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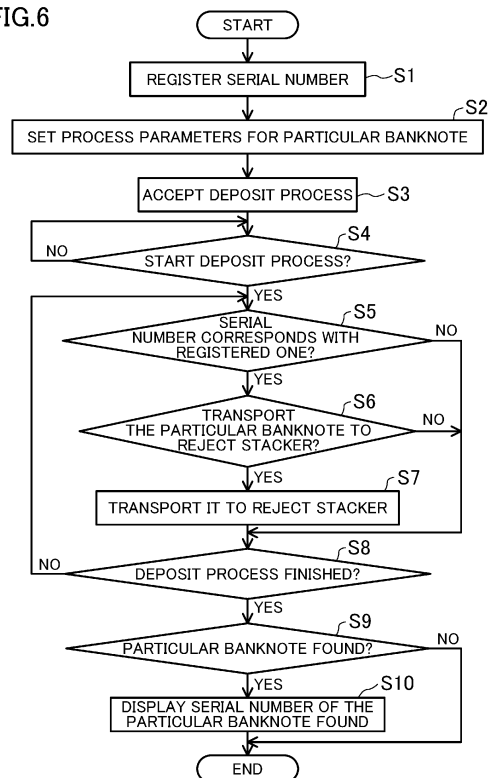
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(54) **PAPER CURRENCY-PROCESSING DEVICE AND PAPER CURRENCY-PROCESSING METHOD**

(57) Disclosed is a banknote handling apparatus 100 including an inlet 24, transport units 7 and 8, a recognition unit 3, a serial number reading unit which reads a serial number of each of the banknotes, a stacking unit 5 which stacks a banknote recognized as normal, and a reject unit 6 to which a banknote recognized as a banknote to be rejected is dispensed. The banknote handling apparatus further includes a registration unit which registers the serial number in advance, a checking unit which checks the read serial number against the registered serial number, and a control unit which performs a predetermined process on a particular banknote, of which the serial number has turned out to correspond with any of the registered serial numbers as a result of the checking.

FIG.6



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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a banknote handling apparatus and a banknote handling method.

BACKGROUND ART

[0002] Patent Document 1 describes a banknote processing machine which sorts banknotes introduced therein according to preset sorting conditions, and stacks the sorted banknotes into different stackers. The banknote processing machine is configured to register, in a database, the serial numbers of the banknotes to be stacked in a particular one of the stackers. The database is an external database connected to the banknote processing machine. With this configuration, the banknotes which have been sorted by the banknote processing machine may be retrieved based on their serial numbers by referring to the database. This configuration allows for handling of counterfeit banknotes.

[0003] Patent Document 2 describes a banknote processing machine similar to that described above. In the machine of Patent Document 2, banknotes that cannot be stacked in the stackers are dispensed to a reject unit, and the serial numbers of the banknotes dispensed to the reject unit are output to an external device provided separately from the banknote processing machine. The external device stores in advance information about the registered serial numbers of counterfeit banknotes, suspected banknotes (that is to say, banknotes which are suspected to be the counterfeit banknotes but which cannot be determined to be genuine or counterfeit ones), and stolen banknotes. The external device checks the serial numbers of the banknotes dispensed to the reject unit against the registered serial numbers. Then, when a serial number corresponding with the registered one is found, the external device displays the serial number on the display unit of the banknote processing machine. This allows an operator to extract counterfeit banknotes, suspected banknotes, and stolen banknotes from the banknotes dispensed to the reject unit.

CITATION LIST

PATENT DOCUMENTS

[0004]

[Patent Document 1] International Application WO2010/32336

[Patent Document 2] International Application WO2011/24305

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0005] When information that "counterfeit banknotes of particular serial numbers are circulated on the market" is provided, there arises a need for extracting the banknotes of the particular serial numbers from the banknotes brought to a teller window in a financial institution or any other institutions.

[0006] The banknote processing machine of Patent Document 1 mentioned above allows for searching the serial numbers registered in the external database for the particular serial numbers after all the banknotes brought to the teller window in the financial institution, for example, are once sorted and stacked into a plurality of stackers. If the search result indicates that banknotes, of which the serial numbers correspond with the particular serial numbers, have been found, these banknotes are extracted from the banknotes stacked in the stacker. However, such a process takes a lot of time and trouble, and may cause a delay in the operations at the teller window in the financial institution.

[0007] According to the banknote processing machine described in Patent Document 2, only the banknotes recognized, by the recognition unit, as banknotes which cannot be stacked in the stackers and are dispensed to the reject unit are checked against the registered serial numbers. Thus, the banknotes cannot be extracted based on their serial numbers even if the banknote processing machine described in Patent Document 2 is used.

[0008] Both of the banknote processing machines described in Patent Documents 1 and 2 require an external device separately provided for registering the serial numbers, which increases the overall size of the machines disadvantageously.

[0009] In view of the foregoing, it is therefore an object of the present disclosure to provide a banknote handling apparatus which allows for performing a predetermined process on banknotes based on the serial numbers that have been registered in advance.

SOLUTION TO THE PROBLEM

[0010] The banknote handling apparatus of the present disclosure includes: an inlet through which banknotes are taken in one by one; a transport unit configured to transport, along a transport path, each of the banknotes taken in through the inlet; a recognition unit arranged on the transport path and configured to recognize the banknotes being transported; a serial number reading unit configured to read a serial number of each of the banknotes being transported; a stacking unit configured to stack each of the banknotes recognized as normal based on a recognition result obtained by the recognition unit; and a reject unit to which each of the banknotes recognized as a banknote to be rejected based on the recognition result by the recognition unit is dispensed.

[0011] The banknote handling apparatus further includes: a registration unit configured to register the serial number in advance; a checking unit configured to check the read serial number against the registered serial number; and a control unit configured to perform a predetermined process on a particular banknote, of which the serial number has turned out to correspond with any of the registered serial numbers as a result of the checking.

[0012] According to this configuration, the registration unit of the banknote handling apparatus registers the serial numbers in advance. The registration unit may be configured to store information about the serial numbers which are manually input by an operator through an input device such as a keyboard (a hardware keyboard or a software keyboard displayed on a display unit).

[0013] The recognition unit recognizes the banknotes taken in through the inlet one by one, and the serial number reading unit reads the serial number of each of the banknotes. The banknote handling apparatus stacks the banknotes recognized, by the recognition unit, as normal ones into the stacking unit, and dispenses the banknotes recognized, by the recognition unit, as banknotes to be rejected to the reject unit. Note that the "banknotes recognized as banknotes to be rejected" are banknotes which have not been recognized as normal ones. In particular, examples of such banknotes include banknotes recognized as counterfeit or unfit banknotes, and banknotes of every denomination and currency but banknotes of a denomination and a currency to be stacked in the stacking unit. The checking unit checks the read serial numbers against the registered ones, and the control unit performs a predetermined process on a particular banknote, of which the serial number has turned out to correspond with any of the registered ones.

[0014] Thus, this banknote handling apparatus allows for detecting, by itself, banknotes having serial numbers corresponding with the registered ones. Unlike the banknote processing machines described in the patent documents cited above, this banknote handling apparatus does not require any external devices. This simplifies the configuration of the apparatus.

[0015] The banknote handling apparatus detects the banknotes having serial numbers corresponding with the registered ones while the banknotes taken in through the inlet are being stacked in the stacking unit. Thus, unlike the banknote processing machine described in Patent Document 1, it is not necessary to perform two processes, namely, sorting the banknotes once to stack them, and then searching the database, and the banknotes having serial numbers corresponding with the registered ones are detectable only through a single process. This saves operator's processing time and trouble, and allows for smooth operation at a teller window in a financial institution or other institutions.

[0016] The banknote handling apparatus may further include a display unit configured to display information, wherein as the predetermined process, the control unit

displays the serial number of the particular banknote on the display unit.

[0017] This configuration allows the operator of the banknote handling apparatus to extract banknotes having serial numbers corresponding with the registered ones from the banknotes stacked in the stacking unit or the banknotes dispensed to the reject unit based on the serial numbers displayed on the display unit.

[0018] As the predetermined process, the control unit may dispense the particular banknote to the reject unit.

[0019] According to this configuration, the banknotes having serial numbers corresponding with the registered ones are also dispensed to the reject unit as well as the banknotes recognized as banknotes to be rejected as described above. This allows the operator to extract easily such banknotes having serial numbers corresponding with the registered ones from the banknotes dispensed to the reject unit.

[0020] As the predetermined process, the control unit may stack the particular banknote in the stacking unit.

[0021] Based on the serial numbers displayed on the display unit, the operator extracts such banknotes having serial numbers corresponding with the registered ones from the banknotes stacked in the stacking unit. The operator visually checks the extracted banknotes to determine whether they are counterfeit ones or not. As a result, if the banknotes are not counterfeit ones, the operator returns the banknotes to the stacking unit and finishes the process. Since the banknotes stacked in the stacking unit have been recognized as normal ones, the process is finished only by returning the banknotes to the stacking unit. On the other hand, if the extracted banknotes are counterfeit or suspected ones, the operator does not return the banknotes to the stacking unit, and performs a different process.

[0022] As the predetermined process, the control unit may stack the particular banknote in the stacking unit and may indicate, on the display unit, what the particular banknote's place is in a stack of banknotes in the stacking unit.

[0023] In this configuration, the operator can see the place of the particular banknote in the stacking unit by reference to the information displayed on the display unit. This allows the operator to extract easily the particular banknote from the banknotes stacked in the stacking unit.

[0024] The registration unit may register any digits of each of the serial numbers, and the checking unit may check the read serial number against the registered digits of each of the serial numbers.

[0025] Reducing the number of digits of the serial number to be registered allows for reducing processing load and time for checking the read serial numbers against the registered ones. The number of digits of the serial numbers to be read by the serial number reading unit may be reduced to correspond to the number of registered digits of the serial numbers. This allows for reducing the processing load and time for reading the serial numbers.

[0026] In this configuration, the modes of registration of serial numbers may be changeable between the mode of registering all digits and the modes of registering only some digits. This allows for flexible use of the banknote handling apparatus, thereby making the banknote handling apparatus even handier.

[0027] The registration unit may further register a denomination of each of the banknotes. The checking unit may check the recognition result obtained by the recognition unit against the registered denomination, and may check the read serial number against the registered serial number. The control unit may perform, based on a result of the checking, a predetermined process on a particular banknote, the denomination and serial number of which correspond with any of the registered denominations and any of the registered serial numbers, respectively.

[0028] This configuration allows for extracting a particular banknote, the denomination and serial number of which both correspond with any of the denominations registered and any of the serial numbers registered, respectively.

[0029] The registration unit may further register a version of the registered denomination. The checking unit may check the recognition result obtained by the recognition unit against the registered denomination and the registered version, and may check the read serial number against the registered serial number. The control unit may perform, based on a result of the checking, a predetermined process on a particular banknote, the denomination, version, and serial number of which correspond with any of the registered denominations, any of the registered versions, and any of the registered serial numbers, respectively.

[0030] The "version of the denominations" refers herein to the "edition" of banknotes including a new edition of banknotes and old editions of banknotes which are different in design, for example. The new banknotes are those which are being issued currently, and the old banknotes are those which were issued previously. The old banknotes include not only banknotes of the last version preceding the new banknotes, but also banknotes issued before the ones of the last version.

[0031] This configuration allows for extracting a particular banknote, the denomination, version, and serial number of which all correspond with any of the denomination registered, any of the versions registered, and any of the serial numbers registered, respectively.

[0032] The registration unit may further register a currency. The checking unit may check the recognition result obtained by the recognition unit against the registered currency, and may check the read serial number against the registered serial number. The control unit may perform, based on a result of the checking, a predetermined process on a particular banknote, the currency and serial number of which correspond with any of the registered currencies and any of the registered serial numbers, respectively.

[0033] This configuration allows for extracting a partic-

ular banknote, the currency and serial number of which both correspond with any of the denominations registered and any of the serial numbers registered, respectively.

[0034] The registration unit may further register a denomination of each of the banknotes, and the checking unit may check a read serial number of a banknote, the denomination of which corresponds with any of the registered denominations, against the registered serial number.

[0035] In this configuration, the banknotes are first sorted according to denomination, and then only the serial numbers of the banknotes of this denomination are checked. This allows for reducing the processing load of checking the serial numbers, thereby reducing the checking processing time.

[0036] Optionally, the serial number reading may be performed on only the banknotes of the registered denomination, and may be omitted on the other banknotes, the denomination of which does not correspond with the registered one. This allows for further reducing the processing load and time.

[0037] The recognition unit may further register a version of the registered denomination, and the checking unit may check a read serial number of a banknote, the denomination and version of which correspond with any of the registered denominations and any of the registered versions, against the registered serial number.

[0038] This configuration allows for checking the serial numbers of banknotes, the denomination and version of which correspond with any of the denominations registered and any of the versions registered, respectively. This allows for reducing the processing load of checking the serial numbers and the checking processing time.

[0039] Optionally, the serial number reading may be performed on only the banknotes of the denomination and version that have been registered, and may be omitted on the other banknotes, the denomination or version of which does not correspond with the registered one. This allows for further reducing the processing load and processing time.

[0040] The registration unit may further register a currency, and the checking unit may check a read serial number of a banknote, the currency of which corresponds with any of the registered currencies, against the registered serial number.

[0041] In this configuration, the banknotes are first sorted according to the registered currency, and then only the serial numbers of the banknotes of this currency are checked. This allows for reducing the processing time and load of checking the serial numbers.

[0042] Optionally, the serial number reading may be performed on only the banknotes of the registered currency, and may be omitted on the other banknotes, the currency of which does not correspond with the registered one. This allows for further reducing the processing load and time.

[0043] The banknote handling apparatus may further

include an acquisition unit configured to acquire information from outside of the apparatus, and the registration unit may register a serial number included in the information acquired through the acquisition unit.

[0044] The "acquisition unit" may retrieve information about the serial numbers from a storage medium (e.g., a storage medium which uses a flash memory such as a USB memory or various types of memory cards), or may receive information about the serial numbers that has been transmitted through a wireless or wired communications line. Use of such a storage medium or communication enables easy and convenient registration of multiple serial numbers at a time.

[0045] A banknote handling method disclosed herein includes: taking in banknotes through an inlet one by one; recognizing the banknotes taken in; reading a serial number of each of the banknotes taken in; stacking, in a stacking unit, each of the banknotes determined to be normal based on a recognition result; and dispensing, to a reject unit, the banknote determined to be rejected based on the recognition result.

[0046] This banknote handling method further includes: registering the serial number of each of the banknotes in advance; checking the read serial number against the registered serial number; and performing a predetermined process on a particular banknote, of which the serial number has turned out to correspond with any of the registered serial numbers as a result of the checking. This banknote handling method allows for detecting a banknote, of which the serial number corresponds with any of the registered ones.

[0047] The predetermined process may be displaying the serial number of the particular banknote on a display unit.

[0048] Alternatively, the predetermined process may also be dispensing the particular banknote to the reject unit.

[0049] Still alternatively, the predetermined process may be stacking the particular banknote in the stacking unit and indicating, on a display unit, what the particular banknote's place is in a stack of banknotes in the stacking unit.

[0050] The banknote handling method may further include registering a denomination of each of the banknotes in advance. A read serial number of a banknote, the denomination of which corresponds with any of the registered denominations, may be checked against the registered serial number.

ADVANTAGES OF THE INVENTION

[0051] The banknote handling apparatus and the banknote handling method described above allow for specifying a banknote having a serial number corresponding with the previously stored one.

BRIEF DESCRIPTION OF THE DRAWINGS

[0052]

- 5 [FIG. 1] FIG. 1 is a view illustrating the appearance of a banknote handling apparatus.
 [FIG. 2] FIG. 2 illustrates a general configuration for the banknote handling apparatus.
 [FIG. 3] FIG. 3 is a plan view illustrating a bundling stacker with a portion thereof not illustrated.
 10 [FIG. 4] FIG. 4 is a block diagram illustrating a general configuration for the banknote handling apparatus.
 [FIG. 5] FIG. 5 is a table showing various combinations of banknotes to be stacked in stackers.
 15 [FIG. 6] FIG. 6 is a flowchart of a serial-number-related process.
 [FIG. 7] FIG. 7 illustrates an example of an on-screen image through which a serial number is registered.
 20 [FIG. 8] FIG. 8 illustrates an example of a dialog box which prompts the user to specify the type of a process to be performed on a particular banknote, of which the serial number has turned out to correspond with any of the registered ones.
 25 [FIG. 9] FIG. 9 illustrates an example of an on-screen image showing the serial number of such a particular banknote that has turned out to correspond with the registered one.

30 DESCRIPTION OF EMBODIMENTS

[0053] Embodiments will be described in detail below with reference to the drawings.

35 (First Embodiment)

<General Configuration for Banknote Handling Apparatus>

40 **[0054]** FIG. 1 illustrates the appearance of a banknote handling apparatus 100, and FIG. 2 illustrates a general configuration for the banknote handling apparatus 100.

[0055] The banknote handling apparatus 100 is placed on a teller counter in a bank, for example, and is used by an operator. The banknote handling apparatus 100 takes loose banknotes therein, stacks banknotes of a predetermined denomination, bundles the banknotes in a predetermined bundling number, and dispenses the bundled banknotes.

50 **[0056]** The banknote handling apparatus 100 includes a hopper unit 2 which takes the banknotes placed thereon into the apparatus, a recognition unit 3 which recognizes the banknotes, bundling stackers 4 which stack the banknotes to be bundled, non-bundling stackers 5 which stack the banknotes not to be bundled, a reject stacker 6 which stacks rejected banknotes, a first transport unit 7 which transports the banknotes taken in through the hopper unit 2 to the recognition unit 3, the bundling stack-

ers 4, the non-bundling stackers 5, and the reject stacker 6, a second transport unit 8 which transports the banknotes stacked in the bundling stackers 4 to the predetermined position, a bundling unit 9 which bundles the banknotes transported by the second transport unit 8, a dispense unit 10 through which the banknotes that have been bundled (hereinafter referred to as "bundled banknotes") are dispensed, and a box-shaped housing 11 which houses the recognition unit 3, the bundling stackers 4, the non-bundling stackers 5, the reject stacker 6, the first transport unit 7, the second transport unit 8, and the bundling unit 9.

[0057] The housing 11 has a top surface 111, a bottom surface 112, and four side surfaces. The housing 11 is a desktop type housing. That is to say, the bottom surface 112 of the housing 11 is not provided with casters or any other similar parts, and thus the housing 11 is configured to be placed on the desk.

[0058] The hopper unit 2 and the dispense unit 10 are provided through a first side surface 113, which is one of the four side surfaces of the housing 11. First outlets 46 of the bundling stackers 4 and second outlets 53 of the non-bundling stackers 5, which will be described in detail later, are provided through a second side surface 114, which is another one of the four side surfaces. The first and second side surfaces 113 and 114 are adjacent to each other.

[0059] The space inside the housing 11 is divided into a first handling section 115 configured to perform various kinds of handling processes for recognizing and sorting the banknotes and a second handling section 116 configured to perform various kinds of handling processes for bundling the banknotes of a kind to be bundled. The second handling section 116 is provided above the first handling section 115. The first handling section 115 includes the hopper unit 2, the recognition unit 3, the non-bundling stackers 5, and the reject stacker 6. The second handling section 116 includes the bundling stackers 4, the second transport unit 8, and the bundling unit 9. Most of the first transport unit 7 is included in the first handling section 115.

[0060] The bundling stackers 4 include two stackers, namely, a first bundling stacker 4A and a second bundling stacker 4B. Both of the first and second bundling stackers 4A and 4B stack the banknotes to be bundled. As will be described in detail later, the banknotes stacked as those to be bundled are determined as appropriate. The banknotes to be bundled are banknotes of a predetermined kind. The predetermined kind is identified by denomination or the orientation of the banknotes, or by determining whether the banknotes are fit or unfit, whether the banknotes are facing up or down, or whether the banknotes are new or not, for example. In this example, the banknotes to be bundled are fit banknotes of a predetermined denomination (e.g., 100 Chinese Yuan). In the following description, the banknotes which are recognized as normal by the recognition unit 3 will be hereinafter referred to as "normal banknotes," the banknotes which are not

recognized as normal by the recognition unit 3 will be hereinafter referred to as "abnormal banknotes," and the banknotes which are transported in an abnormal state, e.g., skewed or multi-fed, will be hereinafter referred to as "abnormally transported banknotes." For example, one of the conditions for determining whether the banknotes are normal or not is whether the serial numbers of the banknotes are distinguishable or not. However, the normality of the banknotes may be checked based on a different condition, or an additional condition may be applied to determine whether the banknotes are normal or not. The banknotes which are determined as the normal banknotes but the destination of which (the bundling stacker, the non-bundling stacker, or other stackers) is not designated will be hereinafter referred to as "undesignated banknotes." The "undesignated banknotes," the "abnormal banknotes," and the "abnormally transported banknotes" will be hereinafter collectively referred to as "rejected banknotes." Among the normal banknotes, those which are not stained or torn significantly will be hereinafter referred to as "fit banknotes," and those which are stained or torn significantly will be hereinafter referred to as "unfit banknotes."

[0061] The first and second bundling stackers 4A and 4B are arranged vertically, i.e., one on top of the other, in the second handling section 116. The first bundling stacker 4A is positioned over the second bundling stacker 4B. The first and second bundling stackers 4A and 4B have the same configuration. When it is not necessary to distinguish the two stackers from each other, they will be hereinafter referred to as "bundling stackers 4." A detailed configuration of the bundling stackers 4 will be described later.

[0062] The non-bundling stackers 5 include two stackers, namely, a first non-bundling stacker 5A and a second non-bundling stacker 5B. The first and second non-bundling stackers 5A and 5B are aligned substantially horizontally, i.e., side by side, in the first handling section 115. The second non-bundling stacker 5B is arranged closer to the hopper unit 2 than the first non-bundling stacker 5A is. When it is not necessary to distinguish the two stackers from each other, they will be hereinafter referred to as "non-bundling stackers 5." A detailed configuration of the non-bundling stackers 5 will be described later. The banknotes to be stacked in the non-bundling stackers 5 may be determined as appropriate. Here, the first non-bundling stacker 5A stacks unfit banknotes of the predetermined denomination. The second non-bundling stacker 5B stacks banknotes of all denominations but the predetermined denomination. The non-bundling stacker 5 is an exemplary stacking unit.

[0063] The reject stacker 6 stacks the rejected banknotes. The reject stacker 6 is positioned closer to the hopper unit 2 than the first and second non-bundling stackers 5A and 5B are. The reject stacker 6 is positioned at a level slightly higher than the first and second non-bundling stackers 5A and 5B. A detailed configuration of the reject stacker 6 will be described later. The reject

stacker 6 is an exemplary reject unit.

[0064] The hopper unit 2 is provided for a portion of the first side surface 113 corresponding to the first handling section 115, and the dispense unit 10 is provided for a portion of the first side surface 113 corresponding to the second handling section 116. Specifically, the first side surface 113 has two recesses in upper and lower portions thereof, and the dispense unit 10 is provided in the upper one of the two recesses, while the hopper unit 2 is provided in the lower one of the two recesses. A step is formed between the dispense unit 10 and the hopper unit 2.

[0065] The hopper unit 2 includes a mount 21 on which banknotes are placed, two guides 22, 22 which guide the banknotes placed on the mount 21, intake rollers 23, an inlet 24 through which the banknotes are taken in, and a banknote sensor 25 which senses the banknotes on the mount 21. In the present embodiment, the banknotes are placed on the hopper unit 2 such that the banknotes are loaded along their shorter edges.

[0066] As shown in FIG. 1, the inlet 24 is arranged at a corner where the mount 21 and the first side surface 113 intersect with each other. The mount 21 is tilted such that the closer to the inlet 24, the lower the level of the mount 21. Thus, the banknotes on the mount 21 go toward the inlet 24 by themselves. The banknotes placed on the mount 21 are taken into the housing 11 through the inlet 24.

[0067] The banknote sensor 25 is provided near the inlet 24. The banknote sensor 25 includes a transmitter which emits light and a receiver which receives the light, and senses the banknotes when the light emitted from the transmitter toward the receiver is blocked. A banknote sensor 45, stacking sensors 52 and 62, and tracking sensors 74 and 103 to be described later are also configured in the same manner. The banknote sensor 25 is arranged such that the light is blocked by the banknotes placed on the mount 21. That is to say, the banknote sensor 25 can sense that the banknotes are placed on the mount 21 when the light is blocked.

[0068] The guides 22, 22 are configured such that the interval between them is adjustable. Specifically, the interval between the guides 22, 22 is adjusted according to the banknotes placed on the mount 21.

[0069] The intake rollers 23 include kicker rollers 23a, feed rollers 23b, and gate rollers 23c. The kicker rollers 23a are partially exposed from the mount 21, and are in contact with the lowermost one of the banknotes placed on the mount 21. The kicker rollers 23a feed the lowermost banknote on the mount 21 to the inlet 24. Thus, the banknotes are taken in through the inlet 24 one by one. The banknotes taken in through the inlet 24 are distributed one by one by the feed rollers 23b and the gate rollers 23c into the housing 11. The banknotes thus taken in are passed to the first transport unit 7.

[0070] The dispense unit 10 includes a dispense port 101 through which the bundled banknotes are dispensed, a stage 102 on which the bundled banknotes dispensed

through the dispense port 101 are placed, and a tracking sensor 103 which senses the bundled banknotes passing through the dispense port 101. The bundled banknotes are dispensed through the dispense port 101 along their shorter edges.

[0071] The stage 102 is tilted such that the more distant from the dispense port 101, the higher the level of the stage 102. The stage 102 is configured to be movable in the vertical direction, and is biased upward by a bias spring (not shown). The stage 102 is located immediately below the dispense port 101 when no bundled banknotes are placed thereon. When the bundled banknotes are placed on the stage 102, the stage 102 moves downward due to the weight of the bundled banknotes. The stage 102 moves downward at least until the uppermost one of the banknotes on the stage 102 is located below the dispense port 101. That is to say, no bundled banknotes are present at the same level as the dispense port 101. Thus, the bundled banknotes dispensed from the dispense port 101 are mounted one after another on the bundled banknotes that have already been placed on the stage 102. The tracking sensor 103 is configured in the same manner as the banknote sensor 25. The tracking sensor 103 is provided at the dispense port 101 to sense the banknotes passing through the dispense port 101.

[0072] The first transport unit 7 may be configured as a transport belt or any other suitable member. The first transport unit 7 includes a main transport path 71, four diverged paths 72, 72, ... diverged from the main transport path 71, sorting mechanisms 73 provided at junctions between the main transport path 71 and the diverged paths, and a plurality of tracking sensors 74 which sense the passage of the banknotes. The first transport unit 7 transports the banknotes along their shorter edges.

The first transport unit 7 is an exemplary transport unit.

[0073] The main transport path 71 extends from the intake rollers 23 to the first bundling stacker 4A. When they need to be distinguished from each other, the four diverged paths 72, 72, ... will be hereinafter referred to as a first diverged path 72a, a second diverged path 72b, a third diverged path 72c, and a fourth diverged path 72d, respectively, in this order so that the most upstream diverged path 72 is regarded as the first diverged path 72a, the second most upstream one as the second, and so on. The first diverged path 72a extends to reach the reject stacker 6. The second diverged path 72b extends to reach the second non-bundling stacker 5B. The third diverged path 72c extends to reach the first non-bundling stacker 5A. The fourth diverged path 72d extends to reach the second bundling stacker 4B.

[0074] The sorting mechanisms 73 are driven by a solenoid (not shown). Each of the sorting mechanisms 73 sorts the banknotes transported through the main transport path 71 depending on whether they need to be guided to an associated one of the diverged paths 72 or not. A tracking sensor 74 is provided upstream of each of the sorting mechanisms 73. The tracking sensors 74 are configured in the same manner as the banknote sensor 25.

That is, the tracking sensors 74 can sense the passage of the banknotes if the reception of light by the receiver of the tracking sensor 74 is temporarily interrupted and then resumed. In guiding the banknotes to the diverged path 72, each sorting mechanism 73 is turned ON as soon as the tracking sensor 74 immediately upstream thereof senses the passage of the banknotes.

[0075] The recognition unit 3 is provided on the main transport path 71 upstream of the first diverged path 72a. The recognition unit 3 is configured to recognize each of the banknotes being transported in terms of their denomination, authentication, and fitness. Specifically, the recognition unit 3 includes a line sensor 31 and a magnetic sensor 32, and senses the feature of each banknote. The recognition unit 3 determines whether the feature of the banknote thus sensed corresponds with any of the features of the banknotes stored, thereby making a determination about their denomination, authentication, and fitness level.

[0076] The recognition unit 3 does not always include the line sensor and the magnetic sensor, but may include any other suitable sensor such as an infrared sensor and an ultraviolet sensor as long as they can sense the features of the banknotes. The line sensor 31 also has the function of optically scanning the serial numbers printed on the banknotes. In the present embodiment, the recognition unit 3 has the function of reading the serial numbers scanned by the line sensor 31, and thus the recognition unit 3 also serves as a serial number reading unit. However, a serial number reading unit may be provided separately from the recognition unit 3. Note that a control unit 120 to be described later may have all of the functions of the recognition unit 3 but the sensing function.

[0077] The second transport unit 8 grips the banknotes stacked in the bundling stackers 4 and transports them to a predetermined position where they are bundled. The second transport unit 8 includes a transport part 82 which grips the banknotes, a horizontal displacement mechanism 83 which displaces the transport part 82 in the horizontal direction, a vertical displacement mechanism 84 which displaces the transport part 82 in the vertical direction, a stage 85 on which the transported banknotes are placed, and a pushing mechanism 86 which pushes the bundled banknotes on the stage 85 toward the dispense port 101. The second transport unit 8 is an exemplary transport unit.

[0078] The transport part 82 includes hands 81 including an upper hand 81a and a lower hand 81b, and a displacement mechanism 87 which displaces the upper hand 81a in the vertical direction. The displacement mechanism 87 supports the upper hand 81a so that the upper hand 81a is movable in the vertical direction, and displaces the upper hand 81a in the vertical direction using a drive motor and a drive belt. The lower hand 81b is fixed so as not to be movable. The transport part 82 can grip the banknotes between the upper and lower hands 81a and 81b by displacing the upper hand 81a vertically using the displacement mechanism 87.

[0079] The horizontal displacement mechanism 83 supports the transport part 82 so that the transport part 82 is movable in the horizontal direction toward or away from the bundling stacker 4. The horizontal displacement mechanism 83 displaces the transport part 82 in the horizontal direction using the drive motor and the drive belt.

[0080] The vertical displacement mechanism 84 includes a guide shaft 84a which supports the horizontal displacement mechanism 83 so that the horizontal displacement mechanism 83 is movable in the vertical direction, and a drive belt 84b which drives the horizontal displacement mechanism 83 along the guide shaft 84a. The vertical movement of the horizontal displacement mechanism 83 displaces the transport part 82 in the vertical direction, too.

[0081] The stage 85 is provided substantially horizontally, and is connected to the dispense port 101 at one end. In bundling the banknotes with the bundling unit 9, the banknotes are placed on the stage 85.

[0082] The pushing mechanism 86 is configured to push the bundled banknotes on the stage 85 toward the dispense port 101.

[0083] The bundling unit 9 bundles the banknotes on the stage 85 with a bundling band. Specifically, the bundling unit 9 includes a bundling band reel 91 housing the bundling band, a bundling band stopper 92 which holds a tip end of the bundling band drawn from the bundling band reel 91, a turning arm 93 which turns the bundling band stopper 92 around the banknotes to wrap the bundling band around the banknotes, and a cutter 94 which cuts the other end of the bundling band wrapped around the banknotes, and a heater 95 which thermally seals the other end of the bundling band thus cut.

[0084] On the second side surface 114 of the housing 11, a touch panel 17 is provided to serve as an operating unit through which information is entered into the banknote handling apparatus 100 and as a display unit which displays information about the banknote handling apparatus 100. Specifically, the touch panel 17 is provided above a second outlet 53b of the second non-bundling stacker 5B and beside a first outlet 46 of the second bundling stacker 4B. The touch panel 17 is a human interface for the operator who operates this banknote handling apparatus 100. The touch panel 17 is an exemplary display unit and an exemplary registration unit.

<Detailed Configuration for Bundling Stacker 4>

[0085] FIG. 3 is a plan view of the bundling stacker 4 with a portion thereof not illustrated.

[0086] The bundling stackers 4 pile and stack the banknotes. Each of the bundling stackers 4 includes a container 40 in which the banknotes are stacked, a stage 41 arranged in the container 40 to carry the banknotes thereon, a stacking wheel 42 (shown in FIG. 2 only) which brings the transported banknotes into the container 40, a door 43 which opens/closes the first outlet 46 to be described later (shown in FIGS. 1 and 3), an aligner

mechanism 44 (shown in FIG. 3 only) which aligns the edges of the stacked banknotes, and a banknote sensor 45 (shown in FIG. 2 only) which senses the banknotes in the container 40.

[0087] The container 40 has a front wall 40a which is located in front in the transport direction of the banknotes and is configured to be movable forward and backward in the transport direction. The position of the front wall 40a is adjusted according to the kind of the banknotes specified as those to be bundled. In other words, the dimension of the container 40 in the transport direction is adjusted based on the dimension of the banknotes as measured along their shorter edges. In particular, the front wall 40a is arranged such that the banknotes brought into the container 40 collide against the front wall 40a and fall as they are to the bottom of the container 40 so as to be stacked there in contact with the front wall 40a. The front wall 40a is also configured to open/close in the vertical direction. The front wall 40a opens when the stacked banknotes are transported by the second transport unit 8.

[0088] The container 40 has openings through the second side surface 114 of the housing 11. That is to say, the second side surface 114 is provided with the first outlets 46 through which the banknotes stacked in the bundling stackers 4 are removed out of the housing 11.

[0089] The door 43 is provided for each of the bundling stackers 4. The door 43 is configured to be rotatable around a predetermined rotation axis to change between an open state where the first outlet 46 is opened and a closed state where the first outlet 46 is closed. The door 43 is made of a material which allows for visual check of the inside of the bundling stacker from outside. For example, the door 43 may be made of a transparent or translucent material (e.g., glass or a resin).

[0090] The door 43 is manually opened/closed. Note that the door 43 is provided with a lock mechanism 47 (shown in FIG. 3 only). The lock mechanism 47 is configured to be able to switch the door 43 between a restricted state where the door 43 is restricted to the closed state and a released state where the door 43 is openable and closable. Particularly, the lock mechanism 47 includes a pin 47a and a drive mechanism 47b including a solenoid and other suitable members for driving the pin 47a. The pin 47a and the drive mechanism 47b are provided on the housing 11, and an engaging member 47c which engages with the pin 47a is provided on the door 43. The lock mechanism 47 is controlled on a bundling stacker (4) basis by a control unit 120 to be described later.

[0091] A stopper 43a (not shown in FIG. 1) which the short edges of the banknotes come into contact with is provided on an inner surface of the door 43. The stopper 43a is made of a material which allows for visual check of the inside of the bundling stacker from outside. For example, the stopper 43a may be made of a transparent or translucent material (e.g., glass or a resin).

[0092] The stacking wheel 42 includes a plurality of

flexible blades, and is driven to rotate when the banknotes are brought into the container 40. The stacking wheel 42 has the function of tapping the banknotes falling into the container 40 on their rear edges in the transport direction so as to help the banknotes fall. Even when the banknotes are brought into the container 40 successively, each of the banknotes is prevented from entering the container in contact with the rear edge of the preceding banknote, and thus the banknotes can be sequentially stacked one by one on top of the previously stacked ones.

[0093] The aligner mechanism 44 is provided for the container 40 on the opposite side from the first outlet 46. The aligner mechanism 44 aligns the edges of the banknotes orthogonal to both of the transport direction and the stacking direction of the banknotes (hereinafter referred to as "the width direction"). In the present embodiment, the banknotes are transported along their shorter edges, and thus the width direction corresponds to the longer edges of the banknotes. That is to say, the aligner mechanism 44 aligns the shorter sides of the banknotes with each other. The aligner mechanism 44 includes an arm 44a provided at an end of the container 40 opposite from the first outlet 46 so as to be rotatable around the shaft extending in the stacking direction of the banknotes, and a stepping motor 44b which rotates the arm 44a. The aligner mechanism 44 presses, with the arm 44a, the banknotes stacked in the container 40 on one of their ends in the width direction (i.e., on one of their shorter sides) toward the door 43 in the width direction to bring the other end of the banknotes in the width direction (i.e., the other short side) into contact with the stopper 43a. Thus, the banknotes in the container 40 are aligned while being in contact with the stopper 43a.

[0094] Two or more banknote sensors 45 are provided for each of the bundling stackers 4. In the present embodiment, two banknote sensors 45 are provided in the container 40 at different positions in the transport direction of the banknotes. Each of the banknote sensors 45 is arranged to project light in the stacking direction of the banknotes in the container 40. That is to say, the banknote sensor 45 can sense the presence of the banknotes in the container 40 when the light is blocked. The provision of the two banknote sensors 45 at the different positions in the transport direction enables any one of the banknote sensors 45 to sense the presence of the banknotes even when the positions of the banknotes vary in the transport direction in the container 40. Note that two or more banknote sensors 45 may be provided at different positions in the direction orthogonal to both of the transport and thickness directions of the banknotes (the direction coming out of the paper of FIG. 2).

<Detailed Configuration for Non-Bundling Stacker 5>

[0095] Since the first and second non-bundling stackers 5A and 5B have the same configuration, they are not distinguished from each other in the following description, and will be hereinafter collectively referred to as "non-

bundling stackers 5". When the non-bundling stackers 5 need to be distinguished from each other, the members of the first non-bundling stacker 5A will be identified hereinafter by the suffix "a" added to their reference numeral, and the members of the second non-bundling stacker 5B will be identified hereinafter by the suffix "b" added to their reference numeral.

[0096] The non-bundling stackers 5 pile and stack the banknotes. Each of the non-bundling stackers 5 includes a container 50 in which the banknotes are stacked, a stacking wheel 51 which brings the transported banknotes into the container 50, and a stacking sensor 52 which senses the presence of the banknotes.

[0097] The container 50 of each of the non-bundling stackers 5 has a tilted bottom. Thus, the banknotes brought into the container 50 are collected to the lower end of the bottom.

[0098] The stacking sensor 52 is provided at the lower end of the bottom of the container 50. The stacking sensor 52 is configured in the same manner as the banknote sensor 25, and senses the banknotes in the container 50 when the light is blocked. The stacking sensor 52 is arranged such that the light is blocked by the banknotes in the container 50.

[0099] The stacking wheel 51 includes a plurality of blades, and catches the transported banknotes between the blades to bring them into the container 50. The banknotes are released from the blades of the stacking wheel 51 near the bottom of the container 50, and are stacked in the container 50.

[0100] The container 50 has openings through the second side surface 114 of the housing 11. That is to say, the second side surface 114 is provided with second outlets 53 through which the banknotes stacked in the non-bundling stackers 5 are removed out of the housing 11. The second outlets 53 have no door, and are kept opened. The second outlets 53a and 53b of the first and second non-bundling stackers 5A and 5B are opened through the second side surface 114 and are arranged side by side in the horizontal direction.

[0101] Each of the non-bundling stackers 5 is provided with a pushing mechanism 54 which pushes the stacked banknotes toward the second outlet 53. The pushing mechanism 54 is provided at the horizontal depth of the container 50 (opposite from the second outlet 53), and is configured to push the banknotes from the horizontal depth to the front (toward the second outlet 53).

<Detailed Configuration for Reject Stacker 6>

[0102] The reject stacker 6 piles and stacks the banknotes. The reject stacker 6 includes a container 60 in which the banknotes are stacked, a stacking wheel 61 which brings the transported banknotes into the container 60, a stacking sensor 62 which senses the presence of the banknotes, and stoppers 64, 64 which prevent the banknotes in the container 60 from being ejected outside.

[0103] Specifically, the container 60 of the reject stack-

er 6 has an opening through the first and second side surfaces 113 and 114 of the housing 11. That is, a reject outlet 63 through which the banknotes stacked in the reject stacker 6 are removed out of the housing 11 is provided through the first and second side surfaces 113 and 114. The reject outlet 63 is opened through the first side surface 113 to be positioned above the inlet 24 and below the dispense port 101. Specifically, the reject outlet 63 is opened immediately below the step between the hopper unit 2 and the dispense unit 10. The reject outlet 63 has no door, and is kept opened.

[0104] The bottom of the container 60 is tilted such that the more distant from the first side surface 113, the lower the level of the bottom. Thus, the banknotes in the container 60 are stacked deep inside the first side surface 113. Thus, the banknotes are prevented from being ejected outside through the reject outlet 63 of the first side surface 113 when they are brought into the container 60.

[0105] The two stoppers 64, 64 are provided at one edge of the bottom of the container 60 closer to the first side surface 113. The stoppers 64 are supported to be rotatable around an axis extending parallel to the edge of the bottom closer to the first side surface 113, and are biased by bias springs (not shown) to stand up on the bottom of the container 60. These stoppers 64, 64 can also prevent the banknotes in the container 60 from being ejected outside through the reject outlet 63 of the first side surface 113. Note that in removing the banknotes stacked in the reject stacker 6 through the reject outlet 63, the stoppers 64, 64 need to be pressed down against the elastic force of the bias springs.

[0106] The stacking wheel 61 includes a plurality of flexible blades, and has the function of tapping the banknotes falling into the container 60 on their rear edges in the transport direction so as to let the banknotes fall. Even when the banknotes are brought into the container 60 successively, each of the banknotes is prevented from being inserted below the rear edge of the preceding banknote, and thus the banknotes can be sequentially stacked one by one on top of the previously stacked ones.

[0107] The stacking sensor 62 is configured in the same manner as the banknote sensor 25, and senses the banknotes in the container 60 when the light is blocked. The stacking sensor 62 is arranged such that the light is blocked by the banknotes in the container 60.

<System Configuration for Banknote Handling Apparatus>

[0108] FIG. 4 is a block diagram illustrating a general configuration for the banknote handling apparatus 100.

[0109] The banknote handling apparatus 100 includes a control unit 120 based on a well-known microcomputer, for example. The control unit 120 is connected to the above-described units, namely, the hopper unit 2, the recognition unit 3, the bundling stackers 4, the non-bundling stackers 5, the reject stacker 6, the first and second transport units 7 and 8, the bundling unit 9, the dispense

unit 10, and the touch panel 17 so as to transmit and receive signals to/from these units. The control unit 120 is also connected to the banknote sensors 25 and 45, the stacking sensors 52 and 62, and the tracking sensors 74 and 103 to receive detection signals from these sensors. The control unit 120 generates a control signal based on the signal supplied from the touch panel 17, the detection signals from the sensors and other suitable signals, and outputs the generated control signal to the hopper unit 2 and other units. The hopper unit 2 and other units operate in accordance with the control signal. Taking the bundling stacker 4 as an example, the control unit 120 controls the front wall 40a of the container 40, the stage 41, the stacking wheel 42, the lock mechanism 47 of the door 43, and the stepping motor 44b of the aligner mechanism 44.

[0110] Further, the banknote handling apparatus 100 is configured to be connectable to an external device 124 through an interface unit 122. The external device 124 is configured to provide various kinds of information, programs and other necessary data for the control unit 120 through the interface unit 122. The interface unit 122 is configured such that a storage medium 123, such as a USB memory or a memory card, is attachable thereto. The banknote handling apparatus 100 is configured to be switchable between a mode in which the information or program provided by the external device 124 is once stored in the storage medium 123 attached to the interface unit 122 and then transmitted to the control unit of the banknote handling apparatus 100, and a mode in which the information or program provided by the external device 124 is transmitted directly to the control unit of the banknote handling apparatus 100 without being stored in the storage medium 123 attached to the interface unit 122. The switching may be performed through an on-screen image displayed on the touch panel 17. Alternatively, the switching may also be made automatically depending on whether the storage medium 123 is attached to the interface unit 122 or not. That is to say, if the storage medium 123 is attached to the interface unit 122, the information or program provided by the external device 124 may be once stored in the storage medium 123 attached to the interface unit 122, and then transmitted to the control unit of the banknote handling apparatus 100. On the other hand, if no storage medium 123 is attached to the interface unit 122, the information or program provided by the external device 124 may be transmitted directly to the control unit of the banknote handling apparatus 100. Transmitting the data directly to the control unit 120 without being stored in the storage medium 123 allows for shortening the processing time. On the other hand, if the data is stored in the storage medium 123, the processing time may increase, but the data may restart being transmitted from the storage medium 123 to the control unit 120 without supplying the data from the external device 124 again in case of an error caused during the transmission of the data from the storage medium 123 to the control unit 120.

[0111] The control unit 120 is configured to store various kinds of information, programs and other data provided by the external device 124 or other devices such that they are used for various kinds of control and other processes.

<Working Mechanism of Banknote Handling Apparatus>

[0112] It will be described how to perform a deposit process using this banknote handling apparatus 100. In the deposit process, loose banknotes are sorted and stacked in the predetermined stackers, and predetermined ones of them are bundled. In the following description, a single kind banknote bundling process will be described, in which a predetermined number of banknotes of a prescribed kind to be bundled are stacked alternately in the first and second bundling stackers 4A, 4B, and the predetermined number of banknotes stacked are bundled sequentially by the bundling unit 9.

[0113] The banknote handling apparatus 100 is placed on a teller counter to be positioned on the front left side of the operator (on the front right side of a customer) when the operator faces the customer over the teller counter. At this time, the banknote handling apparatus 100 is arranged such that the first side surface 113 of the housing 11 faces the customer. In this state, the second side surface 114 of the housing 11 faces the operator. However, since the banknote handling apparatus 100 is located slightly on the front left side of the operator, the customer can also see the second side surface 114.

[0114] Described below is a continuous bundling process, in which the banknotes to be bundled are stacked alternately in the first and second bundling stackers 4A, 4B on a predetermined number basis, and the banknotes stacked in the predetermined numbers are bundled successively by the bundling unit 9.

[0115] First, the operator receives loose banknotes to be deposited from the customer, and places the banknotes on the hopper unit 2. At this time, even if the loose banknotes include banknotes of multiple different kinds, all the banknotes are just placed on the hopper unit 2 without sorting them. The operator adjusts the guides 22 according to the dimension of the banknotes. Then, the operator operates the touch panel 17 to start the intake of the banknotes. The banknote handling apparatus 100 may automatically start the intake of the banknotes when the banknote sensor 25 senses the banknotes placed on the hopper unit 2.

[0116] The banknotes placed on the hopper unit 2 are brought into the housing 11 one by one through the inlet 24 as the intake rollers 23 are activated. The banknotes thus taken in are transported by the first transport unit 7, and pass through the recognition unit 3. The recognition unit 3 senses the kind of the banknotes passed, and informs the control unit 120 of the kind of the banknotes. The recognition unit 3 also reads serial numbers of the banknotes.

[0117] The control unit 120 designates the banknotes'

destination according to the kind of the banknotes. In particular, if the banknotes are fit banknotes of a predetermined denomination to be bundled, the control unit 120 designates the bundling stacker 4 (any one of the bundling stackers 4A and 4B) as their destination. If the banknotes are unfit banknotes of the predetermined denomination to be bundled, the control unit 120 designates the first non-bundling stacker 5A as their destination. If the banknotes are of any denomination other than the predetermined denomination, the control unit 120 designates the second non-bundling stacker 5B as their destination. If the banknotes are rejected banknotes, the control unit 120 designates the reject stacker 6 as their destination.

[0118] The control unit 120 controls the first transport unit 7 such that the banknotes are transported to the stacker designated as their destination. In particular, the control unit 120 controls the sorting mechanism 73 corresponding to the diverged path 72 leading to the destination stacker such that the banknotes are guided from the main transport path 71 to the diverged path 72. The control unit 120 switches the sorting mechanism 73 when the tracking sensor 74 located just before the diverged path 72 senses the banknotes. Further, the control unit 120 controls the stacking wheel 42 or 51 of the destination stacker to bring the banknotes into that stacker.

[0119] The banknotes transported to the bundling stacker 4 are transported to one of the two bundling stackers 4. When the number of banknotes stacked in one of the bundling stackers 4 reaches a predetermined bundling number (e.g., 100), the remaining banknotes are then transported to the other bundling stacker 4. In this example, the banknotes are supposed to be transported to the first bundling stacker 4A first.

[0120] When the banknotes are transported one after another to the first bundling stacker 4A, the stacking wheel 42 rotates to stack the banknotes one by one. The banknotes brought into the container 40 come into contact with the front wall 40a, and thus the longer sides thereof are aligned.

[0121] When the number of banknotes stacked in the first bundling stacker 4A reaches the bundling number, the control unit 120 activates the aligner mechanism 44 to align the shorter sides of the banknotes with each other. Optionally, the control unit 120 may activate the aligner mechanism 44 to align the shorter sides of the banknotes with each other every time the banknotes are brought into the container 40. Then, the control unit 120 controls the second transport unit 8 to grip the banknotes in the first bundling stacker 4A with the hands 81 to transport them to the stage 85. Thereafter, the control unit 120 controls the bundling unit 9 so that the banknotes on the stage 85 are bundled with the bundling band.

[0122] When the number of banknotes stacked in the first bundling stacker 4A reaches the bundling number, the remaining banknotes are stacked in the second bundling stacker 4B. Then, when the number of banknotes stacked in the second bundling stacker 4B reaches the

bundling number, the remaining banknotes are stacked again in the first bundling stacker 4A. By this time, the banknotes in the first bundling stacker 4A have already been bundled, and thus the first bundling stacker 4A is now empty. Thus, the provision of the two bundling stackers 4 allows for performing the bundling process while stacking the banknotes continuously.

[0123] Subsequently, the control unit 120 allows the pushing mechanism 86 to push the bundled banknotes on the stage 85 to dispense them to the stage 102 through the dispense port 101. When the bundled banknotes are dispensed to the stage 102, the stage 102 sinks under the weight of the bundled banknotes to the level at which there are no bundled banknotes horizontally outside of the dispense port 101. Thus, the stage 102 prepares for the next dispense of the bundled banknotes.

[0124] The unfit banknotes of the predetermined denomination are transported to the first non-bundling stacker 5A. When the banknotes are transported to the first non-bundling stacker 5A, the stacking wheel 51a rotates to stack the transported banknotes in the container 50a. Thus, the unfit banknotes of the predetermined denomination are stacked in the first non-bundling stacker 5A. Likewise, the banknotes of every denomination but the predetermined one are transported to, and stacked in, the second non-bundling stacker 5B. The rejected banknotes are also transported to, and stacked in, the reject stacker 6.

[0125] This series of processing steps will be performed over and over again until there are no banknotes placed on the hopper unit 2. The banknote sensor 25 determines whether banknotes are still present on the hopper unit 2 or not.

[0126] When the handling of the banknotes placed on the hopper unit 2 is finished, the rejected banknotes are taken in and recognized again. Specifically, the operator extracts the rejected banknotes from the reject stacker 6, and places them on the hopper unit 2 to take them into the apparatus again. The rejected banknotes are those which were not recognized as normal banknotes for any reason, and thus another attempt is made to take in and recognize them. Banknotes still recognized as rejected banknotes, if any, are restacked in the reject stacker 6. Then, the operator returns those restacked banknotes to the customer.

[0127] Note that the banknotes stacked in the first and second non-bundling stackers 5A, 5B are not taken in again.

[0128] Thus, when the handling of the banknotes placed on the hopper unit 2 and the re-handling of the rejected banknotes are finished, the single kind banknote bundling process is finished, i.e., the counting and sorting of the banknotes passed as those to be deposited by the customer are finished. The touch panel 17 displays the counted amount of the banknotes. The operator asks for a customer's approval of the amount, or checks whether the displayed amount corresponds with the amount described on a deposit slip by the customer, and if the an-

swer is YES, the operator operates the touch panel 17 to confirm the deposit amount. When the confirmation is done, a teller terminal (not shown) is informed of the confirmed deposit amount, thereby finishing the deposit process.

[0129] After the deposit process is finished, the operator removes the bundled banknotes stacked in the dispense unit 10, the banknotes stacked in the bundling stacker 4, and the banknotes stacked in the non-bundling stackers 5, and stores them in a predetermined storage place.

[0130] Through the above-described process, the loose banknotes including banknotes of multiple different kinds are sorted into fit banknotes of a predetermined denomination, unfit banknotes of the predetermined denomination, banknotes of any denominations other than the predetermined denomination, and rejected banknotes. The fit banknotes of the predetermined denomination are bundled into multiple bundles on a bundling number basis.

<Setting of Stackers>

[0131] In the foregoing description, the first and second bundling stackers 4A, 4B stack fit banknotes of a predetermined denomination, the first non-bundling stacker 5A stacks unfit banknotes of the predetermined denomination, and the second non-bundling stacker 5B stacks banknotes of every denomination but the predetermined one.

[0132] However, the banknotes to be stacked in the first and second bundling stackers 4A, 4B and the first and second non-bundling stackers 5A, 5B of the banknote handling apparatus 100 may be determined as appropriate. FIG. 5 shows various combinations of banknotes to be stacked in those stackers. Referring to FIG. 5, the stackers for which no kinds of banknotes are specified may stack any designated kinds of banknotes. The banknotes stacked in the first bundling stacker 4A may be replaced with those stacked in the second bundling stacker 4B, and vice versa. Likewise, the banknotes stacked in the first non-bundling stacker 5A may be replaced with those stacked in the second non-bundling stacker 5B. The combinations shown in FIG. 5 are provided merely as examples, and other combinations are also applicable.

[0133] Pattern 1 shows the combination of the stackers and the banknotes adopted in the above-described continuous bundling process.

[0134] In Pattern 2, the first and second bundling stackers 4A, 4B stack banknotes of a predetermined denomination, and the second non-bundling stacker 5B stacks banknotes of every denomination but the predetermined one. Note that other conditions may be or may not be added as long as the banknotes to be stacked in the first and second bundling stackers 4A, 4B are of the predetermined denomination. For example, the first and second bundling stackers 4A, 4B may stack all banknotes of the predetermined denomination, regardless of their

fitness level, their orientation, and their oldness or newness. Alternatively, the first and second bundling stackers 4A, 4B may stack banknotes of the predetermined denomination that have been sorted according to at least one of conditions such as their fitness level, their orientation, and their oldness or newness. Still alternatively, the banknotes of the predetermined denomination may be sorted into two groups according to their fitness level, their orientation, and their oldness or newness such that the first and second bundling stackers 4A, 4B stack the banknotes of two different properties. The banknotes to be stacked in the first non-bundling stacker 5A may be determined as appropriate. Pattern 1 is an implementation of Pattern 2.

[0135] In Pattern 3, the first and second bundling stackers 4A, 4B stack fit banknotes of the predetermined denomination, and the first non-bundling stacker 5A stacks unfit banknotes of the predetermined denomination. Note that other conditions may be or may not be added as long as banknotes of the predetermined denomination are stacked in the first and second bundling stackers 4A, 4B. The first and second bundling stackers 4A and 4B may stack banknotes of the same property or different properties. Pattern 1 is an implementation of Pattern 3.

[0136] Pattern 3-A is an implementation of Pattern 3. In Pattern 3-A, the first and second bundling stackers 4A, 4B stack the fit banknotes of the predetermined denomination which are further sorted according to still another property. The first bundling stacker 4A stacks the fit banknotes of the predetermined denomination which have their face turned upward, and the second bundling stacker 4B stacks the fit banknotes of the predetermined denomination which have their back turned upward.

[0137] Pattern 3-B is an implementation of Pattern 3. In Pattern 3-B, the first and second bundling stackers 4A, 4B stack fit banknotes of the predetermined denomination which are further sorted according to their fitness level. Specifically, the fit banknotes are sorted into those of Fitness Level 1 (ATM) and those of Fitness level 2 (TELLER). The fit banknotes of Fitness Level 1 are those which are usable in ATMs, and the fit banknotes of Fitness Level 2 are those which are not usable in the ATMs. In other words, if the fitness level has three grades, the banknotes are sorted into fit banknotes of Fitness Level 1, fit banknotes of Fitness Level 2, and unfit banknotes. In this case, Fitness Level 1 corresponds to the first level, Fitness Level 2 corresponds to the second level, and the unfit banknotes correspond to the third level. If the fitness level has two grades, the banknotes are sorted into fit banknotes (FIT) and unfit banknotes (UNFIT). In that case, the fit banknotes correspond to the first level, and the unfit banknotes correspond to the second level. In Pattern 3-B, the first bundling stacker 4A stacks fit banknotes of the predetermined denomination and of Fitness Level 1, and the second bundling stacker 4B stacks fit banknotes of the predetermined denomination and of Fitness Level 2.

[0138] Pattern 3-C is an implementation of Pattern 3.

Pattern 3-C is different from Pattern 3-B in that the banknotes to be stacked in the first and second bundling stackers 4A and 4B and the first non-bundling stacker 5A are further sorted according to yet another property. Specifically, the banknotes stacked in the first and second bundling stackers 4A and 4B and the first non-bundling stacker 5A share the common properties that they are of the predetermined denomination and of one of new and old versions. It may be determined as appropriate whether the banknotes to be stacked there are new ones or old ones.

[0139] In Pattern 4, the first and second bundling stackers 4A, 4B stack banknotes of the predetermined denomination that have one of their face and their back turned upward, the first non-bundling stacker 5A stacks banknotes of the predetermined denomination that have the other of their face and their back turned upward, and the second non-bundling stacker 5B stacks banknotes of every denomination but the predetermined one. It may be determined as appropriate which of the first and second bundling stackers 4A, 4B and the first non-bundling stacker 5A is going to stack banknotes that have their face turned upward, and which of these stackers is going to stack the banknotes that have their back turned upward.

[0140] Pattern 4-A is an implementation of Pattern 4. In Pattern 4-A, banknotes of the predetermined denomination that have one of their face and their back turned upward are further sorted according to yet another property such that they are stacked in the first and second bundling stackers 4A, 4B. Specifically, the first bundling stacker 4A stacks banknotes of the predetermined denomination that have one of their face and their back turned upward which have a print orientation (i.e., an orientation of letters and/or portraits printed on each banknote) corresponding with the transport direction (indicated as "portrait-up" in FIG. 5: this state will be hereinafter referred to as "a print facing forward"). The second bundling stacker 4B stacks banknotes of the predetermined denomination that have one of their face and their back turned upward which have a print facing opposite to the transport direction (indicated as "portrait-down" in FIG. 5: this state will be hereinafter referred to as "a print facing backward").

[0141] In Pattern 5, the first and second bundling stackers 4A, 4B stack banknotes of the predetermined denomination that have one of their face and their back turned upward which have one of the print facing forward or the one facing backward. The first non-bundling stacker 5A stacks banknotes of the predetermined denomination that have one of their face and their back turned upward which have the other of the print facing forward and the one facing backward. The second non-bundling stacker 5B stacks banknotes of the predetermined denomination that have the other of their face and their back turned upward. It may be determined as appropriate which of the first and second bundling stackers 4A and 4B and the first and second non-bundling stackers 5A and 5B is

going to stack banknotes that have their face turned upward, and which of these stackers is going to stack banknotes that have their back turned upward. Further, it may also be determined as appropriate which of the first and second bundling stackers 4A, 4B and the first non-bundling stacker 5A is going to stack banknotes, of which the print faces forward, and which of these stackers is going to stack the banknotes, of which the print faces backward.

[0142] Pattern 6 is different from Pattern 5 in the property of the banknotes stacked in the second non-bundling stacker 5B. In Pattern 6, the first and second bundling stackers 4A, 4B stack banknotes of the predetermined denomination that have one of their face and their back turned upward which have one of the print facing forward and the one facing backward. The first non-bundling stacker 5A stacks banknotes of the predetermined denomination that have one of their face and their back turned upward which have the other of the print facing forward and the one facing backward. The second non-bundling stacker 5B stacks the banknotes of every denomination but the predetermined one.

[0143] Pattern 7 is different from Pattern 4 in the property according to which the banknotes of the predetermined denomination are sorted to be stacked in the first and second bundling stackers 4A, 4B and the first non-bundling stacker 5A. In Pattern 7, the first and second bundling stackers 4A, 4B stack banknotes of the predetermined denomination and of one of new and old versions, the first non-bundling stacker 5A stacks banknotes of the predetermined denomination and of the other of new and olds versions, and the second non-bundling stacker 5B stacks banknotes of every denomination but the predetermined one. It may be determined as appropriate which of the first and second bundling stackers 4A, 4B and the first non-bundling stacker 5A is going to stack new banknotes, and which of these stackers is going to stack old banknotes.

[0144] Pattern 7-A is an implementation of Pattern 7. In Pattern 7-A, banknotes of the predetermined denomination and of one of new and old versions are further sorted according to yet another property to be stacked the first and second bundling stackers 4A, 4B. Specifically, the first bundling stacker 4A stacks fit banknotes of the predetermined denomination and of one of new and old versions, and the second bundling stacker 4B stacks unfit banknotes of the predetermined denomination and one of the new and old versions.

[0145] Pattern 7-B is an implementation of Pattern 7. In Pattern 7-B, banknotes of the predetermined denomination and of one of new and old versions are sorted according to a different property from in Pattern 7-A to be stacked in the first and second bundling stackers 4A, 4B. Specifically, the first bundling stacker 4A stacks banknotes of the predetermined denomination and of one of new and old versions which have their face turned upward. The second bundling stacker 4B stacks banknotes of the predetermined denomination and of one of the new

and old versions which have their back turned upward.

[0146] In Pattern 8, the first bundling stacker 4A stacks banknotes of a first denomination, and the second bundling stacker 4B stacks banknotes of a second denomination.

[0147] In this manner, banknotes of various properties may be designated as banknotes to be stacked in the first and second bundling stackers 4A, 4B and the first and second non-bundling stackers 5A, 5B.

<Particular Process on Banknotes Having Serial Numbers Corresponding with Registered Ones>

[0148] The banknote handling apparatus 100 is also configured to register the serial numbers in advance such that banknotes having serial numbers corresponding with the registered ones are detectable during the above-described depositing process. For example, when information that "counterfeit banknotes of particular serial numbers are circulated on the market" is provided, this configuration allows for easy detection of those counterfeit banknotes or other unwanted banknotes by extracting banknotes of the particular serial numbers from the banknotes brought to a teller window in a financial institution or other institutions.

[0149] In particular, FIG. 6 is a flowchart showing a procedure to be performed from the registration of serial numbers to the depositing process. In Step S1 after the start of the process, serial numbers are registered. The registration of the serial numbers is performed through a registration on-screen image SC1 as shown in FIG. 7. The registration on-screen image SC1 is displayed on the touch panel 17. The registration on-screen image SC1 displays a software keyboard 201. The operator enters the serial numbers one by one by tapping this software keyboard 201 to register them.

[0150] The registration on-screen image SC1 includes a field 202 to which a currency code is entered. The operator enters a three-letter currency code in this field 202. Instead of entering the currency code, selectable options of currency may be shown on the screen. In that case, the operator selects a desired currency from the selectable options presented.

[0151] The registration on-screen image SC1 also includes a field to which the denomination is entered. The operator enters the denomination in the field 203 in a right justified manner. If the operator enters a denomination which does not correspond to the currency code already entered, an error message may be displayed to prompt the operator to enter the denomination again. Alternatively, selectable options of denomination may be shown on the registration on-screen image SC1 according to the currency code entered. This allows the operator to select a desired denomination from the options displayed on the screen. Although not shown, in entering the denomination, the version of the banknotes of the selected denomination may also be entered additionally. The version of the banknotes mentioned herein means

the "edition" of the banknotes, namely, the new edition of the banknotes which are being issued currently, and an old edition of the banknotes which were issued previously. There is not always just a single version of old banknotes, but there may be multiple different versions according to the year of issue.

[0152] On this registration on-screen image SC1, the entry of the currency code and/or denomination may be omitted. If the currency code and/or denomination are/is not entered, banknotes of every currency and/or every denomination may be searched.

[0153] The registration on-screen image SC1 includes a field 204 to which the serial number is entered. The number of digits of the field 204 for entering the serial number is maximized to accept any currency or denomination that can be handled by this banknote handling apparatus 100. Optionally, when the currency and/or the denomination are/is designated, the number of digits of the field 204 may be changed into the number of digits of the serial number corresponding to the currency and/or the denomination designated.

[0154] The field 204 for entering the serial number is also configured to allow the operator to enter only some of the digits of the serial number instead of entering all the digits of the serial number. If some of the digits of the serial number are entered in the field 204, for example, in a right justified manner, checking of the serial number to be described later may be performed by suffix search. On the other hand, if the serial number is entered in the field 204, for example, in a left justified manner, prefix search may be performed. Further, if the serial number is entered only in a center portion of the field 204, the checking may be performed by partial match (that is, when a row of two or more digits entered corresponds with any portion of any of the registered serial numbers, decision may be made that the serial number entered and the registered one correspond with each other, irrespective of the places of the digits).

[0155] In the illustrated example, the registration on-screen image SC1 further includes, in an upper left portion, a button 205 for shifting to the entry of the next serial number. Operating this button 205 allows for registering a plurality of serial numbers one after another. The registration on-screen image SC1 also includes a button 206 for shifting to the serial number which has been entered previously. Operating this button 206 allows for correcting or canceling the serial number which has been registered previously. Besides, in the illustrated example, the registration on-screen image SC1 further includes a "confirm" button 207 and a "cancel" button 208 in a lower right portion. Operating these buttons allows for confirmation and cancellation of the registered serial number. The serial numbers entered or handled in Step S1 are stored in a storage area 121 of the control unit 120. The control unit 120 is an exemplary registration unit.

[0156] Note that in Step S1, the serial numbers may be registered in a different manner from the above-described registration method in which the serial numbers

are registered one by one by operating the touch panel 17 of the banknote handling apparatus 100. Specifically, information about the serial numbers may be stored in advance in a storage medium 123, such as a USB memory or a memory card, such that the stored information about the serial numbers is retrievable from the storage medium 123 attached to the interface unit 122 to register the serial numbers in the storage area 121 of the control unit 120. Alternatively, information about the serial numbers may be received from the external device 124 connected to the banknote handling apparatus 100 to register the serial numbers. The information about the serial numbers transmitted from the external device 124 may be once stored in the storage medium 123 attached to the interface unit 122, and then registered in the storage area 121 of the control unit 120. Instead of storing the information in the storage medium 123 attached to the interface unit 122, the information may be stored directly in the storage area 121 of the control unit 120. These configurations improve the work efficiency when a plurality of serial numbers are registered at a time. The interface unit 122 is an exemplary acquisition unit which acquires information.

[0157] When the serial numbers are registered in Step S1 of the flow shown in FIG. 6, the process proceeds to the next step S2. In Step S2, the parameters of a "particular process" are set which will be performed when a banknote having a serial number corresponding with any of the registered ones is found (such a banknote will be hereinafter referred to as a "particular banknote"). In the illustrated example, the touch panel 17 displays a setting dialog box SC2 as shown in FIG. 8. This setting dialog box SC2 is configured to prompt the operator to determine alternatively whether he or she wants to transport the particular banknote to the reject stacker 6 (that is, "reject") or the non-bundling stacker 5 (that is, "stacker"). The operator sets the parameters of the particular process by selecting either the reject stacker 6 or the non-bundling stacker 5.

[0158] Referring back to the flow shown in FIG. 6, execution of the deposit process is accepted in Step S3, and a determination is made in the next step S4 whether the banknotes are placed on the hopper unit 2 and whether the touch panel 17 has been operated or not. If the banknotes are placed there and if the operation to start the deposit process is done (i.e., if the answer is YES), the process proceeds to step S5. Otherwise (i.e., if the answer is NO), Step S4 is performed all over again.

[0159] In Step S5, as described above, the banknotes are taken in through the inlet 24 one by one, and the recognition unit 3 recognizes not only the banknotes themselves but also their serial numbers. If at least one of the currency and the denomination has been designated in the registration step S1 described above, only the banknotes of the designated currency and/or denomination (including the version) may have their serial numbers read. Thus, limiting the number of banknotes to have their serial numbers read allows for reducing the process-

ing load and shortening the processing time effectively.

[0160] In Step S5, the control unit 120 also checks the read serial numbers against the serial numbers registered in the storage area 121. If at least one of the currency and the denomination (including the version) has been designated, the checking is performed only on the banknotes of the designated currency and/or denomination. This allows for reducing the processing load and shortening the processing time. Note that in Step S5, the control unit 120 may add "AND" to (i.e., combine) a plurality of conditions including the currency and/or the denomination (including the version) and the serial number to check the banknotes. Also, according to the parameters of the registered serial numbers, the control unit 120 may perform the checking by prefix search (that is to say, when some digits of the serial number are entered in a right justified manner in the field 204 for entering the serial number on the registration on-screen image SC1 shown in FIG. 7), by suffix search (that is to say, when some digits of the serial number are entered in a left justified manner in the field 204 for entering the serial number), or by partial match (that is to say, when some digits of the serial number are entered only in a center portion of the field 204 for entering the serial number). The control unit 120 is an exemplary checking unit.

[0161] If the result of the checking reveals that the serial number corresponds with any of the registered ones, the process proceeds from Step S5 to Step S6. On the other hand, if the serial number does not correspond with any of the registered ones, the process jumps from Step S5 to Step S8.

[0162] In Step S6, a determination is made whether or not the reject stacker 6 has been designated in Step S2 as the destination of the particular banknote. If the reject stacker 6 has been designated as the destination of the particular banknote (i.e., if the answer is YES), the process proceeds to Step S7, in which the particular banknote is dispensed to the reject stacker 6.

[0163] On the other hand, if the reject stacker 6 is not designated as the destination (i.e., if the answer is NO), the process does not proceed to Step S7. That is, the particular banknote is transported to the non-bundling stacker 5, and is stacked in the first or second non-bundling stacker 5A or 5B according to its denomination. Specifically, if the particular banknote is a banknote of a predetermined denomination, it is transported to the first non-bundling stacker 5A. On the other hand, if the particular banknote is not a banknote of the predetermined denomination, then it is transported to the second non-bundling stacker 5B. If the particular banknote is a banknote of a denomination (or a currency) that is not to be stacked in any of the first and second non-bundling stackers 5A, 5B, the particular banknote is transported to the reject stacker 6, although the process does not proceed to Step S7.

[0164] In Step S8, a determination is made whether or not all the banknotes placed on the hopper unit 2 have been deposited yet. If the deposit process has not been

finished yet (i.e., if the answer is NO), the process goes back to Step S5 to repeat Steps S5-S8 all over again. On the other hand, if the deposit process has already been finished (i.e., if the answer is YES), the process proceeds to Step S9.

[0165] In Step S9, a determination is made whether or not any particular banknote having a serial number corresponding with any of the registered ones has been found. If any such banknote is found (i.e., if the answer is YES), the process proceeds to Step S10. On the other hand, if no such banknotes are found (i.e., if the answer is NO), the process ends.

[0166] In Step S10, the touch panel 17 displays the serial number of the particular banknote thus found. FIG. 9 shows an example of an on-screen image SC3 displaying the serial number. This on-screen image SC3 includes a field 212 indicating the currency code of the particular banknote found, a field 213 indicating the denomination of the particular banknote found, and a field 214 indicating the read serial number of the particular banknote found. By reference to these items of information, the operator is allowed to extract the particular banknote from the banknotes stacked in the reject stacker 6 or the non-bundling stackers 5.

[0167] In this example, the on-screen image SC3 displaying the serial number may further display the location where the particular banknote is stacked (whether it is stacked in the reject stacker 6 or the first or second non-bundling stacker 5A or 5B), and the place of the particular banknote in the stack of banknotes (i.e., how many banknotes are stacked on or under the particular banknote). These items of information allow the operator to extract the particular banknote easily.

[0168] This on-screen image SC3 further includes a button 215 for displaying information about the next particular banknote, and a button 216 for displaying information about the preceding particular banknote. When two or more particular banknotes are found, the operator operates these buttons 215, 216 as needed to extract the particular banknotes from the reject stacker 6 or the non-bundling stackers 5 sequentially.

[0169] The operator determines whether the extracted particular banknotes are counterfeit ones or not by visual check or any other suitable method. If the banknotes turn out to be counterfeit or suspected ones as a result, these particular banknotes will be managed separately. On the other hand, if they are not counterfeit or suspected ones, the following procedure will be carried out.

[0170] Specifically, since the particular banknote extracted from the non-bundling stacker 5 has already been counted, the particular banknote is returned to the non-bundling stacker 5, and then the deposit process is finished without taking any further action. On the other hand, since the particular banknote extracted from the reject stacker 6 has not been counted yet, and is not a counterfeit or suspected banknote, it has to be counted. Accordingly, this particular banknote is placed on the hopper unit 2 again to be taken into the apparatus again. At

this time, the serial number of the particular banknote is not checked. This allows for smooth counting and stacking of the banknote taken in again.

[0171] As can be seen from the foregoing description, this banknote handling apparatus 100 registers the serial numbers in advance such that any banknote having a serial number corresponding with any of the registered ones is detectable during the deposit process. That is to say, the banknote handling apparatus 100 is allowed to detect a banknote having a serial number corresponding with any of the registered ones all by itself through a single deposit process. This simplifies the configuration of the apparatus, and saves the operator of the banknote handling apparatus 100 a lot of processing time and trouble. This enables smooth operations at a teller window in a financial institution or other institutions.

[0172] On finding any particular banknote having a serial number corresponding with any of the registered ones, the banknote handling apparatus 100 stacks the particular banknote in the reject stacker 6 or the non-bundling stacker 5. Thus, the operator is allowed to extract the particular banknote from the banknotes stacked in the reject stacker 6 or the non-bundling stacker 5. Further, since either the reject stacker 6 or the non-bundling stacker 5 may be designated as the destination of the particular banknote, the optimum destination is selectable depending on how the operator uses the banknote handling apparatus 100. This makes the banknote handling apparatus 100 even handier.

[0173] Further, on finding such a particular banknote having a serial number corresponding with any of the registered ones, the banknote handling apparatus 100 displays information about the serial number of that particular banknote on the touch panel 17 (see FIG. 9). Thus, the operator looks at the screen of the touch panel 17 to extract the particular banknote easily from the banknotes stacked in the reject stacker 6 or the non-bundling stacker 5. At this time, if information about the exact place of the particular banknote in the stack of the banknotes in the stacker is also provided, the operator is allowed to extract that particular banknote more easily and correctly.

[0174] Regarding the registration of the serial number, not just every digit, but also only some digits, of the serial number, may be registered, and therefore, the processing load of reading the serial numbers is reduced, which contributes to speeding up the process advantageously. If all digits of each serial number are supposed to be registered, each banknote taken in the apparatus needs to have each and every digit of its serial number read. This will increase the number of banknotes, the serial numbers of which are not recognizable in all digits, namely, the rejected banknotes. On the other hand, permitting the apparatus to read only some digits of a given serial number results in a decrease in the number of such rejected banknotes. This increases eventually the chances of finding banknotes having serial numbers corresponding with any of the registered ones.

[0175] Since the number of digits of the serial number

to be registered is changeable, the banknote handling apparatus 100 is usable flexibly, thereby making the apparatus even handier.

[0176] If the banknote handling apparatus allows the operator to register the denominations, versions, and currency codes of the banknotes in addition to their serial numbers, the banknotes are detectable with increased accuracy. If their denomination or currency does not correspond with any of the registered ones, the recognition and/or checking of the serial numbers may be omitted. This thus shortens the deposit process time.

[0177] The serial numbers may be registered not only by operating the touch panel, but also by using a storage medium 123 such as a USB memory or a memory card, and by downloading the serial numbers from the external device 124. This allows for easy registration of the serial numbers. This also makes the banknote handling apparatus 100 even easier to use.

[0178] The technique disclosed herein is applicable not only to the banknote handling apparatus 100 configured as described above, but also to banknote handling apparatuses with various other configurations. That is to say, this technique may be applied to a banknote processing machine which counts banknotes while sorting them, and a banknote depositing machine and banknote depositing/dispensing machine which store the banknotes in a storage unit.

DESCRIPTION OF REFERENCE CHARACTERS

[0179]

- 100 Banknote handling apparatus
- 120 Control unit (checking unit, registration unit)
- 122 Interface unit (acquisition unit)
- 17 Touch panel (display unit, registration unit)
- 24 Inlet
- 3 Recognition unit (serial number reading unit)
- 5 Non-bundling stacker (stacking unit)
- 6 Reject stacker (reject unit)
- 7 First transport unit (transport unit)
- 71 Main transport path
- 72a First diverged path
- 72b Second diverged path
- 72c Third diverged path
- 72d Fourth diverged path
- 8 Second transport unit (transport unit)

Claims

1. A banknote handling apparatus comprising:

- an inlet through which banknotes are taken in one by one;
- a transport unit configured to transport, along a transport path, each of the banknotes taken in through the inlet;

- a recognition unit arranged on the transport path and configured to recognize the banknotes being transported;
- a serial number reading unit configured to read a serial number of each of the banknotes being transported;
- a stacking unit configured to stack each of the banknotes recognized as normal based on a recognition result obtained by the recognition unit; and
- a reject unit to which each of the banknotes recognized as a banknote to be rejected based on the recognition result by the recognition unit is dispensed, wherein the banknote handling apparatus further comprises:

- a registration unit configured to register the serial number in advance;
- a checking unit configured to check the read serial number against the registered serial number; and
- a control unit configured to perform a predetermined process on a particular banknote, of which the serial number has turned out to correspond with any of the registered serial numbers as a result of the checking.

2. The banknote handling apparatus of claim 1, further comprising

- a display unit configured to display information, wherein as the predetermined process, the control unit displays the serial number of the particular banknote on the display unit.

3. The banknote handling apparatus of claim 1, wherein as the predetermined process, the control unit dispenses the particular banknote to the reject unit.

4. The banknote handling apparatus of claim 2, wherein as the predetermined process, the control unit dispenses the particular banknote to the reject unit.

5. The banknote handling apparatus of claim 2, wherein as the predetermined process, the control unit stacks the particular banknote in the stacking unit.

6. The banknote handling apparatus of claim 2, wherein as the predetermined process, the control unit stacks the particular banknote in the stacking unit and indicates, on the display unit, what the particular banknote's place is in a stack of banknotes in the stacking unit.

7. The banknote handling apparatus of any one of claims 1-6, wherein the registration unit registers any digits of each of

- the serial numbers, and
the checking unit checks the read serial number
against the registered digits of each of the serial num-
bers.
8. The banknote handling apparatus of any one of
claims 1-6, wherein
the registration unit further registers a denomination
of each of the banknotes,
the checking unit checks the recognition result ob-
tained by the recognition unit against the registered
denomination, and checks the read serial number
against the registered serial number, and
the control unit performs, based on a result of the
checking, a predetermined process on a particular
banknote, the denomination and serial number of
which correspond with any of the registered denom-
inations and any of the registered serial numbers,
respectively.
9. The banknote handling apparatus of claim 8, wherein
the registration unit further registers a version of the
registered denomination,
the checking unit checks the recognition result ob-
tained by the recognition unit against the registered
denomination and the registered version, and
checks the read serial number against the registered
serial number, and
the control unit performs, based on a result of the
checking, a predetermined process on a particular
banknote, the denomination, version, and serial
number of which correspond with any of the regis-
tered denominations, any of the registered versions,
and any of the registered serial numbers, respec-
tively.
10. The banknote handling apparatus of any one of
claims 1-6, wherein
the registration unit further registers a currency,
the checking unit checks the recognition result ob-
tained by the recognition unit against the registered
currency, and checks the read serial number against
the registered serial number, and
the control unit performs, based on a result of the
checking, a predetermined process on a particular
banknote, the currency and serial number of which
correspond with any of the registered currencies and
any of the registered serial numbers, respectively.
11. The banknote handling apparatus of any one of
claims 1-6, wherein
the registration unit further registers a denomination
of each of the banknotes, and
the checking unit checks a read serial number of a
banknote, the denomination of which corresponds
with any of the registered denominations, against
the registered serial number.
12. The banknote handling apparatus of any one of
claims 1-6, wherein
the registration unit further registers a version of the
registered denomination, and
the checking unit checks a read serial number of a
banknote, the denomination and version of which
correspond with any of the registered denominations
and any of the registered versions, against the reg-
istered serial number.
13. The banknote handling apparatus of any one of
claims 1-6, wherein
the registration unit further registers a currency, and
the checking unit checks a read serial number of a
banknote, the currency of which corresponds with
any of the registered currencies, against the regis-
tered serial number.
14. The banknote handling apparatus of any one of
claims 1-6, further comprising
an acquisition unit configured to acquire information
from outside of the apparatus, and
the registration unit registers a serial number includ-
ed in the information acquired through the acquisition
unit.
15. A banknote handling method comprising:

taking in banknotes through an inlet one by one;
recognizing the banknotes taken in;
reading a serial number of each of the banknotes
taken in;
stacking, in a stacking unit, each of the ban-
knotes determined to be normal based on a rec-
ognition result; and
dispensing, to a reject unit, the banknote deter-
mined to be rejected based on the recognition
result, wherein
the method further comprises:

registering the serial number of each of the
banknotes in advance;
checking the read serial number against the
registered serial number; and
performing a predetermined process on a
particular banknote, of which the serial
number has turned out to correspond with
any of the registered serial numbers as a
result of the checking.
16. The banknote handling method of claim 15, wherein
the predetermined process is displaying the serial
number of the particular banknote on a display unit.
17. The banknote handling method of claim 15, wherein
the predetermined process is dispensing the partic-
ular banknote to the reject unit.

18. The banknote handling method of claim 15, wherein the predetermined process is stacking the particular banknote in the stacking unit and indicating, on a display unit, what the particular banknote's place is in a stack of banknotes in the stacking unit. 5
19. The banknote handling method of any one of claims 15-18, further comprising registering a denomination of each of the banknotes in advance, wherein 10
a read serial number of a banknote, the denomination of which corresponds with any of the registered denominations, is checked against the registered serial number. 15
- 20
- 25
- 30
- 35
- 40
- 45
- 50
- 55

FIG. 1

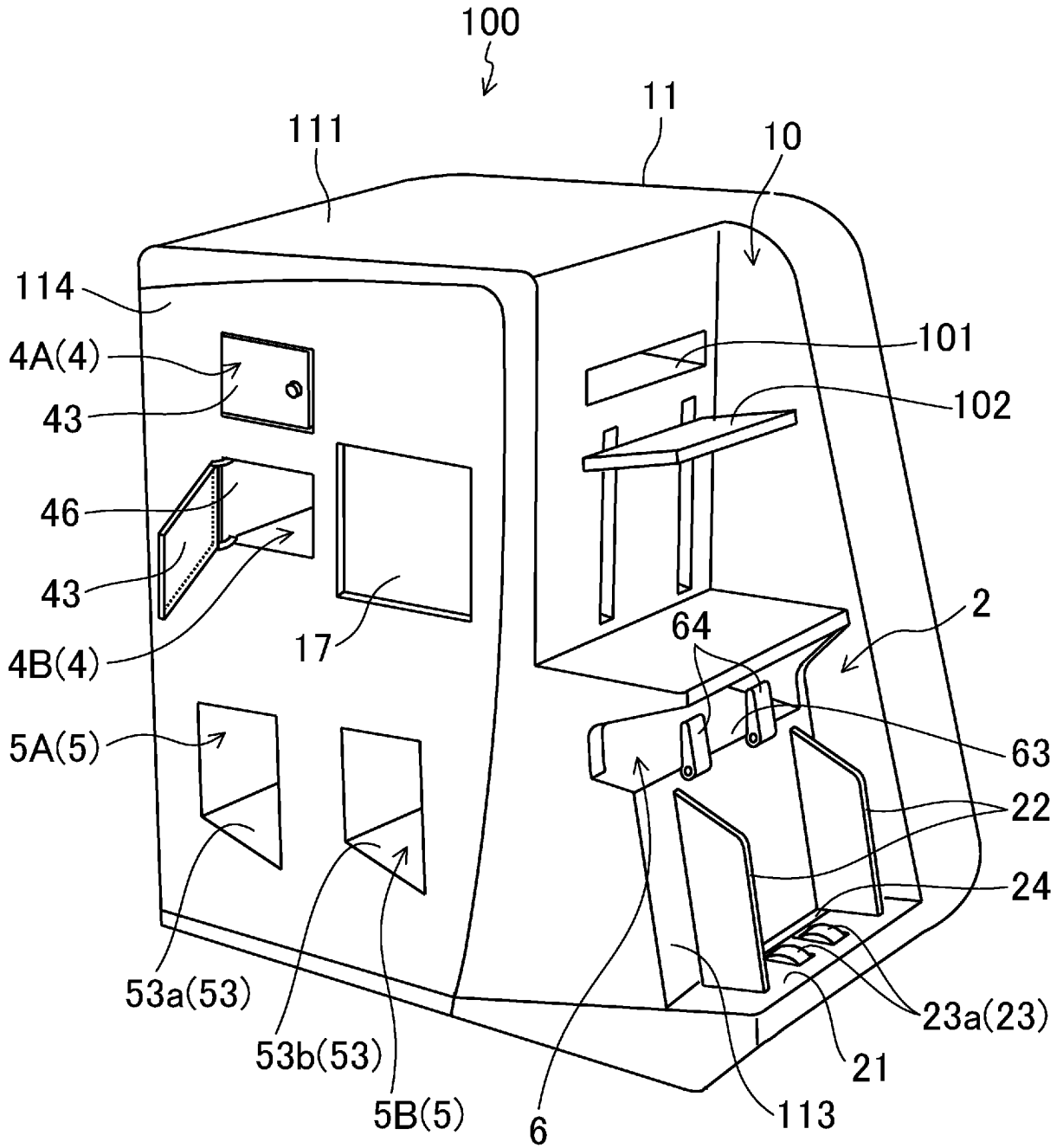


FIG.2

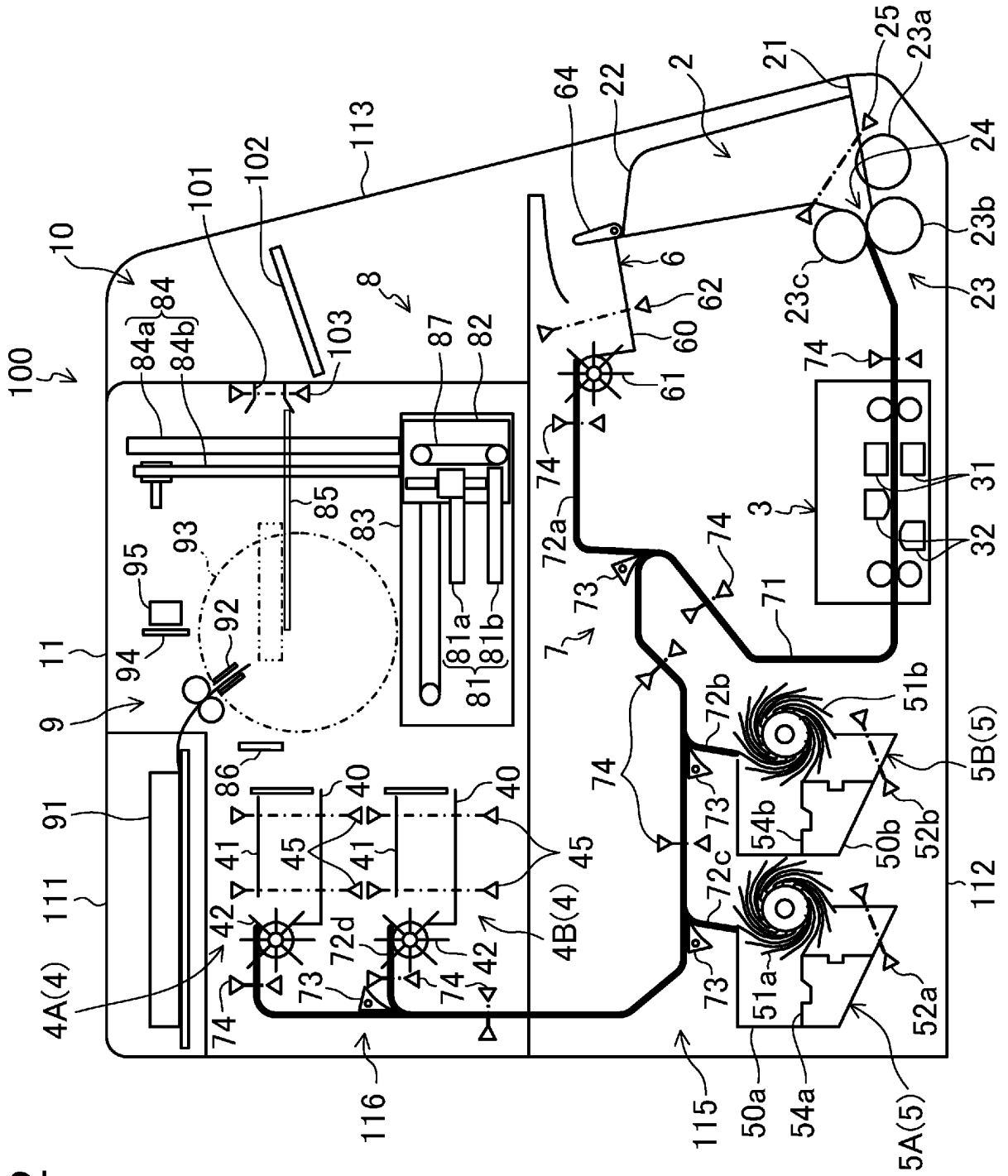


FIG.3

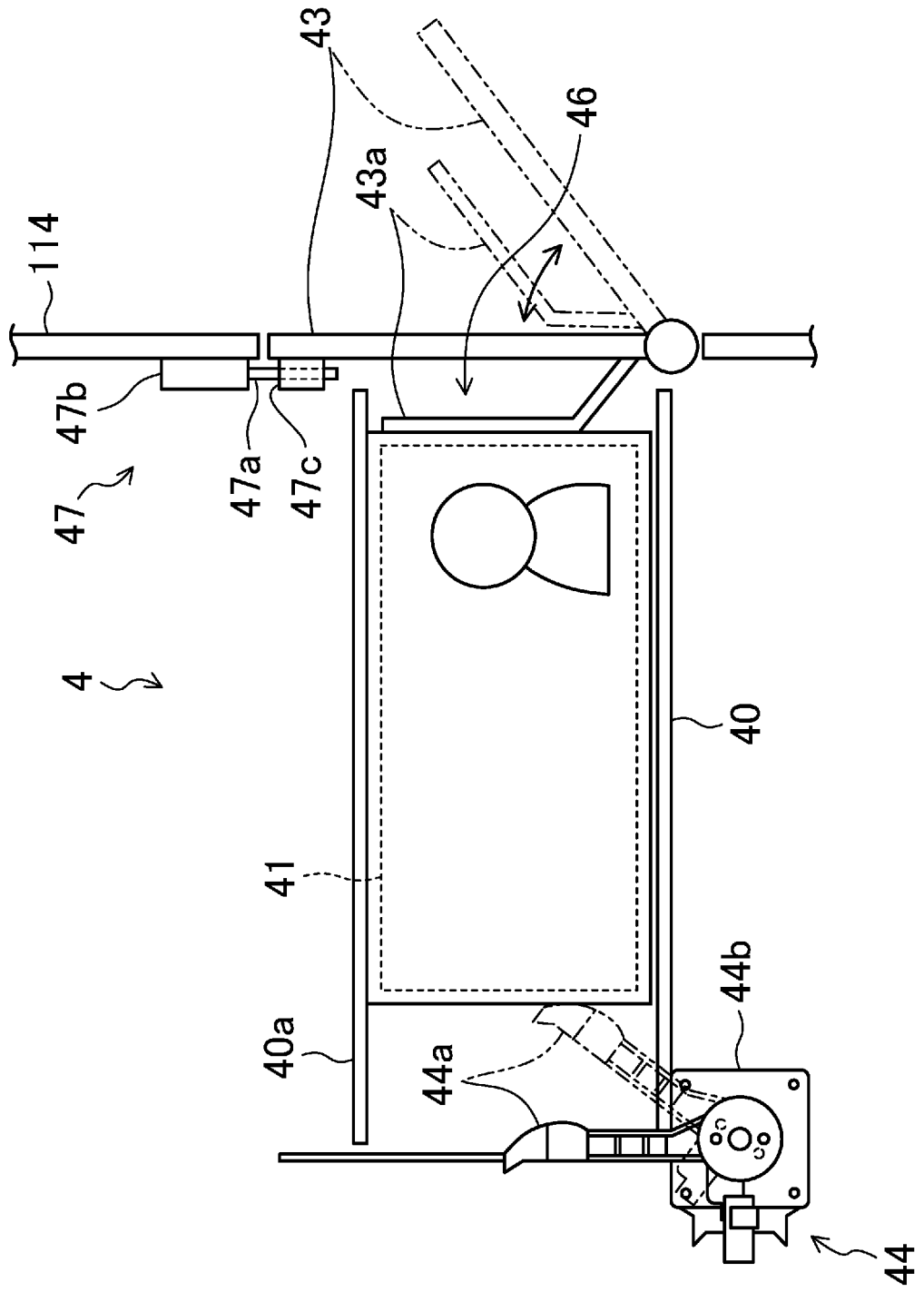


FIG.4

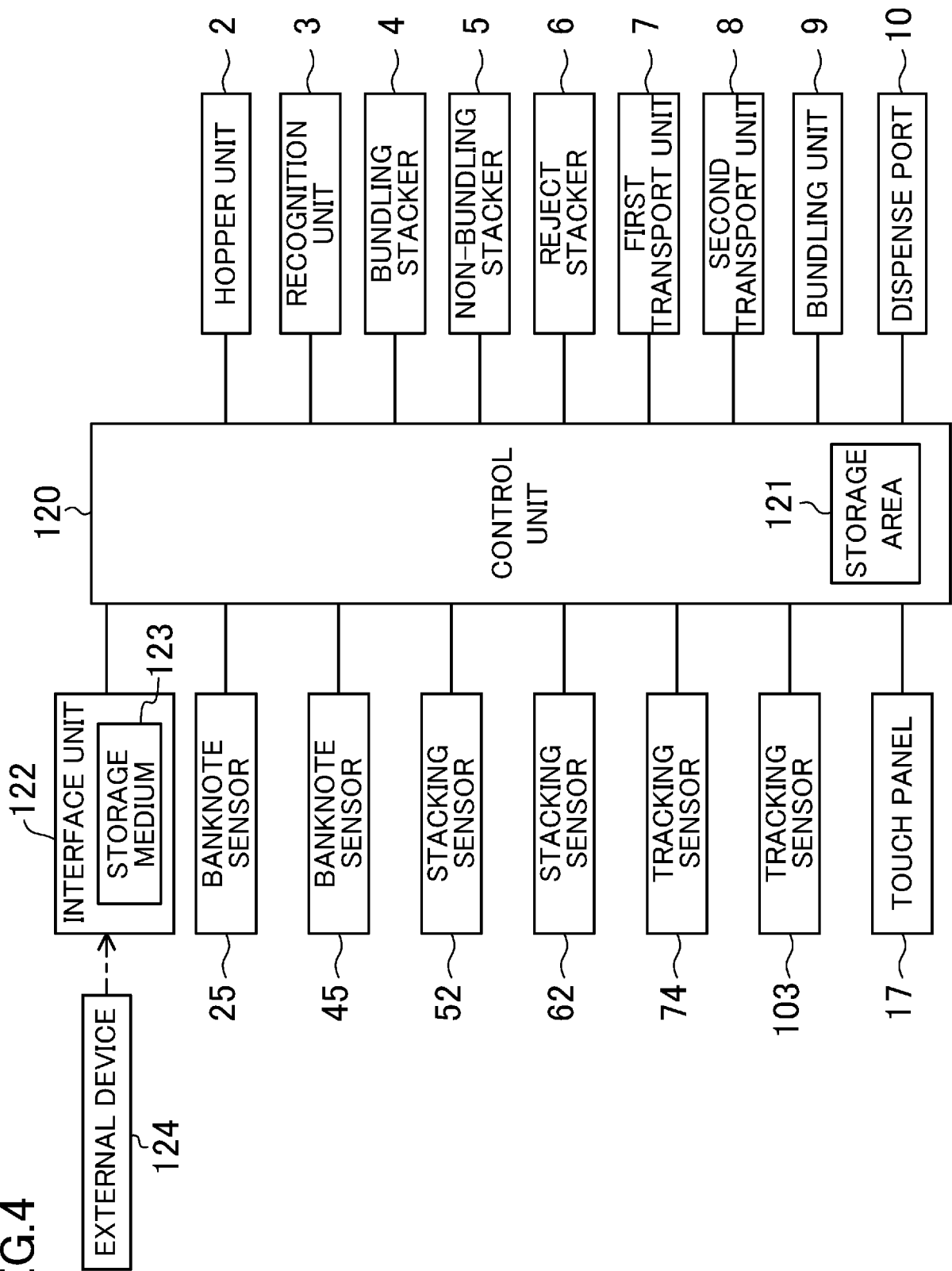


FIG.5

PATTERN	FIRST BUNDLING STACKER 4A	SECOND BUNDLING STACKER 4B	FIRST NON-BUNDLING STACKER 5A	SECOND NON-BUNDLING STACKER 5B
1	PREDETERMINED DENOMINATION			ALL DENOMINATIONS BUT THE PREDETERMINED DENOMINATION
	FIT BANKNOTE		UNFIT BANKNOTE	
2	PREDETERMINED DENOMINATION			ALL DENOMINATIONS BUT THE PREDETERMINED DENOMINATION
3	PREDETERMINED DENOMINATION			
	FIT BANKNOTE		UNFIT BANKNOTE	
3-A	PREDETERMINED DENOMINATION			
	FIT BANKNOTE		UNFIT BANKNOTE	
	FACE	BACK		
3-B	PREDETERMINED DENOMINATION			
	ATM(FIT BANKNOTE)	TLR(FIT BANKNOTE)	UNFIT(UNFIT BANKNOTE)	
3-C	PREDETERMINED DENOMINATION			
	NEW VERSION/OLD VERSION			
	ATM(FIT BANKNOTE)	TLR(FIT BANKNOTE)	UNFIT(UNFIT BANKNOTE)	
4	PREDETERMINED DENOMINATION			ALL DENOMINATIONS BUT THE PREDETERMINED DENOMINATION
	FACE/BACK		BACK/FACE	
4-A	PREDETERMINED DENOMINATION			ALL DENOMINATIONS BUT THE PREDETERMINED DENOMINATION
	FACE/BACK		BACK/FACE	
	PORTRAIT-UP	PORTRAIT-DOWN		
5	PREDETERMINED DENOMINATION			
	FACE/BACK			BACK/FACE
	PORTRAIT-UP/PORTRAIT-DOWN		PORTRAIT-DOWN/ PORTRAIT-UP	
6	PREDETERMINED DENOMINATION			ALL DENOMINATIONS BUT THE PREDETERMINED DENOMINATION
	FACE/BACK			
	PORTRAIT-UP/PORTRAIT-DOWN		PORTRAIT-DOWN/ PORTRAIT-UP	
7	PREDETERMINED DENOMINATION			ALL DENOMINATIONS BUT THE PREDETERMINED DENOMINATION
	NEW VERSION/OLD VERSION		OLD VERSION/NEW ERSION	
7-A	PREDETERMINED DENOMINATION			ALL DENOMINATIONS BUT THE PREDETERMINED DENOMINATION
	NEW VERSION/OLD VERSION		OLD VERSION/NEW ERSION	
	FIT BANKNOTE	UNFIT BANKNOTE		
7-B	PREDETERMINED DENOMINATION			ALL DENOMINATIONS BUT THE PREDETERMINED DENOMINATION
	NEW VERSION/OLD VERSION		OLD VERSION/NEW ERSION	
	FACE	BACK		
8	FIRST DENOMINATION	SECOND DENOMINATION		

FIG.6

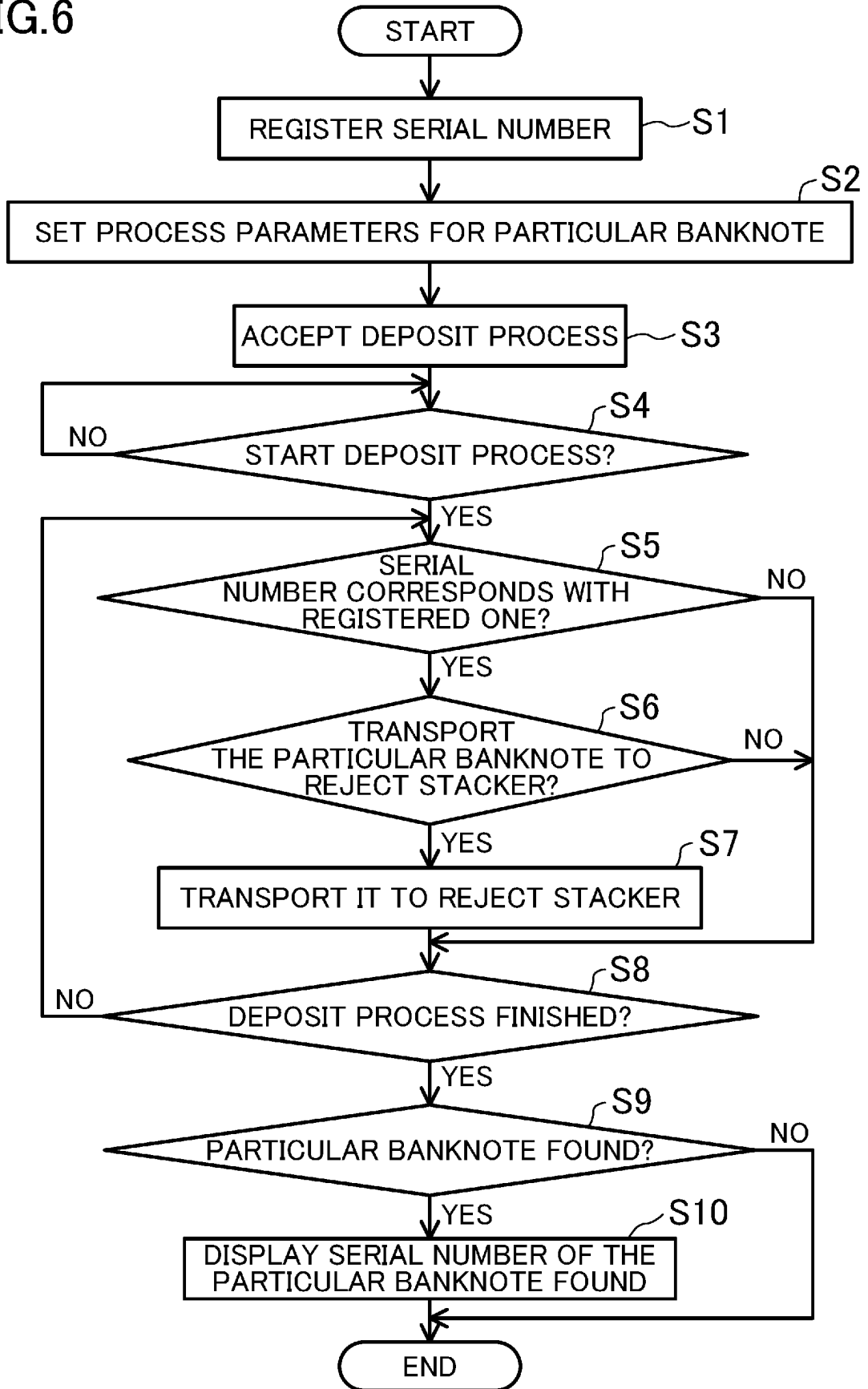


FIG. 7

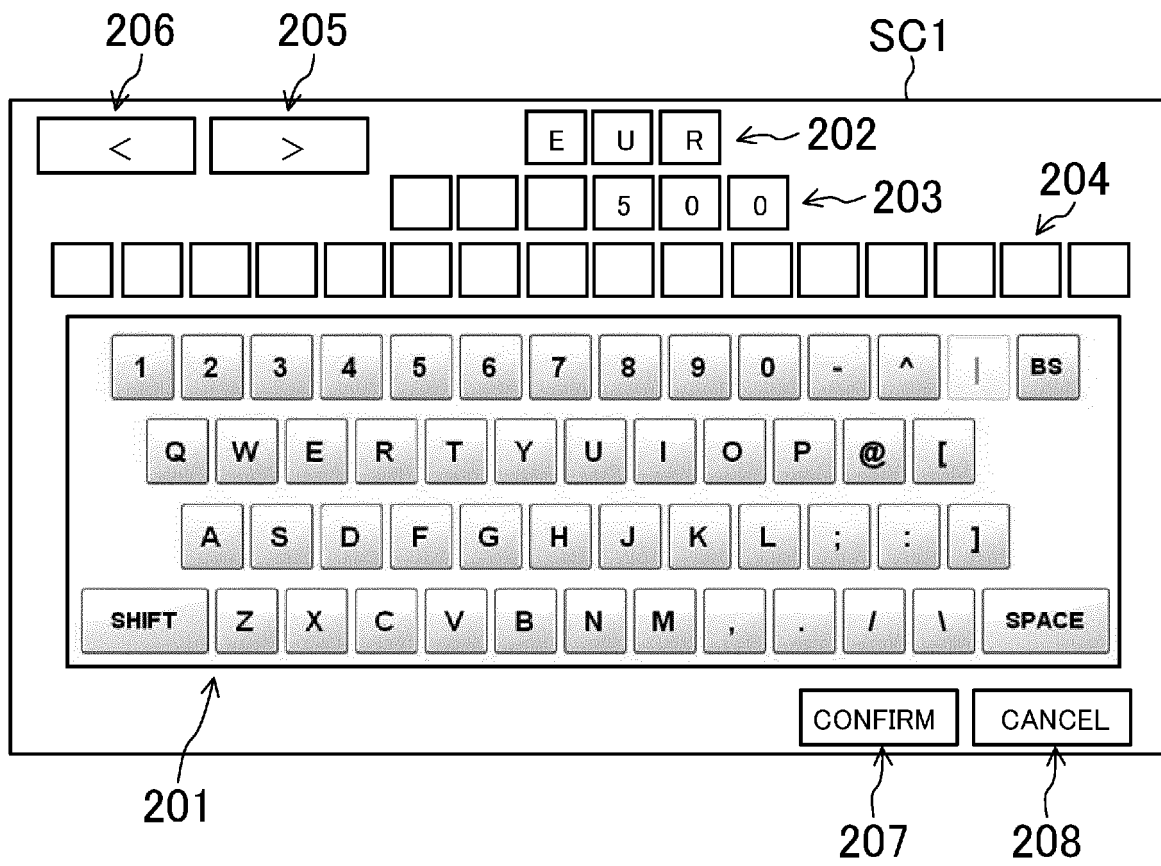


FIG.8

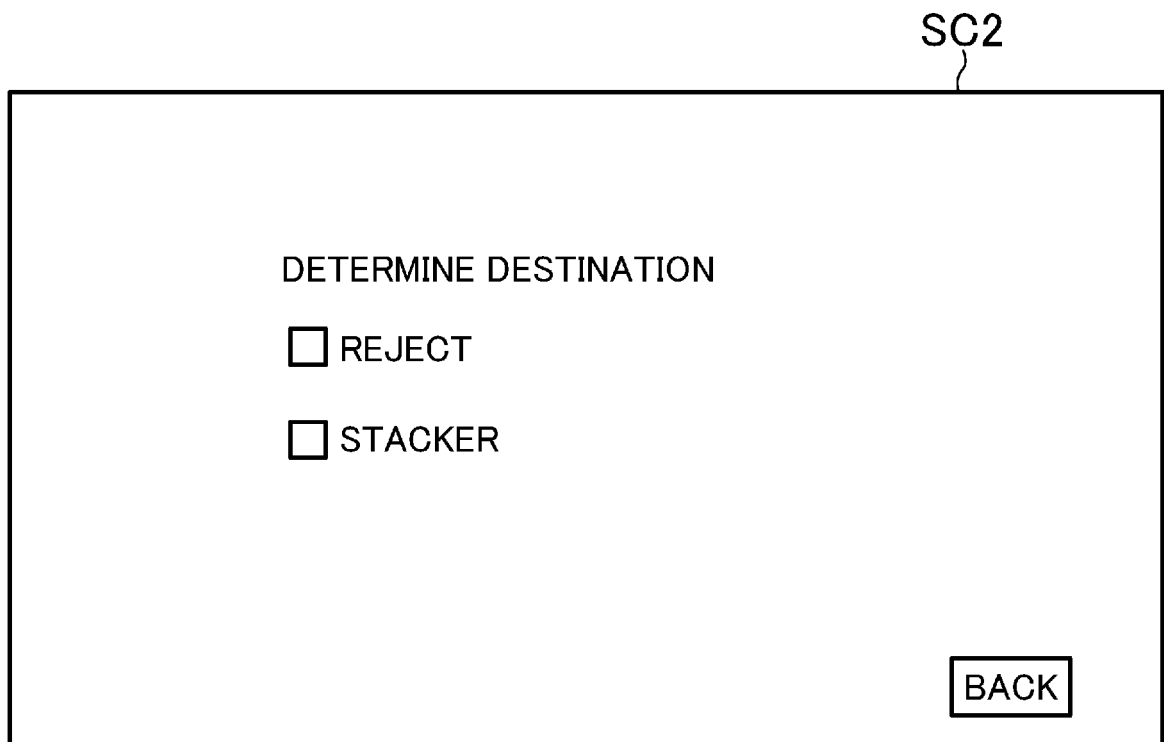
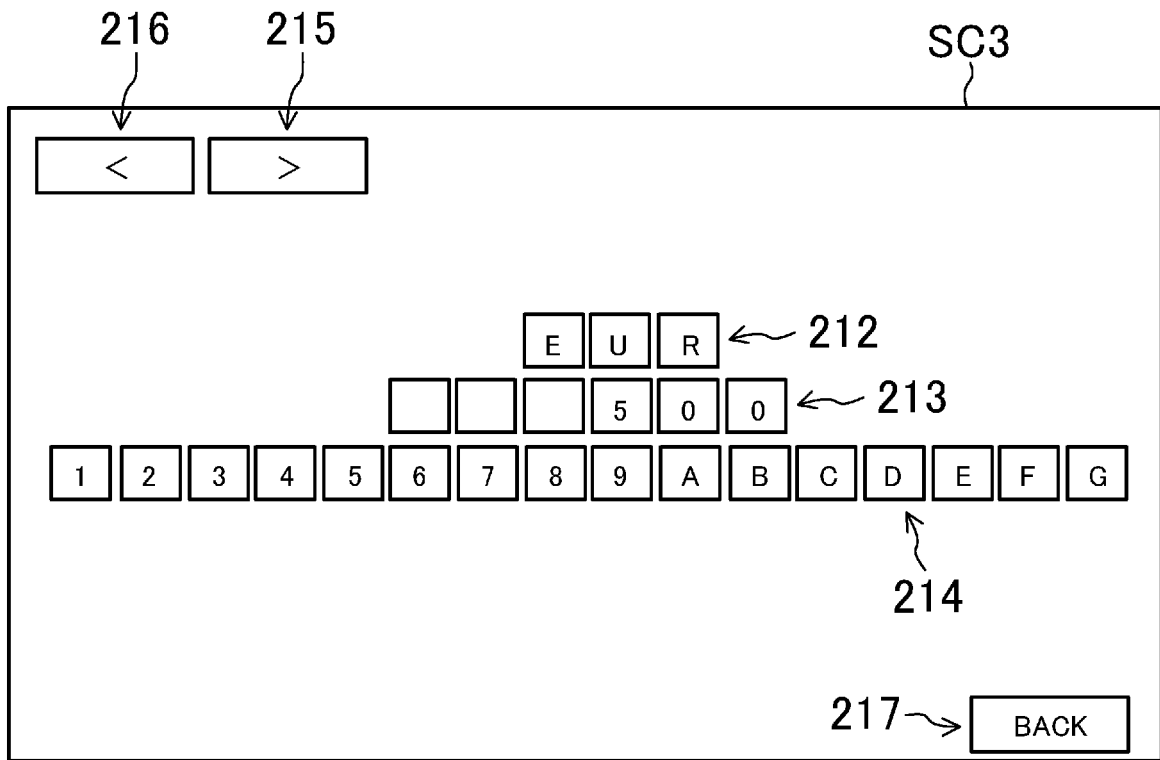


FIG.9



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/001015

A. CLASSIFICATION OF SUBJECT MATTER

G07D9/00(2006.01)i, G07D7/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G07D9/00, G07D7/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2014
Kokai Jitsuyo Shinan Koho	1971-2014	Toroku Jitsuyo Shinan Koho	1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 63-279391 A (Omron Tateisi Electronics Co.),	1, 15
Y	16 November 1988 (16.11.1988),	3-5, 8, 11, 17,
A	page 2, upper right column, line 5 to lower left column, line 10 (Family: none)	19 6-7, 9-10, 12-13, 18
X	WO 2011/024305 A1 (Glory Ltd.),	1-2, 14-16
Y	03 March 2011 (03.03.2011),	4-5, 8, 11, 19
	paragraphs [0029], [0030], [0039], [0045] (Family: none)	
Y	JP 2002-260050 A (Glory Ltd.),	3-5, 8, 11, 17,
	13 September 2002 (13.09.2002),	19
	paragraphs [0028] to [0030] (Family: none)	

 Further documents are listed in the continuation of Box C.
 See patent family annex.

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search
24 March, 2014 (24.03.14)Date of mailing of the international search report
01 April, 2014 (01.04.14)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/001015

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 11-45365 A (Kabushiki Kaisha Oki Software Okayama), 16 February 1999 (16.02.1999), paragraph [0006] (Family: none)	8, 11, 19
A	JP 2009-116646 A (Hitachi-Omron Terminal Solutions, Corp.), 28 May 2009 (28.05.2009), entire text; all drawings & US 2009/114503 A1 & EP 2058772 A2	1-19

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 201032336 A [0004]
- WO 201124305 A [0004]