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(54) **PAPER SHEET PROCESSOR**

(57) The present invention provides a paper sheet handling machine 1 configured to take therein paper sheets from the exterior and then storing the paper sheets in the interior thereof. This paper sheet handling machine 1 includes storage spaces 30p, 40p respectively provided therein. Each storage space 30p, 40p is configured to store therein the paper sheets taken in the machine 1 from the exterior, in a stacked condition. Further, the paper sheet handling machine 1 includes stacking units 30, 40, each having an opening provided in one side face thereof for allowing the paper sheets stored in each storage space 30p, 40p to be taken out, and a transport unit 20 configured to transport the paper sheets taken in the machine 1 from the exterior, toward each of the stacking units 30, 40. In addition, pushing units, each configured to push the paper sheets stored in each storage space 30p, 40p of the stacking unit 30 or 40 toward the opening, are provided to the paper sheet handling machine 1.

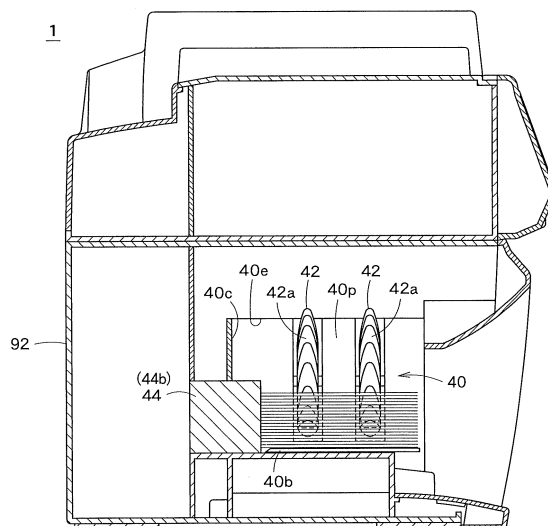


FIG. 4

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a paper sheet handling machine which can take paper sheets therein from the exterior and then store them in the interior thereof.

BACKGROUND OF THE INVENTION

[0002] In the past, a banknote handling machine, which can store therein banknotes deposited from a customer, while sorting them, for each denomination of banknotes, has been known. In the banknote handling machine of this type, the banknotes are first received in a hopper upon a deposit operation for the banknotes, and then the banknotes received in the hopper are fed into the banknote handling machine, one by one, by a banknote feeding unit.

[0003] Thereafter, the banknotes fed in the banknote handling machine are detected, respectively, by a recognition unit provided to a transport path, in regard to the fitness, authenticity, denomination, orientation, face/back, -transported condition and the like. Then, the banknotes that cannot be recognized by the recognition unit (e.g., damaged unfit banknotes or the like) and/or banknotes that have been excluded from the banknotes to be stored in each stacking unit, because of their abnormal transported condition (e.g., an obliquely transported condition or the like), even after they have been sufficiently recognized, will be fed to a reject unit provided in the banknote handling machine.

[0004] Meanwhile, the banknotes judged to be stored in the banknote handling machine by the recognition unit are sorted, for example, for each denomination thereof, based on each recognition result of the recognition unit, and then fed selectively to each stacking unit corresponding to the denomination. As a result, the banknotes are stored in each stacking unit in a stacked state. In this way, the banknotes received in the hopper of the banknote handling machine can be sorted for each denomination thereof and then stored in the banknote handling machine.

[0005] For instance, the banknote handling machine as described above is disclosed in JP2002-74464A.

DISCLOSURE OF THE INVENTION

[0006] However, in the case of the conventional banknote handling machine as disclosed in JP2002-74464A, the banknotes fed into each stacking unit from the transport path are stacked in a relatively rearward portion of the stacking unit. Therefore, an operator cannot readily take out such banknotes stacked in the stacking unit. In particular, in the case the banknotes, each having a relatively small long-edge size, such as euro banknotes or the like, are stored in the banknote handling machine, it

is rather difficult for the operator to confirm the stacked condition of such banknotes with eyes. Therefore, in such a case, some banknotes may be left in the stacking unit, without being taken out by the operator.

[0007] Additionally, in the aforementioned conventional banknote handling machine, when a portion of the banknotes are stored in one stacking unit in an abnormal stacked condition, more specifically, when a portion of the banknotes are stored in the stacking unit in a standing state, there is a risk that only a batch of the banknotes in the normal stacked condition may be taken out, while the portion of the banknotes stored in such an abnormal condition are still left in the stacking unit.

[0008] The present invention was made in light of the above problem. Therefore, it is an object of the invention to provide the paper sheet handling machine, which can facilitate to take out the paper sheets by pushing the paper sheets stored in the rearward portion of each stacking unit toward an opening of the stacking unit, as well as can prevent the paper sheets stored in the stacking unit in the abnormal stacked condition from being left in the stacking unit, without being taken out therefrom, by also pushing such paper sheets stored in the abnormal stacked condition in the stacking unit toward the opening thereof.

[0009] A paper sheet handling machine of the present invention, which is configured to take paper sheets therein from the exterior and then store the paper sheets in the interior thereof, and comprises: a stacking unit having a storage space provided therein and an opening formed in a side face thereof, the storage space being configured to store therein the paper sheets taken in the machine from the exterior, while the opening being configured to allow the paper sheets stored in the storage space to be taken out therethrough; a transport unit configured to transport the paper sheets taken in the machine from the exterior, toward the stacking unit; and a pushing unit configured to push the paper sheets stored in the storage space of the stacking unit, toward the opening.

[0010] According to the above paper sheet handling machine, the paper sheets stored in the relatively rearward portion of the storage space of the stacking unit in a stacked state or standing state can be pushed toward the opening of the stacking unit (or pushed forward when seen on the operator side) by the pushing unit. Therefore, the operator can readily take out the paper sheets stored in the storage space of the stacking unit. Please note that the direction in which the paper sheets are pushed by the pushing unit may be substantially horizontal direction, obliquely upward or obliquely downward. Furthermore, the paper sheets stored in the stacking unit in the abnormal stacked condition, more specifically, the paper sheets stored in the stacking unit in the standing state, can also be pushed toward the opening of the stacking unit. Thus, the above paper sheet handling machine can securely prevent the paper sheets stored in the abnormal stacked condition from being left in the stacking unit, without being taken out by the operator.

[0011] In the paper sheet handling machine of the present invention, it is preferred that the stacking units are provided in a plural number, while the pushing units are also provided in the plural number, corresponding to the respective stacking units. According to this paper sheet handling machine, the paper sheets can be stored in the respective stacking units, while being sorted for each kind thereof, e.g., for each denomination thereof.

[0012] In the paper sheet handling machine of the present invention, it is preferred that the paper sheet handling machine further comprises a first detector provided to the transport unit and configured to detect each paper sheet transported by the transport unit; and a control unit configured to control the pushing unit, and the control unit controls the pushing unit to push the paper sheets stored in the storage space of the stacking unit toward the opening, in the case the first detector detects that a predetermined number of paper sheets are fed to the stacking unit. According to this paper sheet handling machine, the operator can take out the paper sheets from the storage unit, for each batch of the predetermined number of paper sheets.

[0013] In the paper sheet handling machine of the present invention, it is preferred that the paper sheet handling machine further comprises the control unit configured to control the pushing unit, and the control unit controls the pushing unit to push the paper sheets stored in the storage space of the stacking unit toward the opening, in the case the number of the paper sheets stored in the stacking unit reaches a predetermined maximum storage number assigned to the stacking unit. According to this paper sheet handling machine, when the paper sheets can no longer be stored in the stacking unit, the paper sheets stored in the storage space are pushed toward the opening of the stacking unit. Thus, the operator can take out the batch of paper sheets corresponding to the maximum storage number assigned to the storage unit.

[0014] In the paper sheet handling machine of the present invention, it is preferred that the paper sheet handling machine further comprises a second detector provided to the stacking unit and configured to detect whether or not the paper sheets are stored in the storage space of the stacking unit, the control unit is configured to control the pushing unit as well as control the transport unit, and the control unit controls the pushing unit and transport unit to interrupt the transportation of the paper sheets by the transport unit, in the case the first detector detects that the predetermined number of paper sheets is fed to the stacking unit, while controlling the pushing unit and transport unit to restart the transportation of the paper sheets by the transport unit, in the case the second detector detects that the paper sheets, which have been pushed toward the opening by the pushing unit in the stacking unit, are taken out from the stacking unit. According to this paper sheet handling machine, the operator can take out the paper sheets from the stacking unit, for each batch of the predetermined number of paper sheets. Besides, the storage of the paper sheets into the

stacking unit can be automatically restarted, after the operator takes out the batch of paper sheets from the stacking unit.

[0015] In the paper sheet handling machine of the present invention, it is preferred that the control unit is configured to control the pushing unit as well as control the transport unit, and the control unit controls the pushing unit and transport unit to interrupt the transportation of the paper sheets by the transport unit, in the case the first detector detects that the predetermined number of paper sheets are fed to the stacking unit, while controlling the pushing unit and transport unit to restart the transportation of the paper sheets by the transport unit, after the paper sheets are pushed toward the opening by the pushing unit in the stacking unit, thereby newly feeding the paper sheets onto a top face of the paper sheets that have been pushed toward the opening. According to this paper sheet handling machine, the paper sheets can be shifted in position, in the stacking unit, for each batch of the predetermined number of paper sheets. Therefore, the operator can take out the paper sheets from the stacking unit, for each batch of the predetermined number of paper sheets.

[0016] In the paper sheet handling machine of the present invention, it is preferred that the paper sheet handling machine further comprises the control unit configured to control the pushing unit, and the control unit controls the pushing unit to push the paper sheets stored in the storage space of the stacking unit toward the opening, in the case the transportation of the paper sheets to the stacking unit by the transport unit is ended. According to this paper sheet handling machine, the operator can take out the batch of paper sheets from the stacking unit, after the completion of the transportation of the paper sheets to the stacking unit.

[0017] In the paper sheet handling machine of the present invention, it is preferred that the storage space provided in the stacking unit is composed of a space surrounded by a bottom face and one or more side faces of the stacking unit, one of the side faces has a stacking wheel attached thereto, the stacking wheel being configured to stack each paper sheet fed to the stacking unit from the transport unit, in the storage space, and the bottom face constituting the storage space is downwardly inclined toward the one side face having the stacking wheel attached thereto. According to this paper sheet handling machine, since the bottom face constituting the storage space is inclined, the batch of the paper sheets can be stacked in the stacking unit in the situation that the paper sheets are inclined on the bottom face. Thus, each edge of the paper sheets can be well arranged along one side face to which the stacking unit is attached.

[0018] In the paper sheet handling machine of the present invention, it is preferred that the storage space provided in the stacking unit is composed of the space surrounded by the bottom face and one or more side faces of the stacking unit, and a cut-out portion is formed in the bottom face, at one edge thereof on the side of the

opening of the stacking unit. According to this paper sheet handling machine, the batch of the paper sheets pushed toward the opening by the pushing unit can be readily taken out by the operator, while the fingers or the like of the operator are inserted in the cut-out portion provided at the edge formed in the bottom face and provided on the side of the opening of the stacking unit.

[0019] In the paper sheet handling machine of the present invention, it is preferred that the pushing unit includes a pushing member configured to contact with the paper sheets stored in the storage space of the stacking unit and then push the paper sheets toward the opening, and a pushing member driving mechanism configured to drive the pushing member toward the opening.

[0020] In this case, it is further preferred that the pushing member can be reciprocated between a retracted position in which the pushing member is evacuated from the paper sheets while the paper sheets are stacked in the storage space and a pushing position in which the pushing member approaches the opening from the retracted position, and the pushing member waits in the retracted position during a period of time in which the paper sheets are stacked in the stacking unit, while pushing the paper sheets stored in the storage space toward the opening, when the pushing member is moved from the retracted position to the pushing position. According to this paper sheet handling machine, due to the movement of the pushing member from the retracted position to the pushing position, the paper sheets stored in the storage space of the stacking unit can be pushed toward the opening.

[0021] In the paper sheet handling machine of the present invention, it is preferred that when in the retracted position, the pushing member constitutes a rear side face of the storage space of the stacking unit, and the pushing member is comb-shaped to be meshed with the other side face and bottom face constituting together the storage space of the stacking unit. According to this paper sheet handling machine, it is possible to securely prevent the paper sheets stored in the storage space from getting into a gap between the side face or bottom face constituting the storage space, and the pushing member, thus avoiding occurrence of jam of such paper sheets and other like trouble in the stacking unit.

[0022] In the paper sheet handling machine of the present invention, it is preferred that the pushing member is configured so that the paper sheets can be stacked on a top face of the pushing member, and the paper sheets stacked on the pushing member can be moved together with the pushing member, and the pushing member is comb-shaped to be meshed with the side face constituting the storage space of the stacking unit. According to this paper sheet handling machine, when the paper sheets are stacked on the top face of the pushing member, these paper sheets can be moved toward the opening. In addition, it is possible to securely prevent the paper sheets stored in the storage space from getting into a gap between the side face constituting the storage space

and the pushing member, thus avoiding occurrence of jam of such paper sheets and other like trouble in the stacking unit.

[0023] In the paper sheet handling machine of the present invention, it is preferred that the pushing unit includes a plurality of third detectors, each configured to detect the position of the pushing member, and the pushing member driving mechanism can stop the pushing member in a plurality of positions, based on each detection information obtained from the third detectors. In this case, the pushing member can be stopped in the plurality of positions. Thus, the paper sheets stacked on the pushing member can also be stopped in the plurality of positions. Therefore, the paper sheets can be shifted in position, for each batch of the predetermined number of paper sheets, thus enabling the operator to take out the paper sheets, for each batch of the predetermined number of paper sheets, from the stacking unit.

[0024] In the paper sheet handling machine of the present invention, it is preferred that the opening of the stacking unit is provided, such that the direction in which the paper sheets are taken out from the opening can be substantially orthogonal to the direction in which the paper sheets are fed to the stacking unit from the transport unit.

[0025] In this case, the direction in which the paper sheets are fed to the stacking unit from the transport unit may correspond to the short-edge direction of each paper sheet.

[0026] Otherwise, the direction in which the paper sheets are fed to the stacking unit from the transport unit may correspond to the long-edge direction of each paper sheet.

[0027] In the paper sheet handling machine of the present invention, it is preferred that the stacking unit further includes a paper sheet arranging member configured to contact with each edge of the paper sheets pushed toward the opening by the pushing member, thereby arranging the edges of the respective paper sheets. According to this paper sheet handling machine, the paper sheet arranging member can readily arrange the edge of each paper sheet pushed toward the opening of the stacking unit by the pushing unit.

[0028] In the above paper sheet handling machine, it is further preferred that the paper sheet arranging member can be moved in the direction in which the paper sheets are taken out from the stacking unit. According to this paper sheet handling machine, the operator can readily take out each batch of the paper sheets forward from the stacking unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029]

Fig. 1 is a perspective view showing external appearance of the banknote handling machine (or paper sheet handling machine) related to one embodiment

of the present invention.

Fig. 2 is a front view of the banknote handling machine shown in Fig. 1.

Fig. 3 is a cross section of the banknote handling machine, the cross section being taken along a line A-A depicted in Fig. 2 and illustrating the pushing member of the pushing unit located in the retracted position.

Fig. 4 is another cross section of the paper sheet handling machine, the cross section being also taken along the line A-A depicted in Fig. 2 and illustrating the pushing member of the pushing unit located in the pushing position.

Fig. 5 is a schematic view showing internal construction of the banknote handling machine shown in Fig. 1.

Fig. 6 is a perspective view showing the construction of one stacking unit of the banknote handling machine shown in Fig. 1, in which the pushing member of the pushing unit is in the retracted position (i.e., this drawing is related to Fig. 3).

Fig. 7 is a perspective view showing the construction of one stacking unit of the banknote handling machine shown in Fig. 1, in which the pushing member of the pushing unit is in the pushing position (i.e., this drawing is related to Fig. 4).

Fig. 8 is a top view showing the construction of one pushing unit when the pushing member of the pushing unit is in the retracted position as shown in Fig. 6.

Fig. 9 is a top view showing the construction of one pushing unit when the pushing member of the pushing unit is in the pushing position as shown in Fig. 7.

Fig. 10 is an illustration showing a series of operations when the banknotes are stored in one stacking unit.

Fig. 11 is an illustration of the banknote handling machine related to one variation of the present invention, the illustration showing another series of operations when the banknotes are stored in one stacking unit.

Fig. 12 is an illustration showing the construction of one stacking unit of the banknote handling machine related to another variation of the present invention.

Fig. 13 is an illustration showing the construction of the banknote handling machine related to still another variation provided with a dust collector.

DETAILED DESCRIPTION OF THE INVENTION

[0030] Hereinafter, one embodiment of the present invention will be described with reference to the drawings. In this embodiment, one example, in which the paper sheet handling machine of this invention is used as the banknote handling machine adapted for handling the banknotes, is described. However, it should be appreciated that paper sheets (e.g., checks) other than the banknotes can also be applied to the object handled by the paper sheet handling machine of this invention.

[0031] First of all, the general construction of the banknote handling machine of this embodiment will be described with reference to Figs. 1 through 5, especially Figs. 1 and 5.

[0032] The perspective view of Fig. 1 shows the external appearance of the banknote handling machine 1 of this embodiment. As shown in Fig. 1, the banknote handling machine 1 comprises a casing 92 having a substantially rectangular parallelepiped shape, a hopper 11, a first stacking unit (or first stacker) 30, a second stacking unit (or second stacker) 40 and a reject unit 50.

[0033] Fig. 5 schematically shows the internal construction of the banknote handling machine 1 shown in Fig. 1, and particularly illustrates a transport system and a sensor system of the banknote handling machine 1. As shown in Fig. 5, a transport unit 20 is provided in the casing 92 of the banknote handling machine 1. In this case, the transport unit 20 can serve to successively transport the banknotes, one by one, in the casing 92. In addition, a control unit 90 is provided in the banknote handling machine 1, wherein this control unit 90 can serve to control the transport unit 20, pushing member driving mechanism 45 that will be described later, diverters 60, 62 and the like.

[0034] Now, each component of the banknote handling machine 1 as constructed above will be described in more detail.

[0035] The hopper 11 is configured, such that a plurality of banknotes can be placed thereon, in the stacked condition, by the operator. In this case, the banknotes stored in the hopper 11 can be fed into the casing 92 of the banknote handling machine 1, one by one, by a banknote feeding unit 10.

[0036] The banknote feeding unit 10 includes a feed roller 12 adapted for feeding out each banknote, a gate roller (or reverse-rotation roller) 14 provided to be opposed to the feed roller 12 and configured to form a gate part between the feed roller 12 and this gate roller 14, and kicker rollers 16, 18, each adapted for kicking out the banknotes stored in the hopper 11 toward the feed roller 12. While Fig. 5 shows one example, in which the kicker rollers 16, 18 are arranged in two in a longitudinal direction, the arrangement of the kicker roller is not limited to this example. For instance, only one kicker roller (e.g., only the kicker roller 16) may be provided in the banknote handling machine 1. In either case, the banknotes taken in the casing 92 by the banknote feeding unit 10 can be transported by the transport unit 20.

[0037] The transport unit 20 includes an upper transport mechanism 22 extending in a substantially horizontal direction, a lower transport mechanism 24 extending in the substantially horizontal direction below the upper transport mechanism 22, and an intermediate transport mechanism 26 provided between the upper transport mechanism 22 and the lower transport mechanism 24. As shown in Fig. 5, the transport unit 20 composed of the respective transport mechanisms 22, 24, 26 has a substantially U-like shape on the whole. In this case, the

banknotes taken in the casing 92 by the banknote feeding unit 10 can be transported, one by one, by the upper transport mechanism 22, intermediate transport mechanism 26 and lower transport mechanism 24, in this order. The upper transport mechanism 22, intermediate transport mechanism 26 and lower transport mechanism 24 are respectively composed of a combination of belt transport mechanisms: Specifically, each belt transport mechanism is composed of a pair of or three or more rollers and a belt, e.g., a rubber belt, provided over the rollers.

[0038] As shown in Fig. 5, a recognition unit 28 is provided along the upper transport mechanism 22 of the transport unit 20. The recognition unit 28 can serve to detect the fitness, authenticity, denomination, orientation, face/back, transported condition and the like of each banknote transported by the upper transport mechanism 22. As used herein, the term "detect the transported condition" means to detect "whether or not the banknotes are transported obliquely," "whether or not the banknotes are transported in an overlapped condition," "whether or not the banknotes are transported in a chained condition" or the like. Each recognition result of the recognition unit 28 can be transmitted to the control unit 90.

[0039] As shown in Fig. 5, two stacking units 30, 40 are further arranged, in parallel with each other, below the lower transport mechanism 24 of the transport unit 20. Each of the stacking units 30, 40 is configured to store therein, in the stacked condition, the banknotes that have been taken in the casing 92 and then judged to be normal ones by the recognition unit 28. As shown in Fig. 1, the banknotes stacked in each stacking unit 30, 40 can be optionally taken out by the operator. It is noted that the construction of each stacking unit 30, 40 will be detailed later.

[0040] In this embodiment, rotary stacking wheels 32, 42 are provided to the first and second stacking units 30, 40, respectively. Each stacking wheel 32, 42 has a function for first receiving each banknote released from each diversion line 33, 43 toward each stacking unit 30, 40, in a space provided between each adjacent pair of vanes 32a or 42a of the wheel 32, 42, then rotating to allow the banknote to be stored in each stacking unit 30, 40, with the orientation and/or position of the banknote appropriately arranged. Each stacking wheel 32, 42 is attached to a side wall 30a, 40a of each stacking unit 30, 40 that will be described later, and configured to be rotated in an counterclockwise direction in Fig. 2 and 5, about a shaft extending in a direction in which the banknotes are taken out from the stacking unit 30 or 40 (direction orthogonal to the sheet of Fig. 2 or 5).

[0041] Additionally, as shown in Fig. 5, two diverters 60, 62 are provided, in series, along the lower transport mechanism 24. Each diverter 60, 62 has, for example, a nail-like shape, and serves to divert a portion of the banknotes transported by the lower transport mechanism 24, from the lower transport mechanism 24 toward each diversion line 33, 43. The diversion lines 33, 43 are connected with the first and second stacking units 30, 40,

respectively. Thus, the banknotes diverted from the lower transport mechanism 24 by the diverters 60, 62 can be fed into the first and second stacking units 30, 40, via the diversion lines 33, 43, respectively.

[0042] At a downstream end of the lower transport mechanism 24, a release roller 54 for feeding out each banknote and an opposite roller 56 positioned to be opposed to the release roller 54 are provided. With this configuration, each banknote fed to the downstream end of the lower transport mechanism 24 can be released from a gap between the release roller 54 and the opposite roller 56. Thereafter, each banknote released by the two rollers 54, 56 can be stacked, one on another, in the reject unit 50, by a rotary rubber vane wheel 55 provided in the vicinity of the release roller 54 and adapted for beating the banknote. This configuration can facilitate the stacking operation for the rejected banknotes in the reject unit 50, because a rear edge of each banknote released from the gap between the release roller 54 and the opposite roller 56 can be properly beaten by the rotary rubber vane wheel 55 configured for beating the banknote.

Further, as shown in Figs. 1 and 5, a stopper 52 is provided to the reject unit 50. This stopper 52 can serve to prevent each banknote, which has been released from the gap between the release roller 54 and the opposite roller 56, from getting out from the reject unit 50 to the outside of the casing 92. This stopper 52 can be rotated by hand in a clockwise direction in Fig. 5. Therefore, by rotating the stopper 52 by hand in the clockwise direction in Fig. 5, the operator can optionally take out the banknotes stored in the reject unit 50.

[0043] Next, the sensor system of the banknote handling machine 1 will be described. As shown in Fig. 5, a sensor 70 for detecting whether or not the banknotes are placed on the hopper 11 is provided to the banknote feeding unit 10. Further, another sensor 71 is provided to an inlet of the upper transport mechanism 22 in the transport unit 20. This sensor 71 can serve to detect that the respective banknotes are securely taken in the casing 92. Still another sensor 72 is composed of a transparent sensor constituting a part of the recognition unit 28. This sensor 72 can serve to detect the denomination, authenticity or the like of each banknote, based on the light transmittance.

[0044] Sensors 73, 74, 75 are arranged in series along the lower transport mechanism 24 in the transport unit 20, respectively, while the diverters 60, 62 are located between the sensors 73, 74 and between the sensors 74, 75, respectively. The sensor 73 is located on the upstream side relative to the diverter 60 and serves to detect all of the banknotes transported by the lower transport mechanism 24. Meanwhile, the sensor 74 is located on the downstream side relative to the diverter 60 and serves to detect only the banknotes that are not diverted by the diverter 60, from among the banknotes transported by the lower transport mechanism 24. The sensor 75 is located on the downstream side relative to the diverter 62, and serves to detect only the banknotes that are not di-

verted by the diverter 62, from among the banknotes transported by the lower transport mechanism 24.

[0045] Furthermore, sensors 76, 77 are provided to the diversion lines 33, 43, respectively. These sensors 76, 77 can serve to detect the banknotes respectively diverted from the lower transport mechanism 24 and fed to the diversion lines 33, 43, respectively.

[0046] Additionally, sensors 78, 79 are provided to middle parts of the first and second stacking units 30, 40, respectively. These sensors 78, 79 can serve to detect that the banknotes are stacked in each stacking unit 30, 40, in an abnormal state, such as a standing state or the like, respectively. Furthermore, sensors 80, 81 are provided to lower parts of the first and second stacking units 30, 40, respectively. These sensors 80, 81 can serve to detect whether or not the banknotes are stored in the stacking units 30, 40, respectively. In addition, a sensor 82 is provided to the reject unit 50. This sensor 82 can serve to detect whether or not the banknotes are stored in the reject unit 50.

[0047] Each of the above sensors 70 to 82 is connected with the control unit 90, so that detection results of these sensors 70 to 82 can be directly transmitted to the control unit 90, respectively.

[0048] The control unit 90 can serve to control the banknote feeding unit 10, respective transport mechanisms 22, 24, 26 of the transport unit 20, pushing member driving mechanism 45 that will be described later, respective diverters 60, 62 and the like, based on the detection result about each banknote transmitted from the respective sensors 70 to 82 as well as on each recognition result about the banknote obtained from the recognition unit 28. More specifically, the control unit 90 can control each diverter 60, 62 to divert the banknotes judged to be the normal ones from the lower transport mechanism 24 and then feed them to either one of the stacking units 30, 40, based on each recognition result of the banknotes transmitted from the recognition unit 28. It is noted that the operation by this control unit 90 will be detailed later.

[0049] Now, referring to Figs. 2 through 4, the construction of each stacking unit 30, 40 will be described in more detail. In addition, the pushing unit provided to each stacking unit 30, 40 will be detailed. Especially, the pushing unit provided to the second stacking unit 40 will be detailed, by way of example, with reference to Figs. 3, 4, and 6 through 10, and other related drawings.

[0050] In each of the stacking unit 30, 40, a storage space 30p or 40p for storing therein the banknotes in the stacked condition is provided. Further, as shown in Figs. 1 through 4, each front portion of the casing 92 corresponding to the stacking units 30, 40 is opened forward. Thus, the operator can optionally take out the banknotes stored in the respective storage spaces 30p, 40p through such openings of the casing 92. As shown in Figs. 2 through 5, each storage space 30p, 40p is composed of a space surrounded by one side wall 30a or 40a to which the stacking wheel 32 or 42 is attached, a bottom plate 30b or 40b, a ceiling 30e or 40e, the other side wall 30d

or 40d opposite to the side wall 30a or 40a and a rear side wall 30c or 40c opposite to each opening.

[0051] In this embodiment, the direction in which the opening of each stacking unit 30, 40 is opened (i.e., the direction in which the banknotes are taken out through the opening) is orthogonal to the sheet of Fig. 5. Namely, the opening direction of each stacking unit 30, 40 is orthogonal to the direction in which the banknotes are fed from the lower transport mechanism 24 to the stacking unit 30 or 40 via each diversion line 33, 43 (i.e., along the sheet of Fig. 5). In this case, the direction, in which the banknotes are fed from the lower transport mechanism 24 toward each stacking unit 30, 40, corresponds to the short-edge direction of each banknote. Therefore, the operator can take out the banknotes from each stacking unit 30, 40 in the long-edge direction of each banknote. Alternatively, the direction, in which the banknotes are fed from the lower transport mechanism 24 toward each stacking unit 30, 40, may correspond to the long-edge direction of each banknote. Of course, in this case, the operator can take out the banknotes from each stacking unit 30, 40 in the short-edge direction of each banknote.

[0052] As shown in Fig. 2 and other related drawings, each bottom plate 30b, 40b is downwardly inclined toward each side wall 30a, 40a to which the stacking wheel 32 or 42 is provided. Therefore, as shown in Fig. 2 and other related drawings, each stacking unit 30, 40 can store therein the banknotes in an inclined state. With this configuration of each bottom plate 30b, 40b downwardly inclined toward each side wall 30a, 40a, each batch of the banknotes can be stacked in each stacking unit 30, 40, while also being downwardly inclined toward the side wall 30a or 40a. Thus, the batch of the banknotes can be taken out from each stacking unit 30, 40, with each edge of the banknotes well arranged along each side wall 30a, 40a of the stacking unit.

[0053] Further, as shown in Figs. 6 and 7, a cut-out portion (designated by reference numeral 40g in Figs. 6 and 7) is provided to each bottom plate 30b, 40b, at an edge thereof on the opening side (or left lower side in Figs. 6 and 7) of each stacking unit 30, 40. With this configuration, the batch of the banknotes stacked on the bottom plate 40b and then pushed toward the opening by each pushing member 44 that will be described below can be readily taken out by the operator, while the fingers or the like of the operator are inserted in the cut-out portion 40g provided at the edge on the opening side of the bottom plate 40b.

[0054] Additionally, as shown in Figs. 3 and 4, a pushing unit configured for pushing the banknotes stored in each storage space 30p, 40p of the stacking unit 30 or 40 toward the opening is provided to the stacking unit 30 or 40. Now, in regard to the pushing units respectively provided to the stacking units 30, 40, the pushing unit provided to the second stacking unit 40 will be described by way of example. The pushing unit provided to the second stacking unit 40 is composed of the pushing member

44 adapted for contacting with the banknotes stored in the storage space 40p of the second stacking unit 40 and then pushing the banknotes toward the opening (rightward in Figs. 3 and 4), and the pushing member driving mechanism 45 adapted for driving the pushing member 44 toward the opening.

[0055] Now, referring to Figs. 3, 4 and 6 through 10, the pushing member 44 and pushing member driving mechanism 45 constituting together the pushing unit will be described in more detail.

When driven by the pushing member driving mechanism 45, the pushing member 44 can be reciprocated, forward and rearward (or in the direction orthogonal to the sheet of Fig. 2 or leftward and rightward in Figs. 3 and 4), in the stacking unit 40. More specifically, the pushing member 44 can be reciprocated between a retracted position (see Fig. 3) in which the pushing member 44 is evacuated from the banknotes while the banknotes are stacked in the storage space 40p of the stacking unit 40 and a pushing position (see Fig. 4) located nearer to the opening of the stacking unit 40 relative to the retracted position. Namely, as shown in Fig. 3, the pushing member 44 waits in the retracted position, while the banknotes are stacked in the stacking unit 40. Meanwhile, once the banknotes are stored in the storage space 40p of the stacking unit 40, the pushing member 44 is moved from the retracted position to the pushing position, as shown in Fig. 4, while pushing the banknotes stored in the storage space 40p toward the opening. Thereafter, the pushing member 44 is returned from the pushing position (see Fig. 4) to the retracted position (see Fig. 3). This reciprocation of the pushing member 44 is performed by the aforementioned pushing member driving mechanism 45.

[0056] As shown in Figs. 6 through 10, the pushing member 44 is composed of a front-stage portion 44a bent by approximately 120° and formed of a plate-like member, and a rear-stage portion 44b fixedly attached to the front-stage portion 44a. The rear-stage portion 44b has a pushing face 44c provided for contacting with the banknotes stored in the storage space 40p and pushing the banknotes toward the opening. When in the retracted position, as shown in Fig. 6, the front-stage portion 44a constitutes a part of a bottom face and a side face of the storage space 40p. However, when moved to the pushing position, as shown in Fig. 7, the front-stage portion 44a will be hidden under each back side of the bottom plate 40b and side wall 40d. More specifically, as shown in Figs. 6 and 7, the front-stage portion 44a has a comb-like shape that can be meshed with the back face of the bottom plate 40b. This configuration can securely prevent the banknotes stored in the storage space 40p from getting into a gap between the bottom plate 40b constituting the storage space 40p and the front-stage portion 44a, thus avoiding occurrence of jam of such banknotes and other like trouble in the second stacking unit 40.

[0057] As shown in Figs. 6 and 7, the rear-stage portion 44b of the pushing member 44 is fixed to a rear part of the front-stage portion 44a. When in the retracted posi-

tion, as shown in Fig. 6, the pushing face 44c of the rear-stage portion 44b constitutes a part of a rear face of the storage space 40p. Meanwhile, when moved to the pushing position, as shown in Fig. 7, the rear-stage portion 44b will be advanced into the storage space 40p. In this case, as shown in Figs. 6 and 7, the rear-stage portion 44b is also comb-shaped to be meshed with the rear side wall 40c. This configuration can securely prevent the banknotes stored in the storage space 40p from getting into a gap between the rear side wall 40c constituting the storage space 40p and the rear-stage portion 44b, thus positively avoiding occurrence of the jam of such banknotes and other like trouble in the second stacking unit 40.

[0058] As shown in Figs. 8 and 9, the pushing member driving mechanism 45 is composed of, for example, a motor, which can rotate a substantially rectangular first cam 46 about an axis 46a. A projection 46b is provided to the first cam 46. Further, a substantially rod-like second cam 47 is provided to connect the first cam 46 with the front-stage portion 44a of the pushing member 44. This second cam 47 can be rotated about an axis 47a located at a central portion of the cam 47. One end 47c of the second cam 47 is rotatably attached to a back face of the front-stage portion 44a, while the other end of the second cam 47 is provided with an elongated through-hole 47b extending along the second cam 47. In this through-hole 47b, the aforementioned projection 46b of the first cam 46 is fitted. Thus, when the first cam 46 is rotated about the axis 46a, the projection 46b of the first cam 46 will be reciprocated in the elongated through-hole 47b, thereby swaying the second cam 47 about the axis 47a. Further, as shown in Figs. 8 and 9, a guide rail 48 configured for guiding the front-stage portion 44a and rear-stage portion 44b of the pushing member 44 in a fixed direction (i.e., leftward and rightward in Figs. 8 and 9) is provided to the second stacking unit 40.

[0059] With the provision of the aforementioned cams 46, 47 between the pushing member driving mechanism 45 and the pushing member 44, when the pushing member driving mechanism 45 drives the first cam 46 to be rotated about the axis 46a in the clockwise direction in Fig. 8, the second cam 47 can be swayed about the axis 47a, between a position shown in Fig. 8 and a position shown in Fig. 9. As a result, the pushing member 44 attached to the one end 47c of the second cam 47 can be reciprocated, between the position as depicted in Figs. 6 and 8 (i.e., the retracted position) and the position as depicted in Figs. 7 and 9 (i.e., the pushing position), along the guide rail 48.

[0060] Even in the case the operation of the pushing member 44 is stopped because the banknotes are jammed between the bottom plate 40b and/or side wall 40d constituting the storage space 40p and the pushing member 44, during a period of time, in which the pushing member 44 is moved from the retracted position to the pushing position, and the like, the operator can take out such jammed banknotes by returning, by hand, the push-

ing member 44 from the pushing position to the retracted position.

[0061] Now, the operation of the banknote handling machine 1 as constructed above will be discussed.

[0062] First, the plurality of banknotes are placed on the hopper 11 in the stacked condition by the operator. Then, the banknotes stored in the hopper 11 are fed into the casing 92 of the banknote handling machine 1, one by one, by the banknote feeding unit 10. Thereafter, the banknotes taken in the casing 92 are transported by the transport unit 20. Specifically, the banknotes respectively taken in the casing 92 are transported, by the upper transport mechanism 22, intermediate transport mechanism 26 and lower transport mechanism 24, in this order.

[0063] While the banknotes are transported by the transport unit 22, each banknote is detected by the recognition unit 28, regarding the fitness, authenticity, denomination, orientation, face/back, transported condition and the like thereof. In this case, the banknotes that cannot be recognized by the recognition unit 28 (e.g., the damaged unfit banknotes or the like) and/or banknotes that have been excluded from the banknotes, to be stored in each stacking unit 30, 40, because of their abnormal transported condition (e.g., the obliquely transported condition or the like), even after they have been sufficiently recognized, are judged to be the "rejected banknotes" to be fed to the reject unit 50, respectively. Meanwhile, the banknotes that have satisfied predetermined conditions and thus been judged to be the normal banknotes by the recognition unit 28 are recognized as the banknotes to be stored in either one of the stacking units 30, 40, respectively.

[0064] Thereafter, the banknotes are fed to the lower transport mechanism 24 from the upper transport mechanism 22 via the intermediate transport mechanism 26. From among the banknotes transported by the lower transport mechanism 24, the normal banknotes will be diverted from the lower transport mechanism 24 and fed to each of the stacking units 30, 40, by actuation of the diverters 60, 62, respectively. Meanwhile, if some of the banknotes transported by the upper transport mechanism 22 are judged to be the "rejected banknotes" by the recognition unit 28, such rejected banknotes are directly fed to the reject unit 50.

[0065] In this way, the banknotes fed to each stacking unit 30, 40 from the lower transport mechanism 24 will be stored in the corresponding storage space 30p or 40p, in the stacked condition.

Then, the batch of the banknotes stored in each storage space 30p, 40p of the stacking units 30, 40 is pushed toward the opening of each stacking unit 30, 40 by the pushing member 44. More specifically, the control unit 90 controls the pushing member driving mechanism 45 to reciprocate the pushing member 44 between the retracted position as shown in Fig. 3 and the pushing position as shown in Fig. 4, thus performing the pushing operation for the batch of the banknotes by using the pushing member 44.

[0066] As the method for controlling the pushing member driving mechanism 45 by using the control unit 90, various methods can be mentioned. Now, such control methods will be described.

[0067] In a first control method, for example, in the case the sensor 77 detects that a predetermined number of banknotes are fed to the second stacking unit 40, the control unit 90 controls the pushing member driving mechanism 45 to drive the pushing member 44 of the second stacking unit 40, such that the banknotes stored in the storage space 40p can be pushed toward the opening of the stacking unit 40. According to this first control method, the banknotes stored in the storage space 40p can be pushed toward the opening, for each batch of the predetermined number of banknotes. Therefore, the operator can take out the banknotes from the second storage unit 40, for each batch of the predetermined number of banknotes. It is noted that the control operation for the pushing member can also be performed, in the same manner, in accordance with this first control method, in the case such a predetermined number of banknotes are not fed to the second stacking unit 40, but fed to the first stacking unit 30 and then the sensor 76 detects the predetermined number of banknotes fed in the first stacking unit 30.

[0068] In this case, if the first stacking unit 30 and second stacking unit 40 are respectively configured to store therein the banknotes of the same denomination and when the number of the banknotes stored in either one of the first or second stacking unit 30 or 40 reaches the maximum storage number thereof before all of the predetermined number of banknotes are fed to this first or second stacking unit 30 or 40, the remaining banknotes may be continuously fed to the other stacking unit in which the number of banknotes stored therein has not yet reached the maximum storage number. Further, in this case, when the sensors 76, 77 respectively detect that the predetermined number of banknotes have been fed into the first and second stacking units 30, 40, while being appropriately divided thereto, the pushing members of the stacking units 30, 40 will be controlled to push such banknotes stored in the storage spaces 30p, 40p toward the openings thereof, respectively.

[0069] In a second control method, for example, in the case the number of banknotes stored in the second stacking unit 40 reaches the predetermined maximum storage number assigned to this second stacking unit 40, the control unit 90 controls the pushing member driving mechanism 45 to drive the pushing member 44 of the second stacking unit 40, such that the banknotes stored in the storage space 40p can be pushed toward the opening of the stacking unit 40. According to this second control method, when the banknotes can no longer be stored in the second stacking unit 40, the banknotes stored in the storage space 40p are pushed toward the opening of the second stacking unit 40. Thus, the operator can take out the batch of banknotes corresponding to the maximum storage number assigned to the second storage unit 40.

Again, it is noted that the control operation for the pushing member can also be performed, in the same manner, in accordance with this second control method, in the case the maximum storage number of banknotes are not fed to the second stacking unit 40, but fed to the first stacking unit 30.

[0070] In a third control method, for example, in the case the sensor 77 detects that the predetermined number of banknotes are fed to the second stacking unit 40, the control unit 90 interrupts the transportation of the banknotes due to the transport unit 20. Then, the control unit 90 controls the pushing member driving mechanism 45 to drive the pushing member 44 of the second stacking unit 40, such that the banknotes stored in the storage space 40p can be pushed toward the opening of the stacking unit 40. Thereafter, when the sensor 81 detects that the banknotes once pushed toward the opening by the pushing member 44 in the second stacking unit 40 have been taken out from the stacking unit 40, the control unit 90 will restart the transportation of the banknotes by using the transport unit 20. With this third control method, the operator can take out the banknotes from the second stacking unit 40, for each batch of the predetermined number of banknotes. Besides, the storage of the banknotes into each stacking unit 30, 40 can be automatically restarted, after the operator takes out the batch of banknotes from the second stacking unit 40. Again, it is noted that the control operation for the pushing member can also be performed, in the same manner, in accordance with this third control method, in the case the predetermined number of banknotes are not fed to the second stacking unit 40, but fed to the first stacking unit 30. Further, in this case, it is noted that the transportation of the banknotes by the transport unit 20 is interrupted until the banknotes are taken out from the first stacking unit 30.

[0071] Further, in a fourth control method, for example, in the case the sensor 77 detects that the predetermined number of banknotes are fed to the second stacking unit 40 (see Fig. 10(a)), the control unit 90 interrupts the transportation of the banknotes by the transport unit 20. Then, the control unit 90 controls the pushing member driving mechanism 45 to drive the pushing member 44 of the second stacking unit 40, such that the banknotes stored in the storage space 40p can be pushed toward the opening of the stacking unit 40 (see Fig. 10(b)). Once the banknotes are pushed toward the opening by the pushing member 44 in the second stacking unit 40, the control unit 90 will restart the transportation of the banknotes by using the transport unit 20. As a result, the banknotes will be newly fed over the top face of the banknotes already pushed toward the opening in the second stacking unit 40 (see Fig. 10(c)). With this fourth method, the banknotes can be shifted in position, in the second stacking unit 40, for each batch of the predetermined number of banknotes, as shown in Fig. 10(c). Therefore, the operator can take out the banknotes from the second stacking unit 40, for each batch of the predetermined number of banknotes. Again, it is noted that the control operation

for the pushing member can also be performed, in the same manner, in accordance with this fourth control method, in the case the predetermined number of banknotes are not fed to the second stacking unit 40, but fed to the first stacking unit 30. In addition, it is noted that the banknotes can also be shifted in position, in the first stacking unit 30, for each batch of the predetermined number of banknotes.

[0072] In a fifth control method, when the transportation of the banknotes to the respective stacking units 30, 40 by the transport unit 20 is ended, the control unit 90 controls the respective pushing members of the first and second stacking units 30, 40, such that the banknotes stored in the respective storage spaces 30p, 40p can be pushed toward the openings of the stacking units 30, 40, respectively. According to this fifth control method, the operator can take out the batch of banknotes from each stacking unit 30, 40, after the completion of the transportation of the banknotes to each stacking unit 30, 40.

[0073] By employing any one of the above first to fifth control methods, or otherwise by utilizing any other suitable control method, the banknotes stored in each storage space 30p, 40p of the stacking units 30, 40 can be pushed toward the opening of each stacking unit 30, 40 with desired timing.

[0074] As described above, according to the banknote handling machine 1 of this embodiment, the banknotes stored in the relatively rearward portion of each storage space (e.g., the storage space 40p) of the stacking units (e.g., the second stacking unit 40) can be pushed toward the opening of the stacking unit 40 (or pushed forward when seen on the operator side) by the pushing member 44. Therefore, the operator can readily take out the banknotes stored in the storage space 40p of the second stacking unit 40. Furthermore, the banknotes stored in the second stacking unit 40 in the abnormal stacked condition, more specifically, the banknotes stored in the second stacking unit 40 in the standing state, can also be pushed toward the opening of the stacking unit 40. Thus, the banknote handling machine 1 of this embodiment can securely prevent the banknotes stored in the abnormal stacked condition from being left in the stacking unit (e.g., the second stacking unit 40), without being taken out by the operator.

[0075] As described above, the plurality of stacking units are provided in the banknote handling machine 1, and the pushing members are provided, corresponding to the number of the stacking units (i.e., the stacking units 30, 40 in the above embodiment). Therefore, the banknotes can be stored in the respective stacking units 30, 40, while being sorted for each kind thereof, e.g., for each denomination thereof.

[0076] It should be noted that the banknote handling machine 1 of this invention is not limited to the aspects as described above, but various alterations and modifications can be made thereto without departing from the scope of this invention.

[0077] For instance, the number of the stacking units

provided to the banknote handling machine 1 is not limited to two, but may be three or more. In this case, the pushing units respectively composed of the pushing members and pushing member driving mechanisms are provided, corresponding to the number of the stacking units.

[0078] In addition, each stacking unit is not limited to one configured for storing therein the banknotes in the stacked condition. For instance, each stacking unit may be provided for storing therein the banknotes in the standing state.

[0079] Further, the control method provided by the control unit 90 for controlling the pushing member driving mechanism 45 is not limited to those described above. For instance, the control unit 90 may control the pushing members of the respective stacking units 30, 40 to push the banknotes, in the case the unit 90 confirms the completion of the recognition for the banknotes performed by the recognition unit 28 as well as the completion of the transportation of the banknotes into the stacking units 30, 40 performed by the transport unit 20, while controlling the pushing members of the respective stacking units 30, 40 not to push the banknotes, in the case the unit 90 does not confirm the completion of the recognition for the banknotes and/or completion of the transportation of the banknotes.

[0080] In one variation, as shown in Fig. 11, the pushing member 49 can be moved, with the banknotes stacked on a top face thereof. Further, the banknotes stacked on the pushing member 49 can be moved, together with the pushing member 49. In this case, as shown in Fig. 11, sensors 83, 84, 85, each adapted for detecting the position of the pushing member 49, are provided to the pushing unit. With this configuration, the pushing member driving mechanism 45 can stop the pushing member 49 in a plurality of positions, based on each detection information on the pushing member 49 obtained from the respective sensors 83, 84, 85. Again, the pushing member 49 is comb-shaped to be meshed with each side wall 40a, 40d constituting the storage space 40p in the stacking unit 40.

[0081] Now, this variation will be further described with reference to Fig. 11. First, as shown in Fig. 11(a), the banknotes are stacked on the top face of the pushing member 49, while a rear end (i.e., a left end in Fig. 11) of the pushing member 49 is detected by the first sensor 83. Next, the pushing member 49 is moved forward (or rightward in Fig. 11) (see Fig. 11(b)), and thereafter the banknotes are newly stacked on the pushing member 49, while the rear end of the pushing member 49 is detected by the second sensor 84 (see Fig. 11(c)). Then, the pushing member 49 is further moved forward (see Fig. 11(d)), and thereafter the banknotes are further stacked on the pushing member 49, while the rear end of the pushing member 49 is detected by the third sensor 85 (see Fig. 11(e)). In this way, as shown in Fig. 11(e), the banknotes can be shifted in position, for each batch of the predetermined number of banknotes, on the push-

ing member 49.

[0082] As described above, according to the aforementioned variation as shown in Fig. 11, the pushing member 49 can be stopped in the plurality of positions. Thus, the banknotes stacked on the pushing member 49 can also be stopped in the plurality of positions. Therefore, the banknotes can be shifted in position, for each batch of the predetermined number of banknotes, thus enabling the operator to take out the banknotes, for each batch of the predetermined number of banknotes, from the stacking unit.

[0083] In another variation, as shown in Figs. 12(a), 12(b), each stacking unit (e.g., the second stacking unit 40) may further include a banknote arranging member 40f adapted for contacting with and arranging one edge of each banknote pushed toward the opening of the stacking unit 40 (or rightward in Fig. 12) by the pushing member 44. This banknote arranging member 40f is provided to usually extend upward, at one end of the bottom plate 40b of the stacking unit 40. With this configuration, the banknote arranging member 40f can readily arrange the edge of each banknote pushed toward the opening of the stacking unit 40 by the pushing member 44.

[0084] Further, as depicted by a two-dot chain line in Fig. 12(b), the banknote arranging member 40f may be inclined forward and downward (or rightward and downward as shown in Fig. 12) in a direction in which the banknotes are taken out from the stacking unit 40. With such configuration for allowing the banknote arranging member 40f to be inclined from the position depicted by a solid line to the position depicted by the two-dot chain line as shown in Fig. 12(b), the operator can readily take out each batch of the banknotes forward from the stacking unit 40.

[0085] In still another variation, as shown in Fig. 13, a dust collector may be provided to each stacking unit 30, 40 of the banknote handling machine 1.

More specifically, the dust collector is composed of a duct 94 communicated with each storage space 30p, 40p via each opening 30h, 40h formed in the rear side wall 30c or 40c of the stacking unit 30 or 40, a fan 96 provided on the downstream side of the duct 94, and a filter 98 connected with the fan 96. Thus, when the fan 96 is actuated, dust or the like matter present in each storage space 30p, 40p of each stacking unit 30, 40 can be drawn by the duct 94 via each opening 30h, 40h provided in each rear side wall 30c, 40c. Then, the dust drawn into the duct 94 is fed to the filter 98 due to the actuation of the fan 96. As a result, such dust or the like can be collected in the filter 98, while the air, from which the dust or the like is removed, can be released to the outside of the casing 92 from the fan 96.

[0086] This configuration of the banknote handling machine 1 as shown in Fig. 13 can prevent the dust or the like matter from being accumulated on and around the sensors 78, 79, 80, 81 and the like respectively provided to each stacking unit 30, 40, thereby successfully avoiding occurrence of errors due to failures and/or malfunctioning.

tions of such sensors. Further, this configuration can positively prevent the operator from inadvertently inhaling the dust or the like accumulated in each stacking unit 30, 40. In addition, since the dust or the like matter can be collected in the filter 98, the operator can readily remove such dust or the like, which would be otherwise accumulated in each stacking unit 30, 40, by cleaning the filter 98.

Claims

1. A paper sheet handling machine, which is configured to take paper sheets therein from the exterior and then store the paper sheets in the interior thereof, and comprises:

a stacking unit having a storage space provided therein and an opening formed in a side face thereof, the storage space being configured to store therein the paper sheets taken in the machine from the exterior, while the opening is configured to allow the paper sheets stored in the storage space to be taken out therethrough;
a transport unit configured to transport the paper sheets taken in the machine from the exterior, toward the stacking unit; and
a pushing unit configured to push the paper sheets stored in the storage space of the stacking unit, toward the opening.

2. The paper sheet handling machine according to claim 1,
wherein the stacking units are provided in a plural number, while the pushing units are also provided in the plural number, corresponding to the respective stacking units.

3. The paper sheet handling machine according to claim 1, further comprising:

a first detector provided to the transport unit and configured to detect each paper sheet transported by the transport unit; and
a control unit configured to control the pushing unit,

wherein the control unit controls the pushing unit to push the paper sheets stored in the storage space of the stacking unit toward the opening, in the case the first detector detects that a predetermined number of paper sheets are fed to the stacking unit.

4. The paper sheet handling machine according to claim 1, further comprising the control unit configured to control the pushing unit,
wherein the control unit controls the pushing unit to push the paper sheets stored in the storage space of the stacking unit toward the opening, in the case

the number of the paper sheets stored in the stacking unit reaches a predetermined maximum storage number assigned to the stacking unit.

5. The paper sheet handling machine according to claim 3, further comprising a second detector provided to the stacking unit and configured to detect whether or not the paper sheets are stored in the storage space of the stacking unit,
wherein the control unit is configured to control the pushing unit as well as control the transport unit, and wherein the control unit controls the pushing unit and transport unit to interrupt the transportation of the paper sheets by the transport unit, in the case the first detector detects that the predetermined number of paper sheets are fed to the stacking unit, while controlling the pushing unit and transport unit to restart the transportation of the paper sheets by the transport unit, in the case the second detector detects that the paper sheets, which have been pushed toward the opening by the pushing unit in the stacking unit, are taken out from the stacking unit.

6. The paper sheet handling machine according to claim 3,
wherein the control unit is configured to control the pushing unit as well as control the transport unit, and wherein the control unit controls the pushing unit and transport unit to interrupt the transportation of the paper sheets by the transport unit, in the case the first detector detects that the predetermined number of paper sheets are fed to the stacking unit, while controlling the pushing unit and transport unit to restart the transportation of the paper sheets by the transport unit, after the paper sheets are pushed toward the opening by the pushing unit in the stacking unit, thereby newly feeding the paper sheets onto a top face of the paper sheets that have been pushed toward the opening.

7. The paper sheet handling machine according to claim 1, further comprising the control unit configured to control the pushing unit,
wherein the control unit controls the pushing unit to push the paper sheets stored in the storage space of the stacking unit toward the opening, in the case the transportation of the paper sheets to the stacking unit by the transport unit is ended.

8. The paper sheet handling machine according to claim 1,
wherein the storage space provided in the stacking unit is composed of a space surrounded by a bottom face and one or more side faces of the stacking unit, wherein one of the side faces has a stacking wheel attached thereto, the stacking wheel being configured to stack each paper sheet fed to the stacking unit from the transport unit, in the storage space, and

wherein the bottom face constituting the storage space is downwardly inclined toward the one side face having the stacking wheel attached thereto.

9. The paper sheet handling machine according to claim 1,
wherein the storage space provided in the stacking unit is composed of the space surrounded by the bottom face and one or more side faces of the stacking unit, and
wherein a cut-out portion is formed in the bottom face, at one edge thereof on the side of the opening of the stacking unit. 5
10. The paper sheet handling machine according to claim 1,
wherein the pushing unit includes a pushing member configured to contact with the paper sheets stored in the storage space of the stacking unit and then push the paper sheets toward the opening, and a pushing member driving mechanism configured to drive the pushing member toward the opening. 10
11. The paper sheet handling machine according to claim 10,
wherein the pushing member can be reciprocated between a retracted position in which the pushing member is evacuated from the paper sheets while the paper sheets are stacked in the storage space and a pushing position in which the pushing member approaches the opening from the retracted position, and
wherein the pushing member waits in the retracted position during a period of time in which the paper sheets are stacked in the stacking unit, while pushing the paper sheets stored in the storage space toward the opening, when the pushing member is moved from the retracted position to the pushing position. 20
12. The paper sheet handling machine according to claim 11,
wherein when in the retracted position, the pushing member constitutes a rear side face of the storage space of the stacking unit, and
wherein the pushing member is comb-shaped to be meshed with the other side face and bottom face constituting together the storage space of the stacking unit. 25
13. The paper sheet handling machine according to claim 10,
wherein the pushing member is configured so that the paper sheets can be stacked on a top face of the pushing member, and the paper sheets stacked on the pushing member can be moved together with the pushing member, and
wherein the pushing member is comb-shaped to be meshed with the side face constituting the storage 30

space of the stacking unit.

14. The paper sheet handling machine according to claim 13,
wherein the pushing unit includes a plurality of third detectors, each configured to detect the position of the pushing member, and
wherein the pushing member driving mechanism can stop the pushing member in a plurality of positions, based on each detection information obtained from the third detectors. 35
15. The paper sheet handling machine according to claim 1,
wherein the opening of the stacking unit is provided, such that the direction in which the paper sheets are taken out from the opening can be substantially orthogonal to the direction in which the paper sheets are fed to the stacking unit from the transport unit. 40
16. The paper sheet handling machine according to claim 15,
wherein the direction in which the paper sheets are fed to the stacking unit from the transport unit corresponds to the short-edge direction of each paper sheet. 45
17. The paper sheet handling machine according to claim 15,
wherein the direction in which the paper sheets are fed to the stacking unit from the transport unit corresponds to the long-edge direction of each paper sheet. 50
18. The paper sheet handling machine according to claim 1,
wherein the stacking unit further includes a paper sheet arranging member configured to contact with each edge of the paper sheets pushed toward the opening by the pushing member, thereby arranging the edges of the respective paper sheets. 55
19. The paper sheet handling machine according to claim 18,
wherein the paper sheet arranging member can be moved in the direction in which the paper sheets are taken out from the stacking unit.

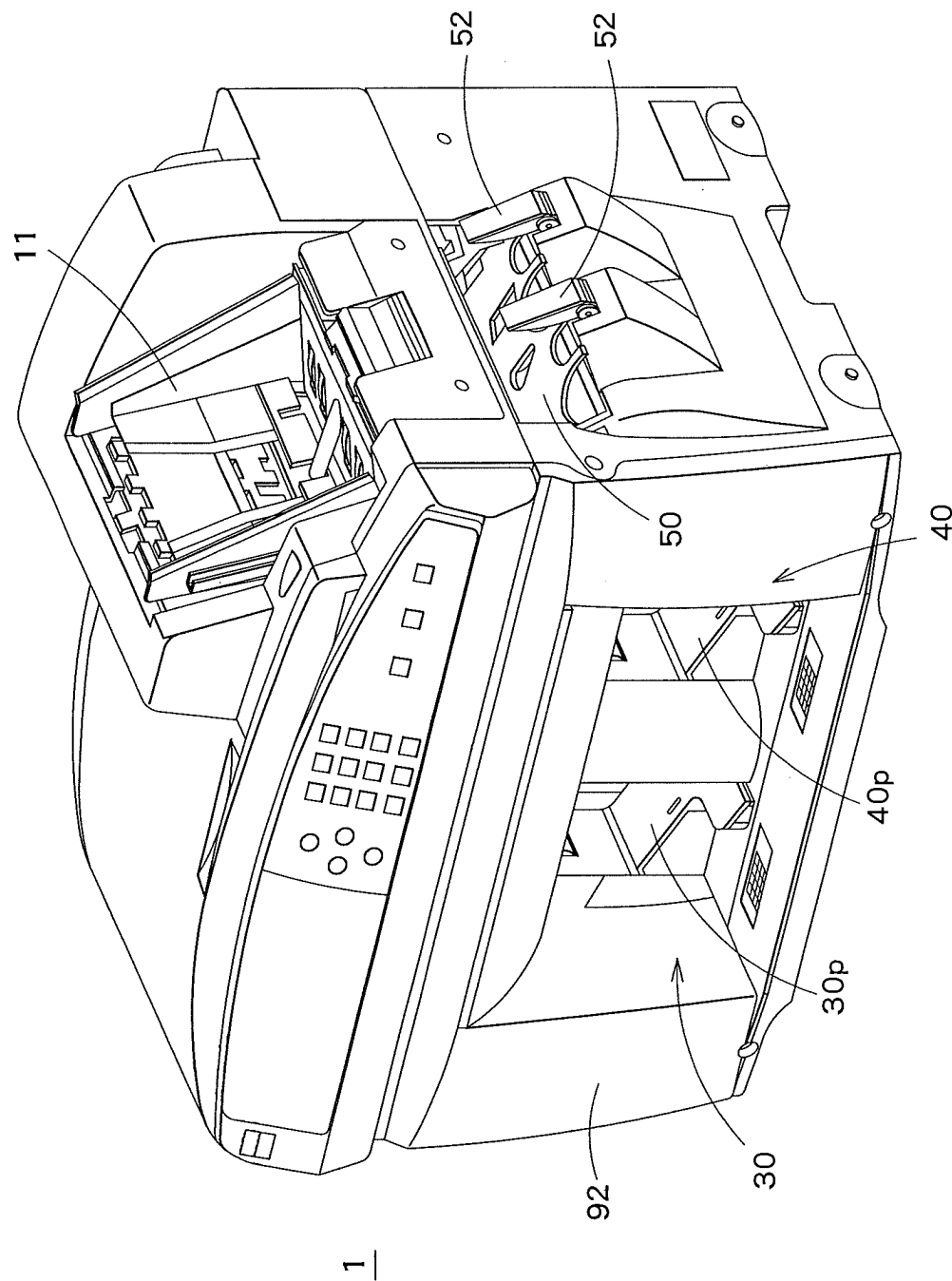


FIG. 1

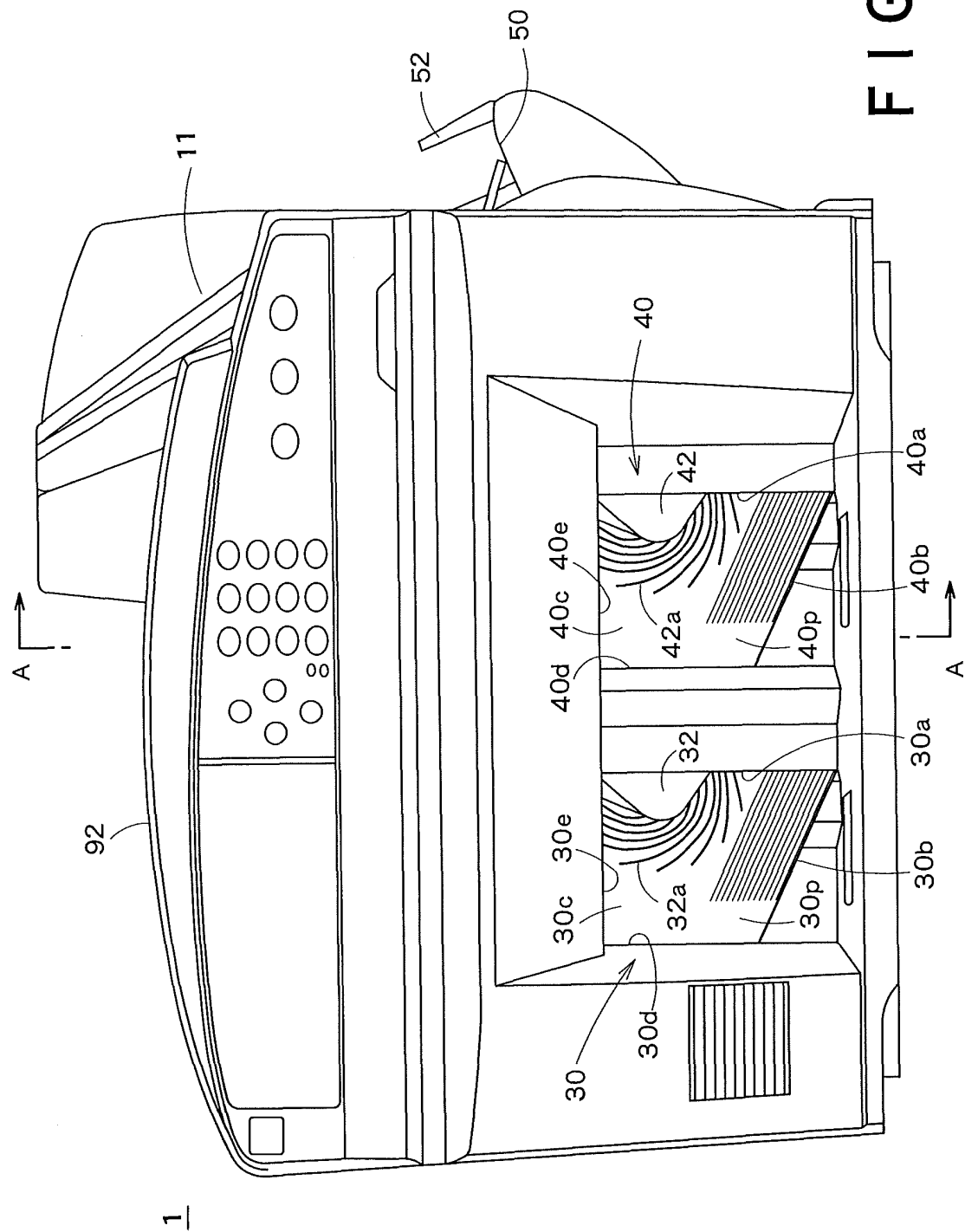


FIG. 2

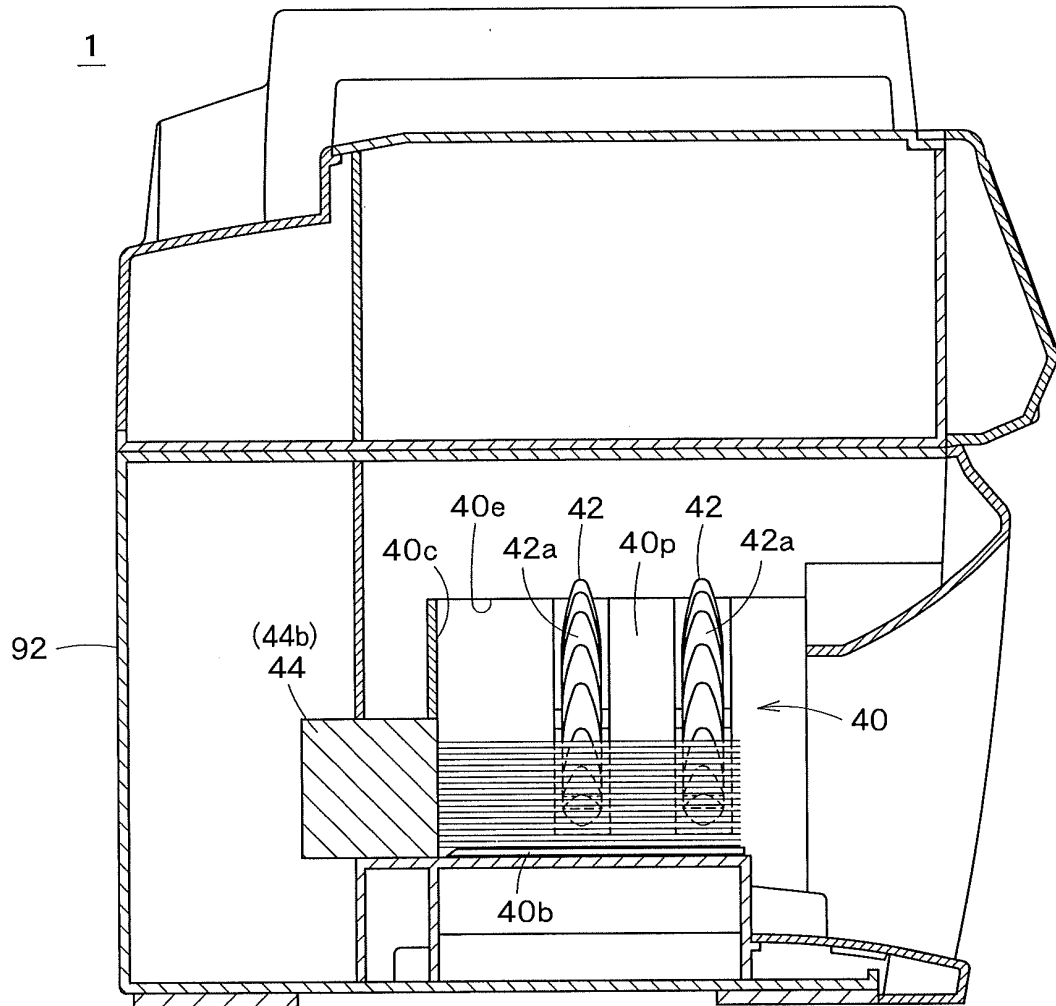


FIG. 3

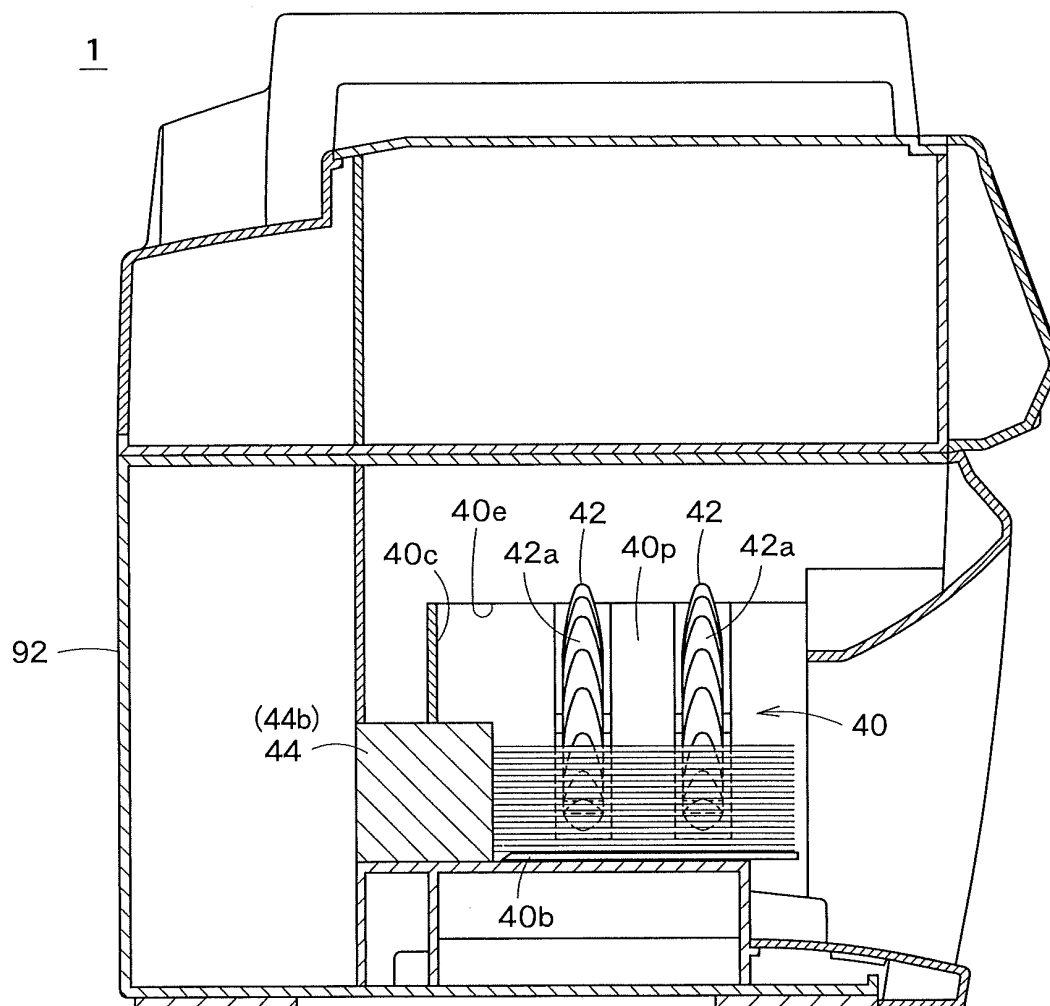


FIG. 4

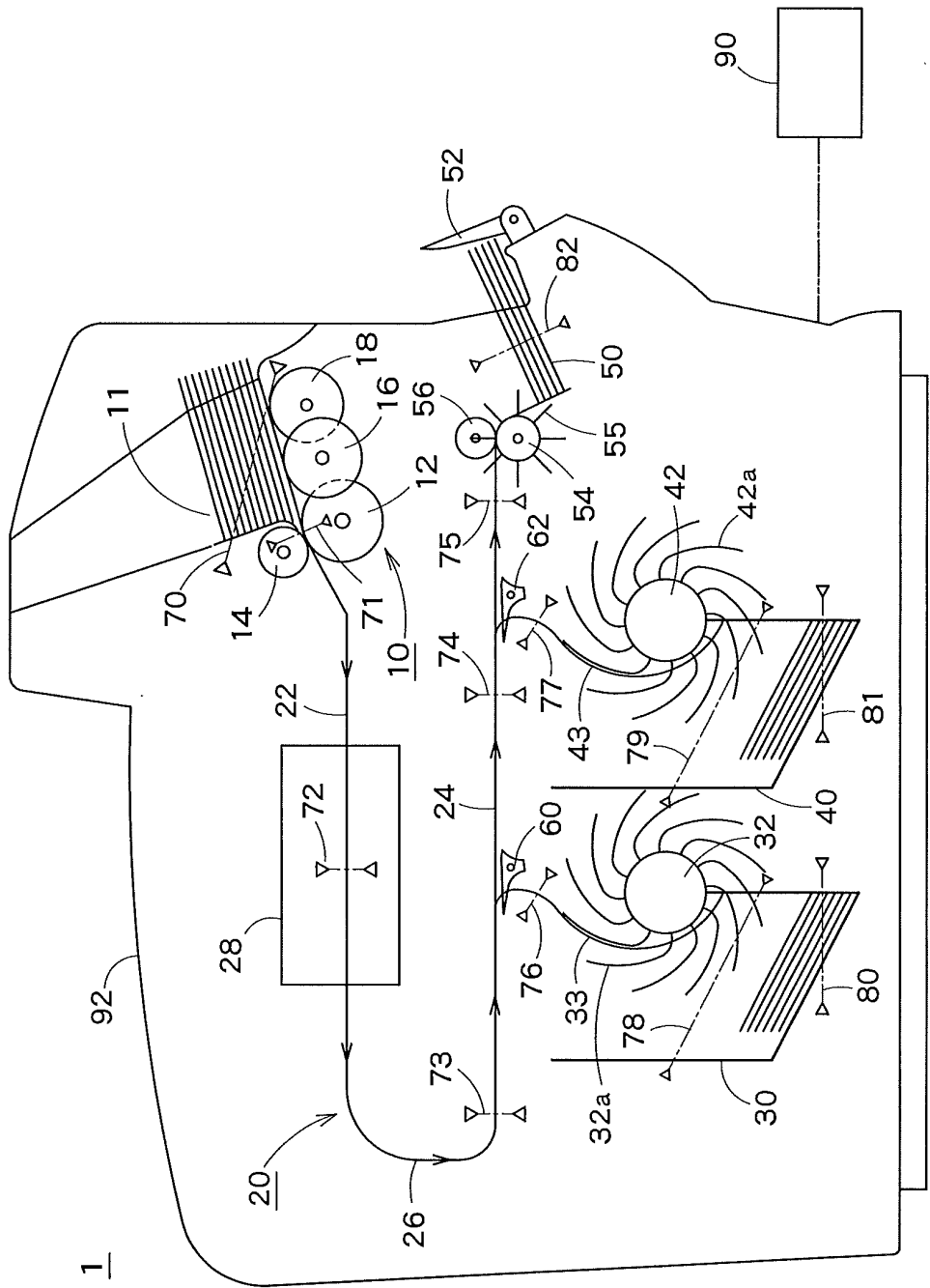


FIG. 5

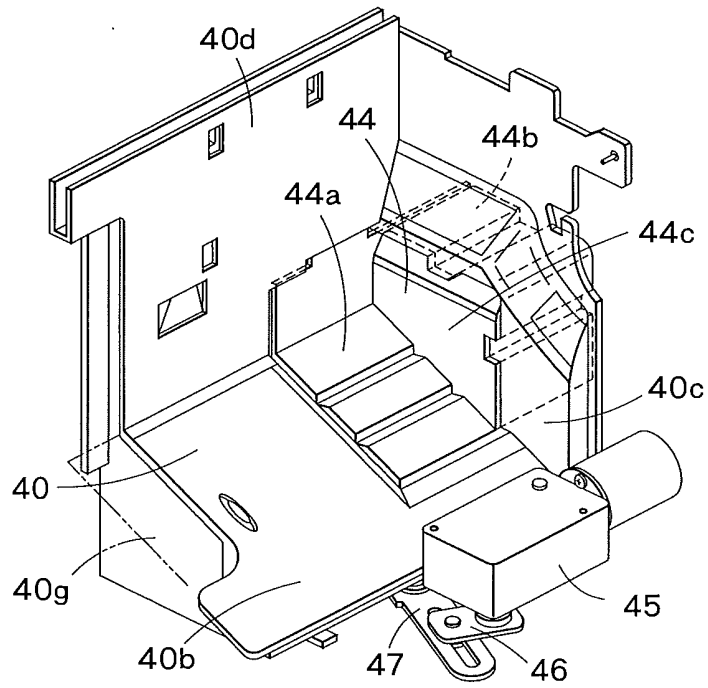


FIG. 6

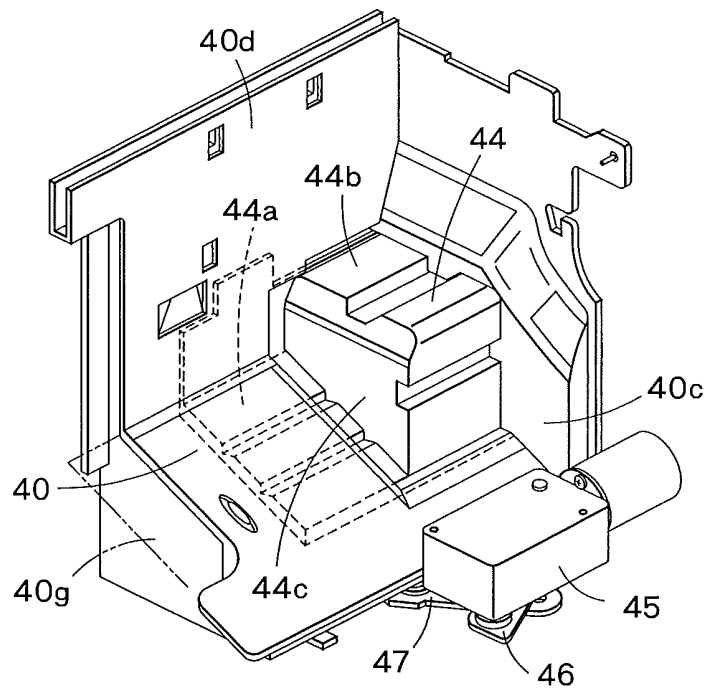


FIG. 7

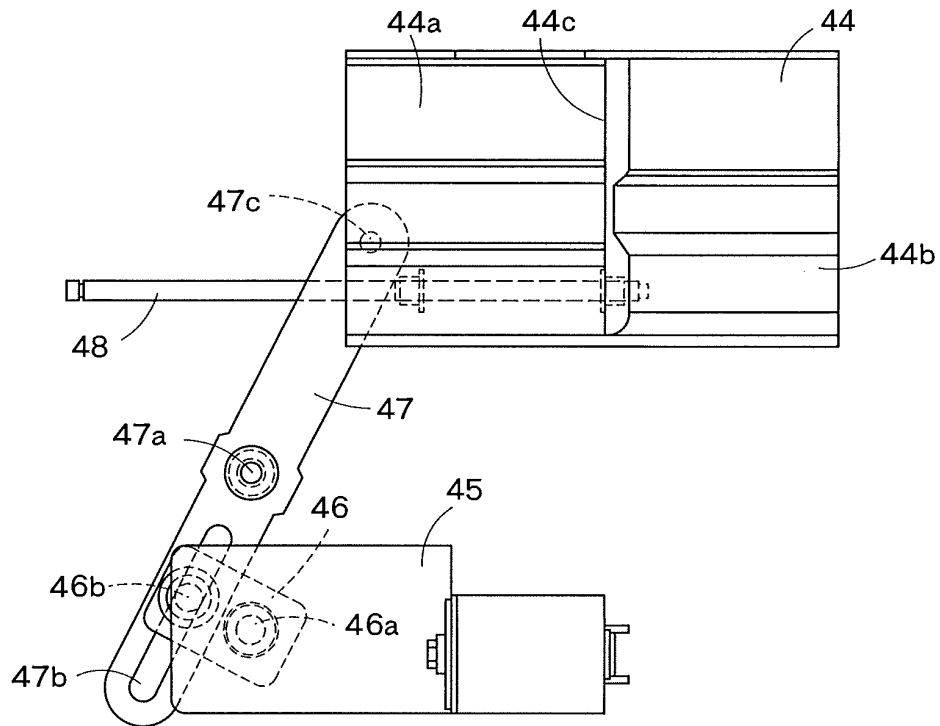


FIG. 8

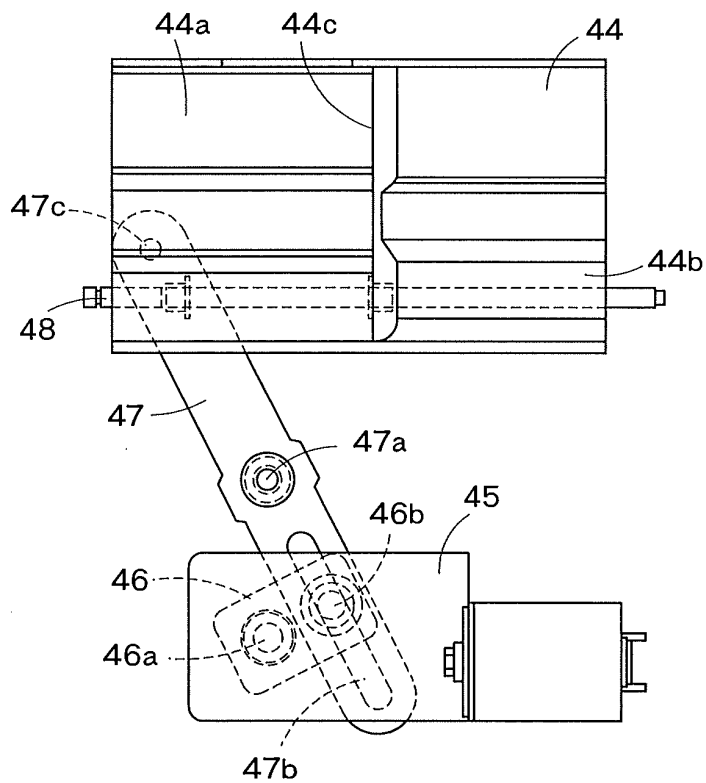


FIG. 9

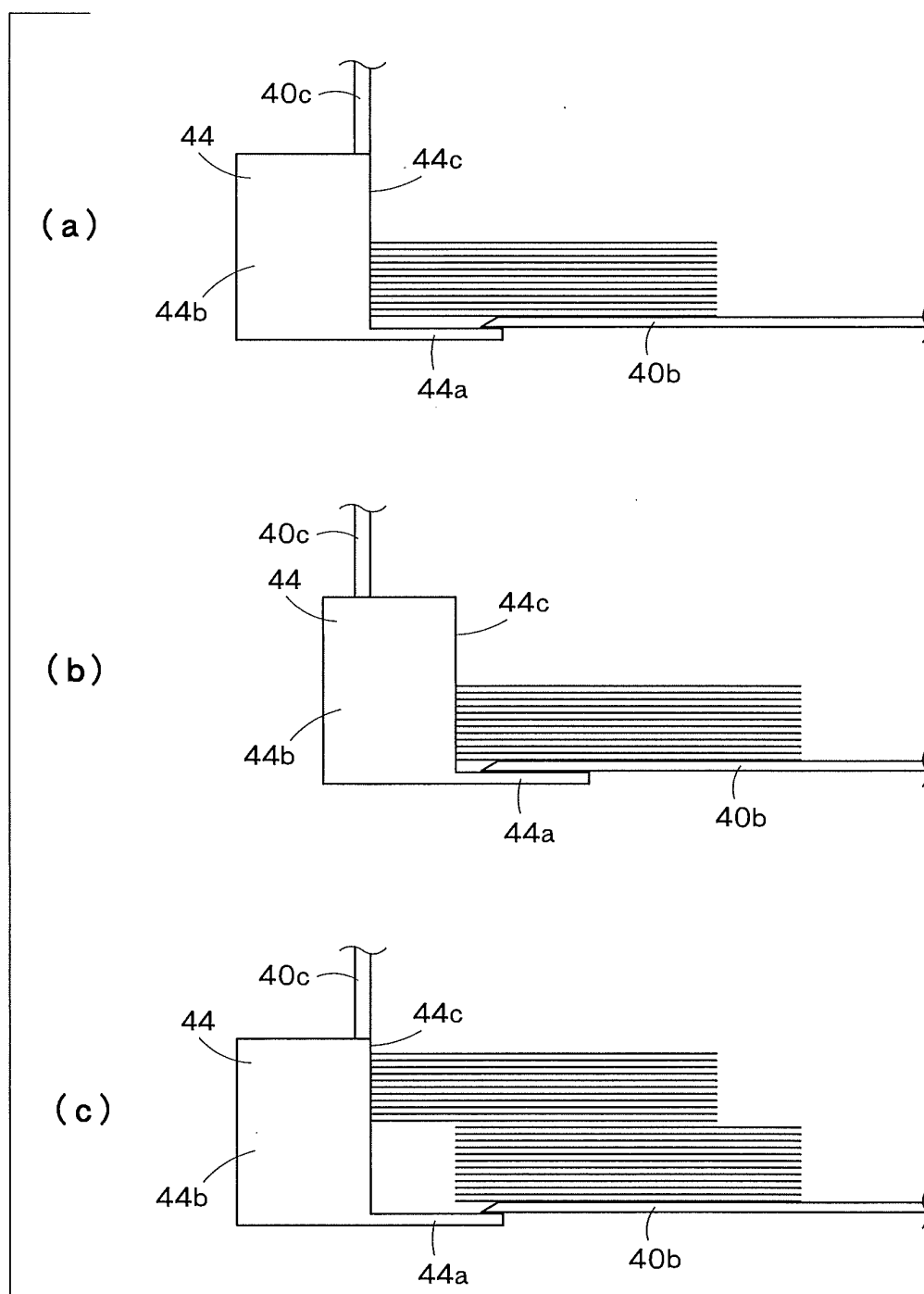


FIG. 10

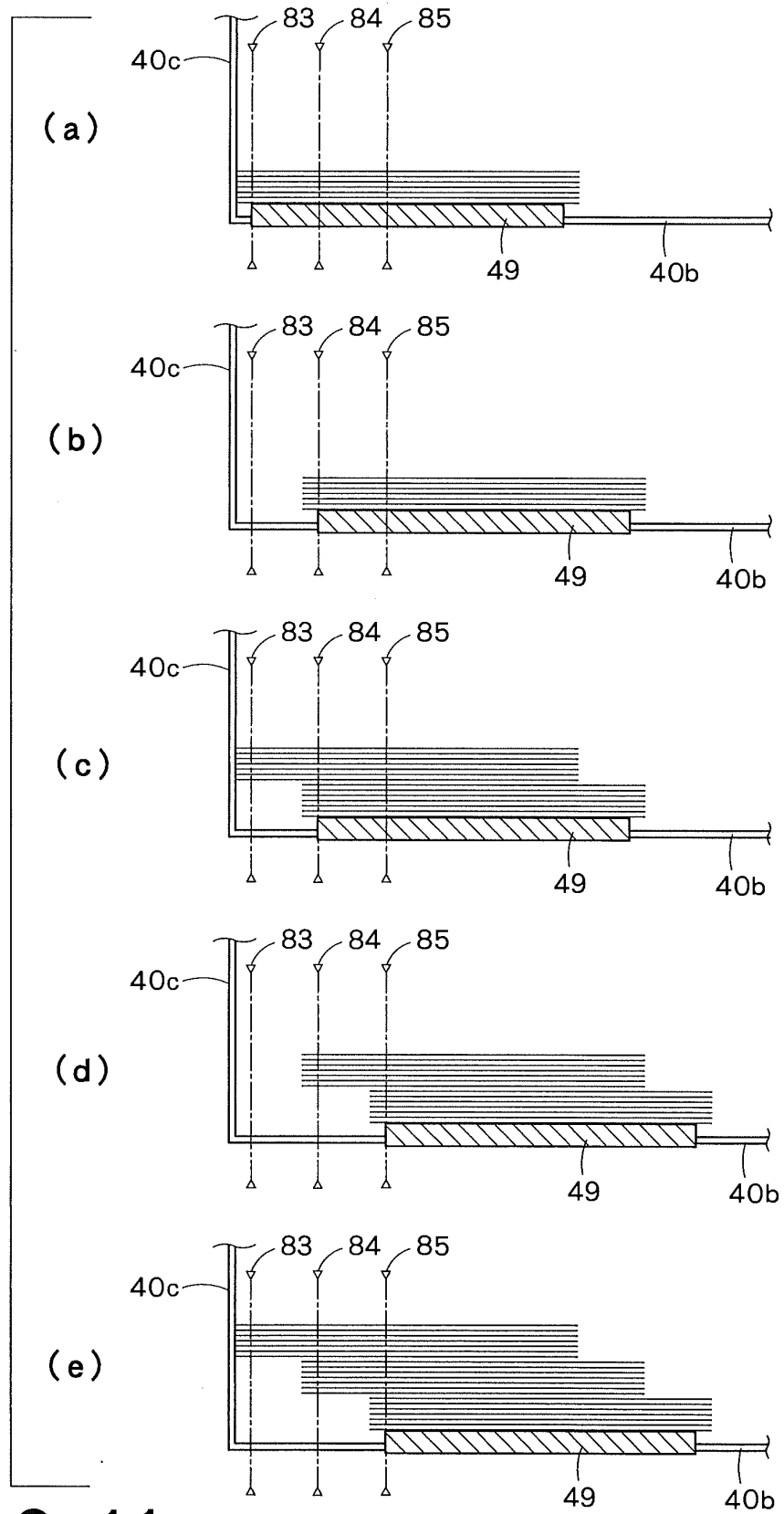


FIG. 11

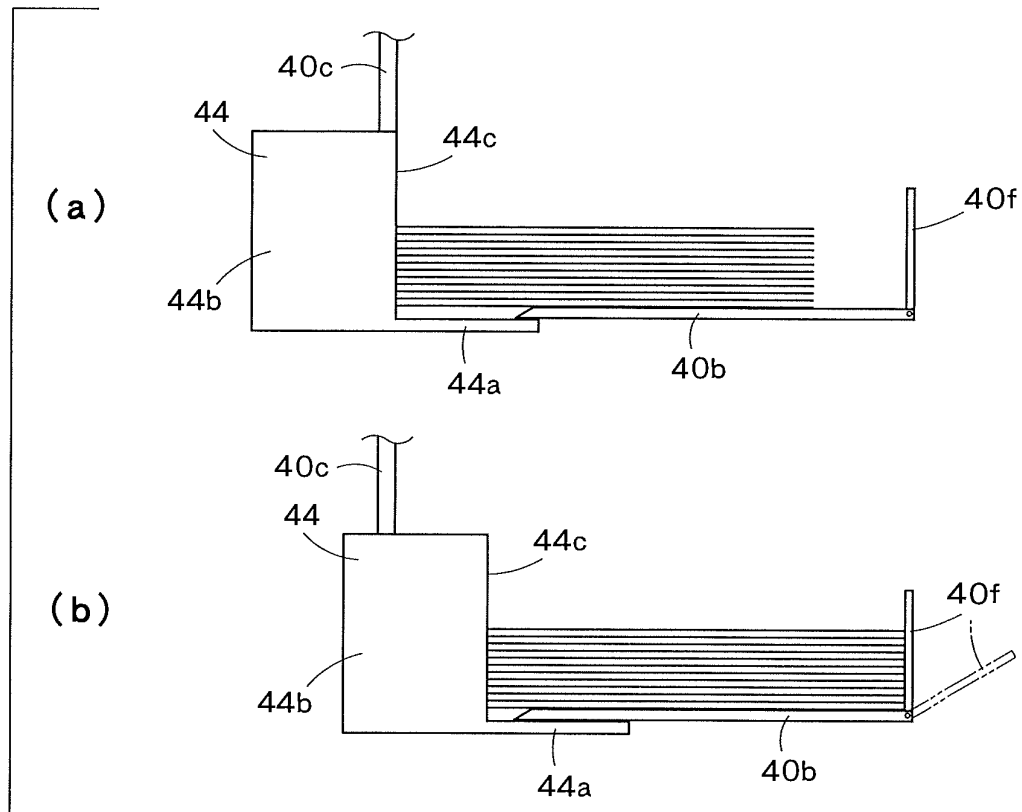


FIG. 12

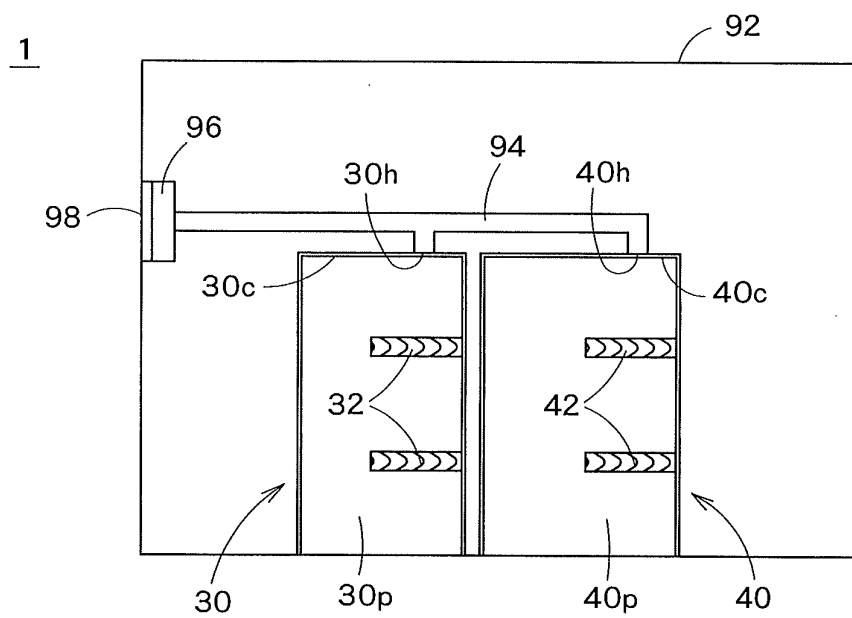


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/066916

A. CLASSIFICATION OF SUBJECT MATTER

G07D9/00(2006.01)i, B65H29/22(2006.01)i, G07D1/00(2006.01)i, G07D11/00(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, B65H29/22, G07D1/00, G07D11/00

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 1996-2007
 Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007

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.
Y	JP 2002-74464 A (Glory Ltd.), 15 March, 2002 (15.03.02), Par. Nos. [0014] to [0021]; Figs. 1, 3 & US 2002-0043443 A1 & EP 001184817 A2 & CN 001340792 A & AU 006553501 A & TW 000501077 B & AU 000780856 B & HK 001045208 A	1-19
Y	JP 62-6279 B2 (Laurel Bank Machines Co., Ltd.), 09 February, 1987 (09.02.87), Column 9, lines 6 to 34; Figs. 7, 8 (Family: none)	1-19

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

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Date of the actual completion of the international search
12 November, 2007 (12.11.07)Date of mailing of the international search report
11 December, 2007 (11.12.07)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/066916

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 3-110695 A (Laurel Bank Machines Co., Ltd.), 10 May, 1991 (10.05.91), Page 7, lower right column, line 10 to page 8, upper left column, line 13; Figs. 2, 4 (Family: none)	3-6
Y	JP 2001-240295 A (Ricoh Co., Ltd.), 04 September, 2001 (04.09.01), Par. Nos. [0180] to [0205]; Figs. 19 to 22 (Family: none)	6, 11, 12, 18, 19
Y	JP 6-298435 A (Canon Inc.), 25 October, 1994 (25.10.94), Par. Nos. [0082] to [0124]; Figs. 6 to 9 (Family: none)	6, 13, 14
Y	JP 2000-247519 A (Nagano Nihon Musen Kabushiki Kaisha), 12 September, 2000 (12.09.00), Par. Nos. [0034] to [0037]; Figs. 7, 8 (Family: none)	6, 13, 14
A	JP 2000-149086 A (Toyo Communication Equipment Co., Ltd.), 30 May, 2000 (30.05.00), Full text; all drawings (Family: none)	1-19
A	JP 6-342487 A (Billcon Corp.), 13 December, 1994 (13.12.94), Full text; all drawings (Family: none)	1-19
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 26722/1985 (Laid-open No. 143274/1986) (Glory Ltd.), 04 September, 1986 (04.09.86), Full text; all drawings (Family: none)	1-19

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002074464 A [0005] [0006]