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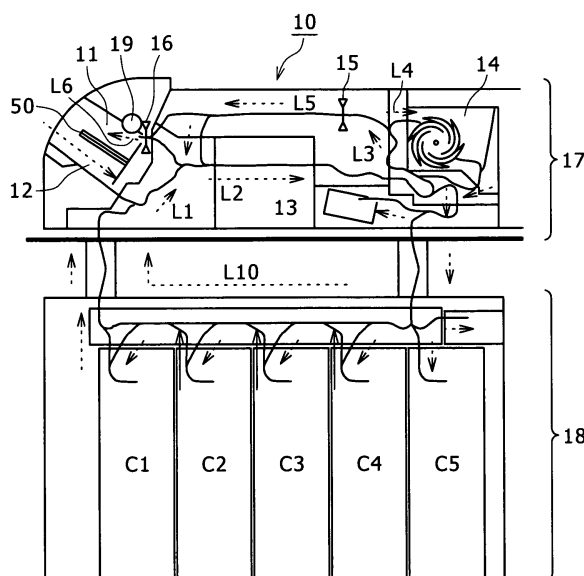
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(54) **Bill processor**

(57) The present invention prolongs a lifetime of an impeller while suppressing the occurrence of noises attributed to the impeller. A bill depositing/dispensing apparatus includes an upper conveying passage, a dispensing port, an impeller, a dispensing port inlet sensor, a dispensing port conveying bill detection sensor, a control part for executing step S22 of detecting whether or not a bill remains between the dispensing port conveying bill detection sensor and the dispensing port inlet sensor

on the upper conveying portion upper conveying passage, and a control part for executing a step S24 of starting the rotation of the impeller in an accumulating direction upon detection of passing of a bill through a conveying passage by the dispensing port conveying bill detection sensor and stopping the rotation of the impeller when remaining of bill is not detected by the control part which executes the step S22 after detecting the accumulation of the bill by the dispensing port inlet sensor and the step S3.

FIG. 1



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a bill processor arranged in the inside of an automatic teller machine of a financial institution, and more particularly to a bill processor which can enhance an accumulation performance.

Description of Related Art

[0002] Usually, the bill processor includes an accumulation part in a bill cassette, a dispensing port or the like. The accumulation part accumulates conveyed bills in a stacked manner. Here, when the bill taken in the inside of the bill processor cannot be identified or skewed, the bill processor does not receive the bill. To directly return the rejected bill to a user, the bill processor arranges a pusher plate in the inside of the accumulation part. Further, in the accumulation part, an impeller is provided for accumulating bills in the accumulation part one by another by hitting and blocking a trailing end portion of the conveyed bill. With the use of such an impeller, the bill accumulation performance can be enhanced. Particularly, with respect to the impeller arranged in the accumulation part of the dispensing port, it is necessary to accumulate the bill in a state that the bill cannot be received and hence, the impeller has vanes longer than vanes of an impeller arranged in the accumulation part of the bill cassette for further enhancing the accumulation performance.

[0003] As such a bill accumulating device, there has been proposed a bill accumulating device which controls the rotation and stopping of the rotation of a motor of an accumulation part based on identification result information acquired by identifying bill (see JP-A-2-221055).

[0004] However, such a bill accumulating device cannot sufficiently prevent noises. To be more specific, a rejected bill that is deposited is a bill deposited by a user and hence, there may be a case that the bill is not aligned due to the reception of the simultaneous reception of two bills or large skewing of the bill. Accordingly, a result of identification and a bill do not correspond to each other in a one-to-one correspondence. When the one-to-one correspondence cannot be acquired, the rotation and the stopping of the rotation of the motor at the dispensing port cannot be finely controlled to a necessary minimum and hence, it is necessary to control the rotation and stopping of rotation of the motor at a fixed time or the like. In this case, noises occur due to a contact between the impeller and the pusher plate and hence, it is impossible to minimize the occurrence of such noises. Particularly, the dispensing port is arranged at a position closest to a user and the noises which occur at the dispensing port occupy a considerably large portion of noises of the whole device. Further, when the bill accumulating device is driv-

en for a long period, there arises a drawback that a lifetime of the impeller becomes shortened.

SUMMARY OF THE INVENTION

[0005] The present invention has been made to overcome the above-mention drawbacks, and it is an object of the present invention to prolong a lifetime of an impeller while suppressing the occurrence of noises attributed to the impeller.

[0006] The present invention is characterized in that the rotation of an impeller in the accumulating direction is started upon detection of passing of a bill through a conveying passage using passing detection means, and the rotation of the impeller is stopped when remaining of bill is not detected by remaining bill detection means after detecting the accumulation of the bill by an accumulation part inlet detection means.

[0007] The passing detection means is arranged closer to a front stage side than the impeller by a distance equal to or more than a distance that the conveying passage conveys the bill for a rotation rising time of the impeller.

[0008] Further, the present invention is characterized in that a pusher plate is moved to an accumulation position upon detection of passing of the bill through the conveying passage by the passing detection means, and the pusher plate is moved to a retracting position where the pusher plate does not interfere with the impeller upon non-detection of the remaining of the bill by the remaining bill detection means after the detection of the accumulation of the bill by the accumulation part inlet detection means.

[0009] According to the present invention, it is possible to prolong the lifetime of the impeller while suppressing the occurrence of noises attributed to the impeller.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 is a side view of a bill depositing/dispensing apparatus;

Fig. 2 is a side view of a dispensing port portion;

Fig. 3 is a block diagram of the bill depositing/dispensing apparatus;

Fig. 4 is an explanatory view of array variables;

Fig. 5 is a timing chart of remaining bill detection;

Fig. 6 is a timing chart of an operation in a normal pattern;

Fig. 7 is a timing chart when a bill stays on a dispensing port inlet sensor;

Fig. 8 is a timing chart when a bill does not arrive at the dispensing port inlet sensor;

Fig. 9 is a timing chart of an operation for processing two overlapped bills;

Fig. 10 is a timing chart of an operation for processing three overlapped bills;

Fig. 11 is a flowchart of an operation based on a detection signal from a dispensing port conveying bill detection sensor;

Fig. 12 is a flowchart of an operation based on a detection signal from the dispensing port inlet sensor;

Fig. 13 is a flowchart of an operation when an operation time ends;

Fig. 14 is a flowchart of an operation based on a detection signal of a dispensing port conveying bill detection sensor in an embodiment 2;

Fig. 15 is a flowchart of an operation based on a detection signal of a dispensing port inlet sensor in the embodiment 2;

Fig. 16 is a flowchart of an operation when an operation time ends in the embodiment 2; and

Fig. 17 is a side view of a dispensing port portion where a retracting position of a pusher plate is arranged.

PREFERRED EMBODIMENTS OF THE PRESENT INVENTION

[0011] Hereinafter, embodiments of the present invention are explained in conjunction with drawings. These embodiments relate to a bill depositing/dispensing apparatus which is installed in financial institutions such as banks and performs cash depositing/dispensing by operations of a user and an attendant.

(Embodiment 1)

[0012] Fig. 1 is a constitutional view showing the internal structure of a bill depositing/dispensing apparatus 10 which constitutes a bill processor as viewed in a side view. Fig. 2 is a cross-sectional view showing the structure of a dispensing port 11 which constitutes an accumulation part as viewed in a side view. The bill depositing/dispensing apparatus 10 executes bill depositing/dispensing processing.

[0013] The bill depositing/dispensing apparatus 10 includes a dispensing port 11 to which a bill to be dispensed or bill rejected in a bill receiving operation is conveyed, an impeller rotating motor 19 for conveying a bill to the dispensing port 11, and a depositing port 12 for receiving a bill inserted by a user.

[0014] As shown in Fig. 2, the dispensing port 11 and the depositing port 12 are arranged vertically in this order, and a pusher plate 50 is arranged between the dispensing port 11 and the depositing port 12 as a partition. The pusher plate 50 is moved by a pulse motor (not shown in drawings) in the upward and downward direction corresponding to a quantity of accumulated bills. In an accumulation part in which bills are accumulated from an upper conveying passage L5 (see Fig. 1) to the dispensing port 11, an impeller 51 is arranged. The impeller 51 is rotatably driven by an impeller rotating motor 19 (see Fig. 1). Accordingly, when the impeller rotating motor 19

is rotated, the impeller 51 can properly accumulate bills conveyed to the dispensing port 11 one by another by hitting and dropping bills.

[0015] The impeller 51 arranged in the dispensing port 11 has vanes having a length larger than a length of vanes of impellers (not shown in drawings) arranged in the first cassette C1 to the fifth cassette C5. This is because that the bill accumulated in the dispensing port 11 is bill inserted by a user and hence, even when the inserted bill is in a worse state than a bill accumulated in the first cassette C1 to the fifth cassette C5, the impeller 51 can stably hit and drop the bill thus assisting the accumulation of bills.

[0016] As shown in Fig 1, in a front stage of the dispensing port 11, a dispensing port inlet sensor 16 which constitutes accumulation part inlet detection means is provided. Further, in a front stage of the dispensing port inlet sensor 16, a dispensing port-conveying bill detection sensor 15 which constitutes passing detection means is provided. The dispensing port-conveying bill detection sensor 15 is arranged at a position remote from the impeller 51 with a distance larger than a conveyance distance amounting to a rising time of the impeller rotating motor 19.

[0017] The bill depositing/dispensing apparatus 10 is constituted of an upper conveying part 17 and a lower conveying part 18 which are separately arranged from each other.

[0018] The upper conveying part 17 includes upper conveying passages L1 to L5 which connect the depositing port 12, the dispensing port 11, the identification part 13 and the temporary holding part 14 in a loop shape. The lower conveying part 18 includes a lower conveying passage L10 which connects the identification part 13 and the first cassette C1 to the fifth cassette C5 in a loop shape. The upper conveying passage L1 and the lower conveying passage L10 are connected with each other at a common connection position. The identification part 13 is positioned at the common connection position.

[0019] Next, a dispensing operation and a storing operation which the bill depositing/dispensing apparatus 10 executes are explained.

[0020] The bill depositing/dispensing apparatus 10 conveys the bill inserted into the depositing port 12 to the identification part 13 arranged at an upper intermediate portion and identifies authenticity, denomination, number, tears, and smears and the like of the bill. After such identification the bill depositing/dispensing apparatus 10 performs intake processing in which the bill is conveyed through a passage including the upper conveying passages L1, L2, L3, L4 and is temporarily held in the temporary holding part 14. When there exists a bill which is determined to be defective in identification in such intake processing, the bill depositing/dispensing apparatus 10 returns the bill to the dispensing port 11 by conveying the bill through the passage including the upper conveying passages L1, L2, L3, L5, L6.

[0021] In the above-mentioned temporary holding part

14, the received bill is temporarily held for every depositing transaction. When the reception of the bill is confirmed, the bill depositing/dispensing apparatus 10 conveys the bill temporarily held in the temporary holding part 14 through the passage including upper conveying passages L3, L5, L2 and the lower conveying passage L10. The bill depositing/dispensing apparatus 10 identifies denomination, number, tears, smears and the like of bill by the identification part 13 arranged in the course of the conveying passage, and stores the bill in the first to fifth cassette C1 to C5 below the passage in a distributed manner.

[0022] Next, a dispensing operation executed by the bill depositing/dispensing apparatus 10 is explained.

[0023] The bill depositing/dispensing apparatus 10 conveys the bill to be dispensed taken out from the first to fifth cassettes C1 to C5 through the passage including the lower conveying passage L10 and the upper conveying passages L1, L2, L3, L5, L6. Further, the bill depositing/dispensing apparatus 10 confirms denomination, number, tears, smears and the like of the bill by the identification part 13, and ejects the bill to the dispensing port 11.

[0024] Fig. 3 shows a control block diagram of the bill depositing/dispensing apparatus 10.

[0025] A control part 31 is constituted of a depositing/dispensing port control part 32 which performs bill feeding from the depositing port 12, a control of the accumulating motor of the dispensing port 11 and a vertical control of the pusher plate 50, a temporary-holding-part control part 33 which controls accumulation and feeding of a bill at the temporary holding part 14, an identification processing part 34 which performs identification of a bill, a main motor control part 35 which performs driving of conveying passages, a sensor control part 36 which performs monitoring of a bill detection sensor, a gate control part 37 which performs an operation of a gate which determines the conveyance destination of a bill, cassette control parts 38-1 to 38-5 which perform feeding and accumulation of a bill in the first to fifth cassettes C1 to C5, and a memory part 39 which stores setting or the like. In response to an instruction from a higher-level control part 30, the control part 31 controls the above-mentioned respective control parts thus performing a bill conveyance control.

[0026] The above-mentioned depositing/dispensing port control part 32 executes a reception/payment control of bill in response to an instruction signal from the control part 31. Further, the depositing/dispensing port control part 32 executes a rotation control of the impeller rotating motor 19 for accumulating the bill conveyed to the dispensing port 11 and a vertical movement control of the pusher plate 50.

[0027] The temporary-hold-part control part 33 accumulates and temporarily holds the deposited bill introduced to the temporary holding part 14 and performs a feeding operation of the bill to cassettes C1 to C5 one by another for respective denominations after the depos-

iting of cash is confirmed.

[0028] The identification processing part 34 performs identification of the bill conveyed to the identification port 13.

5 **[0029]** The main motor control part 35 executes a driving control of the upper conveying passages L1 to L5 and the lower conveying passage L10 in response to an instruction signal from the control part 31.

10 **[0030]** The sensor control part 36 detects a bill conveyance processing state at the upper conveying passages L1 to L5 and the lower conveying passage L10 by bill detection sensors not shown in the drawing arranged at respective conveying positions thus detecting a location where the bill is being conveyed.

15 **[0031]** The gate control part 37 executes a distribution control of distributing plates (gates) not shown in the drawing arranged at branching positions of the respective conveying passages and distributes the conveyed bill to the conveyance processing direction.

20 **[0032]** The first to fifth cassette control parts 38-1 to 38-5 perform a charge/discharge control of bill for respective denominations stored in the first to fifth cassettes C1 to C5.

25 **[0033]** Next, a method for performing an inspection whether bill is present (remains) in an interval between a dispensing port-conveying bill detection sensor 15 and a dispensing port inlet sensor 16 using the dispensing port-conveying bill detection sensor 15 and the dispensing port inlet sensor 16 is explained in detail in conjunction with Fig. 4 to Fig. 10.

30 **[0034]** Fig. 4 is an explanatory view of array variable stored in the memory part 39, and Fig. 5 is a timing chart for explaining the manner of detecting the remaining bill.

35 **[0035]** The control part 31 of the bill depositing/dispensing apparatus 10 determines that the bill has completely passed when a trailing end (falling edge) of the bill detected by the dispensing port-conveying bill detection sensor 15 is also detected by the dispensing port inlet sensor 16 within a monitor time T.

40 **[0036]** To be more specific, when the control part 31 detects the trailing end of the objected bill by the dispensing port-conveying bill detection sensor 15, the control part 31 calculates a trailing end passing expecting time (detected time + distance between the sensors) at a next dispensing port inlet sensor 16 and registers the trailing end passing expecting time at a position of an index A of (see Fig. 4) array variables. Then, the control part 31 increments the index A by +1.

45 **[0037]** A monitoring start time point C for monitoring the bills by the dispensing port inlet sensor 16 on a downstream side is a point of time tracing back from a trailing-end-passing expecting time by a fixed time. Further, the monitoring-time finish time point D is a point of time by tracing back from a point of time that the leading end of the succeeding bill arrives at the dispensing port inlet sensor 16 by a fixed time. When the falling of the dispensing port inlet sensor 16 is detected during the monitor time T between these points C to D, the control part

31 determines that the bill has completely passed and sets all bill monitoring states in front of the position of an index B (see Fig. 4) to "no bill". Then, the control part 31 increments the index B by +1.

[0038] In a passing of bill incompleteness state where falling of the dispensing port inlet sensor 16 is not detected within the monitor time T, when the passing of bill incompleteness state continues for a fixed number of bills (hereinafter described assuming that the number is three), the control part 31 determines that the passing of bill incompleteness state is bill jamming and performs a stopping operation based on an abnormal state.

[0039] Fig. 6 is a timing chart of a normal operation. The falling of the dispensing port inlet sensor 16 is detected within respective monitoring intervals and hence, the bill passes normally.

[0040] Fig. 7 is a timing chart when bill stay occurs in the dispensing port inlet sensor 16. In this case, The falling of the dispensing port inlet sensor 16 can not be detected although the rising of the dispensing port inlet sensor 16 can be detected and hence, the control part 31 determines that the state is bill jamming and performs a stopping operation based on an abnormal state at a point of time that the passing of bill incompleteness state continues for three bills.

[0041] Fig. 8 is a timing chart of bill stay pattern when the bill does not arrive at the dispensing port inlet sensor 16. In this case, the rising of the dispensing port inlet sensor 16 can not be detected and hence, the control part 31 determines that the state is bill jamming and performs a stopping operation based on an abnormal state at a point of time when the passing of bill incompleteness state continues for three bills.

[0042] In both cases described in Fig. 7 and Fig. 8, the trailing end of the bill can not be detected within monitor times of a first sheet, a second sheet and a third sheet and hence, it is determined that the paper passing has not completed and is assumed as a trouble. When it is determined that the trouble occurs, the main motor and the impeller rotating motor 19 are stopped.

[0043] Particularly, there is often a case that the rejected bill are not aligned and hence, two bills become one block within the interval between the dispensing port-conveying bill detection sensor 15 and the dispensing port inlet sensor 16 or one sheet of paper is split in two. In this case, it is preferable that the processing is continued as it is without performing a stopping operation based on an abnormal state. Next, the processing for continuing in such a case is explained in conjunction with Fig. 9 and Fig. 10.

[0044] Fig. 9 is a timing chart of a case when two bills overlap each other at the dispensing port-conveying bill detection sensor 15 and are separated from each other at the dispensing port inlet sensor 16.

[0045] Also in this case, the control part 31 monitors the falling of the dispensing port inlet sensor 16 until a point of time tracing back by a fixed time from a point of time that a leading end of the succeeding bill arrives at

the dispensing port inlet sensor 16. Accordingly, the falling of the dispensing port inlet sensor 16 due to the passing of the succeeding bill can be detected. In an example shown in the drawing, both of the falling due to the passing of the first bill and falling of the passing of the second bill are detected by the dispensing port inlet sensor 16. However, the detection is supposed to be successful even when the falling is detected only one time and hence, the processing can be continued based on the assumption that the bill normally passes.

[0046] Fig. 10 is a timing chart when bill are separated from each other at the dispensing port-conveying bill detection sensor 15 and three bills overlap each other at the dispensing port inlet sensor 16.

[0047] In this case, the three bills are detected as one sheet due to bill stay. However, the trailing end of the third sheet of bill can be detected within a prescribed time and hence, it is determined that the second bill passes together with the third bill.

[0048] In this manner, in both cases shown in Fig. 9, Fig. 10, it is possible to monitor the passing of the bill. By performing the determination in this manner, even when a bill is one to be rejected which is in a bad state such as non-alignment, the presence/non presence of the bill within the interval between the dispensing port-conveying bill detection sensor 15 and the dispensing port inlet sensor 16 can be detected. Further, by retrieving all array variable shown in Fig. 4, even when only one "bill present" is registered, it is determined that the bill is present during monitoring.

[0049] Fig. 11 is a flowchart of operations of the bill depositing/dispensing apparatus 10 executed based on the detection by the sensor 15 for detecting the bill conveyed to the dispensing port. Fig. 12 is a flowchart of operations of the bill depositing/dispensing apparatus 10 executed based on the detection by the dispensing port sensor 16. Fig. 13 is a flowchart of operations of the bill depositing/dispensing apparatus 10 executed in performing ending processing.

[0050] The control part 31 of the bill depositing/dispensing apparatus 10 for performing a receiving transaction feeds bills received from the depositing port 12 into the inside of the machine one by another by rotating the main motor driven using the main motor control part 35. The bill depositing/dispensing apparatus 10 identifies bills fed into the inside of the machine at the identification part 13, and conveys normal bills to the temporary-holding-part 14 and conveys rejected bills to the dispensing port 11 through the passages L5, L6.

[0051] Here, in conjunction with Fig. 11, operations of the bill depositing/dispensing apparatus 10 when bills rejected based on the identification carried out by the identification part 13 arrives at the dispensing port conveying bill detection sensor 15 are explained.

[0052] The control part 31 of the bill depositing/dispensing apparatus 10 inspects whether or not the sensor 15 for detecting a bill conveyed to dispensing port detects bill at the sensor control part 36 (Step S1). When the

sensor 15 for detecting a bill conveyed to dispensing port detects the bill, the control part 31 registers "bill present" at a position of index A in array variables (see Fig. 4) of the memory part 39. Here, the control part 31 also registers the arrival expected time (expected bill trailing-end passing time) when the bill arrives at the dispensing port inlet sensor 16 in the downstream side, and increments index A by +1 (Step S2). Then, the control part 31 starts the rotation of the impeller rotating motor 19 (Step S3).

[0053] Next, at timing before the arrival expected time by a fixed time, the control part 31 starts monitoring of the dispensing port inlet sensor 16.

[0054] As shown in Fig. 12, in monitoring, the control part 31 inspects whether or not the bill passes through the dispensing port inlet sensor 16 at the sensor control part 36 (Step S11). When the dispensing port inlet sensor 16 detects the passing of bill, the control part 31 registers "bill absent" at a position of index B in array variables (see Fig. 4) of the memory part 39, and sets all bill monitoring conditions registered at times before the dispensing port inlet sensor 16 detects the passing of bills to "bill absent" (Step S12). The index B is incremented by +1 each time a bill passes.

[0055] The control part 31 inspects whether current number of stopping times of the impeller rotating motor 19 (accumulated number of stopping times of the impeller rotating motor 19 within a period from starting of an operation of impeller rotating motor to the present) exceeds predetermined number of times of stopping (Step S13). The predetermined number of times of stopping is designated on a setting screen of the higher-level control part 30 in setting operations of the bill depositing/dispensing apparatus. The control part 31 executing Step S13 functions as a number-of-times determination means.

[0056] When the number of stopping times of the impeller rotating motor exceeds the designated number of times of stopping, the control part 31 does not perform the stopping control of the motor thereafter and allows the continuous rotation of the impeller rotating motor 19. In this manner, by inspecting the number of stopping times of the motor and by ceasing the stopping operation of the motor when the number of stopping times of the motor exceed the predetermined number of times of stopping, it is possible to prevent the deterioration and shortening of lifetime of the motor and the impeller 51 caused by starting/stopping of the impeller rotating motor 19.

[0057] When the number of stopping times of the motor does not exceed the predetermined number of times of stopping in Step S13, the control part 31 starts a predetermined-time timer (Step S14).

[0058] When the dispensing port inlet sensor 16 does not detect passing of a bill and the monitoring interval for the third bill detected by the dispensing port conveying bill detection sensor 15 elapses (Step S15), it is recognized that bill jamming occurs and hence, the control part 31 executes error processing and stops the processing (Step S16).

[0059] Fig. 13 is a flowchart of operations of the bill

depositing/dispensing apparatus 10 when the predetermined time is up after starting the predetermined-time timer in Step S14 (see Fig. 12).

[0060] When the designated time is up (Step S21), the control part 31 inspects whether or not a bill being monitored is present between the dispensing port conveying bill detection sensor 15 and the dispensing port inlet sensor 16 (Step S22). The control part 31 which executes this Step S22 functions as a remaining bill detection means.

[0061] When no bill is present in the interval between the dispensing port conveying bill detection sensor 15 and the dispensing port inlet sensor 16 (Step S22: not registered), the control part 31 increments the number of stopping times of the motor by +1 (Step S23). Further, the control part 31 stops the rotation of the impeller rotating motor 19 (Step S24). The control part 31 which executes Step S24 and Step S23 functions as an impeller control means.

[0062] When a bill is present in the interval between the dispensing port conveying bill detection sensor 15 and the dispensing port inlet sensor 16 (Step S22: registered), the control part 31 restarts the predetermined-time timer and returns the processing to Step S25). Here, when the designated-time timer is up again, the control part executes the processing from Step S22.

[0063] According to the above-mentioned embodiment, in performing one depositing transaction, the impeller rotating motor 19 can be operated only when bill is conveyed to the dispensing port 11, and with the absence of bill, the control part 31 can perform a control of stopping the impeller rotating motor 19 even when the depositing transaction is continuing.

[0064] Due to such a constitution, it is possible to minimize noises generated due to a contact between vanes of the impeller 51 and the pusher plate 50.

[0065] Further, it is possible to minimize deterioration of the vanes of the impeller 51 attributed to the contact of vanes of the impeller 51 with the pusher plate 50 thus prolonging the lifetime of the impeller 51.

[0066] Further, a distance between the impeller 51 and the dispensing port conveying bill detection sensor 15 is set longer than a bill-conveying distance corresponding to a rising time of the impeller rotating motor 19 and hence, when bill arrives at the impeller 51, the impeller 51 can be rotated at a fixed speed. Accordingly, the accumulation assisting operation by the impeller 51 can be performed in a stable manner.

[0067] Further, the impeller 51 is arranged at the dispensing port 11 closer to a client facing surface than a first cassette C1 to a fifth cassette C5 and, at the same time, the impeller 51 having vanes longer than vanes of the impellers used in the first cassette C1 to the fifth cassette C5 is controlled and hence, it is possible to acquire an extremely favorable noise prevention effect.

(Embodiment 2)

[0068] Next, as an embodiment 2, the explanation is made with respect to a case where the elevation and lowering of the pusher plate 50 is controlled instead of controlling starting and stopping of rotation of the impeller 51.

[0069] Fig. 14 is a flowchart of operations that the bill depositing/dispensing apparatus 10 executes based on the detection by dispensing port conveying bill detection sensor 15, Fig. 15 is a flowchart of operations which the bill depositing/dispensing apparatus 10 executes based on the detection by the dispensing port inlet sensor 16, Fig. 16 is a flowchart of operations which the bill depositing/dispensing apparatus 10 executes when a predetermined time is up, and Fig. 17 is a cross-sectional view showing the structure of the dispensing port 11 as viewed in a side view.

[0070] First of all, a control part 31 lowers the pusher plate 50 of the dispensing port 11 to a retracted position (see Fig. 17) where the vanes of the impeller rotating motor 19 do not interfere with the pusher plate 50 before a depositing transaction is performed.

[0071] The control part 31 of the bill depositing/dispensing apparatus 10 which executes the depositing transaction operates a main motor using a main motor control part 35, and feeds a bill received from the depositing port 12 into the inside of the machine one by another. Further, the control part 31 operates the impeller rotating motor 19 simultaneously with starting of the depositing operation.

[0072] Here, in conjunction with Fig. 14, the explanation is made with respect to operations ranging from the generation of a bill to be rejected as a result of the identification by the identification part 13 and the arrival of the bill to be rejected to the dispensing port conveying bill detection sensor 15.

[0073] The control part 31 of the bill depositing/dispensing apparatus 10 inspects whether or not the dispensing port conveying bill detection sensor 15 detects a bill in the sensor control part 36 (Step S31). When the dispensing port conveying bill detection sensor 15 detects bill, the control part 31 registers "bill present" at a position of index A in array variables of the memory part 39 (see Fig. 4). Here, the control part 31 also registers an arrival expected time (expected bill trailing-end passing time) when a bill arrives at the dispensing port inlet sensor 16 downstream of the dispensing port conveying bill detection sensor 15, and increments index A by +1 (Step S32). Then, the control part 31 elevates the pusher plate 50 of the dispensing port 11 up to a bill accumulable position (Step S33).

[0074] Next, at timing before the arrival expected time by a fixed time, the control part 31 starts monitoring of the dispensing port inlet sensor 16.

[0075] As shown in Fig. 15, in monitoring, the control part 31 inspects whether or not the bill passes through the dispensing port inlet sensor 16 in the sensor control

part 36 (Step S41). When the dispensing port inlet sensor 16 detects the passing of a bill, the control part 31 registers "bill absent" at a position of index B in array variables of the memory part 39 (see Fig. 4), and sets all bill monitoring states registered at points of time before the dispensing port inlet sensor 16 detects the passing of a bill to "bill absent" (Step S42). The index B is incremented by +1 sequentially each time a bill passes.

[0076] The control part 31 starts a predetermined-time timer (Step S43).

[0077] Fig. 16 is a flowchart of operations when a predetermined time is up after the predetermined-time timer is started in Step S43 (see Fig. 15).

[0078] When the predetermined time is up (Step S51), the control part 31 inspects whether or not a bill being monitored is present between the dispensing port conveying bill detection sensor 15 and the dispensing port inlet sensor 16 (Step S52).

[0079] When no bill is present in an interval between the dispensing port conveying bill detection sensor 15 and the dispensing port inlet sensor 16 (Step S52: not registered), the control part 31 lowers the pusher plate 50 of the dispensing port 11 to a position where the vanes of the impeller rotating motor 19 do not interfere with the pusher plate 50 (Step S53). The control part 31 which executes Step S53 and Step S33 functions as a pusher plate control means.

[0080] When bill is present in the interval between the dispensing port conveying bill detection sensor 15 and the dispensing port inlet sensor 16 (Step S52: registered), the control part 31 restarts the predetermined-time timer and returns the processing to Step S51 (Step S55). Here, when the designated time is up again, the control part 31 executes the processing from Step S52.

[0081] Due to such a constitution, only when a bill is conveyed to the dispensing port 11, the pusher plate 50 is elevated to the accumulating position shown in Fig. 2 and hence, it is possible to minimize the interference time of the pusher plate 50 with the vanes of the impeller rotating motor 19.

(Embodiment 3)

[0082] According to the embodiment 3, in the bill depositing/dispensing apparatus 10 having the above-mentioned constitution, when the number of motor stopping times exceeds a predetermined value in the embodiment 1, the control of the bill depositing/dispensing apparatus 10 is transferred to the control in the embodiment 2. In this case, when the number of motor stopping times exceeds the predetermined value, the respective processing flows shown in Figs. 14, 15 and 16 may be performed. By performing these flows, it is possible to prolong the lifetime of the vanes of the impeller 51 and to minimize noises of the impeller 51.

[0083] The present invention is not limited to the above-mentioned constitutions of the embodiments, and various modifications are conceivable.

Claims

1. A bill processor comprising:

a conveying passage for conveying a bill; 5
 an accumulation part, arranged on a succeeding stage of the conveying passage, for accumulating the bill by stacking;
 an impeller (51) for assisting the accumulation of the bill in the accumulation part; 10
 accumulation part inlet detection means (16), arranged in the vicinity of an inlet of the accumulation part, for detecting the bill;
 passing detection means (15), arranged on the conveying passage, for detecting the passing of the bill; 15
 remaining bill detection means for detecting whether or not the bill remains between the passing detection means (15) and the accumulation part inlet detection means (16) on the conveying passage; and 20
 impeller control means for starting the rotation of the impeller (51) in an accumulating direction upon detection of the bill through the conveying passage by the passing detection means (15) 25
 and stopping the rotation of the impeller upon detection of the remaining of the bill by the remaining bill detection means after detection of the accumulation of the bill by the accumulation part inlet detection means (16). 30

2. The bill processor according to claim 1, wherein the passing detection means (15) is arranged on a front stage of the impeller (51) by a distance equal to or more than a distance that the conveying passage conveys the bill for a rotation rising time of the impeller. 35

3. The bill processor according to claim 1 or 2, further comprising a number determination means for determining whether or not the number of rotation controls of the impeller (51) by the impeller control means arrives at a predetermined number, wherein the impeller control means is configured to execute a control of rotation starting and rotation stopping of the impeller (51) when the number determination means determines that the number of rotation controls does not arrive at the predetermined number, and not to execute the control of rotation starting and rotation stopping of the impeller when the number determination means determines that the number of rotation controls arrives at the predetermined number. 40 45 50

4. The bill processor according to any preceding claim, further comprising: 55

a pusher plate (50) for pushing the bill accumu-

lated in the accumulation part; and
 pusher plate control means for moving the pusher plate (50) to an accumulating position upon detection of passing of the bill through the conveying passage by the passing detection means (15) and moving the pusher plate to a retracted position where the pusher plate does not interfere with the impeller (51) upon non-detection of the remaining of the bill by the remaining bill detection means after the detection of the accumulation of the bill by the accumulation part inlet detection means (16).

5. A bill processor comprising:

a conveying passage for conveying a bill;
 an accumulation part, arranged on a succeeding stage of the conveying passage, for accumulating the bill by stacking;
 an impeller (51) for assisting the accumulation of the bill in the accumulation part;
 a pusher plate (50) for pushing the bill accumulated in the accumulation part;
 accumulation part inlet detection means (16), arranged in the vicinity of an inlet of the accumulation part, for detecting the bill;
 passing detection means (15), arranged on the conveying passage, for detecting the passing of the bill;
 remaining bill detection means for detecting whether or not the bill remains between the passing detection means (15) and the accumulation part inlet detection means (16) on the conveying passage; and
 a pusher-plate control means for moving the pusher plate (50) to an accumulating position upon detection of passing of the bill through the conveying passage by the passing detection means (15) and moving the pusher plate to a retracted position where the pusher plate does not interfere with the impeller (51) upon non-detection of the remaining of the bill by the remaining bill detection means after the detection of the accumulation of the bill by the accumulation part inlet detection means (16).

6. The bill processor according to any preceding claim, wherein the accumulating position of the pusher plate (50) assumes a position where the uppermost bill on the pusher plate is brought into contact with vanes of the impeller (51) which is rotated at the time of accumulating the bill.

7. The bill processor according to any preceding claim, wherein the accumulation part is arranged at a dispensing port (11) from which the bill is paid out.

FIG. 1

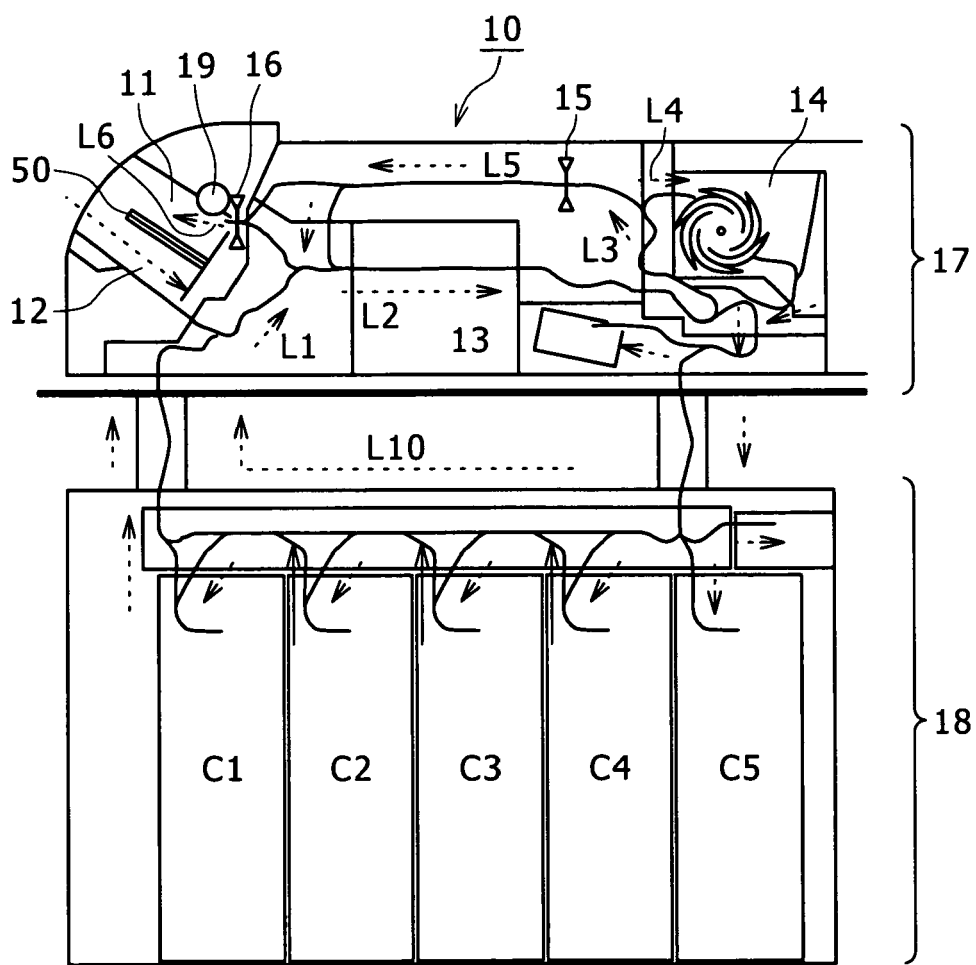


FIG. 2

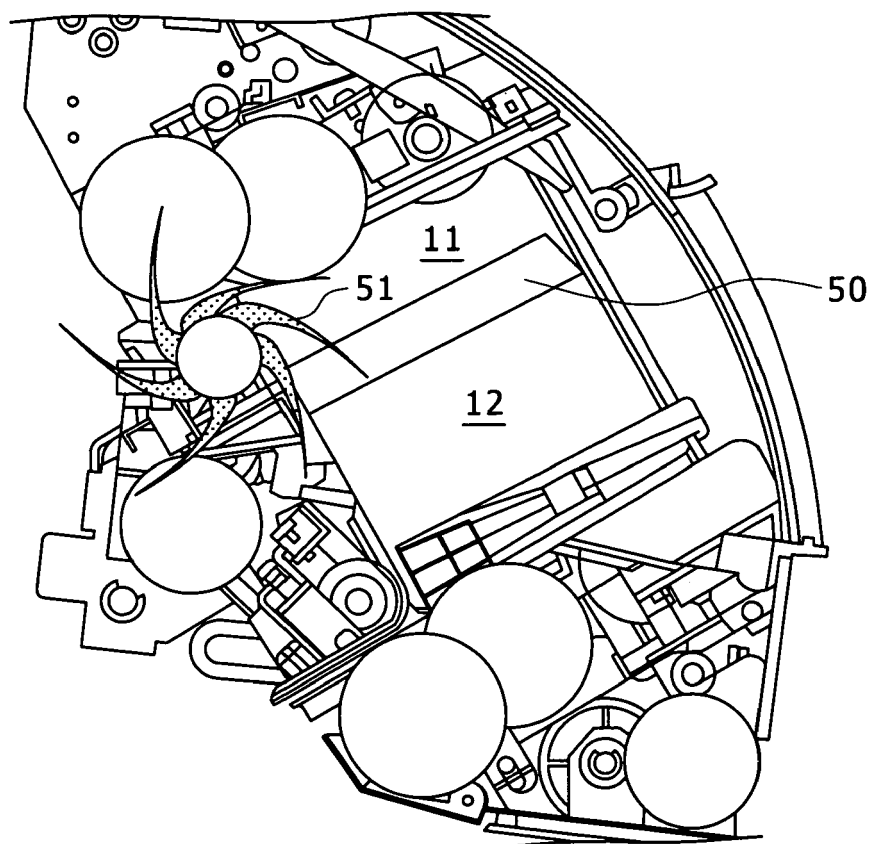


FIG. 3

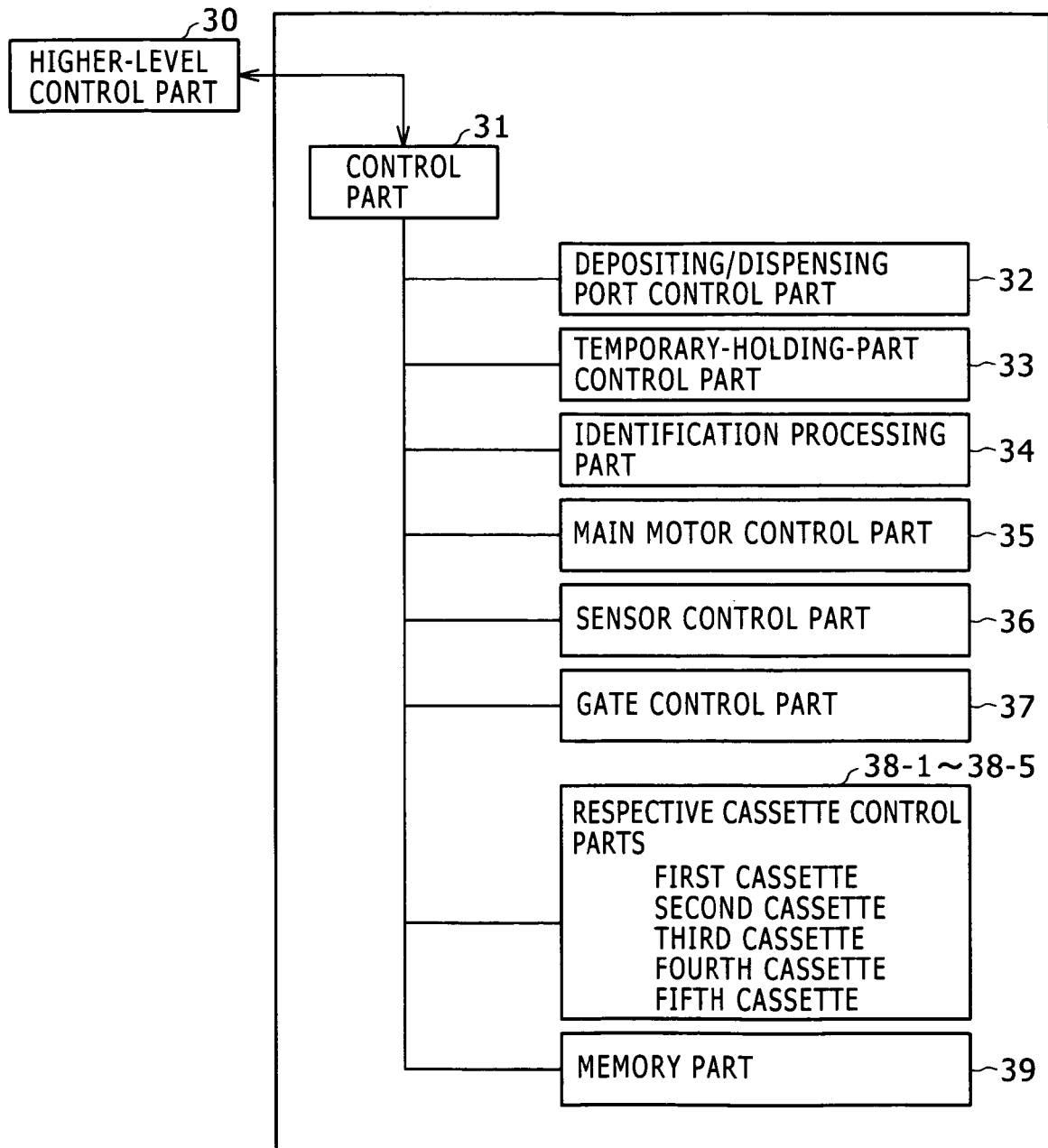


FIG. 4

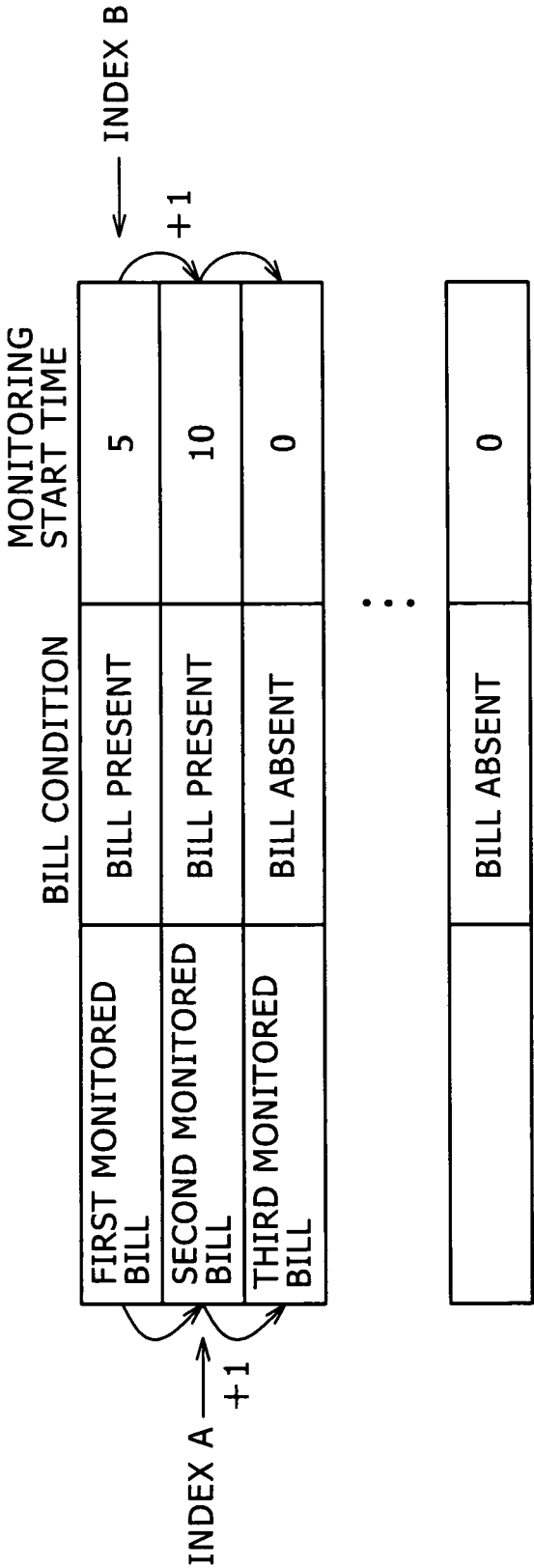


FIG. 5

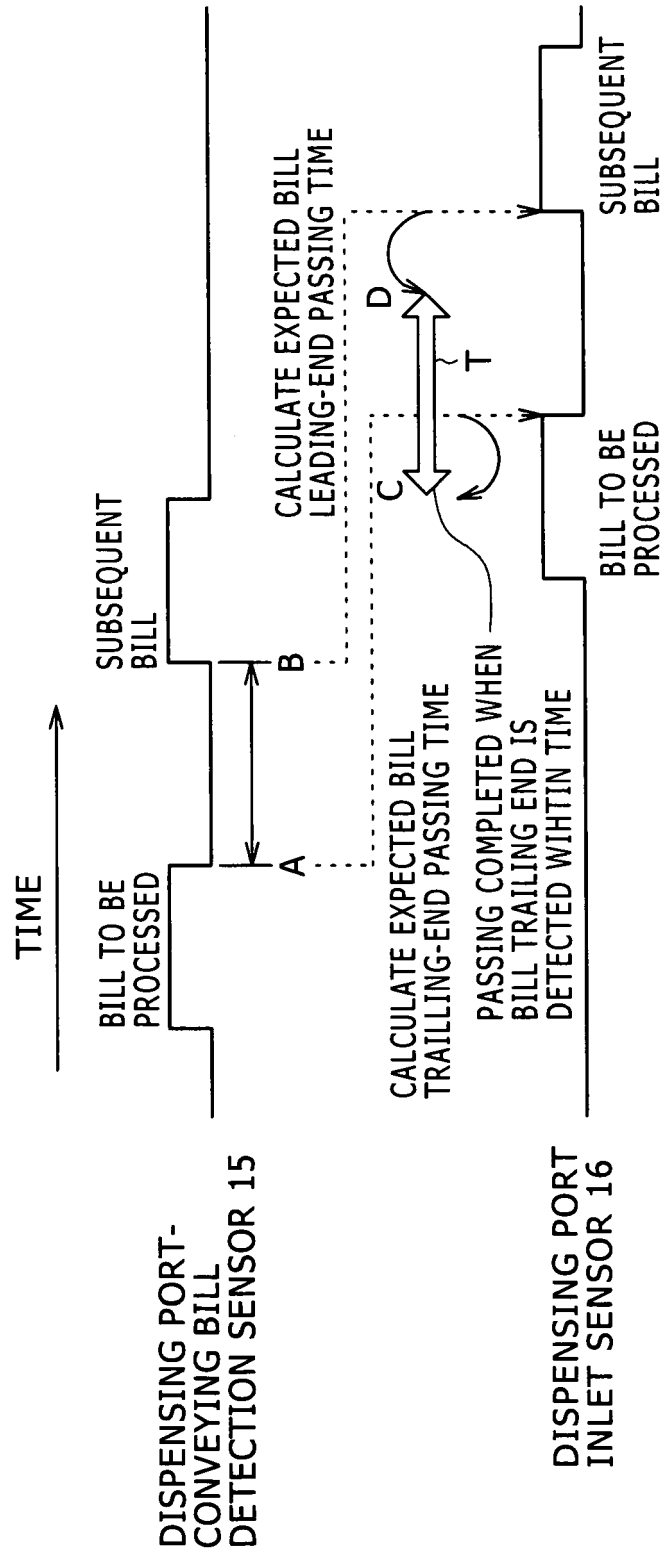


FIG. 6

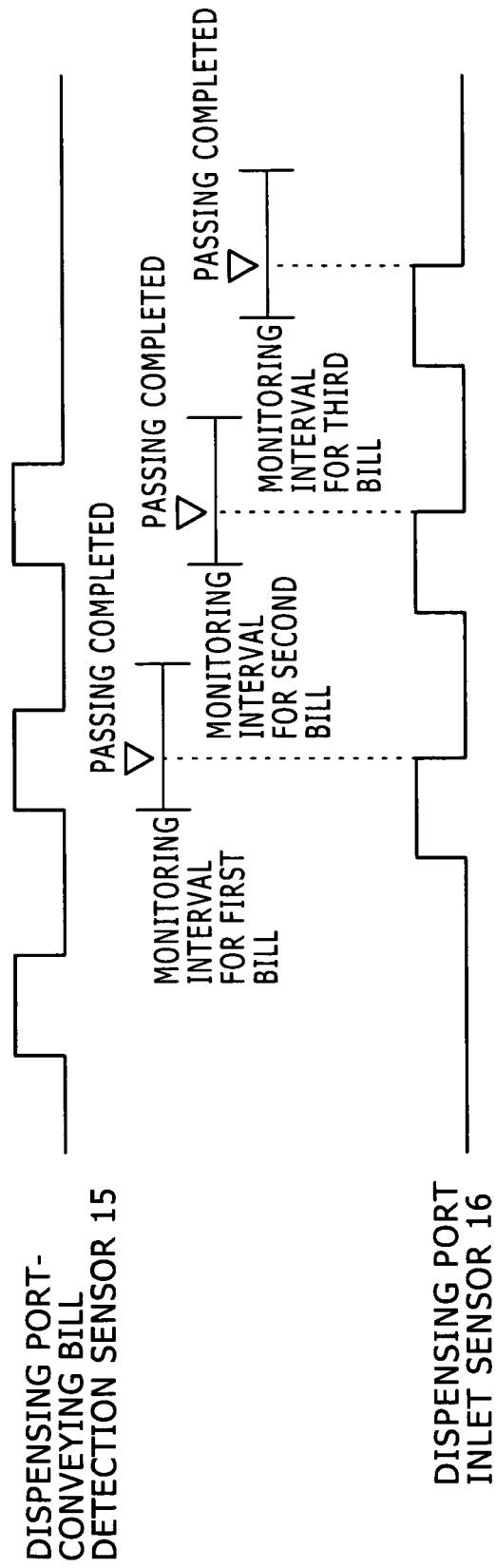


FIG. 7

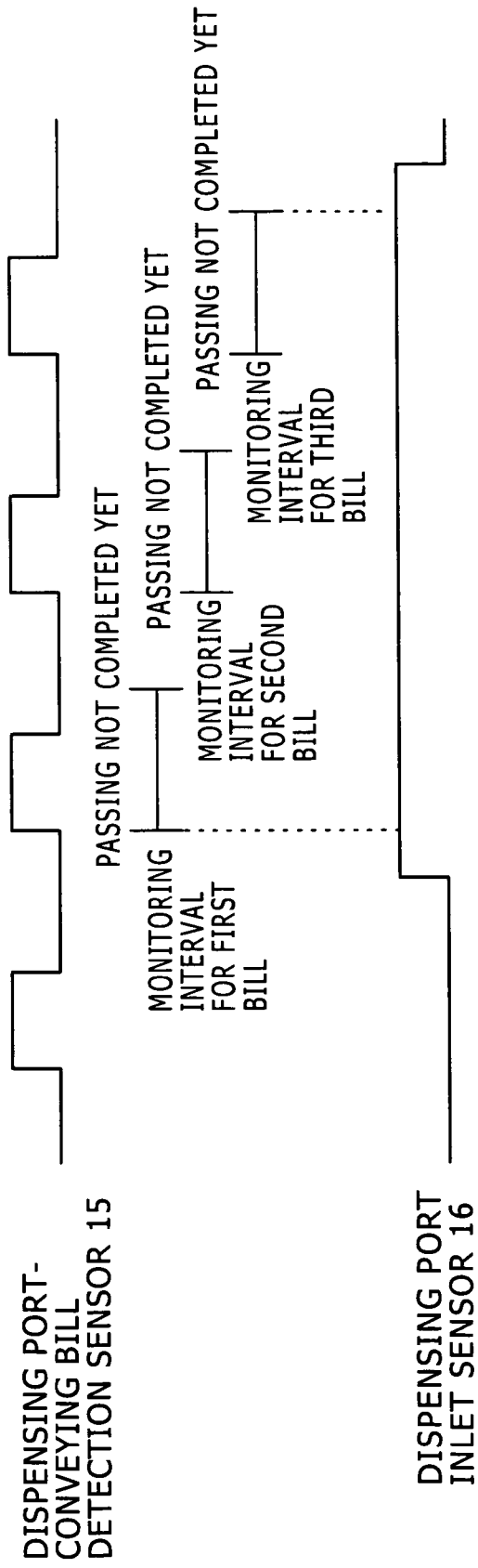


FIG. 8

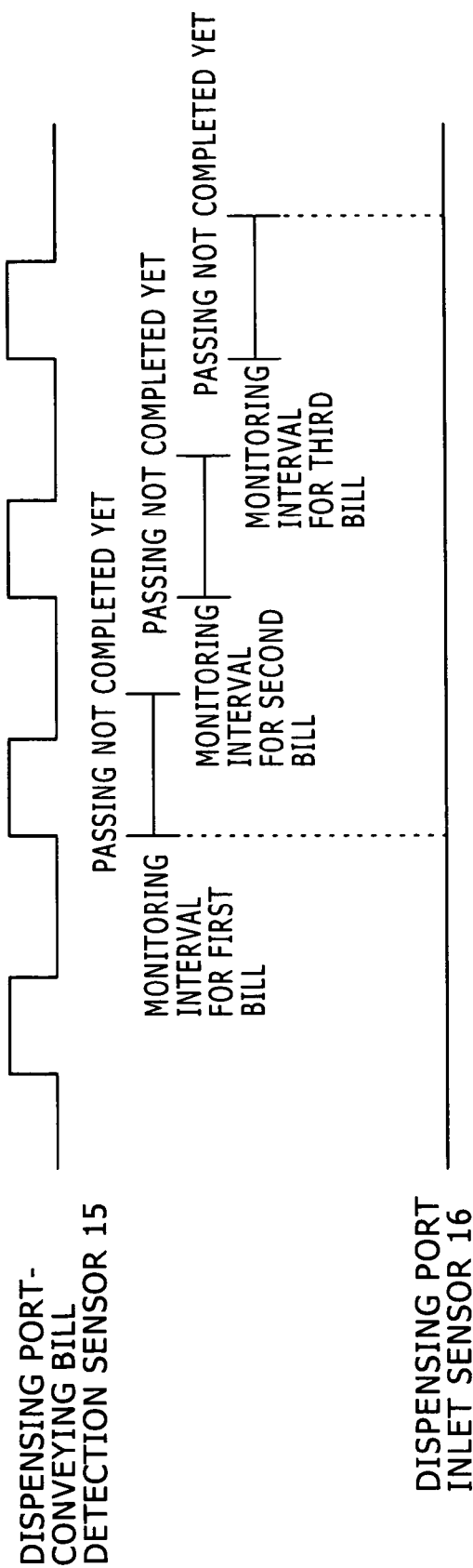


FIG. 9

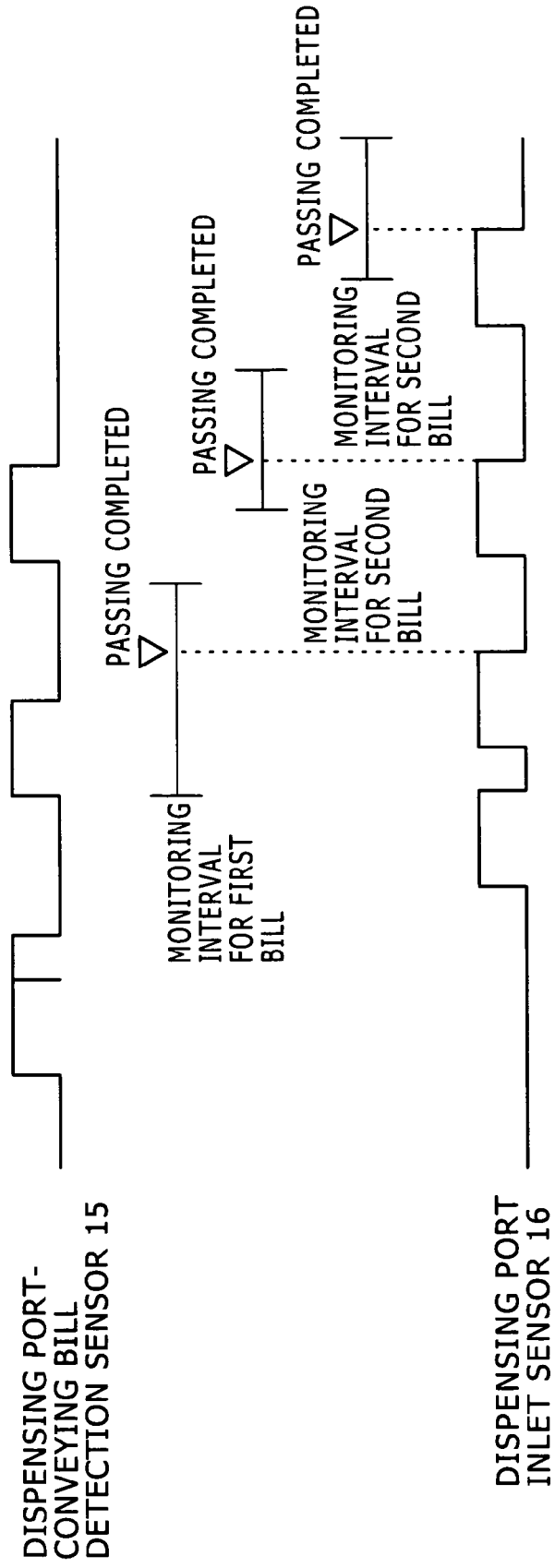


FIG. 10

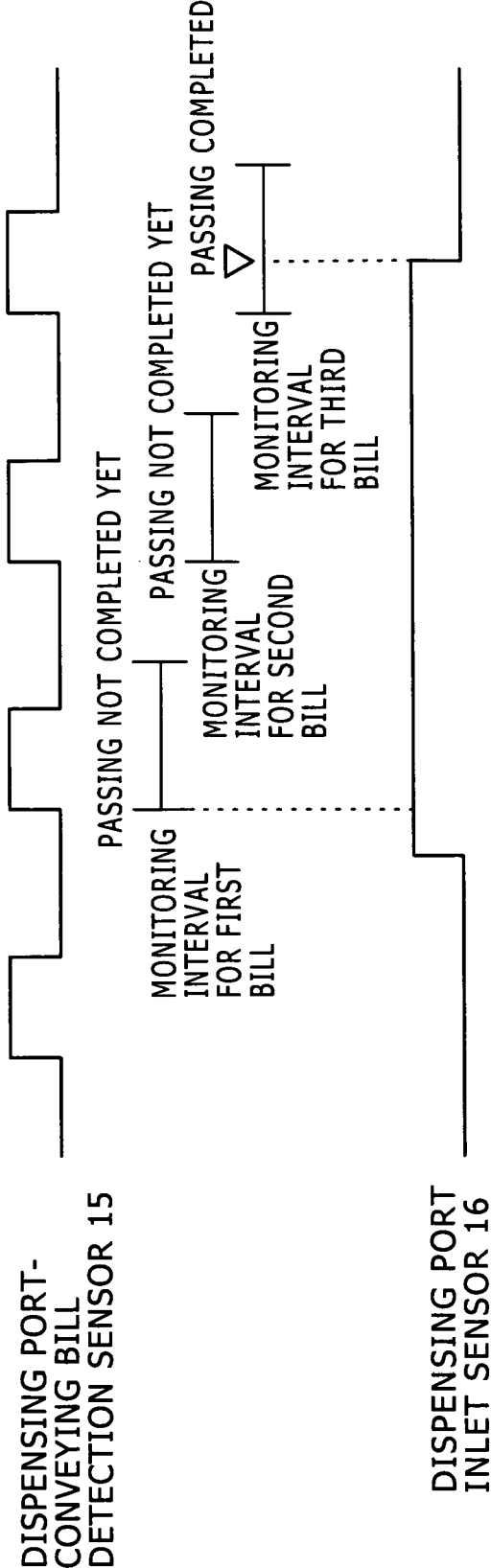


FIG. 11

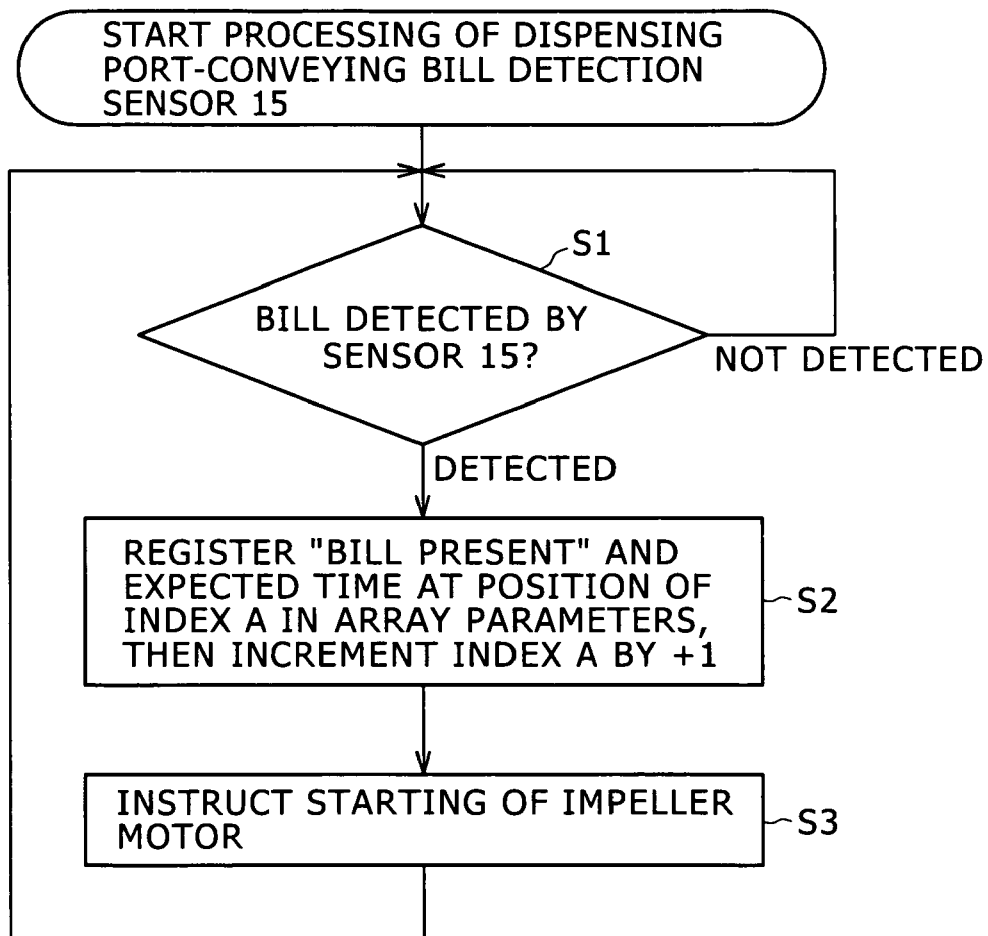


FIG. 12

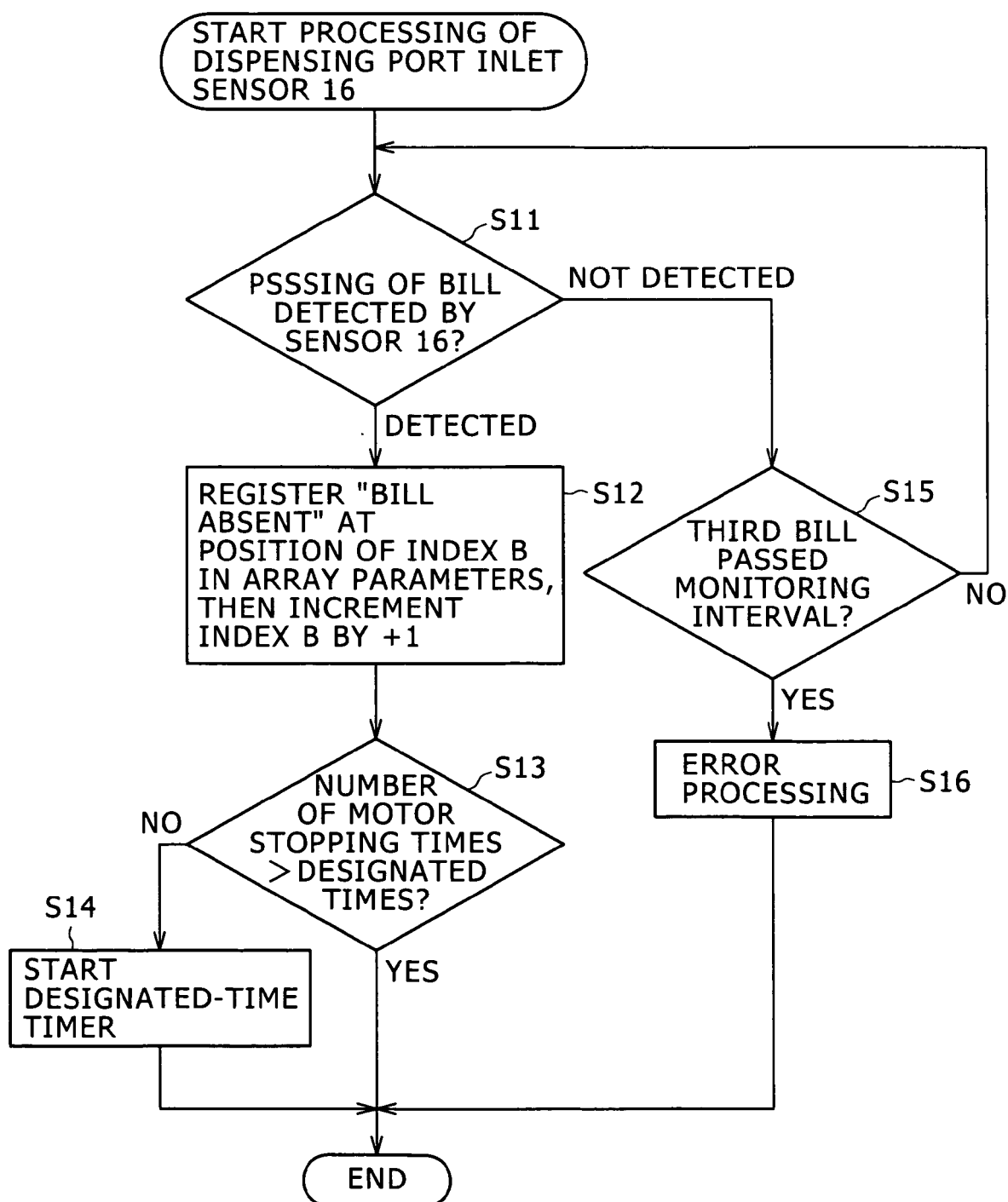


FIG. 13

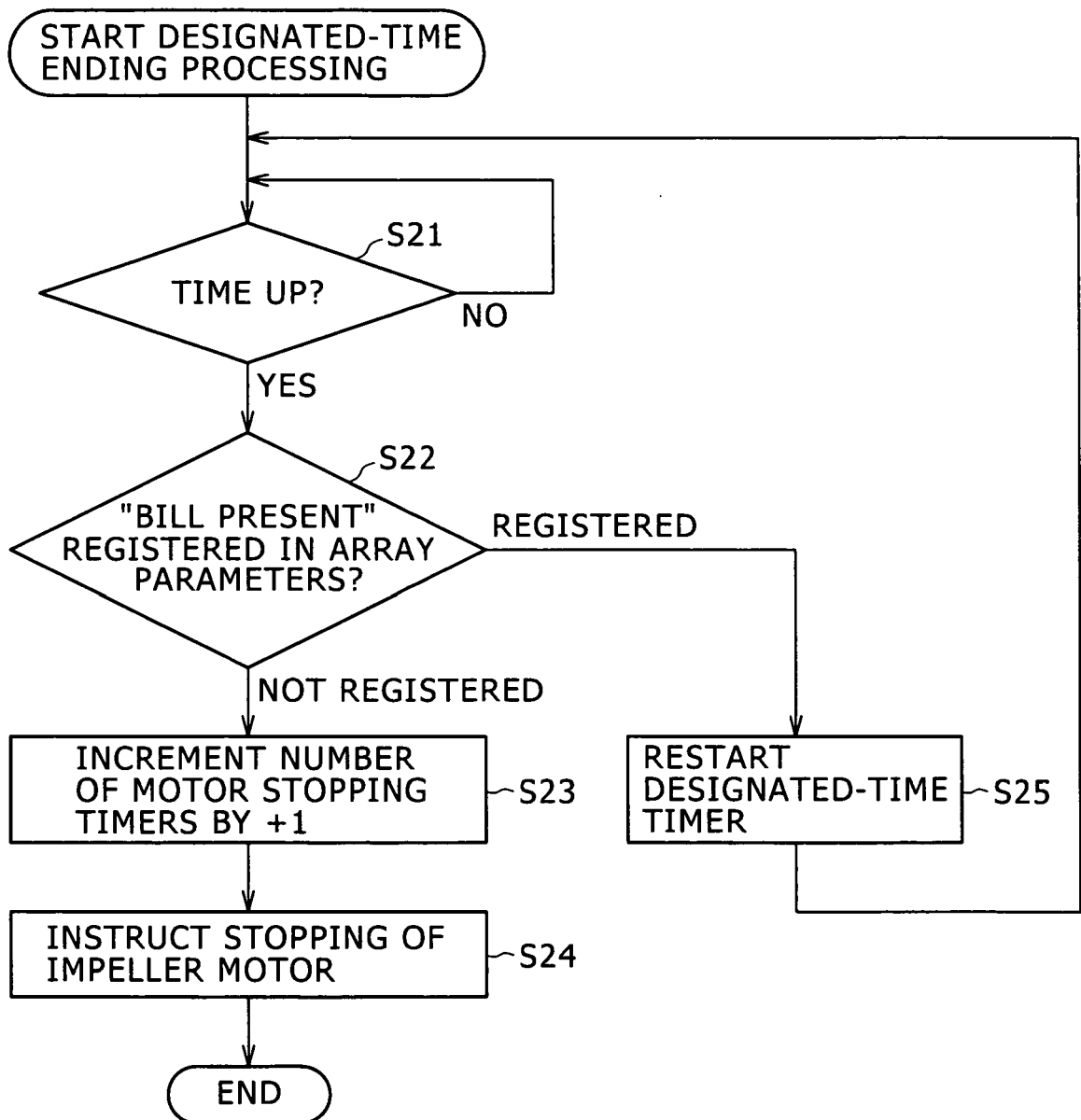


FIG. 14

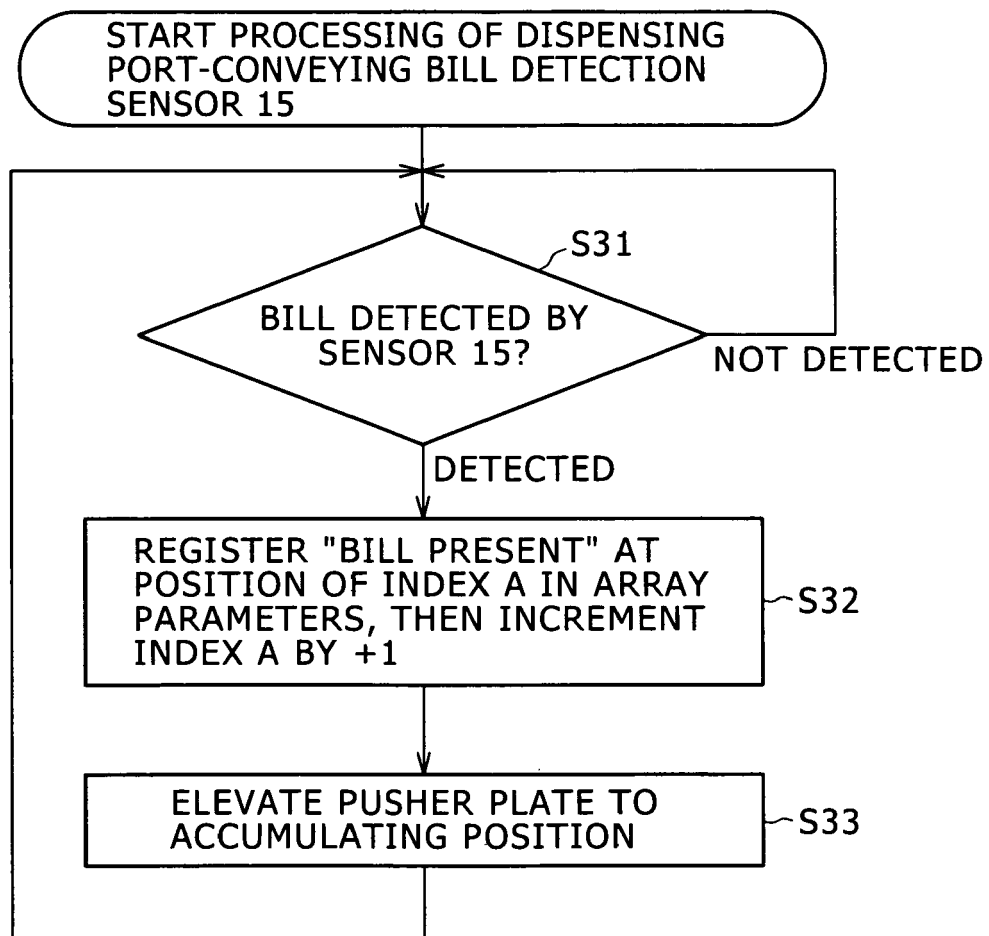


FIG. 15

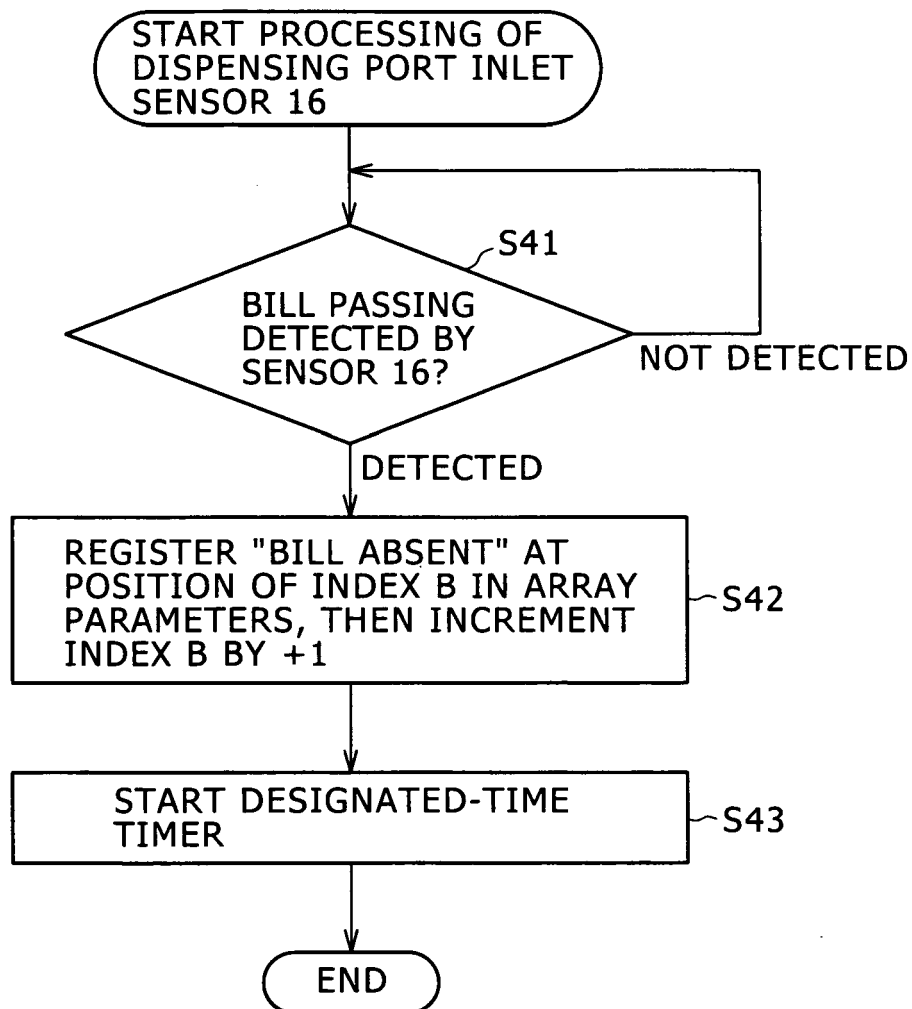


FIG. 16

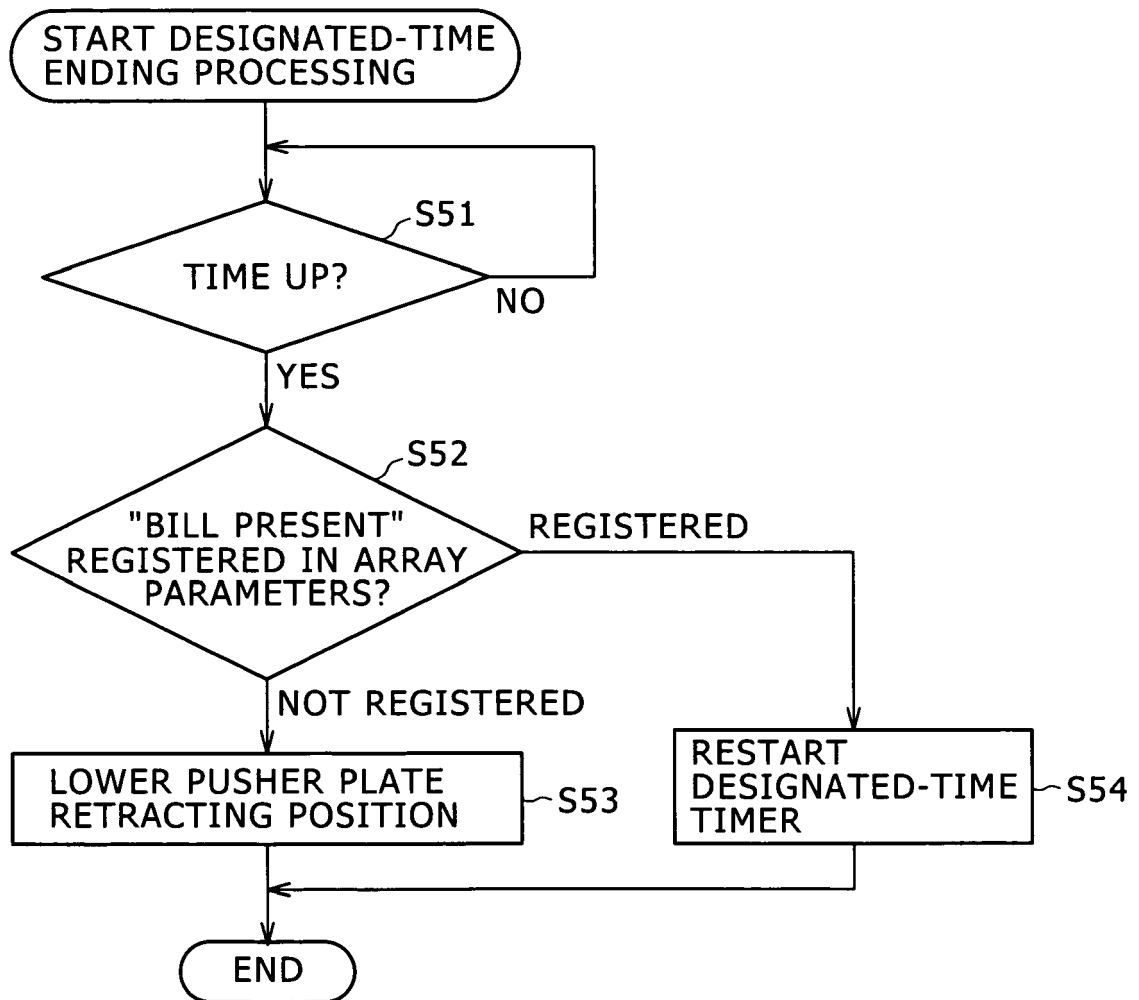
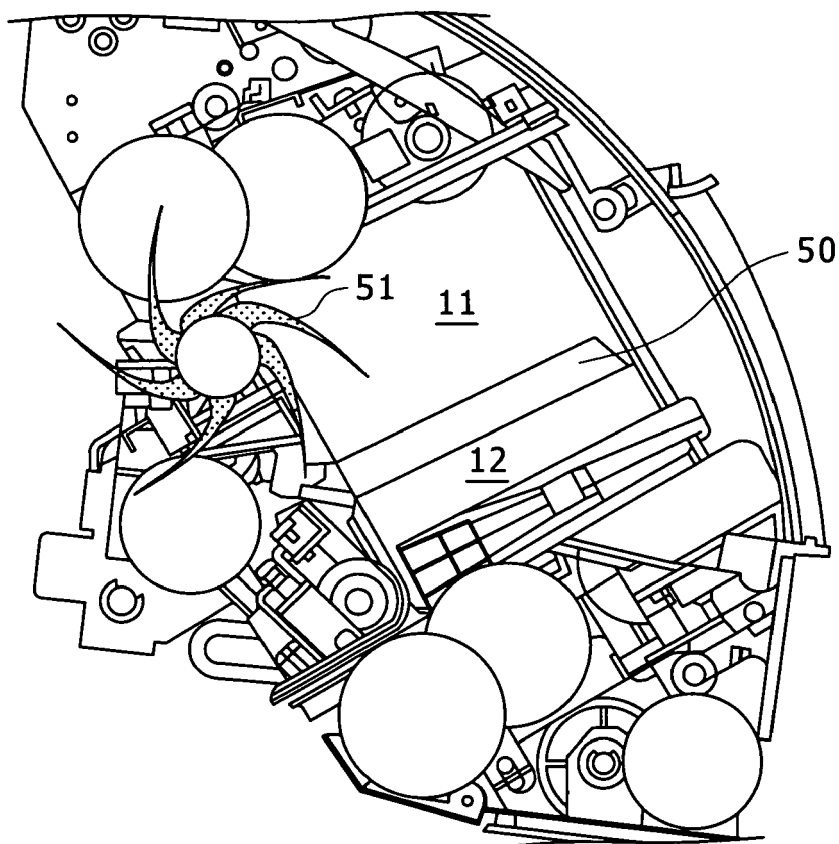


FIG. 17



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2221055 A [0003]