festgestellt wurde.

7. Verkaufssystem nach Anspruch 2, wobei die Leistung der Lichtemitter (242, 720) so eingestellt ist, dass sie die Umgebungslichteinflüsse ausgleicht.

8. Verkaufssystem nach Anspruch 2, wobei die Leistung der Lichtemitter (242, 720) so eingestellt ist, dass sie die Einflüsse des reflektierten Lichts ausgleichen.

9. Verkaufssystem nach Anspruch 1, wobei der Berichtsschaltkreis (235) weiterhin eine Logikschaltung (325B) umfasst, um zu bestimmen, ob dem Kunden ein weiterer Verkaufsversuch angeboten werden soll, was auf einem Vergleich zwischen dem Ergebnis und einer vorbestimmten Regel basiert.

10. Verkaufssystem nach Anspruch 1, wobei die Lieferung aller Produkte verhindert wird, wenn keine Produktauslieferung festgestellt wird.

11. Verkaufssystem nach Anspruch 9, wobei die Lieferung eines Produktsatzes verhindert wird, wenn keine Produktauslieferung festgestellt wird.

12. Vorrichtung zur Überwachung des Einsatzes eines

Verkaufsautomaten (205), der ein Bestellsystem (220) umfasst, das eine Kundenbestellung akzeptiert, und einen Lieferpfad (225), durch den ein von einem Kunden bestelltes Produkt vom Bestellsystem entlang geht, wobei die Vorrichtung Folgendes umfasst:

einen Satz Signalabgabegeräte (242, 720), der sich am Lieferpfad (225) entlang befindet,
einen Satz Signalerkennungsgeräte (252, 725), der sich quer über den Lieferpfad (225) vom Satz der Signalabgabegeräte (242, 720) befindet, und
eine Logikschaltung (235), die am Satz der Signalerkennungsgeräte (252, 725) angeschlossen ist, wobei die Logikschaltung (235) bestimmt, ob ein Produkt am Lieferpfad (225) entlang von einer Ausgabe am Satz der Signalerkennungsgeräte geliefert wird (252, 725),
DADURCH GEKENNZEICHNET, DASS
der Satz Signalabgabegeräte (242, 720) so angeordnet ist, dass jeder von ihnen sequentiell ein Impuls-Lichtsignal ausstrahlt,
jedes Signalerkennungsgerät (252, 725) vom Satz der Signalerkennungsgeräte (252, 725), der mit einem korrespondierenden Signalabgabegerät (242, 720) vom Satz der Signalabgabegeräte (242, 720) abgestimmt wird, und
das mindestens eine Signalerkennungsgerät (252, 725) und das mindestens eine angrenzende Signalerkennungsgerät (252, 725) so betrieben werden, dass sie das Signal vom korrespondierenden aktivierten Signalabgabegerät (242, 720) erhalten, wobei das mindestens eine Signalerkennungsgerät (252, 725) und sein mindestens ein angrenzendes Signalerkennungsgerät (252, 725) nach dem aktivierten korrespondierenden Signalabgabegerät (242, 720) korrespondierend aktiviert wird, außer wenn es vom Durchgang des Produkts unterbrochen wird, wobei die Vorrichtung so angeordnet ist, dass sie zum nächsten Signalabgabegerät sequenziert, bis mindestens eines der korrespondierenden Erkennungsgeräte und sein mindestens ein angrenzendes Erkennungsgerät kein Signal von einem entsprechenden aktivierten Signalabgabegerät feststellt.

Revendications

1. Système de distribution automatique pour vérifier la livraison d'un produit commandé, le système comprenant :

un système de commande (220) pour la réception d'une commande de produit d'un client (210, 270) ;
un système de livraison de produit (215) pour l'envoi du produit (210, 270) se trouvant dans une première position de stockage le long d'un trajet de livraison (225) à une deuxième position de réception du produit ;
un système de contrôle (217) situé le long du trajet de livraison (225) pour la détection du moment auquel le produit passe sur le trajet de livraison (225) depuis la première position à la deuxième position, le système de contrôle (217) balayant optiquement le chemin de livraison (225) pour détecter le passage du produit ; et
un circuit de génération de rapports (235) relié électroniquement au système de contrôle (217) par lequel le circuit de génération de rapports (235) génère un rapport concernant le résultat de la commande du client ;
CARACTÉRISÉ EN CE QUE :

le système de contrôle (217) comprend un ensemble d'émetteurs de lumière (242, 720) situés le long du trajet de livraison et émettant séquentiellement un signal lumineux et un ensemble de détecteurs de lumière (252, 725) situés à travers le trajet de livraison à distance de l'ensemble d'émetteurs de lumière, chaque détecteur de lumière étant aligné avec un émetteur de lumière correspondant, dans lequel le signal lumineux provenant d'un émetteur de lumière est détecté par un détecteur de lumière correspondant (252, 725) aligné avec l'émetteur activé et un détecteur adjacent au détecteur de lumière correspondant à moins qu'il ne soit interrompu par le passage du produit (210, 270), ledit système de contrôle étant agencé de manière à séquencer à un émetteur suivant jusqu'à ce qu'au moins l'un d'un détecteur correspondant et de son détecteur adjacent ne réussisse pas à détecter un signal lumineux depuis un détecteur de lumière respectif activé.

2. Système de distribution automatique selon la revendication 1, dans lequel le système de contrôle (217) comprend :

trois ou plusieurs émetteurs de lumière (242, 720) ; et
trois ou plusieurs détecteurs de lumière (252, 725).

3. Système de distribution automatique selon la revendication 2, dans lequel chacun des émetteurs de lumière émet une lumière infrarouge.

4. Système de distribution automatique selon la reven-

dication 2 comprenant en outre :

une ouverture de détection optique (620) pour chacun des détecteurs de lumière, dans laquelle chaque ouverture est utilisée pour diminuer la plage des angles de lumière incidents susceptibles d'être détectés par celui correspondant des détecteurs de lumière.

5. Système de distribution automatique selon la revendication 2, dans lequel les émetteurs de lumière (242, 720) et les détecteurs de lumière (252, 725) sont alignés de manière à ce que l'espacement entre les faisceaux détectibles rende compte du produit le plus petit qui passe le long du trajet de livraison (225).

6. Système de distribution automatique selon la revendication 5 dans lequel les faisceaux détectibles contiennent la lumière émise par celui activé des émetteurs de lumière (242, 720) et détectée par ledit détecteur aligné et deux détecteurs adjacents au détecteur aligné.

7. Système de distribution selon la revendication 2, dans lequel la puissance des émetteurs de lumière (242, 720) est ajustée pour compenser les effets de la lumière ambiante.

8. Système de distribution selon la revendication 2, dans lequel la puissance des émetteurs de lumière (242, 720) est ajustée pour compenser les effets de la lumière réfléchie.

9. Système de distribution automatique selon la revendication 1, dans lequel le circuit de génération de rapports (235) comprend un circuit logique (325B) pour décider d'offrir une autre tentative de distribution au client sur la base d'une comparaison entre le résultat et une règle prédéterminée.

10. Système de distribution automatique selon la revendication 1, dans lequel la livraison de tous les produits est empêchée si une livraison de produit n'est pas détectée.

11. Système de distribution selon la revendication 9, dans lequel la livraison d'un ensemble de produits est empêchée si une livraison de produit n'est pas détectée.

12. Appareil de contrôle du fonctionnement d'un distributeur automatique (205) comprenant un système de commande (220) pour accepter une commande d'un client et un trajet de livraison (225) sur lequel un produit commandé par un client à partir du système de commande est convoyé, l'appareil comprenant :

un ensemble de dispositifs d'émission de signaux (242, 720) situés le long du trajet de livraison (225) ;
un ensemble de dispositifs de détection de signaux (252, 725) situés à travers le trajet de livraison (225) à distance des dispositifs d'émission de signaux (242, 720) ; et
un circuit logique (235) connecté à l'ensemble de dispositifs de détection de signaux (252, 725), le circuit logique (235) déterminant si un produit est livré le long du trajet de livraison (225) depuis une sortie de l'ensemble de dispositifs de détection de signaux (252, 725) ;
CARACTÉRISÉ EN CE QUE :

l'ensemble de dispositifs d'émission de signaux (242, 720) est agencé de manière à ce que chacun émette un signal lumineux pulsé ;
chaque dispositif de détection de signaux (252, 725) de l'ensemble de dispositifs de détection de signaux (252, 725) étant aligné avec un dispositif d'émission de signaux (242, 720) correspondant de l'ensemble de dispositifs d'émission de signaux (242, 720) ; et
le au moins un dispositif de détection de signaux (252, 725) et au moins un dispositif de détection de signaux adjacent (252, 725) sont actionnables de manière à recevoir le signal du dispositif d'émission de signaux activé (242, 720) correspondant, dans lequel le au moins un dispositif de détection de signaux (252, 725) et son au moins un dispositif de détection de signaux (252, 725) adjacent sont activés en fonction du dispositif d'émission de signaux activé (242, 720) correspondant à moins qu'il soit interrompu par le passage du produit, ledit appareil étant agencé de manière à séquencer à un dispositif d'émission de signaux suivant jusqu'à ce qu'au moins un d'un dispositif de détection correspondant et son au moins un dispositif de détection adjacent ne réussisse pas à détecter un signal depuis un dispositif d'émission de signaux activé.

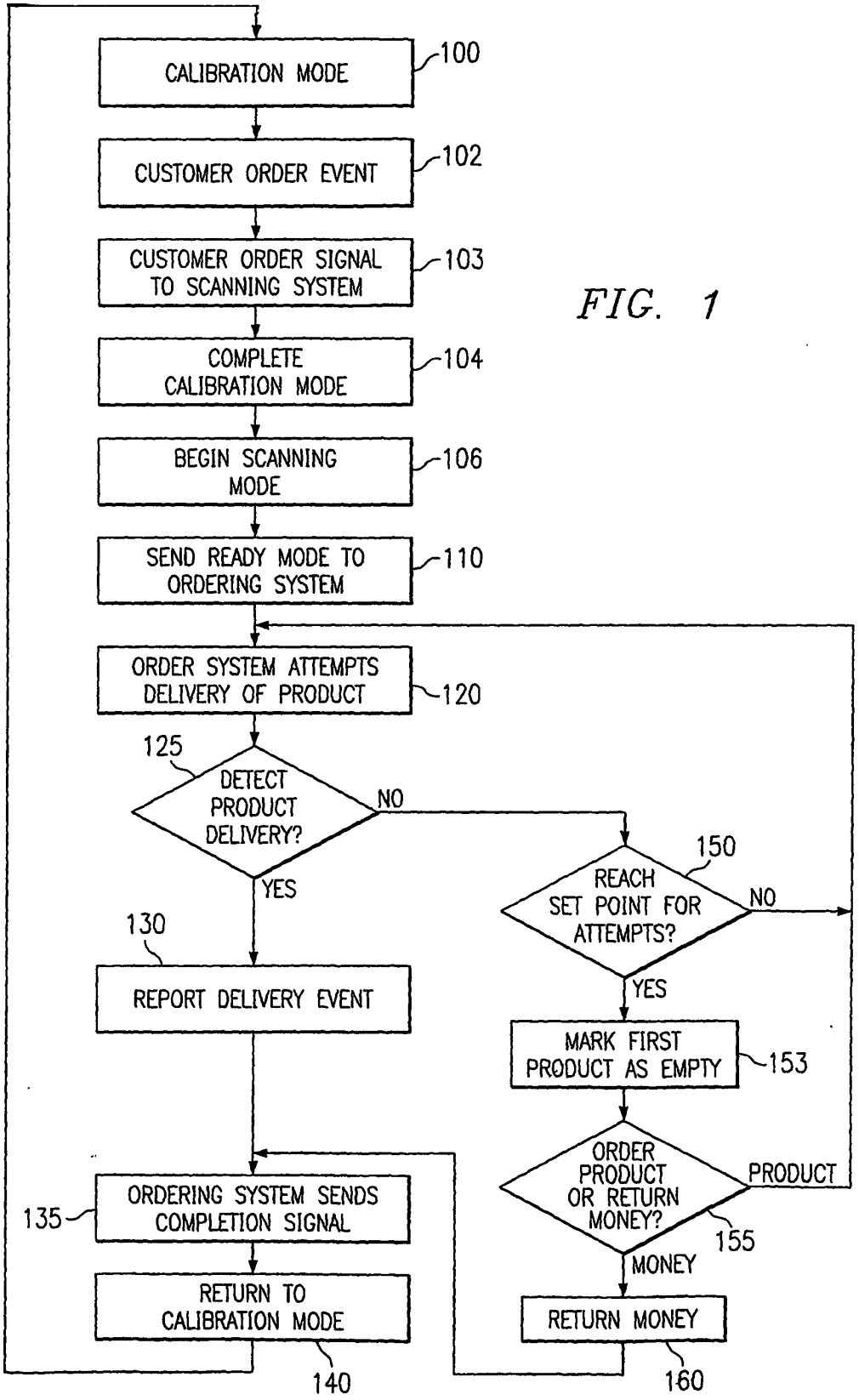
CALIBRATION MODE
100
CUSTOMER ORDER EVENT
102
CUSTOMER ORDER SIGNAL TO SCANNING SYSTEM
103
COMPLETE CALIBRATION MODE
104
BEGIN SCANNING MODE
106
SEND READY MODE TO ORDERING SYSTEM
110
ORDER SYSTEM ATTEMPTS DELIVERY OF PRODUCT
120
125
DETECT PRODUCT DELIVERY?
NO
YES
150
REACH SET POINT FOR ATTEMPTS?
NO
YES
130
REPORT DELIVERY EVENT
MARK FIRST PRODUCT AS EMPTY
153
ORDER PRODUCT OR RETURN MONEY?
PRODUCT
MONEY
155
135
ORDERING SYSTEM SENDS COMPLETION SIGNAL
RETURN TO CALIBRATION MODE
RETURN MONEY
140
160

FIG. 1

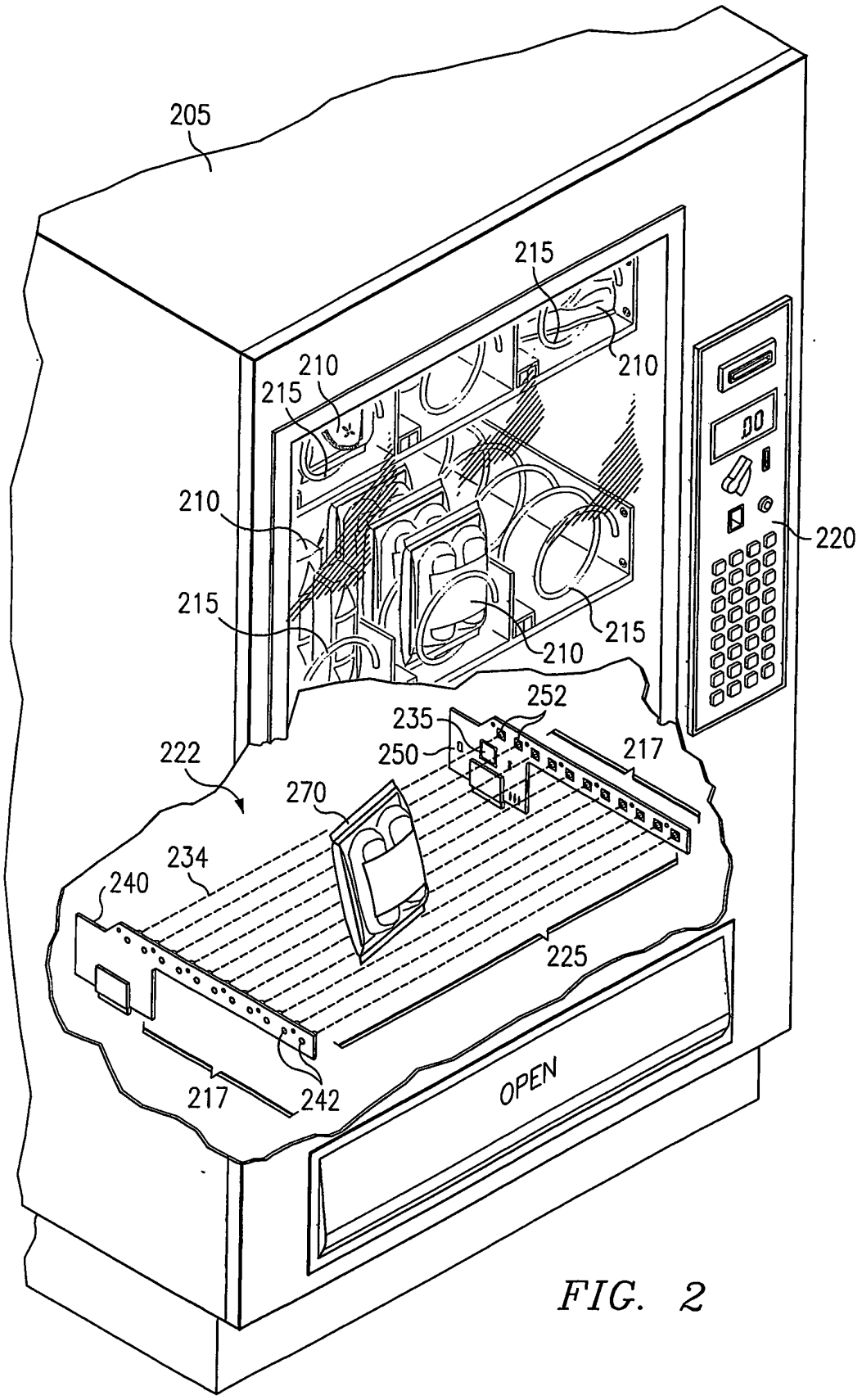
205
215
210
215
210
210
215
210
215
210
220
252
235
250
217
222
270
234
240
225
217
242
OPEN

FIG. 2

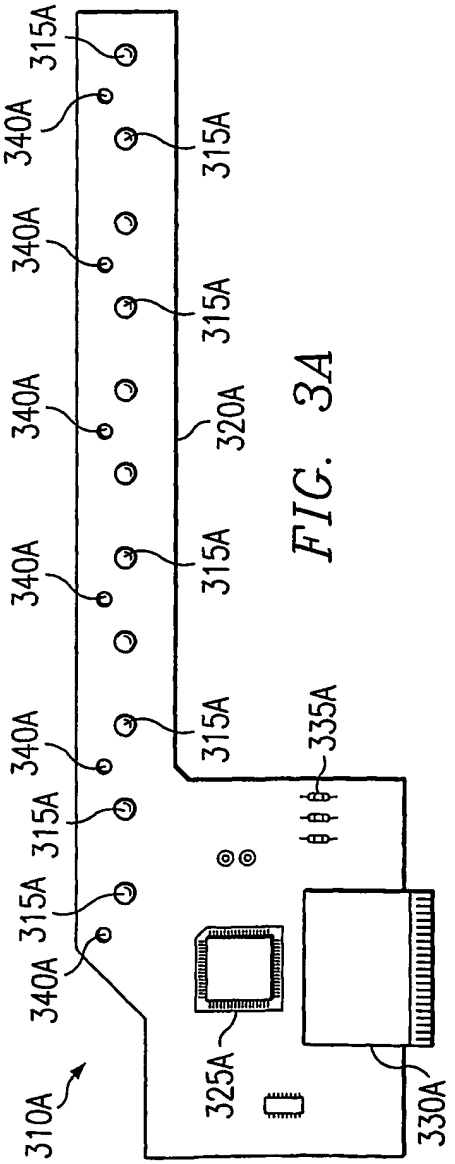
310A
340A
315A
320A
325A
330A
335A

FIG. 3A

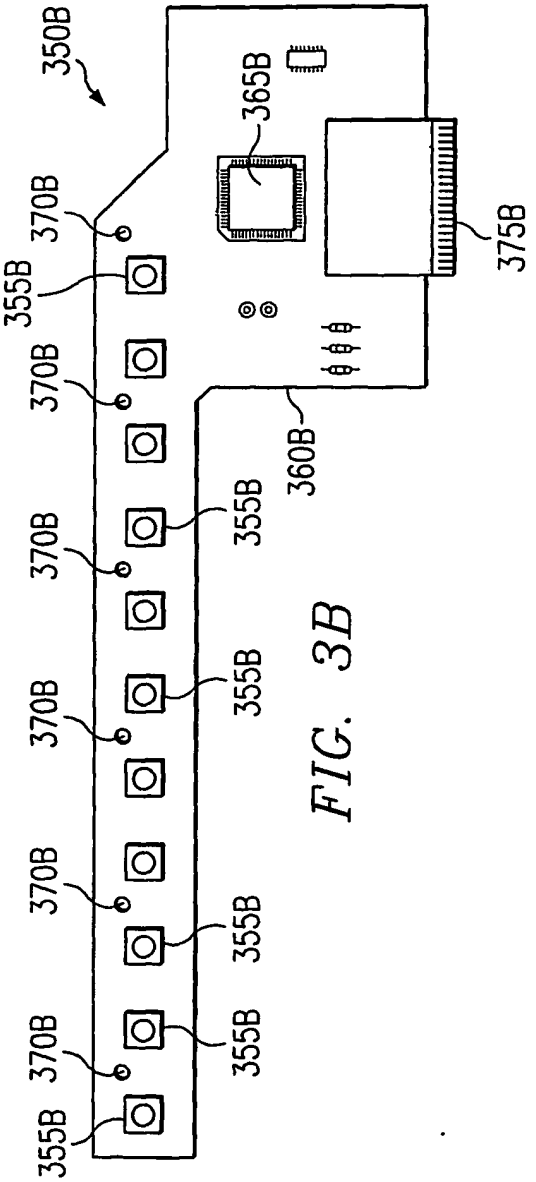
350B
355B
360B
365B
370B
375B

FIG. 3B

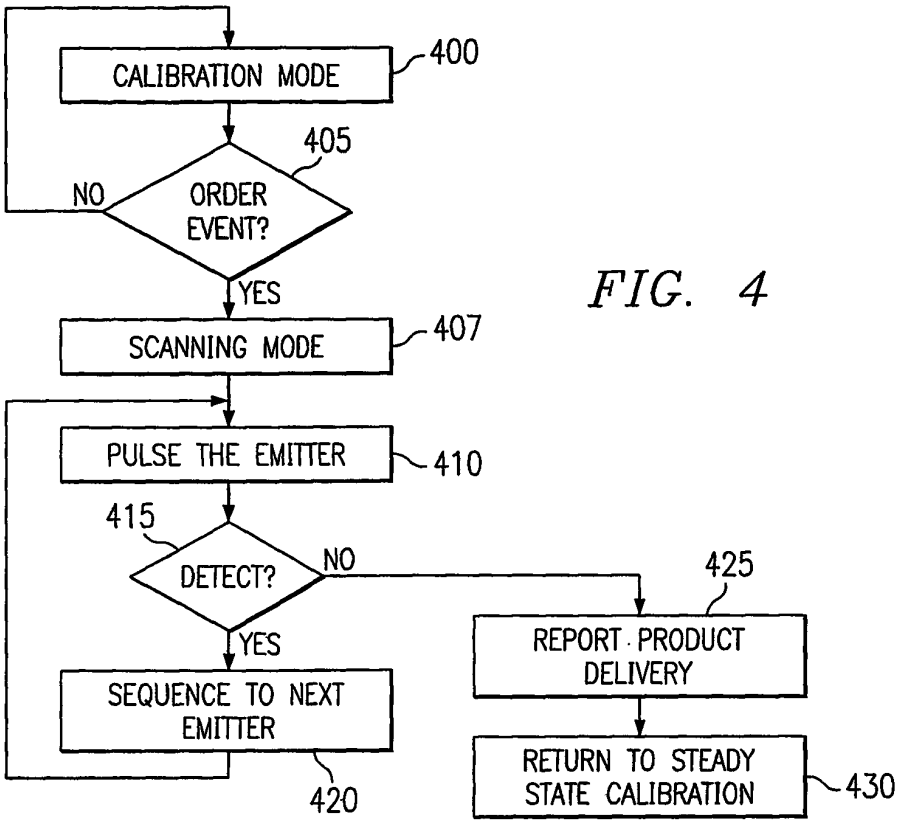
CALIBRATION MODE
400
405
NO
ORDER EVENT?
YES
SCANNING MODE
407
PULSE THE EMITTER
410
415
DETECT?
NO
425
YES
REPORT PRODUCT DELIVERY
SEQUENCE TO NEXT EMITTER
RETURN TO STEADY STATE CALIBRATION
430
420

FIG. 4

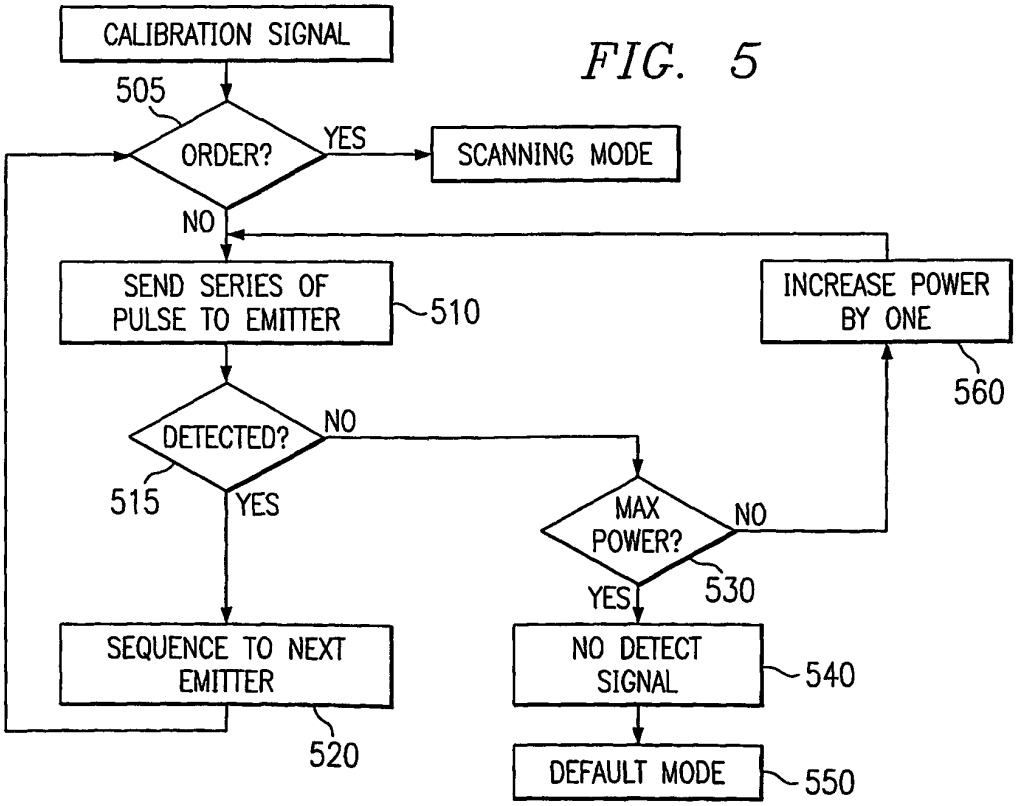
CALIBRATION SIGNAL
505
ORDER?
YES
SCANNING MODE
NO
SEND SERIES OF PULSE TO EMITTER
510
INCREASE POWER BY ONE
560
DETECTED?
NO
515
YES
MAX POWER?
NO
YES
530
SEQUENCE TO NEXT EMITTER
NO DETECT SIGNAL
540
520
DEFAULT MODE
550

FIG. 5

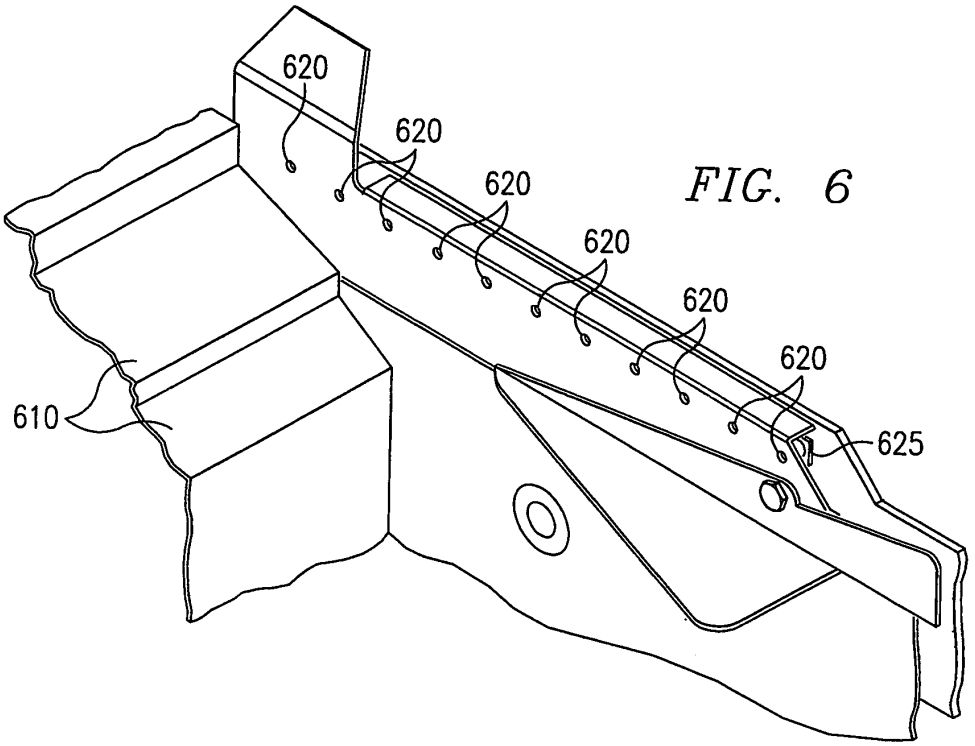
620
620
620
620
620
620
610
625

FIG. 6

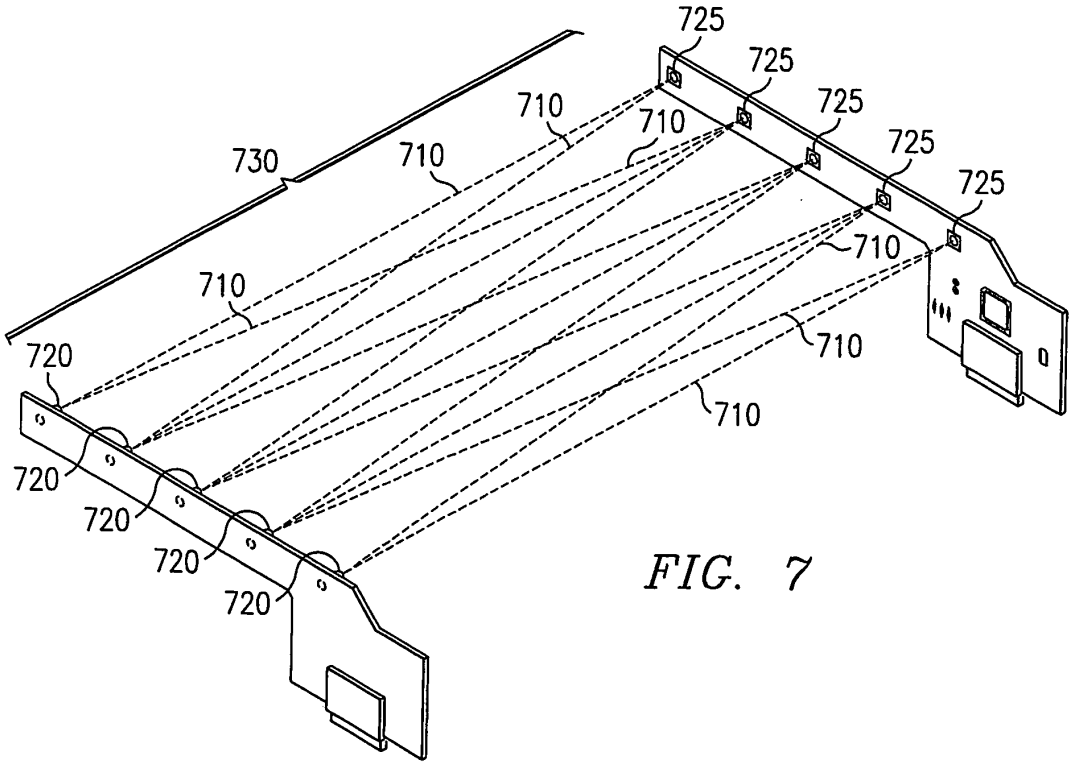
725
725
725
725
725
710
710
730
710
710
710
710
710
720
720
720
720
720

FIG. 7

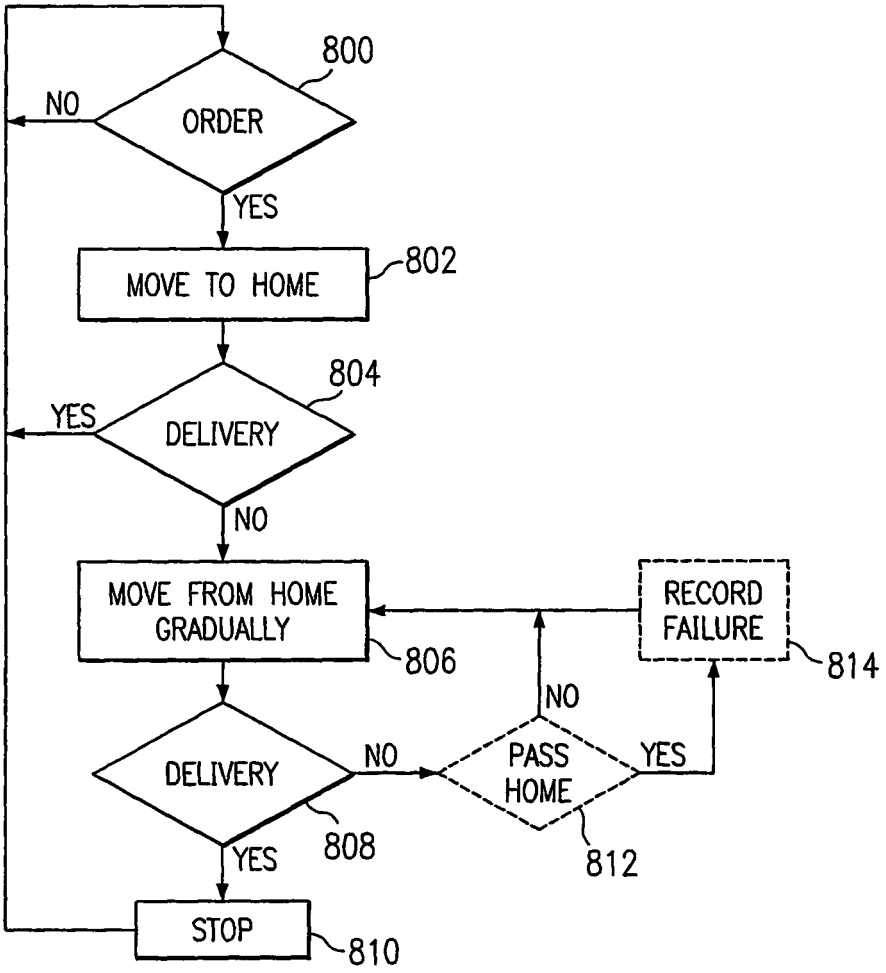
800
ORDER
NO
YES
MOVE TO HOME
802
804
DELIVERY
YES
NO
MOVE FROM HOME GRADUALLY
806
RECORD FAILURE
814
NO
DELIVERY
NO
PASS HOME
YES
808
812
YES
STOP
810

FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 9956255 A **[0004]**