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Description

This invention relates to coin-operated machines.

The invention is particularly, but not exclusively, related to apparatus which can accept, store and dispense coins. Such apparatus is often used with coin-operated vending machines. The apparatus tests inserted coins and stores them if they are acceptable. Unacceptable coins are rejected. If sufficient acceptable coins are inserted, the vending machines is operated. The apparatus dispenses stored, acceptable coins as change.

Such apparatus generally includes a separate coin container for the or each denomination of coin to be dispensed, and a cashbox for any other coin denominations. When a coin container for a particular denomination of coin is full, any further incoming coins of the same denomination are directed to the cashbox.

In coin handling apparatus it is desirable to provide a control circuit which can be used, with a minimum amount of modification, in conjunction with mechanisms and storage facilities suitable for different types of coins, for example the coins of different countries. It may also be desirable for a number of reasons to be able to change the way in which the control circuit operates. EP-A-0018718 and WO-A-8000202 disclose vending machines in which there is a control circuit including a memory storing pricing data determining how much credit is required to enable the vending of a product. A serviceman can alter this data using a keyboard. However, this provides only a relatively small degree of versatility.

According to the invention there is provided a coin-operated machine for vending products or performing a service, the machine having a coin validator which is operable to receive and test coin-like items, routing means for receiving the items from the validator and for selectively causing the items to be directed to different locations, and control means operable to increment a credit count in response to the validator testing an item and determining that it is a genuine coin, to enable the vending of a product or the performing of a service if the credit count is sufficient, and to control said routing means, wherein the control means has a memory storing alterable contents and means for reading the contents and using them to determine the manner in which said control means operates, the machine further including manually-operable means permitting a serviceman to cause at least some of the contents of said memory to be read out and altered, characterised in that said memory has first locations which are made accessible to a serviceman by operating the manually-operable means in a first predetermined manner to place the control means in a first access mode, and second locations which are inaccessible to a serviceman in said first access mode and accessible in a second access mode, access to said second locations requiring the operation of said manually operable means in a second, different predetermined manner which involves entering a predetermined value into a predetermined one of said first locations.

Preferably the user-operable means can be used to access and alter a number of parameters relating to the way in which coins are handled. For example, if the apparatus has a number of separate coin containers, the memory contents may determine which denominations of coins go to the respective containers.

The coins may be directed to their respective locations by movable gates, in which case the memory contents may also determine the sequence in which the gates are operated, and the intervals for which they are operated.

Previously many, or all, of the coin-handling parameters have been unalterable, which required the constructions of different circuits for different types of apparatus. Although switches could have been provided for altering these parameters, as was done for price setting, this would have taken up a great deal of space, increased costs and enabled unauthorised tampering with the circuit to alter the way in which the apparatus operates. The provision of a non-volatile, accessible and alterable memory for storing these parameters now enables a single control circuit to be used in a variety of different apparatuses.

As an alternative, instead of coin-handling parameters the memory may store other information, e.g. information relating to the values of acceptable coins. Preferably, however, both coin value information and coin-handling parameters are stored.

The control circuit may be capable of operation with more than one type of validator. An alterable memory location could be used to identify to the control circuit which validator is being used.

The memory may also store, in an alterable fashion, one or more price settings the or each of which determines how much cash has to be fed to the apparatus before a product will be vended. The structure and operation of the apparatus is thus simplified by providing a common memory and accessing means for price settings and for additional parameters affecting the operation of the apparatus.

The unauthorised alteration of the way in which the apparatus operates can be prevented in a machine of the present invention, by providing two levels of access (although of course further levels could also be provided if desired). This allows certain memory locations, such as those used for price setting, to be easily accessible, and preferably alterable, while other memory locations storing for example coin-handling parameters can be accessed only by authorised operators who know the correct way of operating the input means in order to gain access.

The use of a non-volatile memory is desired to

ensure that the stored information determining the way in which the apparatus operates, including the way it handles incoming coins, is not lost when the power to the apparatus is shut off. The term "non-volatile" is used herein in a broad sense to refer to any kind of memory which can retain information when the main power to the apparatus is interrupted. This could for example be achieved by using a separate battery power supply for the memory.

However, in a preferred embodiment of the invention the non-volatile memory is of a type which retains its contents when its own power supply is terminated. In the embodiment to be described below, the non-volatile memory is an electrically alterable read-only memory (EAROM). However, other memories, such as magnetic bubble type memories, could be used instead.

Preferably, the control means is operable to keep an accumulated total of credit which is incremented in response to the insertion of acceptable coins into the apparatus and which is decremented upon the vending of a product. The control means may be periodically operable to increment the accumulated total without acceptable coins being inserted, the memory storing a value determining when said incrementing without the insertion of acceptable coins is to take place. Thus, the apparatus is provided with a "discount" feature whereby under certain circumstances a user of the machine may be given extra credit without having to insert coins. This facility is preferably provided in an apparatus capable of giving change, so that the user can select whether the extra credit is to be given in the form of change or a vended product.

The apparatus is preferably operable in a "multi-vend" mode, whereby a user can insert coins to accumulate a credit sufficient to purchase more than one product, and then successively operate the apparatus to vend the products without having to insert coins between the vending operations. In these circumstances, the extra "discount" credit can be given only if the user successively operates the apparatus to vend a predetermined number of products (as determined by the contents of the memory) in a single operation. Alternatively, the discount is provided only if the user purchases, in a single operation, products having a total value at least equal to a predetermined, stored amount.

The apparatus may however additionally, or alternatively, provide the "discount" credit in a "single-vend" mode, in which case the apparatus may provide the "discount" credit after a predetermined number of operations of the apparatus.

The ability easily to alter the contents of the memory determining when the "discount" credit is given enables the apparatus to be easily adjusted to suit individual owners' requirements.

Preferably the coin handling apparatus is provided with a digital display which can be operated to reveal the contents of some or all of the memory locations. The display may also provide a display of memory addresses so that the memory can be accessed by operating an input means (e.g. push-buttons) until the correct memory address is shown, the display then being operated to enter a mode in which it displays the contents of the selected memory location, which contents can then be altered.

The display could also be used to display the status of various parts of the circuitry of the coin handling apparatus.

Preferably, the control means includes a microprocessor.

An arrangement embodying the invention will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a schematic diagram of the mechanical part of a coin handling apparatus of a machine in accordance with the invention;

Fig. 2 is a block diagram of the circuit of the coin handling apparatus;

Fig. 3 schematically shows an arrangement for accessing and altering the contents of a memory of the circuit shown in Fig. 2;

Fig. 4 schematically shows one of the coin storage containers of the apparatus; and

Figs. 5 and 6 are flow charts to describe some of the operations carried out by the apparatus.

Referring to Fig. 1, a vending machine (not shown) has a coin handling apparatus 2 including a coil validator 4 for receiving coins as indicated at 6. During the passage of the coins 6 along a path 8 in the validator 4, the validator provides signals indicating whether the coins are acceptable, and if so the denomination of the coins.

Acceptable coins then enter a coin separator 10, which has a number of gates (not shown) controlled by the circuitry of the apparatus for selectively diverting the coins from a main path 12 in any of a number of further paths 14, 16 and 18, or allowing the coins to proceed along the path 12 to a path 20 leading to a cashbox. If the coins are unacceptable, instead of entering the separator 10 they are led straight to a reject slot via a path 30.

Each of the paths 14, 16 and 18 leads to a respective one of three coin containers 22, 24 and 26. Each of these containers is arranged to store a vertical stack of coins of a particular denomination.

A dispenser indicated schematically at 28 is operable to dispense coins from the containers when change is to be given by the apparatus.

The arrangement so far is quite conventional, and the details of particular structures suitable for using as various parts of the mechanism will therefore not be described in detail.

Referring to Fig. 2, the circuit of the present embodiment of the invention incorporates a microprocessor 50 connected to data and address buses 52

and 54. Although separate buses are shown, data and address signals could instead be multiplexed on a single bus. A bus for control signals could also be provided.

The microprocessor 50 is connected via the buses 52 and 54 to a read-only memory (ROM) 56 and a random access memory (RAM) 58. The ROM 56 stores the program controlling the overall operation of the microprocessor 50, and the RAM 58 is used by the microprocessor 50 as a scratch-pad memory.

The microprocessor 50, the ROM 56 and the RAM 58 are, in the preferred embodiment, combined on a single integrated circuit.

The microprocessor 50 is also connected via the buses 52 and 54 to an EAROM 60. The EAROM 60 stores a variety of alterable parameters to be described in more detail later. The EAROM 60 may be of a type which inputs and outputs data in a serial fashion, in which case it may be connected to only a single data line, instead of the data bus 52.

The microprocessor 50 is also coupled via the buses 52 and 54 to input/output circuitry indicated at 62. The circuitry 62 includes a level sensor for each of the coin containers 22, 24 and 26, circuits for operating the dispenser 28 and the gates of the coin separator 10, the circuitry of the coin validator 4, a display visible to a user of the apparatus for displaying an accumulated credit value, and a further display and a set of switches to be described in connection with Fig. 3.

The input/output circuitry 62 also includes an interface between the control circuit of the apparatus and a vending machine to which it is connected.

In operation of the apparatus the microprocessor 50 successively tests the signals from the validator to determine whether a coin has been inserted in the apparatus. It also successively tests the signals from the switches to be described with reference to Fig. 3 to determine whether an operator desires to access the memory locations in the EAROM 60. When a credit has been accumulated, the microprocessor also tests signals from the vending machine to determine whether a vending operation has been carried out. In response to various signals received by the microprocessor 50, various parts of the program stored in the ROM 56 are carried out. The microprocessor is thus arranged to operate and receive signals from the level sensors of the coin containers 22,24 and 26, and to control the gates in the separator 10 in order to deliver the coins to the required locations, and is also operable to cause appropriate information to be shown in the displays of the apparatus and to deliver signals to the vending machine to permit or prevent vending operations. The microprocessor is also operable to control the dispenser to deliver appropriate amounts of change.

The particular sequence of most of the operations carried out by the microprocessor may be the same as those determined by the hard-wired logic in previous apparatus. A suitable program to be stored in the ROM 56 can therefore be designed by anyone familiar with the art, and accordingly only the operations carried out by the particularly relevant parts of this program will be described.

Referring to Fig. 3, the control circuit is provided with a display 100 which can display four digits and a decimal point at any one of four locations each positioned after a respective digit. The circuit also has three pushbuttons, 102, 104 and 106, which can be operated to bring the display 100 into use.

In order to set the apparatus up for use, the pushbutton 102 (referred to as the "start" button) is operated. This is recognised by the microprocessor 50 which then, in accordance with the program stored in the ROM 56, causes the display to read zero. The displayed value can then be incremented by successively pressing the pushbutton 106 (referred to as the "up" button), and decremented by successively pressing the pushbutton 104 (referred to as the "down" button). In this way, the operator can bring the displayed number to any desired value within a predetermined range (above which the display returns to zero). Each of the displayable numbers corresponds to a particular memory location in the EAROM 60.

Once a desired number has been reached, the operator again presses the set button 102, following which the display 100 displays the contents of the appropriate memory location. These contents can then be incremented or decremented by using the up and down buttons 106 and 104, and the altered contents can be entered into the EAROM 60 by again pressing the set button 102. This operation of altering the memory contents can be terminated by pressing the set button 102 twice in succession.

This method is used to set in the EAROM 60 a number of prices so that when the apparatus is used, the microprocessor 50 will recognise when sufficient credit has been accumulated by the insertion of coins to deliver the signals which allow the vending machine to be operated.

By operating the buttons 102, 104 and 106 in a predetermined manner, the operator may gain access to further memory locations of the EAROM 60 (i.e. enter a "second access mode"). This is done by inserting a particular value in a particular memory location which is normally accessible. Then, when the display has been incremented to the highest normally available address, the microprocessor is arranged to look at the memory location storing that particular value and, on noting that the value is present, permit further incrementing of the display to further memory addresses.

This arrangement permits restricted access to certain memory locations. These memory locations can be used to store, for example:

(1) the maximum amount of change which the ap-

paratus will dispense in a single operation. This ensures that a user cannot build up excessive credit and then recover the credit by way of dispensed cash unless he has first operated the vending machine in order to reduce the credit to below the set value.

(2) A "discount" value, which corresponds to the amount of credit awarded in a discount operation.

(3) A "discount" event number, which controls when a discount is to be awarded.

(4) The coin denominations which are acceptable by the apparatus when it is in a state in which it may not be able to deliver change (i.e. when an "exact change" indication is given).

(5) A value which determines whether the apparatus will operate in a single-vend or a multi-vend mode (as referred to above).

(6) A value which determines whether, once a credit has been accumulated, a vending operation must be carried out before any change is given by the apparatus.

Other parameters affecting circuit operation can also be stored.

Still further memory locations can be accessed by operating the pushbuttons 102, 104 and 106 in a further predetermined manner (to achieve a "third access mode"). These further memory locations would normally have appropriate values stored in them on manufacture of the apparatus, and would not require alteration on installation of the apparatus. However it is useful to provide a third level of access whereby an operator can inspect locations, and can also alter these if this ever becomes necessary, for example if a mechanism with which the circuit operates is altered.

The memory locations which are addressed at this third level of access store parameters relating to the way in which coins are handled by the apparatus, and further parameters relating to the values of the coins with which the apparatus is intended to be used.

The coin handling parameters include timing values which determine how long gates are opened or closed, gating parameters which determine which location each denomination of coin is directed to by the gates, and dispensing timing values which determine how long a dispensing mechanism is to be actuated for, and how long the necessary delay period is between the end of one dispensing operation and the beginning of a succeeding dispensing operation. These latter values will depend upon coin size and weight.

The coin value parameters include the relative values of the coins, and a scale factor whereby actual coin values can be calculated and displayed on the credit display of the apparatus.

Other parameters would not normally need to be changed except in special circumstances may also be stored at this third level of access. For example, there may be a memory location storing the minimum number of coins in a coin container below which the apparatus will provide an "exact change" indication to warn that the apparatus may not be able to deliver change.

There may also be a memory location to identify the type of coin validator being used with the apparatus.

The apparatus can be used with an optional audit or accountability system which keeps a record of the transactions carried out by the apparatus. One of the memory locations stores a value indicating whether or not such an audit system is in operation. This memory location is at the third access level, so as to avoid unauthorised tampering with the contents of the location and thereby falsification of the accountability record. However, it is desirable to provide for situations in which an owner of the apparatus wishes to add an audit system to apparatus which has not previously been provided with such a system. To enable this to be achieved simply, there is provided a further memory location at the second level of access into which the owner can insert a special code which causes the microprocessor to enter into the "audit location" at the third level of access a code indicating the presence of an audit system. The microprocessor program is so arranged, however, that it is not possible to use the location at the second access level to cause the storage, in the audit location, of a code signifying that no audit system is in use; the third level of access is required to achieve this.

The result of this is that there is a memory location which can be altered to store at least one particular code (indicating the presence of an audit system) at the second level of access, but can only be altered so as to store a different code (indicating the absence of an audit system) at the third level of access. This provides for simple and convenient modification when audit systems are being added, but prevents or makes very difficult tampering with the system to provide a false indicating that there is no audit system present, which would result in the apparatus failing to record transactions.

Similar arrangements can be used for storing other parameters. It is of course also possible to have a corresponding arrangement at the first and second levels of access, rather than the second and third levels.

With the EAROM 60 storing the appropriate values, which have been entered on installation and/or manufacture, and the apparatus in a condition for use, an operator can use the display 100 and the pushbuttons 102,104 and 106 to check on the operation of the apparatus. By operating the pushbuttons in a certain sequence, for example by pressing the down button 104 prior to pressing the set button 102, one can cause the microprocessor 50 to shift the display into a diagnostic mode. In this mode, the display

100 (and/or the external credit display of the apparatus) displays numbers dependent upon the status of various parts of the apparatus. For example, the apparatus can be arranged to indicate whether any of the coin containers 22, 24 and 27 is empty, whether a sensor in the separator is providing a signal indicating that the separator is jammed, etc.

It is known in conventional coin handling apparatuses to direct coins to coin containers such as those shown at 22, 24 and 26 in Fig.1, and to dispense the coins from the containers in a change dispensing operation. It is also known that the apparatus should recognise when the coins stored in each container reach a relatively low level, so that change may not be available and an indication that only the correct amount of cash should be inserted into the machine is given. Furthermore, it is known to detect when the level of coins is above a predetermined maximum level, so that further coins of the same denomination are directed to the cashbox instead of the coin container.

However, in the past this has usually been achieved by using two level sensors, one for detecting a low level of coins and the other for detecting a high level of coins. The present embodiment provides an arrangement which requires only one level sensor, but which nevertheless operates in the desired manner, as will be explained in the following.

Referring to Fig. 4, each coin container (only container 22 is illustrated in Fig. 4) has a single level sensor formed by a light source 150 and a light detector 152 mounted on opposite sides of the coin container. The level sensor can be operated at any desired time by the microprocessor sending a signal to illuminate the light source 150. This will produce an output from the light detector 152, which is delivered to the microprocessor 50, only if no coin blocks the light path between the source and the detector.

The sensor is located fairly close to, but not at, the bottom of the coin container, although other positions could be used instead. The light detector 152 provides an output signal when the light source 150 is operated only if the number of coins in the container is equal to or less than a predetermined number, referred to herein by the mnemonic MTNUM. Any further coins will block the light from the source 150.

Each time the microprocessor causes a coin to be directed to the coin container, a coin count stored in the RAM 58 for that particular container is incremented. The coin count is decremented every time the microprocessor 50 causes a coin to be dispensed from the container.

The way in which the apparatus operates to keep a count of the coins in the containers will now be described with reference only to the coin container 22. The operation for the other coin containers is identical.

When the apparatus is switched on, the microprocessor 50 reads the sensor 150, 152 associated with the container. If the sensor is uncovered (i.e. if the number of coins is less than or equal to MTNUM) then the microprocessor stores, as the coin count for that container, the value zero. If on the other hand the sensor is covered, then the value stored as the coin count is a further predetermined number referred to herein by the mnemonic FULNUM and corresponding to the desired maximum number of coins in the container.

The stored coin count is subsequently altered in accordance with coin dispensing and accepting operations.

The detailed operation of the apparatus when it receives an acceptable coin of the denomination stored in the container 22 will be described with reference to the flow chart of Fig. 5.

Following the recognition of an acceptable coin at step 500, the microprocessor determines whether the stored coin count (CC) is less than FULNUM at step 502. If not, i.e. if the count indicates that the maximum permitted number of coins is stored in the container, then at step 504 the microprocessor operates the gates to steer the coin to the cashbox. The microprocessor then proceeds, as indicated at step 506, to carry out any subsequent operations such as incrementing a credit total, signalling the vending machine, etc.

Assuming that the coin count is less than FULNUM, then in step 508 the microprocessor operates the steering gates in the separator 10 in order to direct the coin to the coin container 22.

The microprocessor then, in step 510, reads the level sensor for the coin container 22. There then follows a delay period in step 512, wherein the microprocessor waits for a period set by the contents of a location in the EAROM 60 which is alterable at the third level of access. During this period the coin is passing through the separator 10. Then, at step 514, the level sensor of the container 22 is read again.

At step 516 the gates directing the coin to the coin container 22 are closed.

At step 518 the microprocessor determines whether the level sensor of the container 22 is covered. This is done by "OR-ing" the results of the sensing operations at steps 510 and 514. In other words, if in either of these operations the sensor indicates that no coin is present, then the microprocessor assumes that the sensor is uncovered, i.e. that the number of stored coins is equal to or less than MTNUM.

The reason for carrying out the sensing operation twice, with an intervening pause, is to avoid the sensor erroneously indicating that the coin level is greater than MTNUM. This could otherwise occur if a previously accepted coin was passing the level sensor at the time the sensor is read. The delay between the two readings is such that a coin passing the sensor at the time of the first reading would have settled in the container by the time the second reading is taken, and on the other hand any coin passing the level sensor at the time of the second reading would not have

reached the sensor when the first reading was taken.

The time between the opening and closing of the gates sending the coin to the coin container may also be determined by alterable contents of an EAROM location, and may be selected in accordance with the physical properties of the coin.

The period of operation of the gates can be selected as described in British Patent Specification No. 1,582,691.

If, as a result of the sensing operations, it is discovered that the sensor is not covered, the microprocessor proceeds to step 520, in which the coin count is incremented by 1, and to step 506.

On the other hand, if the sensor is covered, then the microprocessor proceeds to step 522. Here the microprocessor determines whether the stored coin count is greater than MTNUM. As the sensor has been found to be covered, then the count should indeed be greater than MTNUM, and if it is then the microprocessor proceeds to step 520 to increment the count.

However if the coin count is less than or equal to MTNUM, the microprocessor proceeds to step 524. At this step, the microprocessor determines whether the coin count is equal to zero. Under normal circumstances, the coin count would be greater than zero, in which case the microprocessor proceeds to step 526, in which the coin count is set equal to a "coin-increasing correction" value of MTNUM plus 2. At this step therefore, the microprocessor corrects any errors in the coin count which may have resulted from the microprocessor, at switch-on, storing an initial coin count of zero when in fact several coins were already stored in the container. Thus, step 526 corrects any inaccurate counts which are smaller than the actual number of coins in the container.

If at step 524, if the microprocessor determines that the coin count is equal to zero, it proceeds to step 528. A zero count should not in fact be obtained, because earlier deliveries of coins to the container in order to raise the level to a position at which the sensor is covered would have increased the coin count. However the zero count may in fact occur if the container has been manually filled, in which case the coin count would not have been incremented. In this situation the coin count would be completely wrong, and to deal with this problem the microprocessor, at step 528, stores the value FULNUM as the coin count. Any discrepancies between the value FULNUM and the actual number of coins in the container will be dealt with in subsequent operations to be described later.

After setting the coin count to the appropriate values, the program proceeds to step 506 and the subsequent operations of the apparatus.

The actual sequence of operations set out in Fig. 5, including the order in which the gates are opened and closed and the coin counts altered, can of course be modified.

The "coin-increasing correction" value MTNUM plus 2 which is stored in step 526 corresponds to the minimum value MTNUM plus 1 at which the sensor is covered, plus an extra 1 for the incoming coin which has just been accepted.

The operation of the apparatus when it is dispensing a coin from the container 22 will now be described with reference to the flow chart of Fig. 6. Coins are of course dispensed only if the coin count is greater than zero. In an alternative arrangement, the apparatus could be arranged to dispense coins only if the coin count is greater than another number, such as MTNUM.

Firstly a change calculation is carried out to determine how many coins of each of the stored denominations are to be dispensed in accordance with the total amount of change and the stored numbers of coins (i.e. the coin counts). Then, for each of the coins to be dispensed, the following sequence is carried out.

At step 600, the coin is dispensed. Then at step 602, the coin count is decremented by 1. The sensor is read at step 604. In the dispensing operation, no problems arise from coins moving past the sensor, and accordingly the sensor is read only once.

At step 606, the microprocessor decides whether the sensor is covered. If it is covered, no modification of the coin count is performed, and the program proceeds to carry out any subsequent operations, such as calculating whether any further change is to be dispensed, altering the accumulated credit etc. as indicated at step 608.

It should be noted that, when the tube sensor is covered, the coin count may be greater than the actual number of coins in the container, but it should not be less than the actual number of coins. This is because the coin count is set to FULNUM on switch-on when the tube sensor is covered. If the coin count is equal to FULNUM, no further coins are directed to the coin container. This arrangement has the advantage that the actual number of coins stored in the container is never greater than FULNUM, and may in fact be kept at a value which is lower than FULNUM until the sensor becomes uncovered, in which case the count is corrected as described below. Thus, the actual amount of cash stored in the container is, for a while at least, kept lower than the maximum permitted value.

If, after the dispensing operation, the sensor is uncovered, the microprocessor proceeds from step 606 to step 610.

If the coin count is greater than MTNUM, then at step 612 the coin count is corrected by setting it equal to a "coin-decreasing correction" value of MTNUM. The program then proceeds to step 608.

If at step 610 the coin count is not greater than MTNUM, the program proceeds directly to step 608.

As a result of the operations described above, a single level sensor is used to enable the apparatus to keep a count of the coins in the container in order to

determine whether coins are to be stored in the container or dispensed from the container. The program is designed so that any inaccuracies in the count are corrected when the level of the coins reaches that of the level sensor. If the initial count is too low because the level of coins was below the tube sensor, then the level will not be allowed to drop lower, but otherwise coins may be stored in and dispensed from the container so that the level may eventually increase to that of the level sensor. On the other hand, if initially the tube sensor was covered but the container was not full, then the level of coins may rise or fall but will not be permitted to rise any higher than the initial level.

Of course the tendency to approach the level of the sensor will depend on the cash inserted and dispensed from the apparatus, so that in actual practice the level of the sensor may not be reached. However this would only occur when there is insufficient demand for change, or an insufficient number of acceptable coins coming into the apparatus. In either case inaccuracies in the coin count are of no significance, because change is either not desired or cannot be given because of shortage of coins.

The values MTNUM and FULNUM are stored in the EAROM and can be altered at the third level of access referred to above. This enables the value FULNUM to be altered to suit individual owners' requirements, and also to be varied for different coin denominations. It is sometimes found that large coins forming a high stack may detrimentally affect the performance of the dispenser. This can be avoided by reducing the value of FULNUM.

The value of MTNUM can be changed to suit different coin containers and sizes of coins, which will alter the number of coins necessary to reach the height of the level sensor.

When the third level of access to the EAROM 60 is reached, the microprocessor is arranged to transfer the coin counts for the various containers to the EAROM 60 so that these coin counts can be inspected.

Preferably, the microprocessor is arranged to read the sensors and store an additional count (either zero or FULNUM) not only when the power is switched on, but also when the pushbutton 102 is pressed. This allows an operator to fill the coin container manually, and then start a new coin count without turning off the power.

The level sensor of each of the containers can be positioned at any desired level. For example, the level sensor could be right at the top of the container. However it is preferred that the level sensor be at a relatively low position to avoid substantially underestimating the actual level of coins at initialisation, which would cause an "exact change only" indication to be given more often than necessary. The sensor could also be right at the bottom of the container, but it is preferably higher than this so as to provide the "exact change" indication as a warning prior to the container being completely emptied. It is generally desirable that the level sensor be at or near the level of coins below which the "exact change" indication is given.

The various operations carried out by the control circuit throughout coin acceptance and dispensing stages, and the delivery of signals to the vending machine may, by way of example, correspond to the operations carried out by the circuitry of the Mentor 3000 system marketed by Mars Money Systems. By way of further example, the stored program may be arranged to cause the circuit to operate in accordance with the techniques describes in British Patent Specification No. 2,006,501.

The coin handling apparatus may be used with machines other than vending machines, although it is particularly useful in circumstances in which change is to be dispensed. By way of example, the apparatus may be used in conjunction with pay telephones. Other examples are amusement and gaming machines, and change-giving machines.

In the illustrated embodiment, the microprocessor 50 carries out many different functions. Clearly, though, discrete circuitry could be used in place of a microprocessor, in which case many of the functions would be carried out by different, respective circuits.

The arrangements described above are also described, and certains aspects thereof relating to the monitoring of the number of coins in a container are claimed, in parent European application No. 82305167.7 (publication No. EP-A-0076640).

Claims

1. A coin-operated machine for vending products or performing a service, the machine having a coin validator (4) which is operable to receive and test coin-like items, routing means (10) for receiving the items from the validator (4) and for selectively causing the items to be directed to different locations (22, 24, 26), and control means (50, 52, 54, 56, 58, 60) operable to increment a credit count in response to the validator (4) testing an item and determining that it is a genuine coin, to enable the vending of a product or the performing of a service if the credit count is sufficient, and to control said routing means (10), wherein the control means (50, 52, 54, 56, 58, 60) has a memory (60) storing alterable contents and means (50) for reading the contents and using them to determine the manner in which said control means (50, 52, 54, 56, 58, 60) operates, the machine further including manually-operable means (102, 104, 106) permitting a serviceman to cause at least some of the contents of said memory (60) to be read out and altered, characterised in that said memory (60) has first locations which are made accessible to a serviceman by operating the

manually-operable means in a first predetermined manner to place the control means (50, 52, 54, 56, 58, 60) in a first access mode, and second locations which are inaccessible to a serviceman in said first access mode and accessible in a second access mode, access to said second locations requiring the operation of said manually operable means in a second different predetermined manner, which involves entering a predetermined value into a predetermined one of said first locations.

2. A machine as claimed in claim 1, wherein said memory (60) includes a location the contents of which can be altered to at least one predetermined value by operating said manually-operable means (102, 103, 106) in one of said access modes, but which can be altered to at least one different predetermined value only by operating said manually-operable means (102, 104, 106) in a different access mode.

3. A machine as claimed in any preceding claim including a display (100) for displaying the contents caused to be read out by operation of the manually-operable means (102, 104, 106).

4. A machine as claimed in claim 3, wherein the display (100) is further operable to display the addresses of the accessed memory locations.

5. A machine as claimed in any preceding claim wherein the memory (60) has a third set of locations which can be accessed by operating the manually-operable means (102, 104, 106) in a third predetermined manner.

6. A machine as claimed in any preceding claim, wherein said memory (60) stores parameters determining the respective paths (14, 16, 18, 20) along which the control means (50, 52, 54, 56, 58, 60) causes the routing means (10) to direct different types of items.

7. A machine as claimed in any preceding claim, wherein the routing means (10) comprises a plurality of gates which are selectively operable by the control means (50, 52, 54, 56, 58, 60) to direct the items to different locations, and wherein the memory (60) stores parameters determining the times for which the respective gates are operated.

8. A machine as claimed in any preceding claim, wherein the memory (60) stores parameters determining how much the credit count is incremented in response to the testing of different types of genuine coins.

9. A machine as claimed in any preceding claim, wherein the memory (60) stores pricing information determining the value to which the credit count has to be incremented to enable the vending of a product or the performing of a service.

10. A machine as claimed in any preceding claim, wherein said control means (50, 52, 54, 56, 58, 60) is operable additionally to increment said credit count without determining that a tested item is a genuine coin.

11. A machine as claimed in claim 10 wherein said memory (60) stores a parameter determining when said additional incrementing is to take place.

12. A machine as claimed in any preceding claim, wherein the control means (50, 52, 54, 56, 58, 60) is further operable to cause a dispenser (28) to dispense at least one type of genuine coin from a container (22, 24 or 26) in a change-giving operation.

13. A machine as claimed in claim 12, wherein one of said locations (22, 24 or 26) to which coins are directed is said container, and wherein the control means (50,52, 54, 56, 58, 60) is operable to direct coins of that type to said container (22, 24 or 26) only if the number of coins in the container is less than a predetermined number (FULNUM) stored in said memory (60).

14. A machine as claimed in any preceding claim wherein the memory has an auxiliary power supply for allowing the memory to retain its contents on interruption of the main power supply.

15. A machine as claimed in any one of claims 1 to 13, wherein the memory (60) is a non-volatile electrically alterable read-only memory.

Patentansprüche

1. Münzbetätigte Vorrichtung zum Verkauf von Erzeugnissen oder zur Ausführung einer Arbeitsleistung, wobei die Vorrichtung einen Münzen-Gültigkeitsprüfer (4), der so betätigbar ist, daß er münzenartige Gegenstände annimmt und prüft, eine Leiteinrichtung (10), die die Gegenstände von dem Gültigkeitsprüfer (4) empfängt und bewirkt, daß sie selektiv unterschiedlichen Orten (22, 24, 26) zugeführt werden, und eine Steuereinrichtung (50, 52, 54, 56, 58, 60) aufweist, die so betätigbar ist, daß sie dann, wenn der Gültigkeitsprüfer (4) einen Gegenstand prüft und ihn als echte Münze feststellt, einen Kredit-Zählwert

erhöht, den Verkauf eines Erzeugnisses oder die Ausführung einer Arbeitsleistung freigibt, wenn der Kredit-Zählwert ausreicht, und die Leiteinrichtung (10) steuert, wobei die Steuereinrichtung (50, 52, 54, 56, 58, 60) einen Speicher (60) zur Speicherung veränderbarer Inhalte und eine Einrichtung (50) zum Auslesen der Inhalte und zu deren Verwendung zur Bestimmung der Betriebsweise der Steuereinrichtung (50, 52, 54, 56, 58, 60) aufweist, und wobei die Vorrichtung ferner eine von Hand betätigbare Einrichtung (102, 104, 106) enthält, mittels der eine Wartungsperson das Auslesen und Ändern mindestens einiger der Inhalte des Speichers (60) bewirken kann, dadurch **gekennzeichnet**, daß der Speicher (60) erste Plätze, die für eine Wartungsperson dadurch zugänglich werden, daß die von Hand betätigbare Einrichtung in einer ersten vorgegebenen Weise so betätigt wird, daß die Steuereinrichtung (50, 52, 54, 56, 58, 60) in einen ersten Zugriffsmodus gelangt, und zweite Plätze aufweist, die für eine Wartungsperson in dem ersten Zugriffsmodus unzugänglich sowie in einem zweiten Zugriffsmodus zugänglich sind, wobei der Zugriff zu den zweiten Plätzen die Betätigung der von Hand betätigbaren Einrichtung in einer zweiten, unterschiedlichen vorgegebenen Weise erfordert, bei der ein vorgegebener Wert in einen vorgegebenen der ersten Plätze eingegeben werden muß.

2. Vorrichtung nach Anspruch 1, wobei der Speicher (60) einen Platz aufweist, dessen Inhalt durch Betätigung der von Hand betätigbaren Einrichtung (102, 103, 106) in einem der Zugriffsmoden in mindestens einen vorgegebenen Wert geändert werden kann, jedoch in mindestens einen unterschiedlichen vorgegebenen Wert nur dadurch geändert werden kann, daß die von Hand betätigbare Einrichtung (102, 104, 106) in einem unterschiedlichen Zugriffsmodus betätigt wird.

3. Vorrichtung nach einem der vorhergehenden Ansprüche mit einer Anzeige (100) zur Darstellung der Inhalte, deren Auslesung durch Betätigung der von Hand betätigbaren Einrichtung (102, 104, 106) bewirkt wird.

4. Vorrichtung nach Anspruch 3, wobei die Anzeige (100) ferner so betätigbar ist, daß sie die Adressen der abgefragten Speicherplätze darstellt.

5. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei der Speicher (60) eine dritte Gruppe von Plätzen aufweist, zu denen Zugriff durch Betätigung der von Hand betätigbaren Einrichtung (102, 104, 106) in einer dritten vorgegebenen Weise besteht.

6. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei der Speicher (60) Parameter zur Bestimmung der jeweiligen Bahnen (14, 16, 18, 20) speichert, längs denen die Steuereinrichtung (50, 52, 54, 56, 58, 60) die Zuführung der unterschiedlichen Arten von Gegenständen durch die Leiteinrichtung (10) veranlaßt.

7. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Leiteinrichtung (10) mehrere Gatter umfaßt, die durch die Steuereinrichtung (50, 52, 54, 56, 58, 60) selektiv derart betätigbar sind, daß sie die Gegenstände verschiedenen Orten zuführen, und wobei der Speicher (60) Parameter zur Bestimmung der Zeiten speichert, während der die jeweiligen Gatter betätigt werden.

8. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei der Speicher (60) Parameter speichert, die angeben, um welchen Betrag der Kredit-Zählwert bei der Prüfung unterschiedlicher Arten von echten Münzen erhöht wird.

9. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei der Speicher (60) Preisinformationen speichert, die den Wert angeben, auf den der Kredit-Zählwert erhöht werden muß, um den Verkauf eines Erzeugnisses oder die Ausführung einer Arbeitsleistung freizugeben.

10. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Steuereinrichtung (50, 52, 54, 56, 58, 60) so betätigbar ist, daß sie den Kredit-Zählwert zusätzlich erhöht, ohne zu bestimmen, daß ein geprüfter Gegenstand eine echte Münze ist.

11. Vorrichtung nach Anspruch 10, wobei der Speicher (60) Parameter speichert, die bestimmen, wann die zusätzliche Erhöhung stattfinden soll.

12. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Steuereinrichtung (50, 52, 54, 56, 58, 60) ferner so betätigbar ist, daß sie in einem Wechselgeld-Ausgabevorgang die Ausgabe mindestens einer Art von echten Münzen aus einem Behälter (22, 24 oder 26) mittels einer Abgabeeinrichtung (28) bewirkt.

13. Vorrichtung nach Anspruch 12, wobei einer der Orte (22, 24 oder 26), denen die Münzen zugeführt werden, der besagte Behälter ist, und wobei die Steuereinrichtung (50, 52, 54, 56, 58, 60) so betätigbar ist, daß sie Münzen dieser Art dem Anzahl an Münzen in dem Behälter kleiner ist als eine in dem Speicher (60) gespeicherte vorgegebene Zahl (FULNUM).

14. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei der Speicher eine Hilfs-Energieversorgung aufweist, die es ermöglicht, daß der Speicher bei Unterbrechung der Haupt-Energieversorgung seinen Inhalt beibehält.

15. Vorrichtung nach einem der Ansprüche 1 bis 13, wobei der Speicher (60) ein elektrisch veränderbarer nicht-flüchtiger Festspeicher ist.

Revendications

1. Machine actionnée par des pièces de monnaie pour la distribution de produits ou la délivrance d'un service, cette machine comportant un dispositif (4) de validation des pièces de monnaie, qui peut agir de manière à recevoir et contrôler des articles en forme de pièces de monnaie, des moyens d'acheminement (10) servant à recevoir les articles en provenance du dispositif de validation (4) et à provoquer d'une manière sélective l'acheminement de ces articles jusqu'à différents emplacement (22,24,26), et des moyens de commande (50,52,54,56,58,60) pouvant agir de manière à incrémenter un nombre compté correspondant à un crédit en réponse au fait que le dispositif de validation (4) contrôle un article et détermine qu'il s'agit d'une pièce de monnaie authentique, afin d'autoriser la distribution d'un produit ou la délivrance d'un service si le nombre compté représentant un crédit est suffisant, et pour commander lesdits moyens d'acheminement (10), et dans lequel les moyens de commande (50,52,54,56,58) possèdent une mémoire (60) mémorisant un contenu modifiable, et des moyens (50) pour lire ce contenu et l'utiliser pour déterminer de quelle manière lesdits moyens de commande (50,52,54,56,58,60) fonctionnent, la machine comportant en outre des moyens (102,104,106) pouvant être actionnés manuellement et permettant à un dépanneur de déclencher la lecture et la modification d'au moins une partie du contenu de ladite mémoire (60), caractérisée en ce que ladite mémoire (60) possède des premiers emplacements, qui sont rendus accessibles à un dépanneur au moyen de l'actionnement des moyens pouvant être actionnés par le dépanneur, d'une première manière prédéterminée, afin de placer les moyens de commande (50,52,54,56,58,60) dans un premier mode d'accès, et des seconds emplacements, qui sont inaccessibles à un dépanneur dans ledit premier mode d'accès et sont accessibles dans un second mode d'accès, l'accès auxdits seconds emplacements nécessitant l'actionnement desdits moyens pouvant être actionnés manuellement, d'une seconde manière différente prédéterminée, qui implique l'introduction d'une valeur prédéterminée en l'un prédéterminé desdits premiers emplacements.

2. Machine selon la revendication 1, dans laquelle ladite mémoire (60) contient un emplacement, dont le contenu peut être modifié pour prendre au moins une valeur prédéterminée grâce à l'actionnement desdits moyens (102,103,104) pouvant être actionnés manuellement, dans l'un desdits modes d'accès, et qui peut être modifiée pour prendre au moins une valeur prédéterminée différente, uniquement sous l'effet de l'actionnement desdits moyens (102,104,106) pouvant être actionnés manuellement, selon un mode d'accès différent.

3. Machine selon l'une quelconque des revendications précédentes, incluant un système d'affichage (100) servant à afficher le contenu, dont la lecture est déclenchée par l'actionnement des moyens (102,104,106) pouvant être actionnés par le dépanneur.

4. Machine selon la revendication 3, dans lequel le système d'affichage (100) est en outre à même d'afficher les adresses des emplacements de mémoire, auxquels l'accès est réalisé.

5. Machine selon l'une quelconque des revendications précédentes, dans laquelle la mémoire (60) comprend un troisième ensemble d'emplacements, auquel l'accès peut être réalisé par actionnement des moyens (102,104,106) pouvant être actionnés par le dépanneur, selon une troisième manière prédéterminée.

6. Machine selon l'une quelconque des revendications précédentes, dans laquelle ladite mémoire (60) mémorise des paramètres déterminant les trajets respectifs (14,16,18,20), le long desquels les moyens d'acheminement (10) dirigent différents types d'articles sous la commande des moyens de commande (50,52,54,56,58,60).

7. Machine selon l'une quelconque des revendications précédentes, dans laquelle les moyens d'acheminement (10) comprennent une pluralité de portes, qui peuvent être actionnées de façon sélective par les moyens de commande (50,52,54,56,58,60) pour diriger des articles en des mémoires différents, et dans lequel la mémoire (60) mémorise les paramètres déterminant les durées, pendant lesquelles l es portes respectives sont ouvertes.

8. Machine selon l'une quelconque des revendications précédentes, dans laquelle la mémoire (60)

mémorise des paramètres déterminant de quelle manière le nombre compté constituant un crédit est incrément en réponse au contrôle de types différents de pièces de monnaie authentiques.

9. Machine selon l'une quelconque des revendications précédentes, dans laquelle la mémoire (60) mémorise une information de prix déterminant la valeur, jusqu'à laquelle le nombre compté constituant un crédit doit être incrémenté pour autoriser la distribution d'un produit ou la délivrance d'un service.

10. Machine selon l'une quelconque des revendications précédentes, dans laquelle lesdits moyens de commande (50,52,54,56,58,60) peuvent agir de façon additionnelle pour incrémenter ledit nombre compté constituant un crédit sans détermination du fait qu'un article contrôlé est une pièce de monnaie authentique.

11. Machine selon la revendication 10, dans laquelle ladite mémoire (60) mémorise un paramètre déterminant l'instant où ladite incrémentation additionnelle doit être exécutée.

12. Machine selon l'une quelconque des revendications précédentes, dans laquelle les moyens de commande (50,52,54,56,58,60) peuvent en outre être actionnés pour amener le distributeur (28) à délivrer au moins un type de pièce de monnaie authentique à partir d'un récipient (22, 24 ou 26) lors d'une opération lors de laquelle on rend la monnaie.

13. Machine selon la revendication 12, dans laquelle l'un desdits emplacements (22,24 ou 26), vers lesquels les pièces de monnaie sont dirigées, est ledit récipient, et dans lequel les moyens de commande (50,52,54,56,58,60) peuvent agir de manière à diriger des pièces de monnaie de ce type en direction dudit récipient (22,24,26) uniquement si le nombre des pièces de monnaie situées dans le récipient est inférieur à un nombre prédéterminé (FULNUM) mémorisé dans ladite mémoire (60).

14. Machine selon l'une quelconque des revendications précédentes, dans laquelle la mémoire possède une alimentation en énergie auxiliaire permettant à la mémoire de conserver son contenu lors d'une interruption de l'alimentation en énergie principale.

15. Machine selon l'une quelconque des revendications 1 à 13, dans laquelle une mémoire (60) est une mémoire morte, non volatile, modifiable électriquement.

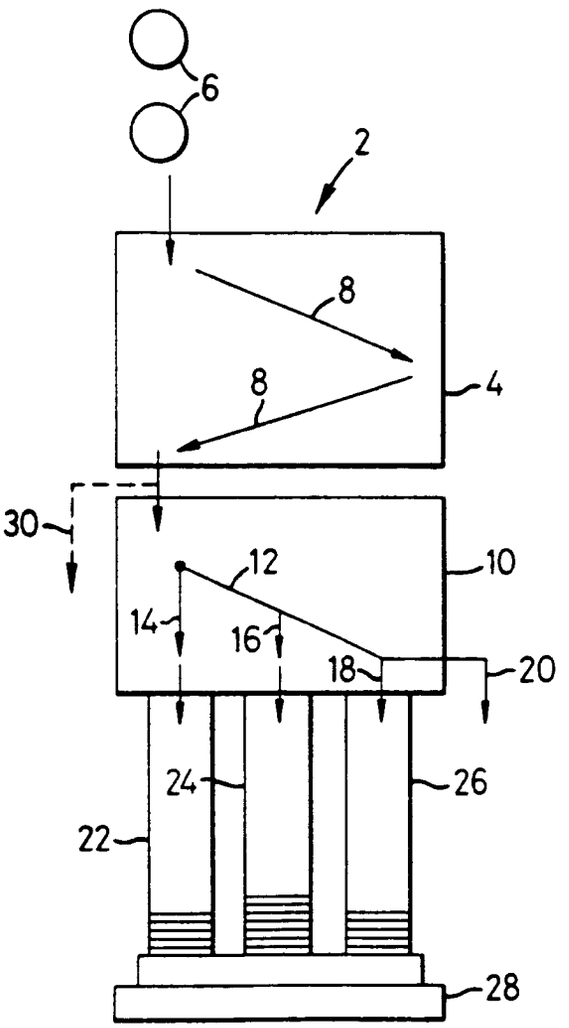

FIG.1

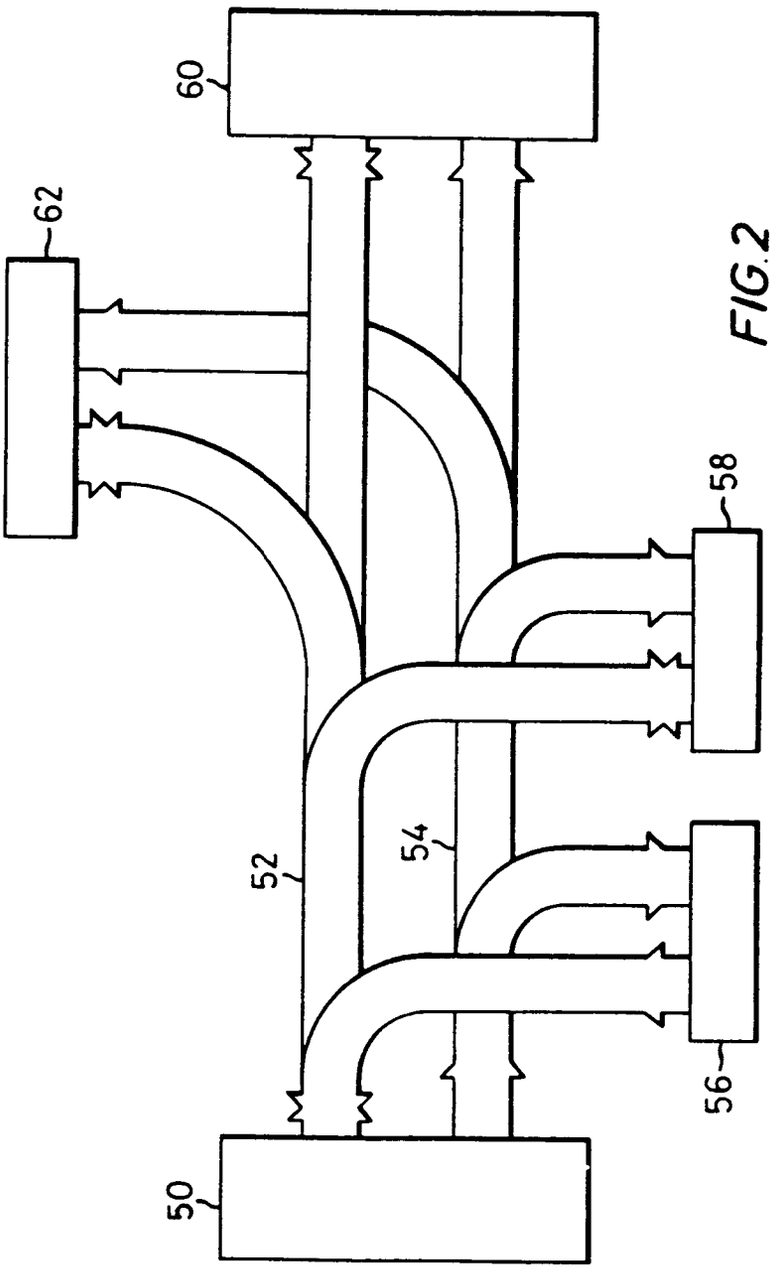

FIG.2

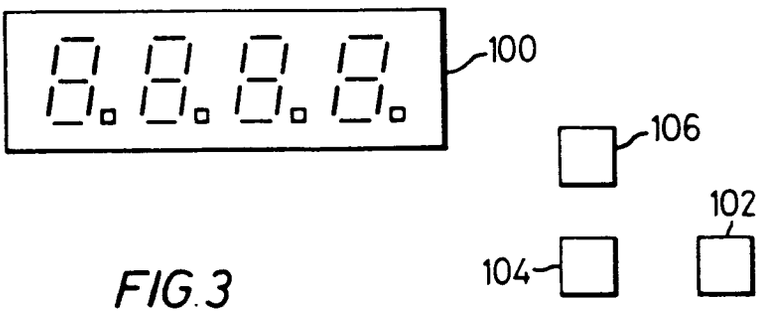

FIG.3

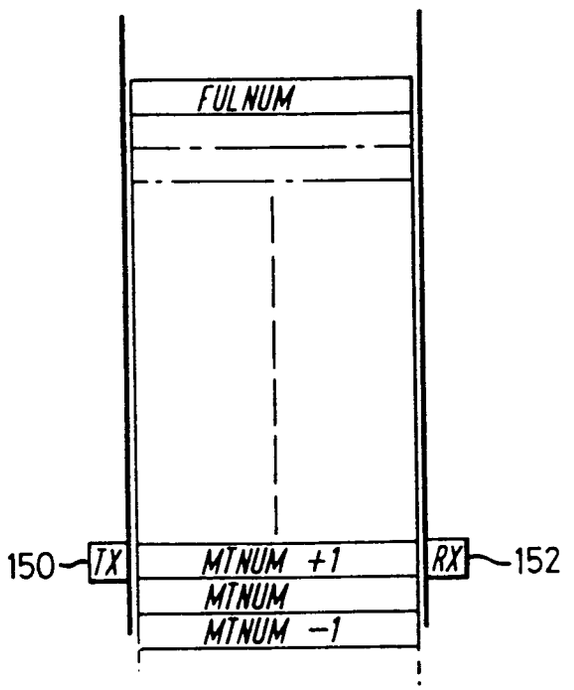

FIG.4

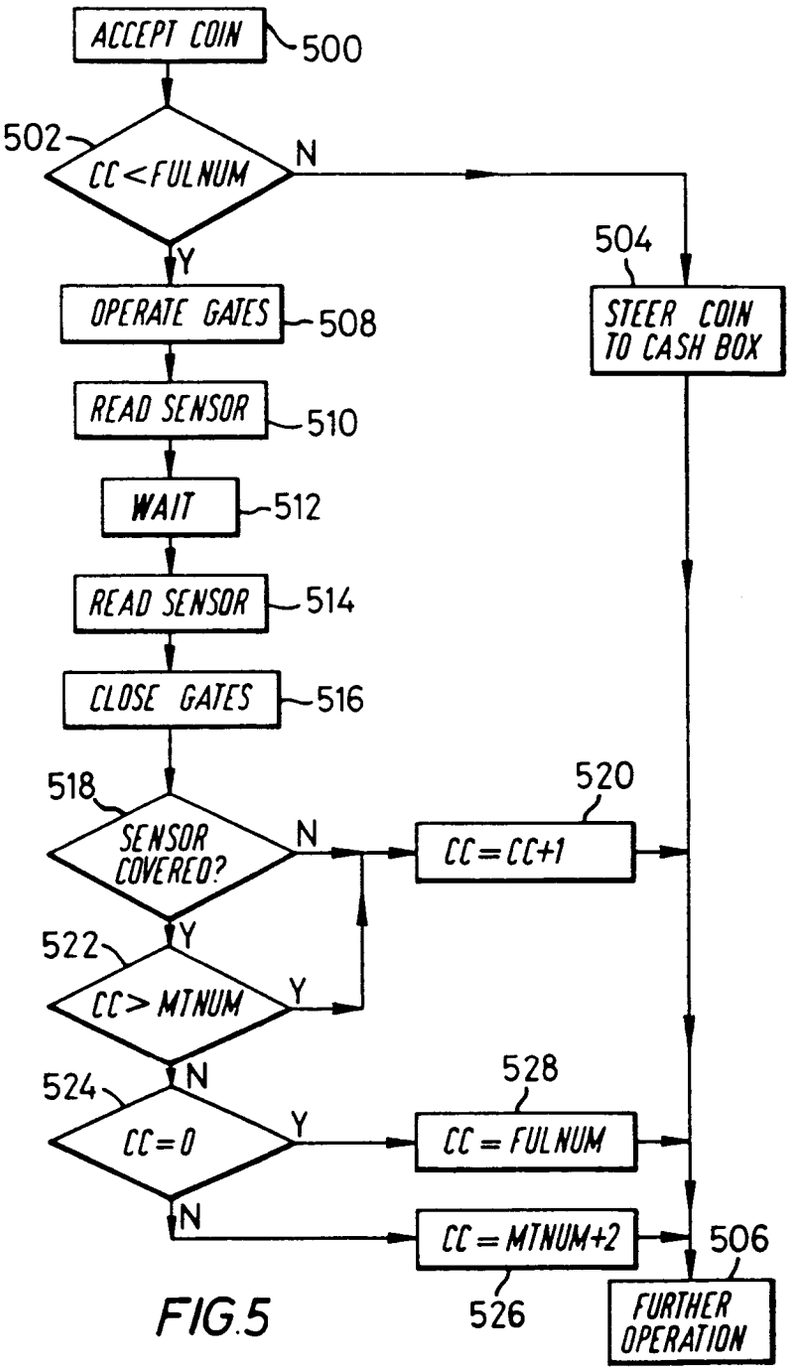
ACCEPT COIN
500
502
CC<FULNUM
N
Y
504
STEER COIN TO CASH BOX
OPERATE GATES
508
READ SENSOR
510
WAIT
512
READ SENSOR
514
CLOSE GATES
516
518
SENSOR COVERED?
N
520
CC=CC+1
Y
522
CC>MTNUM
Y
N
524
CC=0
Y
528
CC=FULNUM
N
CC=MTNUM+2
526
506
FURTHER OPERATION

FIG.5

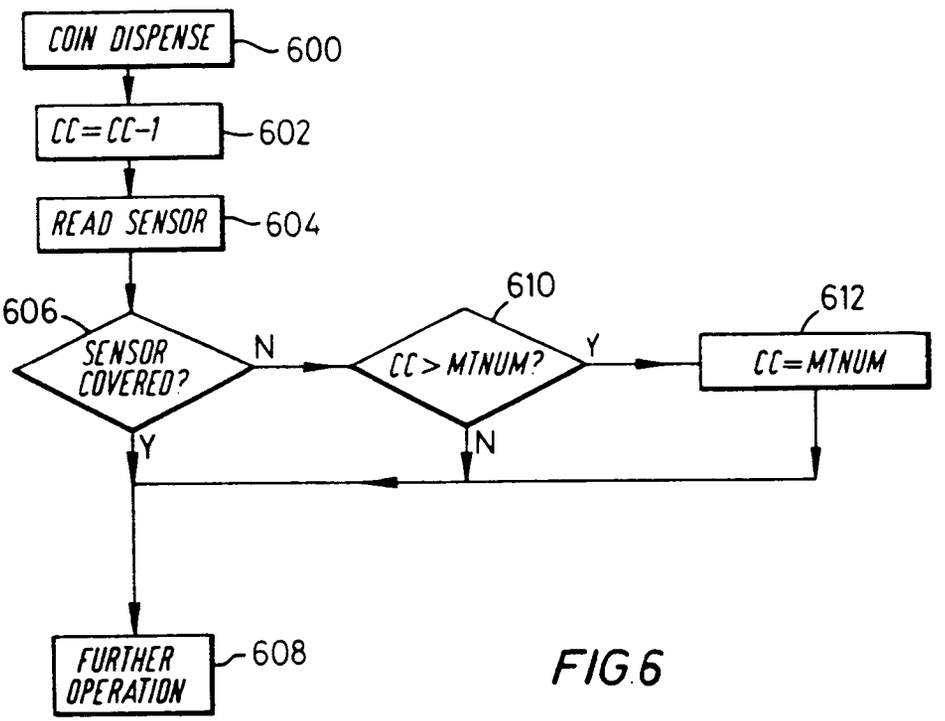
COIN DISPENSE
600
CC=CC-1
602
READ SENSOR
604
606
SENSOR COVERED?
N
610
CC>MTNUM?
Y
612
CC=MTNUM
Y
N
FURTHER OPERATION
608

FIG.6