

SHEET PROCESSING APPARATUS AND
BILL PROCESSING APPARATUS

BACKGROUND OF THE INVENTION

5 1. Field of the Invention

This invention relates to a sheet processing apparatus and a bill processing apparatus for handling various bills different in size, such as domestic bills and foreign bills, and more particularly to a sheet processing apparatus and a
10 bill processing apparatus for taking out various bills in response to a transport direction length of the handled bills.

2. Description of the Related Art

In the description to follow, a bill processing apparatus is taken as an example. The bill processing apparatus comprises
15 a validation section, a temporary hold section and a storage section. The bill processing apparatus introduces bills entered in a bill inlet into the validation section one by one for checking each bill for validity, and temporarily holds the bills determined valid in the temporary hold section. The bills
20 are taken out one by one from the temporary hold section after the bills are determined to be paid in, and stored in the storage section.

In this case, the bill inlet and the temporary hold section comprises a taking-out mechanism for taking out the stacked
25 bills one by one into a transport passage at the following stage;

for example, as shown in FIG. 6, a taking-out mechanism 61 of roller rotation type is known. In this taking-out mechanism 61 of roller rotation type, a pickup roller 64 is placed facing the inclined stack face of bills 63 stacked slantingly in a bill stack section 62. The pickup roller 64 is driven by a taking-out motor 65 and one bill 63 is taken out at a time by the operation of one revolution of the pickup roller 64.

However, proper spacing needs to be provided so as to prevent one bill to be taken out and the another bill from coming in contact with each other and occurring a transport error, and so as to prevent the bill taking-out pitches from becoming too wide. Thus, the size of the pickup roller 64 for taking out one bill at one revolution needs to be matched with the largest denomination size of the bill to be transported. If a large bill exceeding the acceptable limits of the pickup roller is issued and used after the size of the pickup roller is set to the denomination size, the apparatus cannot be applied and a new compatible pickup roller becomes necessary.

As shown in FIG. 7, a taking-out mechanism 71 of sensor sensing type is also known. In this taking-out mechanism 71 of sensor sensing type, a pickup roller 74 is placed facing the inclined stack face of bills 73 stacked slantingly in a bill stack section 72. The pickup roller 74 is driven for rotation by a taking-out motor 75 for taking out bills 73 one at a time. A taking-out sensor 79 is disposed in a transport

portion between a feed roller 76 and a gate roller 77 which are disposed at the taking-out position, and a transport roller 78 at the following stage. Rotation of the taking-out motor 75 is controlled based on a sense signal of the taking-out sensor 79 and the bills 73 are taken out one by one at proper taking-out pitches accordingly.

In this case, however, as shown in FIG. 8, if the stop timing of stopping rotation of the pickup roller 74 is delayed, the next bill 73b is taken out following the previous bill 73a, resulting in continuous taking out the bills.

Further, as shown in FIG. 9, the taking-out motor 75 is stopped in agreement with the bill of the smallest size among the bills to be transported. When a bill 73c of a large size is taken out, a transport roller 80 positioned on the side of the exit of the bill stack section 72 pulls and transports the bill 73c while the pickup roller 74 is stopped taking out the bill 73c. Therefore, the stopped pickup roller 74 and the transport roller 80 pull together the same bill 73c at both sides thereof and a distance 81 at which the rear end part of the bill 73c is pulled is lengthened, resulting in an increase in wear of the pickup roller 74 and damage to the bill.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide a sheet processing apparatus and a bill processing apparatus

wherein to take out sheets, the data by size of the sheets to be taken out is acquired and software of the sheet taking-out system is controlled in response to the data by size, whereby the sheets can be taken out stably with taking-out output fitted
5 for the size of each sheet without the necessity for mechanical taking-out system adjustment.

The object can be achieved by a sheet processing apparatus for accepting sheets different in size, according to the present invention, which comprises storage means for previously storing
10 data by size of all sheets to be accepted and taking-out control data responsive to the data by size of the all sheets; specification means for specifying data by size of sheets; acquisition means for acquiring the data by size of the sheets and the taking-out control data responsive to the data by size
15 of the sheets specified by the specification means from the storage means; and taking-out control means for performing taking-out control of data by size of the sheets accepted in the sheet processing apparatus based on the data by size of the sheets and the taking-out control data responsive to the
20 data by size of the sheets acquired by the acquisition means.

In the sheet processing apparatus, it is preferable that the specification means is an input key for inputting the data by size of sheets to be accepted in the sheet processing apparatus or a read section for reading the data by size of the sheets
25 accepted in the sheet processing apparatus.

Further, in the sheet processing apparatus, it is preferable that the taking-out control means controls the stop timing of a taking-out motor.

The object can be also achieved by a bill processing apparatus according to the present invention. The bill processing apparatus has a bill insert for inserting bills, a validation section for determining the validity and denomination of the inserted bills, a temporary hold section for temporarily holding the determined bills and a storage section for storing the bill temporarily held in the temporary hold section. The bill processing apparatus comprises storage means for previously storing data by size according to denomination of all bills to be inserted and taking-out control data responsive to the data by size of the all bills; specification means for specifying data by size of bills; acquisition means for acquiring the data by size of the bills and the taking-out control data responsive to the data by size of the bills specified by the specification means; and taking-out control means for performing taking-out control of data by size of the bills inserted and determined in the bill processing apparatus based on the data by size of the bills and the taking-out control data responsive to the data by size of the bills acquired by the acquisition means.

According to the invention, to accept sheets, the official in charge previously knows the size of each handled sheets before

the sheets are accepted, and thus specifies the data responsive to the size through the specification means. The specified data by size and the taking-out control data responsive to the data by size previously stored in the storage means are acquired
5 by the acquisition means. The taking-out control means sets output responsive to the data by size of the sheets accepted based on the acquired taking-out control data responsive to the data by size and controls taking out the sheets one by one with the setup output.

10 Consequently, taking-out system software for controlling rotation output of a pickup roller may be controlled in response to the sheet size and taking-out control fitted for the sheet size is automatically provided by controlling the software. Thus, mechanical adjustment and parts change of the taking-out
15 portion such as changing the pickup roller to a large diameter can be omitted.

The size of each handled sheet is previously known and thus can be specified by the official in charge before the sheets are taken out, so that the official in charge can easily enter
20 the data by size from the outside. After this, when the sheets are taken out and data of the sheets is read, the data by size can be automatically specified based on the read data. Further, if both the official-in-charge-specified data and the automatically read specification data are used, stable data
25 with still higher accuracy can be provided.

Further, to control the stop timing of the taking-out motor in response to the data by size of sheets, the complete one-sheet taking out operation fitted for the sheet length can be accomplished. Thus, unstable taking out such as continuous
5 taking out or idle taking out is canceled and highly reliable taking-out performance based on software control can be provided.

To apply the sheet processing apparatus to a bill processing apparatus, the official in charge previously knows
10 the handled denomination and thus if the denomination data is specified, the specified data by size and the taking-out control data responsive to the data by size stored in the storage means are acquired by the acquisition means and based on the data, the taking-out control means performs taking-out control
15 according to denomination responsive to the accepted bill length.

Therefore, stable taking-out performance fitted for the length of each bill can be automatically provided simply by controlling software. Although the standard size of each
20 current bill is changed, if the new standard data is stored, the taking-out control operation fitted for the new bill size can be automatically updated by the software.

Since taking-out control is performed as much as the taken-out bill length, the just enough, stable operation of
25 the pickup roller placed in the taking-out portion can be

accomplished and further contact in the overload state caused by pulling a bill is decreased, whereby the wear symptom of the outer peripheral surface of the pickup roller can be suppressed for prolonging the life thereof and taking-out output
5 fitted for each of the bills of multiple denominations can be provided. In particular, if the bill size is changed, automatic change can be made for dealing with the bill size change simply by updating storage of the changed data, so that if the bill processing apparatus is used in every country in the world where
10 the bill sizes vary from one country to another, it can be used intact simply by controlling software in a similar manner.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic representation of transport to show
15 a temporary hold passage of a bill processing apparatus;

FIG. 2 is a schematic representation of transport to show storage passages of the bill processing apparatus;

FIG. 3 is a block diagram of a control circuit of the bill processing apparatus;

20 FIG. 4 is a flowchart showing the paying-in processing operation of the bill processing apparatus;

FIG. 5 is a flowchart showing the storage processing operation of the bill processing apparatus;

FIG. 6 is a side view of the main part showing the bill
25 taking-out state of a taking-out mechanism of roller rotation

type;

FIG. 7 is a side view of the main part showing the bill taking-out state of a taking-out mechanism of sensor sensing type;

5 FIG. 8 is a side view of the main part showing the state of the taking-out mechanism of sensor sensing type in which bills are easily taken out continuously; and

FIG. 9 is a side view of the main part showing the bill taking-out state of the taking-out mechanism of sensor sensing
10 type when the bill size is large.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the accompanying drawings, there is shown a preferred embodiment of the invention.

15 The drawings show a bill processing apparatus incorporated in an automatic teller machine (ATM). In FIG. 1, the bill processing apparatus 11 comprises a paying-in/paying-out transport structure for handling bills of several denominations different in size on the top, that
20 is a bill inlet/output 12, a validation section 13, a temporary hold section 14, a reject and hold section 15 and a stack wheel 16. The bill inlet/output 12 is opened to one side of the top for taking bills in and out. The validation section 13 is disposed in an inner space communicating with the bill
25 inlet/output 12 and determines the validity of a bill and the

denomination thereof. The temporary hold section 14 is positioned to the depth at the following stage of the validation section 13. The bill determined to be valid in the validation section 13 is introduced into the temporary hold section 14
5 for temporarily holding the bill. The reject and hold section 15 is positioned in the upper part at the following stage of the validation section 13. The bill determined to be invalid is rejected to and held in the reject and hold section 15. The stack wheel 16 for temporarily holding bills is disposed at
10 the preceding stage of the temporary hold section 14 and the bills introduced into the stack wheel 16 are stacked on each other and held.

Further, the temporarily held bills are taken out one by one from the temporary hold section 14 and are transported
15 to and stored in any of first to fourth cartridges C1 to C4 on the bottom corresponding to denominations or a reject cartridge C5 on the bottom. The bills from the reject and hold section 15 are transported to the bill inlet/outlet 12 so that they can be rejected.

20 The elements 12 to 16 and C1 to C5 are connected by a transport line L like a loop and transport processing is performed in response to processing items such as paying-in processing, paying-out processing, and careful examination processing.

25 A display 17 and input keys (containing also input keys

also used as a touch panel of the display 17) 18 for the official
in charge are disposed on the top of the outside for displaying
various pieces of guide information of processing item input
guide, operation procedure, paying-in specification
5 information, etc., and inputting processing items.

FIG. 2 shows storage passages from the temporary hold
section 14 to the cartridges C1 to C5. The bills determined
to be paid in are taken out one by one from the temporary hold
section 14 onto the transport line L and are again introduced
10 into the validation section 13 for determining the denomination
of each bill. Then the bills are distributed to and stored
in the first to fourth cartridges C1 to C4 corresponding to
the determined denominations. Bills inadequate for
distribution; such as broken bills, are stored in the reject
15 cartridge C5.

FIG. 3 is a block diagram of a control circuit of the
bill processing apparatus. A CPU 31 controls the circuits of
the bill processing apparatus 11 according to a program stored
in ROM 32 and stores control data in RAM 33 so that the data
20 can be read.

To perform bill transport processing, various pieces of
control data are input to the CPU 31. In the bill taking-out
system, a taking-out sensor 71 of sensor-sensing type (see FIG.
7) is disposed at each of the taking-out positions of the bill
25 inlet/outlet 12 and the temporary hold section 14. The

taking-out sensor 71 of sensor sensing type has a taking-out sensor S (corresponding to the taking-out sensor 79 in FIG. 7) at the taking-out position for sensing and checking the bill taking-out state.

5 A taking-out motor M is driven based on a taking-out control signal of the CPU 31, and the CPU 31 controls the stop timing of the taking-out motor M in response to the length of a taken-out bill.

 The RAM 33 previously stores data of all denominations
10 of handled bills, for example, stores data of the stop timing of the taking-out motor M responsive to the data by size of every denomination. The CPU 31 compares the data stored therein with the bill to be taken out and performs taking-out control responsive to the taken-out bill length.

15 The validation section 13 comprises validation RAM 34 provided with the validation function of checking the denomination of each bill for validity and a storage function of storing the data by size of the checked denomination. When
20 the official in charge specifies a previously known denomination by operating the input key 18 in the paying-in processing of bills, the data by size corresponding to the specified denomination is read from the validation RAM 34.

 In addition, when a bill passes through the validation section 13 and the denomination of the bill is read in the storage
25 operation of bills, automatically the data by size corresponding

to the denomination is also read from the validation RAM 34.
The read data by size is transferred to the CPU 31 and is utilized
as taking-out control data.

Before taking out a bill, the CPU 31 reads the data by
5. size of bills stored in the validation RAM 34 or the data by
size of bills already accepted in the validation section 13,
and performs taking-out control according to the corresponding
denomination responsive to the data by size of bills accepted
based on the read data by size and taking-out control data stored
10 in the RAM 33.

To perform taking-out control, the CPU 31 controls the
stop timing of the taking-out motor M in response to the bill
length and matches the rotation amount of the pickup roller
with the bill taking-out length. If such a stop control is
15 performed, a bill of a long size comes in rotation contact with
the pickup roller until completion of taking out the bill, and
sufficient driving force can be conveyed to the end. Further,
for a bill of a short size, driving is stopped at the same time
as taking out the bill is complete, and continuous taking out
20 the next bill can be prevented. Thus, the rotation amount of
the pickup roller becomes neither too large nor too small and
stable one-bill taking out operation can be accomplished.
Therefore, unstable taking out such as continuous taking out
or idle taking out is prevented and taking-out control fitted
25 for the bill length can be executed simply by performing software

control responsive to the data in the RAM 33 and the validation RAM 34.

Stable taking-out performance fitted for the size of each bill can be thus automatically provided simply by controlling software corresponding to the bill size. Even if the standard size of each current bill is changed, the taking-out operation responsive to the new size can be performed if software is controlled in response to the new size of the bill. Thus, the stable taking-out operation can be accomplished from beginning to end regardless of change in the bill size. Therefore, overload on the pickup roller and the bill is decreased, the wear symptom of the pickup roller is reduced, and taking-out performance corresponding to the bills different in size can be provided.

The paying-in processing operation of the described bill processing apparatus 11 will be discussed with reference to a flowchart of FIG. 4.

To perform paying-in processing of bills, the stop timing of the taking-out motor M of the bill inlet/outlet 12 needs to be set in response to the bill length. At this time, if the official in charge enters previously known denomination data by operating the input key 18, the CPU 31 acquires the data by size of bills from the validation RAM 34 previously storing the data by size of handled bills at step n1. Then, to prevent continuous taking out of bills, the CPU finds the

minimum bill size of bills to be paid in from the acquired data by size at step n2.

Subsequently, the CPU 31 starts taking-out control with drive output responsive to the found minimum bill size. In this case, the CPU 31 defines the stop timing of the taking-out motor M and determines the rotation amount of the pickup roller. The bills are taken out one by one based on the rotation amount of the pickup roller (step n3).

The bills taken out one by one into the inside through the bill inlet/outlet 12 at the paying-in time are checked one by one for validity and denomination in the validation section 13. Then the bills are introduced into the temporary hold section 14 at the following stage and are temporarily held therein, as shown by the thick solid line in FIG. 1.

The bill storage processing operation from the temporary hold section 14 will be discussed with reference to a flowchart of FIG. 5.

To perform the storage operation of bills, the CPU 31 previously acquires the data by size of bills read in the validation section 13 in the temporary bill holding process (step n11). Thus to prevent continuous taking out of paid-in bills, the CPU finds the minimum bill size of the temporarily held bills based on the acquired data by size (n12).

The CPU 31 determines the stop timing of the taking-out motor M fitted for the bill length from the value of the found

minimum bill size (step n13).

At the determined stop timing of the taking-out motor M, the bills temporarily held in the temporary hold section 14 are taken out one by one and are stored in the cartridges C1 to C4 corresponding to the denominations, as shown by the thick solid line in FIG. 2.

In this case, for the bills taken out from the temporary hold section 14, the data by size is already acquired because the bills passed through the validation section 13 in the temporary holding process. Thus stopping the taking-out motor M of the temporary hold section 14 can be controlled with accuracy with reference to the data. If software is controlled for each bill in response to the denomination, the taking-out performance becomes still more stable.

As described above, to take out bills, the stop timing of the taking-out motor can be controlled based on the data by size of bill specified and the stored taking-out control data corresponding thereto. Therefore, the bills are taken out one by one in response to the bill length.

Particularly, stable taking-out performance fitted for the length of each bill can be automatically provided simply by controlling software of the taking-out system. Even if the standard size of each current bill is changed, the software can automatically update to the taking-out control operation fitted for the new bill size if the new standard data is stored.

For the pickup roller for rotating as much as the taken-out bill length, the problem of too much or too little rotating is solved and contact with a bill in an overload state is decreased, whereby the wear symptom of the outer peripheral surface of the pickup roller can be suppressed for prolonging the life thereof. Also, just enough taking-out output fitted for the bills different in size can be supplied. In particular, if the bill size is changed, automatic change can be made simply by updating storage of the changed data. Therefore, if the bill processing apparatus is used in every country in the world where the bill sizes vary from one country to another, it can be used intact simply by controlling software in a similar manner.

However, the invention can be applied based on the technical spirit as defined in the appended claims and is not limited to the specific embodiment of the invention.

WHAT IS CLAIMED IS:

1. A sheet processing apparatus for accepting sheets different in size, comprising:

storage means for previously storing data by size of all
5 sheets to be accepted and taking-out control data responsive to the data by size of the all sheets;

specification means for specifying data by size of sheets;

acquisition means for acquiring the data by size of the
10 sheets and the taking-out control data responsive to the data by size of the sheets specified by said specification means from said storage means; and

taking-out control means for performing taking-out control of data by size of the sheets accepted in said sheet
15 processing apparatus based on the data by size of the sheets and the taking-out control data responsive to the data by size of the sheets acquired by said acquisition means.

2. The sheet processing apparatus as claimed in claim 1,
20 wherein said specification means is a input key for inputting the data by size of sheets to be accepted in said sheet processing apparatus.



3. The sheet processing apparatus as claimed in claim 1,
25 wherein said specification means is a read section for reading

the data by size of the sheets accepted in said sheet processing apparatus.

4. The sheet processing apparatus as claimed in claim 1,
5 wherein said taking-out control means controls the stop timing of a taking-out motor.

5. The sheet processing apparatus as claimed in claim 1,
wherein said storage means includes first storage means for
10 previously storing the data by size of all sheets to be accepted and second storage means for previously storing the taking-out control data responsive to the data by size of the all sheets.

6. The sheet processing apparatus as claimed in claim 1,
15 wherein the sheets are bills.

7. A bill processing apparatus having a bill insert for inserting bills, a validation section for determining the validity and denomination of the inserted bills, a temporary
20 hold section for temporarily holding the determined bills and a storage section for storing the bill temporarily held in the temporary hold section, said bill processing apparatus comprising:

storage means for previously storing data by size
25 according to denomination of all bills to be inserted and



taking-out control data responsive to the data by size of the
all bills;

specification means for specifying data by size of bills;

acquisition means for acquiring the data by size of the
5 bills and the taking-out control data responsive to the data
by size of the bills specified by said specification means;
and

taking-out control means for performing taking-out
control of data by size of the bills inserted and determined
10 in said bill processing apparatus based on the data by size
of the bills and the taking-out control data responsive to the
data by size of the bills acquired by said acquisition means.

8. The bill processing apparatus as claimed in claim 7,
15 wherein said specification means is the validation section.

