

SPECIFICATION

TITLE OF THE INVENTION

COIN SORTER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a coin sorter to be incorporated in an automatic vending machine, an automatic exchanging machine or the like for sorting the coins it receives.

2. Background Art

Known coin sorters can be classified into mechanical type that uses mechanical means for detecting the material, the dimensions and the weight of each coin it receives and electronic type that relies on electronic means for such detection, of which the electronic type has been getting popularity because it is more reliable in terms of sorting accuracy and dimensional compactness. An electronic coin sorter typically comprises an oscillator coil arranged on a side of the moving track of received coins and designed to be oscillated with a predetermined frequency by electromagnetic excitation and an sensor coil arranged on the opposite side of the track and electromagnetically connected to the oscillator coil such that the denomination of the coin can be identified by detecting the output voltage of the

sensor coil that is attenuated when a coin passes between them and comparing it with a reference value, a predetermined tolerance being provided for the comparison as a function of the expected level of sorting accuracy. Therefore, the tolerance is reduced if a relatively rigorous sorting accuracy is selected and increased if a less rigorous sorting accuracy is required.

Known methods of selecting the sorting accuracy include the following; (1) the use of a switch for selecting the sorting accuracy provided for each denomination of the coins to be sorted and (2) the use of a mode selection switch that automatically operates for a given sorting accuracy level for a specific denomination according to the number of coins of the denomination received after the sorting accuracy switching mode is selected by the mode selection switch.

With the method (1) above, for instance, the operation of sorting out ¥10 coins from all the other coins is performed with a high level of sorting accuracy when the switch for ¥10 coins is turned on and with a low level of sorting accuracy when the switch is turned off. On the other hand, with the method (2) above, a tolerance of a first bandwidth corresponding to the lowest level of sorting accuracy is selected for ¥10 coins if a single ¥10 coin is received after the mode selection switch is turned on, another tolerance value of a second bandwidth corresponding to the second

lowest level of sorting accuracy is selected for ¥10 coins if two ¥10 coins are received after the switch is turned on, still another tolerance value of a third bandwidth corresponding to the third lowest level of sorting accuracy is selected for ¥10 coins if three ¥10 coins are received after the switch is turned on and so on.

Documents describing known coin sorters include Japanese Patent Publication No. 6-54509 (G07D 5/00).

However, with the above described known method (1), switches as many as the number of denominations of the coins to be sorted have to be provided for selecting the sorting accuracy and only two levels of sorting accuracy can be selected. With the known method (2), on the other hand, a large number of coins of a given denomination have to be prepared in order to enhance the sorting accuracy level for that denomination and hence a considerable time has to be spent for achieving the desired level if it is high.

SUMMARY OF THE INVENTION

In view of the above problems of known coin sorters, it is therefore the object of the present invention to provide a coin sorter with multiple sorting accuracy levels at low cost and each level can be selected quickly.

According to the invention, the above object is achieved by providing a coin sorter comprising a mode

switching means for switching from a coin sorting mode to a sorting accuracy level selection mode and vice versa, a memory means for storing the reference values with given respective tolerances for all the denominations to be dealt with the coin sorter, a coin determining means for determining the denomination and the genuineness of each received coin by comparing an output signal of a sensor arranged along a moving track of received coins and designed to produce the output signal representing certain properties of each received coin with a corresponding one of said reference values, a switch means for selecting a sorting accuracy level, a denomination specifying means for specifying a denomination according to the result of said coin determining means for each received coin in the sorting accuracy level selection mode and a sorting accuracy level selecting means for selecting an appropriate one of said tolerances according to the number of times for which said switch means is operated.

According to another aspect of the invention, there is provided a coin sorter comprising a mode switching means for switching from a coin sorting mode to a sorting accuracy level selection mode and vice versa, a memory means for storing the reference values with given respective tolerances for all the denominations to be dealt with the coin sorter, a coin determining means for determining the denomination and

the genuineness of each received coin by comparing an output signal of a sensor arranged along a moving track of received coins and designed to produce the output signal representing certain properties of each received coin with a corresponding one of said reference values, a switch means for selecting a sorting accuracy level, a denomination specifying means for specifying a denomination according to the result of said coin determining means for each received coin in the sorting accuracy level selection mode and a sorting accuracy level selecting means for selecting an appropriate one of said tolerances according to the period of time during which the switch means is depressed.

Preferably, said switch means may also be used for said mode switching means.

Preferably, the coin sorter may notify the selected sorting accuracy level by flashing an indicator lamp or sounding an indicator buzzer for a predetermined number of times after the selection of the sorting accuracy level selection mode.

Preferably, the coin sorting mode may be restored if no denomination is specified nor any tolerance is selected in a predetermined period of time after the selection of the sorting accuracy level selection mode.

With any of the above arrangement, the memory means stores the reference values with given respective tolerances

for all the denominations to be dealt with the coin sorter and the coin determining means determines the denomination and the genuineness of each received coin by comparing an output signal of a sensor arranged along the moving track of received coins and designed to produce the output signal representing certain properties of each received coin with a corresponding one of said reference values. When the sorting accuracy level selection mode is selected for such a coin sorter, the denomination specifying means specifies a denomination according to the result of said coin determining means for each received coin in the sorting accuracy level selection mode and the sorting accuracy level selecting means selects an appropriate one of said tolerances according to the number of times for which said switch means is operated or according to the period of time during which the switch means is depressed, whichever appropriate.

As a result, a sorting accuracy level can be selected for a specified denomination only by using a single coin of that denomination and turning on and off the switch means for a predetermined number of times. Thus, a multiple sorting accuracy levels can be provided without using a costly coin sorter and the operation of selecting a specific sorting accuracy level can be carried out in a very short period of time.

If a coin sorter according to the invention is so

arranged that the sorting accuracy level selection mode is automatically selected when said switch means is turned on or off, the switch means for selecting a sorting accuracy level can be used also as the mode switching means.

The selected sorting accuracy level can be confirmed by arranging the coin sorter such that it notifies the selected sorting accuracy level by flashing an indicator lamp or sounding an indicator buzzer for a predetermined number of times in the sorting accuracy level selection mode.

If a coin sorter according to the invention is so arranged that the coin sorting mode is restored if no denomination is specified nor any tolerance is selected in a predetermined period of time after the selection of the sorting accuracy level selection mode, the coin sorting mode can be restored by interrupting the ongoing operation even when the coin sorting mode selection mode is selected by mistake or the switch is depressed for a wrong number of times in the operation of selecting a sorting accuracy level.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a preferred embodiment of the invention.

Fig. 2 is a graph showing the relationship between the distribution of output data and the sorting accuracy level of the coin sorter.

Fig. 3 is a flow chart for the operation of selecting a sorting accuracy level.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, the present invention will be described by referring to the accompanying drawings that illustrate a preferred embodiment of the invention.

Fig. 1 is a block diagram of the preferred embodiment. Referring to Fig. 1, it comprises a microcomputer 1, a coin sensor 2, a coin determining circuit 3, a solenoid driver 4, a real/false coins sorting solenoid 5, a passing coin sensor 6, a passing coin identifying circuit 7, a sorting accuracy level selecting switch 8, which may be a button switch or a touch type switch, a lamp driver 9 and an indicator lamp 10.

The coin sensor 2 is arranged along a moving track of the coins received by the coin sorter and comprises an oscillator coil and a receiver coil. The coin determining circuit 3 determines the denomination and the genuineness of the coin being sorted according to voltage representing certain properties of the coin and outputted from the coin sensor 2. The solenoid driver 4 drives the real/false coins sorting solenoid 5 to forward the coin to a real coin track or a false coin track according the result of the operation of the coin determining circuit 3. The passing coin sensor 6

and the passing coin identifying circuit 7 detects the coin passing through the real coin track. The lamp driver 9 and the indicator lamp 10 are arranged to confirm the sorting accuracy level selected at the time when the current sorting accuracy level selection mode is selected. The microcomputer 1 controls the coin determining circuit 3, the solenoid driver 4, the passing coin identifying circuit 7, the lamp driver 9 and other related components and comprises a memory M for storing the reference values for all the denominations of coins and the related tolerances for each of the sorting accuracy levels with which the coin sorter can operate.

Now, the relationship between the sorting accuracy level and the tolerance will be described below.

Fig. 2 is a graph showing the relationship between the distribution of output data from the coin sensor and the sorting accuracy level. The transverse axis of the graph represents the output voltage of the coin sensor 2 and the ordinate axis represents the frequency of occurrences for each of given bandwidths.

Referring to Fig. 2, if five levels of I through V are arranged for the sorting accuracy, a largest tolerance bandwidth is assigned to the accuracy level I on the both sides of voltage V_0 . a second largest tolerance bandwidth is assigned to the accuracy level II, a third largest tolerance bandwidth is assigned to the accuracy level III and so on, a

smallest or most rigorous tolerance bandwidth being assigned to the accuracy level V.

A desired sorting accuracy level is selected in the above embodiment by the following operational procedures.

Fig. 3 is a flow chart for the operation of selecting a sorting accuracy level. This operation is carried out by the microcomputer 1 (shown in Fig. 1) when the sorting accuracy level selecting switch 8 (shown in Fig. 1) is turned on.

Step 1: The microcomputer determines if the number of times for which the sorting accuracy level selecting switch 8 is turned on within a predetermined time interval is one or not.

Step 2: If the number of times is one, the microcomputer 1 starts a timer for timing the elapse of a predetermined period of time (typically several seconds). The timer is incorporated in the program for this operation.

Step 3: It checks the output of the passing coin identifying circuit 7 and determines if a coin is received by the coin sorter or not.

Step 4: If there is no received coin, it determines if the timer has run out of time or not.

Step 5: If it is determined in Step 3 that there is a received coin, it determines the denomination of the received coin according to the output of the coin determining

circuit 3 and selects the level I of sorting accuracy for the denomination.

Step 6: It causes the lamp driver 9 to flash the indicator lamp 10 once in order to notify that the level I is selected for coin sorting accuracy.

Step 7: If it is determined in Step 1 that the number of times for which the switch is turned on is not one, it determines if the number of times for which the switch is turned on is two or not.

Steps 8 through 10: Similar to Steps 2 through 4.

Step 11: If it is determined in Step 9 that there is a received coin, it determines the denomination of the received coin according to the output of the coin determining circuit 3 and selects the level II of sorting accuracy for the denomination.

Step 12: It causes the lamp driver 9 to flash the indicator lamp 10 twice in order to notify that the level II is selected for coin sorting accuracy.

Step 13: If it is determined in Step 7 that the number of times for which the switch is turned on is not two, it determines if the number of times for which the switch is turned on is three or not.

Steps 14 through 16: Similar to Steps 2 through 4.

Step 17: If it is determined in Step 15 that there is a received coin, it determines the denomination of the

received coin according to the output of the coin determining circuit 3 and selects the level III of sorting accuracy for the denomination.

Step 18: It causes the lamp driver 9 to flash the indicator lamp 10 three times in order to notify that the level III is selected for coin sorting accuracy.

In a similar way, the level IV or V of sorting accuracy is selected if the number of times for which the sorting accuracy level selecting switch 8 is turned on four times or five times respectively.

While a sorting accuracy level is selected according to the number of times for which the sorting accuracy level selecting switch 8 is turned on in the above embodiment, it may alternatively be so arranged that a sorting accuracy level is selected according to the period of time during which the switch 8 is depressed. With such an arrangement if the indicator lamp 10 is designed to flash with predetermined regular intervals as long as the switch 8 is depressed, the number of times for which the lamp 10 flashes corresponds to the period of time during which the switch 8 is depressed or the selected level of sorting accuracy so that the operator can depress the sorting accuracy level selecting switch 8 for a right period of time.

While the above embodiment sorts coins it receives by comparing the output voltage of the coin sensor 2 with a

reference value for each, a coin sorter according to the invention may be so arranged as to compare the output frequency of the coin sensor 2 with a reference value for each coin. Again, while the above embodiment uses an indicator lamp that flashes for a number of times corresponding to the selected sorting accuracy level, the indicator lamp 10 may be replaced by an indicator buzzer that sounds for a number of times corresponding to the selected sorting accuracy level.

[Advantages of the Invention]

As described above in detail, with a coin sorter according to the invention, a sorting accuracy level can be selected for a specified denomination only by using a single coin of that denomination and turning on and off the switch means for a predetermined number of times. Thus, a multiple sorting accuracy levels can be provided without using a costly coin sorter and the operation of selecting a specific sorting accuracy level can be carried out in a very short period of time.

Additionally, if a coin sorter according to the invention is so arranged that the sorting accuracy level selection mode is automatically selected when said switch is turned on or off, the switch means for selecting a sorting accuracy level can be used also as the mode switching means.

Still additionally, the selected sorting accuracy level can be confirmed by arranging the coin sorter such that it notifies the selected sorting accuracy level by flashing an indicator lamp or sounding an indicator buzzer for a predetermined number of times in the sorting accuracy level selection mode.

Finally, if a coin sorter according to the invention is so arranged that the coin sorting mode is restored if no denomination is specified nor any tolerance is selected in a predetermined period of time after the selection of the sorting accuracy level selection mode, the coin sorting mode can be restored by interrupting the ongoing operation even when the coin sorting mode selection mode is selected by mistake or the switch is depressed for a wrong number of times in the operation of selecting a sorting accuracy level.

WHAT IS CLAIMED IS:

1. A coin sorter comprising:

a mode switching means for switching from a coin sorting mode to a sorting accuracy level selection mode and vice versa;

a memory means for storing reference values with given respective tolerances for all the denominations to be dealt with the coin sorter;

a coin determining means for determining the denomination and the genuineness of each received coin by comparing an output signal of a sensor arranged along a moving track of received coins and designed to produce the output signal representing certain properties of each received coin with a corresponding one of said reference values;

a switch means for selecting a sorting accuracy level;

a denomination specifying means for specifying a denomination according to the result of said coin determining means for each received coin in the sorting accuracy level selection mode; and

a sorting accuracy level selecting means for selecting an appropriate one of said tolerances according to the number of times for which said switch means is operated.

2. A coin sorter comprising:



a mode switching means for switching from a coin sorting mode to a sorting accuracy level selection mode and vice versa;

a memory means for storing reference values with given respective tolerances for all the denominations to be dealt with the coin sorter;

a coin determining means for determining the denomination and the genuineness of each received coin by comparing an output signal of a sensor arranged along a moving track of received coins and designed to produce the output signal representing certain properties of each received coin with a corresponding one of said reference values;

a switch means for selecting a sorting accuracy level;

a denomination specifying means for specifying a denomination according to the result of said coin determining means for each received coin in the sorting accuracy level selection mode; and

a sorting accuracy level selecting means for selecting an appropriate one of said tolerances according to the period of time during which the switch means is depressed.

3. A coin sorter according to claims 1 or 2, wherein said switch means is also used for said mode switching means.



4. A coin sorter according to any one of claims 1, 2 and 3, wherein the selected sorting accuracy level is notified by flashing an indicator lamp or sounding an indicator buzzer for a predetermined number of times after the selection of the sorting accuracy level selection mode.

5. A coin sorter according to any one of claims 1, 2, 3 and 4, wherein the coin sorting mode is restored if no denomination is specified nor any tolerance is selected in a predetermined period of time after the selection of the sorting accuracy level selection mode.

