US012394269B2

(12) **United States Patent**
Fujii et al.

(10) **Patent No.: US 12,394,269 B2**
(45) **Date of Patent: Aug. 19, 2025**

(54) **COIN PROCESSING DEVICE**

(71) Applicants: **LAUREL BANK MACHINES CO., LTD.**, Tokyo (JP); **LAUREL MACHINERY CO., LTD.**, Osaka (JP); **LAUREL PRECISION MACHINES CO., LTD.**, Osaka (JP)

(72) Inventors: **Kota Fujii**, Osaka (JP); **Naruto Okahashi**, Sanda (JP); **Nobuo Hamada**, Osaka (JP); **Ryo Tanaka**, Osaka (JP)

(73) Assignees: **LAUREL BANK MACHINES CO., LTD.**, Tokyo (JP); **LAUREL PRECISION CO., LTD.**, Osaka (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 998 days.

(21) Appl. No.: **17/437,727**

(22) PCT Filed: **Feb. 21, 2020**

(86) PCT No.: **PCT/JP2020/007147**
§ 371 (c)(1),
(2) Date: **Sep. 9, 2021**

(87) PCT Pub. No.: **WO2020/184152**
PCT Pub. Date: **Sep. 17, 2020**

(65) **Prior Publication Data**

US 2022/0148359 A1 May 12, 2022

(30) **Foreign Application Priority Data**

Mar. 14, 2019 (JP) 2019-046928

(51) **Int. Cl.**
G07D 3/14 (2006.01)
G07D 3/06 (2006.01)
G07D 5/08 (2006.01)

(52) **U.S. Cl.**
CPC ***G07D 3/14*** (2013.01); ***G07D 3/06*** (2013.01); ***G07D 5/08*** (2013.01)

(58) **Field of Classification Search**
CPC .. G07D 3/14; G07D 3/06; G07D 5/08; G07D 9/008; G07D 9/04
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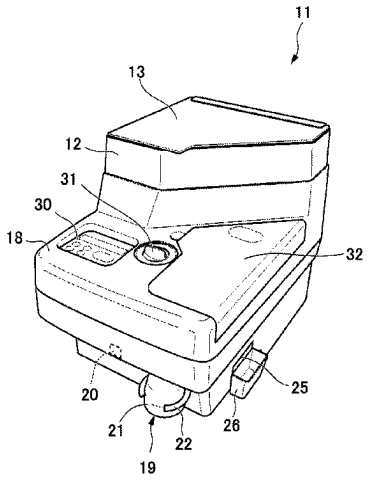
Primary Examiner — Jeffrey A Shapiro
(74) *Attorney, Agent, or Firm* — Nixon & Vanderhye P.C.

(57) **ABSTRACT**

A coin processing device includes: a feed belt that normally rotates in contact with the upper side of a coin to convey the coin to a conveyance passage extending from an inlet-side passage portion to an outlet-side passage portion; a conveyance motor that normally rotates the feed belt during the normal rotation; a detection unit that detects the coin passing through a position determined in advance in the conveyance passage; and a control unit that switches the conveyance motor from a first rotation state where the conveyance motor normally rotates at a first rotation speed to a second rotation state where the conveyance motor normally rotates at a
(Continued)



second rotation speed slower than the first rotation speed, in response to detection of the coin by the detection unit, and then rotates the conveyance motor.

1 Claim, 9 Drawing Sheets

(58) **Field of Classification Search**
USPC 453/7, 11, 56
See application file for complete search history.

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FIG. 1

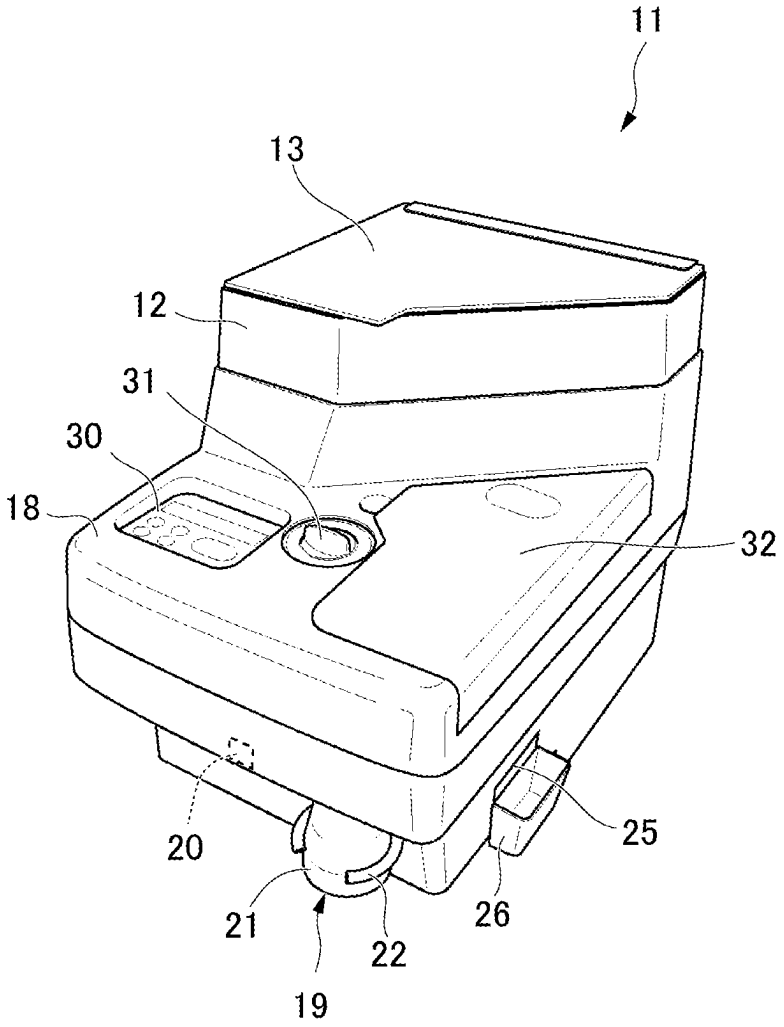


FIG. 2

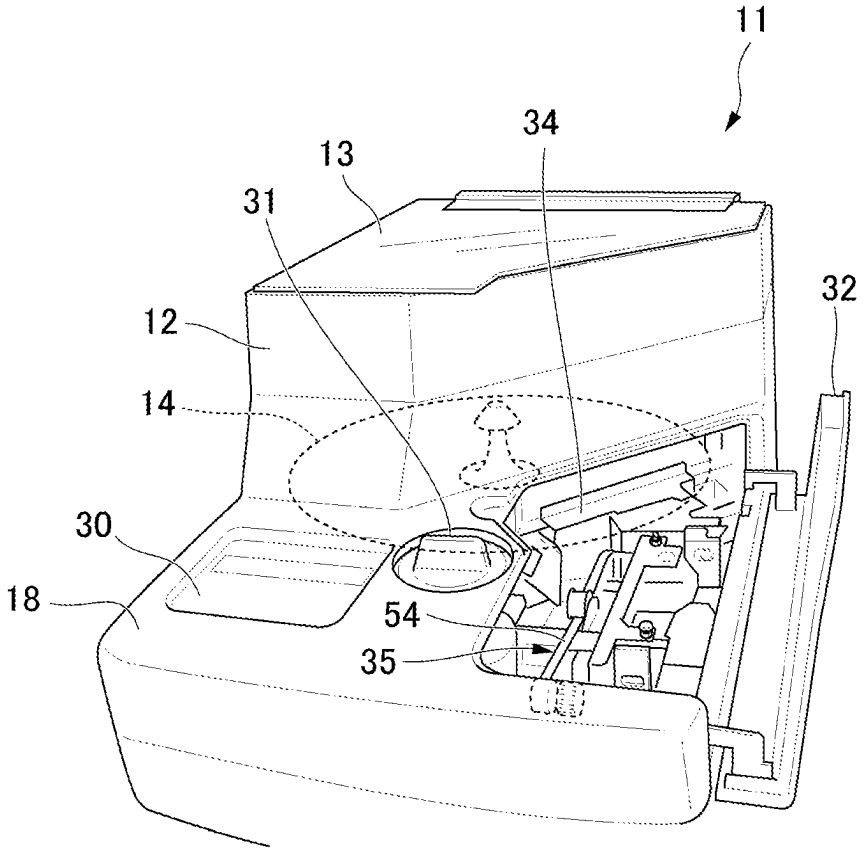


FIG. 3

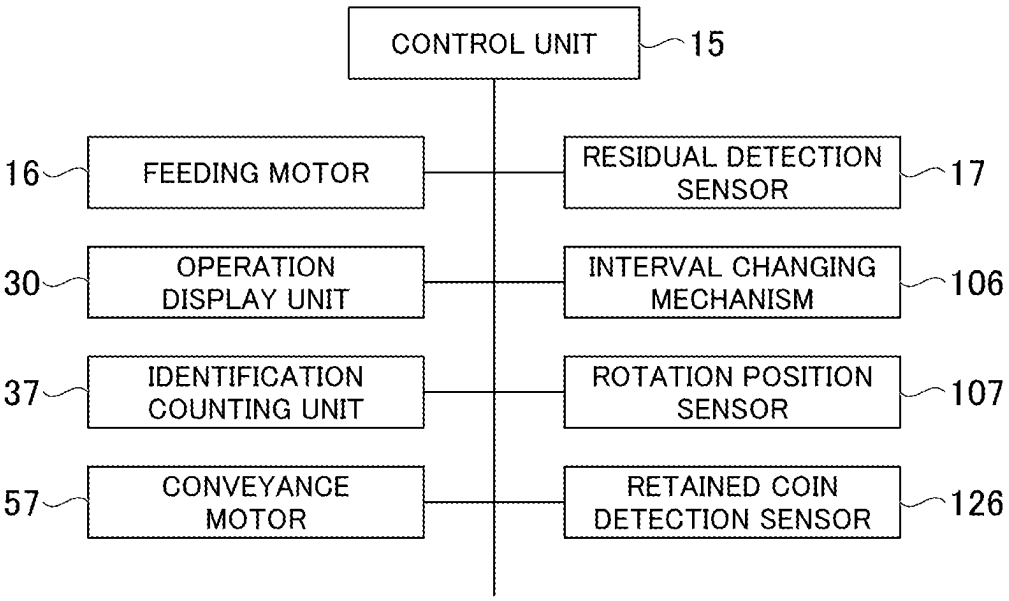

CONTROL UNIT
15
16
FEEDING MOTOR
RESIDUAL DETECTION SENSOR
17
30
OPERATION DISPLAY UNIT
INTERVAL CHANGING MECHANISM
106
37
IDENTIFICATION COUNTING UNIT
ROTATION POSITION SENSOR
107
57
CONVEYANCE MOTOR
RETAINED COIN DETECTION SENSOR
126

FIG. 4

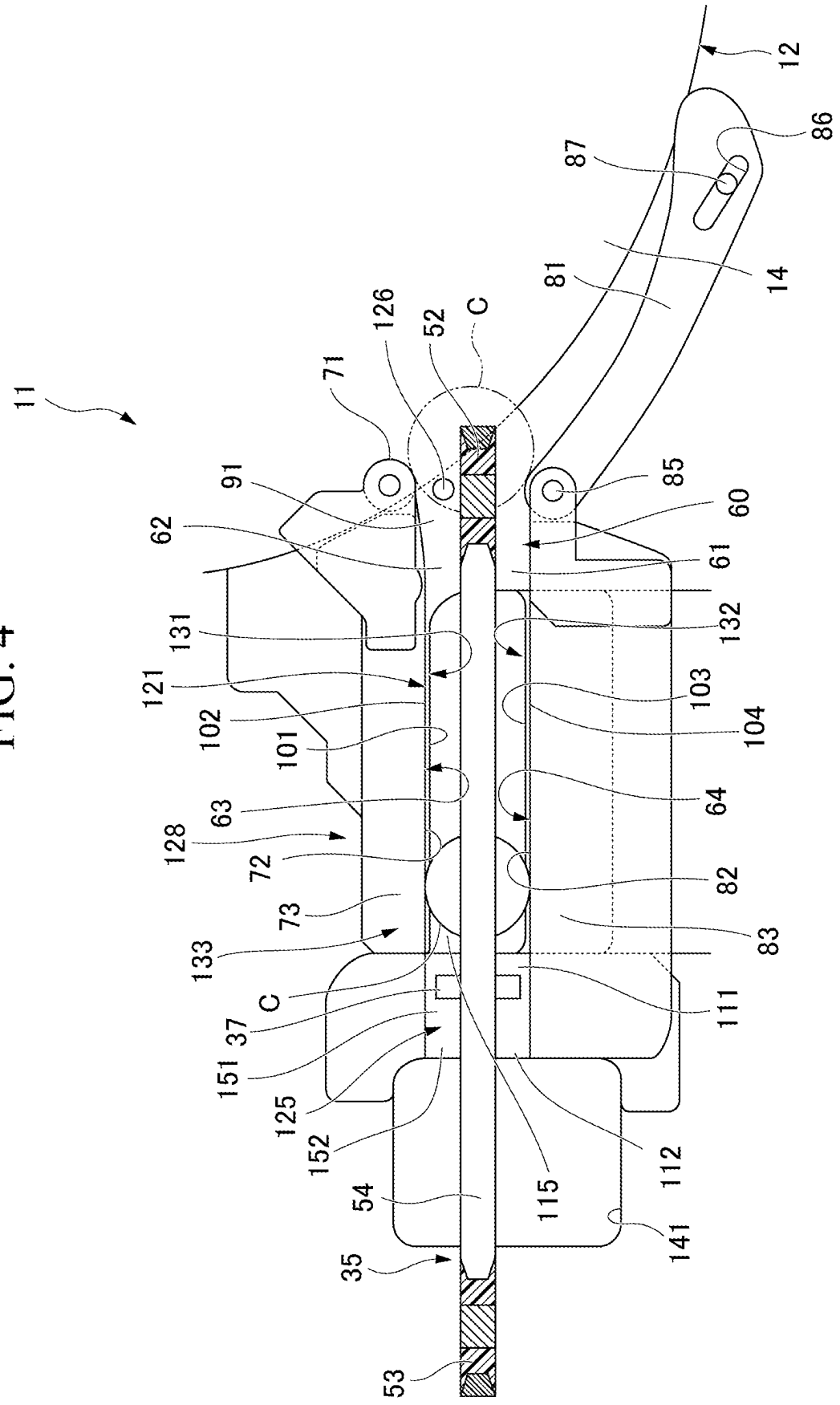

11
12
14
35
37
52
53
54
60
61
62
63
64
71
72
73
81
82
83
85
86
87
91
101
102
103
104
111
112
115
121
125
126
128
131
132
133
141
151
152
C

FIG. 5

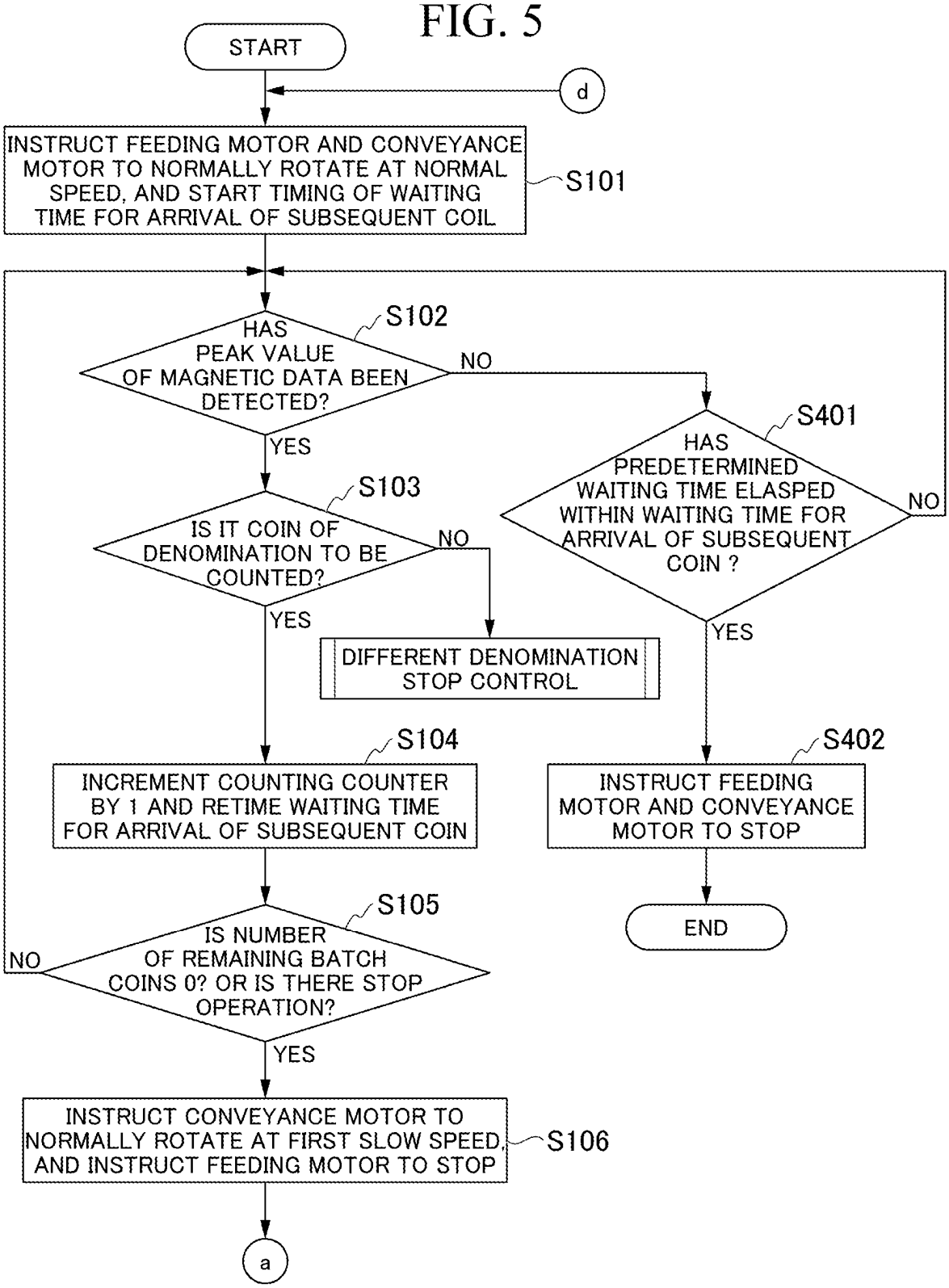

START
d
INSTRUCT FEEDING MOTOR AND CONVEYANCE MOTOR TO NORMALLY ROTATE AT NORMAL SPEED, AND START TIMING OF WAITING TIME FOR ARRIVAL OF SUBSEQUENT COIL
S101
S102
HAS PEAK VALUE OF MAGNETIC DATA BEEN DETECTED?
NO
YES
S401
HAS PREDETERMINED WAITING TIME ELASPED WITHIN WAITING TIME FOR ARRIVAL OF SUBSEQUENT COIN ?
NO
YES
S103
IS IT COIN OF DENOMINATION TO BE COUNTED?
NO
YES
DIFFERENT DENOMINATION STOP CONTROL
S104
INCREMENT COUNTING COUNTER BY 1 AND RETIME WAITING TIME FOR ARRIVAL OF SUBSEQUENT COIN
S402
INSTRUCT FEEDING MOTOR AND CONVEYANCE MOTOR TO STOP
END
S105
IS NUMBER OF REMAINING BATCH COINS 0? OR IS THERE STOP OPERATION?
NO
YES
INSTRUCT CONVEYANCE MOTOR TO NORMALLY ROTATE AT FIRST SLOW SPEED, AND INSTRUCT FEEDING MOTOR TO STOP
S106
a

FIG. 6

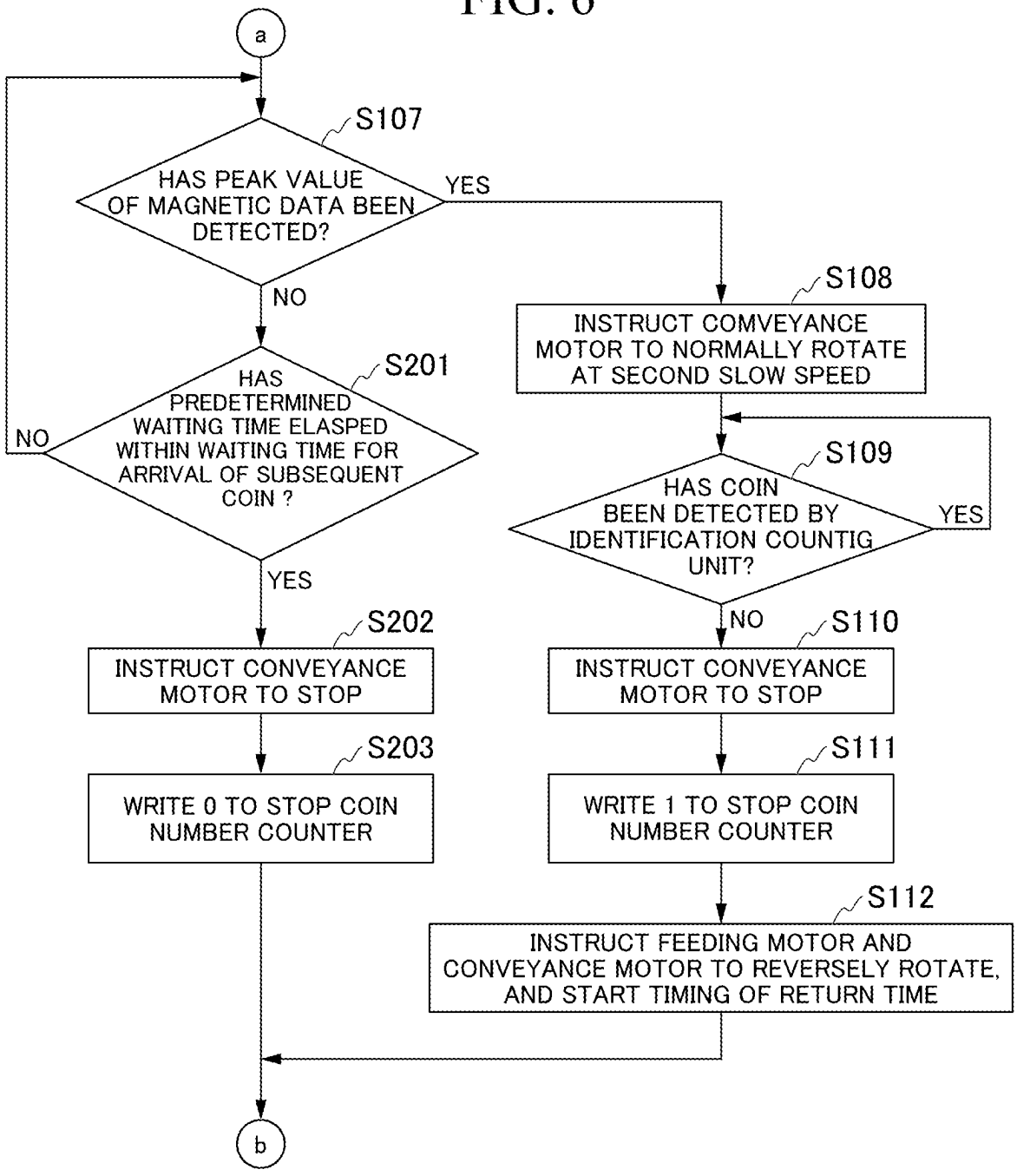

a
S107
HAS PEAK VALUE OF MAGNETIC DATA BEEN DETECTED?
YES
NO
S108
INSTRUCT COMVEYANCE MOTOR TO NORMALLY ROTATE AT SECOND SLOW SPEED
S201
HAS PREDETERMINED WAITING TIME ELASPED WITHIN WAITING TIME FOR ARRIVAL OF SUBSEQUENT COIN ?
NO
YES
S109
HAS COIN BEEN DETECTED BY IDENTIFICATION COUNTIG UNIT?
YES
NO
S202
INSTRUCT CONVEYANCE MOTOR TO STOP
S110
INSTRUCT CONVEYANCE MOTOR TO STOP
S203
WRITE 0 TO STOP COIN NUMBER COUNTER
S111
WRITE 1 TO STOP COIN NUMBER COUNTER
S112
INSTRUCT FEEDING MOTOR AND CONVEYANCE MOTOR TO REVERSELY ROTATE, AND START TIMING OF RETURN TIME
b

FIG. 7

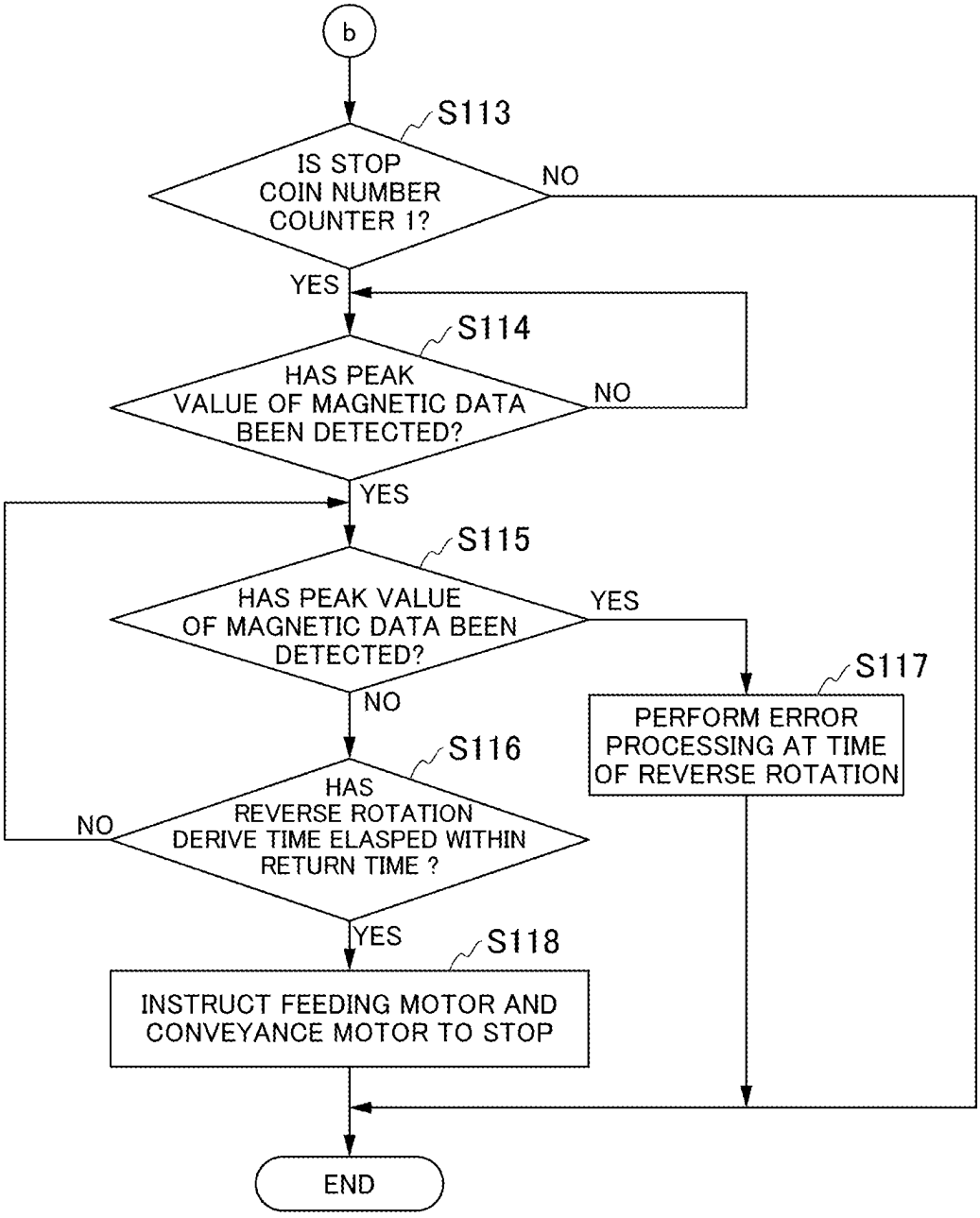

b
S113
IS STOP COIN NUMBER COUNTER 1?
NO
YES
S114
HAS PEAK VALUE OF MAGNETIC DATA BEEN DETECTED?
NO
YES
S115
HAS PEAK VALUE OF MAGNETIC DATA BEEN DETECTED?
YES
S117
PERFORM ERROR PROCESSING AT TIME OF REVERSE ROTATION
NO
S116
HAS REVERSE ROTATION DERIVE TIME ELASPED WITHIN RETURN TIME ?
NO
YES
S118
INSTRUCT FEEDING MOTOR AND CONVEYANCE MOTOR TO STOP
END

FIG. 8

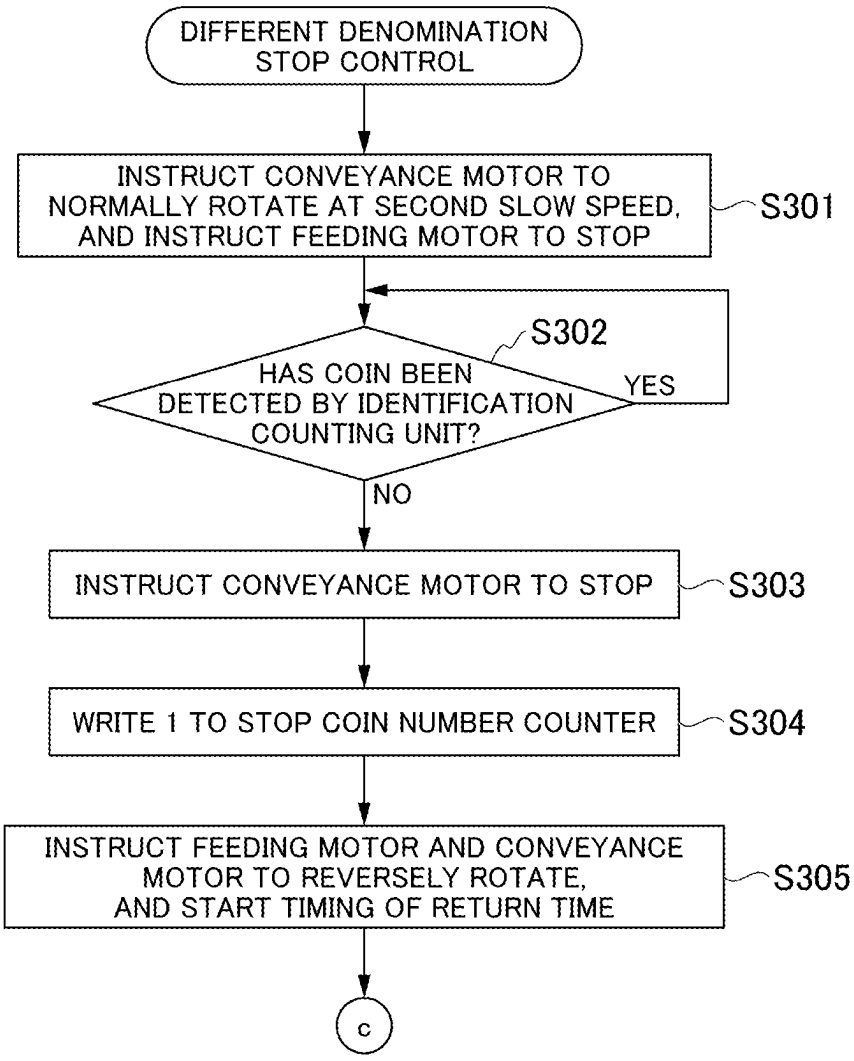
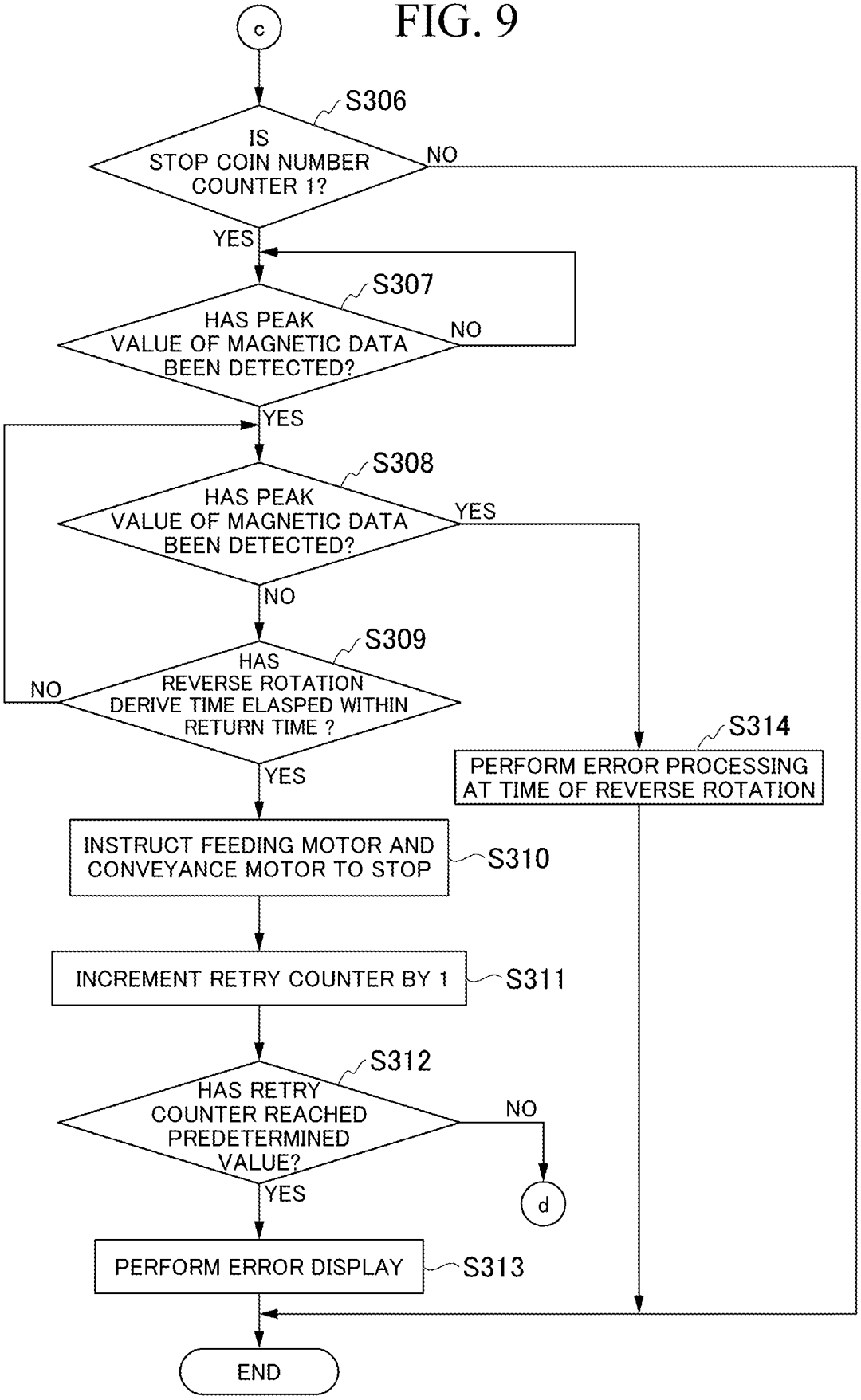

DIFFERENT DENOMINATION STOP CONTROL
INSTRUCT CONVEYANCE MOTOR TO NORMALLY ROTATE AT SECOND SLOW SPEED, AND INSTRUCT FEEDING MOTOR TO STOP
S301
S302
HAS COIN BEEN DETECTED BY IDENTIFICATION COUNTING UNIT?
YES
NO
INSTRUCT CONVEYANCE MOTOR TO STOP
S303
WRITE 1 TO STOP COIN NUMBER COUNTER
S304
INSTRUCT FEEDING MOTOR AND CONVEYANCE MOTOR TO REVERSELY ROTATE, AND START TIMING OF RETURN TIME
S305
C

FIG. 9


c
S306
IS STOP COIN NUMBER COUNTER 1?
NO
YES
S307
HAS PEAK VALUE OF MAGNETIC DATA BEEN DETECTED?
NO
YES
S308
HAS PEAK VALUE OF MAGNETIC DATA BEEN DETECTED?
YES
NO
S309
HAS REVERSE ROTATION DERIVE TIME ELASPED WITHIN RETURN TIME ?
NO
YES
S314
PERFORM ERROR PROCESSING AT TIME OF REVERSE ROTATION
INSTRUCT FEEDING MOTOR AND CONVEYANCE MOTOR TO STOP
S310
INCREMENT RETRY COUNTER BY 1
S311
S312
HAS RETRY COUNTER REACHED PREDETERMINED VALUE?
NO
YES
d
PERFORM ERROR DISPLAY
S313
END

COIN PROCESSING DEVICE

This application is the U.S. national phase of International Application No. PCT/JP2020/007147 filed Feb. 21, 2020 which designated the U.S. and claims priority to Japanese Patent Application No. 2019-046928, filed Mar. 14, 2019, the entire contents of each of which are incorporated herein by reference.

TECHNICAL FIELD

The present invention relates to a coin processing device.

Priority is claimed on Japanese Patent Application No. 2019-046928, filed Mar. 14, 2019, the content of which is incorporated herein by reference.

BACKGROUND ART

Patent Document 1 below discloses a coin processing device having a mechanism for removing unacceptable coins. When an unacceptable coin is detected, the coin processing device holds the unacceptable coin between first stopper means and second stopper means provided on the downstream side of a coin collection port in a conveyance guide through which the coin passes. Next, the coin processing device returns all the coins following the unacceptable coin onto a rotating disk of a coin pool part, and then sets the interval between guide plates forming a coin sorting passage to be larger than the diameter of the largest-diameter coin to be processed. Next, the coin processing device releases the holding of the unacceptable coin by the first stopper means and the second stopper means. Thereafter, the coin processing device reversely conveys the unacceptable coin to the upstream side in the conveyance, that is, the rotating disk side of the coin pool part, and causes the unacceptable coin to fall into the coin collection port between the guide plates, where it is collected by collection means.

PRIOR ART DOCUMENTS

Patent Document

Patent Document 1

Japanese Unexamined Patent Application, First Publication No. H02-193287

SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

In the device disclosed in Patent Document 1, a structure is made in which the coin is stopped by causing protrusion portions of the first and second stopper means to enter the inside of a conveyance path from the right and left side surface portions of the conveyance guide through which the coin passes, by the driving of each solenoid. In addition to this method, there is also known a method of stopping a coin by causing a pin-shaped protrusion portion to protrude into a conveyance path from the upper side or the lower side of the conveyance path by the driving of a solenoid to bring it into contact with the conveyed coin.

In this manner, in order to prevent a target coin such as an unacceptable coin from being conveyed to the downstream side of a predetermined position on a coin conveyance path, in the coin processing device of the related art, a stopper mechanism that is composed of a drive source (an electrical part) such as a solenoid (a plunger solenoid or a rotary solenoid) and a protrusion portion (a mechanical member) needs to be provided. Therefore, the cost of the coin processing device of the related art becomes high. Further, in the coin processing device of the related art, an occupied space for incorporating the stopper mechanism is required, and therefore the layout inside the device is restricted. Further, in the coin processing device of the related art, since the coin is stopped by bringing the protrusion portion into contact with the coin which is being conveyed at a high speed, a collision sound is generated at the time of collision between the coin and the protrusion portion, and they collide with or rub against each other and generate dust.

An object of the present invention is to provide a coin processing device in which a manufacturing cost can be reduced, the degree of freedom of layout in the device can be improved, and a reduction in noise and dust suppression can be attained.

Means for Solving the Problems

In order to achieve the above object, according to a first aspect of the present invention, there is provided a coin processing device including: a feed belt that normally rotates in contact with an upper side of a coin to convey the coin to a conveyance passage extending from an inlet-side passage portion to an outlet-side passage portion; a conveyance motor that normally rotates the feed belt during the normal rotation; a detection unit that detects the coin passing through a position determined in advance in the conveyance passage; and a control unit that switches the conveyance motor from a first rotation state where the conveyance motor normally rotates at a first rotation speed to a second rotation state where the conveyance motor normally rotates at a second rotation speed slower than the first rotation speed, in response to detection of the coin by the detection unit, and then rotates the conveyance motor.

According to the first aspect, the control unit switches the conveyance motor that normally rotates from the first rotation state to the second rotation state in response to the detection of the detection unit and then rotates the conveyance motor. In this way, the conveyance speed of the coins to be stopped is switched to a lower speed and then stopped. Therefore, it is possible to accurately stop the coin to be stopped. Accordingly, a stopper mechanism is not required in the conveyance passage of the coin processing device.

In a coin processing device according to a second aspect of the present invention, in the first aspect described above, a falling portion for causing the coin to fall from the outlet-side passage portion is provided on a downstream side of the outlet-side passage portion opposite to the inlet-side passage portion, and the control unit performs stop control for stopping one coin to be stopped on the outlet-side passage portion that is on the downstream side with respect to the detection unit, by switching the conveyance motor from the first rotation state to the second rotation state in response to detection of the one coin to be stopped by the detection unit, and then stopping the conveyance motor in response to a change from a detection state where the detection unit detects the one coin to be stopped to a non-detection state where the detection unit does not detect the one coin to be stopped.

According to the second aspect, the control unit performs the stop control for switching the conveyance motor from the first rotation state to the second rotation state, based on the detection of one coin to be stopped by the detection unit,

and then stopping the conveyance motor in response to a change from the detection state of one coin to be stopped by the detection unit to the non-detection state. In this stop control, since one coin to be stopped is stopped on the outlet-side passage portion that is on the downstream side with respect to the detection unit, the one coin to be stopped does not fall into the falling portion. Accordingly, even if there is no stopper mechanism, the coin to be stopped can be kept on the outlet-side passage portion without falling into the falling portion.

In a coin processing device according to a third aspect of the present invention, in the second aspect described above, the outlet-side passage portion has an outlet-side passage end portion that is disposed between the detection unit and the falling portion, and the outlet-side passage end portion has a size in which one coin with a smallest diameter among coins to be processed can remain and two or more coins cannot remain.

According to the third aspect, the outlet-side passage portion has the outlet-side passage end portion having a size in which one coin with the smallest diameter among coins to be processed can remain and two or more coins cannot remain, between the detection unit and the falling portion. Therefore, only one coin to be stopped can be stopped at the outlet-side passage end portion, and it is possible to cause all the coins that have been conveyed in the direction of the downstream side ahead of the coin to fall into the falling portion. Accordingly, even if there is no stopper mechanism, it is possible to cause all the coins that have been conveyed in the direction of the downstream side ahead of one coin to be stopped to fall into the falling portion.

In a coin processing device according to a fourth aspect of the present invention, in the third aspect described above, after the control unit performs the stop control, the control unit reversely rotates the conveyance motor to perform switching to conveyance of the coin toward an upstream side opposite to the downstream side, and then confirms the detection state of the one coin to be stopped by the detection unit.

According to the fourth aspect, after the control unit performs the stop control, the control unit reversely rotates the conveyance motor to perform switching to conveyance of the coin toward an upstream side opposite to the downstream side. Thereafter, the control unit confirms the detection state of the one coin to be stopped by the detection unit. In this way, it is possible to determine that none of the coins conveyed in the direction of the downstream side ahead of the one coin to be stopped remain on the outlet-side passage portion. Accordingly, even if there is no stopper mechanism, it is possible to determine that all the coins conveyed in the direction of the downstream side ahead of the one coin to be stopped have fallen into the falling portion.

In a coin processing device according to a fifth aspect of the present invention, in any one of the second to fourth aspects described above, the detection unit includes a magnetic sensor, and when a coin other than a falling target to be caused to fall into the falling portion is detected based on the detection of the detection unit, the control unit sets the coin to be the one coin to be stopped.

According to the fifth aspect, since the detection unit includes a magnetic sensor, the detection of one coin to be stopped and the detection of a coin of a denomination different from a designated denomination can be performed with the same magnetic sensor. Accordingly, the cost can be further reduced.

In a coin processing device according to a sixth aspect of the present invention, in any one of the second to fifth aspects described above, the control unit switches the conveyance motor from a third rotation state where the conveyance motor rotates at a third rotation speed faster than the first rotation speed in the first rotation state to the first rotation state, in response to the detection of one coin on the downstream side with respect to the one coin to be stopped by the detection unit.

According to the sixth aspect, the control unit switches the conveyance motor from the third rotation state having the third rotation speed faster than the first rotation speed in the first rotation state, to the first rotation state, in response to the detection of one coin on the downstream side with respect to the one coin to be stopped by the detection unit. Therefore, the control unit can switch from the third rotation state to the first rotation state having a lower speed than the third rotation state, and then switch from the first rotation state to the second rotation state having a lower speed than the first rotation state. Accordingly, the conveyance speed of the coin to be stopped is switched to a lower speed and then stopped, so that it is possible to more accurately stop the coin to be stopped.

Advantageous Effects of the Invention

According to the present invention, it is possible to provide a coin processing device in which the cost of the coin processing device is reduced, the degree of freedom of layout inside the device is improved, and a reduction in noise and dust suppression are attained.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view showing a coin processing device according to an embodiment of the present invention.

FIG. **2** is a partial perspective view showing a state where a feed part cover of the coin processing device according to the embodiment of the present invention is opened.

FIG. **3** is a block diagram showing a configuration of a control system of the coin processing device according to the embodiment of the present invention.

FIG. **4** is a plan view, partly in section, showing a main part of the coin processing device according to the embodiment of the present invention.

FIG. **5** is a flowchart showing a part of batch processing that is executed by the coin processing device according to the embodiment of the present invention.

FIG. **6** is a flowchart showing a part of the batch processing that is executed by the coin processing device according to the embodiment of the present invention.

FIG. **7** is a flowchart showing a part of the batch processing that is executed by the coin processing device according to the embodiment of the present invention.

FIG. **8** is a flowchart showing a part of the batch processing that is executed by the coin processing device according to the embodiment of the present invention.

FIG. **9** is a flowchart showing a part of the batch processing that is executed by the coin processing device according to the embodiment of the present invention.

EMBODIMENTS FOR CARRYING OUT THE INVENTION

A coin processing device according to an embodiment of the present invention will be described below with reference to the drawings.

A coin processing device **11** of the present embodiment is for counting coins of one designated denomination to be

counted. Specifically, in the coin processing device **11**, processing target coins that can be selected and set as coins of a denomination to be counted are six denominations: 1-yen coins, 5-yen coins, 10-yen coins, 50-yen coins, 100-yen coins, and 500-yen coins. The coin processing device **11** counts the coins of the denomination to be counted selected from among these denominations.

As shown in FIG. **1**, the coin processing device **11** has, at an upper portion thereof, a hopper **12** serving as a coin pool part that opens upward and pools input coins, and a hopper cover **13** that opens and closes the upper opening of the hopper **12**. As shown in FIG. **2**, a rotating disk **14** is disposed below the hopper **12**. The rotating disk **14** is driven by a feeding motor **16** that is controlled by a control unit **15** shown in FIG. **3**, and rotates around a vertical axis. The hopper **12** is provided with a residual detection sensor **17** that detects coins remaining in the hopper **12**. The residual detection sensor **17** outputs a detection result to the control unit **15**.

As shown in FIG. **1**, the coin processing device **11** has a main body part **18** protruding forward (to the operator side) from the hopper **12**, on the lower side with respect to the hopper **12**. The main body part **18** has, at a front portion thereof, a chute **19** protruding downward and a power switch **20**. The chute **19** has a chute main body **21** that discharges the coins of the denomination to be counted after counting to the outside. Further, the chute **19** has a locking ring **22** for locking a storage bag (not shown) to the chute main body **21**.

A discharge port **25** for discharging coins of a denomination different from the denomination to be counted to the outside of the coin processing device **11** is provided at a side portion of the main body part **18**. An exclusion box **26** having an upper opening and receiving and accommodating the coins discharged from the discharge port **25** is provided at the side portion of the main body part **18**.

The main body part **18** has, on the upper surface of a portion on the front side with respect to the hopper **12**, an operation display unit **30** that receives a pressing operation from an operator and performs display toward the operator, and a course width adjusting knob **31** that is rotated by the operator. A feed part cover **32** that covers the inside of the main body part **18** when it is in a closed state, as shown in FIG. **1**, and partially opens the inside of the main body part **18** when it is in an open state, as shown in FIG. **2**, is provided on the front-side upper surface of the main body part **18**. When the coin of the denomination to be counted is selected from among the coins to be processed, the course width adjusting knob **31** is rotated to be fitted to a position corresponding to the coin of the denomination to be counted.

As shown in FIG. **2**, a sorting ring **34**, a conveyance drive unit **35**, a conveyance passage **60** (FIG. **4**), and an identification counting unit **37** (a detection unit) are provided at the positions below the feed part cover **32** inside the main body part **18**. The sorting ring **34** separates one by one the coins that are fed from the rotating disk **14**. The conveyance drive unit **35** conveys the coins separated and fed one by one by the sorting ring **34** from the rotating disk **14**. The identification counting unit **37** (the detection unit) detects the coins C that are being conveyed through the conveyance passage **60** by the conveyance drive unit **35** when it passes through a predetermined position in the conveyance passage **60**. The identification counting unit **37** (the detection unit) includes a magnetic sensor that performs the identification and counting of the coins C. The identification counting unit **37** outputs magnetic data, which is a detection result, to the control unit **15** shown in FIG. **3**.

As shown in FIG. **4**, the conveyance drive unit **35** has a take-in pulley **52**, a drive pulley **53**, an endless feed belt **54**, and a conveyance motor **57** (FIG. **3**) that drives them. The take-in pulley **52** is disposed at an upper portion on the outer periphery side of the rotating disk **14**. The drive pulley **53** is disposed in parallel with the take-in pulley **52** at a position away from the rotating disk **14** such that the position in an axial direction and the height are aligned with those of the take-in pulley **52**. The feed belt **54** is wound around the take-in pulley **52** and the drive pulley **53**. The rotation state of the conveyance motor **57** is controlled by the control unit **15**.

As shown in FIG. **4**, the take-in pulley **52** and the drive pulley **53** support the feed belt **54** at both ends thereof. In addition to the take-in pulley **52** and the drive pulley **53**, one or a plurality of intermediate pulleys that support the feed belt **54** at the intermediate position thereof may be provided. The drive pulley **53** of the conveyance drive unit **35** is driven and rotated by the conveyance motor **57** shown in FIG. **3**. The take-in pulley **52** shown in FIG. **4** is a driven pulley that is driven with respect to the drive pulley **53** by being driven through the feed belt **54** by the drive pulley **53**. The conveyance motor **57** is a stepping motor. The conveyance motor **57** rotates the drive pulley **53**, the feed belt **54**, and the take-in pulley **52** by being rotated to be controlled by the control unit **15** shown in FIG. **3**.

As shown in FIG. **4**, the conveyance passage **60** for conveying the coins C is provided below the feed belt **54** to extend along the feed belt **54** inside the main body part **18** shown in FIG. **2**. The conveyance passage **60** has an inlet-side passage portion **61** that is disposed below the position of the take-in pulley **52**. The conveyance passage **60** further has a pair of wall portions **63** and **64** that are disposed on both sides with the feed belt **54** interposed therebetween and stand vertically from an upper surface **62** of the inlet-side passage portion **61**. The upper surface **62** of the inlet-side passage portion **61** is horizontally disposed, and supports the lower surfaces of the coins C fed from the rotating disk **14** from below.

The coins C are separated from the rotating disk **14** one by one by the sorting ring **34** (FIG. **2**) and fed onto the upper surface **62** of the inlet-side passage portion **61**. The conveyance drive unit **35** conveys the coins C between the pair of wall portions **63** and **64** with the feed belt **54** in contact with the upper sides of the coins C fed to the inlet-side passage portion **61**.

The wall portion **63** on one side includes an inlet roller **71** whose side closest to the rotating disk **14** is supported to be rotatable around the vertical axis. The wall portion **63** is provided with a fixed wall **73** that is fixed in position and has, on the wall portion **64** side, a wall surface **72** extending along the feed belt **54** away from the rotating disk **14**. The fixed wall **73** extends to the side opposite to the rotating disk **14** with respect to the inlet-side passage portion **61**. The wall surface **72** of the fixed wall **73** stands vertically from the upper surface **62** of the inlet-side passage portion **61**.

The wall portion **64** on the other side includes an arc-shaped guide wall **81** whose side closest to the rotating disk **14** is curved along the outer peripheral surface of the rotating disk **14**. The wall portion **64** is provided with a movable wall **83** having, on the wall portion **63** side, a wall surface **82** extending along the feed belt **54** from the vicinity of the end portion on the take-in pulley **52** side of the guide wall **81**. The movable wall **83** extends to the side opposite to the rotating disk **14** with respect to the inlet-side passage portion

61. The wall surface 82 of the movable wall 83 stands vertically from the upper surface 62 of the inlet-side passage portion 61.

The wall surface 82 of the movable wall 83 and the wall surface 72 of the fixed wall 73 are parallel to each other and face each other with the height positions aligned with each other. The movable wall 83 horizontally moves toward and away from the fixed wall 73 while maintaining the positional relationship with the fixed wall 73 in the extending direction, in a state where the wall surface 82 is parallel to the wall surface 72 of the fixed wall 73.

One end of the guide wall 81 is connected to the movable wall 83 by a connection pin 85 extending vertically. In this way, the guide wall 81 is rotatable around the connection pin 85. Further, the guide wall 81 has an elongated hole 86 formed at the other end thereof to extend in a length direction. A pin 87 fixed in position and extending vertically is disposed in the elongated hole 86. When the movable wall 83 moves, the guide wall 81 rotates with respect to the movable wall 83 with the connection pin 85 as the center while moving with respect to the pin 87 in the elongated hole 86. In this way, the guide wall 81 follows the movement of the movable wall 83.

An inlet 91 on the rotating disk 14 side of the pair of wall portions 63 and 64 is formed by the inlet roller 71 and the end portion on the connection pin 85 side of the guide wall 81. The width of the inlet 91 is set to be equal to the interval between the wall surface 82 of the movable wall 83 and the wall surface 72 of the fixed wall 73. The guide wall 81 having a curved shape guides the coins C from the rotating disk 14 of the hopper 12 toward the space between the pair of wall portions 63 and 64. The end on the inlet 91 side of the guide wall 81 is connected to the movable wall 83 through the connection pin 85, and is configured to be movable in conjunction with the movable wall 83.

The conveyance passage 60 has, on the lower side of the fixed wall 73, a support portion 101 that is fixed in position and protrudes toward the movable wall 83 side with respect to the wall surface 72. The support portion 101 has an upper surface 102 that is disposed on the same plane as the upper surface 62 of the inlet-side passage portion 61. The support portion 101 extends from the inlet-side passage portion 61 to the side opposite to the rotating disk 14.

The conveyance passage 60 has, on the upper side of the movable wall 83, a support portion 103 protruding toward the fixed wall 73 side with respect to the wall surface 82. The support portion 103 has an upper surface 104 that is disposed on the same plane as the upper surface 62 of the inlet-side passage portion 61. The support portion 103 extends from the inlet-side passage portion 61 to the side opposite to the rotating disk 14. The support portion 103 is fixed to the movable wall 83 and moves integrally with the movable wall 83.

The conveyance passage 60 has an outlet-side passage portion 112 on the side opposite to the inlet-side passage portion 61 with respect to the pair of support portions 101 and 103. The outlet-side passage portion 112 has an upper surface 111 that is disposed on the same plane as the upper surfaces 62, 102, and 104. Here, the portion surrounded by the inlet-side passage portion 61, the pair of support portions 101 and 103, and the outlet-side passage portion 112 configures a rejection hole 115. That is, the pair of support portions 101 and 103 form the rejection hole 115 between them. The rejection hole 115 is connected to the discharge port 25 shown in FIG. 1. A coin C that has fallen into the rejection hole 115 is discharged from the discharge port 25 through a rejection chute (not shown) and is accommodated in the exclusion box 26. The pair of wall portions 63 and 64 guide the outer peripheral surface of the coin C between the inlet-side passage portion 61 and the outlet-side passage portion 112.

The pair of support portions 101 and 103 configure an intermediate passage portion 121 that supports the outer periphery sides of the lower surfaces of the coins C between the inlet-side passage portion 61 and the outlet-side passage portion 112. The upper surface 62 of the inlet-side passage portion 61, the upper surface 102 of the support portion 101 and the upper surface 104 of the support portion 103 of the intermediate passage portion 121, and the upper surface 111 of the outlet-side passage portion 112 configure a conveyance surface 125 that is the upper surface of the conveyance passage 60.

The outlet-side passage portion 112 has the identification counting unit 37. The identification counting unit 37 includes a magnetic sensor that detects the coins C moving on the outlet-side passage portion 112 and counts the coins C while identifying the denomination thereof. The conveyance passage 60 has a falling hole 141 (a falling portion) provided on the side opposite to the intermediate passage portion 121 of the outlet-side passage portion 112. The coins C are identified and counted by the identification counting unit 37 of the outlet-side passage portion 112, and then fall from the falling hole 141 (the falling portion) of the conveyance passage 60. In other words, the falling hole 141 for causing the coins C to fall from the outlet-side passage portion 112 is provided on the side opposite to the inlet-side passage portion 61 of the outlet-side passage portion 112. The coins C which have fallen from the falling hole 141 are discharged from the chute main body 21 (FIG. 1) of the chute 19 to the outside of the coin processing device 11 through an internal chute (not shown).

As shown in FIG. 4, the feed belt 54 of the conveyance drive unit 35 comes into contact with the upper sides of the coins C separated from the rotating disk 14 one by one by the sorting ring 34 (FIG. 2) and fed onto the inlet-side passage portion 61 (FIG. 4). The feed belt 54 conveys the coins C from the inlet 91 side of the pair of wall portions 63 and 64 toward the rejection hole 115. If the coins C do not fall at the rejection hole 115, the feed belt 54 further conveys the coins C toward the outlet-side passage portion 112 and finally causes the coins C to fall into the falling hole 141.

The coins C are fed one by one from the rotating disk 14 onto the upper surface 62 of the inlet-side passage portion 61 of the conveyance passage 60. The coins C are conveyed between the wall surface 72 of the fixed wall 73 and the wall surface 82 of the movable wall 83 in the pair of wall portions 63 and 64. That is, the feed belt 54 of the conveyance drive unit 35 comes contact with the coins C fed onto the upper surface 62 of the inlet-side passage portion 61 from the upper side and moves the coins C along the conveyance passage 60. At that time, in the coins C, while the outer peripheral surfaces thereof are guided by the pair of wall portions 63 and 64, the lower surfaces thereof move on the upper surfaces 102 and 104 of the pair of support portions 101 and 103 from the upper surface 62 of the inlet-side passage portion 61, and further move on the upper surface 111 of the outlet-side passage portion 112. At that time, the pair of support portions 101 and 103 support the outer periphery sides of the lower surfaces of the coins C by the upper surfaces 102 and 104.

In this way, the conveyance drive unit 35 and the conveyance passage 60 convey the coins C from the inlet-side passage portion 61 side toward the falling hole 141. In other words, the coins C are supported by the inlet-side passage

portion **61**, the pair of support portions **101** and **103**, and the outlet-side passage portion **112**, and are moved by the conveyance drive unit **35**. At that time, the pair of wall portions **63** and **64** guide the outer peripheral surfaces of the coins C, and the pair of support portions **101** and **103** support the outer periphery sides of the lower surfaces of the coins C. The conveyance drive unit **35** and the conveyance passage **60** configure a coin conveyance unit **128** that sandwiches the coins C from above and below and conveys the coins C. The conveyance drive unit **35** configures a drive portion and an upper-side portion of the coin conveyance unit **128**. The conveyance passage **60** configures a lower-side portion of the coin conveyance unit **128**.

The outlet-side passage portion **112** has an outlet-side passage end portion **151** having a predetermined length, which is disposed between the identification counting unit **37** and the falling hole **141**. An upper surface **152** of the outlet-side passage end portion **151** is disposed on the same plane as the upper surface **62** of the inlet-side passage portion **61** and the upper surfaces **102** and **104** of the pair of support portions **101** and **103**, and configures a part of the upper surface **111** of the outlet-side passage portion **112**.

The upper surface **152** of the outlet-side passage end portion **151** is set to a size in which one smallest-diameter coin (that is, the 1-yen coin in Japan) among the coins to be processed can be placed (can remain) thereon in a state where the smallest-diameter coin is pressed from above by the feed belt **54**, but two or more coins cannot be placed (cannot remain). Therefore, the outlet-side passage end portion **151** has a size in which, with respect to all the denominations of the coins to be processed, only one coin can be placed while being pressed from above by the feed belt **54**. In other words, the outlet-side passage end portion **151** has a size in which, with respect to the coins of all the denominations of the coins to be processed, two coins cannot be arranged in series while being pressed from above by the feed belt **54**, and a size in which one of two coins in series falls into the falling hole **141**. The length in a coin conveyance direction from the center of the identification counting unit **37** to the end portion on the falling hole **141** side of the outlet-side passage end portion **151** is set to, for example, 14 mm.

Moving positions of the movable wall **83** and the support portion **103** are adjusted by an interval changing mechanism **106** shown in FIG. **3**. The course width adjusting knob **31** shown in FIGS. **1** and **2** is provided with a rotation position sensor **107** shown in FIG. **3**, which detects the rotation position thereof. The interval changing mechanism **106** changes the distance between the pair of wall portions **63** and **64** and the distance between the pair of support portions **101** and **103** according to the rotation position of the course width adjusting knob **31**, which is detected by the rotation position sensor **107**.

The fixed wall **73** and the support portion **101** configure a fixed side course guide wall **131**, and the movable wall **83** and the support portion **103** configure a movable side course guide wall **132**. The fixed side course guide wall **131** and the movable side course guide wall **132** configure a small-diameter coin exclusion type sorting course **133** that excludes coins C having a diameter smaller than that of the designated denomination to be counted through the rejection hole **115**.

Further, with respect to coins C having a diameter larger than that of the designated denomination to be counted, as shown by a two-dot chain line in FIG. **4**, the inlet roller **71** configuring the inlet **91** and the guide wall **81** come into contact with the coins having a larger diameter to restrict entry of the coins from the inlet-side passage portion **61** into the conveyance passage **60**. The inlet-side passage portion **61** has a retained coin detection sensor **126** provided in the vicinity of the inlet roller **71**. The retained coin detection sensor **126** detects retained coins C whose entry is restricted on the inlet **91** side, and outputs the detection signal to the control unit **15**.

If the rotation position of the course width adjusting knob **31** is regarded as a position corresponding to the 500-yen coin having the largest diameter, among the coins of the denominations to be counted, the control unit **15** sets the distance between the wall surface **72** of the fixed wall **73** and the wall surface **82** of the movable wall **83** and the distance between the facing tip surfaces of the pair of support portions **101** and **103** to be a predetermined 500-yen coin counting distance by the interval changing mechanism **106**. The 500-yen coin counting distance is a distance causing a 500-yen coin to be supported by the pair of support portions **101** and **103** without falling into the rejection hole **115**, and causing a 10-yen coin smaller than the 500-yen coin to fall into the rejection hole **115**. At this time, the distance between the wall surface **72** and the wall surface **82** becomes slightly larger than the diameter of the 500-yen coin. At this time, the width of the inlet **91**, which is equal to the distance between the wall surfaces **72** and **82**, also becomes slightly larger than the diameter of the 500-yen coin, which is the largest-diameter coin of the denomination to be counted.

In this way, the coin processing device supports the 500-yen coin, which is the largest-diameter coin among the denominations to be counted, with the pair of support portions **101** and **103**, while the 10-yen coin, the 100-yen coin, the 5-yen coin, the 50-yen coin, the 1-yen coin, and the like having a smaller diameter the 500-yen coin are caused to fall into the rejection hole **115**. That is, at this time, the interval between the fixed side course guide wall **131** and the movable side course guide wall **132** becomes a predetermined 500-yen coin counting interval corresponding to the counting of the 500-yen coins to cause the smaller-diameter coins to fall into the rejection hole **115** without causing the 500-yen coins to fall into the rejection hole **115**. In this state, with respect to the coins other than a counting target, which have a larger diameter than the 500-yen coins, the inlet roller **71** configuring the inlet **91** and the guide wall **81** come into contact with the coins to restrict the movement thereof in the direction away from the rotating disk **14**, in other words, the entry thereof between the fixed side course guide wall **131** and the movable side course guide wall **132**.

If the rotation position of the course width adjusting knob **31** is regarded as the position of the 10-yen coin as the coin of the denomination to be counted, the control unit **15** sets the distance between the wall surface **72** of the fixed wall **73** and the wall surface **82** of the movable wall **83** and the distance between the tip surfaces of the pair of support portions **101** and **103** to be a predetermined 10-yen coin counting distance. The predetermined 10-yen coin counting distance is a distance causing the 10-yen coin to be supported by the pair of support portions **101** and **103** without falling into the rejection hole **115**, and causing the 100-yen coin having a smaller diameter than the 10-yen coin to fall into the rejection hole **115**. That is, at this time, the interval between the fixed side course guide wall **131** and the movable side course guide wall **132** becomes a predetermined 10-yen coin counting interval corresponding to the counting of the 10-yen coins to cause the coins having a smaller diameter than the 10-yen coins to fall into the rejection hole **115** without causing the 10-yen coins to fall into the rejection hole **115**. In this state, with respect to the

500-yen coins or the like having a larger diameter than the 10-yen coins, the inlet roller **71** configuring the inlet **91** and the guide wall **81** come into contact with the coins to restrict the movement thereof in the direction away from the rotating disk **14**.

If the rotation position of the course width adjusting knob **31** is regarded as the position of the 100-yen coin as the coin of the denomination to be counted, the control unit **15** sets the distance between the wall surface **72** of the fixed wall **73** and the wall surface **82** of the movable wall **83** and the distance between the tip surfaces of the pair of support portions **101** and **103** to be a predetermined 100-yen coin counting distance. The predetermined 100-yen coin counting distance is a distance causing the 100-yen coin to be supported by the pair of support portions **101** and **103** without falling into the rejection hole **115**, and causing the 5-yen coin having a smaller diameter than the 100-yen coin to fall into the rejection hole **115**. That is, at this time, the interval between the fixed side course guide wall **131** and the movable side course guide wall **132** becomes a predetermined 100-yen coin counting interval corresponding to the counting of the 100-yen coins to cause the coins having a smaller diameter than the 100-yen coins to fall into the rejection hole **115** without causing the 100-yen coins to fall into the rejection hole **115**. In this state, with respect to the 500-yen coins, the 10-yen coins, and the like having a larger diameter than the 100-yen coin, the inlet roller **71** configuring the inlet **91** and the guide wall **81** come into contact with these coins to restrict the movement thereof in the direction away from the rotating disk **14**.

If the rotation position of the course width adjusting knob **31** is regarded as the position of the 5-yen coin as the coin of the denomination to be counted, the control unit **15** sets the distance between the wall surface **72** of the fixed wall **73** and the wall surface **82** of the movable wall **83** and the distance between the tip surfaces of the pair of support portions **101** and **103** to be a predetermined 5-yen coin counting distance. The predetermined 5-yen coin counting distance is a distance causing the 5-yen coin to be supported by the pair of support portions **101** and **103** without falling into the rejection hole **115**, and causing the 50-yen coin having a smaller diameter than the 5-yen coin to fall into the rejection hole **115**. That is, at this time, the interval between the fixed side course guide wall **131** and the movable side course guide wall **132** becomes a predetermined 5-yen coin counting interval corresponding to the counting of the 5-yen coins to cause the coins having a smaller diameter than the 5-yen coins to fall into the rejection hole **115** without causing the 5-yen coins to fall into the rejection hole **115**. In this state, with respect to the 500-yen coin, the 10-yen coin, the 100-yen coin, and the like having a larger diameter than the 5-yen coin, the inlet roller **71** configuring the inlet **91** and the guide wall **81** come into contact with these coins to restrict the movement thereof in the direction away from the rotating disk **14**.

If the rotation position of the course width adjusting knob **31** is regarded as the position of the 50-yen coin as the coin of the denomination to be counted, the control unit **15** sets the distance between the wall surface **72** of the fixed wall **73** and the wall surface **82** of the movable wall **83** and the distance between the tip surfaces of the pair of support portions **101** and **103** to be a predetermined 50-yen coin counting distance. The predetermined 50-yen coin counting distance is a distance causing the 50-yen coin to be supported by the pair of support portions **101** and **103** without falling into the rejection hole **115**, and causing the 1-yen coin having a smaller diameter than the 50-yen coin to fall into the rejection hole **115**. That is, at this time, the interval between the fixed side course guide wall **131** and the movable side course guide wall **132** becomes a predetermined 50-yen coin counting interval corresponding to the counting of the 50-yen coins to cause the coins having a smaller diameter than the 50-yen coins to fall into the rejection hole **115** without causing the 50-yen coins to fall into the rejection hole **115**. In this state, with respect to the 500-yen coin, the 10-yen coin, the 100-yen coin, the 5-yen coin, and the like having a larger diameter than the 50-yen coin, the inlet roller **71** configuring the inlet **91** and the guide wall **81** come into contact with these coins to restrict the movement thereof in the direction away from the rotating disk **14**.

If the rotation position of the course width adjusting knob **31** is regarded as the position of the 1-yen coin as the coin of the denomination to be counted, the control unit **15** sets the distance between the wall surface **72** of the fixed wall **73** and the wall surface **82** of the movable wall **83** and the distance between the tip surfaces of the pair of support portions **101** and **103** to be a predetermined 1-yen coin counting distance. The predetermined 1-yen coin counting distance is a distance causing the 1-yen coin to be supported by the pair of support portions **101** and **103** without falling into the rejection hole **115**, and causing the coins having a smaller diameter than the 1-yen coin to fall into the rejection hole **115**. That is, the interval between the fixed side course guide wall **131** and the movable side course guide wall **132** becomes a predetermined 1-yen coin counting interval corresponding to the counting of the 1-yen coins to cause the coins having a smaller diameter than the 1-yen coins to fall into the rejection hole **115** without causing the 1-yen coins to fall into the rejection hole **115**. In this state, with respect to the 500-yen coin, the 10-yen coin, the 100-yen coin, the 5-yen coin, the 50-yen coin, and the like having a larger diameter than the 1-yen coin, the inlet roller **71** configuring the inlet **91** and the guide wall **81** come into contact with these coins to restrict the movement thereof in the direction away from the rotating disk **14**.

As shown in FIG. **3**, the feeding motor **16**, the operation display unit **30**, the identification counting unit **37**, the conveyance motor **57**, the residual detection sensor **17**, the interval changing mechanism **106**, the rotation position sensor **107**, and the retained coin detection sensor **126** are communicably connected to the control unit **15**.

As shown in FIG. **4**, in the coin processing device **11** of the present embodiment, a stopper mechanism that comes into contact with the coins C from the front in the conveyance direction at the time of the conveyance of the coins C toward the falling hole **141**, thereby restricting falling of the coins C into the falling hole **141** and keeping the coins C on the outlet-side passage portion **112**, is not provided at the outlet-side passage portion **112** that includes the outlet-side passage end portion **151**. Further, a stopper mechanism that comes into contact with the coins C from the front in the conveyance direction at the time of the conveyance of the coins C toward the rotating disk **14**, thereby restricting the movement of the coins C to the rotating disk **14** and keeping the coins C on the outlet-side passage portion **112**, is also not provided at the outlet-side passage portion **112**. In the coin processing device **11** of the present embodiment, as a method of stopping the coins C that are conveyed by the coin conveyance unit **128** without providing such a stopper mechanism, a method of stopping the coins by speed control of the conveyance motor **57**, which is a stepping motor, is adopted.

As described above, the conveyance drive unit **35** that includes the feed belt **54** comes into contact with the coins C separated from the rotating disk **14** one by one by the sorting ring **34** and fed onto the inlet-side passage portion **61** on the upper side, thereby conveying the coins C on the conveyance passage **60** from the inlet **91** side of the pair of wall portions **63** and **64** toward the rejection hole **115**. If the coins C which are being conveyed do not fall at the rejection hole **115**, the conveyance drive unit **35** further conveys the coins C toward the outlet-side passage portion **112** and finally conveys the coins C to the falling hole **141**.

In the feed belt **54** and the conveyance motor **57** that drives the feed belt **54**, as described above, the rotation direction for conveying the coins C from the inlet-side passage portion **61** to the outlet-side passage portion **112** on the conveyance passage **60**, in other words, from the rotating disk **14** side toward the falling hole **141** side, is set to be normal rotation. On the other hand, the rotation direction for conveying the coins C from the outlet-side passage portion **112** toward the inlet-side passage portion **61** on the conveyance passage **60** in the direction opposite to the normal rotation is set to be reverse rotation. The feed belt **54** comes into contact with the coins C on the upper side and normally rotates to convey the coins C from the inlet-side passage portion **61** toward the outlet-side passage portion **112**. At this time, the conveyance motor **57** normally rotates the feed belt **54** at the time of normal rotation. Further, the feed belt **54** comes into contact with the coins C on the upper side and reversely rotates to convey the coins C from the outlet-side passage portion **112** toward the inlet-side passage portion **61**. At this time, the conveyance motor **57** reversely rotates the feed belt **54** at the time of reverse rotation. The upstream side in the conveyance direction at the time of the normal rotation of the feed belt **54** is defined as the upstream side at the time of normal rotation, and the downstream side in the conveyance direction at the time of the normal rotation of the feed belt **54** is defined as the downstream side at the time of normal rotation. The inlet-side passage portion **61** is disposed on the upstream side at the time of normal rotation with respect to the outlet-side passage portion **112**. On the other hand, the outlet-side passage portion **112** is disposed on the downstream side at the time of normal rotation with respect to the inlet-side passage portion **61**.

In the rotating disk **14** and the feeding motor **16** that drives the rotating disk **14**, the rotation direction of feeding the coins C from the rotating disk **14** toward the inlet-side passage portion **61** is set to be normal rotation. The rotation direction in which the coins C which are returned from the inlet-side passage portion **61** in the direction opposite to the normal rotation are received in the rotating disk **14** is set to be reverse rotation.

Next, the processing of the coin processing device **11** will be described with reference to the flowcharts shown in FIGS. **5** to **9**. Here, batch processing will be described in which the coins C of the denomination set in advance, among the coins C input in the hopper **12**, are discharged from the chute **19** by the number of coins set in advance, and stored in the storage bag (not shown) mounted to the chute **19**.

The operator selects the denomination to be counted (for example, the 500-yen coin) on the operation display unit **30**. The operator inputs the number of coins (for example, 100 coins) to be processed in this batch processing on the operation display unit **30**. Further, the operator sets the rotation position of the knob **31** to the position of the denomination to be counted (for example, the 500-yen coin) with the course width adjusting knob **31**. If such a setting is made, the control unit **15** controls the interval changing mechanism **106** to give a feeling according to the denomination to be counted. That is, the control unit **15** makes the fixed side course guide wall **131** and the movable side course guide wall **132** have the interval (for example, the 500-yen coin counting interval) for causing coins having a diameter smaller than that of the denomination to be counted to fall into the rejection hole **115** without causing the coins of the denomination to be counted to fall into the rejection hole **115**. At the same time, the control unit **15** causes the operation display unit **30** to display a display prompting input of the coins C of the denomination to be counted into the hopper **12**.

If the operator inputs the coins C into the hopper **12**, the residual detection sensor **17** detects the input of the coins C. Then, the control unit **15** causes the operation display unit **30** to display a display prompting a start operation. If the start operation is input to the operation display unit **30** by the operator, the control unit **15** outputs an instruction signal instructing the feeding motor **16** and the conveyance motor **57** to normally rotate at a normal speed. At the same time, the control unit **15** starts timing of a waiting time for arrival of a subsequent coin (step **S101**). In this way, the rotating disk **14** and the feed belt **54** enter the usual normal rotation state where they normally rotate at the normal speed.

Then, the coins in the hopper **12** are fed toward the space between the wall surface **72** of the fixed wall **73** and the wall surface **82** of the movable wall **83** on the upper surface **62** of the inlet-side passage portion **61** of the conveyance passage **60** while being separated one by one by the sorting ring **34** due to the centrifugal force of the rotating disk **14** that normally rotates at the normal speed.

Next, the feed belt **54**, which normally rotates at the normal speed, comes into contact with the coins C fed onto the upper surface **62** of the inlet-side passage portion **61** from the upper side to move the coins C along the conveyance passage **60**. At that time, the coins C having a larger diameter than the coins C of the denomination to be counted come into contact with the inlet roller **71** configuring the inlet **91** and the guide wall **81**, and thus the movement thereof to the downstream side at the time of normal rotation is restricted. Further, the coins C of the denomination to be counted and a fake coin C having almost the same diameter as the coins C move downstream while the outer peripheral surfaces thereof are guided by the wall surface **72** of the fixed wall **73** and the wall surface **82** of the movable wall **83**. At this time, the lower surfaces of the coins C move from the upper surface **62** of the inlet-side passage portion **61** to the downstream side at the time of normal rotation on the upper surfaces **102** and **104** of the pair of support portions **101** and **103** and further on the upper surface **111** of the outlet-side passage portion **112**. Then, the coins C of the denomination to be counted and the fake coin C having almost the same diameter as the coins C move on the conveyance passage **60** to the downstream side at the time of normal rotation at the normal speed integrally with the lower side portion of the feed belt **54** that normally rotates at the normal speed. Further, the coins C having a smaller diameter than the coins C of the denomination to be counted fall from the rejection hole **115**, are discharged from the discharge port **25** through a rejection chute (not shown), and are accommodated in the exclusion box **26**.

In this way, the feed belt **54** and the conveyance passage **60** convey the coins C of the denomination to be counted and the fake coin C having almost the same diameter as the coins C from the inlet-side passage portion **61** side toward the outlet-side passage portion **112** side. In other words, the

coins C of the denomination to be counted and the fake coin C having almost the same diameter as the coins C are supported by the inlet-side passage portion **61**, the pair of support portions **101** and **103**, and the outlet-side passage portion **112** of the conveyance passage **60** and moved by the driving of the feed belt **54**. At that time, the pair of wall portions **63** and **64** guide the outer peripheral surfaces of the coins C, and the pair of support portions **101** and **103** support the outer periphery sides of the lower surfaces of the coins C.

The coins C of the denomination to be counted and the fake coin C having almost the same diameter as the coins C are conveyed by the feed belt **54** which is in the usual normal rotation state where it normally rotates at the normal speed, as described above, and move to the downstream side at the time of normal rotation on the upper surface **111** of the outlet-side passage portion **112** at the normal speed. During this movement, the coins C and the fake coin C pass through the identification counting unit **37** which is a magnetic sensor provided at the outlet-side passage portion **112**. Here, the identification counting unit **37** measures the magnetism of the coins C which have passed through it, and determines whether or not a peak value of the obtained magnetic data is detected (step S**102**). If the identification counting unit **37** detects the peak value of the magnetic data (step S**102**: YES), the control unit **15** determines that the identification counting unit **37** has detected a coin C. At the point in time of this determination, the coin C is located at a predetermined position facing the identification counting unit **37** in the conveyance direction.

In step S**102**, if the identification counting unit **37** detects the coin C, the control unit **15** compares the peak value of the magnetic data thereof with the master data stored in advance, and identifies whether or not the coin C is a coin of the denomination to be counted (step S**103**).

[In a Case where the Coin is a Coin of the Denomination to be Counted]

In a case where the coin C detected in step S**102** is identified as a coin of the denomination to be counted (step S**103**: YES), the control unit **15** increments a counting counter by 1, as the counting value of the coins C in this batch processing. At the same time, the control unit **15** retimes the waiting time for arrival of a subsequent coin from 0 (step S**104**). Next, the control unit **15** subtracts the counting value of the counting counter from the number of coins to be processed (for example, 100 coins) set in this batch processing to calculate the number of remaining coins to be processed (the number of remaining batch coins). The control unit **15** determines whether or not the number of coins C has reached the number of coins to be processed in the batch processing, that is, whether or not the number of remaining batch coins is 0, and determines whether or not a stop operation has been input to the operation display unit **30** (step S**105**). If the number of remaining batch coins is not 0 and the stop operation has not been input to the operation display unit **30** (step S**105**: NO), the processing returns to step S**102**. The coin C identified as a coin of the denomination to be counted in step S**103** is conveyed by the feed belt **54** that normally rotates at the normal speed to move to the outlet-side passage end portion **151**, falls from the falling hole **141**, and is discharged from the chute **19** through an internal chute (not shown).

By repeating the processing shown in steps S**102** to S**105**, a number the coins C of the denomination to be counted set at the time of start of this batch processing can be caused to sequentially fall into the falling holes **141** and collected in the storage bag (not shown) mounted to the chute **19**.

In the determination of step S**102**, if the identification counting unit **37** does not detect the peak value of the magnetic data, in other words, if the identification counting unit **37** does not detect the coin C (step S**102**: NO), the control unit **15** determines whether or not a predetermined waiting time has elapsed within the waiting time for arrival of the subsequent coin whose timing has been started in step S**101** or the waiting time for arrival of the subsequent coin whose timing has been restarted in step S**104** (step S**401**). If the predetermined waiting time has not elapsed within the waiting time for arrival of the subsequent coin (step S**401**: NO), the processing returns to step S**102**. If the predetermined waiting time has elapsed within the waiting time for arrival of the subsequent coin (step S**401**: YES), the control unit **15** outputs an instruction signal instructing the feeding motor **16** and the conveyance motor **57** to stop (step S**402**). In this way, the rotating disk **14** and the feed belt **54** stop. Then, the batch processing is ended. That is, in a case where there are no more coins C to be counted during the batch processing, even if the coins C caused to fall into the falling hole **141** do not reach the number of coins to be processed in the batch processing, the batch processing is forcibly ended and the rotating disk **14** and the feed belt **54** are stopped.

By repeating the processes of steps S**102** to S**105**, as described above, the coins C of the denomination to be counted are caused to sequentially fall into the falling hole **141**. If the peak value is detected in step S**102**, the coin is identified as a coin of the denomination to be counted in step S**103**, the counting value of the counting counter becomes the number of coins to be processed in this batch processing due to the coins C whose counting counter is incremented by 1 in step S**104**, and the number of remaining batch coins becomes 0 (step S**105**: YES), the coin C becomes the last coin C (for example, the 100th coin) in the batch processing.

If the number of remaining batch coins becomes 0 (step S**105**: YES), the control unit **15** outputs an instruction signal instructing the conveyance motor **57** to normally rotate at a first slow speed slower than the normal speed. At the same time, the control unit **15** outputs an instruction signal instructing the feeding motor **16** to stop (step S**106**). Even in a case where it is determined in step S**105** that the stop operation has been input to the operation display unit **30**, the control unit **15** performs the same control as in a case where the number of remaining batch coins becomes 0.

In step S**106**, the control unit **15** outputs an instruction signal instructing the feeding motor **16** to stop, whereby the rotating disk **14** stops. At the same time, the conveyance motor **57** is switched from the usual normal rotation state where the conveyance motor **57** normally rotates at the normal speed to the first slow normal rotation state where the conveyance motor **57** normally rotates at the first slow speed. According to this, the feed belt **54** also normally rotates at the first slow speed slower than the normal speed until then. The conveyance motor **57** is switched to the first slow speed, whereby the last coin C of the number of coins to be processed in a state where the number of remaining batch coins is 0 in step S**105** moves to the downstream side at the time of normal rotation at the outlet-side passage end portion **151** at the first slow speed slower than the normal speed, and falls into the falling hole **141**.

More specifically, the normal speed described above is prepared in two types: a high-speed mode and a low-speed mode, according to the counting speed selection of the operator. The design value of the high-speed mode is 1318 mm/s, and the design value of the low-speed mode is 1040 mm/s. With respect to these normal speeds, the first slow

speed is set to a speed in consideration of a margin for lowering the speed, and the design value is 452 mm/s. That is, when a large-diameter coin with a large mass (specifically, the 500-yen coin) is being conveyed at the normal speed, even if the stop operation is performed with the detection by the identification counting unit **37** as a trigger, the stop position of the coin C moves in the conveyance direction due to inertia. As a result, the coin C cannot stay on the outlet-side passage end portion **151**, and there is a possibility that the coin C may erroneously fall into the falling hole **141** on the downstream side. In order to solve this, it is necessary to start the deceleration control of the conveyance motor **57** in stages, and as described above, the feed belt **54** is controlled to normally rotate at the first slow speed slower than the normal speed.

Even after the last coin C to be processed in this batch processing is detected, the identification counting unit **37** detects magnetism, thereby determining whether or not the peak value of the magnetic data is detected (step **S107** in FIG. **6**).

{In a Case where there is a Subsequent Coin on the Upstream Side at the Time of Normal Rotation of the Last Coin in the Batch Processing}

In FIG. **6**, in the determination in step **S107**, if the identification counting unit **37** detects the peak value of the magnetic data (step **S107**: YES), the control unit **15** determines that the identification counting unit **37** has detected the coin C to be stopped (for example, the 101st coin), which is a target to be stopped, following the last coin C (for example, the 100th coin) that is processed in this batch processing. At the point in time of this determination, the coin C to be stopped is located at a position facing the identification counting unit **37** in the conveyance direction.

If the peak value of the magnetic data of the coin C to be stopped is detected (step **S107**: YES), the control unit **15** outputs an instruction signal instructing the conveyance motor **57** to normally rotate at the second slow speed slower than the first slow speed (step **S108**).

In this way, the conveyance motor **57** is switched from the first slow normal rotation state where the conveyance motor **57** normally rotates at the first slow speed to the second slow normal rotation state where the conveyance motor **57** normally rotates at the second slow speed slower than the first slow speed. According to this, the feed belt **54** normally rotates at the second slow speed slower than the first slow speed. At this time, the rotating disk **14** is maintained in the stopped state. If the feed belt **54** rotates at the second slow speed, the coin C to be stopped, which is adjacent to and follows the last coin C to be processed in this batch processing, moves to the downstream side at the time of normal rotation at the outlet-side passage end portion **151** at the second slow speed slower than the first slow speed. In this manner, the control unit **15** switches the conveyance motor **57** that normally rotates from the first slow normal rotation state to the second slow normal rotation state having the second slow speed slower than the speed of the first slow normal rotation state, in response to the detection of the identification counting unit **37**, and then rotates the conveyance motor **57**.

Here, the second slow speed of the conveyance motor **57** is a speed at which the coin C can be stopped immediately after the conveyance motor **57** receives an instruction signal instructing it to stop, thereafter, and, for example, 339 mm/s is set as a design value thereof.

After the control unit **15** outputs an instruction signal for normal rotation at the second slow speed to the conveyance motor **57**, the control unit **15** determines whether or not the identification counting unit **37** has detected the coin C to be stopped, which is adjacent to and follows the last coin C to be processed in this batch processing, according to the detection of the magnetic data thereof (step **S109**). In this determination, if the identification counting unit **37** is in a detection state where it detects the magnetic data at a level equal to or higher than a predetermined value, thus detecting the coin C to be stopped (step **S109**: YES), the control unit **15** performs waiting by repeating step **S109** until a non-detection state is created where the magnetic data detected by the identification counting unit **37** reaches a level lower than the predetermined value, and thus the coin C to be stopped is not detected.

If the identification counting unit **37** does not detect the magnetic data of the coin C to be stopped at a level equal to or higher than the predetermined value, and thus the non-detection state is created where the coin C is not detected (step **S109**: NO), the coin C to be stopped passes through the identification counting unit **37**. That is, at the point in time when the coin C to be stopped is changed from the detection state to the non-detection state, the coin C to be stopped does not face the identification counting unit **37**, does not fall into the falling hole **141**, and is located at a predetermined position on the outlet-side passage end portion **151**.

As described above, if the identification counting unit **37** does not detect the coin C to be stopped (step **S109**: NO), the control unit **15** outputs an instruction signal instructing the conveyance motor **57** to stop (step **S110**). In this way, the feed belt **54** which has been normally rotated at the second slow speed until then stops immediately. Even at this time, the rotating disk **14** is maintained in the stopped state. If the feed belt **54** stops, the coin C to be stopped, which has been detected in step **S107**, stops on the outlet-side passage end portion **151**. If the feed belt **54** stops, only one coin C to be stopped, which is adjacent to and follows the last coin C to be processed in this batch processing, is located on the outlet-side passage end portion **151**.

In other words, at the point in time when, at the time of the normal rotation of the conveyance motor **57** at the second slow speed, a change from the detection state where the level of the magnetic data of the coin C detected by the identification counting unit **37** is equal to or higher than a predetermined value to the non-detection state where the level of the magnetic data is not equal to or higher than the predetermined value is made, the control unit **15** outputs an instruction signal to stop to the conveyance motor **57**. Then, one coin C, which stops together with the feed belt **54**, does not fall into the falling hole **141** and remains at the outlet-side passage end portion **151**, and if all the coins C which have been conveyed to the falling hole **141** side ahead of the coin C are normal, they fall into the falling hole **141**. The outlet-side passage end portion **151** is set to be in a dimensional relationship that satisfies such an operation with respect to the coins C of all the denominations of the coins to be processed. In this manner, even if there is a subsequent coin C adjacent to the upstream side at the time of normal rotation with respect to the coin C remaining at the outlet-side passage end portion **151** at the time of stop of the feed belt **54**, the identification counting unit **37** does not detect the peak value of the magnetic data of the subsequent coin C.

Further, in other words, the second slow speed of the conveyance motor **57** is a speed at which the coin C to be stopped can stop on the outlet-side passage portion **112** on the downstream side of the identification counting unit **37** after the coin C to be stopped is detected by the identification counting unit **37**.

In the flow of the processing shown in steps S101 to S106 described above, the control unit **15** switches the conveyance motor **57** from the usual normal rotation state (the third rotation state), which has a speed faster than the first slow normal rotation state (the first rotation state) where the conveyance motor **57** rotates at the first slow speed, to the first slow normal rotation state, in response to the detection by the identification counting unit **37** of the last coin C to be processed in the batch processing, which is on the downstream side at the time of normal rotation by one coin with respect to one coin C to be stopped.

Further, in the flow of the processing shown in steps S107 to S110 described above, the control unit **15** switches the conveyance motor **57** from the first slow normal rotation state (the first rotation state) where the conveyance motor **57** rotates at the first slow speed to the second slow normal rotation state (the second rotation state) where the conveyance motor **57** rotates at the second slow speed, in response to the detection by the identification counting unit **37** of one coin C to be stopped, which has been conveyed next to the last coin C to be processed in the batch processing. Thereafter, the control unit **15** performs stop control for stopping the conveyance motor **57**, in response to the change from the detection state of one coin C to be stopped by the identification counting unit **37** to the non-detection state.

Due to this stop control, the control unit **15** stops only one coin C to be stopped on the outlet-side passage end portion **151** which is on the downstream side at the time of normal rotation with respect to the identification counting unit **37** in the outlet-side passage portion **112**. Here, the outlet-side passage end portion **151** has a size in which one coin C of the coins of all the denominations of the coins to be processed can be placed (can remain) and two or more coins cannot be placed (cannot remain). Therefore, in this stop control, the last coin C to be processed in the batch processing, which is adjacent to the downstream side at the time of normal rotation of one coin C to be stopped, and all the previous coins C before it are caused to fall into the falling hole **141**.

The first slow normal rotation state switched from the usual normal rotation state in step S106 is continued as it is until it is switched to the second slow normal rotation state in step S108 thereafter. Further, the second slow normal rotation state switched from the first slow normal rotation state in step S108 is continued as it is until it is switched to the stopped state in step S110 thereafter.

The control unit **15** outputs the instruction signal instructing the conveyance motor **57** to stop, in step S110, and then writes 1 to a stop coin number counter (step S111). Here, in the stop coin number counter, the number of coins C that have to pass through the identification counting unit **37** at the time of reverse rotation conveyance to be performed from now on is set. That is, one is set as the number of coins C that have to pass through the identification counting unit **37** at the time of the reverse rotation conveyance.

Next, the control unit **15** outputs an instruction signal instructing the feeding motor **16** and the conveyance motor **57** to reversely rotate, and starts timing of a return time (step S112). Then, a reverse rotation state is created where both the rotating disk **14** and the feed belt **54** reversely rotate.

Thereafter, the control unit **15** determines whether or not the stop coin number counter is 1 (step S113), and in a case where the stop coin number counter is 1 (step S113: YES), that is, in a case where there is a coin C following the last coin C to be processed in the batch processing, the identification counting unit **37** determines whether or not the peak value of the magnetic data has been detected (step S114). In the determination in step S114, if the peak value of the magnetic data is not detected (step S114: NO), waiting is performed by repeating step S114. Here, if the coin C whose peak value is detected in step S114 is normal, as described above, only one coin C which was a target to be stopped remains on the outlet-side passage end portion **151**.

In the determination in step S114, if the peak value of the magnetic data is detected (step S114: YES), the control unit **15** again determines whether or not the identification counting unit **37** has detected the peak value of the magnetic data (step S115). The identification counting unit **37** usually detects only the peak value of the magnetic data of one coin C which was a target to be stopped, as described above, and therefore, in step S115, the peak value of the magnetic data is not detected. That is, step S114 and step S115 are processing for confirming that only one coin C has passed through the identification counting unit **37**.

In step S114, the determination for detecting the coin C is performed according to whether or not the identification counting unit **37** detects the peak value of the magnetic data. This determination may be performed according to whether or not the identification counting unit **37** detects a level equal to or higher than a predetermined threshold value of the magnetic data. That is, the state where the identification counting unit **37** detects that the magnetic data is at a level equal to or higher than the predetermined threshold value may be defined as the detection state of the coin C, and the state where the identification counting unit **37** detects that the magnetic data is at a level lower than the threshold value may be defined as the non-detection state of the coin C. If the identification counting unit **37** detects that one coin C which was a target to be stopped has been changed from the detection state to the non-detection state, the control unit **15** may determine that the coin C has passed through the identification counting unit **37** at the time of the reverse rotation conveyance. Further, the same applies to the determination in step S115.

In step S115, if the identification counting unit **37** does not detect the peak value of the magnetic data (step S115: NO), whether or not a predetermined reverse rotation drive time required for returning all the coins C remaining on the conveyance passage **60** to the rotating disk **14** has elapsed within the return time whose timing has been started in step S112 is determined (step S116). The design value of the reverse rotation drive time is set to, for example, 200 ms.

If by the reverse rotation drive time has not elapsed within the return time (step S116: NO), the processing returns to step S115. Step S115 and step S116 are repeated until the reverse rotation drive time elapses within the return time. If the reverse rotation drive time elapses within the return time (step S116: YES), the control unit **15** outputs an instruction signal instructing the feeding motor **16** and the conveyance motor **57** to stop (step S118), and ends the batch processing.

In this way, the rotating disk **14** stops and the feed belt **54** stops. In this manner, the rotating disk **14** and the feed belt **54** are set to be in the reverse rotation state until the reverse rotation drive time elapses within the return time. In this way, with the processing of steps S101 to S110 in which the number to be batch-processed of coins C of the denomination to be counted are discharged to the chute **19**, all the coins C fed from the rotating disk **14** to the conveyance passage **60** which exceed the number of coins to be batch-processed can be returned to the rotating disk **14**.

As described above, one coin C which was a target to be stopped, which has been conveyed next to the last coin C to be batch-processed, is returned to the rotating disk **14** at the end of this processing.

As described above, by the reverse rotation conveyance after the stop control, all the coins C on the conveyance passage **60** are finally returned to the hopper **12**. During this period, the number of coins C detected by the identification counting unit **37** is only the 101st coin C. That is, this is because the number of coins C that pass through the identification counting unit **37**, temporarily stop on the outlet-side passage end portion **151** (for example, a total length of 14 mm), are then reversely conveyed by the reverse rotation of the conveyance motor **57**, and pass through the identification counting unit **37** again is only the one that can stay on the outlet-side passage end portion **151**. With the conveyance of the 101st coin, the control unit **15** determines that all the coins C up to the 100th coin have fallen into the falling hole **141** located on the downstream side at the time of normal rotation from the outlet-side passage end portion **151** and been conveyed to the chute **19** through an internal chute (not shown).

In the determination in step **S115**, if the identification counting unit **37** detects the peak value of the magnetic data that cannot be originally detected (step **S115**: YES), the control unit **15** determines that the last coin C to be processed in the batch processing has been returned to the outlet-side passage portion **112**, and stops the feeding motor **16** and the conveyance motor **57**. Further, the control unit **15** performs error processing at the time of reverse rotation for performing error display indicating that the last coin C to be processed in the batch processing has been returned on the operation display unit **30** (step **S117**), and ends the batch processing.

That is, in a case where the identification counting unit **37** detects two or more coins at the time of reverse rotation conveyance, it is an unforeseen situation and a situation occurs in which the last coin C to be processed in the batch processing, which has to fall into the falling hole **141**, has been returned onto the conveyance passage **60**. As a cause, for example, a state is assumed where the 100th coin C, which is the last coin to be processed in the batch processing, and the 101st coin C which was a target to be stopped are connected to each other by tape or the like. At this time, the control unit **15** causes the occurrence of an error to be displayed on the operation display unit **30** and also performs a notification by a buzzer or the like. In this way, the operator is urged to perform confirmation and removal of the coin.

In the flow of the processing shown in steps **S111** to **S118** described above, after the stop control described above is performed, the control unit **15** reversely rotates the conveyance motor **57** to perform switching to the reverse conveyance of the coin C toward the upstream side at the time of normal rotation opposite to the downstream side at the time of normal rotation. Thereafter, the control unit **15** confirms that one coin C to be stopped has been detected by the identification counting unit **37**. If only one coin C to be stopped is detected by the identification counting unit **37**, since the control unit **15** can determine that all the coins C conveyed in the direction of the downstream side at the time of normal rotation ahead of one coin C to be stopped did not remain on the outlet-side passage portion **112**, it is not regarded as an error.

{In a Case where there is No Subsequent Coin on the Upstream Side at the Time of Normal Rotation of the Last Coin in the Batch Processing}

In the determination in step **S107**, if the peak value of the magnetic data is not detected (step **S107**: NO), whether or not a predetermined waiting time has elapsed within the waiting time for arrival of the subsequent coin retimed in step **S104** in response to the detection of the last coin C to be processed in the batch processing in step **S102** is determined (step **S201**). Here, for the predetermined waiting time, for example, 500 ms is set as a design value. If the predetermined waiting time has not elapsed within the waiting time for arrival of the subsequent coin, the processing returns to step **S107**, and steps **S107** and **S201** are repeated. If the predetermined waiting time has elapsed within the waiting time for arrival of the subsequent coin (step **S201**: YES), the control unit **15** outputs an instruction signal instructing the conveyance motor **57** to stop (step **S202**). In this way, the feed belt **54** stops. Even at this time, the rotating disk **14** is maintained in the stopped state.

With respect to the control of the conveyance motor **57**, similar to the control of the feeding motor **16**, it is desirable for the time associated with the stop operation to be short (for example, 0 ms). However, due to the nature in which the stepping motor is used for the conveyance motor **57**, it is necessary to perform deceleration control for preventing step-out, and since immediate stop is not possible, it is preferable for a predetermined time determined in advance to be provided between the time when it is determined that a stop has to be made and the time when an instruction signal instructing to stop is output.

In step **S202**, after the control unit **15** outputs the instruction signal instructing the conveyance motor **57** to stop, the control unit **15** writes 0 to the stop coin number counter (step **S203**). Thereafter, the processing proceeds to step **S113**. In step **S113**, since the stop coin number counter is 0 and not 1 (step **S113**: NO), the batch processing is ended.

[In a Case where the Coin is a Different Denomination Coin that is not a Coin of the Denomination to be Counted]

In a case where the coin C in which the peak value of the magnetic data is detected by the identification counting unit **37** in step **S102** is identified as a different denomination coin that is not a coin C of the denomination to be counted (step **S103**: NO), in other words, in a case where it is identified as a coin C other than a falling target to be caused to fall into the falling portion **141**, the control unit **15** performs different denomination stop control shown in FIGS. **8** and **9**.

That is, the control unit **15** outputs an instruction signal instructing the conveyance motor **57** to normally rotate at the second slow speed slower than the previous normal speed. At the same time, the control unit **15** outputs an instruction signal instructing the feeding motor **16** to stop (step **S301**). That is, the control unit **15** instantly reduces the speed of the conveyance motor **57** from the normal speed to the second slow speed even slower than the first slow speed that is slower than the normal speed.

Due to step **S301**, the rotating disk **14** stops and the conveyance motor **57** is switched from the usual normal rotation state where the conveyance motor **57** normally rotates at the normal speed to the second slow normal rotation state where the conveyance motor **57** normally rotates at the second slow speed. According to this, the feed belt **54** rotates at the second slow speed slower than the normal speed. If the feed belt **54** rotates at the second slow speed, the different denomination coin C to be stopped, which is not identified as a coin C of the denomination to be counted in step **S103**, moves to the downstream side at the time of normal rotation at the outlet-side passage end portion **151** at the second slow speed slower than the normal speed. In this manner, the control unit **15** switches the conveyance motor **57** that normally rotates from the usual normal rotation state to the second slow normal rotation state having the second slow speed slower than the rotation speed in the

usual normal rotation state, in response to the detection of the identification counting unit **37**, and then rotates the conveyance motor **57**.

After the instruction signal for the normal rotation at the second slow speed is output to the conveyance motor **57**, the control unit **15** determines whether or not the identification counting unit **37** has detected the magnetic data of the different denomination coin C to be stopped (step **S302**). In this determination, if the identification counting unit **37** detects the magnetic data at a level equal to or higher than a predetermined value and is in a detection state where the magnetic data is detected as the different denomination coin C (step **S302**: YES), the control unit **15** performs waiting by repeating step **S302** until a non-detection state is created where the level of the magnetic data of the identification counting unit **37** becomes less than a predetermined value, so that the different denomination coin C is not detected.

If the non-detection state where the magnetic data of the different denomination coin C to be stopped is not detected at a level equal to or higher than a predetermined value by the identification counting unit **37** is created (step **S302**: NO), the different denomination coin C passes through the identification counting unit **37**. In other words, if the non-detection state where the different denomination coin C to be stopped is not detected by the identification counting unit **37** is created, the different denomination coin C to be stopped is located at a predetermined position on the outlet-side passage end portion **151**, where it does not face the identification counting unit **37** in the conveyance direction and does not fall into the falling hole **141**.

If the non-detection state where the different denomination coin C to be stopped is not detected by the identification counting unit **37** is created (step **S302**: NO), the control unit **15** outputs an instruction signal instructing the conveyance motor **57** to stop (step **S303**). In this way, the feed belt **54** stops immediately. Even at this time, the rotating disk **14** is maintained in the stopped state. If the feed belt **54** stops, the different denomination coin C to be stopped, which has been detected in step **S103**, stops on the outlet-side passage end portion **151**. If the feed belt **54** stops, as described above, only one different denomination coin C to be stopped is located on the outlet-side passage end portion **151**. However, even if there is the coin C on the upstream side at the time of normal rotation with respect to the different denomination coin C, there is no case where the identification counting unit **37** detects the peak value of the magnetic data of the coin C.

In the flow of the processing shown in steps **S103** and **S301** to **S303** described above, if the different denomination coin C other than the coin of the denomination to be counted, that is, the coin C other than the falling target to be caused to fall into the falling portion **141**, is detected based on the detection of the identification counting unit **37**, the control unit **15** sets the different denomination coin to be one coin C to be stopped. The control unit **15** switches the conveyance motor **57** from the usual normal rotation state (the first rotation state) where the conveyance motor **57** rotates at the normal speed to the second slow normal rotation state (the second rotation state) where the conveyance motor **57** rotates at the second slow speed, in response to the detection of one coin C to be stopped by the identification counting unit **37**. Thereafter, the stop control for stopping the conveyance motor **57** is performed in response to a change from the detection state of one different denomination coin C to be stopped by the identification counting unit **37** to the non-detection state.

Due to this stop control, one different denomination coin to be stopped is stopped on the outlet-side passage end portion **151** which is on the downstream side at the time of normal rotation with respect to the identification counting unit **37** in the outlet-side passage portion **112**. Here, the outlet-side passage end portion **151** has a size in which one coin of the coins of all the denominations to be processed can remain, but two or more coins cannot remain. Therefore, the same applies to different denomination coins having the same outer diameter as a regular coin, and in this stop control, the coin C of the denomination to be counted during the batch processing, which is on the downstream side at the time of normal rotation of one different denomination coin to be stopped, falls into the falling hole **141**.

The second slow normal rotation state switched from the usual normal rotation state in step **S301** is continued as it is until it is switched to the stopped state in step **S303**.

In step **S303**, after the control unit **15** outputs the instruction signal instructing the conveyance motor **57** to stop, the control unit **15** writes 1 to the stop coin number counter (step **S304**). Here, the stop coin number counter indicates the number of coins C that have to pass through the identification counting unit **37** at the time of reverse rotation conveyance to be performed from then on. That is, one coin C is set to pass through the identification counting unit **37** during the subsequent reverse rotation conveyance.

Next, the control unit **15** outputs an instruction signal instructing the feeding motor **16** and the conveyance motor **57** to reversely rotate, and starts the timing of the return time (step **S305**). Then, a reverse rotation state is created where both the rotating disk **14** and the feed belt **54** reversely rotate.

Thereafter, the control unit **15** determines whether or not the stop coin number counter is 1 (step **S306**), and in a case where the stop coin number counter is 1 (step **S306**: YES), that is, in a case where instead of the coin of the denomination to be counted, one different denomination coin C which was a target to be stopped is located on the outlet-side passage end portion **151**, whether or not the peak value of the magnetic data has been detected by the identification counting unit **37** is determined (step **S307**). Here, the coin C whose peak value is detected in step **S307** is one different denomination coin C which was a target to be stopped and which remains on the outlet-side passage end portion **151**, as described above.

In the determination in step **S307**, if the identification counting unit **37** detects the peak value of the magnetic data (step **S307**: YES), the control unit **15** again determines whether or not the peak value of the magnetic data has been detected by the identification counting unit **37** (step **S308**). The identification counting unit **37** usually detects only the peak value of the magnetic data of one different denomination coin C which was a target to be stopped, as described above, and therefore, in step **S308**, the peak value of the magnetic data is not detected. That is, step **S307** and step **S308** are processes for confirming that only one different denomination coin C has passed through the identification counting unit **37**.

In step **S307**, the determination for detecting the coin C is performed according to whether or not the identification counting unit **37** detects the peak value of the magnetic data. This determination may be performed according to whether or not the identification counting unit **37** detects a level equal to or higher than a predetermined threshold value of the magnetic data. That is, the state where the identification counting unit **37** detects that the magnetic data is at a level equal to or higher than the predetermined threshold value

may be defined as the detection state of the coin C, and the state where the identification counting unit **37** detects that the magnetic data is at a level lower than the threshold value may be defined as the non-detection state of the coin C. If the identification counting unit **37** detects that one coin C which was a target to be stopped has been changed from the detection state to the non-detection state, the control unit **15** may determine that the coin C has passed through the identification counting unit **37** at the time of the reverse rotation conveyance. Further, the same applies to the determination in step S**308**.

In step S**308**, if the identification counting unit **37** does not detect the peak value of the magnetic data, whether or not a predetermined reverse rotation drive time required to return all coins C remaining on the conveyance passage **60** to the rotating disk **14** has elapsed within the return time whose timing has been started in step S**305** is determined (step S**309**). Here too, the design value of the reverse rotation drive time is set to, for example, 200 ms.

If the reverse rotation drive time has not elapsed within the return time (step S**309**: NO), the processing returns to step S**308**. Step S**308** and step S**309** are repeated until the reverse rotation drive time elapses within the return time. If the reverse rotation drive time elapses within the return time (step S**309**: YES), the control unit **15** outputs an instruction signal instructing the feeding motor **16** and the conveyance motor **57** to stop (step S**310**).

In this way, the rotating disk **14** stops and the feed belt **54** stops. The rotating disk **14** and the feed belt **54** are set to be in the reverse rotation state until the reverse rotation drive time elapses within the return time. In this way, if one different denomination coin C which was a target to be stopped has an outer diameter shorter than the length from the wall surface **72** to the tip of the support portion **103** or the length from the wall surface **82** to the tip of the support portion **101**, it is possible to cause the coin to fall into the rejection hole **115**. Further, in a case where it is not possible to cause the coin to fall into the rejection hole **115**, both of the one different denomination coin C which was a target to be stopped and the coin C on the conveyance passage **60** on the upstream side at the time of normal rotation with respect to the one different denomination coin C can be returned to the rotating disk **14**. As described above, the one different denomination coin C which was a target to be stopped returns to the rotating disk **14** at the end of this processing.

In step S**310**, if the control unit **15** outputs the instruction signal instructing the feeding motor **16** and the conveyance motor **57** to stop, the control unit **15** increments a retry counter by 1 (step S**311**), and whether or not the retry counter has reached a predetermined retry setting value is determined (step S**312**). If the retry counter has not reached the predetermined retry setting value (step S**312**: NO), the processing returns to step S**101**. If the retry counter has reached the predetermined retry setting value, error display (step S**313**) indicating that the different denomination coin C is mixed in and urging to perform the confirmation and the removal of the coin C are performed, and the batch processing is ended. Here, the predetermined retry setting value of the retry counter is configured such that any value can be freely set on the operation display unit **30** through an input operation.

For example, in a case where the retry setting value is set to 1, if the different denomination coin C is detected during the first batch processing and in step S**311**, the retry counter is incremented by 1 to become 1, the error display is performed in step S**313** without returning to step S**101**, in other words, without performing retry, and the batch processing is ended.

Further, for example, in a case where the retry setting value is set to 2, if the different denomination coin C is detected during the first batch processing and in step S**311**, the retry counter is regarded as being 1, the processing returns to step S**101** and the retry is performed. If the different denomination coin C is detected during the retry batch processing and in step S**311**, the retry counter is incremented by 1 to become 2, the error display is performed in step S**313** and the batch processing is ended. In a case where a plurality of retry setting values are set in this manner, if it is possible to cause the different denomination coin C to fall into the rejection hole **115** with the reverse rotation conveyance as described above, then the batch processing can be restarted and continued as it is.

In the determination in step S**308**, if the identification counting unit **37** detects the peak value of the magnetic data that cannot be originally detected (step S**308**: YES), the control unit **15** determines that the coin C located on the downstream side at the time of normal rotation with respect to the one different denomination coin C which was a target to be stopped has been returned to the outlet-side passage portion **112**. In this way, the control unit **15** stops the feeding motor **16** and the conveyance motor **57**. Further, the control unit **15** performs error processing at the time of reverse rotation (step S**314**) for performing the error display indicating that the last coin in the batch processing has been returned on the operation display unit **30**, and ends the batch processing. Here, the situation where the last coin C in the batch processing is detected is, for example, a case where the coin C that has fallen into the falling hole **141** is connected to the one different denomination coin C which was a target to be stopped with tape or the like, as described above, or the like.

In the flow of the processing shown in steps S**304** to S**309** described above, after the stop control described above is performed, the control unit **15** reversely rotates the conveyance motor **57** to perform switching to the conveyance of the coin C toward the upstream side at the time of normal rotation, which is opposite to the downstream side at the time of normal rotation. Thereafter, the detection state of one different denomination coin C to be stopped by the identification counting unit **37** is confirmed. If only one different denomination coin C to be stopped is detected by the identification counting unit **37**, the control unit **15** can determine that none of the coins C conveyed in the direction of the downstream side at the time of normal rotation ahead of the one different denomination coin C to be stopped remain on the outlet-side passage portion **112**.

Here, if a stop operation is input to the operation display unit **30** during the batch processing, the determination in step S**105** becomes YES, and then the control unit **15** performs control similar to the case of determining that the number of remaining batch coins is 0, in step S**105** described above.

According to the coin processing device **11** of the embodiment described above, the identification counting unit **37** detects one coin C to be stopped, which has been conveyed next to the last coin C to be processed in the batch processing. The control unit **15** switches the conveyance motor **57** from the first slow normal rotation state (the first rotation state) where the conveyance motor **57** rotates at the first slow speed to the second slow normal rotation state (the second rotation state) where the conveyance motor **57** rotates at the second slow speed, in response to the detection of the one

coin C to be stopped by the identification counting unit **37**, and then rotates the conveyance motor **57**. In this way, the control unit **15** can stop the coin C to be stopped at an accurate position by switching the conveyance speed of the coin C to be stopped to a low speed and then stopping it. Accordingly, the coin processing device does not require a stopper mechanism. Therefore, it is possible to reduce the cost of the coin processing device, improve the degree of freedom of layout inside the device, and attain a reduction in noise and dust suppression.

Further, the identification counting unit **37** detects the different denomination coin C other than the coin of the denomination to be counted, that is, the coin C other than the falling target to be caused to fall into the falling portion **141**. The control unit **15** regards this different denomination coin as one coin C to be stopped. The control unit **15** switches the conveyance motor **57** from the usual normal rotation state (the first rotation state) where the conveyance motor **57** rotates at the normal speed to the second slow normal rotation state (the second rotation state) where the conveyance motor **57** rotates at the second slow speed, in response to the detection of one coin C to be stopped by the identification counting unit **37**, and then rotates the conveyance motor **57**. In this way, the conveyance speed of the coin C to be stopped is switched to a low speed and then stopped, so that it is possible to stop the coin C to be stopped at an accurate position. Accordingly, the coin processing device does not require a stopper mechanism. Therefore, it is possible to reduce the cost of the coin processing device, improve the degree of freedom of layout inside the device, and attain a reduction in noise and dust suppression.

Further, the identification counting unit **37** detects one coin C to be stopped, which has been conveyed next to the last coin C to be processed in the batch processing. The control unit **15** switches the conveyance motor **57** from the first slow normal rotation state (the first rotation state) where the conveyance motor **57** rotates at the first slow speed to the second slow normal rotation state (the second rotation state) where the conveyance motor **57** rotates at the second slow speed, in response to the detection by the identification counting unit **37**. Thereafter, the control unit **15** performs stop control for stopping the conveyance motor **57**, in response to the change from the detection state of one coin C to be stopped by the identification counting unit **37** to the non-detection state. Due to this stop control, one coin C to be stopped is stopped on the outlet-side passage end portion **151** which is on the downstream side at the time of normal rotation with respect to the identification counting unit **37** in the outlet-side passage portion **112**. Accordingly, even if the coin processing device does not have a stopper mechanism, the coin to be stopped can be kept on the outlet-side passage portion **112** without causing it to fall into the falling hole **141**.

Here, the outlet-side passage end portion **151** has a size in which one coin C of the coins of all the denominations of the coins to be processed can remain, but two or more coins cannot remain. Therefore, in this stop control, the last coin C to be processed in the batch processing, which is adjacent to the downstream side at the time of normal rotation of one coin C to be stopped, and the previous coin C are caused to fall into the falling hole **141**. In this manner, only one coin C to be stopped can be stopped (remain) at the outlet-side passage end portion **151**, and all the coins C to be processed in the batch processing, which have been conveyed in the direction of the downstream side at the time of normal rotation ahead of the one coin, can be caused to fall into the falling hole **141**. Accordingly, even if the coin processing device does not have a stopper mechanism, all the coins C to be processed in the batch processing, which have been conveyed in the direction of the downstream side at the time of normal rotation ahead of one coin C to be stopped, which has been conveyed next to the last coin C to be processed in the batch processing, can be caused to fall into the falling hole **141**.

Further, the identification counting unit **37** detects the different denomination coin C other than the coin of the denomination to be counted, that is, the coin C other than the falling target to be caused to fall into the falling portion **141**. The control unit **15** regards this different denomination coin as one coin C to be stopped. The control unit **15** switches the conveyance motor **57** from the usual normal rotation state (the first rotation state) where the conveyance motor **57** rotates at the normal speed to the second slow normal rotation state (the second rotation state) where the conveyance motor **57** rotates at the second slow speed, in response to the detection of the one coin C to be stopped by means of the identification counting unit **37**. Thereafter, the stop control for stopping the conveyance motor **57** is performed in response to a change from the detection state of one different denomination coin C to be stopped by the identification counting unit **37** to the non-detection state. Due to this stop control, one different denomination coin C to be stopped can be stopped on the outlet-side passage end portion **151** which is on the downstream side at the time of normal rotation with respect to the identification counting unit **37** in the outlet-side passage portion **112**. Accordingly, even if the coin processing device does not have a stopper mechanism, the different denomination coin C to be stopped can be kept on the outlet-side passage portion **112** without causing it to fall into the falling hole **141**.

The outlet-side passage end portion **151** has a size in which one coin C of the coins of all the denominations of the coins to be processed can remain, but two or more coins cannot remain. This also applies to a different denomination coin C with the same outer diameter as the regular coin C. In this stop control, the coin C of the denomination to be counted during the batch processing, which is on the downstream side at the time of normal rotation of one different denomination coin C to be stopped, falls into the falling hole **141**. In this manner, only one different denomination coin C to be stopped can be stopped at the outlet-side passage end portion **151**, and the coins C of all the denominations to be counted, which have been conveyed in the direction of the downstream side at the time of normal rotation ahead of the coin C, can be caused to fall into the falling hole **141**. Accordingly, even if the coin processing device does not have a stopper mechanism, the coins C of all the denominations to be counted, which have been conveyed in the direction of the downstream side at the time of normal rotation ahead of one different denomination coin C to be stopped, can be caused to fall into the falling hole **141**.

Further, the control unit **15** performs the stop control described above in response to the detection of the last coin C in the batch processing, and then reversely rotates the conveyance motor **57** to switch the conveyance of the coin C from the downstream side at the time of normal rotation toward the upstream side at the time of normal rotation opposite to the downstream side. Thereafter, the control unit **15** confirms the detection state of one coin C to be stopped, which has been conveyed next to the last coin C to be processed in the batch processing, by the identification counting unit **37**. If only one coin C to be stopped is detected by the identification counting unit **37**, the control unit **15** can determines that none of the number of coins C to be

processed in the batch processing, which have been conveyed in the direction of the downstream side at the time of normal rotation ahead of one coin C to be stopped, remain on the outlet-side passage portion. Accordingly, even if the coin processing device does not have a stopper mechanism, it is possible to determine that all the coins C to be processed in the batch processing, which have been conveyed in the direction of the downstream side at the time of normal rotation ahead of one coin C to be stopped, have fallen into the falling hole **141**.

Further, the control unit **15** determines the falling of all the number of coins C to be processed in the batch processing by performing conveyance control for reciprocating one coin C to be stopped across the detection unit. That is, in order to perform this determination, the detection unit need only be provided with one magnetic sensor, and it is not necessary to provide another sensor on the downstream side at the time of normal rotation from the detection unit. Therefore, the effect of further suppressing the part cost of the coin processing device is exhibited.

Further, the control unit **15** performs the stop control described above in response to the detection of the different denomination coin C, and then reversely rotates the conveyance motor **57** to switch the conveyance of the coin C from the downstream side at the time of normal rotation toward the upstream side at the time of normal rotation opposite to the downstream side. Thereafter, the control unit **15** confirms the detection state of one different denomination coin C to be stopped by the identification counting unit **37**. If only one different denomination coin C to be stopped is detected by the identification counting unit **37**, the control unit **15** can determine that the coins C of all the denominations to be counted, which have been conveyed in the direction of the downstream side at the time of normal rotation ahead of one different denomination coin C to be stopped, do not remain on the outlet-side passage portion **112**. Accordingly, even if the coin processing device does not have a stopper mechanism, it is possible to determine that the coins C of all the denominations to be counted, which have been conveyed in the direction of the downstream side at the time of normal rotation ahead of one different denomination coin C to be stopped, have fallen into the falling hole **141**.

Further, since the identification counting unit **37** includes a magnetic sensor, the detection of one coin C to be stopped and the detection of the different denomination coin C other than the designated denomination can be performed with the same magnetic sensor. Therefore, the cost of the coin processing device can be further reduced.

Further, the control unit **15** switches the conveyance motor **57** from the usual normal rotation state (the third rotation state) having a faster speed than the first slow normal rotation state (the first rotation state) where the conveyance motor **57** rotates at the first slow speed to the first slow normal rotation state (the first rotation state), in response to the detection of the last coin C to be processed in the batch processing, which is one coin downstream from one coin C to be stopped at the time of normal rotation, by the identification counting unit **37**. Therefore, the conveyance speed of the coin C to be stopped, which has been conveyed next to the last coin C to be processed in the batch processing, can be switched to a lower speed and then stopped. Accordingly, the control unit **15** can stop the coin C to be stopped at a more accurate position.

INDUSTRIAL APPLICABILITY

The present invention can be applied to coin processing devices which are installed in financial institutions, stores, or the like, and can provide a coin processing device in which the cost of the coin processing device is reduced, the degree of freedom of layout inside the device is improved, and a reduction in noise and dust suppression are attained.

REFERENCE SIGNS LIST

11: coin processing device
15: control unit
37: identification counting unit (detection unit)
54: feed belt
57: conveyance motor
61: inlet-side passage portion
112: outlet-side passage portion
141: falling hole (falling portion)
151: outlet-side passage end portion
C: coin

The invention claimed is:

1. A coin processing device comprising:

a feed belt configured to normally rotate in contact with an upper side of a coin, which is fed from a rotating disk, to convey the coin to a conveyance passage extending from an inlet-side passage portion to an outlet-side passage portion;

a conveyance motor configured to normally rotate the feed belt during the normal rotation;

a detection unit configured to detect the coin passing through a position determined in advance in the conveyance passage; and

a control unit configured to switch the conveyance motor from a usual normal rotation state where the conveyance motor normally rotates at a usual normal rotation speed to a first slow normal rotation state where the conveyance motor normally rotates at a first slow normal rotation speed slower than the usual normal rotation speed, and configured to switch the conveyance motor from the first slow normal rotation state to a second slow normal rotation state where the conveyance motor normally rotates at a second slow normal rotation speed slower than the first slow normal rotation speed, in response to detection of the coin by the detection unit, and then rotates the conveyance motor,

wherein the control unit is configured to

perform batch processing in which the control unit conveys a predetermined numbers of the coins of a predetermined denomination set to the outlet-side passage portion,

switch the conveyance motor from the usual normal rotation state to the first slow normal rotation state in response to the detection unit detecting a last coin of the predetermined numbers of the coins subject to the batch processing,

switch the conveyance motor from the first slow rotation state to the second slow rotation state in response to the detection unit detecting a coin to be stopped following the last coin subject to the batch processing in a case where the coin to be stopped is conveyed on the conveyance passage following the last coin,

after switching the conveyance motor from the first slow rotation state to the second slow rotation state, stop the conveyance motor in response to the detection unit changing from detecting the coin to be stopped to not detecting the coin to be stopped so that the control unit causes the coin to be stopped to stop at an end portion on a downstream side of the outlet-side passage portion, and

thereafter reversely rotate the conveyance motor to perform conveyance of the coin to be stopped toward an upstream side opposite to the downstream side so as to return the coin to be stopped to the rotating disk.

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