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Specification

Title of the Invention

Coin Accumulation Apparatus

5 Background of the Invention

The present invention relates to a coin accumulation apparatus for accumulating an inserted and sorted coin.

A coin accumulation apparatus of this type is used for, e.g., a public telephone or a vending machine. When coins are inserted, this apparatus sorts the inserted coins on the basis of the size and material. Coins which are determined as authentic coins upon sorting are accumulated in a coin accumulation section.

15 The authentic coins accumulated in the coin accumulation section are stored in a coin storage section in response to speech communication in the public telephone or purchase of goods in the vending machine.

Figs. 11A and 11B schematically show the section of a coin distribution section in a conventional coin accumulation apparatus. In Figs. 11A and 11B, reference symbol CO denotes an inserted coin. Reference numeral 101 denotes a sorting lever; 102, a return lever which swings about a fulcrum C in a direction indicated by arrows; and 103, a path through which the coin CO rolls.

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In this arrangement, when the inserted coin CO rolling along the path 103 is not an authentic coin, the sorting lever 101 does not operate, so accumulation of the inserted coin CO in the coin accumulation section is inhibited, as shown in Fig. 11A. In this case, the inserted coin CO is returned through a return path in accordance with clockwise pivotal motion of the return lever 102.

On the other hand, when the inserted coin CO rolling along the path 103 is an authentic coin, the sorting lever 101 is actuated to guide the inserted coin CO to the accumulation section, as shown in Fig. 11B. Upon confirming, with a sensor, that one authentic coin is accumulated in the accumulation section or has passed through the coin distribution section to the coin accumulation section side, the sorting lever 101 is restored.

Assume that authentic coins are continuously inserted. When the first coin rolls onto the return lever 102, a rear end portion 102A of the return lever 102 swings clockwise from the rolling surface of the coin path 103 and inhibits the second coin from passing to the accumulation section.

As a measure against continuous insertion of coins, the conventional coin accumulation apparatus inhibits accumulation of subsequent coins in the accumulation section by using the return lever 102. For

this reason, the return lever 102 having an arc length larger than the coin diameter and the return lever pivoting space are required. This results in an increase in cost of the apparatus, and simultaneously, size reduction of the apparatus is difficult.

Summary of the Invention

It is an object of the present invention to provide a compact and inexpensive coin accumulation apparatus having no return lever as a measure against continuous insertion of coins.

In order to achieve the above object, according to the present invention, there is provided a coin accumulation apparatus comprising a coin sorting section for sorting coins inserted from a coin slot into an authentic coin and a counterfeit coin, the coins including first and second coins, a coin sensor arranged in a coin path from the coin slot to the coin sorting section, a coin accumulation section for accumulating the authentic coin, a coin return section for returning the counterfeit coin, a sorting lever for distributing the inserted coin to one of the coin accumulation section and the coin return section on the basis of a sorting result by the coin sorting section, a magnet for driving the sorting lever, and control means for, when the coin sorting section determines that the first coin is an authentic coin, starting driving the magnet, and when the second coin following the first coin is

detected by the coin sensor within a predetermined time from the start of driving to the start of an operation of the sorting lever, immediately stopping driving the magnet, thereby distributing the first and second coins
5 to the return section.

Brief Description of the Drawings

Fig. 1 is a block diagram showing the electrical arrangement of a public telephone having a coin accumulation apparatus shown in Fig. 4;

10 Figs. 2A to 2E are flow charts showing the operation of the public telephone shown in Fig. 1;

Fig. 3 is a flow chart showing details of an SM magnet operation shown in Fig. 2C;

Fig. 4 is a schematic view showing the
15 arrangement of a coin accumulation apparatus according to an embodiment of the present invention;

Fig. 5 is a longitudinal sectional view of the coin accumulation apparatus shown in Fig. 4;

Fig. 6A is a front view showing the
20 arrangement of a coin accumulation section shown in Figs. 4 and 5;

Figs. 6B and 6D are plan views showing the arrangement of the coin accumulation section shown in Figs. 4 and 5;

25 Fig. 6C is a sectional view showing the arrangement of the coin accumulation section shown in Figs. 4 and 5;

Figs. 7A and 7B are views for explaining the operation of a coin distribution section;

Figs. 8A and 8B are timing charts of a sorting magnet and sorting lever for accumulating/returning a
5 coin;

Figs. 9A to 9F are views showing the operating states of the sorting lever shown in Figs. 7A and 7B;

Fig. 10 is a block diagram showing the driving circuit for the sorting magnet shown in Figs. 9A and 9B;
10 and

Figs. 11A and 11B are views showing a conventional measure against continuous insertion of coins.

Description of the Preferred Embodiment

15 The present invention will be described below in detail with reference to the accompanying drawings.

Fig. 4 schematically shows the arrangement of a coin accumulation apparatus used for a public telephone. A coin accumulation apparatus 1 comprises a
20 sorting passage 11 as a path for sorting coins, an accumulation passage 12 as a path for coins which are determined as authentic coins upon sorting and to be accumulated, an accumulation section 13 arranged at the terminal end of the accumulation passage 12 to
25 accumulate coins, return passages 14, 15A, and 15B as coin return paths, a storage passage 16 as a coin storage path, and a storage passage 17 for storing

coins. The return passage 15A is used to return coins accumulated in the accumulation section 13. The return passages 14 and 15B are used to return coins which are determined as defective coins upon sorting.

5 An inserted coin CA is detected by an insertion detection sensor 41. It is determined whether the inserted coin CA is an authentic coin on the basis of the diameter and material respectively detected by a diameter sensor 42 and a material sensor 43 provided in
10 the sorting passage 11. If it is determined upon sorting that the inserted coin has a defect, a sorting lever 50B is switched to the return passage 14 side so that the defective coin is returned through the return passages 14 and 15B as a returned coin CC. The returned
15 coin CC is detected by a return detection sensor 47.

 On the other hand, when it is determined upon sorting that the inserted coin is an authentic coin, the sorting lever 50B is switched to the accumulation
passage 12 side so that the authentic coin is guided to
20 the accumulation section 13 through the accumulation passage 12. The authentic coin is detected by pass sensors 44A and 44B provided in the accumulation passage 12 and then accumulated in the accumulation section 13 as an accumulated coin CB.

25 The accumulation section 13 has a plurality of racks which are integrally arranged in the horizontal direction to accumulate coins with their surfaces

opposing each other. To accumulate a coin, the accumulation section 13 slides in the direction of thickness of coins to position a free rack at the position of the accumulation passage 12, thereby
5 accumulating a coin in each rack.

When coins are accumulated in the accumulation section 13, and speech communication is performed in the public telephone, one of the accumulated coins is stored in a coin box (not shown) through the storage passage 16
10 as a stored coin. At this time, the stored coin is detected by a storage detection sensor 46. When speech communication is complete, all coins remaining in the accumulation section 13 are returned through the return passage 15A. In both storing and returning a coin in
15 the accumulation section 13, the accumulation section 13 slides in the direction of thickness of coins such that the rack where the coin is accumulated coincides with the position of the storage port or the return port.

Fig. 5 shows the longitudinal section of the coin accumulation apparatus shown in Fig. 4. The coin
20 accumulation apparatus has not only the sensors arranged in the passages shown in Fig. 4 but also a sorting magnet (SM magnet) 50A for driving the sorting lever 50B shown in Fig. 8, a storage/return lever 52B for guiding
25 the accumulated coin CB in the accumulation section 13 to the storage passage 16 or a return passage 15, a magnet 52A for driving the storage/return lever 52B,

accumulation gates 53B for accumulating/holding the accumulated coins CB in the accumulation section 13, and a magnet 53A for opening/closing the accumulation gate 53B.

5 As described above, the accumulation section 13 has a plurality of racks integrally formed, and coins are individually accumulated in the racks. These racks are slid by rotating a motor, as will be described later. To accumulate a coin, one of free racks and the
10 outlet of the accumulation passage 12 are positioned, so that the coin is accumulated in the free rack.

 To store a coin accumulated in one of the racks of the accumulation section 13, a predetermined rack is slid and positioned to the inlet of the storage
15 passage 17. The magnet 53A is driven to open the accumulation gate 53B of the rack, thereby storing/returning the coin.

 The accumulation gates 53B of the racks are opened/closed under the control of a common magnet 53A.
20 More specifically, when a rack moves to the storage position, an arm 53C is actuated by driving the magnet 53A to open the accumulation gate 53B of the rack, as shown in Fig. 6D. After this, when the magnet 53A is restored, the accumulation gate 53B is closed by a
25 spring (not shown).

 As shown in Figs. 6A and 6B, the accumulation section 13 has eight racks R1 to R8 capable of

accumulating coins, and racks H and H' arranged to sandwich the racks R1 to R8 and guide an inserted coin to the return passage 15A. The racks H and H' have no accumulation gates.

5 The rotation speed of a motor M for sliding the racks is detected by an encoder E shown in Fig. 6A and transmitted to a control circuit such as a CPU (Central Processing Circuit). As shown in Fig. 6A, the accumulation section 13 has hole portions (slits) 13A
10 and 13B. These slits 13A and 13B are detected by a rack position sensor 45 shown in Fig. 6C and transmitted to the control circuit. The control circuit recognizes the rack sliding condition from the detected slit positions.

 An operation of distributing the inserted coin
15 CA will be described next. If it is determined that the inserted coin CA is a defective coin, the restored state is maintained without driving the sorting magnet 50A.
 With this operation, the sorting lever 50B is kept in a coin blocking state, thereby guiding the inserted coin
20 CA to the return passage 14, as shown in Fig. 7A. On the other hand, when the inserted coin CA is determined as an authentic coin, the sorting magnet 50A is driven to retreat the sorting lever 50B from the coin passage and open the coin passage, thereby guiding the inserted
25 coin CA to the accumulation passage 12, as shown in Fig. 7B.

This will be described in detail. As shown in Fig. 10, the sorting magnet 50A is driven by an operating current from a sorting magnet driving circuit 50 under the control of a control circuit 40 to close (closed state) and open (open state) the coin passage with the sorting lever 50B.

More specifically, when an operation signal a is output from the control circuit 40, the sorting magnet driving circuit 50 energizes a coil 50C of the sorting magnet 50A in the operation direction to open the sorting lever 50B. When a restoration signal b is output from the control circuit 40, the sorting magnet driving circuit 50 energizes the coil 50C of the sorting magnet 50A in the restoration direction to close the sorting lever 50B.

Figs. 8A and 8B show the relationship between the timing for supplying the operating current to the coil 50C of the sorting magnet 50A and the timing when the sorting lever 50B changes from the closed state (restored state) to the open state (operating state).

At timing t1, the operation signal a is output from the control circuit 40, and the operating current is supplied from the sorting magnet driving circuit 50 to the coil 50C. At timing t2 30 ms after timing t1, driving the sorting lever 50B is started. At timing t3 40 ms after timing t1, the sorting lever 50B is opened.

Figs. 9A to 9F schematically show the operating states of the sorting lever 50B in correspondence with timings t1 to t3 in Figs. 8A and 8B. The sorting lever 50B has an L-shaped arm 50E having a distal end portion 50h and a lever portion (delay lever mechanism) 50D having a notch portion 50F with a cam surface. The sorting lever 50B swings about a fulcrum 50G.

In the closed state until timing t1, the sorting lever 50B is at a position shown in Figs. 9A and 9C. The inserted coin CA rolling through the coin passage is blocked by the sorting lever 50B, drops from the coin passage, and is guided to the return passage 14. At timing t1, energization to the coil 50C of the sorting magnet 50A is started. Until timing t2 30 ms after timing t1, the sorting lever 50B which performs a delay operation keeps the closed state.

At timing t2, the arm 50E starts pivoting clockwise about the fulcrum 50G, as shown in Fig. 9D. At this time, the distal end portion 50h of the arm 50E slides on the cam surface of the notch portion 50F.

After timing t2, the arm 50E is further pivoted clockwise, so the distal end portion 50h disengages from the cam surface of the notch portion 50F, as shown in Fig. 9E. After this, as shown in Fig. 9F, the distal end portion 50h of the arm 50E pivoted clockwise is brought into contact with the edge

of the notch portion 50F, so the sorting lever 50B starts pivoting together with the arm 50E.

At timing t3 40 ms after the start of energization to the sorting magnet 50A, the sorting lever 50B retreats from the coin passage and is opened, as shown in Fig. 9B. In this state, the inserted coin CA rolling through the coin passage reaches the accumulation passage 12 without being blocked by the sorting lever 50B and is accumulated in the accumulation section 13.

When the coil 50C of the sorting magnet 50A is energized in the restoration direction in the state shown in Fig. 9B, as shown in Figs. 8A and 8B, the arm 50E returns to the initial state in Fig. 9C, and the sorting lever 50B also returns to the state in Fig. 9A.

As described above, the sorting magnet 50A requires a time of 30 ms from the start of energization to the coil 50C until the sorting lever 50B starts the opening operation of guiding the coin to the accumulation section 13. Therefore, when energization is stopped within 30 ms after the start of energization to the coil 50C, the sorting lever 50B maintains the closed state.

When coins continuously roll, the accumulation section 13 cannot accumulate a plurality of authentic coins in one rack. In this case, the above-described characteristics of the sorting magnet 50A are utilized.

If it is determined that the second coin is inserted while the sorting magnet 50A is being driven to accumulate the first authentic coin, energization to the sorting magnet 50A is stopped. With this operation,
5 both the first and second coins are guided to the return passage 14, so the two authentic coins are prevented from being guided to one rack.

Fig. 1 shows the arrangement of the control system of a public telephone of a station power supply
10 scheme having the above-described coin accumulation apparatus.

Referring to Fig. 1, reference numeral 21 denotes a GS relay driving circuit for closing the DC loop of telephone lines (to be referred to as lines
15 hereinafter) L1 and L2; 22, a coin box removal detection circuit for detecting removal of the coin box for storing coins; 23, an off-hook detection circuit; 24, a reset circuit; and 25, a call reception detection circuit. Reference numeral 26 denotes a charging signal
20 reception circuit for receiving a charging signal arriving at the lines L1 and L2; 27, a polarity inversion/line disconnection detection circuit for detecting polarity inversion and line disconnection of the lines L1 and L2; 28, a diode bridge for giving a
25 polarity to the output stage; 29, a modem for transmitting/receiving communication information of various types; and 30, a power supply circuit for

storing a microcurrent from the station power supply and supplying the stored voltage to the portions of the telephone.

Reference numeral 31 denotes a forced
5 disconnection circuit for forcibly disconnecting the loop of the lines L1 and L2 because of a shortage of cash; 32, a mute circuit for short-circuiting the output stage in sending a dialing signal; 33, a talking circuit connected to the lines L1 and L2; 34, an MF (Multi
10 Frequency) signal sending circuit for outputting a dialing signal or various tone signals to the lines L1 and L2; 35, an MF reception circuit for receiving an MF signal arriving from the lines L1 and L2; 36, a DT
15 signal reception circuit for detecting a dial tone (DT) arriving at the lines L1 and L2; and 37, a theft detection circuit for detecting theft of a handset constituted by a transmitter T and a receiver R.

The control circuit 40 is constituted by a CPU (Central Processing Unit) for controlling the entire
20 public telephone. Not only the above-described units but also the sensors 41 to 47 described with reference to Figs. 4 and 5 are connected to the control circuit 40. In addition, magnet driving circuits 50, 52, and 53 for driving magnets and a motor driving circuit 51 for
25 driving the motor M are also connected to the control circuit 40.

The control circuit 40 is also connected to the encoder E for detecting the rotation situation of the motor M, a TRR relay driving circuit 54, an LCD (display section) 55, a keyboard 56 having dial keys and
5 the like, and a memory 57. Reference symbol HS denotes a hook switch; gs, a GS relay contact; r1 and r2, R relay contacts; and trr1 and trr2, TRR relay contacts.

The operation of the control circuit 40 of the public telephone having the above arrangement will be
10 described next with reference to the flow charts of Figs. 2A to 2E and 3.

In Fig. 2A, when an off-hook operation is performed to use the public telephone, the hook switch HS in Fig. 1 is turned on. With this operation, the DC
15 loop of the lines L1 and L2 is closed, and simultaneously, the GS relay driving circuit 21 is driven by the output from the off-hook detection circuit 23, and the GS relay contact is also closed (step S1). The microcurrent from the station power supply is
20 supplied to the power supply circuit 30 through the closed lines L1 and L2. The power supply voltage is output from the power supply circuit 30 to various portions including the control circuit 40, so the control circuit 40 is powered on (step S2).

25 The powered-on control circuit 40 controls the motor driving circuit 51 to rotate the motor M and checks whether rack movement in the accumulation section

13 is normally performed (step S3). If YES in step S3,
it is detected through the rack position sensor 45
whether the rack H shown in Figs. 6A and 6B is at the
home position corresponding to the outlet of the
5 accumulation passage 12 (step S4).

If YES in step S4, a DT (dial tone) detection
timer (not shown) is started (step S5). If time in the
DT detection timer is not up yet (step S6), the relay
contacts r1 and r2 are switched to the mute circuit 32
10 side, and the presence/absence of a DT arriving at the
lines L1 and L2 is determined through the DT signal
reception circuit 36 (step S7).

The presence/absence of an accumulated coin in
each rack is stored in a predetermined area of the
15 memory 57. If YES in step S7, the control circuit 40
confirms, with reference to the corresponding area of
the memory 57, whether coins are accumulated in all of
the racks R1 to R8 of the accumulation section 13, i.e.,
a full accumulation state is set (step S8). If NO in
20 step S8, a free rack is checked (step S9). If the free
rack opposes the outlet of the accumulation passage 12,
the flow advances to step S31 in Fig. 2B.

If it is determined in step S10 that the free
rack does not oppose the outlet of the accumulation
25 passage 12, it is determined whether the motor M is to
be rotated in the forward direction or reverse direction
to cause the free rack to oppose the outlet of the

accumulation passage 12 (step S11). For forward rotation, motor forward rotation processing is performed (step S12). For reverse rotation, motor reverse rotation processing is performed (step S13). Next, 5 time-up of a timer which has started in step S12 or S13 is determined (step S14). If a predetermined free rack is slid to the outlet of the accumulation passage 12 before time-up, rack operation OK information is set in the memory 57 (step S15), and the flow advances to step 10 S31 in Fig. 2B.

If time is up in the timer before the free rack slides to the outlet of the accumulation passage 12, the flow advances to steps S20 and S21 (to be described later), and then step S22. In step S22, use 15 inhibition is displayed on the LCD 55, and processing waits for on-hook (step S17). When an on-hook state is detected through the off-hook detection circuit 23, the forced disconnection circuit 31 is controlled to disconnect the DC loop of the lines L1 and L2 for 1 sec 20 and disconnect the line (step S18). After this, the GS relay driving circuit 21 is driven to restore the GS relay (step S19), and the telephone is powered off.

Similarly, when the rack sliding operation is not normally performed in step S3, error processing from 25 step S22 is performed. If time in the DT detection timer is up before DT detection in step S6, an on-hook instruction is displayed on the LCD 55 (step S16).

After this, error processing from step S17 is executed. When the rack does not slide to the home position in step S4, abnormality processing (to be described later) from step S101 in Fig. 2E is performed. If coin
5 accumulation in all racks (full accumulation) is detected in step S8, it is determined whether coins necessary for speech communication are accumulated in the accumulation section 13, and the flow advances to step S42 in Fig. 2B to allow dialing.

10 In processing from step S31 in Fig. 2B, first, it is determined, on the basis of information stored in the memory 57, whether a coin to be stored or returned is present in the accumulation section 13. If a coin to be stored or returned is present, the coin is stored or
15 returned. That is, it is determined whether the rack where the coin to be stored is accumulated is at the storage position (the position corresponding to the inlet of the storage/return passage 17) (step S31).

If YES in step S31, the switch lever 52B is
20 switched to guide the coin to the storage passage 16 side, and then the accumulation gate of the rack is opened to store the accumulated coin to the coin box through the storage/return passage 17 and the storage passage 16 (step S32). At this time, the output from
25 the storage detection sensor 46 is checked to determine whether the coin is normally stored in the coin box (step S35). If YES in step S35, the corresponding

information stored in the memory 57 is cleared (step S36).

5 If NO in step S31, it is determined whether the rack which accumulates the coin to be returned is at the position corresponding to the inlet of the storage/return passage 17 (step S33). If YES in step S33, the switch lever 52B is switched to guide the coin to the return passage 15B side, and then, the accumulation gate of the rack is opened to return the
10 accumulated coin through the storage/return passage 17 and the return passage 15A (step S34). At this time, the output from the return detection sensor 47 is checked to determine whether the coin is normally returned (step S35). If YES in step S35, the
15 corresponding information stored in the memory 57 is cleared (step S36).

Next, it is determined whether the free rack is at the accumulation position (the outlet of the accumulation passage 12). If NO in step S37, the flow
20 returns to step S8 in Fig. 2A, and in processing from step S11, the motor M is rotated in the forward or reverse direction to move the free rack to the accumulation position. If NO in step S37, insertion of a coin is permitted (step S38), and the credit (amount
25 of accumulated coins) and the tariff (telephone charge per unit time) are compared (step S39).

Immediately after the off-hook operation, no coin to be stored or returned is present in the accumulation section 13, and the flow immediately advances to step S37. In this case, the amount of coins accumulated in the accumulation section 13 is "0", and a coin insertion permission is displayed on the LCD 55 (step S40).

After the insertion detection sensor 41, the diameter sensor 42, and the sort sensor 43 are energized, it is determined through the insertion detection sensor 41 whether coin insertion is detected (step S41). If YES in step S41, the flow advances to step S51 in Fig. 2C.

In step S51 in Fig. 2C, it is determined, on the basis of the sorting result of the diameter sensor 42 and the sort sensor 43, whether the inserted coin is an authentic coin (step S52). If YES in step S52, energization to the sensors is stopped to stop sorting coins (step S53). Next, the SM magnet (sorting magnet) 50A is driven (step S54) to change the sorting lever 50B from the closed state shown in Fig. 7A to the open state shown in Fig. 7B to guide the inserted coin to the accumulation passage 12. Almost simultaneously with driving the sorting lever, the pass sensors 44A and 44B are energized.

The contents of driving processing of the SM magnet 50A in step S54 will be described later in detail with reference to the flow chart of Fig. 3.

After the accumulation timer is started (step
5 S55), it is determined whether the inserted coin has sequentially passed the positions of the pass sensors 44A and 44B in the accumulation passage 12 before time-up (steps S57 and S60). When the inserted coin has passed the pass sensor 44A before time-up of the
10 accumulation timer, the SM magnet 50A is restored (step S58). When the inserted coin has further passed the pass sensor 44B, it is determined that the coin is accumulated in a free rack of the accumulation section 13. The amount of the accumulated coin is added to the
15 memory 57, and the credit is stored (step S61) and displayed on the LCD 55 (step S62). After the coin accumulation information is set in the memory 57 (step S63), the flow returns to step S8 in Fig. 2A to move the next free rack to the accumulation position.

20 In this manner, inserted coins are sequentially accumulated in free racks. If the coin has not passed the pass sensor 44A before time-up of the accumulation timer in step S56, the SM magnet is restored (step S64), and then, the flow returns to step
25 S37 in Fig. 2B. Similarly, if the coin has not passed the pass sensor 44B before time-up of the accumulation timer, the flow returns to step S37 in Fig. 2B. If it

is determined in step S52 that the inserted coin is not an authentic coin, sorting coins is stopped (step S65), and then, the flow returns to step S37 in Fig. 2B.

If it is determined in step S39 that the
5 amount (credit) of coins accumulated in free racks exceeds the unit telephone charge (tariff), a dialing permission is displayed on the LCD 55 (step S42). Next, the presence/absence of coin insertion, dialing, and charging signal reception is repeatedly determined
10 (steps S41, S43, S47, and S48). In this state, when dial information is input from the keyboard 56, it is confirmed that the called party is not busy (step S45), and then the input dial number is displayed on the LCD 55 (step S45). At the same time, a dialing signal is
15 sent from the MF signal sending circuit 34 to the lines L1 and L2 side (step S46).

By sending the dialing signal to the lines L1 and L2, the called party is called. When the polarity inversion/line disconnection detection circuit 27
20 detects in step S44 that the called party has answered the call, and the busy state is set, the flow returns to the above-described repetitive routine from step S41.

In the busy state, when the charging signal arrives at the lines L1 and L2 and is received by the
25 charging signal reception circuit 26 in step S47, or a charging signal based on an autonomous charging scheme is generated, the flow advances to charging processing

from step S71 in Fig. 2D. When the on-hook operation is performed in the busy state in step S48, the flow advances to on-hook processing from step S103 in Fig. 2E.

5 Charging processing in Fig. 2D is executed in the following manner. The unit telephone charge is subtracted from the amount of accumulated coins, and the result is stored in the memory 57 (step S71) and displayed on the LCD 55 (step S72). On the basis of the
10 information stored in the memory 57, storage coin selection processing is executed to select the position of a rack where a coin to be stored is accumulated (step S73). A coin storage request is set as the selection result of this coin selection processing (step S74), and
15 then, it is determined whether the coin accumulated in the rack with the storage request can be stored (step S75).

 If YES in step S75, it is determined that the position of the rack matches the position of the inlet
20 (storage position) of the storage/return passage 17 (step S76). If YES in step S76, the flow advances to step S82.

 If NO in step S76, it is determined whether the motor M is rotated in the forward or reverse
25 direction (step S77). In accordance with the determination result, the rack is moved to a desired storage position by rotating the motor in the forward or

reverse direction (step S78 or S79). Simultaneously, the timer is started to monitor time-up of motor forward rotation processing or motor reverse rotation processing (step S80). When movement of the rack to the storage
5 position is detected in step S76 before time-up of the timer, the flow advances to step S82.

When time is up in the timer before rack moves to the desired storage position in step S80, the line is disconnected for 1 sec (step S81), and the flow advances
10 to error processing from step S20 in Fig. 2A.

In step S82, the switch lever 52B is switched to guide the coin to the storage passage 16 side, and subsequently, the accumulation gate of the rack is opened (step S83). The coin accumulated in the rack is
15 stored in the coin box through the storage/return passage 17 and the storage passage 16. At this time, coin storage detection determination by the storage detection sensor 46 and coin return detection determination by the return detection sensor 47 are
20 performed (steps S84 and S88). If the stored coin is detected in step S84, the amount information in the coin box is added and stored in the memory 57 (step S85), the accumulation gate is closed (step S86), and the accumulation information is cleared (step S87). After
25 this, the flow returns to step S75 to store the next coin.

When the coin to be stored is detected by the return detection sensor 47 in step S88, the accumulation gate is immediately closed (step S89), and the accumulation information is cleared (step S90). After
5 line disconnection for 1 sec (step S91), the flow advances to irregular processing from step S101 in Fig. 2E.

In abnormality processing in Fig. 2E, an on-hook instruction is displayed on the LCD 55 (step
10 S101), and then, it is detected on the basis of the output from the off-hook detection circuit 23 whether the on-hook operation is performed. If YES in step S102, the flow advances to step S103. Similarly, when the on-hook operation is performed in the busy state in
15 step S48 in Fig. 2B, the flow advances to step S103.

In step S103, "THANK YOU" is displayed on the LCD 55. It is determined from the information stored in the memory 57 that coins which have not been stored or returned yet are accumulated in the racks (step S104).
20 If YES in step S104, the flow advances to step S106.

If NO in step S104, it is confirmed whether the rack H is at the home position corresponding to the outlet of the accumulation passage 12 (step S105). If YES in step S105, the flow advances to step S18 in
25 Fig. 2A. Line disconnection and GS relay restoration are performed, and processing is ended (steps S18 and

S19). If NO in step S105, the flow advances to step S106 to return the rack H to the home position.

In step S106, the loop of the lines L1 and L2 is opened for 1 sec. Subsequently, when a coin which
5 has not been stored or returned is present, the storage/return schedule (sequence) is determined on the basis of the storage situation in the memory 57 (step S107).

Next, in accordance with the determined
10 schedule, it is determined whether the position of the rack which accumulates the first coin to be stored or returned coincides with the inlet position of the storage/return passage 17 (step S108). If YES in step S108, the flow advances to processing from step S113.
15 If NO in step S108, the motor M is rotated in the forward or reverse direction to move the rack to the inlet position of the storage/return passage 17 (steps S109 to S112). As the rack accumulating the first coin to be stored or returned, a rack farthest from the home
20 position is selected.

It is determined in steps S113 and S115 whether the coin is to be stored or returned. If the coin is to be stored, storage processing is performed (step S114). If the coin is to be returned, return
25 processing is performed (step S116). The accumulation information stored in the memory 57 in association with the rack is cleared (step S117), and then, it is

determined whether the rack H is at the home position (step S118). If it is determined in step S113 or S115 that no coin to be stored or returned is present in the rack at the storage position, the flow immediately
5 advances to step S118.

If YES in step S118, the flow advances to step S18 in Fig. 2A. Line disconnection and GS relay restoration are performed, and processing is ended. If NO in step S118, motor reverse rotation processing is
10 performed to move the rack by one rack toward the home position (step S119), and the flow returns to step S113. At the same time, the timer is started. Until the rack H reaches the home position in step S118 or until time-up of the timer, coin storage processing is
15 executed after step S113 (step S114), or coin return processing is executed after S115 (step S116).

When time is up in the timer before the rack reaches the desired position in step S112 or S120, the flow returns to step S20 in Fig. 2A to perform error
20 processing. In this error processing, it is checked whether the error count reaches 5 (step S20). If YES in step S20, a rack operation NG representing the failure in the rack operation is set in the memory 57 (step S21). A use inhibition is displayed on the LCD 55 (step
25 S22). Upon detecting the on-hook operation, line disconnection and GS relay restoration are performed, and processing is ended (steps S18 and S19).

In Fig. 2C, when insertion of a coin is detected in step S41 in Fig. 2B, the diameter sensor 42 and the coin sort sensor 43 sorts the coin (step S51). It is determined on the basis of the sorting result that
5 the coin is an authentic coin (step S52). If YES in step S52, the SM magnet 50A is driven (step S54) to change the sorting lever 50B from the closed state to the open state, thereby guiding the inserted coin to the accumulation passage 12.

10 This operation will be described in detail with reference to Fig. 3. To accumulate the authentic coin in the accumulation section 13, the operating current is supplied to the SM magnet 50A (step S400). Subsequently, the first timer for counting 30 ms and the
15 second timer for counting 40 ms are started (steps S401 and S402).

Time-up of the first timer is determined (step S403). If NO in step S403, it is determined whether the second coin is detected by the sensors 42 and 43 (step
20 S404). If NO in step S404, time-up of the second timer is determined (step S405). If NO in step S405, the flow returns to step S403. The routine in steps S403 to S405 is repeated until the second coin is detected or until time-up of the second timer.

25 If time is up in the first timer in step S403, and after 10 ms, time is up in the second timer in step S405, supply of the operating current to the SM magnet

50A is stopped (step S406), and the flow returns to accumulation timer start processing in step S55 in Fig. 2C.

5 In this case, the sorting lever 50B changes from the closed state to the open state, so the inserted authentic coin (first authentic coin) is guided to the accumulation passage 12 side and accumulated in the accumulation section 13. At this time, the accumulated coin is detected by the pass sensor.

10 If the second authentic coin is detected by the sensors 42 and 43 in step S404 during the operation of the first timer, supply of the operating current to the SM magnet 50A is immediately stopped (step S407). With this operation, the sorting lever 50B keeps the
15 closed state without being opened, as described above, so that not only the second authentic coin but also the first authentic coin inserted precedingly is guided to the return passage 14. Next, return of the coin is monitored on the basis of the output from the return
20 detection sensor 47 (step S408). When return of the coin is confirmed, the flow returns to step S64 in Fig. 2C to restore the SM magnet.

According to this embodiment, when insertion of the second authentic coin is detected while the SM
25 magnet 50A is being driven to accumulate the first authentic coin, energization to the magnet 50A is

immediately stopped, and the first and second authentic coins are guided to the return passage.

In the above description, when the second inserted coin is detected as an authentic coin during the first authentic coin accumulation operation in 30 ms, supply of the operating current to the SM magnet is stopped. However, energization to the SM magnet may be stopped when the second inserted coin is detected by the insertion detection sensor 41 arranged at the coin slot.

10 In this case, the second inserted coin can be detected in an earlier time, so each coin can be more properly guided to the return passage.

In this embodiment, the coin accumulation apparatus is applied to a public telephone. However,

15 this coin accumulation apparatus can be applied to any apparatus using coins, including a vending machine, to obtain the same effect as described above.

As has been described above, according to the present invention, when insertion of the second coin is detected within a predetermined time after driving the SM magnet is started to accumulate the first authentic coin, driving the magnet is immediately stopped, and the continuously inserted first and second coins are guided to the return passage, thereby preventing the

20 continuously inserted coins being accumulated in the accumulation section. In addition, since the

25

conventional return lever can be omitted, the apparatus can be made inexpensive and compact.

Furthermore, with the insertion sensor arranged at the insertion port, insertion of the second
5 coin can be quickly detected to stop driving the magnet.
Therefore, when coins are continuously inserted, two coins can be properly guided to the return passage.



What is claimed is:

1. A coin accumulation apparatus characterized by
2 comprising:
3 a coin sorting section (11) for sorting coins
4 inserted from a coin slot into an authentic coin and a
5 counterfeit coin, the coins including first and second
6 coins;
7 a coin sensor (41, 42, 43) arranged in a coin
8 path from the coin slot to said coin sorting section;
9 a coin accumulation section (13) for
10 accumulating the authentic coin;
11 a coin return section (14) for returning the
12 counterfeit coin;
13 a sorting lever (50B) for distributing the
14 inserted coin to one of said coin accumulation section
15 and said coin return section on the basis of a sorting
16 result by said coin sorting section;
17 a magnet (50A) for driving said sorting lever;
18 and
19 control means (40) for, when said coin sorting
20 section determines that the first coin is an authentic
21 coin, starting driving said magnet, and when the second
22 coin following the first coin is detected by said coin
23 sensor within a predetermined time from the start of
24 driving to the start of an operation of said sorting
25 lever, immediately stopping driving said magnet, thereby



26 distributing the first and second coins to said return
27 section.

2. An apparatus according to claim 1, wherein
2 said sensor comprises a sort sensor arranged
3 in said coin sorting section to determine whether the
4 coin is an authentic coin, and
5 said control means stops driving said magnet
6 when said sort sensor determines that the second coin is
7 an authentic coin within the predetermined time from the
8 start of driving said magnet.

3. An apparatus according to claim 1, wherein
2 said sensor comprises an insertion sensor
3 arranged near the coin slot to detect insertion of the
4 coin, and
5 said control means stops driving said magnet
6 when said insertion sensor detects insertion of the
7 second coin within the predetermined time from the start
8 of driving said magnet.

4. An apparatus according to claim 1, further
2 comprising a delay lever mechanism (50D) for coupling
3 said magnet to said sorting lever to delay an operation
4 of said magnet and transmit the operation to said
5 sorting lever.



5. An apparatus according to claim 4, wherein
2 said delay lever mechanism comprises
3 an operation lever (50E) operating in
4 synchronism with the operation of said magnet and having
5 a distal end portion (50h) acting on said sorting lever,
6 and
7 a notch (50F) formed in said sorting lever and
8 brought into contact with the distal end portion of said
9 operation lever, and
10 the distal end portion of said operation lever
11 moves in the notch without acting on said sorting lever
12 until a predetermined time elapses.